

**THE DIRECTIONS OF PROTECTION AND  
DEVELOPMENT OF NATURAL ENVIRONMENT OF  
A METROPOLIS ON THE EXAMPLE OF THE POZNAŃ  
METROPOLITAN AREA**

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The aim of this study is a presentation of issues related to directions of changes which take place in natural environment in heavily urbanized areas, in a metropolis and the interaction of the central city and municipalities of the metropolitan area in the issue of natural environment. It shows natural environment as an important factor influencing functional and spatial conditionings of a metropolitan area.

Keywords: natural environment, metropolitan area, metropolis

## **1. INTRODUCTION**

The spatial planning and development act of 27 March 2003 introduced the term 'metropolitan area'. According to the act, it is the area of a city and its functionally related surroundings. For a metropolitan area, a land development plan of the metropolitan area is prepared as part of the land development plan of the voivodeship.

To specify a metropolitan area, the primary importance is the delimitation of its borders based on adopted assumptions and a wide spectrum of delimitation criteria. The aim of delimitation of metropolitan areas is designation of settlement schemes which, in terms of functional and spatial relations and advancement of urbanization processes, will provide integrity and will differ only in the administrative status of included territorial units (Z. Gontarski, „Obszary metropolitalne w Polsce”. Polska Akademia Nauk, Komitet Przestrzennego Zagospodarowania Kraju, Warszawa 1980 r.).

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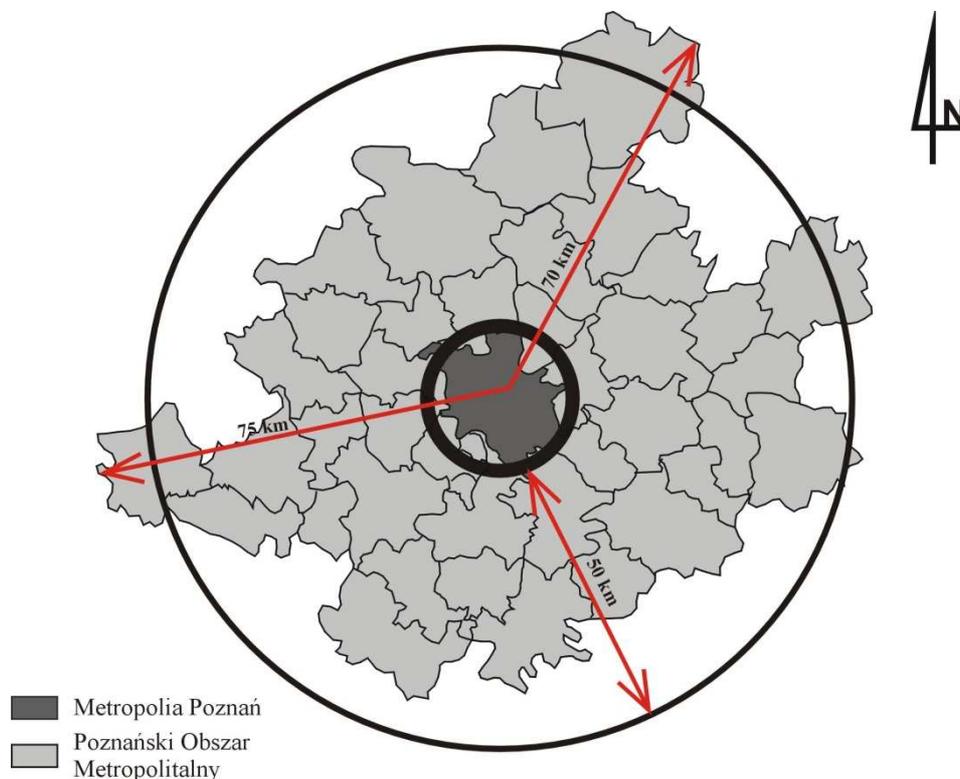


Fig.1. Area – central view –diagram Source: author’s study – based on “the Poznań Metropolitan Area” Wielkopolskie Biuro Planowania Przestrzennego w Poznaniu (regional spatial planning office in Poznań), Poznań 2006

The delimitation of the Poznań Metropolitan Area was conducted on the basis of studies and analyses of urbanization processes in relation to the area surrounding the city of Poznań in the following research aspects.

Poznań Metropolitan Socio-economic environment expressed inter alia by demographic changes such as population density and dynamics of population growth;

1. Accessibility of public transport expressed by 30 min isochrone of a journey by public transport in relation to the distance of 10, 30 and 50 kilometres to the centre of the metropolis and 60 min isochrone of a journey by public transport in relation to the distance of 10, 30 and 50 kilometres to the centre of the metropolis;
2. Natural environment expressed inter alia by valorization of agricultural production area, index of forest coverage, area percentage of nature conservation units in municipalities;

3. The delimited Poznań Metropolitan Area covers 45 municipalities including Poznań. The area includes 10 poviats towns and 15 other towns. The acreage of the area equals 6205 km<sup>2</sup> (20.8% of the area of the voivodeship). The Poznań Metropolitan Area is inhabited by 1326.9 thousand people, which constitutes 39% of the inhabitants of the voivodeship. The population density is 214 people per 1 km<sup>2</sup>, whereas the average population density in the voivodeship equals 112 people per 1 km<sup>2</sup>.

After: Poznań Metropolitan Area, Wielkopolskie Biuro Planowania Przestrzennego w Poznaniu (regional planning office in Poznań), Poznań 2006.

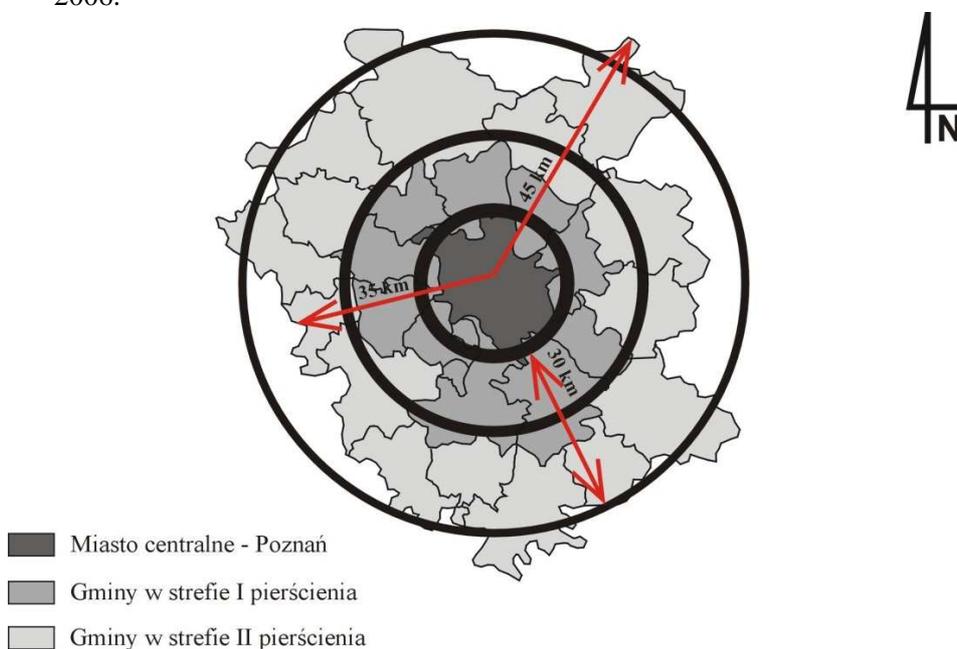


Fig. 2. Poznań Metropolitan Area – central view – diagram. Source: author's study based on the spatial development plan of the Greater Poland Voivodeship – the Poznań Metropolitan Area, wielkopolskie Biuro Planowania Przestrzennego in Poznań (regional spatial planning office in Poznań), 2003

The delimitation of the Poznań Metropolitan Area was conducted on the basis of studies and analyses of urbanization processes in relation to the area surrounding the city of Poznań in the following research aspects:

- socio-economic environment and spatial development expressed by demographic changes and changes in the socio-economic structure of the population;

- transportation accessibility and distance expressed by a 30 min. isochrone of time accessibility of means of public transportation and a 30 km isochrone of distance; natural environment.

## **2. RESOURCES OF NATURAL ENVIRONMENT**

The quality of natural environment is directly dependent on the condition of biotic elements of nature. The problem of anthropopression on natural environment exists in highly urbanized areas, agglomerations and metropolises. The anthropopression occurs where it is characterized by superior assets, where geodiversity and biodiversity occur. Apart from inadequate level of knowledge related to this issue in society as well as in local governments, there is the lack of systematic solutions, including inter alia a system of sufficient compensations for individuals who accomplish pro-ecological actions connected with optimizing energy consumption in households and in entire residential and farming areas.

The questions of ecology are better and better recognized and implemented on the local level and beyond. The role of education in local governments and local communities increases. Pro-ecological actions are undertaken in all fields and at all levels beginning from the increase of awareness in scientific circles by the introduction of pro-ecological issues to schools at every level of education. This increasingly better ecological awareness contributes to numerous actions in all fields of economic and social existence. A sustainable development has become the aim of actions of local communities as well as local authorities at the ecological, economic and social level.

Climatic and hydrologic conditionings contribute to water shortages, especially for farming purposes, but also to deterioration of water purity in lakes used for recreational and touristic purposes within the Poznań Metropolitan Area. The problem is the deficiency of water retention in reservoirs, little ground retention and lack of storage reservoirs regulating water flow in the catchment area.

There is a slight danger of flooding for the Poznań Metropolitan Area from the Warta river, but it is possible only in extreme cases. It is influenced by the river control conducted over the years and urbanization of flood plains, which causes low accumulation of overflowing water. The share of flood plains in the Poznań Metropolitan Area constitutes only around 5% in relation to endangered areas in the Greater Poland voivodeship. The status quo is assured by the storage reservoir 'Jeziorsko' located near the upper catchment area of the Warta river between Sieradz and Uniejów.

During the flood (also called the flood of the century) in 1997, the flooded areas covered the Mosina-Śrem part (especially the area of Rogalinek) of the

Poznań agglomeration, fragments of oxbows, meanders near Luboń and flood plains to the north of the water intake 'Dębina', causing health risks. The natural polders of the Warta river played an important role in the reduction of the risk of flood; they included the part devoid of dikes from Nowa Wieś Podgórna to Śrem and from Śrem to Rogalinek.

Small storage reservoirs are important for the local environments. They are: Kowalskie Lake, Śródka, Iwno, and Malta Lake, and ponds: Olszak, Browarny, Młyński, Antoninek, and Radzyny. The protection against floods from the Warta river and its tributaries are embankments, which protect cubature objects. The length of embankments of river valleys in communes on the Warta river equals 38.1 km, including 10.0 km of girdle embankments within the borders of Śrem.

The directions of natural environment protection and development cover actions within the range of energy, underground and surface water protection and rational water management. Inadequate amounts of drinking water, its high consumption and overuse of underground waters in highly urbanized areas enforce actions to modernize water intakes, water conditioning plants and power transmission grids in order to minimize the loss during the transfer. It is necessary to build local intakes and maximally reduce underground water use for industry by the introduction of new technological developments.

The problem conditioning the development of a metropolis is provision of adequate high, rule abiding standard of living of inhabitants, but above all, access to drinking water in sufficient amounts and rationalization of energy consumption by the use of alternative sources.

The conditions for having access to proper quality drinking water are:

1. Maintenance of balance in natural environment and its maximal protection against uncontrolled urbanization;
2. Protection of existing drinking water resources by rigorous application of protective zones around water intakes;
3. Reservation of area for new water infrastructure facilities in spatial planning
4. Building water mains;
5. Modernization and automatization of water supply plants and pumping stations;
6. Building missing fragments and modernization of the existing water-pipe networks;
7. Constant monitoring of facilities and water intakes.

For environment protection, apart from water-pipe networks, an efficient sewerage system including the sanitary and rain system, is also important.

For reliable wastewater collection and its proper neutralization, necessary are:

1. protection against uncontrolled urbanization;
2. Efficient sewage treatment plants;

3. Modernization and development of pumping mains to already existing sewage treatment plants;
4. Reservation of an area for new sewerage infrastructure facilities in spatial planning;
5. Building sewage systems in new housing estates;
6. Building storage reservoirs;
7. Use of alternative ways of rainwaters disposal and application;
8. Development of rainwater sewage systems with cleaning facilities as well as building and development of facilities storing rainwaters in water catchment area.

Reasonable waste management is yet another factor influencing the quality of urbanized environment, especially areas heavily adapted, such as metropolises. It should be based on waste sorting, recycling and introduction of technologies reducing detrimental effects and amounts of industrial waste. There is a need for application of standards in hierarchies of waste management. Currently working waste dumping grounds in the ,Poznań Metropolitan Area which have long forecast operating life, as well as waste dumping grounds designed in land development plans, all assure proper and non-colliding waste management.

It is vital to introduce systematic solutions to problems of industrial waste management and issues related to pesticide burial areas and medical or veterinary waste.

Nature conservation, development of technical infrastructure, rational management of water, sewage and waste as well as application of pro-ecological sources of heat energy will directly contribute to the protection and development of natural environment of an agglomeration.

The directions of protection and development of the Poznań Metropolitan Area, apart from essential actions connected with technical infrastructure within the scope of environmental protection, should assume the continuation of the concept of wedge-shaped / ring-shaped system of greenery for the city of Poznań devised by prof. Władysław Czarnecki and Adam Wodziczko in the 1920s and 1930s. The wedge-shaped / ring-shaped system of greenery was the basis of the structure of land development plans in the city and distinguished it in the country.

The role of green areas in the structure of the city is irreplaceable, so it is important to aim at the preservation of existing resources and change and develop them in a creative way. The function of social and pro-health functions of these areas increases. They decide about the quality and comfort of life, well-being and health of inhabitants of an agglomeration. Parks and gardens have always distinguished precious architectural objects and enhanced the social status of their owners.

In an urbanized agglomeration with dense street network and tight built-up area, greenery was pushed aside. The increase of pro-ecological awareness and social needs of living in healthy environment forced actions which favoured preservation of precious green areas, as well as their modernization and development.

The legal act of 16.04.2004 on nature preservation<sup>1</sup> and the legal act of 03.02.1995 on farming and forest areas<sup>2</sup> obliged communes to proper care of greenery and trees. The character of greenery in cities is very diverse and depends on buildings. Greenery is different in areas of housing estates, where gardens have utilitarian, decorative and recreational functions; in city centres; and in housing estates, where greenery forms a garden-park for all inhabitants and has a function of public space. Greenery incorporated into building areas is diversified with small architectural elements, playgrounds, and has the recreational-rest function.

Plants along routes, which play the role of isolation, soothe noise, stop a part of exhaust fumes and dust, are subject to heavy degradation. Parks, lawns and city gardens create larger enclaves of greenery and should be thoroughly protected. In the suburbs, in communes of metropolitan areas this role is fulfilled by manorial, church and cloister parks with a wide range of trees and bushes, diversified by ponds that make attractive enclaves and ecosystems.

The main roles of greenery in cities are:

1. Creation of landscape and enhancing esthetical architectural and spatial compositions;
2. Neutralizing pollution and diminishing noise;
3. Creation of microclimate;
4. Giving inhabitants an opportunity to contact nature on everyday basis, enabling recreation and rest;
5. Creating social spheres in parks.

Green areas are devised in physical management plans and the owner of the area is responsible. Greenery, especially in heavily urbanized areas, has become even more valued element of the functional-spatial structure in existing town-planning systems and designed housing, service and farming facilities.

Greenery in metropolis should be embraced by:

1. Protection of existing green areas;
2. Renewal, modernization, protection and development of existing green areas;
3. Saving old trees which are naturally and socially precious;
4. Work related to the improvement of safety for users of green areas, including proper lighting and paving park paths, safety of passages and bridges;

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<sup>1</sup> Dz. U. Nr 92, poz. 880

<sup>2</sup> Dz. U. Nr 16, poz. 78

5. Tidying of existing forest areas, including the ones beside the road;
6. Proper condition of little architecture and playgrounds for children.

These actions enable proper functioning of green areas of a metropolis, create friendly environment and influence the improvement of social relationships among users of common space, and they are an element creating healthy living environment. Another form of greenery is made by monumental cemeteries often placed in the centres of metropolises. Their function, apart from the fundamental one, is also extended by diverse old trees and fine tomb sculptures.

The role of greenery is not only limited to the ecological aspect, but also has social, esthetic and functional-spatial aspects.

The Poznań agglomeration is composed of the central city and communes of zone I and II of the ring. The Poznań Metropolitan Area is composed of the central city – metropolis and communes from the zone I, II and III.

The communes adjacent to the central city, which are under its functional-spatial and socio-economic influence, belong to zone I. The communes in zone III are significantly less connected by factors, conditionings and economic or social relations than communes in zone I and II. However, factors, conditionings and ecological relations play an important part in urbanization processes of a metropolis.

Natural bonds of the central city and communes create a common system and in many aspects introduce social development of the whole metropolis.

### **3. DIAGNOSIS OF NATURAL ENVIRONMENT RESOURCES**

One of the most important problems in the Poznań Metropolitan Area is uneven location of natural areas, which form 'ecological islands'. Many of them are beyond protected areas, which causes their further degradation.

The development of building industry and the constant lack of investment areas cause that numerous natural areas are becoming developers' target. Natural environment of adjacent communes is more and more endangered due to increasing anthropopression. However, the process of urbanization will not diminish, so a deep analysis of all location decisions and local plans of spatial development made according to the rule of sustainable development and investments will reduce their negative effects.

The dynamically developing city of Poznań claims further farming areas, especially in adjacent communes in zone I of the ring. Road and technical infrastructure construction tightly connected with the development of the Poznań Metropolitan Area cause further reduction of green areas and farmlands.

Also, degradation of the Poznań Metropolitan Area is caused by external factors, such as improper agricultural actions, irrational energy management, global warming and reduction of the amount of drinking water.

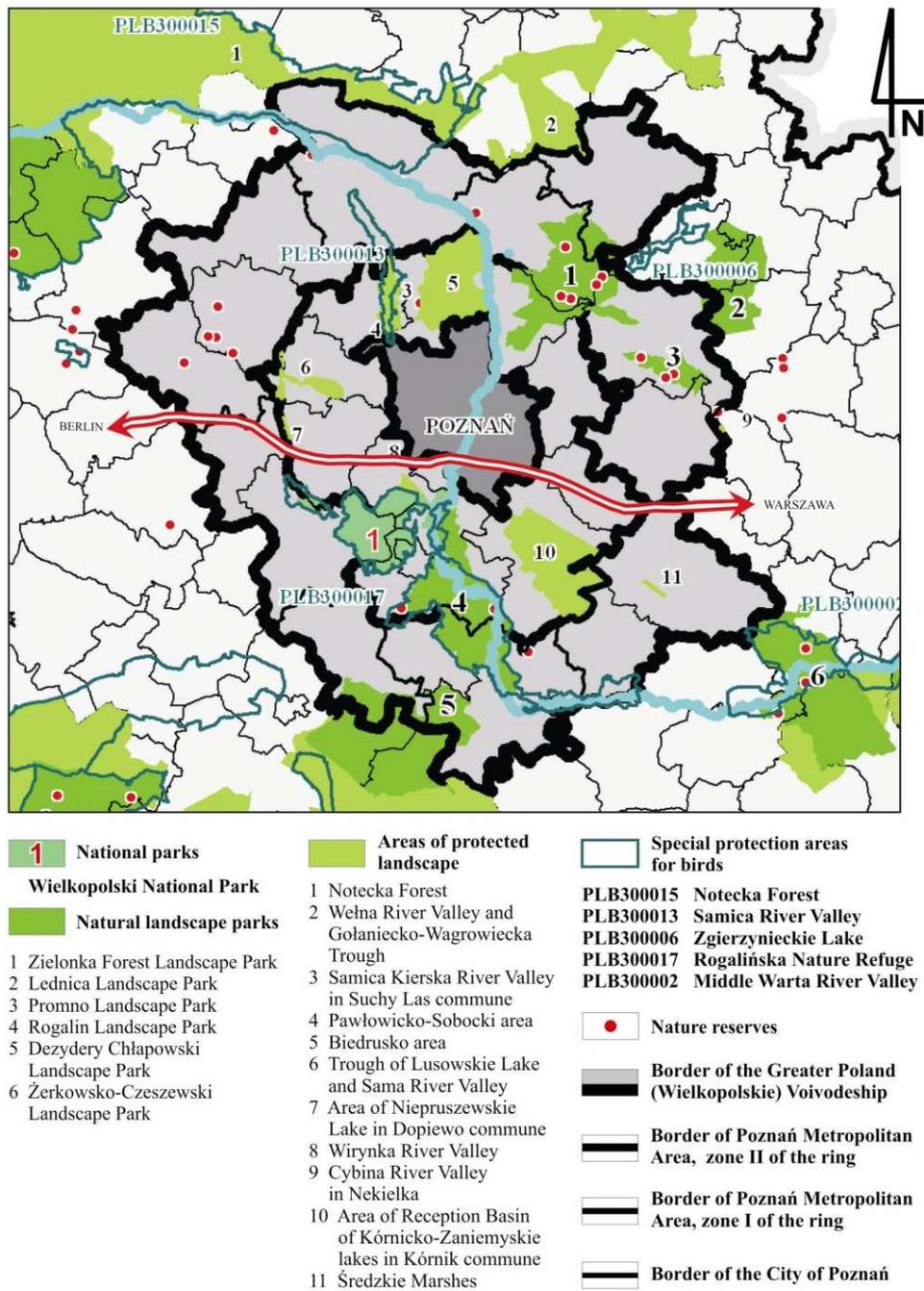


Fig. 3. Protected environmental area of Poznań Metropolitan Area.

After recognition of the state of natural environment resources of the Poznań Metropolitan Area, it may be ascertained that they possess a significant value thanks to the existence of:

- Diverse farming-forest-meadow environment with large quantities of surface water;
- Compact complex of agricultural production areas with high quality classification;
- Favourable ground-water conditions for the development of building industry;
- The Warta river being the main ecological axis;
- Good forest coverage – 21.3% of the Poznań Metropolitan Area (10% of the Greater Poland voivodeship);
- Good amount of natural resources, gas deposits, thermal waters with industrial signification for local purposes.

It may be assumed that the most serious threat for the environment in the process of changes and development occurs in adjacent communes, in zone I of the ring.

The diagnosis of the state of the environment in adjacent communes in zone I revealed that negative factors influencing changes in environment may include:

1. Reduction of valuable farming and natural areas by:
  - a. development and creation of road and railway networks
  - b. development and creation of linear technical infrastructure
  - c. development and creation of housing estates within communes
  - d. development of area-consuming fields of economy
  - e. creation of large shopping centres in the commune of Tarnowo Podgórne and Komorniki
  - f. creation of large waste deposits
2. Pollution of water and atmosphere by:
  - a. lack of sewage systems and rainwater drainage in all urbanized areas
  - b. emission of harmful exhaust fumes resulting from different emission sources
  - c. improper agricultural actions
3. Degradation of greenery by:
  - a. treating green areas as a reserve for building industry
  - b. excessive emission of harmful exhaust fumes in city centres
  - c. inappropriate way of winter road maintenance due to excessive use of chemical compounds destroying trees
  - d. no planting of greenery as replacement in green areas
  - e. inappropriate maintenance of existing greenery

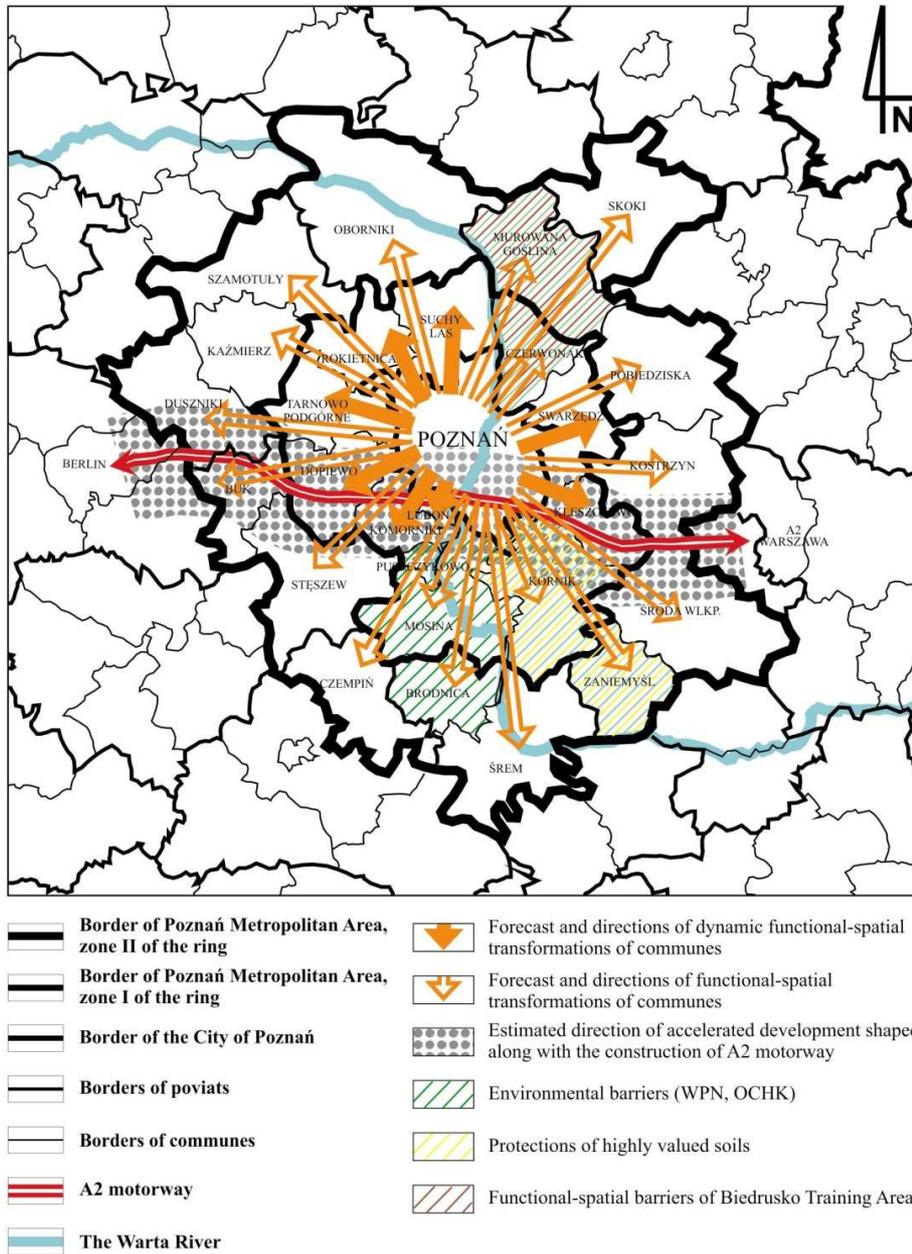


Fig. 4. Forecast of directions-spatial transformations of communes within the impact zone of the central city, impact of the socio-economic potential and predispositions of local communities, and impact of local authorities on transformation and development

#### 4. CONCLUSIONS

One of the most basic problems of the Poznań Metropolitan Area is uneven distribution of natural areas. They form 'ecological islands', which under anthropopression, are being diminished. The development of building industry and constant lack of areas for investments cause that many naturally valuable areas of metropolis become the target of developers' actions. The developing central city, Poznań, takes over further farmlands, especially in the adjacent communes. Road constructions and technical infrastructure tightly connected with the development of the Poznań Metropolitan Area causes reduction of natural areas and areas for agricultural industry.

Such further actions will lead to significant degradation of natural environment, especially in the adjacent communes in zone I. In zone II and III of the ring, communes remain more agricultural. Dense complexes of soils of high quality classification form areas of intensive farming industry, which makes it impossible to change their purpose. Agricultural production areas of metropolitan area with a high rate of soils with high quality classification forms a certain barrier for further intensive urbanization. Rational management of area by sensible, sustainable functional-spatial and social-economical development may stop the chaotic urbanization of areas in communes forming a metropolitan area.

Protection of environmental values of agglomerations and metropolitan areas can be achieved through implementation of rules of eco-development, such as (inter alia):

- systemic approach to areas of high environmental value, treated as an element of functional-spatial structurization;
- prevention of intensification of real estate development, inter alia through execution of investment absorption capacity of a given area in compliance with ecological priorities;
- introduction of a compulsory system of analyses of construction (housing) market capacity to prevent overinvestment of the land.

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## KIERUNKI OCHRONY I ROZWOJU ŚRODOWISKA PRZYRODNICZEGO METROPOLII NA PRZYKŁADZIE POZNAŃSKIEGO OBSZARU METROPOLITALNEGO

### Streszczenie

Celem opracowania jest przedstawienie zagadnień związanych z kierunkami zmian jakie zachodzą w środowisku przyrodniczym na terenach silnie zurbanizowanych, w metropolii oraz analiza wzajemnych relacji miasta centralnego i gmin obszaru metropolitalnego na płaszczyźnie środowiska przyrodniczego. Pokazanie środowiska przyrodniczego jako istotnego czynnika wpływającego na uwarunkowania funkcjonalno-przestrzenne obszaru metropolitalnego. Jednym z ważniejszych problemów Poznańskiego Obszaru Metropolitalnego jest nierównomierne rozłożenie obszarów przyrodniczych. Tworzą one, „wyspy ekologiczne”, które pod wpływem antropopresji ulegają ciągłemu zmniejszaniu. Rozwój budownictwa i ciągły brak terenów pod tego typu inwestycje powoduje, że wiele obszarów cennych przyrodniczo metropolii staje się celem działań deweloperów. Rozwijające się coraz bardziej dynamicznie miasto centralne Poznań pochłania kolejne tereny rolnicze, szczególnie gmin stykowych. Budowa dróg i infrastruktury technicznej ściśle powiązana z rozwojem Poznańskiego Obszaru Metropolitalnego powoduje kurczenie się terenów przyrodniczych i rolniczej przestrzeni produkcyjnej.

Dalsze postępowanie tego typu doprowadzi do znacznej degradacji środowiska przyrodniczego, szczególnie gmin stykowych strefy I pierścienia. W strefie II i III pierścienia, gminy w większym stopniu zachowują swoją rolniczą funkcję. Zwarte kompleksy gleb o wysokiej bonitacji tworzą rejon intensywnej gospodarki rolnej, co uniemożliwia zmiany ich przeznaczenia. Rolnicza przestrzeń produkcyjna gmin obszaru

metropolitalnego o dużym wskaźniku gruntów rolniczych o wysokim stopniu bonitacji stanowi pewnego rodzaju barierę dla dalszej intensywnej urbanizacji. Racjonalna gospodarka przestrzenią poprzez świadomy, równoważony rozwój funkcjonalno-przestrzenny i społeczno-gospodarczy może powstrzymać chaotyczną urbanizację terenów gmin tworzących obszar metropolitalny