getech

Workflow For Mapping Integrated Above- And Below-Ground Geothermal Favourability In Central Europe

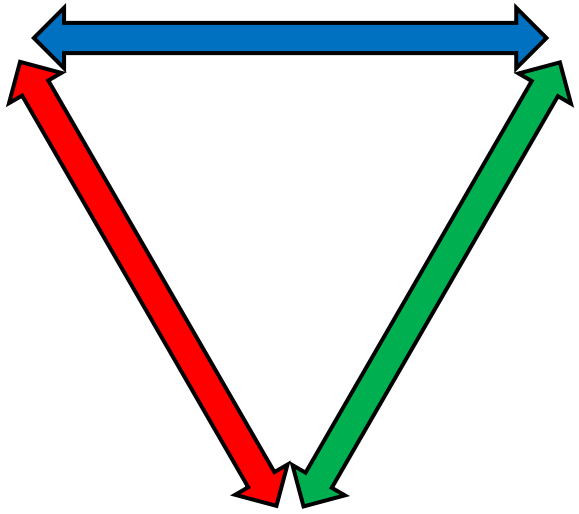
GEOTHERMAL 2024

Heating up the Market

REGIONAL GEOTHERMAL EXPLORATION

End-User Demand

Subsurface Resource



Constraints

Earliest possible integration of regional and sub-regional geospatial data sets
Across all components of the workflow

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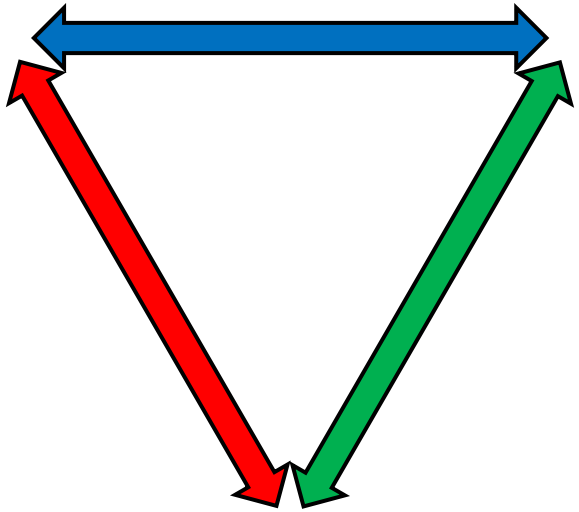

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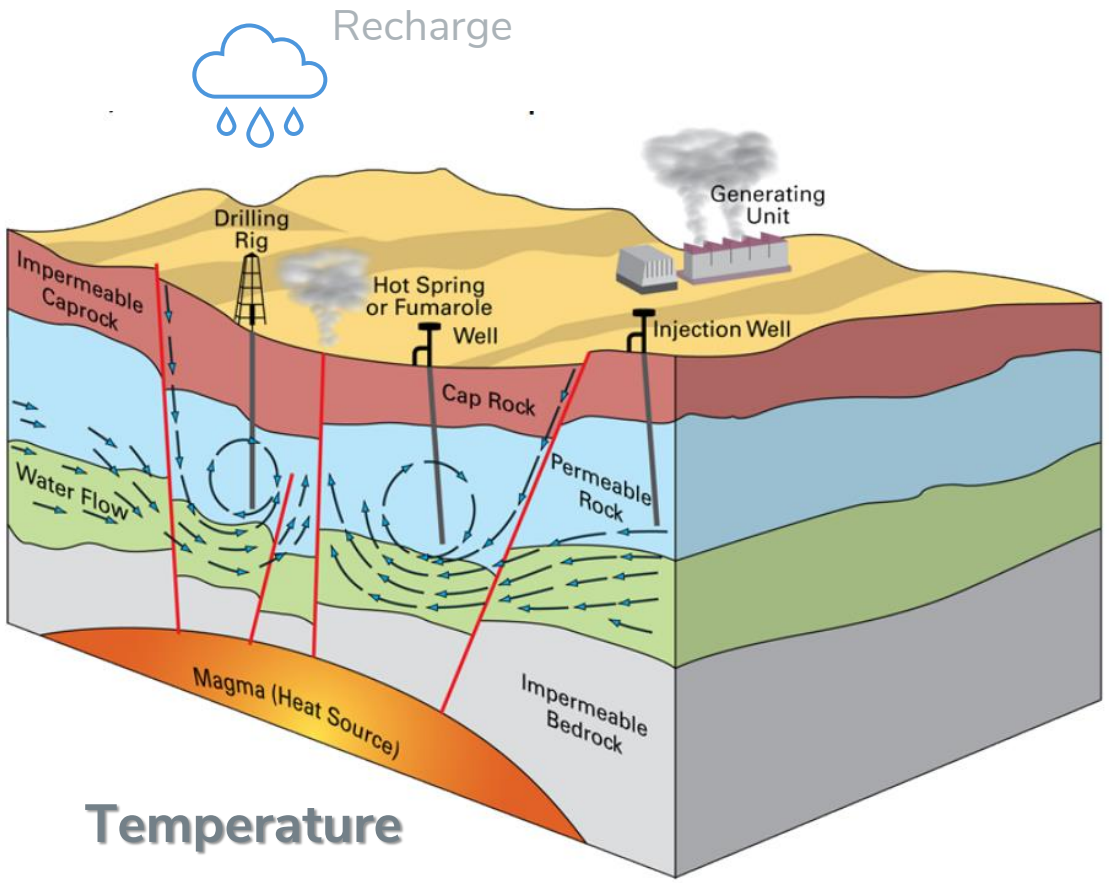
Subsurface Resource – A Hierarchy of Controls

- **Temperature**
- **Faults and stress state**
- Lithology
- Recharge

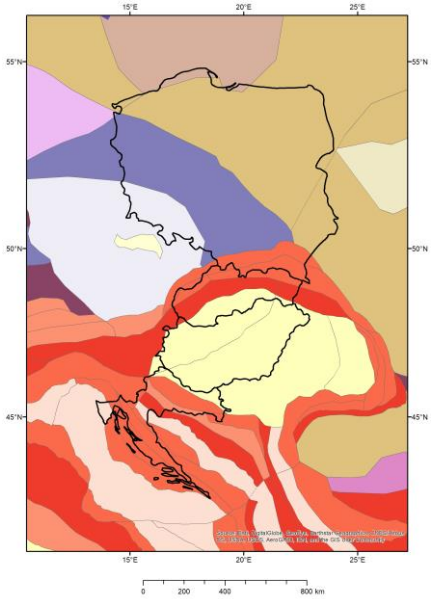


Faults

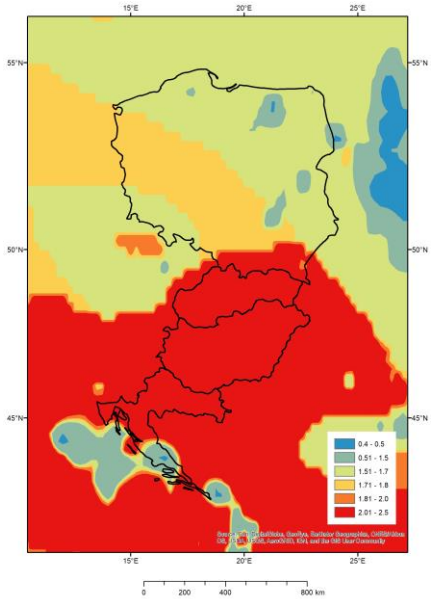
Lithology

Temperature

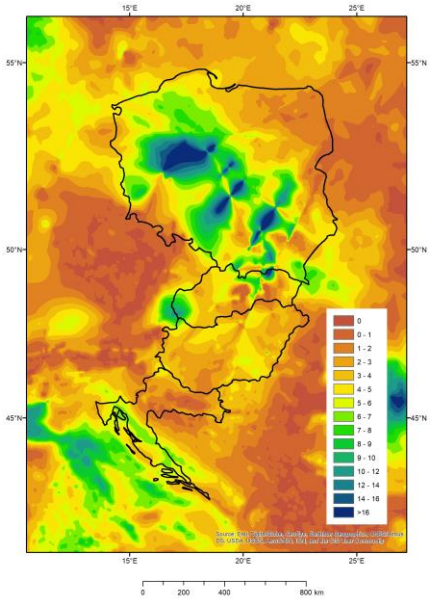
Subsurface Resource – Temperature



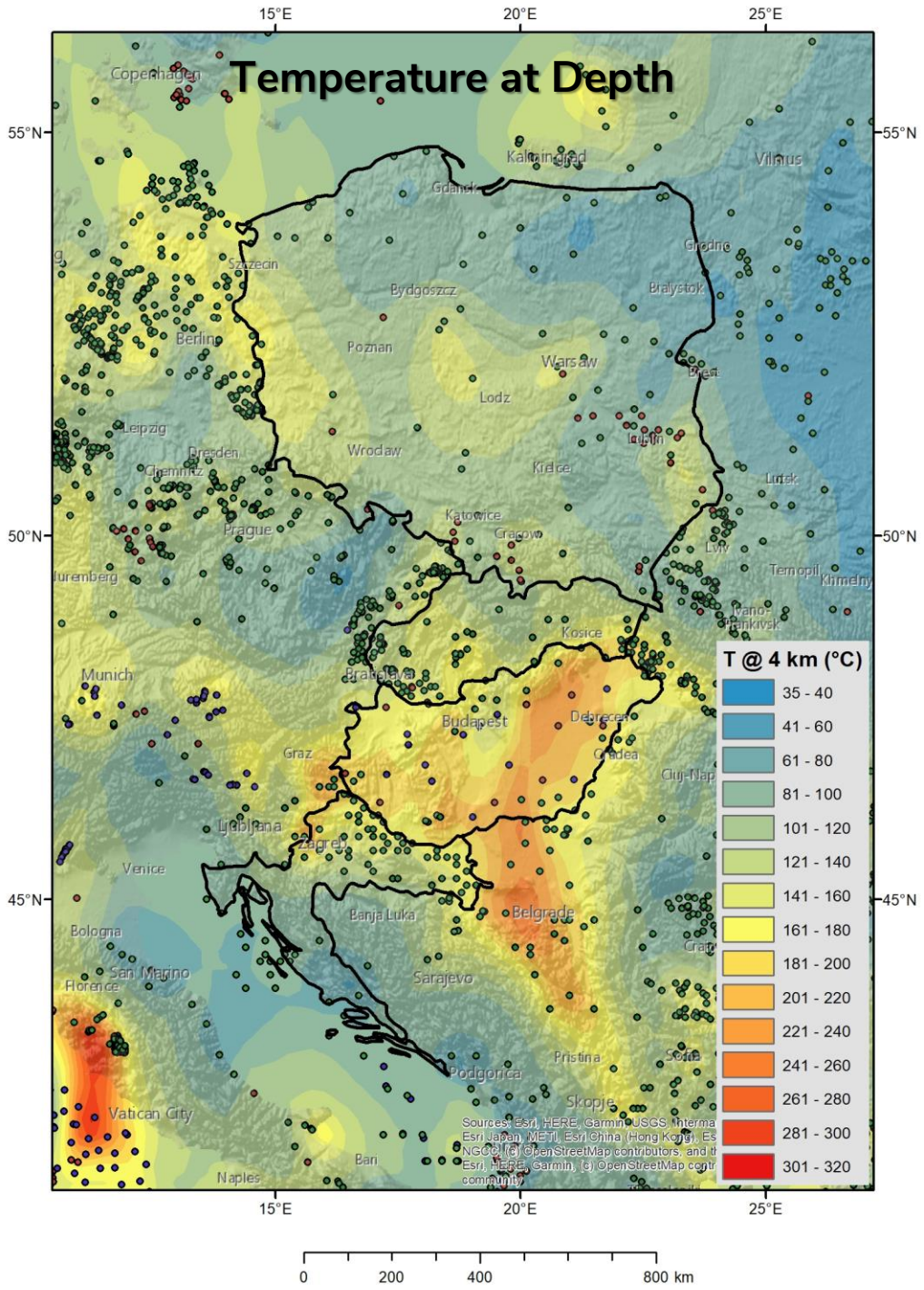
Crustal Architecture



Radiogenic Heat Production

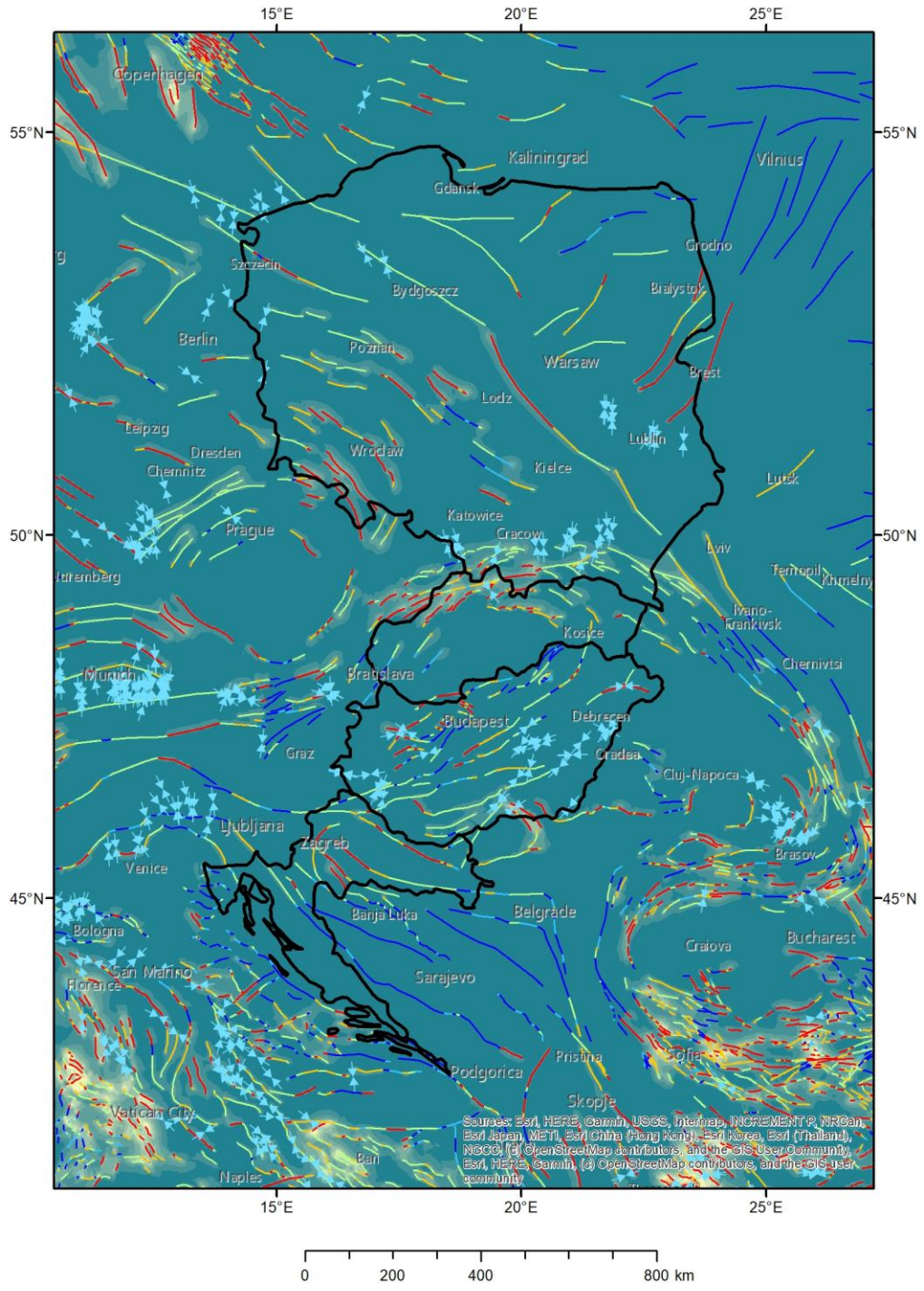


Sedimentary Cover



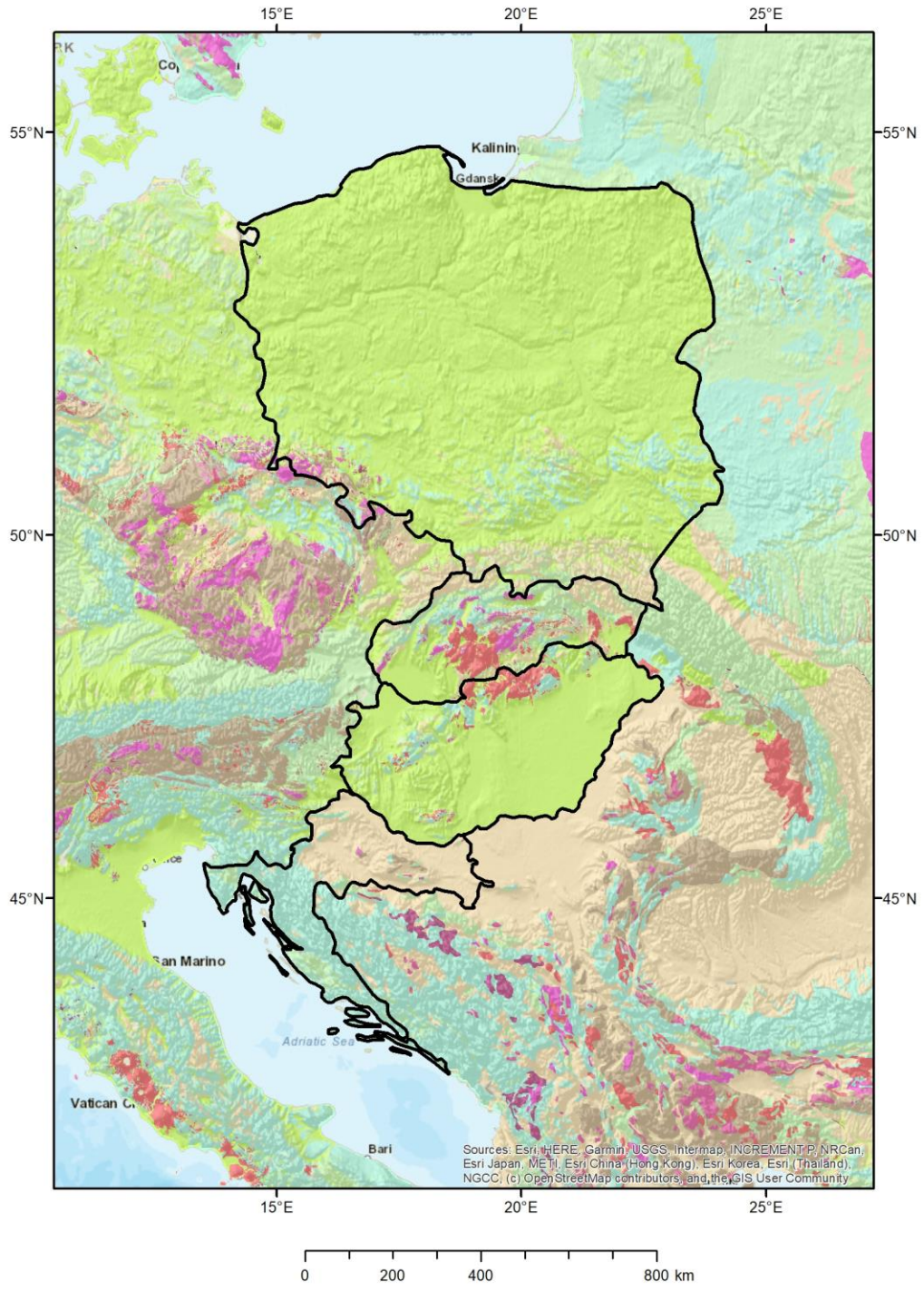
Subsurface Resource – Faults

- Faults provide pathways for fluids to carry heat (map shows major faults at scale 1:1M)
- Orientation with respect to S_{Hmax} (maximum horizontal stress) determines if the fault is open or closed to fluid flow.



Subsurface Resource – Lithology

- Different technologies are adapted to different lithologies
- Traditional doublets prefer high permeability rocks (fractures, karst, coarse clastic, …)
- Enhanced Geothermal Systems (EGS) prefer frackable rocks (suitable Young's Modulus, Poisson's Ratio, S_{Hmax} orientation)
- Advanced Geothermal Systems (AGS) prefer low permeability rocks

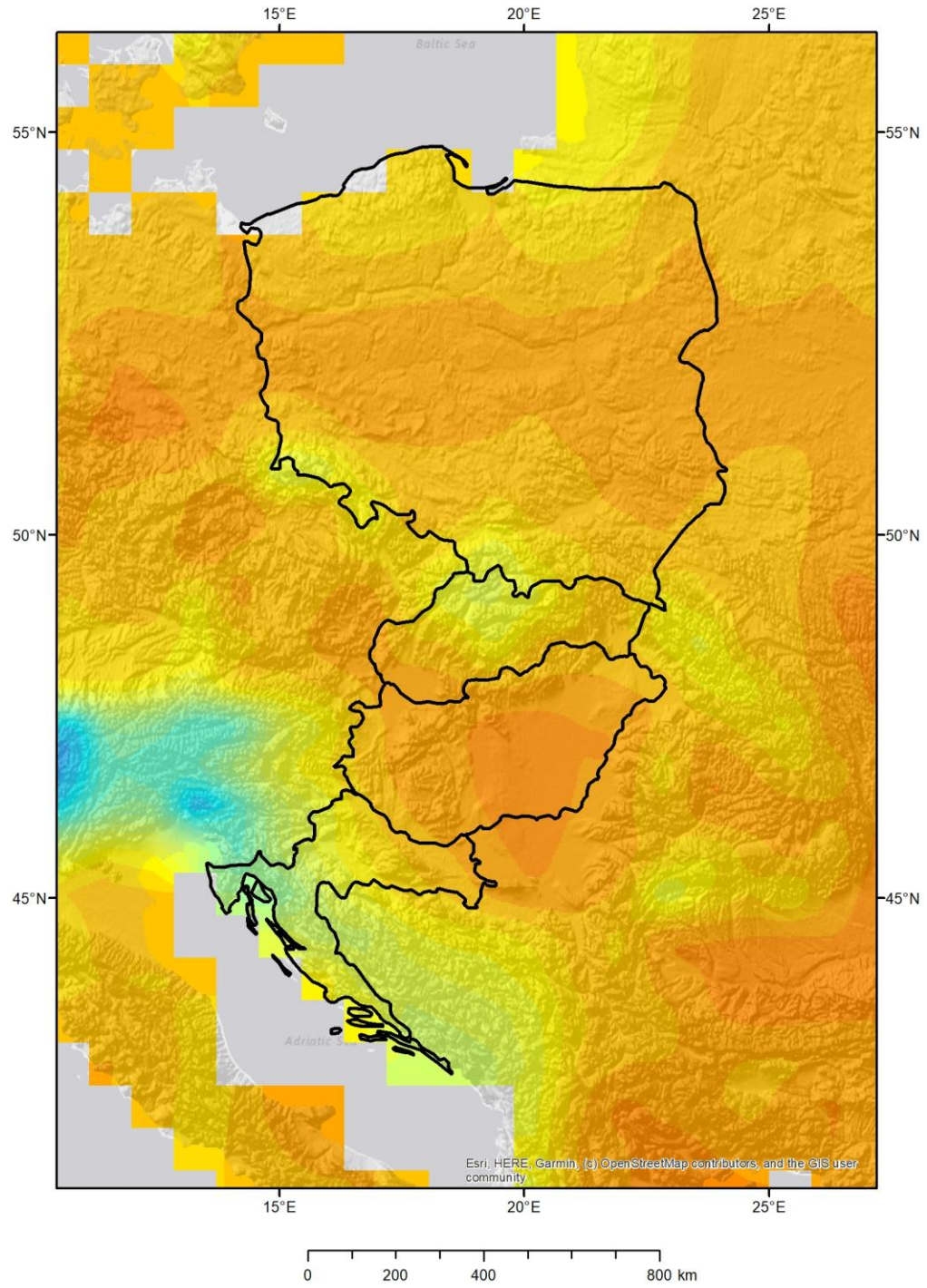


Subsurface Resource – Recharge

Replacing what is lost to the atmosphere

Mean Annual Precipitation (mm)

- 0 - 100
- 101 - 200
- 201 - 300
- 301 - 400
- 401 - 500
- 501 - 600
- 601 - 700
- 701 - 800
- 801 - 900
- 901 - 1,000
- 1,001 - 1,100
- 1,101 - 1,200
- 1,201 - 1,300
- 1,301 - 1,400
- 1,401 - 1,500
- 1,501 - 1,600
- 1,601 - 1,700
- 1,701 - 1,800
- 1,801 - 1,900
- 1,901 - 2,000
- 2,001 - 2,100
- 2,101 - 2,200
- 2,201 - 2,300
- 2,301 - 2,400
- 2,401 - 2,500
- 2,501 - 2,600



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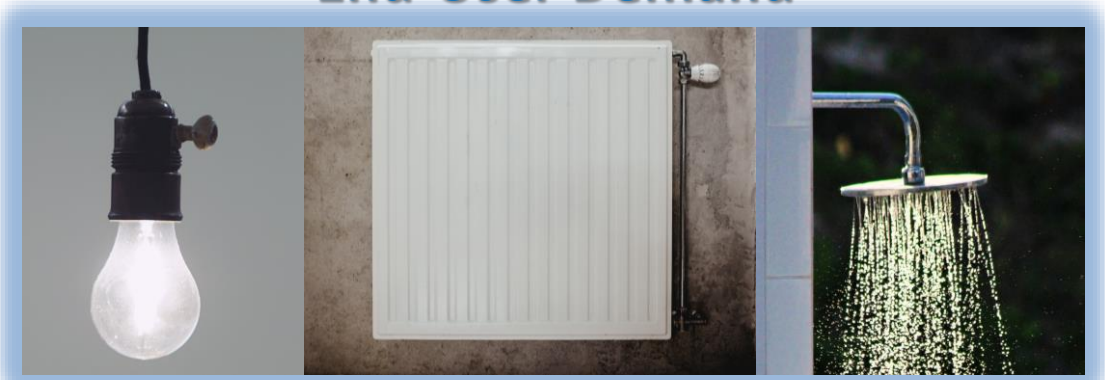
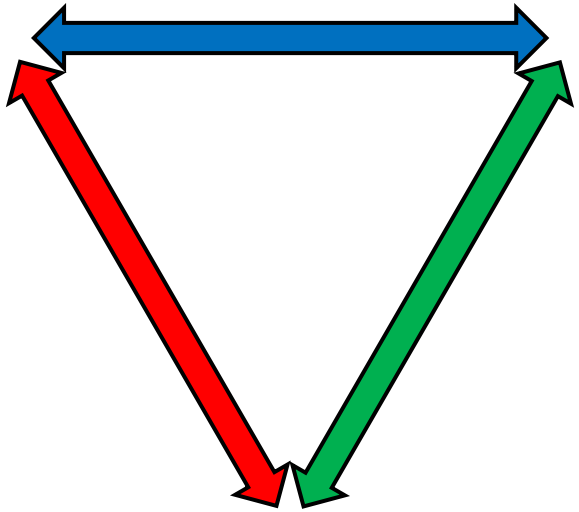
End-User Demand



Subsurface Resource



Constraints

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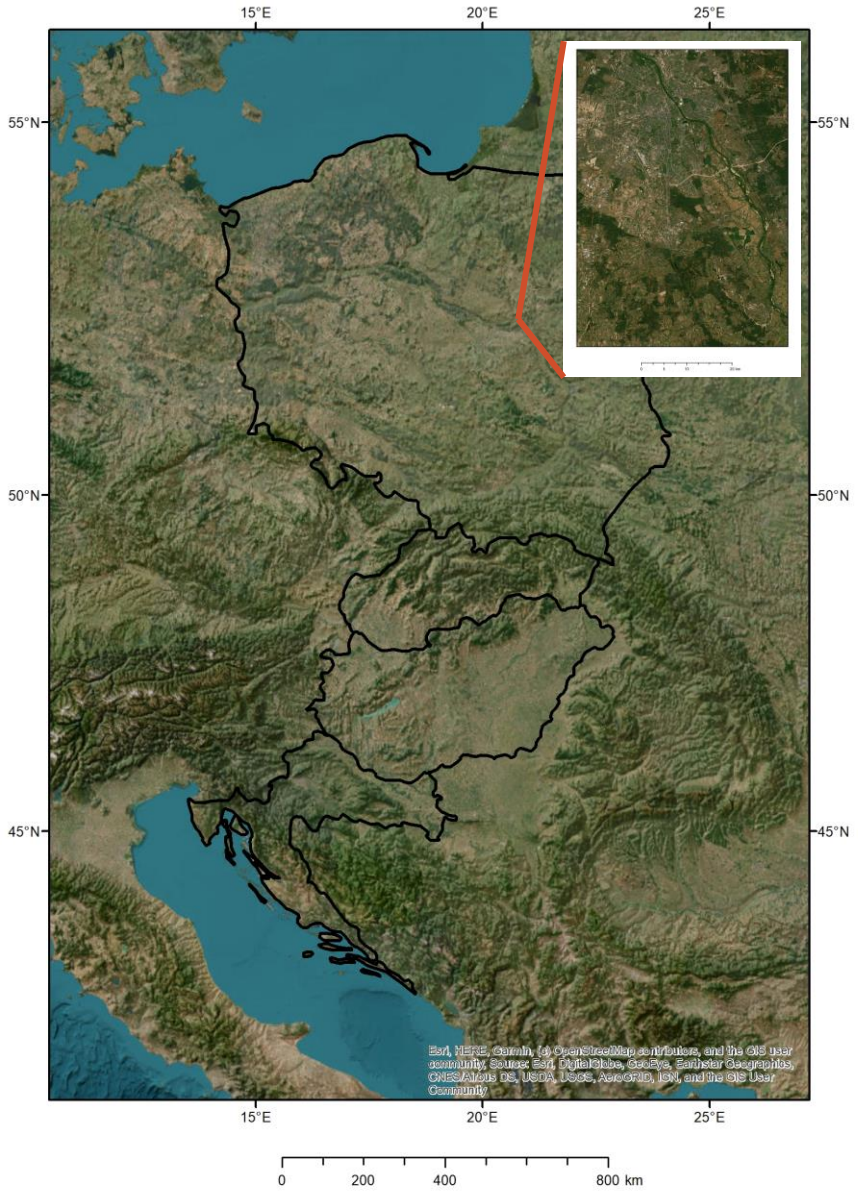
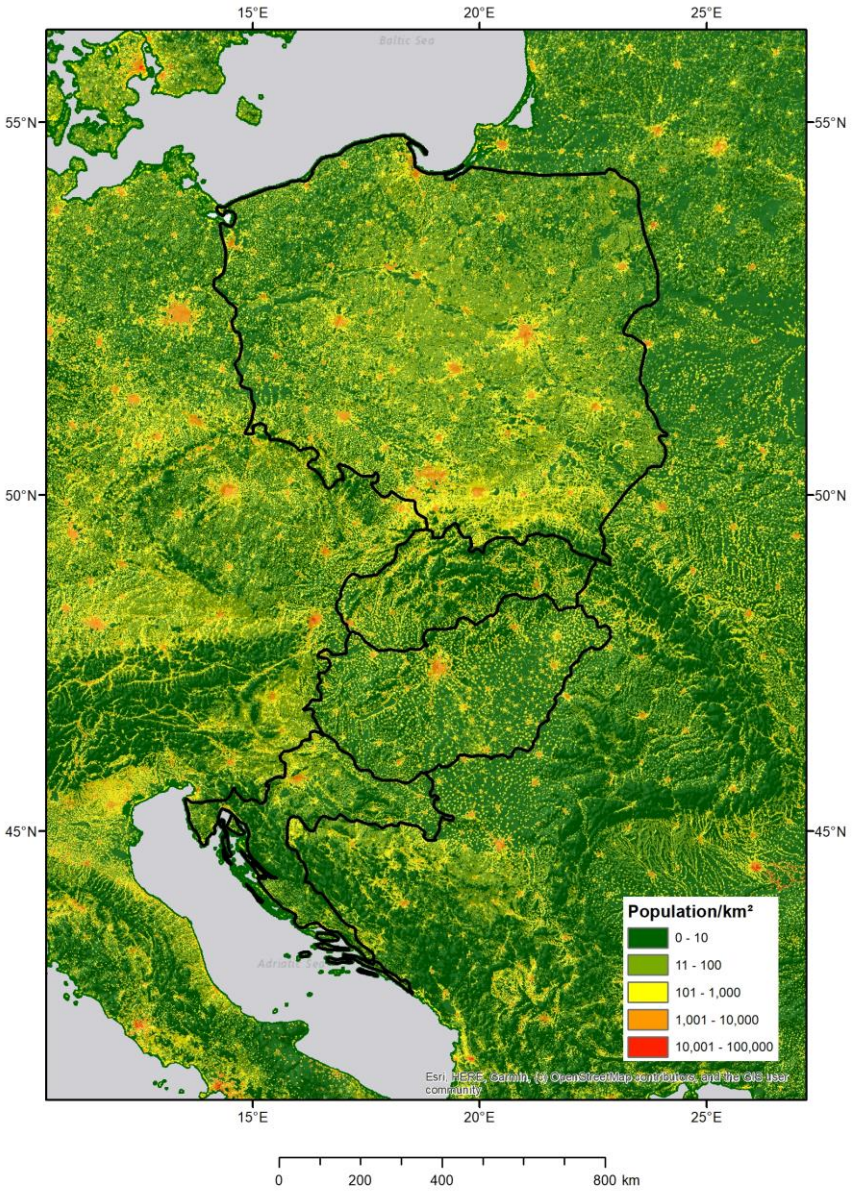
Across all components of the workflow

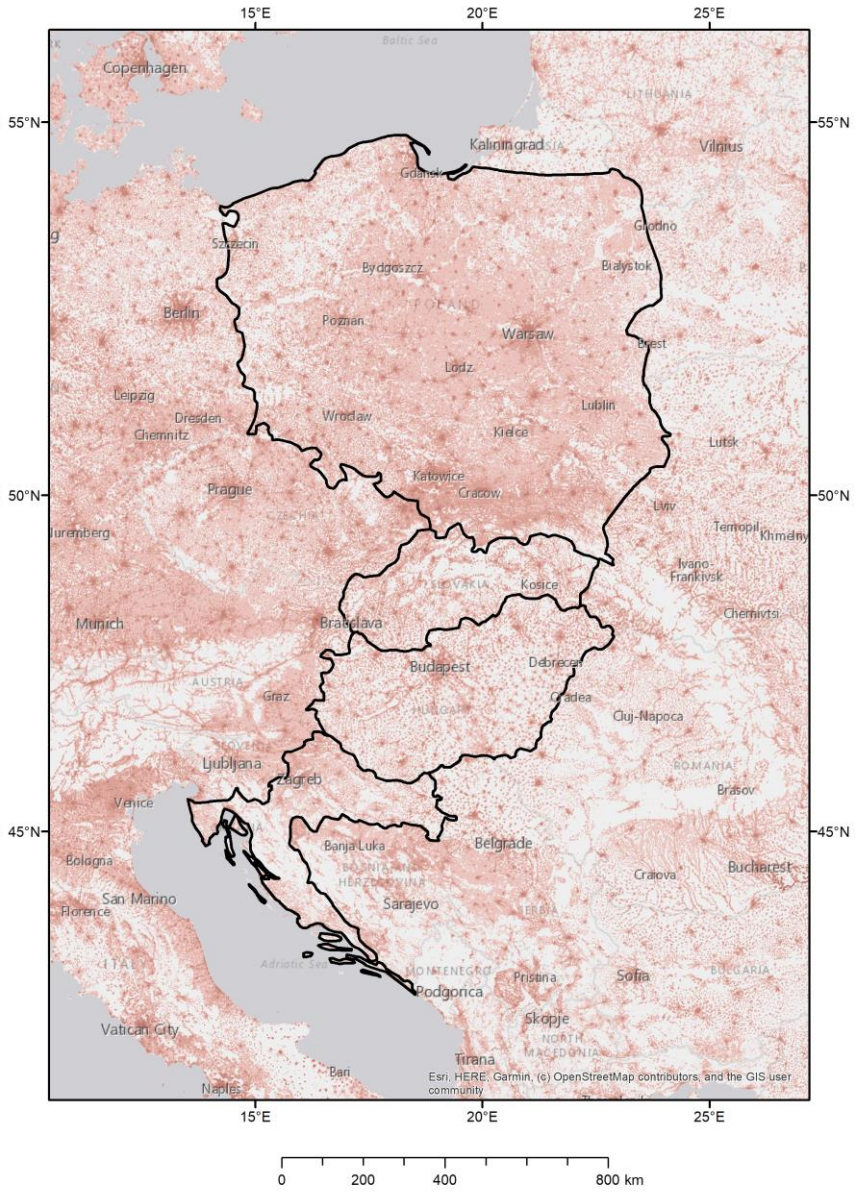
Demand – Favorability Mapping

- Start with diverse data (points, rasters, pictures, …)
- Convert to rasters in sensible units
- Scale to favorability (0 to 1)

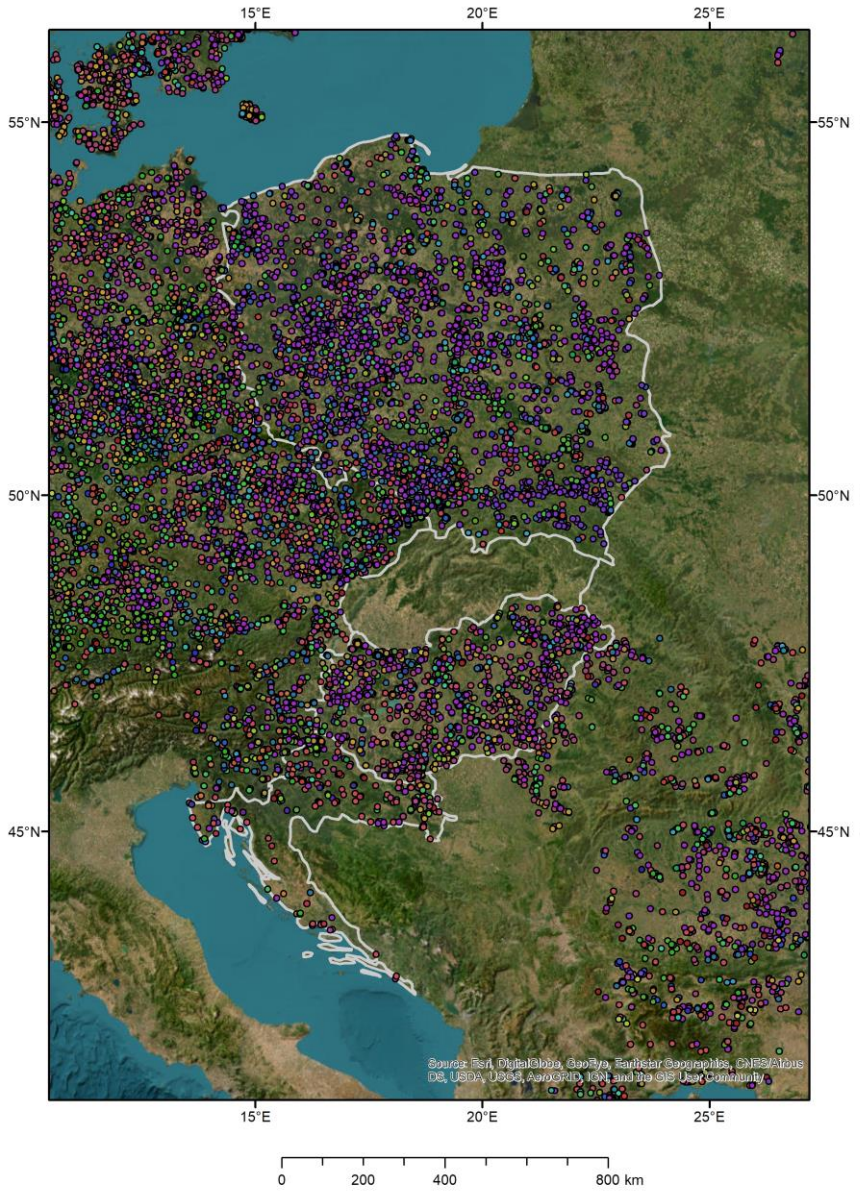
Example – Population Density

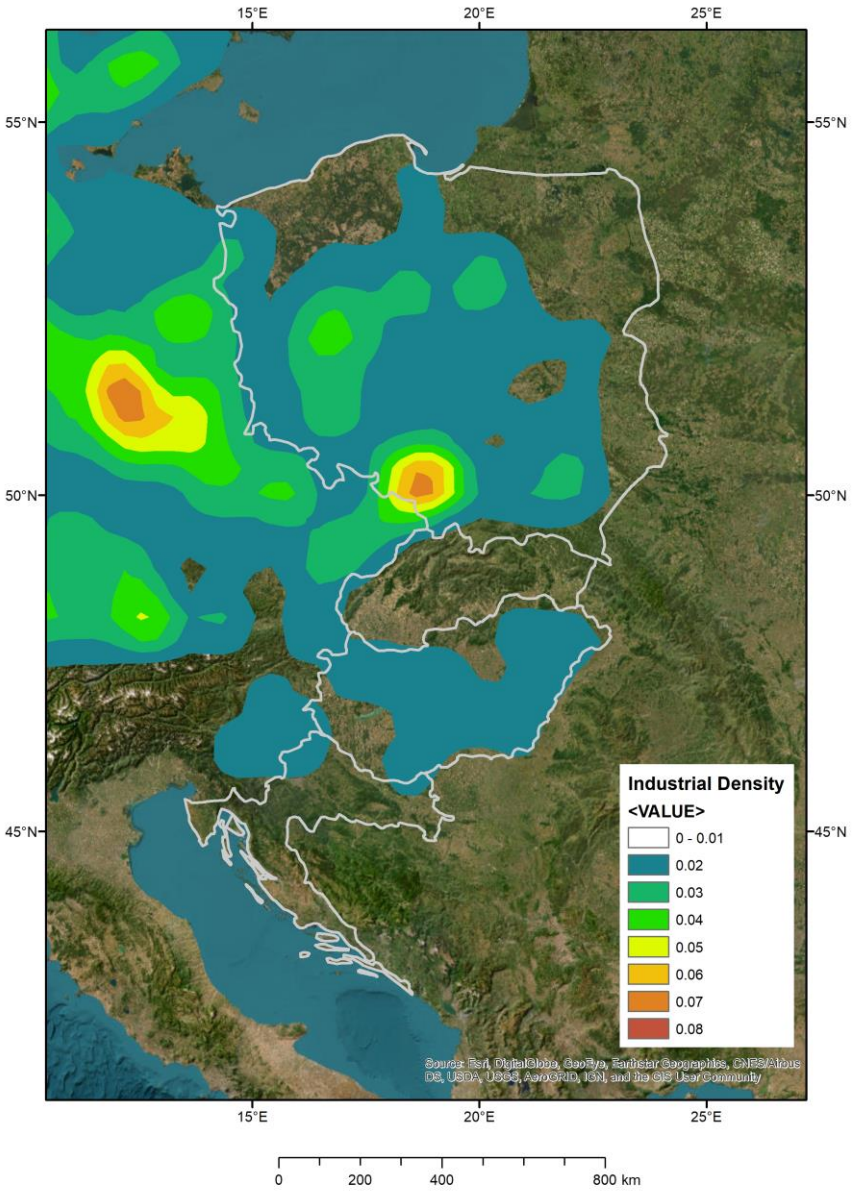


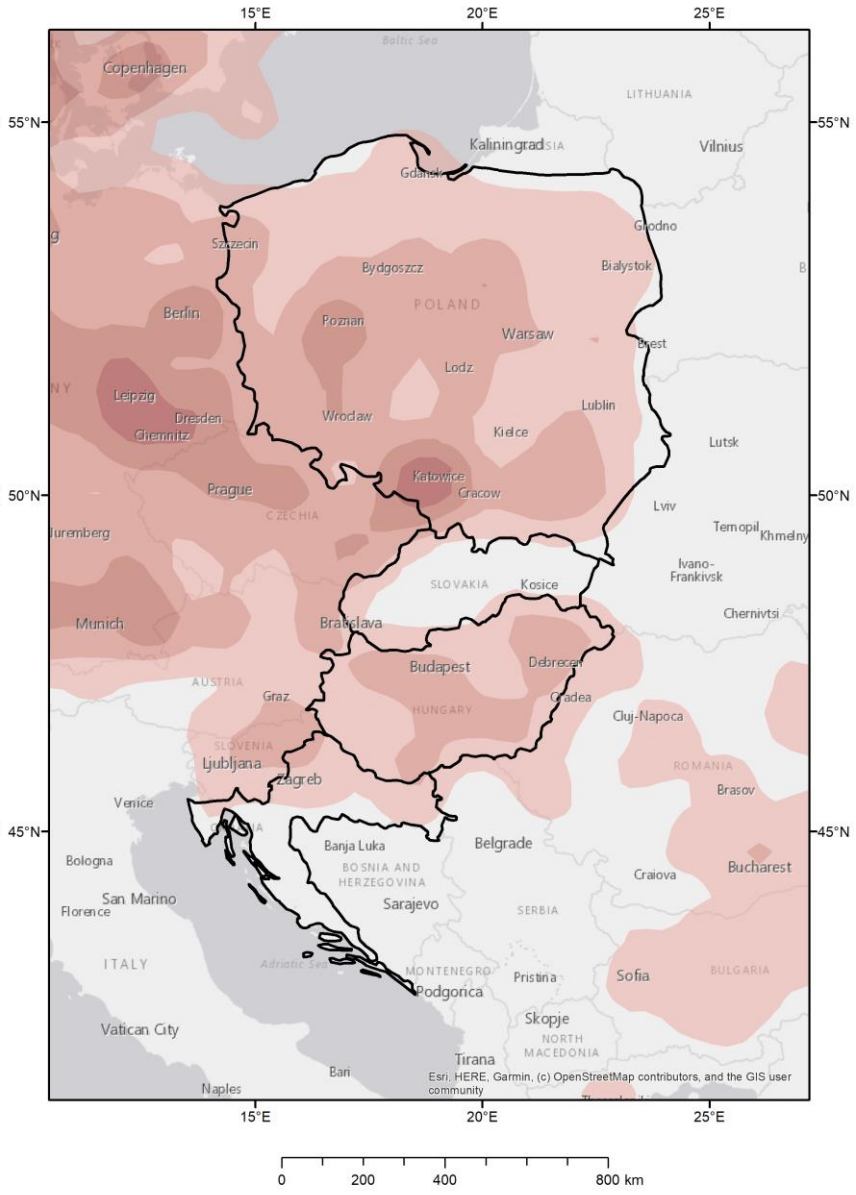




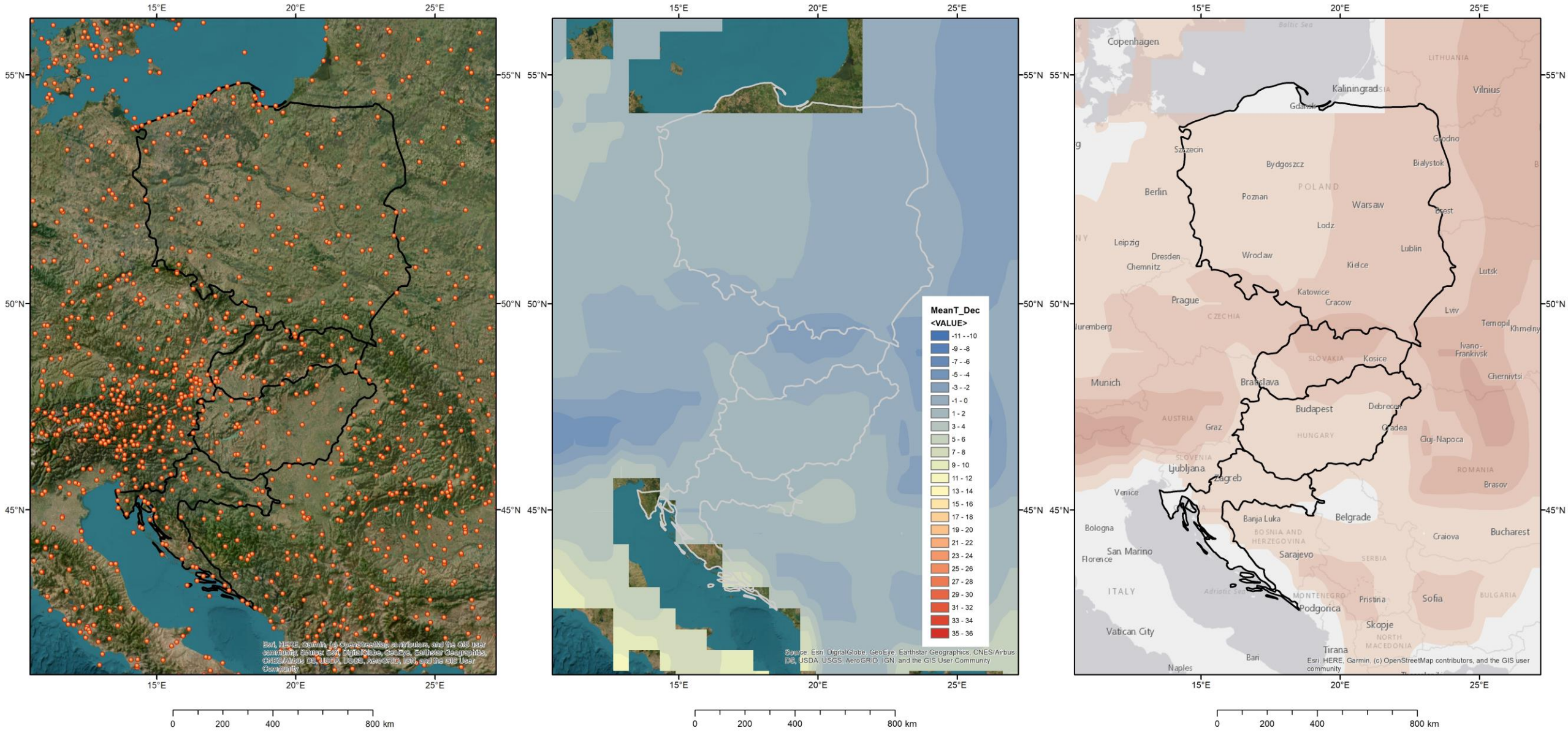
Example – Industrial Density



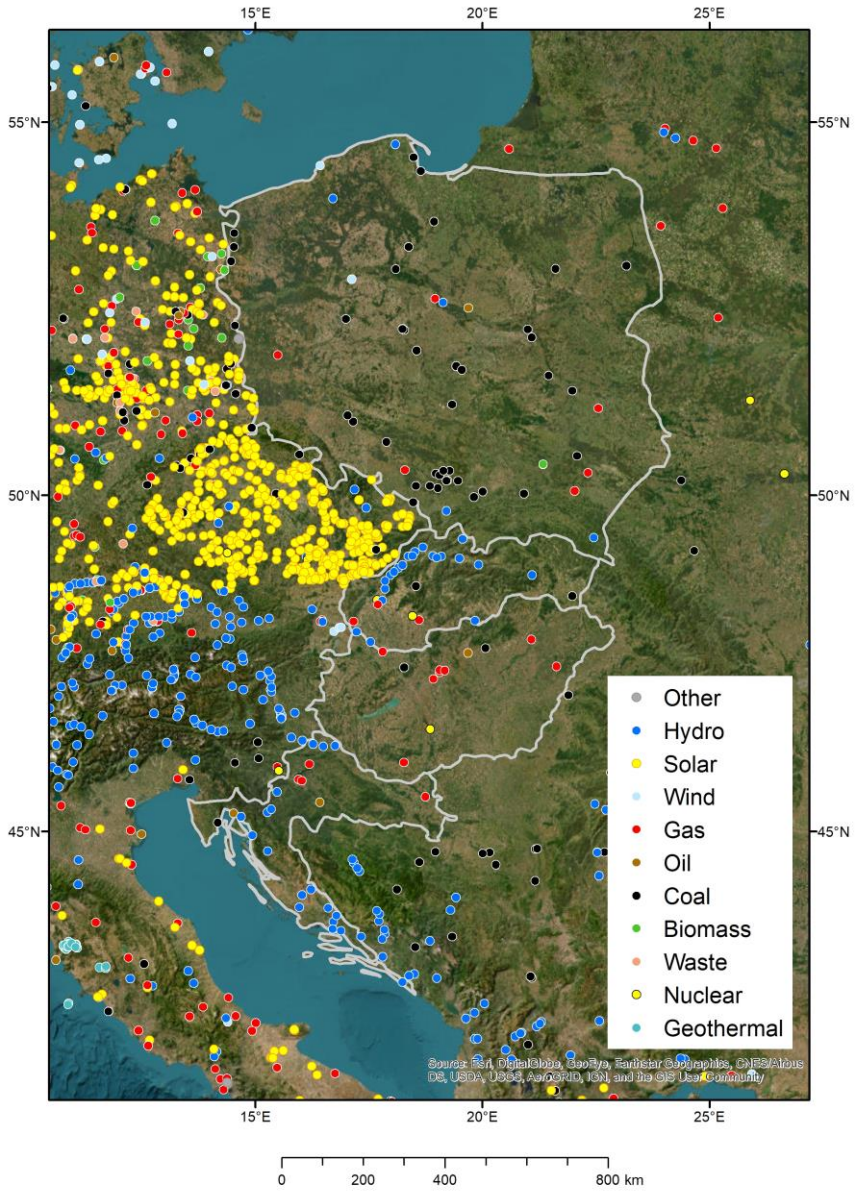


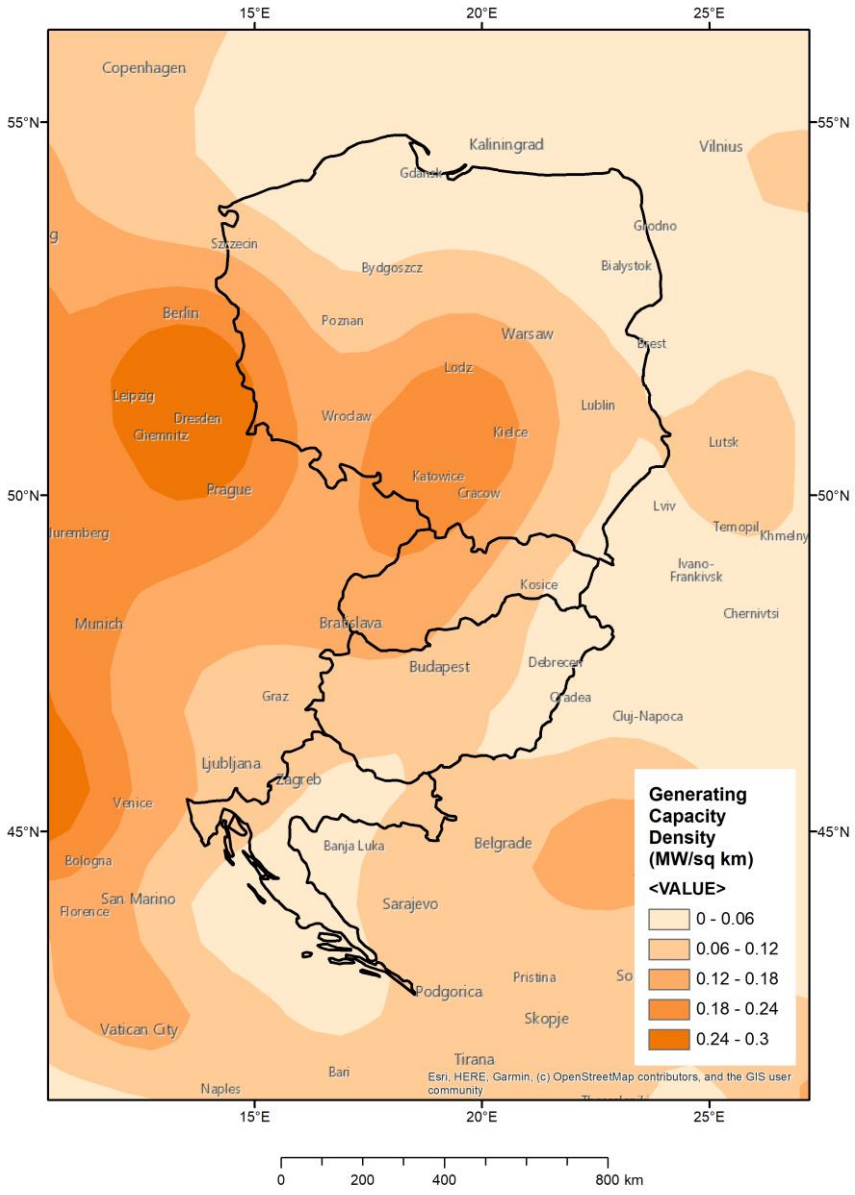


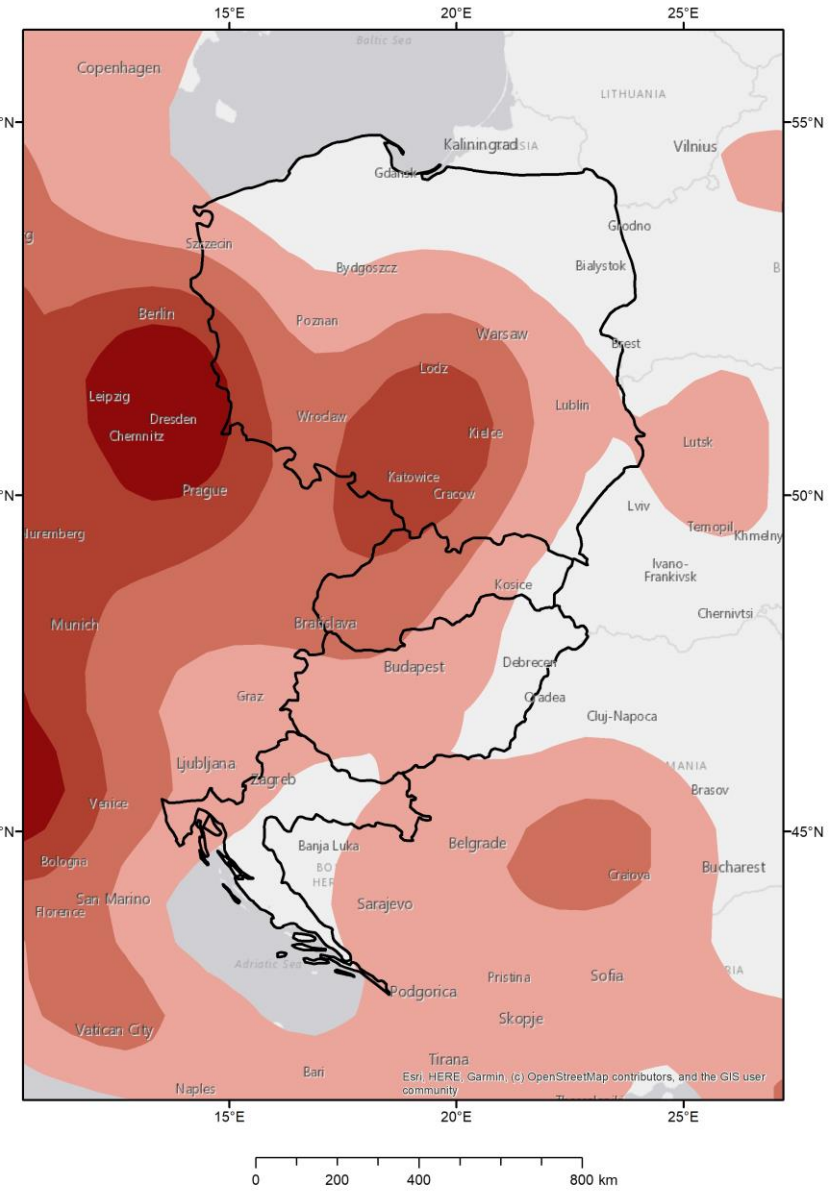
Example – Heating Demand



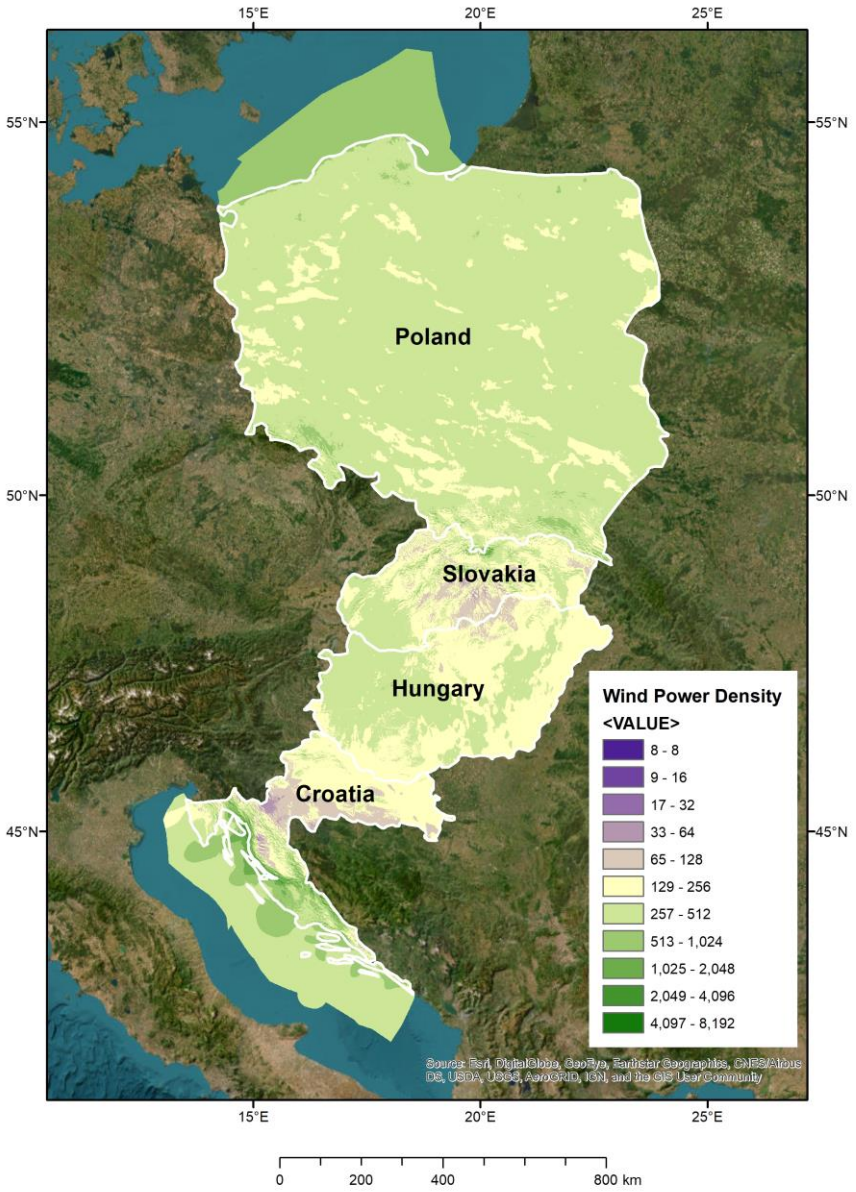
Example – Existing Power Generation







Example – Potential Green Power Generation



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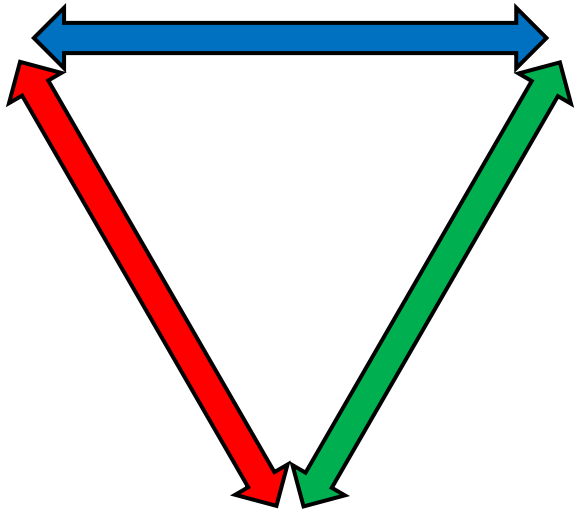

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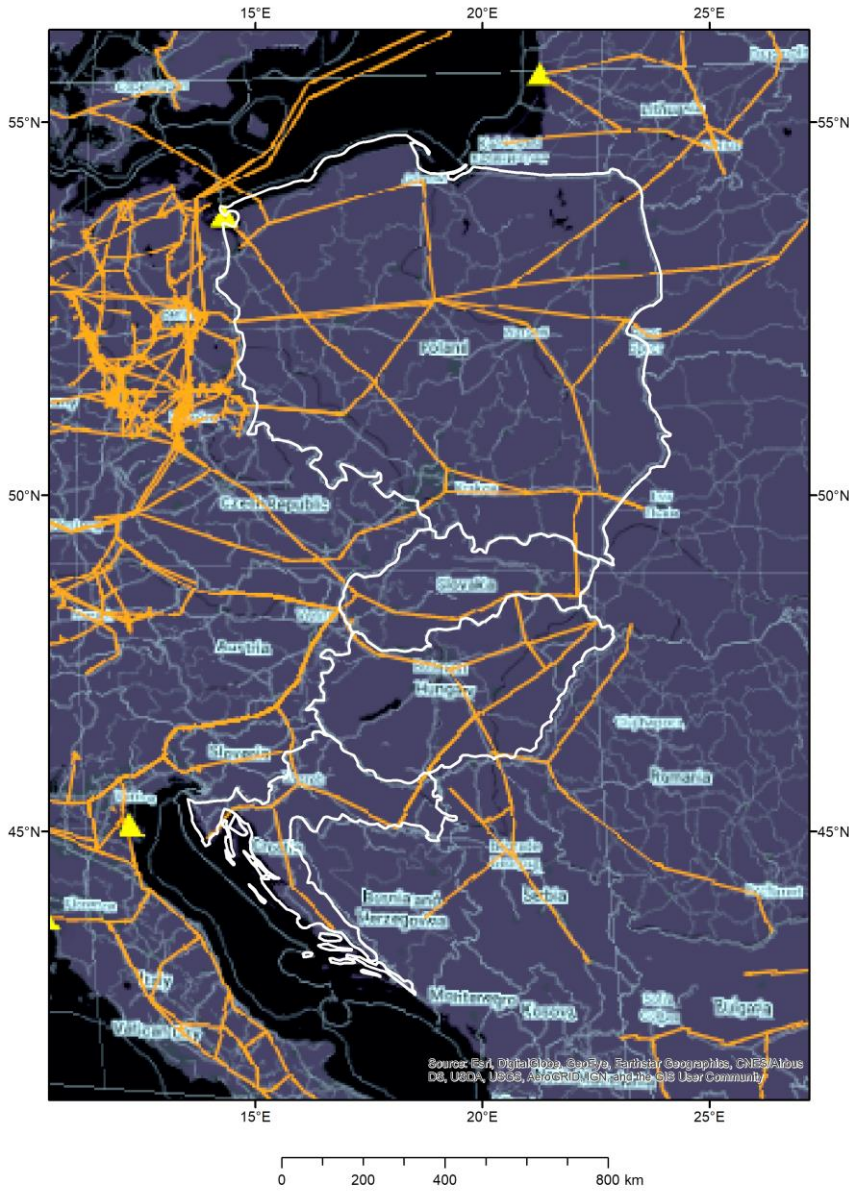
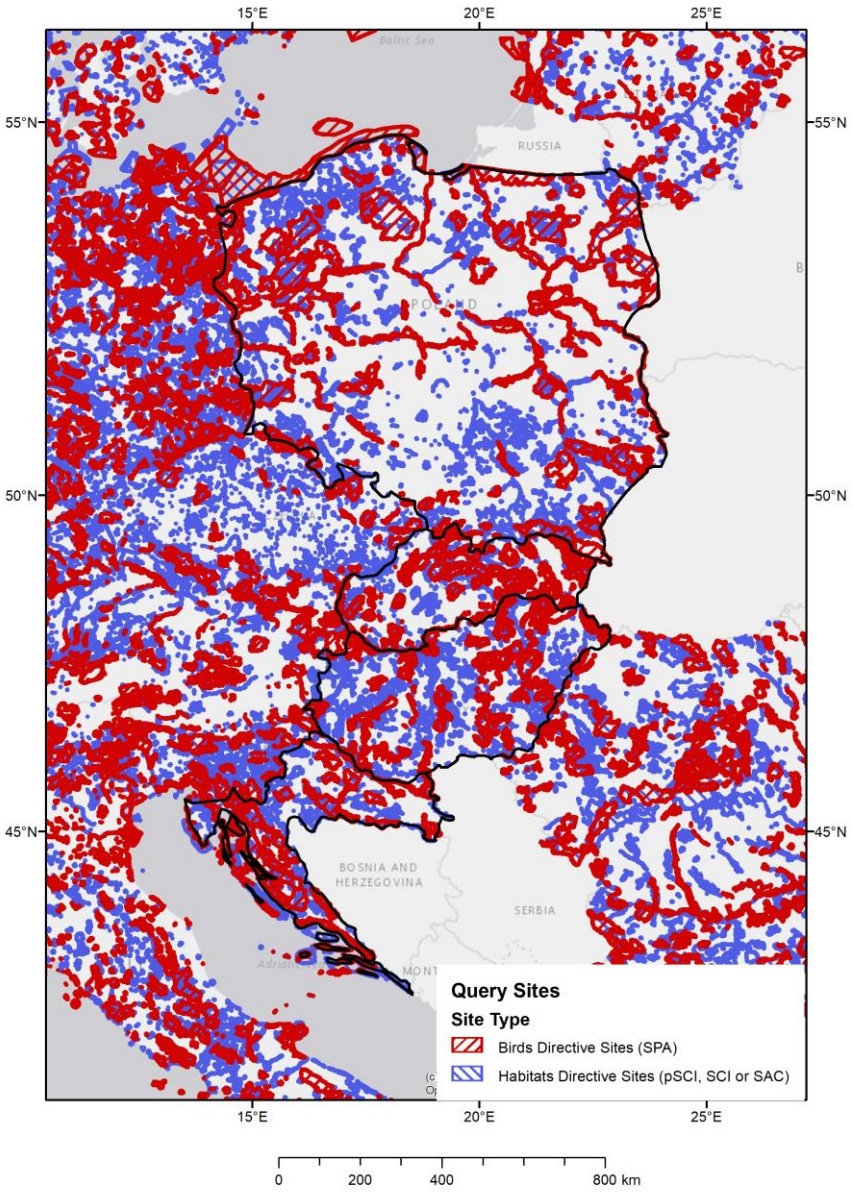
Transmission Infrastructure & Nature Protection





Posing Questions – Where would I find…

- A densely populated city,
- with high industrial demand,
- where the summers are hot and the winters are cold,
- far from electric transmission lines and conventional power generation, and
- on top of a good geothermal resource?

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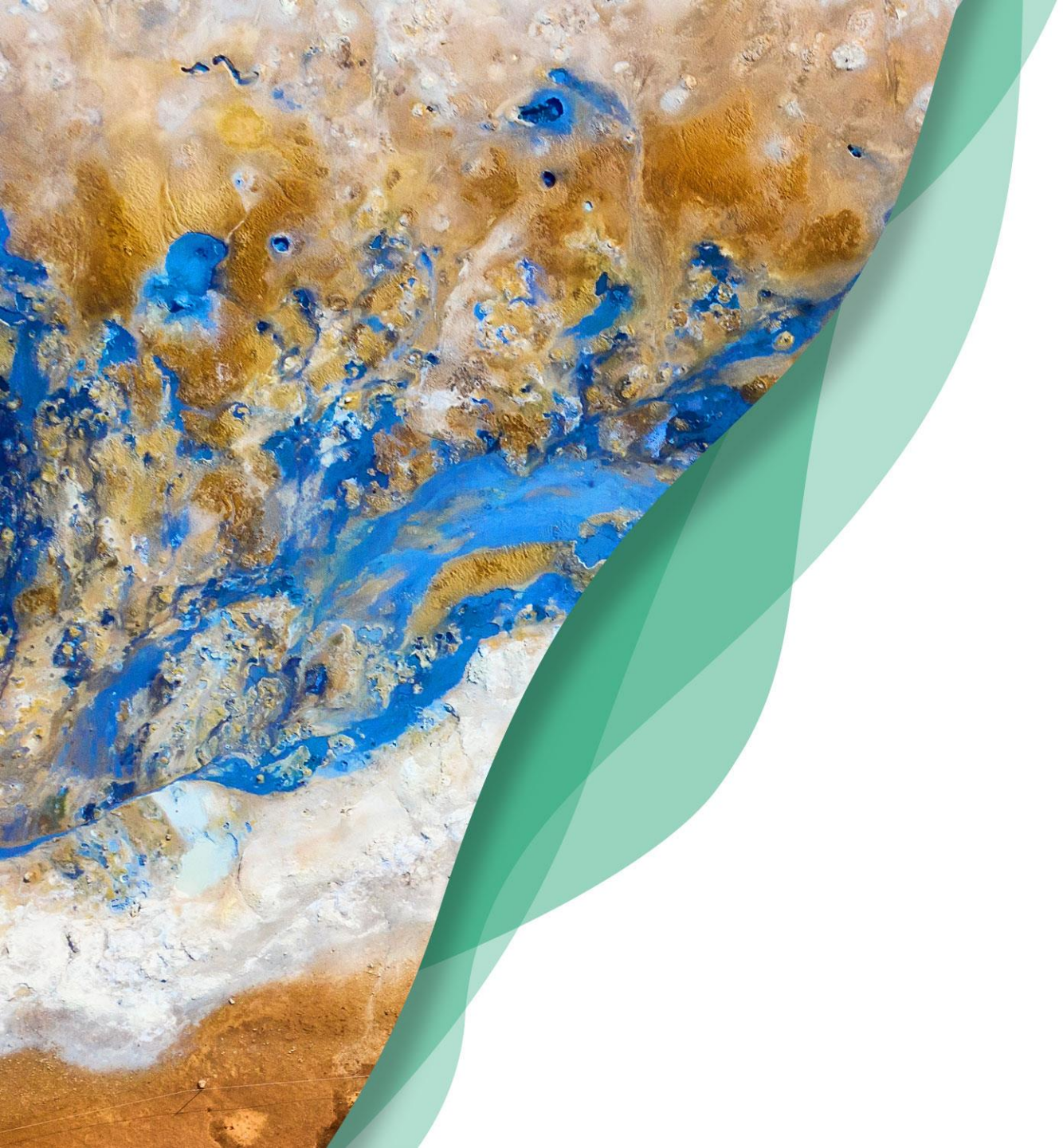
Üdvözöljük Debrecenben!



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