

# MODELLING OF THE INFLUENCE OF WEIRS AND LAND USE ON THE HYDROLOGICAL SYSTEM OF THE LOWER BIEBRZA VALLEY

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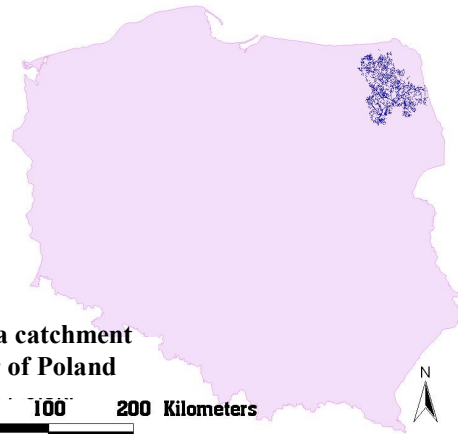


# PLAN OF PRESENTATION

- Description of the research area
- Aim of the research
- Model SIMGRO
- Schematization of data
- Modelling scenarios
- Conclusions



# BIEBRZA VALLEY



Legend:

Biebrza catchment  
Border of Poland

100 0 100 200 Kilometers



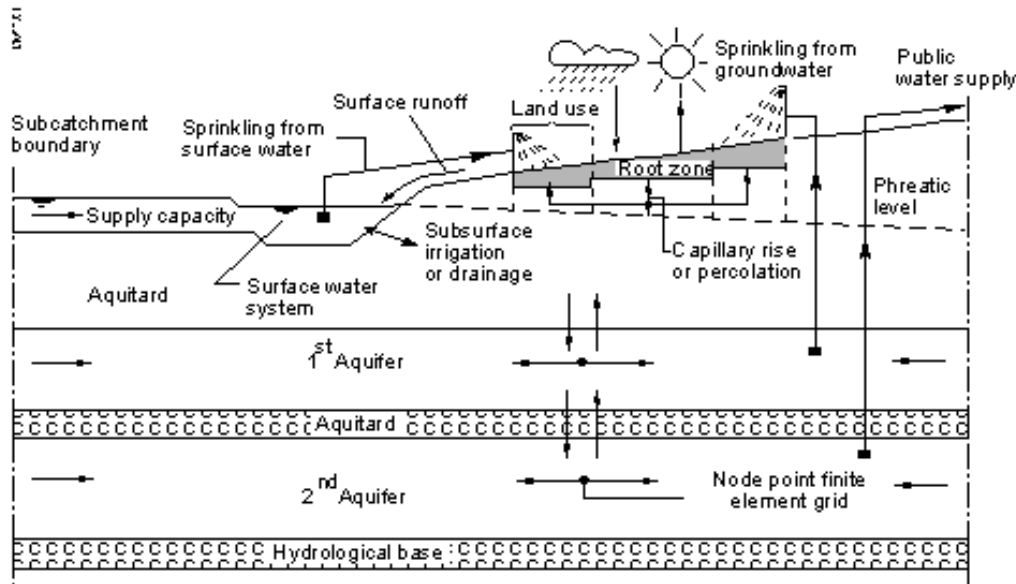
## PROBLEMS OCCUR ON THE AREA

- Lowering of groundwater table
- Succession of scrubs and trees on open meadow territory
- Mineralization of hydrogenic soils

## AIM OF THE RESEARCH

Forecasting influences of building weirs and land use changes on groundwater level

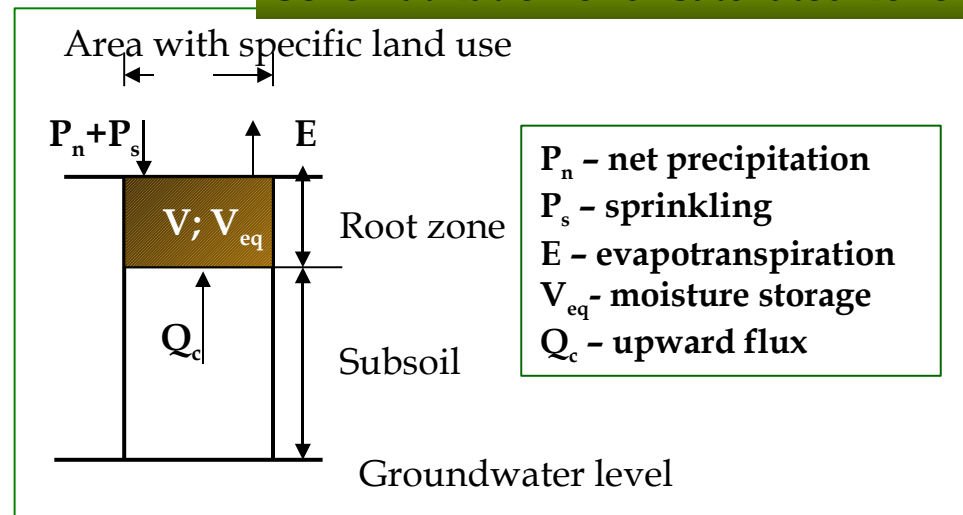
# MODEL SIMGRO



- **Surface zone:**
  - Land use
  - Surface water
- **Unsaturated zone:**
  - Root zone
  - Sub soil
- **Saturated zone:**
  - Aquifers
  - Aquitards

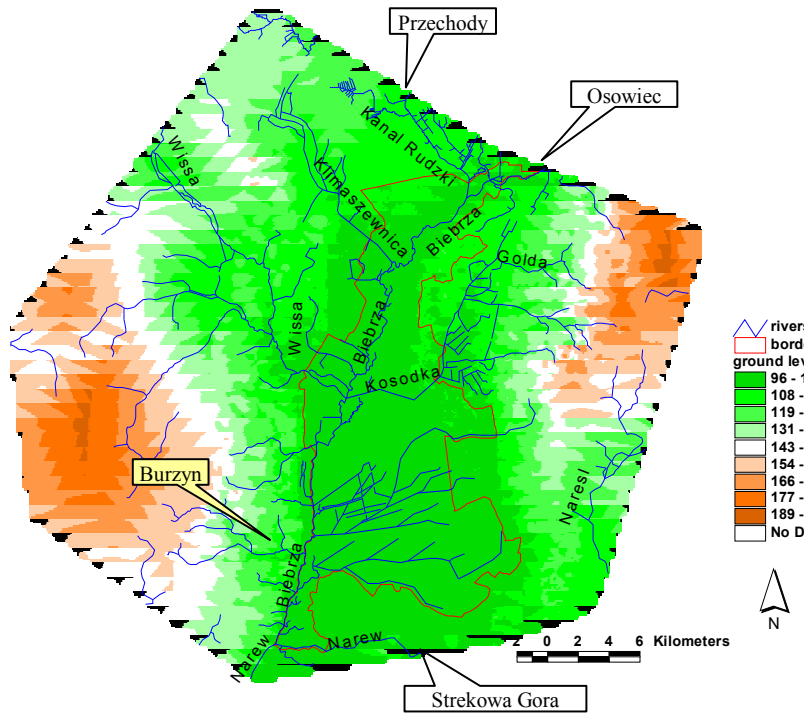
## Schematization of unsaturated zone

Schematization in SIMGRO of the hydrological system within a nodal subdomain by means of an integration of saturated zone and surface water (Quernaer and van Bakel, 1989)

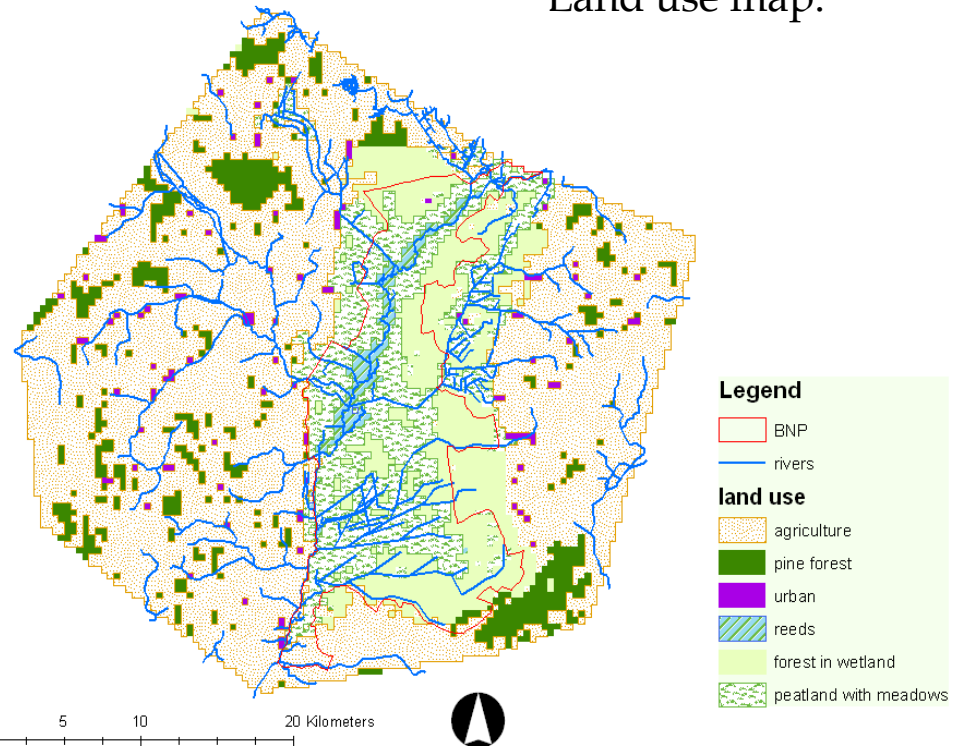


# SCHEMATIZATION OF DATA

Topographic map of the modelled area.

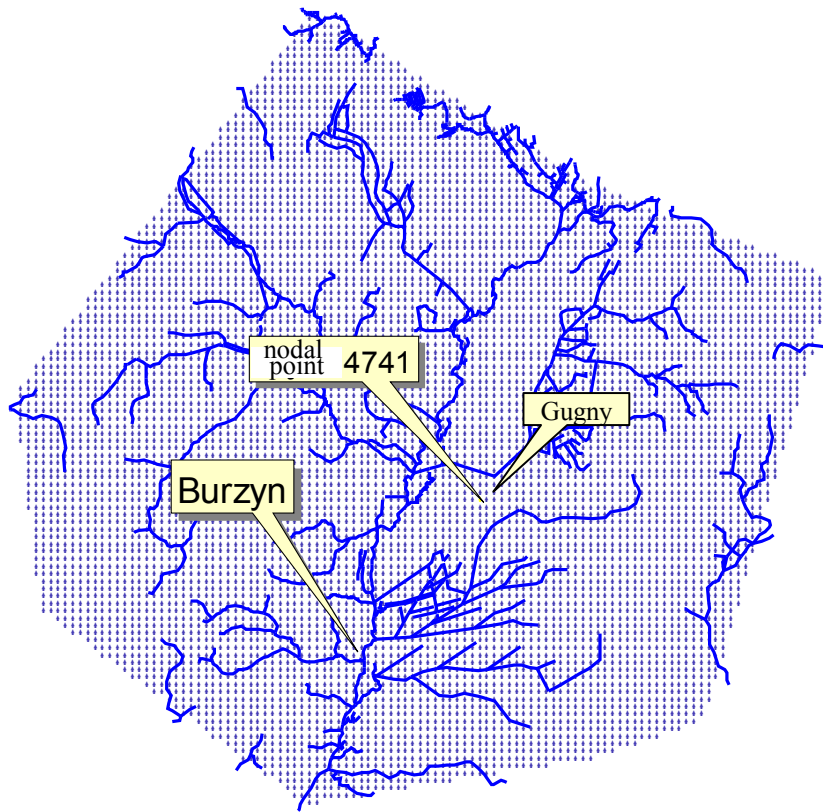


Land use map.

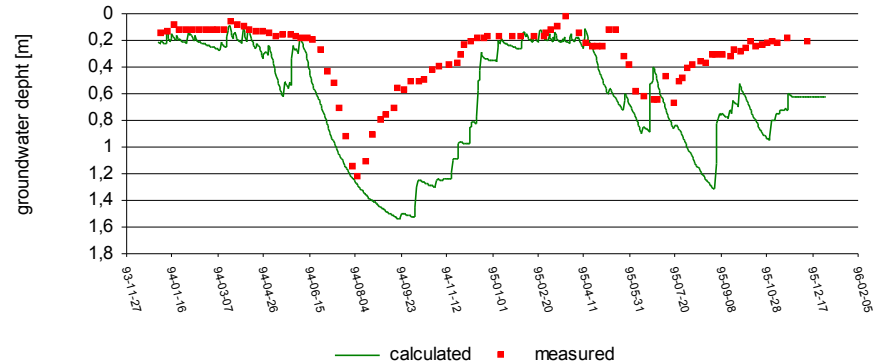


**126 000 ha**  
**7854 nodal points**

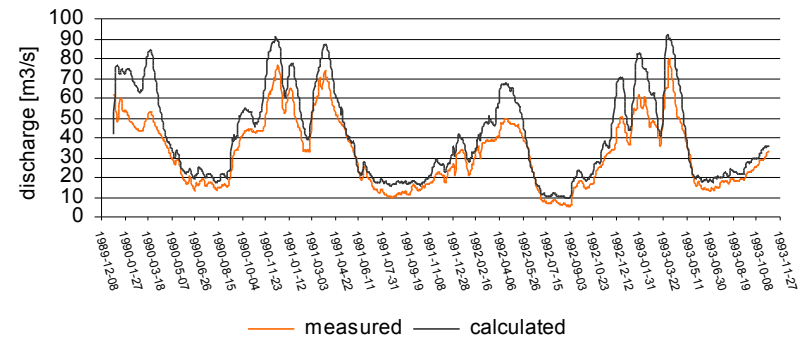
# VERIFICATION



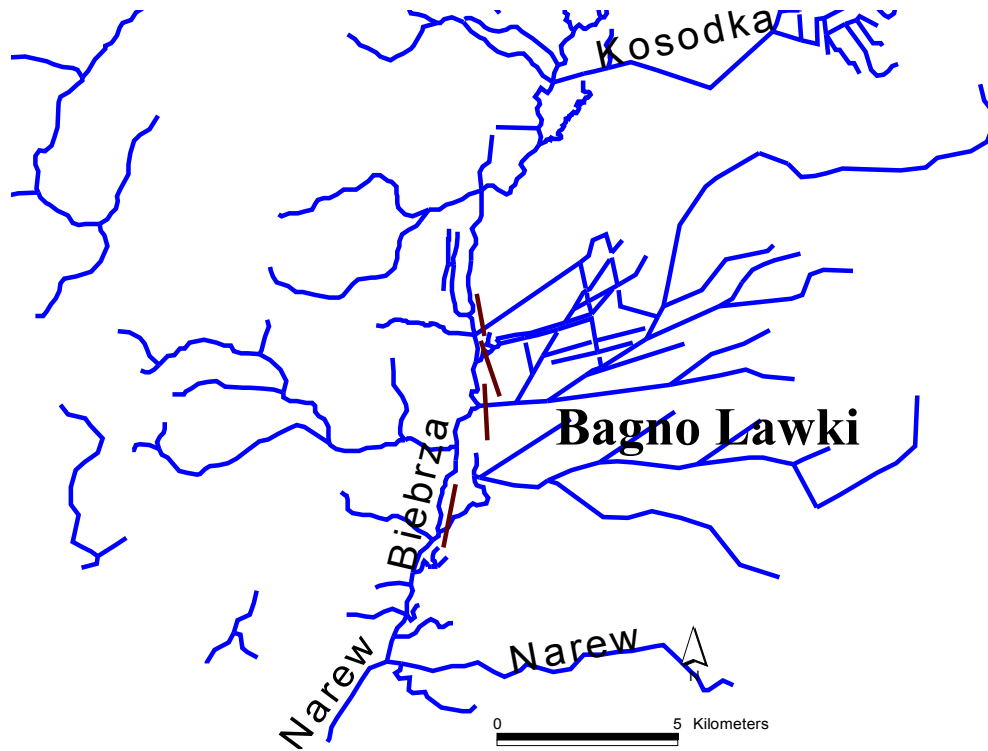
Groundwater level measured in piezometer 9 and calculated in nodal point 4741.



Daily discharges at Burzyn gauge station measured and calculated.



# SCENARIOS A - BLOCKING CANALS

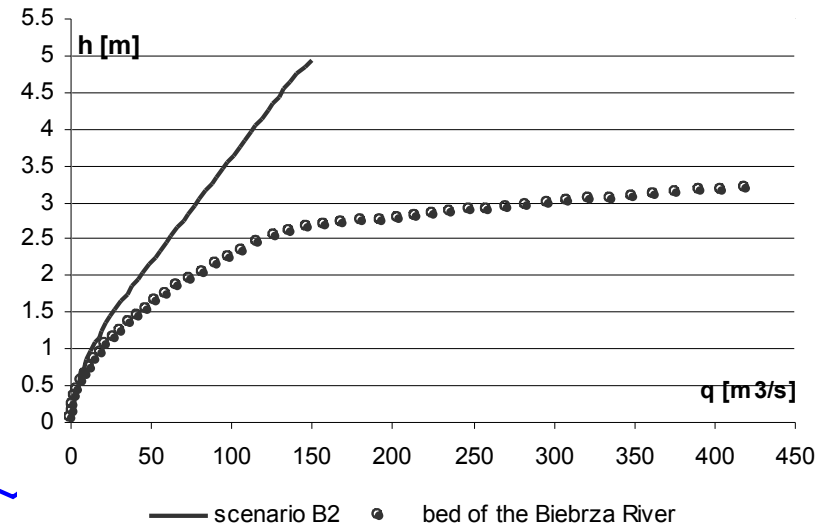
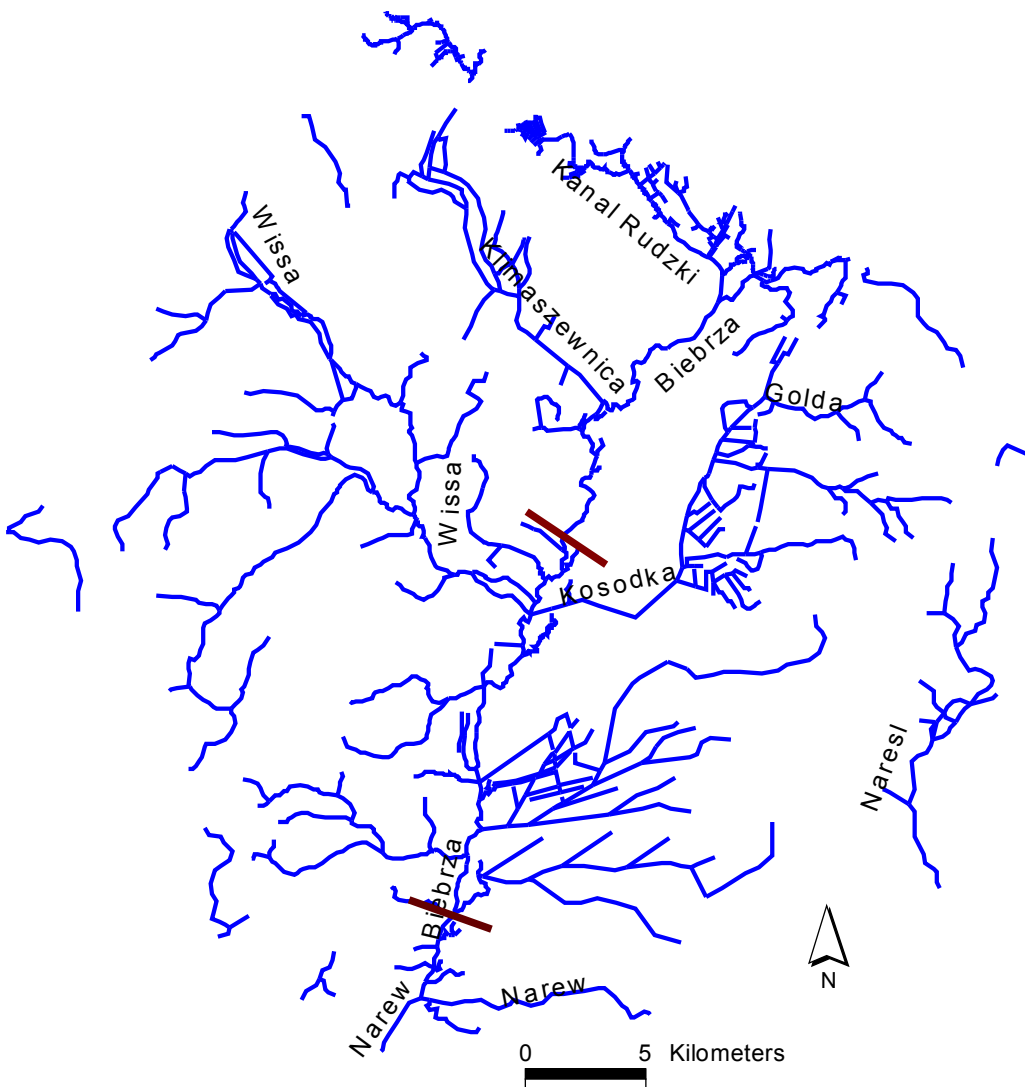


Scenario A1 - Four weirs in small canals on Bagnó Lawki. Crest of weirs were 0.2 m below ground level

Scenario A2 – Blocking of each small canals on Bagnó Lawki, (63 weirs) with crest 0.2 m below ground level



# SCENARIOS B - BLOCKING RIVER



Scenario B1 - two weir in the Biebrza river bed with crest 0.5 m below ground level. Rating curve for weirs is identical to the one for the Biebrza river bed.

Scenario B2 - two weir in the Biebrza river bed with crest 0.5 m below ground level. Rating curve for weirs was changed.



# SCENARIOS C – CHANGES OF LAND USE



*Wetland birch forest.*



*Pastures and meadows.*

Scenario C1 - “no action”  
management – deciduous forest would  
overgrown meadows areas

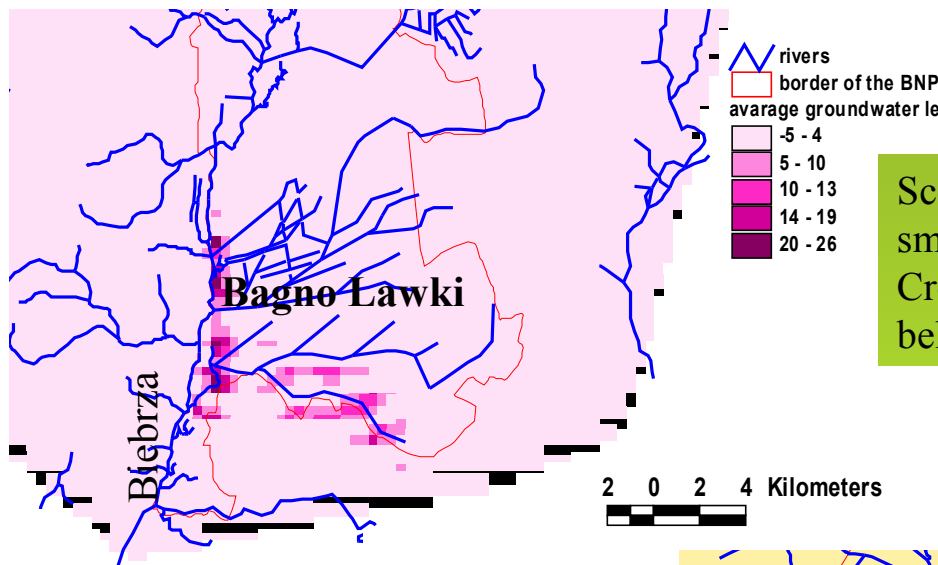
Scenario C2 – meadow would  
overgrown deciduous forest area



*Reed communities.*

# SCENARIOS A - BLOCKING CANALS

Average groundwater level changes in summer – differences between scenario A1 and 0

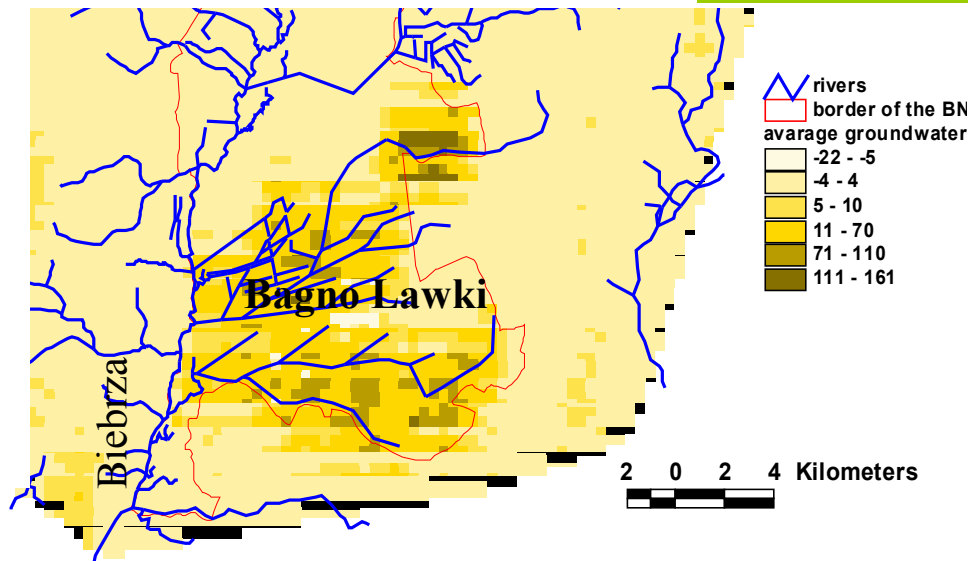


Scenario A1 - Four weirs in small canals on Bagno Lawki. Crest of weirs were 0.2 m below ground level

Changes of groundwater level would occur on **4.6%** of the Valley area in Scenario A1 and **37%** of the Valley area in Scenario A2

Average groundwater level changes in summer – differences between scenario A2 and 0

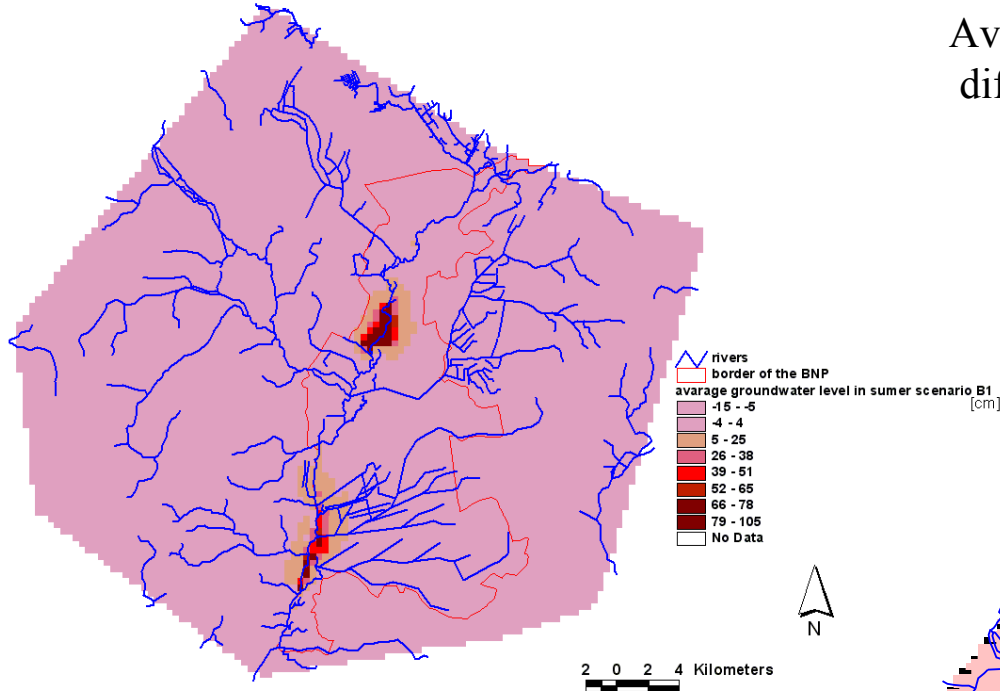
Scenario A2 – Blocking of each small canals on Bagno Lawki, (63 weirs) with crest 0.2 m below ground level





# SCENARIOS B – BLOCKING RIVER

Average groundwater level changes in summer – differences between scenario B1 and 0.

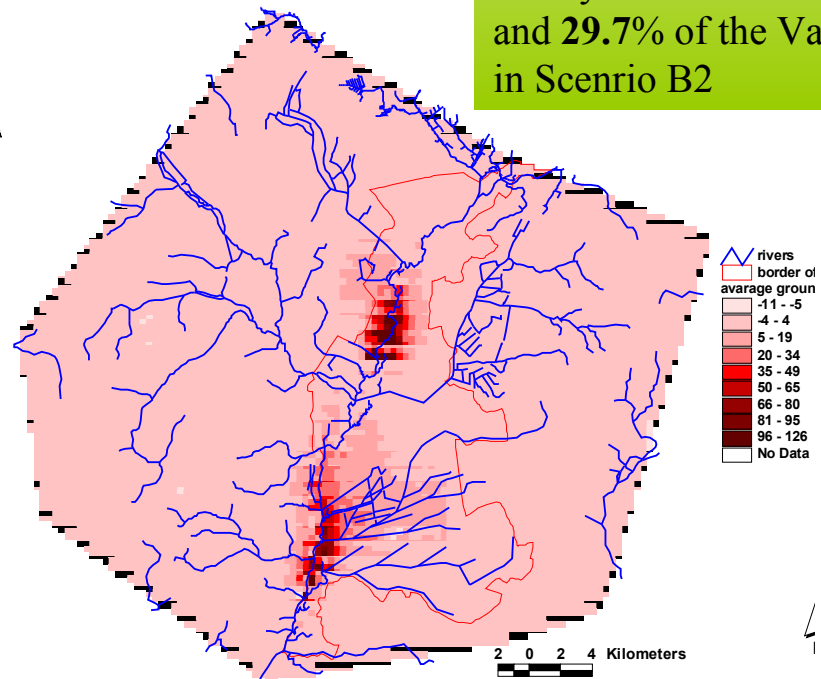


Scenario B1 - two weir in the Biebrza river bed with crest 0.5 m below ground level. Rating curve for weirs is identical to one for the Biebrza river bed.

Changes of groundwater level would occur on **10.1%** of the Valley area in Scenario B1 and **29.7%** of the Valley area in Scenario B2

Average groundwater level changes in summer – differences between scenario B2 and 0

Scenario B2 - two weir in the Biebrza river bed with crest 0.5 m below ground level. Rating curve for weirs was changed.

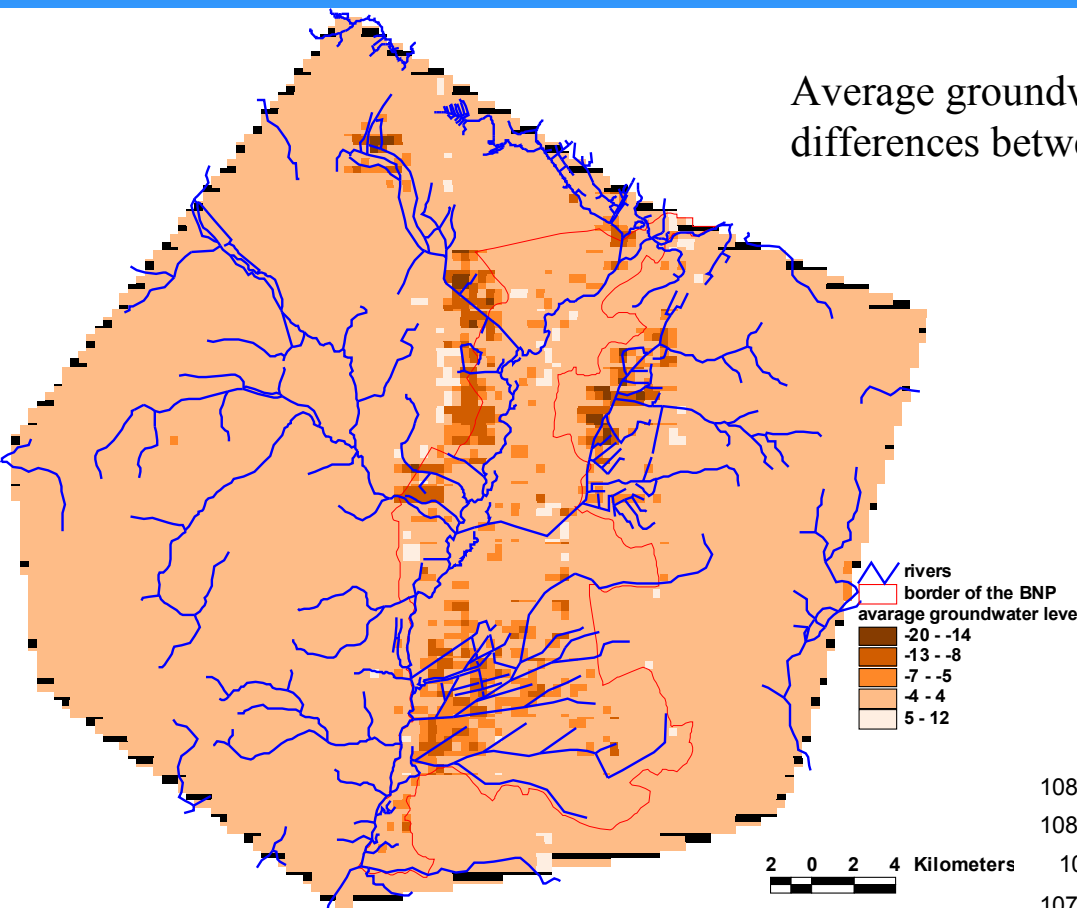


# SCENARIOS C – CHANGES OF LAND USE

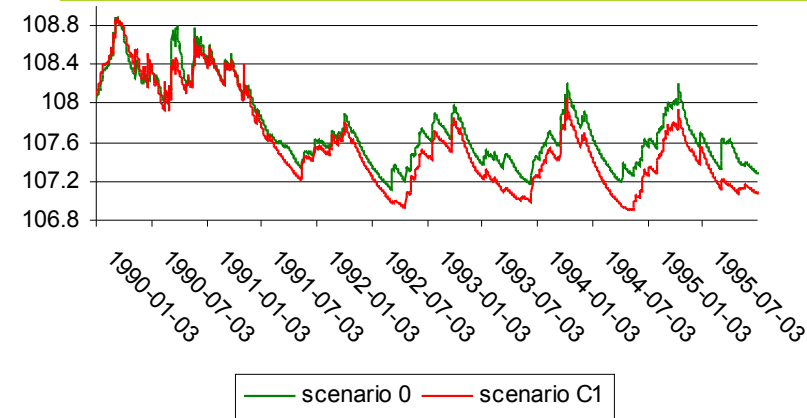
Average groundwater level changes in summer – differences between scenario C1 and 0.



*Not-mowing meadow.*



Groundwater level in nodal point 2774 where landuse were changed from meadow to forest.

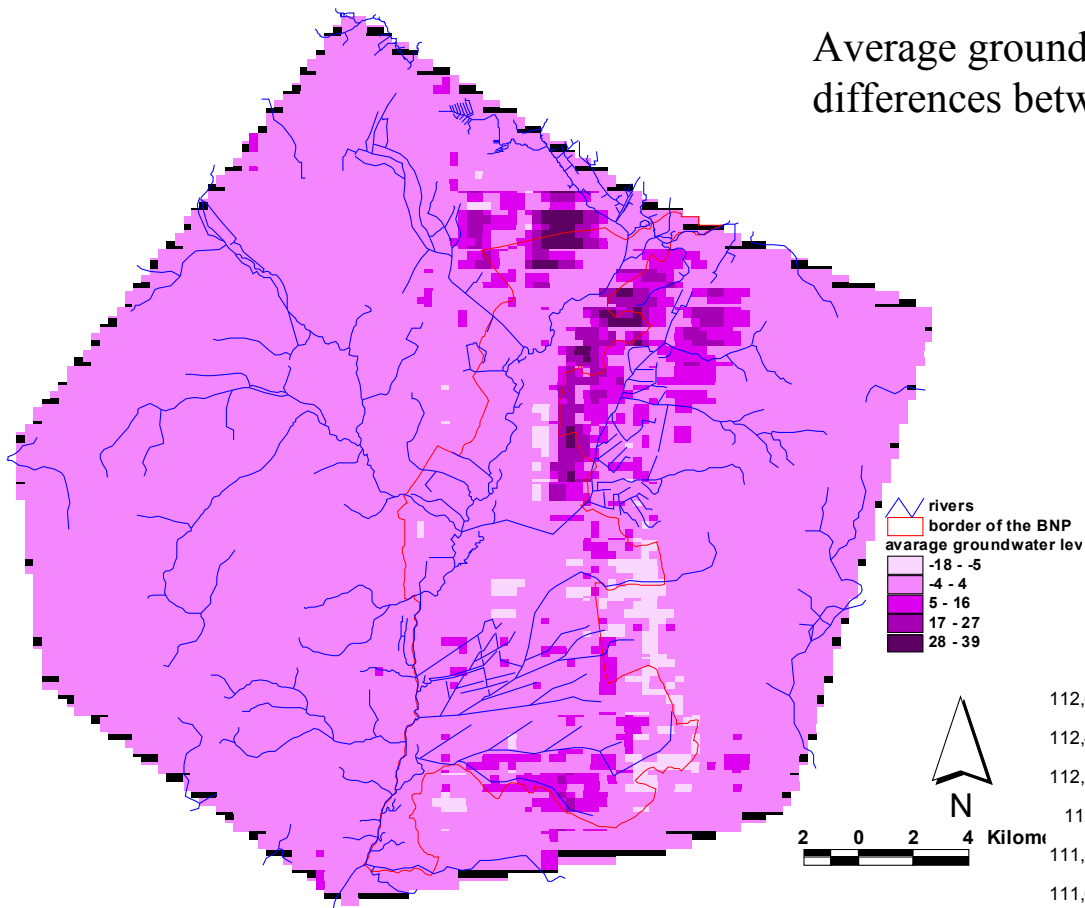


Scenario C1 - “no action” management – deciduous forest would overgrown meadows areas



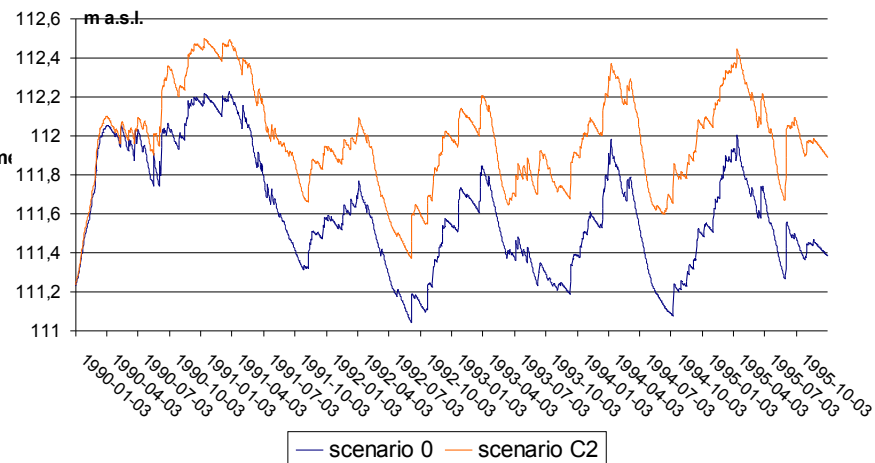
# SCENARIOS C – CHANGES OF LAND USE

Average groundwater level changes in summer – differences between scenario C2 and 0.



*Mowing meadow.*

Groundwater level in nodal point 836 where landuse were changed from forest to meadow.



Scenario C2 – meadow instead of deciduous forest area



# CONCLUSIONS

In the lower Biebrza most beneficial for soil moisture seemed to be scenario, which assumed building weirs on all small canals on Bagno Ławki.

Modelling proved that land use is a crucial thing and it should be considered before taking on decisions. Mowing meadows on the area sustain unique plant communities and not decrease groundwater level. If “no action” scenario was implemented groundwater level would decrease rapidly.

Results of the modellig might be helpful to choose the best scenario to implement in the area. They might be also used for further analysis of ecological, geographical and economical situation of the area.



**THANK YOU FOR ATTENTION**

