Institute of Geography and Spatial Organization
Polish Academy of Sciences

Marek Degórski

Wind Energy as a Regional Development Factor or Source of Spatial Problems

Kecskemét (Hungary), 25-26 October 2012

Instytut Geografii i Przestrzennego Zagospodarowania
im. Stanisława Leszczyckiego
POLSKIEJ AKADEMII NAUK

Study carried out by Institute of Geography and Spatial Organization Polish Academy of Sciences for Kujawsko-Pomorskie Region in Torun.

prof. dr hab. **Marek Degórski** – lead of the project
dr **Jarosław Baranowski**
dr hab. **Mirosław Błaszkiewicz**
prof. dr hab**. Krzysztof Błażejczyk**
dr **Dariusz Brykała**
dr **Bożena Degórska**
dr **Piotr Gierszewski**
dr hab. **Tomasz Komornicki**

According to strategic documents such as: “Poland’s Energy Policy until 2030” and “Strategy of Development of renewable Energy Sources”, Poland plans to increase the share of energy based on renewable sources to 15% by 2020. The wind energy, in addition to geothermal energy and hydroelectric power, is one of the central forms of energy production from renewable sources obtainable in the geographical environment.

Wind Energy

as a Regional Development Factor or Source of Spatial Problems

The Kujawsko-Pomorskie voivodeship is ranked first in the country in terms of the number of wind turbines installed (about 420) and third as regards the amount of power production generated by wind farms. At the same time, an average power capacity of a single wind power plant installed in the Kujawsko-Pomorskie voivodeship is equal to 1.08MW, which is one of the lowest power capacities in the whole of the country

Wind Energy

as a Regional Development Factor or Source of Spatial Problems

Aim of the study

The aim of the presentation is a multi-directional evaluation of natural environment, landscape, social, economic, technical and legislative conditions for the development of wind energy in the Kujawsko-Pomorskie voivodeship (region-province). A lack of legislative regulations concerning the conditions for location of wind farms in Poland causes that there is ongoing prolonged discussions between various groups of people, i.e. the investors, decision-makers and NGOs, in the context of the validity or legality of wind power plants location.

<u>The aim of the study carried out in five thematic groups:</u>

A. Study of spatial order in the region according to the wind energy.

B. Socio-economic study of the usefulness of wind energy.

C. Technological study for the solutions of wind energy development

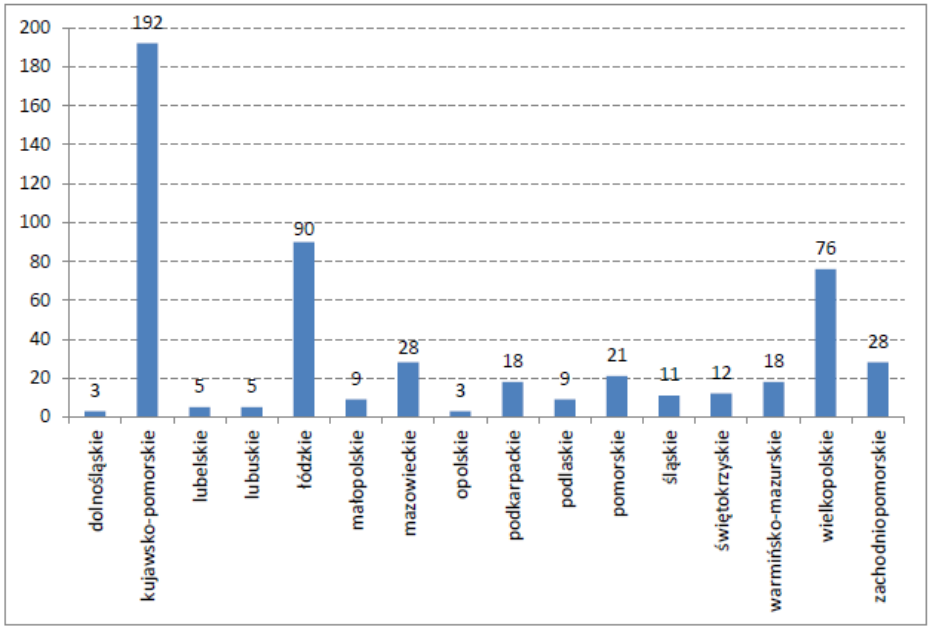
D. Law analysis of wind energy.

E. Regional study of environmental conditions for wind energy development

DIAGNOSIS

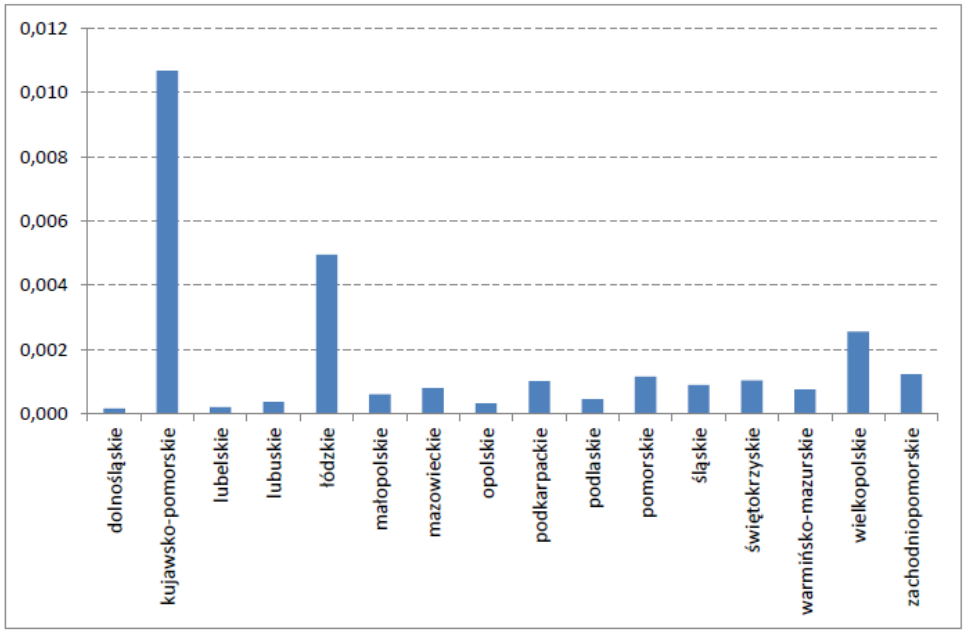
Wind energy

Rozwój energetyki wiatrowej



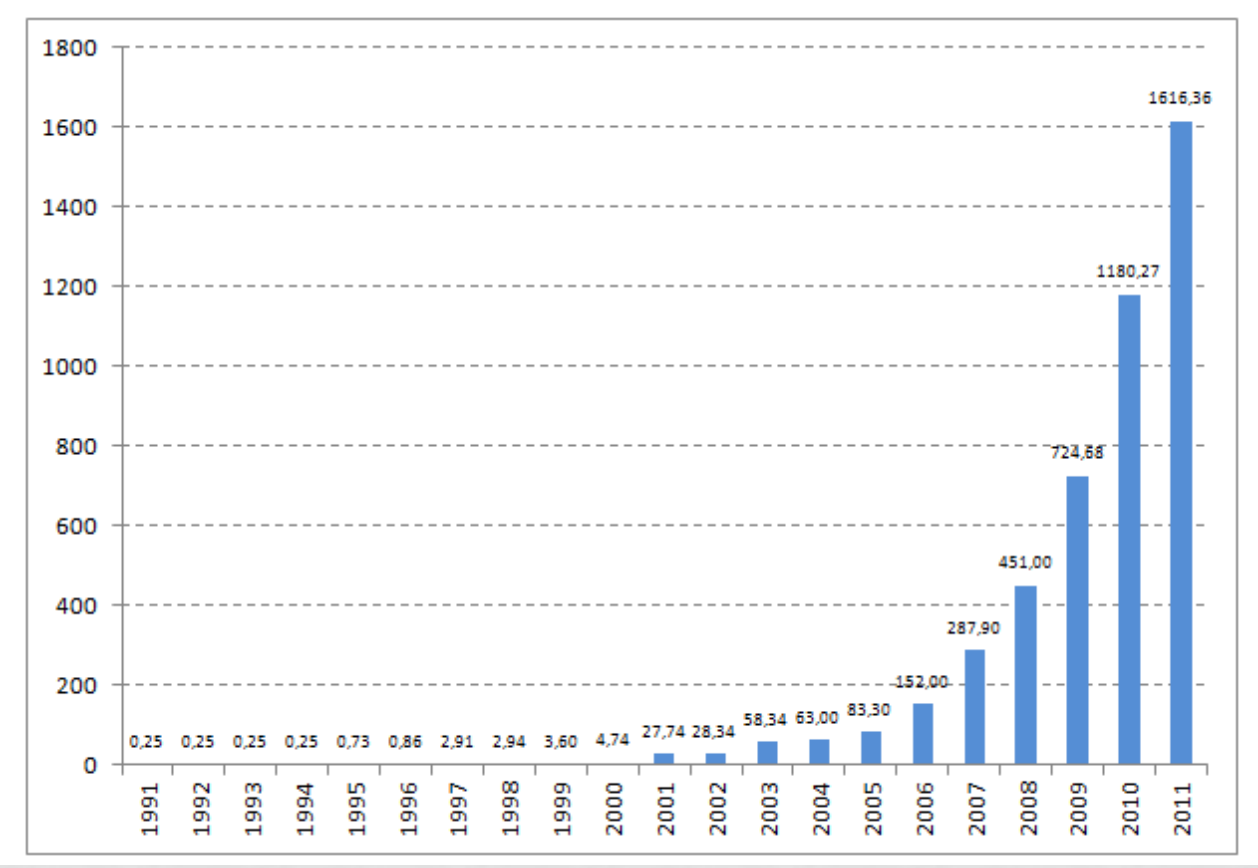
In July. 2011 r. about 420 wind turbines

Number of wind farms according to the regions (2011), URE.



Number of wind farms per 1 km^2 area of the region (2011), URE.

Rozwój energetyki wiatrowej

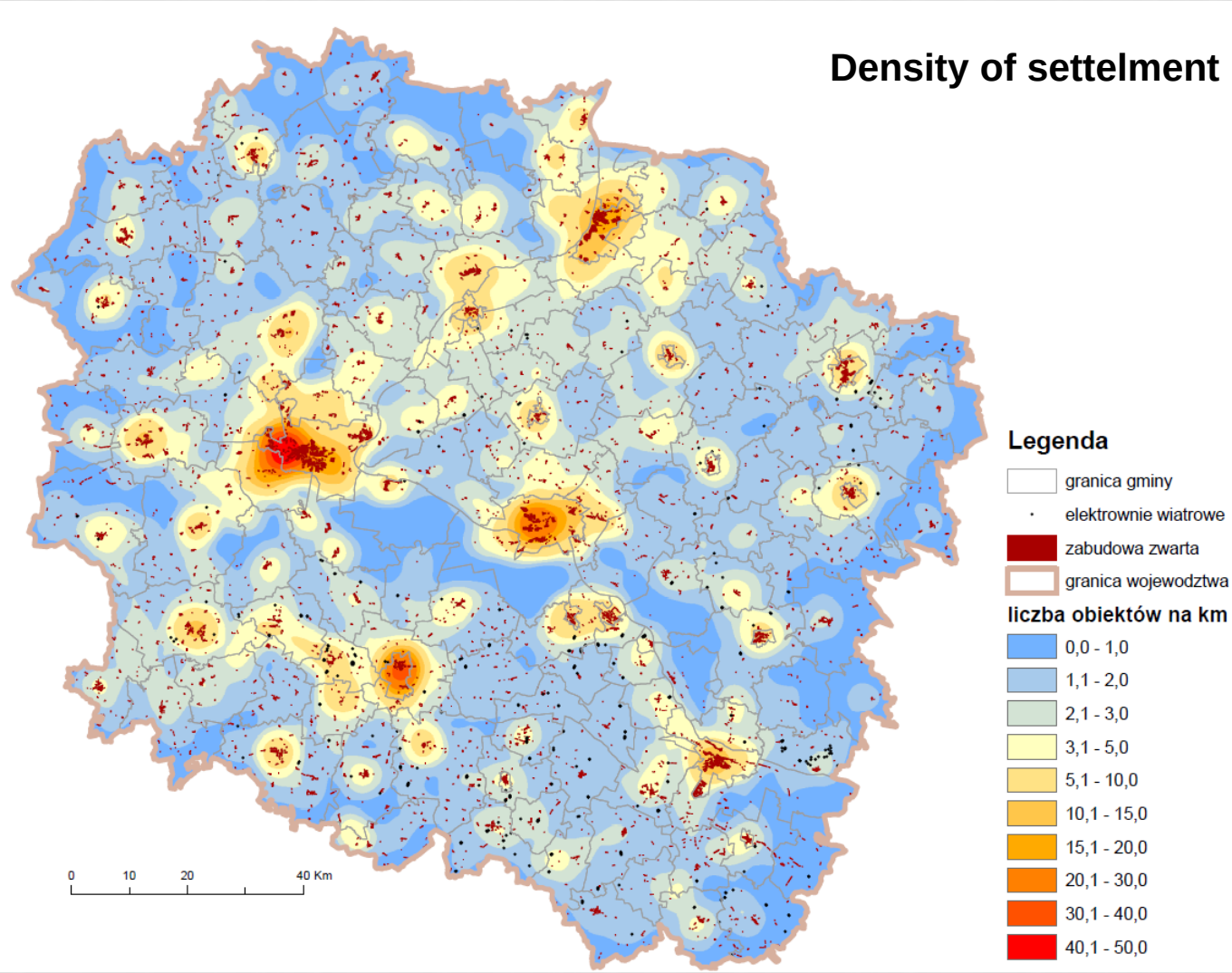


Changes of wind turbines power in Poland, 1991-2011

Wind energy development

Settlement conditions

Settlement conditions



Wind energy development

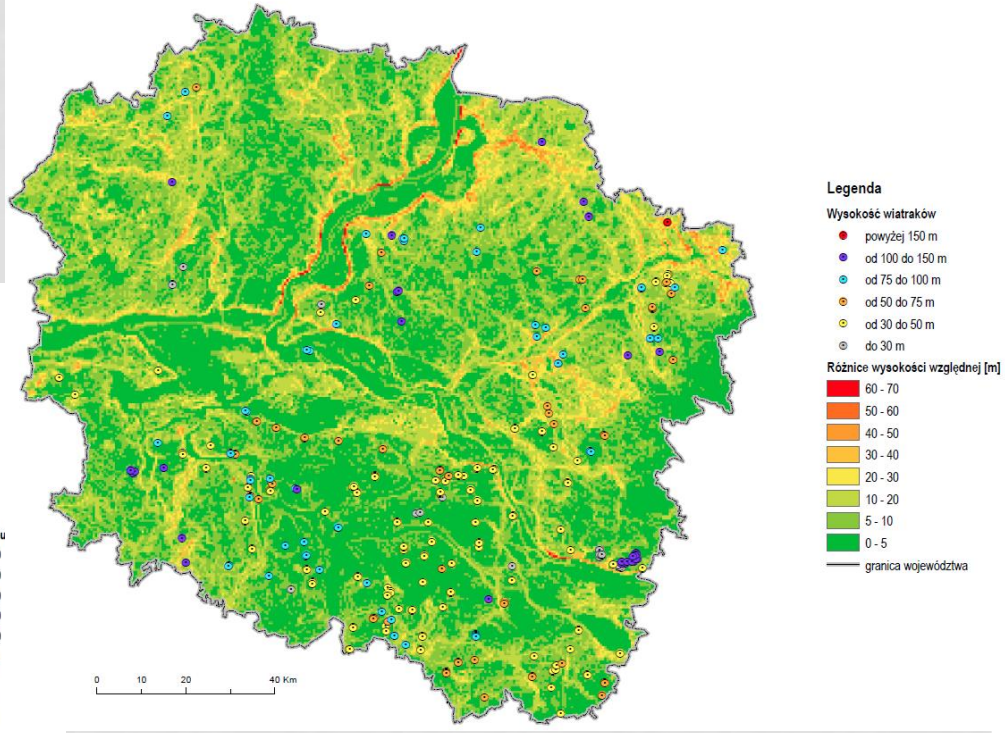
Environmental conditions

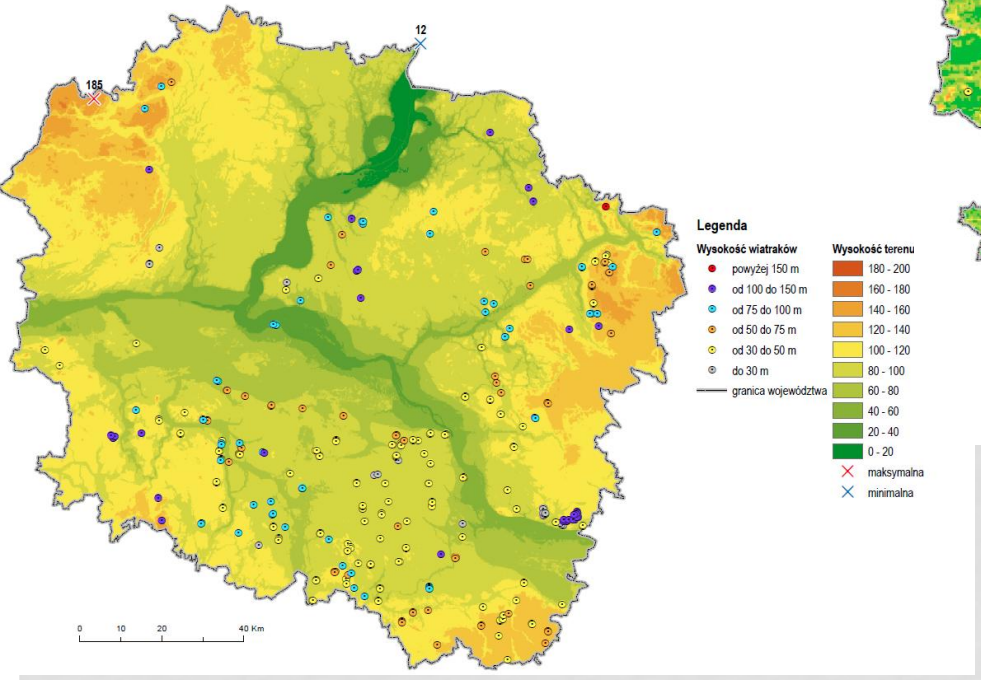
Environmental conditions

Physico-geographical conditions of the Kujawsko-Pomorskie voivodship do not create barriers to the development of wind energy. Wind conditions in the region, structure of land-use with huge prevalence of arable areas that are characterized by a low rate of surface roughness, as well as terrain relief, all these elements constitute favourable factors for development of wind energy. The region is characterized by a considerable natural environment potential and rich cultural landscape resources, which results in specific consequences for location of wind power plants. Within its area wildlife corridors are found of an international significance such as the Vistula and Drwęca River valleys, as well as ecological corridors of national significance, like the Brda and Noteć Rivers. The Toruń Basin constitutes an important ecological hub, being a bird sanctuary during the autumn bird migrations from North and East Europe towards South and West of the continent. In addition, in the region there are *i.a.* four sites of huge significance to EU, namely bat sanctuaries (**Grudziądz citadel, forts in Toruń, Świecie castle and church in Śliwice**) as well as eight areas of special protection for birds, being elements of the European ecological network NATURA 2000

Relief conditions

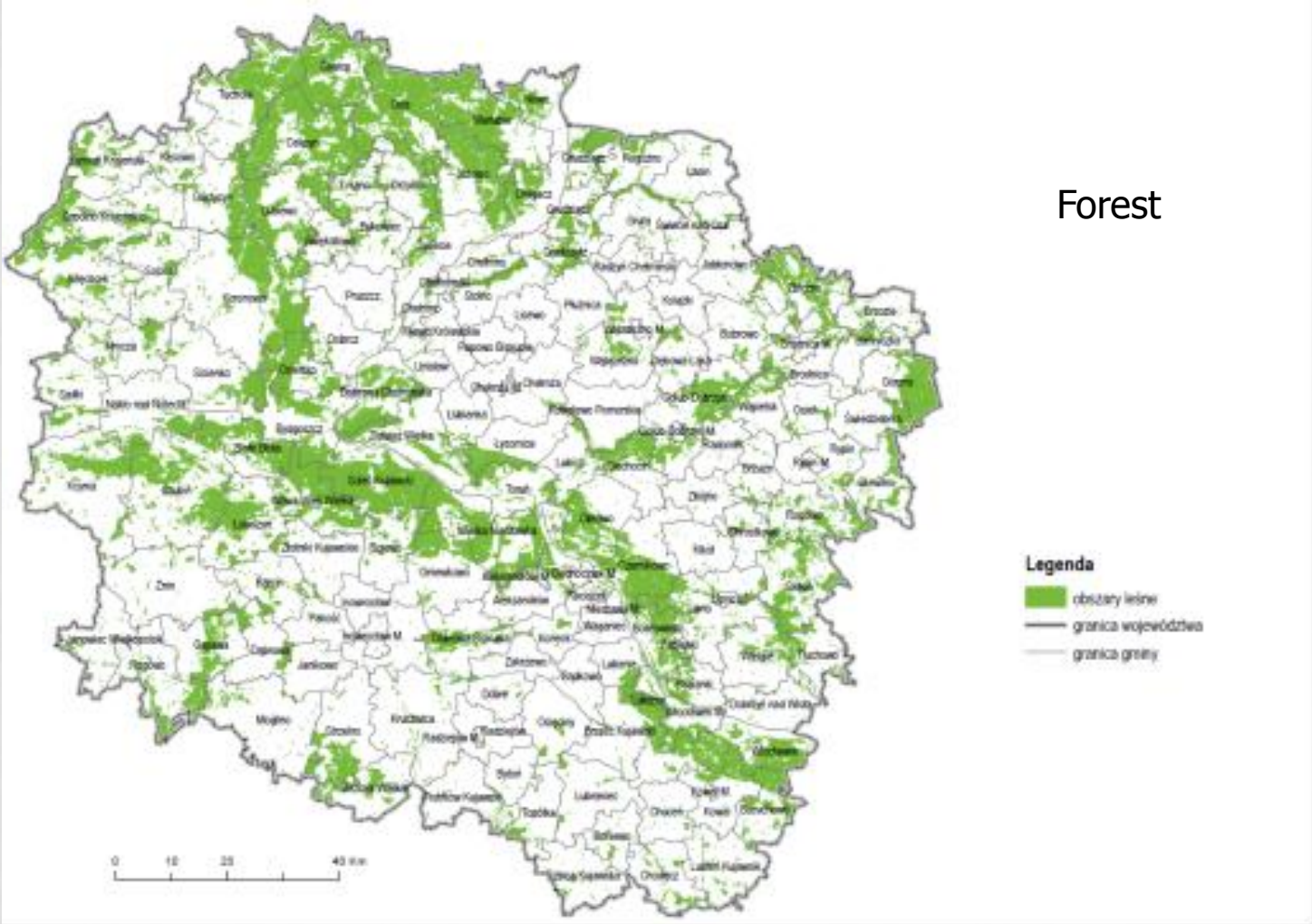
Deniwelation





Hipsometric

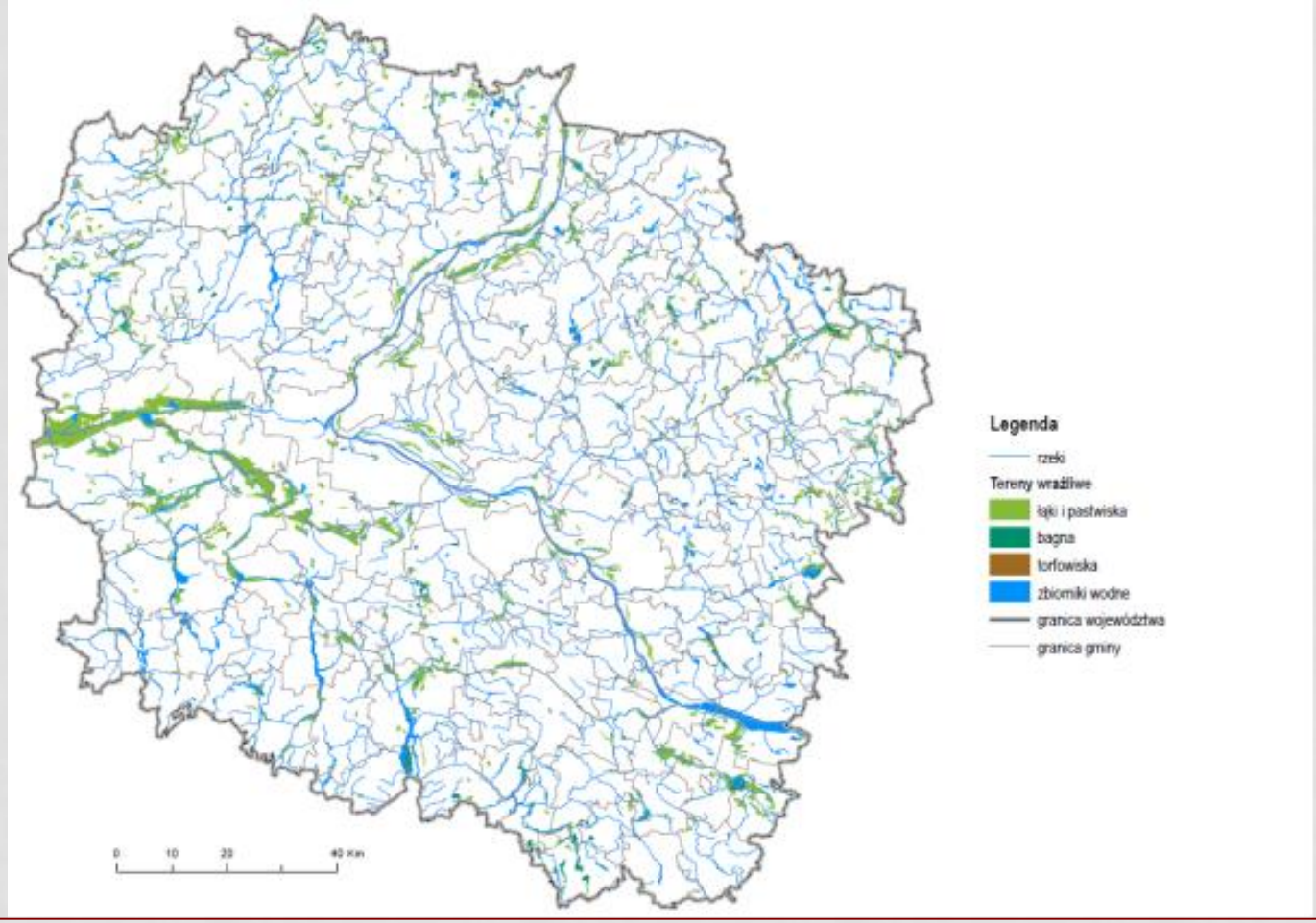
Land use conditions



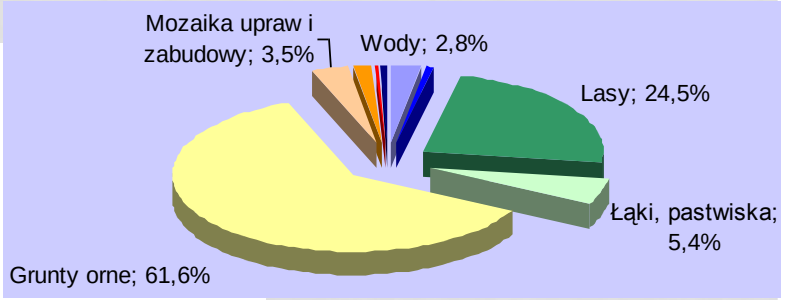
Forest

Land use conditions

Hydrogenic i semihydrogenic areas determined on the basis of CLC (2006)



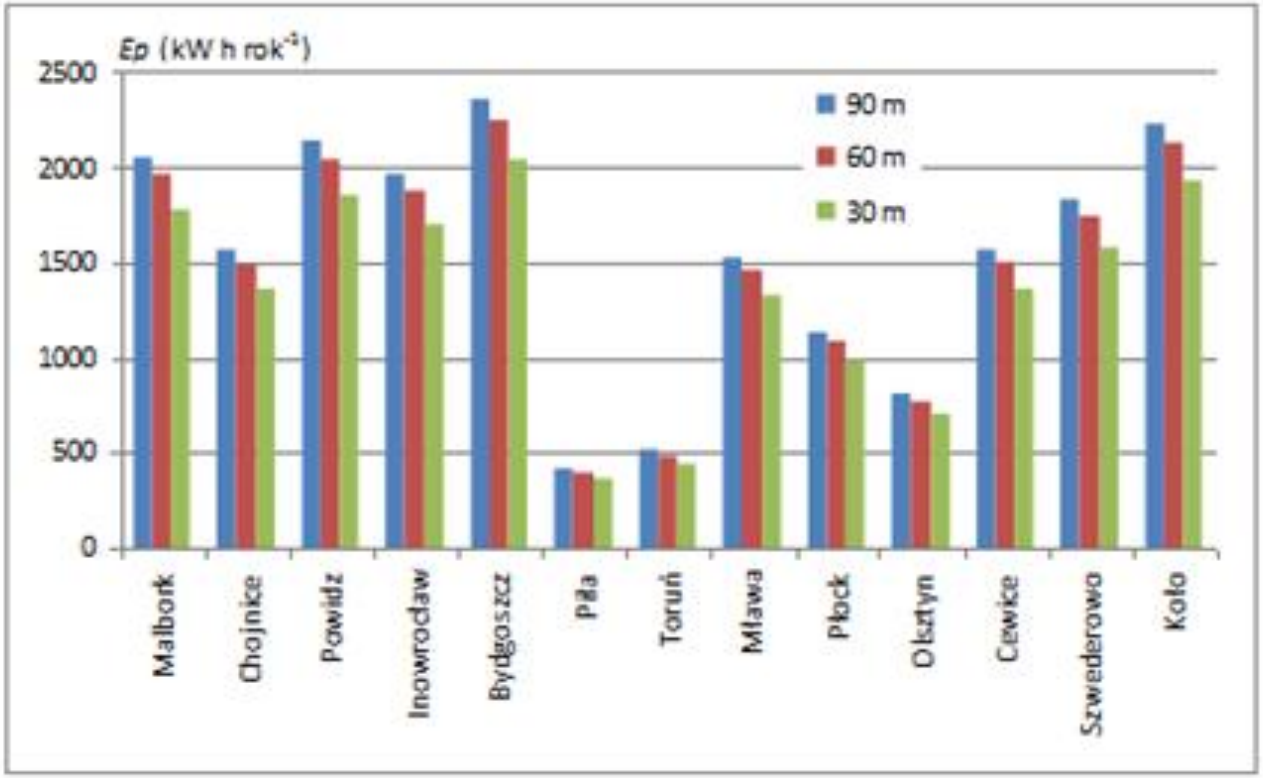
Land cover - coarseness



- Wody
- Łąki, pastwiska
- Zabudowa luźna
- Bagna
- Grunty orne
- Zabudowa zwarta
- Lasy
- Mozaika upraw i zabudowy
- Pozostałe

Anemological conditions

Potential energy of the wind (Ep) determinrd for the areas around of metherological station on the level of 30, 60, 90 m a.l. l.

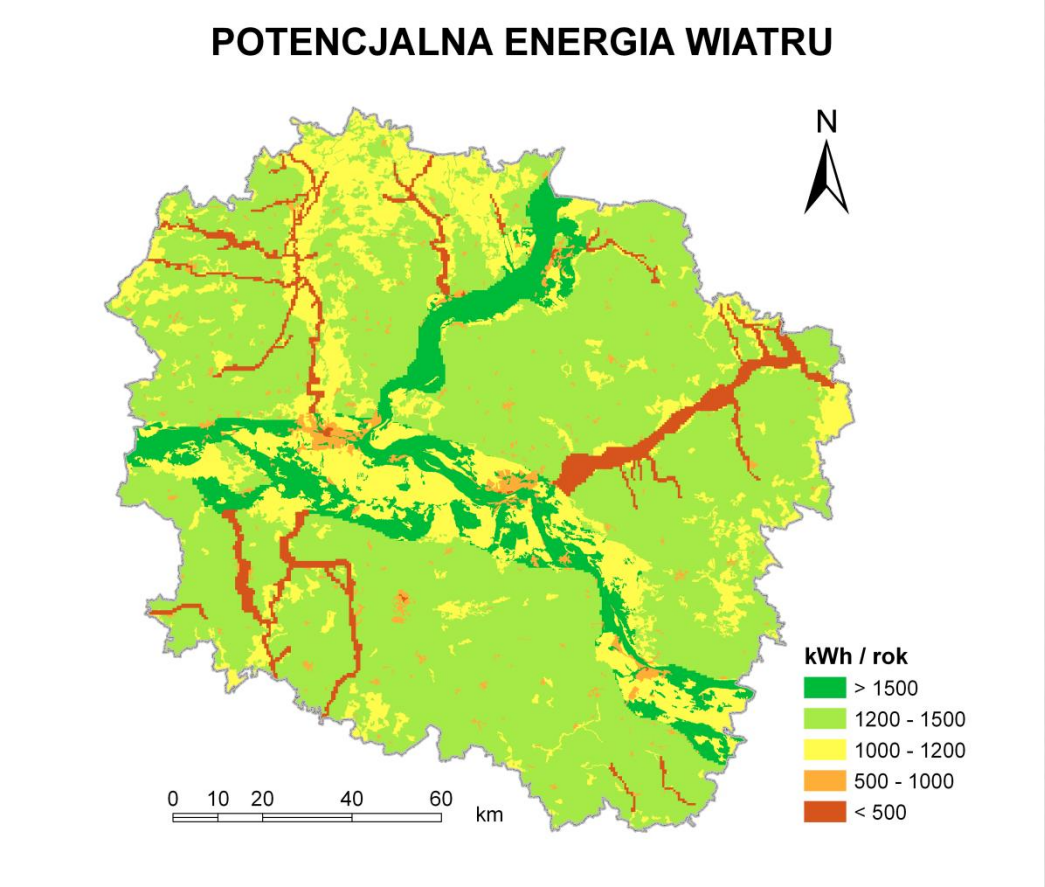


Anemological conditions

Spatial diversity of wind energy Ep kW/year on the level of 90 m over land level

- 1 – stacje meteorologiczne z obliczonymi wartościami *Ep*,
- 2 – obszary dużych miast o zmniejszonych wartościach *Ep*

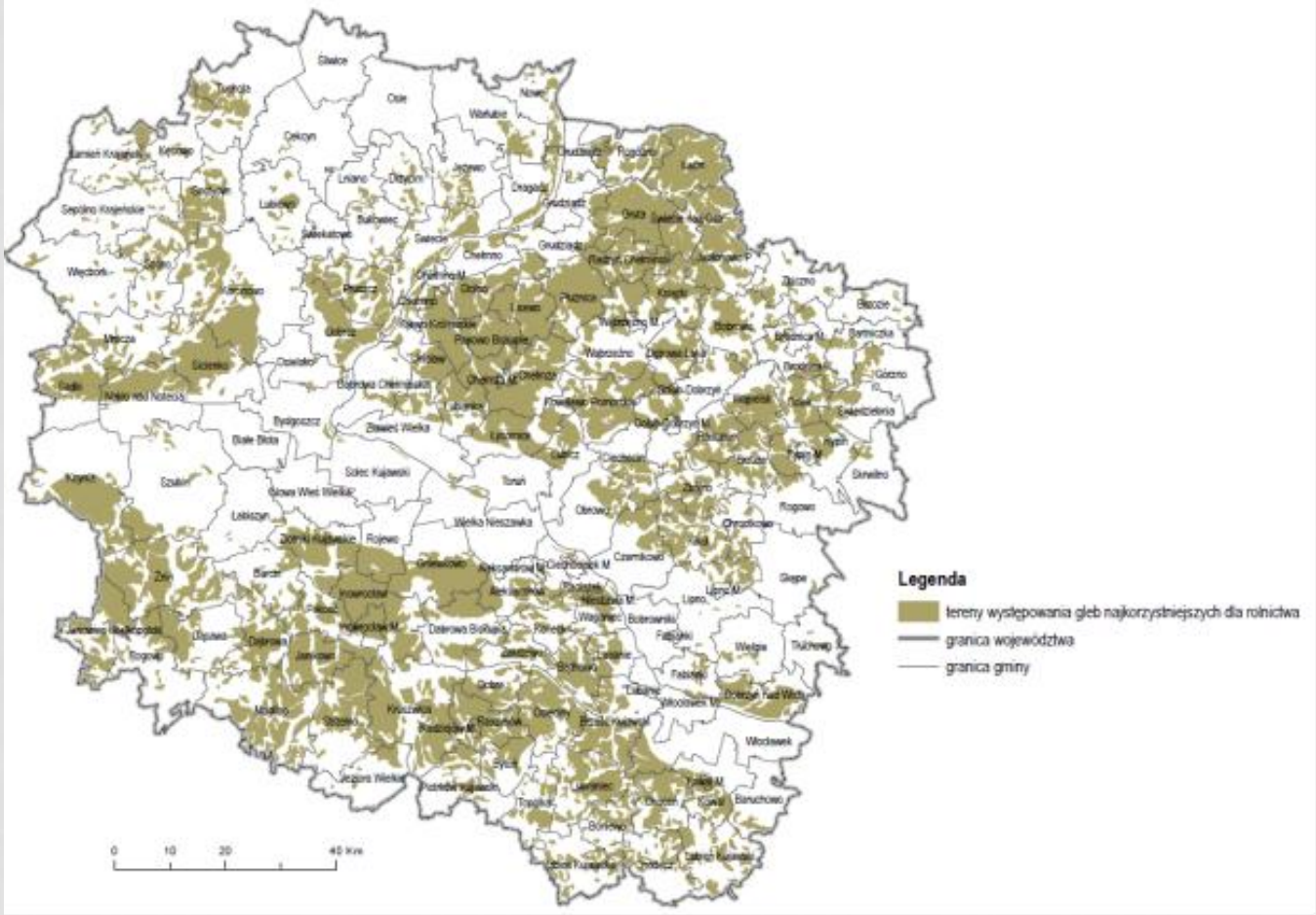
Uwarunkowania anemologiczn



Potential energy of the wind with regards of coarseness conditions in differnt types of landscape

Soil conditions

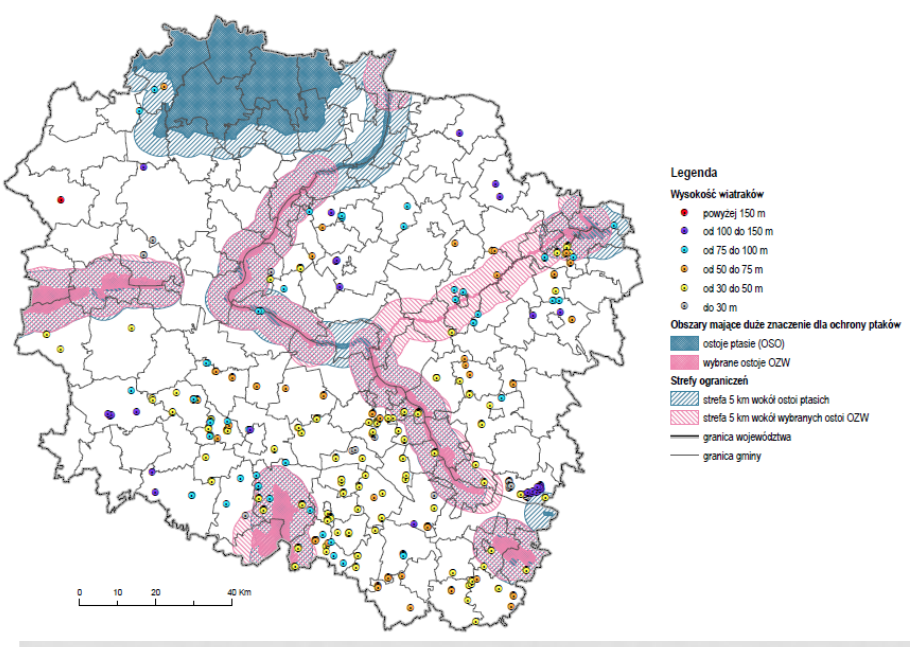
Soils with highest value for agriculture development



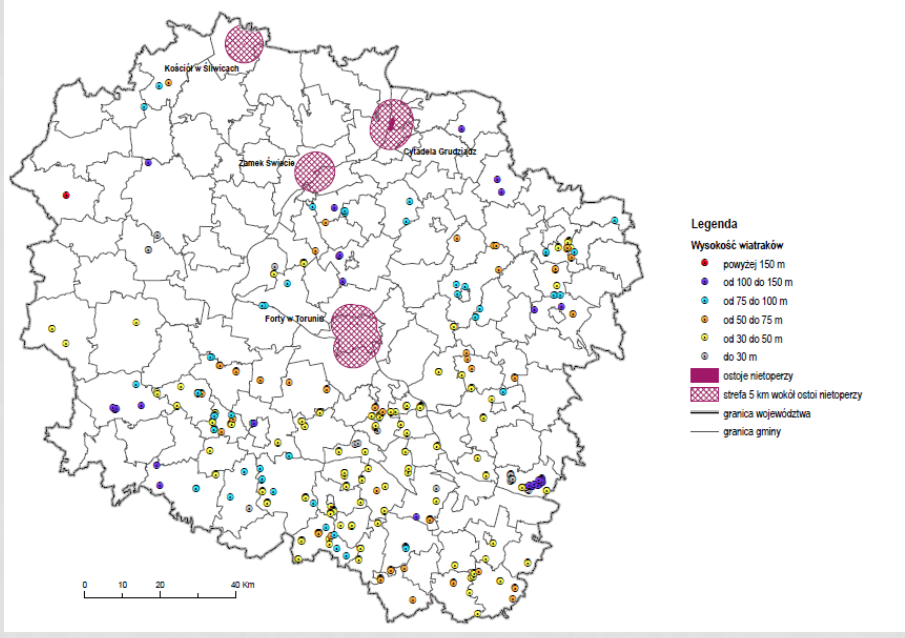
Źródło: warstwa pozyskana z zasobów Biura Planowania Przestrzennego i Regionalnego we Włocławku

NATURA 2000

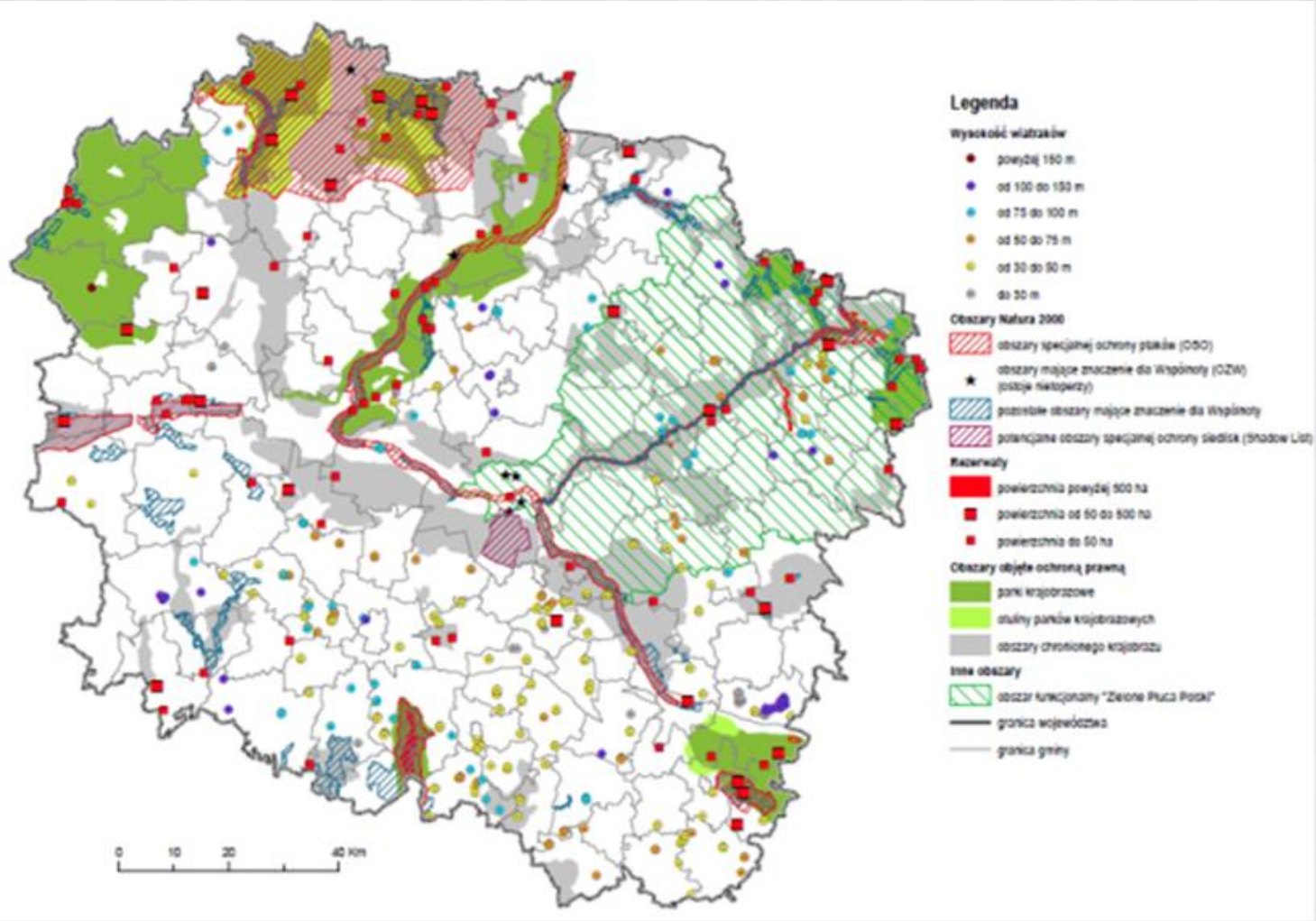
5 km from OSO



5 km from OZW

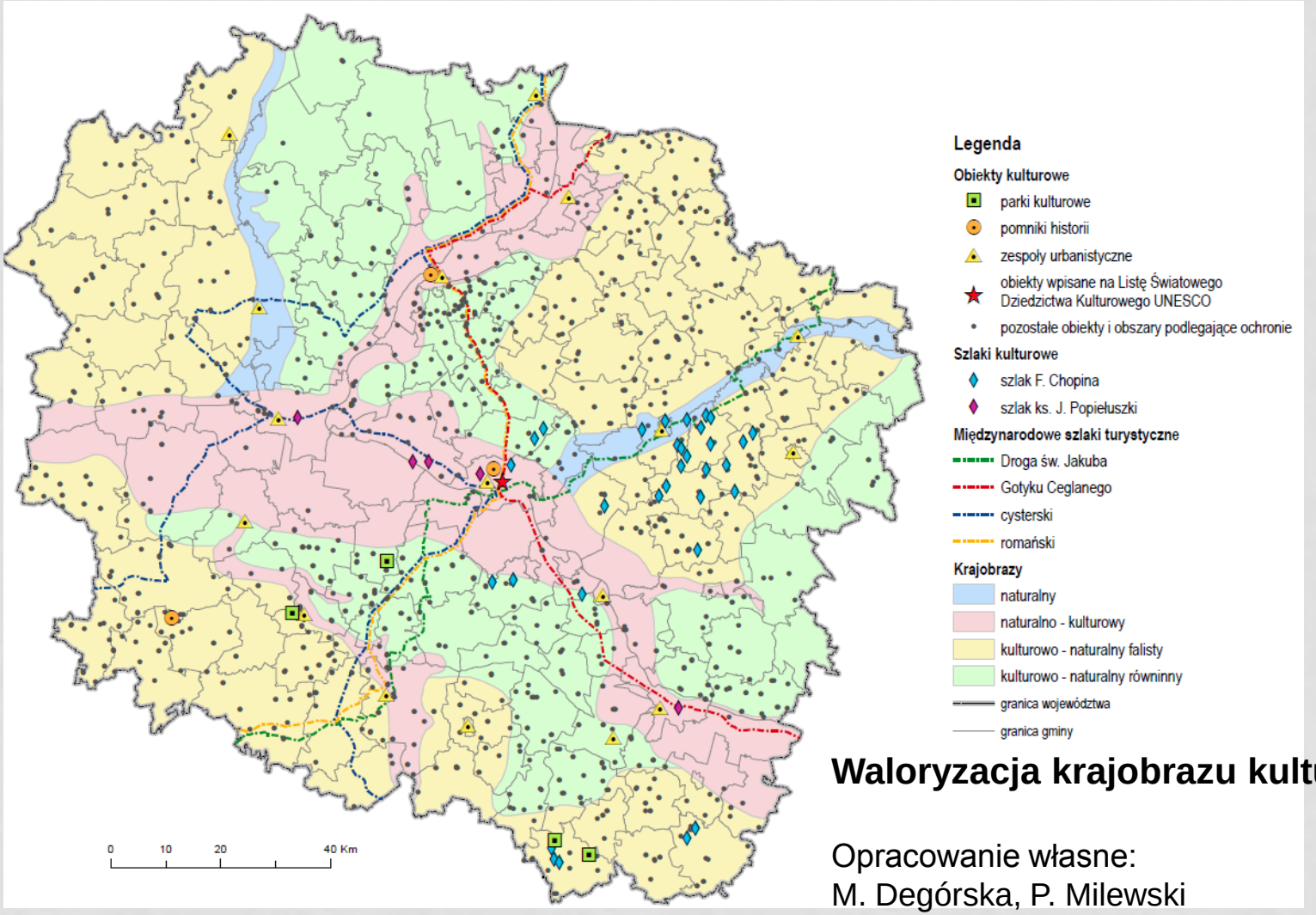


Environmental protektion



Opracowanie własne na podstawie materiałów dotyczących obszarów chronionych udostępnionych przez RDOŚ w Bydgoszczy

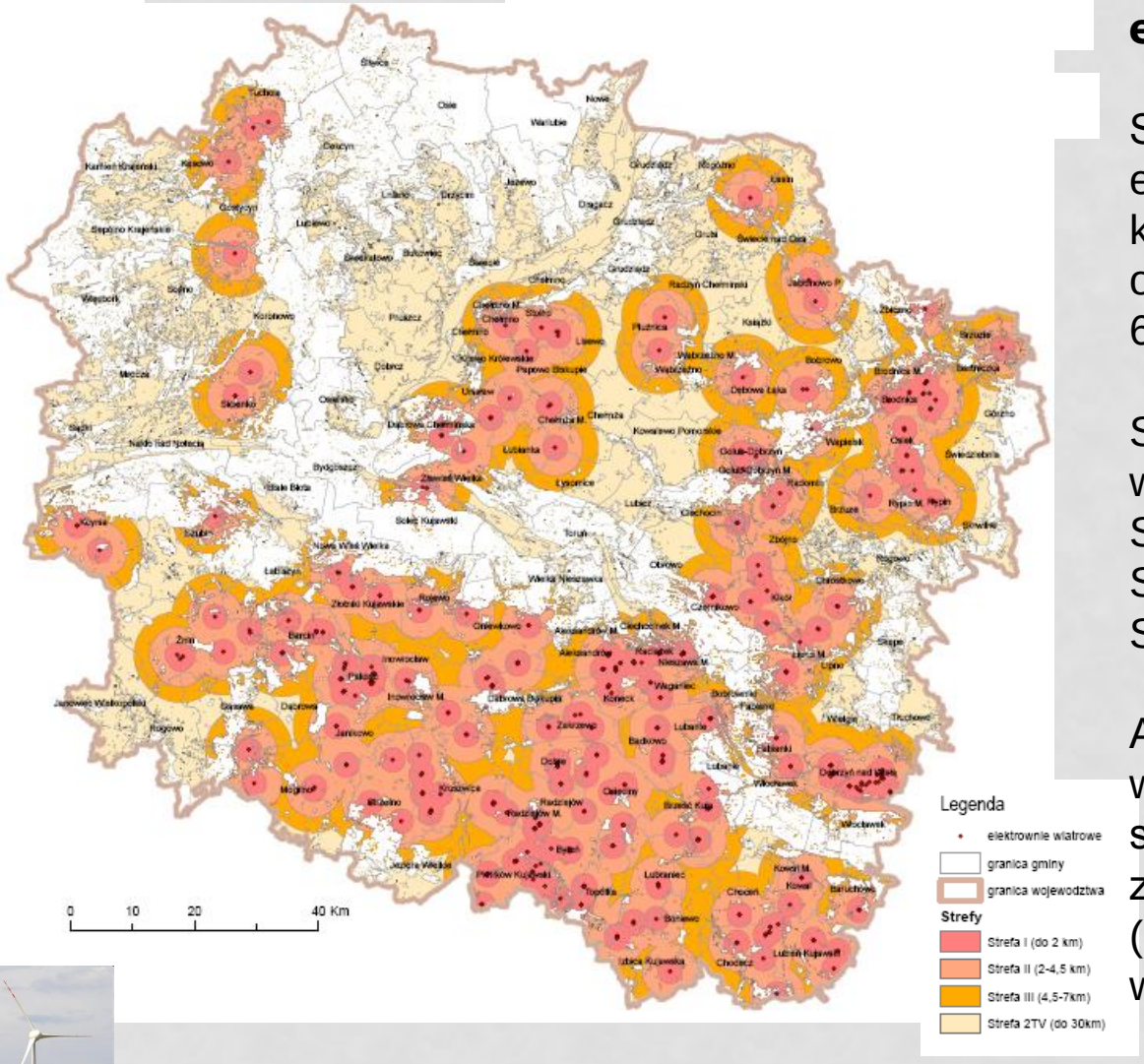
Landscape conditions



Waloryzacja krajobrazu kulturowego

Opracowanie własne:
M. Degórska, P. Milewski

Landscape dominants



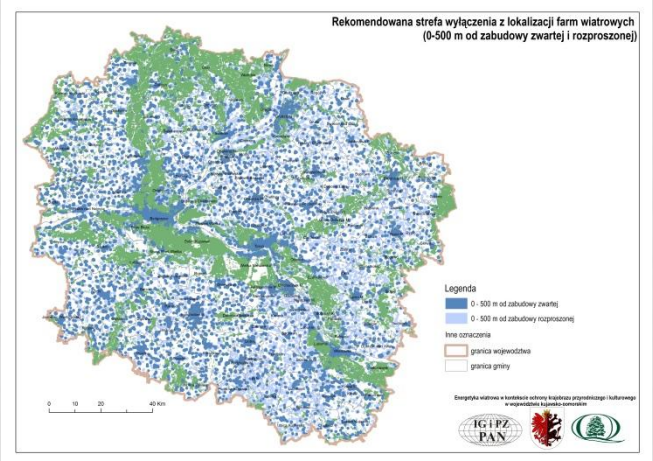
Zasięg stref widzialności elektrowni wiatrowych

Strefa teoretycznej widzialności elektrowni wiatrowych w woj. kujawsko-pomorskim obejmuje obszar 11.017 km2, co stanowi 61,4% powierzchni województwa.

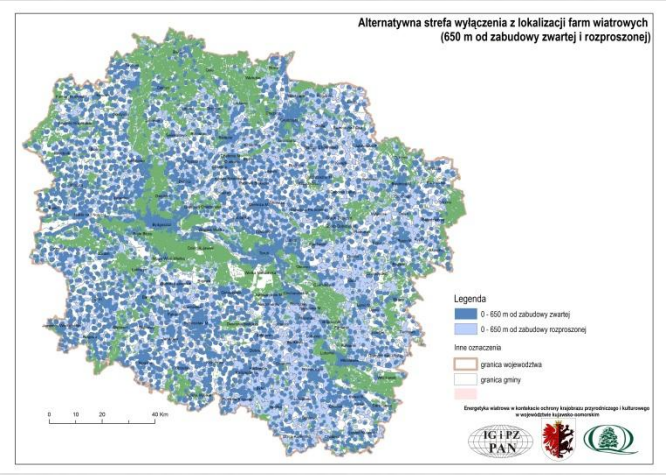
Strefa I - 10,3% powierzchni województwa,
Strefa II - 19,3%,
Strefa III – 12,8%,
Strefa IV – 19%

Aż na 29,6% powierzchni województwa elektrownie wiatrowe są elementami wyraźnie zaznaczającymi się w krajobrazie (I i II strefa oddziaływania wizualnego).

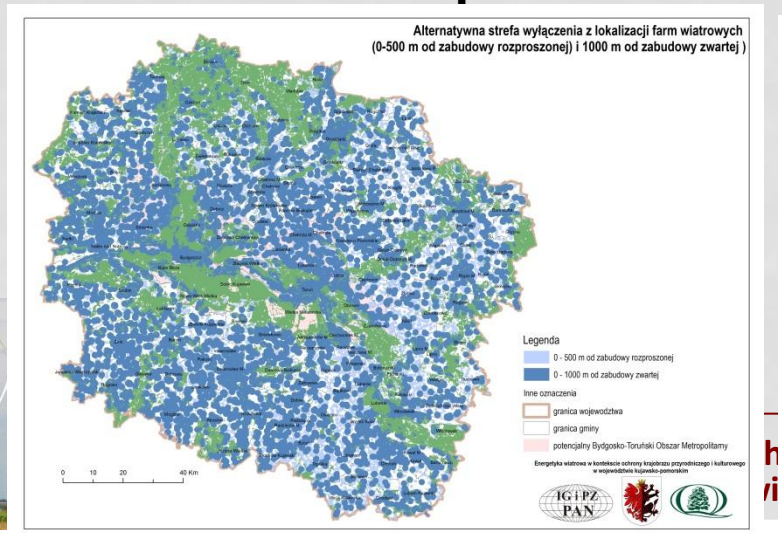
500 m from compact and dispersed settlement



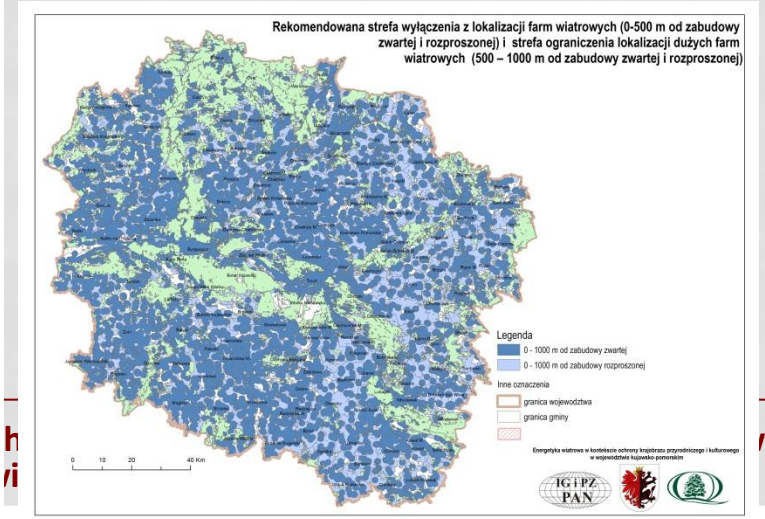
650 m from compact and dispersed settlement



500 m from dispersed settlement and 1000 m from compact settl.

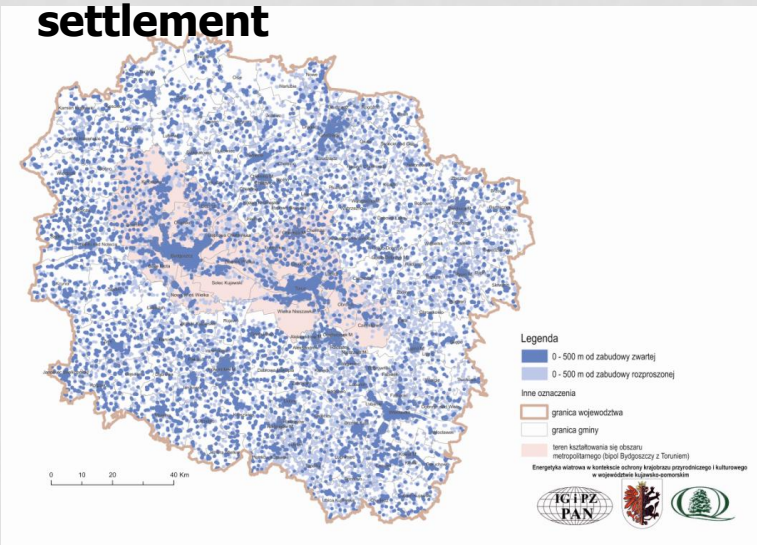


1000 m from m from compact and dispersed settlement

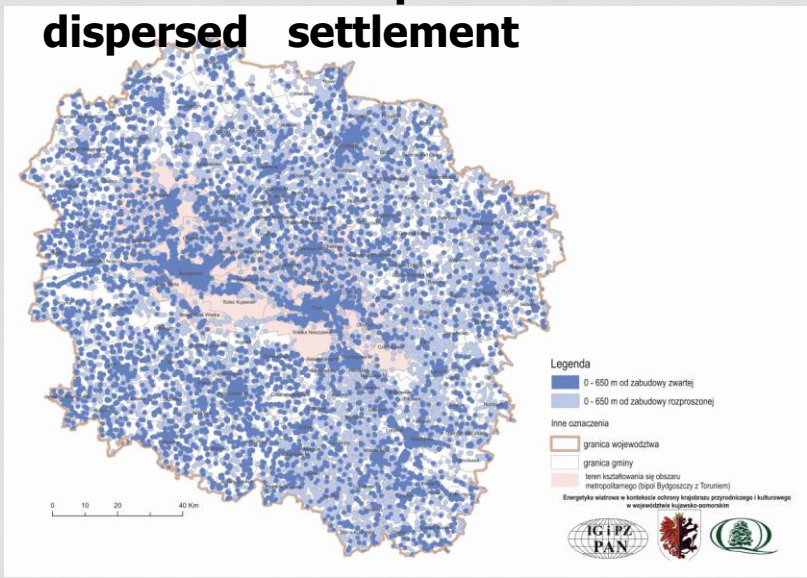


Localization in line to the distance of wind turbine

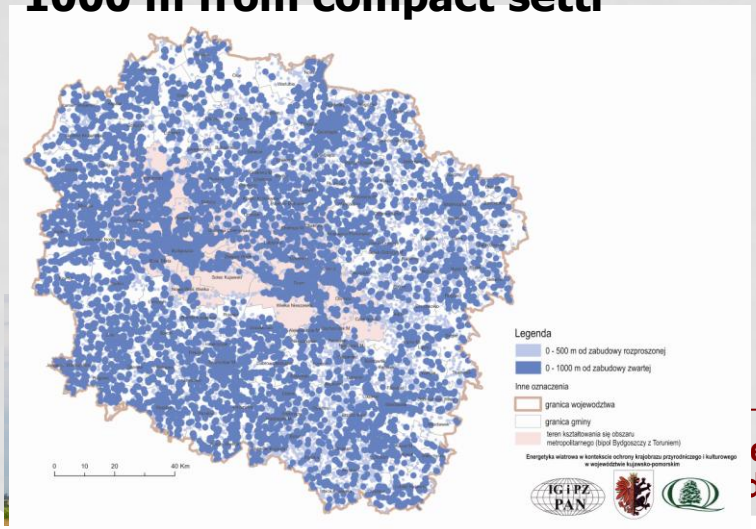
500 m from compact and dispersed settlement



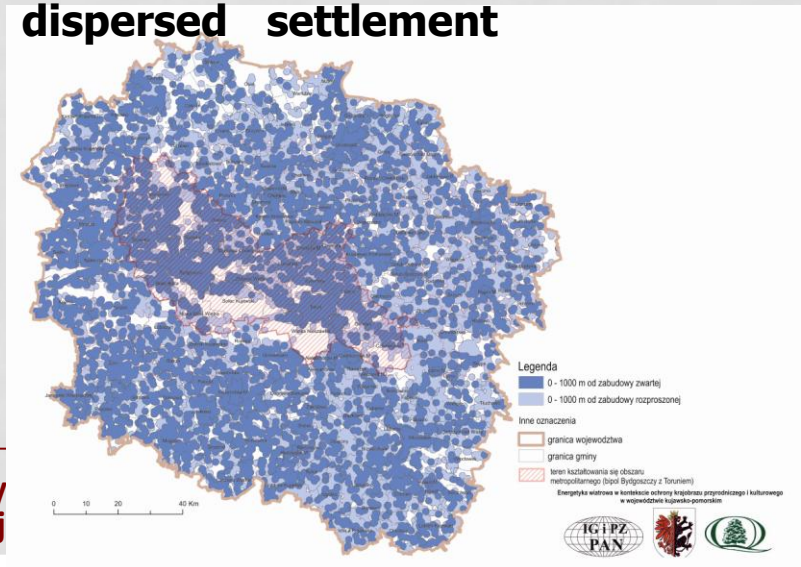
650 m from compact and dispersed settlement



500 m from dispersed settlement and 1000 m from compact settl

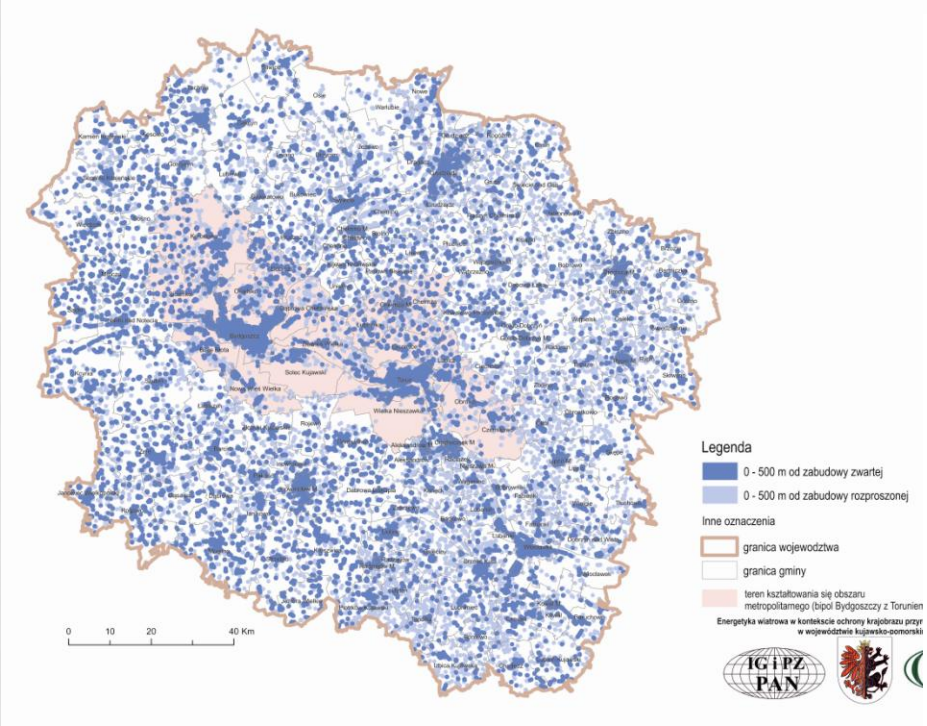


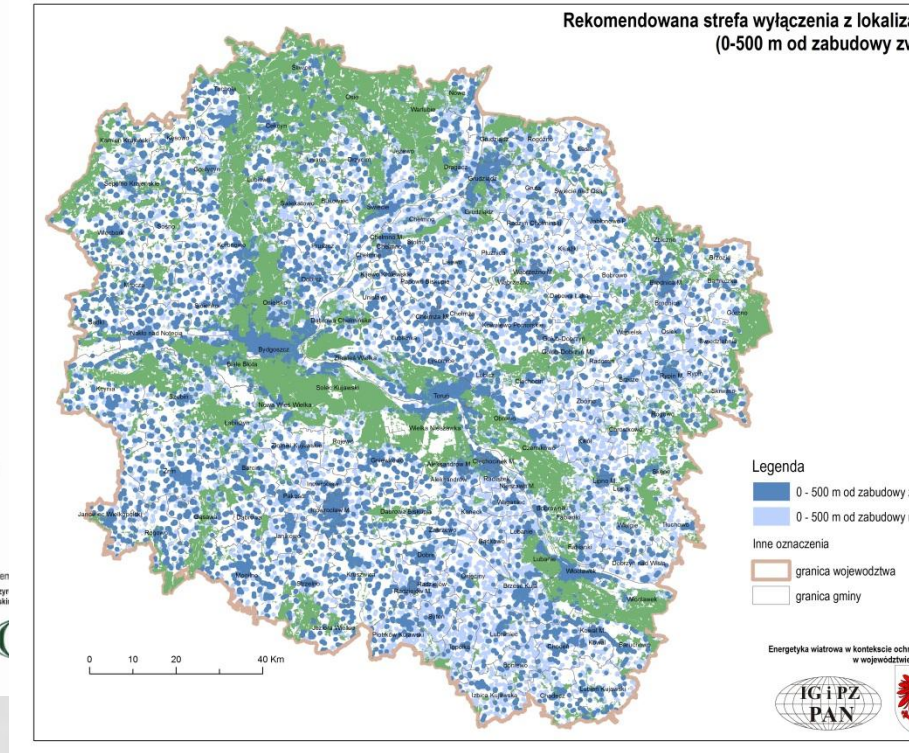
1000 m from m from compact and dispersed settlement



e ochrony
dztwie kuj

LOKALIZACJA ZABUDOWY A ROZWÓJ ENERGETYKI WIATROWEJ

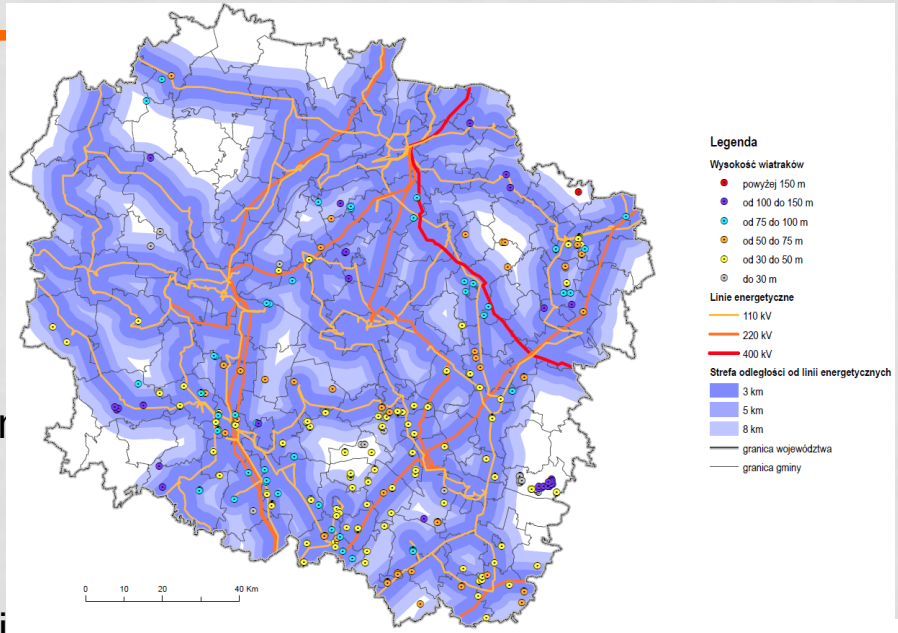




Rekomendowana strefa wyłączenia z lokalizacji farm wiatrowych 0-500 m od zabudowy zwartej i rozproszonej oraz zachowanie terenów rozwojowych wokół dużych miast (bipol Bydgoszczy i Torunia)

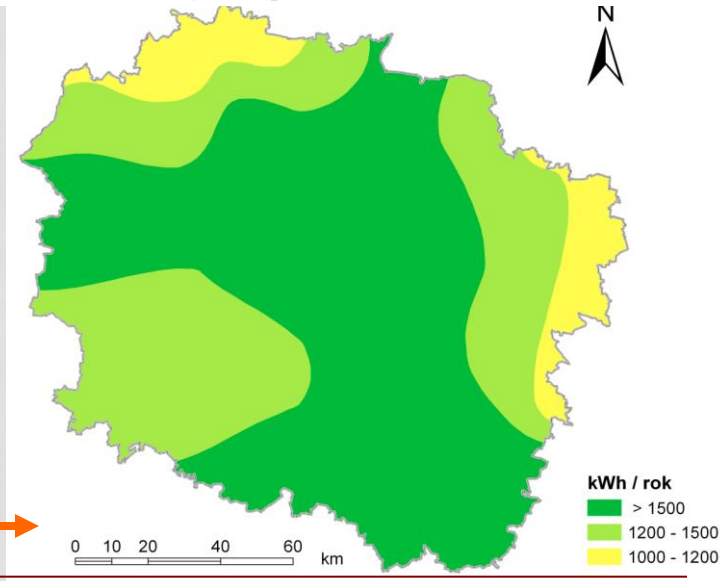
Economical conditions

Access to energy networks and the actual location of wind turbines



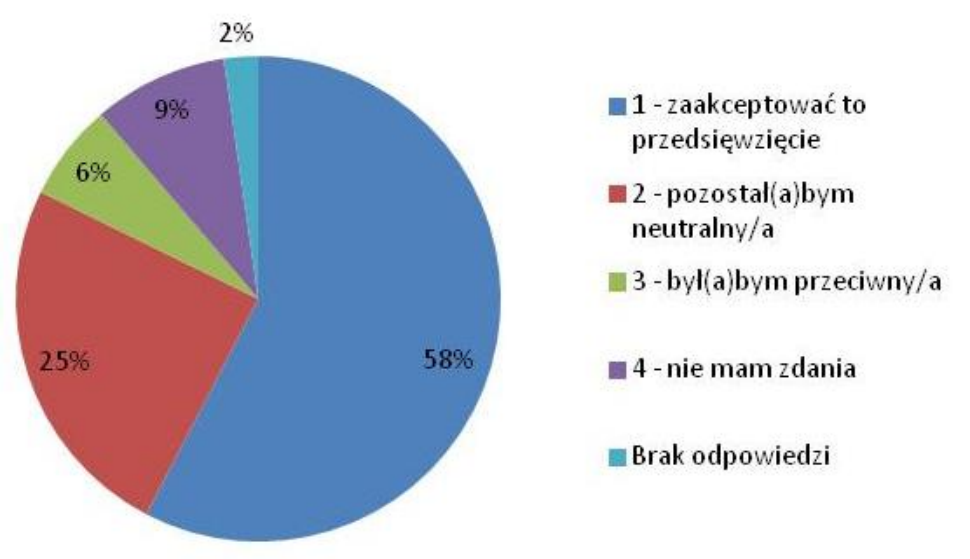
The greatest potential for wind power (over 1500 kWh) is preserved in valeys the current trough alon the Vistula River and the middle Noteć.

The most important from the point of view of wind energy seem to be investing in transmission lines i rural areas, where access to the network is weaker and good climatic conditions (the valley of the Vistula River in the region of Lake Wloclawek, central zone - in the triangle Bydgoszcz-Toruń-Inowrocław). Conducted reasoning applies only to cost-effectiveness.



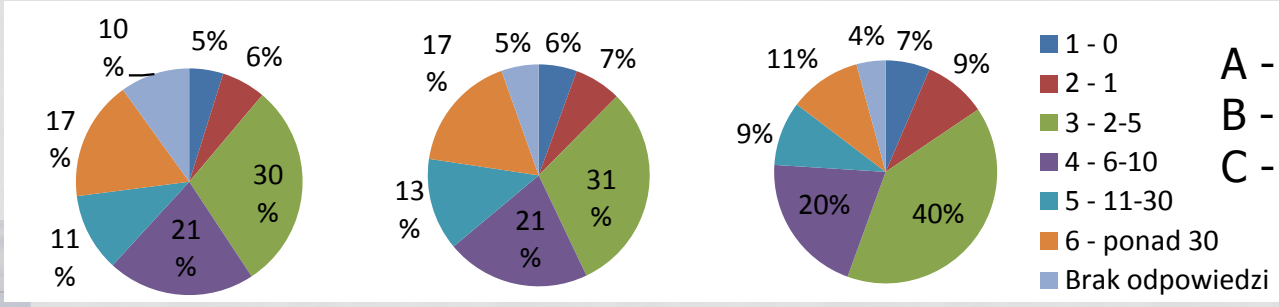
Potencjał energetyczny wiatru

Perception



Attitudes towards the construction of new wind farms in the municipality

Acceptable number of new wind turbines near the respondent's place of residence (by type locality)



A - wind turbines operate
B - the planned construction
C - no fans

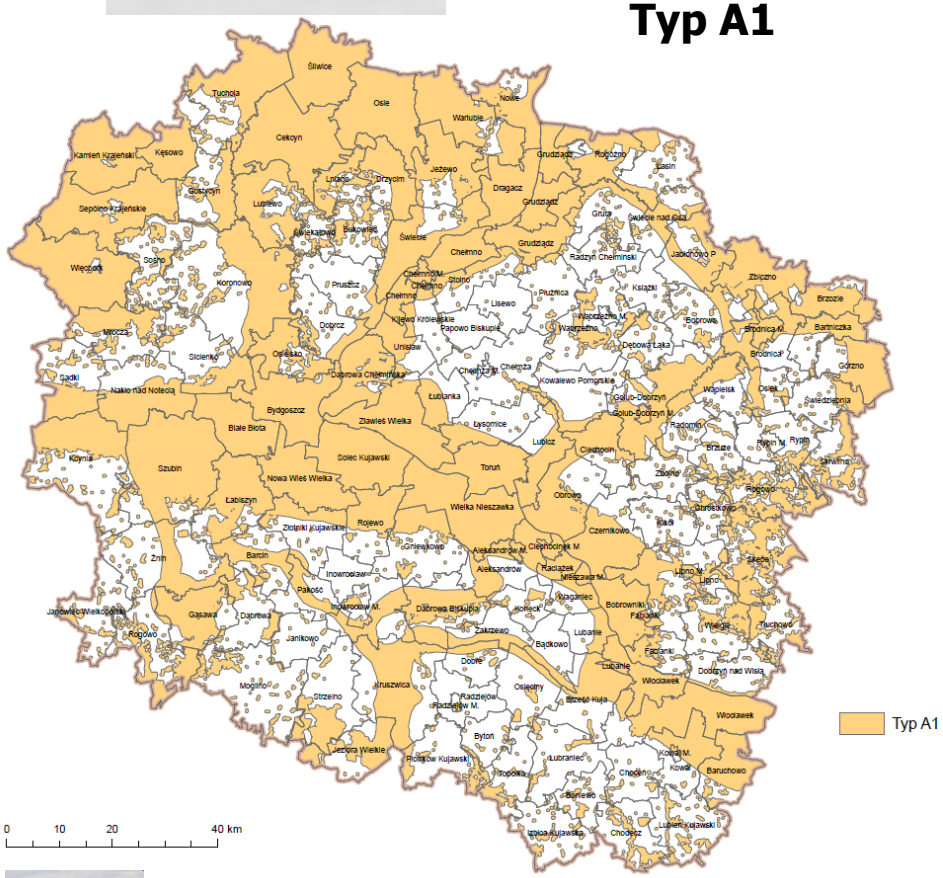
Synthesis (typology of the

<table>
<tr><th colspan="2" rowspan="2"></th><th colspan="4">Jakość życia</th></tr>
<tr><th><500 od zwartej</th><th>>500 od zwartej i <500 od rozproszonej</th><th>500-1000 od zwartej i rozproszonej</th><th>>1000 od zwartej i rozproszonej</th></tr>
<tr><td rowspan="3">Ochrona dziedzictwa przyrodniczego i kulturowego</td><td>Obligatoryjna ochrona</td><td colspan="4">A1</td></tr>
<tr><td>Ograniczona ochrona</td><td rowspan="2">A2</td><td>B1</td><td colspan="2">B2</td></tr>
<tr><td>Brak zidentyfikowanych ograniczeń o wymiarze ponadlokalnym</td><td>B3</td><td>C1</td><td>C2</td></tr>
</table>

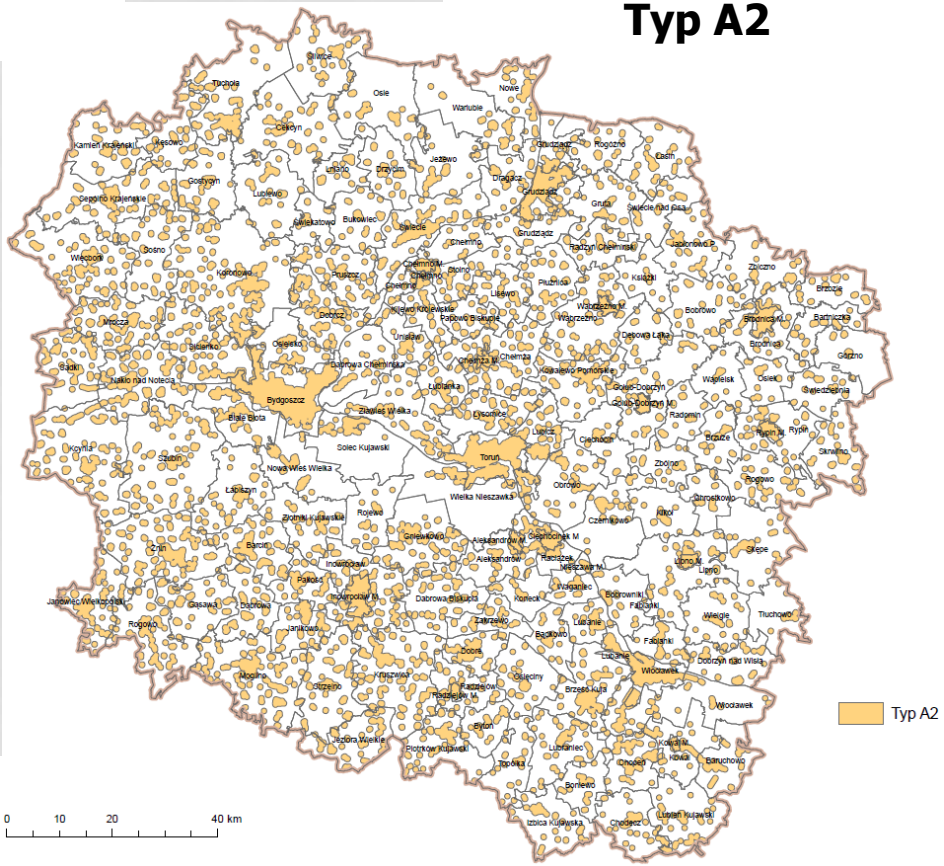
Rekomendacje (1) – typ A1 i A2

A1 – obligatoryjna ochrona, A2 – ograniczona ochrona, brak ograniczeń/ odległość < 500 m od zabudowy zwartej

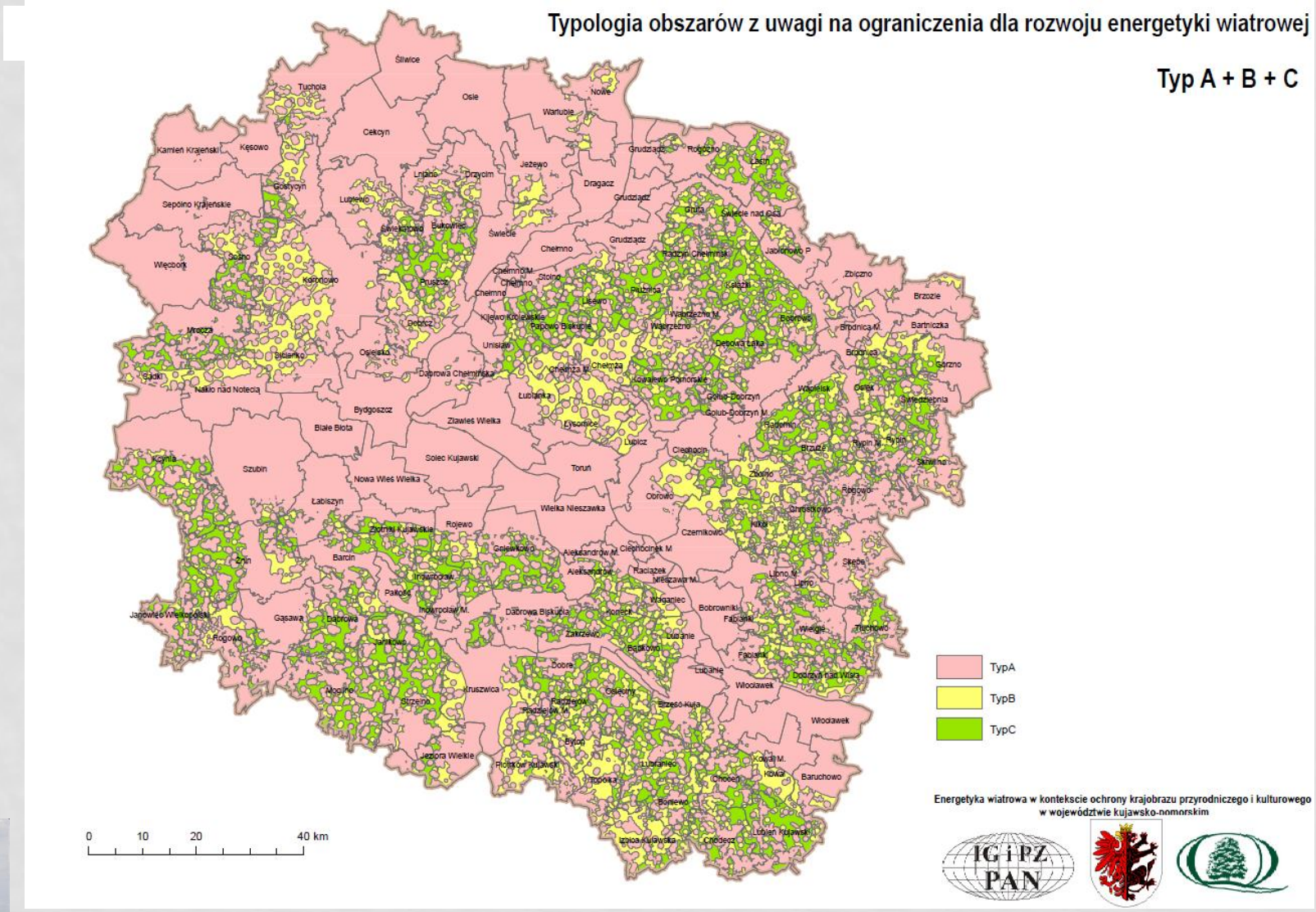
Typ A1



Typ A2



Rekomendacje (10) – typ A+B+C



Thank you for your attention