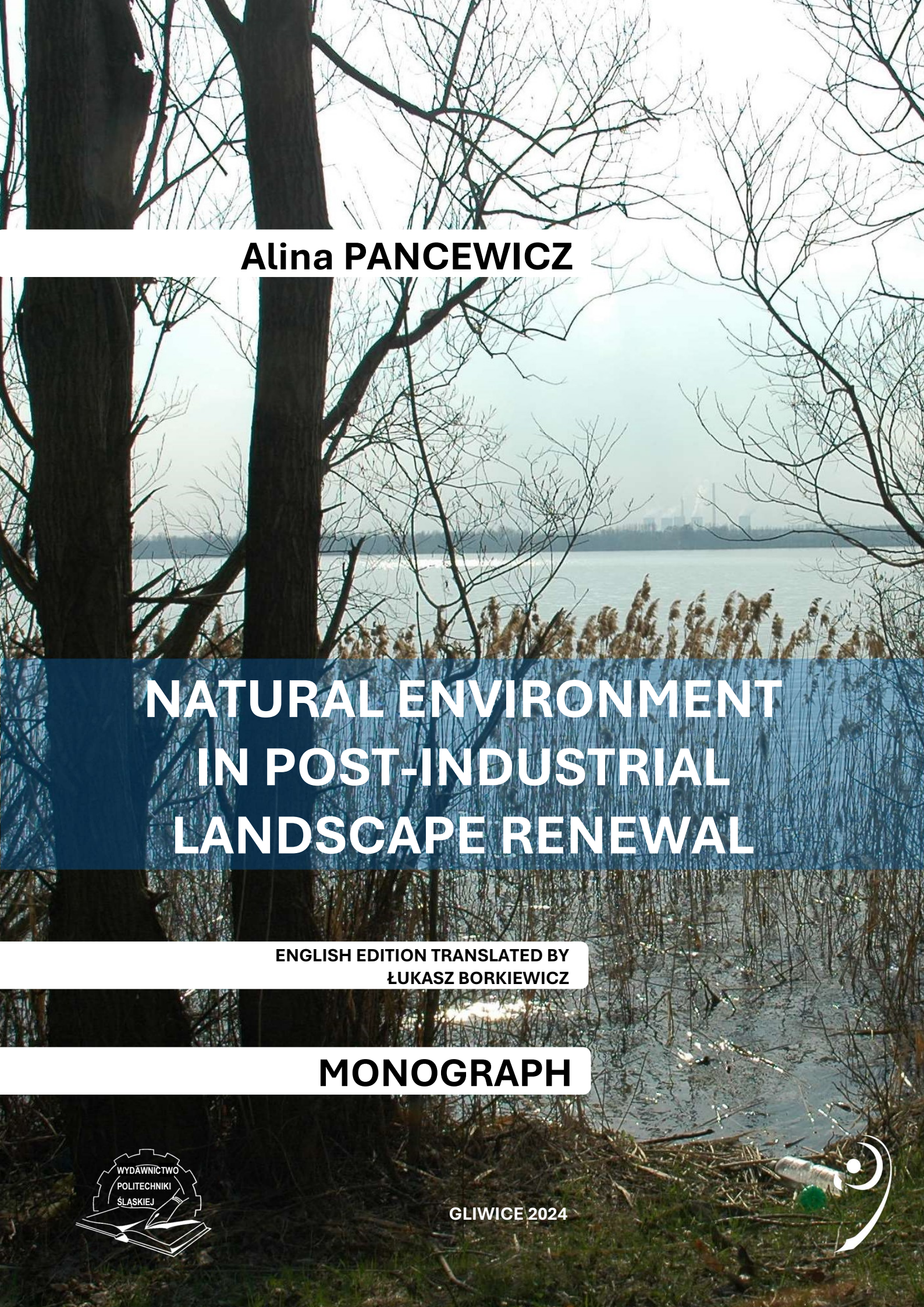

Alina PANCEWICZ

NATURAL ENVIRONMENT IN POST-INDUSTRIAL LANDSCAPE RENEWAL

ENGLISH EDITION TRANSLATED BY
ŁUKASZ BORKIEWICZ

MONOGRAPH

WYDAWNICTWO POLITECHNIKI ŚLĄSKIEJ

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Alina PANCEWICZ

On the cover: Water reservoir „Pogoria II" in the post-exploitation sand pit in Dąbrowa Górnicza, photograph by A. Pancewicz

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Translated by
Łukasz BORKIEWICZ

The first edition of the monograph: Natural environment in the post-industrial landscape was published in Polish in 2011 under the title: Środowisko przyrodnicze w odnowie krajobrazu poprzemysłowego.
The problem of landscape renewal in urbanised areas, analysed in terms of the importance of the natural environment to this process, is central to the development of cities and post-industrial regions around the world. The English edition of the monograph in a digital version is intended to increase the accessibility and outreach of the publication.

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CONTENTS

SPIS TREŚCI

Zabrze Biskupice on the Bytomka river, in the foot of Ruda dump; photograph by A. Pancewicz

1. FOREWORD

> „People make attempts to shape their natural environment as they desire, but even in the most heavily urbanised environment, nature takes part in creating the *genius loci*. The lasting character of a place is always a resultant of complex interactions between nature and culture. [...] Therefore, the crux of this problem is not whether we will modify nature or refrain from doing that, but how we will modify it."
> Dubois R., 1986

This monograph addresses the problem of landscape renewal in urbanised areas, analysed in terms of the importance of the natural environment to this process. Special attention has been attached to certain natural components, degraded by human industrial activity, such as dumps, mine workings, artificial water reservoirs, and polluted rivers. The process of their transformation is gradually gaining the status of a priority activity in respect of space and landscape management. Since the release of U Thant's report of 1969, highlighting the problem of excessive environmental pollution and depleting natural resources, as well as the 1972 report by the Club of Rome entitled *The Limits to Growth*, analysing the prospects for further development of technical civilisation, specific changes initiated across the world have brought the problems of the quality of the built and natural environment to the forefront, and have enabled new concepts for the development of industry-related areas to emerge. In Poland, it was not until the political and economic changes of the 1990's that a new approach to urban landscape had become viable. Post-industrial areas – once predominantly associated with environmental and health hazards – started being perceived as development opportunities. As time passed, individual elements of the degraded natural environment joined the areas of organised urban greenery and enclaves of *wild nature* as some of the very few available places where people and nature could actually come together, becoming important landscape components and altogether one of the most fundamental parts of the spatial structure of urbanised areas. Some of them have acquired new economic or cultural functions, others are treated as backup areas, not being developed instantaneously, while only a minor fraction of them is reclaimed for greenery purposes.

The assumption underlying this study is that the elements of the natural environment and/or landscape degraded through industrial activity, included in the processes of spatial planning and urban design, can be crucial to urban renewal. When reused and adequately redeveloped, they can become priority areas from the perspective of urban development and making the spatial and functional structure of industrial brownfields more transparent. Given their effect on positive image building, they can stimulate the economy, highlight new employment opportunities, and raise the standard of living. They can also contribute to the protection of open spaces against uncontrolled economic annexation, replenishment and development of natural systems, and co-creation of spatial governance for urbanised areas.

STATE OF RESEARCH

The crux of the relationship between the natural environment and urbanised areas is the highlight of numerous scientific disciplines. Two main trends clearly stand out in this respect in the existing literature and research on the subject. One pertains to the functioning and development of the natural environment in urban and landscape structures. The other concerns urban renewal of degraded post-industrial sites. Selected matters addressed by representatives of such disciplines as geography, biology, history, sociology, or architecture and urban planning highlight this problem against the context of a specific field of knowledge, and in different space-time perspectives. There are very few papers which elaborate upon the problem of revitalisation and reuse of the degraded elements of the natural environment in the process of post-industrial landscape renewal. This body of problems also encompasses international, European Union-wide, and national legal acts and strategic documents which emphasise the need to tackle designing and planning of the built environment – harmonised with nature – in a complementary fashion[1].

In the discourse on the city as such, as well as on its history, landscape, structure, or urban composition, the overall body of problems related to how green areas are developed is extensively addressed in non-Polish literature, e.g.: Lynch K. (1960), Mumford L. (1961), Chadwick G. F. (1966), Giedion S. (1968, Polish edition), Mc Harg I. L. (1971), Hall P. (1975), Bacon E. (1976), Alexander Ch. (1977), Laurie I. C. (1979), Trancik R. (1986), Turner T. (1987, 1998), Pregill P. and Volkman N. (1999), Clark P. (ed.) (2006) et al[2].

In Poland, matters such as developing the natural environment in urban areas, when perceived from the perspective of the scientific disciplines residing in the interface between geographical and biological sciences, are addressed by urban physiography,[3] physical geography[4], landscape ecology[5], and urban ecology[6] [Różycka W. (1965),

[1] These include the following documents: Green Charter, Brussels (1990); Rio Declaration on Environment and Development (1992); Charter of European Sustainable Cities and Towns Towards Sustainability, Aalborg (1994) European Landscape Convention, Florence (2000); Johannesburg Declaration on Sustainable Development (2002); New Charter of Athens: A Vision for Cities in the 21th Century, Lisbon (2003); Leipzig Charter on Sustainable European Cities (2007), and the most relevant Polish laws: Spatial Planning and Development Act (2003); Environmental Protection Law (2001); Nature Conservation Act (2004); Act on the access to information on the environment and its protection, public participation in environmental protection, and environmental impact assessments (2008); Act on the historic heritage protection and conservation (2003); Act on the protection of agricultural and forest land (1995); Geological and Mining Law (1994), etc.

[2] Lynch K. 1960. *The image of the city*. MIT Press Cambridge; Mumford L. 1961. *The city in history*. Brace and World, New York; Chadwick G.F. 1966. *The Park and the Town*. The Architectural Press, London; Giedion S. 1968. *Przestrzeń, czas i architektura. Narodziny nowej tradycji* (Space, time, and architecture. The birth of a new tradition). PWN, Warsaw; Mc Harg Ian L. 1971. *Design with nature*. New York; Hall P. 1975. *Urban and Regional Planning*. David and Charles Holding Ltd Baltimore; Alexander Ch., Ishikawa S., Silverstein M. 1977. *A Pattern Language: towns, buildings, construction*. Oxford University Press, New York; Bacon E.N. 1976. *Design of cities*. Penguin Group, New York; Laurie I.C. 1979. *Nature in cities: the natural environment in the design and development of urban green space*. John Wiley&Sons, New York; Trancik R. 1986. *Finding Lost Space. Theories of Urban Design*. Wiley, New York; Turner T. 1987. *Landscape planning*. Hutchinson, London; Turner T. 1998. *Landscape planning and environmental impact design*. Routledge, London; Pregill P., Volkman N. 1999. *Landscapes in History. Design and Planning in the Eastern and Western Tradition*. John Wiley&Sons, New York; Clark P. (ed) 2006. *The European City and Green Space*. London, Stockholm, Helsinki and St. Petersburg, 1850-2000 Ashgate, UK, Aldershot.

[3] Urban physiography studies, analyses, and assesses natural conditions in a comprehensive manner.

[4] Physical geography is the study of how the natural environment functions.

[5] Landscape ecology is concerned with the spatial and temporal relations between biocenoses and their environment in specific landscape systems. The research conducted in this field mainly focuses on the open landscape (mainly agricultural), which makes it difficult to use it when planning urban natural systems.

[6] Urban ecology defines the relations between the ways in which the built environment and the natural environment are shaped. It involves studying urban natural systems, and assumes an interdisciplinary view of the human-environment relationship, considered against urban planning and city management. The outcomes of the urban ecology research are

Kondracki J. (1976), Richling A. (1992), Richling A., Solon J. (1994), Szponar A. (2003), Zimny H. (2005)].[7] The views of architects, urban planners, planning professionals, and landscape architects on the matters of greenery vis-à-vis spatial planning, developing urban and regional natural systems, urban composition, as well the structure of the city and cityscape have been discussed by numerous authors, including Tolwinski T. (1963), Ciołek G. (1965), Czarnecki W. (1968), Wejchert K. (1974), Bogdanowski J. (1968, 1976), Malisz B. (1981), Orzeszek-Gajewska B. (1992), Böhm A. (1994, 2006), Stępniewska B. (1996), Ostrowski W. (1996), Dubel K. (1998), Czerwieniec M., Lewinska J. (2000), Szulczewska B. (2002), Przewozniak M. (2002), Wisniewska W. (2002), Żarska B. (2002), Drapella-Hermansdorfer A., ed. (2004, 2005), Haber Z., Urbański P. (2005), Szumanski M. (2005), Królikowski J. (2006), Zachariasz A. (2006), Skalski J. A. (2007)[8].

diverse models demonstrating how cities function, including the concept of a city perceived as an *anthropogenic system*, as proposed in 1991 by Wiesław Anders of the Gdańsk University of Technology and his team.

[7] Różycka W. 1965. *Zarys fizjografii urbanistycznej* (Outline of urban physiography). Arkady, Warszawa; Kondracki J. 1976. *Podstawy regionalizacji fizycznogeograficznej* (Fundamentals of physical and geographical regionalisation). PWN, Warsaw; Richling A. 1992. *Kompleksowa geografia fizyczna* (Comprehensive physical geography). PWN, Warsaw; Richling A., Solon J. 1994. *Ekologia krajobrazu* (Ecology of the landscape). PWN, Warsaw; Szponar A. 2003. *Fizjografia urbanistyczna* (Urban physiography). PWN, Warsaw; Zimny H. 2005. *Ekologia miasta* (Urban ecology). Advertising and Publishing Agency Arkadiusz Grzegorczyk, Warsaw.

[8] Tolwiński T. 1963. *Urbanistyka* (Urban planning). Vol. III. *Zieleń w urbanistyce* (Greenery in urban planning). PWN, Warsaw; Ciołek G. 1965. *Planowanie przestrzenne a krajobraz* (Spatial planning and landscape). In: Szafer W. (ed) *Ochrona przyrody i jej zasobów. Problemy metody* (Protecting nature and its resources. Methodological problems). Vol. I. Krakow; Czarnecki W. 1968. *Planowanie miast i osiedli* (Planning of towns and districts). Vol. III. *Krajobraz i tereny zielone* (Landscape and green spaces). PWN, Warsaw-Poznań; Wejchert K. 1974. *Elementy kompozycji urbanistycznej* (Elements of urban composition). Arkady, Warsaw; Bogdanowski J. 1968. *Architektura krajobrazu. Wybrane problemy studialne, projektowe i konserwatorskie* (Landscaping. Selected research, design, and conservation problems). Krakow University of Technology, Krakow; Bogdanowski J. 1976. *Kompozycja i planowanie w architekturze krajobrazu* (Composition and planning in landscaping). PWN, Wrocław; Malisz B. 1981. *Zarys teorii kształtowania układów osadniczych* (General outline of the theory of evolution of settlement systems). Arkady, Warsaw; Orzeszek-Gajewska B. 1992. *Kształtowanie terenów zieleni w miastach* (Shaping urban green spaces). PWN, Warsaw; Böhm A. 1994. *Architektura krajobrazu, jej początki i rozwój* (Origins and evolution of landscaping). Krakow University of Technology, Krakow; Böhm A. 2006. *Planowanie przestrzenne dla architektów krajobrazu. O czynniku kompozycji* (Spatial planning for landscape architects. The composition factor). Krakow University of Technology, Krakow; Stępniewska B. 1996. *Tendencje kształtowania zieleni w wiekach XIX i XX w Europie* (19th and 20th century trends in European soft landscaping). Publishing House of the Wrocław University of Science and Technology, Wrocław; Ostrowski W. 1996. *Wprowadzenie do historii budowy miast. Ludzie i środowisko* (Introduction to the history of town building. People and environment). Publishing House of the Warsaw University of Technology, Warsaw; Dubel K. 1998. *Uwarunkowania przyrodnicze w planowaniu przestrzennym* (Natural determinants in spatial planning). Economics and Environment Publishing House, Białystok; Czerwieniec M., Lewińska J. 2000. *Zieleń w mieście* (Urban greenery). Institute of Spatial and Municipal Economy, Krakow; Szulczewska B. 2002. *Teoria ekosystemu w koncepcjach rozwoju miast* (Theory of ecosystems in urban development concepts). Warsaw University of Life Sciences (SGGW), Warsaw; Przewoźniak M. 2002. *Kształtowanie środowiska przyrodniczego miast* (Shaping the natural environment of cities). Publishing House of the Gdańsk University of Technology, Gdańsk; Wiśniewska W. 2002. *Krajobrazy codzienne* (Everyday landscapes). *Zeszyty Naukowe* (Scientific Journal), no. 903. *Rozprawy Naukowe* (Scientific Papers), book 308, Łódź University of Technology, Łódź; Żarska B. 2002. *Ochrona krajobrazu* (Landscape protection). Publishing House of the Warsaw University of Life Sciences (SGGW), Warsaw; Drapella-Hermansdorfer A. (ed) 2004. *Kształtowanie krajobrazu: idee, strategie, realizacje. Część I. Saksonia, Brandenburgia, Berlin* (Landscaping: ideas, strategies, developments. Part I. Saxony, Brandenburg, Berlin). Publishing House of the Wrocław University of Science and Technology, Wrocław; Drapella-Hermansdorfer A. (ed) 2005. *Kształtowanie krajobrazu: idee, strategie, realizacje. Część II.` Londyn i okolice* (Landscaping: ideas, strategies, developments. Part II. London and its surroundings). Publishing House of the Wrocław University of Science and Technology, Wrocław; Haber Z., Urbański P. 2005. *Kształtowanie terenów zieleni z elementami ekologii* (Soft landscaping with elements of ecology). Publishing House of the Poznań University of Life Sciences, Poznań; Szumański M. 2005. *Strukturalizacja terenów zieleni* (Green space structuring), vol. 295, Scientific Papers and Monographs, Warsaw University of Life Sciences, Warsaw; Królikowski J. 2006. *Interpretacje krajobrazów* (Interpreting landscapes). Publishing House of the Warsaw University of Life Sciences, Warsaw; Zachariasz A. 2006. *Zieleń jako współczesny czynnik miastotwórczy ze szczególnym uwzględnieniem roli parków publicznych* (Urban greenery perceived as a contemporary city-forming factor, highlighting the role of public parks). *Architecture* series. Monograph no. 336. Krakow University of Technology, Krakow; Skalski J. A. 2007. *Analiza percepcyjna krajobrazu jako działalność twórcza, inicjująca proces projektowania* (Perceptive analysis of landscape as a creative activity). Publishing House of the Warsaw University of Life Sciences, Warsaw.

Some examples of the Polish and foreign achievements in this respect, as well as of projects, concepts and ideas illustrating the above problem have been described in scientific journals and conference materials, among which the following are particularly noteworthy. Polish journals: *Człowiek i Środowisko, Urbanista, Architektura Krajobrazu, Teka Komisji Urbanistyki i Architektury*, *Kwartalnik Architektury i Urbanistyki PAN*, *Przegląd Urbanistyczny (*Man and the Environment, Urbanist, Landscape Architecture, Collection of the Commission for Urban Planning and Architecture, Quarterly Journal of Architecture and Urban Planning of the Polish Academy of Sciences, Urban Review); bulletins of the Committee for Spatial Economy and Regional Planning of the Polish Academy of Sciences (KPZK PAN); publication series of the Warsaw University of Life Sciences: *Krajobraz z paragrafem*, *Przyroda i miasto* (Landscape with paragraph, Nature and city); foreign periodicals: *Landscape and Urban Planning* [LUP], *Landscape Architecture*, *Landscape, Topos, Urban Studies, Urban Design, Town Planning Review* [TPR], *Journal of Architectural and Planning Research*.

The other theme found in the foregoing studies pertains to the problem of the transformation of brownfields and the related elements of the natural environment. Most of the research and scientific endeavours undertaken in this field, addressing degraded urban and regional structures, address this problem from a spatial and urban planning perspective. Researchers' efforts predominantly focus on the problem of transformation of post-industrial facilities and sites (Dziewoński M. (1969), Minorski J. (1977), Berg L. van den. (1982), Bonenberg W. (1985), Juzwa N. (1988), Tomaszek S. (1989), Szady E. (1990), Brandenburg H. (1998), Gasidło K. (1998)), and to a lesser extent on the transformation of the environment and degraded natural elements, perceived from the point of view of architecture and urban planning (Klemens J. (1985), Niezabitowska E. (1987))[9].

Many Polish research centres are involved in the discourse on the processes of renewal of degraded areas, and industrial brownfields in particular. The developments achieved in this field are described in numerous publications, including those released by the Committee for Spatial Economy and Regional Planning of the Polish Academy of

[9] Dziewoński M. 1969. *Przestrzenne zagospodarowanie dla celów wypoczynkowych terenów zniszczonych przez górnictwo w Górnośląskim Okręgu Przemysłowym* (Development of the land devastated by mining operations in the Upper Silesian Industrial Region for leisure purposes). Scientific Journal of the Silesian University of Technology, *Construction* series, book 25, Gliwice; Minorski J. 1977. *Środowisko przyrodnicze a gospodarka przestrzenna* (Natural environment vs land management). Arkady, Warsaw; Berg L. van den, et al. 1982. *Urban Europe, A Study of Growth and Decline*. Pergamon Press, Oxford; Bonenberg W. 1985. *Przemysł w mieście. Ekologiczna metoda modernizacji zakładów przemysłowych zlokalizowanych na obszarach intensywnie zurbanizowanych* (Ecological method of upgrading industrial facilities located in highly urbanised areas). Scientific Journal of the Silesian University of Technology, *Architecture* series, book 3, Silesian University of Technology, Gliwice; Juzwa N. 1988. *Kształtowanie przestrzenne przemysłu na obszarach intensywnie zurbanizowanych* (Spatial development of industry in highly urbanised areas). Scientific Journal of the Silesian University of Technology, book 8, *Architecture* series, Silesian University of Technology, Gliwice; Tomaszek S. 1989. *Przestrzenne uwarunkowania ochrony i kształtowania środowiska Aglomeracji Górnośląskiej* (Spatial premises of the environmental protection and development in the Upper Silesian Agglomeration). Ossolineum, Wrocław, Warsaw, Krakow; Szady E. 1990. *Uwarunkowania przekształceń przestrzennych powierzchni wyeksploatowanych kopalń* (Conditions of spatial transformation of the premises of decommissioned mines). Scientific Journal of the Silesian University of Technology, no. 1068, Gliwice; Brandenburg H. 1998. *Restrukturyzacja regionów przemysłowych* (Restructuring industrial regions). Publishing House of the Silesian University of Technology, Gliwice; Gasidło K. 1998. *Problemy przekształceń terenów poprzemysłowych* (Brownfield transformation problems). Scientific Journal of the Silesian University of Technology, no. 1408, *Architecture* series, book 37, Publishing House of the Silesian University of Technology, Gliwice; Klemens J. 1985. *Problemy zagospodarowania zwałów poprzemysłowych górnictwa węgla kamiennego, na przykładzie Aglomeracji Górnośląskiej* (Problems of the redevelopment of hard coal mining waste dumps – the Upper Silesian Agglomeration example). Scientific Journal of the Silesian University of Technology, no. 825, *Architecture* series, Silesian University of Technology, Gliwice; Niezabitowska E. 1987. *Infrastruktura społeczna i przyrodnicza przemysłu. Stan istniejący. Prognozy rozwoju* (Social and natural infrastructure of industry. Current status. Development projections). Scientific Journal of the Silesian University of Technology, no. 902, *Architecture* series, book 6.

Sciences (KPZK PAN), scientific journals, or technical periodicals of individual institutions.

Truly impressive is the collection of papers on the transformation of the natural environment which take into account the problems of protection, remediation, and re-development of the environmental components degraded by industrial activity, and this collection is dominated by such scientific disciplines as geography, biology, environmental engineering, ecology, economics, and mining: Skawina T. (1962), Greszta J., Morawski S. (1972), Żmuda S. (1973), Uberman R. (1994), Czaja S. (1999), Tokarska-Guzik B. (2000), Rostański A. (2006), Myga-Piątek U. (ed.) (2007) et al[10]. This body of problems has also been widely elaborated in numerous journals, including: *Przegląd Geologiczny, Kształtowanie środowiska geograficznego i ochrona przyrody na obszarach uprzemysłowionych i zurbanizowanych*, *Problemy ekologii, Przegląd Przyrodniczy, Aura, Prace geograficzne, Człowiek i środowisko*, or *Inżynieria ekologiczna* (Geological Review, Shaping the Geographical Environment and Protecting Nature in Industrialized and Urbanized Areas, Problems of Ecology, Natural Review, Aura, Geographical Works, Human and Environment, or Ecological Engineering).

Of all these sources, studies, articles, and other publications on the transformation of the Upper Silesian Agglomeration are particularly worth mentioning. These include the series entitled *Modelowe formy zagospodarowania GOP* (Model forms of development of the Upper Silesian Industrial Region) published by the Polish Academy of Sciences (PAN) or *Śląski Kwartalnik Urbanistyki i Architektury* (Silesian urban planning and architecture quarterly) by the Commission of Urban Planning and Architecture of the Polish Academy of Sciences, Bulletins of the post-graduate course in Spatial and Urban Planning of the Silesian University of Technology, as well as materials released by Fundacja Przestrzeni Górnego Śląska (Foundation for the Upper Silesian Space). One should definitely make sure not to overlook the numerous studies conducted by the researchers from the Faculty of Architecture of the Silesian University of Technology, most frequently presented in the scientific journals of the Silesian University of Technology under the *Architecture* series[11]. What also matches this research trend is the author's long-term studies using the example of the evolution and decline of the post-industrial areas in the Upper Silesian

[10] Skawina T. 1962. *Rekultywacja hałd oraz gleb dotkniętych wpływami szkód górniczych i przemysłowych* (Reclamation of heaps and soils affected by mining and industrial damage). In: *Materiały i wyniki konferencji polsko-czeskiej na temat współpracy w zakresie badań nad GOP i Ostrowsko-Karwińską niecką węglową* (Materials and deliverables of the Polish-Czech conference on the collaboration under the research on the Upper Silesian Industrial Region and the Ostrava-Karviná coal basin). Bulletin no. 65, Polish Academy of Sciences, Committee for the Upper Silesian Industrial Region (GOP), Warsaw; Greszta J., Morawski S. 1972. *Rekultywacja nieużytków poprzemysłowych* (Regeneration of post-industrial areas). National Agricultural and Forestry Publishers, Warsaw; Żmuda S. 1973. *Antropogeniczne przeobrażenia środowiska przyrodniczego konurbacji górnośląskiej* (Anthropogenic transformations of the natural environment in the Upper Silesian Conurbation). Silesian Scientific Institute in Katowice, PWN, Warsaw-Krakow; Uberman R. 1994. *Zagospodarowanie i wykorzystanie wyrobisk poeksploatacyjnych w górnictwie węgla brunatnego* (Redevelopment and utilisation of depleted lignite workings). In: *Górnictwo węgla brunatnego* (Lignite mining). Materials from the 1st Congress, Publishing House of the Wrocław University of Science and Technology, Wrocław; Czaja S. 1999. *Zmiany stosunków wodnych w warunkach silnej antropopresji (na przykładzie konurbacji katowickiej)* (Water regime changes under the conditions of heavy anthropopressure – the Katowice conurbation case). Publishing House of the University of Silesia, Katowice; Tokarska-Guzik B. 2000. *Przyrodnicze zagospodarowanie nieużytków miejsko-przemysłowych na przykładzie centrów górniczych Europy* (Development of idle urban land and industrial brownfields for natural purposes – examples of European mining centres). In: *Inżynieria Ekologiczna* (Environmental engineering), no. 1; Rostański A. 2006. *Spontaniczne kształtowanie się pokrywy roślinnej na zwałowiskach po górnictwie węgla kamiennego na Górnym Śląsku* (Spontaneous vegetation cover formation on hard coal spoil heaps in Upper Silesia). Publishing House of the University of Silesia, Katowice; Myga-Piątek U. (ed) 2007. *Krajobrazy przemysłowe I poeksploatacyjne* (Industrial and post-mining landscapes), vol. VI, publications of the Committee for Cultural Landscape of the Polish Geographical Society, no. 6, Committee for Cultural Landscape of the Polish Geographical Society, Sosnowiec.

[11] These include papers supervised by: K. Gasidło, N. Juzwa, J. Klemens, E. Niezabitowska, S. Tomaszek, as well as numerous independent studies (cf. footnote 9).

Agglomeration, performed under the research project of the Ministry of Science and Higher Education entitled *Znaczenie elementów środowiska przyrodniczego w procesie odnowy zdegradowanego krajobrazu miejskiego Aglomeracji Górnośląskiej (2008–2011)* (Function of individual elements of natural environment in the process of urban renewal of the degraded landscape of the Upper Silesian Agglomeration (2008–2011)) – research activities of the Faculty of Architecture of the Silesian University of Technology (2002–2011), as well as under the REKULA (Restrukturierung von Kulturlandschaften) project (2003–2006)[12]. They marked the onset of regular studies on the renewal of the landscape of Polish as well as Western European cities and industrial brownfields.

The issue tackled by the author corresponds to the overall body of problems related to the sustainable development of the urban environment of Polish cities. Being a very topical and important matter, it makes the transformation of post-industrial urban landscape a subject discussed at numerous spatial planning, urban design, and architecture conferences. These include the cyclic international conferences organised by the Faculty of Architecture of the Silesian University of Technology, entitled *Urban Landscape Renewal (ULAR)*, or by the Faculty of Architecture of the Krakow University of Technology – *Trends and needs of the transformation of cities and regions vis-à-vis the pursuit of sustainable development and integration with the European Union.* Other regular events include: *Landscape Architecture Forum* (held under the auspices of various universities), *Different Faces of Sustainability* or *Landscape Development: Ideas, Strategies, Achievements* by the Faculty of Architecture of the Wrocław University of Technology, landscape seminars of the Cultural Landscape Commission, events organised by the Faculty of Earth Sciences of the University of Silesia, conferences associated with the Regentif project, organised by the Krakow University of Technology and the AGH University of Science and Technology in Krakow, conferences associated with the Revita-Silesia project, implemented by the Department of Economy of the Office of the Marshal of Silesian Voivodeship in Katowice, and numerous others.

Since 2004, i.e. Poland's accession to the European Union, the research on the urbanised environment has become increasingly important for the development of the theory and practice of urban and spatial planning. The activities undertaken in London, Paris or Berlin, as well as in the Ruhr or Lower Lusatia have become models to follow for many concepts and projects implemented under the conditions of the Polish economy and society. However, once established, such a model approach to the process of transformation of brownfields is not ready to be transferred directly to other areas. It is the diversity of the industry-degraded elements of the natural environment, varying external and internal conditions, specific cultural identity, and dissimilarity of the planning, financial, or organisational tools in use that make a case-by-case approach necessary. A representative example of the foregoing is the Upper Silesian Agglomeration, whose landscape clearly reflects the complexity of the problems and the enormity of the conflicts associated with the industrial development and the progressing degradation of the natural environment.

A comparison of the examples presented in the study along with an analysis of the applicable planning standards as well as the legal acts and strategic documents currently in force provided grounds for drawing conclusions concerning the manner in which

[12] The REKULA project, implemented under the European INTERREG III B CADSES programme, concerned transformation of the cultural landscapes degraded by industrial operations. It covered three different regions: the landscape of Lower Lusatia, the Italian region of Veneto, and the Upper Silesian Agglomeration. What intertwined them was the need for renewal combined with landscape protection based on highlighting the most distinctive elements of the natural and cultural environment.

individual elements of the post-industrial natural landscape are introduced into the spatial planning process. The conclusions thus formulated expand the discourse on the rationale behind and the future course of the transformation of the degraded land within industrial brownfields.

Given the relationships between developed and nature-dominated areas, as well as their resulting social, economic, cultural, compositional, or visual interdependencies, the commonsensical aspect of the utility value of the research in question is demonstrating the possibility of utilising the degraded elements of the natural environment by applying a *triple perspective*: regional – closely related to the planning of a new landscape; urban planning – perceiving degraded areas as an element inextricably linked with the urban spatial and functional structure; and architectural – where individual elements may become the factors which determine the uniqueness of specific places.

PURPOSE OF THE STUDY

The main purpose of this study is to discuss the possibility of integrating elements of the natural landscape, degraded by industrial activity, with the process of spatial planning and urban design by highlighting the relevant opportunities or barriers associated with the process of urban renewal. The study attempts to find an answer to the question about the extent to which it is possible to solve the said problems under the conditions of the Polish spatial planning system.

The premise underpinning the study is to identify and examine the following issues:

- evolution of the views on the problem of transformation of urbanised areas, connected with industry;
- importance of the natural environment in developing the new governance for urbanised areas;
- classification of the elements of the natural environment degraded by production activity;
- opportunities for creating a new post-industrial landscape.

The author considers this body of problems particularly important, but also familiar, perceiving it from the perspective of an inhabitant of a post-industrial agglomeration and from the perspective of her research activity. This research was inspired by direct observation of the phenomena which cause new elements of the natural environment to emerge, subject to natural succession, such as dumping grounds, mine workings, artificial water reservoirs, as well as degraded rivers and waterfronts. The foregoing also triggered a need for closer examination of the processes which make or can make the aforementioned elements some of the most important factors in the process of post-industrial landscape transformation. Even though they may represent a threat at the moment, when transformed with the natural environment in mind, they become an opportunity to create a new quality for a given space. Considering the current state of research, such an approach to the overall body of urban renewal problems seems innovative in nature.

SCOPE OF THE STUDY

The research conducted by the author was limited to areas degraded as a consequence of production activity, thus narrowed down to the elements of the natural environment which had emerged in the territories of post-industrial cities and agglomerations. Next to dumps, mine workings, and artificial water reservoirs, also rivers polluted by industry and the adjacent waterfronts were taken into consideration. The study does not aim to discuss the extensive body of problems pertaining to the industrial brownfields found within urbanised areas in a comprehensive fashion. It addresses neither the problems of revitalisation of other types of industrial brownfields, such as the areas transformed by previous railway, military, or transport activity, nor the broad field of issues related to the reclamation of former harbour activity areas. The rationale underlying this study also disregards detailed considerations of the institutional, investment, organisational, and financial aspects of the brownfield transformation process. Being particularly multifaceted and vast, this sphere stretches beyond the scope of this study.

STRUCTURE OF THE STUDY

The structure of this study is determined by its assumptions. It has been divided into five main sections, preceded by an introduction and concluded with a summary.

1. The **Foreword** introduces the subject matter addressed by the author, highlights the current state and purpose of the research, explains the structure and scope of the study, and defines some key concepts.

2. Natural environment in urbanised landscape. Problem evolution – this section is devoted to the importance of the natural environment against the history of the development of cities and urbanised areas. It provides an overview of urban planning concepts and visions, and highlights the diverse ways of pursuing a harmonious human environment, starting from places of habitation (home, neighbourhood) to various urban clusters, and ultimately addressing the regional perspective and the landscape itself. Besides touching upon the relevant ideas and implementation premises, the problem addressed in the study is also analysed against the available national and international documents, reports, and declarations.

3. The chapter entitled **Selected examples of cities and urbanised post-industrial areas. Case studies** addresses specific examples to analyse the role of the natural environment in developing the functional and spatial structure, creating natural systems, and building a new image of cities and urbanised areas. It also showcases how industrial brownfields are integrated into the process of landscape renewal.

4. Natural environment of post-industrial areas is a chapter which discusses the environmental components degraded by industrial activity. It is centred around the characteristics of dump sites, mine workings, artificial water bodies, contaminated rivers and riparian zones, and it identifies the opportunities for their transformation and redevelopment.

5. The chapter entitled **Post-industrial landscape renewal process. Conclusion** analyses the problems in question against the system of spatial planning and the related legal premises. It highlights specific limitations to the transformation process and defines the opportunities created by introducing elements of the degraded natural environment into the pursuit of a new landscape of urbanised areas.

TERMINOLOGY

The meaning of the terms used in the study seems obvious in many cases, but having reviewed them, one comes to a conclusion that, depending on the field of expertise and the context of use, their meaning may often differ. The terms of key importance to the paper, such as: urban renewal, natural environment, landscape, green space, open space, natural system, or industrial brownfield, are subjects of research in numerous scientific fields, each perceiving them from the perspective of its specific interests. This necessitates defining specific concepts associated with post-industrial landscape renewal, which may prove useful to fully understand the role of the degraded elements of the natural environment involved in this process.

Landscape is an external expression of the environment, or its *physiognomy*. One of the oldest definitions, coined by Antoine Furetière in 1690, describes landscape as a view of the land that stretches as far as the eye can reach[13]. A review of the encyclopaedic definitions of this notion confirms this point of view, referring to landscape as an area which can be swept by the sight, an observable space, or physiognomy[14]. Depending on the field of expertise and the problems addressed, these definitions diverged more or less from the intuitive and colloquial understanding of the concept of landscape[15]. Gradually, it started being perceived as a synthesis of the natural and cultural environment[16]. In consideration of landscape qualities, the following were taken into account: ecological, aesthetic, and cultural qualities of individual areas and the associated elements of the natural environment, developed by both forces of nature and human activity. This is also how they are defined in the Nature Conservation Act of 2004[17]. Understanding landscape from the angle of the values and elements specified in that regulation seems to be the optimal approach when taking measures aimed at landscape development and protection in degraded urbanised structures. The European Landscape Convention (2000) elaborates upon this aspect more broadly. It expresses preoccupation with landscape as an element of Europe's shared heritage, whose character is the consequence of the action and interaction of natural and/or human factors. It also defines the importance of landscape vis-à-vis the quality of life of urban populations, recognising degraded areas, both common and ordinary as well as those of high quality, widely recognised as beautiful, as

[13] Acc. to Jean-Robert Pitte, *Histoire du paysage français* (History of the French landscape), vol. I. Pluriel, Paris 1994, p. 17. After: Wiśniewska W. 2002, op. cit., p. 26.

[14] *Wielka encyklopedia powszechna PWN* (PWN's great popular encyclopaedia). PWN, 1965, vol. VI; *Słownik języka polskiego* (Polish language dictionary). PWN, 1978; *Encyklopedia powszechna* (PWN's popular encyclopaedia). *PWN*, 1984; *Grand Larousse Encyclopédique* (Larousse's great encyclopaedia), 1963; *Dictionnaire de l'urbanisme et de l'aménagement* (Dictionary of urban planning and development), 1988; *The Oxford English Dictionary*, 1989.

[15] Geographical sciences postulate that landscape is equivalent to the external appearance of the Earth's surface at a given place. It is the result of the interaction between various natural phenomena and processes, where geological and geomorphological processes prevail. Natural sciences focus on the biological sphere of landscape problems, highlighting their natural grounds. In the field of engineering, on the other hand, spatial planning seeks to determine the trends, foundations, and vectors of economic transformations in landscapes. Landscaping, perceived as the art of landscape shaping, is a method based on acting rationally, guided by aesthetic premises, in a harmonious relationship with the natural and cultural environment.

[16] Krzymowska-Kostrowicka A. 1993. *Krajobraz jako przedmiot badań w ujęciu aksjologicznym* (Landscape as a research subject – an axiological perspective). In: Pietrzak M. (ed) *Ekologia krajobrazu w badaniach terytorialnych systemów rekreacyjnych* (Landscape ecology in the territorial studies of recreational systems). Adam Mickiewicz University, Poznań; Bogdanowski J. 1994. *Droga od percepcji do ochrony i kształtowania krajobrazu* (From perception to landscape protection and development). In: Bogdanowski J. (ed) *O percepcji środowiska* (On perception of landscape). Scientific Journal of the Polish Academy of Sciences, *Człowiek i Środowisko* (People and environment) scientific quarterly, book 9; Wolski P. 1988. *O pojęciu krajobrazu i jego stosowaniu w dziedzinie architektury krajobrazu. Problemy architektury krajobrazu* (On the notion of landscape and its use in landscaping. Landscaping problem). Publishing House of the Warsaw University of Life Sciences, Warsaw.

[17] Nature Conservation Act of 16 April 2004, Art. 5(23).

parts of landscape. When perceived from the perspective of an architect and urban planner, landscape means a certain space which can be captured by the sight, dominated by certain characteristic urban or architectural components as well as natural elements, altogether forming an image of the space where people dwell[18].

Landscape degradation is a process which can be understood against the context of the vulnerability of individual elements of the natural environment to the threats related to the continuous reduction of biological activity, deterioration of the quality indicators of the atmosphere, water, soil, and plant products, or climatic characteristics. Its consequence is the declining economic and aesthetic value of landscape. These phenomena reflect the processes associated with individual stages of civilisation development, such as deforestation, soil modification, annexation of agricultural and forest land for new functions, extraction of minerals, development of transport infrastructure, or suburbanisation processes. The most extreme cases of landscape degradation are linked with the human activity of industrial nature, its consequences including: soil removal from land surface, industrial waste dumping, deformation of terrain relief, water regime transformation, or changes to the vegetation cover[19].

Landscape renewal encompasses the entirety of the processes associated with protecting, developing, planning, and preserving landscapes devastated and degraded by human activity. This involves a variety of technical and aesthetic procedures: rehabilitation – repairing damaged landscapes, remediation – restoring the utility and natural values (biological productivity), redevelopment – rectifying inappropriate forms of development, and creation – developing new landscapes, different from the existing ones[20]. Their purpose is to set a target for and to harmonise the changes which arise from social, economic, and environmental processes, as well as to strengthen the regional identity and improve the living conditions of people[21]. What attracts special attention is the post-industrial landscapes, which need to be completely restructured anew due to previous industrial interventions, in ways that can help in restoring their natural balance and creating the landscape identity[22]. The renewal of urbanised landscapes entails not only combining the developed and the natural part of the environment into a harmonious whole, but also sustaining appropriate relations between the quality of the environment and the dynamics of economic growth. Providing opportunities to influence the renewal processes so as to make sure that the spatial management measures implemented in urbanised areas are rational, and that the landscape changing as a consequence of these activities is not being deprived of its qualities is a problem directly linked with the field of spatial planning. This process is part of the trend of sustainable development of the urbanised environment of cities and industrial brownfields.

Urban renewal is a concept which dates back to the 1930's, and it is profoundly ingrained in the doctrine of modernism. It is a process of adapting the state of development of cities along with the elements of their spatial structure to the changing needs of their population. Its ultimate goal is ensuring harmonious growth of cities by

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[18] Bogdanowski J., Łuczyńska-Bruzda M., Novak Z. 1973. *Architektura krajobrazu* (Landscaping). Warsaw-Krakow, passim.
[19] Żmuda S. 1973, op. cit., pp. 86–157.
[20] Czarnecki W. 1968, op. cit., pp. 16–21.
[21] European Landscape Convention, Florence, 2000.
[22] *Przekształcanie krajobrazów. Zalecenia na przykładzie trzech europejskich krajobrazów poprzemysłowych* (Transforming landscapes. Recommendations based on the examples of three European post-industrial landscapes). Publications of the Italian-Polish-German project REKULA – Restructuring of Cultural Landscapes, 2006, INTERREG III B ERDF EU initiative, pp. 7–13.

considering the preservation, intensification, transformation, or restoration of the old resources in the urban fabric and linking them with new spatial and aesthetic qualities, social expectations, and cost-effectiveness. The foregoing pertains to elements of architecture, urban planning, and technical infrastructure, but also elements of the natural environment as well as legal, economic, administrative, and political aspects[23]. Urban renewal is an umbrella term, primary in nature towards such measures undertaken on a local basis as rehabilitation, revalorisation, redevelopment, restructuring, modernisation, or revitalisation[24]. When perceived as a planning activity, it targets both entire city territories as well as selected areas under intensive use. These include residential districts, inner city quarters, urban complexes, public spaces, industrial brownfields, military brownfields, transport networks, municipal infrastructure, urban wastelands – as idle areas are commonly referred to – or lands commonly referred to as *green*. Considering the natural factor, urban renewal entails designing and forming the urban systems of green areas, developed or supplemented by utilising nature-transformed degraded land formerly used for purposes of railway, military, or transport operations, and areas transformed by human industrial activity. The meaning of the *renewal* concept appears to be broader still if one takes not only cities but also agglomerations of urban and industrial nature into account. The problem of urban renewal is becoming a precondition for defining a new image of cities and for improving the quality of life of large urban populations. When perceived in this fashion, this process must be multidirectional, staggered in time, and sensitive to dynamic transformations.

Reclamation is a comprehensive activity aimed at adding or restoring the utility value of degraded or devastated land in view of its future use. This process entails cleaning, securing, rendering available, land surface profiling, and restoring biological productivity of devastated land through adequate technical, agrotechnical, and biological treatments. And finally, it is a stage of transformation which precedes the proper land development[25]. Assuming that this concept is linked with individual elements of the natural environment, degraded by industrial activity, one can refer to the provisions of Polish Standard PN-64-G-01203:1964, where the phrase „reclamation of open pits and dumps" is used to describe all the activities and procedures aimed at restoring such a condition of post-mining areas and dump sites which enables their rational utilisation for economic, industrial, or other purposes[26]. The term *reclamation* has also been defined in the Environmental Protection Law (2001) as well as in the Act on the Protection of Agricultural and Forest Land (1995)[27]. The *Governmental Programme for Brownfields* of 2004 (*Program rządowy dla terenów poprzemysłowych*) refers to the process of land reclamation and redevelopment aimed at restoring a condition which enables it to perform utility functions as *revitalisation*[28].

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[23] Sumień T., Furman-Michałowska J., Ufnalewska K., Wąs W. 1989. *Odnowa miast europejskich* (Renewal of European cities). Institute of Spatial and Municipal Economy, Warsaw, p. 5.

[24] Sumień T., Topoczewska T., Ufnalewska K. 1992. *Problemy odnowy zagospodarowania miast i stref podmiejskich na przykładzie Łódzkiego Zespołu Miejskiego* (Renewal problems in the redevelopment of urban and suburban areas – the Łódź metropolitan area case). Institute of Spatial and Municipal Economy, Warsaw, p. 6.

[25] Ibid., p. 9; Skawina T. 1962, op. cit., p. 33.

[26] Polish Standard (PN-64-G-01203:1964) *Open-cast mining. General terminology*.

[27] In accordance with the Environmental Protection Law, reclamation consists in restoring the environment to the state corresponding to that prior to the adverse transformation of the natural landform and attaining a state of natural equilibrium (Article 3(8); Article 260(4)). The Act on the protection of agricultural and forest land defines land reclamation as follows: „providing or restoring the utility value or natural qualities to degraded or devastated land through adequate landscaping, improving physical and chemical properties, regulating water regime, restoring soil, reinforcing slopes, as well as reconstructing or constructing necessary roads" (Article 4(18)) [translated from Polish by Łukasz Borkiewicz].

[28] *Program rządowy dla terenów poprzemysłowych* (Governmental Programme for Brownfields), op. cit., item 1.1.

Renaturation (also renaturalisation), otherwise called *natural succession*, is a process which the relevant Polish Standard (PN-G-07800:2002) defines as the spontaneous encroachment of plant and animal communities on transformed land[29]. Considering this notion against the context of idle post-mining land, renaturation can be understood as a process leading to the restoration of the ecological conditions of the original habitat as well as natural plant communities in a given part of the landscape. This phenomenon progresses on account of spontaneous colonisation of transformed habitats or it can be an outcome of active restoration of the ecosystems destroyed by human activity[30]. A term considered synonymous with renaturation is also *nature healing*.

Urban natural system comprises a variety of green spaces within the urban fabric (naturally or spontaneously forming, or anthropogenic), that are intertwined and expanded by links with suburban open spaces or with the regional ecological system. Their purpose is to preserve the system of biologically active areas (nodes, patches, ecological corridors, green wedges or links in the natural environment) blending into the city, as well as to ensure connectivity both between them and with similar structures situated on city outskirts[31]. Natural systems can be divided into two basic types: internal – co-creating the city structure, starting from individual natural elements to vast green areas, and external – surrounding the city and being connected with it in functional (natural processes) and physiognomic (landscape potential) terms, as well as in respect of utility (suburban zones of investment, food production, recreation)[32]. These can be analysed along with the systems of open spaces, recreational areas, or protected areas. The notion of *urban natural system* is directly linked with the field of spatial planning. It is understood as a set of planning concepts whose common goal is to identify specific areas and natural elements in the city structure which are spatially interlinked (including those situated outside the boundaries of urbanised areas) and which perform an environment-forming function[33]. Next to the elements of the built environment, it co-determines the city's spatial structure, it is associated with its urban composition, and it affects the cityscape. In Poland, the urban natural system concept emerged in the field of spatial planning in the late 1980's, while the idea itself evolved in the 1990's[34].

Human environment is the overall body of natural (environmental) components, as well as material, spiritual, and social values considered necessary to satisfy human psychocultural and physiological needs. According to the Environmental Protection Law (2001), the term *environment* is understood as encompassing the entirety of natural elements, including those transformed by human activity, and particularly land surface, minerals, waters, air, landscape, climate, and other elements of biodiversity, as well as the

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29 Polish Standard (PN-G-07800:2002) *Open-cast mining. Land reclamation. General design guidelines.*

30 Tokarska-Guzik B. 2003. *Rekultywacja czy renaturalizacja? Czyli o możliwych kierunkach zagospodarowania wyrobisk poeksploatacyjnych* (Recultivation vs renaturation. On the potential paths of post-mining brownfield redevelopment). In: *Kształtowanie krajobrazu terenów poeksploatacyjnych w górnictwie* (Landscaping of post-mining brownfields). Proceedings of an international scientific conference, AGH University of Science and Technology, Krakow University of Technology, Krakow, pp. 156–157.

31 Szulczewska B. 2002, op. cit., pp. 78–91.

32 Przewoźniak M. 2009. *Kwalifikacja systemów przyrodniczych miast. Teoria i zastosowania w zarządzaniu obszarami zurbanizowanymi* (Classification of urban natural systems. Theory and practical application in the management of urbanised areas). In: Markowski T., Drzazga D. (eds) *System przyrodniczy w zarządzaniu rozwojem obszarów metropolitalnych* (Natural system in the management of the metropolitan area development). Studies of the Committee for Spatial Economy and Regional Planning of the Polish Academy of Sciences CXXIII, pp. 35–50.

33 Szulczewska B., Kaftan J. (eds) 1996. *Kształtowanie Systemu Przyrodniczego Miasta* (Soft landscaping in cities). Institute of Land Management and Housing, Warsaw, pp. 53–62.

34 Szulczewska B., Kaliszuk E. 2005. *Koncepcja systemu przyrodniczego miasta: geneza, ewolucja i znaczenie praktyczne* (Concept of an urban natural system: origin, evolution, and practical relevance). Files of the Committee for Urban Planning, Architecture, and Landscape Studies of the Polish Academy of Sciences, Lublin Branch, pp. 7–24.

interaction between all these elements[35]. Such an approach makes it possible to define the environment as a system which consists of a variety of natural elements forming spatial natural units (natural environment) and of the elements of anthropogenic origin (comprising the cultural environment), altogether determining the quality of life of urban communities. In cities and urban-industrial agglomerations, it is precisely the natural environment that functions as a particular source of the means utilised to satisfy social and economic needs, and as the natural potential which affects people's prospective development, health, well-being, and safety.

Natural environment, as specified in the Nature Conservation Act (2004), consists of the landscape along with the elements of inanimate nature as well as natural and transformed habitats including their fauna and flora[36]. When understood in terms of urban space, this pertains to urbanised areas dominated by both elements of organised nature, subject to planned human activity, and those created as a consequence of negligence. Together with the elements of the cultural environment, they determine the spatial structure, composition, and landscape of urbanised areas. The environment's attractiveness depends to a large extent on the landscape diversity and the qualities of its individual components, but also on the extent and scale of the transformations caused by economic activity.

Elements of the natural environment – those analysed in this study are: terrain relief, water, vegetation, and landscape. In urbanised industrial brownfields, their specific examples are the elements degraded by production activity, such as dumps, quarries, sand pits, gravel pits, artificial water reservoirs, or polluted rivers. They occur either individually or are parts of a larger stretch of brownfields.

Open space is a term often used interchangeably with *green space*. However, its meaning is broader, and the scope of this concept is not utterly clear. The factor commonly understood as distinguishing open spaces from others is non-development. Each process of urban space development leaves areas which are used less intensively or not used at all within city borders. Therefore, in-city open-space areas can be the remnants of non-developed and non-urbanised parts of the city. They are predominantly formed by agricultural and forest land situated on city outskirts, waterfronts, and water bodies, but also inner city areas intended for lawns, green squares, parks, or urban greenery[37]. They are considered against the context of different space division concepts (in functional terms, there are public open-space areas, semi-public and community open-space areas, or private open-space areas)[38] and problems connected with their accessibility[39]. Urban open spaces are designed and developed to enable them to perform economic, natural (climatic, biological, hydrological), landscape-forming, as well as non-natural functions (recreational, aesthetic, or cultural). For inhabitants of urbanised areas, they function as

[35] Environmental Protection Law of 27th April 2001 (Journal of Laws of 2001, no. 62, item 627), Art. 3(39).
[36] Nature Conservation Act of 16 April 2004 (Journal of Laws of 2004, no. 92, item 880), Art. 5(20).
[37] According to the definition based on uniform European indicators, public open spaces are understood to include: public parks, gardens, open spaces to be used exclusively by pedestrians and cyclists, except for green traffic islands or median strips, as well as cemeteries (unless local authorities officially recognise their functions: recreational, natural, historical, or cultural), open-air sports facilities, unpaid and accessible to all, and private property (agricultural land, private parks) with free-of-charge access (*Towards a Local Sustainability Profile: European Common Indicators*, indicator A. 4).
[38] Garvin A. 2000. *Parks, Recreations and Open Spaces: A twenty-First Century Agenda*, American Planning Association, Chicago, pp. 20–25. After: Zachariasz A. 2006, op. cit., pp. 12–13.
[39] According to the European Common Indicators, the maximum walking distance to access open spaces is 300 metres. The European Environment Agency, DG Regional Policy, and ISTAT (*Italian Instituto Nazionale di Statistica*) have set the maximum time to reach open spaces at 15 minutes (*Towards a Local Sustainability Profile. European Common Indicators*, indicator A. 4).

points of contact with nature, enable rest and recreation, create good health conditions for life, and finally, make regions more attractive to tourists[40]. On top of that, one should also consider the economic value of open spaces, increasing the quality of the inhabitable environment. The Polish legal system lacks a clear definition of this concept, which would describe it in essence. However, such a definition was introduced in the 1960's into the American legislation (US Housing Act of 1961). It defined open space as undeveloped land with the potential to meet the recreational needs of the urban population, and addressed its aesthetic, scenic, or protective functions[41]. In this study, open space is perceived as an integral part of urban natural systems, co-determining the landscape identity of urbanised areas[42].

Industrial brownfields, as defined for the purposes of this study, are areas which used to be, but no longer are, utilised for production activity (related to mining and hauling, processing, extracting, or obtaining raw materials, energy, and labour for shipping and storing products or for waste processing). Furthermore, no longer do they perform auxiliary functions that accompany the production process (storage, transport, administration). They include transformed land, being an integral part of the production process, characterised by various spatial forms diversified in shape, to be found on the ground level. Special importance is attached to mine workings and dump sites, as well as other sites not occupied by enclosed structures. In a broader sense, industrial brownfields are also areas under the impact of industrial activity (in physical, economic, and social terms)[43]. According to the 2004 Governmental Programme for Brownfields, industrial brownfields are defined as degraded, vacant, or underutilised land, originally intended for economic activity which has been discontinued[44].

Degraded areas include stretches of land whose utility value has dwindled compared to their original value. According to the definition provided in the Governmental Programme for Brownfields, they are contaminated sites[45] or areas whose natural topography has been altered in an adverse manner. In a broader sense, these include areas formerly utilised for railway, transport, or military operations, sites which have developed due to inadequate farming activity, as well as industrial brownfields whose value was declining as the civilisation development progressed. The range of subjects addressed in this study has been intentionally limited to the areas formed as a consequence of decommissioning of industrial plants which had blended into the landscape as anthropogenic forms of land surface development, altered elements of the water system, and transformed vegetation – all to be found in urbanised areas. Their very presence causes a number of issues, including nonconformity with environmental standards, unemployment, landscape degradation, as well as negative economic and physical impact on the surroundings.

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[40] *Gospodarka Przestrzenna Gmin: poradnik* (Municipal spatial economy – a guidebook). 1998. Vol. I, Institute of Spatial and Municipal Economy, Krakow Branch, Krakow, Llewelyn-Davies, London, Krakow, p. 268.

[41] Zachariasz A. 2006, op. cit., pp. 11–12.

[42] This approach is relevant to the provisions of the English law, where this concept has been used since the early 19th century when referring to the development of urban natural systems. This was confirmed in the Metropolitan Open Land Act of 1877.

[43] Gasidlo K. 1998, op. cit., pp. 7–8.

[44] *Program rządowy dla terenów poprzemysłowych* (Governmental Programme for Brownfields). Ministry of Environment, Warsaw, 2004, item 1.1.

[45] In accordance with item 1.1 of the Governmental Programme for Brownfields (2004): „a contaminated site is a site where the permissible concentrations of certain chemical substances, as specified in the Regulation of the Minister of Environment of 9 September 2002 on soil quality standards and land quality standards (Journal of Laws no. 165, item 1359) have been exceeded" [translated from Polish by Łukasz Borkiewicz].

Devastated areas are the stretches of land which have completely lost their utility value and require regeneration in order for any form of use to continue. Some equivalent terms commonly used in Poland to denote devastated areas include *nieużytki, ugory*, *odłogi* (farrow, barren, idle land of post-industrial nature), which roughly correspond to the English term *derelict industrial land*, meaning industrial brownfields not yet developed for new functions, or the French *friches industrielles* and the German *Industriebrache*, both referring to brownfields in the broad sense of the notion[46]. Some other terms one can typically come across in this domain include *urban brownfields,* meaning extensively developed land which can be used for purposes of diverse investment projects, as well as *wasteland, brownfield* or *disused land* and *brownfield site*, defining areas whose renewal, development, or reclamation may be hindered by the presence or potential presence of hazardous substances, pollutants or contaminants[47].

Urban green spaces are areas that contain elements of the natural environment linked with other components of the spatial structure and landscape of the city. They can be understood as biologically active urban areas[48] or undeveloped areas whose predominant functions are recreation and leisure[49]. They are defined in light of the functions they perform and are associated with areas deliberately planted with vegetation[50]. The legal definition of this concept is provided in the Nature Conservation Act (2004) which describes green spaces as „areas, including technical infrastructure and buildings functionally related to them, covered by vegetation, located within boundaries of villages with compact development or cities, performing aesthetic, recreational, health-promoting, or sheltering functions, particularly parks, greens, promenades, embankments, botanical, zoological, allotment and historic gardens, cemeteries, as well as vegetation that complements streets, squares, historic fortifications, buildings, landfill sites, airports, railway structures, and industrial facilities"[51]. The foregoing definition highlights the potential classification of green spaces in terms of their functions as well as the location within a given structural unit or in urban composition systems. This definition links urban green spaces with degraded areas and industrial brownfields.

Landscape identity is an expression of a specific approach to the notion of landscape, aimed at preserving its specifics, natural and cultural heritage, as well as characteristics of a given city/region, while respecting the requirements of the present day, defining new values, and taking into account the applicable legal regulations and standards, as well as needs of the population that dwells in urbanised areas. The foregoing involves a shift in how forgotten, overlooked, and disregarded elements are perceived, evaluated, and rediscovered. It also reflects the need to search for places and symbols of identity which are important for both landscape creation as well as consolidation of the *genius loci*. Such an approach is aligned with the provisions of the European Landscape Convention, according to which landscape, understood as an essential component of

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46 Gasidlo K. 1998, op. cit., p. 8.

47 *Brownfields and Land Revitalization. Brownfields Definition*, U. S. Environmental Protection Agency, available online at: http://epa.gov/brownfields/overview/glossary.htm; *Glossary of Brownfields Terms*, Brownfields Center, Environmental Law Institute, available online at: http://www.brownfieldscenter.org/big/glossary.shtml [accessed on 2011].

48 Regulation of the Minister of Infrastructure on the technical requirements for buildings and their location (2002).

49 Giedych R. *Zarys prawnych przemian konkretyzacji pojęcia „tereny zieleni" w II połowie XX wieku w Polsce* (Outline of the changes in the legal perspective of the *greenery* concept in the 2nd half of the 20th century in Poland). In: Giedych R., Szumański M. (eds) 2005. *Tereny zieleni jako przedmiot planowania miejscowego, wybór tekstów* (Green space as the subject of local land use planning, selection of studies). Publishing House of the Warsaw University of Life Sciences, Warsaw, pp. 64–72.

50 Haber Z., Urbański P. 2005, op. cit., passim.

51 Nature Conservation Act of 16 April 2004, Art. 5(21) [translated from Polish by Łukasz Borkiewicz].

human environment, expresses the cultural and natural diversity they share, and provides the foundation of their identity[52]. This also entails the concept of *evolutionary landscape*, mentioned in the UNESCO World Heritage List in the context of how the significant stages of civilisation development are reflected, being the complex outcome of the interaction between various forces of nature and human economy. This approach proves particularly important when analysed from the perspective of landscape formation and conservation in urbanised industrial brownfields[53].

[52] European Landscape Convention, op. cit., Chap. II, Art. 5.
[53] *Operational Guidelines for the Implementation of the World Heritage Convention*, UNESCO World Heritage Centre 2005, Annex 3:*Guidelines on the inscription of specific types of properties on the World Heritage List*, p. 84.

Water reservoir in a decommissioned lignite open pit, Großräschen, photograph by B. Bulawa

2. NATURAL ENVIRONMENT IN URBANISED LANDSCAPE. PROBLEM EVOLUTION

It is in the successive stages of the civilisation's evolution, in the history of science and technology, in the growth of industry, as well as in the process of change of the awareness and needs of urban communities that one seek the reasons for the different ways in which the natural environment can be harnessed to shape the urbanised space.

This chapter represents an attempt to depict the evolution of the views on the role of the natural environment in the transformation of urban areas. Its goal, on the other hand, is to highlight the importance of the environment's individual elements in the development of urban structures across the history, in the formation of natural systems, as well as in landscaping.

The history of human culture and civilisation is in fact the history of urban development. In this day and age, more than a half of the world's population dwells in urban clusters. The outcome of the ever-growing population is the progressing urbanisation whose beginning dates back to the dawn of industrialisation.

> By the mid-20th century, there had been approximately 50 cities with a population of one million or more. Only 30% of the world's population had inhabited cities. In 1975, there were already 195 cities that boasted similar figures, and by 2000, their number had risen to 387, with 47% of the population living in cities. In 2010, of all the world's agglomerations, at least 476 had a population of one million and more. There are 63 agglomerations of over five million people, five of which are to be found in Europe. These are: Moscow, Istanbul, London, Paris, and Madrid. Poland is dominated by highly urbanised areas, with around 61.2% of the country's population living in cities. It is estimated that in 2030, around 60% of the Earth's population will live in cities; in Europe this figure is to reach 80%, while in Poland it is expected to reach 72%[1].

The consequence of the foregoing processes is a growing conflict between the human economic activity and the nature, being continuously *tamed*. This leads to spatial differentiation in terms of the state of development of urbanised areas and an increasing diversity of urban green spaces.

Therefore, special consideration is given to the following problems:

- changing views on the role of greenery in the development of cities,
- main elements of the natural environment embedded in urbanised areas,
- contemporary national frameworks of environmental regulations and shaping the living conditions for the inhabitants of urbanised areas.

All the above problems are intertwined with the domain of urban design and spatial planning.

[1] *World Urbanization Prospects, The 2001 Revision*, 2002, United Nations – Department of Economic and Social Affairs, New York, pp. 77 and 162–167; www.citypopulation.de [accessed on 2011]; *Rocznik statystyczny RP* (Statistical yearbook of the Republic of Poland), 2009, Central Statistical Office (GUS), Warsaw.

2.1. Stages of development of urbanised areas

The very crux of the relationship between the built environment and the natural environment is in the need to seek balance in human–nature relations. This has always been evident throughout the long history of settlement, and only the ways in which it is pursued have changed. These have always depended on various factors: economic, political, communication, social, or aesthetic criteria. The successive stages of the civilisation's evolution reveal the essence of the transformation and subordination of the natural environment to mankind. They range from using topography to create urban layouts, to introducing green spaces into built features, to seeking solutions enabling the built environment to mutually permeate and blend with the elements of nature. The civilisational transitions of societies and of the means they employ to meet their needs, the abruptness of changes within the urban system, the growing exploitation of mineral resources, the production of commodities and various kinds of other goods, as well as the processing of energy and matter have all caused an imbalance between the natural and the built environment. The foregoing manifests itself in the living conditions of people, the spatial structure of urban areas, the functioning of greenery systems, as well as the quality of the environment's individual elements (pollution, threats, or degradation). The contemporary urbanised landscapes clearly show how harmonious this process has been and to what extent the natural elements have been dominated by other city-forming factors. Landscape affecting and altering phenomena are difficult to place precisely in time. There are specific sets of social and physical characteristics and premises typical of individual periods, resulting from the conditions of the previous era and the development rationale for the future ones. These vary according to a given country's development level. They are defined by watershed inventions, breakthrough events, wars or catastrophes that became the germs of changes, contributing to the rapid development or renewal of cities and regions. What appears to be particularly important in the relationship between the natural and the built environment is the phases of development related to the dominant role of technology, the way in which energy is acquired, and the resulting changes in the mindset of urban communities. They demonstrate the interdependences between the natural environment and economic phenomena. In an attempt to grasp the essence of individual development periods, Lewis Mumford (1961) identified four phases associated with the diversification of energy use: eotechnical, palaeotechnical, neotechnical, and biotechnical. Each of them has affected the manner in which the natural environment is shaped and treated in urbanised areas.

> Considering the process of industrial development, one can notice the cyclic nature of certain phenomena, arising from new requirements and technical capabilities. Lewis Mumford's breakdown can be understood as somewhat equivalent to a concept known as the **Kondratiev cycles** (1925), defining a period of dynamic economic growth and a subsequent period of stagnation (adaptation), recession, and finally recovery within each long-term cycle of economic conditions. Saturation with the cycle-specific technological innovations results in their gradual adaptation, dissemination and, finally, obsolescence, which provides the very grounds for further technological progress, already characteristic of a new cycle. Hampering the momentum of technological changes contributes to defining threats and new concepts as well as opportunities that shape the human environment. This process is inextricably linked with the

way in which the world is perceived and with the evolution of the planning ideas leading to improved quality of life and ecological balance in urbanised areas[2]. According to Kondratiev, a single long cycle of economic development lasts between 45 and 60 years. The transitions between cycles are mainly associated with major inventions, new technologies, manufacturing innovations, or new energy sources. To date, four such cycles have been documented. The first (1789–1845) was the Industrial Revolution and the beginning of great trade. The second cycle (1845–1896) was the era of railway, steam engine, and electricity, as well as the development of small businesses. The third cycle (1898–1949) was characterised by turbulent socio-political and economic changes, the advent of cars, chemicals, plastics, and further growth of large businesses. The fourth cycle (since 1949) is the age of biotechnology, nanotechnology, computer networks, and large multinational corporations[3].

Mumford claims that the first (eotechnical) phase, which lasted from the 10th to the 18th century, defined the time when mechanisation gradually displaced other economic activities. It involved the utilisation of environment-derived resources for human needs, including the power from wind, water and wood, while marginalising environmental problems and overlooking moral and social difficulties.

The greatest environmental, economic, and social changes for the development of cities emerged in the second phase, which began in the 18th century. Mumford highlights three major dates in this period: 1700 – beginnings of the industrial revolution, 1870 – climax of growth, 1900 – beginning of a rapid decline[4]. This period was associated with the phenomenon of the Industrial Revolution; it was a time of scientific discovery and technical invention, but also of population growth. The natural environment had become subordinated to economic, transport-related, and social factors. Starting from the 1840's and through to the early 20th century, the most industrialised countries saw a genuine economic boom. Industry began to interfere with almost all areas of human life, thus gaining a new and dominant city-forming function. The process of uncontrolled urbanisation gave rise to new forms of urban settlement, comprising multiple units and generally referred to as agglomerations or conurbations, whose siting was determined by the access to mineral resources[5]. These changes not only affected the spatial and functional development of towns, but also transformed their landscape to a considerable extent. Densely populated industrial agglomerations and large cities were exposed to the negative effects of excessive urbanisation and industrialisation. Their ecological balance had been upset, which was accompanied by constant human interference with the environment and exploitation of its resources.

The accumulation of social, environmental, spatial, and political problems became apparent in the second half of the 19th century. The pursuit of continuous improvements in mining and metallurgy, the dissemination of machinery which was supposed to bring harmony and social order to the society, and the decoupling of production from natural conditions came at the expense of the quality of human life. Considering the

[2] Juzwa N. 1988, op. cit., pp. 67–70.
[3] Schumpeter J. 1960. *Teoria rozwoju gospodarczego* (Theory of economic development). PWN, Warsaw; Piskozub A. 1976. *Kierunek rok dwutysięczny* (Destination – year 2000). PAX Publishing Institute, Warsaw; Juzwa N. 1988, op. cit.; Bartkowiak R. 2008. *Historia myśli ekonomicznej* (History of economics). Polish Economic Publishing House, Warsaw; Gasidlo K. 2010. *Kierunki przekształceń przestrzeni przemysłu* (Trends in the transformations of the space of industry). Publishing House of the Silesian University of Technology, Gliwice.
[4] Mumford L. 1966. *Technika a cywilizacja. Historia rozwoju maszyny i jej wpływ na cywilizację* (Technics and Civilization). PWN, Warsaw, p. 130.
[5] Malisz B. 1981, op. cit., pp. 55–64.

predominance of the machine as the driving force, a devastated and polluted natural environment, harnessed and subordinated to industrial activity, was perceived as something abstract. It did not count for it had no market value. What mattered was mainly the economic growth, measured by the indices of production and consumption. New towns were built on areas contaminated with industrial waste. The factories deployed within their boundaries did not take the existing natural conditions into account. The excessive exploitation of the natural environment and the disregard for the balance between production and consumption caused land surface devastation, air pollution, and damage to vegetation. The degraded elements of the natural environment, such as dumps or pits, were recognised as normal components of the human environment[6]. Overcrowded, missing adequate water supply, unprotected by any sanitary regulations, and unconnected with suburban open spaces, cities became sources of numerous social problems. The spatial separation of workplace and home as well as the transformation of the agricultural community into an industrial one were arguably the most important consequences of the spatial development of industry[7].

The next interval, namely phase three (neotechnical), spanning the period from the 1890's to the 1950's, laid new economic foundations based on the use of electricity, utilities, novel means of transport, and the production of plastics. Within this period, one could observe a new approach to urbanised areas, accompanying the process of intensification of the global economy and aligned with the principles of the Athens Charter of 1933. The functional division of the urban space represented a reaction to the effects of industrialisation, the over-concentration of urbanised areas, and the deteriorating living, working, and leisure conditions of urban communities. „Chaos has entered the cities," the Athens Charter proclaimed[8]. The reasons for the dwindling living conditions listed in the document included lack of access to green spaces as well as their inadequate use and insufficient amount.

Starting from the 1950's, the period of stagnation was followed by a phase of growth which lasted until the 1970's. It was founded not only on scientific innovations, but also on the advances in social and natural sciences, based on the observations of the behaviour and needs of living organisms. Lewis Mumford called this period the biotechnical phase. It coincided with a rapid progress of medical, sociological, and psychological sciences, aimed at improving the quality of human life and satisfying human needs. This also affected the principles according to which cities functioned, based on the biological analogies of symbiosis, social competitiveness, or succession and invasion[9].

While the idea of the Athens Charter was being disseminated, another phenomenon emerged, comprising the formation of networks of new towns around large agglomerations. They were intended to curb the uncontrolled urban sprawl and the ongoing influx of people from rural to urban territories.

> As the structure of big cities was being slackened in 1946 along with the establishment of the *New Towns Committee*, a network of satellite towns was created around **London**: Stevenage, Hatfield, Harlow, Hemel Hempstead, Bracknell, Ceawley, Basildon, and Welwyn. Some further examples of towns built from scratch included Livingston near

[6] Mumford L. 1966, op. cit., p. 132.
[7] Juzwa N. 1988, op. cit., p. 22.
[8] Athens Charter, 1933, I/8.
[9] The Chicago School of social ecology, mainly studying social processes and phenomena taking place in the urban space, formulated the concept of *urban ecology* – a scientific field dealing with the research of urban natural systems, on the one hand, and with the analysis of human-environment relations, on the other, all in the context of urban planning and management (Zachariasz A. 2006, p. 48; Szulczewska B., Kaftan J. 1996, pp. 15–16).

Edinburgh, Skelmersdale near Liverpool, or Cumbernauld and East Kilbride near Glasgow.
In 1965, following the English model, five new towns were planned to be built outside **Paris**: Melun-Senart, Evry, Saint-Quentin-en-Yvelines, Marne-la-Vallee, and Cergy-Pontoise.
The late 1960's and early 1970's saw the beginnings of a system of small satellite compounds (garden towns) of residential and commercial function developed in Sweden on the outskirts of large agglomerations. That is how the towns of Hialbo, Hammarkullen, Storas, Gardsten, Angered, and Rannebergen had emerged around **Gothenburg**[10].

Ushering in the development of modernism in urban planning, the Athens Charter triggered a significant change in terms of how urban structures were formed. An abundance of city models were developed with reference to the recommendations it contained (L. Hilberseimer's settlement unit, J. Voženílek's ideal industrial city, S. Koziński's concept of development based on an urban structural unit)[11]. Planning of the spatial and economic growth of the city became primary to its relationship with the natural environment and the spiritual values represented by a given community. While the enormous housing estates of the 1960's and 70's were being planned, their designers shunned traditional urban interiors, comprising streets and squares, and no attention was paid to creating and adding diversity to the urban landscape. The concept of house siting among the greenery was treated very schematically. In many cases, the emerging elements or vegetation clusters were arranged haphazardly, while tall greenery was almost non-existent. The predominant features included non-organised greenery and stretches of land overgrown with grass and weeds. However, it must be noted that some of the estates erected at that time actually provided their residents with access to green space. The huge modernist residential quarters built in Warsaw, composed of several to more than a dozen neighbourhood units, featured district parks ranging in size from a dozen to several dozen hectares. Some of their characteristics included meticulously selected tree and bush species, water used to compose spatial layouts, and pre-defined sports and recreation sites. These included the housing estates of Targówek Mieszkaniowy, built between 1974 and 1979, designed by architects M. Handzelewicz-Wacławek, Z. Wacławek and J. Kalinowski, or Bródno, designed in 1961 and extended in the 1970's according to a design by J. Szulecka and J. Stanisławski. Also many of the quarters of blocks of flats built of brick in Warsaw in the 1960's featured internal green spaces, designed and actually developed (districts of Saska Kępa or Żoliborz). One should definitely also consider the housing estates erected in the 1950's in Tychy, designed by K. Wejchert and H. Adamczewska, linked by green routes with public urban and suburban parks and forests.

The severance of bonds with traditional urban structures and urban composition, as well as the deterioration of cultural identity had left its mark on urban communities. As Wacław Ostrowski noted: „Postmodernists claimed[12] that the *green city* idea had fallen by the wayside, while calling for a return to fringe development and a traditional street"[13].

[10] Masztalski R. 2005. *Przeobrażenia struktury przestrzennej małych miast Dolnego Śląska po 1945 roku* (Transformations of the spatial structure of small Lower Silesian towns past 1945). Publishing House of the Wroclaw University of Science and Technology, Wroclaw, p. 14.
[11] Niezabitowska E. 1987, op. cit., p. 76.
[12] Ostrowski W. 1996, op. cit., p. 246 [translated from Polish by Łukasz Borkiewicz].
[13] At the turn of the twentieth century, postmodernism contributed to a return to the mistakes of the nineteenth century urban planning, introducing maximally large residential areas to small sites already developed for investment purposes without ensuring that they had access to greenery.

Consequently, in light of the problems related not only to expansion, but also to urban fabric revitalisation, public health, and improvement of living conditions, the need to link cities with the natural environment as well as landscape identity building lost their importance.

Meanwhile, industrial civilisation was transforming ever larger stretches of land into urbanised space. Successive industrial development plans translated into growing exploitation of nature and human resources, increasing pollution and environmental nuisance, exacerbating the conflicts between economic growth and the need for environmental protection. All these developments made it necessary to search for remedies. Depending on the level of industrial civilisation, different methods were employed to counterbalance environmental and social threats. These included concepts to change the spatial structure in cities and agglomerations, aimed at reducing the concentration of industry in urbanised areas, most of which ultimately proved to be costly, yet ineffective[14]. Some examples of the foregoing are the agglomeration decentralisation and spatial development programmes for London and Paris, or the Upper Silesian Industrial Region (GOP) deglomeration plans. The consequences of this process included vacant spaces left behind, known as *post-industrial wasteland*, characterised by devastated natural environment, contaminated soil, polluted water, waste dumps, and numerous pits. They had a disruptive effect on the surrounding built-up areas, which gradually succumbed to recession[15]. What all these developments had also entailed was devaluation of the urban fabric surrounding industrial brownfields as well as negative social impacts.

Other attempts to mitigate the imminent threats became apparent in the prescriptive measures introduced to minimise their impact, including: protection zones for individual emission sources, vegetation buffers surrounding industrial facilities, or protective filters underneath towns, industrial plants, or transport routes. Passive protective measures were reflected in the attempts to provide settlement areas with adequate ventilation, using dump sites as screens to direct air runoff, and using artificial water bodies as land development features[16].

> In Poland, it was the Regulation of the Council of Ministers on the principles of establishing and managing protection zones, arising from the provisions of the 1980 Act on the protection and shaping of the environment, that specified the matter of designating and managing **protection zones**. Within the zones surrounding facilities emitting pollutants which could not be eliminated or reduced by technical measures, the construction of residential buildings, leisure facilities, permanent residence facilities, allotment gardens, as well as sports and recreation facilities was prohibited. All these areas could only be developed through afforestation or tree and shrubbery planting. They formed protective barriers of high green belts, mixed with areas of low greenery and grassland, allowing adequate ventilation or movement of pollutants. Depending on the results of the air pollution and noise emission measurements or the dust and pollutant concentrations, they stretched on areas ranging between 50 and 1,000 m in radius around the site, or sometimes even further[17]. And yet the effectiveness of such measures was rather negligible. This was due to the state of

[14] Malisz, B. 1981, op. cit., pp. 69–72.

[15] Pietri J. 1980. *Ugory przemysłowe i readaptacja obiektów przemysłowych* (Post-industrial fallows and re-adaptation of industrial facilities). After: Juzwa N. 1988, op. cit., p. 61.

[16] Niezabitowska E. 1987, op. cit., pp. 102–103.

[17] Klemens J. 1993. *Przestrzenne i prawne uwarunkowania kształtowania stref ochronnych* (Spatial and legal determinants of buffer zone development). In: Scientific Journal of the Silesian University of Technology, no. 1132, *Architecture* series, book 20, Silesian University of Technology, Gliwice, pp. 83–90.

> development of the protection zones (high share of residential development), the inappropriate delimitation of boundaries, not matching the range of impact of the production activity, and the relationship between the dynamics of change of industry and the pursuit of planning goals[18].

In the 1960's and 1970's in Western Europe, and starting from the mid-1980's in Poland, as the decentralisation of cities and the transformation of state controlled economy into free market economy progressed, the process of abandoning exploited sites and facilities by the industry accelerated[19]. This resulted in making considerable stretches of land situated in attractive urban spaces available for siting purposes. At the same time, transformation of derelict or degraded brownfield sites became an issue. These transformation efforts were not aimed at restoring the former natural fabric of the areas in question, but at creating a new functional and spatial arrangement of urbanised areas, shaping new social, cultural, and natural structures, and building a new image of post-industrial cities and agglomerations. The emerging third generation of urban agglomerations, following the cities of the pre-industrial era and the industrial cities, was meant to create new urban systems and structures based on the transformed natural environment, in line with the concept of sustainable development.

At the end of the twentieth century, one could observe several model examples of incorporating the natural environment into the process of renewal of degraded post-industrial urbanised areas and their landscaping. Some of the best implementations of this kind include the endeavours undertaken in the north of the Ruhr under the IBA Emscher Park project[20] (1989–1999), in Lower Lusatia – IBA Fürst-Pückler-Land (2000–2010), in the Aachen/Maastricht/Liege region (Meuse-Rhein Euroregion) – the EuRegionale programme (2008), or in the French region of Nord-Pas-de-Calais (1990's).

The problem of industrial brownfield transformation and reuse was included in the agenda of a wider process of the urbanised landscape renewal.

2.2. Greenery in urban development

The history of town construction reveals the duality of human nature. On the one hand, there is the tendency to juxtapose dwelling places with nature, and on the other hand, one seeks to live close to nature. As a result of this dichotomy, the approach to the use of the natural environment as an element of the composition, landscape, and spatial order of urbanised areas has changed throughout the civilisation's evolution and history.

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[18] Juzwa N. 1988, op. cit., p. 94.

[19] Gasidło K. 1998, op. cit., p. 14.

[20] The tradition of international building exhibitions (IBA) in Germany dates back to the early 20th century. The initial four editions were held between 1901 and 1904 in Darmstadt-Mathildenhohe. In the 1930's, new forms were sought for buildings and housing estates (the Werkbund exhibitions, including the Weissenhof housing development in Stuttgart), while in the 1950's, IBA Interbau 1957 in Berlin dealt with the problem of reconstruction of the towns destroyed during the war. Another exhibition held in Berlin (IBA Alt 1977–1987) focused on the restoration and promotion of inner-city areas. Drawing from the achievements of the latter, the IBA Emscher Park 1989–1999 international building exhibition represented an attempt to transfer the experience of operational planning at the city scale to the regional planning level. IBA Fürst-Pückler-Land 2000–2010 prioritised landscaping problems. IBA Urban Redevelopment Saxony-Anhalt 2010 returned to cities, presenting 15 different urban concepts and tools for urban renewal. The latest edition of the exhibition, IBA Hamburg 2006–2013, has attempted to answer the question about the future of multinational metropolises in the age of globalisation.

Fig. 1. *The Garden of Love*, a painting by Hieronymus Bosch, ca. 1450

Fig. 2. Early Renaissance garden, Palazzo Piccolomini in Pienza, Tuscany, 1459

Fig. 3. Renaissance garden, ca. 1565; *Spring*, a painting by Pieter Brueghel

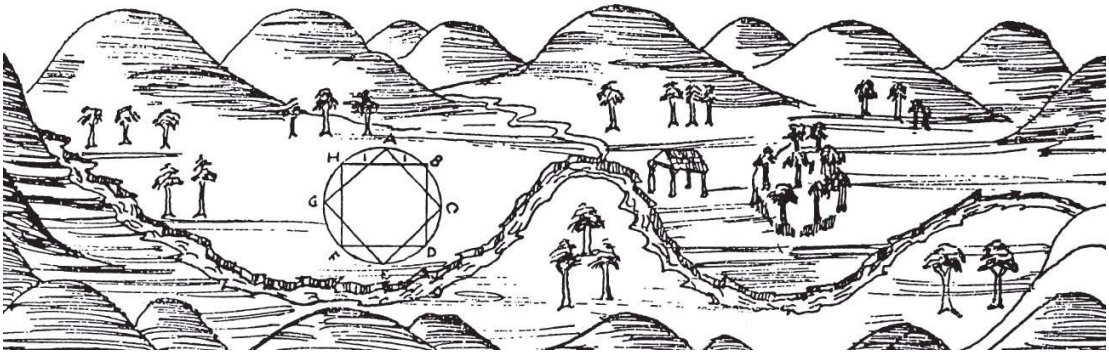

Fig. 4. The Ideal City of Sforzinda, Antonio Averlino Filarete, 15th century

The coupling of all these relationships became evident as early as in the ancient Greece and Rome, where the geometric regularity of streets and building compounds was opposed by the need and desire to live outside the city. It was in the suburban and rural manors (Roman *villa suburbana* or *villa rustica*) that their residents sought contact with nature. What also contributed to the pursuit of this goal was the small private gardens and the rather scarce tidy green spaces to be found inside urban areas[21]. Typical of the Roman civilisation were small green squares situated inside urban quarters as well as public gardens located outside the city (*pratum commune*). Many park areas, usually owned by the rich, were not accessible to the rest of the urban population[22].

In the Middle Ages, even though nature was considered by the Church to represent the profane sphere, and *shutting oneself away* from the surrounding nature was a rather common trend[23], one could actually make contact with it as soon as the city walls were left behind.[24] That is where one would find woodlands, fields, and waterside areas, initially remaining in private use, and over time rendered available to a wider range of visitors. The *pratum commune* gardens as well as floral meadows, known as gardens of love, continued to function, providing city dwellers with space to meet and have fun[25]. Also the locations of suburban villas, blending into the surrounding nature, were growing in importance.

During the Renaissance, the geometry of the urban spatial structure started being adapted to the local topography. More and more greenery was introduced within the city walls. Natural landscape motifs became important as they began to appear in the composition of urban interiors. The suburban zone gained in importance as well, and not just as a backup land for the growing city, but as a place of leisure for town dwellers or a means of escape from the crowded and polluted city.

In the 15th century, Leon Battista Alberti praised the life in suburban villas, claiming that the people who dwelled there could live in an environment which was healthy and beautiful, thus making them nobler. Moreover, their places of residence overlooked both the green countryside and the city[26]. Alberti (1462) also proposed specific principles concerning the location, climate, and compositional methods for establishing links between natural elements and the city, in which he demonstrated the relationship between the city and the surrounding nature, and strived to make people sensitive to landscape quality[27]. Similarly, in an attempt to explain how sites for the construction of suburban and rural houses are chosen, Andrea Palladio (1570) referred to being liberated from the city's hustle, bustle and congestion on the upside, while in return he proposed a „cheerful, pleasant, comfortable, and healthy" life in contact with nature and the vastness of

[21] Jellicoe G.S. 1975. *The landscape of man. Shaping the environment from prehistory to the present day*. Thames&Hudson, London, pp. 117 and 129.
[22] Ostrowski W. 1996, op. cit., p. 286.
[23] In the urban space, greenery was reduced to small church cemeteries as well as castle and monastery gardens. They performed utilitarian functions in the first place. They were primarily meant to allow an escape from the world than to enable actual contact with nature, the latter being treated rather symbolically.
[24] Böhm A. 2006, op. cit., p. 23.
[25] The outskirts of English settlements saw the areas typically known as *commons* (communal and municipal areas) to develop, traditionally intended for recreation purposes. They were the prototypes of green squares, being gradually surrounded by buildings. Further popular forms of development included hunting grounds or animal gardens, which were the prototypes of parks. In the early 14th century Italy, meadows were developed for the purposes of recreation and entertainment of residents on the outskirts of cities such as Siena and Florence (Böhm A. 1994, p. 20; Zachariasz A. 2006, p. 28).
[26] Ostrowski W. 1996, op. cit., p. 209.
[27] Alberti L.B. 1960. *Ksiąg dziesięć o sztuce budowania* (On the art of building in ten books). Warsaw, p. 20.

landscape, where one can „live as happily as it is virtually possible here on earth"[28]. One can notice an accurate reflection of the change in the attitude towards nature in urbanised systems in the siting of the Renaissance city model. In the 15th century concept of the ideal city having a star-shaped layout, its author, Antonio Averlino Filarete (Sforzinda, 1460–1464), highlighted not only the environmental factors related to a specific location, its climate, and the elements which bring harmony, order, and comfort to human life, but he also recognised nature's potential, suggesting that towns should be sited next to hills with woodlands for recreation purposes[29].

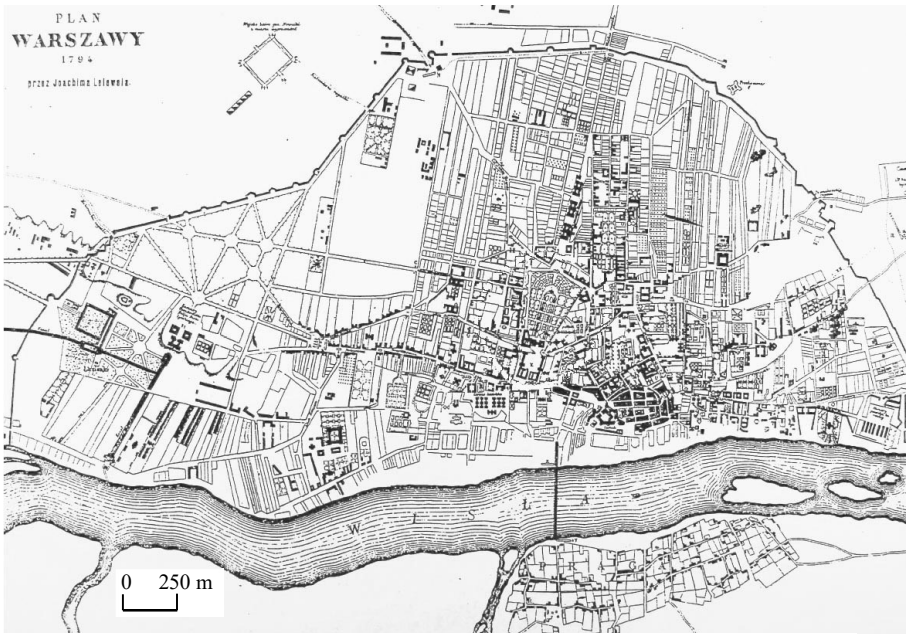

Fig. 5. Plan of Warsaw from 1794, showing the King Stanislaus Axis and the Saxon Axis

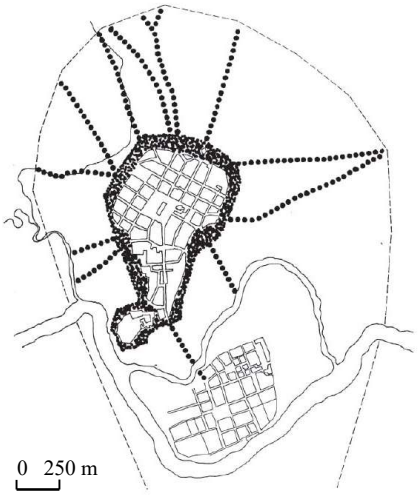

Fig. 6. The Planty park ring in Krakow, 1820–1830, including its radial lay.out of avenue-like streets; mid-19th century plan

Fig. 7. Bath, 1727–1770, the *crescent* residential compound against the city structure; 18t.h century plan

[28] Palladio A. 1955. *Cztery księgi o architecture* (The four books of architecture). PWN, pp. 117–118 [translated from the Polish language version by Łukasz Borkiewicz].
[29] Giedion S. 1968, op. cit., pp. 66–72.

It was also then that the link between the natural elements and the city was increasing its scale. Initially, this relationship pertained to the settlement system itself. Over time, the undeveloped, open stretches of land adjacent to or surrounding urbanised areas began to be perceived as the elements which added diversity to and shaped the city fabric by providing pleasant views. Not without a reason, it was during the Renaissance that the idea of nature being superior to art emerged. Although undefined, this relationship actually determined the link between the urban fabric and the natural factor in both architectural and urban planning terms[30].

In the Baroque era, when emphasis was clearly put on the composition factor, it was considered fundamental to search for functional and aesthetic relationships between the essential elements of the urban landscape: cultural and natural. When transformed, composed, and planned, nature was used to make the city more aesthetically appealing[31]. What could be noticed in the geometrisation of the 18th century urban space was the connections between building compounds and nature as well as between built public space and green areas. The use of undeveloped land connected with the natural environment acquired importance with respect to urban organism shaping. In line with the idea of nature harnessing (*forcer la nature*)[32], suburban open spaces were also subject to design processes (Versailles 1661–1708). Greenery or water started being used as the elements which co-created the built-up space, only to become integral components of the urban and extra-urban organism, forming abundant park compounds surrounding not only manors, but also inner city buildings. This heralded changes in the lifestyle of urban communities. There were attempts to seek spatial relationships between work, home, and leisure, linking nature to every aspect of human life. This phenomenon became particularly evident in the late Baroque. On the one hand, it manifested itself in the search for ways to come in contact with nature through recreation outside the city as well as building houses in the countryside, while on the other hand, the economic values of open spaces finally gained recognition (e.g. residential compound in Bath, England, 1727–1770).

It was in this period that linear urban concepts started being implemented more and more frequently: boulevards or promenades formed on ramparts or in the place of demolished urban fortifications[33]. These were **the first examples of urban spaces being reclaimed and reused: originally *redundant* from the perspective of the proper development and functioning of a growing city, and transformed with nature in mind**. The areas thus developed were used for recreation purposes, offering abundance of greenery and particularly attractive facilities. Walking paths, playgrounds for children, horse trails, and viewpoints represented the attempts to satisfy the inhabitants' demand for public green space.

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[30] Böhm A. 2006, op. cit., p. 30.

[31] In Poland, a characteristic example of how green spaces can be incorporated into the urban fabric was the urban planning and landscaping projects completed in Warsaw in the 18th century, such as the Saxon Axis or the King Stanislaus Axis. Urban parks, rendered accessible to the general public, were created in the late 18th and the early 19th century, including: Ujazdów Park in Warsaw, the Planty garden ring in Krakow, the Saxon Garden in Lublin, as well as the increasingly numerous botanical, zoological, exhibition, or spa parks (Zachariasz A. 2006, op. cit., p. 35).

[32] Giedion S. 1968, op. cit., p. 165.

[33] There were cases where the city walls were relocated up to three times as the city grew. Once they had been ultimately removed, the outer moats remained, only to be backfilled and planted with trees, thus forming ring-shaped parks (Polish *planty*). This way, the first systemically arranged layouts were created. The ring type systems are still characteristic of historic cities, and the ring-shaped parks are usually maintained as representative of the heritage greenery surrounding former city centres.

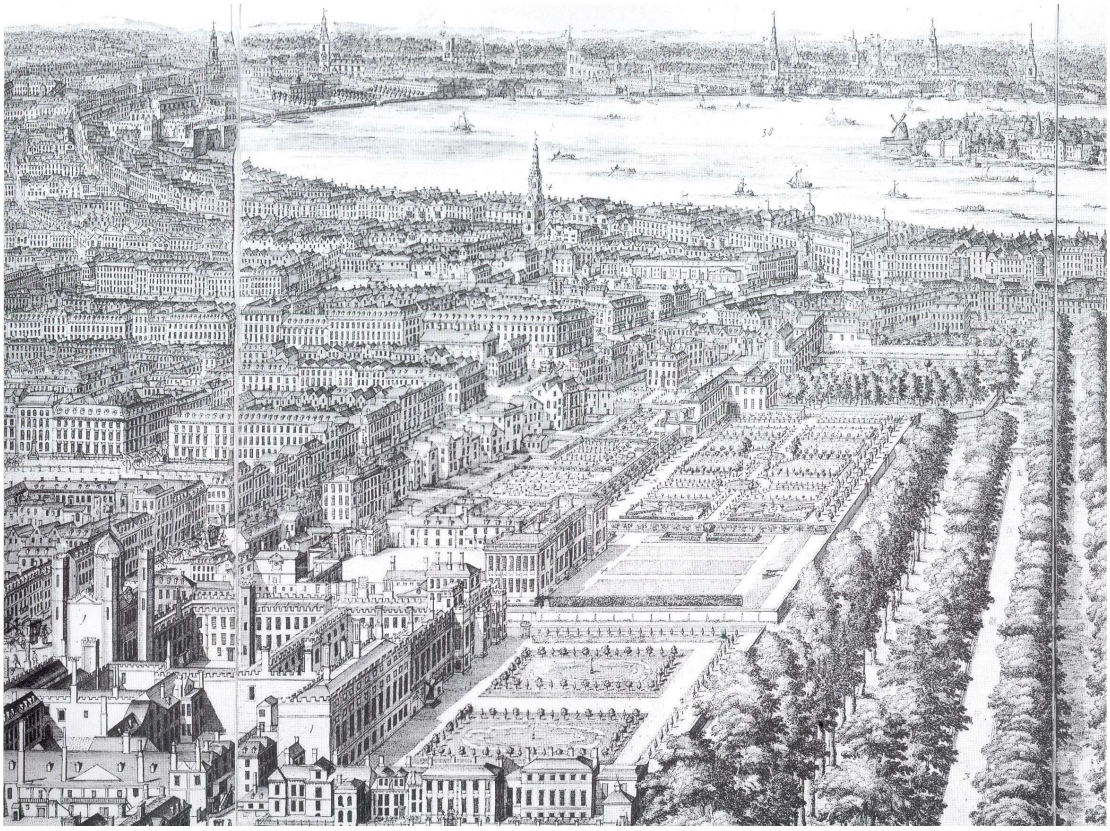

Fig. 8. London, St James' Park, early 18th century; etching by Johannes Kip

Fig. 9. Prior Park Landscape Garden in Bath, 18th

Avenues and promenades linked the major highlights in the city space. Green spaces started being visited by more and more people. It was then that private gardens began to be rendered accessible to the general public, and the very first public facilities, such as municipal parks, lawns, tree-lined streets, and squares designed in a garden fashion, were established. All these new green spaces were developed next to palace compounds, sited within the core urban fabric or in the space newly acquired by overstepping the boundaries of former fortifications.

One of the achievements of the British urban planning was a green city square surrounded by built features, which started emerging as early as in the seventeenth century. London's green squares of Covent Garden (1630), Bloomsbury Square (1665), Soho Square (1681), or Grosvenor Square (1695) became model designs in this respect. What they effectively brought into the urban landscape was public greenery, thereby raising the living standards of city dwellers. Fifteen of them were arranged in the 18th century, but their greatest evolution took place in the 19th century. It was then that the royal gardens of Hyde Park, Kensington Gardens, Green Park, or St James' Park were developed in central London, ultimately to be opened to the general public. Altogether, they formed a network of green areas that shaped the spatial image of London[34].

The 18th century witnessed the formation of extensive residential and garden suburbs, gradually encapsulated within city borders (e.g. the Świdnickie suburb in Wrocław), as well as the concept of linking human settlements with their vast surroundings (e.g. the Royal Saltworks at Are-et-Senans in the Forest of Chaux, designed by C. N. Ledoux, 1773–1779). In the late 18th and early 19th century, new types of parks, special-purpose gardens (botanical, zoological, open-air museums), sports and recreational grounds, and the accompanying green spaces or forest parks began to emerge in cities. They were intended to serve the purposes of leisure, meetings, and sports activities, thereby representing a new category of public space, accessible to all social strata. In Germany, people's parks (*Volksgarten*) started being established at the end of the 18th century, with the entertainment aimed at the bourgeoisie in the focus. They had inspired the founders of what later became culture and leisure parks. The second half of the 19th century also saw the birth of allotment gardens, which did not become widespread until the 20th century.

By subduing nature, people often tended to put it in geometric frames. This was particularly evident in the garden compositions, which considerably grew in scale over time, only to become an integral component of the urban fabric. Such an approach contrasted with the English examples of landscape parks, representing affirmation of nature in its original form, geometry being replaced by free-form layouts. It was there that, for the first time, nature ceased to play a secondary role in relation to people, thus becoming their friendly and equal partner, bringing them inexhaustible benefits, providing opportunities for relaxation and spiritual comfort[35]. The romantic gardens of the early 19th century exhibited worship of untamed nature, and yet its idyllic reflection was frequently as artificial as the geometric vision of nature. What proved conducive to their conception was the philosophical views of David Hume, formulated in 1740 in his *Treatise on Human Nature*, the trends and ideas which had led Jean-Jacques Rousseau to worshiping the *natural man*, as well as the general demands for man's return to nature.

[34] Giedion S. 1968, op. cit., pp. 683–961; Morris A.E.J. 1994. *History of Urban Form: Before the Industrial Revolution*. Harlow, pp. 262–266; Böhm A. 1994, op. cit., p. 51; Ostrowski W. 1996, op. cit., p. 212.
[35] Jellicoe G.S. 1975, op. cit., p. 233.

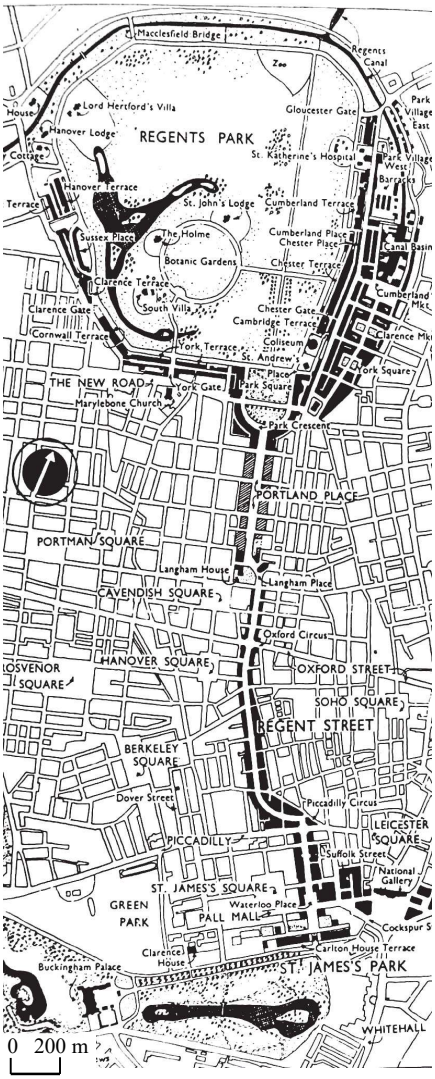

Fig. 11. Plan of Regent's Park in London, 1820–1830

Fig. 10. Regent's Park in London, bird's eye view, 2011

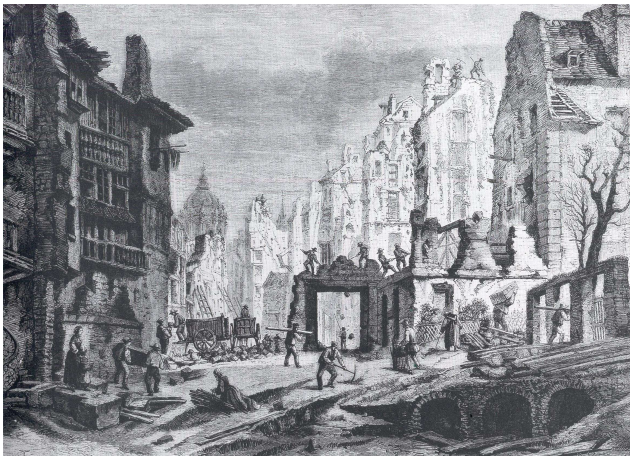

Fig. 12. Redevelopment of Paris under G. E. Haussmann, 1858

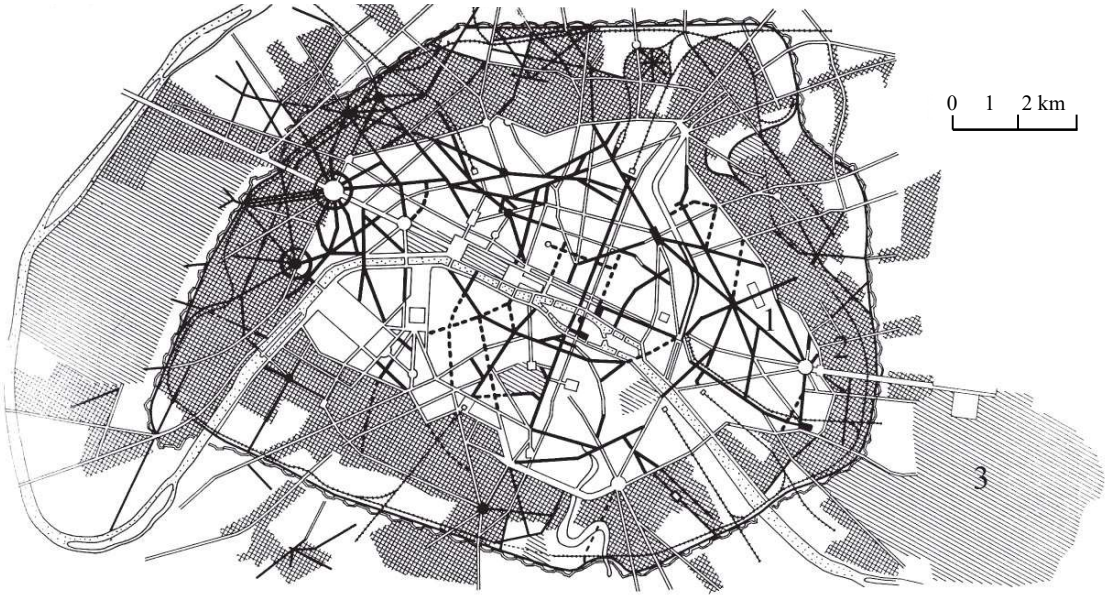

Fig. 13. Outline of Haussmann's main works conducted in Paris in the 19th century: 1 – new streets, 2 – new construction sites, 3 – new parks

The variety of measures undertaken at that time had increased the interest in bringing the natural factor into the urban scale. Urban green spaces gradually became elements of the natural system, designed with reference to the urban layout and suburban greenery.

> The project which clearly stood out among the ventures which utilised greenery in shaping public spaces within the urban structure was **Regent's Park in London** (1820–1830), designed by John Nash. What it envisaged was that an extensive park complex should be established, surrounded by a walking path, linked with residential and commercial buildings, as well as with a diversified transport network. Plots of land were delimited within the park area for exclusive villa development and a ducal residence. The park was intended to serve economic, utilitarian, aesthetic, and prestige functions. According to Nash, it was to be a private garden city for the aristocracy, surrounded by a ring of residential buildings. However, this project was never to be completed in its entirety. Nevertheless, the greenery was actually utilised here as a factor that raised the attractiveness of the housing to be sited in the vicinity, rather than as public greenery. One may conclude that, in a way, the needs of the city dwellers gave way to the interests of a selected target group, in this case[36].

A breakthrough in the design of urban green spaces was the effort aimed at addressing them in the planning process associated with the rapid urban development and regeneration. One of the most important examples of the foregoing was the large-scale redevelopment of Paris, conducted between 1853 and 1869 and managed by Georges Eugène Haussmann. It represented an attempt to create a vision of an ideal city of a harmonious structure.

> **Georges Eugène Haussmann** wanted Paris to be the first of the largest cities to be adapted to the requirements of the industrial era. On the other hand, his idea was to create a framework for the great tradition and heritage preserved in Paris. His plans involved establishing a network of public spaces whose inherent feature would be redesigned or newly created green spaces. What it brought to life was, among other accomplishments, wide tree-lined streets, such as the avenue of Champs-Elyseés, or urban garden sites like green squares, boulevards, promenades, or parks[37]. The 19th century squares designed by Haussmann, abounding in greenery and modelled on the squares of London, constituted public spaces located in the busiest parts of the city. The boulevards were meant to carry all kinds of vehicular traffic. One of their characteristics was the rows of tall trees. Commercial facilities or famous cafés were set up in their direct vicinity. What Haussmann developed in Paris was a system of parks based on the model of English landscape gardens. Their purpose was to provide the city with an opportunity to connect with nature, and to serve all those who used the public urban space for recreational, aesthetic, or scenic purposes. One of the deliverables of this redevelopment project was the Monceau public park established at the very city centre. There were also parks created on vacant and degraded areas: Montsouris in the south, and Buttes-Chaumont in the north. Designed with impressive panache as the venues of entertainment and leisure for those who enjoyed walking, suburban and urban parks,

[36] Giedion S. 1968, op. cit., pp. 702–708.
[37] In the 19th century, following the Parisian example, boulevards were developed in all major European cities (e.g in. Vienna, Leipzig, Brussels, Prague, Wroclaw, or Szczecin). Only English cities shunned them (Czarnecki W. 1968, p. 359).

> gardens, green squares, and promenades created a proper system of green spaces which blended into the city fabric. In consideration of the need to improve transport and the population's health, Haussmann's plans also covered the city outskirts, which, together with the open areas and the forest parks to be found there, set new development trends. The idea was to create a green belt around the whole of Paris, along the line of the city fortifications. This belt was assumed to completely encircle the city, thus connecting the two large parks in the east and west. It was to be formed by huge gardens with avenues for the residents of the new suburbs and the adjacent communes. This plan was never accomplished. The green belt territories were later utilised for six- and seven-storey residential buildings, which effectively restricted the development of Paris, no less than the fortifications had done before. What remained of all the developments planned was only the two parks (Bois de Boulogne and Bois de Vincennes, developed in the second half of the 19th century) with an area of approximately 800 ha each[38].

The spatial structure of the nineteenth-century cities was mainly determined by the processes associated with industrialisation and urbanisation. And since these were dynamic and spontaneous processes, the rapidly sprawling cities developed chaotically. As a consequence of the abrupt and rapid industrial boom observed in England, France and Germany, entire new quarters emerged in the immediate vicinity of manufacturing plants, densely developed with terraced houses, predominantly of the initiative of local authorities or factory owners. Initially, they were sited in rural areas, since production was largely dependent on natural conditions. The birth of the steam engine made it possible to build industrial plants within urban quarters. Workers' housing estates that emerged around them formed large stretches of monotonous residential development where greenery was of marginal importance. The compositional arrangement of only very few of them heralded the advent of the *garden city* concept. They were characterised by low standards of residential, industrial, and warehouse development. „Separated from the countryside by miles of cobbled streets, children did not know the sight of fields and farmsteads; they did not know what violets, lilies or buttercups looked like; they did not know the smell of mint, rose and acacia, of freshly ploughed land, of hay drying in the sun, of the pungent scent of seashore or of salty marshes"[39]. The society reacted to all these issues with an urge to escape from mechanised civilisation.

The rationale behind using natural elements was rather to add variety to the geometric monotony of cities, while it was definitely less frequently associated with attempts to improve the quality of life. Consequently, at the end of the 19th and the beginning of the 20th century, urban planners started searching for concepts that would enable them to solve the problem of green space development aligned with city dwellers' needs. They began to recognise just how important nature's impact was on the functioning of the city, its surroundings, and human life. Green spaces gradually became an element which was intentionally used by urban planners to shape the spatial structure of urbanised areas[40].

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[38] Giedion S. 1968, op. cit., pp. 712–746; Wagenaar M. *Haussmann, Baron Georges-Eugène*. In: Hutchison R. (ed) 2010. *Encyclopedia of Urban Studies*. Vol. 1, Sage Publication Inc., pp. 344–346.

[39] Mumford L. 1966, op. cit., p. 151 [translated from the Polish language version by Łukasz Borkiewicz].

[40] It was not until the mid-19th century that the first legal regulations concerning the use of green spaces in cities appeared. *An Act Promoting the Public Health* was introduced in England in 1848, imposing an obligation to establish public gardens on the cities where none had existed yet. This initiated a process which led to urban green spaces becoming subject to legal forms of protection. The year 1859 saw the enactment of the *Recreation Grounds Act*, and the *Open Spaces Act* was passed in 1881 in England, creating further opportunities for establishing and planning green spaces.

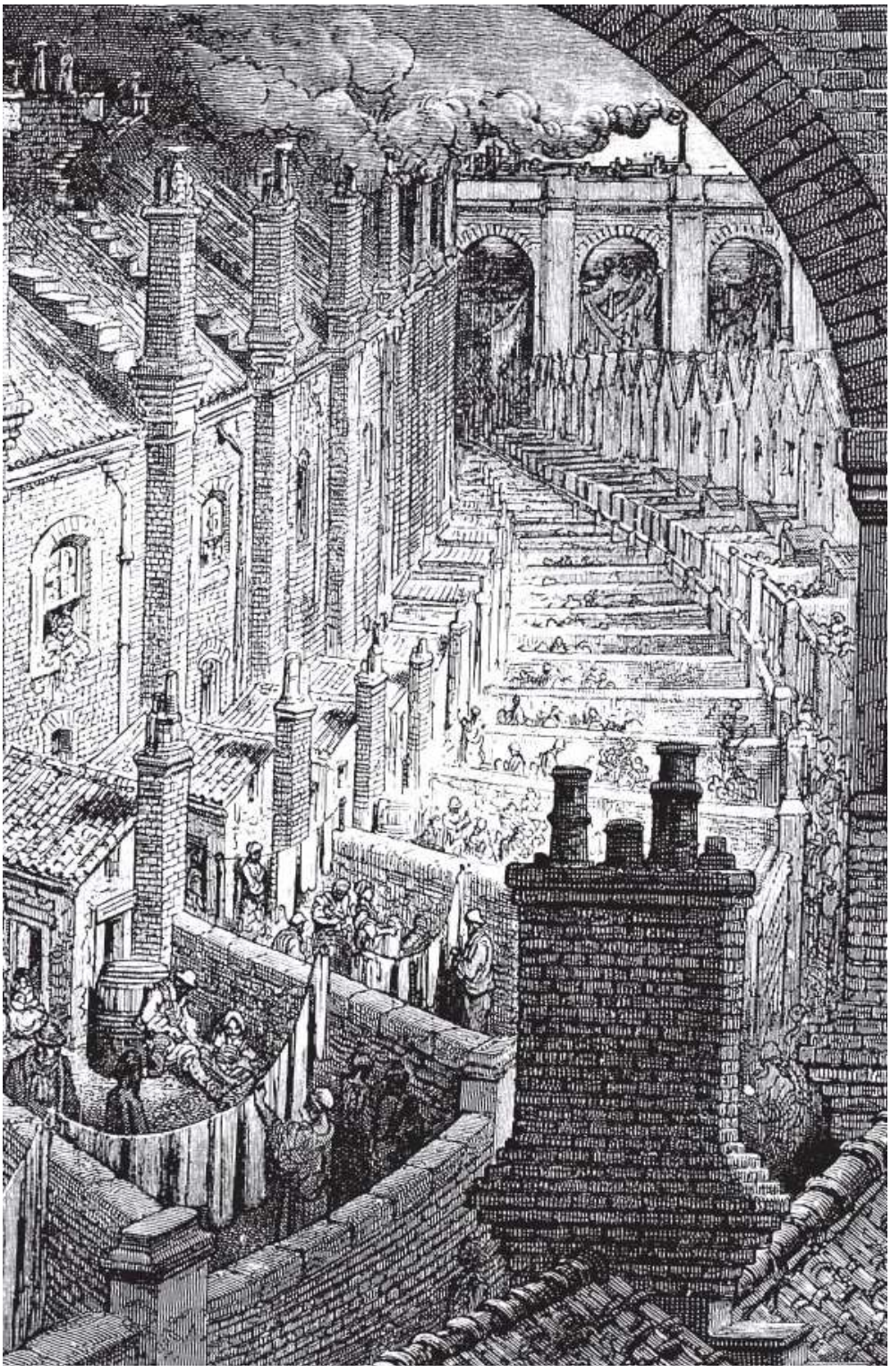

Fig. 14. London city district of the late 19th century, Gustave Doré

A watershed moment for the development of green spaces in cities was their incorporation into the urban planning process. The laws passed in England in the 20th century concerned matters such as national parks and access to open spaces (*National Parks and Access to the Countryside Act*, 1949), planning of towns and peri-urban areas (*Town and Country Planning Act*, 1947), or urban development (*Town Development Act*, 1952) (Böhm A. 2006, op. cit., p. 45, Zachariasz A. 2006, op. cit., p. 33).

The pursuit of a harmonious linkage between the place of human habitation and nature was clearly evident in various models of urban settlement, plans of cities and regions, as well as in the ideas disseminated by the reformers, theorists, and practitioners of urban planning. The common denominator of these diversified concepts was the search for a way to make the most of nature with human needs in mind while taking into account the very essence of the relationship between people, work, place of residence, and leisure.

2.3. Urban planning visions of the 20th century cities

Urban planning scholars had been looking for a vision of cities with higher technical, utilitarian, and aesthetic qualities since the late 19th century. The diverse planning efforts undertaken by idealists, social scientists, or representatives of various scientific disciplines pursued a city of ideal structure and functionality. Theorists perceived green spaces as a factor which crystallised the city structure, yet no theory had become a universal model of the ideal city. Many of such concepts were based on a **radial-concentric model of spatial urban development**.

Numerous model visions of urbanised space emerged in response to the ever intensifying processes of industrialisation, urbanisation, urban concentration, rapid urban growth, as well as dispersion of development. Many of them belittled the importance of green spaces (consider the following concepts: an alternative form of urban settlement proposed by Robert Owen (1817) – New Lanark, Scotland (1800–1825), and New Harmony, Indiana USA (1825); Charles Fourier's idea of phalansteries (*phalanstére*) (1822)). Successive city models incorporated systemically organised green spaces into the spatial structure. The model of radial arrangement of green spaces emerged in the 1920's, in Adolf Rading's „schematic plan of the great city of the future." The wedge- and ring-shaped natural system was characteristic of Paul Wolf's model of a three-sector garden city (1919). One of the earliest planning projects to use elements of nature in order to balance out the needs of the urban population as well as to develop a harmonious urban structure was the 1829 plan to introduce concentric rings of greenery into London, as proposed by John Claudius Loudon. Loudon arranged the open spaces surrounding London so as to delineate areas for future urbanisation and rural zones. What he also suggested was to keep some of the former suburban meadows (*commons*) unfenced, to be used by the general public for recreation purposes. This concept paved the way towards conscious and informed formation of green spaces, considered as a factor in maintaining control over the urban sprawl phenomenon[41]. Theodor Fritsch's concept known as the *city of the future* (1896) is particularly noteworthy among the theoretical models. It represented the first attempt to slacken the compact layout of urban development by introducing *green wedges* accompanying traffic routes, converging from the peripheries towards the inner city[42].

The problem of urban healing was troubling to many, but everyone addressed this issue in a different manner. Next to the purely idealistic aspect of the problem, also its economic side – i.e. the profit and loss calculation and especially the land price – was considered very significant. There were two noteworthy trends in the urban planning concepts conceived during the first half of the twentieth century, both related to the way

[41] J.C. Loudon's idea preceded Ebenezer Howard's concept by 70 years, and Patrick Abercrombie's *Greater London* plan, introducing the green belt – by 115 years.
[42] Malisz B. 1981, op. cit., p. 183.

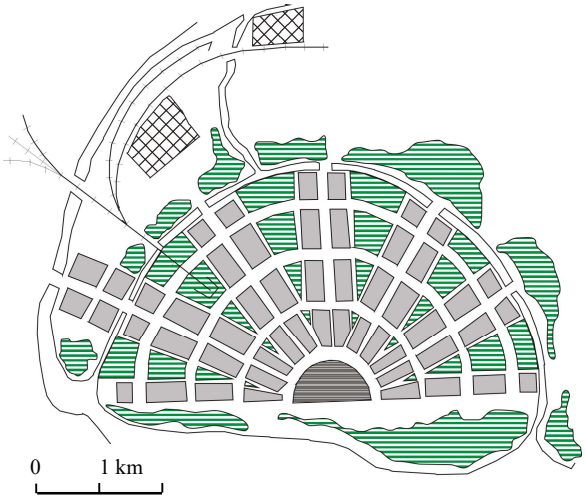

Fig. 15. Theodor Fritsch's model of 1896; author's elaboration based on: Malisz B., 1981

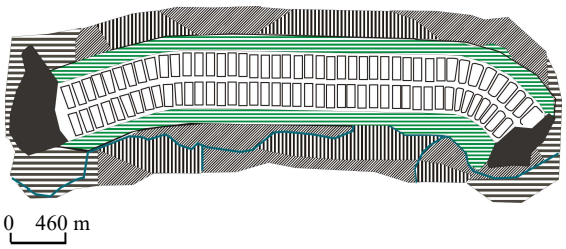

Fig. 16. Linear city model of 1882 by Arturo Soria y Mata; author's elaboration based on: www.urbanity.es [accessed on 2011]

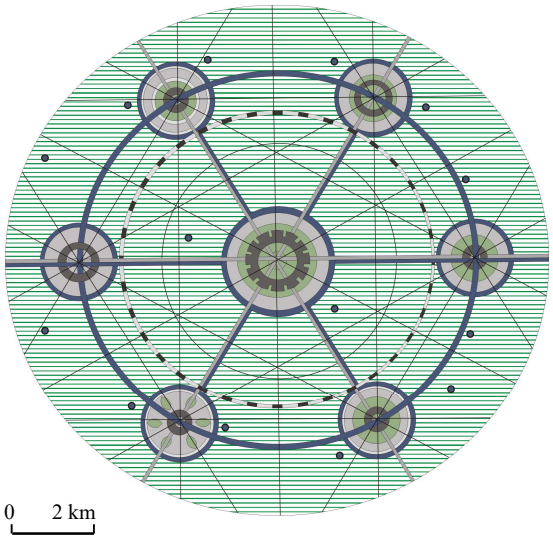

Fig. 17. Ebenezer Howard's *Social City* model of 1898, depicting a complex of six garden cities, arranged around the Central City, having a total area of 267 km^2 and a population of 250,000; author's elaboration based on: Howard E., 1898, diagram no. 7

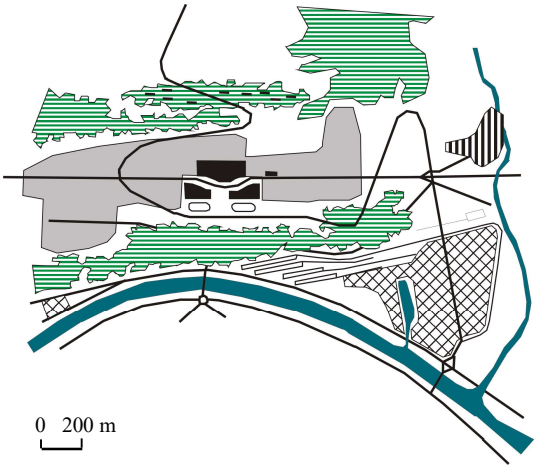

Fig. 18. Tony Garnier's industrial city model of 1901; author's elaboration based on: Malisz B. 1981

green areas were treated in the spatial structure of the city. One was Ebenezer Howard's garden city (1898), whose main idea was to reduce the city size and the influx of people from the countryside.

Ebenezer Howard's concept was supposed to provide a solution to the housing problems of the late 19th century. It was created to prevent and restrict the sprawl of large cities, frequently dominated by chaotic building development or industrial districts. It was based on the concentric model, being in fact the very first attempt to create a de-concentrated model, where units of 32,000 inhabitants were thought to function as independent organisms, forming satellite systems gradually being developed around larger cities[43]. Seeking functional and aesthetic harmony in the relation between the city and open spaces, Howard introduced zoning for both agglomeration and satellite town scale[44].

This idea decisively determined the relationship between work, home life, and leisure, as well as between the city and its suburbs. It showcased the essence of the link between urban areas and the natural landscape, and defined the role of open spaces, making them relevant to the city structure. These areas ceased to be the mere *not yet developed* lands, became proper subjects in the discourse, and gained their character. The garden city externalised the economic and climatic advantages of living outside the compact urban structure. Howard believed that the city should be an integrated unit of efficient, healthy, and enjoyable living. His idea was to create an attractive environment for human habitation, mainly by emphasising the need for the development of public spaces and by introducing landscaped green spaces into the urban fabric[45].

Although Howard's idea enjoyed great popularity and won many acolytes in England, the United States[46], France, Germany, as well as in Poland[47], the garden city concept never

[43] Its superiority was proved through its adaptation under the London deglomeration concept (as proposed by C.B. Prudom), according to which the small towns around the great city were to be developed into units of roughly 32,000 inhabitants. The open spaces, mostly used for agriculture, stretching around each of them, were to protect them from merging. However, the garden cities which had been completed, i.e. Letchworth and Welwyn, failed to live up to the hope for relieving the pressure affecting the rapidly expanding London (Malisz B. 1981, op. cit., p. 185).

[44] Howard's ideal city was to be formed by a set of concentric zones, with the hub of the social life at the centre, featuring public buildings enveloped by a circular park surrounded by gardens. A large circular avenue with trees and greenery would run between the centre and the outer circle, cutting through residential areas. Industrial facilities would be located on the periphery, adjacent to the agricultural land formed by fields, meadows, pastures, orchards, and forests (the *rural belt*), encircling the agglomeration.

[45] Howard E. 1902. *Garden Cities of To-morrow*. Sonnenschein&Co., Ltd., London, passim; Giedion S. 1968, op. cit., pp. 752–755; Malisz B. 1981, op. cit., pp. 183–186; Böhm A. 2006, op. cit., pp. 48–51.

[46] A concept according to which suburbs were to be developed in harmony with nature emerged as early as in 1869 in the United States. The geometric grid of streets was abandoned in favour of organic avenues. Consequently, small residential complexes connected with the city by means of transport were established, and their advantages included the possibility of communing with nature, relaxation, and harmony (*romantic suburbs*). However, these complexes were very often absorbed by the city, an example being Riverside – a suburban village located on the river Des Plaines in the Chicago suburbs, designed by F.L. Olmsted and C. Vaux. Among the cities shaped with reference to Howard's ideas, some *green cities* clearly stand out, including Radburn, New Jersey (1928–32), and Noris, Tennessee (1933), or *greenbelt towns*, such as Greenbelt, Maryland, Greenhills, Ohio, and Greendale, Wisconsin.

[47] In Poland, the garden city idea was pursued by substituting greenery for old fortifications, thus creating diverse natural systems. In Krakow, which Howard called a naturally developed garden city during his stay in 1912, a radial-concentric system of green spaces was established. Although the first ring-shaped park emerged as early as in 1822 where medieval walls used to be, it was not until later that it became linked via radial avenues planted with trees with the second ring, created on the site of the 19th-century fortifications (the Krakow Commons). These systems emphasised the need to tie together individual elements of the natural environment, enabling them to permeate the entire urban organism. In Warsaw, traces of Howard's ideas can be found in *Schemat rozwoju Warszawy i okolic* (Plans for the Development of Warsaw and Surroundings) by Alfons Gravier, prepared in 1911 but never implemented, the result of which was

exerted an actual impact on the redevelopment of major cities. In fact, satellite cities became more of *green suburbs* or garden estates, rather than places which combined the characteristics of a nearly rural landscape with the living standards of a small town not far from a big city. Nevertheless, this idea had inaugurated a new era in the history of the construction of cities, where specific systems of settlement units, known as urban agglomerations, could clearly be distinguished[48]. Howard's concept had laid foundations for the regional planning of urbanised areas.

The idea of a city being perceived as a part of a larger whole found its continuation in the *Social City* concept, used by Patrick Geddes in 1900 to emphasise the importance of the environmental link between the city and its region. As per the latter idea, each polycentric urbanised area should develop on the grounds of its own natural resources, in ecological balance and with resource recovery made possible[49].

The second trend was represented by the concepts of Arturo Soria y Mata (1882), Eugéne Hènard (1910), and Le Corbusier (1922, 1930), all of whom sought to improve urban living conditions by segregating the fundamental functions related to work, home, leisure, and transport, separated or delimited with green spaces.

Le Corbusier's concept of the *Contemporary City* (*Ville Contemporaine*), co-authored with Pierre Jeanneret, aimed at siting vertically compacted residential buildings, spaced at a considerable distance from one another, in a strict geometric layout within green park-like sites (vertical garden city). They were to be surrounded by multi-storey buildings typical of big-city architecture, referred to *immeubles-villas*, providing each family with a terrace garden[50]. Their vicinity was assumed to be dominated by strips of woodland and farmland, several kilometres wide, providing a reserve territory for further development and separating the future garden cities from the central area. Traces of a similar approach can be found in the modernist *Plan Voisin* of 1925, aimed at the redevelopment of central Paris. Le Corbusier and Jeanneret intended to transform the congested inner-city quarters to the north of the river Seine into a spacious garden city, comprising a regular grid of streets and filled with repetitive vertical architectural forms set amidst greenery and recreational areas. Le Corbusier's further explorations were reflected in the 1930 model of the *Radiant City* (*La Ville Radieuse*), featuring elements of a strip layout that defied typically concentric urban development. Nevertheless, its approach to linking the dwelling place with nature remained unchanged. High-rise buildings with rooftop gardens were still to be sited in a *great park*[51].

a concentric belt of suburban sites, including gardens, designed to be established around the urban areas. Further references to *garden settlements* can be seen in the concepts underlying the districts of Saska Kępa, Podkowa Leśna, parts of Zalesie Dolne, Bielany, or Czerniaków. Some other plans and developments inspired by Howard's idea and implemented in Polish towns include those completed in Radom, Starachowice, the Silesian district of Giszowiec, or Pawłowice near Wrocław (Böhm A. 2006, pp. 124–129). The principle of creating new towns to unburden the densely urbanised centre is also evident in the regional plan for the Upper Silesian Industrial Region, developed in the 1950's by R. Pienkowski (Tychy, Pyskowice, Ząbkowice). Nowadays, the *garden city* idea is pursued by designing residential units featuring green spaces or by introducing recreational areas to urban fringes.

[48] Chmielewski J.M. 2001. *Teoria urbanistyki w projektowaniu i planowaniu miast* (Theory of urbanism in city designing and planning). Publishing House of the Warsaw University of Technology, Warsaw, p. 62.

[49] Woltier J. *Regional Planning*. In: Hutchison R. (ed) 2010. *Encyclopaedia of Urban Studies*, vol. 2, Sage Publication Inc., p.650.

[50] Syrkus H. 1984. *Społeczne cele urbanizacji. Człowiek i środowisko* (Social goals of urbanisation. People and environment). PWN, Warszaw, pp. 122–127.

[51] Ostrowski W. 1975. *Urbanistyka współczesna* (Contemporary urban planning). Arkady, Warsaw, pp. 44–47.

Concepts based on linear urban development somewhat opposed the garden city model, although their common denominator was an attempt to continue following the idea that residential sites should be moved outside the boundaries of heavily urbanised areas. It was Arturo Soria y Mata who originated the *linear city* idea and put it forward in 1882. He created an image of a city of infinite length and a width of 500 metres, stretching along the lines of railway or other means of transport. In line with this idea, each family would have its own garden and would be separated by a short distance from fields and forests. That was meant to be a way to build an open town of rural character.

A more elaborate version of the linear city concept was presented by González del Castillo in 1919. He divided the development belt, much wider than as Soria had envisioned, into zones of different function, shaped by a network of parks and green spaces linked with the surrounding agricultural land and forests[52].

N. A. Milutin's strip-shaped city model of the 1920's (conceived with Volgograd, former Stalingrad, in mind) assumed that the settlement system should be functionally divided into parallel strips intended for industry, housing, and leisure. They were separated by parkland greenery, isolating the industry from the residential development, on the one hand, while forming a zone intended for the inhabitants' relaxation, on the other hand. Some further linear or linear-centric settlement models included those designed by G. del Castillo (Belgium) in 1919, L. Hilberseimer (*The New City*) in 1944, the NER group (Moscow) in 1968, or the 1956 strip layout curved around the core city by W. Schürmann, and each of them envisaged easy access to all the areas, including open spaces, surrounding the built-up land, arranged along main transport routes[53].

Meanwhile, Tony Garnier presented his **vision of an Industrial City** (***Cité Industrielle***) in 1904. The model abandoned the concentricity of urban layouts, and in doing so, it provided an intermediate link in the transition towards the strip-based systems. Industry, which had penetrated cities so strongly and evidently, became the dominant factor in the formation of the urban cluster, being somewhat a target and a starting point at the same time. Having recognised the need to link industrial sites with residential areas, green spaces, the inner city, or individual public spaces, the author of this model introduced the principle of functional zoning, connected with the concept of an open city, permanently bound with the region and its physiography. Garnier emphasised the need to facilitate people's contact with greenery by introducing it directly into residential areas. He designed houses set in the midst of vegetation, with no property divisions, which altogether were intended by the originator to make an impression of a city as a large park. Garnier highlighted the role of green spaces, both at the scale of individual urban interiors and of entire sites[54].

In a pursuit to slacken the former compact settlement layouts by introducing green spaces, another model emerged alongside the concentric and linear models, one called by B. Malisz a **carpet model**[55]. It resulted from replacing a homogeneous urban organism with a multicellular system, evenly distributed over a specific area. An example of this approach was Ernst Gloeden's 1923 concept of a city layout comprising any number of settlement units, their arrangement based on a traffic grid, each surrounded by open spaces. To a smaller scale, the same problem was addressed by Frank Lloyd Wright, as his *Broadacre City* concept of 1935 manifested the principle of the suburban land use in large American agglomerations. The crux of this idea was to disperse residential and

[52] Ostrowski W. 1996, op. cit., p. 490.
[53] Malisz B. 1981, op. cit., pp. 189–195.
[54] Giedion S. 1968, op. cit., pp. 755–761, Ostrowski W. 1996, op. cit., p. 219; Malisz B. 1981, op. cit., p. 189.
[55] Malisz B. 1981, op. cit., p. 196.

commercial development as much as possible in open areas, which was intended to breed harmony between customised family-oriented building development and nature[56].

Further search for increasingly flexible urban structures gave birth to **network models** based on the transport system which determined how green spaces and development areas were to be distributed. Some of their characteristics included the lack of transparent urban planning composition and not using the existing natural conditions to create a landscape identity (e.g. Kevin Lynch's multi-centre network based on triangular transport links (1960), Colin Buchanan's South Hampshire concept (1967), or Milton Keynes co-designed by Richard Llewelyn-Davies (1970))[57].

> In the 1960's, much attention was paid in the **United States** to the economic value of the natural environment, which translated into measurable profits for developers planning to build up suburban areas. Ian I. McHarg epitomised the environmental approach to the design of the city, its surroundings, as well as the entire region, assumed to proceed in a controlled fashion[58]. He stressed how important it was not only to value the laws of nature but also to have a capacity to make the most of them in such a way that they both served the residents and brought profit to investors. Preceded by research, the valuation pertained to the elements of the natural environment and the landscape, including: geology, hydrography, physiography, flora, fauna, soil, as well as scenic, historical, and educational qualities. The outcome was assumed to be a division of a given area into zones of diverse levels of urbanisation and recreational potential[59].

The 1960's and 70's saw the advent of new ideas and visions of cities of the future. **It is then that a model of an ecological and *sustainable* city** emerged, based on the need to expand natural areas, to develop green systems permeating the urban fabric, and to create a network of ecological corridors enabling protection of natural ecosystems. The idea sought to colonise the city through greenery, emphasising the sustainability of the natural environment and the natural diversity of species and ecosystems. It guaranteed that the needs of urban communities would be satisfied, while stressing the need for some restrictions to be imposed. The quality of the environment and its harmonious development became the subjects of numerous theoretical and practical studies on the planning composition of urban layouts, on landscape design and structure, or on the perception of space[60]. Meanwhile, one could observe the development of trends commonly referred to as *green cities* or *eco-cities*[61], as well as the conception of such notions as *landscape urbanism*[62], *ecourbanism*[63], or *sustainable urbanism*[64], and such planning movements

[56] Nelson A.C. *Broadacre City*. In: Hutchison R. (ed) 2010. *Encyclopaedia of Urban Studies*. Vol. 1, Sage Publication Inc., pp. 83–86.
[57] Ostrowski W. 1975, op. cit., pp. 173–194.
[58] Mc Harg Ian I. 1971. *Design with Nature*. New York, passim.
[59] Böhm A. 2006, op. cit., pp. 87–88.
[60] Lynch K. 1960, op. cit.; Alexander Ch., Ishikawa S., Silverstein M. 1977, op. cit.; Rapoport A. 1977. *Human aspects of Urban Form*. Oxford, Pergamon Press; Trancik R. 1986, op. cit.
[61] Register R. 2002. *Ecocities: building cities in balance with nature*. Berkeley Hills Books, Berkeley, California.
[62] Waldheim Ch. 2006. *The Landscape Urbanism Reader*. Princeton Architectural Press.
[63] Ruano M. 1999. *Ecourbanism (Sustainable Human Settlements: 60 case studies)*. Editorial Gustavo Gili, SA, Barcelona.
[64] Farr D. 2007. *Sustainable Urbanism: Urban Design With Nature*. Villey.

as *New Urbanism*[65] or *Green Urbanism*[66]. It was increasingly frequent that scientific research and theoretical discourse translated into actual designs and implementations of contemporary concepts of ideal cities and cities of the future. One of the very first of such urban visions of megastructures based on renewable energy sources was Paolo Solari's *arcology* developed in the 1970's. Many new concepts and implementations emerged already in the 21st century. However, all the measures being undertaken have generally boiled down to the following three models[67]: construction of new cities based on state-of-the-art technologies and renewable energy sources (typical of Asian, Middle Eastern, and African countries)[68], redevelopment of existing urban complexes, and development of new self-sufficient and energy-efficient quarters/estates in harmony with nature and inhabitants' needs (Western Europe, USA)[69]. What they all have in common is, on the one hand, the eco-friendly solutions applied in artificially created surroundings (rainwater management principles, introducing green walls and roofs, green and blue corridors) and, on the other hand, complete harnessing and subordination of the natural environment, and a failure to adapt the emerging urbanised areas to natural conditions and local traditions.

In 1998, the European Council of Town Planners (ECTP), acting independently of the European Union bodies, was preparing a document commonly referred to as the New Athens Charter, promoting contemporary principles for the design of 21st century urban structures. It relied on the principles of multifunctionality, diversity, protection of the identity of urban space and the environment, health, human safety, and consideration for the cultural needs of urban communities. The New Athens Charter (1998) emphasised the role of green and open spaces in defining the landscape identity of cities as well as the continuity and coherence of the spatial structure. This approach was complemented by the New Athens Charter of 2003 which set forth a vision for the future of European centres of population, envisaged as sustainable, healthy, and green cities. It highlighted the need to preserve the abundance and diversity of cultural heritage, the local specificity, the continuity of traditions, and the harmonious combination of the built and natural environment. What it considered important was a city developed to be open to nature and making sure that city dwellers gained contact with elements of the natural heritage,

[65] The urban design and spatial planning trend referred to as *New Urbanism* emerged in the United States in the 1980's in response to the destruction caused by urban sprawl. It was modelled on the garden city idea and the concepts of *city beautification* (City Beautiful Movement). The fundamental tenets of New Urbanism were efforts aimed at protecting open spaces, the hierarchical nature of the spatial structure of urbanised areas, and referring to the traditional values of urban space. (Calthorpe P.A. 1992; Katz. P. 1994; Chase J., Crawford M., Kaliski J. (eds), 1999).

[66] The concept of *Green Urbanism* combines the possibility of introducing new technologies, sustainable design of urban spaces and landscapes, and greater responsibility for the natural environment. Its crux is the need to change the lifestyle of urban communities, and in particular, to optimise energy consumption (Beatley T. 1999, pp. 5–12).

[67] Kosmala M. 2010. *Osiedla ekologiczne-moda czy konieczność? Cz. 1* (Eco-friendly residential developments – fashion or necessity? Part 1). In: *Zieleń miejska* (Urban Greenery), no. 7/8 (40), pp. 64–67.

[68] The following examples stand out among the cities of the future: Gwanggyo Power Center (by MVRDV architects), New Songdo City (by Kohn Pedersen Fox), or Incheon (by Foster & Partners) in South Korea near Seoul, China's Tianjin or Ordos near the Mongolian border, Dongtan on Chongming Island near Shanghai, One-North on the outskirts of Singapore (by Zaha Hadid), Zira off the coast of Baku in Azerbaijan (by Bjarke Ingels Group, BIG), Masdar City in the United Arab Emirates, 17 km from the centre of Abu Dhabi (by Foster & Partners), La Cité du Fleuve, in Africa, which is being developed on two islands in the river Congo near Kinshasa, or Eco Atlantic City to be built in Lagos, Nigeria.

[69] Prominent among the European eco-friendly developments and cities are Germany's Vauban (established on the premises of former barracks) and Riesenfeld in Freiburg, built as part of a garden city project, Scotland's Slateford Green development in Edinburgh, Austria's Florisdorf, Nordmanngasse in Vienna, England's Beddington eco-city near London, Sweden's Bo01 in Malmo, or Denmark's Nordhavn in Copenhagen, the latter built on port sites. Projects which follow this path are also related to the renewal of urban spaces, and revitalisation of individual quarters in particular, for instance the post-industrial district of El Poblenou in Barcelona.

such as visually appealing landscapes, parks, green squares, reserves, and various kinds of open space, agricultural areas and water bodies. The Charter also highlighted the importance of spatial planning as an important tool for preserving elements of the natural and cultural legacy, playing a key role in shaping new open spaces linked with the urban development fabric. At the same time, it emphasised the need to protect the natural complexes of the European continent against the expansion of urbanised area systems. They are to be „effectively protected against the extension and multiplication of these urban networks, through a combination of regulatory and stimulatory measures, as well as by promoting awareness of their value and the essential need for conservation and enhancement"[70].

2.4. Natural systems in urbanised structures

Until the mid-19th century, the urban fabric had been dominated by point-based green spaces such as parks, gardens, or green squares[71]. As cities developed by transforming their structure and constantly seeking to improve the relationships between people, built environment, and nature, complex solutions began to emerge, binding individual areas into **systems of urban green space**[72]. They initially consisted of elements of the natural environment, located within boundaries of urban areas, inextricably linked with its structure and spatial composition. These included water courses and bodies, parks, gardens, lawns, squares, avenues, and boulevards, as well as zones of protective and buffer vegetation, altogether referred to as urban green space. As the spatial structure of cities became increasingly complex, urban green space systems lost their original and explicit transparency. Suburban green spaces, such as forests, meadows, and fields, linked by green walking and cycling routes and ecological corridors, gradually grew in importance. Fringe areas, often of high natural, cultural, and economic value, were becoming recreational areas for city dwellers, effectively raising their living standards. Connected with regional forests, on the one hand, and with the green belts and wedges cutting into the urban fabric, on the other hand, they formed an organic whole in many cases. Initially, they served to maintain the system's compactness, but their function expanded over time. Peripheral open spaces began to help in countering urban sprawl by becoming a buffer zone between neighbouring urban areas. The foregoing became particularly important in heavily industrialised areas, where more urban centres had developed, collectively forming industrial districts.

As cities continued to grow and mono- or polycentric agglomerations developed, greenery evolved into an element which allowed the boundaries of individual structural units to become more transparent. However, these were not individual fragments, but a system of natural structures permeating built-up areas, forming a network of links between greenery islands, connected with the extra-urban system. The evolution of such structures was based, successively, on the principles of equal access (geometric models of

[70] *New Charter of Athens 2003*, *A Vision for Cities in the 21th Century*, Lisbon [translated from the Polish language version by Łukasz Borkiewicz].

[71] Characteristic of this period were stretches of urban greenery (i.e. promenades or avenues) connecting important elements of the spatial structure; also circles of boulevards or ring-shaped parks were developed (e.g. Planty in Krakow, 1820–1830, Wroclaw embankments, 1810–1838). They represented the first examples of layouts of a systemic nature.

[72] In the English-language literature, the elements of the natural environment incorporated into the structure of cities and the spatial systems thus developed are referred to as the *green structure*. It comprises green spaces created as a result of natural processes as well as the man-made ones: parks, gardens, sports venues, recreational sites, forests, riverside and rural areas surrounding cities (Dubhem B. 2005, p. 13).

green space distribution), consolidation of available resources (emerald necklace model), equal area share (hierarchical park system model), defragmentation of the natural environment (model of patches and corridors), as well as its compensation (compact city model)[73].

Individual natural systems arose from the natural predispositions of the land, the existing greenery clusters, the degree of surface transformation, and the structure of urbanised areas. Inextricably linked with the urban composition of cities, they were responsible for the diversified spatial layouts.

The following **urban green space systems** could be distinguished among historic layouts[74]:

- **ring-shaped** – characteristic of historic cities, featuring green spaces that formed closing rings, modelled on the 17th century Parisian boulevards. It developed in the mid-19th century in most European cities, where the demolished medieval city walls and backfilled moats were replaced by rings of boulevards or walking parks (the Vienna Ring Road, 1858–1860, the Budapest Ring Road, 1867, the boulevards of Brussels and Hamburg, the Planty park ring in Krakow, 1820–1830);
- **radial (wedge-shaped)** – a layout in which suburban greenery surrounding the inner city penetrates it in wedge-like structures; typical of towns built along arterial, radially-arranged roads, where the land free from traffic infrastructure was used for green wedges. This system is also characteristic of the cities where such a layout was simply imposed by local physiographic conditions (e.g. cut through by a river). Making the most of the physiographic conditions, this layout is often classified as a separate **natural** (**physiographic**) system[75];
- **combined** – a layout which combines the features of ring-shaped and radial systems, where the suburban greenery penetrates the city in wedges and cuts through the existing rings of greenery;
- **strip-shaped** (**strip-and-cross-shaped**) – applied in larger cities geometrically based on a regular grid of streets. The strips typically matched the width of a unit of building development, a boulevard, or walking avenues. This is a relatively recent model which can be found in newly designed US cities;
- **patch-shaped** – based on green spaces scattered around the city in a rather random and chaotic manner, their layout resembling green patches. Most frequently, these patches form public parks, former manor, palace, or monastery parks, 19th century green squares, or non-developed fragments of building sites.

[73] Drapella-Hermansdorfer A. 2008. *Podstawy teoretyczne kształtowania systemów zieleni miejskiej* (Theoretical foundations of urban greenery system development). Materials from the conference entitled: *Systemy zieleni miast w teorii i praktyce XXI wieku* (Theory and practice of the 21st century urban greenery systems). Wrocław, available online at: http://www.um.wroc.pl/m3508/p99138.aspx [accessed on 2011].

[74] Urban greenery systems were addressed in literature by Czarnecki W. (1968, pp. 143–155), as well as by: Zielonko A. (1973, pp. 25–26); Orzeszek-Gajewska B (1982, pp. 22–30); Klemens J. (1986, pp. 97–104); Haber Z., Urbański P. (2005, pp. 113–116); Zachariasz A. (2006, pp. 99–103).

[75] This layout creates favourable conditions for vegetation growth, development of greenery (mainly of park type), and construction of walking paths along rivers or lake banks. Such a classification has been introduced by Haber Z. and Urbański P. (2005, op. cit., p. 116).

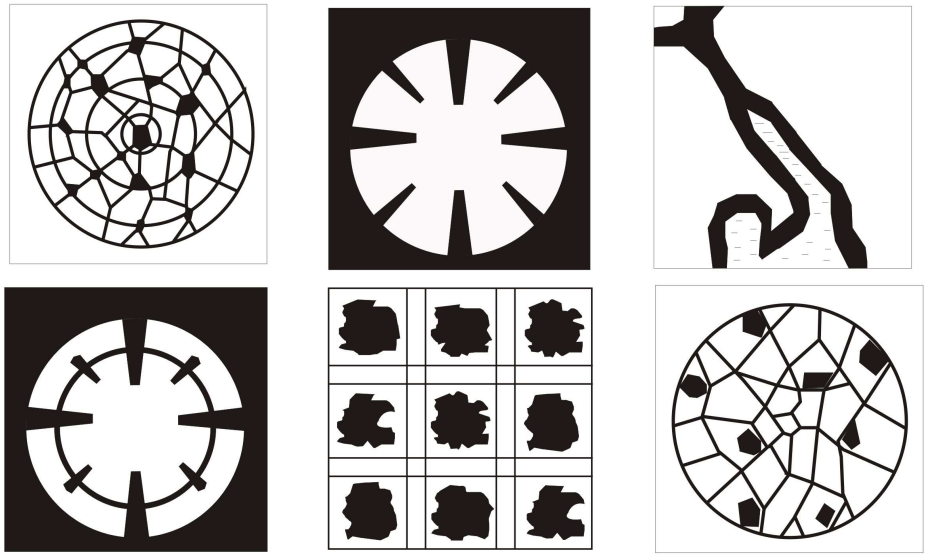

Fig. 19. Layouts of urban green space systems: ring-shaped, radial, natural, combined, strip-and-cross-shaped, patch-shaped; author's elaboration based on: Czarnecki W., 1968; Haber Z., Urbański P., 2005

The search for spatial and functional urban systems in the 19th century was related to the deteriorating urban living conditions and people's isolation from nature. It was due to the progressing urbanisation and environmental threats that the systems being designed became elements of the remedial measures undertaken in urbanised areas. They had to take into account the inevitability of further spatial growth of cities and agglomerations as well as the need to protect the natural environment, and they had to pursue harmony and optimal balance between the built and natural environment. It was also important to find an adequate spatial structure of the city and its appropriate links with the region, so that ultimately one could create harmonious principles of an ideal human settlement[76]. The search for the links between the built and natural environment began to surface under many urban initiatives.

What emerged in the second half of the 19th century was the **concept of parkways** – roads set within strips of public greenery, dedicated to recreation and linking urban green spaces with suburban open areas. They were modelled on the boulevards of Paris. The first *parkways* were designed by Frederick Law Olmsted in New York and Boston in an attempt to create linear connections between parks. This resulted in the formation of triple tree lined traffic routes, used for recreational travelling[77]. Agata Zachariasz claims that it was in the parkways concept that the integration of transport routes and open spaces took shape, representing specific integration of technology and nature[78]. It demonstrated the need for merging the existing resources and paved the way towards the tradition of creating **linear metropolitan parks**. It was actually initiated by Olmsted in the town of Buffalo where, starting in 1868, he created a system comprising six municipal parks linked by a network of parkways. According to the author, they were intended to become the backbone around which the urban structure would take shape. In follow up to this idea, between 1880 and 1887, F. L. Olmsted and Ch. Eliot developed

[76] Kowalewski A.T. 2005. *Rozwój zrównoważony w procesach urbanizacji* (Sustainable development in urban planning processes). In: *Nauka* (Science), no. 1, pp. 123–146.
[77] Fein A. 1968. *Landscape into Cityscape: Frederick Law Olmsted's Plans for Greater New York*. Ithaca, Nowy York, p. 157.
[78] Zachariasz A. 2006, op. cit., p. 40.

a complex of parks in Boston[79], known as the *Emerald Necklace*. It was made up by an urban greenery system set along the rivers of Charles, Stony Brook, and Muddy, linked with the city via a network of parkways, 8 km long in total. To this day, it still provides the city dwellers with recreation opportunities, abounding in habitat areas for various animal and bird species. Similar park systems were established in Minneapolis, Quincy, Rochester, Omaha, and Washington DC.

The spatial range of such natural systems increased over time. They began to include not only urban green spaces, but also those of suburban nature. The transition from the urban to the regional scale became evident when larger spatial and landscape complexes started being incorporated into natural systems. It was characteristic of them to combine greenery and architectural elements into a cohesive whole, reflecting a harmonious vision of the world.

> One of the first spatial and landscape complexes in Europe was the area of Dessau-Wörlitz, commonly known as the ***Garden Kingdom*** (***Gartenreich***). Founded between 1762 and 1825 by Leopold II Frederick Franz, Duke of Anhalt-Dessau, it has ever since been a great example of comprehensive landscape development and cultivation at a regional scale. The most crucial element of this landscape composition was the river Elbe, while its foundations – the local stretches of meadows, forests, and fields, as well as the interlinked palaces, gardens, and park sites, rendered available for recreational and leisure purposes. Designed with the local community in mind, the said park site was intended to contribute to the formation of the place's spatial and social governance. The economic governance, on the other hand, was to be provided by active, reformed economy based on agriculture, forestry, and crafts. At the same time, the park space was co-created by areas used for economic purposes, thus showcasing combination of beauty and utility as well as harmonious integration of natural and cultural environments[80].

The role of urban green space systems in the development of urban structures also became evident in industrial agglomerations. Considering the urban planning activities undertaken within the territory of the contemporary Upper Silesian Agglomeration, one should definitely mention an urban planning concept dating back to the 1920's, assuming that **an integrated urban organism was to be created along the then national border, composed of three towns: Bytom, Gliwice, and Zabrze** (*Plan der Dreistädteeinheit Beuthen-Hindenburg-Gleiwitz*, 1926)[81]. This idea arose from a project of homogeneous economic, administrative, and social development of an area of ca. 600 km^2, developed by Professor Friedrich Gerlach, a construction advisor and a city councillor of Berlin[82].

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[79] The Emerald Necklace comprised parks such as: Boston Public Garden, Boston Commons, Commonwealth Avenue, Back Bay Fens, Riverway, Olmsted Park, Jamaica Park, Arnold Arboretum, and Franklin Park.

[80] Hirsch E. 1985. *Dessau-Wörlitz. Aufklärung und Frühklassik* (Dessau-Wörlitz. Enlightenment and Early Classicism). Koehler&Amelang, Leipzig, pp. 11, 158; Kwaśniewski A. *Królestwo Ogrodów księcia Leopolda von Anhalt-Dessau. W poszukiwaniu oświeceniowej jedności natury i człowieka* (The Garden Kingdom of Leopold I, Prince of Anhalt-Dessau. In pursuit of the human–nature unity idea of the Enlightenment). In: Drapella-Hermansdorfer A. (ed) 2004. op. cit., pp. 13–15.

[81] After World War I, the territory of today's agglomeration was divided between the Weimar Republic and the Second Polish Republic.

[82] Szczypka Gwiazda B. 2004. *Urbanistyka i architektura ziem górnośląskich w obrębie Republiki Weimarskiej 1918–1933* (Urbanism and architecture of the Upper Silesian territories within the Weimar Republic, 1918–1933). In: Chojecka E. (ed) *Sztuka Górnego Śląska od średniowiecza do końca XX wieku* (The art of Upper Silesia from the Middle Ages until the end of the 20th century). Silesian Museum, Katowice, pp. 325–344.

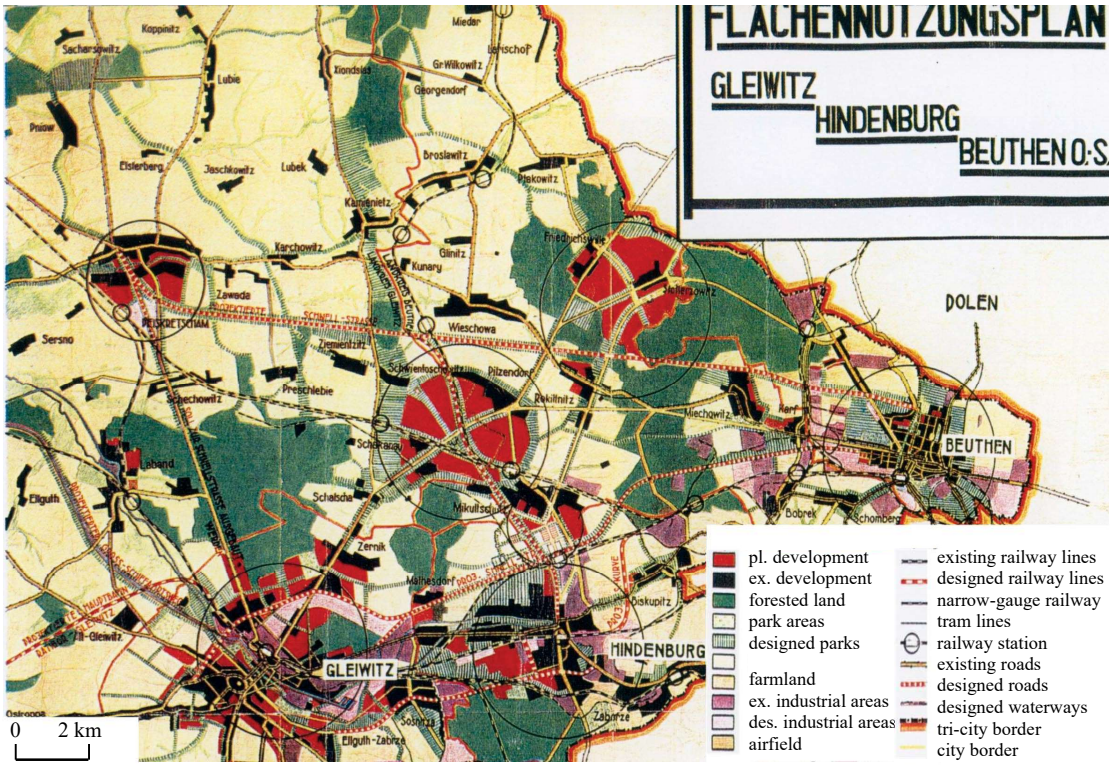

Fig. 20. Map of the Bytom-Zabrze-Gliwice Tri-City, 1926

Besides introducing a specific settlement policy and a concept of municipal development as well as designating industrial sites, the Tri-City project envisaged that a network of green spaces be created, comprising forests, park sites, allotment gardens, cemeteries, and sports facilities, assumed to form a coherent urban organism along with the development areas organically linked with the former. This venture emphasised the need to preserve the original landscape qualities of the industrial region. What it also highlighted was the functional and aesthetic qualities of man-made nature which, along with the architecture linked with it, was intended to play a special function in the process of shaping the cultural and social life of city dwellers, providing them with opportunities for direct contact with the natural environment. As proposed, the Bytom-Gliwice-Zabrze Tri-City concept, based on an assumption that it should be surrounded by a system of residential units, integrated with individual municipalities in terms of transport and economy, and sited within green and recreational areas, was modelled on Howard's utopian *garden city* idea. The blueprints for the green spaces closely linked with the building development were prepared by Moritz Wolf and Gustav Allinger. The Municipal Park (*Stadtpark*) in Zabrze was to become one of the key elements of the urban park compound planned. In Gliwice, the intention was to make the most of the natural landscape surrounding the city to enclose it with a green belt, connected with the inner city's park sites and green spaces via a system of promenades and roads. The most important enclave of greenery in the centre of Gliwice was assumed to be made up by two parks: the Municipal Park (*Stadtpark,* contemporarily known as the Fryderyk Chopin Park) and the Kaiser Wilhelm Park (today's Bolesław Chrobry Park). According to the project concept, they were to be linked with a system of pedestrian promenades set along the regulated bed of the river Kłodnica, jointly forming a leisure area offering access to recreation

facilities (sports stadium, outdoor swimming pool). In Bytom, the problems associated with the formation of nature enclaves set against the inner city's compact building development was addressed as early as in the 19th century. The most important decision was to establish the Municipal Park (*Stadtpark*), which became one of the largest green spaces in the region over time. The park was intended to be a coherent complex of the city's open-access leisure sites, jointly forming a system of urban green spaces, linked with the regional green space system.

> Meanwhile, the dynamic urbanisation of the late 19th and early 20th century observed in the United States increasingly often shifted the attention to the need to create and secure sufficient land for park purposes, perceived as important for improving city dwellers' quality of life. The need to *beautify* became a hallmark of the plans prepared for numerous American cities, including San Francisco and Chicago (the City Beautiful Movement). That was where the efforts aimed at establishing in-city parks came to the fore, emphasising the possibility of open green sites and the urban fabric becoming intertwined, and also concepts which envisaged preservation of sites offering special natural qualities began to emerge.

In the twentieth century, **natural protective systems** gained widespread acclaim. They emerged in response to the abrupt and uncontrolled urban sprawl. One of the most remarkable urban planning accomplishments of the first half of the 20th century, highlighting the importance of the natural environment for shaping the urbanised environment, was the **idea of *green belts***. On the one hand, the systems of green belts to be established around London, as proposed by Patrick Abercrombie (1944), or in the Scottish Clydeside conurbation (1946), was a determinant of the growth of highly urbanised areas, safeguarded them against uncontrolled dispersal of building development, and preserved the distinctiveness of individual structural units. On the other hand, it provided special means to protect fringe open spaces (forests, meadows, agricultural land). The protection against excessive investment typically resulted not so much from the specific environmental qualities of areas, but from the necessity of curbing the tendency of large and medium-size cities to sprawl. It was also attributable to the need to provide the local population with access to areas perceived valuable in terms of recreation and leisure, situated within a short distance of where they lived. The green belts established a visual boundary between city and countryside, thus supporting the formation of diversified landscapes. The rationale behind the implementation of the green belts idea was the need to create links between built and natural areas. However, the siting of such belts presented many problems. It involved the necessity of the spatial policy being competently implemented in a long term; in a way, it forced local authorities to pay compensation or to otherwise indemnify landowners affected by the restrictions imposed on certain areas, and made it necessary to ensure sufficient land reserve within city borders for purposes of residential and industrial investment projects.

Another way of linking urban green enclaves with open spaces in a systemic manner was the formation of **green strips**. It was the ecological corridors, routes, junction areas, biocentres, and buffer zones, used as „bandage for the wounded landscape," that became the links which enabled the transition from the urban to the regional scale[83]. On top of their natural function, these strips also gained recreational, leisure, cognitive, and scenic roles, so highly valued by those who lived in urbanised areas. On account of the limited

[83] Soule M.E., Gilpin M.E. 1991. *The theory of wildlife corridor capability*. In: Saunders D.A., Hobbs R.J. (eds) *Nature Conservation 2. The role of corridors*. Surrey Baetty & Sons, Chipping Norton, pp. 3–8.

opportunities for acquiring new green spaces in cities, linear natural structures were often limited to the scale of *green* footpaths and cycleways (*greenways)*, waterfront trails (*blueways),* or aboveground paths (*skyways*)[84]. Considering the users' needs, the above list can be extended with the walking and cycling trails (*pleasureways*), as defined by Kevin Lynch[85], connecting in-city open areas and forming a system of loops, easily accessible to residents, yet with limited vehicular access.

Starting from the mid-20th century, *parkways* were replaced by ***greenways***, making it possible to adequately shape the system of vehicular, pedestrian, and cycling traffic, embedded in sites of attractive landscape. The first such developments include the Santa Clara Greenway or the Platte River Greenway in Denver (1974). They exemplified the multifunctional character of natural linear systems. *Greenways* are ecologically relevant corridors, forming a network of public open spaces and recreational trails, routed along both natural areas of strip layout as well as man-made sites. Some of them evolved on the foundations of abandoned railway lines, urban public roads, or historic trade routes, while others made the most of natural ecological corridors running along rivers, streams, and hills. They could be routed both within congested urban agglomerations and linked into a regional network, forming a *linear open space system*. Their function was, on the one hand, to improve the quality of the environment (protection and formation of ecological corridors, necessary for animal migration or exchange of species), and on the other hand, to provide city dwellers with access to recreational sites (development of ecotourism; walking, cycling, water, or horse riding networks; promotion of healthy lifestyles). The vast systems or networks of *greenways,* linked with a system of scenic, landscape, and historic routes, allowed the natural as well as the cultural heritage of cities and regions to be explored[86]. Having received elements of tourist infrastructure, they also gained the economic dimension. Their purpose was to support and stimulate local communities by driving the entrepreneurial spirit, creating jobs and a framework for implementing initiatives or projects related to nature and landscape protection, preserving heritage, and promoting tourism[87].

The linear system of open spaces was frequently created by linking strips of parkland greenery developed along rivers. The contemporary *blueways* stretching along waterfronts serve the purposes of transport and recreation, but can also be included in riverside revitalisation operations. Various programmes intended to highlight and make the most of the compositional, aesthetic, and natural qualities and functions of rivers arose from the urbanised landscape renewal activities performed in numerous cities (Valencia, London, Berlin, Wrocław, Krakow).

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[84] Turner T. 1995a. *Greenways, blueways, skyways and other ways to a better London. Landscape and Urban Planning.* In: *Landscape and Urban Planning*, vol. 33, issues 1–3, London, pp. 269–282.

[85] Banerjee T., Southworth M. (eds). 1995. *City Sense and City Design. Writings and Projects of Kevin Lynch.* The MIT Press, pp. 81–86 and 94.

[86] Little Ch.E. 1990. *Greenways for America.* The Johns Hopkins University Press; Turner T. 1995. *City as Landscape: A Post Post-Modern View of Design and Planning.* Taylor & Francis, pp. 199–208.

[87] *Sopron Declaration*, Environmental Partnership for Sustainable Development (2006); *Lille Declaration*, European Greenways Association (2000).

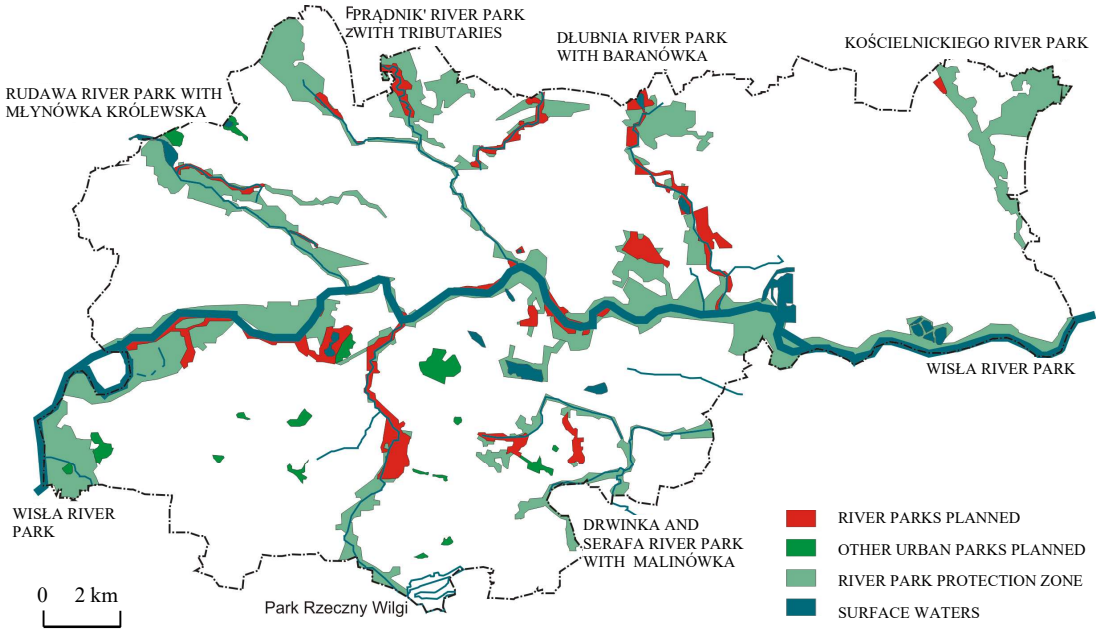

Fig. 21. Municipal green space investments planned in Krakow, author's elaboration based on: map of the Faculty of Environmental Protection, Krakow 2013

The hydrographic system of the city of **Krakow** provided grounds for what ultimately became the new links between public green spaces. The **River Parks** concept[88] was designed to make use of the land reserve existing within the city limits, located along the Vistula and its tributaries. It envisaged that the seven sites proposed for the *river parks* (the rivers Vistula, Dłubnia, Prądnik, Rudawa, Wilga, Potok Kościelnicki, Drwinka, and Serafa along with Malinówka) could be linked with the system of legally protected parts of the landscape surrounding the city. The goal of a system created in this manner is to stimulate the economy of riverside areas, to use the transport function of navigable rivers, and to combine recreational features with flood control investments. Using the water network as the system's backbone makes it possible to connect it with the structure of the city's individual spatial units, to obtain access to waterfront greenery, and to activate sites of high cultural and natural qualities on the river banks[89]. This system is completed with the industrial brownfields reclaimed for nature's sake. According to the authors, the prerequisite for ensuring the sustainability of *river parks* is to define for them statutory forms of nature and cultural landscape conservation (nature and landscape

[88] This concept arose from two studies: *Kompleksowy program rozwoju zieleni miejskiej dla Krakowa* [Comprehensive programme of urban greenery development for Krakow] of 1996 (authors: A. Böhm, K. Pawłowska, A. Zachariasz, Z. Bednarz) and *Studium architektoniczno-inżynierskie możliwości podwyższenia obwałowań wiślanych w Krakowie* (Architectural and engineering study of the options to raise the Vistula embankments in Krakow) of 1996–1997 (collective study supervised by J. Henning, E. Nachlik, A. Böhm). It was introduced into the draft Land Use Study for Krakow passed in 2003.

[89] The following venues can be found in the vicinity of the river park: the monasteries of Tyniec and Bielany, the manor compound in Przegorzały, Salwator, the Kościuszko Mound, the Norbertine Monastery, the Wawel Castle, the view point overlooking the Old Town and the district of Kazimierz, the Skałka basilica, St. Benedict's hill with a fort, the Krakus Mound, the Mogiła Abbey, and the wetlands of Nowa Huta. The water network can connect the Complex of Jurassic Landscape Parks with the Wolski Forest complex, the area of the Niepołomice Forest, the Bielany-Tyniec Landscape Park, the Tenczynek Landscape Park, the Krakow Valleys, the Ojców National Park, the Dłubnia Landscape Park, and Zakrzówek (Böhm A. 2006, op. cit., p. 257).

complexes, culture parks), or to link them more closely with the existing landscape parks (by extending their territories)[90].
In **London**, a system of riverside parks (***London Riverside Parklands***) is being developed along the eastern bank of the Thames under a project aimed at linking patches of greenery and ecological corridors. Coordinated by the London Thames Gateway Development Corporation (LTGDC) since 2004, the project has served as an example of how different protective measures can be combined with natural resource management methods. The parks envisaged in the project are created before the building development planned through a long-term investment policy based on public-private partnership. Another programme which defines the manner in which London's natural system is developed *is* ***The Blue Ribbon Network***, based on London's land use plan of 2004. It covers the city's entire water network, including: the Thames and its tributaries, London's other rivers and streams, and its system of canals, docks, ponds, and lakes. It seeks to increase the attractiveness of the landscape, to create public spaces, and to use the waterfront for tourism, water transport, water-intensive industry, water sports, and leisure activities, in the broad sense. The environmental objective is to restore natural habitats and floodplains, and to protect biodiversity. As a consequence of the programme, numerous cycle paths, waterways, and footpaths have been built, also aimed at improving the waterfront's visual appeal and a sense of safety among the people who use this space.

Nowadays, in the contemporary spatial planning of urbanised areas, new systems of green space are generally not created, but instead, the existing ones are complemented or extended. Cities develop complex spatial structures, whose layouts actually lost their original explicit transparency long ago. They typically feature combined green space systems, founded on historic layouts.

Poznań is a city where a wedge and ring-shaped green space system, designed by Władysław Czarnecki in 1932, is an inherent part of the spatial structure. The very essence of this concept was to make the most of the local topographical conditions to ensure that the urban green spaces were linked with the open spaces outside the city as well as to provide their spatial continuity.

Cities differ in terms of size, degree of pollution, degradation of individual elements of the natural environment, building development and population density, land use, as well as the extent to which different zones have blended together (natural ecosystems and degraded sites neighbouring on one another). One can create model natural systems and general principles determining the degree of development and protection of the natural environment, but it is always necessary to adapt the chosen layout to the specifics of a given city.

[90] Ibid., p. 257.

Fig. 22. Grand Paris 2030, R. Rogers, 2008

Fig. 23. Grand Paris 2030, Y. Lion, 2008

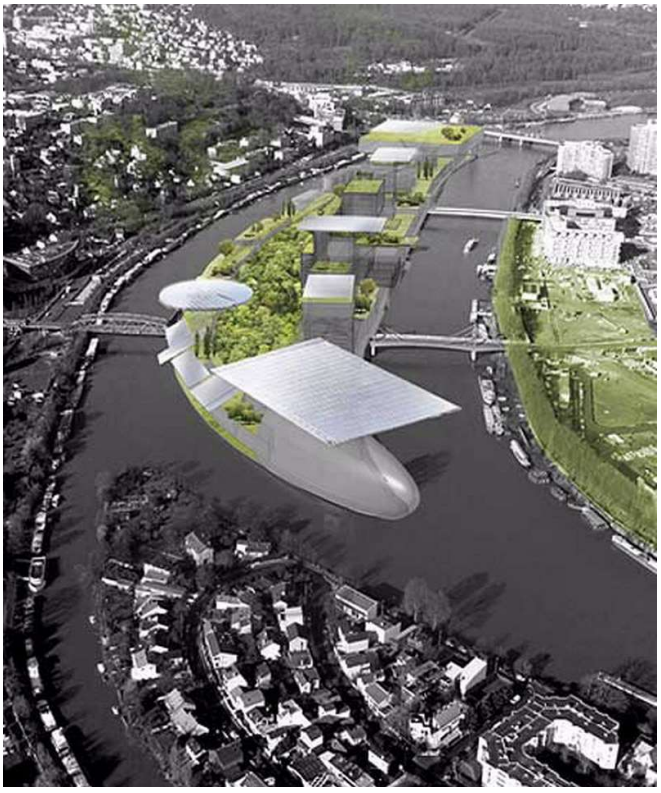

Fig. 24. Grand Paris 2030, J. Nouvel, 2008

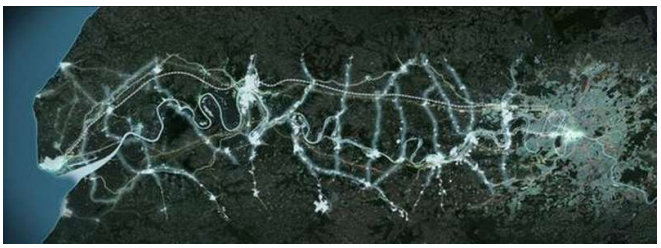

Fig. 25. Grand Paris 2030, A. Grumbach, 2008

The rationale behind the concept of linking key urban green spaces is making sure that nature functions properly in urban areas, improving biological, climatic, and hydrological conditions, and at the same time, providing adequate living conditions for the inhabitants of contemporary cities. In the case of large cities and agglomerations, green spaces are augmented and linked with their surroundings by creating natural systems on account of the need for their spatial structure to be slackened, among other reasons. The foregoing results from the urbanisation processes underway, the development of vehicular traffic, or the changing needs of city dwellers.

The Paris metropolitan area is 75% of open space, including farmland and woodland. In the 1980's, a plan was put forward to restore a nearly continuous *green belt* surrounding Paris within a radius of 20–30 km of the centre, comprising forests, parks, farmland, etc. The entire 90,000 hectare area was assumed to be used for leisure purposes by the urban community. Further concepts emerged as the vision known as ***Grand Paris 2030*** was being developed in 2007–2008. Among the problems it addressed was the protection and development of green spaces (one of the goals it assumed was 50% of the area being biologically active). Most of these concepts highlighted the need for concentric development determined by the ring-shaped layout of open spaces stretching around the metropolis. In his vision, Jean Nouvel assumed that the spaces used for agriculture should form a green oxygenating ring around urbanised areas (*front de terre*). Yves Lion of the Descartes group proposed six legally protected agricultural parks to be established around Paris, functioning as productive areas. What the regional visions also envisaged was the need to integrate urban areas with nature through a network of metropolitan green spaces. Richard Rogers proposed that Paris should be enclosed in a green ring comprising open spaces and that a system of urban green spaces linked by boulevards and parks be established. Additionally, he designed a new green axis of Paris (*green corridor*), forming a seven-kilometre-long multifunctional linear park, linking Parisian public spaces together, the urban infrastructure with energy production centres, and the city centre with the suburbs. Of the 10 concepts submitted by architects of worldwide acclaim, only one clearly opposed the concentric visions for the development of the Paris metropolitan area. It was conceived by Antoine Grumbach who proposed a *Metropolis on the Seine* to be established, arranged linearly along the Seine valley from Paris via Rouen to Le Havre (over a length of 350 km). According to this vision, the riverside areas were to become a green corridor, or rather a *great street*, with all the abundance of footpaths, cycle paths, recreational areas, as well as industrial plants and residential compounds, divided by stretches of farmland, altogether forming a harmonious whole.

What poses a significant problem in urban agglomerations or multi-centre metropolitan areas[91] is planning a coherent system in which open spaces and urban greenery links can seamlessly intertwine. One way to solve it is to delimit and preserve open spaces which separate individual urbanised areas, thus preventing suburban sprawl.

[91] The multi-centre metropolitan area is formed by several agglomerations functioning as a network. These include the Randstadt district (population of 7 million), the Rhine-Ruhr region (population of 11 million), the Vienna-Bratislava region (population of 4.6 million), and the Öresund region (population of 2.5 million) (Zygierewicz A. 2006, p. 3).

In the 1960's, a concept of *edge conurbation* (*Randstad Holland*) was created in the Netherlands, only to develop into the **Randstad metropolitan area**, composed of four agglomerations: Rotterdam, Amsterdam, Utrecht, and The Hague. Comparable in size to London or Paris, this area resembles a horseshoe in shape. Surrounded by a complex of larger and smaller towns, the conurbation's centrally set *green heart* in between the cities is made up of stretches of open space, covering an area of 97,000 ha, comprising forests, water bodies, recreational areas, and sites of protected natural landscape. They provide a buffer zone for the agglomerations[92].

In **Copenhagen**, a wedge-shaped setup of green spaces (known as the *finger plan*, modelled on a five-fingered hand) was created under the 1947 Greater Copenhagen regional plan by Steen E. Rasmussen and Peter Bredsdorff. Its pre-assumption was that the city's urbanised zone would evolve along the railway lines, separated by green wedges set to define the boundaries of urban development, linking the suburbs with the inner city and providing a protective system for open spaces, at the same time[93].

In different parts of Europe, **regional parks** laid foundations for the creation of ecosystems as well as for the preservation and development of cultural and natural resources. Considering the German examples, such as the Emscher Landscape Park (*Emscher Landschaftspark*, 1989), the Rhein-Main Regional Park (*Regionalpark RheinMain*, 1994), the regional parks around Berlin and Brandenburg (*Regionalparks Berlin-Brandenburg,* 1998), or the Saar Regional Park (*Regionalpark Saar*, 2004), regional park development strategies became a tool for urban landscaping as well as for ecological, socio-cultural, and economic renewal of urbanised areas. The experience gained as the open space system had been designed contributed to underscoring the relevance of the natural factor in the spatial development of large cities and agglomerations[94]. Originally conceived as multifunctional features, regional parks concentrate on either defining or highlighting the identity of and on shaping the cultural landscape of cities and regions, being the very essence of the meshing between open spaces and urbanised areas. They are used as an instrument to promote territorial awareness and competitiveness vis-à-vis other regions. The main advantage of regional parks is their flexibility and capacity to adapt to changing conditions[95].

The prototype for the foregoing measures is the **Regional Park of Central Germany** (2001). It represents an attempt to create balance between the development and conservation of the resources offered by the space located between two agglomerations: Berlin-Potsdam in the north and Leipzig-Halle in the south. It offers an opportunity to control the suburbanisation phenomenon, to prevent the landscape degradation on the fringes or urbanised areas, and to overcome administrative constraints while pursuing goals common to the entire region. It was created by linking patches and corridors of greenery to form a kind of ecological macro-corridor of diversified natural structure. It connects natural formations with developing areas, and keeps the urban agglomerations at a distance, while linking them at the

[92] Ostrowski W. 1975, op. cit., pp. 133–136.

[93] Zachariasz A. 2006, op. cit., p. 101.

[94] Some typical examples include: The Rhine-Neckar-Palatinate Regional Landscape Park, the Greater Stuttgart Landscape Park, the Green Ring of Leipzig, Hanover, or Munich.

[95] Gailing L. 2007. *Regional Parks: Development Strategies and Intermunicipal Cooperation for the Urban Landscape*. In: *German Journal of Urban Studies*, vol. 46, no. 1, available online on the Deutsches Insitut für Urbanistic website at: www.difu.de [accessed on 2011].

same time. It is decisive of the equilibrium between the utility value of resources and their conservation, thus providing an opportunity to balance out the region's economic growth and the measures employed to constrain its unplanned development[96].
Making sense of landscape – a landscape for the senses was the motto underpinning the conception of the **Rhine-Main Regional Park** idea in 1994, emphasising the value of regional green corridors integrated into a system of open spaces. It pertains to a series of parks stretching over 500 km, providing the foundations of green corridors, linked by the existing and planned sites of special landscape qualities, i.e. recreation areas, parks, nature conservation areas, and landmarks. Also the green ring surrounding Frankfurt (*Frankfurt Green Belt*) was incorporated into the park system[97].

In Poland, not until the interwar period and the time directly following World War II had it been properly recognised that the layouts of green spaces needed to be adapted to the natural conditions at hand or that the layouts which linked urban and suburban areas required their continuity to be maintained[98]. It was precisely then that green space planning evolved in Polish cities. According to a concept that emerged, there was a need for conscious shaping of the *green space system* – one which provided the local population with access to both green spaces and recreational areas[99]. Scientists realised the role of nature's elements in the formation of the urban fabric by defining the initial nature conservation plans of a regional scale[100]. The gist of the nature conservation philosophy was to identify ways of managing resources in harmony with nature. It found its reflection in urban physiography, encompassing research, analysis, and comprehensive assessment of natural conditions, applied in city planning. This approach can be traced back to the studies underlying the Functional Warsaw concept from the 1930's.

Conceived by Jan Chmielewski and Szymon Syrkus in 1934, the **Functional Warsaw** plan laid down a principle of the structural arrangement of settlement units and the functional, economic, and social links between the city and the region. This was reflected in both the city structure and the layout of its open spaces. The plan was intended to increase the relevance of the river Vistula as an important element crystallising the city structure[101].

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[96] Kegler H. *Resource Region: Regional Park „Mitteldeutschland" – Central Germany*, available online at: www.ceunet.de [accessed on 2011].
[97] Rautenstrauch L. 2006. *Zum Stand der im Dingé Regionalpark RheinMain* (On the current standing of the Rhine-Main Regional Park). In: *Collage, Zeitschrift für Planung, Umwelt und Städtebau* (Collage. Journal for Planning, Environment and Urban Development), no. 2, pp. 19–21.
[98] A draft regulatory plan of Warsaw from 1916 proposed a wedge-shaped layout of green spaces, which later, at the turn of the 1920's, according to the plan prepared by S. Różanski's team, evolved into a wedge and ring-shaped setup with a circle of *reserves* surrounding the city and a system of internal bypasses (Czarnecki W. 2008, p. 234).
[99] Tołwiński T. 1963, op. cit., p. 299.
[100] In Poland, the traditions of environmental protection date back a long way, but nature conservation as a proper social movement had not been initiated until the second half of the 19th century, as in other regions of Europe. The earliest form of legal protection of nature in Poland was established by means of what was referred to as the ruler's *regalia*, which emerged right at the dawn of the Polish state. They pertained to certain spheres of economic activity, reserved exclusively for the ruler or a person holding special powers endowed by the former. Hunting and fishing regalia were particularly important for nature conservation. Further legal acts of this kind included those concerning the protection of beavers, yew trees, and aurochs, introduced by kings Bolesław Chrobry, Władysław Jagiełło, and Zygmunt III, respectively, as well as subsequent laws, ordinances, and decrees protecting individual species of animals and plants, which had continued until 1934 when the first comprehensive Nature Conservation Law was enacted (Żarska B. 2003, pp. 20–21). The Nature Conservation Law currently in force in Poland is the Act of 16 April 2004.
[101] Chmielewski J., Syrkus S. 1934. *Warszawa Funkcjonalna* (Functional Warsaw). Association of Polish Architects (SARP), Warsaw. After: Malisz B. 1981, op. cit., pp. 196–197.

Over time, the economic aspect taken into account when shaping urban natural systems was gradually complemented with biological concerns. Experts began to ponder on how to consider the natural environment against specific urban conditions and how to develop the city with regard to its natural conditions. In the mid-1970's, this debate had ultimately led to the conception of an idea known as the **Ecological System of Protected Areas (Ekologiczny System Obszarów Chronionych, ESOCh)**. Its direct conceptual follow-up was a **nature-based urban spatial structure model**, proposed in 1986 by Zofia Stala. Its underlying assumption was that, in every city, there should be balance between discernible natural and anthropogenic components (open and built-up areas), providing the basis for the city's spatial development. This concept involved a method for designating areas of natural predisposition to create a system of open spaces, constituting the very essence of the city's natural structure. This method was employed while working on the **Urban Natural System (System Przyrodniczy Miasta, SPM)**. The SPM concept was developed by Barbara Szulczewska and Jacek Kaftan in 1996. It represented a comprehensive approach to the principles of urban natural environment shaping. The system was made up of areas with overarching natural functions (climatic, hydrological, and biological). All non-natural functions (recreation and leisure-related as well as residential and aesthetic) were identified as secondary. Such separation of functions was due to the need to differentiate planning and design activities related to the landscaping of individual structures. The SPM concept included a breakdown into nodal areas and nodes as well as into corridors and extensions, linked not only with one another but also with the regional natural system via material and energy exchange processes[102].

> The notion of the **Urban Natural System** emerged in urban planning theory and practice in the late 1980's, while it fully evolved in the 1990's. What became the goal of numerous planning concepts, defining the principles according to which urban ecosystems were to function, was to identify interconnected areas, mainly of the natural function, in the spatial structure of a city, to ensure that individual elements of urban nature perform their function effectively, and to improve the living conditions of city dwellers[103].

As cities began to sprawl and authorities strived to keep them sustainable, it became important to mind the legibility and compactness of their natural systems and to address the need to disseminate networks of greenways and park sites while keeping the built environment compact and multifunctional. The opportunity to enrich, complement, and ensure the continuity of the natural system of cities and agglomerations arises from the **reclamation of deteriorated and decapitalised industrial brownfields**. Transformed for nature's sake, they can form new urban green spaces (parks), parts of ecological corridors, ecological routes and nodes, and connect natural systems at a local as well as

[102] Szulczewska B., Kaftan J. (eds) 1996. *Kształtowanie Systemu Przyrodniczego Miasta* (Soft landscaping in cities). Institute of Land Management and Housing, Warsaw, pp. 29–34.

[103] The foundation of the theoretical concepts (the natural model of the urban spatial structure, the urban natural system, the ecological matrix, the idea of green routes, ecological infrastructure, etc.) was laid by the principles proposed by several reconised professionals, including: Roman Andrzejewski, whose principles concerned the preservation of the continuity of ecosystems in time and space, the diversity of ecological niches, as well as the adequacy in the relationship between the biotic environment and its abiotic conditions; Herbert Sukopp and Peter Werner, who defined the principles of ecological zoning, protection of habitats in the investment process, or inclusion of buildings in the structure of ecosystems (Szulczewska B., Kaliszuk E. 2005. *Koncepcja systemu przyrodniczego miasta: geneza, ewolucja i znaczenie praktyczne* (Concept of urban natural system: origins, evolution, and practical relevance). In: Files of the Committee for Urban Planning, Architecture, and Landscape Studies of the Polish Academy of Sciences, Lublin Branch, p. 8).

regional scale. When adequately developed, they can facilitate access to diverse forms of leisure and recreation for residents, and provide them with an opportunity to stay in contact with nature. It is for the purposes of ecological sustainability as well as mitigation or improvement of climatic and health conditions of the city that degraded sites, once renewed, should be incorporated into natural systems, which is also important for the pursuit of balance in the city's functional and spatial layout as well as of new landscape quality.

It was in the **Upper Silesian Industrial Region** in the 1960's that a protective forest strip was designed to envelop the urbanised areas, making the most of the convenient layout of the local woodlands surrounding the agglomeration's major cities (cf. Chapter 3). It was meant to improve local climate and health conditions, perform natural and scenic functions, and provide recreation and tourism opportunities. The crux of the concept was making the most of industrial brownfields to enhance recreational functions.

In the **Ruhr**, at the end of the 1980's, a regional green space system was established under the umbrella of the IBA Emscher Park, only to become the foundation for the redevelopment of the urban and ecological structure of nearby towns and the entire region (cf. Chapter 3). Industrial brownfields transformed for nature's purposes joined the core elements of the landscape renewal strategy.

A particular form of cooperation between the city and the surrounding municipalities has been pursued in **Leipzig** since 1996 to form what is commonly referred to as *Green Belt Leipzig*. It partially consists of reclaimed post-mining sites, where pits were planned to be filled with water to form a new anthropogenic lake district and where vast stretches of adjacent land were to be afforested to ultimately gain recreational functions.

In **Hannover**, back in 1997, a programme entitled *Hannover: Garden-like City* was prepared in an attempt to develop a system of green spaces shaped into an 80 km long ring encircling the city. It was designed to comprise woodland, farmland, and recreational areas, as well as greenery wedges that linked the city with its surroundings. The river Leine became the system's axis, while its complementary elements were the nearby degraded sites in need of conversion for natural purposes.

One of the first green spaces to have been established on industrial brownfields was the Buttes-Chaumont public park in Paris (1864–1867), developed on the beds of limestone exposed when being extracted during the redevelopment of Paris by G. E. Haussmann, designed by Jean-Charles Adolphe Alphand and Jean-Pierre Barillet-Deschamps. On account of its advantageous location and attractive vantage points, the rocky cliffs with a distinctive 50-metre-high *stone needle*, streams or waterfalls, the park became very popular among the Parisians looking for opportunities to spend free time.

In Poland, the site attractiveness and the potential for transforming industrial brownfields into naturally valuable areas was recognised already in 1870 in the city of Bytom, when 43 hectares of idle post-mining land, formerly occupied by the decommissioned Teresa calamine extraction facility, were reclaimed and redeveloped into recreation and park facilities, which is how the Franciszek Kachel Municipal Park was founded. In 1896, owing to the efforts undertaken by a local teacher, Wojciech Bednarski, a decommissioned limestone quarry, known as the Twardowski School (Szkoła Twardowskiego), was transformed into a municipal park, later named the Bednarski Park,

in the Krakow district of Podgórze. Walking paths and recreational grounds were created at both the quarry and the idle post-mining sites[104].

Several decades later, one of the best examples of the natural development of industrial brownfields, acclaimed both in Poland and across the whole Europe, materialised as **Silesian Park** – formerly **Regional Park of Culture and Recreation** (**WPKiW**) at the very heart of the Upper Silesian Agglomeration. The decision on its foundation was made at the end of 1950 on the initiative of General Jerzy Ziętek. The construction works started as early as in 1951, with Władysław Niemirski as the Silesian Park's chief designer. It was developed on an area of 600 hectares of derelict land occupied by mining and smelting spoil heaps, waste dumps, water-filled sinkholes, and bootleg pits (small coal mines illegally established on outcrops of coal beds)[105]. The post-industrial landform of the area was used to create a new water system. The material acquired by dismantling the heaps served to form the basin of the future sports stadium as well as for the construction of roads. One of the truly unique characteristics of the Silesian Park was that it had been built from scratch, without relying on any existing tree stand (the original tree cover was only 7%). The park compound received passive and active leisure facilities, which made it a place of recreation and entertainment for the residents of the entire region[106]. It would not have been possible to complete such an enormous and innovative project in such a remarkably short time (about 12 years) if it had not been for the centralist administration and management system of that day and age. After a local government system had been introduced in Poland, under the new administrative structure and in light of the altered and unclear funding sources, the Silesian Park lost the capacity to function harmoniously. Still, owing to its undeniable natural and cultural value, it continues to be decisive of the entire region's landscape identity.

In this day and age, the rules according to which the green space systems of large cities and agglomerations are shaped arise from the need to reconcile the requirements of environmental protection with human needs and the governing principles of urbanised areas. However, such an approach is no novelty. It can be traced across history to numerous model urban planning concepts seeking to create the principles of an ideal human dwelling place, existing in harmony with nature.

2.5. Natural elements of urbanised areas

When analysed against the background of urbanised areas, the natural environment is a broad concept comprising elements of different properties and of varying surface area. Their characteristics depend on natural and cultural conditions as well as on the urban and economic development of urban spaces.

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[104] In Poland, the first attempts at industrial brownfield reclamation and redevelopment for forestry were made in 1929, on the premises of the former sand pits in the towns of Strzemieszyce, Pawłów, and Makoszowy, and those aimed at redevelopment for agricultural purposes – on the former lignite mining sites in the 1960's.

[105] In total, the landform changes covered 259 hectares, which accounted for 45% of its total area. The problem encountered while developing the park was overcoming the obstacles of high concentration of air pollutants due to industrial activity. What also became necessary was creating suitable conditions for plant vegetation on chemically degraded, mechanically damaged, desiccated or waterlogged soils (Szczepanska J. 1988, pp. 15–25).

[106] At the park's highest elevation (ca. 320 m above sea level), the Planetarium and Astronomical Observatory were erected. The park's eastern section is occupied by the Silesian Zoological Garden and the Funfair. Its western part hosts the Silesian Stadium and the Upper Silesian Ethnographic Park, the latter holding 52 objects of old rural architecture from the regions of the Silesian Beskid, Upper Silesia, and Dąbrowa Basin on a total area of 22,000 hectares. The park is annually visited by approx. 12–15 million people from Poland and abroad.

The most important components of the natural environment, interpreted in the context of the composition, structure, or planning of urban layouts, are those which determine the shape of and occur on the land surface. There are close interrelationships between the terrain relief, vegetation, and water system observed in the landscape.

Variable in time, the economic, political and social, cultural and civilisational, or scenic and spatial conditions defined new perspectives for the transformation and utilisation of the natural environment. Depending on the needs of local populations, the technical capabilities, and the characteristics of a given site, as well as the spatial premises adopted, **greenery performs the following functions**[107]:

- **biological** – absolutely crucial for the quality and condition of the environment; when introduced into urban areas, greenery improves air quality, removes pollen and pollutants, maintains humidity, produces oxygen, cools the air, traps dust, provides shade, dampens noise, protects against wind, and affects the microclimate of a given place; by introducing naturally active clusters of greenery, one can create routes of ecological importance, buffer belts, or protection zones, surrounding the features which cause the most nuisance;
- **educational** – the presence of green spaces is conducive to the integration of local communities, promotes a desire to learn about nature and to respect its laws, conveys information about the natural history of the city or urbanised area, emphasises the cultural continuity of the urban organism, and becomes a reflection of the needs of its population;
- **compositional and aesthetic** – greenery is a factor which determines the appearance, character, and aesthetic appeal of a city; it performs a representative function for the city, affects its spatial and functional composition, adds variety to the city silhouette, and determines the landscape identity; the purpose of greenery development is to maintain the attractiveness and diversity of the urbanised space;
- **economic** – the quality of greenery gives economic value to the space, and it can also be an important indicator of the quality of life of the people who live in urbanised areas; additionally, urban greenery also comprises areas of productive character: agricultural, horticultural, fruit farming, or wood land;
- **leisure and recreational** – green spaces provide city dwellers with an opportunity to have contact with nature on a daily basis, allow them to regenerate physically and mentally, counteract stress conditions and, on a larger scale, pathological phenomena observed in society; the smaller the distance of a place of residence from green spaces and the larger their area, the greater their positive influence on human psyche.

Nowadays, nature has become a decisive factor in overcoming the difficulties associated with the speed of everyday life of highly developed societies in intensely urbanised environments. Yet the overarching function of contemporary green spaces has invariably been the satisfaction of people's needs connected with living, working, and leisure. Depending on the differentiating criterion, diverse **classifications of green spaces** have been applied[108]. Considering natural, functional, and locational factors, it seems reasonable to divide green spaces into eight classes, differing in surface area, species composition of the vegetation, and the manner in which it is distributed or utilised. These

[107] The functions of urban greenery have been addressed by numerous authors, including: Czarnecki W. 1968, op. cit, p. 140; Niemirski W. 1973, pp. 12–16; Orzeszek-Gajewska B. 1982, op. cit., p. 96; Czerwieniec M., Lewińska J. 2000, op. cit., pp. 17–47; Haber Z., Urbański P. 2005, op. cit., pp. 75–82; Zachariasz A. 2006, op. cit., p. 86.

[108] The classification of green spaces was a problem addressed by many authors, such as: Czarnecki W. 1968, op. cit., pp. 139–142; Zielonko A. 1973, pp. 24–25; Orzeszek-Gajewska B. 1982, op. cit., pp. 97–174; Czerwieniec M., Lewińska J. 2000, op. cit., pp. 11–15; Haber Z., Urbański P. 2005, op. cit., pp. 27–74; Zachariasz A. 2006, op. cit., pp. 87–89.

are: woodlands; parks and sites of park characteristics; active farmlands; allotment and backyard gardens; green squares, lawns, and surface greenery of traffic routes; roadside trees and other isolated trees, shrubs, and small patches of greenery; waterfront vegetation of water courses and bodies; wastelands, fallow lands, ruins, and other marginal communities[109].

When considering the cultural role of the natural environment and its social dimension, the above classification should be expanded. In this respect, the traditional breakdown divides urban green spaces into public-access greenery (parks, lawns, green squares, boulevards, promenades), special-purpose greenery (predominantly limited in use, e.g. vegetated buffer strips, traffic infrastructure greenery, gardens, cemeteries), and auxiliary greenery (accompanying industrial and storage sites, culture and community services, technical and economic services, and residential areas), typically excluded from public use, areas used for purposes of agriculture and forestry (horticulture, production, agriculture and farming, commercial forests), as well as tourist and recreational sites (suburban forests, historical parks, national parks)[110]. What has affected the variety of classifications of urban green spaces is a process of combining them into natural systems and their increasing spatial reach. One of the most comprehensive overviews of all types of greenery is the classification proposed by Alfons Zielonko, completed by Agata Zachariasz[111]. It introduces the following breakdown:

- **green spaces intended for leisure**: passive (walking and leisure parks, lawns, green squares, boulevards, and promenades) and active (sports, theme, folk, culture, and leisure parks, as well as municipal forests and forest parks);
- **special-purpose green spaces**: fully accessible (buffer tree stands and greenery of transport routes, i.e. streets, roads, railways, air transport infrastructure, as well as *greenways*) and of limited accessibility (educational gardens: botanical, dendrological, zoological, ethnographic parks, horticultural centres and exhibitions; historical parks and gardens; science and technology parks; cemeteries, and employee allotment gardens);
- **accompanying green spaces** at or next to: residential buildings (multi-family and single-family buildings; community gardens); children's facilities (playgrounds, crèches, kindergartens, allotment gardens; facilities of summer/winter play centres, school trips combined with education, and holiday trips); schools and universities (campuses); facilities of community, culture, arts, health, welfare, and sports centres; office facilities; diverse infrastructural services (power engineering, communications, sewage disposal, water supply, and storage facilities); shopping centres and complexes; manufacturing plants and other industrial facilities, as well as ecological *greenways*;
- **areas used for agriculture and forestry**: plant nurseries, production farms, and commercial forests;
- **sightseeing and recreation areas**: forests, suburban and regional parks, leisure centres, nature conservation and historic heritage conservation sites (landscape parks, reserves, Natura 2000 sites, protected landscape sites, local nature conservation sites, culture parks).

[109] Such a breakdown was used, among others, in the programme known as *Poznań 2010. The Metropolitan Strategy*; source: www.metropoliapoznan.org [accessed on 2011].
[110] Czarnecki W. 1968, op. cit., p. 140.
[111] Zachariasz A. 2006, op. cit., p. 88.

As the foregoing implies, the greenery of urbanised areas consists of the dominant elements of organised nature, subject to planned human activity, as well as minority areas moulded by the forces of nature, commonly referred to as enclaves of *wild nature*. What the above classifications highlight is that such collations lack more detailed identification of the green spaces which have developed as a consequence of human negligence – areas shaped by natural succession processes and natural sites transformed by industrial operations. Instead, they are categorised as green spaces accompanying manufacturing plants and other industrial facilities.

The development of industry in the late 19th and early 20th century changed the approach to the natural environment. The extraction of mineral resources, and especially coal, zinc and lead ores, as well as sand, had triggered anthropogenic transformations of and disruptions to the spatial structure and landscape of numerous towns and agglomerations. It resulted in a loss of harmony between urban space, culture, and nature, only to become a source of threat to humans. Every decision made under the umbrella of spatial management had some negative impact on the natural environment, causing destruction of its components. These were affected by such phenomena as, for instance, accumulation of solid waste, disruption of water regimes, soil contamination with heavy metals, air pollution with dust and sulphur or nitrogen compounds, deformation of the earth's surface, changes to the flora, or impoverishment of the animal world. By the mid-19th century, industry had been allowed to interfere in space virtually without any limitations.

Deep mining of coal beds became one of the greatest threats to the natural environment of industrial cities. There are numerous environmental hazards associated with mining: ground subsidence, formation of sink holes and water-filled pits due to mining operations, accumulation of large quantities of mine waste on spoil heaps, causing adverse landscape changes, discharge of large quantities of saline water into rivers, or formation of sizeable drainage areas disturbing water regimes over large territories[112]. Unconstrained mining operations performed under forested areas led to degradation, reduced productivity, and waterlogging of soil, changes in the structure of forest communities, and dying out of forest stands. Land use changes cause long-lasting effects and are often impossible to eradicate. Water-filled pits, rickety trees, or even tree stumps are motifs typical of the natural landscape of post-industrial cities and agglomerations. Further characteristic features include successional and ruderal vegetation, accompanying traffic routes, buildings, mineral extraction facilities, as well as landfill sites and dumps.

It would be biased to consider only the negative effects of industry on the natural environment. **There are new green spaces, varying in size and form, linked to industry to a different degree, which have been created in urbanised industrial areas alongside the existing organised green spaces and rather scarce fragments of nature not transformed by man**. They have become an essential part of the fabric of urbanised areas and urban lifestyles (Table 1).

[112] Rostański A. *Zagrożenia środowiska przyrodniczego* (Threats to the natural environment). In: Rostański K. (ed) 1983. *Przyroda województwa katowickiego* (Nature of Katowickie Voivodeship). Wydawnictwo Kubajak, Krzeszowice, pp. 168–177.

Table 1

Functions and forms of industrial greenery – chronological and spatial perspective									
Functions of industry-associated greenery	**Forms of industry-associated greenery**								
	13th century		**19th century**			**20th century**			
raw material greenery	cultivated plots of land providing raw material for production								
nutritional greenery	cultivated plots of land at workers' housing estates, providing basic sustenance					factory allotment gardens			
protective greenery							green buffer zones to isolate nuisance industry		
buffer greenery							buffer greenery complexes to isolate nuisance areas on industrial premises		
land reserve greenery							green zones on industrial premises, intended for plant expansion		
greenery of special aesthetic appeal			garden and park sites adding aesthetic quality to factory owners' villas			ornamental greenery at the entrance to and inside industrial facilities			
recreational greenery				recreational areas near industrial facilities (meadows, parks); allotment gardens		green spaces around and inside production facilities; recreational areas outside industrial facilities; urban parks; brownfield parks			
successional greenery (incl. remediation and reclamation greenery)								greenery on uncultivated brownfield sites	

Prepared by: Gasidło K. in cooperation with Sulimowska-Ociepka A.; source: Gasidło K. 2010

Until the 1970's and 80's, greenery had primarily performed the protective and buffering role, as it obstructed the view over unpleasant buildings and protected the surroundings against various types of pollution: dust, aerosols, or gases[113]. As time passed, its function began to involve also the following functions:

- initiation – accelerating natural succession;
- protection – preventing erosion or invasion by undesirable species;
- remediation – eliminating or neutralising pollution;
- direct economic benefits (crops)[114].

[113] Many brownfields require measures aimed at protecting the site from erosion, changing the physical and chemical structure of the soil, and eliminating harmful contaminants. Much contribution to the foregoing is attributable to the method of natural succession or purification of soils and sediments from heavy metals, petroleum derivatives, and radioactive substances, making use of the phenomena of accumulation of these pollutants in plants, known as phytoremediation (Gasidło K. 2007. *Zielone dziedzictwo przemysłu* (Industry's green heritage). In: *Czasopismo Techniczne* (Technical Journal), *Architecture* series, book 7-A, Krakow University of Technology, Krakow, p. 40).

[114] Gasidło K. 1998, op. cit., p. 45.

After 1980, as the economic structure of industry changed and new technologies started to emerge, many components of the natural environment were transformed. The value of land as a natural resource was recognised and diverse industry restructuring measures were undertaken. **The elements characteristic of the industrial landscape, such as dump sites, mining pits, or artificial bodies of water, began to be perceived in a new light.** Some of them proved to be valuable in geological (open pits, outcrops, sink holes, overflow site) and natural terms (rich flora, adjacent plant communities, new species combinations). Precious few turned out to be quite unique across a given region (decommissioned quarries in Blachówka and Czeladź, abandoned mine workings near Tarnowskie Góry), while others offer unique qualities on a country-wide or even European scale (soda ash heap in Jaworzno, dumping grounds near Manchester)[115]. The most valuable preserved forms of the natural environment, subject to legal protection, along with the elements left to natural succession form what may be called *green islands*, counterbalancing the highly urbanised territories of cities and agglomerations.

The consequence of the progressing concentration of urban population, the shrinking of naturally valuable areas, and the drive towards improving the quality of urban space and the quality of life of city dwellers is that the anthropogenic elements of the natural environment, left to natural succession, have become the most easily accessible green spaces within urbanised areas. As the affluence of the society increases, so does the fashion and demand for active leisure and for widely accessible areas intended for this purpose. Initially abandoned and decrepit, industrial brownfields along with their respective anthropogenic forms, when adequately transformed and developed, have provided means to cater to this demand.

The end of the twentieth century, when the process of comprehensive regeneration of the areas degraded by industrial activity properly commenced, saw them gain a new value. They became essential for further economic development. At present, they are perceived as land reserve, enabling new urban planning solutions to be deployed in order to upgrade the spatial and functional structure of cities. Transformed for nature's sake, brownfields are growing in importance as an inherent element of the strategy to improve the health conditions and quality of urban life. The proximity of green spaces, recreational sites, and sports features contributes to the attractiveness of urbanised areas, boosts the value of adjacent properties, and attracts new investment. With regard to green spaces, the problem of access to sites located within city boundaries and to open spaces located outside city boundaries is considered equally significant as the access to basic services and essential for good quality of life and sustainable development of urbanised areas[116]. The measure applied in this respect is the area of in-city green spaces per inhabitant or the percentage share of green spaces in the city's total area (Tables 2 and 3)[117].

[115] Tokarska-Guzik B. 2002. *Walory przyrodnicze województwa śląskiego - stan, zagrożenia i perspektywy ochrony* (Natural qualities of Silesian Voivodeship – current status, threats, and protection prospects). In: *Krajobraz jako wizerunek tożsamości regionalnej – zagrożenia, ochrona i kształtowanie* (Landscape as the image of regional identity – threats, protection, and creation). IV Landscaping Forum – Bulletin, no. 40, Katowice, pp. 41–56.

[116] Zachariasz A. 2006, op. cit., p. 5.

[117] The World Health Organisation (WHO) standards, which most cities fail to meet, stipulate that the minimum area of green space per one inhabitant of an urban agglomeration should be 50 m².

Table 2

Green spaces in major Polish cities					
City	**Total city area (ha)**	**Population**	**Green area (ha)**	**Green area (m^2) per capita**	**Share (%) of green spaces in total city area**
Warsaw	51,724	1,709,781	6,850	40.1	13.2
Łódź	29,325	747,152	3,689	49.4	12.6
Wrocław	29,282	632,162	3,051.3	48.3	10.4
Bydgoszcz	17,598	358,928	4,941.4	**137.7**	**28.1**
Toruń	11,572	206,013	1,000.6	48.7	8.6
Lublin	14,745	350,462	1,498.2	42.7	10.2
Krakow	32,680	754,624	3,038.8	40.3	9.3
Opole	9,655	126,203	648	51.3	6.7
Rzeszów	9,755	172,683	545.7	31.6	5.6
Białystok	10,212	294,153	880.6	29.9	8.6
Gdańsk	26,168	455,581	2092	45.9	8.0
Kielce	10,965	205,094	585.6	**28.6**	**5.3**
Olsztyn	8,833	176,142	2126	120.7	24.0
Poznań	26,185	557,264	3,537.7	63.5	13.5,%
Szczecin	30,055	406,941	3,254.2	80.0	10.8,%

Author's elaboration based on statistics from the Central Statistical Office's Local Data Bank (GUS BDR), 2009

Table 3

Green spaces in the cities of the Upper Silesian Agglomeration					
Upper Silesian Agglomeration cities	**Total city area (ha)**	**Population**	**Green area (ha)**	**Green area (m^2) per capita**	**Share (%) of green spaces in total city area**
Gliwice	13,388	193,089	606.7	31.4	4.5,%
Bytom	6,944	183,788	412.6	22.4	5.9,%
Zabrze	8,040	188,029	884.9	47.1	11.0,%
Ruda Śląska	7,773	143,807	485.1	33.7	6.2,%
Świętochłowice	1,331	54,292	249.8	46.0	2.2,%
Chorzów	3,324	113,014	845.3	**74.8**	**25.4,%***
Piekary Śląskie	3,998	58,677	104.8	**17.9**	**2.6,%**
Siemianowice Śląskie	2,550	71,086	271.0	38.1	10.6,%
Katowice	16,467	307,179	1,218.6	39.7	7.4,%
Sosnowiec	9,106	219,352	819.6	37.4	9.0,%
Dąbrowa Górnicza	18,873	128,025	609.7	47.6	7.4,%
Mysłowice	6,575	75,065	188.1	25.1	3.2,%
Jaworzno	15,267	95,512	778.5	81.5	5.1,%
Tychy	8,164	130,107	623.4	47.9	7.6,%
total	187,432	2,703,246	8,098.1	590.6	

*The disproportion between Chorzów and other municipalities of the Upper Silesian Agglomeration is attributable to the fact that the entire Silesian Park is situated within the city's administrative borders.

Author's elaboration based on statistics from the Central Statistical Office's Local Data Bank (GUS BDR), 2009

The urban green spaces collated in the tables above include walking and recreation parks, lawns, street greenery, residential green spaces, cemeteries, and forests[118]. For most Polish cities, the factors of urban greenery area per inhabitant are similar, with Kielce and Rzeszów having the lowest values, while Bydgoszcz and Olsztyn the highest (Table 2). However, these differences, resulting from a variety of internal and external conditions, are not the main focus of analysis. It is, on the other hand, a comparison of the basic data concerning the total area of green spaces in major Polish cities with that of the cities in the Upper Silesian Agglomeration (Table 3). Having compared the data in both tables, one can conclude that the average size of green spaces in post-industrial cities (contrary to the common opinion) does not differ significantly from the average of the other large Polish cities. The area of the Upper Silesian Agglomeration is characterised by a considerable share of urban green space, namely 9.3%. One reason for that is the presence of the greenery developed by industry which has become an important part of the fabric of urbanised areas. It includes, among other forms of green space, numerous sites of landscaped greenery, dating back to the industrial era[119], and greenery accompanying production facilities.

Over the recent years, the green spaces growing in size in the post-industrial cities and agglomerations have become increasingly affected by the vegetation emerging on account of the processes of natural succession as well as reclamation, renaturation, and revitalisation of degraded brownfields. What can also be perceived as common to the present day is the greenery associated with modern spatial clusters of industrial and scientific facilities, i.e. technology or industry parks, the consequence of which is that new sustainable urbanised space is being developed with the natural environment as its inherent and inseparable component.

2.6. Contemporary human environment

The process of mindset changing and maturing enough to embrace the sustainability philosophy can be analysed on two levels. Next to the ideological and executional trends, making it possible to put ideas into practice, the second level is of a declarative and general nature, and it is considered from the perspective of documents, reports, declarations, or charters defining targets for the protection and development of the human environment. It is very frequent that no interaction occurs between these spheres. However, the consequence of the foregoing is the growing awareness of the factors threatening the environment as well as of the need to protect and shape it in a conscious manner.

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[118] Central Statistical Office's Local Data Bank (GUS BDR), 2009.

[119] The natural system of the Upper Silesian Agglomeration was supplemented by the organised greenery sites developed in the late 19th and early 20th century. These included: the palace and park sites located predominantly on the outskirts of urbanised areas (Świerklaniec, Bytom Miechowice, Plawniowice), but also inside the most intensively developed urban areas (Siemianowice Śląskie, Sosnowiec); recreation zones and health recovery resorts for workers, established in suburban areas bought out by large industrial corporations and individual industrialists (Chorzów Zdrój near Königshütte [allotment gardens and spas], Mokre Zdrój near Mikołów [spa and venues dedicated to holding festivities]; neighbourhood parks created by industrial plant owners to provide better living and recreation conditions for skilled workers (Katowice Giszowiec, Borsig in Zabrze Biskupice, Bytom Łagiewniki, Sosnowiec Milowice); company-owned parks, established on industrial premises and in their immediate vicinity (Alfred Park in Katowice Welnowiec, Tychy – Princely Brewery, the park of the Technical Equipment Factory in Gliwice); municipal parks, established in urban and suburban areas (Bismarck Park, T. Kosciuszko Park in Katowice, Chrobry Park in Gliwice, municipal park in Bytom, Zielona park in Dąbrowa Górnicza); allotment gardens, located in a direct vicinity of workplaces (Fabiańczyk A. *Zabytkowe parki* (Heritage parks). In: Rostański K. (ed) 1983, op. cit., pp. 144–158).

Examples of such endeavours were already known to ancient civilisations. Nevertheless, the actions actually undertaken would typically mitigate negative effects instead of eradicating root causes. In the highly industrialised countries of Western Europe, not until the 1970's had the need to protect the natural environment and raw material resources enjoyed adequate attention. In the socialist countries of Eastern Europe, environment-conscious policies were introduced much later still. For a long time, this region continued to be governed in line with a strategy of immediate economic effect, which led to destruction of the urbanised landscape. The period of recession triggered a change to the way in which people understood rational shaping of the natural environment, exploitation of its resources, and environmental protection. Pursuing the quality of life in harmony with nature, in both material and psychological terms, was gradually becoming the overarching goal of development at large. This body of problems was ultimately integrated into socio-economic and land use policies, which happened in follow-up to the report prepared and released in 1968 by **UN Secretary-General U Thant** entitled *Problems of the Human Environment*. The document provided data demonstrating the destruction of ecosystems and the negative consequences of this process. Its purpose was to highlight the need for immediate action aimed at stopping the global crisis caused by the human attitude towards the environment. The reasons for the collapse of the relationship between both were sought in the demographic boom, industrialisation, deterioration of arable land, unplanned growth of urban areas, shrinking of open space, fading of natural ecosystems, destruction of nature, and the absence of connections between high-end technology and environmental requirements. Although previously noted, yet continuously marginalised, the problem of limited space and land resources was properly defined, with the conclusion that they needed to be used rationally and conserved[120].

Successive conferences were organised to discuss how the environment could be shaped and protected on an international scale, which had a direct effect on introducing numerous regulations, contained in several fundamental strategic documents such as acts, declarations, charters, conventions, treaties, protocols, or resolutions. Even though they had no actual legal force, they still influenced those responsible for the creation of places of human habitation, and they set some general trends for the renewal of the natural landscape[121].

The starting point for further efforts intended to ensure that the natural environment could develop in urbanised areas was the 1987 report entitled *Our Common Future*, released by the World Commission on Environment and Development founded in 1983 by Gro Harlem Brundtland. It proposed a **sustainable development concept** which ultimately became a new philosophy based on the respect towards and reasonable use of nature's goods as well as on harmony with the environment. It also laid the foundations for the

[120] The initial symptoms of urban civilisations approaching the thresholds of growth were also highlighted in the reports to the Club of Rome (The Limits to Growth, 1972; Mankind at the Turning Point, 1974; Reshaping the International Order, 1976; etc.), which warned humankind of the consequences of exponential population growth, economic consumption, rapid industrialisation, consumption of non-renewable resources, and the deteriorating environment (Meadows D.H., Randers J., Meadows D.L. 1972).

[121] The most important of them are: Convention Concerning the Protection of the World Cultural and Natural Heritage (1972), World Conservation Strategy (1980), Basel Convention (1989), Convention on Environmental Impact Assessment (1991), Helsinki Convention (1992), Rio Declaration on Environment and Development (1992), Convention on Biological Diversity (1992), Pan-European Biodiversity and Landscape Strategy (PELBS, 1995), Kyoto Protocol to the UN Framework Convention on Climate Change (1997), European Spatial Development Perspective (ESDP, 1999), Cartagena Protocol (2000), European Sustainable Development Strategy (ESSD, 2001).

forthcoming transformations of urbanised areas and became a part of the international legal framework, while in Poland, it even found its way into the constitution[122].

> The measures undertaken by the Brundtland Commission had contributed to the convention of the 1992 UN Conference on Environment and Development, known as the Earth Summit, in Rio de Janeiro, the direct effect of which was linking the environmental protection issue to social and economic development. From the specific perspective of the urbanised environment, the global action programme known as **Agenda 21**, drawn up at the conference to call for support for the measures aimed at pursuing the sustainability principles in practice, proved to be of paramount importance[123]. Agenda 21 inspired authorities to create the respective national, regional, and local Agendas 21 (LA 21), defining their visions of harmonious development. This was reflected in a shift of attitude towards spatial planning, urban and architectural design, and urban landscaping.

However, the principle of sustainable cities is not entirely new. The original model of permanently sustainable development was nature itself, understood as a system designed to protect and sustain life[124]. This principle comprises some key elements which can be traced back to different examples of spatial structures of past centuries. Suffice it to give another thought to the concepts proposed by Ebenezer Howard, Patrick Geddes, or Frank Lloyd Wright, all of whom made remarkable attempts to link the city with nature in a holistic manner.

Predominant in the past, the consumerist attitude towards nature and its resources eventually began to transform. Ecological awareness emerged in people, efforts aimed at conservation and preservation of environmental qualities started to attract more and more attention, and the partnership between people and nature was emphasised[125]. What also changed was the philosophy underpinning the human perception of the environment. The focus was being gradually shifted from the measures intended to reduce the negative effects of human activity to those meant to prevent pollution. The quality of human habitation began to be understood as dependent on the quality of the natural environment. The process which commenced at the same time consisted in building the image of a city as a place open to and in harmonious relationship with nature.

It was also understood that documents, declarations, reports, as well as political, social, or economic organisations and institutions did not affect the state of the environment on a global scale. Nor had any governmental policy or public opinion changed significantly. On the contrary; at the United Nations 2002 World Summit on

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122 The first Polish definition of sustainable development appeared in 1992 in the report by Polish environmental movements entitled *Ekorozwój w Polsce* (Eco-development in Poland). It set the foregoing concept against the context of human needs, defining it as a strategy for a pursuit of decent life within the limits established by what is physically and biologically attainable. The principle of sustainable development was laid down in Article 5 of the Polish Constitution, and it was also introduced into the National Environmental Policy.

123 Some major documents considered crucial for the environment were also signed at this conference, namely the Convention on Biological Diversity, the Convention on Climate Change, as well as the Rio Declaration on Environment and Development – the Earth Charter and the Declaration on Forests. They have all been taken into consideration in many documents of national or supranational scope.

124 Drapella-Hermansdorfer A. *Krajobraz współczesny jako pole poszukiwań twórczych* (Modern landscape as a sphere of creative pursuits). In: Drapella-Hermansdorfer A. (ed) 2004, op. cit., p. 43.

125 This has been highlighted at a number of conferences, including: *Conserving Europe's Natural Heritage*, Maastricht (1993); ministerial conferences devoted to assessing the state of the continent's environment and developing environmental programmes; UN's World Summit on Sustainable Development, Johannesburg (2002), concerning environmental, social, health, and economic issues (Żarska B. 2003, op. cit., pp. 20–29).

Sustainable Development in Johannesburg, its main goal being to review the implementation of Agenda 21, it actually noted was that the negative human impact on nature had reached its historical peak and continued to grow.

At the same time, increasing attention began to be attached to the need for systemic protection of the natural environment, resulting in the European Union's sustainable development strategy, predominantly based on the formation of large-area natural structures. In the 1990's, the foregoing caused numerous ecological network concepts to emerge, such as the idea of the Baltic Green Ring, the Green Heart of Europe (the Carpathian Ecoregion), or the Green Lungs of Europe. They addressed the overall body of natural and cultural environment problems at national and international levels, covering not only natural habitats, but also transformed urbanised areas (rural and urban). 1995 saw the arrival of the European Green Belt initiative, intended to create an ecological network of protected areas, stretching from the Barents Sea to the Black Sea. The Green Belt connects national parks, biosphere reserves, and protected cross-border areas, as well as valuable unprotected natural sites located in borderlands. Its purpose is also to support regional development initiatives implemented with a view to protecting nature, introducing balance between human activity and the natural environment, and increasing opportunities for the socio-economic development of local communities[126].

Aimed at protecting the diversity of the natural environment, linking it with the urbanised environment, and maintaining balance between both these spheres, diverse community programmes and initiatives introduced by international organisations, such as *Man and Biosphere* (1975), *The Role of Cities in Sustainable Development* (1989), *Sustainable Cities Programme* (1994), or URBAN II (2000), significantly grew in importance.

> In the sphere of protection of natural landscape qualities, **Poland** cooperates with most European countries, with almost all neighbouring countries, as well as with the USA and Canada. To date, Poland has ratified or signed more than 40 regional or global environmental conventions. Numerous networks established under international programmes cut through Poland to reconcile the goals of protection with those of economy, and to preserve the cultural heritage associated with specific natural formations, including the MaB biosphere reserves and the Ramsar Convention on wetlands, which are of international importance, especially for waterfowl habitats, or the HELCOM Baltic Sea Protected Areas, identified on the grounds of the 1992 Helsinki Convention. Poland has also joined various European ecological programmes and networks, e.g. EECONET, CORINE, and Natura 2000, aimed at protection of Europe's natural heritage, including: protection of biodiversity, defining nature conservation policy targets and pursuing these targets, and inspiring diverse state services in this dimension. This form of protection pertains only to the most valuable natural areas.

The pursuit of sustainable development in the urbanised space has become the foundation of the urban planning and landscaping transformations observed in many European cities. This has manifested itself in the processes of redevelopment of degraded areas, in the change of attitude towards spatial planning or urban and architectural design, as well as in how the new image of contemporary cities is being built. The quality of the natural environment has become a determinant of the standard of human life in the city. The latest generation of urban agglomerations, currently taking shape before our very eyes

[126] www.europeangreenbelt.org [accessed on 2011].

in line with the concept of sustainability, seeks to create new urban systems based on natural structures in transition, functioning in harmony with nature and the world of natural laws. A consequence of these developments is the urban policy currently crystallising at the EU level. Many documents functioning at the European scale, relating to the principles of spatial development, emphasise the need for systemic protection of natural sites and connect the problem of nature conservation with the spatial reach and structure of cities, thus making local authorities responsible for the quality of human life as well as the quality of individual elements of the natural environment in the city. Nevertheless, they do not provide any direct legal grounds for national urban policies, only a general framework for individual measures implemented by the Member States.

The first programmes defining and addressing environmental issues against the context of sustainable development of urbanised areas entered into the European politics between 1973 and 1986 (Environmental Action Programmes). Their task was to solve the problems of pollution caused by industrial activity, to link environmental issues with the processes of new technology implementation and economic development, to introduce the Environmental Impact Assessment (EIA) scheme, and to develop a policy covering various aspects of urban ecology[127].

In the 1990's, the European Commission released a series of reports and communications intended to guide urban planning activities which shaped the contemporary urban environment. One of the first harbingers of the new directions the European policy would head for in this sphere was the 1990 **Green Paper on the Urban Environment**[128], where some general principles for addressing environmental threats were proposed[129]. In Poland, the principles of protection of urban greenery against overdevelopment were set forth in 1994 in the **National Charter for Urban Greenery and Landscape**, prepared and edited under the supervision of Longin Majdecki. It also highlighted the need to restore natural continuity as well as to protect biodiversity and identity of the place. All its demands and recommendations went unheeded.

The value of natural resources and their role in the social and cultural life of cities was emphasised by the **Aalborg Charter** (the Charter of European Cities and Towns Towards Sustainable Development) of 1994, promoting ecological lifestyle among city dwellers. It emphasised the need for making the most of the „indicators of sustainable development of urban systems" when creating policies and exercising measures of control. Also the provisions of the **Leipzig Charter** on Sustainable European Cities (2007) relied on the common principles and strategies intended to contribute to the

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127 Gasidlo K. 2010, op. cit., pp. 47–48.

128 *Green Paper on the Urban Environment*, 1990, Commission of the European Communities, Brussels.

129 Further relevant EU documents include: *Urbanization and the functions of cities in the European Community* (1992), *Towards an urban agenda in the European Union* (1997), *European Sustainable Cities* (1996), studies on the statistical concepts for European cities (Eurostat 1992), the concept for establishing the European Spatial Planning Observation Network – ESPON (1997), *The EU compendium of spatial planning systems and policies* (1997), *European Spatial Development Perspective (ESDP). Towards Balanced and Sustainable Development of the Territory of the European Union* (1999).

129 Further relevant EU documents include: *Urbanization and the functions of cities in the European Community* (1992), *Towards an urban agenda in the European Union* (1997), *European Sustainable Cities* (1996), studies on the statistical concepts for European cities (Eurostat 1992), the concept for establishing the European Spatial Planning Observation Network – ESPON (1997), *The EU compendium of spatial planning systems and policies* (1997), *European Spatial Development Perspective (ESDP). Towards Balanced and Sustainable Development of the Territory of the European Union* (1999). The EU's latest documents mainly focus on the problems of urban development and renewal. The most important of them include the following: *Lille Action Programme* (2000), *Urban Acquis – Urban Agenda for the EU*, Rotterdam (2004), *Bristol Agreement* (2005), *EU Territorial Agenda – Towards a More Competitive and Sustainable Europe of Diverse Regions* (2007), *Leipzig Charter on Sustainable European Cities* (2007), Marseille Declaration (2008), Opinion of the European Economic and Social Committee on *The need for an integrated approach to urban regeneration* (EESC 760/2010), Opinion of the Committee of the Regions on *The role of urban regeneration in the future development of urban areas in Europe* (2010), Barcelona Agenda – *Towards a Local European Agenda* (2010).

development of European cities. Attention was paid to the cultural and health aspects, including the use of degraded quarters against the context of the city as a whole. From the point of view of how natural systems were designed and developed, the Charter pointed at the need for holistic strategies and coordinated actions on the part of all the persons and institutions involved in the process of urban development – ones which would transcend the boundaries of individual municipalities. It also reoriented the available planning tools towards creating a coherent vision for urban areas[130].

In 2010, in response to the global financial, economic, and social crisis, which affected both the economy and the quality of life of European communities, the EU Member States signed **the Toledo Declaration**, whose focal point was integrated „green, environmentally friendly, and ecological" urban regeneration. Having highlighted the relevant problems of contemporary cities, i.e. globalisation, climate change, increasing demand for limited resources, migration processes, ageing populations or other demographic changes, the Declaration emphasised integrated, smart, sustainable, and coherent urban development, ensuring the right quality of life to city dwellers. With the environmental perspective in mind, among a variety of aspects, it pointed at „recycling land (by means of urban regeneration, the redevelopment or reuse of abandoned, derelict or unused areas) as a key strategy for contributing towards the reduction of land consumption," preventing unnecessary changes in the use of undeveloped land and open spaces into urbanised areas, and „combating 'urban sprawl'"[131]. It also stressed the need for „protecting natural, landscape, forestry, water resources, agricultural areas, etc. around cities and strengthening their links or articulation with cities (for example, with green belts and/or corridors connected to and in continuity with the network of public parks and spaces), 're-greening' the existing city, etc"[132].

The degree to which in-city space (including degraded areas) is utilised can be measured using what is referred to as the **European sustainable land use indicators**, listed among the European standards (*European Common Indicators: Towards a Local Sustainability Profile*) developed in 2001. Of the variety of aspects they address, using an annual scale, they define the percentage share of new development on undeveloped land (*greenfields*), the percentage share of new development on abandoned or recultivated land (*brownfields*), as well as the area covered by various restoration programmes[133]. These indicators provide a hands-on tool to control how urbanised areas are to develop in terms of the conversion of open space and the use of degraded land. They help in adequate management of landscaping programmes, which translates into actual urban landscapes being created.

Most of the aforementioned documents emphasise the need for rational use of all environmental resources, including degraded space, and for systemic protection of natural areas, including the elements of the natural environment damaged by industrial activity. These processes are connected with spatial planning, the latter being supported by numerous indications, instructions, or specific recommendations contained in the codes, laws, and policies applicable in a given country. After all, as Władysław Czarnecki wrote, spatial planning means skilful landscaping[134].

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130 *Leipzig Charter on Sustainable European Cities*, 2007.
131 *Toledo Declaration* on urban development 2010; Polish translation, p. 11, available online at: www.mrr.gov.pl [accessed on 2011]
132 Ibid., p. 11.
133 *Towards a Local Sustainability Profile – European Common Indicators*, Indicator no. B. 9.
134 Czarnecki W. 1968, op. cit., p. 9.

Landscape renewal and shaping activities have taken a prominent role in terms of the development of built and natural environment. Civilisational changes have proved that nature conservation in cities is not only about protecting areas of high natural value. In order to maintain high levels of biodiversity and ensure appropriate functioning of ecosystems, one must protect all elements of the natural network, including degraded urbanised landscapes. Drawn up in 2000 in Florence, the **European Landscape Convention** (ELC) committed the EU states to pursue the goals of protection, planning, and informed landscaping in their respective policies[135]. According to the Convention, landscape is understood as an element of the environment which:

- has an important public interest role in the cultural, ecological, environmental and social fields,
- constitutes a resource favourable to economic activity,
- contributes to the formation of local cultures and consolidation of the European identity,
- is a basic component of the European natural and cultural heritage,
- is an essential component of human being's surroundings,
- is a key element of individual and social well-being[136].

Most importantly, however, this resolution focuses on the landscape in its broad sense, and it does not refer only to the most valuable areas characterised by outstanding qualities, but also takes into account common degraded areas, created as an outcome of the interaction between natural and anthropogenic factors. The preamble to the ELC reads that „landscape is an important part of the quality of life for people everywhere: in urban areas and in the countryside, in degraded areas as well as in areas of high quality, in areas recognised as being of outstanding beauty as well as everyday areas," and the Convention further states that „landscape planning means strong forward-looking action to enhance, restore or create landscapes"[137]. In this context, all activities related to the remediation and revitalisation of industrial brownfields, where natural qualities can become part of new functions related to recreation, leisure, and tourism, have significantly grown in importance. They will contribute to a change in the perception of and the importance attached to the urbanised space, as well as to a shift in thinking about the quality of the post-industrial landscape.

[135] The extent to which the solutions proposed under the European Landscape Convention (officially recognised by Poland in 2004) have been implemented is virtually negligible. However, Poland has undertaken to perform a detailed survey, analysis, and assessment of the condition of individual landscapes, and to set qualitative goals for their development, as well as to ensure extensive participation of local communities in the process of urban landscape transformation.

[136] European Landscape Convention, Florence, 2000, Preamble.

[137] Ibid., Article 1.

Fig. 26. View of the Bełchatów power plant from Kamieńsk Hill; photograph by G. Byczkowski

2.7. Conclusions

What lies at the foundation of the contemporary attempts to define principles for shaping human living conditions in post-industrial areas is the entire body of experiences stemming from the changing relationships between the city, human beings, and nature. The successive stages in the development of urbanised areas, the urban planners' visions of cities, or the natural systems interwoven into the urban spatial structure have made it possible to identify the threats and opportunities attributable to the fact that elements of the natural landscape have been incorporated into the planning system. Having analysed the process of evolution of the planning ideas, leading to improved quality of life and enabling the ecological balance to be maintained in urbanised areas, one may reach the following conclusions:

- the standpoints, rules, and principles pertaining to the protection and shaping of the human environment must be declarative, universal, and very general (charters, declarations, reports) as they trigger a change in mentality – a shift from the philosophy of economic growth to that of sustainability, thus creating a kind of behaviour pattern;

- how *reality is created* depends on the imagination, knowledge, and determination of planners and designers, and although it does not always reflect specific views and ideas, it does highlight conflicts and awaken public awareness;

- defining threats has influence on how new concepts are conceived and how opportunities that shape the human environment emerge;

- the links between economic development and the exploitation of natural and human resources are reflected in the landscape of urbanised areas;

- landscaping is a process which consists in exerting continuous control of natural and cultural changes. It may lead to landscape degradation, but also to formation of new elements of the natural environment which, upon being transformed, can present an opportunity to create new quality of urban space;

- landscape renewal has contemporarily become a process of restoring natural, economic, and social balance to urbanised areas, while the landscape itself has acquired the status of a public good and has become a factor decisive of the quality and identity of its inhabitants.

The river Rawa in Katowice; photograph by A. Pancewicz

3. SELECTED EXAMPLES OF CITIES AND URBANISED POST-INDUSTRIAL AREAS. CASE STUDIES

The reason why opportunities for creating new green spaces and transforming them into an extended system are so much in demand is the progressing fragmentation of the existing natural areas. Given the uncontrolled urban sprawl, resulting from the industrial development, the problem is to maintain the cohesion and continuity of the links with as well as the compositional transparency of the natural urban structure. Abrupt urbanisation has been contributing to the dwindling of the overall area of open spaces which – when addressed as investment reserve – are becoming a sphere of confrontation between economic, social, and environmental interests. At the same time, a characteristic of the contemporary cities and agglomerations is the presence of new *easy-to-transform* sites which raise high hopes of restoring the vitality and attractiveness of urbanised space.

Referring to selected examples, this chapter is intended to demonstrate the role the natural environment plays in terms of how the functional and spatial structure of urbanised areas is developed and how individual elements of the degraded natural environment are transformed and introduced into the landscape renewal process as a result of conscious and informed planning activity.

SELECTION CRITERIA

The selected examples of cities (Poznań, Berlin, London) and urbanised post-industrial areas (Clydeside, the Ruhr, Lower Lusatia) have been analysed from the perspective of the following aspects:

- consistency in undertaking specific planning activities,
- making the most of the natural environment's potential in terms of shaping and complementing the spatial and functional structure of cities and agglomerations,
- utilising the qualities and elements of the natural environment when driving the development processes of urbanised areas in specific directions,
- looking for positive features of the landscape transformations happening in industrial brownfields.

The examples referred to in this study have been intentionally chosen to address the aforementioned problems at two spatial scales: local and regional, each characterised by different level of detail, coverage of the planning methods and measures employed, and the degree of environmental impact. They have also been differentiated in terms of how much they are saturated with the problems of urbanised areas associated with industrial activity, ranging from the areas barely affected by industry to those that are commonly perceived as tantamount to industry.

Poznań has a reputation of an orderly city, where the potential of the natural environment has been skilfully tapped to complement the urbanised structure, this quality being an outcome of many years of planning activity.
Berlin clearly stands out in terms of how it combines natural and cultural elements into a coherent whole and how the policy of nature compensation is pursued, as well as by the contribution of the environmental elements to the development and renewal of the urban space.
London, along with its surrounding green belt, epitomises the early planning measures undertaken in Europe to make the most of the natural environment in order to drive and guide urban development.
Clydeside is a model example demonstrating how the spatial structure of urbanised areas can be shaped and how to strike a balance between the built and natural environment through regional planning activities.
The Ruhr and Lower Lusatia have been chosen on account of the specificity of their industrial brownfields, characterised by urbanisation processes of varying intensity as well as the fact that environmental, economic, and spatial renewal policies have been successfully designed and implemented there. The planning and remedial measures envisaged in the Ruhr region have been deployed at a regional scale, while in Lower Lusatia, they pertained to landscape renewal.

Documenting the dynamics of changes and the essence of landscape transformation, the above examples provided grounds for the author's research on the **Upper Silesian Agglomeration**. Consequently, the planning processes and measures implemented across this Agglomeration have been analysed from the perspective of the elements of the degraded natural environment integrated into the process of renewal of the local post-industrial landscape.

3.1. Poznań

Poznań is an example of consistent long-term utilisation of the local natural potential in developing the city structure.

The wedge and ring-shaped natural system designed for the city, based on specific natural and historical conditions, has become an inherent part of the urban layout. Some elements of this model emerged already in 1903 and 1914 in the zoning plans by Joseph Stübben. They envisaged two designated rings of greenery: one comprising the parks and promenades associated with the former fortifications surrounding the city centre, and one consisting of the avenues stretching along the bypass roads on the perimeter of the western and southern districts[1]. In 1925, Professor Adam Wodziczko pointed out that the existing green spaces formed a proper system somewhat spontaneously, in which they provided a unique opportunity to preserve large green complexes within the inner city, affected its health-related and aesthetic qualities, and ensured water conservation and adequate ventilation[2]. The beginnings of the wedge and ring-shaped system date back to

[1] These plans also assumed the establishment of the Sołacki Park, which was to be the cradle for the development of the western green wedge. A second radial element also appeared, i.e. the Dębina wedge, including riparian forests and woods typical of this district (Kodym-Kozaczko G. 2005. *Rozwój Poznania w planowaniu urbanistycznym w latach 1900-1990* (Development of Poznań in the urban planning of the years 1900–1990). In: Jakimowicz T. (ed) *Architektura i urbanistyka Poznania w XX wieku* (Architecture and urban planning in the 20th century Poznań). Wydawnictwo Miejskie, Poznań, pp. 25–30).
[2] The natural and scenic qualities of the Warta river valley and of its tributaries were of special importance. The Warta flows through the city's territory along a north–south axis, with the river Bogdanka and the slightly smaller valley of the Junikowski Stream joining it from the west, the streams of Główna and Cybina – from the east, and many other rivers and streams, such as the Różany Potok in the north and the Gluszynka in the south.

1929, when they were included in the General Development Plan for the City of Poznań by Seweryn Pajzderski. Besides the rings, following in Stübben's footsteps, it also envisaged four green wedges to be established, cutting into the urban fabric[3]. The year 1931 saw a competition for a concept of regulation and development of Poznań, which illustrated how the greenery system was to be used in the planning of the city structure[4].

Władysław Czarnecki was the first to tap the city's entire natural potential by creating a comprehensive model of the urban greenery system under his preparatory studies for the master plan in 1932[5]. The ring and wedge-shaped system he had proposed, integrated with the transport network linking residential districts with the local centres of social and commercial activity as well as industrial sites, became one of the core structural elements of the city in the making by putting its spatial layout in order. In 1934, the concept was incorporated into the Poznań city master plan, only to become one of the most outstanding achievements of the 20th century Polish urban planning[6].

This greenery system comprised two main components: radial wedges and green bypasses. Making the most of the city's topographical layout, Czarnecki outlined four main green wedges: northern (*Klin Naramowicki*), southern (*Klin Dębinski*), western (*Klin Golęcinski*), and eastern (*Klin Cybiński*), which branched radially and gradually widened the further they moved away from the centre towards the outskirts. Slightly less distinct, the fifth wedge (*Klin Głowieński*) stretched from the river Warta along its main valley towards the forests of Wierzenica and Promno. Their arrangement was based on the intersecting layout of the valleys of the Warta, Cybina and Bogdanka rivers, which had long been kept free from development. The wedges were intended to link the densely built-up 19th century city centre with the suburban open spaces, enabling the city dwellers to enjoy active recreation opportunities. The layout and development of the green wedges envisaged in the plans changed as one moved away from the centre – from the majestic park greenery of strategic function to the sports and forest parks situated in the vicinity of intensively built-up residential districts, to the regional forest complexes surrounding Poznań (the National Park of Greater Poland to the south, the lands surrounding the village of Biedrusko to the north, the forest of Zielonka to the north-east, and the belt of forests stretching along the river Cybina to the east). A total of 10 such wedges, separating the city's individual districts, were defined in the course of further developments in this respect[7].

Another important component of Poznań's greenery system was made up by its three concentric bypasses. Unlike the wedges, they emerged as a result of planned human activity. The inner ring is a remnant of medieval fortifications[8]. The middle one consists of what remained of the first in-city system of the 19th century Prussian forts and their interconnecting ramparts, known as the Stübben Ring[9]. The third and outer green bypass

[3] Kodym-Kozaczko G. 2005, op. cit., p. 33.

[4] All of the competition entries assumed four green wedges to be established. One of them also envisaged formation of a wide ring of greenery intended to bind the city's outer forts, while others proposed an additional green wedge, stretching from the Citadel premises towards the north (Wodziczko A. 1931, pp. 90–100).

[5] Czarnecki W. 2006. *Wspomnienia architekta, 1931-1939* (Architect's memoirs, 1931–1939), vol. II, Grzeszczuk-Brendel H., Kodym-Kozaczko G. (selection and editing), City Publishing House, Poznań, pp. 52–53.

[6] Professor Adam Wodziczko was a scientific consultant in the drafting of the general plan.

[7] Urbański P., Szpakowska B., Raszeja E. 2008. *Walory rekreacyjne zieleni Poznania* (Recreational qualities of the Poznań greenery). In: *Nauka. Przyroda. Technologie* (Science – Nature – Technologies), vol. II, book 4, p. 3.

[8] Contemporarily, it is considerably fragmented, comprising several small lawns and green squares surrounding the old town.

[9] Today, Stübben's ring consists of vast parks and lawns extending along the riverside boulevards. Its most important element is the site of the former Citadel, whose greenery links with the floodplains of the river Warta via the Szelągowski park.

is a belt which stretches along the outer ring of forts of the Prussian fortress erected in the second half of the 19th century, Featuring the preserved circles of *fortress grounds*, as they are commonly referred to (i.e. undeveloped military grounds scattered around the town proper)[10]. It was planned to include reserves, agricultural land, horticultural land, orchards, forests, and municipal cemeteries. Besides performing recreational and health-related roles, it was also intended to counteract the uncontrolled expansion of Poznań onto suburban areas and to preserve the land reserve, thus providing the city with an opportunity to flexibly adapt to some unpredictable needs and functions.

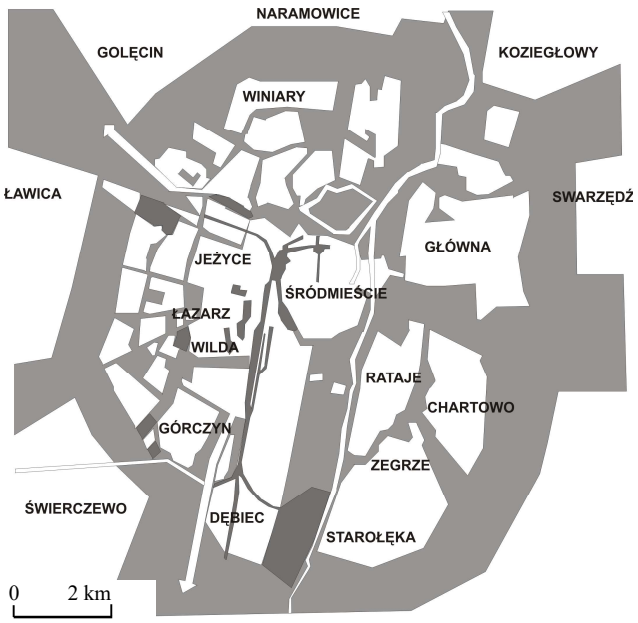

Fig. 27. Plan of Poznań's greenery system; author's elaboration based on W. Czarnecki's draft of 1932

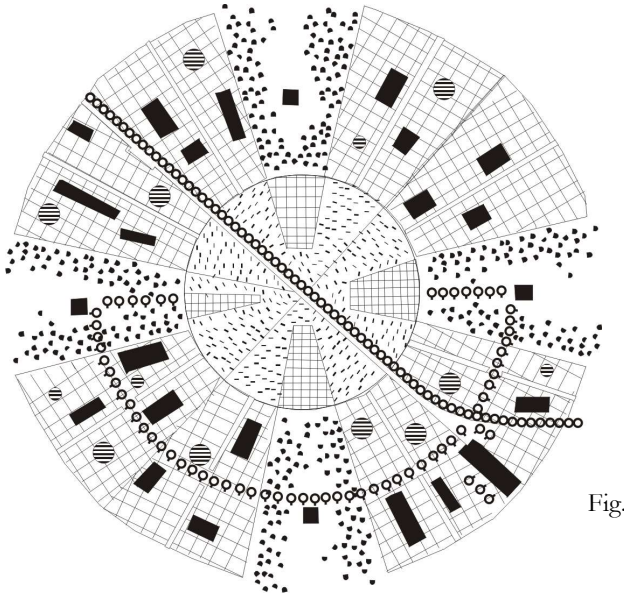

Fig. 28. Wedge and ring-shaped layout of the urban greenery system; author's elaboration based on W. Czarnecki's draft of 1932

[10] This ring once surrounded the city, while it rests within its borders now. Until the mid-20th century, it had been continuous in nature, and nowadays, the linkage between the greenery of individual sites has been preserved only in several places. There are eighteen *islands* of greenery within its boundaries, located around the large forts, connected via a system of smaller enclaves of semi-natural vegetation, overgrowing dozens of auxiliary shelters (known as interfields). The local vegetation has undergone extensive secondary succession.

Władysław Czarnecki planned to develop a system of tourist routes and hiking trails within the green bypasses. He also sited special strolling paths (for walking, horseback riding, and cycling) along the wedges, both those leading to tourist and holiday destinations, and those dedicated to daily leisure[11]. The greenery which surrounded and filled the city's main peripheral arteries and exit routes performed buffer, scenic, and community functions (e.g. a housing estate with adjacent small gardens for families of unemployed people was built within the northern wedge in 1934).

An important characteristic of Poznań's greenery system was its continuity and connectivity with the open spaces outside the city, providing the biodiversity of species and ecosystems. As envisaged in the 1934 master plan, the greenery system was to span as far as to the city limits, while further green spaces, according to Czarnecki, were to be defined in the regional plan[12].

Subsequent proposals for the spatial development of Poznań assumed that the large-scale urban greenery system would be preserved and extended, but in practice it was becoming gradually decrepit and fragmented[13]. The city did not escape the process of abrupt and spontaneous expansion, as a consequence of which it is now difficult to find any remnants of the aforementioned continuous spatial structures in its contemporary plans. Allocating open green spaces for various kinds of investment, contrary to their ecological function, ruptured the city's spatial continuity and caused degradation of its historic wedge and ring-shaped urban greenery system. The measures implemented within the wedges wreaked particularly great havoc. Besides the dynamic development of service and manufacturing activity and the arrival of retail and service centres, the tendency to introduce linear elements (such as high-voltage lines or roads) became dangerous to their character and landscape. Another problem turned out to be the lack of clearly defined boundaries of the green wedges[14]. However, many of the remaining elements of the natural system still provide recreational opportunities to the city dwellers.

> The green spaces currently to be found within the northern wedge (**Klin Naramowicki**) exist next to industrialised areas. Its characteristic feature is the semi-natural ecosystems with a considerable surface area of local nature conservation sites. This area provides a green space reserve performing recreational functions.
> There are recreational gardens, horse racing tracks, and bowling alleys within the contemporary southern wedge (**Klin Dębinski**). One can also find there remnants of past allotment gardens and rowboat harbours, as well as a woodland complex commonly known as Dębina, the John Paul II park, the city courtyard, and sports grounds. At the city outskirts, the wedge is interrupted by the industrial facilities in Luboń. Past these facilities, it blends with the forested areas of the National Park of Greater Poland (*Wielkopolski Park Narodowy*) and the woodland complexes stretching along the Głuszyna and Głuszynka valleys. Although discontinuous, this area provides opportunities for diversified recreation for the inhabitants of Poznań.

[11] Only three such walking arteries were designed: one leading to Lake Kierskie, along the Bogdanka valley, another one stretching to Lake Góreckie, and two routed towards the forests and lakes in the vicinity of Wierzenica, Promno, Zielonka, Olendry, as far as to Murowana Gościna. Promenade greenery was to link urbanised areas with those intended for active recreation (Czarnecki W. 2006, p. 54).

[12] Czarnecki W. 2006, op. cit., p. 56.

[13] The 1962 plan of Poznań by Zygmunt Paszek placed more emphasis on shaping green wedges than rings. It increased their number and provided them with water reservoirs (Ostrowski W. 1975, p. 317).

[14] Municipal Revitalisation Programme for the Industrial and Post-Military Sites of the City of Poznań, 2010.

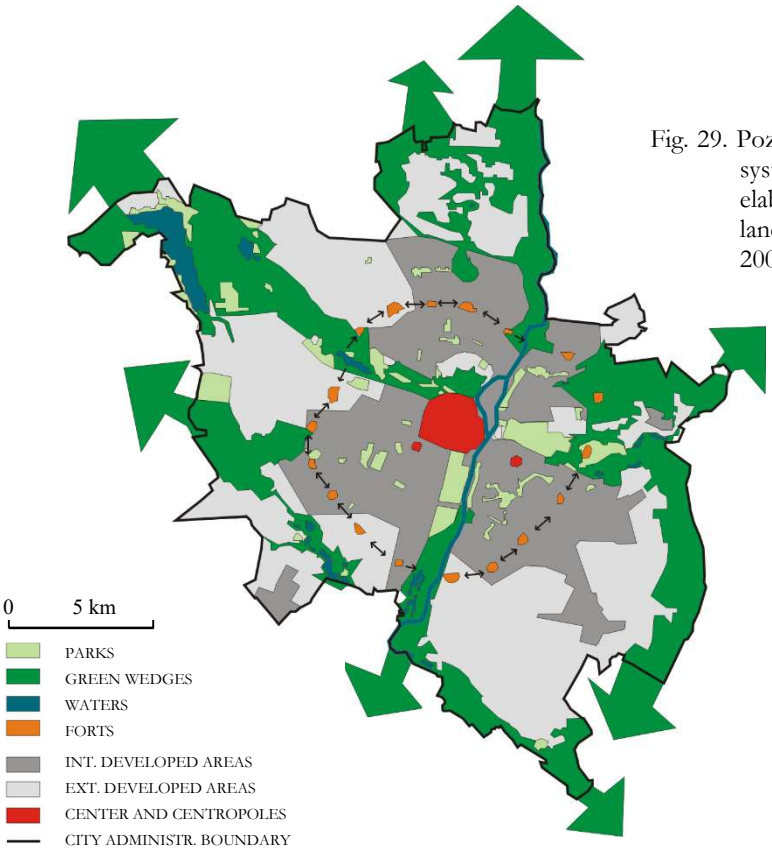

Fig. 29. Poznań city model – contemporary system of green spaces; author's elaboration based on the study of land use conditions and directions, 2008

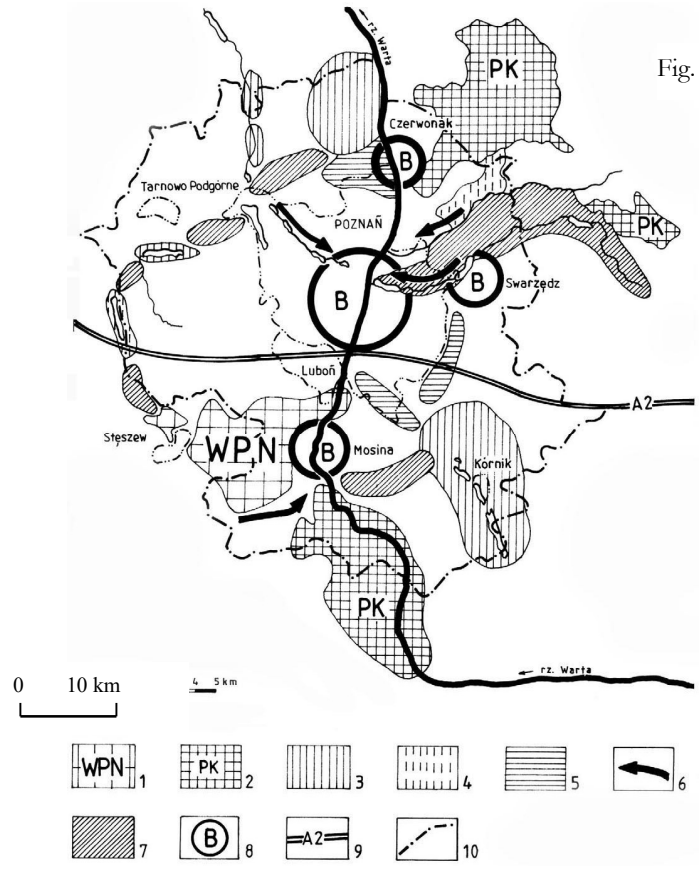

Fig. 30. *Ecological grid* concept – proposal for a spatial system of natural interconnections within the Poznań Metropolitan Area:
1–5 – existing and planned conservation areas:
1 – National Park of Greater Poland,
2 – landscape parks,
3 – landscape protection areas,
4 – planned landscape protection areas,
5 – nature and landscape complexes,
6 – valley ecological connectors,
7 – arable land and forested areas to be excluded from urbanisation,
8 – space barriers of superficial character (towns within the boundaries of the Poznań Metropolitan Area),
9 – A2 motorway,
10 – Poznań Metropolitan Area boundary
Source: Raszka B., Kasprzak K. 2009

The **western wedge of the Bogdanka valley** is where the inner city inhabitants actively spend their free time. The area offers numerous local nature conservation sites, sports and recreation facilities, including natural lakes: Kierskie and Strzeszyńskie, as well as two artificial reservoirs: lake Rusałka and the pond of Sołacz. What also matters is the location of developed municipal forests, family allotment gardens, as well as of the Dendrological Garden of the Poznań University of Life Sciences, the Pharmacognostic Garden of the University of Medical Sciences, and the Botanical Garden of the Adam Mickiewicz University.

The most important recreational feature of the **eastern wedge of the Cybina valley** is Lake Malta. The other urban green spaces comprising this wedge, along with their adjacent forests, including the greenery of White Mountain or the Poznań Zoo, form a compact and diversified natural complex.

The Junikowski Stream valley, officially classified as a local nature conservation site, utilised – similarly to the other green wedges – as a place for rest and recreation, is an important part of Poznań's greenery. However, its landscape is evidently spoiled by the industrial facilities to the north-east (Rudnice, Kopanina, Luboń)[15].

Poznań's contemporary natural system is an important component of the landscape which determines the city identity. The green spaces comprising this landscape (urban parks; educational, zoological, allotment gardens; green spaces; residential and buffer greenery; as well as cemeteries, fort greenery, forests, meadows, and pastures) perform ecological, social, and scenic functions. They cover nearly 73 km^2, i.e. 27% of the city's area. Forests and urban greenery represent the largest fractions in this structure, with 59% and 16% respectively[16]. Nearly 60% of them are owned by the Municipality of Poznań, while the remaining areas belong to private owners, the State Treasury, and the Polish Association of Allotment Owners[17]. Increasing urbanisation is causing gradual fragmentation of this system. Considering the ratio of green spaces per capita or the percentage share of green space in the total city area, it can be noticed that the area of green spaces has been decreasing over the recent years (except for the last year), as shown in Table 4.

Table 4.

Green spaces in the city of Poznań*					
Year	**Total city area (ha)**	**Population**	**Green area (ha)**	**Green area (m^2) per capita**	**Share (%) of green space in total city area**
2005	26 137	567882	3821,9	67,30	14,62
2006	26 185	564951	3778,0	66,87	14,43
2007	26 185	560932	3547,3	63,24	13,55
2008	26 185	557264	3537,7	63,48	13,51
2009	26 185	554221	3694,3	66,66	14,12

* According to the Central Statistical Office (GUS), urban green spaces include walking and recreation parks, lawns, street greenery, residential green spaces, cemeteries, and municipal forests.

Author's elaboration based on statistics from the Central Statistical Office's Local Data Bank (GUS BDR), 2006–2010

[15] Urbański P., Szpakowska B., Raszeja E. 2008, op. cit., p. 3.

[16] There are nearly 260 distinctive green space units in Poznań, including: 43 parks, 112 lawns, 90 allotment gardens, 3 science and research parks, 2 zoological gardens, the Palm House, and 24 cemeteries (Poznań Development Strategy until 2030).

[17] Data according to the Poznań Development Strategy until 2030.

There are numerous reasons for this phenomenon: treating green spaces as land reserve for investment, destructive impact of transport, air pollution along transport routes, deterioration of soil conditions due to excessive salinity and soil sealing, water poverty and insufficient deep aeration, unfavourable climate conditions of recent years, lack of financial resources for adequate maintenance and new urban greenery, as well as devastation attributable to people[18]. The 2009 increase in the share of green space in the total area proves that, in order to prevent the degradation of green spaces, it is not enough to simply preserve and sustain its historic layout, while it is also necessary to integrate new areas into the natural system. This matter is specified in detail in the provisions of strategic documents[19], highlighting numerous requirements, including the need for:

- preserving and restoring the continuity of the existing ring and wedge-shaped elements of the urban greenery system layout;
- upgrading, surveying, reclaiming, and developing new organised green spaces (parks, lawns, roadside and residential greenery) aimed at unburdening naturally formed green spaces and improving the living conditions of local communities;
- optimised utilisation of the natural environment as a space for recreation and rest;
- maintaining and enhancing biodiversity resources;
- building a system of protected areas, remaining in continuity with the surrounding areas in such a manner as to actually enable conservation of the protected natural systems at a regional and national scale, and to reconcile the city's growth with the protection of biologically active area;
- eliminating the problem of devastated land (through reclamation of landfill sites and industrial brownfields)[20].

These provisions prove that it is actually **an opportunity for the maintenance of natural systems to make use of the existing undeveloped open spaces and derelict sites** which can be adapted for purposes of the expansion of green spaces, recreation and leisure, afforestation, or park greenery development. **An important factor to this process is the role played by degraded industrial brownfields, reclaimed and redeveloped for nature's sake**[21].

Analysis of the topographic maps compiled in the years 1987–1993 made it possible to identify a total of 134 industrial brownfield sites within the territory of Poznań[22]. Over time, their number was systematically decreasing as a result of accelerated economic development, growing affluence of the society, structural and spatial transformations, and gradual introduction of new functions into the degraded sites, intended to stimulate the economic revival of urban areas. The transformation trends identified in this respect are

[18] 2008 land use study of the city of Poznań.

[19] The strategic documents pertaining to the local and regional scale include: Voivodeship Development Strategy until 2020, Greater Poland's Regional Operational Programme for 2007–2013, Strategic Development Programme for the City of Poznań, City Development Plan for 2005–2010, Land Use Study, Environmental Protection Programme for the City of Poznań for 2009–2012, or Municipal Revitalisation Programme for the Industrial and Post-Military Sites of the City of Poznań, 2010.

[20] Environmental Protection Programme for the City of Poznań for 2009–2012, adopted on 12 May 2009 under Resolution of the Poznań City Council no. LIV/729/V/2009.

[21] Some examples include the sites located in the city centre (those around Stübben's Ring or elements of the 19th century system of post-Prussian fortifications) and post-industrial areas to be found on the city outskirts, including the area commonly referred to as *Kopanina*, north-east of the Junikowski Stream, comprising degraded sites subject to the process of natural succession, featuring numerous yet small artificial water reservoirs – remnants of the former clay ponds (source: Municipal Revitalisation Programme for the Industrial and Post-Military Sites of the City of Poznań, 2010).

[22] Mizgajski A., Machnicki M. 2009. *Prawidłowości w zagospodarowaniu terenów poprzemysłowych. Przykład Poznania* (Regular trends in the development of industrial brownfields. The Poznań case). In: *Problemy Ekologii Krajobrazu* (Problems of landscape ecology), vol. XXIV, p. 117.

dominated by residential, sales and service, as well as office and administration functions. The changes made with nature, sports and recreation in mind are of marginal importance[23]. The foregoing is directly attributable to the location quality of industrial brownfields and the economic conditions of the transformation process[24].

The city's potential also lies in its degraded riverside areas. Inextricably linked with the structure of Poznań, its history and economic development, the river Warta is also what binds the city's major sites (in respect of nature and recreation). It integrates the city with the areas most highly appreciated by the inhabitants in terms of weekend recreation and leisure (the National Park of Greater Poland, the Zielonka Forest Landscape Park). It is an inherent part of the urban natural system. Along with its tributaries, it forms wedges of greenery (commonly known as the *green cross*) and contributes to the wedge and ring-shaped structure of greenery in Poznań. The river also creates the cultural landscape, with historically valuable building compounds to be found along its banks, including the island of Ostrów Tumski, or the districts of Śródka and Chwaliszewo. Its weaknesses, however, is the proximity of industrial sites and brownfields, poor accessibility to water, and untapped tourism and transport potential[25]. The contemporary revitalisation measures are implemented with various goals in mind, including new features to be bestowed upon industrial brownfields and the river brought back to the city (revitalisation of the town of Śródka and the Warta embankments).

Poznań is a city whose individuality stems from the capacity to bind natural and cultural assets into a coherent spatial whole, while the city's consistent planning process provides an opportunity for maintaining the continuity of these bonds.

3.2. Berlin

Berlin is an example of a city whose development was determined by its setting in the natural environment, while individual elements of the natural system contributed to the formation of its landscape identity. Over time, they became some of the major urban renewal factors.

One of Berlin's characteristics[26] is the diversified urban landscape and the capacity to combine natural and cultural elements into a cohesive whole. The standard to which many of its designers referred was the historical landscaping plans of the late 18th and early 19th century by Peter Joseph Lenné, Herman von Pückler-Muskau, or Karl Friedrich Schinkel. However, as the city grew with great pace, its industry spread, its population increased excessively, and its urban structures gradually transformed, it became necessary to search for a method that would enable the city's spatial governance to be restored. This could be achieved by integrating its natural system and linking it with the suburban greenery structure. In response to these problems, the **Greater Berlin Plan**

[23] The measures proposed for the future include the following: development of a complex of ponds on the post-mining land in the vicinity of Fabianów, Kotowo, and Mieleszyńska street, designed as open greenery with the option of adding pedestrian and bicycle routes (Poznań Development Strategy until 2030).
[24] Mizgajski A., Machnicki M. 2009, op. cit., p. 120.
[25] Januchta-Szostak A. 2007. *Waterfront – the New Image of the City. Transformation of the Warta Valley in Poznan*. In: *Urban Heritage: Research, Interpretation Education*, scientific conference proceedings, Vilnius Gediminas Technical University Publishing House *Technika*, Vilnius pp. 101–115.
[26] In 2010, Berlin's population was approx. 3.4 million people inhabiting an area of approx. 891 km² (*Die kleine Berlin-Statistik 2010*, available online at: www.stadtentwicklung.berlin.de [accessed on 2011]).

(*Gesamtplanung für Groß-Berlin*) was proposed in 1910 by Hermann Jansen, who had adapted Ebenezer Howard's idea for the city's specific needs. Jansen created a system which consisted of two green rings. The smaller one was to be found inside the urban structure, while the larger one was located outside the area of intense urbanisation, comprising forests, parks, gardens, and meadows. It was intended to curb the spontaneous building development while performing an ecological function for the city. New built-up areas were supposed to be developed outside the green stretches of land, with only small residential units left within. What Jansen proposed to be created between the rings was green corridors permeating the dense urban fabric. His plan affected the city's further growth and provided grounds for the trends later observed in the conservation of open spaces.

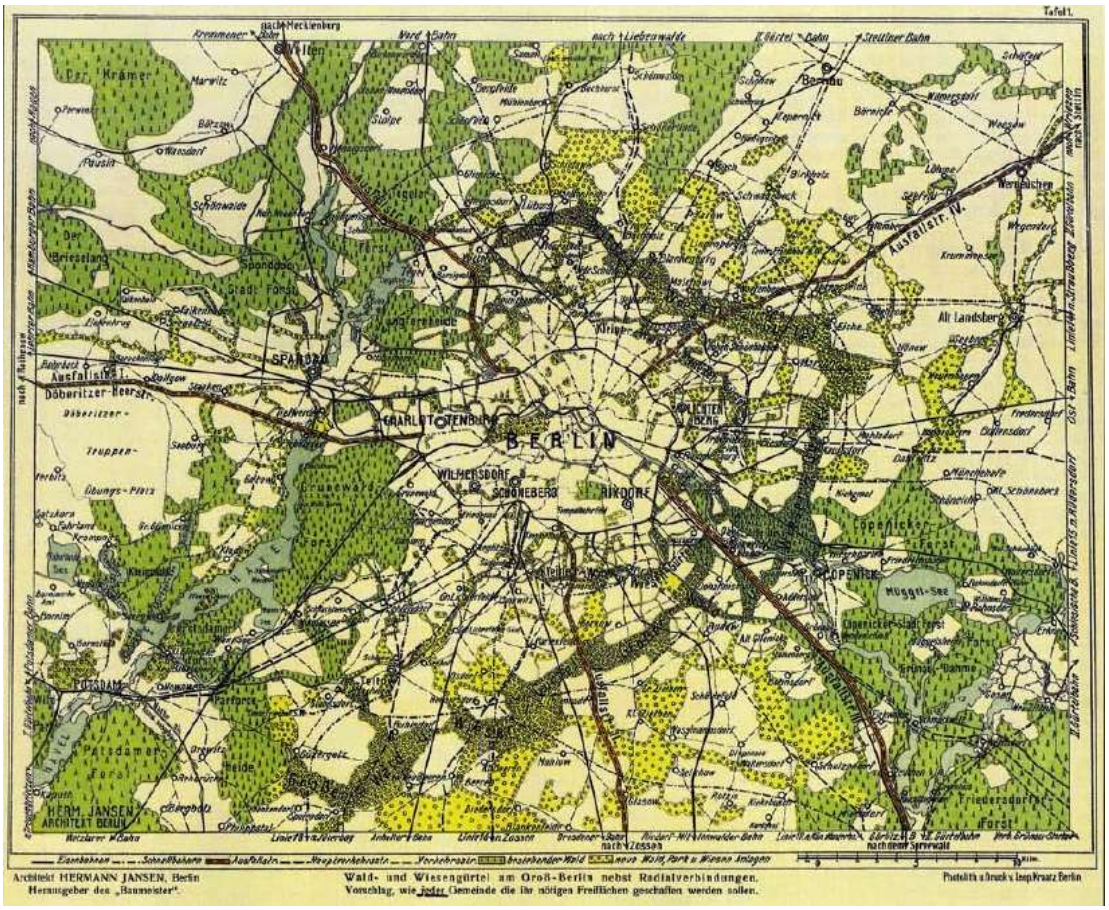

Fig. 31. Greater Berlin Plan, Jansen H. 1910; source: Architekturmuseum TU Berlin, Inv. No. 20541

Another attempt to create an ideal open space system was the Master Plan for the Development of Berlin, drawn up between 1926 and 1933 at the Urban Development Department managed by Martin Wagner. In 1929, it provided grounds for the conception of the **Open Space System Master Plan** (*Generalfreiflächenplan*) by M. Wagner and C. Koeppen. The green rings it defined, along with the major elements of the natural environment, were to create a strip of links. The system's binding elements were the gardens, cemeteries, river valleys, minor watercourses, and a chain of lakes surrounding the inner city – all to be found within the urban structure.

Not until the 1980's, when the Nature Conservation Act came into force[27], had the local nature related problems received proper attention. And it was only after the German reunification (1990) that the goals of spatial planning, pursued as part of the city redevelopment process, included preservation of landscape diversity and strengthening the role of the environment in urban development. Having evolved into a crucial component of the urban spatial planning process, the 1994 **Berlin Landscaping Programme** (*Berlin Landschaftsprogramm*) exerted major influence on how the city's natural structures were being developed[28]. It defined an urban greenery system based on a model of two concentric rings cross-cut by two strips of main ecological corridors. The inner ring, formed already in the late 1920's and early 1930's based on the outline of the developed area of that time, consisted of parks, allotment gardens, and cemeteries[29]. The system's outer strip delimited the boundary between the then urbanised area and the suburban zone. It was intended to curb the spontaneous growth of the suburban development. The city centre was linked with the peripheral open spaces and parks via green connections (ecological corridors), evolving in an east–west axis along the river Spree and a north–south axis along selected urban canals[30]. Considering the requirements of the city's natural revitalisation, the Landscaping Programme highlighted the need for:

- conservation and development of inner city greenery and open spaces, predominantly intended for recreation purposes, as well as of the transition zone greenery – for agricultural purposes;
- creating a system of ecological corridors;
- waterfront reclamation and development;
- greening of areas of intensive residential development[31].

The rationale behind all the measures undertaken while creating the natural system was densification of both the inner and the outer green strip, making it possible to combine the scattered park and forest sites into a coherent area. The existing green spaces were gradually complemented with newly designed parks and recreational areas[32]. They were developed by consistently pursuing the **policy of nature compensation**, implemented under ongoing investments. Many of them were sited on degraded industrial brownfields. Some made the most of the natural qualities newly created in a process of natural succession (Schöneberg Südgelände nature park)[33].

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[27] The Nature Conservation Act provided legal grounds for the development of landscape programmes and landscape plans.

[28] Urban spatial planning functions at different levels and degrees of detail. The most important areas are covered by separate plans. In accordance with the federal law, statutory planning is based on the General Zoning Plan (*Flächennutzungsplan – FNP*, Berlin) and local zoning plans (*Bebauungspläne*). Also specific to Berlin are the following documents: sector-specific land use plans (*Stadtentwicklungspläne – StEP)*, intermediate area plans and concepts (*Berechsentwcklungspläne – BEP und Panwerke*), and urban design plans (*Städtebauliche Konzepte und Rahmenpläne*). The following ones directly affect the environment: landscape programmes (*Landschaftsprogramm*) and local landscaping plans (*Landschaftspläne*); source: *Berlins Zukunft gestalten, Flächennutzungsplanung für Berlin*, FNP-Bericht 2009, available online at: www.stadtentwicklung.berlin.de [accessed on 2011].

[29] This ring was once an outer belt of urban greenery, but as the city grew, it became an inner belt.

[30] www.stadtentwicklung.berlin.de [accessed on 2011].

[31] Drapella-Hermansdorfer A. *Zrównoważony Berlin. Poszukiwanie równowagi w skali miasta* (Sustainable Berlin. Towards a city-scale balance). In: Drapella-Hermansdorfer A. (ed) 2004, op. cit., p. 76.

[32] There are currently ca. 2,500 parks and recreational facilities in Berlin with a total area of 6,400 ha (*Die kleine Berlin-Statistik 2010*, op. cit.).

[33] Drapella-Hermansdorfer A. 2005a, *Zielone osie i zielone pierścienie Berlina* (Berlin's green axes and rings). In: Files of the Committee for Urban Planning, Architecture, and Landscape Studies of the Polish Academy of Sciences, Lublin Branch, p. 81.

Fig. 32. Berlin's open space system; author's elaboration based on the Landscaping Programme, 1994

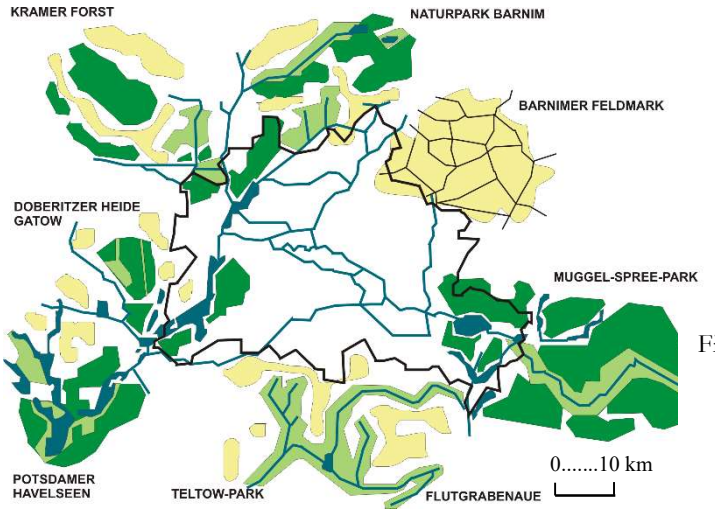

Fig. 33. Regional parks of Berlin and Brandenburg, 1998; author's elaboration based on Regionalparks in Brandenburg und Berlin…, 2001

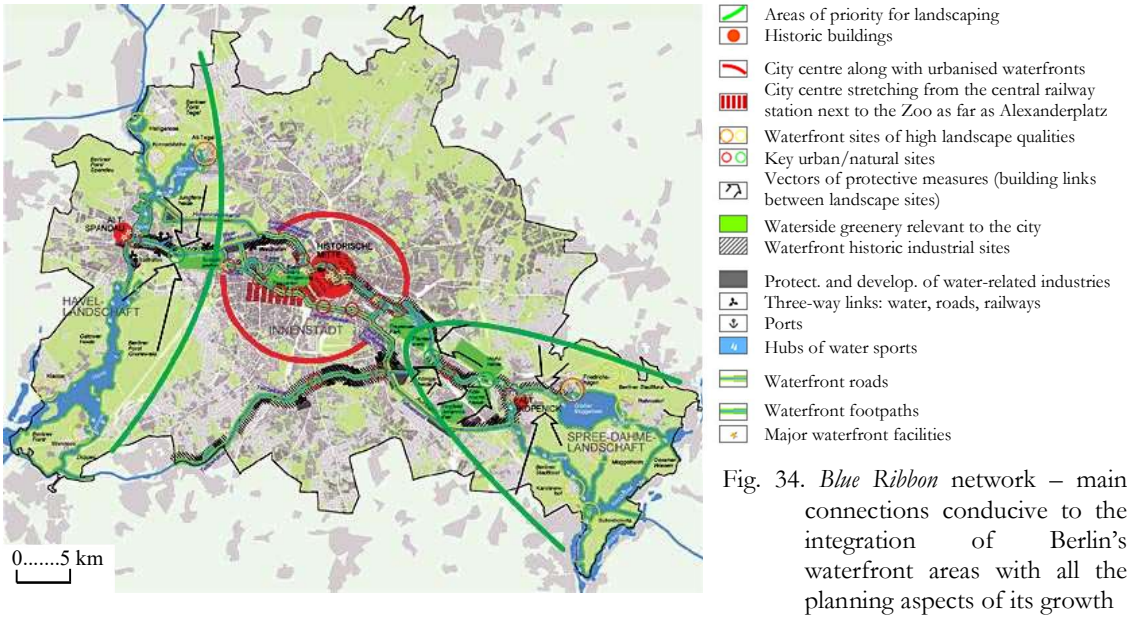

Fig. 34. *Blue Ribbon* network – main connections conducive to the integration of Berlin's waterfront areas with all the planning aspects of its growth

An element which complemented the greenery system and set targets for further development of the city's natural structure was its water network (rivers, ports, canals and lakes surrounding the city)[34]. The waterways connect the Spree with the Havel, with the inner lake system, as well as with the water and park complex near Potsdam. The river Spree mainly performs a functional and compositional role in the city. Major public spaces and recreation or leisure sites have been gradually developing along its channel, comprising embankments available to pedestrians, marinas, a network of cycle paths, or sunbathing sites. In the upper reaches, outside the city, the river valley was subject to renaturation processes. Once restored, the oxbow lakes, woodlands, and meadows started to function as natural water retention areas. Rivers and canals evolved into the main axis of urban renewal (e.g. the Kreuzberg district along the Landwehr canal or the former harbour area in the Tegel district). **What became the very essence of Berlin's system was the combination of building development, greenery, and water into a coherent landscape**. On the banks of rivers and lakes, as well as in degraded industrial brownfields, port, unloading, and storage sites, waterfront towns – as they were commonly referred to – began to emerge (Wasserstadt Oberhavel, Rummelsburg), enabling Berliners to settle in urbanised areas, yet having a direct contact with nature. They also provided an alternative to suburban settlement.

Both the Landscaping Programme and the Nature Conservation Programme contributed to the formation of a natural network linking the inner city greenery with the suburban open spaces. They also delimited the boundaries of the natural areas defined under the zoning plans being implemented. Those who designed the system pondered upon the role of open spaces as a benchmark of the quality of urban space. Their ecological, recreational, educational, compositional, aesthetic, and – last but not least – economic importance was emphasised[35].

Intended to prevent the urban sprawl phenomenon, the 1998 Metropolitan Plan for the Spatial Development of Berlin and Brandenburg established eight regional parks surrounding the city. Berlin's outer green strip comprised the regional parks of Krämer Forst, Döberitzer Heide, Potsdamer Havelseen, Teltow, Müggel-Spree, Flutgrabenaue, Barnimer Feldmark, and Naturpark Barnim. Their goal was to protect open spaces for the purpose of high quality of life to be sustained for the region's population, making the region more attractive to tourists, as well as protecting the fringes of the urbanised areas, characteristic of Berlin's periphery. In line with the idea of sustainability, the development of natural structures was to be compatible with the economic, social, and spatial potential. Further away from the city, another ring of landscape parks was established, intersected by stretches of natural macro-corridors. These include the strip linking the Barnim Nature Park with the Schorfheide-Chorin Biosphere Reserve in the north, the Regional Park of Central Germany in the south, and the strip of culture parks, featuring a biosphere reserve, stretching along the Spree as far as the Lusatian Lake District, formed under IBA Fürst-Pückler-Land programme[36].

[34] Considering the total area of Berlin in 2010, water surface accounted for 6.7 per cent, agricultural land – 4.3%, recreational sites – 11.4%, forests – 18.3%, transport and circulation – 15.3%, production areas – 0.9%, development areas – 41.3%, and other areas – 1.8% (*Die kleine Berlin-Statistik 2010*, op. cit.).

[35] www.stadtentwicklung.berlin.de [accessed on 2011].

[36] *Regionalparks in Brandenburg und Berlin. Strategien für eine nachhaltige Entwicklung des Metropolenraumes* (Regional parks in Brandenburg and Berlin. Strategies for sustainable development of the metropolitan area for the year 2001), Gemeinsame Landesplanung Berlin-Brandenburg, Ministerium für Landwirtschaft, Umweltschutz und Raumordnung des Landes Brandenburg/Senatsverwaltung für Stadtentwicklung des Landes Berlin, Potsdam.

What supplements and completes the principles of the Landscaping Programme, being continuously updated, is the Berlin Spatial Development Plan (*Flächennutzungsplan Berlin*), whose latest revision of 2009 prioritised the conservation as well as qualitative and quantitative improvement of urban green spaces. This trend is to be followed by regenerating the existing parkland and by creating green links between the existing and newly designed open spaces. **Major importance is attached to degraded areas, especially waterfront brownfields**[37]. Their environmental renewal comprises a number of measures: land and water purification on brownfield sites, waterfront reclamation, creating green spaces around residential districts, or erecting eco-friendly energy-saving buildings. It also aims at creating modern housing, business, culture, or recreation districts linked with the river[38]. All these measures are intended to create favourable conditions for the development of multifunctional structures ensuring balance between work, leisure, and life at home.

In light of the financial crisis, from 2007 onwards, it became necessary to set new priorities for the development of urban green spaces. These were proposed in numerous documents, including the Urban Development Concept – Berlin 2020 (*Stadtentwicklungskonzept*, STEK 2020), which found it particularly important to curb the urbanisation process, to close and complement the network of 20 major urban green corridors, and to create a strategy for temporarily developed areas towards nature. This approach offers an opportunity to further utilise industrial brownfields by making the most of their potential to ensure the continuity of natural structures and to unceasingly strive to improve the quality of urban space.

Given the high efficiency and flexibility of the German planning system, having addressed the relevant social problems and the need for economic growth, both the various planning concepts and the projects implemented offer a chance to keep the city of Berlin on a path towards sustainable development.

3.3. London

London is an interesting example of big city development issues as well as of the role played by elements of the natural environment and transformed brownfields altogether forming an urban green space system.

London is one of the cities whose growth has been extremely rapid and abrupt. In the nineteenth century, over the course of a century, the area of London expanded sixfold[39]. Despite a variety of concepts being proposed[40], its urban greenery systems also developed in a manner which was not entirely controlled. In a sense, they were a consequence of the growth of industrial civilisation and its impact on the urban fabric, the natural environment, and people.

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[37] Tölle A. 2009. *Przekształcanie terenów poprzemysłowych w Berlinie według „dziesięciu postulatów zrównoważonego rozwoju miast nad wodą"* (Brownfield transformation in Berlin in line with the ten sustainable development demands of water cities). In: *Problemy ekologii krajobrazu* (Problems of landscape ecology), vol. XXIV, pp. 101–113.

[38] *Flächennutzungsplan Berlin 2009*, document available online at: www.stadtentwicklung.berlin.de [accessed on 2011].

[39] In 1750, the population of London was 0.5 million. It was the largest European city at that time. Over the course of the 19th century, the population grew from 1 to 6.5 million. By 2007, the population had grown to 7.5 million. In 2010, the London urban area was inhabited by approx. 7.7 million and covered an area of 1,607 km^2 (Hutchinson R. (ed) 2010. *Encyclopedia of Urban Studies*, vol. 1, p. 460).

[40] The plans by J.C. Loudon (1829), P. Abercrombie (1944), and T. Turner (1992).

In 1929, 100 years after J. C. Loudon conceived the plan of London's concentric green rings, Raymond Unwin prepared the main principles of the urban spatial policy for the *Greater London Regional Planning Committee.* Following Howard's model, yet only to a certain extent, he proposed that a *green girdle* be established around London, three to four kilometres in width, assumed to provide the city dwellers with leisure opportunities. In 1938, the *Green Belt Act* introduced a ban on the development of the land located outside the city's physical boundaries and formulated rules to be followed while shaping the green ring further on. The *Metropolitan Green Belt*, being a strip of 5 to 10 km in width, surrounding the in-city urbanised area, was intended to secure agricultural land and counteract migration into the city. Outside its outer limits, new towns were envisaged to be built.

The most remarkable concept of linking the built environment with the natural environment was **Patrick Abercrombie's** 1944 Greater London Plan, also known as the Abercrombie Plan. Its conception was stimulated by the war damage, sustained particularly by the eastern industrial part of the city. Abercrombie's starting point was an assumption that open spaces suitable for both recreation and leisure constituted an important factor in maintaining and improving the human health in urbanised areas. He built his plan on three underlying premises: defining standards for urban green spaces (1.6 hectares of parkland per 1,000 inhabitants), delimiting a green belt, and creating a system of inter-park connections. The plan envisaged that well-spaced units of the settlement structure should be linked with the city's transport infrastructure and greenery system. Abercrombie specified in detail how individual elements could be combined into a coherent natural and recreational system: from individual gardens or parks to a network of *parkways*[41], to green wedges, to a ring-shaped system of open spaces. An important component of this concept was a single spacious **Green Belt**, approximately 50 km in radius and slightly less than 9 km in width, embracing the city from the outside. Modelled on what Loudon (1829) and Howard (1898) had proposed, and based on the official motion submitted by the Greater London Regional Planning Committee in 1935, the belt accommodated agricultural, recreational, and natural functions. On its fringes, commonly referred to as the rural ring, both the well-developed *existing new towns* and *planned new towns* were sited in a satellite arrangement[42]. Within the urban structure, Abercrombie delineated an inner **Green Chain**, and defined how the two rings should be linked by a radial system of corridors.

This plan had not become viable until an opportunity emerged to supplement the greenery system with brownfield sites, converted for nature's sake. The extent of their degradation had successfully discouraged private investors, thus providing an opportunity for public investment projects to create new green spaces. One of the first revitalisation projects (1967) was a regional park planned to be established on the decrepit land stretching along the river Lee.

[41] The *parkways* formed a system of linear connections, accommodating seven different categories: linear strips of open space, riverside boulevards, midland paths, bridleways, cycleways, motor vehicle routes, and arterial roads.

[42] The satellite towns envisaged in this plan (i.e. Harlow and Stevenage – referred to as the first generation of new towns in the UK) were characterised by wide strips of green space penetrating urban complexes and a heavily developed service centre located near a collective transport stop (Malisz B., 1981, op. cit., p. 186). The original satellite towns were also intended to have their own *green belt*. By 1973, 26 New Towns and 14 *green belt* areas had been created with a total area of 15,500 km^2 .

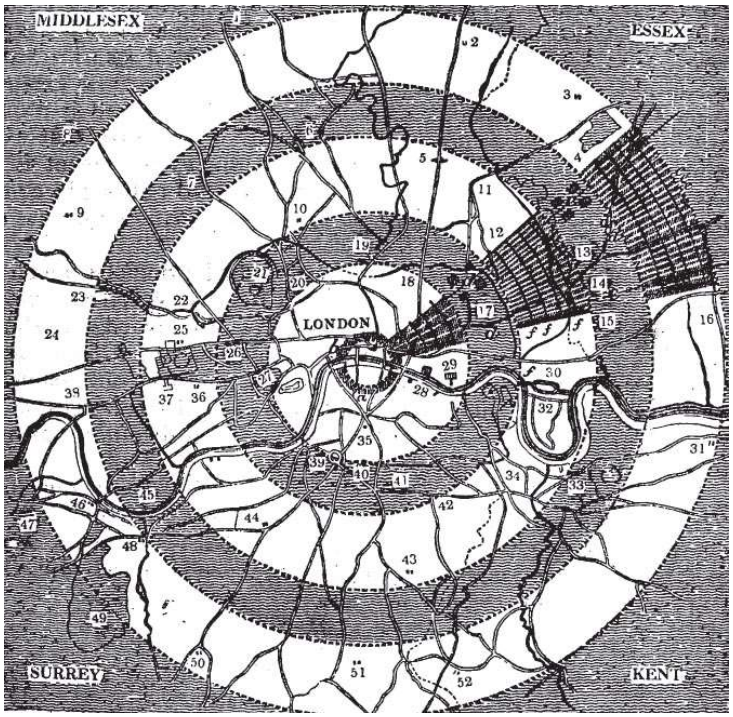

Fig. 35. London according to Loudon's plan, 1829; concept of concentric green belts

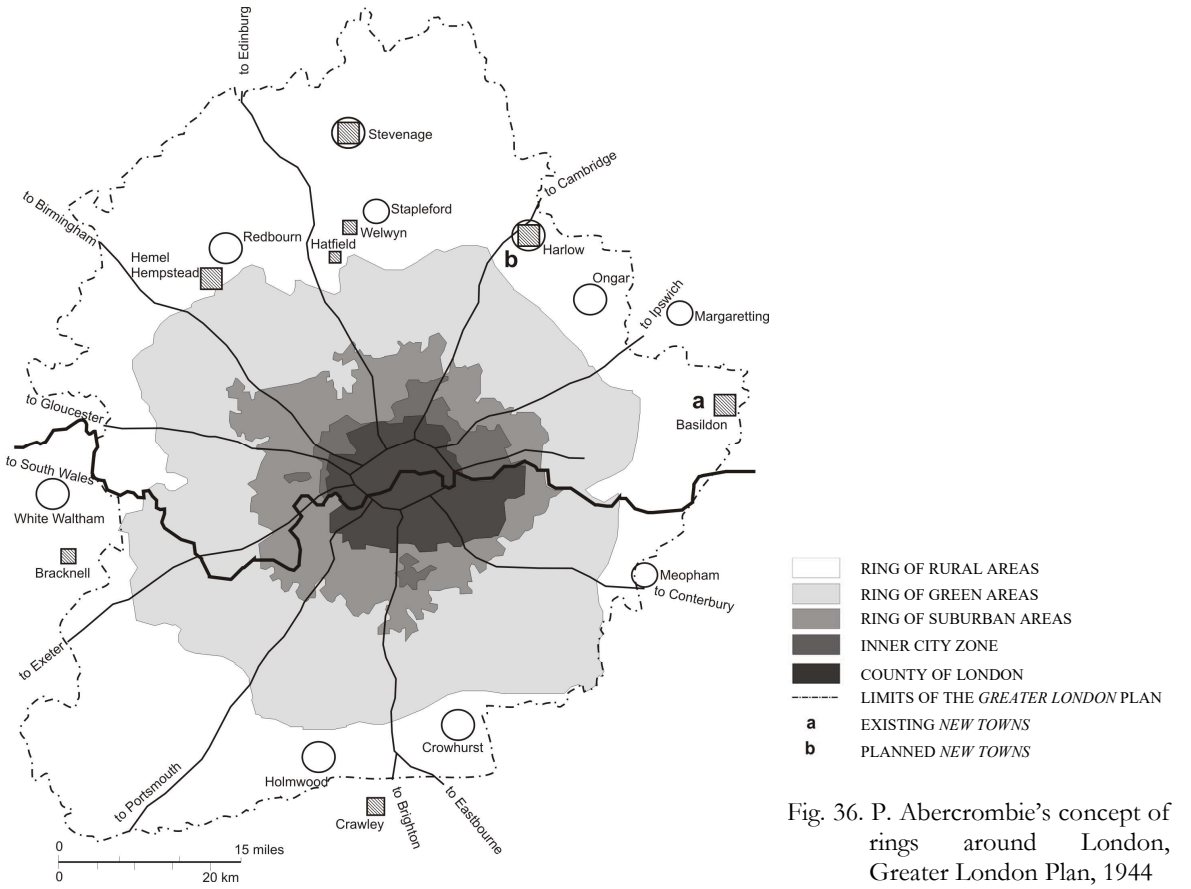

Fig. 36. P. Abercrombie's concept of rings around London, Greater London Plan, 1944

(from Ware in Hertfordshire to the point where the river Lee meets the Thames)[43]. The plan to develop these areas emerged still under Abercrombie's supervision. Its backbone was a natural corridor created by converting degraded sites. It comprised a chain of sports and recreation sites and facilities, interlinked by a system of footpaths, cycle paths, and waterways. Later on, it was supplemented with new developments, ultimately to serve the purposes of the Olympic Village, established there in 2012.

In 1969, the Greater London Development Plan, put forward by the Greater London Council (GLC), identified **three main elements of the natural system: Green Belt**[44], **Metropolitan Open Land**, and **Open Lands**[45]. The zone known as the *Metropolitan Open Land* was introduced to protect in-city green spaces, i.e. parks, forests, golf courses, gardens, playgrounds, cemeteries etc. The *Open Lands* zone, on the other hand, featured urban parks only. Such a division stemmed from the research into the development of the open spaces which changed the standards applicable to them. Numerous urban sites lacking green space itself or access to it were identified by that means. Consequently, the standards proposed by Abercrombie were rejected, while a hierarchy of open spaces was proposed in their stead according to the differences in their size and functions.

Since the dissolution of the Greater London Council in 1986, the city had not had any strategic planning body. In an effort to fill this gap, the London Planning Advisory Committee (LPAC) was established. Under its strategic advisory activity, aimed to produce specific guidelines for local zoning plans[46], the rationale behind preserving the Green Belt along with its recreational and agricultural features was substantiated, while the need for renewal of the degraded areas was underscored at the same time. However, recreation and nature conservation were not defined as the ring's main purposes, although the need for changes in this respect was noted. In fact, studies of the Green Belt had shown that its boundaries were rather flexible and subject to transformations. Some parts of the belt were earmarked for development, while others were added to it. Instead of a system intended to link urban parks (*Park System*), the *Green Chain* idea was promoted.

> The **Green Chains** were assumed to comprise the following elements: links between open spaces (such as St James's Park, Green Park, Hyde Park, and Kensington Gardens in central London), paths cutting through natural sites and urbanised areas, stretching over long distances (South London's Green Chain Walk), ecological corridors inaccessible to the public, such as those situated along railway embankments (Parkland Walk in North East London), and linear parks along rivers (Thames Barrier Park). Green Chains were designed and implemented in South East London, with an intent to extend them over the whole city territory.

[43] Although the park idea was suggested by Abercrombie in 1944, the concept remained in abeyance until 1961 and was then revisited by Alderman Lou Sherman, Mayor of Hackney. The Lee Valley Regional Park was eventually established in 1967, covering an area of 4,000 hectares.

[44] At that time, the *green belt* covered 23% of the Greater London area. The local authorities considered the possibility of introducing residential development in a strip of 3,237.6 ha, but the idea was ultimately rejected.

[45] In England, the term *open land* was in use since the early 19th century when referring to the Metropolitan Open Land Act of 1877. It encompassed vacant urban land of value for creating new natural and recreational sites or for protecting the existing natural resources.

[46] The LPAC produced a document for the Ministry of the Environment entitled *Strategic Advice'8 on London Planning*, which provided grounds for the preparation of *Strategic Guidance'9*, which was to pertain to the thirty-three planning districts remaining within the territory affected by the former GLC.

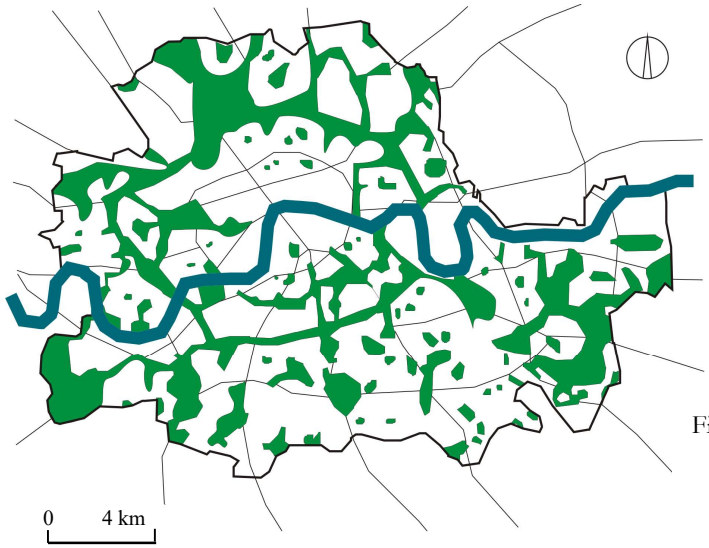

Fig. 37. Greenery system designed for London by P. Abercrombie in 1944; author's elaboration based on Abercrombie's draft

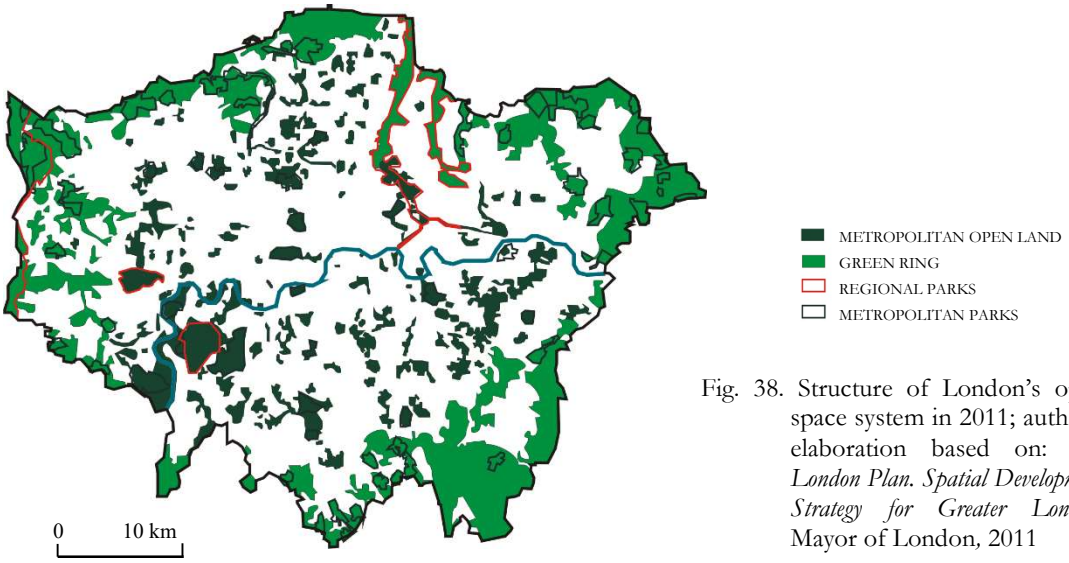

Fig. 38. Structure of London's open space system in 2011; author's elaboration based on: *The London Plan. Spatial Development Strategy for Greater London,* Mayor of London, 2011

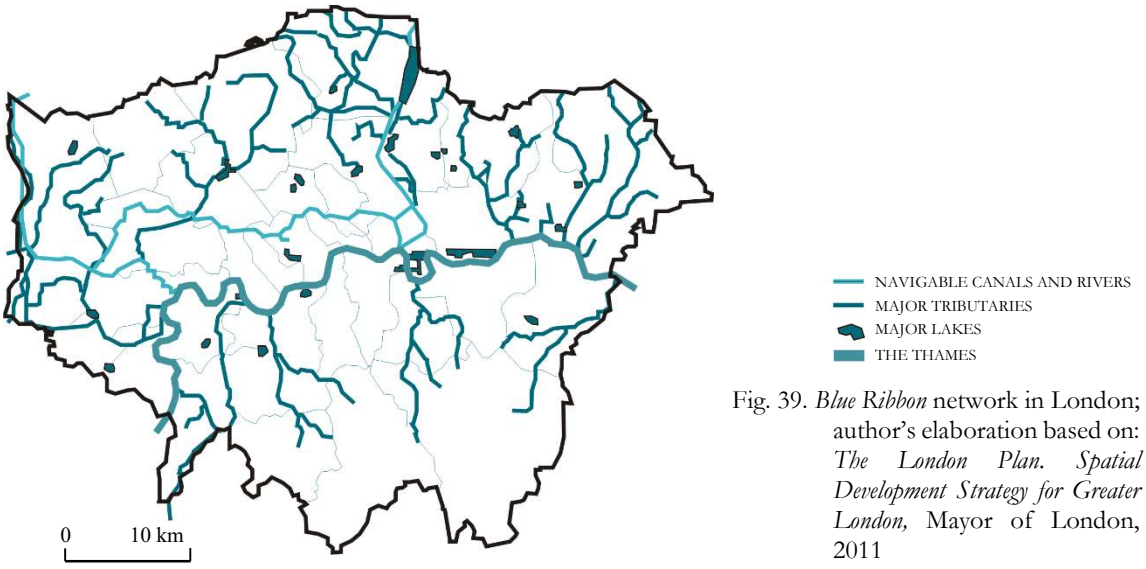

Fig. 39. *Blue Ribbon* network in London; author's elaboration based on: *The London Plan. Spatial Development Strategy for Greater London,* Mayor of London, 2011

> The largest completed Green Chain section, i.e. the South East London Green Chain, was created in 1977. It comprises a system of 300 green spaces interlinked by an approximately 40-mile grid of footpaths and cycleways, sports areas, and open spaces, embedded in the landscape of extensively built-up industrial districts. This area provides Londoners with leisure opportunities in one of the city's urbanised parts and enables them to experience contact with nature. The entire system is based on preserved agricultural and forest lands subject to protection[47].

The system of open spaces was gradually being developed based on assessments of the quality of its individual elements, including their ecological, structural, educational, social, and cultural values, as well as of the characteristics of their location. 1992 saw the conception of the Plan of Strategic Open Space in London, drawn up by Tom Turner, indicating both the existing and the potential locations for the Metropolitan Green Belt, Metropolitan Open Land, Green Chains and Walks. It specified recommendations for green space planning and defined opportunities for further development of the green chain, perceived as a strategic system of links between the open spaces in the city[48].

Until the present, the development within the boundaries of London's *green ring* has dispersed, yet the space between buildings is still filled with vast open spaces[49]. It is with these spaces in mind that the local spatial policy is implemented, aimed to prevent uncontrolled urban sprawl and keep the neighbouring towns from merging, to support adequate maintenance of the open areas between urbanised areas, and finally to foster sustainable development principles. It also seeks to preserve and restore the natural and cultural landscape of cities and their fringes. In accordance with the spatial policy in place[50], maintenance of the green belts is currently intended to provide city dwellers with access to open spaces, as well as to protect the landscape, valuable natural sites, and agricultural land. The continuity of the belts is sustained by deploying the regional strategic policy which has established the framework for and clear boundaries of the green belts, set the rules aimed at protecting the areas they comprise, and made it possible to define new green spaces[51].

What has become particularly important is utilising and incorporating degraded post-industrial sites and abandoned urban sites into the urban green space system once they have been transformed and developed for natural, recreational, or educational purposes, all contributing to a new quality of the urban landscape.

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[47] Żolnierek-Mazurek K. *Przyrodnicza rewitalizacja zdegradowanych dzielnic Londynu* (Revegetation of London's degraded districts). In: Drapella-Hermansdorfer A. (ed) 2005, op. cit., pp. 43–47.

[48] Turner T. 1998. *Landscape planning and environmental Impact design London*. UCL Press, London, available online at: http://www.um.wroc.pl/m3508/p99138.aspx [accessed on 2011].

[49] The contemporary green ring surrounding London is no longer characterised by the protection from urban sprawl. Its priority has become the protection of open land against over-investment. This manifests itself in the efforts aimed at incorporating new (often incidental) sites into the greenbelt as compensation for land taken away and earmarked for development (e.g. Stevenage case). The foregoing can attributed to the population growth, the need for continuous development, and the right of local authorities to include or exclude land from the green belt area. The spatial policies in place are not strong enough to stop this phenomenon (*Green Belts: a greener future*, 2010, Natural England and the Campaign to Protect Rural England).

[50] The principles according to which the green belt concept is implemented are laid down in the National Planning Policy Guideline; document available online at: www.london.gov.uk [accessed on 2011].

[51] *Planning Policy Guidance 2: Green Belts (PPG2)*, 1995; document available online at: www.ice.org.uk [accessed on 2011].

New spatial planning rules related to how the city's natural system was to be shaped were introduced under the **2004 London Plan**, coordinated by the Greater London Authority (GLA). The document proposed a number of various principles, including those pertaining to the planning of the city's waterfront space, referred to as the **Blue Ribbon Policy**, comprising the Thames and its tributaries, the canal network, reservoirs and lakes, as well as docks and covered sections of rivers, streams, and canals. It also put forward a policy for the protection and development of the biodiversity of the water system, assumed to be implemented by:

- proposing new solutions that would increase the natural value,
- opening up covered rivers and restoring water courses,
- securing the qualities of the Thames floodplain[52].

Emphasis in the London Plan was placed on creating a system of footpaths and cycleways, on the concept of *calm spaces* characterised by reduced noise levels, as well as on the role of public spaces, i.e. plazas or green squares, as part of a system of urban greenery. One of the most significant arguments raised in the Plan was the necessity of preparing Open Space Strategies under the local planning framework to protect, develop, and enhance all kinds of green space covered by the scope of the document[53]. The open space policy, as provided in the 2004 Plan, pertained to such aspects as: identifying new missing areas which could be allocated as urban green spaces; creating new functional and spatial links based on city dwellers' actual needs; improving accessibility across the network; promoting and protecting *green corridors* and *green chains* as valuable in themselves or adding value to local communities; and ensuring that the inclusion of urban green spaces in the spatial policy provides an opportunity for the city to grow[54].

In 2011, when updating the London Plan[55], the local authorities underscored the solutions concerning the promotion of open spaces and their major role in the formation of the city's spatial structure. Some further notions emphasised in the plan revision included the distinctive nature of the Blue Ribbon system[56], and the need to develop and protect the links functioning in the *network of green infrastructure* as well as to make them more specific, while the range of the projects implemented under this network was extended. The Plan also introduced a detailed classification of open spaces, including: regional parks, metropolitan parks, neighbourhood parks, municipal parks and open spaces, small open spaces, small parks, and linear open spaces. The Plan was essentially meant to protect all open spaces against inadequate development, seeking to improve their quality, to enhance their biodiversity, and to make the most of their natural and cultural heritage[57].

London's strategic policy strongly emphasises the pre-assumption that, next to the Green Belt, the Metropolitan Open Land, the Blue Ribbon Network, and the system of diversified urban green spaces of strategic importance, including degraded sites in need

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[52] *London Plan 2004*, *Improving London's water space*, Section 4C: *The Blue Ribbon Policy*; document available online at: www.london.gov.uk [accessed on 2011].

[53] *London Plan 2004*, The Greater London Authority, ibid.

[54] *London Plan 2004*, *Improving London's open environment*, Chapter 3, Part D 4, ibid.

[55] *The London Plan. Spatial Development Strategy for Greater London*, Mayor of London 2011; document available online at: www.london.gov.uk [accessed on 2011].

[56] The Blue Ribbon Network concept has highlighted the need to pursue the best and most efficient use of waterfronts for inland navigation (for purposes of tourism and freight), recreation, sport, housing, protection of environmental qualities, and flood defences (*The London Plan 2009,* Chapter 7 – *London's Living Places and Spaces*, *Blue Ribbon Network*, ibid.).

[57] *London Plan 2009*, Chapter 2 – *London's Places*, Chapter 7 – *Living places and spaces*, ibid.

of renewal and urban public spaces, **green space is an essential component of the urban spatial structure**.

3.4. Clydeside

The planning efforts undertaken in the Scottish region of Clydeside[58] have become a role model of regional planning, incorporating the use of open spaces in defining the development and structure of heavily urbanised areas, including industrial agglomerations.

This region emerged and received its structure on account of the local heavy industry and shipbuilding operations, along with their urban-industrial infrastructure, accompanying agriculture, and natural landscape. The urbanisation of Clydeside caused numerous problems, the solving of which was attempted by a team of urban planners led by sir Patrick Abercrombie and Robert H. Matthew. They decided that, for the area to function sustainably, its regional planning must go hand in hand with the planning of its economic and social dimensions. Consequently, the region had to be considered as a whole, or as an economic unit, an outcome of which was the **Clyde Valley Regional Plan** which they produced in **1946**. It was in the Plan that they sought balance between urban spaces and open spaces in terms of their use and development. Abercrombie decided to follow the principles he had already applied in the Greater London Plan, according to which urbanised areas were to be encircled with a *green belt*. They specifically pertained to a conurbation composed of the most industrialised towns in the region, formed around Glasgow. The green belt of the Clydeside conurbation was intended to protect the environment, curb the urban sprawl process, contain the expansion of development into fringe areas, and provide opportunities for developing recreational features. The belt consisted of agricultural land, river valleys, woodlands, and areas of fragmented development, stretching between towns and the countryside. Although the ring-type greenery systems intended for the Clyde Basin and the Greater London essentially relied on the same model, there were marked differences between them, attributable to the differences in local conditions. There are numerous peat bogs stretching along water courses in the Clyde river basin, as well as mountainous lands unsuitable for development, as a result of which new development sites were designated in line with the region's topography. Attractive recreational sites were situated further away from urbanised areas, separated from them by a strip of agricultural land which became a base for weekend leisure activities. Consequently, the recreational use of the Clydeside green belt was less intensive than in Greater London. The inner green belt line delimited a boundary around built-up areas. The outer line corresponded to the edges of nearby moors, thus defining the boundaries of commercial agricultural lands. The area of the belt itself was intended to meet the nutritional needs of urban communities. Consequently, it was to perform agricultural and productive functions (fields and orchards) in the first place, while the recreational functions were secondary. Abercrombie also intended to bring public institutions, namely hospitals, into the belt, as he argued that their efficacy would rise in an open space setting. According to the plan, all major towns and urbanised areas were to be separated by the open spaces of green corridors.

[58] The Clydeside conurbation is a region composed of Dumbarton, Clydebank, Bearsden, Milngavie, Glasgow, Strathkelvin, Cumbernauld, Kilsyth, Monklands, Motherwell, Hamilton, East Kilbridge, Clydesdale, Eastwood, Renfrew, and Inverclyde.

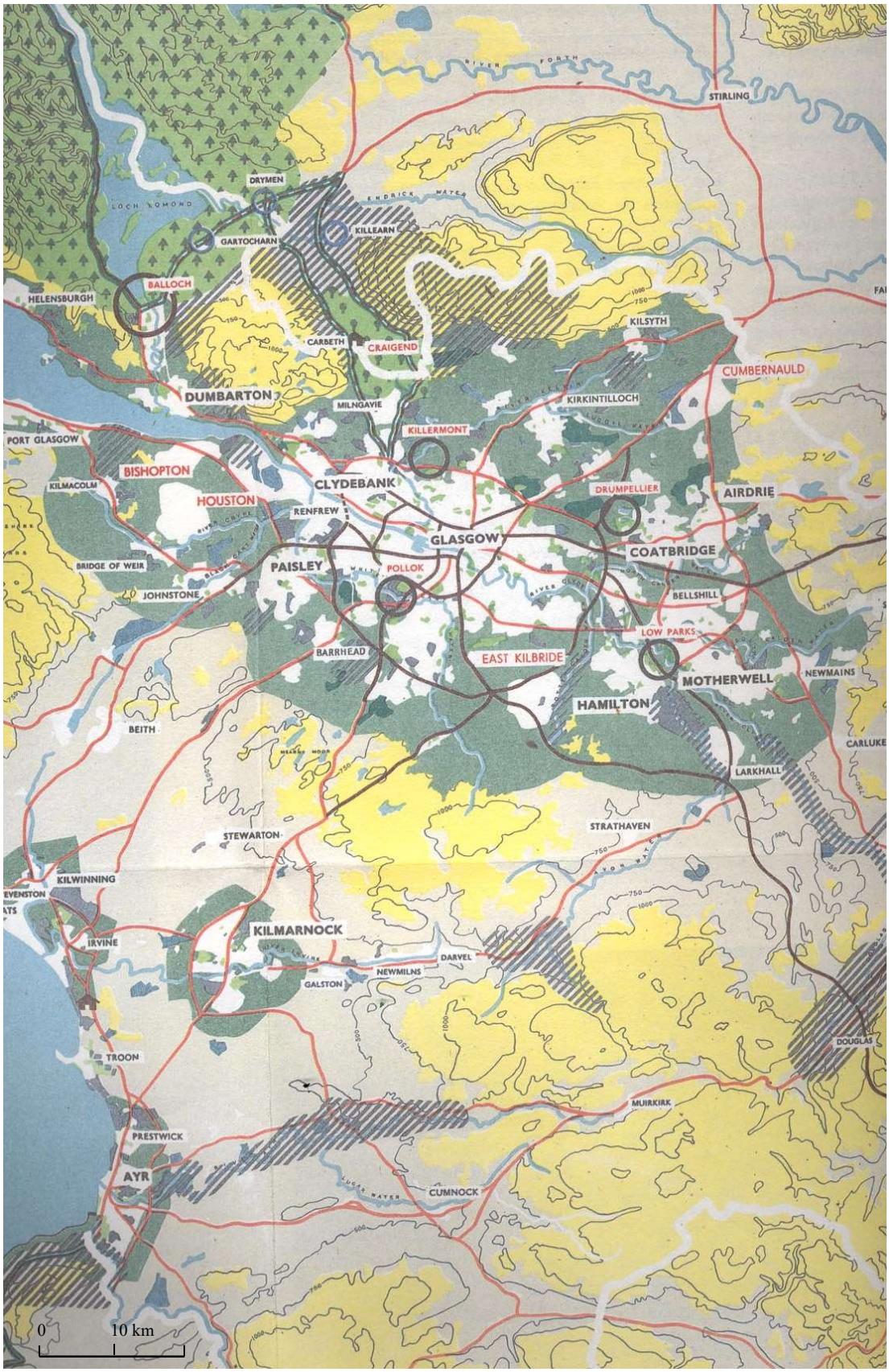

Fig. 40. Open spaces, Clyde Valley Regional Plan, Patrick Abercrombie and Robert H. Matthew, 1946

The backbone which connected green spaces and enabled them to penetrate urban areas was supposed to be the Clyde Valley[59].

The problem of searching for the correct spatial structure of the Clydeside conurbation and its regional links in order to create a harmonious, ecological, and compact area never ceased to be topical over time. Work on the region's development strategy continued, as it was revised, its implementation supervised, outcomes monitored, and necessary modifications introduced. **In 1991, the Clydeside region authorities were officially recognised by the European Community and the European Council of Town Planners for their approach to regional planning and its effectiveness**.

1995 saw the release of the **Strathclyde Structure Plan**[60]. Great importance was attached in the document to the existing spatial structures, historical layouts, natural systems, cultural qualities, as well as spatial and functional bonds of local communities. They provided foundations for the development concepts aimed at making the area more attractive to residents and tourists, and increasing its economic potential. The preparation of the Clydeside conurbation structure plan was intended to help in controlling the region's development processes, monitoring and regulating them, and taking responsibility for the progressing changes. One of the plan's cornerstones was developing a natural system based on Abercrombie's green belt model. It was decided that the green belt area (103,400 ha) would play an essential role in the process of the region's revival, the fundamental principle of which was maintaining its fixed boundaries around the urbanised areas. It was also found necessary to undertake complementary measures to preserve and shape green spaces, to improve the quality of recreational areas, to optimise the accessibility of transport networks, and to minimise infrastructure costs (especially in areas somewhat detached from the conurbation proper). These objectives were confirmed in the Regional Development Strategy, defining a framework for the region's development until the year 2006. It highlighted the economic, social, and environmental growth of the region as the most important aspects, these to be achieved by regenerating the built environment and the surrounding green belt, increasing the vitality of urban and rural areas, using renewable energy sources, reducing pollution, preserving the region's natural and cultural heritage (seeking balance between nature conservation and the possibility of using environmental resources), and integrating land development patterns with the transport system[61]. This strategy became the foundation of more targeted policies deployed at a local scale[62].

An important aspect in the planning of the sustainable development of the Clydeside area was the emphasis put on the **use of degraded brownfields and abandoned urban sites having natural, cultural, and educational potential**, located both in urbanised areas and within the surrounding green belt. It was established that their reclamation and development for natural purposes would maximise the functional efficiency and the actual impact of the green belt.

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[59] *Clyde Valley Regional Plan 1946, A report prepared for Clyde Valley Regional Planning Committee by P. Abercrombie and R. H. Mattiew, 1949*, 1996, Nevisprint Ltd, Fort William, Scotland, passim.

[60] The plan stretched as long as to the Strathclyde region, which includes: Clyde Valley, Ayrshire, Argyll, and Bute.

[61] *Strathclyde Structure Plan 1995*, 1991, Department of Physical Planning, Strathclyde Regional Council, pp. 38–76.

[62] Structure plans were first introduced in 1968 by way of the *Town and Country Planning Act*, functioning as strategic development plans prepared at a regional level.

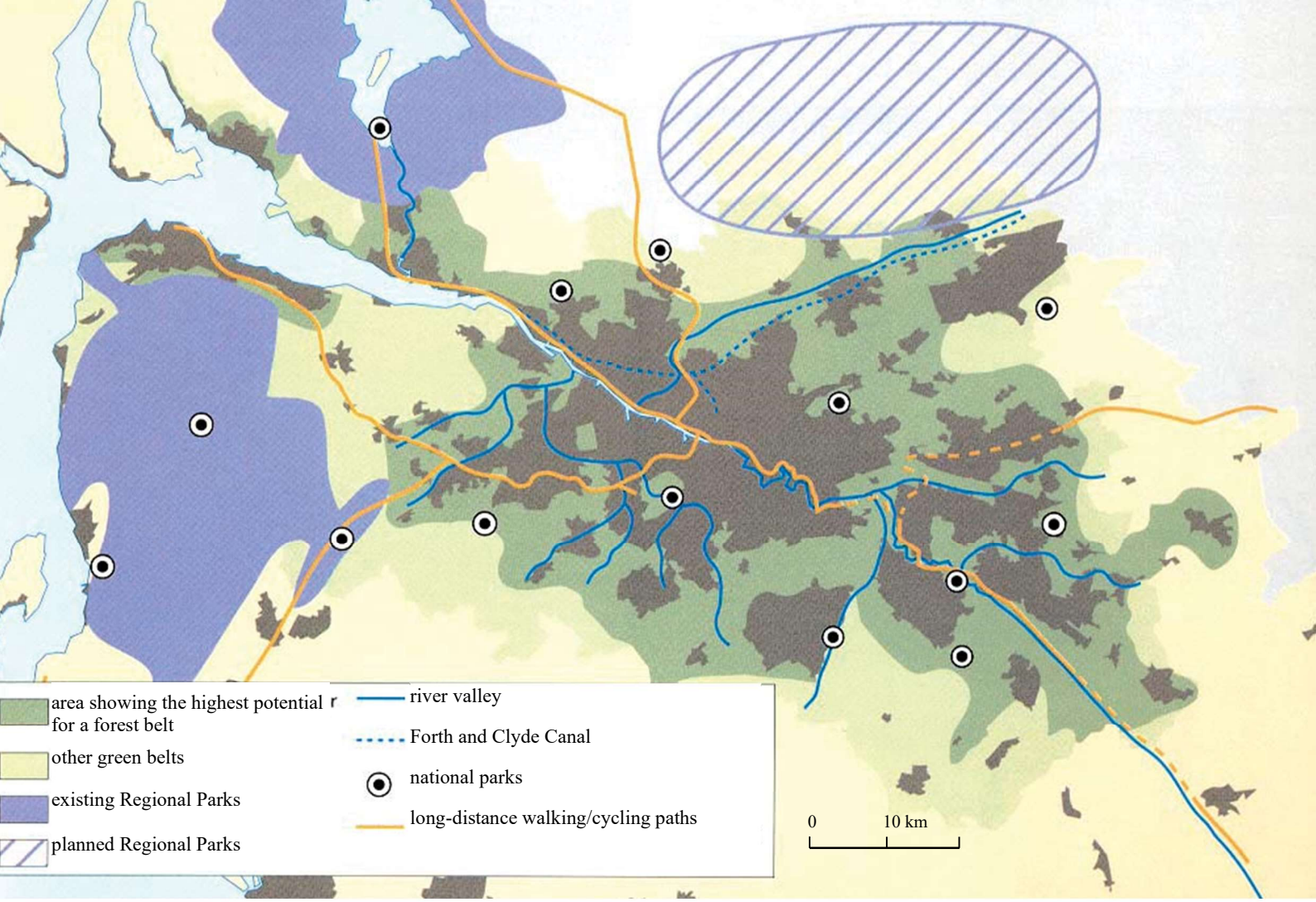


Fig. 41. Open spaces of the Clydeside conurbation, Strathclyde Structure Plan, 1995

Fig. 42. Strathclyde – industrial brownfields in need of redevelopment

Fig. 43. Strathclyde – riverside brownfields converted into residential areas

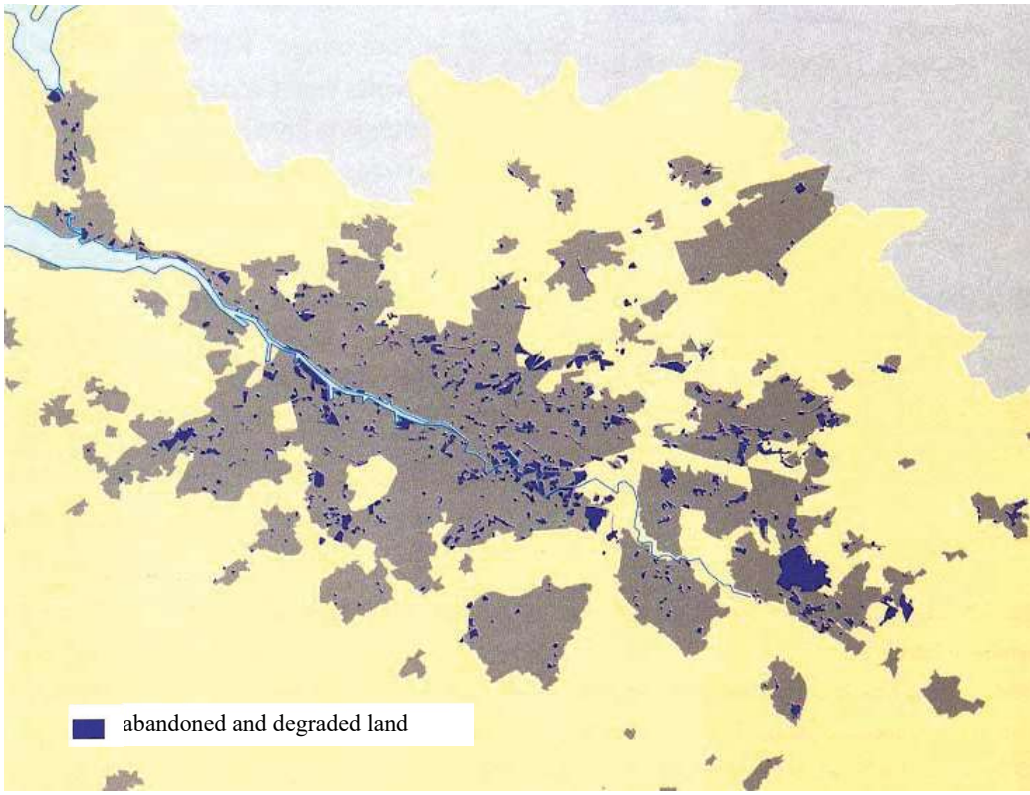


Fig. 44. Strathclyde – distribution of degraded and derelict sites, Strathclyde Structure Plan, 1995

There were 4,800 hectares of brownfields identified within the conurbation: degraded, abandoned, and neglected land, which – following renewal processes – could be reused for residential, business, or industrial purposes, or incorporated into the urban green space system[63]. In line with the principles of sustainable development or of a compact city, it was proposed that more should be invested in the urbanised areas in order to minimise the consumption of natural resources, to avoid the unnecessary loss of the green belt's open space lost to urban sprawl, and to increase the attractiveness of the available places of habitation and work. The boundaries of the green belt were specified in detail in local spatial development plans, taking both the relevant strategic guidelines and local circumstances into consideration, and substantiating them by economic and environmental benefits.

Over time, the policy of „removing" open space from the green belt and converting it into built-up areas turned out to be the region's problem. Consequently, activities aimed at protecting open spaces became more important than urban sprawl prevention.

The Clydeside case clearly proves that the problem of urbanised landscape renewal should be analysed at a regional as well as local scale. What also proves to be important to this process is the right choice of planning, legal, financial, and organisational tools. However, the real issue is the necessity of sustaining and building on the experience acquired throughout the long years of the planning process[64].

3.5. The Ruhr

The Ruhr provides an example of how using elements of the natural environment degraded by industrial activity can influence the renewal of the spatial and functional structure, as well as the image and character of intensively urbanised post-industrial areas.

The measures implemented to solve the problems typical of the Ruhr[65] exemplify a comprehensive environmental, economic, and spatial region revival strategy, developed by taking into account modernisation of state and municipal institutions, as well as working towards new planning and managerial methods. Adopted already in the 1960's, the plans to expand the local green space system had failed to evolve into anything more than mere plans[66]. Not until the revitalisation and restructuring actions launched in 1989

63 *Strathclyde Structure Plan 1995*, op. cit., pp. 138–161.

64 Strategic plans are no longer drawn up in the contemporary UK. In accordance with the 2004 Planning and Compulsory Purchase Act, they were replaced by Regional Spatial Strategies (RSS), while the uniform local land use plans – by a set of Local Development Documents. The year 2008 saw the enactment of the Planning Act, which moved the burden of regional planning responsibilities and functions to the Regional Development Agencies. The subsequent act (The Local Democracy, Economic Development and Construction Act 2009), in an attempt to simplify the regional planning process, merged the Regional Spatial Strategies with other strategies used to address individual planning issues into a single strategic document (Regional Strategies). In 2010, the Secretary of State for Communities and Local Government announced all the regional plans and to have been cancelled and intended to legislate for the formal abolition of the plans and the organisations responsible for them. This meant that planning decisions would not refer to regional plans, but would instead be made on the basis of the local policies contained in Local Development Frameworks and the information acquired in the preparation of the former regional plans; source: www.planninghelp.org.uk [accessed on 2011].

65 The Ruhr (4,433 km^2) is a region in geographical, historical, and spatial terms, but does not have separate administrative structures. It is situated within three administrative regions: Düsseldorf, Muenster, and Arnsberg, and is covered by three different regional zoning plans.

66 Sekula B. 1979. *Wpływ zanieczyszczeń atmosfery, gleby i wody na kształtowanie przestrzennej struktury zurbanizowanego środowiska* (Effect of atmosphere, soil and water pollution on the formation of the spatial structure of the urbanised environment).

under the umbrella of the International Building Exhibition *Emscher Park* (IBA) had any of the actual problems of the region's most dilapidated northern part been solved[67]. One of the fundamental assumptions of the spatial concept implemented in the region was **redevelopment of the urban and ecological structure of the cities and of the region as a whole based on transformation of industrial brownfields**[68]. Its goal was to improve the people's quality of life, including their life, work, and leisure environments. It was assumed that the conditions of city dwelling, closely linked to natural assets, affect the competitiveness and growth capacity of the entire region. Its scenic attractiveness, on the other hand, is affected by such elements of the cultural heritage – specific to post-industrial areas – as workers' settlements, compounds of decommissioned industrial facilities of high architectural or urban planning qualities, components of industrial infrastructure, and anthropogenic elements of the natural environment (e.g. dumps, mining pits).

The revitalisation of the Ruhr region's natural landscape was possible owing to the **coordination of the regional green space system**, providing an ecological backdrop to the renewal of the entire area. Based on the early 20th century concept of seven Regional Ecological Corridors (*Die Regionalen Grünzüge*) developed by Robert Schmidt[69], the goal being pursued was to bind together and complement the north–south arranged corridors as well as to rebuild the east–west axis regional ecological corridor along the river Emscher. Combining parks and public green spaces of 17 towns on the banks of the Emscher, an area of 320 km^2 formed the Emscher Landscape Park[70]. It was functionally aligned with the following principles:

- preserving, linking, and improving the quality of the existing open spaces;
- creating new green spaces;
- utilising and reclaiming industrial brownfields – degraded, abandoned, or unused land, predominantly subject to natural succession[71];
- raising the area's ecological value (increasing forested area, linking individual biotopes, ecological restoration of water courses, intensification of agricultural production);
- creating cultural and natural landscapes through conservation, artistic interpretation, and new development of typical landscape elements previously transformed by industry[72].

In: *Aspekty ekologiczne w planowaniu przestrzennym silnie uprzemysłowionych aglomeracji* (Ecological aspects in the spatial planning of heavily industrialised agglomerations). PWN, Warsaw–Poznań, pp. 73–105.

67 The IBA Emscher Park area (more than 800 km^2) comprised 17 towns with administrative district status (Bochum, Castrop, Dortmund, Duisburg, Essen, Gelsenkirchen, Herne, Oberhausen, etc.), stretching along the river Emscher and having a population of 2 million. They formed a roughly rectangular shape with a latitudinal alignment and dimensions of 75 x 15 km.

68 Ganser K., Siebel W., Sieverts T. 1993. *Die Planungsstrategie der IBA-Emscher-Park – Eine Annaeherung* (The planning strategy of IBA Emscher Park. The approach). In: *RaumPlanung*, 61, Dortmund, pp. 112–118.

69 This concept was further developed in 1966 in the Ruhr Development Plan (*Gebirtsentwicklungsplan für das Ruhrgebiet, GEB*). The Plan referred to the open spaces stretching along the north-south axis between the region's cities as Regional Ecological Corridors (Schwartze-Rodian M. 1996, p. 220).

70 The landscape park initially covered an area of 320 km^2. Following the completion of the IBA, its area increased to 457 km^2, encroaching on urban territories and forming new links between urbanised areas and the natural landscape (*Internalional Building Exhibition Emscher Park. The projects 10 years later*, 2008, Fachgebiet Städtebau, Stadtgestaltung und Bauleitplanung, Fakultät Raumplanung, TU Dortmund Eds, Klartext Verlag, Essen).

71 Using individual anthropogenic landforms, rendering them available for recreational purposes as parks or reservoirs, and linking them to elements of cultural heritage, an attempt was made to endow them with special value. The aim was to create a network of landmarks in the urban structure which shaped the region's landscape.

72 *International Building Exhibition Emscher Park*..., op. cit., pp. 16–53.

The Emscher Landscape Park's planning system relied on **non-formalised, open, and very flexible spatial planning procedures**. A three-tier informal governance model was created for purposes of the park development. It enabled seamless transition between project management at a regional, i.e. conceptual, scale, breaking it down into details (master zoning plans covering the park's individual sections), arranging the required funds and means, and actually implementing local-scale projects. It also made it possible to develop principles of cooperation, compromise seeking, and experience exchange between all the parties to the planning process[73]. Thus designed, the process received governmental support under the brownfield regeneration scheme.

The measures undertaken in pursuit of the region's transformation covered numerous aspects relevant to the everyday life of urban communities. Some of the priority projects particularly worth mentioning, addressing various environmental renewal problems, were as follows:

- industrial landscape parks larger than 50 ha, arranged on brownfields, exposing and highlighting elements of the industrial past (Duisburg Nord Landscape Park, Nordsternpark in Gelsenkirchen);
- municipal parks of less than 25 ha, surrounded by residential districts and business parks, utilising individual elements of the natural environment degraded by industrial activity (Kunstwald Teutoburgia in Herne, Erin Landscape Park in Castrop-Rauxel, Stadtpark Prosper III in Botrop);
- landscape parks of the pre-industrial culture, preserving (in a modified form) the remains of agrarian and forest culture (Mechtenberg Landscape Park within the Bochum–Essen–Gelsenkirchen triangle, or Gehöltgarten Ropshorst in Oberhausen).

One of the characteristics of transformation of the urbanised landscape is exhibiting a formation commonly referred to as a *wild industrial forest*, comprising residual woodland preserved within industrial surroundings as well as spoil heaps and landfill sites, reclaimed, redeveloped, or transformed through artistic activity into *landmarks* (*landmarken-Kunst*) or vantage points, functioning as nodes on tourist routes[74]. What bound individual elements and sites of the Emscher Landscape Park was a system of footpaths, cycle paths, hiking trails, and waterways rendered available for recreational purposes. It provided an opportunity for the local landscape to be perceived anew and increased its accessibility, which was a prerequisite for the urban community to become familiar and identify with the transformed areas. In order to highlight the most distinctive elements of the natural environment degraded by industry, a special tourist trail was created, known as the Route of Industrial Nature (*Route der Industrienatur*), linking the post-industrial landscape with the regional open space system, highlighting the phenomena of natural succession on spoil heaps, stock piles, or former industrial premises.

[73] Schwarze-Rodrian M. 1996. *Interkommunale Zusammenarbeit: Voraussetzung für die Freiraumpolitik im Ruhrgebiet* (Inter-municipal cooperation. A prerequisite for the open space policy in the Ruhr region). In: *Selle K. Planung und Kommunikation. Gestaltung von Planungsprozessen in Quartier, Stadt und Landschaft* (Planning and communication. Shaping the planning processes for the neighbourhood, city, and landscape). Wiesbaden, Berlin, pp. 220–223.

[74] *International Building Exhibition Emscher Park*..., op. cit., passim.

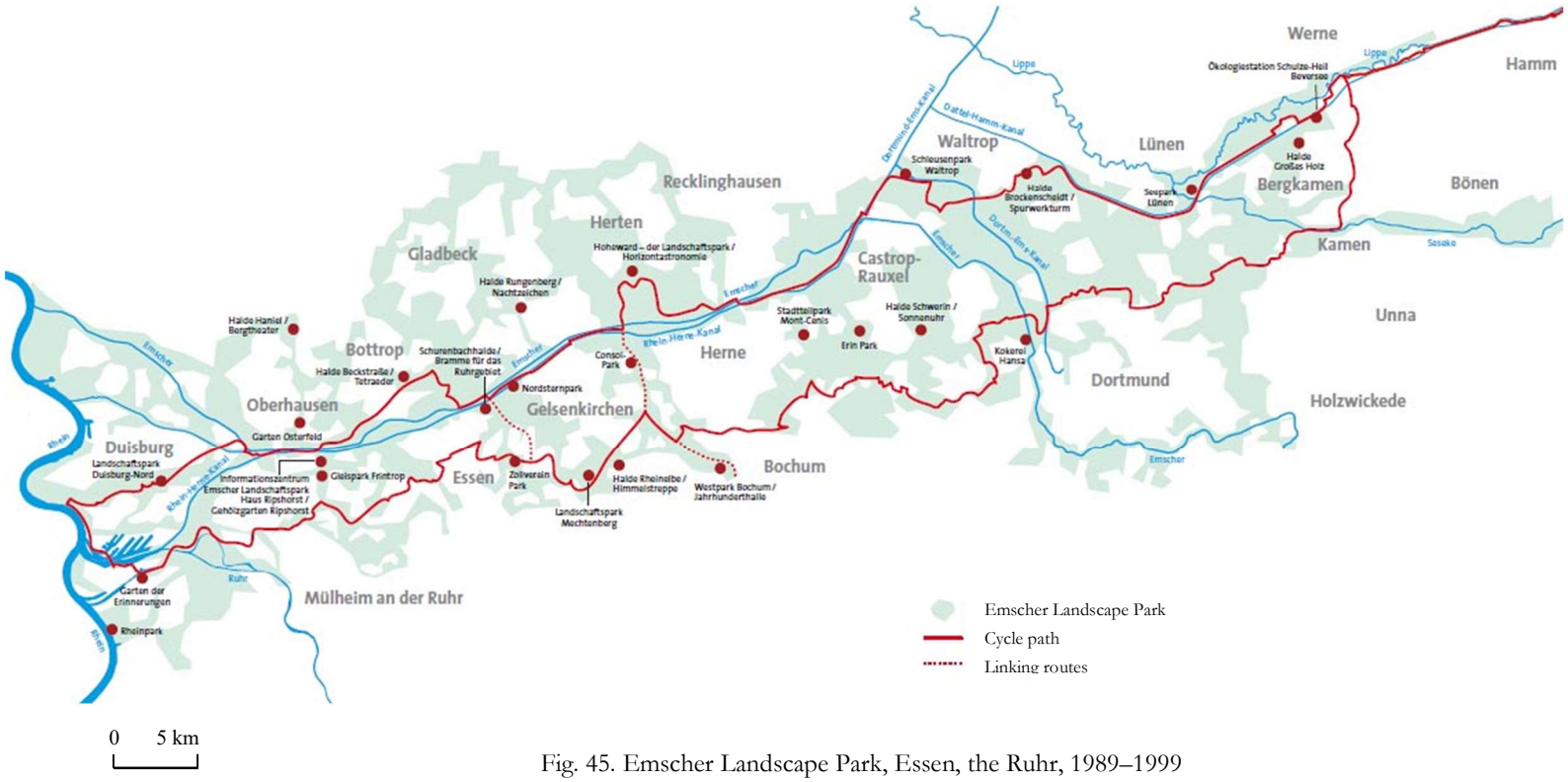


Fig. 45. Emscher Landscape Park, Essen, the Ruhr, 1989–1999

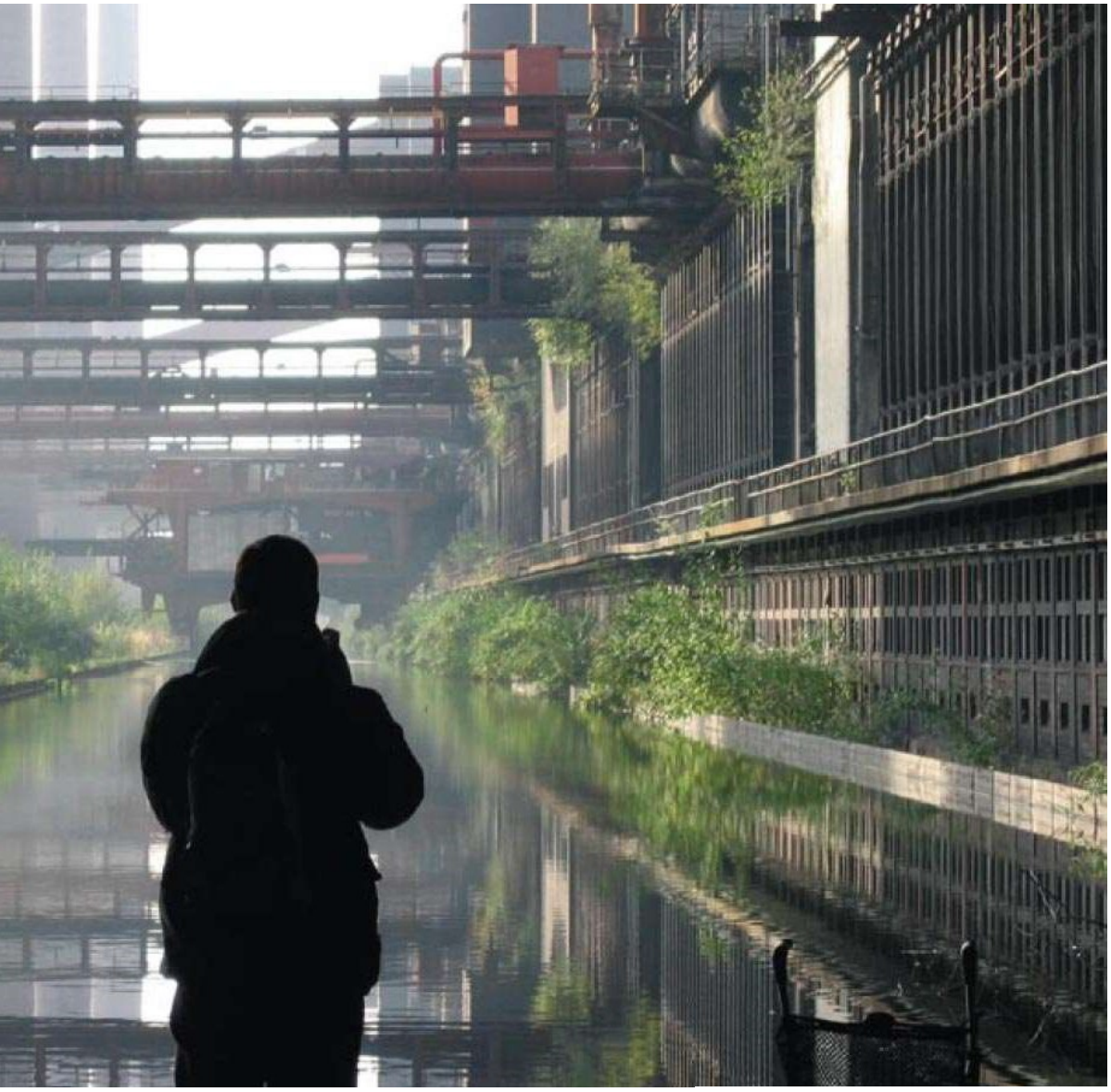


Fig. 46. Zollverein coking plant, the Ruhr

One of the fundamental components of the environmental and landscaping strategy for the region renewal became the river Emscher, transformed into a main sewer as a consequence of rapid industrial development. In order for the actions undertaken in this respect to be effective, its natural character needed to be restored. The concept of the ecological revival of the river, conceived under the Emscher Park (IBA) initiative, envisaged in the first place that the quality of the water supplied to the river should be improved and its capacity raised by constructing an underground duct carrying the effluents entering the river, building additional wastewater treatment plants, expanding the system designed to manage the discharge of rainwater from adjacent residential compounds and industrial parks directly into water courses, and finally, by rehabilitating the river tributaries[75]. Only then were the waterfronts reclaimed. The purpose of the revitalisation measures was to integrate these areas into the urban spatial structure, and by that means, to transform the Emscher valley into an attractive and multifunctional landmark space for the entire region and its cities[76]. The Emscher river restoration process manifested the desire to strike a balance between safety, aesthetic appeal, and functionality. This approach conditioned further planning activities, whose grounds were laid down in two main documents: the Emscher Future Development Plan (*Der Masterplan Emscher-Zukunft 2003–2006*) and the Emscher Landscape Park Spatial Development Plan (*Masterplan Emscher Landschaftsplan 2010*). They both emphasised the need for:

- implementing flood control measures;
- ecological development of the water system;
- ensuring continuity of the open space system and ecological networks;
- building a system of riverside greenery (river parks) with recreational and leisure features;
- making the character of the riverside space coherent.

They also emphasised the intent to improve the scenic qualities of the riverside region (harmonising the landscape in the strip of land adjacent to the river and restoring the natural character of the riverside areas) and the standard of living of the local population (new opportunities for recreation, cultural exchange, living and working on the water). The measures undertaken for these purposes largely pertained to the local scale, effectively aiming to:

- change the image of the urban space (by creating new public spaces, linking riverside areas with the adjacent urban structure);
- stabilise the urban development of riverside districts (through adequate selection of functions assigned to individual development zones);
- upgrade technical infrastructure;
- increase the economic value of the urbanised areas as well as their attractiveness for tourists[77].

However, the Emscher Landscape Park Spatial Development Plan performed even more functions. It was meant to outline a strategy for the future and the landscape park development trends, altogether combined with the economic and urban revival of the

[75] The renewal of the Emscher river's natural system is a process intended to continue until 2027, ibid.

[76] Schwarze-Rodrian, M. 2006. *Emscher Landschaftspark – die zweite Phase* (The Emscher landscape park – phase two). In: *Ministerium für Umwelt des Saarlandes (MfU)/Akademie für Raumforschung und Landesplanung (ARL)*, LAG Hessen/Rheinland-Pfalz/Saarland ed., Kooperation als Erfolgsfaktor für Regionen im Wandel, Saarbrücken, p. 34–35.

[77] *Der Masterplan Emscher – Zukunft 2003–2006* (The Emscher future master plan 2003–2006); document available online at: www.eglv.de [accessed on 2011]; *Masterplan Emscher Landschaftsplan 2010* (The Emscher landscaping master plan 2010), 2005, Klartext Verlag, Essen.

urbanised areas (since the master plan encompassed as many as 20 municipalities). Its goal was also to highlight the need for structural and functional links between individual areas, for the sustainable development of the region and its individual cities, and for the landscape to be harmoniously shaped. The plan was to expand the territory of the regional ecological corridors by incorporating in-city green spaces and recreation areas as well as to transform the New Emscher Valley (*Neue Emschertal*) – an area of crucial significance for the East–West Regional Ecological Corridor. It further envisaged to encompass some new urban planning concepts and landscaping projects, many of which were to be implemented on industrial brownfields, including the following: Green Ring (*Grüne Ring*), Phoenix-West technology park, Phoenix-Ost service and residential park in Dortmund, projects Ewald and New Horizons (*Neuen Horizonte*), new development of the Hoheward dump site in Herten, Water Gardens in Westpark, Bochum, as well as redevelopment of the Zollverein park and the Krupp-Gürtel service and residential park in Essen.

Midway the region's renewal process, once numerous measures had been successfully deployed, the initial economic growth came to a halt. The foregoing was attributable to many reasons, including hampered population growth (despite the migration from East Europe) and a decline in the number of investors (Germany's national policy had placed greater emphasis on structural changes in East Germany, which was where potential investors were looking for valuable land). Consequently, the demand for new housing decreased and the 700 ha of land prepared for investment remained vacant. From that time onwards, the nature of the transformation process changed, particularly in scale. It was no longer dominated by large initiatives, but rather by smaller projects, including the measures connected with the *Land Art* movement. Local politicians began to favour other types of investment, such as large shopping and entertainment centres, the outcome of which was the traditional town centres falling into decline. However, once brought to life and then gradually complemented, the natural system has remained an important part of the region's spatial and functional structure, which is what its new landscape reflects.

The measures undertaken there have become a remarkable example of how the natural environment can be incorporated into the process of landscape renewal in a degraded urban fabric. The natural system implemented in the Ruhr has become a model for other German metropolitan regions, such as Berlin (8 regional parks), Stuttgart (Stuttgart Region Landscape Park), or Frankfurt (Rhine-Main Regional Park).

3.6. Lower Lusatia

The scheme of measures implemented the industrially degraded, extensively urbanised area of Lower Lusatia is an example of comprehensive landscape renewal aimed at producing its new aesthetic qualities.

They were attributable to the scale of the region's spatial and economic restructuring problems, including the large area of land in need of reclamation and revitalisation, absence of links and direct interrelations between large urban areas, as well as deficit of intellectual assets. Unemployment and declining residential stock (vacant buildings, deteriorating technical infrastructure) due to labour migration constituted further issues identified in the region. Its heavy industry-based economy, mainly associated with lignite mining, had disturbed all the basic elements of the natural environment, causing changes

to the terrain relief (numerous mining pits and heaps), disturbance of the land's geological stability and water regime, destruction of soil structure and its biological values, air and water pollution, and landscape degradation. However, the main assets of Lower Lusatia are invariably the pieces of its cultural and natural landscape untouched by industrial activity, including the palace and park compounds of Prince Herman von Pückler in Bad Muskau and Cottbus-Branitz, the Spreewald Biosphere Reserve, the Lower Lusatian Landscape Park (*Naturpark Niederlausitzer Landrücken*), and the riverside areas of the rivers Black Elster, Spree and Neisse.

One could have obviously waited patiently for the landscape to transform spontaneously over the next few decades – the pits to fill with water, the banks to succumb to natural succession, and nature to finally take over the area, but instead, local authorities decided to implement planning measures to guide and drive the transition process, to redefine the region's landscape identity, and to restore its overall balance. The main goal of the transformation efforts undertaken in the region was to transform the built and natural environment in a way which would contribute to satisfying the needs of contemporary inhabitants of urbanised areas. The main theme of the regeneration process was the search for a vision of life in the region, a new image for the post-industrial areas, and opportunities for economic development based on innovation, making the natural environment redevelopment truly comprehensive. The outcomes expected of these efforts were to comprise social renewal, including involvement of local communities in the transformation process, creation of new jobs, as well as safe and stable living conditions. Once coal-dependent, the region was to become a place of high-end technology and new media, as well as new production, service, leisure, and tourist facilities.

Faced with the complexity of the regional renewal issues and the inefficiency of statutory spatial planning instruments, new informal planning tools were engaged. Besides the concept of development of the region's administrative districts (*Kreis*) or its *Agenda 21*, defining a vision for the future growth of the entire region, it was the IBA Fürst-Pückler-Land 2000–2010 international building exhibition that became the format which allowed the problems of regional renewal in Lower Lusatia to be addressed in a comprehensive manner. It covered an area of approximately 5,000 km^2, including the city of Cottbus, four districts: Oberspreewald-Lausitz, Dahme-Spreewald, Spree-Neisse, and Elbe-Elster, forming the Lausitz-Spreewald Planning Community, as well as fragments of Saxony and Poland bordering on Brandenburg. The spatial concept developed under the IBA umbrella focused primarily on the problems of landscaping as well as the environmental and economic renewal of this poorly urbanised region (area of 5,000 km^2 inhabited by ca. 623,000 people). Nine areas of comprehensive transformation were defined, referred to as *landscape islands*, their boundaries non-coincident with the applicable administrative divisions. Specific landscape concepts and pilot projects aimed at highlighting the respective landscape qualities started being implemented within each island. Their fundamental goals are as follows[78]:

[78] *Internationale Bauausstellung (IBA) Fürst Pückler Land 2000 bis 2010: Projektkatalog* (Project catalogue: International Building Exhibition Fürst-Pückler-Land), 1999, Internationale Bauausstellung Fürst-Pückler-Land, Grossraschen; *Transformation. Industrial Landscapes in the process of sustainable renewal*, 2001, LMBV, Berlin; *Neue Landschaft Lausitz* (New Lusatian landscape), 2010, Catalogue, Internationale Bauausstellung Fürst-Pückler-Land 2000-2010, Jovis.www.iba-see2010.de [accessed on 2011]

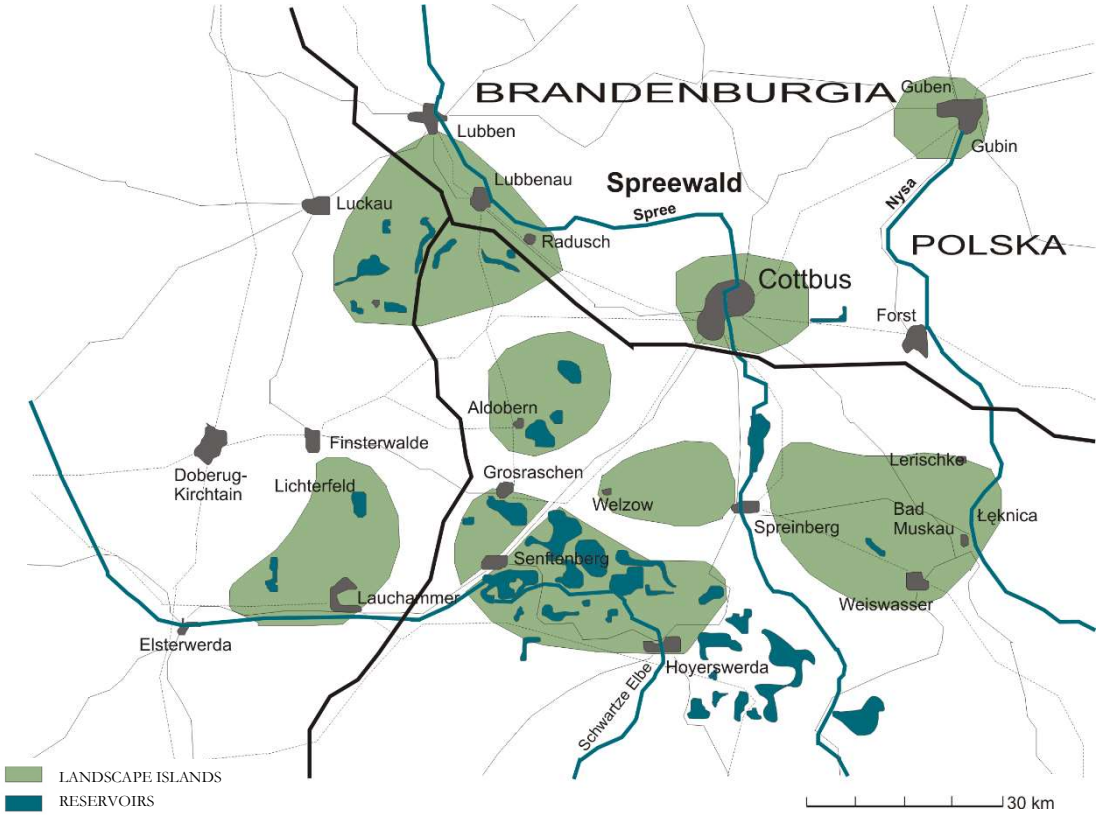


Fig. 47. Spatial concept of the nine *landscape islands* of *IBA Fürst-Pückler-Land*, 2000-2010; author's elaboration based on www.iba-see2010.de [accessed on 2011]

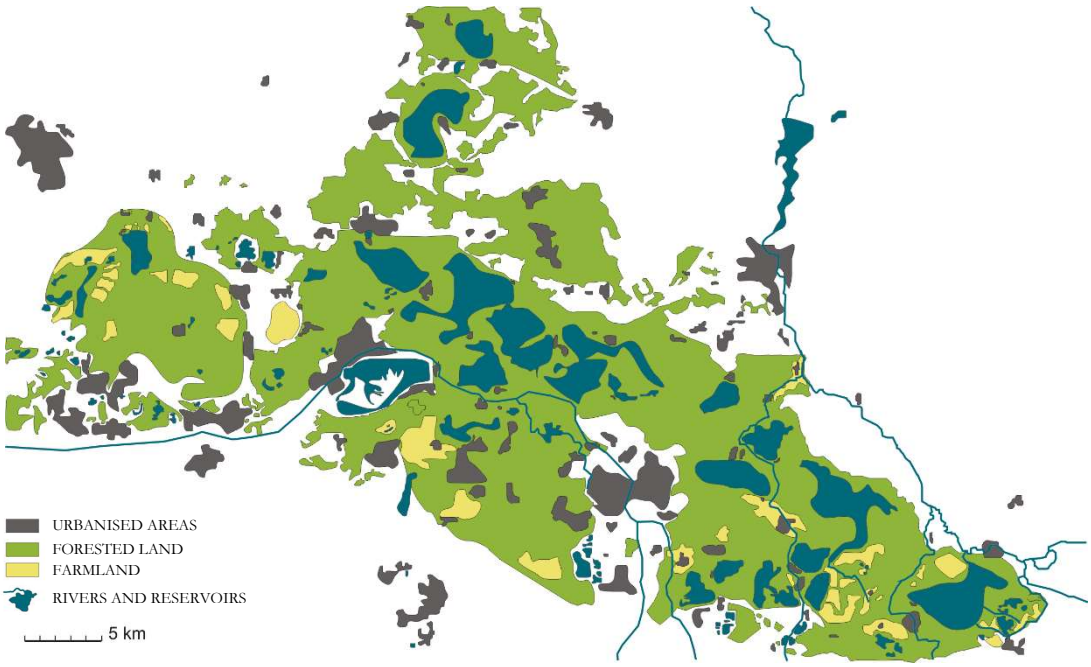


Fig. 48. Lusatian Lake District; author's elaboration based on www.lausitzerseenland.de [accessed on 2011]

- **Shaping a new landscape using *heritage* elements by employing contemporary technologies**
  Referring to the region's *old* identity by transforming the cultural landscape rooted in history (Bad Muskau-Nochten district), highlighting former workers' settlements (Marga garden city), using and preserving monuments of lignite mining, industrial facilities, mining machinery (providing access to the F60 conveyor bridge near Lichterfeld), and areas of depleted opencast mines. The new landscape is to reach back to the pre-industrial identity (Slavic fortress of Raddusch, cultural landscape of Fürstlich Drehna), aiming to preserve the historical spatial layout of villages and centres of medium-sized and small towns, integrating castles in need of restoration, palaces featuring leisure areas (Spreewald, Oberlausitz), and the Prince Pückler's parks in Bad Muskau and Cottbus-Branitz.

- **Creating new functions and forms of space use in areas *marked* by industry**
  The reclamation measures implemented beforehand had prepared the area for the new forms of its use for purposes of forestry (soil fertilising and planting), agriculture (deep liming of areas intended for cultivation, spreading humus, systematic fertilisation)[79], leisure and tourism (neutralisation of acidified water stored in mining pits, deacidification of spoil heaps, reduction of sulphates, compaction of unstable soil), as well as residential development and economic activity. There were ideas to introduce new forms of housing (*floating houses*) and high quality transport infrastructure as a precondition of mobility and proper functioning in spatial structures characterised by low population density[80]. Modern industrial centres and recreation sites, such as the LAUBAG mine, the Black Pump (*Schwarze Pumpe*) power plant, or the *Lausitzring* racing circuit, were also included in the transformation plans.

- **Perceiving landscape as a tourism product**
  Post-mine landscape is promoted as an element of *tourist adventure*. Landscape attractiveness and diversity are to be ensured by a network of cycle paths, waterways, bridle paths, hiking trails, or special-purpose routes used to guide different types of visitors around industrial buildings, infrastructure elements, and opencast sites. Non-reclaimed areas are taken into consideration as links between the green spaces planned and the existing towns and villages (Cottbus – concept of city–lake linkage). Individual projects are intended to catalyse the development of urbanised areas, and stimulate a pursuit of new prospects for them (artistic ventures performed in the area of Gräbendorf-Greifenhain: outdoor sculpture exhibition, floating bridge to connect the town of Pritzen with the Altdöbern palace and park compound).

[79] Not until the reclamation process continues for 7 years is the soil suitable for certain agricultural crops, while it may take even up to 30 years to develop its full production capacity. In the case of redevelopment for forestry purposes, afforestation is possible already one year after the initial soil fertilisation (Wojtyszyn B. *Kraina Księcia Pücklera. Strategia realizacji Pojezierza Łużyckiego* (Prince Pückler's land. The Lusatian Lake district development strategy). In: Drapella-Hermansdorfer A. (ed) 2004, op. cit., p. 61).

[80] *Przekształcanie krajobrazów. Zalecenia na przykładzie trzech europejskich krajobrazów poprzemysłowych* (Landscape transformation. Recommendations based on the examples of three European post-industrial landscapes), 2006, op. cit., p. 88.

The degraded natural environment is one of the key factors decisive of the attractiveness of a new landscape. It is addressed from different angles: at times, as ecosystems spontaneously regenerating on degraded land (successional vegetation in the area of Seese-Schlabendorf, natural landscape of Sielmanns Naturlandschaft Wanninche, Grünhaus nature paradise near the F60); some other time, as new forms of temporary use in the process of reclamation of former mining pits (Welzow region – creation of desert and energy landscapes). Their purpose is also to emphasise the contrast between the pre-industrial and industrial landscape and the post-industrial nature (natural future of restored ecosystems), and to create a background for the presentation of the region's industrial past (Lauchhammer-Klettwitz).

At the forefront of the transformation process is a project known as the **Water World of the Lusatian Lake District** (*Wasserwelt Lausitzer Seenkette*). Emphasis was put on the use of anthropogenic post-industrial landscape forms, such as artificial hills, sinkholes, and post-mining pits. The intention was to create 12,200 hectares of new reservoirs and 42,200 hectares of green space, forming a system of open recreational areas, linked by bridleways, footpaths, and cycle paths, featuring occasional highlights such as circulation paths and vantage points[81]. The efforts undertaken in relation to the reclamation of mining pits involved:

- profiling slopes and bottoms;
- shoreline modelling;
- restoring groundwater levels;
- flooding pits with precipitation water and water from nearby rivers (Spree, Elster, Mulde, Neisse, Saale, etc.) by means of pipelines or navigable channels[82];
- treatment of acidified waters;
- compacting unstable soils in areas intended for the construction of recreational facilities;
- and finally, seeding grass, planting shrubs, and forming sod on shores.

Among the 23 water bodies with a total area of 13,178 ha, only a few are currently filled with water and actually used (Dreiweiberner See, Gräbendorfer See, Grünewalder Lauch, Knappensee, Senftenberger See, Silbersee, and a few others), while others are being filled and are partly used (Bergener See, Geierswalder See, Partwitzer See, Sedlitzer See, etc.), the filling expected to be completed between 2012 and 2017[83]. However, it is already evident that obtaining the required amount of water poses a problem.

This artificial waterscape is intended to be the fourth largest lake district in Germany. The transformation of Lower Lusatia into a land of water provides the region with a wide range of opportunities to use water for sports and recreational activities, to create new jobs, and to gain waterborne access to the surrounding cultural heritage sites (palaces, parks, gardens, objects of infrastructure). In the future, the artificial reservoirs are supposed to become parts of a larger water system, connecting Berlin with Lower Lusatia.

The Lusatian landscape has been transforming slowly, and where competently highlighted, it grows in attractiveness. „[...] These dry and semi-flooded pits, looking like something out of a science fiction film, along with their unusual faults, erosion ditches, small ponds, islands, and unique flora and fauna endow the landscape with special charm. Whoever encounters this landscape for the first time feels somehow provoked by it. Its

[81] *Internationale Bauausstellung (IBA) Fürst Pückler Land 2000 bis 2010*, op. cit., p. 13.
[82] Forty-six pits were intended to be flooded first, with the remaining 178 pits assumed to receive water gradually, the water table raising as hydrological conditions would improve.
[83] www.lausitzerseenland.de [accessed on 2011].

partiality and singularity, and the emergence of the new stimulate the imagination and inspire collective thinking and collaboration in attempts to shape this landscape"[84]. Every kind of landscape acquires a new value[85]: one – artistic or aesthetic, and yet another one – social. However, these qualities must not be measured according to the economic laws of supply and demand. Their meaning is stretched over time, and yet because of the everlasting values the landscape holds and its relevance to people, all of its forms demand interest and require protection.

The very essence of the Lower Lusatian landscape transition lies in the consistently pursued vision of changes, efficiently managed planning process[86], political will, means of financing, competent management, and good cooperation with municipal authorities in terms of inventiveness, consultancy, and implementation.

Fig. 49. Welzow, Lower Lusatia

Fig. 50. Lusatian Lake District – viewing tower by the Sorno Canal, between lakes Sedlitz and Geierswalde

[84] *Internationale Bauausstellung (IBA) Fürst Pückler Land 2000 bis 2010*, op. cit., p. 13 [translated from the Polish language version by Łukasz Borkiewicz].

[85] Analysis of the Lusatian region made it possible to distinguish between four landscape types: „beautiful official landscape" – the biotope of Spreewald and Prince Pückler's parks; „stagnation landscape" – mining areas; „built landscape" – civilisation's achievements in terms of infrastructure development; „industrial-technical landscape" – open pits, dumps, factories, and power plants (*Przekształcanie krajobrazów. Zalecenia na przykładzie trzech europejskich krajobrazów poprzemysłowych* (Landscape transformation. Recommendations based on the examples of three European post-industrial landscapes), 2006, op. cit., p. 55).

[86] Cities, municipalities, counties, the federal state of Brandenburg, and the bordering parts of Saxony and Berlin were involved in the planning process. The mining companies of LMBV and LAUBAG joined it as partners.

3.7. Upper Silesian Agglomeration Insights

The research undertaken in the territory of the Upper Silesian Agglomeration was inspired by both the study of the Western European examples of renewal of cities and urbanised post-industrial areas, where elements of the natural environment and/or landscape have become some of the fundamental transformation factors, as well as observation of specific phenomena causing new elements of the natural environment subject to natural succession to emerge: spoil heaps, mining pits, artificial water reservoirs, degraded rivers and waterfronts[87].

The Upper Silesian Industrial Region (*Górnośląski Okręg Przemysłowy, GOP*) had long been regarded primarily as a region which generated significant income for the country's economy. Planning capabilities in the past were rather limited and invariably secondary to the pressure of economic development based on coal mining and processing. Long time had passed before the centre of attention started gradually moving towards solving problems related to improving the quality of the natural environment, the living conditions of urban communities, and landscape transformation.

There were repeated attempts made within the agglomeration territory to create long-term development policy tools aimed at restoring the right balance between the natural and built environment. These pertained to both the agglomeration fringes and its most heavily urbanised centres. In the first **GOP Regional Plan**, drafted under the supervision of Romuald Pieńkowski (1949–1953)[88], an attempt to improve the living conditions of the people who inhabited highly urbanised centres was entwined in the principle of deglomeration of human settlements and parts of industry. Further development of the industrial and residential functions was moved to the fringe areas, offering more advantageous environmental conditions. What the plan also envisaged was modernisation of settlement systems, improvement of living conditions, development of a wide range of services, extension of water management systems, reclamation of industrial brownfields, and creation of new leisure areas[89]. In parallel with the GOP Regional Plan, city-specific master plans were being prepared. The first **General Long-Term Plan of Spatial Development of the GOP Towns and Settlements**, prepared under the supervision of B. Malisz and R. Pieńkowski (1953–1954), introduced a concept for improving the natural environment and the living conditions of the local population by establishing belts of buffer and recreation greenery, both inside and outside GOP's nodal zone, using reclaimed mining pits and other vacant brownfield sites. At the same time, following in the footsteps of General Jerzy Ziętek, whose idea enabled Silesian Park (formerly Regional Park of Culture and Recreation) to be created on the industrial brownfields in the city of

[87] The Upper Silesian Agglomeration (*Aglomeracja Górnośląska*) stretches on an area of 1,218 km^2 and its population is approx. 2 million. Over the years, its official name changed. Between 1975 and 1990, it was referred to as the Upper Silesian Industrial Region (*Górnośląski Okręg Przemysłowy*); between 1990 and 2003, it was mainly referred to as the Katowice Agglomeration (*Aglomeracja Katowicka*); and the name Upper Silesian Agglomeration, also used in this paper, has settled in since 2004, following the adoption of the Silesian Voivodeship Zoning Plan. Since the incorporation of the Metropolitan Association of Upper Silesia (*Górnośląski Związek Metropolitalny*) in 2007, the name Metropolis GZM (*Górnośląsko-Zagłębiowska Metropolia*) has also been used. In 2017, the Council of Ministers issued the regulation regarding the creation of the metropolitan association under the name Metropolis GZM (Górnośląsko-Zaglębiowska Metropolia). As of 1 January 2018. the Metropolis GZM started its operation. The area of the Upper Silesian Agglomeration is its part.

[88] The plan identified the central zone, referred to as *GOP A*, with an area of 704 km^2.

[89] Tomaszek S. 1989, op. cit., pp. 16–20.

Chorzów, further two parks of a similar type were proposed to be established in the borderlands of Gliwice and Zabrze as well as Dąbrowa Górnicza and Będzin[90].

In the late 1950's, the need to improve the living conditions in the agglomeration's central part and to address the urban sprawl problem came to the fore. The original plan was revised by the Provincial Urban Planning Agency in Katowice under the supervision of Marian Dziewoński and released as the **Master Plan for the GOP Cluster of Towns and Settlements** (1961–1964). It criticised the assumptions adopted in its predecessor, highlighting a disproportion between the assumed development of GOP's central part and the agglomeration's fringes. Attention was drawn to the possibility of using land reserves to build new residential quarters and the need to redevelop old inner city districts. Emphasis was placed on the landscape and natural environment transformation. Plans were made to increase the fraction of land intended for urban greenery and recreation features, to create forest parks, and to address the need for leisure centres to be organised on regenerated brownfields. Unfortunately, many of the objectives set in this plan have never been accomplished. Progressing concentration of industry in a relatively small area combined with the failure to reclaim industrial brownfields caused the quality of life of the inhabitants of GOP to decline still, and the same could be said about the condition of the natural environment.

Parallel to the regional plans[91], core development strategy documents were prepared, aimed to ensure that chosen elements of the natural environment would be utilised for recreation purposes. These included the *Study of Suburban Recreation in the Northern Fringes of the Upper Silesian Industrial Region* (original title: *Studium wypoczynku podmiejskiego na terenie północnego obrzeża GOP*) of 1966. In 1969, based on the principles and guidelines previously laid down in the Master Plan for GOP's towns and settlements, the Provincial Urban Planning Studio in Katowice prepared a **study of the development of GOP's forest buffer strip for recreational purposes** under the supervision of Wojciech Armata. It was in fact the very first meaningful attempt to stimulate the transformation and protection of the natural environment and landscape of post-industrial areas. The rationale behind the Forest Buffer Strip (*Leśny Pas Ochronny*) was to create an outer envelope for the region. It comprised a strip of forests encircling the agglomeration in a radius of 30 km from its major cities. It was intended to safeguard it against the nuisance of industry while enabling recreation in a direct proximity of residential areas. This required intense redevelopment of the vegetation cover of the major forest complexes as well as their adaptation to the recreational and leisure functions[92].

[90] Joseph-Tomaszewska E. 1988. *Krajobraz regionu przemysłowego – wybrane problemy planistyczne województwa katowickiego* (The landscape of an industrial region – selected planning problems of Katowickie Voivodeship). In: *Śląski Kwartalnik Urbanistyki i Architektury* (Silesian architecture and urban planning quarterly), book 3, *Zieleń obszarów przemysłowych* (Greenery of industrial areas), Committee of Urban Planning and Architecture of the Polish Academy of Sciences, Katowice Branch, Katowice, p. 9.

[91] The problems of shaping the right natural conditions were addressed in numerous documents, including the concept for the development of the Upper Silesian Urban Agglomeration, prepared under the supervision of Wojciech Armata in 1972–1973, or the prospective master plan for the urban development of GOP, developed in 1977 by Michał Dolhun's team. The above studies, just like Dziewoński's plan, had not been officially approved due to the large number of issues impossible to solve within the timeframe imposed by the plans (ibid., pp. 9–10).

[92] The economic policy implemented since the 1960's in the territories managed by the State Forests authority (*Lasy Państwowe*) was aimed at emphasising the environmental and social functions of forests, and particularly at developing the climatic and health, natural and landscaping, recreational and tourist functions as dominant over the functions of production and raw material provision.

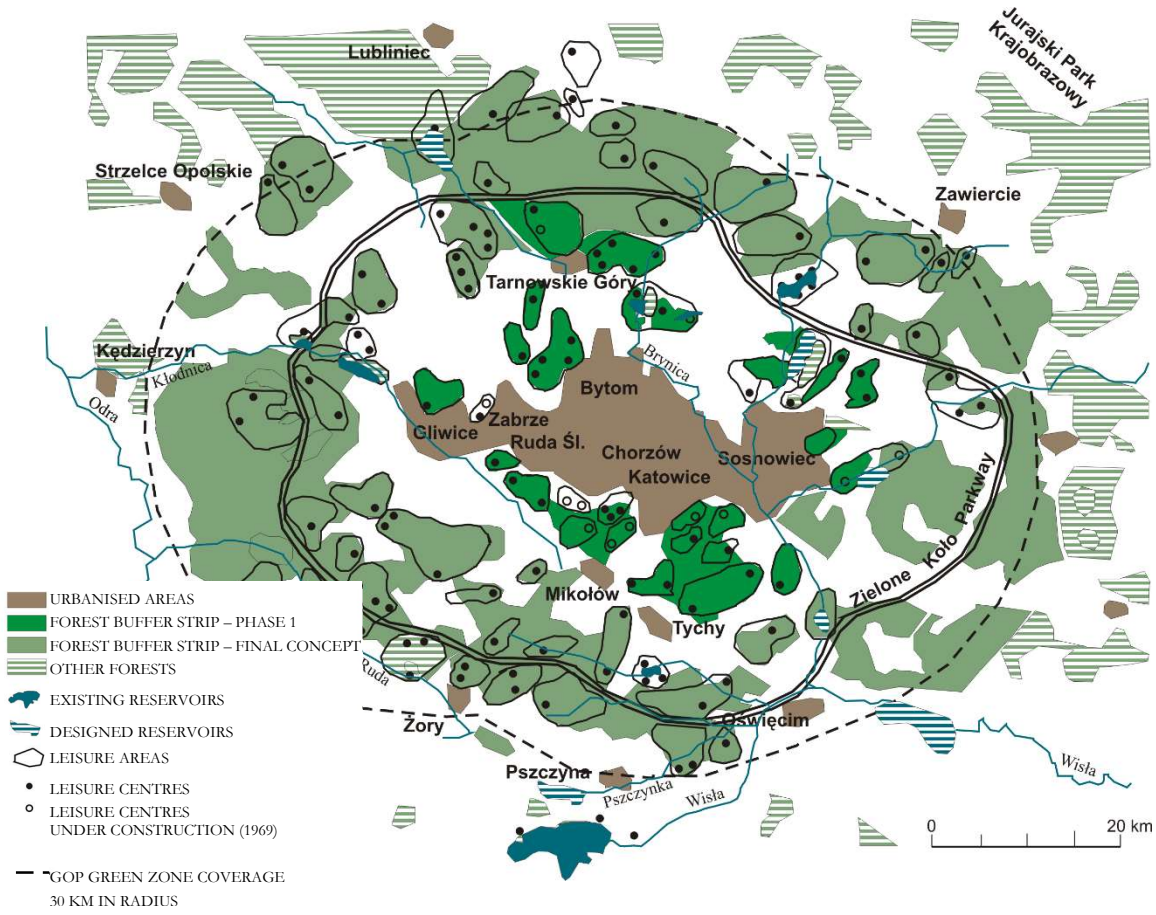


Fig. 51. Status of the recreational development of GOP's Forest Buffer Strip, 1969; author's elaboration based on: Tomaszek S. 1989; Krauz K. 1979

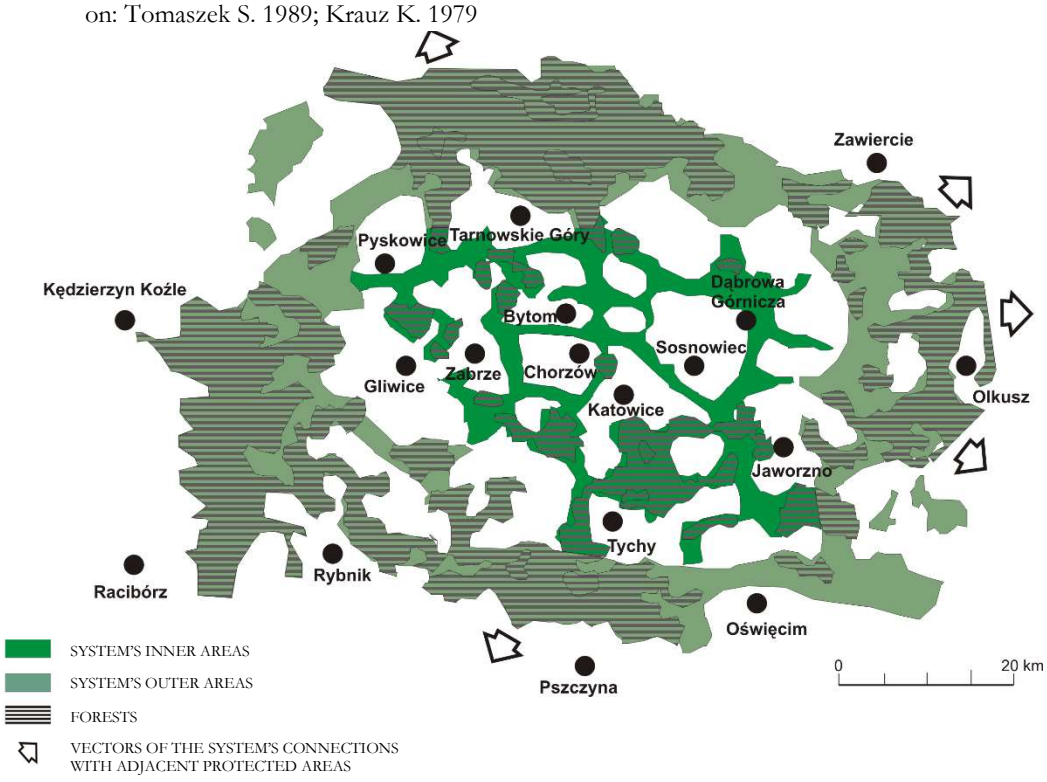


Fig. 52. Ecological System of GOP's Protected Areas, 1980; author's elaboration based on: Tomaszek S. 1989; *Concept and programme...*, 1992

Consequently, the tree cover of the agglomeration's core territory had been significantly augmented, which manifested itself in an increase in the area of urban parks and lawns[93]. The purpose of the concept was to ensure that the decommissioned sand pits and other industrial brownfields within the strip would be redeveloped for recreational purposes. Dozens of leisure centres sited on the outskirts of the Agglomeration were established as part of the Forest Buffer Strip project to provide basic service and recreational functions. Only the best-arranged of them have survived, typically located on the banks of water bodies and having convenient connections with neighbouring towns.

However, the design assumptions underlying the Forest Buffer Strip project were not pursued in a consistent manner. Between its conception and December 1976, the total area of the Forest Buffer Strip declined by 1,307.83 ha[94]. The territories originally intended to develop into the region's *green lungs* gradually succumbed to industrialisation, causing increasing degradation of the forests. What also largely contributed to the changes in the structure of the natural environment, and consequently landscape deterioration as well, was the unplanned siting of many new facilities, industrial compounds, or municipal development projects. On top of that were the political and economic transformations taking place in Poland.

> A typical example illustrating the above issues was the industrial facility built in the 1970's in **Ząbkowice-Łosień** on an area of 825 ha, originally being one of the world's largest pig iron smelters. Known as the **Katowice Steelworks** (*Huta Katowice*), the project sited on the agglomeration's eastern fringes ripped into the Forest Buffer Strip territory-to-be. This clearly proved that Upper Silesia was being treated solely as a raw material and energy supply hub. When confronted with economic requirements and current needs, the region's scenic and spatial qualities had been completely disregarded. However, the negative effects of this investment actually reached as far as beyond the region itself.

The comprehensive policy for the protection of forest resources and their utilisation for productive and recreational purposes, initiated at the time when the Forest Buffer Strip was designed and developed, found its continuation in the implementation of the **Ecological System of Protected Areas** (*Ekologiczny System Obszarów Chronionych*, ESOCh) concept, defined in the Prospective Plan of Spatial Development of the Katowickie Voivodeship of 1980. One of its assumptions was to regenerate the degraded natural environment by introducing a system of internal greenery, integrating settlement units into urban complexes, and developing an ecological system of protected areas based on GOP's Forest Buffer Strip as well as on a concept of the Complex of Jurassic Landscape Parks (*Zespół Jurajskich Parków Krajobrazowych*). However, the ESOCh system was to cover not only forested areas, but all other elements of the ecological structure across the entire territory which later became Silesian Voivodeship. It consisted of nature reserves, landscape parks, and protected landscape areas. Special attention was attached to the ventilation of the compactly urbanised agglomeration centre, streamlining of the

[93] Several larger, dispersed areas of landscaped greenery were envisaged within the GOP territory, including: the area of the Bytomka valley between Zabrze and Biskupice, the area of Hugon Hill, the Katowice–Sosnowiec neighbourhood park, etc. Between 1961 and 1970, the total area of parks and greens in Chorzów increased from 48 to 159 hectares, in Dąbrowa Górnicza – from 89 to 120 hectares, in Ruda Śląska – from 141 to 185 hectares, and in Sosnowiec – from 107 to 142 (Żmuda S. 1973, p. 157).

[94] The Forest Buffer Strip initially covered an area of 32,440 ha. Further 3,162 ha of private forests were then incorporated into the Strip territory (Krauz K. 1979, pp. 171–184).

siting of green spaces according to habitat conditions as well as their role in shaping the natural structure. The idea behind the ESOCh system was to protect areas of special natural qualities, create and maintain urban green spaces, improve the biological and social living conditions of the local population, and aim at creating large protected complexes. It was important to secure their spatial continuity by developing the system of protected areas in an adequate manner. The system was to comprise both organised greenery and enclaves of wild nature, linked together by strips of cultural landscape, providing opportunities for the local flora and fauna to migrate. All these measures were aimed at counteracting environmental degradation, on the one hand, and at protecting and enhancing the natural environment, on the other hand, while developing links between open spaces under the regional ecological network. The intended outcome was to be a harmonious natural landscape.

The concept of the Ecological System of Protected Areas turned out not entirely adequate to the status of preservation of the agglomeration's biodiversity as well as to the needs in this respect. Established on the grounds of the ESOCh concept, the system of protected areas proved inconsistent and incomplete, in terms of both space protection and management structure[95].

The problem of landscape devastation, pollution, and environmental hazards within the boundaries of the agglomeration, inextricably linked with the deterioration of the quality of life of its inhabitants, was reflected in the *Study for the Identification of Conflicts Related to the Management of Space and Resources in the Katowice Agglomeration* (*Studium identyfikacji konfliktów związanych z gospodarowaniem przestrzenią i zasobami w Aglomeracji Katowickiej*), prepared by BPP in 1984. It listed air, water, and soil pollution, devastation of soil, hazards to human health and life, as well as deterioration of landscape qualities as the main environmental issues. The overall body of landscape development and protection problems was perceived as representative of the conflicts observed in the sphere of management of space as well as natural and cultural resources[96].

Over the years, further concepts for the protection and development of areas active in terms of nature and recreation based on industrial brownfields were created in the agglomeration. One of them was a model concept for the formation of meridionally arranged ecological corridors inside the agglomeration using areas of phased-out coal mines (*Modelowa koncepcja ukształtowania wewnątrz aglomeracji południkowych korytarzy ekologicznych w oparciu o tereny likwidowanych kopalń węgla kamiennego*), developed in 1989 by Ewa Szady. One of its assumptions was that afforestation of brownfields could optimally complement the local natural structures, linking them with the existing open space systems surrounding the agglomeration[97].

[95] Joseph-Tomaszewska E. 1988, op. cit., pp. 8–14; Tomaszek S. 1989, op. cit., p. 29.
[96] Ibid., op. cit., p. 10.
[97] Szady E. 1990. *Uwarunkowania przekształceń przestrzennych powierzchni wyeksploatowanych kopalń* (Conditions of the spatial transformations of the premises of depleted mines), Scientific Journal of the Silesian University of Technology, no. 1068, Gliwice, pp. 171–176.

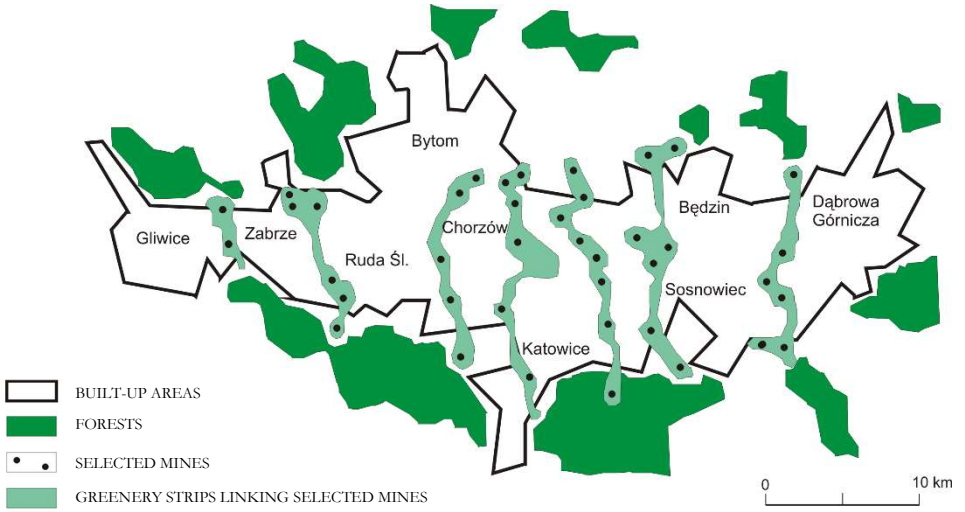


Fig. 53. Concept of GOP's ecological corridors covering mining facilities by Ewa Szady, 1989; author's elaboration based on: Szady E. 1993

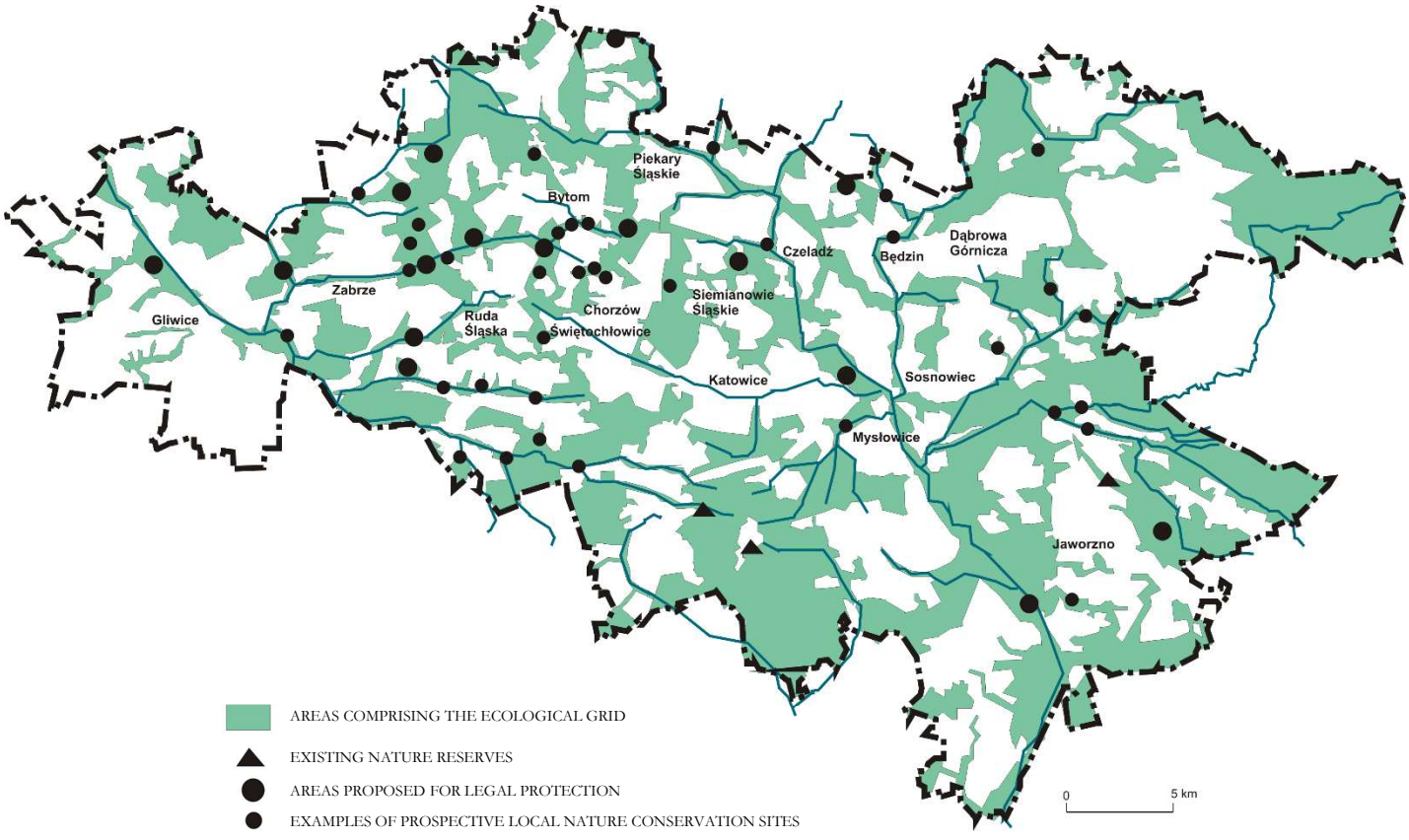


Fig. 54. System of protected areas of the Upper Silesian Agglomeration – ecological grid, 1991; author's elaboration based on: *Concept and programme*...., 1992

The year 1991 saw the release of the *Study for the Development of the System of Protected Areas in the Katowickie Voivodeship* (*Studium kształtowania systemu obszarów chronionych województwa katowickiego*), accompanied by the parallel preparations of the GOP Restructuring Programme[98], and then, as ordered by the Department of Architecture and Landscape of the Voivodeship Office in Katowice, the ***Concept and Programme for the Development of a System of Protected Areas of the Katowice Agglomeration*** (*Koncepcja i program wykształcenia systemu obszarów chronionych Aglomeracji Katowickiej*) was developed. The purpose of the latter was to address aspects enabling environmental restoration and support for the capacity of the natural system. A goal which became particularly important was developing a policy for the protection and development of the environment, as well as for restoring and raising the attractiveness of the agglomeration's natural and cultural qualities and functions. The document emphasised the need for improvement in the spheres of quality of human life, attractiveness of places of habitation, accessibility of recreational areas, extirpation of climate and health nuisances, and the aesthetic appeal of the surroundings of individual towns.

> As the concept was being elaborated, **environmental quality criteria** were defined **for the territory of the Upper Silesian Industrial Region**. The following factors were listed as relevant: ecological safety of the environment for the sake of the agglomeration inhabitants (reduction of pollution nuisance, improvement of air quality, isolation of residential areas from sources of atmospheric contamination); functionality of the environment (appropriately shaped and accessible recreational space with adequate infrastructure); aesthetic quality, harmony, and abundance of the landscape considered in the context of cognitive, aesthetic, and identity-building values, and conditions for the functioning of and adding variety to natural structures (continuity of ecosystems – degree of fragmentation of the settlement structure, diversification of natural structures, sustainability – preservation of natural values, saturation of the Agglomeration space with biologically active areas)[99].

The natural system proposed under this concept was intended to organise the spatial and functional structure of the agglomeration and to protect the resources of its natural environment. It comprised an **ecological grid**, understood as a **networked layout of open spaces**, ensuring continuity of ecosystems and adequate fragmentation of the settlement structure. It envisaged that GOP's territory would be intersected with a system of ecological corridors, providing connectivity with the region's fringes and enabling control over the extent to which its territory would be utilised for investment purposes. The grid structure consisted of biologically active open spaces, including ecological strips, typically comprising river valleys and forest complexes, mainly to be found on the agglomeration outskirts. The system was to be complemented and bound by degraded sites and areas extensively utilised for investment projects (their biological potential being considerably reduced), which required comprehensive restoration of their natural

[98] The territory of the Upper Silesian Industrial Region (as per the studies preceding the work on the *Concept...*) was 1,250 km² (the Agglomeration currently extends over ca. 1,218 km²), of which open space accounted for 2/3 of the total area. The open space structure was dominated by forest communities (approx. 20% of the GOP area), meadow and grassland vegetation, and arable fields occupying more than 40% of the GOP area (*Koncepcja i program wykształcenia systemu obszarów chronionych Aglomeracji Katowickiej* (Concept and programme for the formation of a system of protected areas of the Katowice Agglomeration), materials for the Regional Committee for Nature Conservation, BRR Sp. z o.o., Voivodeship Office in Katowice, Katowice 1991, unpublished).

[99] *Koncepcja i program wykształcenia systemu obszarów chronionych Aglomeracji Katowickiej* (Concept and programme for the formation of a system of protected areas of the Katowice Agglomeration), op. cit., pp. 12–13.

environment and determination of their future use functions. Nature revitalisation was assumed as their priority in the grid. The grid itself was meant to serve the following purposes:

- preserving valuable elements of nature and landscape,
- protecting ecological corridors,
- maintaining continuity of ecosystems,
- maintaining the right balance between open spaces and urbanised areas,
- ensuring that the agglomeration's system of protected areas was linked with adjacent territories.

In order to make sure that the ecological grid development procedure was efficient, two variants of legal solutions had been proposed. One of them envisaged conferring the status of a landscape park upon the grid or creating a system of landscape parks whose layout would correspond to the grid's strip layout. Variant two boiled down to using diverse forms of legal protection (protected landscape sites, cultural parks, buffer forests) for its individual elements. In both cases, the implementation of the ecological grid concept was assumed to be the main tool of spatial policy, created at the regional level. Nevertheless, none of these options had been successfully implemented.

In the same year, Katowice saw the release of the official opinion of the Ecological Council to the President of the Republic of Poland concerning the most urgent undertakings intended to improve the living conditions of the inhabitants of Upper Silesia. The Programme of Ecological Measures (*Program działań ekologicznych*) prepared in 1993 listed numerous tasks to be completed, including those related to improving the quality of individual elements of the natural environment, minimising hazards, reducing the environmental impact of mining operations, and developing degraded sites into parks, lawns, and tree stands. It was also found prerequisite that a system of protected areas should be established and the Upper Silesian Ecological Park concept implemented[100]. However, this programme also failed to be deployed[101].

Further endeavours aimed at developing a coherent natural system were initiated and driven by the 1994 Act on spatial development. Successive planning studies[102] accounted for the need to preserve the continuity of the local natural structures, including the ECONET-POLSKA ecological corridors, regional ecological systems of protected areas, or other structures defined on the basis of the patch-corridor-matrix landscape model. What the provisions of the regional planning documents clearly emphasised was the necessity of protecting and shaping the environment, including the need to improve the quality of the natural and cultural environment and increase the attractiveness of urban space through revitalisation of post-industrial and post-military sites as well as reclamation of degraded land. The strategies currently implemented in Silesian Voivodeship generally address the overall body of problems related to the region landscaping and the role of

[100] In 1993, for the area of the cluster of cities comprising Gliwice, Zabrze, Bytom, Ruda Śląska, Chorzów, Świętochłowice, and Katowice, a concept for creating a coherent system of green spaces in the central part of the Agglomeration, referred to as the Upper Silesian Ecological Park, was created by W. Strabel and J. Włodarczyk. Its aim was to improve the quality of the environment and the associated living conditions of the local population. The concept envisaged that individual green elements would be connected via ecological and functional links. Development intensity zoning was intended to protect local natural processes (Strabel W., Włodarczyk J. *Górnośląski Park Ekologiczny* (Upper Silesian Ecological Park), unpublished. After: Böhm A. 2006, op. cit., pp. 253–254).

[101] Kozłowski S. 2002. *Ekorozwój. Wyzwanie XXI wieku* (Eco-development. Challenge of the 21st century). PWN, Warsaw, pp. 275–280.

[102] Between 1994 and 1998, analyses and studies were conducted concerning the spatial development of the former voivodeships: Bielskie, Częstochowskie, and Katowickie, culminating in the preparation of a land use study for these regions. The 1999 administrative reform of the country, which merged the aforementioned units into Silesian Voivodeship, rendered these studies irrelevant.

individual elements of the natural environment in creating a new quality of urbanised space[103]. The most recent Master Zoning Plan of 2004 (along with its amendment of 2010) for Silesian Voivodeship contains provisions which define the utility and adequacy of natural structures, however, being overly general in terms of scale and lacking guidelines for the protection, development, and creation of landscapes of individual urbanised areas, including the Upper Silesian Agglomeration, it demands a more detailed and interdisciplinary approach to this matter[104].

An attempt to formulate a common approach to the problems of the Agglomeration renewal was made in 2007 as the Metropolitan Association of Upper Silesia (*Górnośląski Związek Metropolitalny*, GZM) was founded, its boundaries coinciding with those of the Upper Silesian Agglomeration. An outcome of the cooperation between the Metropolitan Association's member cities was the document officially referred to as the Development Strategy for the Metropolis of Upper Silesia and Dąbrowa Górnicza Basin – *Silesia 2025*, defining areas of activity to be implemented or coordinated by GZM and its municipalities. Its goal is to create a new image of the Silesia Metropolis as a territory that offers good living conditions, clean environment, and aesthetically appealing space. One of the priorities set in the strategy is the care for the high quality of the natural environment, including deceleration of its degradation processes as well as its efficient protection. The objective of environmental renewal is envisaged to be fulfilled through a number of measures, such as the following:

- revitalisation of water courses and reservoirs, including restoration of their biological, scenic, and tourist/recreational functions;
- revegetation of degraded and devastated sites;
- strengthening of natural resources;
- protection of landscape qualities.

The foregoing should result in enlarging the green space in highly urbanised areas[105].

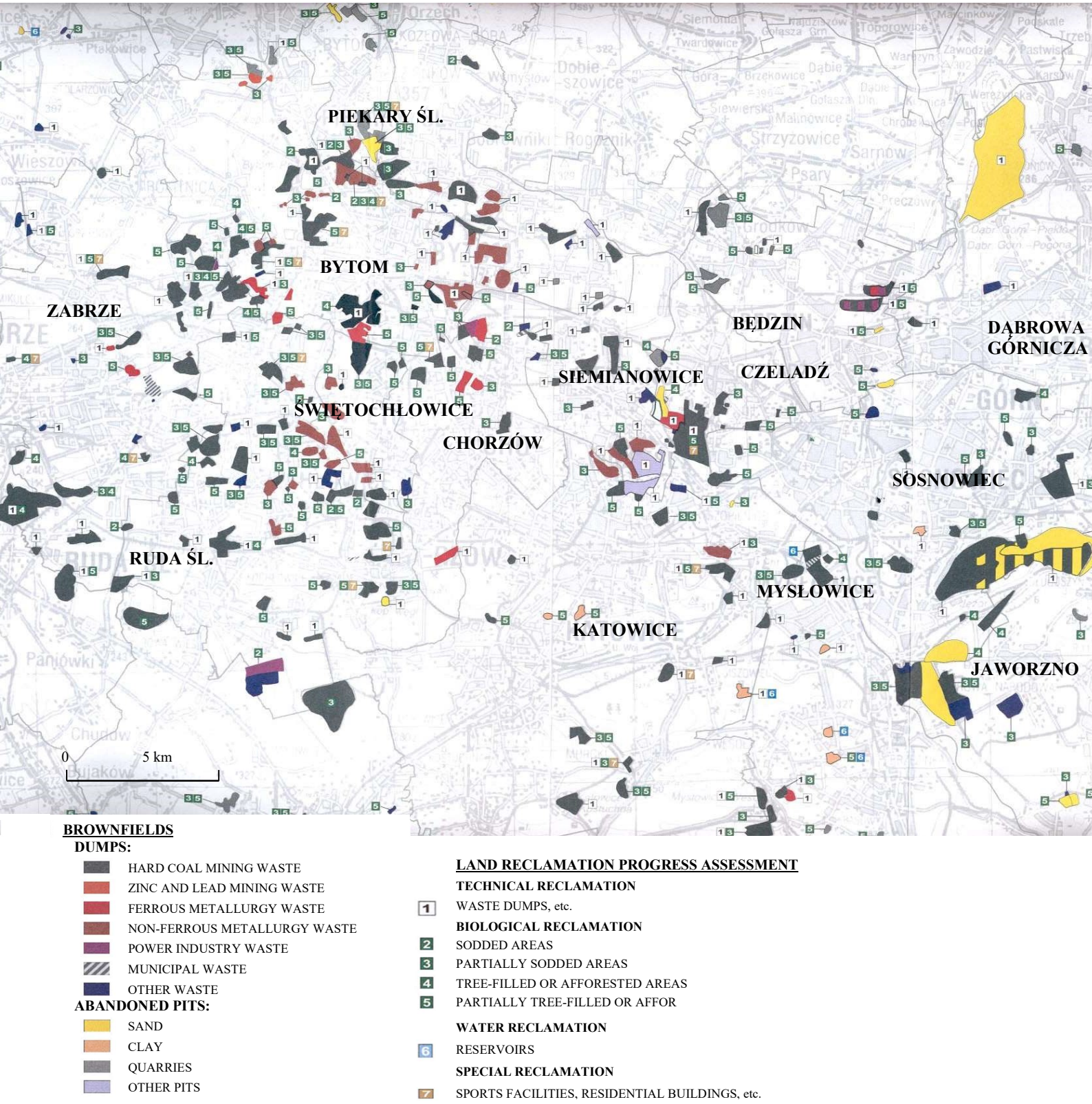
Now, the renewal of the built and natural environment of the Upper Silesian Agglomeration has become part of the tasks of the GZM Metropolis established in 2017.

[103] The strategic documents of Silesian Voivodeship which pertain to the overall body of environmental problems of the Agglomeration and its fringes include the voivodeship development strategy, the tourism development strategy, or the sports development strategy. Work is currently underway on Silesian Voivodship's nature conservation strategy.

[104] Silesian Voivodeship Zoning Plan, 2004 (including the amendment of 2010), available online at: www.slaskie.pl [accessed on 2011].

[105] Development Strategy of the Metropolis of Upper Silesia and Dąbrowa Basin (*Górnośląsko-Zagłębiowska Metropolia Silesia*) until 2025, available online at: www.silesiametropolia.eu [accessed on 2011].

Fig. 55. Silesian Park, Chorzów; photograph by A. Pancewicz



BROWNFIELDS

DUMPS:

- HARD COAL MINING WASTE
- ZINC AND LEAD MINING WASTE
- FERROUS METALLURGY WASTE
- NON-FERROUS METALLURGY WASTE
- POWER INDUSTRY WASTE
- MUNICIPAL WASTE
- OTHER WASTE

ABANDONED PITS:

- SAND
- CLAY
- QUARRIES
- OTHER PITS

LAND RECLAMATION PROGRESS ASSESSMENT

TECHNICAL RECLAMATION

1 WASTE DUMPS, etc.

BIOLOGICAL RECLAMATION

2 SODDED AREAS
3 PARTIALLY SODDED AREAS
4 TREE-FILLED OR AFFORESTED AREAS
5 PARTIALLY TREE-FILLED OR AFFOR

WATER RECLAMATION

6 RESERVOIRS

SPECIAL RECLAMATION

7 SPORTS FACILITIES, RESIDENTIAL BUILDINGS, etc.

Fig. 56. Map of degraded areas in the Upper Silesian Agglomeration, including assessment of their reclamation progress, based on an ecophysiographic study prepared for purposes of the Master Zoning Plan for Silesian Voivodeship, 2003

What comes as a particularly important initiative undertaken by GZM is the international project entitled **Periurban Parks – Integrating natural and rural areas into our cities**, implemented between 2010 and 2012[106]. Its purpose is to enable sharing experiences related to suburban open space policy-making, focusing particularly on the creation and management of parks in these areas. The project is intended to improve local environmental conditions, protect the landscape, and maintain biodiversity in sites adjacent to heavily urbanised areas, while rendering them available for recreational purposes. The territory selected for the project within the Upper Silesian Agglomeration represents a small part of the former Forest Buffer Strip, stretching on an area of approximately 80 km^2, located mainly within the borders of Katowice and the adjacent cities of Mysłowice and Tychy. It comprises forest complexes (98%) and five recreation centres, each containing an anthropogenic water reservoir, i.e.: Dolina Trzech Stawów (Katowice), Janina-Barbara (Katowice), Bolina (Katowice), Słupna (Mysłowice), and Wesoła Fala (Katowice/Mysłowice). The project is expected to contribute to the protection of the existing open spaces and allow new green spaces to be formed, integrated into the regional natural system.

Industrial brownfields remain to be a topical issue. 6,600 ha of degraded post-industrial sites of various types have been identified in the Agglomeration (Table 5). They cover 5.4% of the total area of this territory. They are particularly concentrated in the central part of the Agglomeration (occupying more than 11% of the area of Katowice, and 6–11% in Chorzów, Świętochłowice and Bytom). In other cities, degraded sites and industrial brownfields represent between 3 and 6% of area[107]. Analysing their structure, one can notice (leaving aside the sites at risk of discontinuous deformation) that, among the elements of the natural environment degraded by industrial activity, the largest surface area is attributable to dumps of various kind (1,763 ha). When adequately selected, reclaimed, and utilised, along with their artificial reservoirs, quarries, sand and gravel pits (430 ha), they represent a potential which can be tapped to create a new landscape for the Agglomeration.

Table 5

Structure of degraded sites and industrial brownfields in the Upper Silesian Agglomeration

Item	Type	Area [ha]	% share
1.	hard coal mining waste dumps	959	14.5
2.	decommissioned process halls, warehouses, product storage yards, other disused buildings and facilities	671	10,2
3.	other waste dumps	804	12.2
4.	reservoirs, flooded and boggy areas	239	3.6
5.	quarries, sand and gravel pits	191	2.9
6.	land at risk of discontinuous terrain deformation	2,786	42.2
7.	other industrial brownfields	960	14.5
	Total	6,610	100

Source: Jarczewski W., Huculak M., Śmietana W. 2010, based on RSIP database

[106] The project involves 14 partners from 11 European Union countries. It is financed by the European Regional Development Fund under the INTERREG IVC programme. The project is intended to make the most of the exchange of experience and analysis of national solutions in order to develop a common methodology as well as formulate recommendations for the incorporation of periurban parks into the European Union legislation.

[107] Jarczewski W., Huculak M., Śmietana W., 2010, *Korzyści społeczne, ekonomiczne i środowiskowe wynikające z rewitalizacji terenów zdegradowanych, w tym poprzemysłowych* (Social, economic, and environmental benefits of the revitalisation of degraded areas, including industrial brownfields), Revita-Silesia, Institute of Urban Development, Krakow, p. 34; available online at: www.revita-silesia.pl [accessed on 2011].

In Silesian Voivodeship, as in Poland at large, there are no systemic solutions oriented towards a comprehensive process of transformation of industrial brownfields. Therefore, it is necessary to survey and classify them in a reliable manner, solve the outstanding ownership disputes, and overcome the existing legal and financial barriers. Among the efforts undertaken in the Upper Silesian Agglomeration in respect of the revitalisation of industrial brownfields, two projects particularly deserve to be mentioned. One is the **Industrial Brownfield Surveying and Valuation Methodology** (2003), which provides tools for acquisition of site-specific information, guidelines for building databases, a land classification methodology based on hazard assessment (preliminary, full), and a method for categorising the suitability of post-mining sites for further development. It provided grounds for the second document, namely the **Regional Programme for the Transformation of Industrial Brownfields and Degraded Areas** (2008). Its aim was to strengthen and streamline the transformation process in line with the relevant ecological requirements (providing safeguards against environmental hazards and risks), social expectations, and economic conditions, enabling brownfields to be reused in an economically efficient manner. Consequently, a set of data logging, analysis, assessment, and decision making support tools were developed. The areas recorded in the Regional Spatial Information System (RSIP) database were reviewed from the perspective of the selection of those in need of supra-local measures. The sites in question were also surveyed in terms of their conversion potential with a view to their economic and social utility. Both the foregoing documents, along with the Regional Database of Industrial Brownfields, constitute significant achievements of the Marshal's Office in terms of brownfield regeneration at a regional scale[108].

The attempts made in the recent years to reclaim industrial brownfields and to improve the landscape of the Upper Silesian Agglomeration have mainly been made locally. Most of the measures undertaken in that respect have focused on the revitalisation of post-industrial sites and facilities for purposes of culture (museums, galleries, concert halls), housing (lofts), services (shopping centres, supermarkets, office buildings), or enterprise development (incubators, industry and technology parks, economic activity zones, universities, new investments), while the sheer number of **completed projects successfully transforming industrial brownfields for natural purposes** or enabling their conservation has been rather unimpressive. Hardly any of them had regional significance, some entailed application of legal protection forms, and yet a few covered but one-off project activities (Table 6). There are those among them which already call for upgrading or repeated revitalisation, while others require land development supplementing, ensuring transport accessibility, or linking with the surrounding urban fabric. Other initiatives undertaken within the Upper Silesian Agglomeration territory have not always been successful. Many of them have never risen beyond the sphere of design and conceptual work. And yet they have all played a momentous role in the dissemination of environmentally conducive behaviour patterns and in raising the environmental awareness of local authorities and communities.

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[108] *Metodyka waloryzacji terenów poprzemysłowych* (Methodology for the valorisation of post-industrial areas), 2003, prepared under the project entitled *Wdrożenie Regionalnego Systemu Informacji Przestrzennej (RSIP) w Województwie Śląskim dla wsparcia planowania regionalnego i lokalnego, restrukturyzacji regionu oraz zarządzania w sytuacjach kryzysowych* (Implementation of the Regional Spatial Information System in Silesian Voivodeship to support regional and local planning, regional restructuring, and crisis management); *Wojewódzki Program Przekształceń Terenów Poprzemysłowych i Zdegradowanych, dla województwa śląskiego* (Provincial programme for the transformation of industrial and degraded areas in Silesian Voivodeship), 2008, developed by the IETU/GIG consortium; *Technologie rewitalizacji i zagospodarowania terenów zdegradowanych, w tym poprzemysłowych* (Technologies for the revitalisation and management of degraded areas, including post-industrial sites), 2009, Institute for Ecology of Industrial Areas (IETU) in Katowice, Revita-Silesia, Katowice, pp. 9–10.

Table 6

Examples of industrial brownfield conservation and transformation for natural and recreational purposes within the Upper Silesian Agglomeration

Item	Project name	Location	Implementation time	Subject and scope of development/conservation
1.	Franciszek Kachel Municipal Park	Bytom	1870–1900	Reclamation and development of 43 ha of post-mining wasteland formerly used by the Teresa calamine extraction facility
2.	*Grota* Park	Bytom	~1920	Development of 2.6 hectares of land surrounding two post-mining ponds for recreation purposes, and as a place of worship since 1938
3.	*Tysiąclecia* Park	Sosnowiec	1922	Development of 0.9 hectares of mining pits and reclaimed industrial brownfields.
4.	*Strzelnica* Municipal Park	Ruda Śląska	1930–1960	Development of 14.8 ha of former sand pits
5.	Silesian Park	Chorzów	1951–1990	Reclamation and development of 600 ha of abandoned post-mining land formerly used by the Prezydent hard coal mine
6.	*Dolina Górnika* Recreation Site	Chorzów	1952–1965	Development of two water reservoirs formerly used by the Barbara-Chorzów hard coal mine, surrounded by spoil heaps and abandoned sites, for recreation and sports purposes
7.	*Skałka* Sports and Recreation Centre	Świętochłowice	1964	Development of 34 ha of industrial brownfield, including a subsidence pond and a spoil heap
8.	General Haller Park	Dąbrowa Górnicza	1966–1977	Development of 26.3 ha of former mine waste dumps of the Reden hard coal mine
9.	Forest Buffer Strip (*Leśny Pas Ochronny*)	Forest strip within a radius of 30 km from the Agglomeration's main cities	1968–1988	Development of approx. 180,000 ha of industrial brownfields for recreational purposes, including conversion of disused sand pits into reservoirs: Dolina Trzech Stawów (Valley of Three Ponds) in Katowice, Pogoria artificial lakes in Dąbrowa Górnicza, Pławniowice in Gliwice, Sosina in Jaworzno, etc.
10.	Green square in Floriańska street	Chorzów	1974	Reclamation of 2 ha of mining waste heap under voluntary community action
11.	*Blachówka* documentation site	Bytom	1995	Applying forms of legal protection to a former dolomite pit of approx. 6. ha in area
12.	Spoil heaps of hard coal mines: Wieczorek, Halemba, and Rozbark; zinc waste and slug dumps of the Katowice Steelworks, etc.	Katowice, Ruda Śląska, Bytom, Siemianowice Śl. etc.	1995–1999	Reclamation of dumps by the FRISOL soilless greening method
13.	Halemba ponds	Ruda Śląska	1996	Reclamation and development of subsidence ponds in the Borowskie Forests: Borówka recreation and holiday centre; ponds used for angling: Kiszka, and Korytnik I, II, III and IV
14.	*Żabie Doły* nature and landscape complex	Bytom/Chorzów	1997	Applying forms of legal protection to an area of 226 ha, comprising settling ponds, waste dumps, and idle land, formed during the operation of the former Orzel Biały zinc ore mine
15.	*Staw pod Chorzowem* local nature conservation site	Siemianowice Śl./Chorzów	1997	Applying forms of legal protection to an area of 3.25 ha comprising floodplains and waterlogged sites of the decommissioned Polska hard coal mine
16.	*Park Pszczelnik* local nature conservation site	Siemianowice Śląskie	1997	Applying forms of legal protection to an area of 8.21 ha partially comprising former sand pits
17.	Park of Roses	Chorzów	1997–2000	Revitalisation of the park's section through reclamation and development of two ponds in former sand pits
18.	Dolomity Sportowa Dolina	Bytom	2001–2002	Conversion of a dolomite open pit into a year-round recreation and winter sports centre
19.	*Mlaki* local nature conservation site on the Pogoria I lake	Dąbrowa Górnicza	2002	Applying forms of legal protection to 7 ha of wetlands and woodlands developed on a non-flooded level of a former frac sand mine

Table 6 cont.

Item	Project name	Location	Implementation time	Subject of development/conservation
20.	*Pogoria II* local nature conservation site	Dąbrowa Górnicza	2002	Applying forms of legal protection to 40 ha of the shoreline areas and wetlands at the pit lake
21.	Local nature conservation site of the Piaśniki-Chropaczów park and forest complex	Świętochłowice	2003	Applying forms of legal protection to the Śląsk hard coal mine brownfields, afforested after WWII, and to reservoirs formed in former clay pits, developed for recreational purposes
22.	*Staw Foryśka* local nature conservation site	Świętochłowice	2003	Applying forms of legal protection to an anthropogenic reservoir of high natural qualities, partial developed for recreational purposes
23.	*Kuźnica Warężyńska* reservoir	Dąbrowa Górnicza	2005	Reclamation of 560 ha of former sand pit for hydrological purposes and partially for sports and recreation
24.	Sportowa Dolina 2 – *Środula Sport* centre	Sosnowiec	2005–2006	Development of a park along with a recreation and sports centre
25.	*Amelung* ponds	Chorzów	2007	Reclamation and development of two subsidence pits formed due to mining operations
26.	Nature and landscape complex of *Suchogórski Labirynt Skalny*	Bytom/Tarnowskie Góry	2008	Applying forms of legal protection to 19.84 ha of land comprising fragments of natural landscape of post-mining origin
27.	Piece of land on the river Ślepiotka	Katowice	2010–2011	Revitalisation and recreational development of a riverside area of 4.13 ha and partial restoration of a section of the river under the REURIS programme

Author's own collation; source: Jezierski H. 2000; Konopka Z. 2003; Lapski A. 2009; Stankiewicz B. 2011; planning documents concerning the cities of the Upper Silesian Agglomeration

CONCLUSIONS

The Western European cases referred to in this chapter are all positive examples, demonstrating consistency in planning efforts. Despite their considerable diversification and the resulting need for a case-by-case approach, having compared them, one can identify several regularities:

- the foundation of the new landscape shaping process is the comprehensive nature of the planning measures;
- relevant to the renewal process is developing a network of links between the natural and cultural components decisive of the spatial governance of urbanised areas;
- when successfully introduced and maintained, continuity of natural systems reduces uncontrolled urban sprawl, moves the burden of investment inside cities, makes it possible to avoid unnecessary loss of open spaces, protects rural territories, and fosters the development of recreation and leisure functions of local and regional importance;
- expansion of the natural system of urbanised areas is possible if degraded industrial brownfields are included in the process; when regenerated and redeveloped for natural purposes, they can become complementary elements, helping to create a new post-industrial landscape;
- landscape renewal can become the main driver of economic and social growth of cities and urbanised areas.

Analysed against other examples, the case of the Upper Silesian Agglomeration clearly stands out due to the absence of a holistic approach to the urban transformation process, the spontaneity of the measures actually employed, and the lack of consistency in the planning process. The transformations observed in the Agglomeration's cities raise

questions concerning the post-industrial landscape identity of the entire area. Its problem (with regard to land use and spatial planning) is the largely polycentric nature of urban centres as well as the fact that a large number of brownfield sites have developed in-between the cities. Further problems include the particular aspirations of the authorities of individual municipalities and the lack of information concerning the anthropogenic hazards and their impact on both the natural environment and human health.

The chance to alter the landscape of the Upper Silesian Agglomeration is truly minute at this day and age, which is attributable to a number of factors, including the following:

- risk involved in financing investments on brownfields of unknown or identified yet numerous constraints and hazards to human health and the environment, investments aimed at developing new retail, office, cultural, and residential functions, as well as green spaces, tourism, and recreation,
- prerequisite of technical and environmental regeneration of individual sites and landscape elements transformed by industrial operations (reclamation, renaturation, restoration, and infrastructure-related procedures),
- time intensity of the measures being deployed,
- related costs and capabilities of local authorities (unavailability of financial resources, unawareness of the strategic goal, etc.).

What appears to be an opportunity to maintain the spatial governance in industrial brownfields and to create a new image of the Upper Silesian Agglomeration is adequate planning and management of the renewal process. The potential success in this respect is determined by:

- interdisciplinary studies which assume a holistic view of landscape renewal,
- a strategic vision for the development of urbanised areas,
- an emotionally engaged entity (person or institution) to lead the endeavours,
- legal legitimacy of the planning process,
- access to financial resources needed for the process to be implemented.

It is also important to make sure that the goal of brownfield transformation is intentionally oriented and the regeneration process adequately organised, but also to be flexible and open in planning operations, to build regional and national lobbies, to be able to move from the regional to the local scale, and to undertake educational and promotional activities. All these problems constitute the very core of the discourse on the development of new post-industrial landscapes.

The conclusions arising from the foregoing considerations have provided both the rationale of and the grounds for seeking new possibilities of space management, land use, and shaping of a new landscape quality. Consequently, the overall body of urban renewal problems has been extended to include elements of the natural environment degraded by industrial operations, such as waste dumps, mining pits, artificial reservoirs or rivers, and waterfronts. When transformed and adequately managed, they can indeed become inherent to new natural structures – an embodiment of cultural identity. To that end, one must explore their characteristics and identify specific transformation targets and new development opportunities.

Dolomite quarry in Bytom; photograph by A. Pancewicz

4. NATURAL ENVIRONMENT OF POST-INDUSTRIAL AREAS

The evolution of the natural environment associated with industrial activity has caused diverse landscape forms and new anthropogenic elements to emerge – some more and some less favourable to people. The search for adequate relations with nature has become a part of the process of brownfield transformation and shaping new landscapes of urbanised areas.

The overarching goal of this chapter is to characterise individual elements of the natural environment which have developed on brownfield sites and to identify the opportunities for or limitations to their transformation and redevelopment. Its specific objectives can be defined as follows:

- identify those elements which – once they have been subjected to appropriate forms of protection and integrated into an intentionally shaped system of green spaces, and after numerous reclamation, restoration, or revitalisation measures have been implemented – can provide grounds for optimised and harmonious development and use of urbanised areas;
- demonstrate the relevance of elements such as dumps, pits, artificial water reservoirs, and degraded rivers for landscaping, supplementing ecosystems, bonding the functional and spatial structure of urbanised areas, as well as influencing the quality of urban space and the standard of living of the local population.

What the contemporary spatial and economic development of urbanised areas seeks to achieve is, on the one hand, concentration of functions (investments) within the urban space and, on the other hand, relaxation of investment. In the first case, investments are typically made in vacant urban sites, industrial brownfields, or areas formerly used for railway and military operations, but there is also a tendency to develop land which has hitherto served a natural function, while in the second case, opportunities are sought to establish new public spaces and greenery sites which can satisfy city dwellers' needs. Assuming that urban communities crave for contact with nature and that the natural landscapes in cities do not provide it in abundance, it becomes necessary to make up for the missing elements and to protect the most valuable ones. This is possible by making the most of the opportunities inherent in land degraded by industrial activity. Even though dumps, pits, or artificial reservoirs typically represent no great value and may constitute an environmental hazard, they have become an integral part of the townscape of many post-industrial cities and agglomerations. When subject to processes of natural succession or transformed for nature's sake, some of them have evolved into places of leisure and recreation for the local population – reservoirs of local biodiversity. Others, developed for cultural purposes, have acquired a distinctive spatial form, capable of affecting the neighbouring urban fabric. And yet others have contributed to the formation of strong emotional and cultural bonds within urban communities, based on a sense of familiarity and identity with a specific place. They can be considered among the important factors affecting the way in which the image and character of urbanised areas are carved.

4.1. Characteristics of individual elements of the degraded natural environment

The diversity and specificity of the natural environment transformations observed in post-industrial areas become evident when one scrutinises individual components thereof. They can be linked to terrain relief, hydrography, climate, soils, or vegetation cover. The interpretation of the notions of degraded post-industrial sites and their element as well as the diversity in their typology (features, forms, functions, and interrelations) have made it possible to recognise the scale and specifics of the related problems. The foregoing has also allowed the elements which are considered useful to the urban landscape restoration process to be highlighted. Relying on various attempts to classify industrial brownfields[1] and the types of degraded elements associated with them, one can conclude that the most common transformations of the natural environment pertain to topography and changes in hydrography. The elements associated with them have developed both convex (dumps) and concave forms (pits, artificial reservoirs, degraded rivers), as summarised in Table 7, while flat forms, developed as a consequence of terrain levelling (excavation backfilling or heap levelling), constitute an intermediate group.

Table 7

Taxonomy of main elements of natural environment transformations				
		Item	**Types of degraded elements**	**Subtypes of degraded elements**
Anthropogenic landforms	Convex forms	I	Dumping grounds	1. hard coal mining spoil heaps 2. zinc and lead mining waste dumps 3. power industry waste dumps 4. ferrous metallurgy waste dumps 5. non-ferrous metallurgy waste dumps 6. glass industry waste dumps 7. other dumping grounds, e.g. of municipal waste, sewage sludge, chemical industry waste
	Concave forms	II	Mining pits	8. quarries 9. clay pits 10. sand and gravel pits 11. former peat extraction sites 12. former open pit mining sites (iron ore mining sites, abandoned shafts and bootleg pits, abandoned calamine workings)
Water regime transformations		III	Artificial water reservoirs	13. settling ponds, farm ponds, storage lakes, impounding reservoirs, fire fighting reservoirs, backfilling water reservoirs 14. subsidence ponds, reservoirs in subsidence troughs 15. reservoirs of various origins, backfilled with waste material
		IV	Rivers and riverside areas	16. industrial effluent ditches, canals 17. former port sites, storage sites and yards*

* sites to be considered among flat forms

Author's elaboration based on: Paprzycki E. 1956; Skawina T. 1962; Wrona A., Gołubowicz J., Broda J. 1996

[1] Paprzycki E. 1956. *Klasyfikacja nieużytków poprzemysłowych* (Classification of idle post-industrial land), Bulletin of the Polish Acedemy of Sciences, Committee for the Upper Silesian Industrial Region; Skawina T. 1962, op. cit.; Greszta J., Morawski C. 1972, op. cit.; Golda T. 1993. *Rekultywacja, Skrypty uczelniane* (Land reclamation. Academic course books), no. 1356, AGH University of Science and Technology in Krakow; Wrona A., Gołubowicz J., Broda J. 1996. *Główne problemy zagospodarowania terenów zniszczonych dla potrzeb budownictwa w województwie katowickim* (Main brownfield economy problems from the perspective of the construction industry in Katowickie Voivodeship). In: *Gospodarka terenami zniszczonymi działalnością człowieka* (Economy of areas degraded by human activity), conference proceedings, Institute of Environmental Engineering Fundamentals, Zabrze.

Research implies that the aforementioned four types of degraded elements, i.e. dumping grounds, mining pits, artificial reservoirs, as well as rivers and riverside areas, show the greatest potential for the restoration of natural qualities in brownfields. Their use and development can affect the way in which new natural and cultural landscapes are shaped, and consequently also how the living conditions of the contemporary population of urbanised areas are improved.

ANTHROPOGENIC LANDFORMS

It has been for the exploitation of mineral resources and other human activities related directly to nature that the territory of industrial cities and regions is characterised by a high degree of land transformation. Assuming the landform origin criterion as the baseline, the terrain relief of the areas affected by industrial activity is to be considered as an outcome of the following factors:

- direct human impacts, since it is people who have intentionally created new landforms, such as heaps, embankments, dykes, fills, mounds, tips, holes, trenches, abandoned workings, ditches, terraces, levelled sites, planes, etc.;
- indirect effect of anthropogenic activity, creating conditions for natural processes that would not otherwise emerge without this kind of intervention: alluvial fans, upheavals, sinkholes, subsidence troughs, crevices, funnels, grooves, ledges, faults, landslides[2].

The diversity of anthropogenic landforms made it necessary to address individual elements or their groups having similar features on a case-by-case basis. Their relevance to the spatial structure of urbanised areas is determined, among other aspects, by their shape, size, relation to the natural relief, type of material they are made of, or their location against urban systems. The forms which have become most characteristic of the landscape of post-industrial cities and agglomerations are those developed by underground, open cast, and rock mining operations, namely heaps, pits, or artificial water reservoirs. Most of them cause unfavourable landscape transformations, overwhelm landscapes with their vastness (some stretching on a dozen or so to several dozen hectares), pose some threat, disturb harmony, or introduce a sense of spatial disorder. However, on account of their common nature, scale, and impact, these geomorphological forms of anthropogenic origin represent, in qualitative terms, a new feature of urbanised space, inherent in the cultural landscape. Discovering their value can contribute to the creation of distinctive *places*, which prove helpful when one attempts to determine the landscape identity and seeks to build a new image for industrial brownfields. Along with the elements of the built environment, they are witnesses to the history and cultural heritage of the industrial era.

[2] Żmuda S. 1973, op. cit., p. 90.

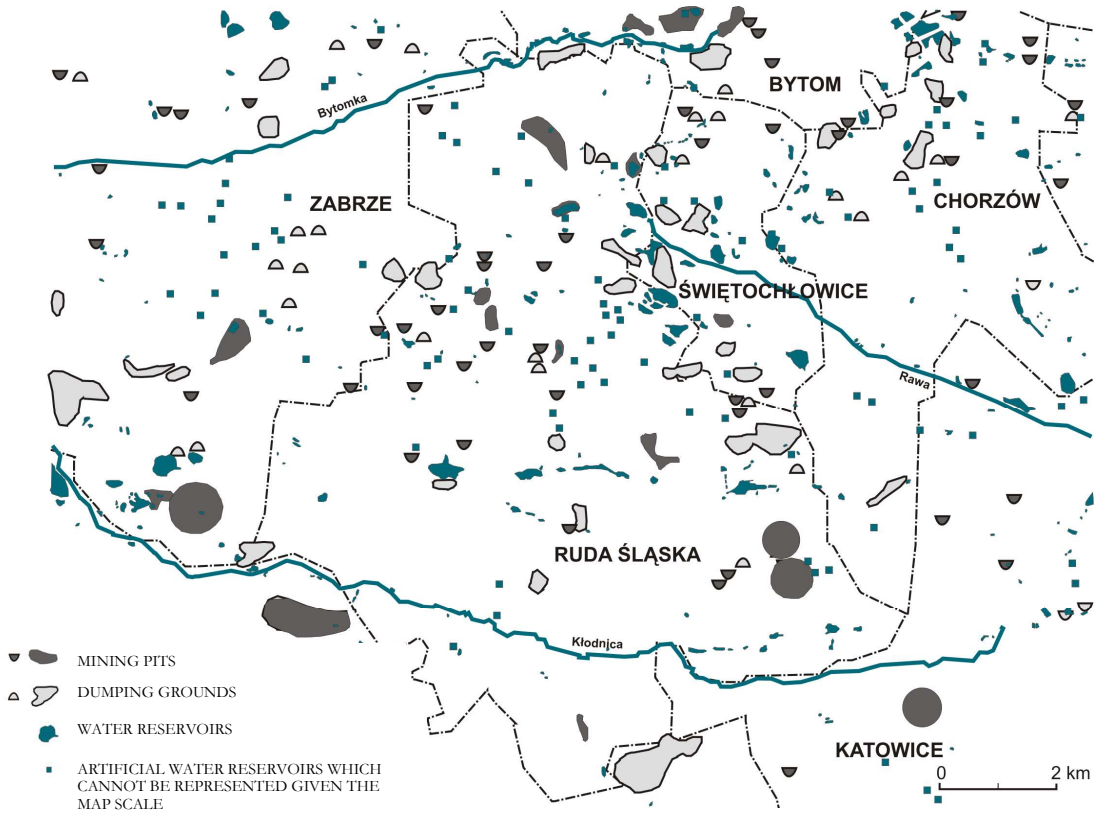

Fig. 57. Anthropogenic landforms of selected cities of the Upper Silesian Agglomeration; author's elaboration based on sozological maps

Fig. 58. „Grand Canyon" in Świętochłowice – Chropaczów district; photograph by A. Pancewicz

Post-industrial dumping grounds, commonly referred to as dumps, constitute the anthropogenic landform which arguably exerts the strongest impact on landscape. In France, they are called *mountains of toil*. Massive amounts of various rock material sorts, predominantly of mine origin, but also delivered from steelworks, power stations, as well as combined heat and power plants, provide testimony to man's violent subjugation of nature. The sheer scale of their omnipresence, impact, but also potential utility demands that they be examined more closely.

> Prepared in the 1950's by the Commission for the Management of Disused Industrial Land, operating under the umbrella of the Committee of the Polish Academy of Sciences for the Upper Silesian Industrial Region, the **classification of dumping grounds** categorised them in such a manner as to establish their development potential according to: **shape** (conical and dome-shaped; table-shaped, with flat peaks and steep slopes; ridge-shaped, with narrow and long peak, and steep slopes; flat – approaching ground level); **origin** (coal mining waste dumps; zinc mining dumps – calamine, sphalerite; ferrous mine waste dumps; lime-based mine waste dumps – waste from limestone quarries, construction and lime firing waste; zinc flotation tailings; coal fines from drilling fluid settling ponds; coal slag – furnace slag; iron slag from high furnaces; iron slag from open-hearth furnaces; zinc slag; sludge heaps from sewage treatment plants; waste dumps from chemical factories); **activity status** (active dumps – currently being formed; active dumps – dumped over, active dumps – burning; inactive dumps – dumping completed; thermal activity ceased [overburnt heaps] or not performed [non-overburnt heaps]; inactive dumps in operation – being dismantled); **mechanical composition** (dumps of dust, silt, gravel, debris, cemented waste, e.g. due to overburning); **extent of vegetation cover** (bare heaps without vegetation; greened – with sparse herbaceous vegetation cover; sodded – covered with dense herbaceous vegetation cover; wooded – covered with woody vegetation)[3].

Dumping grounds become an environmental and space-related issue for every post-industrial city. They have negative effects on the natural environment and its components: lithosphere, hydrosphere, atmosphere, and biosphere. Such effects may even come to the surface decades later. Their very existence causes large territories to be excluded from agricultural use and production, leading to soil deterioration, water regime disturbance, and adverse changes to the chemical composition of ground and surface waters in their direct vicinity (salt leaching from the spoil heap material, mainly of chlorides and sulphates). Widely accessible dumping grounds represent a threat to local inhabitants. They contain lead, zinc, cadmium, and other elements harmful to humans. What also poses a danger is the amount of coal they contain, which may self-ignite. A burning spoil heap releases gases, such as carbon monoxide and dioxide, which are a nuisance to the surroundings[4].

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[3] Firek W., Paprzycki E. 1955. *Zagadnienie hałd w zagospodarowaniu przestrzennym Górnośląskiego Okręgu Przemysłowego* (Problem of dumping grounds against the land use in the Upper Silesian Industrial Region). In: Nechay J. (ed) *Stan prac nad użytkowaniem hałd* (Current state of progress in the redevelopment of dumping grounds), Bulletin no. 1, Warsaw, p. 13. Also: Klemens J. 1985, op. cit., pp. 28–30.

[4] Rostański A. 1996. *Hałdy poprzemysłowe - uciążliwy, a zarazem interesujący element krajobrazu Górnego Śląska* (Post-industrial spoil heaps – nuisance that catches an eye in the Upper Silesian landscape). In: *Przegląd Przyrodniczy* (Nature review), vol. VII, book 3/4, Naturalists Club of the Lubusz Land, Świebodzin, pp. 257–260.

Fig. 59. Mine waste dump in Mikulczyce, a district of Zabrze; photograph by A. Pancewicz

Fig. 60. Dolomite mining waste dumps in Sandomierz; photograph by B. Bulawa

Dumping grounds typically fail to blend into the local landscape or blend into it incorrectly. The foregoing stems from their improper siting, technical or economic issues, and their inappropriate profiling[5]. The solutions applied in practice result in dumping grounds developing forms that are unsuited to the surrounding landscape and require significant earthworks to adapt them to the requirements of the future reclamation and redevelopment methods envisaged[6].

The heaps which dated back to the late 18th and early 19th century were typically spread flat, making the most of the uneven or sloping terrain in the vicinity. The vacant land acquired by that means was frequently utilised for future building development[7]. Large heaps of waste rock and smelting slag started emerging in the second half of the 19th century, formed in the direct vicinity of mines or smelters, and even within enclosed industrial plants. Huge dumps were gradually piling up outside the premises of industrial facilities, often in close proximity of settlements or on the fringes of sparse woodlands. Some of the dumps were located in small valleys, within forest complexes, and outside residential areas. Vast and relatively low, they were rather easily *concealed* in the landscape, in most cases. Some dumps were sited on former mine workings, such as sand pits, thus completely altering the character of the local landscape. Concave landforms, accompanied by relatively small conical heaps, yet of interesting shapes, rendered their territories somewhat *lunar* in appearance (these are known as *bad-land*). The landforms least favourable to the landscape are vast dumps resembling mesas, with broad peaks and steep slopes. These formations were most typically heaped on hillsides or valley slopes and left without any vegetation cover[8]. Further interesting landforms, landscape-wise, are the remnants of iron ore mining. Currently covered by vegetation, they have formed numerous dome-shaped hills and knolls imitating natural formations (Blachownia, Częstochowa)[9].

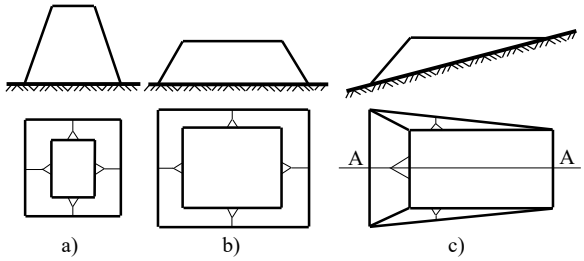

Fig. 61. Most typical forms of above-ground dumps and landfills:
a) cone, b) prism, c) on-slope heap; diagram by A. Ostręga, 2004.

[5] In a sense, the technological process of spoil heap building induced the formation of dumps with regular shapes (cuboids, cones) and steep slopes.

[6] Uberman R., Ostręga A. 2004. *Sposoby rekultywacji i zagospodarowania zwałowisk nadkładu i składowisk odpadów górniczych* (Methods for reclaiming and redeveloping overburden dumping grounds and mining waste heaps). In: *Górnictwo Odkrywkowe* (Open pit mining), R. 46, no. 7/8, pp. 81–82.

[7] The central part of downtown Sosnowiec, which was developed in the interwar period, is located on enormous dumping grounds left of the decommissioned Pogoń coal mine and Emma steelworks, both out of operation for decades (Firek W., Paprzycki E. 1955). On the premises of the dismantled dump of the former Marta ironworks (phased out in 1924) and on the spoil heap of the Katowice mine, the following features were built: part of the Koszutka housing estate, the Spodek sports and performance hall, the largest block of flats in Upper Silesia at that time, known as *Superjednostka*, seats of numerous institutions, office buildings, and transportation areas (Pakuła L. 1994, pp. 131–142).

[8] Sendobry K., Grygierczyk S., Waga J. 1989. *Waloryzacja geomorfologiczna form antropogenicznych województwa katowickiego* (Geomorpholoical valorisation of anthropogenic landforms in Katowickie Voivodeship). In: *Waloryzacja przestrzeni województwa katowickiego z obrzeżem w zakresie wartości przyrodniczych, kulturowych, krajobrazowych* (Valorisation of the space of Katowickie Voivodeship including its fringes in terms of the natural, cultural, and landscape qualities), Wojewódzkie Biuro Projektów, Katowice, p. 13.

[9] Pawelczyk W., Sarno I. 1994. *Waloryzacja przestrzeni przyrodniczo-kulturowej Górnego Śląska według form terenu* (Valorisation of the natural and cultural space of Upper Silesia according to terrain forms), materials of the Foundation for the Space of Upper Silesia, Sosnowiec, p. 9.

Fig. 62. Conical tips in Czerwionka-Leszczyny; photograph by A. Pancewicz

Fig. 63. Skalny heap in Łaziska Górne; photograph by A. Pancewicz

It seems to be a mistake to consider dumping grounds solely in terms of environmental risks. These places can be vibrant with life, and their natural (biodiversity, scenic value) and social qualities (educational, recreational potential) may be surprising. Not only plants and animals, but also people living in the vicinity have adapted to the conditions dumps create. Nature itself makes attempts to deal with stone debris dumping. Trees, shrubs, and a wide variety of plant species spontaneously grow on the surface of dumps, forming new pioneer habitats. They are often rare species (specific to mountains and foothills), at risk of extinction in neighbouring sites. Pheasants and hares can often be encountered on their slopes. These artificial mounds are also places where numerous fossils can be found. Over time, dumping grounds have become a distinct landform with power to affect architecture and urban planning in the vicinity. They can be hidden in the landscape or prevail over it (having distinctive colours or spatial forms). Their aesthetic qualities may be surprising, eye-catching with unexpected hues and diversified red-yellow-brown-black tints. They cause the landscape they form, scrutinised every day, to be perceived by most of human senses[10]. From the perspective of the local population, dumping grounds have become familiar features, often providing entertainment opportunities, and sometimes even allowing people to make a living (some pick the coal remains found on the dumps, half mixed with rock, as well as wood and scrap metal). Over generations, local communities have developed a strong emotional connection with such places, based on a sense of identity with the industrial physiognomy and its symbolic character[11]. They are easily discernible and recognisable signs of the cultural uniqueness of a given territory, a kind of landmark which makes it possible to locate other elements in space[12].

> One can find from several to more than a dozen such anthropogenic elevated landforms in each city of the **Upper Silesian Agglomeration**. The two best-known mining waste dumping sites are located on the fringes of the Agglomeration: next to the Rydułtowy hard coal mine in the town of Rydułtowy, and on the premises of the Bolesław Śmiały hard coal mine in Łaziska Górne (the Skalny dump)[13]. The cities of the **Ruhr** are known as Europe's largest cluster of dumping grounds. Many of them became popular and recognisable once they had received new functions linked to artistic activity: Rheinelbe and Rungenberg in Gelsenkirchen, Haniel or Beckstrasse in Bottrop, Schurenbach in Essen, Hoheward in Herten, etc.

[10] Mind the words of Franciszek Starowieyski, who described elements of the Upper Silesian landscape as follows: „The heaps bear witness to the fact that industry exploded here in the 19th century and created such a landscape." He also adds: „The heaps – just like cathedrals and castles – are now monuments. I found a wonderful place near Piekary Śląskie with heaps remaining of a non-ferrous metals smelter and a beautiful dump of slag mixed with cinder. Beautiful heaps of intense red colour with a marvellous mesh of cracks and small caves. A strange microclimate has developed around these heaps; strangely exuberant flora. [...] I went there the other day and tried to paint the heap; I squeezed out a lot of dark purple brown and nothing worked. I don't know how many layers I had to apply to achieve that unique brown hue of the heap. It's a pity that I couldn't bring the late Joseph Beuys with me, because he had been a true specialist in brown colour, and only he would have seen what real brown was. I would very much like to see a landscape park of spoil heaps established there. Or maybe not precisely there; after all, there are many more places like that. [...] There were heaps in the suburbs of Katowice, in the district of Welnowiec – not the largest ones, but they were heaped up in hot condition. They looked like the rocks the Chinese painters of the Kangxi period loved so dearly. They were openwork forms with clearances, with some kind of creepers and weeds weaving there. The heaps were all grey and black and brown" (Świerszcz J. (ed) *Pejzaż śląski Franciszka Starowieyjskiego* (Franciszek Starowieyjski's Silesian landscape). In: *Gazeta Katowicka*, no. 174, 07/1991) [translations from Polish by Łukasz Borkiewicz].

[11] The inhabitants of Czerwionka-Leszczyny had become so strongly connected with the conical heaps formed by the coal mining operations of the Dębieńsko mine that they undertook to defend them against dismantling, while emphasising their identification role and landscape-building character, at the same time.

[12] Lynch K. 1960, op. cit.

[13] The heap in Rydultowy, with a height of 110 m and an area of 37 hectares (according to some sources, it is considered the highest in Europe) and the Skalny heap in Łaziska Górne, with a height of 92 m and an area of 30 hectares, partly covered with vegetation, are dominant elements of the suburban landscape.

Fig. 64. Quarry in Jaworzno; photograph by A. Pancewicz

Fig. 65. Open pit at the Bełchatów lignite mine; photograph by G. Najgiebauer

Dumps embedded in the urban landscape become the *necessary evil*, in a sense. As time passes, they *grow into* the landscape, and they cease to be so distinctive or perceived as unfamiliar. However, this process is not permanent; it can be subject to further metamorphoses happening even within a generation's timespan. It suffices to find a specific economic demand and an associated economic factor to make dumps *vanish* from the landscape[14]. Changes like these create chaos and a sense of spatial disorientation among the local population. On the other hand, when adequately used and adapted to new needs, they can turn into a *familiar* element of the natural landscape again. Some of them, as they actively succumb to vegetation and the inhabitants gradually become *accustomed* with them, embody the pursuit of a traditional identity built on the foundations of industrial heritage and the need to neutralise the negative spatial effects of this heritage.

Mine pits represent a landscape feature which is typical of both large cities and agglomerations of industrial nature as well as of certain small towns. Their size, shape, and location depend on where and what kind of raw material had been extracted on the given site and on the extraction technology applied. They can be found in both open spaces as well as intensely developed areas, and they have evolved into sunken (in lowlands), sloped, and sloped/sunken (on hill slopes) landforms[15]. They may have different shapes: gorges, channels, basins, hollows, holes, depressions, furrows, or troughs. They also vary in size, ranging from several tens of square metres to several tens of hectares, occasionally reaching several square kilometres[16]. The diversity of pits has contributed to introducing numerous classifications of these mine workings.

> Having considered the specificity of the emerging pits, **Edward Paprzycki** (1956) categorised these landforms as follows: **quarries** (broken down according to the material extracted, i.e. limestone, dolomite, marl, and sandstone, as well as according to their activity status: active, i.e. operated, and decommissioned, i.e. abandoned); **sand pits** (subdivided according to the water regime: dry, with groundwater levels deep enough for woody vegetation to develop, waterlogged – where groundwater surfaces periodically, and flooded with water, and according to the extent of vegetation cover development: bare, greened, sodded, wooded); **clay pits** (attributable to the extraction of clay, shale, and silt); **subsidence pits** (emerging due to mining operations as a consequence of land subsiding and groundwater level rising); **abandoned shafts** (remnants of bootleg pits); **abandoned workings** (remnants of open pit extraction of silver, lead, and zinc ores); **abandoned open pit mining grounds** (iron ore, coal)[17].
>
> **Tadeusz Skawina** (1962) distinguished between **earth pits** and **stone (rock) pits** created by open pit extraction of frac sand, hard coal, lignite, clay, sand, slag, and other diverse rock deposits[18].

[14] Recently, the most common action, which is additionally cost-effective for municipalities, is dismantling the heaps and utilising the material thus acquired for motorway construction.
[15] Malewski J. 1999. *Systemowe uwarunkowania rekultywacji i zagospodarowania wyrobisk* (System conditions of mining pit reclamation and redevelopment). In: Malewski J. (ed) *Zagospodarowanie wyrobisk* (Development of mining pits). Publishing House of the Wrocław University of Science and Technology, Wrocław, pp. 198–225.
[16] Żmuda S. 1973, op. cit., p. 95.
[17] Paprzycki E. 1956, op. cit. In: Bulletin of the Polish Academy of Sciences, Committee for the Upper Silesian Industrial Region. After: Klemens J. 1985, op. cit., pp. 28–30.
[18] Skawina T. 1962, op. cit. After: Klemens J. 1985, op. cit., pp. 30–31.

Fig. 66. Sand pit in Bukowno; photograph by Ł. Jedynak

Fig. 67. Gravel pit in Sobolewo; photograph by T. Dziemian

The formation of pits usually entails devastation of the local vegetation cover and water regime disturbance over the entire area subject to mining operations. It also contributes to the partial changes occurring in adjacent sites. The protection of mining areas prevents them from being freely built-up and otherwise developed. However, in numerous cases, completely new landscape qualities are thus acquired, which is attributable precisely to mine workings. The landforms which may develop on these premises include ponds or waterlogged sites, supplied by rivers, precipitation water or groundwater. Valuable species of flora and fauna tend to settle in walls of mining excavations. This, however, largely depends on their characteristics, i.e. shape, depth, edge profile, or size[19].

Small pits are usually situated on the fringes of urbanised areas – on fields and uncultivated farmland, less often in forested areas. The vast majority of them evolve into small, shallow, and unstructured forms. They do not represent any major natural values, nor are they particularly significant in terms of geological or educational value. Their accumulation within a relatively small area results in considerable *perforation* of the land and adversely affects its landscape quality. Numerous pits are extensively utilised, heavily neglected, and frequently littered. Only small pits where loose rock used to be mined are restored fairly quickly and harmoniously integrated into the landscape[20]. Their role is limited to increasing the diversity and attractiveness of the environment as well as to shaping the specific microclimate of peri-urban territories.

Large-area pits are typically found in extensively and intensively developed sites, predominantly on slopes, often covering several hills (quarries), in river valleys (sand and gravel pits), and in loess areas (clay pits and brickyards). These may include landforms of negative scenic qualities, associated with the culture of mining, and those of positive qualities, characterised by an interesting geological structure[21]. In cases where the latter have not developed into waste dumping grounds (for production waste or municipal waste), they can be utilised as sites with potential for ecological development. Unlike small landforms, these pits offer more opportunities of adaptation for research, education, or sightseeing functions[22]. They can be more easily integrated into the landscape and converted for recreational purposes. Former solid or loose rock extraction pits, once they have been adequately prepared and the right reclamation target chosen for them, can be utilised for virtually any kind of activity[23].

[19] Kozakiewicz R. 2000. *Charakterystyka wyrobisk po eksploatacji surowców skalnych w aspekcie ich wykorzystania dla celów rekreacji i turystyki* (Characteristics of depleted rock mining workings from the perspective of their development for recreation and tourism). In: *Inżynieria Środowiska* (Environmental engineering), vol. 5, book 1, AGH University of Science and Technology in Krakow, Academic Publishing House for Scientific and Teaching Materials, Krakow, pp. 163–174.

[20] In most cases, it is not economically and sociologically feasible to fully rehabilitate small pits, including the operation of filling the void previously formed and restoring the area to its original condition. They are mostly unsuitable for direct development for recreational purposes.

[21] Sendobry K., Grygierczyk S., Waga J. 1989, op. cit., pp. 21–25.

[22] Many pits contain fossil soils, organogenic sediments, and geological structures of relevance to life sciences.

[23] The potential paths of recovery of depleted mining pits are as follows: agriculture (meadows and pastures, arable land, orchards, vegetable production) and forestry, both of which are difficult to follow on account of the lack of the right soil, exploration (based on elements of the natural environment), recreation (making the most of the attractiveness of landscape and the surroundings, as well as their accessibility), and construction (only possible on ground-levelled mine workings, used for low-rise buildings).

Fig. 68. Artificial water reservoir in Czeladź; photograph by A. Pancewicz

Fig. 69. Artificial water reservoir in Piekary Śląskie; photograph by A. Pancewicz

WATER IN POST-INDUSTRIAL LANDSCAPE

The land use changes associated with agriculture, urbanisation, and industrialisation have caused quantitative and qualitative transformations of the entire water system. Special importance is attributed to the extraction of mineral resources which has transformed water regimes over large urbanised areas. This phenomenon has manifested itself in numerous ways, including in the changes to the chemical and physical structure of water, the nature of the water environment as well as its utility value, the changes to the river system, the increased and more regular water flow calculated on an annual basis, the formation of water reservoirs in post-mining pits, the changes to the groundwater levels, the disruption of the natural water cycle, as well as either waterlogging or drainage of land[24]. These changes of point-based or territorial reach can be considered both locally and regionally. The most distinctive elements of the water network, clearly discernible against the landscape of post-industrial areas, are the following:

- artificial water reservoirs, and
- polluted river network.

The **artificial water reservoirs** created through industrial activity are characterised by significant diversification in terms of surface area, depth, and shape. Their number, social relevance, and function in the development of specific microclimatic conditions render them predisposed to play a crucial role in the process of landscaping of post-industrial areas. Some of them evolved as an outcome of deliberate human activity. These are small reservoirs, intentionally shaped and filled with discharged water, performing pre-defined functions: fire-fighting, sports and recreation, and industrial. They also include settling ponds and farm ponds, storage lakes, retention basins, and other man-made formations associated with the production cycle of industrial plants. Another group comprises reservoirs which developed due to unintended effects of human activity. These include all kinds of water reservoirs formed by filling land depressions created by surface and underground mining of minerals (formed in sinkholes and subsidence troughs)[25]. In genetic terms, they can be divided into the following types:

- sinkholes (resulting from ore and coal mining),
- pits (phased-out sites of sand and clayey material extraction),
- quarry formations,
- artificial special-purpose reservoirs (excavations dug for special functions, concrete reservoirs, sites featuring spillage bunds, retention and storage reservoirs)[26].

Both the potential and the total surface area of artificial water reservoirs can cause landforms which may be referred to as *anthropogenic lake districts* to develop in highly urbanised post-industrial areas[27].

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[24] Żmuda S. 1973, op. cit., pp. 101–102.

[25] Ibid., pp. 116–118.

[26] Jankowski A.T. 1991. *Wpływ podziemnej działalności górniczej na kształtowanie stosunków wodnych* (Impact of underground mining on water regime formation). In: Jankowski A.T., Trembaczowski J. (eds) *Zmiany środowiska geograficznego w warunkach silnej antropopresji (wybrane zagadnienia), cz. 2. Zmiany stosunków wodnych w regionie górnośląskim* (Geographical changes under the conditions of intense anthropopressure (selected problems). Part 2. Water regime changes in the Upper Silesian region), Sosnowiec, pp. 5–22.

[27] Jankowski A.T., Rzętala M. *Stań badań limnologicznych w regionie górnośląskim* (State of limnological research in the Upper Silesian region). In: Jankowski A., Rzętala M. (eds) 2004. *Jeziora i sztuczne zbiorniki wodne, funkcjonowanie, rewitalizacja i ochrona* (Lakes and artificial water reservoirs – functioning, revitalisation, and protection), Faculty of Earth Sciences of the University of Silesia, Polish Limnological Society, PTG – Katowice branch, Sosnowiec, pp. 101–109.

Table 8

Number and surface area of the water reservoirs in the cities of the Upper Silesian Agglomeration at the beginning of the 21st century		
Upper Silesian Agglomeration cities	**Number of water reservoirs**	**Surface area of water reservoirs (ha)**
Bytom	120	104
Chorzów	29	53
Dąbrowa Górnicza	59	761
Gliwice	81	95
Jaworzno	41	148
Katowice	95	**237**
Mysłowice	30	178
Piekary Śląskie	41	**21**
Ruda Śląska	**127**	103
Siemianowice Śląskie	10	18
Sosnowiec	62	94
Świętochłowice	**22**	36
Tychy	42	167
Zabrze	97	66
Total:	**856**	**2,081**

Source: Rzętała M., Rzętała M. A. 2008

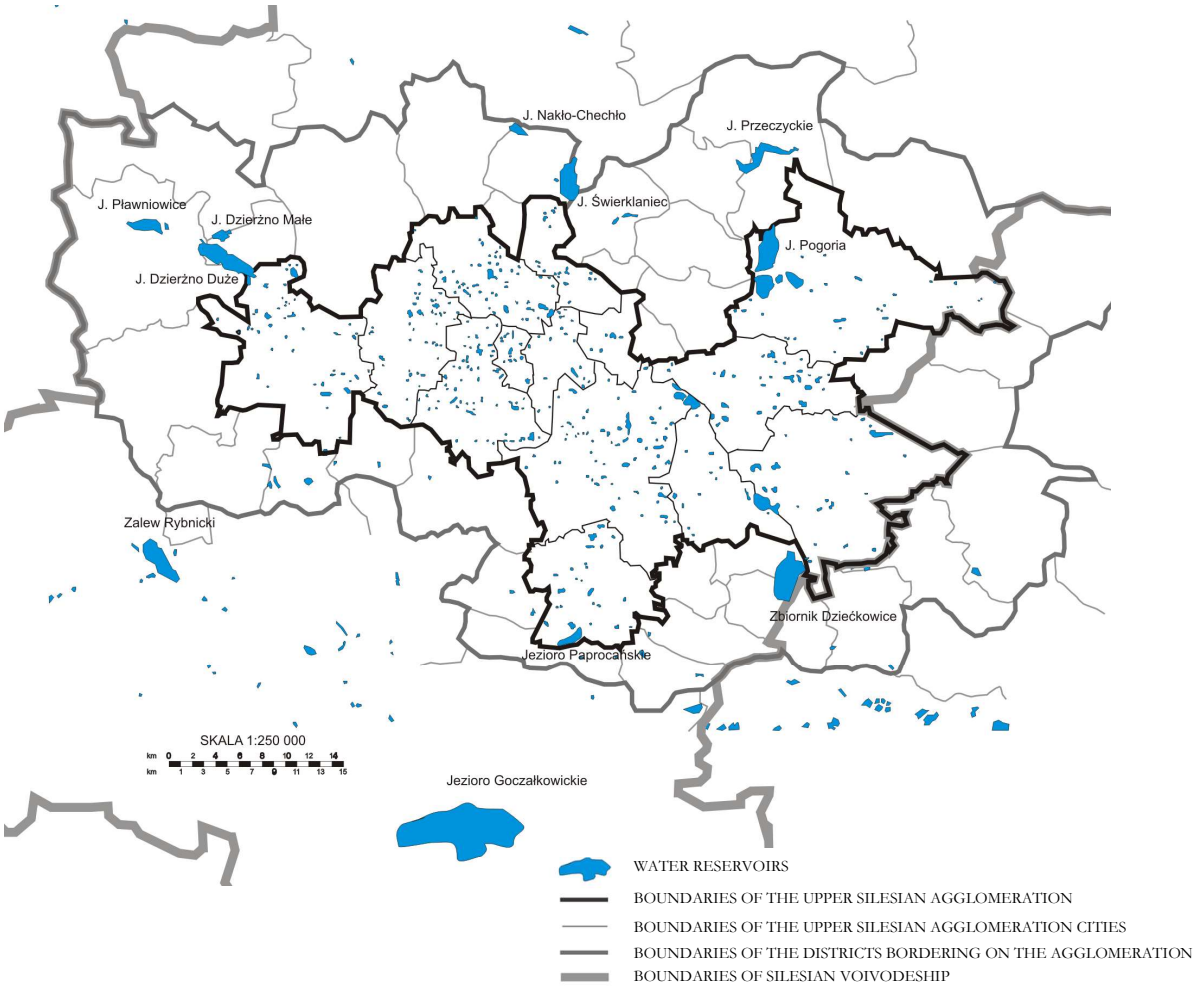

Fig. 70. Water reservoirs in the Upper Silesian Agglomeration; author's elaboration

There are currently 856 water reservoirs within the boundaries of the **Upper Silesian Agglomeration** (Table 8)[28]. They are unevenly scattered, most of them to be found in areas where mining traditions date the furthest back, namely in Katowice, Mysłowice, Bytom, and Ruda Śląska, but also within the limits of Tychy. Their predominant landform is a small reservoir, with an area of no more than 1 ha, developed for various purposes in the vicinity of industrial facilities as well as those whose origins are related to land subsidence as a consequence of deep coal mining[29]. According to Stanisław Żmuda, the distribution of artificial water reservoirs within the Agglomeration area is clearly marked by the regionalisation of their specific types. The western part of this territory is dominated by reservoirs formed in subsidence troughs, while the eastern part – by surface mining pits filled with water. The largest number of drainage reservoirs can be found in the valleys of the rivers Kochłówka and Bytomka. Those formed in abandoned sand pits are concentrated between Katowice, Mysłowice, and Sosnowiec, but can also be spotted near Siemianowice Śląskie and Dąbrowa Górnicza. In the vicinity of Sosnowiec and Dąbrowa Górnicza, one may also come across reservoirs created in former open coal mining pits. There are reservoirs developed in pits abandoned after the extraction of lead and zinc ores was discontinued near Bytom, while the northern and eastern parts of the region host reservoirs formed in post-limestone mining pits[30]. Actually, one can hardly find any water reservoirs in the territory of the Agglomeration which developed without human intervention. Nevertheless, there are but a few still bodies of water created in naturally forested areas[31].

The attractiveness of artificial water reservoirs is determined by several factors: distance from urbanised areas, accessibility, location relative to areas of natural and scenic value, degree of development of tourism infrastructure, as well as reservoir type, character, size, or shoreline profile[32]. Their impact can be considered in either positive or negative terms.

On the one hand, they bring numerous benefits to people and the natural environment. In urban areas poor in natural water bodies, artificial reservoirs improve microclimate, enable irrigation of adjacent agricultural land, and improve soil quality. They are home to a wide array of plant and animal species. Most of them are typically characterised by good water quality, making them attractive to many types of visitors (e.g. beachgoers, anglers). Their diversity (as they differ in slope and bottom shapes, or surface area which can vary from more than a thousand square metres to even several dozen hectares) also adds variety to the landscape. On account of their potential use for tourism and recreation, they represent valuable and highly demanded assets in the spatial structure of post-industrial cities and regions. Despite their relatively small spatial reach, many of them play an important role in terms of the functioning of the entire landscape strip of valleys, forming one of the most important valley ecosystems.

[28] Rzętała M.A., Rzętała M. 2008. *Zbiorniki wodne na obszarze Górnośląskiego Związku Metropolitalnego* (Water reservoirs within the territory of the Metropolitan Association of Upper Silesia). In: Dulias R., Hibszer A. (eds) *Górnośląski Związek Metropolitalny. Zarys geograficzny* (Metropolitan Association of Upper Silesia. A geographical outline), Sosnowiec, pp. 71–81.

[29] Rzętała M. 1995, *Zróżnicowanie występowania zbiorników wodnych na terenie Górnośląskiego Okręgu Przemysłowego* (Diversification of the occurrence of water reservoirs within the Upper Silesian Industrial Region). In: *Kształtowanie środowiska geograficznego i ochrona przyrody na obszarach uprzemysłowionych i zurbanizowanych* (Formation of geographical environment and nature conservation in industrialised and urbanised areas), no. 20, University of Silesia, Katowice–Sosnowiec, pp. 5–9.

[30] Żmuda S. 1973, op. cit., p. 118.

[31] Rzętała M. 1995, op. cit., pp. 5–9.

[32] Kozakiewicz R. 2000, op. cit., pp. 163–174.

Fig. 71. Overflow site in Ruda Śląska; photograph by A. Pancewicz

Fig. 72. Settling pond in Zabrze; photograph by A. Pancewicz

Some of them can be considered as landscape elements fully assimilated with their surroundings[33]. Artificial reservoirs are crucial for environmental protection, natural compensation, and pursuit of sustainable development of urban territories. However, the natural value of the reservoirs found in urbanised and industrialised zones is negligible compared to the naturally valuable green spaces outside urbanised areas.

On the other hand, artificial water reservoirs set limits to the freedom of spatial development. Their negative environmental impact often manifests itself in the degradation of the land in their immediate vicinity. Waterlogging of large forested areas, often located on the fringes of intensely urbanised territories, leads to deterioration of soil fertility, destroys tree stands, reducing their productive capacity, and causes huge damage to the forest management and recreational potential[34]. The reservoirs considered particularly hazardous, where located in the most heavily industrialised areas, are the settling ponds of the chemical, metallurgical, power, and mining industry, as well as flotation basins. Due to the toxicity of the materials stored in them, they pose a huge environmental threat. Also overflow sites (water-filled pits), formed through subsidence and subsequent collapse of the land, are highly problematic to urban areas[35]. Many of them are filled with saline water and various toxic substances. Only those found in forested areas are supplied with relatively clean subsoil water, which makes them potential sites for habitation and refuge of many plant and animal species.

The anthropogenic water reservoirs to be found in urban or suburban areas, on the fringes of housing estates or among fields, are characterised by their non-permanent character – some are seasonal, while others are continuously blended into their surroundings. Insofar as some are drained and backfilled, new ones emerge elsewhere[36]. Over time, they cease to be so distinctive and perceived as alien in the landscape**.** However, where their surroundings are marshy and neglected, if combined with other elements of a degraded post-industrial landscape (dumps, landfills, deteriorating elements of the industrial infrastructure), they can only add to the spatial chaos and negative perception of the landscape. Some of them require legal protection, limitation of human interference, and safeguarding against devastation; others need proper reclamation and adequate development[37].

Most artificial water reservoirs, when linked with a system of public spaces, can become attractive recreational sites and distinctive features in the landscape of urbanised areas.

The river network is a witness to the transformation of the urban planning and cultural processes taking place in the urban space. It links the urbanised structure and the natural wealth of waterfronts, as well as the elements of the natural environment located inside the urban fabric and the open spaces outside the city. In the past, the river performed a number of functions which affected the city's structure, spatial profile, and landscape.

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[33] Jankowski A.T., Rzętała M. *Stań badań limnologicznych w regionie górnośląskim* (State of limnological research in the Upper Silesian region). In: Jankowski A., Rzętała M. (eds) 2004, op. cit., pp. 101–107.

[34] Tokarska-Guzik B., Rostański A. 1996a. *Rola zatopisk (zalewisk) pogórniczych w renaturalizacji przemysłowego krajobrazu Górnego Śląska* (Relevance of post-mining water-filled pits (overflow sites) for the restoration of the industrial landscape of Upper Silesia). In: *Przegląd Przyrodniczy* (Nature review), vol. VII, book 3/4, Świebodzin, pp. 267–271.

[35] The resulting sinkholes collect water from surface and underground runoff, thus turning into artificial water reservoirs. As a consequence of the formation of subsidence troughs, the entire existing relief is remodelled. Watersheds are moved and the river network is changing (Szczypek T., Wach J. 1992, pp. 5–13).

[36] There were 488 water bodies in the Upper Silesian Agglomeration of the 1970's.

[37] Most anthropogenic water reservoirs are assumed to be transformed for purposes of the following three main functions: recreation and water sports, fishery, as well as retention and sedimentation of the natural suspended matter from flood waters along with water storage for economic needs.

Fig. 73. The river Rawa in Katowice; photograph by A. Pancewicz

Fig. 74. The river Bytomka in Ruda Śląska; photograph by A. Pancewicz

Economic, political, social, cultural, or natural conditions, changing over time, defined new paths for the development of riverside areas, providing the grounds for their evolution. The advent of industrial culture caused the impact of rivers to gradually decline, and triggered the transformation of their natural character. In many cases, the fact that autonomous industrial features, not linked with the city structure, were sited on the river banks (this being followed by non-uniform and chaotic development), as well as some unfavourable topographical changes, degradation and poor regulation altogether rendered rivers nearly completely eliminated from the landscape of cities and agglomerations. What also contributed to such a state of matters was a number of phenomena directly evoked by human activity, including:

- poor water quality (pollution exceeding standards),
- inadequate river bank improvement (concreted channels, high dikes),
- terrain deformation (depressions, interior basins, waste rock dumps),
- riverbed relocation and straightening,
- water regime disturbances (drainage, waterlogging, flooding)[38].

The perception of riverside areas was also largely affected by the untapped functions of rivers: composition building, integration, representation, and recreation. Consequently, in-city rivers were seen as sources of threats rather than of potential benefits for a long time. Instead of providing a zone of open space with natural and scenic qualities, so crucial to urbanised areas, riverside areas and the river itself succumbed to widespread degradation.

The post-industrial era did not improve the relationship between the city and the river. As the economic recession and the process of deindustrialisation progressed, waterfronts, which used to be strongly linked with industry, lost their primary function and even began to be perceived as a barrier to the spatial urban development.

> In many contemporary cities, the main waterfront transformation issues are in fact financial constraints, a disorganised legal and financial status, lack of investors with sufficient resources to implement comprehensive measures, and – last but not least – the attitude of the local authorities or the inhabitants themselves. An example which adequately illustrates this body of problems is the **Upper Silesian Agglomeration**, where the **riverside landscape** tends to be overlooked and underestimated by both city dwellers and other users of the urbanised space. It is predominantly neglected, devastated, and utterly unremarkable. Such an impression is magnified by strong industrialisation and urbanisation, as well as by inappropriate economic policies of individual municipalities. The Agglomeration lies within two river basins of the Vistula and the Oder. The Vistula river basin consists of the rivers Biała Przemsza, Czarna Przemsza, and Brynica, while the Oder river basin – the Kłodnica and the Bierawka, along with their numerous tributaries. The rivers which comprise their catchment areas are short, narrow, with low gradients and scarce water resources, and of little importance to the region's economy. Their impact on the shape, function, or use of waterfronts is negligible. The catchments of the rivers flowing through the Upper Silesian Agglomeration cities are among the areas most heavily transformed by human activity.

[38] The sewage discharged from industrial plants became a problem. At times, their quantity often even exceeded the amount of natural water discharged from this area. This contributed to the formation of numerous artificial water ditches connecting industrial plants with natural watercourses, clearly discernible against the urban landscape.

Fig. 75. The Kochłówka in Zabrze; photograph by A. Pancewicz

Fig. 76. The Kłodnica in Gliwice; photograph by A. Pancewicz

> Some of them are diked (the Brynica in Czeladź), others are hidden between high railway embankments (the Biała Przemsza between Jaworzno and Sosnowiec), while yet others are covered over large sections (the Rawa in Katowice). Very few river valleys, such as the Brynica with its ponds, oxbow lakes, and park areas in Czeladź, or the Drama and Kłodnica river valleys, have in spite of all developed into places of existence for particular biocoenoses, eligible for landscape conservation[39].

Not until the late 20th century had rivers become strategically significant for urban development. Many riverside areas which had been completely neglected until recently were given another chance to become part of public urban spaces and natural systems. The industrial brownfields situated on river banks – well sited and clearly discernible against the spatial structure – have become both an opportunity and a challenge for cities worldwide.

What has become the primary goal of riverside restoration is not only to bring degraded yet strategically sited areas back to life and to make the most of them, but also to define new urbanistic and architectural quality in these areas. This calls for reconciling the public interest with the short-term, and often conflicting, actions taken by existing owners and users, as well as achieving economic, social, natural, and cultural benefits associated with the actions previously initiated.

Nowadays, shaping a harmonious relationship between the river and the city is fundamental to sustainable development. This includes creation of new spatial forms as well as interactions with the natural and cultural environment in consideration of hydrology, ecology, sociology, and economics. The interface between the river and the urbanised space entails both threats and opportunities. Consequently, water management and flood control have become priorities for spatial planning of urbanised areas.

4.2. Transformation possibilities

Industrial land use is subject to different phases of development which affect the relations with the natural environment. A sequence of phases, such as planning, development, maturity, and decline, leads to a process of renewal (regeneration) of both an industrial site and its natural components (landforms, water regime, vegetation cover)[40]. Once mining, manufacturing, or processing activities are discontinued, with reference to the principles of sustainable development and a comprehensive approach to the problem of transformations, it is necessary to change the functional and spatial structure of industrial brownfields by defining new relations between elements of the natural, social, and technical environment, and by coordinating the entire process as well as its individual measures[41].

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[39] The Brynica valley is classified in the Voivodship's System of Protected Areas as an ecological corridor, linking the regional elements of the ESOCh in the north and south of the region. In the Gliwice section, the Kłodnica is characterised by the natural character of its banks and the soft organic flow line. Thanks to these features, it adds variety to both the composition and landscape of the city. However, this characteristic of the river has not been highlighted in any way. There is no access to the water body itself, and there are very few vantage points from which one could experience the river's scenic quality.

[40] Gasidło K. 1998, op. cit., pp. 26–27.

[41] Ziobrowski Z. et al. (ed) 2000. *Rewitalizacja, rehabilitacja, restrukturyzacja, odnowa miast* (Revitalisation, rehabilitation, restructuring, and renewal of cities), Institute of Spatial and Municipal Economy, Krakow Branch, Krakow, passim.

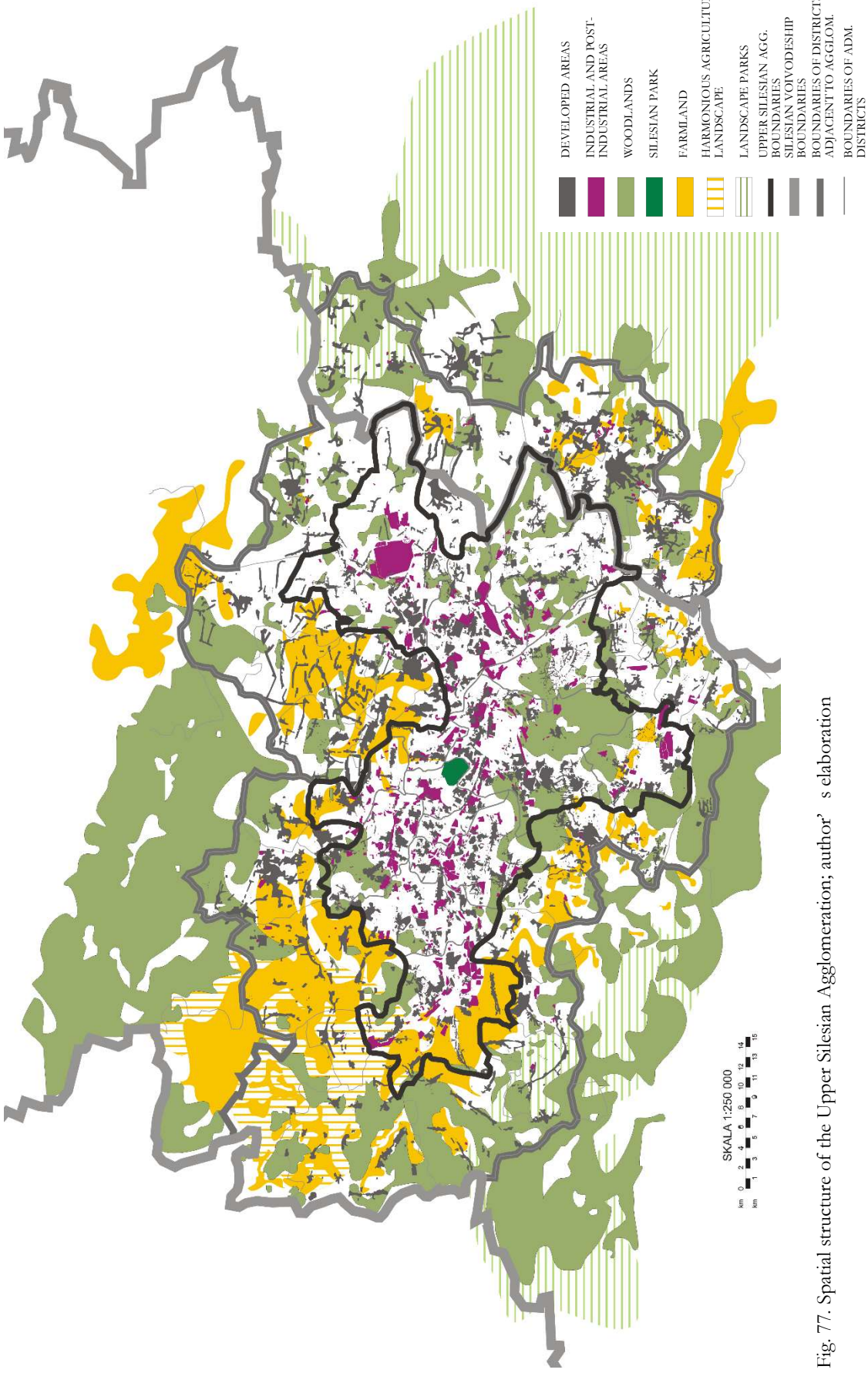

Fig. 77. Spatial structure of the Upper Silesian Agglomeration; author's elaboration

Planning of the transformation process for a degraded environment should be underpinned by a conviction that the economic growth of a post-industrial region depends on the quality of its natural environment and the attractiveness of the urban space, both of which affect the standard of living of the population of urbanised areas. The measures of such transformation should, therefore, focus on the problems of conversion of urbanised space and protection of the natural environment, including the landscape. However, the aim of these measures is not to restore the former natural structure, but rather bring the degraded sites which belong to ecological systems *closer to nature* in terms of their condition, define new values held precious from the perspective of the urban space users, as well as create a functional and spatial system and a new state of equilibrium between a given area and the urban environment. These measures raise hopes that it is possible to secure human health, restore the balance between the natural and built environment, find a balance between the necessary protection of environmental resources and the possibility of utilising them, define the conditions for the biological recovery of degraded areas, and achieve spatial order and harmony in the urbanised landscape[42].

Transformation of individual degraded elements should be based on their identification as well as determination of the related environmental, social, and spatial risks. In the event that land surface has been transformed for industrial purposes, and that large areas of land have been excluded from use, the harmful effects of the residual contaminants remaining on site must be eliminated, and the transformed sites must regain their biological activity and aesthetic qualities of the landscape[43]. The foregoing can be achieved through extensive reclamation procedures.

Measures aimed at improving the capacity of a given site to accommodate new functions are usually very time- and cost-intensive. They consist of numerous steps, which include: in-depth surveying, establishing the scope of problems, implementing a monitoring programme, and defining follow-up activities along with their utility value, efficiency, and cost-effectiveness. In order to set targets for reclamation and redevelopment, and to define the conditions for transformation, one must first examine in detail the possibilities or limitations of individual elements in terms of their suitability for new functions as well as their susceptibility to transformations. When based on informed decisions, the chosen transformation targets can influence the efficient use of industrial brownfields[44].

[42] Dubel K. 1998, op. cit., pp. 74–114.

[43] Pollution abatement consists primarily in applying technical and organisational measures for neutralisation, treatment, or separation and containment. Biological activation comprises measures aimed at accelerating or facilitating natural succession, selection of the species to be introduced, or renaturation (Gasidło K. 1998, op. cit., p. 43).

[44] According to the classification provided in the Polish Standard (PN-G-07800:2002 *Open-cast mining. Land reclamation. General design guidelines*), the potential paths of land reclamation are as follows: agriculture (arable land, grazing land, orchards, gardens), forestry (development for forest purposes: production and buffer forests), municipal functions (e.g. for parks, lawns, sports and recreation facilities), hydrology (water reservoirs and the construction thereof), and special purposes (development for purposes other than recultivation for agriculture, forestry, municipal functions, and hydrology).

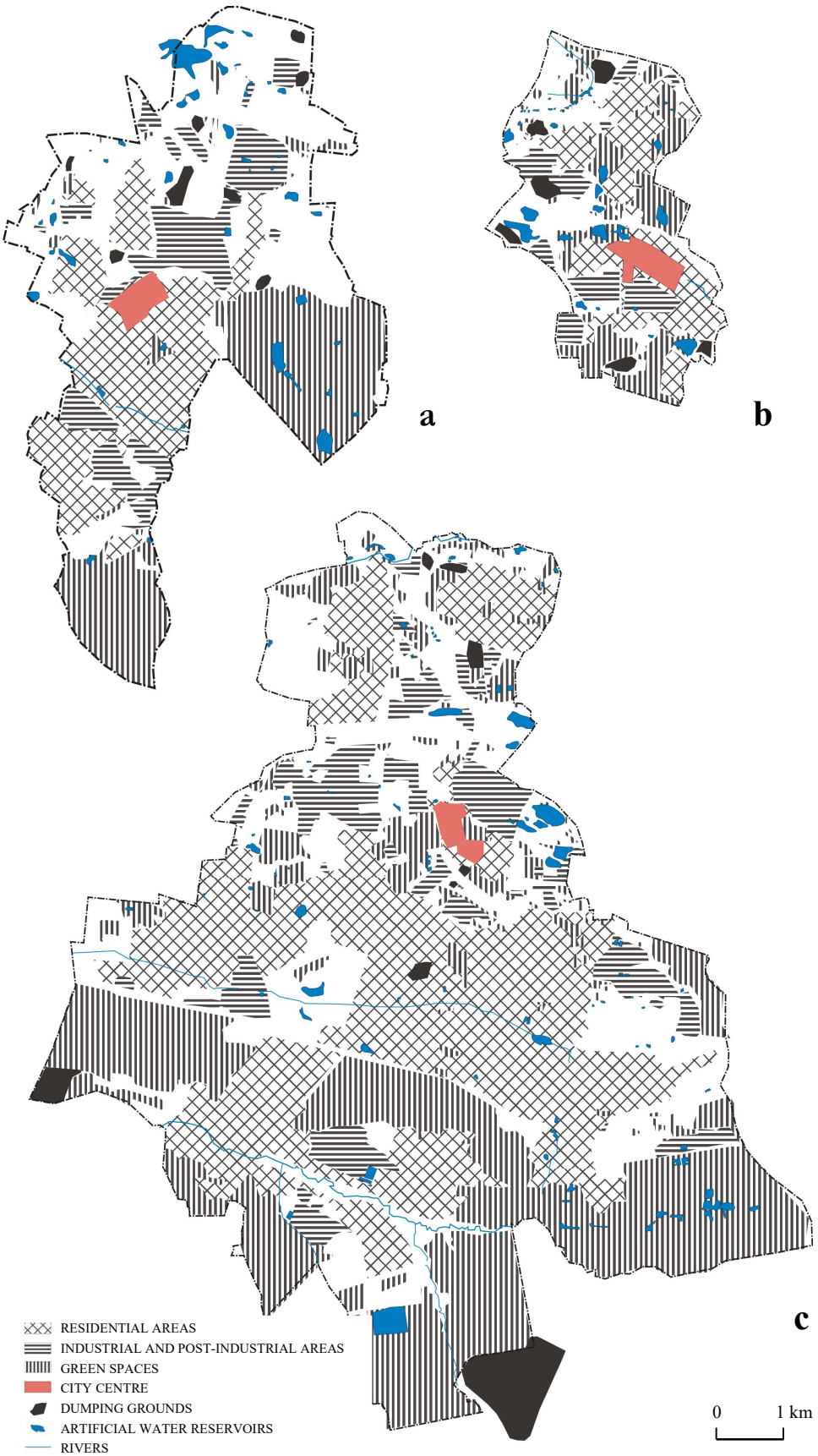

Fig. 78. Dumping grounds, artificial water reservoirs, and rivers against the structure of selected cities in the Upper Silesian Agglomeration: a – Chorzów, b – Świętochłowice, c – Ruda Śląska; author's elaboration

The manner in which land is reclaimed and redeveloped depends on the degree of its degradation, the type of its specific element, and its ultimate use, as intended. The adaptability of individual anthropogenic landforms are largely determined by certain technical aspects: characteristics of the physical structure, chemical composition of soil, hydrogeological conditions, topography, size of the area assumed to be reclaimed, and intended land use. Some other factors worth mentioning in this respect are: technological capabilities, organisation and management of the entire process, political circumstances, social demand, and economic background. The transformation process in its entirety requires a range of research and information, legal, organisational and financial, educational, as well as marketing instruments to be employed. In their efforts, urban planners and spatial planning consultants need to work closely with specialists representing diverse scientific disciplines: ecologists, biologists, hydrologists, geomorphologists, structural engineers, communication experts, and sociologists. What also matters is the cooperation of all stakeholders: regional authorities, local authorities, institutions, as well as specialised construction and engineering companies. Individual stages of the process should be presented and discussed at public meetings with city dwellers as the potential users of the transformed sites. The measures to be undertaken should correspond to the inhabitants' aspirations as to living in an aesthetically appealing space, contribute to raising the market value of the land, and provide grounds for seeking balance in the development of post-industrial cities and brownfields.

What matters from the potential users' point of view is the siting of individual elements, their surface area, accessibility, linking with the urban fabric, the existing infrastructure, as well as the cultural and natural qualities of adjacent sites. It is also important to be able to draw benefits from the use of land, to make the most of the qualities at hand, and to create new values which, when combined with technical capabilities, are decisive of the integration of individual forms into the functional and spatial structure of urbanised areas and the natural system. It also depends on the ingenuity of those involved in the process whether a given mine working or dump site will be adapted for the benefit of people and the environment, or if it remains a troublesome testament to previous industrial activity.

A characteristic feature of a significant fraction of idle post-industrial land is their undeveloped character. Abandoned in this state, they await more favourable economic conditions and coherent planning efforts. Many of them are at least subject to some minimalist reclamation or revegetation measures. In the case of dumping grounds, the former may consist in preserving them as they are, which sometimes proves to be the most technically and economically sound solution. Some of the most typical procedures applied to this end include surface levelling[45], land covering with a protective biological layer of fertile soil, and vegetation planting.[46] When thus prepared, former dumping grounds provide a land reserve for future developments. Keeping them investment-ready, as they are commonly referred to, may be due to a lack of demand for a given site, lack of funds for its development, or simply lack of a planning concept. Leaving a piece of land idle, its attractiveness being mainly attributable to its advantageous location within the city structure, can also constitute a means of increasing its value.

[45] Mining waste, i.e. waste rock, tailings, as well as soil and dirt from excavations, waste from construction, repair, and demolition of building and road structures, is used for landscaping.

[46] In such cases, the base of the vegetation cover is typically provided by grass, which rather quickly forms dense sod to prevent dusting from waste, stabilise the surface layer of spoil heaps, and eventually yield a quick visual effect.

Among the potential modes of brownfield transformation, two types of measures stand out as particularly relevant to the urban landscape transformation process. They aim at:

- **restoring natural qualities**, intended to enable restoration of the balance and vitality of urbanised areas, placing emphasis on recreation and leisure, creating areas of intensive public life, and stimulating tourism;
- **searching for elements decisive of cultural identity**, making it possible to create a setting in which the past – reflecting the very essence of the industrial city or region – and the present – emphasising the identity and the scenic character of a given place – can be confronted.

Both these modes make it possible to utilise the qualities of the natural elements comprising the areas degraded by industrial activity. Not only do they enable transformation and adaptation of the urban features or complexes accompanying the industry, but they offer an opportunity to preserve the cultural and natural heritage, and to shape a new landscape of urbanised areas.

What can also be noticed in the process of transformation of industrial brownfields is a pursuit of their **economic utilisation**. Considering the existing possibilities of using degraded natural elements, and leaving aside the frequent land revegetation for forestry purposes (productive forests) as well as for agricultural purposes (the latter being marginal at the moment), the most common activity considered cost-effective by the municipalities where these elements can be found is dismantling dumps in order to reclaim the mining waste originally stored there. To this end, earthwork, engineering, or hydro-engineering techniques are employed[47]. Dumps and heaps can perform energy-related functions. There are wind farms installed on some of them, partially satisfying the electricity demand of local communities. On others, energy crops, such as willow, Jerusalem artichoke, or silvergrass (miscanthus) are planted, later to be used as energy feedstock to heat nearby buildings or for research purposes. Dumping grounds can function as sources of heat, but in order to use them one must first install oxygenation and degassing systems as well as suitable heat exchangers. The energy thus obtained can be consumed to heat residential premises or greenhouses to increase the productivity of vegetable farming. Thermal energy from large dumps can also be used on a temporary basis to freeze the ice rinks or artificial toboggan runs built on their slopes. Post-mining pits are frequently utilised for storage of production waste. Those which are converted into artificial water bodies, besides performing the recreational function, serve as drinking water reservoirs or are used for purposes of water regime control, flood defences, wastewater treatment, as well as farming of fish and other aqueous species.

However, the economic rationale behind the brownfield transformation process considered in the context of nature is of lesser importance in terms of landscape renewal. This mode of operation should be considered along with the possibility of utilising the built environment elements inherent in the degraded areas. This entails adapting disused

[47] The material extracted from dumping grounds is used, among other purposes, for construction of roads, embankments, and railway sleepers; dykes for water reservoirs, rivers, and settling ponds; engineering structures for landfills and storage facilities; and as a filtering agent in sewage treatment plants. Part of the material is utilised for the reconstruction and reclamation of degraded areas, e.g. pits and sinkholes, as well as a resource for the production of construction materials (powder for bituminous masses, cement, technical chalk, ceramic tiles, and as concrete production aggregate), lime and magnesium fertilisers, and glass. One of the methods of reclamation of dumps consists in developing engineering forms using waste rock from the extraction of coal deposits (railway embankments, backfilling of subsidence troughs, road construction). This represents deliberate landscape remodelling, which is necessary in areas where several mines are in operation at the same time and the mining activity is performed at a large scale.

buildings, siting retail or catering services, acquiring low-cost land which can be allocated for residential, office, or educational functions, establishing business incubators and municipal infrastructure[48]. Nevertheless, when addressed from such a perspective, this problem exceeds the thematic scope of this publication.

RESTORATION OF NATURAL QUALITIES

Activities aimed at transformation of degraded elements of the natural environment are based on restoring their natural qualities, replenishing urban greenery systems, shaping the landscape identity, as well as creating urban and regional ecological systems. These measures are particularly important where processes of spontaneous restoration of natural structures have contributed to the emergence of new aesthetic, cultural, and natural qualities.

Creating an adequate and sustainable ecosystem on degraded land entails the need to improve the existing habitat conditions in order to facilitate spontaneous succession, or to promote conditions enabling acceleration of the development of new plant communities or their restoration. The biological processes taking place spontaneously on degraded sites are characteristic in that an abundance of species emerge there, including rare fauna and flora at risk of extinction in adjacent areas[49]. Once enriched with vegetation, the degraded elements often lose their original industrial character and create permanent enclaves of greenery on urbanised land. By that means, they contribute to the development of new natural and landscape qualities.

Dumping grounds represent a special case in this context. According to Adam Rostański[50], having been re-developed, they can become secondary habitats (substitutes for natural and semi-natural biocoenoses at risk of eutrophication), part of urban greenery (woods and groves), *wild life* refuges (especially in highly urbanised places), and components of the ecological system of post-industrial urban areas. On the one hand, such an approach has a positive effect on the landscape, and on the other hand, it enables a relative balance to be attained in the environment. The natural value of these landforms manifests itself in their biodiversity (rare and endangered species), newly formed and highly specific ecological systems, landscape values, or the opportunity to observe interesting biological (microevolutionary) processes which they provide. Consequently, they can be used for teaching purposes and for environmental or geological studies, or become documentation sites and cultural features of historic importance as monuments to the heritage of post-industrial cities or agglomerations.

[48] Krzysztof Gasidlo analyses the possibilities of economic use of industrial brownfields in detail (Gasidlo K. 1998, op. cit., pp. 99–122).
[49] Rostański A. 2006, op. cit., p. 19.
[50] Rostański A. 1996, op. cit., p. 260.

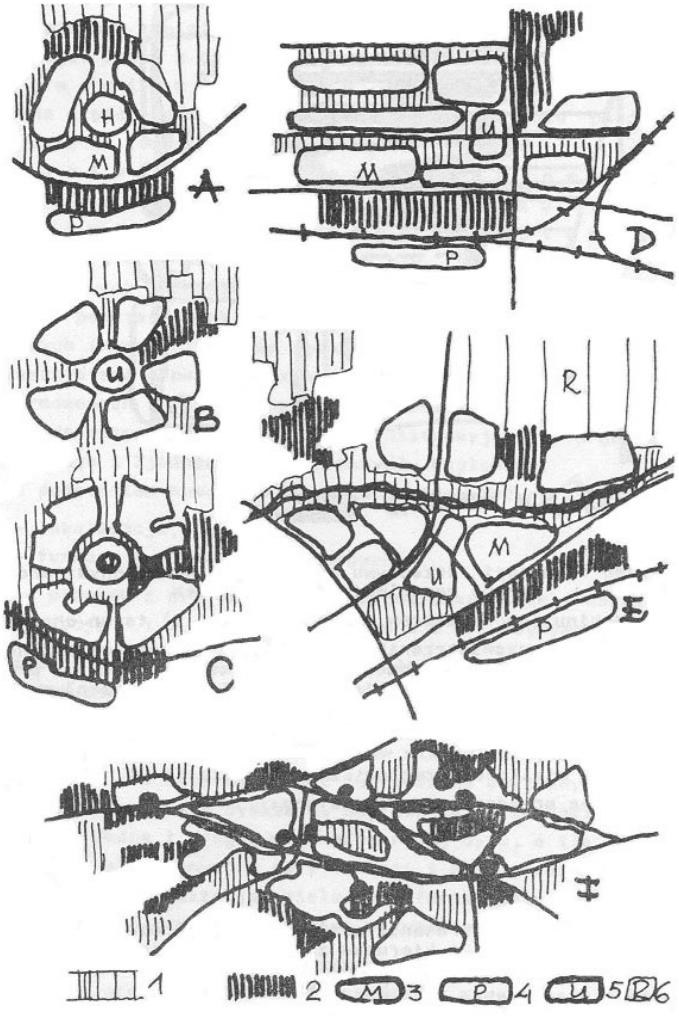

Fig. 79. Options of using dumps and heaps to develop (supplement and shape) greenery systems – examples of agglomeration greenery systems (A, B, C, D, E):
1) existing greenery, 2) dumping grounds, 3) residential areas, 4) industrial areas, 5) services, 6) farmland; prepared by Janina Klemens, 1985.

The most popular and cost-effective way to manage degraded areas is using methods which accelerate natural succession. Although these are long-term processes, they do not require high capital expenditure, and the plants that spontaneously colonise these areas form a permanent cover. It takes up to several decades for a forest community to develop spontaneously on dumps or in pits, but this kind of vegetation is best adapted to thriving in such an environment[51].

[51] In Poland, the largest sites reclaimed for forestry purposes were the external dumping grounds of the lignite mines of Adamów, where about 790 ha were recultivated, Konin – with approx. 790 ha, and Turów – with more than 1,400 ha reclaimed. Ultimately, the land reclamation status at the Belchatów lignite mine (BOT KWB Belchatów S.A.), measured by the ratio of the area reclaimed for forestry to the area taken away from forestry, is 1:1.3 (Uberman R., Ostręga A. 2004, op. cit., p. 86). In order for the development for forestry purposes to be fully effective, several generations of the main components of the tree stand need to be replaced, while the undergrowth and undercoat stabilisation takes equally long time, which may come to as much as several hundred years (Rostański A. 2006, op. cit., p. 127).

The natural environment elements which have been degraded through industrial activity can be converted into **natural succession parks** (areas greened by methods which accelerate spontaneous succession), as Krzysztof Rostański calls them. The measures undertaken to this end require informed and deliberate shaping of land surface, introducing centres of dispersion functioning as origins of plant spreading, putting emphasis on the artistic and aesthetic effect. They are characterised by low recreational capacity, low development and maintenance costs, and high resistance to vandalism[52].

The reclamation trend least frequently followed for ecological as well as socio-economic reasons is the conversion of industrial brownfields into land intended for agricultural use. In most cases, the rationale behind this mode of development is undermined by sanitary requirements and ecotoxicological risks, but also by the fact that there is an abundance of existing uncultivated agricultural land. However, dumps or pits can be pre-treated in such a manner that cereal, fruit trees, or energy crops can be planted on them[53]. Still, this mode of development is favoured only in a few specific cases, especially at large-area dumps and pits formed on the premises of former lignite mines[54].

When subject to the natural succession process, in many cases, human-degraded elements of the natural environment are covered by legal protection. This is particularly important in cases where one of the priorities of nature conservation in urbanised areas is the preservation of biotic diversity which involves protection of natural heritage. They are valuable for numerous reasons, including the capacity to co-create and complement systems of protected areas or open spaces, or to be included in the natural and cultural fabric of cities and agglomerations. At the core of this form of protection is also the ability to make use of the qualities thus acquired for human needs.

In England's Black Country region, being an agglomerations with a long mining tradition, one of the most well-known degraded sites subject to legal protection is the depleted Wren's Nest limestone quarry in Dudley near Birmingham. In 1956, it received the *national nature reserve* status (*Wren's Nest National Nature Reserve*). Many other sites have also been converted into local nature reserves. Some have been designated as *sites of special scientific interest* (SSSI). The lowest rank in the hierarchy of protection forms is that of *urban nature parks*. The first of them was established in London in 1977, on the premises of derelict docks on the Thames[55].

[52] Rostański K. 2003. *Sukcesja naturalna jako sposób na zagospodarowanie terenów poprzemysłowych* (Natural succession as the path towards industrial brownfield development). In: *Kształtowanie krajobrazu terenów poeksploatacyjnych w górnictwie* (Landscaping of post-mining areas), proceedings of an international scientific conference, AGH University of Science and Technology, Krakow University of Technology, Krakow, pp. 145–153.

[53] Part of the idle land available on the premises of the former Snail Beach lead ore mine in West Midlands (England) has been reclaimed for agricultural functions. Following the implementation of a special methodology to immobilise heavy metals in the ground, they are now used as pasture land (Rostański A. 2000, p. 83).

[54] Some dumping grounds of lignite mines in Poland have been prepared for agricultural activity (approx. 400 ha of land were recultivated for agriculture at the Konin mine: on top of cereals and energy crops, fruit trees (apple, pear, apricot) and flowers (roses) were planted). However, the soil impoverishment on mine premises and the change in the economic and social conditions associated with the political transformation meant that, in many cases, agricultural reclamation was abandoned to the extent previously planned.

[55] Tokarska-Guzik B. 1996a. *Możliwości przyrodniczego zagospodarowania nieużytków miejskich i poprzemysłowych na przykładzie aglomeracji katowickiej* (Options for the development of idle municipal and post-industrial land for natural purposes – the Katowice Aglomeration case). In: *Gospodarka terenami zniszczonymi działalnością człowieka* (Economy of areas degraded by human activity), Institute of Environmental Engineering Fundamentals of the Polish Academy of Sciences, Zabrze, pp. 345–350.

In the city of Brno, the Rose Quarry (*Růžénin Lom*), operated in the first half of the 20th century and then left exposed to the effects of nature (wind and water) for a long time, became a habitat for many endangered and protected plant and animal species, as well as a favourite place for family trips for the inhabitants of the city and its vicinity (located 4.5 km from the city centre). It is currently a part of the Velká Klajdovka Protected Landscape Area.

In the industrial area of Wallonia in the Ardennes, on the border between Belgium and Germany, numerous former zinc and lead ore mining pits were placed under local ecological protection (*protected calamine area*) in the North Eifel Nature Park in the second half of the 20th century.

In North Rhine-Westphalia, also in the second half of the 20th century, calamine pits were converted into nature reserves (*Naturschutz-Gebiet, NSG*) under the governmental framework concept of nature conservation[56].

In the Upper Silesian Agglomeration, one of the first sites of anthropogenic origin covered by legal protection, i.e. designated as a nature and landscape complex, was a set of ponds developed on the premises of the former frac sand pits in Szopienice-Borki, commonly referred to as the Szopienice Lake District (area of approx. 200 ha)[57]. However, not until the year 2000 had it been officially under protection. A copybook showcase of conservation is the nature and landscape complex of Żabie Doły, established in 1997 on the border of Bytom, Chorzów, and Piekary Śląskie. It is a distinctive and unique complex of anthropogenic ponds, pits, and post-industrial heaps, which had developed as an outcome of zinc and lead ore mining operations. With an area of approx. 226 hectares, it accommodates natural and semi-natural habitats as well as breeding and dwelling grounds for many amphibian and bird species[58].

Fig. 80. Żabie Doły complex in Bytom; photograph by A. Pancewicz

[56] Rostański A. 2006, op. cit., p. 132.

[57] Tokarska-Guzik B. 2002. *Walory przyrodnicze województwa śląskiego - stan, zagrożenia i perspektywy ochrony* (Natural qualities of Silesian Voivodeship – current status, threats, and protection prospects). In: *Krajobraz jako wizerunek tożsamości regionalnej – zagrożenia, ochrona i kształtowanie* (Landscape as the image of regional identity – threats, protection, and creation), IV Landscaping Forum – Bulletin, no. 40, Katowice, p. 46.

[58] Ledwoń K., Imielski M., Koj A. 1999. *Charakterystyka zespołu przyrodniczego Żabie Doły* (Characteristics of the Żabie Doły natural complex). In:] *Aura*, no. 3, pp. 30–31; Tokarska-Guzik A., Rostański A. 1996. *Zapadliska górnicze w aglomeracji katowickiej. Ich znaczenie i możliwości zagospodarowania* (Post-mining sinkholes in the Katowice Agglomeration – their relevance and development options). In: *Gospodarka terenami zniszczonymi działalnością człowieka* (Economy of areas degraded by human activity), Institute of Environmental Engineering Fundamentals of the Polish Academy of Sciences, Zabrze, pp. 147–149.

Nevertheless, undertaking nature conservation measures must not be limited to a mere formal process. Specific modes of legal protection need to be implemented in parallel to a complementary planning process which should result in choosing an adequate land use form, rendering a given site accessible, and linking it with the surrounding urban fabric. What it also entails is that every area under transformation should be addressed individually, and that one should seek to strike a balance between the protection of natural resources and the capacity to use them.

Development for natural and recreational purposes. On account of its positive public perception, the most attractive measure, yet at the same time, the most capital-intensive one, especially in the initial phase of transformation, is the conversion of degraded elements of the natural environment into new greenery sites. Nowadays, one can observe a new generation of sustainable urban and landscape parks, most of which are developed in post-industrial areas, often affected by unemployment and in need of profound structural changes[59]. Their siting is a direct consequence of the lack of free space inside the city. It is also becoming a response to the problems of growing cities and agglomerations concerning land maintenance and reclamation, as well as finding new functions for post-military, post-shipyard, or post-railway brownfield sites[60]. When subjected to deliberate development activities or to either spontaneous or initiated natural succession processes, these areas can become specific means of complementing the natural systems of post-industrial cities and agglomerations. They make use of completely new natural habitats, adapted to local conditions, which accommodate rare and protected plant and animal species. Linking urban greenery with suburban open spaces, they create spatial, scenic, and landscape bonds which ensure continuity and harmony of natural systems. What they become may be seen as *green islands* amidst intensively developed territories.

> **In London**, a park commonly referred to as a *green mile in the city centre* (Mile End Park) was established in 2000 on the premises of former riverside industrial sites. It forms a long green ecological corridor (30 hectares in area), stretching along Regent's Canal, from Victoria Park to Limehouse Basin on the Thames.
> **In Milan**, in the late 20th and early 21st century, many new urban green spaces were developed on degraded brownfield and riverside areas. Particularly noteworthy are the projects by Andreas Kipar and Giovanni Sala, including the Bicocca municipal park, established on 29 hectares of former Pirelli manufacturing plant, the PRU Leoni culture park with an area of 16 hectares, developed on the grounds formerly occupied by the OM Scalo Romana T.I.B.B. factory, the PRU Rubatiino municipal park, sited on the premises of the former Innocenti-Maserati factory on the river Lambro, next to the city ring road, as well as the Borgoverde park on the banks of the Martesana[61].

[59] Some of the earliest examples of how degraded land could be utilised for purposes of nature and recreation were English parks, including the park developed on a shale heap in Wolverhampton (1846), the park created on a slag and ash heap in Willenhall (1920), or a widely acclaimed nature monument – the recreation site in the county of Dudley established on coal spoil heaps. The most numerous attempts to reclaim and reuse degraded land for nature and recreation were made over the last years of the 20th century (Nord-Pas-de Calais, the Ruhr).

[60] Among the contemporary parks established on reclaimed land, the following clearly stand out: parks developed on post-mining sites (Nordsternpark in Gelsenkirchen), former steelworks premises (Duisburg-Nord Landscape Park in Duisburg), former storage sites (Parc Bercy in Paris), post-port sites (Thames Barrier Park in London), post-railway sites (Natur-Park Schöneberger in Berlin), post-military sites (Elbauenpark in Magdeburg), at transport routes and junctions (Jardin Atlantique in Paris), on urban wasteland (Natur-Park Schöneberger Südgelände in Berlin), and some others.

[61] www.landsrl.com [accessed on 2011].

Fig. 81. Bicocca, Milan, designed by A. Kipar and G. Sala

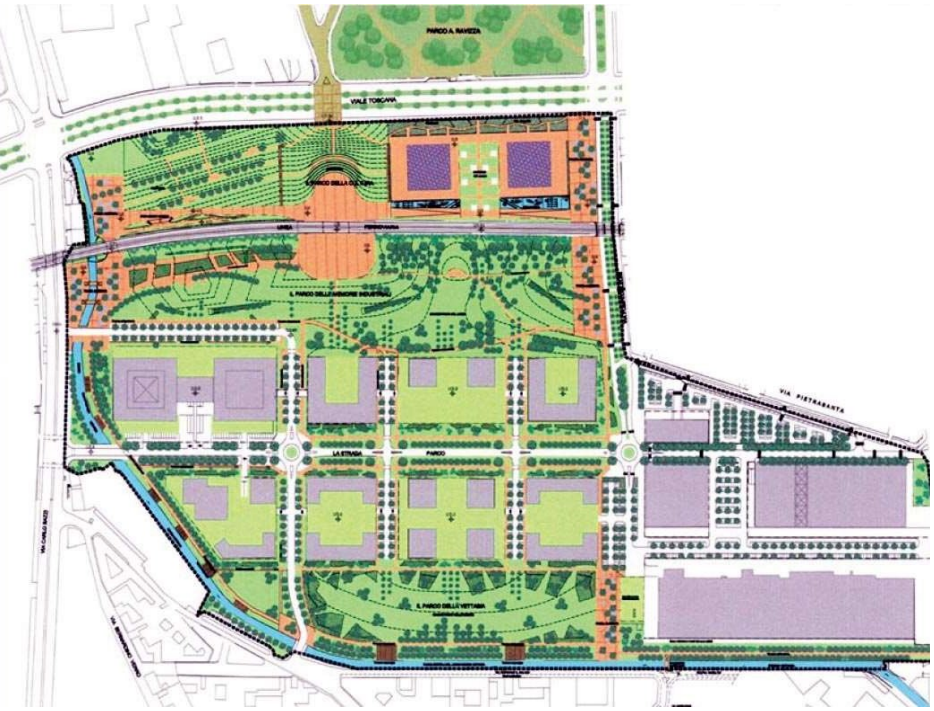

Fig. 82. PRU Leoni, Milan, designed by A. Kipar and G. Sala

Fig. 83. PRU Rubattino, Milan, designed by A. Kipar and G. Sala

Some of the degraded areas, converted into amusement parks, botanical or geological gardens, offer inhabitants a range of leisure activities in contact with nature. These projects have made their fair share of contribution to the development of the local economy, raised the level of entrepreneurship in the communities neighbouring on the park, initiated development of tourism services and infrastructure, and influenced the increase in the value of adjacent areas.

In Germany, many degraded sites have been redeveloped for leisure and entertainment functions. These include the amusement parks of Phantasialand (1967) near Brühl or CentrOpark (1996) in Oberhausen, built on former mine workings. In Rinteln, a culture park (*Steinzeichen Steinbergen*) was developed in 2000 on the site of a partially reclaimed and partly operational quarry, while the town of Münchenhagen saw the inauguration of an open-air dinosaur museum (*Dinosaurier Freichtmuseum*) in 1991. Further notable German examples of this kind include a former mining pit in Bochum, placed under legal protection in 1962 and converted into a geological garden 10 years later, as well as an open pit in Osnabrück, where an academic botanical garden was established after the limestone extraction had been discontinued.

Diverse anthropogenic landforms, incorporated into planning assumptions, and often intentionally shaped or landscaped, are inherent in new green spaces of urbanised industrial brownfields. Reclaimed waste dumps, pits, or artificial water reservoirs, featuring networks of foot, cycle, or bridle paths, evolve into the nuclei of compositional systems in the making. Such measures are undertaken at a local urban scale, where individual elements become part of park sites, as well as a regional scale, where – once combined into compositional systems – they become part of the region's spatial, functional, and landscape structure.

In London, the business estate of Stockley Park was established in 1985 on the premises of a former gravel mine, used as a landfill site. The terrain was deliberately profiled to enrich the local landscape with hills, valleys, ponds, groves, golf course lawns, horse riding trails, and spaces for sports. Waste material was utilised to form the area, only to be covered with gravel and specially prepared soil. A distinctive feature of this park is the artificial water reservoirs developed in the former clay extraction pits, fed with rainwater from roofs, roads, and car parks[62].

The local landscape of Nordsternpark (1997) **in Gelsenkirchen** is inextricably linked with its pyramid-shaped heap. Designed by Dani Karavan and Ulrich Humpert for the 1997 BUGA horticulture show (*Bundesgartenschau*), it is covered with diverse vegetation, functioning as a viewpoint overlooking the transformed post-industrial landscape[63].

On a territory of approx. 1,000 ha **south of Leipzig** that once belonged to the Zwenkau/Cospuden mine, the Cospuden landscape park was established in 2000. Its fundamental components are the successional vegetation and two artificial water reservoirs: Cospudener See and Kulkwitzer See. Water parks and well-equipped tourist infrastructure were developed on their banks. The complex is interconnected by a network of foot, cycle, and bridle paths. The park's other advantage is its siting in the ecological corridor linking the city centre with its southern fringes[64].

[62] Gasidlo K. 1998, op. cit., pp. 111–113.

[63] Drapella-Hermansdorfer A. *Rehabilitacja pejzażu przemysłowego – ratunek czy odroczenie wyroku?* (Rehabilitation of post-industrial landscape – actual rescue or mere respite?). In: Drapella-Hermansdorfer A. (ed) 2000, op. cit., pp. 12–13.

[64] Drapella-Hermansdorfer A. *Rehabilitacja pejzażu przemysłowego – ratunek czy odroczenie wyroku?* (Rehabilitation of post-industrial landscape – actual rescue or mere respite?). In: Drapella-Hermansdorfer A. (ed) 2000, op. cit., pp. 4–6.

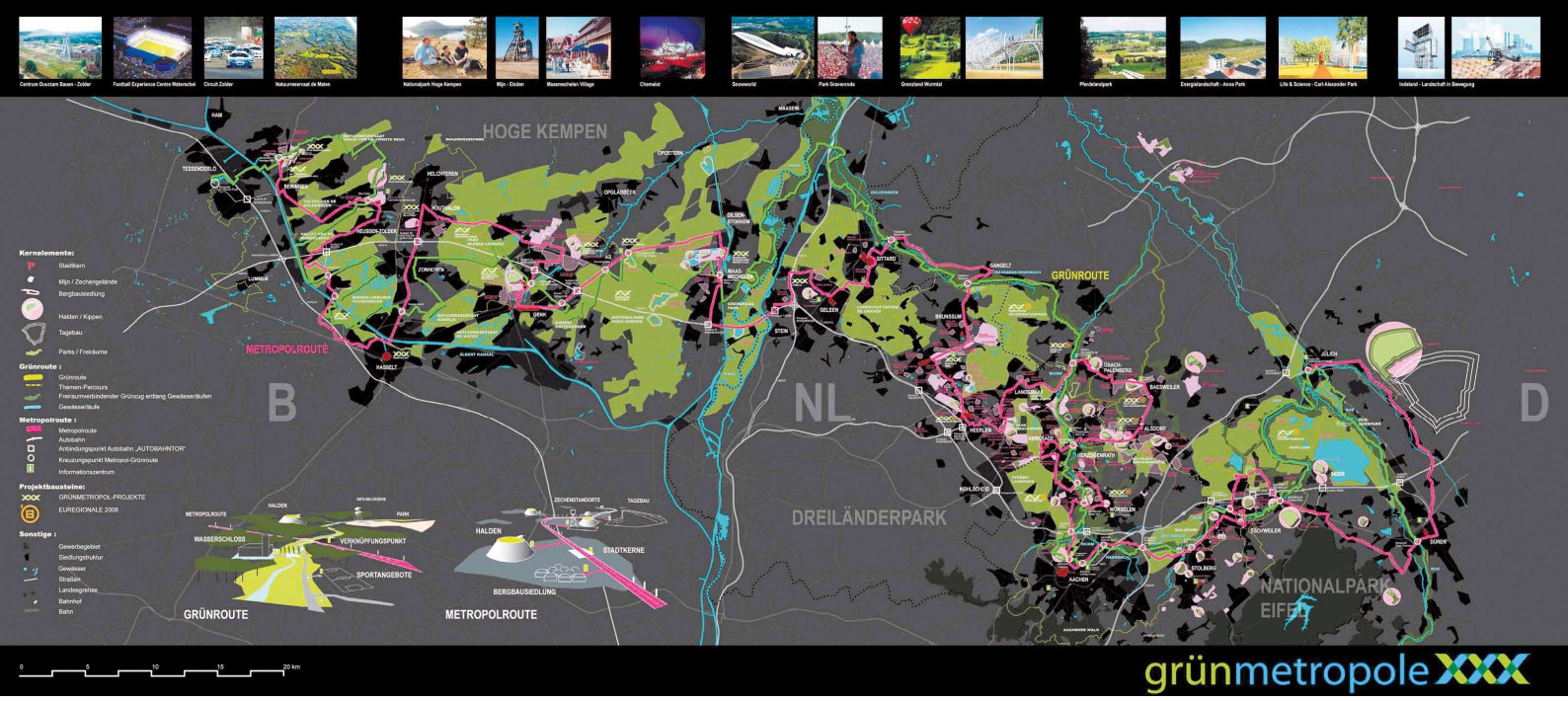

Fig. 84. The *Green Metropolis* regional development plan for the Aachen/Maastricht/Liege region, 2004.

Fig. 86. Municipal park in Bieruń Nowy; photograph by A. Pancewicz

Fig. 85. Colpodean park near Leipzig; photograph by K. Rostański

Fig. 87. Nordsternpark, Gelsenkirchen; photograph by K. Rostański

In Bieruń Nowy, biologically rehabilitated waste rock dumps became elements of the local municipal park (1994). The park's main designers: Janusz Bogdanowski and Zbigniew Myczkowski, along with the co-designers formed them into stepped mounds with paths spirally climbing to their tops. Covered with a layer of soil, grass, and hedges forming geometrical spirals along the paths, the mounds are open to strollers and cyclists. For a better landscaping effect, the rock masses were partly moved to restore the ponds that once existed in this area and to ensure passability of the nearby creek. However, achieving the original intent proved to be problematic. Maintaining plants on such unfavourable ground turned out to be difficult, which ultimately undermined the concept of using the dumps for recreational purposes[65].

In the Aachen/Maastricht/Liege area (Meuse–Rhine Euroregion), a regional development plan known as the *Green Metropolis* (*Grünmetropole*) was conceived under the EuRegionale 2008 programme. Its main premise was to establish a regional structure with a system of two overlapping routes to form its axis: the *Green* and the *Metropolitan* routes (*Grünroute* and *Metropolroute*), approximately 200 km in length, building the urban DNA of the *Green Metropolis*. The Metropolitan route was intended to link the centres of each town and their sites of the highest cultural importance, while the Green route was to interconnect open spaces with individual urban greenery sites. What the concept authors proposed was to use elements of the post-industrial landscape, including the partially reclaimed and redeveloped spoil heaps and former mining pits that dominated over the region's landscape. These diverse forms of post-industrial landscape were defined as key elements of its spatial composition. Stretching over 70 km, the long chain of tips, known as the tip landscape (*Haldenlandschaft*), became the compositional and functional axis of the concept. The project comprised individual tips, some situated within the city boundaries, of which may had been transformed into green spaces of considerable ecological and recreational value through natural succession. Currently, urban parks, technology parks, and innovative housing projects (*Anna Park* in Alsdorf, *Carl Alexander Park* in Baesweiler, or *Parkstadt Lumburg* and *Gangelt*) are being developed on and around the former dumping grounds. Recreation venues (e.g. *Blausteinsee*) are built around former pits which have been converted into artificial reservoirs. Owing to the EuRegionale 2008 programme, elements of the natural environment degraded by industrial activity have become some of the main factors in the region's transformation[66].

A characteristic of urban green spaces created in areas previously occupied by industry is the negligible interference with the cultural landscape. This manifests itself not only in keeping anthropogenic landforms, but also those elements of infrastructure and equipment or objects typical of industrial activity that remind us of the previous function of a given area. Combined with the green elements, they determine the character of

[65] Myczkowski Z. 2003. *Studia i aranżacje krajobrazowe wybranych obiektów poeksploatacyjnych na przykładzie parku „Wzgórz Paciorkowców" i zbiorników wodnych w Bieruniu* (Landscaping studies and compositions of selected post-indutrial facilities – the case of the Wzgórze Paciorkowców park and water reservoirs in Bieruń). In: *Kształtowanie krajobrazu terenów poeksploatacyjnych w górnictwie* (Landscaping of posft-mining sites), proceedings of an internatioanl scientific conference, AGH University of Science and Technology, Krakow University of Technology, Landscaping Section of the Committee of Urban Planning and Architecture of the Krakow Branch of the Polish Academy of Sciences, Krakow, pp. 87–97.

[66] *Masterplan Gruenmetropole. Industrielle Folgelandschaft des Nordraumes der Drei-Laender-Region* (The Grünmetropole Master Plan. Industrial landscape of the northern part of the three-state region), 2005, EuRegionale 2008, Agentur GmbH; www.gruenmetropole.de [accessed on 2011].

a place, provide testimony to its cultural heritage, and become a component of the landscape identity.

Nordsternpark in Gelsenkirchen (1998) was developed on an area of 100 ha of a former hard coal mine, on both banks of the river Emscher and the Rhine–Herne Canal. The main goal of the project was to combine recreation and leisure functions with the industrial landscape. The park was dominated by linear axes and landscape structures, as well as by areas covered by spontaneously growing vegetation. Inherent in the concept are such features as the linkage with the river and the canal, the waterfront development, and the utilisation of the distinctive mine shaft towers or concrete walls adapted for climbing[67].

The landscape park of Duisburg-Nord in the Ruhr, developed on 200 ha of industrial brownfields, is characteristic in how its anthropogenic landforms have been utilised, converted into attractive green spaces for recreation. Organised green spaces have been linked with areas subject to spontaneous natural succession, while gardens, sports areas, and playgrounds have been functionally connected with exposed elements of industrial infrastructure and industrial facilities developed anew[68].

The Polish examples of similar nature are characterised by a smaller scale of the measures undertaken. Some water-flooded pits, still having numerous elements of mining equipment left at the bottom, are rendered available for diving (e.g. open pit in Jaworzno, Zakrzówek quarry in Krakow). Open-air museums and ecomuseums are established on premises of former industrial facilities to display certain elements of infrastructure, equipment, and installations that once served production purposes against the natural landscape (e.g. ecomuseums of the Kamienna river valley in Starachowice (2001) or the Dymarki in Tarchalice (2005)). Many of them stretch along routes known as *greenways*.

A role model agglomeration where numerous efforts are made to create a new quality of public space, harmonise the urban greenery system, develop strip-shaped green corridors, and make use of the available degraded sites for recreation is Paris. Since the late 1970's, Paris has been a witness to a process of renewal of natural structures, predominantly based on reclamation of brownfields, former storage facilities, and stretches of former rail tracks (Parc de la Villette, Parc André Citroën, Parc de Bercy, Promenade Plantee, Bastille-Bois de Vinncennes, and many others).

Parc de la Villette, designed by Bernard Tchumi, was developed in 1984–1987 on the premises of former slaughterhouses. Its hallmarks are monumental public utility buildings of educational and cultural functions, as well as elements of technological and industrial nature, clearly inspired by deconstructivism and conceptualism. Tchumi followed in the footsteps of Jacques Derrida, adopting postmodern philosophy as the foundation of his concept. He was concerned solely with the form, having assumed that the function would follow. The need for contact with nature, being the very essence of such spaces, was somewhat pushed to the margin, while the forms of leisure associated with nature were less attractive compared to the functions

[67] *International Building Exhibition Emscher Park. The projects 10 years later*, 2008, Fachgebiet Stadtebau, Stadtgestaltung und Bauteitplanung, Fakultat Raumplanung, TU Dortmund, Essen, pp. 40–41.
[68] Ibid., pp. 32–35.

the facilities would perform. Greenery was subordinated to the overall layout.

The Citroën Park (1990–1992), designed by Alain Provost and Gilles Clément[69], was developed on 13 ha of former car factory. Thanks to the technologically advanced materials used, simple geometric arrangements, and compositional links with the river, alluding to the French tradition of garden art, this park has become a public space landmark and a centre for a new neighbourhood established on reclaimed degraded land.

Parc de Bercy (1993–1997) was developed according the concept by Ian Le Caisne and Philippe Raguin[70] on the premises of a former wine storage facility on the river Seine. Its spatial form is very innovative, based on the identity of the place and respect for the existing natural and cultural assets. Both the Citroën Park and Parc de Bercy were developed as part of a comprehensive effort to render the riverside area accessible and to combine it with the spatial whole (system of terraces, paths, and vantage points). They also seamlessly blend into the historic system of parks and gardens sited on the river banks (Botanical Garden, Tuileries Garden, the gardens of Les Invalides, Champs de Mars)[71].

Development for sports and leisure purposes. Conversion of degraded areas for recreational and natural purposes is often combined with their sports function. The main rationale behind the development of individual anthropogenic forms is to create a base for different types of activity, taking both the social demand and individual characteristics of individual elements of the natural environment into account. Former mining pits, spoil heaps, or water features are becoming parts of larger sports and leisure compounds. They can feature swimming pools, specific sports facilities, strolling areas, cycle paths, or even ski slopes. It is also common that they are used for extreme sports, including for off-road car rallies, or as motocross and extreme cycling tracks (freeride, slopestyle, dirt jumping, downhill)[72].

In London, within the boundaries of a brownfield site in the valley of the river Lee, a 42 km long strip of urban greenery, known as the Lee Valley Regional Park, was designed and developed in 1967 with sports and recreation facilities (cf. Chapter 3).

In Bottrop, Germany, a ski centre (*Alpincenter*) was completed in 2001 on an industrial waste heap. Built into the heap slope, the venue comprises a 640 m long and 30 m wide piste ready to be used all year round.

In Bytom, the sports centre known as *Dolomity Sportowa Dolina* (2001–2002) was embedded in the anthropogenically diversified landscape modelled on the original German concepts. Its sports facilities, including year-round ski runs, a winter play park, and a toboggan run, were developed by converting spoil heaps intentionally piled for that purpose.

[69] The park concept was brought by the collaboration of several architects: Patrick Berger, Jean-François Jodry, and Jean-Paul Viguier.

[70] The park was designed by a group of architects: Bernard Huet, Madeleine Ferrand, Jean-Pierre Feugas, and Bernard Leroy.

[71] Barzilay M., Hayward C., Lambard-Valentino L. 1984, *L'invantion du parc, Graphite - Establissement public du parc de La Villette,* Paris; Micheloni P., Grillet T. 1993, *L'Atelier Parisien d'Urbanisme, Pavilon de L'Arsenal*, Paris Project no. 30/31, Paris; Cortesi I. 2000, *Il parco pubblico. Paesaggi 1985-2000*, Federoco Motta Editore, Milan, passim.

[72] In the 1950's, motocross trails of 1,750 m in length were developed on one of Zabrze's dumping grounds from the late 19th and early 20th century. It was the venue for European championship qualifying races, which attracted around 60,000 fans. One of Walbrzych's spoil heaps still hosts an annual rally of the Polish Off-Road Championships, regarded as one of the toughest of its kind in country.

Fig. 88. Dolomity Sportowa Dolina in Bytom; photograph by A. Pancewicz

Fig. 89. Skihalle in Bottrop

These features complemented the numerous nearby cycle paths, as well as running and walking trails, significantly diversified in terrain and difficulty level[73]. **In Sosnowiec**, four ski runs were created on an artificial slope as part of the *Środula Sport* project (2005–2006). Next to the sports facilities in Bytom, they have become some of the largest winter centres in the regions of Upper Silesia and Dąbrowa Górnicza Basin (*Zagłębie Dąbrowskie*). **In Bełchatów**, the sports and recreation centre of *Góra Kamieńsk* was established in 2004 on a slope of an outdoor spoil heap originally formed by the Bełchatów lignite mine, providing winter sports as well as hiking and cycling opportunities[74].

A common way to foster sports and recreation activities in urbanised areas is by utilising **artificial water reservoirs developed in post-mining pits**. Their potential lies in the opportunity to form new types of cultural landscape associated with recreation, tourism, and nature conservation. The benefits of this kind of development need to be considered in a broader sense. Converting pits into water reservoirs can be economically and environmentally efficient. The very essence of this mode of transformation is:

- site regeneration for water-related purposes;
- securing nature and landscape qualities in the surroundings (by establishing biocoenosis conservation zones);
- rendering reservoirs and their immediate surroundings available for recreation;
- ultimately, using reservoirs not only for water sports and recreation, but also for retention, flood control, and fishery management;
- developing reservoir surroundings for residential or forestry purposes.

Developed in that fashion, water reservoirs become new permanent landscape features with a positive environmental impact. If designed correctly, they can even be perceived as more attractive for water recreation than natural reservoirs[75]. Completing such development projects leads to the restoration of the original groundwater level as well as of local ecosystems. It is also accompanied by a process of renewal of the natural environment, as new habitats evolve, local nature conservation sites are established, species of flora and fauna emerge and grow in numbers. Naturalists emphasise that aquatic, marsh, and peat bog vegetation developing in artificial habitats does not differ in its composition and character from analogous communities found in natural habitats[76]. The change in the local climate improves the health conditions of these areas and creates opportunities for water sports (sailing, canoeing, windsurfing, diving) or for hiking and cycling.

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[73] This revitalisation project received an award from the Regional Fund for Environmental Protection and Water Management (WFOŚiGW) in recognition of exemplary development of post-industrial sites and an award from the Marshal of Silesian Voivodeship for creating a positive image of Silesian Voivodeship and contributing to the development of tourism in the region.

[74] The Góra Kamieńsk centre stretches on 1,480 hectares and rises to an altitude of 195 meters. The resort offers ski runs of approx. 760 and 150 m in length and three ski lifts: a 723 metre-long chairlift and two T-bar lifts (approx. 700 and 150 m). The area of the ski slope along with its infrastructure is about 10 hectares. A 620 metre-long toboggan run, a climbing wall, and bicycle trails have also been built on the slope.

[75] Kozakiewicz R. 2000, op. cit., pp. 163–174.

[76] Szwedo I. et al. 1995. *Ścieżki dydaktyczne po terenach rekultywowanych Kopalni Piasku „Szczakowa" S.A. Propozycja zajęć dydaktycznych z ekologii i odbudowy zdegradowanego środowiska* (Educational trails on the reclaimed sites of the Szczakowa sand mine. Proposed educational courses on ecology and renewal of degraded environment), Wydawnictwo Planta, Krzeszowice, passim; Jedrzejko K. 1987. *Szata roślinna w krajobrazie terenów przemysłowych Wyżyny Śląskiej* (Vegetation cover in the landscape of the Silesian Upland), proceedings of the Polish–Czechoslovakian symposium on *Problems of the industrial region of Upper Silesia and Ostrava land*, Faculty of Earth Sciences of the University of Silesia, Katowice–Sosnowiec, pp. 49–56; Czylok A. 1997. *Pionierskie zbiorowiska ze skrzypem Equisetum variegatum Schleich w wyrobiskach po eksploatacji piasku* (Pioneer vegetation patches featuring the *Equisetum variegatum Schleich* rush on deplted sand pits). In: Wika S. (ed) *Roślinność obszarów piaszczystych* (Flora of sandy land), University of Silesia – ZJPK, Katowice–Dąbrowa Górnicza, pp. 61–66.

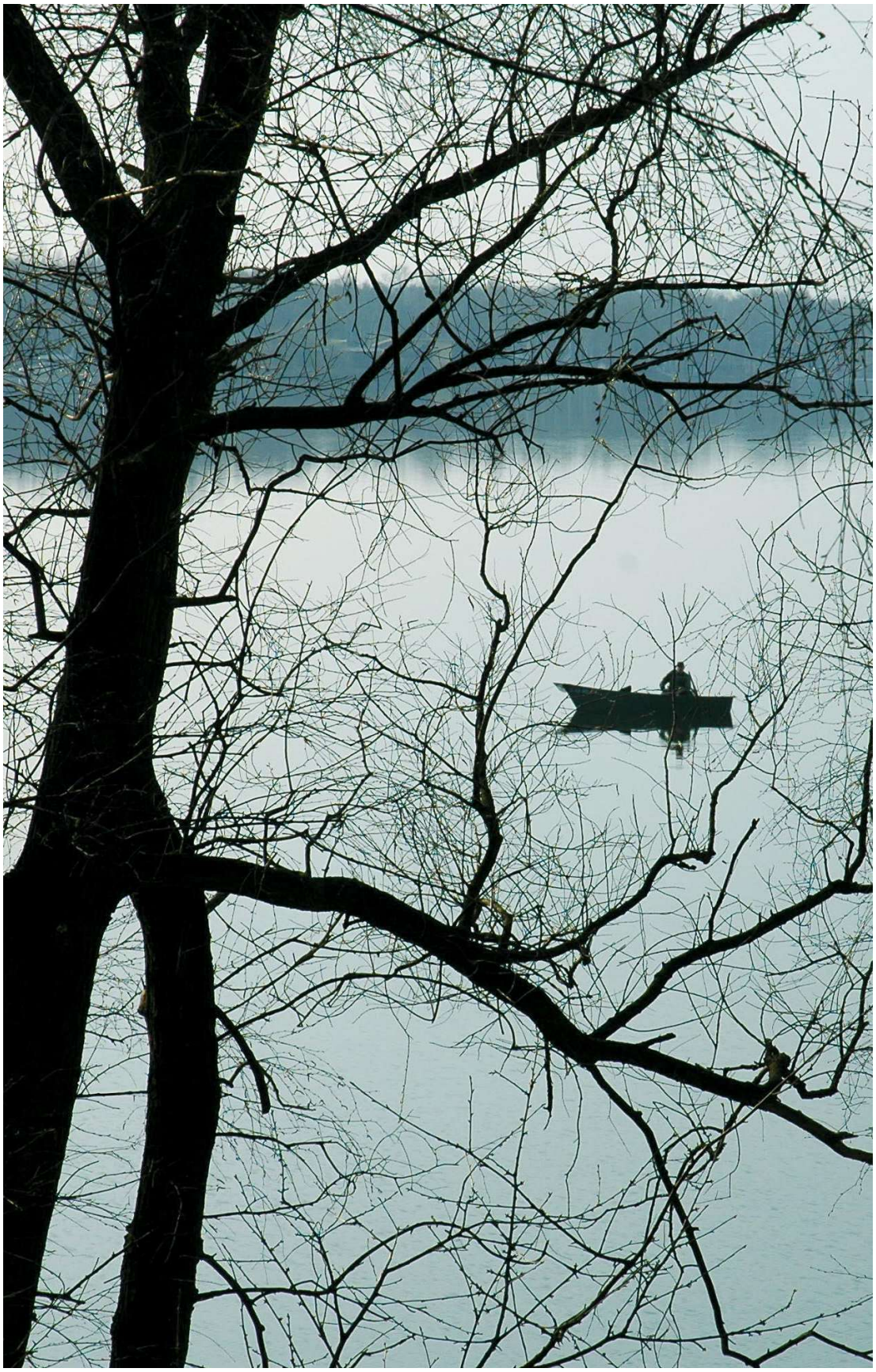

Fig. 90. Pogoria II reservoir in Dąbrowa Górnicza; photograph by A. Pancewicz

This triggers cultural transformations in the communities of post-industrial areas and drives new specialised forms of economic activity to emerge (e.g. newly established nautical shops or companies providing specialised nautical services).

The most favourable mode of development is each time determined by the specific character of a given post-mining pit and its surroundings. A decommissioned mine working usually does not meet the requirements of a water body. Therefore, it is first necessary to profile the slopes, reduce the depth, or change the geometry (shoreline irregularity, islands or peninsulas to be formed). What also proves extremely important is the capacity to quickly fill the reservoir with water. The water abstraction time can vary from several years to several decades, depending on the pit size, the number of nearby water courses, or the groundwater level. The quality of the water in the reservoir also depends on the supply sources. Even though projects of this kind may come across considerable obstacles, and the suitability of the designed water reservoir is not always reliably documented against its intended function, this mode of pit development tends to be accepted by local communities and local authorities without any criticism. It can be projected many years in advance (Rakowice) and implemented after the deposit depletion or while it is being phased out (Pogoria in Dąbrowa Górnicza), and even with some underwater mining operations continuing within a limited dedicated area (Kuźnica Warężyńska)[77].

The anthropogenic water reservoirs of the Pogoria complex in Dąbrowa Górnicza clearly stand out against the rest of the city, but also against the natural landscape of the entire Upper Silesian Agglomeration. Developed in the open pits remaining of the former sand extraction near a phased-our coal mine, they form a hydrological and ecological complex of artificial water bodies of natural and recreational importance, also known as the Dąbrowa Lake District. It consists of the following reservoirs: Pogoria I (1938–1943) with an area of 70 ha, Pogoria II (1976–1978) – 25 ha, Pogoria III (1973–1975) – 210 ha, and Pogoria IV – Kuźnica Warężyńska (2005) – 560 ha. Their total surface area is approx. 865 ha. The water in the reservoirs is categorised as class I and II of purity. Individual sections of the shoreline are under legal protection on account of their high natural qualities: stands of protected plant species and waterfowl refuges. There are numerous forest complexes and local nature conservation sites in the immediate vicinity, adding to the attractiveness of the lakes. One can find the Błędów Desert (*Pustynia Błędowska*), the Eagles' Nests Landscape Park (*Park Krajobrazowy Orlich Gniazd*), and the Jurassic Strongholds Trail (*Szlak Warowni Jurajskich*) within a radius of merely 20 km. In addition to the excellent conditions for water sports, especially sailing and rowing, as well as the proximity of a sports and entertainment arena and the NEMO water park, it is also planned that a horse racing track, a golf course, a botanical garden, and a small zoo be established on the sites surrounding the artificial reservoirs. So strongly embedded in the local natural environment, these features can add further value to the new landscape qualities already acquired.

[77] The intent behind the reclamation of the Kuźnica Warężyńska reservoir in Dąbrowa Górnicza was to enable sand mining until the documented reserves of the deposit have been depleted, to perform reclamation for hydrological and forestry purposes in areas where this was already possible, to secure natural qualities by creating biocenotic protection zones and local nature conservation sites, to render the reservoir and its immediate surroundings available for recreation by making the most of the existing transport links and the site's natural and landscape attractiveness, and to ultimately allocate the area for retention and flood control, recreation, protection of biocenotic resources, residential development, and forest management.

Among the landforms which are also developed for water-related and recreational purposes in the Upper Silesian Agglomeration one should also mention the sinkholes formed in places of underground mining of raw materials or in former clay pits, as well as post-mining overflow sites (e.g. the complexes of ponds in Tychy's district of Czułów, in Szopienice-Borki, as well as in the Millennial District (*Osiedle Tysiąclecia*) and the Valley of Three Ponds (*Dolina Trzech Stawów*) in Katowice). However, the measures undertaken in this scope require consistency in the planning process.

An example of how anthropogenic reservoirs situated at the fringes of residential areas can be used is the **Amelung project of revitalisation of former industrial ponds**, originally developed as a consequence of the Barbara coal mine operations, completed in the city of **Chorzów** in 2007. It is there that an area of 15.68 ha has been reclaimed (by removing bottom sediments, upgrading the water supply and sewage disposal system to eliminate contamination, profiling and sealing troughs, improving the terrain relief, modifying the shoreline), and the grounds in the ponds' direct vicinity have been developed for diverse purposes (by planting new vegetation, structural landscaping, building foot/cycle paths and playgrounds, and installing a new lighting system). Owing to all these endeavours as well as the advantageous location, this area has successfully become a popular recreation and leisure venue for the inhabitants of Chorzów[78]. Nevertheless, there are some issues yet to be resolved there, including poor linkage with neighbouring sites and public safety.

Fig. 91. Regenerated anthropogenic reservoirs of Amelung in Chorzów; photograph by. A. Pancewicz

[78] The project of *Revitalisation of the Amelung reservoir complex in Chorzów* won the award of the Marshal of Silesian Voivodeship in the 2008 competition for the Best Public Space in Silesian Voivodeship under the Urban Planning category for representing a model example of revitalisation of a post-industrial site and for creating a new space in the city centre that offers good conditions for recreation and relaxation to the local community and enables daily contact with nature. In 2009, it also received an award from the Society of Polish Town Planners under the category of *Revitalised Green Space – Best Developed Space in Poland.*

A testimony to the importance of the role performed by post-mining pits developed for hydrological and landscaping purposes in the process of seeking a new landscape identity is given by the variety of measures undertaken on the sites of former lignite mining operations[79]. The various solutions applied differ in terms of the pit size, the scale of the planning activities, as well as the formal, legal, economic and social conditions taken into account.

> The potential recognised in the possibility of using the Lower Lusatian post-mining pits for water- and recreation-related functions was identified by Otto Rindt as early as in the 1960's. It was his idea to create the **Lusatian Lake District** (*Lausitzer Seenkette*) analogically to the system of lakes surrounding Berlin and Potsdam. Rindt's original plans envisaged dividing the enormous Ilse mine pit into smaller fragments, developed into artificial water reservoirs, parks, and settlements. His visions were revisited under the IBA Fürst-Pückler-Land project. It brought to life a unique complex of artificial water reservoirs, linked by a system of canals, forests, and recreational areas (cf. Chapter 2). Along with the corresponding urban complexes, the *water world* of the Lusatian Lake District was intended to form a system of sites which would be attractive to both visitors to the region and its natives. The measures envisaged in this scope were not only supposed to trigger changes to the landscape at a regional and local scale, but also social and economic transformation of the entire post-industrial territory. In the 1960's, works began with a view to filling one of the open pits with water, only to convert it into contemporary Lake Senftenberger. Completed within five years, the reservoir became one of the largest artificial lakes in Europe, used for recreation and nature conservation purposes. However, its significant disadvantage was the lack of spatial and functional links with the town of Senftenberg (difficult access, no visual contact). In 2003, a vision was proposed under the EUROPAN-7 competition to develop a town connected with the lake via a canal and a harbour basin, both to be built on an area reclaimed after a housing estate had been demolished. This example clearly proves that the essence of the attractiveness of artificial water reservoirs lies in their accessibility and siting amidst the urban structure. Even the most attractive reservoir will never blend into the city fabric without functional and spatial links with the urbanised area.

New development of industry-degraded elements of the natural environment can contribute to enriching the urbanised landscape (often already highly transformed), and make it possible to protect more valuable open spaces, for instance by reducing the pressure of tourism. However, insisting on imposing a specific regeneration path or seeking to bring degraded lands back to nature no matter the costs can be a waste of resources[80].

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[79] In Poland, lignite mining pits were initially converted into water reservoirs without having explicitly identified the functions they were to perform. Over time, as they grew in size and depth, the main purpose for which they were used continued to be water-related. Development of depleted pits for hydrological functions is also envisaged for the mines still in operation, including the largest ones. Such a concept can be observed implemented in the former pits of the Adamów lignite mine in Turek (artificial water reservoirs of Bogdałów and Przykona) or in the closing pits of the Konin lignite mine (Morzysław, Niesłusz, Gosławice, Kazimierz Południe, Pątnów, and Lubstów).

[80] The reclaimed Skalny heap in Łaziska Górne has turned into a mountain covered with lush vegetation over the recent years, becoming a popular venue for family walks. At the same time, it represents extreme nuisance to the local population, as it releases gases accompanied by strong odour, i.e. sulphur dioxide and nitrogen oxide, and poses a threat of spontaneous combustion. The situation is similar in Zabrze-Biskupice, where the Ruda heap, often visited by enthusiasts of hiking and biking along wild trails leading to the decommissioned and the only preserved old quarry and

Land development solely for nature's sake seems to be unreasonable where numerous neighbouring sites of higher natural qualities are earmarked for building development. Additionally, one should ponder upon the rationale behind developing brownfield sites for recreational purposes where idle uncontaminated land is available in the vicinity. What seems to be the main problem in this respect is the capacity to create a landscape which would be perceived as *familiar* by the local population – one that would provide opportunities for recreation in ecologically, functionally, and aesthetically decent conditions.

Fig. 92. Haniel, Bottrop; photograph by RVR/Kozlowski

Fig. 93. Haniel, Bottrop; photograph by AP

the wild ponds in Zabrze, emits smoke and burns constantly. In Wiślinka, the heap of white phosphogypsum, which the town authorities intend to convert into a valuable recreational facility for residents of the Gdańsk agglomeration and tourists, is actually far from leak-tight, and contaminated effluents flow into the river Martwa Wisla as well as to groundwaters. There are many radioactive substances in the heap: phosphorite rock contains uranium, radium, and polonium, and these substances can also be found in phosphogypsum.

SEEKING CULTURAL IDENTITY

Restoration of the natural value of areas degraded by industrial activity prepares them for new features of different character to be introduced. Elements such as dumps, pits, artificial water reservoirs, or riverside areas, complementary to the functions of regenerated post-industrial sites, can also perform diverse culture-building functions. Some are incorporated into tourist routes and rendered accessible to the public, others become witnesses to the previous industrial activity and the history of post-industrial cities or agglomerations, while yet others serve as the background for various cultural events and activities.

The Haniel tip (developed in 1992–1999), situated next to the operating Prosper Haniel hard coal mine **in Bottrop, Germany**, provides space for an open forum of dialogue between art and religion. It was designed by Josef Hermanns as a blend of two overlapping spiral mounds. There is an amphitheatre on top of one of them, where theatrical performances and concerts are held. The second mound is a place of religious worship, created as a sign of the church's solidarity with the region, heavily burdened by the crisis of the mining industry. The interior of the **Hochlarmark** industrial waste heap **in Recklinghausen** (1975) was developed into an imitation of an underground mine, now holding a training centre for mining professionals (*Trainingsbergwerk der DSK*). The centre provides an opportunity to convert theoretical knowledge into practical machinery and equipment handling know-how. The artificial mine created inside the heap is also open to the public.

In Poland, the largest rock amphitheatre (7,000 seats and 23,000 standing places) was built in 1934–1936 in a disused **basalt quarry on Mount Saint Anna** in the Opole region. It is also among the largest venues of this type in Europe. Equally famous is the amphitheatre designed for 5,000 people, built in the **Kadzielnia limestone quarry in Kielce** (1971). It hosts diverse culture events (concerts, shows) intended mainly for the city dwellers. A part of the quarry has been converted into a geological reserve. The venue is an element of a system of green spaces, binding the city's valuable natural sites into a strip-shaped layout.

Numerous mineral mining workings have been transformed into cultural sites and venues. Some of them are of historical value (e.g. gravel pits next to the Treblinka penal labour camps, at the Gross Rosen granite mines in Rogoźnica, in Mauthausen-Gusen, Austria, or in Flossenbürg and Natzweiler-Struthof in Germany). Others (especially quarries) have been used to expose interesting geological phenomena or to demonstrate the land's geological cross-section, including the structure of its individual strata.

Some of the Polish cases where interesting geological phenomena had been revealed in the course of mining operations include the **basalt rose in Wilcza Góra near Złotoryja** or the abrasive surfaces in the former **Bonarka Quarry in Krakow**.

In **Krasiejów**, in the early 1980's, premises of the former silt quarry became the site of an archaeological excavation where specimens of Triassic vertebrates were discovered, including the world's only remains of a pre-dinosaur creature named *Silesaurus opolensis*. That is also where a theme park was established in 2010.

Fig. 94. Eden Project, Cornwall

Fig. 95. Kadzielnia quarry in Kielce; photograph by A. Mlynarczyk

Another interesting example of how depleted mining pits could be utilised is **the Eden Project by Nicholas Grimshaw in St Austell, Cornwall** (2001). Created on 15 ha of land degraded by 160 years of kaolin mining, it is a symbol of industrial brownfield regeneration. Large domes made of plastics have been designed on the former mine site, with subtropical and Mediterranean plants growing underneath, forming what was referred to as a botanical microcosm. The venue also accommodates a centre of research and documentation for the successful restoration projects implemented in post-mining areas. It has been conceived as a *living theatre of plants and people* whose mission is to promote understanding of the interplay between these two domains.

Development for purposes of composition, identification, and representation. It is increasingly often that degraded areas become venues of artistic activity, highlighting the character of a given place. The **Land Art trend** clearly draws on this approach, characterised by activities that have more in common with scenography, by introducing dominant spatial signs or compositional elements into the landscape. Many brownfield restructuring and reclamation programmes follow this trend, implemented at different spatial scales: both architectural and urban. Art-related activities can inspire people to look at the post-industrial landscape from a different perspective, allowing them to rediscover what seems familiar. This involves specific landscaping efforts which do not require high investment or extensive transformation. Through artistic activity (light productions, visual art objects), the landscape acquires new artistic qualities[81]. Mine workings become inspiration or a backdrop for art[82]. Huge heaps with sculptures on top, dominating over the surrounding area, visible from a distance, and additionally illuminated at night, form a system of landmarks and act as symbols. They prove particularly useful in agglomerations, where formal boundaries between towns become blurred.

In the Ruhr, unique **identification landmarks** (*Landmarken-Kunst*) were established on numerous heaps under the IBA Emscher Park project, many of which were direct references to the region's industrial past. A 50-metre-high structure with three viewing platforms (*Tetraeder*), known as the *steel crown*, installed in 1994 on the flat top of the Beckstrasse heap in Bottrop-Batenbrock, is considered one of the most important of these landmarks. The unique sculpture was designed by Wolfgang Christ, while its illumination system – by the light artist Jurgen LIT Fisher. Equally distinctive is the Schurenbach heap in Essen[83], where a 67-tonne steel sculpture entitled *Gate to the Ruhr* (*Bramme für das Ruhrgebiet*) by the American artist Richard Serra was erected on a plateau in 1998.

The flat top of the Rheinelbe dump in Gelsenkirchen hosts a sculpture placed there in 1999, at an altitude of 106 m, by Herman Progann, commonly known among the local community as the *Stairway to Heaven* (*Himmelstreppe*), composed of 30 concrete elements originally forming the foundations of the Hardenberg mine buildings. It is but one of many sculptures by this artist, who has thus transformed a post-industrial wasteland into a landscape of artistic activity.

[81] Böhm A. 2006, op. cit., pp. 203–207.

[82] A nearly 100 kilometre-long walking promenade, accompanied by art installations placed alongside, was developed on the banks of the Goitzsche/Pouch (Lower Lusatia) artificial water reservoirs, formed in depleted pits of lignite and amber deposits.

[83] On the Schurenbach heap in Essen (43 ha in area and 50 m in height), tree planting and grass sowing on the slopes began in 1986, i.e. while mine waste was still being stored there. Once the walking and cycling paths had been prepared, in the following years, the dumping ground became a recreational site for the local community.

Fig. 96. Tetraeder, Bottrop; photograph by Pressearchiv Bottrop

Fig. 97. Angel of the North in Gateshead; photograph by A. Gormley

Fig. 98. Heap in Rydultowy; photograph by A. Materna

Near the amphitheatre on the Haniel tip in Bottrop, painter and sculptor Augustin Ibarrola has placed an installation composed of more than a hundred railway sleepers symbolising industrial civilisation.

In East Germany, near the town of Bitterfeld, the project known as the Iron City (*Ferropolis*) was completed in 1995 on the premises of a former lignite mine. Its defining feature is the landscape dominated by the machines formerly used in open pit coal mining. They became the starting point for the landscape arrangements performed in line with the principles of land art. Over the years, this area evolved into a technology museum and a centre for culture and entertainment offering a wide range of tourism services.

In northern England, on the outskirts of Gateshead, a giant installation called the *Angel of the North* was erected in 1998 on one of the local coal heaps. The sculpture was conceived by Anthony Gormley with reference to the statue of Christ in Rio de Janeiro. It is 20 m high and 54 m wide, made of a special grade of corrosion-resistant steel.

In Poland, an inscription of more than 2.5 metres in height and 20 metres in width which reads „Szarlota" was placed on top of the eastern part of the tip in the town of Rydułtowy, modelled on the „Hollywood" sign in Los Angeles. It was intended to highlight the most distinctive place in the town as well as its industrial character.

People seek *beauty* in post-industrial landscapes, to which they subsequently refer in various fields of art. The creative output of artists (painters, filmmakers, writers) increases public awareness and builds a sense of togetherness at the interface between urban communities and degraded landscape. Quoting Weronika Wiśniewska: „Communing with landscapes can be a purely passive experience, but it may well be accompanied by a great wealth of feelings. This goes hand in hand with an equally great wealth of forms of representation and interpretation – from painting, photography, literature, even music, to scholarly treatises which analyse this view in a multi-directional manner, and in as much detail as the purpose and scope of research demands"[84]. This kind of landscape can either be a creative inspiration or a place where art is confronted with the reality, as it is perceived. The works which make use of nature, when presented by artists, endow the site with the character of a permanent exhibition, and are intended to stimulate people to think about the effects of degradation and human impact on the environment and the possibilities of landscape renewal.

In a Lusatian village of Pritzen, transformed by lignite mining operations, the degraded landscape inspired the creative activity undertaken under the IBA Fürst-Pückler-Land programme. The original development vision was to convert the village into a testing ground for artistic activity and a venue for landscaping biennales. Among the 16 outdoor art objects created in this spirit, Herman Prigann's 1993 project entitled ***Yellow Ramp*** (*Gelbe Rampe*) clearly stands out. The author formed a geoglyph, intended to resemble a stepped pyramid, covered with vegetation. On top of it, he placed a platform overlooking the emerging artificial water reservoir and the landscape in transition. Another notable piece is the project entitled ***Landscape with a Lake – Swamp*** (*Landschaft mit See – Sumpf*), designed by Nils Udo in 1995. It depicts an artificial lake formed like an egg, being a symbol of the rebirth of life, and functioning as a metaphor for the changes occurring in the region. The artist set

[84] Wiśniewska W. 2002, op. cit., p. 24 [translated from Polish by Łukasz Borkiewicz].

a doorframe on the waterfront with an open double-leafed door, intended to be closed after the water has filled the pit and the area has become covered with vegetation, symbolising the very moment of re-submission to nature. All these efforts, conducted as part of Niederlausitz Biennale, highlighted the necessity of artistic activity being a collective endeavour. Aptly combined into a larger whole, they represented the changes observed in the post-industrial landscape[85].

The purpose of renewal of specific elements of the natural environment degraded by industrial activity is not only to restore their natural life, but also to **define a new quality of urbanised space**. Adding new values, raising the standard of living of the local population, or changing the image of a city or agglomeration are all aspirations which architects and urban planners began to pursue by referring to the landscape and spatial qualities of the degraded natural environment. Some of the best examples of the foregoing approach include attempts to shape a harmonious **relationship between post-industrial waterfronts and urbanised areas**. They include highlighting the interactions between the natural and cultural environment, exposing the hydrological, ecological, sociological, and economic problems at hand. The interface between the river and the urbanised space entails both threats and opportunities. Water management, with cleaning of rivers and formation of flood defences in particular, has become a priority in the spatial planning of urbanised areas. Many European post-industrial cities have responded to the problems of waterfronts by creating revitalisation programmes dedicated to degraded areas and by presenting them as an opportunity for economic growth and for successful pursuit of new urban goals and aspirations.

In Rotterdam, the development strategy known as ***Rotterdam Waterstad 2035*** was prepared in response to the threats posed by water, proposing a number of solutions, such as the following: developing a specific residential environment on the water (*water fortresses*, houses on mounds, piles, dikes, piers, pontoon platforms, or boats), arranging public spaces of retention (water squares, parks on the water), and concentrating the city's centre-building functions on the river Meuse[86].

In Berlin, acting in line with a set of rules known as **Ten Principles for Sustainable Urban Waterfront Development**[87], the importance of water in the cityscape as well as the essence of regeneration of degraded sites of former port and industrial operations were emphasised to achieve ecological, economic, social, spatial and functional benefits, as well as to win an alternative to suburbanisation processes. These principles became the foundation of Berlin's Water Towns concept (*Wasserstadt Oberhavel* in the Spandau district on the Upper Havel and *Wasserstadt Rummelsburg* in the eastern part of Berlin on the river Spree)[88].

[85] Zienowicz M. *Kraina Księcia Pücklera. Kształtowanie obszaru Pritzen jako dzieła sztuki zbiorowej* (Prince Pückler's land. Shaping the area of Pritzen as a collective piece of art). In: Drapella-Hermansdorfer A. (ed) 2004, op. cit., pp. 69–71; www.iba-see.de [accessed on 2011]; www.pritzen.de [accessed on 2011].

[86] *Rotterdam Waterstad 2035*, P. de Greef (ed) Jap Sam Books 2006, passim.

[87] This document was among the deliverables of a series of international workshops (1999) entitled *Sustainable Urban Development*, organised under EXPO 2000. It defined the priorities and paths of the efforts aimed to enable revitalisation of urban waterfronts, and not only locally, but also at the scale of global water structures. The numerous principles listed there included the need for protecting the quality of water and environment, integrating waterfronts into the existing urban fabric, preserving the cultural identity of waterfronts, diversifying them in functional terms, public access to water, public-private partnerships, public participation in the renewal process, long-term scheme and continuity of the revitalisation process, and the exchange of information and experience at an international level (www.waterfront-net.org) [accessed on 2011].

[88] *Wasser in der Stadt. Perspektiven einer neuen Urbanität* (Water in the city. Perspectives of new urbanity [accessed on 2011]), 2000, U. Hellweg, J. Oltmanns (eds) Transit, Berlin, passim; Tölle A. 2009. *Przekształcanie terenów poprzemysłowych w Berlinie*

It seems obvious that the structure of development, greenery, and open waters should all be tied together under revitalisation efforts. However, the needs and requirements of the natural environment are often at odds with the spatial policy of local authorities, economic priorities, and the expectations of investors or private owners. There are many examples of riverside areas reclaimed over the last few decades which demonstrate the effect of diverse conditions on the creation of urban space. Some illustrate the influence of financial and economic forces on planning and designing intentions, others – the power of political action and the ability to circumvent certain legal regulations, while yet others show the large-scale nature of project-based activities[89]. Above all, however, these examples prove that re-developed riverside areas can catalyse the renewal of post-industrial landscapes, have the capacity to create a new image of urban areas, and can also deliver economic benefits. Their side effect is increased public interest in developing such sites as well as the value of the property adjacent to the river.

An example of comprehensive waterfront regeneration at a city scale is the revitalisation of the **Cheonggycheon (the Han tributary)**, a small river flowing through Seoul, completed in 2003. Having completely *vanished* from the cityscape for a long time, the river was discovered anew. As a result of project-based activities, the industrial and commercial riverside areas have been transformed into financial districts. The nearby multi-lane roads running along the former river channel were removed. 22 bridges were built in an area of nearly 6 km in length, the space between them developed in a diversified manner, providing unique characteristics to each quarter. The sites directly adjacent to the river were converted into green spaces, only to be linked with other natural elements of the city. The revitalisation measures caused a 100 per cent increase in the economic value of the land on the river banks. Numerous retail, catering, office, and residential developments arose in the vicinity. The river has become the city's most important public space[90].

A case of a waterfront revitalisation approach differing in every aspect from the aforementioned measures is that of one **of the Upper Silesian Agglomeration rivers**, namely **the Rawa**. The Rawa flows through the most industrialised and urbanised part of the Agglomeration, representing an extremely negative example of the river network transformation and degradation of the natural landscape. Despite the channel regulating activities continuing since the second half of the 19th century, the river, encased and covered in many sections, remained an undesirable element of the urban landscape. Neither the remedial measures undertaken to date in the scope of water and sewage management nor the hydro-engineering works concerning the riverbed have been completed. In order to contribute to the natural landscape restoration process, the river must not be polluted or represent any threat to people. By the time this status is achieved, any attempts to bring the Rawa back to the Agglomeration cities will be confined to the domain of ideas, design competitions and workshops, and unfulfilled provisions in planning documents.

według „dziesięciu postulatów zrównoważonego rozwoju miast nad wodą" (Brownfield transformation in Berlin in line with the ten sustainable development demands of water cities). In: *Problemy ekologii krajobrazu* (Problems of landscape ecology), vol. XXIV, pp. 101–113.

[89] *Waterfronts in Post-industrial Cities*, 2004, R. Marshall (ed) Spon Press Taylor&Francis Group, London, New York, p. 6.

[90] Chin Y. 2006. *Cheonggyecheon – Revitalization of an Urban River*. In: *Topos Parks*, no. 55, p. 40–44.

Fig. 99. Cheonggycheon, Seoul; photograph by M. Ball

Fig. 100. Guggenheim Museum on the Nervión, Bilbao; photograph by D. Doyle

Fig. 101. The river Rawa in Katowice as per the „Concept of redevelopment of the road network, public squares, tram tracks, and technical infrastructure within the Roundabout–Market Square zone" to be implemented under the project of „Redevelopment of the city centre of Katowice," variant 2, team project; chief architectural designer: R. Antonowicz, 2011

Since the relocation of industrial features to the urban fringes, riverside areas (including former port facilities) have become perfect spots for new functions to be defined: housing, business, culture, recreation, or entertainment (Amsterdam, Rotterdam, Hamburg, London). Sited in close proximity to historic city centres, and linked with them in terms of culture, landscape, and transport, they have played a significant role in the process of building the new image of urban areas. They are attributed great importance for the development of cities, their structure and composition, as well as for changing the mindset of post-industrial communities[91].

Much effort to regenerate riverside areas was made in **Duisburg on the Rhine** (1991–2001). The development plan prepared by Foster and Partners for the old harbour, providing new functions for the post-industrial buildings, also envisaged that attractive public spaces of commercial and recreational character should be established. The drive to change the city's image from an industrial centre to a city on the Rhine became clearly apparent. These measures reduced the pressure to invest in open spaces, encouraged foreign investors, and attracted tourists.

In Rotterdam on the Meuse, the development concept prepared by Rem Koolhaas for Kop van Zuid, Wilhelminapier, launched in 2009, contributed to rediscovering the river's past functions in the spheres of composition, representation, and identification. The spatial and functional changes introduced there were associated with the city's economic and social transformation. Among other aspects of this process, a new generation of residents and workers had emerged (known as *yuppies* or creative intelligentsia)[92].

Measures undertaken to renew post-industrial landscapes are aimed at using the river as an important component in the spatial composition of cities. This makes it possible to highlight the natural qualities as well as the architectural and urbanistic links of riverside areas. One of the characteristics of revitalised space is gradually becoming the creation of **public spaces of a landmark function**, including boulevards, promenades, paths, and viewpoints. Their role is to highlight those elements of spatial development which influence and are decisive of the landscape of riverside interiors. What also matters is the emerging new functions utilised to satisfy the needs of urban communities, providing diverse users with a continuous choice of leisure activities in contact with the *urbanised nature*.

In Amsterdam, the revitalisation efforts on the river IJ began in the 1980's. The waterfront redevelopment proceeded without any comprehensive plan; instead, there were non-statutory strategic actions taken in response to market expectations. What was characteristic about them was that they comprised both the old town conservation and the regeneration of degraded sites. Considering how dense the local urban fabric is, often exceeding 100 houses per ha, the expanse of water has compensated the city dwellers for the scarcity of green space. The development of the IJ waterfront created an opportunity to connect it with the open landscape.

In Hamburg, as part of the International Building Exhibition (IBA) activities, specific measures were undertaken in 2006–2013 on the land

[91] Meyer, H. 1999. *City and Port: urban planning as a cultural venture in London, Barcelona, New York, and Rotterdam: changing relations between public urban space and large-scale infrastructure*. Utrecht, Netherlands: International Books.

[92] Januchta-Szostak A. 2008. *Kreowanie tożsamości na styku wody i miasta* (Creating identity at the water and city intersection). In: *Urbanist*, no. 8, pp. 31–33.

between the arms of the river Elbe, representing a mixture of housing development, brownfield, and former port sites. The outcome of the transformation was to be a harmonious urban landscape combining elements of the natural and built environment. A special case of the regeneration efforts conducted in Hamburg's post-industrial waterfronts is the Hafencity district. With the area of 380 ha, it is currently the largest urban development project in Europe (referred to as a *city within a city*). It is assumed to perform a range of diverse functions: office space, housing, retail, and culture, and to combine the historic traditions of the port with the new cultural identity of a growing city.

In Shanghai, the rationale behind the revitalisation of the Bund district stretching along the Huangpu (implemented in 1992–2010) was to clean up the river, make it more accessible, and create a district that would function as a cultural link between the new and the historic part of the city. What became particularly significant in this respect was establishing visual, compositional, and structural interconnections between the river and its neighbourhood, as well as binding urban green spaces with the river and incorporating them into the system of open spaces and regional parks.

Introducing unique functions and forms into the space of degraded areas in transition to highlight their specific location as well as high-quality objects of architecture and urban planning solutions can become a catalyst for further development of adjacent urbanised areas and contribute to new understanding of their identity. The foregoing has been demonstrated by a number of projects, including: *New Metropolis* designed by Renzo Piano (1997) and *Silodam* by MVRDV in Amsterdam (2002), London's *Millenium Dome* designed by Richard Rogers (1999), *Elbphilharmonie* in Hamburg designed by the Swiss agency Herzog & de Meuron (2007–2013), and many others. All these spectacular built features have become new cultural focal points in the transformed riverside areas, enabling the city silhouette to express itself anew.

In Bilbao on the river Nervion, since the late 1980's, the foundations of the planning efforts aimed at transforming the industrial city into an environmentally friendly territory included strengthening the role of the river as a principal component of the urban structure, altering and redeveloping the waterfront, improving water quality, and establishing new green spaces. The utilisation of the degraded riverside land along the river provided an opportunity to implement a new system of public spaces, including linear waterfront parks, as well as office, service or residential facilities. That is also where several major development projects were sited, designed by world's most acclaimed architects. The most famous of them is by far the Guggenheim Museum, designed by Frank Gehry (1997). Owing to its function, form, and structure, it has become the nodal point of the waterfront space, while its commercial success has made this cultural and economic wonder the cradle of a phenomenon called *the Bilbao effect*. Many other projects represented attempts to solve major problems of the sites located along the river, including the urban planning and development concept of the new island of Zorrozaurre by Zaha Hadid (2003). Most of the measures implemented in the city were intended to improve the quality of life and the attractiveness of the urban space.

What appears to be a crucial factor in the process of riverside renewal is protecting along with redefining the natural heritage qualities, followed by searching for the elements that determine the land's cultural identity. This involves both the adaptation of culturally

significant sites and the re-use of the recreational potential of the city waterfront by creating chains of tourist attractions accessible from the river. The Oder in Wrocław, the Brda in Bydgoszcz, the Spree in Berlin, or the Thames in London – they all provide evidence that opening up the city to the river, activating waterways, increasing the aesthetic and functional quality of waterfronts, integrating them into the system of urban greenery, and highlighting the landscape identity can catalyse positive changes to the structure and the process of development of urbanised areas. However, the remedial measures undertaken in such cases must rely on a strategic vision for the entire area, aimed at implementation of a planning process as well as its efficient management.

> One of the characteristics of the **Upper Silesian Agglomeration** is that no planning activity implemented at the regional scale takes the problem of riverside landscape renewal into account. Most of the remedial measures undertaken there are either environmental protection[93] or revitalisation programmes limited to defining single local-scale tasks. A pilot project implemented between 2008 and 2011 under the REURIS (Revitalisation of Urban River Spaces) international framework covered the valley of the river Ślepiotka in Katowice. The project's main premise was to create a coherent vision for the revitalisation and management of the riverside space, with the following detailed objectives: partial renaturation of the river in the suburban space, utilisation of the abandoned riverside areas to increase retention, and restoration of the local ecological corridor in the valley's urbanised part. The project was intended to provide the local population with improved river access, make the areas adjacent to the river more attractive, highlight its aesthetic qualities, introduce new development forms, and establish *soft* forms of recreation (recreational facilities such as playgrounds, a *green amphitheatre*, educational and walking paths, descents to the valley floor, educational squares, viewpoints)[94].

However, one should not seek the opportunities for comprehensive changeover of the natural and cultural landscape of post-industrial cities and brownfields only in restoring the natural condition of rivers and in redeveloping riverside areas, since it is clearly necessary to include all elements of the natural environment into this process, including the degraded remainders of the past industrial activity, such as dumping grounds, open pits, and artificial water reservoirs. What must be defined is both a vision and a general course of the intended development, as well as individual measures which build distinctive and unique landscape features, functioning as landmarks in the urbanised space.

[93] One example of such programmes is *Przyjazna Kłodnica* (Friendly river Kłodnica) of 2005.
[94] www.reuris.gig.eu [accessed on 2011].

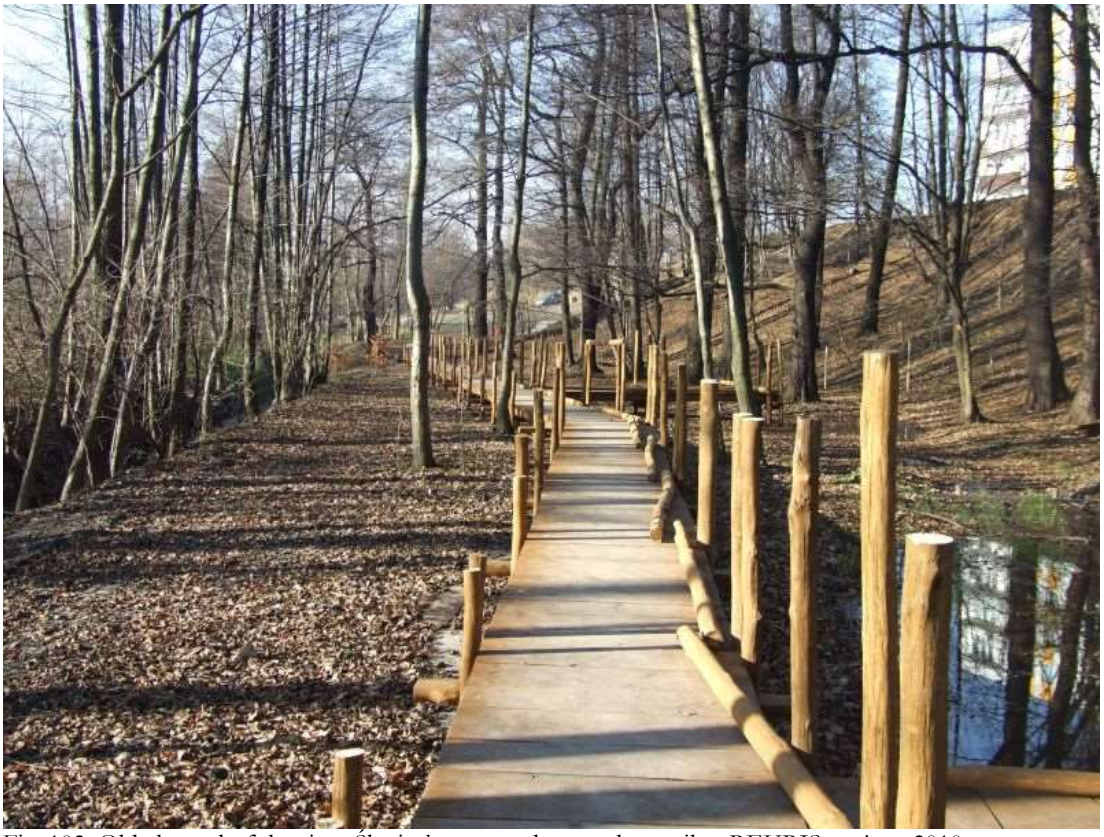

Fig. 102. Old channel of the river Ślepiotka restored – a path on piles, REURIS project, 2010

4.3. Conclusions

Considering the principles of sustainable development and assuming a comprehensive approach to the problem of transformation, the natural environment elements degraded by industrial activity require new relationships between the natural, cultural, social, and technical environment, as well as coordination of both the entire process and its individual measures. Using them to enhance the natural qualities and to highlight the cultural identity of industrial brownfields leads not only to increasing the attractiveness and diversity of the landscape, but also to creating a new quality of urbanised space.

The examples of individual anthropogenic elements analysed in this chapter, including mine workings, dumping grounds, artificial water reservoirs as well as rivers and degraded riverside areas, make it possible to identify both the opportunities and the constraints related to the process of their transformation and to the possibility of new development (Table 9).

Table 9

Options and characteristics of transformation of individual elements of degraded natural environment				
Elements of degraded natural environment	**Development options**		**Characteristics of transformation process**	
	existing or potential qualities of sites	**new features**	**positive (opportunities)**	**negative (constraints)**
Dumping grounds Mine workings Anthropogenic water reservoirs Rivers and riverside areas	- natural, - historical, - semiotic, - symbolic, - artistic, - aesthetic, - scenic, - landscape, - composition, - identification, - representation,	- organised and successional green spaces: municipal parks, landscape parks, natural succession parks, sodded land, shrubland, woodland; - forested land: buffer and commercial forests; - agricultural land: arable land, grazing land, orchards; - water bodies: water reservoirs, flood control reservoirs, breeding ponds; - recreation: leisure, tourism; - sports: water sports, extreme sports, winter sports, walking paths, cycle paths; - entertainment: amphitheatres, stages, exhibitions, amusement parks; - education, exploration, promotion, information: educational paths, thematic paths, tourist trails, botanical gardens, geological gardens; - conservation: nature conservation forms, culture parks; - housing; - retail and services; - economy: production, power generation, infrastructure, municipal services;	- creating new landscapes; - discovering the identity of a place; - expanding green spaces in urbanised areas; - interlinking and complementing the system of urban and regional greenery; - extending the system of protected sites; - protection of open spaces; - urban sprawl prevention; - improving and creating habitats for numerous flora and fauna species; - increasing forest cover index; - introducing unique objects of architecture, urban complexes, and works of art; - creating new public spaces; - social acceptance; - improving quality of human life;	- environmental and health risks; - high process costs: reclamation, restoration, revitalisation; - technical, procedural, organisational issues; - planning obstacles; - stereotypes and biases; - lack of vision, strategic goal, and leader (person, institution) of transformations; - insufficient coordination of activity, lack of collaboration between partners to the process; - legal and ownership-related issues;

Author's elaboration

Having collated individual elements of the degraded natural environment, identified the available options for new development, and listed the characteristics decisive of the process of their transformation, one can draw the following conclusions:

- The diversity of the elements of the natural environment transformed by industrial activity, the multiplicity of their redevelopment options, and the lack of unambiguous assignment of new functions to individual elements all demonstrate the need for a case-by-case approach. A model-based approach only makes it possible to identify the groups in which particular forms of development are more advisable than others. Dumping grounds, mine workings, and artificial water reservoirs are most suited for natural purposes, especially for recreation, leisure, and sports. They can also perform certain cultural functions, serving representation, identification, and composition. This development path is primarily chosen for rivers and riverside areas, closely linked with architectural features and urban complexes.
- Not all anthropogenic elements can be utilised for new functions of relevance in urbanised space; some of them, due to the sheer scale of degradation and the resulting environmental, social, and spatial risks, should be excluded. In many cases, the measures undertaken require a lot of capital investment and application of modern technologies, which – given that there can be idle unpolluted sites in the vicinity – puts the validity of such measures into question when it comes to using them on brownfields.
- It is necessary to perform a comprehensive survey of all anthropogenic elements and to identify the most valuable ones, which should be protected, or those whose transformation for natural or cultural purposes is expected to affect the landscape renewal and to highlight the identity of the place.
- The process of transformation of degraded areas must start with the restoration of natural qualities (using natural succession processes, creating new areas of organised greenery). This goal can be pursued for its own sake or, in individual cases, it may represent a stage which precedes the actual (future) development for purposes of culture, housing, business, and other functions. The outcome thus attained is a new quality of landscape.
- Transformation of the elements degraded by industrial activity must be a complete process, beginning with a vision and creative approach, represented in spatial planning and urban design (reclamation, restoration, and revitalisation measures), and finally involving promotion, education, and commitment of the local population, as well as monitoring of outcomes.
- The approach to the transformation process depends on numerous factors, both internal and external, affecting the relationships between people and the natural as well as built environment. These include cultural, environmental, social, spatial, legal, planning, technical, and economic factors. They represent the needs of the population inhabiting post-industrial areas, define the requirements of the natural environment, specify the opportunities and constraints of the transformation process, as well as the vulnerability of individual elements (dumps, pits, artificial water reservoirs, and water courses) to transformations (Table 10).

Table 10

Factors affecting the transformation of the elements of degraded natural environment	
External factors	**Internal factors**
– location – distance from residential areas, leisure and recreation sites, areas of natural and scenic value; – accessibility – proximity of means of transport, footpaths, cycle paths, car parks, tourism infrastructure; – ownership status; – degree of urbanisation of adjacent areas; – functions as well as natural and cultural qualities of surroundings; – technological capabilities, method of organisation and management of the transformation process; – forms nature and monument conservation arising from legal regulations; – planning factors: local development plan provisions, investments planned (local, supra-local); – economic aspects, business activity, promotion and information activity; – cultural patterns, social behaviour, and needs of urban communities;	– risks: environmental, spatial, health-related; – degree of air, soil, and water pollution; – microclimate conditions, geological structure; – intensity of transformation of land surface, vegetation, and water regime; – natural (natural succession, extent of vegetation cover), cultural, economic, social qualities; – surface area; – type and number of elements present: dumping grounds, mine workings, artificial water reservoirs, water courses; – characteristics of individual elements (surface area, shape, depth, physical structure, chemical composition); – infrastructure development level: type and technical condition; – intensity and quality of site development;

Author's elaboration based on: Gasidlo K., 1998, p. 125.

The aforementioned factors, specific to post-industrial areas, make it possible to identify these elements of the degraded natural environment which – when reclaimed and reused – can yield the greatest natural, cultural, social, and economic benefits. The actions undertaken in pursuit of such goals can be implemented through:

- protection of natural (sites with specific vegetation) and cultural values (industrial heritage sites);
- protection against overinvestment or alteration of development form (idle post-industrial land with landscape qualities and social potential, fallow land) – stage preceding proper (future) development;
- natural reclamation (acceleration of spontaneous regeneration processes and use of native plant material of local origin) and restoration (renaturation);
- revegetation (redevelopment, new qualities being introduced to stimulate the development of urbanised areas).

Overlooking any of the relevant factors may reduce the opportunity for or even eliminate individual anthropogenic elements from taking part in the process of renewal of urbanised areas.

Efficiently used and developed dumping grounds, mining pits, artificial water reservoirs, and riverside areas can affect the spatial and functional structure, composition, image, and landscape of post-industrial areas, complement the system of urban and regional green spaces, strengthen tourism, as well as raise the standard of living of the local population and the quality of urbanised space.

Conical spoil tip in Czerwionka-Leszczyny; photograph by A. Pancewicz

5. POST-INDUSTRIAL LANDSCAPE RENEWAL PROCESS. CONCLUSION

In large cities and urban-industrial agglomerations, whose degraded environment and difficult living conditions do not promote development, but are conducive to growing threats instead, urban renewal is directly associated with the expansion of natural systems. The rationale behind the efforts aimed at creating or maintaining coherent links between various elements of the natural environment and preserving their diversity boils down to:

- building such a planning system that would counter the negative effects of civilisational processes, including increased energy consumption, growing environmental pollution, fragmentation of ecosystems, reduction of landscape quality, loss of its diversity, and changes to its structure;
- proposing measures to pursue the following objectives: reducing the anthropopressure (maintaining open spaces, preserving the appropriate proportion and quality of green spaces and biodiversity of the vegetation cover), forming new green spaces linked with the urban fabric, and providing city dwellers with unconstrained access to places of rest and recreation in contact with nature;
- finding the right proportions between the necessary conservation of environmental resources and the possibility of using them, and striking a harmonious balance between the natural and cultural elements in human settlements.

What appears to be a genuine opportunity in the process of transforming urbanised areas, developing new green spaces, and replenishing natural systems is making the most of the transformed elements of the natural environment degraded by industrial activity.

The overall body of problems related to the process of renewal of the urbanised post-industrial landscape has been discussed in three perspectives:

- development and conservation of the natural environment relative to the spatial planning system,
- transformations of industrial brownfields developed for natural purposes, analysed against the relevant spatial planning and legal conditions,
- opportunity presented by a pursuit of a new landscape for post-industrial areas.

With regard to the foregoing, there are questions still to be answered. To what extent is that feasible against the Polish spatial planning system, and is it possible that the pursuit of a new image of urbanised areas could be a remedy for the economic recession of post-industrial cities and regions, for the landscape degradation, as well as for the schematic nature of the perception of and thinking about the quality of the degraded natural environment?

5.1. Natural environment vs spatial planning system

As the awareness of the threats caused by the industrialisation process, the expansive nature of investment, and ecological imbalance grew, the role performed by green spaces in urbanised areas started to be recognised and appreciated. The planning approach changed, conservation systems began to emerge, and legal acts were established to ensure that green spaces would be secured and adequately utilised. This process mainly concerned the elements of the highest natural value. Those considered merely prospective remained overlooked for a long time. Gradually, it became increasingly important to highlight all the qualities of the natural environment, including of its degraded components, to intentionally transform and compose it, to define the principles and methods of such transformation, and to stimulate the development of cities and urbanised areas by making the most of it[1].

Spatial planning plays a crucial role in this process. The primary goal of spatial planning is to protect the value of the spheres of nature and culture, providing both the contemporary and future generations with convenient living conditions and the opportunity to enjoy the numerous resources of the environment. It is equally important to:

- address cities as ecosystems;
- maintain harmony between the built and the natural environment (strike a balance between economically sound urban development and ensuring healthy living conditions);
- protect and regenerate the natural and cultural landscapes of cities and their outskirts;
- make rational use of the existing resources of open and built-up space, being particularly attentive to the utilisation of degraded areas, industrial brownfields, and abandoned urban sites;
- reduce the consumption of natural components by maintaining, conserving, or restoring the natural environment's resources;
- identify and highlight the valuable elements of the natural environment marked by industrial activity.

Green space planning should be underpinned by the conviction that the economic development of urbanised areas depends on the quality of the natural environment, the attractiveness of the urban space and its architecture, as well as the landscape harmony. All these features increase the competitiveness of cities and attract investment. Adequate landscaping and protection of natural qualities can become a control mechanism for the development of individual territories, responsible for the planned development of urbanised areas.

One of the issues facing large cities and post-industrial agglomerations in the sphere of natural environment shaping and protection is the phenomenon of suburbanisation. In this context, one of the main tasks of spatial planning is setting the right orientation for this process.

[1] Chmielewski J.M. 2001, op. cit., p. 373.

In France, a solution which has proved particularly useful when tackling this problem is delimiting two functional zones in land use plans, the defining criterion being whether or not development is permissible, namely the urbanised zone (U) and the natural zone (N)[2]. According to the **British and American planning practice**, development zones are defined by establishing what is referred to as the Housing Development Boundary – in England, or the Urban Growth Boundary – in the United States, thereby setting limits to the development of open spaces by way of delimitation and restrictions[3]. **In Germany**, the restrictive functions in the planning practice are performed by either landscaping programmes (*Landschaftsprogramm*) or landscaping plans (*Landschaftspläne*), protecting urban fringes from the phenomenon of suburbanisation[4].

In Poland, the sprawl of cities, and agglomerations in particular, is becoming a somewhat tolerated process. This makes it necessary to approach open spaces from the perspective of the natural environment, where it is associated with the ways to shape the system of green spaces and to protect the areas of the highest natural qualities, as well as from the perspective of the built environment, where open spaces are considered part of the spatial structure, affect the standard of living of the local population, and are decisive of the landscape quality. Such a dichotomous approach is reflected in the spatial policy, legal conditions, and attempts to seek planning opportunities in pursuit of sustainability. Problems at hand can be solved by optimising the development of urbanised areas, by utilising degraded land, industrial brownfields, and abandoned urban sites, as well as by maintaining balance between protecting open spaces and rendering them available, to the extent necessary to satisfy human needs.

Legal determinants of the planning process. The planning activities undertaken in Poland result from the applicable laws and regulations in place. These are both higher-order legal acts and the implementing acts associated with the former, as well as local legal regulations. It is the knowledge of the relevant planning procedure and the methods used to implement it that determines the approach adopted when seeking to inhibit adverse phenomena resulting from spontaneous development. The most fundamental law regulating the matters of land use is the Act of 27 March 2003 on spatial planning and land use. This document has defined and introduced a three-tier planning system comprising the national level (the concept of the country's spatial development lays down specific requirements towards environmental protection, taking the sites subject to legal protection into account), the regional level (the provincial zoning plans extend the scope of natural conditions to include elements specific to the given voivodeship, and define the system of areas under protection), and the local level (the land use intended for individual areas is strictly regulated in local zoning plans). Local authorities have gained the greatest authority to implement their spatial policy in terms of shaping green spaces and natural landscapes, and their planning efforts are crucial to urban regeneration and development – they set the limits of diverse renewal measures through planning

[2] The rules of zoning, along with the method of development, and the problems of plan drawing and describing, as applied in French planning practice, are laid down in the law of *Code de l'Urbanisme* (Wiśniewska W. 2002, pp. 157–158).
[3] *CYNNLUN LLEOL ERYRI Local Plan 1993-2003*, Written Statement, Snowdonia National Park Authority, Wales, UK, p. 88. After: Zarzycka-Hajdukiewicz J. 2009. *Tereny otwarte współczesnym problemem planowania przestrzennego* (Open space as the problem of contemporary spatial planning), doctoral dissertation supervised by Z. Kamiński, vol. 1, Faculty of Architecture of the Silesian University of Technology, Gliwice, p. 29; Jaeger W.K., Plantinga A.J. 2007. *How have land-use regulations affected property values in Oregon?* Oregon State University Extension Service, Special Report 1077, pp. 29–33.
[4] Williams R.H. 1984. *Planning in Europe: urban and regional planning in the EEC*, *Urban and Regional Studies*, no. 11, George Allen & Unwin (publishers) Ltd London, Boston, Sydney, p. 23; www.stadtentwicklung.berlin.de [accessed on 2011].

regulations, zoning and land use plans, and they promote the renewal process by providing the legal grounds that can lead to the transformation of the landscape of urbanised areas.

> **Land use studies** (studies of land use conditions and spatial development paths) have replaced the master plans which used to be prepared and which addressed spatial issues in a comprehensive manner. However, land use studies are not formally acts of local law, and their purpose is to define the spatial policy at the municipal level, based on a comprehensive analysis of the relevant conditions. Provisions of the relevant acts stipulate in a rather generic manner that the study must particularly identify the areas subject to and the principles of protection of the environment and its resources, nature, cultural landscape and health resorts, cultural heritage, monuments and assets of modern culture, and with reference to degraded areas – the sites in need of transformation, rehabilitation, or reclamation[5].

Where open spaces attract great interest of potential investors, the only possibility of shaping and protecting them seems to be the procedure of zoning plans, making it possible to pass such an act of local law that would protect them or enable their adequate development. **Local zoning (land use) plans** must be consistent with the provisions of the corresponding land use studies. Creating a formal link between the content required of the local zoning plans under the applicable regulations and the development of green spaces, the Spatial Planning and Development Act imposes an obligation to take into account the principles of protection of the environment, nature, cultural landscape, cultural heritage, monuments, and assets of modern culture, as well as an obligation to define spatial governance. These plans specify, as appropriate, the boundaries of the areas in need of transformation or reclamation, and the boundaries of recreation and leisure sites[6]. One can make use of their provisions to affect the form of protection of the areas which should remain unchanged, or – by way of prohibitions, orders, permits, and restrictions – to control the extent of permissible transformation of the environment. The matters regulated by most plans include the form of conservation of natural systems, the principles of green space development (protection of biodiversity, natural links, valuable ecosystems), and finally, the manner in which favourable living conditions are to be created for the local population and the local landscape qualities protected. Not only do they cover zoning aspects, but in most cases also the obligatory share of biologically active areas or official orders to preserve certain elements of the environment (e.g. water reservoirs). Only some of these plans contain more detailed provisions, for instance those concerning the natural spatial structure. The most effective way to preserve natural systems is to allocate land for forestry, water, or organised greenery functions, completely excluding building development or limiting it to a considerable extent[7]. Local plans can also impose obligations to prepare separate studies on the development of green spaces for specific investment projects. However, in the absence of standards, one may speak of significant diversity in the classification of green spaces and inconsistency in the approach to how they are shaped, while the implementation of individual provisions often becomes the subject of a game of socio-economic interests at the level of a given municipality. By

[5] Spatial Planning and Development Act of 27 March 2003, items 10.1 and 10.2.
[6] Ibid., items 15.2 and 15.3.
[7] In areas of mineral extraction, the provisions of the plans address the subjects of the risks associated with mining operations. In the case of surface mining areas, detailed arrangements are formulated regarding the paths of land use, the principles of protection of the existing forms of development, overburden protection and management, as well as the conditions of environmental protection and the targets for reclamation (Korzeniak G. 2001, pp. 231–246).

way of specific arrangements, local zoning plans should define the manner in which sites are to be developed using greenery, providing detailed requirements under which such goals will be pursued.

> The policy of green space development requires various kinds of **spatial and urban planning standards** to be prepared and deployed[8], so that they can be used to determine the level of satisfaction of city dwellers' needs as well as to verify how individual spatial policy tasks are pursued in practice. The main groups of standards include those which pertain to the use of space (green space per capita), land use (development intensity and density), functional standards conditioning the standard of living (minimum area of biologically active land within a developed area)[9], and special standards (concerning landscape, conservation and development of greenery). They should be followed when formulating spatial policies and development strategies, and when preparing zoning as well as investment and financing plans, so that, ultimately, the green spaces in the making conform with the principles of sustainability[10].

The planning system reveals certain legal gaps which render planning regulations insufficient to contain numerous adverse phenomena attributable to the spontaneous growth of cities and agglomerations[11]. In the absence of local zoning plans (the average fraction of territory covered by local plans is 25.6%)[12], numerous interpretation issues pertaining to land use arise. The outline planning permissions issued by the municipality, where they substitute for a local zoning plan, are not subject to the requirement of compliance with the study. Also, they often contain no guidelines as to the problems of green space shaping and environmental protection. They do not require any additional documents addressing environmental issues to be drawn up, which ultimately makes the transformation of open spaces detached from any analysis of the environmental impact of these transformations. The foregoing frequently contributes to unplanned changes in the mode of use of specific areas, failing to create actual opportunities for proper shaping of greenery systems or spatial governance within a given territory. This often happens at the expense of potential open spaces, as defined in the relevant land use study, which are

[8] According to the Spatial Planning and Development Act (2003), standards should be understood as „sets and scopes of requirements for studies and planning documents, as well as principles for the application of specific land development parameters" (Article 2(15)). The notion of urban planning standards represents quantitative or qualitative indicators which define the ways in which urbanised space is developed. These include the service area in m^2 per inhabitant, the development intensity, the principles of development of special use sites, etc. (*Studium uwarunkowań i kierunków zagospdoarowania przestrzennego gminy. Poradnik metodyczny* (Municipal land use study. Methodology guidebook), 1996, Institute of Spatial and Municipal Economy, Krakow, pp. 23–26).

[9] The standards defining the indicator which determines the necessity of using a certain part of the land for biologically active areas are laid down in the Regulation of the Minister of Infrastructure (2002) on the technical conditions for buildings and their location. They address the need for an indicator specifying the percentage of biologically active areas on sites allocated for multi-family housing, health care and education buildings (at least 25% or 30% in the case of complexes of multi-family buildings). These standards can be extended by the provisions of local zoning plans or decisions on land use conditions (Regulation of the Minister of Infrastructure (2002) on technical conditions for buildings and their location, Chapter 8, par. 39 and par. 40).

[10] Dylewski R., Nowakowski M., Szopa M. 2003. *Poradnik urbanisty. Standardy, przykłady, przepisy* (Urban planner's guidebook. Standards, examples, regulations), Society of Town Planners – Warsaw branch, Warsaw, p. 64; Kozłowski S. 2002, op. cit., pp. 186–187; Drapella-Hermansdorfer A. (ed) 2003, *Wrocławskie Zielone wyspy. Projekt zarządzania zasobami środowiska miejskiego* (Green islands of Wroclaw. Plans for the management of the urban environment resources), Publishing House of the Wroclaw University of Science and Technology, Wroclaw, p. 44; Zachariasz A. 2006, op. cit., p. 158.

[11] Chmielewski J.M. 2001, op. cit., p. 379.

[12] *Raport o stanie i uwarunkowaniach prac planistycznych w gminach na koniec 2008 roku* (Data according to the Report on the state and conditions of planning work in municipalities as of the end of 2008), Institute of Geography and Spatial Development of the Polish Academy of Sciences, Warsaw, 2010.

allocated for various investment purposes instead of functioning as extensions of the city's natural system. Another issue encountered in this respect is the planning procedures, which are extremely complicated and bloated beyond actual needs.

Next to local law, an additional tool of spatial policy is an **abundance of state laws and legal regulations which set standards for and principles of the protection of natural and environmental assets**. The four most important of them are the following: the Environmental Protection Law of 27 April 2001, the Nature Conservation Act of 16 April 2004, the Act on prevention and remediation of environmental damage of 13 April 2007, and the Act on the access to information on the environment and its protection, public participation in environmental protection, and environmental impact assessments of 3 October 2008. Other means and measures of environmental protection are governed by some other specific regulations, including: the Act on the protection of agricultural and forest land (1995), the Water Law (2001), the Geological and Mining Law (1994), or the Forests Act (1991).

What also proves crucial from the point of view of the protection and development of the natural environment is the role of **documents accompanying the planning process**, drawn up in the course of the environmental impact assessment proceedings, such as ecophysiographic studies and environmental impact projections. The competent environmental protection authorities, while conducting their environmental impact assessments, hold the capacity to affect how both public and private space is to be shaped, acting through specific provisions of individual decisions (e.g. on the environmental conditions of consent to project implementation) and specifying numerous conditions a project should meet in terms of greenery formation within a given area. Some of the relevant planning documents which set the paths for the development of urban green spaces by taking natural and urban-economic conditions into account are the **implementation schemes of the greenery maintenance and development policy**. They have kept the guidelines and trends indicated in the relevant land use studies, and provide an analysis of individual natural elements and a general inventory of green spaces, including their characteristics and survey results. The purpose of these schemes is to select sites considered particularly important for the city from the perspective of the intended changes and additions to the urban green spaces.

Protective measures. The changing social and economic reality, the progressing anthropopressure, and the need to intensify reclamation of the degraded natural environment have all triggered the need to secure and protect areas and elements of considerable natural qualities. Depending on the conditions, scale, and context, protective measures can assume different perspectives of this problem: landscaping, urban planning, or architectural. Protection, in this case, may entail legal means of securing the existing condition and safeguarding it from further changes. It can also be implemented through the rational use of environmental resources, harmonious landscaping, and adequate spatial development, including far-reaching transformations in terms of land use (redevelopment, restoration, or new development). The task of spatial planning against specific nature conservation targets is to select and legally sanction such land use which would stimulate the pursuit of nature and landscape conservation goals.

The subject of this protection form is both inanimate and animate nature, i.e. terrain relief and its vegetation cover, as well as some of the human creations which have been permanently set in a given area.

In the Polish legal system, protection of specific elements of the natural environment is possible owing to specific provisions of state laws and local laws, and by taking into consideration the relevant protection requirements provided in planning documents: programmes, concepts, strategies, studies, and plans. From the perspective of the Spatial Planning and Development Act (2003), the foundation for ensuring the protection of green spaces is provided by the transposition of the provisions concerning them into the **local zoning plan**.

Under the Nature Conservation Act (2004), the means decisive of the capacity to effectively maintain ecological processes and stability of ecosystems, preserve biodiversity, and protect landscape qualities and greenery include the various **forms of nature conservation** applied to different resources, creations, and elements of nature. They must be taken into account in different kinds of planning documents, including local zoning plans.

In accordance with the Act on the historic heritage protection and conservation (2003), cultural landscapes, historic urban or rural layouts containing forms of designed greenery, parks, gardens, and other forms of designed greenery, as well as relics of economic activity are subject to protection by being entered into the register of monuments or by establishing a **culture park**. This translates into an obligation to draw up a conservation plan and a local zoning plan for a given territory. Preservation of the most valuable landscape elements is also possible by designating **conservation zones**.

Protection of the degraded natural environment is based on systemic measures – from single point-type elements to surface forms, blending into diverse interconnected complexes. Spatial planning also involves the aspects of distribution of these forms across the urban structure and identification of the opportunities to make the most of their qualities. What appears to be problematic is the investment pressure on the industrial brownfields of the most attractive siting, often subject to natural succession processes. Where this is the case, these rather scarce green spaces face a threat of their potential being curbed, regardless of their contribution to the city's natural system.

The foundation for all the activities related to nature conservation and shaping of the natural environment, as defined in various planning studies, is a **planning process**, once it has been adequately prepared. One of its components is a **diagnosis of the existing status**, comprising a detailed survey and analysis of all components of the natural environment and their interconnections, including: main elements of the ecological structure of natural space, large-area and individual forms of nature and landscape protection, all components of the environment subject to protection (waters, forests, soils, mineral resources), or areas in need of special protection against degradation. In intensely urbanised and industrialised areas, especially in urban-industrial agglomerations[13], special attention is attached to the diagnosis of problematic sites, where individual forms of human activity have caused undesirable changes to the natural environment and have considerably disrupted its functioning, impeding the proper development of other forms of activity and threatening human existence. These include: areas of urbanisation and suburbanisation (transformation of open spaces of natural value) and industrial brownfields (degraded, devastated, and transformed sites in need of reclamation). It is also necessary to delimit units of degraded landscape or designated

[13] Urban agglomerations are listed in the Second National Environmental Policy among the most important functional areas for the ecological policy.

zones of spatial policy which are crucial for urban landscaping (including, for example, zones of conservation of special natural qualities, zones of industrial brownfield restructuring and reclamation, and zones of protection of green space or scenic qualities).

> The foundation on which the process of urbanised post-industrial landscape protection and restoration rests is the **elimination of all factors leading to environmental degradation**, threatening human existence. This can be achieved through control, isolation or clean-up, biological activation, and other measures related to the reclamation of potentially threatening sites. This is also facilitated by improving the continuity of ecosystems, increasing the forest cover index, expanding the system of protected areas (including industrial brownfields where a naturally valuable environment has developed; establishing reserves, local nature conservation sites, and educational trails), and improving the microclimate (control of water regime, terrain relief, and land cover). What also matters is the protection of open spaces by increasing the supply of areas situated inside the urban fabric (degraded sites, industrial brownfields, abandoned urban sites) and using them to satisfy the needs of the local population, especially those related to sports and recreation (establishing recreation centres of local and regional importance)[14].

Spatial policymaking should define specific **operational objectives and paths**, including:

- substantiating the need to protect and strengthen the system of protected areas and to build regional natural structures, as well as the need to transform heavily degraded areas or areas at risk of degradation, decisive of the region's specificity as well as of the rational use and operation thereof;
- confronting environmental development goals with economic goals and socio-ecological needs;
- defining the principles of implementation, such as: protection and increase of biological and landscape diversity, formation of a regional network of natural links and a system of protected areas, relations between people's economic activity and the need to protect the natural environment;
- defining the paths towards the pre-set goals pursued through individual measures, such as: eco-friendly policymaking in the scope of land use and development, based on local spatial planning or revitalisation of industrial brownfields.

The policy of nature conservation and environmental development in urbanised areas also defines the various **ways to pursue the pre-set goals**. These include the principles and mechanisms applied in the implementation of the spatial policy, define the tools which should be employed, and establish the level of cooperation with neighbouring regions and local government units. Successful functioning of natural systems depends on good management, coordination of activities between different environmental services, and provision of permanent funding sources. The vulnerability of green spaces to degradation also triggers the need for continuous monitoring of the measures being implemented, making it possible to review changes to the land use and to introduce amendments, where needed.

Spatial planning in contemporary Poland neither guarantees efficient protection nor provides opportunities for the development of green spaces. The foregoing applies to the

[14] Gasidło K., Gorgoń J. (eds) 1999, op. cit., pp. 157–160.

areas of the highest natural value as well as to those which have been degraded to a considerable extent, whose protection or potential transformation for nature's sake could be the determinants of the cultural identity of urban communities. This is attributable to the following causes:

- shortcomings of the legal framework (problems being marginalised and overgeneralised);
- negative attitude of landowners and municipal authorities towards implementation of specific forms of nature conservation (fear of losing economic benefits, problems with financing);
- unfavourable design practices (contradictions between public expectations and socioeconomic interests)[15].

5.2. Brownfield transformations

Landscape renewal has become a priority need for many European cities and agglomerations, and so has the effective use of brownfield sites located inside the urbanised space. Under Polish conditions, the opportunities which the transformation of post-industrial sites presents are still poorly utilised. Despite the considerable area of brownfields and the potential qualities of the natural environment transformed by industrial activity, they are solely perceived from the perspective of the threats and potential costs they entail, and seem to be marginalised by both local and regional authorities as well as by urban and spatial planners. The decisive factor behind the success of any endeavour related to the renewal of the natural environment of post-industrial areas is whether or not this body of problems has been addressed in the domain of fundamental legal regulations. The various forms of applicable legislation, from the Constitution to acts and regulations, to special governmental schemes[16] and other auxiliary instruments[17] are essentially based on how the process of reclamation and redevelopment of degraded areas is regulated.

However, there are no dedicated laws governing land management that would provide:

- higher law stringency in cases of unlawful land use or abandonment;
- necessity of using measures of prevention against land degradation upon discontinuation of production activity (conducting environmental risk studies, preparing plans for reclamation or setting aside);
- possibility of planning modifications related to the implementation of new technologies;
- possibility of raising funds for the transformation process[18].

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[15] Chwalibóg K. 2007. *Krajobraz i polityka* (Landscape and politics). In: *Urbanista* (Urbanist), no. 1, pp. 11–16.

[16] Striving to solve environmental problems, in 2004, the Council of Ministers adopted the *Governmental Programme for Brownfields*. Its strategic goal was creating conditions and mechanisms conducive to the development of brownfield sites in line with the principles of sustainable development. Its direct objectives boiled down to preparing a system for degraded land management for purposes of land reclamation, restoring sites degraded by industrial activity to economic use, limiting the process of taking over non-degraded land for industrial investment, developing a sector of businesses engaged in the rehabilitation of degraded land, and managing the associated rise of a new labour market. This programme has not been launched, and remains a merely declarative document.

[17] Such auxiliary instruments tools include the geological and economic maps of Poland prepared by the National Geological Institute for individual municipalities. They illustrate individual problems in a manner which proves useful when implementing the process of reclamation and redevelopment of industrial brownfields.

[18] Gasidlo K. 1998, op. cit., p. 157.

These specific regulations could prevent excessive land transformation, and could make it possible to utilise post-industrial sites in line with the current needs of the local and regional communities and to avoid spatial chaos in urbanised areas.

In Poland, the overall body of problems of brownfield transformations is addressed in the following four acts: the Environmental Protection Law, the Act on the protection of agricultural and forest land, the Geological and Mining Law, and the Spatial Planning and Development Act[19]. The legal provisions of these acts separate the reclamation process from the stage of redevelopment of degraded land, designating different entities as responsible for this process[20]. They do not specify any requirements concerning the organisation of the reclamation process[21]. Consequently, given the high costs involved, many production facilities operating within a given area avoid or limit their reclamation efforts, or intentionally prolong the decision-making process[22].

The **Environmental Protection Law** (2001) imposes an obligation upon the entities which undertake or conduct extraction of mineral deposits to subsequently reclaim the sites of former mining operations and to restore proper condition of other elements of the natural environment. It also defines paths for the implementation of new forms of development of reclaimed brownfields (for purposes of forestry, agriculture, recreation, or municipal operations). However, the act does not refer to devastated technical infrastructure and post-industrial buildings.

The **Act on the protection of agricultural and forest land** (1995) specifies the degree of reduction or loss of the utility value of land, the party responsible for land reclamation, the path to and the time limits for its completion, and the procedure to recognise the process as completed. The act applies only to the sites which had been agricultural or forest land prior to the industrial activity, or to those which are intended to be rehabilitated for such purposes. Nevertheless, numerous degraded sites are to be found within intensely urbanised

[19] The various problems of degraded post-industrial sites are also referred to in the following documents: Act on waste of 27 April 2001, Act on fixed property management of 21 August 1997, Act on land registers and mortgage of 6 July 1982, Act on the general tax code of 29 August 1997, Civil Code of 23 April 1994. The possibility of reusing degraded post-industrial sites is also evidenced by other documents and instruments in force. One of the premises and targets underlying the *National Environmental Policy for 2009–2012, with an Outlook to 2016* is the reclamation and restoration of natural, recreational, or agricultural functions to degraded land. According to the *National Regional Development Strategy for 2007–2013* and the *National Development Plan for 2007–2013*, the goal of regional policy should be supporting the processes of reclamation and development of degraded industrial brownfields, sites formerly used by railway, and abandoned military grounds in order to improve spatial governance and increase the land's attractiveness in terms of tourism, investment, and natural potential.

[20] The Act on the protection of agricultural and forest land distinguishes between the term *land development*, meant to be for purposes of agriculture, forestry, or other use of reclaimed land, and the term *land reclamation*, understood as the process in which degraded or devastated land is given or restored utility or natural value. As defined by the act, the parties responsible for the reclamation include the one responsible for the loss of the land's value, e.g. mining companies. Those to be held responsible for the land development are, for instance, a municipality or a private investor (Act on the protection of agricultural and forest land of 3 February 1995; unified text of 2004: Journal of Laws no. 121, item 1266, Article 4).

[21] Reclamation activities are also conducted in degraded areas under the current provisions of the Act on the prevention and remediation of environmental damage of 13 April 2007 (Journal of Laws of 2007, no. 75, item 493). It implements Directive 2004/35/EC of the European Parliament and of the Council of Europe of 21 April 2004 on environmental liability with regard to the prevention and remedying of environmental damage. However, the act in question still does not define the term *reclamation* as applied to the remediation of the effects of mining operations. Instead, it imposes an obligation to conduct remedial actions in terms of soil and water purification, restoration of natural landforms, afforestation, planting trees and new vegetation, and reintroduction of damaged species.

[22] Reclamation work often requires support from other sources, which include the State Treasury as well as the cohesion, earmarked, structural, decommissioning, and other funds of the European Union.

areas, which in many cases excludes them from the scope of this legislation.

The **Geological and Mining Law** (1994) defines the obligations of the entities conducting mining operations in the field of land reclamation, and specifies the time limits for determining the specific measures to be implemented. In the event of decommissioning of a mining facility, the act makes the relevant entrepreneur obliged to undertake the necessary measures to protect the environment, reclaim the land, and develop the post-mining sites.

The **Spatial Planning and Development Act** (2003) defines the planning documents which set the main targets for national, regional, and municipal development policies. It is possible that the plans, programmes, or strategies formulated at various administrative levels are deployed if they are reflected in the provisions of the corresponding local zoning plans. On the one hand, this instrument seems to be employed too rarely by municipalities to counteract undesirable transformation of brownfield sites, while on the other hand, it is sometimes considered insufficient.

In their provisions, legal regulations place a strong emphasis on the reclamation of degraded land for economic (agriculture, forestry) purposes. This is largely attributable to the statutory obligation to restore the original condition of deformed land[23]. Other transformation paths are of marginal importance, or are completely ignored. However, on account of the costs incurred while implementing reclamation measures, 15–20% of the areas in question will not stand a chance of being subjected to such activities, a similar fraction can be reclaimed without the contribution of public authorities, while the rest of them will be revitalised with partial involvement of public funds and using the available legal and financial facilities[24].

The national legislation lacks regulations which would comprehensively cover the problem of brownfield revitalisation. It does not function at the statutory level, where the tasks and competences of individual levels of local and regional government are defined. There are neither any regulations providing grounds on which one could design and prepare specific revitalisation measures for industrial brownfields, nor statutory provisions on the procedures for drawing up a local revitalisation programme – a document which is prerequisite to apply for funds from the European Regional Development Fund for the implementation of projects in the field of renewal of degraded urban areas[25]. Such provisions are only to be found in legal acts of lower rank, such as ordinances or guidelines. Poland lacks systemic solutions aimed at comprehensive transformation of industrial brownfields. There are also no national-level regulations indicating the entities responsible for the performance of the tasks related to the revitalisation of degraded areas, specifying the scope of their competence, sources of funding, or the procedures for planning and pursuing such tasks, locally and regionally. Furthermore, revitalisation projects are not part of the sphere of public tasks, and nor do they constitute in-house tasks of any local government unit.

[23] The Environmental Protection Law stipulates that „land reclamation in connection with the unfavourable transformation of the natural terrain consists in restoring it to its previous state" (Article 103). Most industrial brownfields had performed forestry or agricultural functions before the period of industrialisation.

[24] Starzewska-Sikorska A., 2008, *Przekształcanie terenów poprzemysłowych jako działanie służące podniesieniu atrakcyjności regionu* (Transformation of post-industrial sites as a measure used to raise the attractiveness of regions). In: *Krajobraz zbudowany na węglu* (Landscape built on coal), Institute for Ecology of Industrial Areas (IETU) in Katowice, Katowice, pp. 26–34.

[25] One of the key tools for local development and rehabilitation of degraded sites and elements of the natural environment is *natural urban revitalisation*. This concept is used in the strategic and operational documents of the European Union and Poland in the context of urban revitalisation programmes.

What proves indispensable with regard to renewal of urbanised areas, besides regulations, is active measures, stimulation, and facilitation, which is why, next to formal (statutory) planning, also **non-formalised and non-binding planning procedures** are important. Their purpose is to seek optimal solutions, acceptable to all stakeholders, used to prepare guidelines for statutory planning and to streamline the implementation of individual measures[26]. The Polish informal planning instruments include studies, analyses, or development strategies, all of which make it possible to prepare planning decisions aligned with the act on spatial planning and development, as well as action plans and programmes used to determine the paths and principles of, as well as the forms of oversight over the pursuit of the pre-assumed objectives of spatial policy. Some of them are operational in nature; they serve to actively implement the spatial solutions envisaged, stimulate the transformation process, and perform the functions of coordination, activation, and information exchange. Acting through operational plans and programmes, as well as financial, organisational, and legal tools that support the entire process, operational instruments increase the spatial, social, and economic efficiency of the spatial policy and the projects implemented in areas degraded by industrial production[27]. Most of them are inextricably linked with mandatory planning, and serve to clarify details of planning regulations or precede these regulations.

In Western Europe, many different approaches to the problem of industrial brownfield restoration have emerged over the years. Certain states created extensive programmes aimed at supporting national or regional investments, or even new institutions were established from scratch to manage the process. Others built adequate legal frameworks, regulatory systems, and instruments fostering the process of brownfield transformation[28].

The restructuring programmes intended for **German post-industrial regions** focused mainly on the problems of urban space development as well as protection of the natural environment and landscape. They were founded on land reclamation measures, development of industrial brownfields for natural and cultural purposes (or setting them aside), and their integration into the regional system of protected areas. The environmental protection regulations in force provided a favourable legal framework for transformation processes. Specific premises for degraded regions were established through informal arrangements, providing guidelines for local and regional zoning plans. A common denominator of most programmes supporting regional development was the adopted methodology of planning through projects, along with the spatial concept of landscape parks.

The brownfield restructuring strategy adopted in **France** was intended to create potential investment sites on industrial brownfields, representing a land reserve, in a sense, not subject to instantaneous development. In the 1990's, the immediate greening of sites and incorporating them into the system of regional and local greenery

[26] Ziobrowski Z. *Instrumenty i narzędzia operacyjne* (Operational instruments and tools). In: Ziobrowski Z. et al. (ed) 2000, op. cit., pp. 23–31.

[27] Among the most important of the industrial brownfield regeneration programmes and projects which have placed emphasis on the use of elements of the natural environment in cities and agglomerations, the following have stood out over the recent years: Integrated Operational Programme of Regional Development (ZPORR), URBAN+ Community Initiative, Operational Programe *Territorial Cohesion and Competitiveness of Regions*, RESCUE, Regentif, Revita-Silesia, or REURIS. The measures implemented by their means have highlighted the role of individual elements of the degraded natural environment, defined specific proposals for their protection or new development, and identified tools for the sustainable redevelopment of industrial brownfields.

[28] Ferber U. (ed) 2006. *Tereny Zdegradowane. Podręcznik* (Degrades areas. Textbook), interdisciplinary educational tool for the regeneration of degrades areas, passim.

resulted in successfully reclaiming 3,200 ha of post-industrial area in the coal region of Nord-Pas de Calais, of which 1,000 ha were forested. On such a basis, a system of green spaces was created to provide the framework for the region's new spatial structure.
In the **United Kingdom**, brownfield transformation is stimulated by environmental protection regulations. The legal grounds for the management and financing of the transformation of degraded land is provided by the Derelict Land Act (1982), and the Environment Act (1995), amended in 2000. Their essential purpose was to establish a governmental agency appointed to assist the implementation of environmental measures, and to define contaminated land against its planned (prospective, rather than present) function. The matters of protection of brownfield sites with special environmental qualities are regulated by the Natural Environment and Rural Communities Act of 2006[29].

The crux of the measures aimed at creating a coherent natural system, based on revitalisation and recovery of in-city brownfields, regeneration of damaged natural resources, and formation of a healthy and safe living space for inhabitants, is the attempt to design **long-term development strategies** embedded in the spatial policy for a given urbanised area and individual cities[30]. Comprehensive strategies serve to define a detailed programme of measures, an organisational framework and tools which altogether comprise a complete process of urban landscape renewal, above administrative divisions. An integral part of such strategies is defining the criterion of the environment's requirements and of its protection, which includes identifying and designating areas of natural value, providing maintenance of the network of open spaces, and above all, preventing them from being built up. A cohesive strategic vision for urbanised areas should be designed by relying on the principle of prioritisation in solving various problems of renewal of degraded post-industrial areas by taking the hierarchic nature of planning into account.

Next to the concept and vision of the development of an entire area, which should be integrated in a legally binding manner with supra-local zoning plans, the efforts undertaken at the scale of individual cities also present significant opportunities. They can face up to the challenges of increasingly complex urbanised areas and their new spatial structures, thus linking the natural and cultural landscape *in-between cities*[31]. What characterises spatial planning under non-formalised urban and regional operational programmes is **project-based planning** as well as concentration of efforts on those elements or areas which show the highest potential for market success. This model can be described as lacking a specific structure plan, limiting planning interventions to point-based activities, placing the emphasis on project implementation, and having pre-defined timeframes for the planning and implementation phases. Projects such as those are often central to a given development strategy. Focusing on individual tasks and stressing the importance of their rapid implementation make the process of spatial change clearly

[29] www.legislation.gov.uk [accessed on 2011].
[30] A comprehensive strategy to initiate a holistic process of landscape renewal is particularly important where a region faces a sudden decline in economic activity or depopulation (Lower Lusatia). With regard to the development of areas in operation (Veneto) or in the case where development sites border on degraded areas (Upper Silesian Agglomeration), one can resort to one-off revitalisation measures highlighting the role of natural landscape elements (planning by projects); source: *Przekształcanie krajobrazów. Zalecenia na przykładzie trzech europejskich krajobrazów poprzemysłowych* (Landscape transformation. Recommendations based on the examples of three European post-industrial landscapes), 2006, op. cit., pp. 59–107.
[31] The term *in-between city* (*Zwischenstadt*) was coined in 1997 by Thomas Sieverts. It pertained to the space on the fringes of large cities and agglomerations.

visible within a short period of time, provide inspiration for further action, and affect the manner in which a positive image of cities and agglomerations is built. However, where projects and investment resources are distributed over a large territory, and where the spatial links between them are insufficient, the impact of individual projects at the regional scale can be weakened. In the absence of supra-local spatial planning instruments, individual municipalities may implement individual development policies which are competitive towards those of the neighbouring municipalities. If the planning activity is oriented towards the city interior, it is possible to discover the potential inherent in the elements of the natural environment degraded by industrial activity. Renewal processes unveil their identity, strengthen and highlight their cultural and natural qualities, and allow new landscape qualities to be created. All such measures can stimulate the economy and increase the competitiveness and attractiveness of the urbanised space, and by focusing on the interior of urban areas, they can also curb the phenomena of urban sprawl and open space appropriation for investment purposes, which is clearly aligned with the pursuit of sustainability and the *connected city* vision[32].

The mere conception of a policy for the renewal of urbanised areas will not eliminate brownfields, nor will it change their image without active participation of local authorities. In order to successfully launch the process of brownfield renewal and adaptation for new functions, it is extremely important to find allies. Ensuring the right balance between the participants to this process contributes to the implementation of specific projects, which stimulates further development of urbanised areas. In all such efforts, one should consider the benefits for the city and the region in the first place, and they should involve contribution from many equal partners: public and private investors, special-purpose organisations, experts, and especially local communities, who are the future users of the new space. It is necessary to provide financial support from the state, remove legal barriers, and develop mechanisms to promote the development of these areas. What also proves indispensable is to change their structure by developing new relationships between elements of the natural, social, and technical environment, and by coordinating both the entire process and its individual measures. Revitalisation policy should pursue ecological renewal and creation of regional and local landscape identity, in both cultural and natural terms, based on the assumption that only some of the elements of the natural environment transformed by industrial production can be utilised and developed for natural, cultural, or commercial functions. Actually, many industrial brownfields will remain unusable and with no chance of development as a consequence of considerable environmental hazards and a variety of conditions to be taken into account: technical, economic, ownership or location related, as well as due to the proximity of land considered *easier* to develop[33]. Spatial, strategic, and economic planning should address all these aspects.

In conclusion, the opportunity to redevelop brownfields, degraded and abandoned, particularly for natural purposes, prevents dispersion of development, reduces the urbanisation pressure on open spaces, enables the continuity of natural systems to be maintained, changes the image of urbanised areas, and improves the quality of human life as well as the surrounding environment. However, in most cases, the chance to go through a complete process of brownfield transformation in cities or urbanised areas is small. With reference to the various considerations on such subjects as the sustainable development

[32] *New Charter of Athens, A Vision for Cities in the 21st Century*, European Council of Town Planners, Lisbon, 2003.
[33] The reuse of degraded land is considered economically viable if the return on the investment exceeds the adaptation costs.

of urbanised areas, the formation of green spaces and landscapes, and the transformation of brownfields, and considering the applicable provisions of legal regulations as well as the conclusions of many scientific and research studies devoted to this body of problems[34], it is possible to identify the **legal and planning restrictions as well as economic, social, and environmental barriers to the process of brownfield conversion for natural purposes** (Table 11).

Having defined the specific barriers which hinder the redevelopment of brownfields and their integration into natural systems, and based on a synthesis of the elements of the process of brownfield transformation for natural purposes, one can design and propose **specific measures considered necessary to complete the post-industrial landscape renewal process** (Table 12).

If the process of transformation of industry-degraded areas is to proceed in a controlled and planned manner, it is necessary to determine the vectors, variants, and strategies for the relevant transformations at the regional level, and to incorporate them into local zoning plans. However, in order to make the most of the opportunities inherent in the redevelopment of brownfields in line with the principles of sustainable development, one must apply a **comprehensive and systemic approach across the entire process, and have profound understanding of the relationships between all its elements** (Table 13).

[34] Juzwa N. 1988; Gasidło K. 1998; Zuziak Z. 1998; Gasidło K., Gorgoń J. (ed) 1999; Dubel K. 2000; Chmielewski J. M. 2001; Wiśniewska W. 2002; Przewoźniak M. 2002; Giedych R. Szumański M. 2004; Lorenz P. 2005; Böhm A. 2006; Zachariasz A. 2006; Chwalibóg K. 2007.

Table 11

Barriers to the process of brownfield transformation for natural purposes		
Economic and social barriers	**Legal and planning barriers**	**Environmental and spatial barriers**
- indebtedness of urban centres; - problems in the attempts to finance reclamation and revitalisation projects; - need for costly technological solutions; - unregulated legal and ownership status; - lack of knowledge about land value and market analyses, i.e. about the demand for investment on industrial brownfields and entities interested in revitalisation; - high supply of greenfield investment sites; - lack of acceptance from private entities (land owners) and public institutions towards projects of low commercial value; - constraints related to the implementation of specific legal forms of nature conservation or protection provided by conservation officers; - mindset barrier while addressing the problems of brownfield transformation; - lack of social participation among local communities;	- incomplete recognition of the problems of industrial brownfields;* - lack of institutional responsibility for degraded sites as well as for spatially, economically, and socially coherent areas beyond the administrative borders of municipalities; - lack of statutory regulations on industrial brownfield revitalisation; - insufficient political commitment to the matters of reclamation and reuse of degraded sites at all administrative levels; - low flexibility of the planning process;** - deficit of legal and organisational, as well as financial instruments; - absence of accurate criteria for delimitation of sites in need of transformation or reclamation; - lack of indicators and parameters which define the state of balance and the degree of harmonisation of the natural and built environment, especially in terms of the intensity of development, the built-up to biologically active area ratio, and the minimisation of the phenomenon of suburbanisation at the expense of open spaces; - absence of a universal system of protection of the natural and cultural landscape in the context of spatial governance and conservation of greenery, including valuable elements of the natural environment transformed by industrial activity, subject to the process of natural succession;	- high levels of air and water pollution; - soil degradation; - land instability; - unregulated water regimes; - health risks for the population living in the vicinity of a given area; - progressing space degradation; - proximity of operating industrial facilities; - no documentation on the layout and condition of technical infrastructure and land development; - poor accessibility by means of transport; - unsurveyed natural and cultural qualities of a given area and its individual elements;

* deficits in terms of: systems of information about the characteristics of brownfields, environmental risks, and measures required to reclaim and reuse them; expertise exchange, cooperation, and seamless transfer of information between potential participants to the process of renewal of degraded sites; monitoring of open space development, making it possible to analyse data on the changes in land use; metrics and methods of analysis and assessment of the transformation process

** lack of spatial surveys performed at a regional scale, covering a coherent urbanised area/agglomeration, guiding its comprehensive development while providing grounds for the development of local zoning plans; lack of local zoning plans or their excessive spatial fragmentation preventing comprehensive analysis of the problems of nature conservation and development of natural environment; deficit of regulations explicitly defining the scope of subjects to be addressed in planning studies on shaping green spaces as a system, being an integral part of the urban spatial structure

Author's elaboration

Table 12

Proposed measures/solutions necessary in the process of brownfield transformation for natural purposes		
Economic and social solutions/measures	**Legal and planning measures/solutions**	**Environmental and spatial measures/solutions**
- comprehensive surveys, expert reports, marketing studies, evaluations; - estimating transformation process risks; - enabling management and planning of urban agglomerations and empowering them in the state's administrative structure; - establishing an institution to coordinate and manage the transformation process; - cooperation between three groups of actors: the state, local government, and businesses; - raising funds to stimulate development; - developing opportunities for public participation; - promotion, information exchange, and education campaigns; - research and scientific activity; - analysing the public demand for green spaces in terms of quantity and quality; - research in the field of urban and economic marketing;	- unifying legal provisions and introducing regulations pertaining to reclamation and redevelopment of brownfield sites; - passing a law that would directly refer to the problems of rehabilitation of degraded areas, allow prevention of spatial, social, and economic degradation phenomena, and define tools for the creation of new green spaces (revitalisation act); - linking and standardising strategic planning documents; - openness and flexibility of the planning process, enabling dynamic control of the transformation process; - maintaining adequate relations between mandatory and operational planning; - incorporating the vision of industrial brownfield development in a legally binding manner in regional and local zoning plans; - raising the relevance of the land use study; - establishing an obligation to provide conformity between outline planning permissions and land use studies; - including the problems of brownfield redevelopment in local zoning plans; - delimiting industrial brownfields; - clarifying and unifying the nomenclature of spatial planning and land use; - formalising the matters of green space development and protection, creating natural systems and systems of landscape protection, as well as delimiting and harmonising urbanised and natural landscape zones in the legal framework;	- developing a database of industrial brownfields and individual natural elements degraded by production activity; - creating a vision of urbanised post-industrial landscape renewal; - developing a system for valorisation of individual elements, i.e. pits or dumps, for the prospects of their re-development; - developing a system of post-industrial landscape valorisation; - determining potential transformation paths or intended use of industrial brownfields; - identifying potential scenarios to proceed with the process of brownfield transformation by taking ecological criteria as well as economic and social objectives into consideration; - developing/supplementing natural systems by taking the intended use of brownfields into account; - preparing a programme for the monitoring and control of the outcomes obtained;

Author's elaboration

Table 13

Synthesis of the components of the process of brownfield transformation for natural purposes				
Stakeholders	**Site/element attributes**		**Measures undertaken**	**Relevant implementation tools**
- state and local government; - NGOs, social organisations, foundations; - industrial enterprises; - spatial and urban planners; - private entities; - investors, developers; - local communities; - experts in various fields: architecture, landscaping, biology, ecology, geography, hydrology, sociology, economics, marketing, etc.;	spatial	- position against the entire region, city, elements of spatial and functional structure; - access by means of transport; - surface area; - form, height, spatial extent, number of elements: dumps, pits, etc.; - functions and qualities of surrounding areas; - intensity and quality of development of a given area and its surroundings;	- obtaining knowledge about the possibility of redevelopment of industrial brownfields; - creating a vision of the transformation process; - development for natural (recreational and sports) or cultural purposes; - creating links with surrounding areas; - utilising existing infrastructure; - adapting existing facilities and changing their function; - developing new built features and urban complexes; - creating new public spaces; - conservation of cultural heritage (culture parks, industrial nature trails);	- analyses, pre-implementation surveys, expert reports; - brownfield databases; - development strategies (regional and local); - zoning plans (regional and local); - plans, operational programmes; - architectural and urban planning projects; - land use competitions for specific sites; - revitalisation programmes; - urban renewal programmes; - planning, programming, and designing standards;
	environmental	- degree of air, soil, and water pollution; - microclimate conditions; - geological structure; - transformation of land surface, vegetation, water regimes; - physical structure and chemical composition of individual elements; - position against the natural system of cities and regions, the system of protected areas, and open spaces;	- identifying and classifying post-industrial areas and their individual elements; - reducing pollution (control, isolation, treatment); - reclaiming degraded elements; - regulating water regimes and terrain relief; soil stabilisation; - delimiting degraded landscape units; - establishing diverse forms of nature conservation; - expanding and ensuring continuity of urban natural systems and the system of protected areas; - landscape protection; - landscape shaping and creative forming; - environmental monitoring; - coordinating various environmental services involved in specific activities; - educational and promotional campaigns;	- analyses, expert reports, natural and landscape valorisation measures; landscape studies; - databases on environmental conditions of brownfield sites; - nature conservation strategies; - zoning plans (regional and local); - environmental impact assessments; - environmental impact projections; - conservation plans; - environmental protection programmes; - implementation programmes of the green space maintenance and development policy; - environmental standards;
	economic and social	- location attractiveness; - investment attractiveness; - ownership status; - land development condition; - degree of infrastructure development; - state of knowledge about sites and their individual elements; - current form of land use by local communities; - sense of belonging and connection to the place;	- organisational activities: solving ownership issues, tenders, contracts, procurement of permits, opinions; - estimating transformation costs; - appointing operators to manage the transformation process; - organising project teams; - preparing scenarios for the development of individual brownfield sites; - estimating site attractiveness for future users; - use for economic purposes; - promotional campaigns; - investment activities; - educational campaigns; - economic monitoring;	- analyses of outlet markets, ownership status, land use forms; - expert reports; - databases of brownfield sites and entities potentially interested in their transformation; - social and economic strategies; - plans, operational programmes; - zoning plans (regional and local); - revitalisation programmes; - EU projects and funds; - subsidies, loans, tax reliefs; streamlining revitalisation procedures; - research projects: - educational and promotional programmes and campaigns; - citizen participation;

Author's elaboration

Having recognised all the system's elements and the interrelationships between them, one can define a model sequence of measures and actions relevant to the process of transformation of industrial brownfields, reclaimed for natural purposes:

- **identification and detailed survey** (inventory) of sites at the local and regional scale (location, size, main types, categories and types of elements of natural environment transformation);
- **estimation of the risks inherent in the transformation process** (recognising collisions, development constraints, as well as environmental, social, and spatial threats);
- **identification of transformation potential** (assessing qualities and defining prospective vectors for transformation or intended use of degraded areas; identifying potential scenarios to proceed);
- **transformation process preparation** (clarifying boundaries, defining how the development goals of urbanised areas and cities correlate with the possibility of their implementation on post-industrial areas, ensuring synergy of local projects for the use of degraded areas and elements of the natural environment situated at interfaces of municipalities, securing legal, organisational, financial, urban planning, and architectural instruments[35], establishing institutions of territorial and legal character authorised to manage[36], defining the tasks to be incorporated into local zoning plans, implementing educational and promotional campaigns);
- **implementation** (choosing parties responsible for the pursuit of individual tasks, signing contracts, acceptance of works);
- **use phase** (managing, monitoring)[37].

By defining the measures necessary to succeed in the process of industrial brownfield transformation, along with identifying the degraded elements of the natural environment intended to be developed or protected, defining the internal and external factors affecting them, as well as economic, social, legal, and environmental barriers thereto, one can strive to solve the problems of post-industrial area renewal in an organised and comprehensive manner. The foregoing also creates an opportunity to search for a balance between the built and natural environment, and to shape a new landscape quality of post-industrial cities and regions.

[35] Among the instruments common to the renewal processes of many post-industrial regions of Europe, the following can be mentioned: grants for land reclamation, local economy development, infrastructure development, regional institutions for industrial fixed property management, economic promotion, strengthened expropriation rights, strengthened land use control, tax exemptions for investors, etc. (Gasidło K., Gorgoń J. (eds) 1999, op. cit., p. 59).

[36] The following are some of the noteworthy Western European special-purpose institutions ready to manage the process of brownfield transformation: the UK's Urban Development Corporation, Germany's Ruhr Land Fund (*Grundstückfonds Ruhr*), the Catalan Institutes of Land Management (*Institut Catala del Sol*), and the French Public Land Management Companies (*Etablissement Public Foncier – EPF*). In Poland, the supra-local level institutions engaged in the activities performed on brownfields are Regional Development Agencies.

[37] The procedure which applies when brownfield sites are subject to transformation was developed on the grounds of the conclusions arising from the studies by numerous authors, including: Gasidło K. 1998, op. cit., pp. 152–154; Gasidło K., Gorgoń J. (eds) 1999, op. cit., pp. 158–160; Ziobrowski Z. et al. (ed) 2000, op. cit., pp. 17–31.

5.3. Searching for a new landscape of urbanised post-industrial areas

> „It is probably not beyond our capabilities to repair the damage done to nature through industrialisation; however, it will be more difficult to formulate new positive values for the contemporary life."
> Dubois R., 1986

The human pursuit of continuous growth and creation of places to live, work, and rest in harmony with the natural environment is the very foundation of the civilisation's development. It is also a driving force in the process of urban renewal of degraded areas, one which finds its reflection in the landscape.

The following elements provide the grounds for the protection, planning, and deliberate shaping of the landscape:

- creative approach to/idea/strategic vision of the landscape transformation process,
- intellectual promoter of the efforts undertaken (person or institution), emotionally involved and holding adequate organisational capacity,
- appropriate planning tools as well as financial and organisational instruments[38].

Landscape should be a representation of the principles of sustainable development, the condition of culture, and the awareness of the local population. However, this is not so obvious in post-industrial cities and agglomerations. The interference in the natural environment has contributed not only to the transformation of the landscape, but in certain cases, even to its irreversible degradation. Consequently, not only the environment has been transformed, but also the living conditions of people. Thus **an urbanised post-industrial landscape has emerged**, forming more than the elements of the built environment, such as places of habitation and work, i.e. architectural structures, urban complexes, and infrastructure elements typical of the technical-industrial era, namely the natural space, developing under the influence of productive human activity. This space features modelled land surface of specific characteristics, modified water environment, and transformed vegetation. Complemented by both *organised* and *neglected* greenery as well as enclaves of *wild* nature, components such as dumps, pits, artificial water reservoirs, and water courses are inseparably ingrained in the urbanised space. The spirit of such a landscape is reflected in the following description of the post-industrial areas to be found in Western Europe:

> „Places that are not cities, suburbs, or villages, having neither a core which identifies them nor distinct peripheries; the landscape which surrounds them is something in between: neither vast meadows and fields nor parks and gardens, but rather remnants, isolated green scraps, dilapidated, contaminated, worn out, and cut-through; single-family houses that do not match the background... and beside them, large and crowded multi-family blocks, carelessly designed, surrounded by car parks and a selection of no-man's spaces, sometimes wrapped in a thick *fur* of greenery just to create a more bearable view...; uncontrolled, sprawling urban fringed and peripheries; *islands* – sometimes forming an archipelago, at other times,

[38] Juzwa N. 2003. *Tereny poprzemysłowe w aspekcie zarządzania rozwojem regionalnym* (Industrial brownfields analysed from the perspective of regional development management). In: Klasik A. (ed) *Zarządzanie rozwojem lokalnym i regionalnym w kontekście integracji europejskiej* (Management of local and regional development against European integration), Bulletin of Committee for Spatial Economy and Regional Planning of the Polish Academy of Sciences, book 208, Warsaw, pp. 219–234.

> single and scattered across a sea of disposable and banal objects; old factories – monumental and symbolic; some destroyed, some still operational; all accumulated around old settlements in slumber, having the features of something untamed, and yet concealed behind the patina of transitory things; old settlements, living oases, proofs of urban design and architectural tradition"[39].

Urbanised post-industrial landscape is, to a large extent, a neglected and unremarkable landscape. It must not be perceived as a beautiful expansive view, providing a backdrop for selected architectural features or urban complexes. However, it is highly specific and characterised by qualities produced both in the past and presently. These qualities are unique to a given place, stemming from the economic, social, and cultural processes observed in it. Nature has done its fair share to this landscape – subjugated in the name of order, in some cases, while at other times, affirmed in its genuine form. At the interface with the outcomes of industrial human activity, it has created a new quality in the landscape. When combined with cultural heritage, its conservation or adequate management can bring measurable economic and social benefits to urbanised areas.

Factors such as the sheer amount of brownfields, the absence of ideas for their redevelopment, the extent of the related threats, and the scarcity of planning tools and methods as well as financial resources have made it difficult to restore the balance between nature and culture, or between aesthetic qualities and economic efficiency, while satisfying human needs at the same time. In many cases, this has become a luxury that not every city or region can afford.

With the transformation of social and economic systems, an opportunity has emerged to transform urbanised space as well as to renew its landscape and redefine its value. What proves to be challenging when transforming post-industrial landscapes is the capacity to apply new technologies and to combine them with economic and environmental benefits. The implementation of innovative solutions connected with landscaping has stimulated social transformations and contributed to certain changes in the mindset of post-industrial communities.

In many Western European cities and regions, attempts to induce spatial and urban planning renewal have been made for several decades now, intended to stimulate their further economic, spatial, and functional development, and aimed at increasing the attractiveness of their landscapes (Nord-Pas-de-Calais, Veneto, Dessau-Bitterfeld-Wittenberg, the Ruhr, Lower Lusatia, Potsdam, Berlin, Hamburg, Barcelona, Bilbao). New methods and paths for the development of degraded areas are sought, defining and determining the perception of the post-industrial landscape. And the elements of the natural environment transformed by industrial activity play an important role in the process of building the new landscape identity.

[39] Wachsen K. 1996. *Change Without Growth, Sustainable Development for the 21st Century*. VI Architecture Biennale Venice. In: Juzwa N. 2003, op. cit., p. 219 [translated from the Polish language version by Łukasz Borkiewicz].

Fig. 103. First generation of measures implemented for purposes of landscape renewal. Borynia-Jar dumping grounds in Jastrzębie-Zdrój: since 1983, reclamation works have been conducted there on an area of 70 hectares, comprising such procedures as levelling of slopes and the flat top of the heap, greening by traditional methods, using fertile soil and by the soilless FRISOL method

Fig. 104. Second generation of measures implemented for purposes of landscape renewal. Cospuden landscape park, south of Leipzig: outcomes of the reclamation and redevelopment of the dumps and pits of the former Zwenken/ Cospuden lignite mine; photograph by K. Rostański

Fig. 105. Third generation of measures implemented for purposes of landscape renewal. Water World of the Lusatian Lake District, Sedlitzer See region; photograph by R. Ludewig

Considering the projects, strategies, and programmes aimed at the transformation of urbanised post-industrial areas, the discernible **landscapes are aligned with three predominant approaches to the use of degraded natural elements**:

- **economic**
  based on the extraction of mineral deposits, forestry production, and the use of renewable energy in industrial brownfields; they entail searching for a different mode of land use, and affect the economic revival of the neighbouring land;
- **social**
  highlighting forms of development for purposes of recreation and leisure, sports and tourism; their potential lies in the high capacity to attract diverse users, create new jobs catering to the needs of the developing service civilisation, and offer attractive leisure activities in contact with nature;
- **cultural**
  stemming from the need to protect industrial heritage, emphasising the cultural identity and natural legacy associated with a number of aspects, including the process of natural succession; expressing human awareness and attachment to places, traditions, everyday life; representing a sentimental need to preserve elements of *the past*, identifying the place, affecting the image of cities, stressing the distinctiveness and industrial character of urbanised areas.

Irrespective of the goal originally assumed, each of the landscapes thus created is characterised by its unique structure (understood as the quantity and type of its specific qualities), diversity (quantity, quality, and intensity of occurrence of individual elements), and spatial composition (their arrangement against one another and occurrence). They rarely occur individually. A new landscape is a resultant of a combination of individual methods, functions, and action strategies employed.

Having analysed the strategies implemented in post-industrial cities and regions, one can distinguish between **three generations of planning and project-related activities aimed at landscape renewal**:

I. reducing the harmful impact of industry through landscaping
restoring post-industrial sites to a condition close to natural through damage remediation and reclamation for purposes of forestry and agriculture;

II. incorporating elements of the post-industrial natural environment into concepts of spatial planning and urban design
attempts to manage environmental resources in a comprehensive manner, protect and supplement natural systems, create a network of links between cultural and natural heritage sites, develop new urban green spaces, and highlight the most attractive elements of degraded landscape;

III. creating new landscaping concepts
creating *landscapes of the future,* disparate from the pre-industrial and industrial image of urbanised areas.

In each of these three generations, the natural environment plays a fundamental role in the process of landscape restoration. The measures undertaken initially (starting from the 1970's) only mitigated or minimised the negative effects of industry. The diverse procedures which involved decontamination, protection, and rendering land accessible, land surface grading, and restoring biological productivity (sodding, planting shrubs and trees, irrigation, accelerating natural succession processes, or introducing new species) constituted attempts to reintegrate post-industrial areas with the natural environment and to restore the disturbed biological balance. The efforts which were also aimed at creating a positive impact on the surroundings were usually of a local nature (reclamation of individual dumps or pits). In the late 1980's, landscape transformation attained regional coverage. In the case of many of the measures in question, individual elements of the degraded environments, such as pits, dumps, artificial water reservoirs, or industrially polluted rivers and riverside areas, have become their distinctive features. Their redevelopment and conversion into green spaces helped them contribute to building a new quality of urbanised space (Cospuden landscape park near Leipzig). Upon entering the 21st century, transformation of brownfields evolved into an outcome of creative visions and comprehensive strategies, giving rise to further new landscaping concepts, where a decisive role, equally important as the cultural and natural conditions, is played by the conceptual ideas of the authors and initiators of new development forms (Water World of the Lusatian Lake District). Paying attention to the utilisation of degraded land while seeking to develop *landscapes of the future* cannot be solely attributed to the mere need for a beautiful view, but instead, it reflects the need to create a habitable environment in harmony with nature and in line with the requirements of those who inhabit post-industrial areas. The foregoing proves that a new hierarchy of values has been emerging in the process of creation of the surrounding space. It also leads to defining new models of spatial governance: urban planning and architectural (composition, transparency), functional (utility, adequate selection of functions), aesthetic (image, symbolism, *beauty* of the place), psycho-social (identification with the place, sense of identity and security), or ecological (natural, environmental, health qualities). In fact, their interconnectedness is an integral part of the process leading to sustainable development of cities and post-industrial areas.

Spatial governance has contemporarily been replaced by a need for *otherness* and by commercialisation of urbanised space. The ugliness of degraded landscapes can be beautifully highlighted, and where it contrasts with a harmonious landscape and its characteristic spatial governance, it can be even perceived as an intriguing or puzzling variety of beauty. Post-industrial landscapes are indeed intriguing in their distinctiveness, fascinating with the sheer magnitude of devastation and the proximity of threat, clearly standing out for their vastness, complexity, and the intensity of the spatial transformations observed. One can neither overlook nor remain indifferent towards them. Engaging with them is like establishing a contact with the history of the city and with its true identity. In urban planning and landscaping terms, the significance of such places may also be found in their distinctiveness, attributable to surprising shapes, exceptional flora and fauna, or colour saturation of their individual elements. Features of degraded landscapes can become distinctive qualities of a given place as they cease to be perceived as mere peculiarities. Combined with the capacity to shape a new image of urbanised areas and the necessary technical innovation, these qualities themselves become attractions, the popularity and effective use of which can yield economic, natural, and social benefits, restore spatial order, and influence the perception of modern cities and post-industrial agglomerations.

The process in which new landscapes are developed reflects the aspiration to strengthen competitiveness. It equally pertains to cities and agglomerations, which is why it can be analysed at two spatial scales: local and regional. **From the perspective of local activities**, an attempt to synthesise the overall body of problems of post-industrial landscape renewal processes is a somewhat risky and problematic endeavour. The foregoing stems from the fact that each urban area is characterised by a highly unique economic and political status as well as landscape and nature condition. Nonetheless, many transformed cities provide excellent examples of how the application and duplication of the models of transformation measures effectively deployed elsewhere have proved successful in economic and social terms. Using such a model in culturally diversified places may lead to transformation, or even elimination, of the original nature of a given place, losing its identity, and unification of areas in a manner which makes them difficult to distinguish from other urban areas. However, it can also make it possible to find universal values which – once properly utilised – will become the starting point for creating a new quality of the urbanised space. Incorporating elements of the natural environment degraded by industrial activity into this process opens up new opportunities for the creative use of the urban fabric. Making the most of these elements to expand natural systems delivers an impulse to change the image and perception of cities, and to accelerate their spatial development. Landscaping projects implemented in areas of former open pit mines, recreation and leisure sites evolving from industrially degraded elements of the natural environment, or cultural features embedded in post-industrial sites and facilities have become the balancing or complementary part of networks linking major cultural attractions and natural systems. As natural structures are changing and the system of landscape links is becoming increasingly specific, hope is rising that one can actually attain economic benefits, change the economic profile, and attract new investments related to tourism, recreation, or stimulation of cultural life. Such efforts entail numerous subsequent investments, consistently developing the ecosystem and enabling new paths of socio-economic growth. They essentially boil down to inducing a change in the image of a post-industrial city, turning it into a city perceived as optimal for life, work, and leisure, while being attractive to tourists at the same time. In many cases, this process constitutes a response to the problems of unemployment and urban depopulation. Therefore, it seems reasonable to place emphasis on the development of tourism based on the existing and potential natural and landscape assets, as well as on the progress of science and cutting edge technologies.

Landscape renewal in urbanised areas should be **regional in scope**. In post-industrial agglomerations, it is becoming a necessity that healthy living conditions are secured, which entails care for the natural environment, access to green and open spaces provided to the urban population, as well as the need to protect peri-urban open spaces against the growing exploitation pressure. It is also important to develop a creative vision of the landscape and to diversify it, thus making sure that it is attractive and competitive towards other areas, that it can also provide a remedy for the schematic perception and thinking of the quality of the transformed natural environment. Adequately developed and highlighted, numerous interconnected elements of the natural environment degraded by industrial activity can become the prime mover of landscape transformation, the key constituent of its spatial composition, and the foundation for the renewal of post-industrial areas.

SYNTHESIS

The contribution of the natural environment to the development of urban structures as well as the formation of natural systems and landscapes is associated with all stages of the evolution of human civilisation. How the natural elements transformed by industrial production are incorporated into the process of renewal of urbanised post-industrial landscapes reflects the contemporary processes of changing mindsets and becoming mature enough to actually implement the philosophy of sustainable development. Landscape transformation begins in people's minds, which is precisely why it is necessary to change the processes of perceiving, evaluating, and rediscovering the elements already forgotten, overlooked, and disregarded.

On account of the sheer scale of the problem and the potential costs which it involves, leaving the creation of post-industrial landscapes to nature is currently the most common strategy. After all, even in its most deteriorated and transformed state, nature tends to revive, and as this phenomenon proceeds the value of landscape grows. Nevertheless, such a perception of this problem seems to be overly simplistic. **In some cases, it takes a bold vision and a creative approach to notice beauty in a degraded landscape and to endow it with a new quality**. It is then that nature may be more than the mere backdrop, but actually mould the physiognomy of the environment of human habitation to an equal degree as other elements. The outcome will be a new landscape which, despite the extent of transformations, can be harmonious, while the lapse of time will relieve it of the burdens of degradation and make it appear as if it has always been so. When perceived in this context, recognising the natural qualities of post-industrial areas and identifying places of exceptional value, which deserve conservation, preservation, or conversion, becomes all the more important. Dumps, pits, artificial water reservoirs, polluted rivers, as well as adjacent riverside areas, deliberately selected and redeveloped, provide an opportunity to create new positive qualities, valuable from the perspective of those who use the urban space.

Analysed against the overall body of spatial planning and urban design problems, the process of brownfield transformation, aimed not only at intense urbanisation, but also taking the potential siting of greenery and public spaces into account, is conducive to the preservation of the continuity of ecosystems, changes the image of urbanised areas, and raises the competitiveness and attractiveness of cities and regions. Technology, being continuously improved, increases the chances for creating space that is friendly to both people and the environment. At the same time, non-standard spatial solutions as well as bold urban planning and architectural concepts generate new opportunities for shaping the spatial and functional structure of urbanised areas. Next to the process of revitalisation of post-industrial built features and compounds, transformation of elements of the degraded natural environment becomes an expression of the search for places and symbols of identity considered crucial when creating and strengthening the *genius loci*, fosters cultural transformation of post-industrial communities, boosts their creativity, changes mindsets, and drives the economic growth of post-industrial areas.

It takes time and money to design a harmonious spatial layout, and yet its successful implementation can provide a wealth of satisfaction as well as some measurable benefits of natural, cultural, social, and economic nature not only to those who actually use the urban public space, but also to urban planners and designers. Where a bold vision blends with the pragmatic side of the renewal process via adequate legal, financial, and organisational methods and instruments, the measures undertaken stand a chance of being effective, and the yardstick of their success will be the new quality of the post-industrial landscape.

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LIST OF FIGURES

Cover: Water reservoir „Pogoria II" in the post-exploitation sand pit in Dąbrowa Górnicza; photograph by A. Pancewicz.

On separators between chapters respectively:

Zabrze Biskupice on the Bytomka river, in the foot of Ruda dump; photograph by A. Pancewicz, p. 6.
Water reservoir in a decommissioned lignite open pit, Großräschen; photograph by B. Bulawa, p. 22.
The river Rawa in Katowice; photograph by A. Pancewicz, p. 78.
Dolomite quarry in Bytom; photograph by A. Pancewicz, p. 128.
Conical spoil tip in Czerwionka-Leszczyny; photograph by A. Pancewicz, p. 190.

LIST OF TABLES

NATURAL ENVIRONMENT IN POST-INDUSTRIAL LANDSCAPE RENEWAL

Abstract

This monograph addresses the problem of landscape renewal in urbanised areas, analysed in terms of the importance of the natural environment to this process. Special attention has been attached to certain natural components, degraded by human industrial activity, such as dumps, mine workings, artificial water reservoirs, and polluted rivers.

The main purpose of this study is to discuss the possibility of integrating elements of the natural landscape, degraded by industrial activity, with the spatial planning and urban design process. The assumption underlying this study is that their reuse and skilful development can making the spatial and functional structure of industrial brownfields more transparent, protection of open spaces against uncontrolled economic annexation, replenishment and development of natural systems, and co-creation of spatial governance for urbanised areas.

The premise underpinning the study is to identify and examine the following issues:

- evolution of the views on the problem of transformation of urbanised areas, connected with industry;
- importance of the natural environment in developing the new governance for urbanised areas;
- classification of elements of the natural environment degraded by production activity;
- opportunities for creating a new post-industrial landscape.

The role of the natural environment in the civilisational development of cities and agglomerations is discussed in the context of historical urban concepts and visions, looking for a place to live with an ideal structure and functions, implementation assumptions and the contemporary framework of national arrangements for the environment and the formation of living conditions for the population in urban areas.

The way in which elements of the natural environment have been integrated into development processes is illustrated by examples of cities and post-industrial areas. They are considered from the point of view of: the consistency of planning activities undertaken, the role of the natural environment in shaping and complementing spatial and functional structures, and the participation of brownfields in this process. Conclusions from the above considerations have become the basis for the search for new uses of brownfield sites, as well as the starting point for detailed research on the Upper Silesian Agglomeration.

An important part of the work focusses attention on the characteristics of the various elements of the degraded natural environment, the possibility of their transformation and redevelopment. The transformation process was placed in the spatial planning issues. Limitations and opportunities for the integration of post-industrial sites into natural systems are indicated, participants in this process, and more important activities and implementation tools relevant to model solutions are identified.

The conclusion of the work is the search for a new landscape identity of urbanised areas. It is the author's desire that the conclusions drawn from the above considerations contribute to the creation of bold visions and creative approaches in the process of post-industrial landscape renewal and enrich the discussion on the desirability of transforming post-industrial areas in a natural direction.

ŚRODOWISKO PRZYRODNICZE W ODNOWIE KRAJOBRAZU POPRZEMYSŁOWEGO

Streszczenie

Przedmiotem monografii jest problematyka odnowy krajobrazu obszarów poprzemysłowych zurbanizowanych, rozważana pod kątem znaczenia w tym procesie środowiska przyrodniczego. Szczególną uwagę poświęcono elementom przyrodniczym zdegradowanym przez działalność produkcyjną: zwałowiskom, wyrobiskom, sztucznym zbiornikom wodnym i zanieczyszczonym rzekom.

Głównym celem pracy jest wskazanie możliwości wprowadzenia wybranych elementów środowiska przyrodniczego zdegradowanego w proces planowania przestrzennego i projektowania urbanistycznego. Założono, że ponowne wykorzystanie i umiejętne ich zagospodarowanie może przyczynić się do uczytelnienia struktury przestrzenno-funkcjonalnej obszarów poprzemysłowych, ochrony terenów otwartych przed niekontrolowaną aneksją gospodarczą, uzupełnienia systemów przyrodniczych oraz współtworzenia ładu przestrzeni zurbanizowanej.

W pracy zgromadzono zasób wiedzy dotyczący zagadnień związanych z:

- ewolucją poglądów na problem transformacji obszarów zurbanizowanych, związanych z przemysłem,
- znaczeniem środowiska przyrodniczego w kształtowaniu nowego ładu obszarów zurbanizowanych,
- charakterystyką i możliwościami przekształceń elementów środowiska przyrodniczego zdegradowanego w wyniku działalności produkcyjnej,
- możliwością kreowania nowego krajobrazu poprzemysłowego.

Rola środowiska przyrodniczego w rozwoju cywilizacyjnym miast i aglomeracji została omówiona w kontekście historycznie ujętych koncepcji i wizji urbanistycznych, poszukujących miejsca zamieszkania o idealnej strukturze i funkcjach, założeń realizacyjnych oraz współcześnie obowiązujących ram narodowych ustaleń dotyczących środowiska i kształtowania warunków życia ludności w obszarach zurbanizowanych.

Sposób, w jaki elementy środowiska przyrodniczego zostały włączone w nadanie kierunku procesom rozwojowym ilustrują przykłady miast i obszarów poprzemysłowych. Rozpatrywane są one z punktu widzenia: konsekwentności podejmowanych działań planistycznych, roli środowiska przyrodniczego w kształtowaniu i uzupełnianiu struktur przestrzenno-funkcjonalnych oraz udziału w tym procesie terenów poprzemysłowych. Wnioski płynące z powyższych rozważań stały się podstawą do poszukiwania nowych sposobów użytkowania terenów poprzemysłowych, a także punktem wyjścia do szczegółowych badań dotyczących Aglomeracji Górnośląskiej.

Istotna część pracy skupia uwagę na charakterystyce poszczególnych elementów środowiska przyrodniczego zdegradowanego, możliwości ich przekształcenia oraz ponownego zagospodarowania. Proces transformacji umiejscowiono w problematyce planowania przestrzennego. Wskazano ograniczenia i możliwości włączenia terenów poprzemysłowych w systemy przyrodnicze, określono uczestników tego procesu, ważniejsze działania oraz narzędzia realizacyjne istotne dla rozwiązań modelowych.

Podsumowaniem pracy jest poszukiwanie nowej tożsamości krajobrazowej obszarów zurbanizowanych. Pragnieniem autorki jest, aby wnioski wysnute z powyższych rozważań przyczyniły się do tworzenia śmiałych wizji i twórczego podejścia w procesie odnowy krajobrazu poprzemysłowego oraz wzbogaciły dyskusję na temat celowości przekształceń terenów poprzemysłowych w kierunku przyrodniczym.

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