Optimalisation of the wind farm location planning with of GIS methods based on a Hungarian case study area (Csongrád county)

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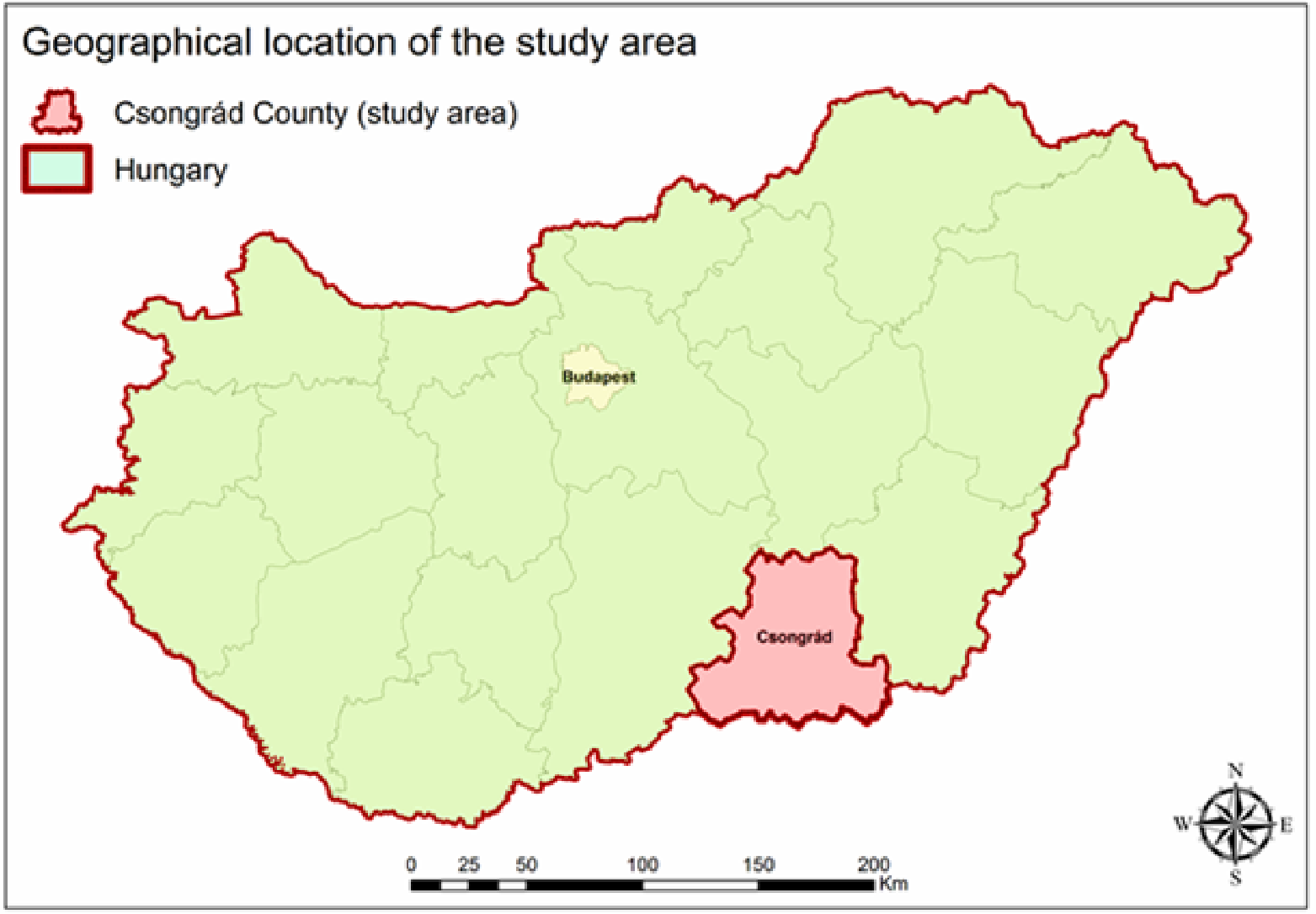
Introduction

- Growing use of the renewable energy sources
- Need for a GIS based spatial analysis of the energy potentials and limiting factors
- Our goal: a methodology which can be used for the spatial planning of wind farms

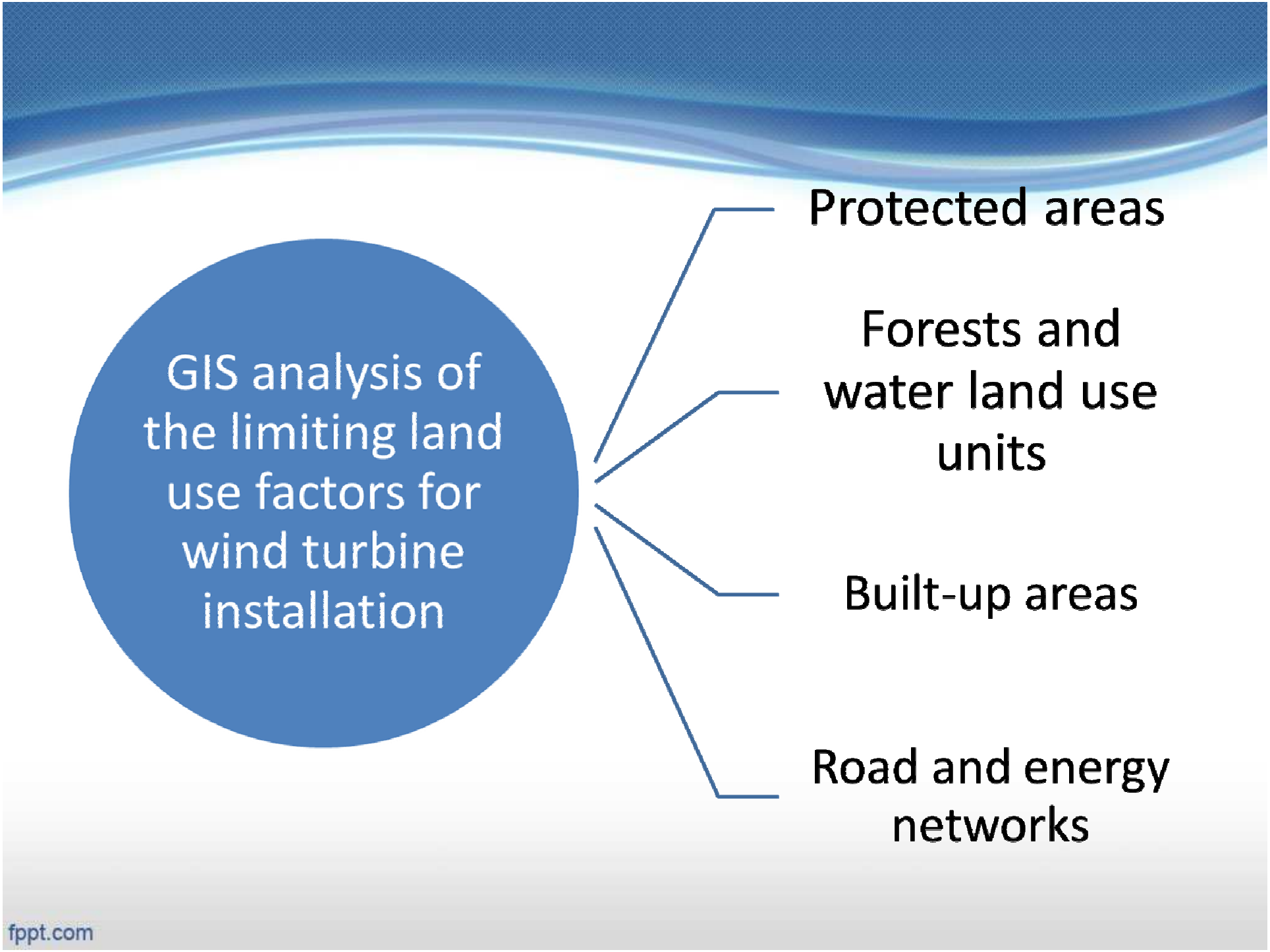
Geogrophical location of study area



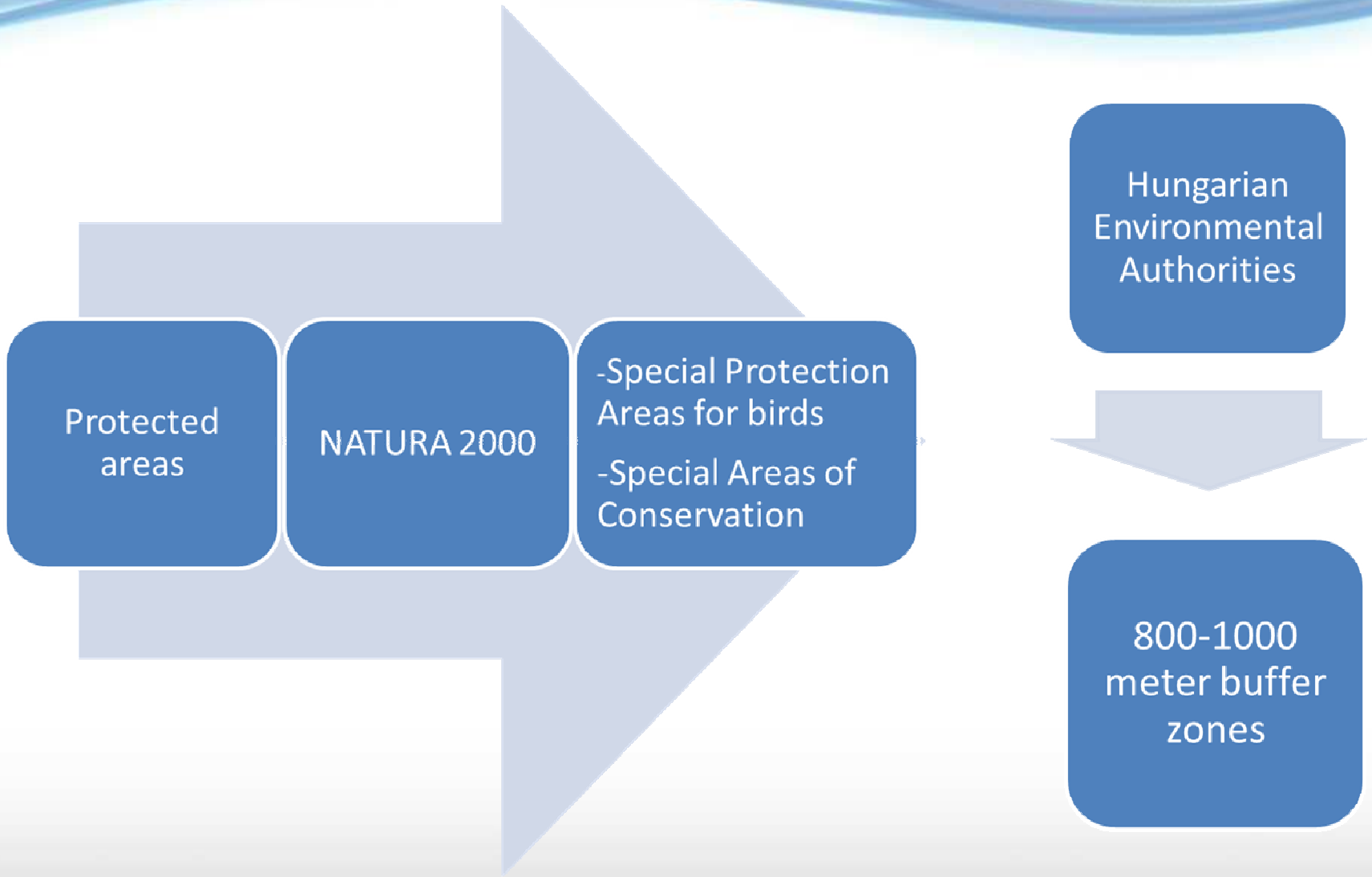
Materials and Methods

The used database:

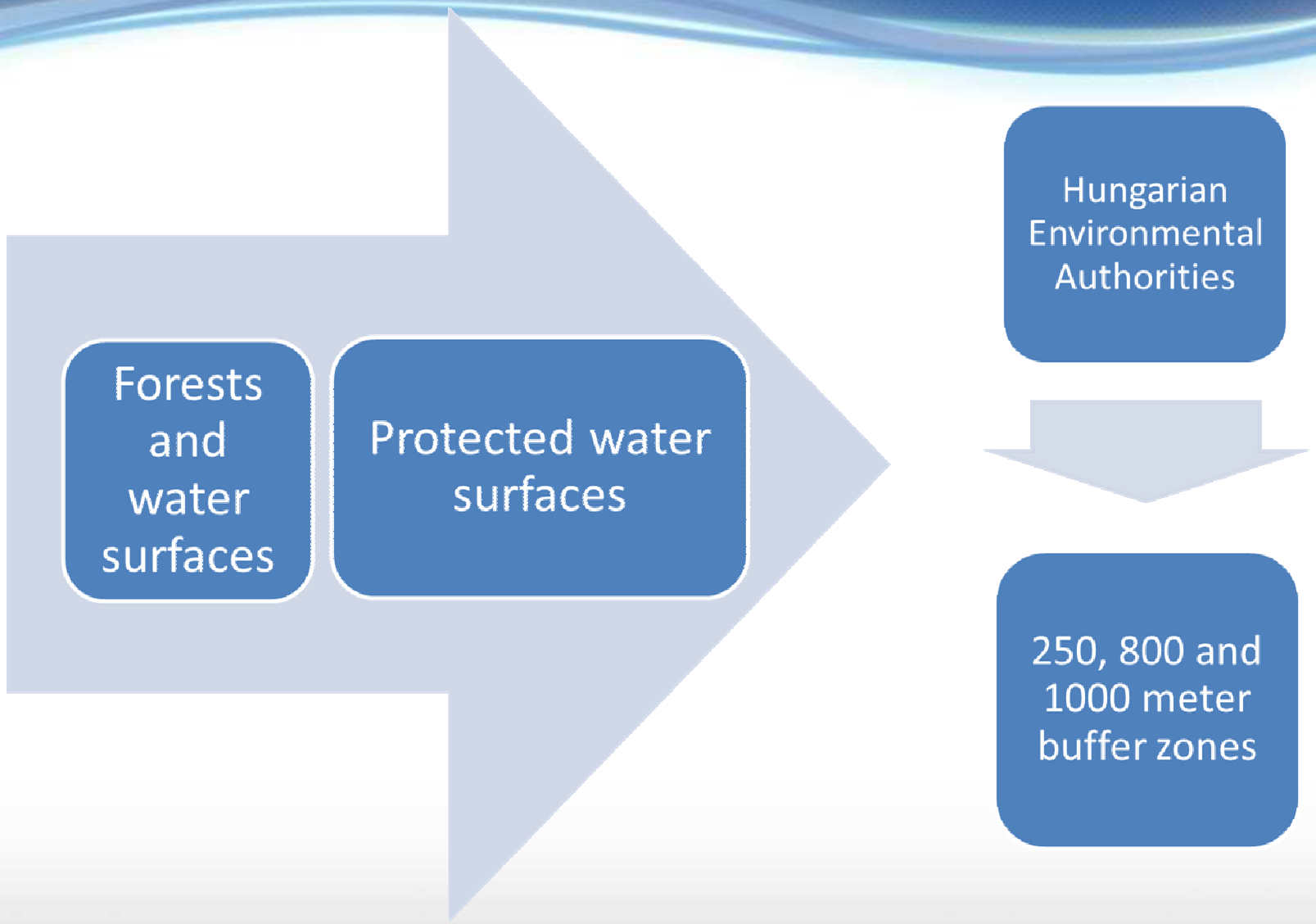
- CORINE 2006 Land Cover Map
- digital road and electricity network map
- Hungarian Digital Information System of Protected Areas
- Synoptic meteorological databases


GIS analysis of the limiting land use factors for wind turbine installation
Protected areas
Forests and water land use units
Built-up areas
Road and energy networks

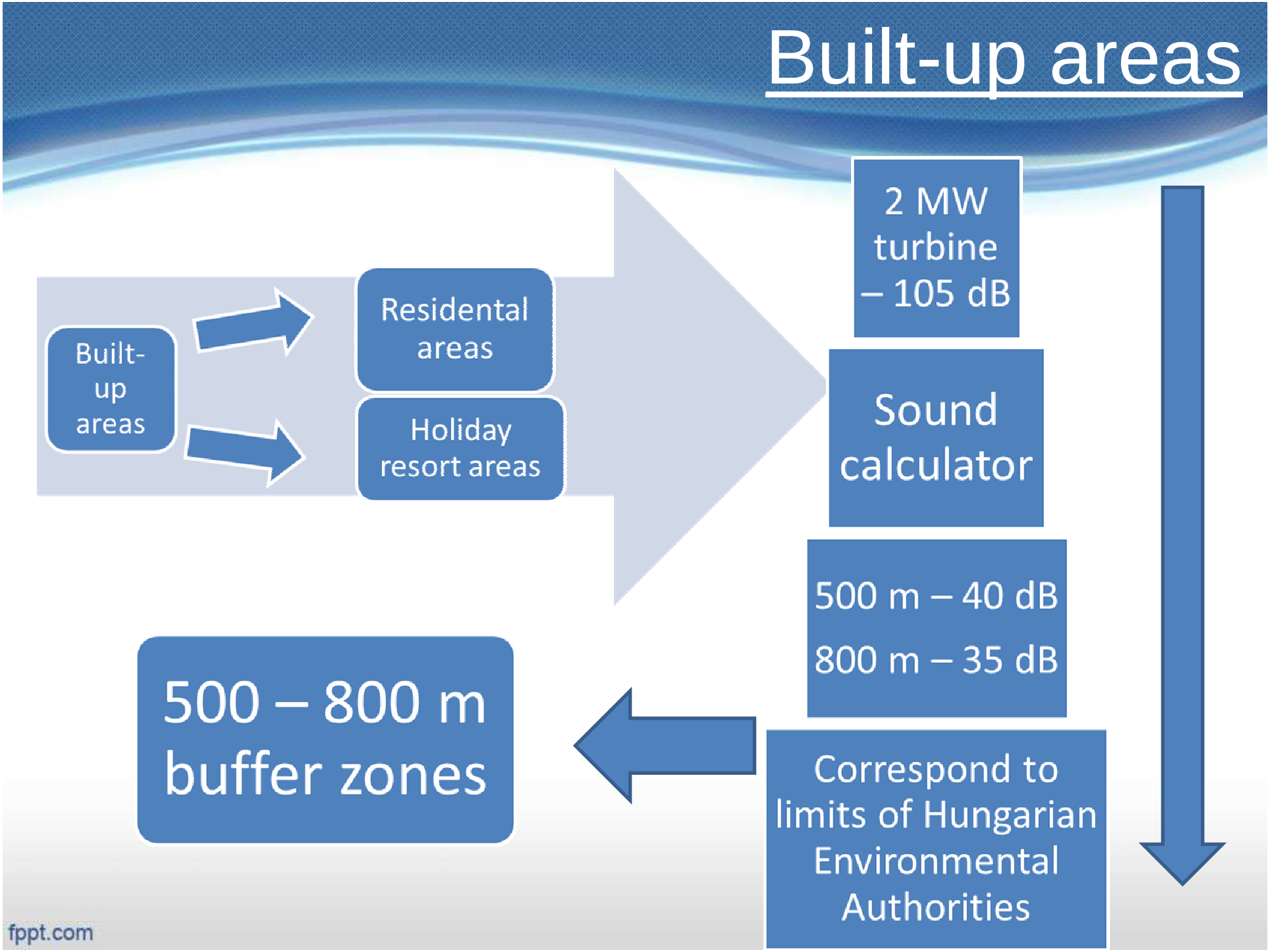
Protected areas



Forest and water land use units



Built-up areas



Road and Energy networks

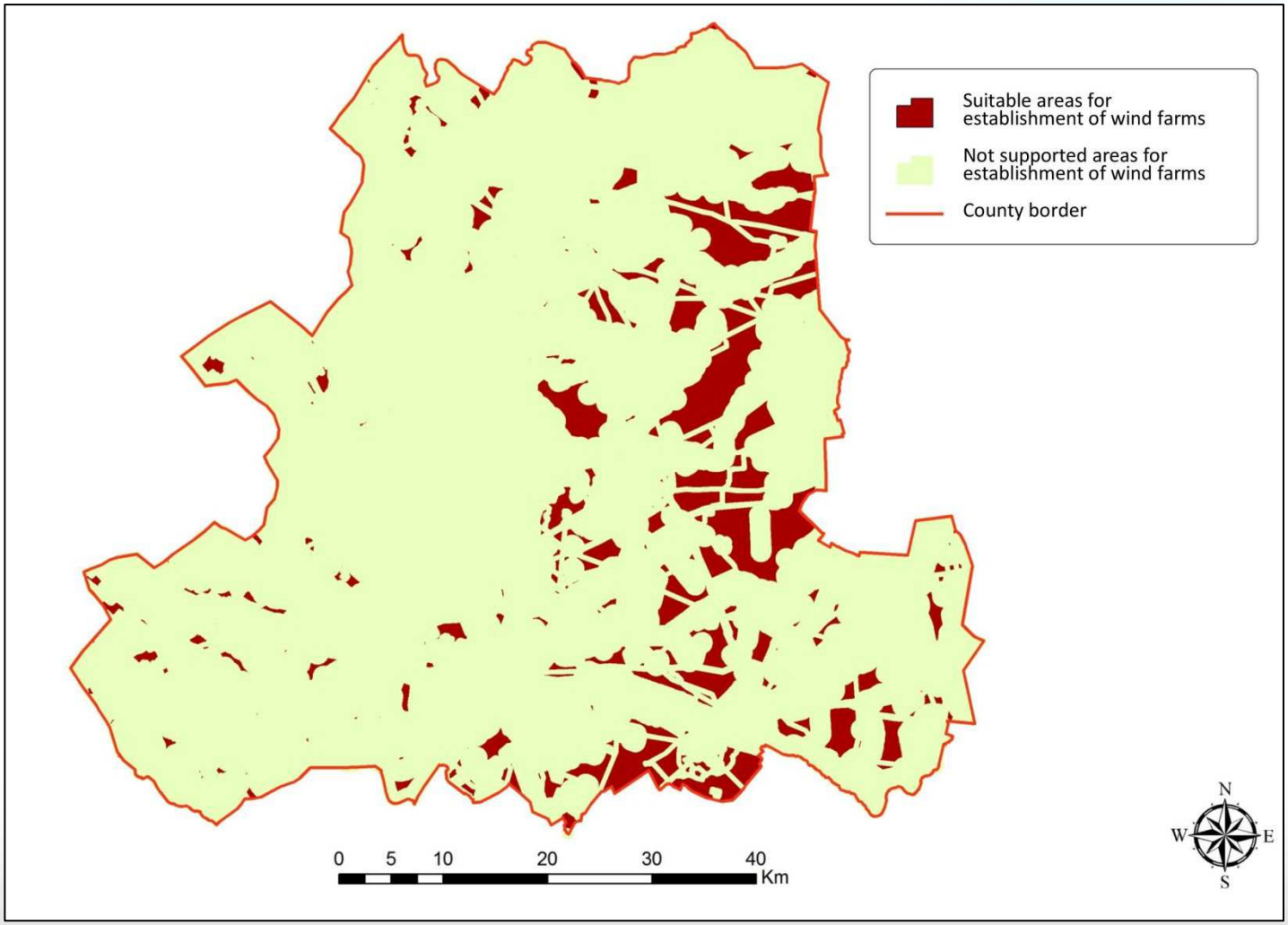
Road
- Paved road
- Road networks

Electrical
- 120 kV
- 400 kV networks

Hydrocarbon
- International
- Hungarian networks

250 meter buffer zones

The limiting land use factors for wind turbine installation with buffer zones of the study area



GIS analysis of supporting aspects of wind power installation

Electricity network
(120 kV and 400 kV high voltage)

- Within 15 km distance

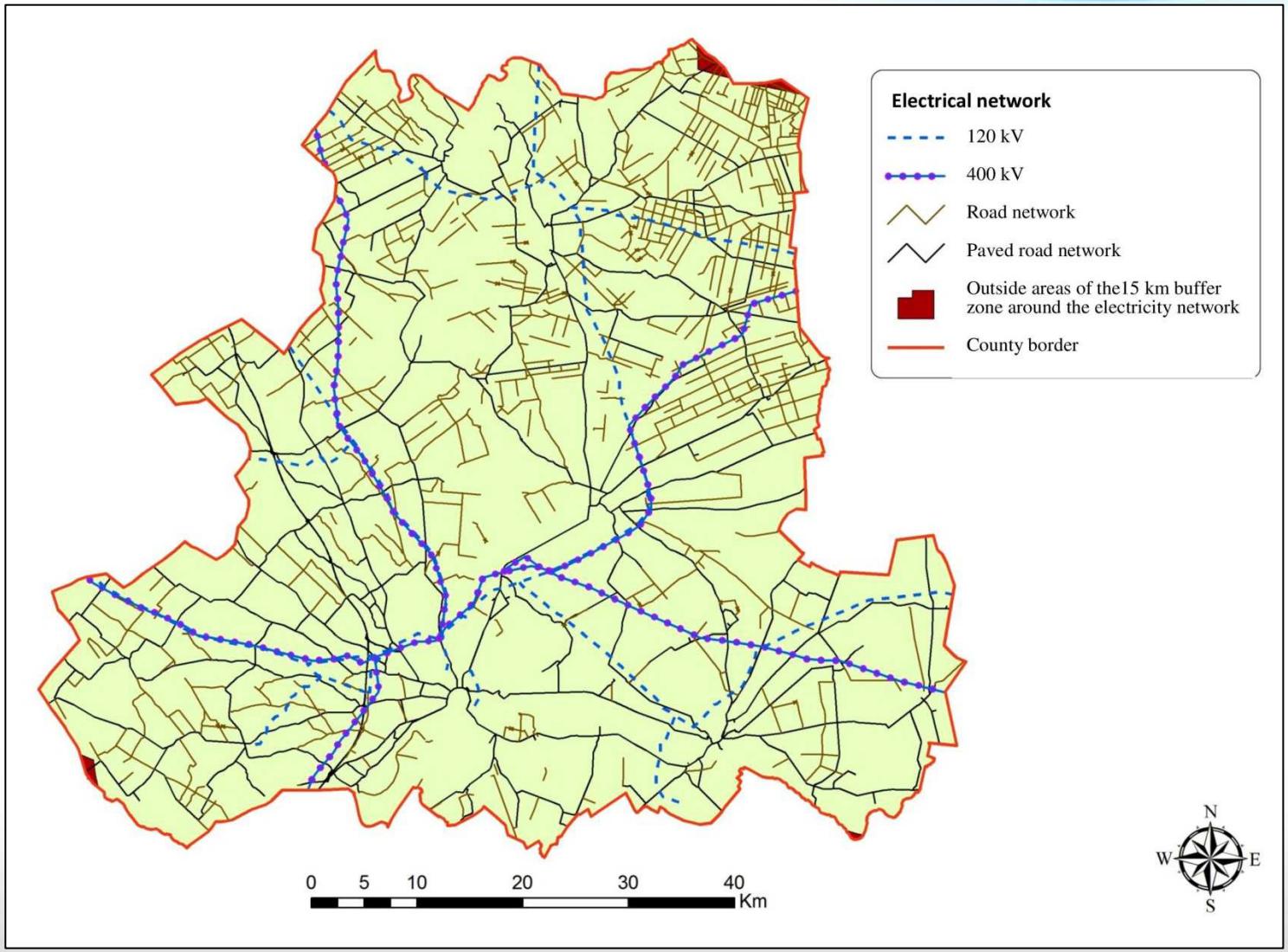
Paved road network

- Service way

Windmill density map

Wind potential map of the study area

Supporting aspects of wind power installation of the study area



Historical windmills as indicators of the wind energy potential

Georefered II. Military Survey maps

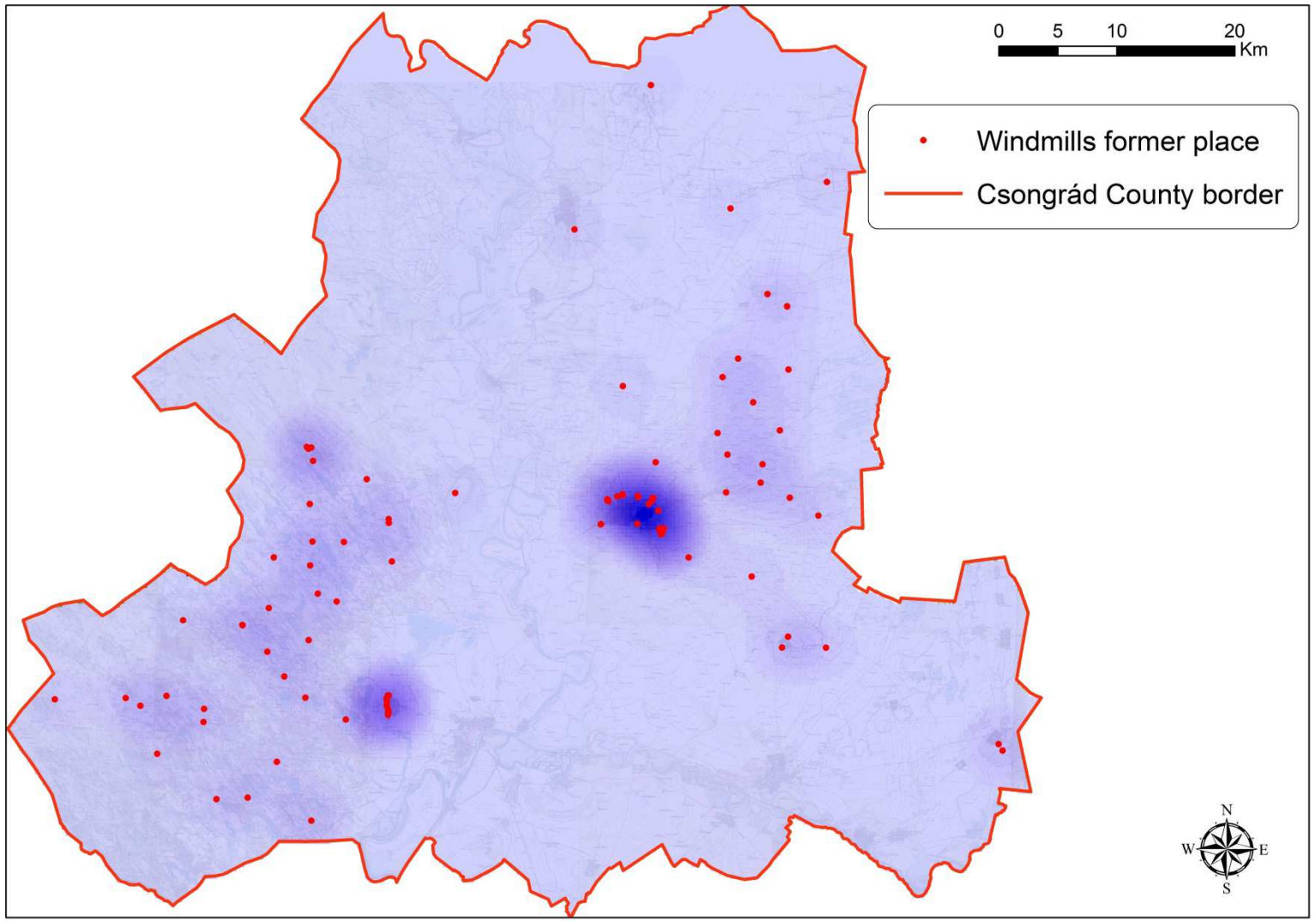
96 windmills were identified and digitalized

Every windmill with 3 km buffer zone

Counting the windmills within buffer

Generate density map

Windmill density map of the study area based on II. Military Survey (1870)



Wind potential map of the study area using GIS methods

Database:

- Hungarian Meteorological Service (4 stations)
- Időkép.hu (3 statinons)
- M43 motorway (4stations)
- M5 motorway (4stations)
- Ogimet.com

Hellman exponential function

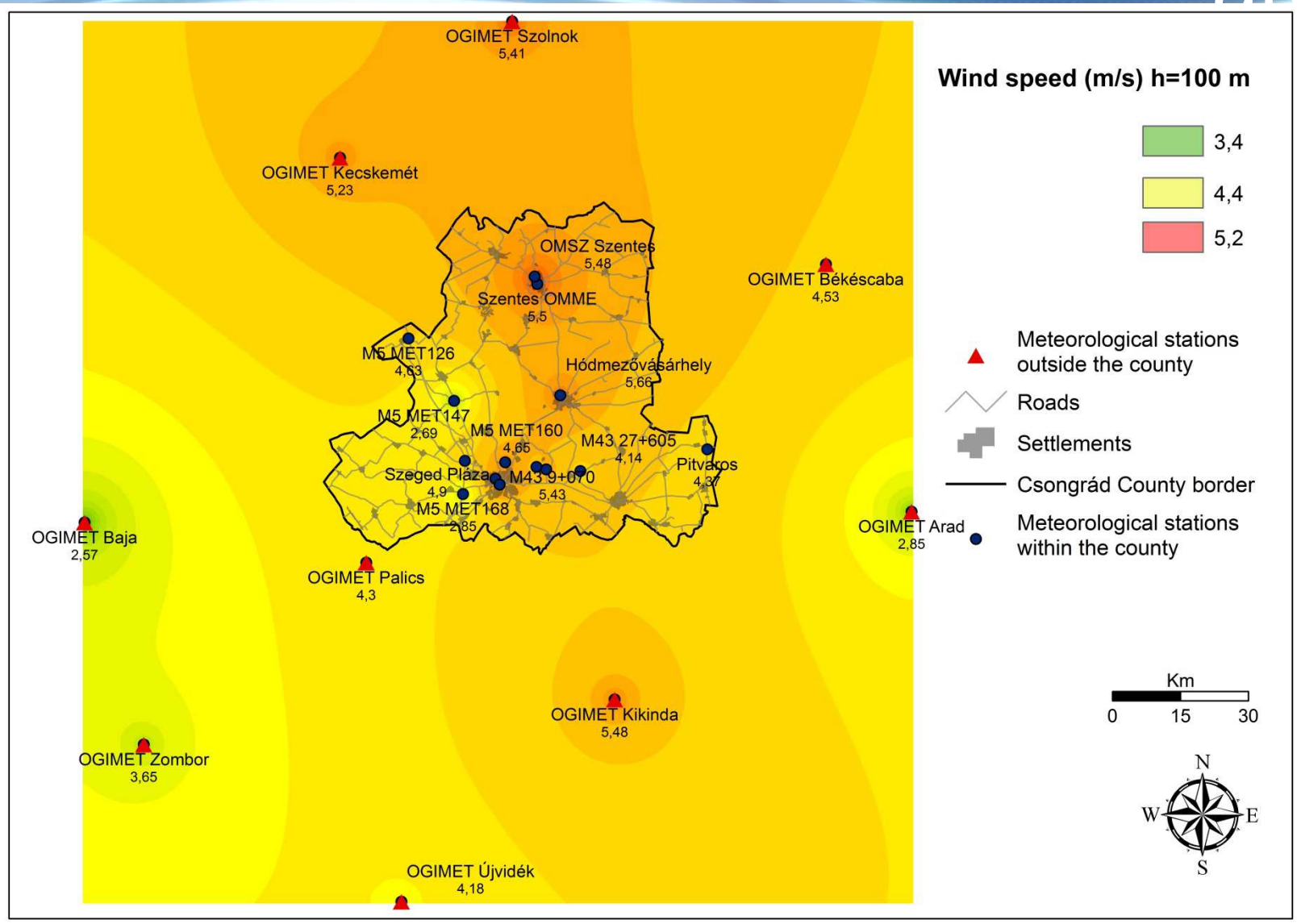
- Hellman exponent,
- Davenport's classification
- Calculate data for 100 m height

$$v_w(h) = v_{10} * \left(\frac{h}{h_{10}}\right)$$

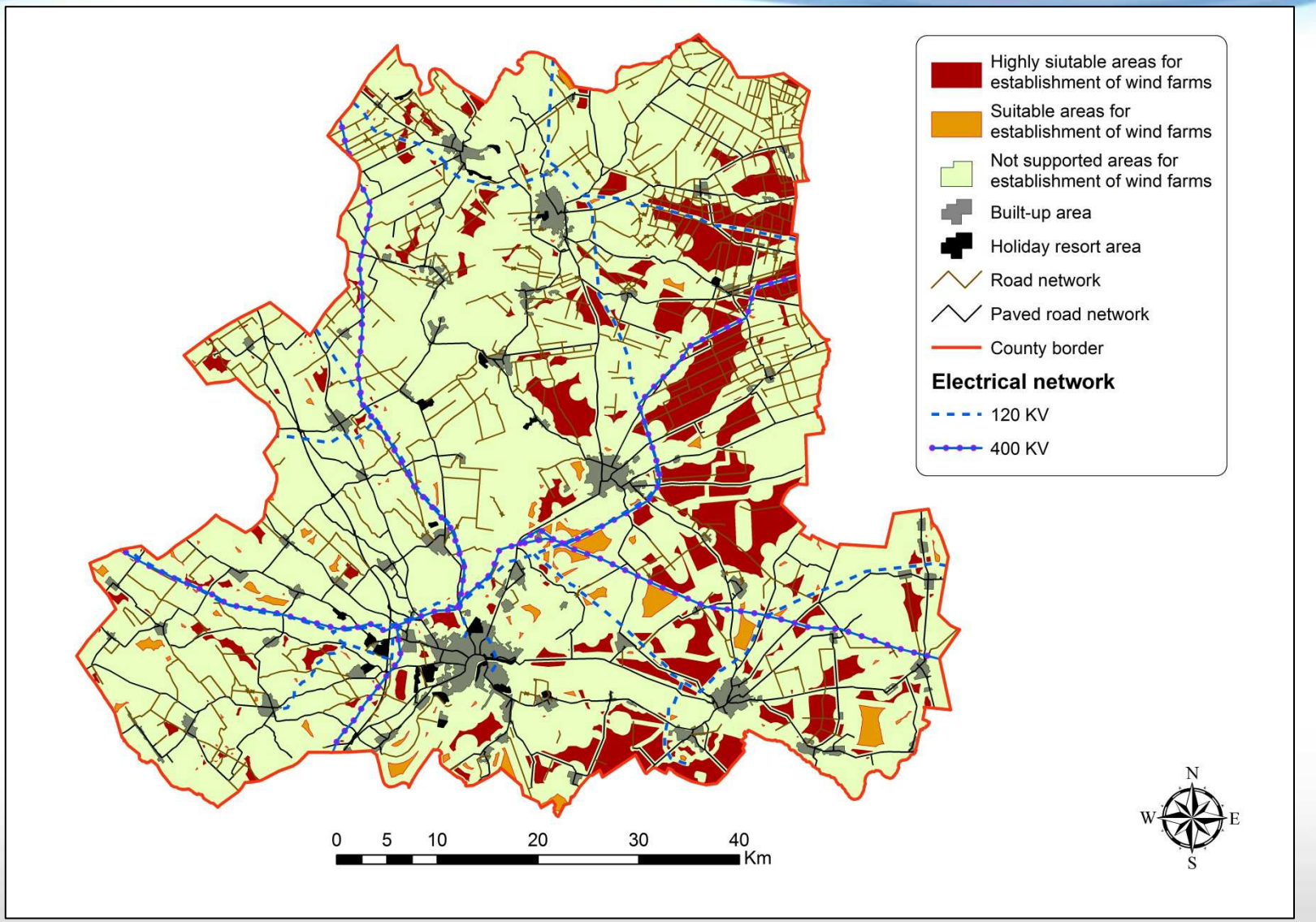
IDW interpolation

- Interpolation of 100 m heigth data

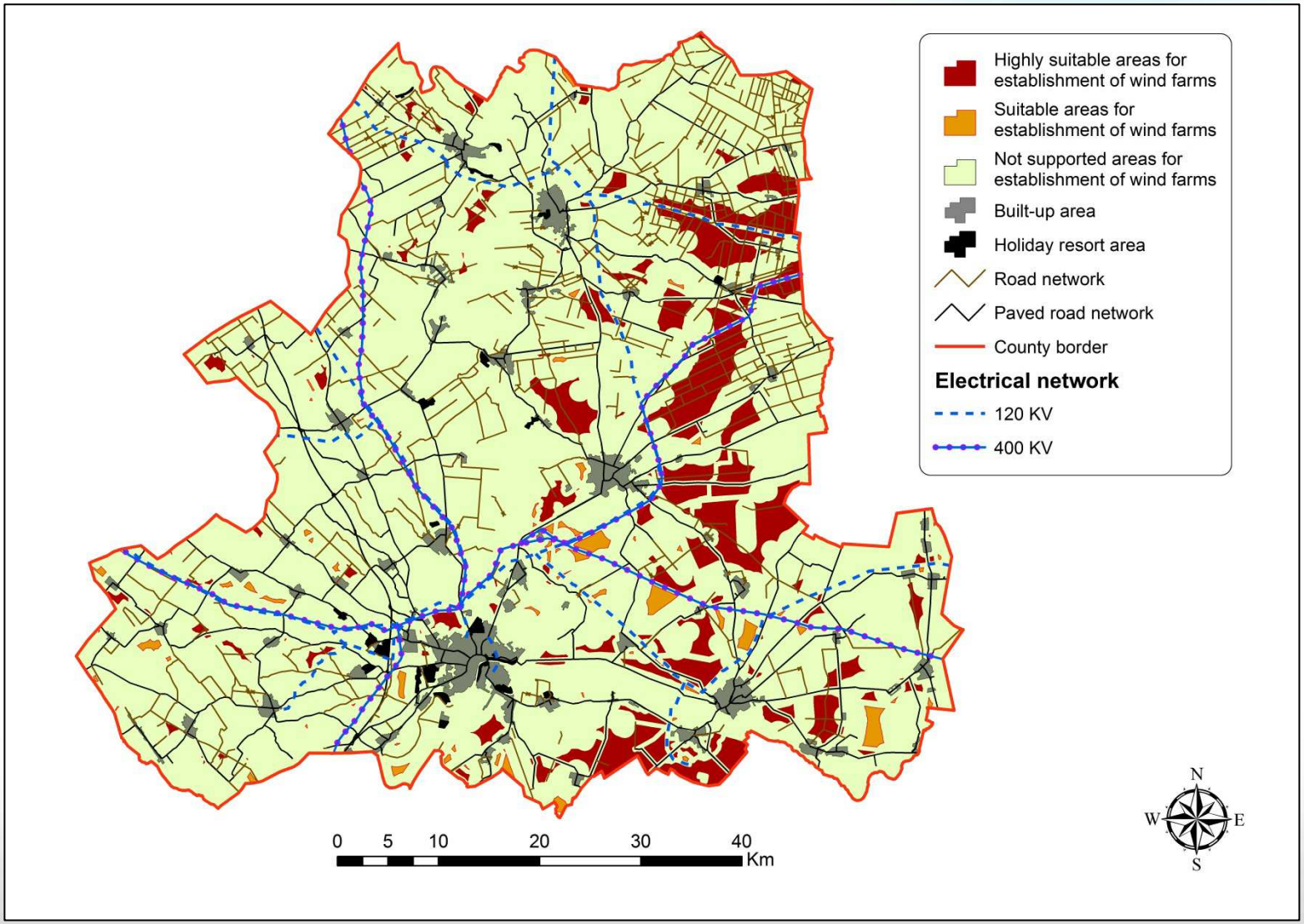
Wind potential map of the study area



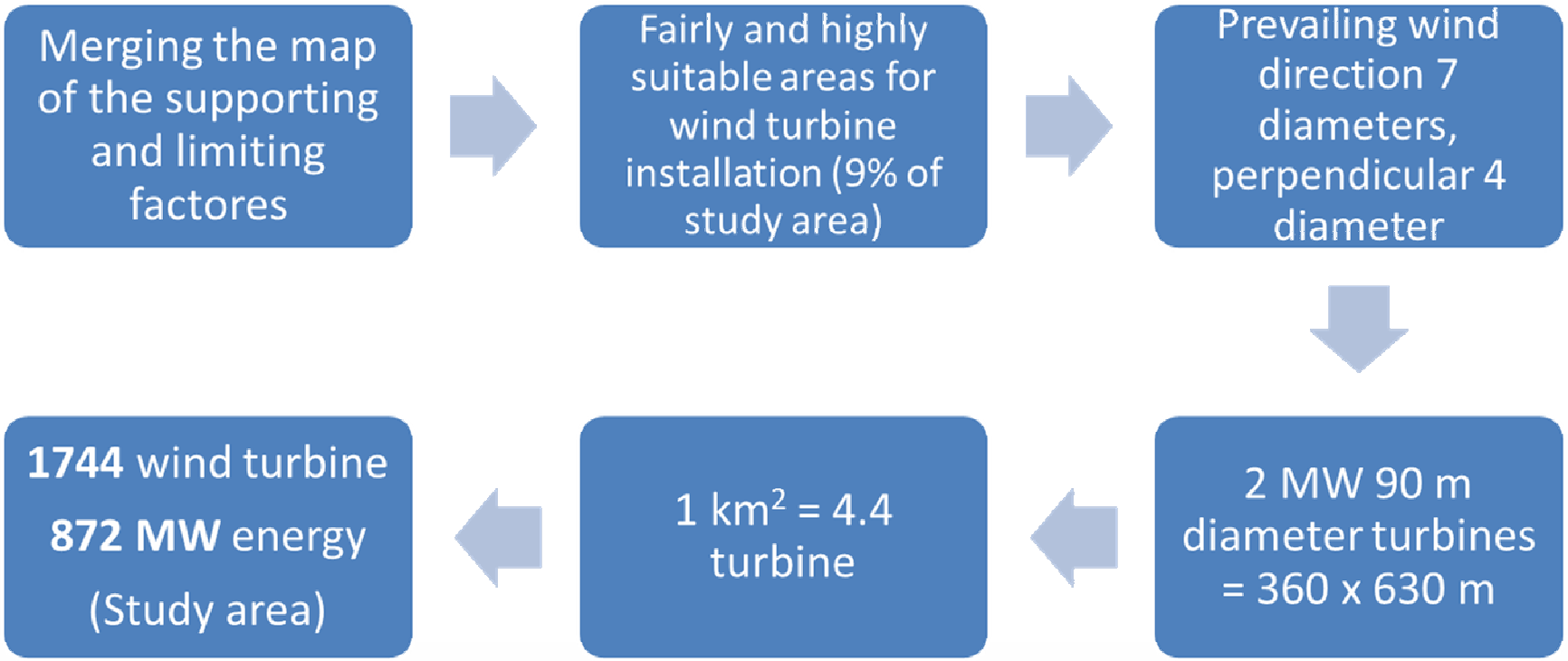
Suitable areas for establishment of wind farms of the study area (800 m)



Suitable areas for establishment of wind farms of the study area (1000 m)



Wind energy power potential calculations



Results

- Windmill density map
- Wind potential map
- Delineation (2 scenarios) of the highly suitable and suitable areas for establisments of wind farms of the study area
- Wind energy power potential calculations for the suitable areas

THANK YOU VERY MUCH FOR YOUR KIND ATTENTION!