Methodology for analysis of biomass potential in landscape using GIS in the Czech Republic

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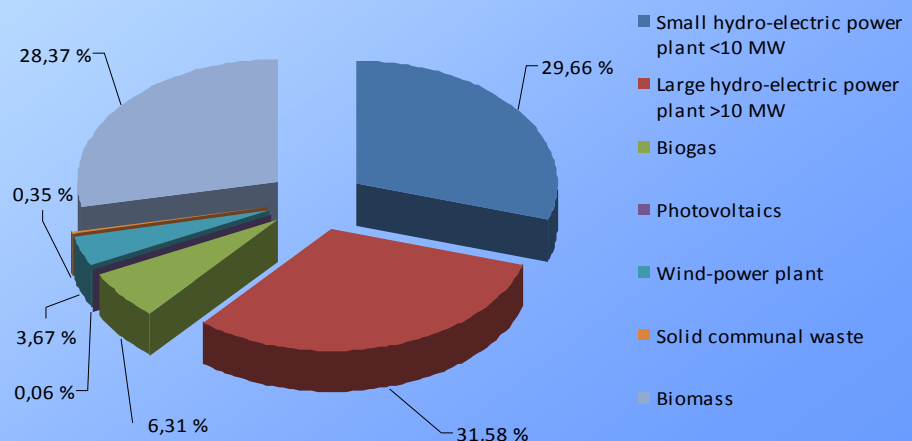**Průhonice**

Biomass in the Czech Republic

- Out of all RES, biomass has the biggest potential for heat and power in the Czech Republic in the long-term perspective.

- According to the current energy policy, biomass should cover 85% of all RES by 2030.

- Biomass on other side is very diverse, dispersed and logistically most difficult RES

National indicative goal in RES

(% of PES utilised for electricity from RES)

- 8% in 2010   and   16,7% in 2030
- In 2007: 4,7% (biomass 28,4%)

Graph of electricity production from RES in CZ in 2007

Legend:
- Small hydro-electric power plant <10 MW
- Large hydro-electric power plant >10 MW
- Biogas
- Photovoltaics
- Wind-power plant
- Solid communal waste
- Biomass

Values: 28,37 %, 29,66 %, 0,35 %, 3,67 %, 0,06 %, 6,31 %, 31,58 %

Goals of our methodology
for analysis of biomass potential

- Bring accurate information (data and maps) about amount and distribution of biomass potential in landscape.

- Create instrument for strategic planning of state, regions, communities, energy and agricultural enterprises.

- Contribute to the economically efficient and environmentally acceptable development of bioenergy in regions of the Czech Republic.

Methodological approach
for analysis using GIS

- <u>On agricultural soil</u> is based on assigning yields of individual biomass sources (crops) to the „production and ecological soil units" (**BPEJ** in Czech) of the Czech agricultural land valuation.

- *Yields for „new" energy crop are derived from from experimental and commercial plantations and expert evaluations*

- On <u>forest land</u> approach is based on a similar principle, but using units of forest types (**SLT** in Czech) of Czech forest managenet.

Methodological approach
for analysis using GIS

Also include:

- Constraints for soil utilization e.g. needs for agriculture (food production), nature and environment protection (protected zones, soil erosion risks etc.)

- Cost of biomass to identify economic potential (minimum price approach)

Biomass sources in analysis

- cereal straw (5 crops)

- rape straw,

- biomass from permanent grasslands,

- forest residuals,

- intentionally grown biomass (7 woody and perenial energy crops).

Main data sources

- The primary map base is the state maps.

- Maps and databases of BPEJ, SLT.

- Map of actually grown crops (LPIS).

- Soil suitability types of all selected energy crops in the BPEJ units and their yield curves.

The main instruments for processing these data:

- GIS SW TopoL

Analysis of individual biomass resources

Residual straw

- tables of grain yield of all selected crops related to **BPEJ** units are used

- To ensure that straw yields are calculated only for arable lands the map of actually grown crops (**LPIS**) is used.

- straw yields are calculated from grain yields using the coefficient of the straw share (**Ks**) e.g., for wheat it ranges between 0.8–1.0

Example output: straw potential

Yields of wheat straw on arable land in Central Bohemia region

Yields of wheat straw

- 2,94 - 3,19 t (DM)/ha
- 3,20 - 3,73 t (DM)/ha
- 3,74 - 4,24 t (DM)/ha
- > 4,25 t (DM)/ha
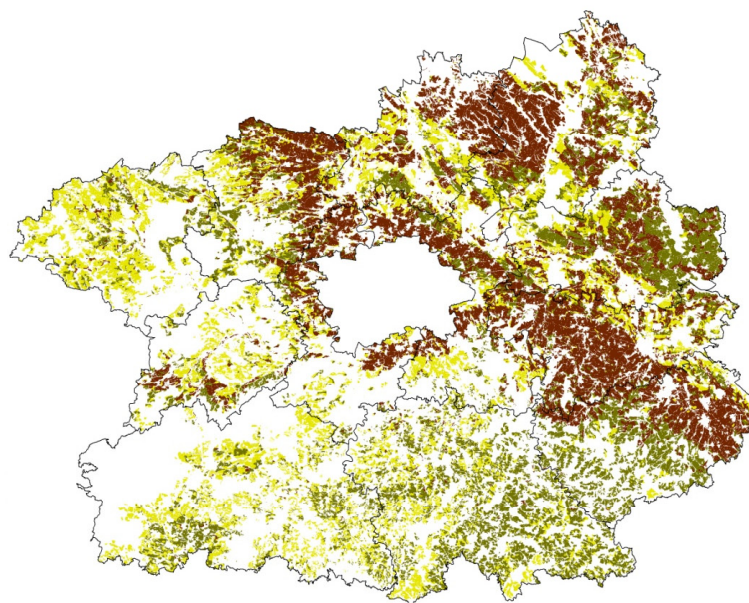
1 : 750 000

0 5 10   20   30   40   km

Zdroj dat: agregovaná data BPEJ © VÚMOP,
LPIS, výnosy pšenice - MZe, administrativní hranice © ČSÚ
Grafické zpracování CENIA, GALLO PRO, s.r.o.

Analysis of individual biomass resources

Permanent grasslands

- grass yields from tables related to BPEJ units are used similarilly as with the straw.

- „raw" grass are converted to dry biomass yields (coefficient 0.20).

- Map of actually grown crops **(LPIS)** is used to ensure that the grass yields are determined only on grasslands.

Example output: grass potential

Yields of grass (dry) on permanent grasslands in Central Bohemia region

Yields of permanent grasslands
- without defined yield
- 0,90 - 4,20 t (DM)/ha
- 4,21 - 5,38 t (DM)/ha
- 5,39 - 6,53 t (DM)/ha
- > 6,54 t (DM)/ha
- arable land

1 : 750 000

0 5 10   20   30   40   km

Zdroj dat: agregovaná data BPEJ © VÚMOP,
LPIS, výnosy TTP - MZe, administrativní hranice © ČSÚ
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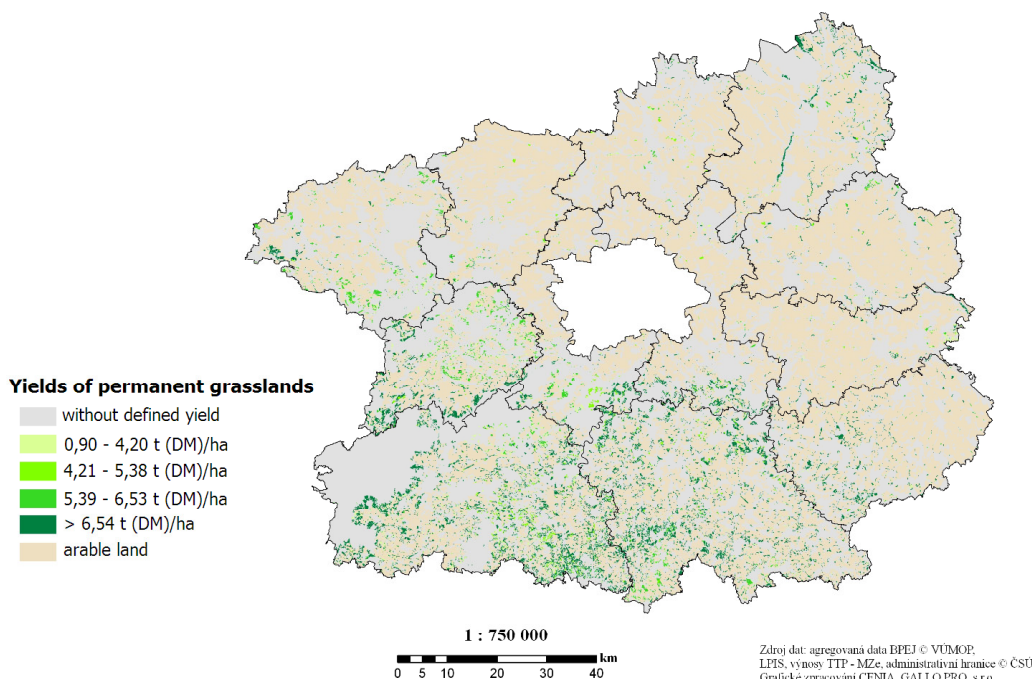
Analysis of individual biomass resources

Forest residuals

- Expected yields of wood biomass for individual forest stands can be determined in detail from Czech forest management plants which are based on so called forest types (**SLT**)

- For assesment of forest residuals on higher administrative levels (NUTS – 2 and 3), coefficient for forest logging residuals (K_{LZ}) was calculated (K_{LZ} = 0.63 t/ha; 60% water).

Potential of individual biomass resources

Energy crops

- Soil suitability types and yield curves for 7 selected energy crops (***willow, poplar, reed canary grass, miscanthus, hybrid sorel***) has been done, based on results of field testing and expert evaluation.

- Expected yields assigned to each BPEJ unit were used to create a yield map/layer of the GIS model.

- In the next step, overlapping the of yield and available soils layers provides realization of potential of intentionally grown biomass
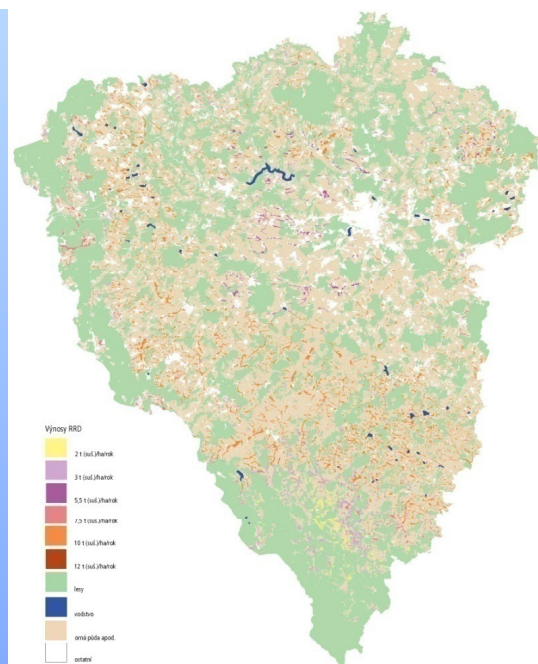
Example output: Potential of willow and poplar

Yields of willow and poplar SRC in Plzen region
100% of area   10% of area
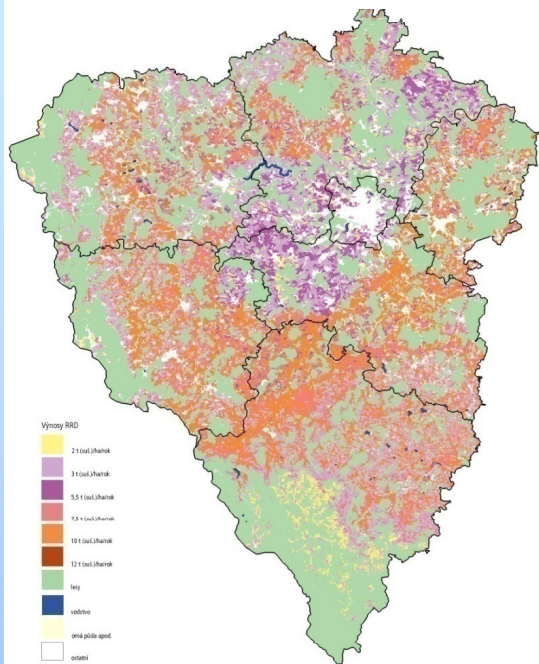
Conclusions

- Result of until now carried out work shows that our methodological approach enables detailed and dynamic analysis of potential of main biomass sources for different administrative units (level) – from communities up to national level.

- Produced data can be used for efficient decision-making not only on the state level (updating a state strategy or setting up support system) but also by investors when realizing projects for biomass utilization.

- Complete results of analysis of biomass potential using GIS for the Czech Republic will be published in 2010.

- Methodology can be in principle applied also in others states with existing land valuation systems.

Thank you for your attention

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