University of Agriculture in Krakow,
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Department of Hydraulic Engineering and Geotechnics

Management of protected areas Natura2000 under flood conditions on the example of the Małopolska Przełom Wisły

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Disaster Risk Reduction, Krakow, Poland, 9-11th of May

UNIWERSYTET ROLNICZY
im. Hugona Kołłątaja w Krakowie

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Plan :

1. Introduction
2. Field mesurements
3. Impact of an Island on discharge capacity
4. Outside of the river – oxbow lakes and amphibians
5. Water flow in the river bed covered by plants
6. Impact of the spatial dispertion of the plants on the water level
7. Summary

1. Introduction

Habitat directive

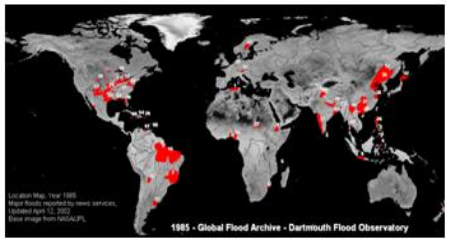
1992. Habitat directive. Nature 2000 network, species protection, Important habitats types.

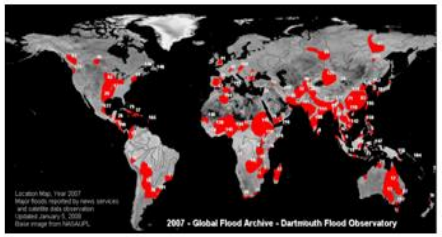
Water Framework Directive

2000. Water EU policy. Water law in Poland. Environmental Protection Law

Flood Framework

2006. The target of the Flood Framework is the limitation of the flood risk and the consequences of the flood in EU Countries, 2015 – designing of the risk management plans





Przyjęcie przez Parlament EU 2007r.

Penalty for the loss of the values in Natura2000 site:

36 mln € once + 600 € daily x (deprivation) factor

Kary za utratę walorów w obszarze N2000: 36 mln € jednorazowo + 600 € dziennie * wskaźnik szkodliwości…

1. Introduction

2010, flooded area - Sandomierz

1. Introduction

„Environment or people ?"

Questions

- Questions for engineers:
  - What creates the flood risk?
  - Are habitats and species damaged from the flood protective measures?

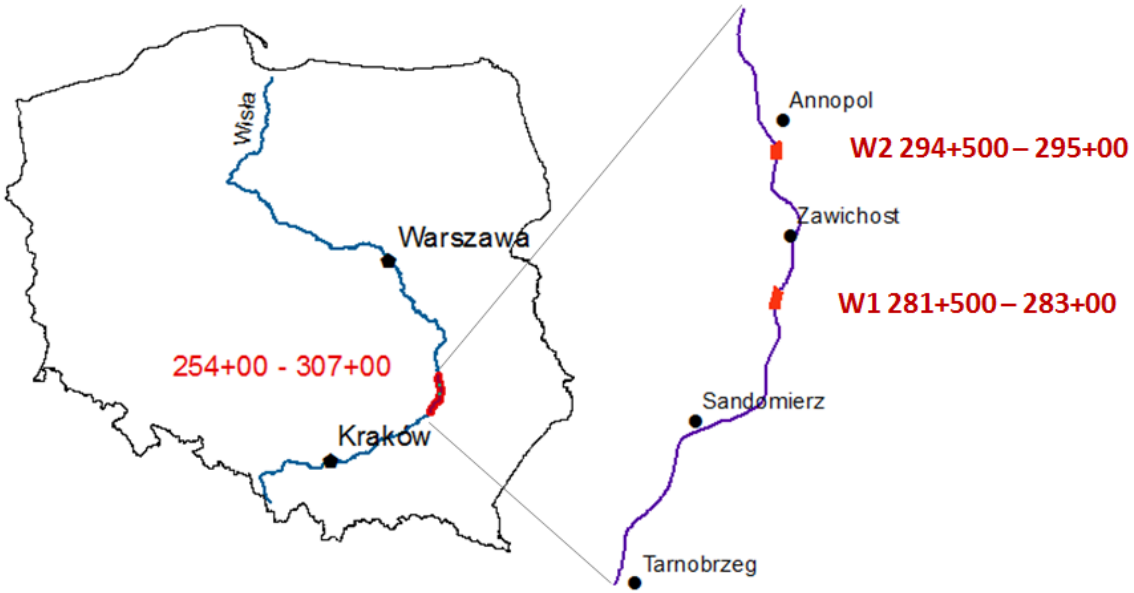
- Questions for naturalists:
  - Where the tern nests?
  - Where the tern prey?
  - Where the protected arts of fish can be found?
  - Where are the riparian forests and what is their value
  - Where are the protected amphibians?
  - **What are the limtis of the existance?**

A request of local authorities regarding the liquidation of the Natura2000 sites

Where the tern nests?

Successfully?

2. Field Mesurements

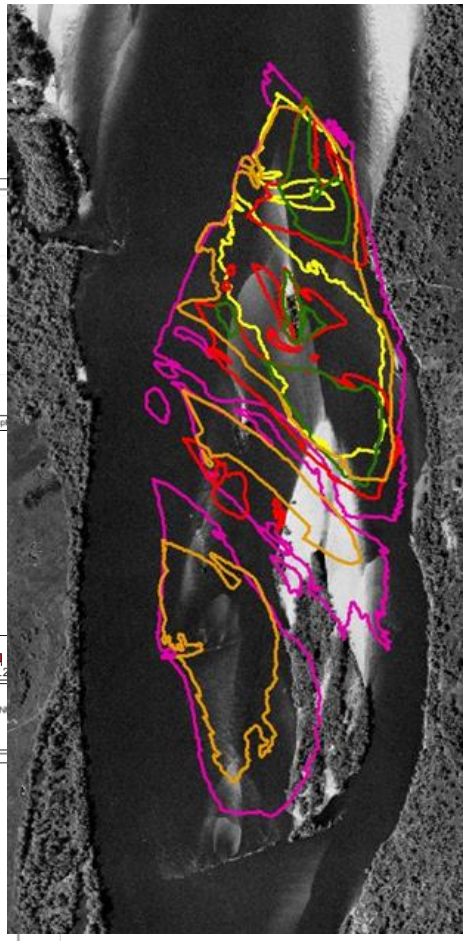


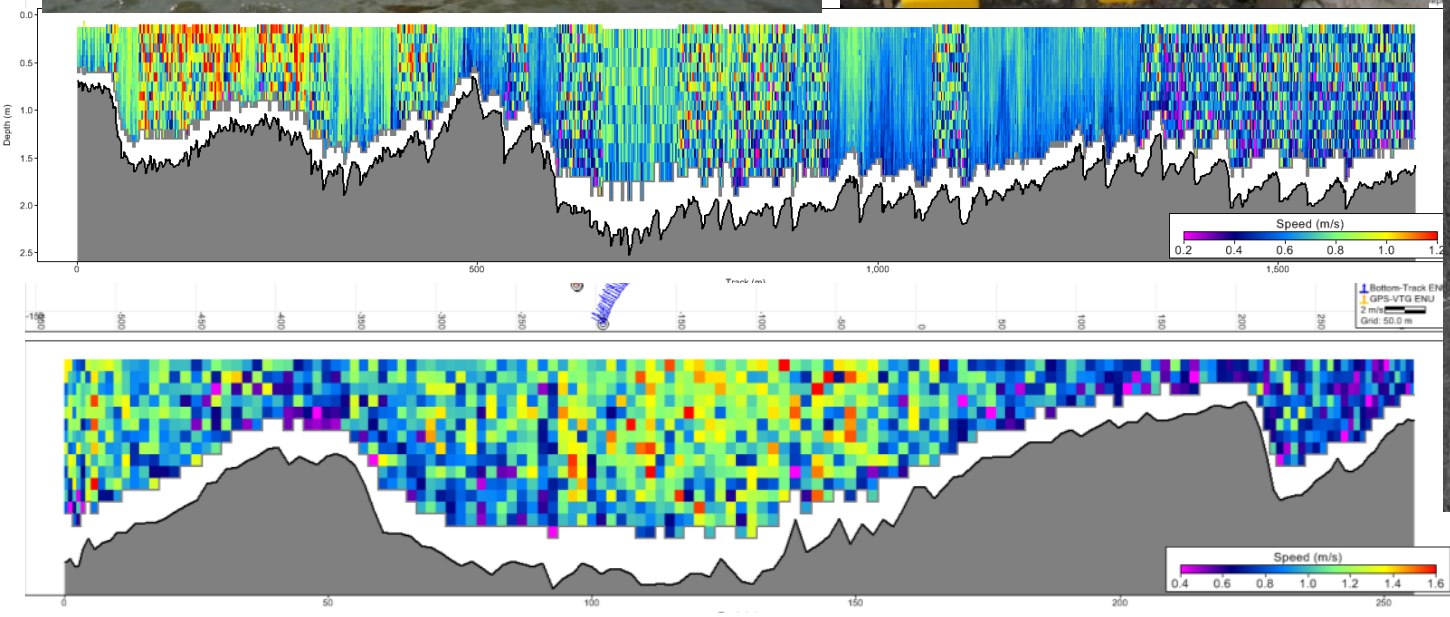
- River bed configuration,
- Water level configutation,
- Discharge,
- Depth distribution,
- Water velocities distribution,
- Granulometric composition of the river bed material

Island 1; Kępa Chwałowska
Island 2; Opoka Duża

2. Field Mesurements

Spatial distribution of the hydraulic parameters ADCP, river bed configuration

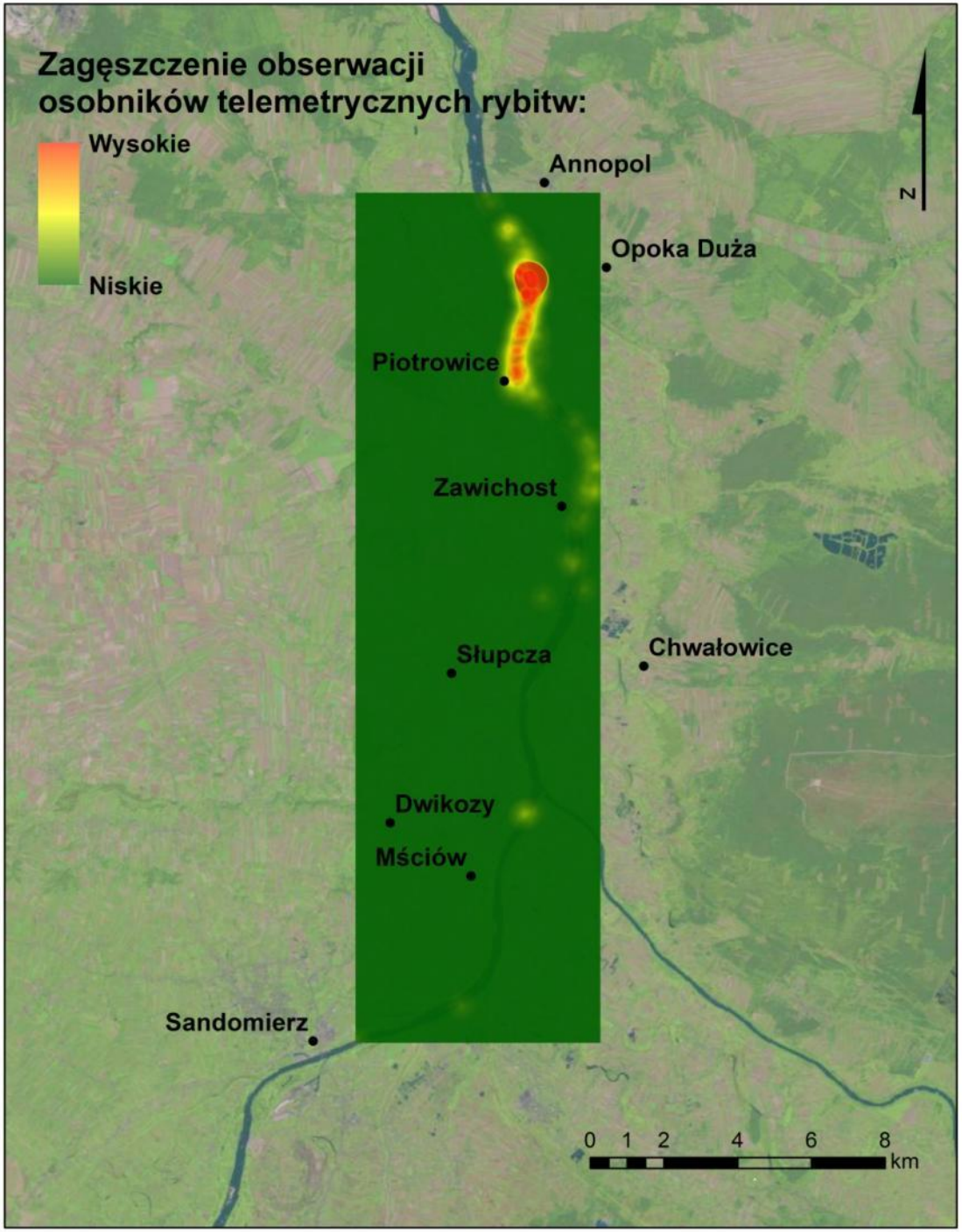




2. Field Mesurements

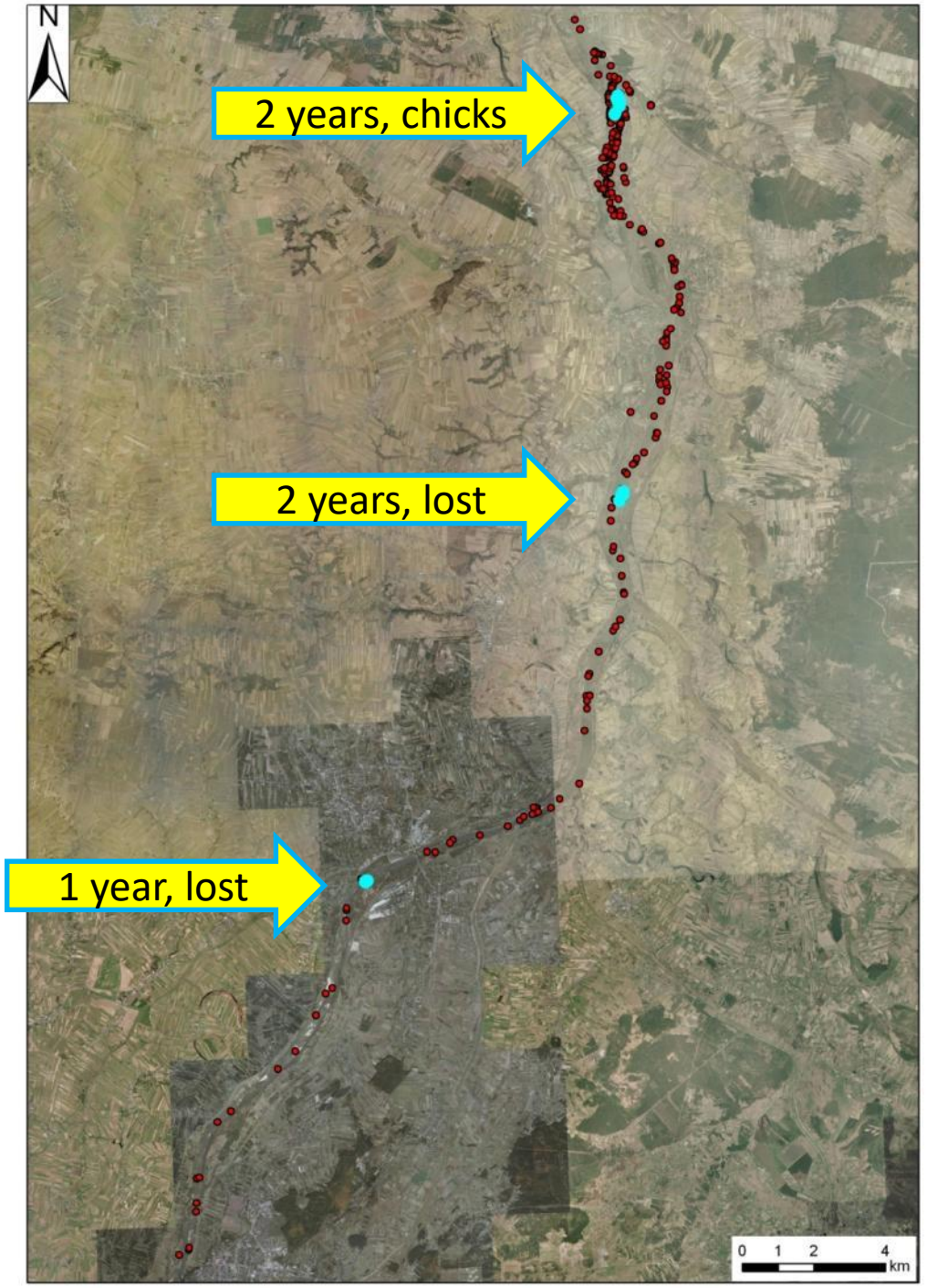
Where the tern feeds?

Terns are using only limited parts of the whole river

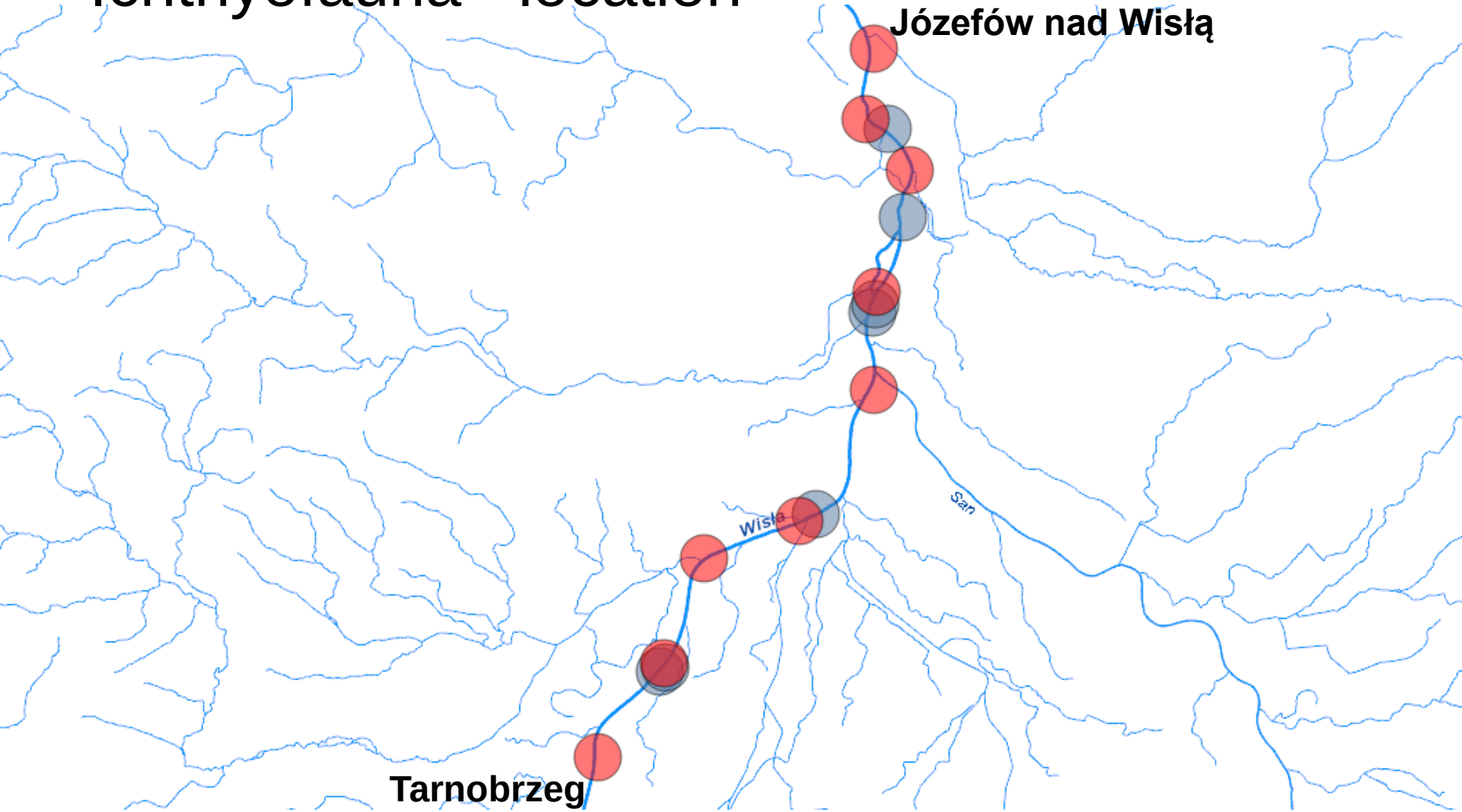


Three nesting locations!
Two regular!
One successfull!

- For the population of the tern important are two nesting locations on two islands, the third isn't regular and dangerous. Only one is productive each year.



Ichthyofauna - location



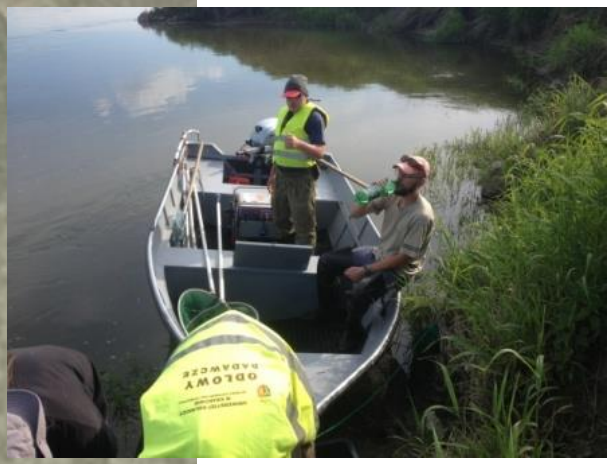
~ 300 m

~ 4 m

Wisła

~ 470 m

Dragnet:
– dimention: 15 × 3 m
– knotless fabric ot the net, mesh size: 8 mm
– surface: 10–200 m^2
– 4–12 locations arround deposition site



The size of the fishing locations is often less than 1% river width

Ichthiological results

Electrofishing :

–**8500 Fishes catched** (combined mass of **74 kg**)

– 25 species found

Seine net:

–**4396 fishes catched**

–**18** species found (+ 2 taxons not indentified)

Trammel net:

–**43 Fishes catched** (combined mass of **36 kg**)

–**5** species found


Romanogobio kesslerii
kiełb Kesslera
Romanogobio belingi
Gobio gobio
Kiełb pospolity

Sapa (*Ballerus sapa*) – spacies catched only in one type of river habitat

Ecological conditions validation

Stanowisko	EFI+	Klasa
Tarnobrzeg	0,6167	II
Zawierzbie	0,7156	II
Sandomierz	0,6258	II
Kamień Łukawski	0,5501	III
Bożydar	0,5853	II
Kępa Chwałowska	0,7673	II
Zawichost	0,7797	II
Piotrowice	0,6970	II
Linów	0,6883	II
Basonia	0,5293	III
Józefów nad Wisłą	0,5708	II

Klasa	EFI+
I	0,917–1,000
II	0,562–0,917
III	0,375–0,562
IV	0,187–0,375
V	0,000–0,187

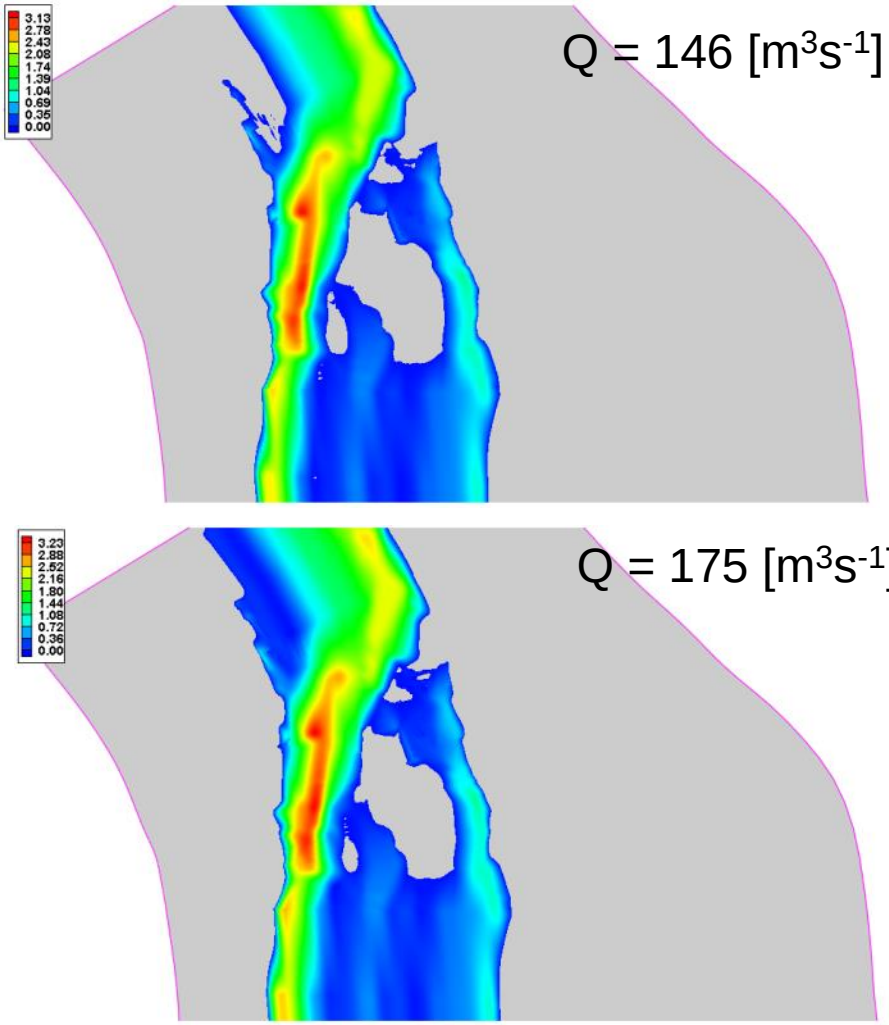
Wskaźnik: Siedlisko

EFI+	Ocena
I–II	FV
III	U1
IV–V	U2

Diadromous species factos (< 0,500): +1 class (?)

3. Impact of an Island on channel capacity

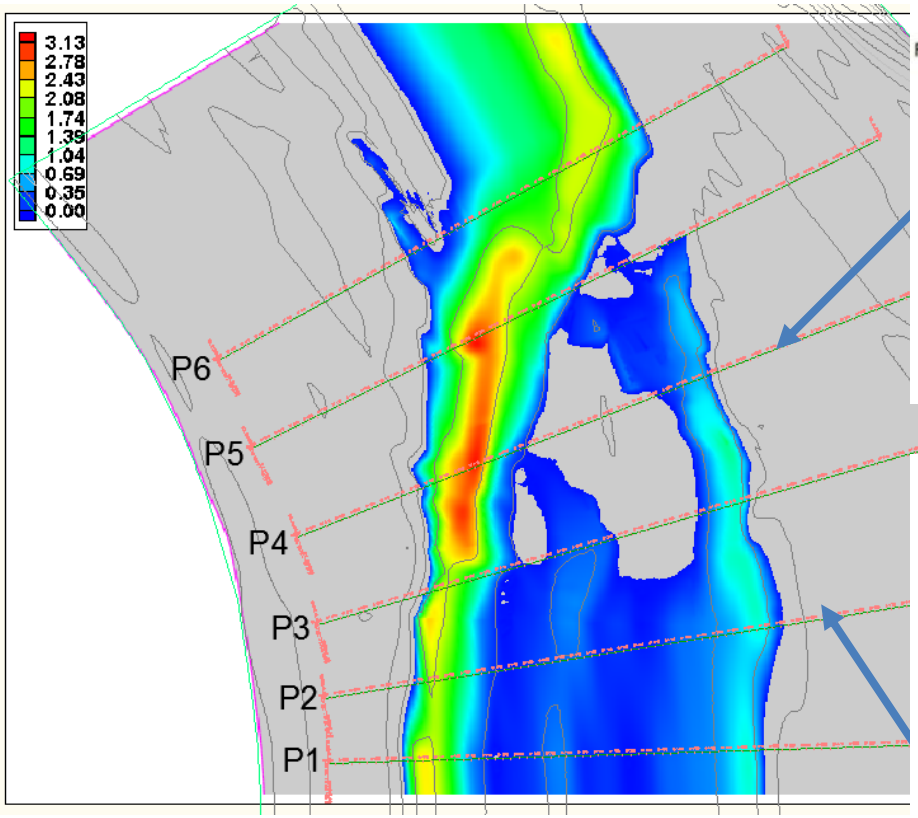
Vistula River, Piotrowice – Annopol, Island 2, Opoka Duża

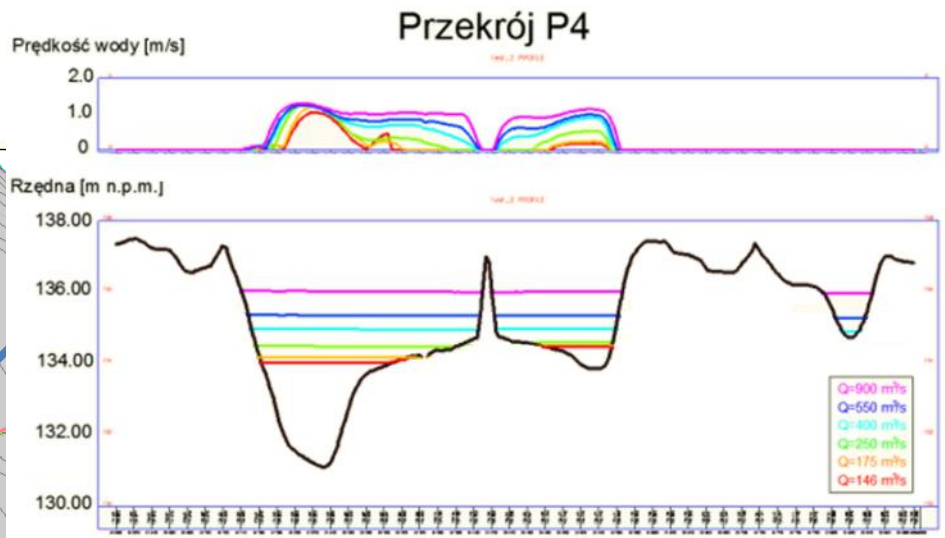


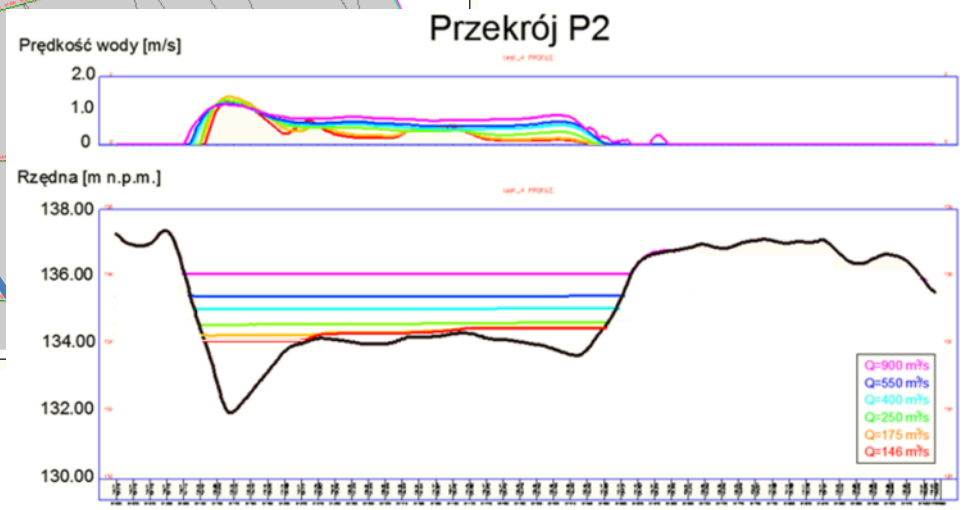
Numerical model 2D – water depth, 2015 r.

3. Impact of an Island on channel capacity

Water depth distribution (Island is flooded)

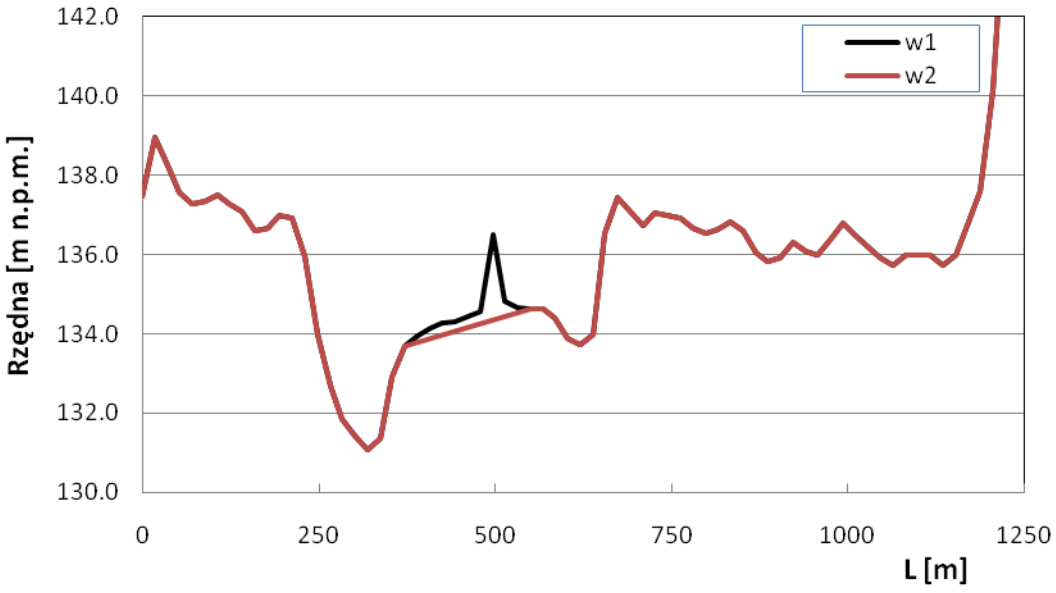




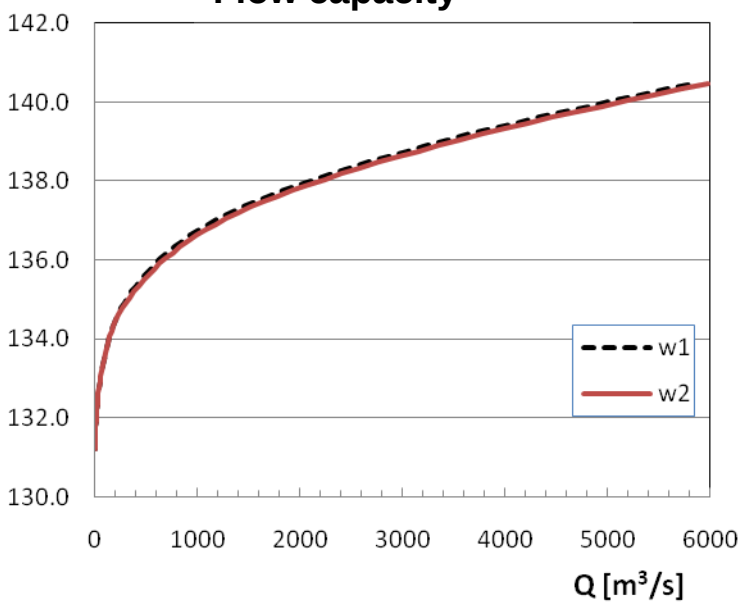


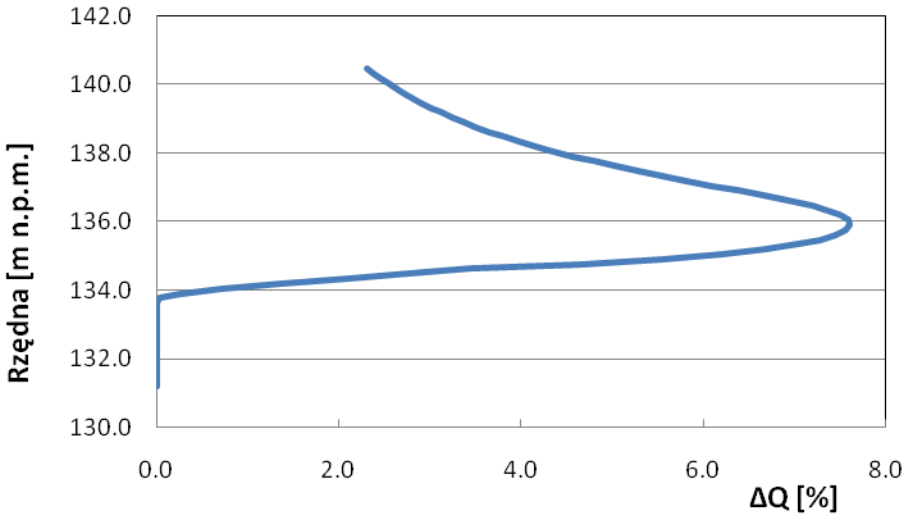
Island 2, Opoka Duża

3. Impact of an Island on channel capacity



Flow capacity



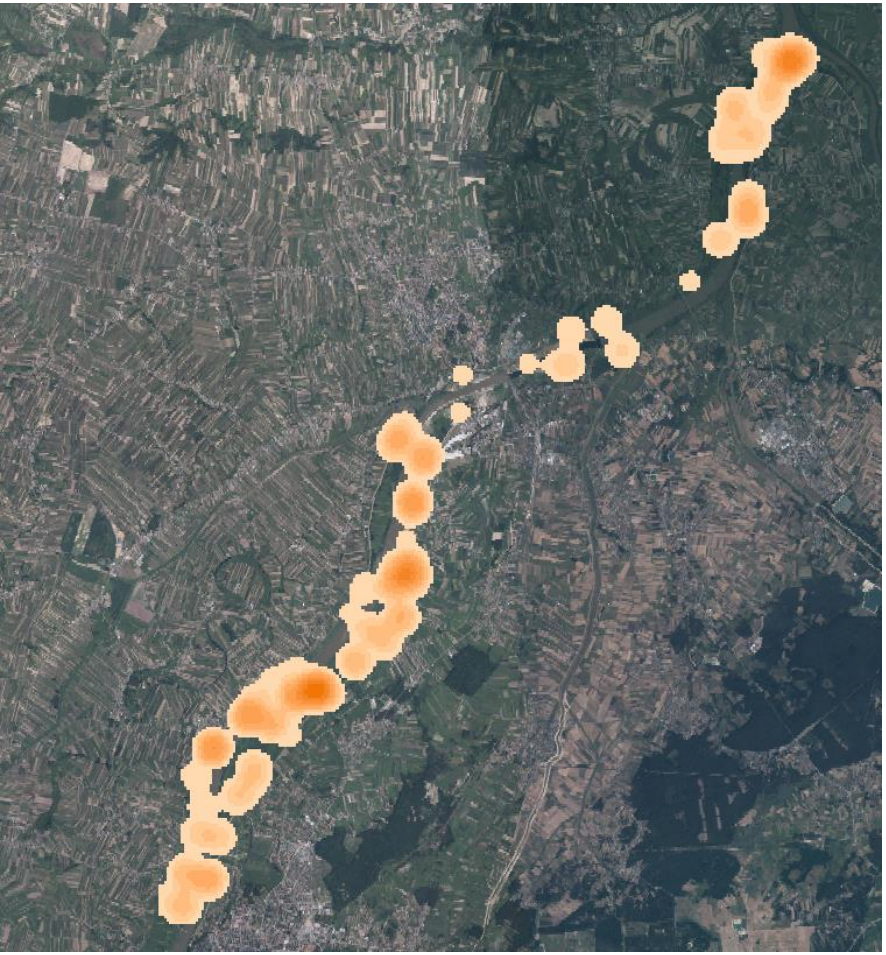


Island 2, Opoka Duża

Relative change in discharge capacity in %

4. Outside of the river – oxbow lakes and amphibians

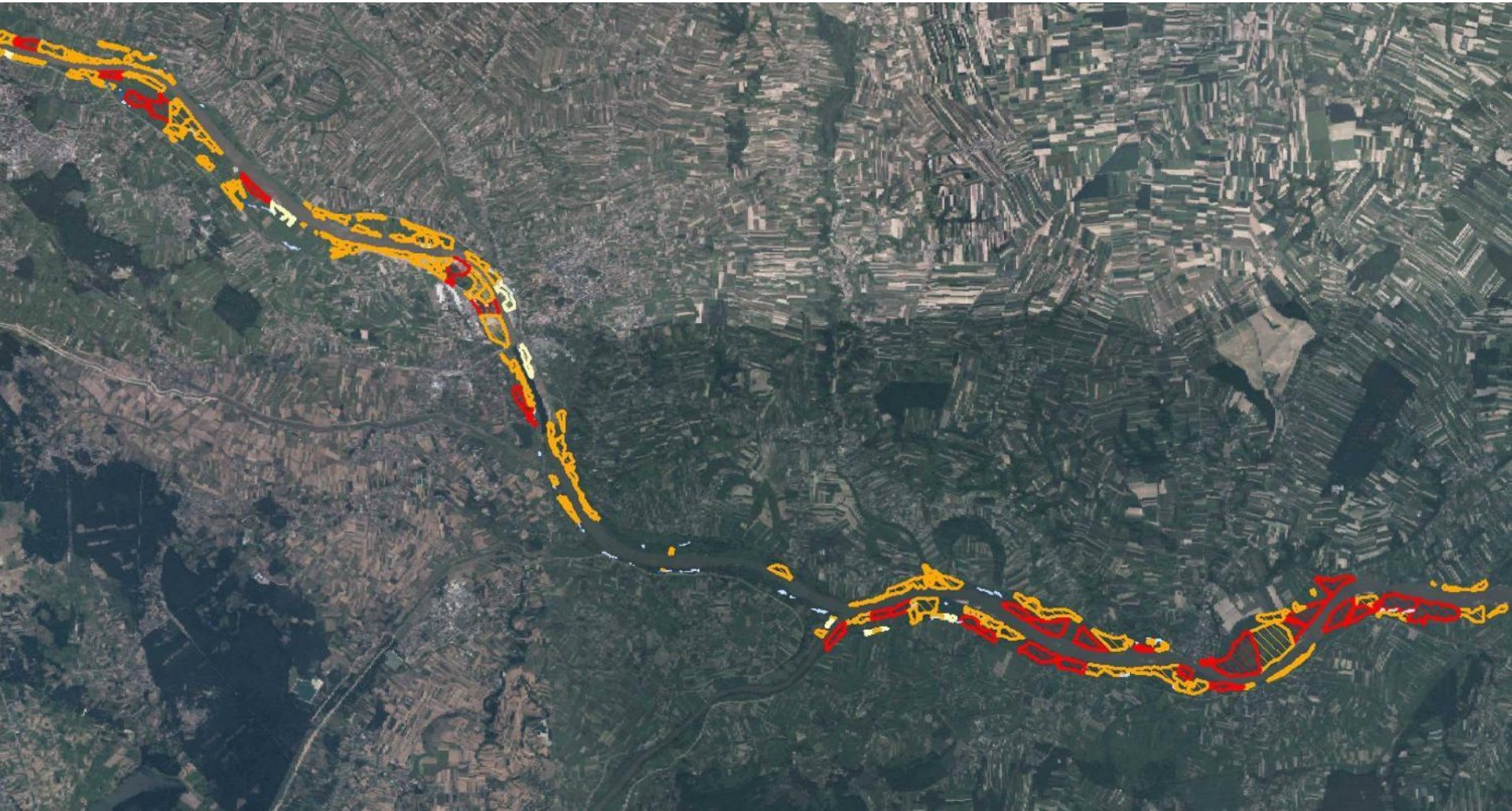
Relative density



Dispertion reach

4. Outside of the river – riparian forests

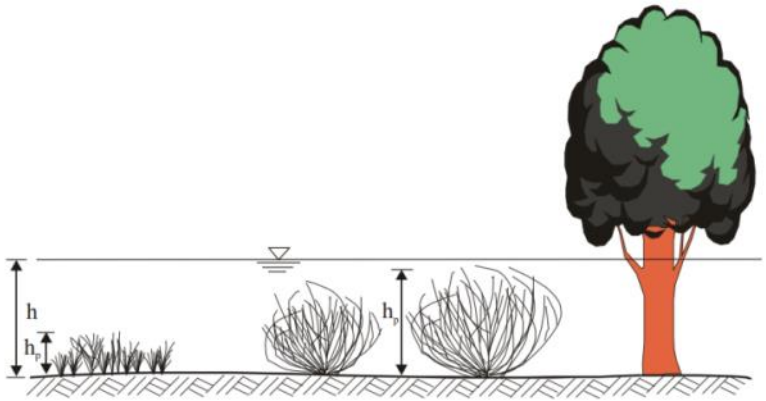
Feeling of the tress but where?



5. Water flow in the river bed covered by plants

Plants classification (1985)

- low $h_p << h$
- middle $h_p \approx h$
- high $h_p > h$

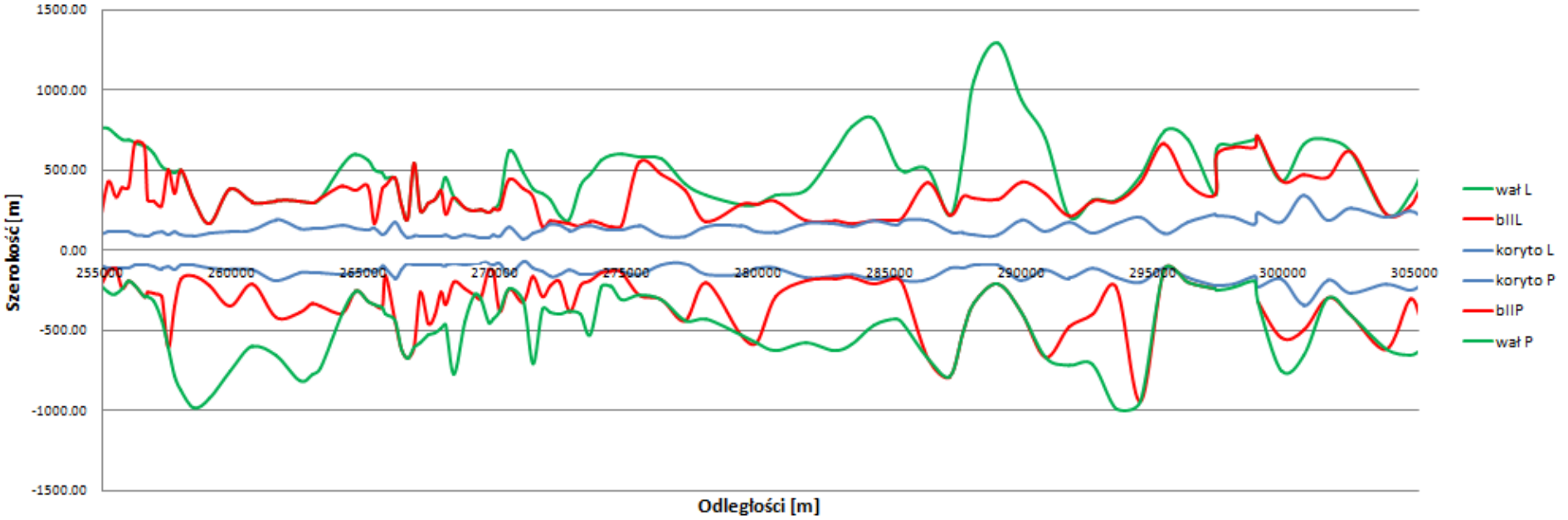


Active coss-section combined from main river bed and flood zones of calculated:

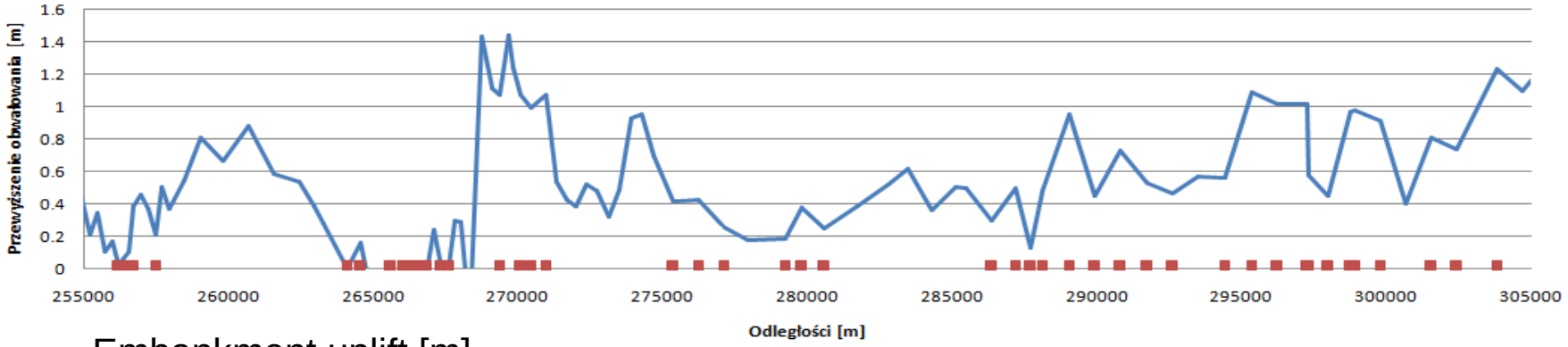
$$b_{II} = \frac{R_h^{4/3}}{8gn_z^2\left(0.068e^{0.56C_T} - 0.056\right)}$$

b_{II} – width of the interaction [m], R_{hz} – hydraulic radius of the flood zone[m], n_z – roughness coefficient , C_T –"slip-velocity„ parameter acc. to Pasche [Pasche 1984], $C_T=f(\Omega)$, Ω –parameter discibing spatial distribution of the plants.

5. Water flow in the river bed covered by plants – active zone

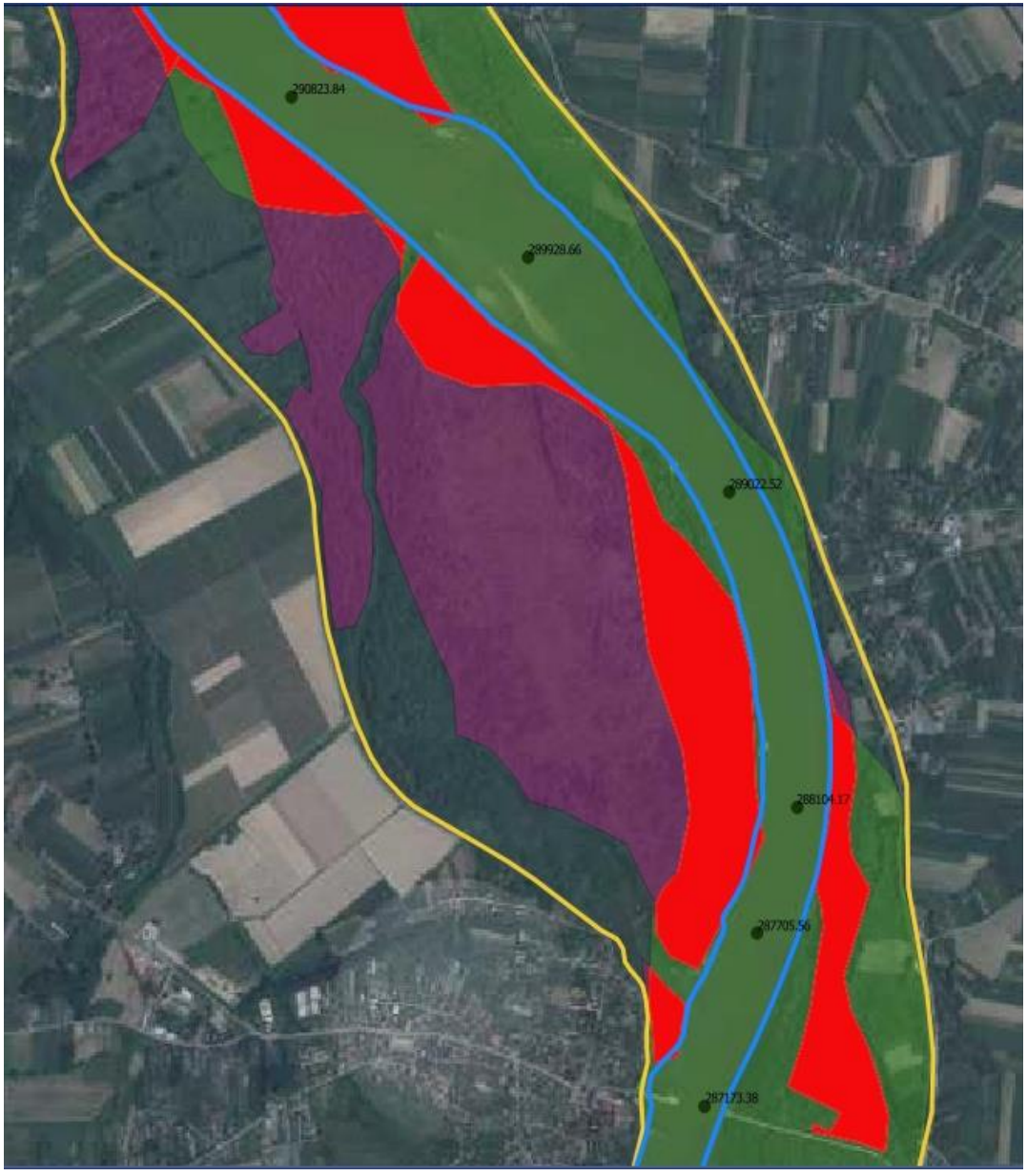


W4 – felling of the trees in chosen cross-sections, diversification ot the C_T



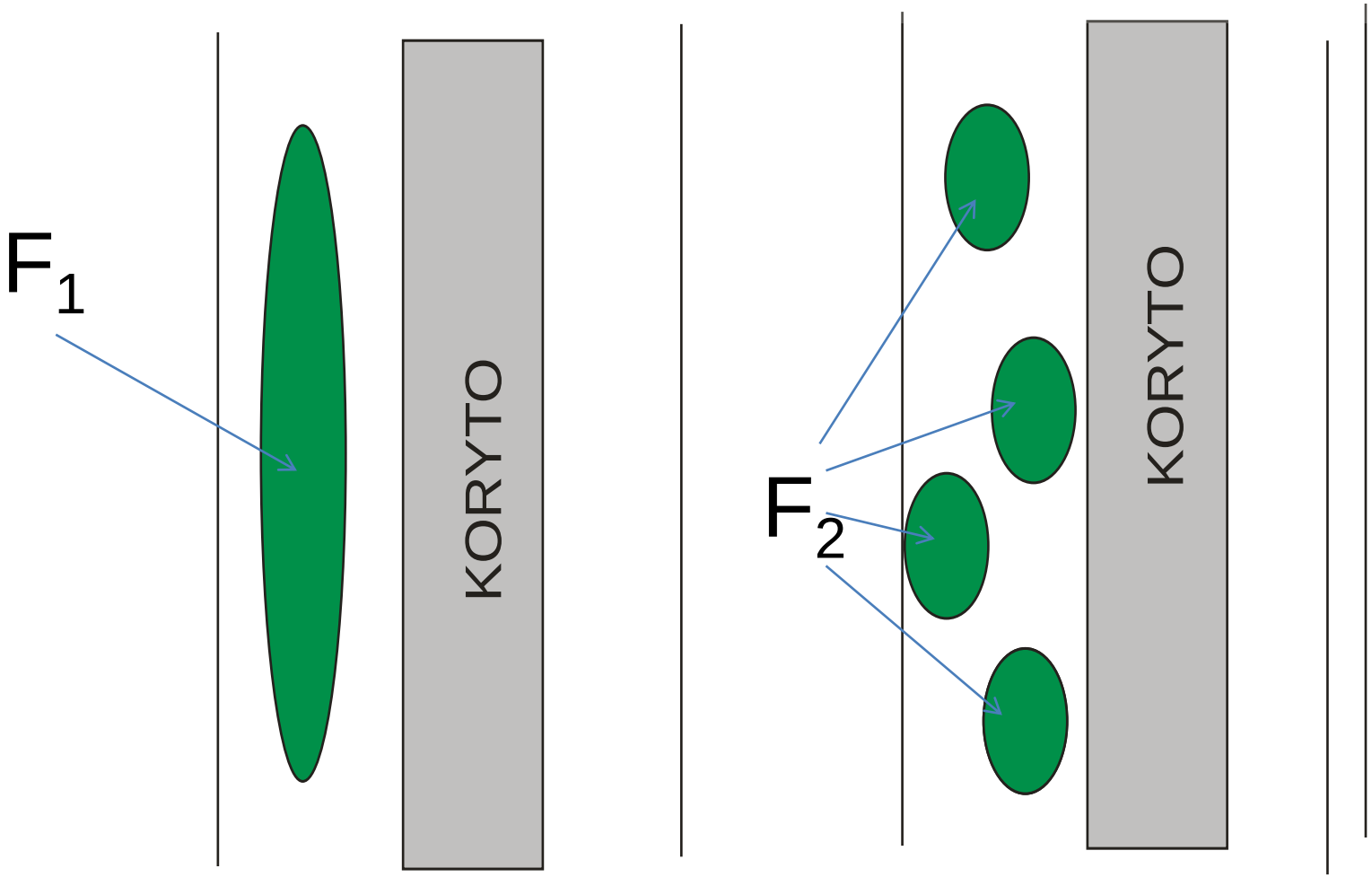
Embankment uplift [m]

The „collisions” zones between flood and habitat protection



The „collisions” zones between flood and habitat protection

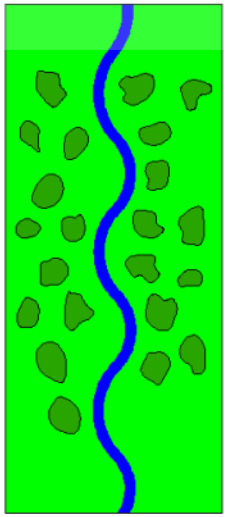
6. Impact of the spatial dispertion of the plants on the water level

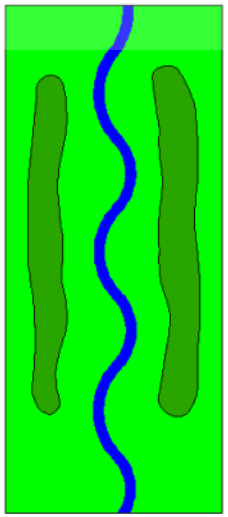


$$F_1 = F_2$$

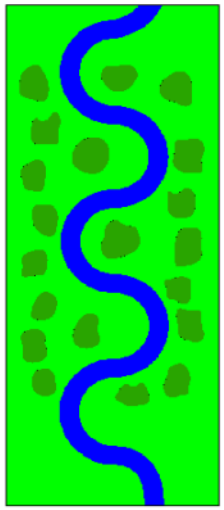
6. Impact of the spatial dispertion of the plants on the water level

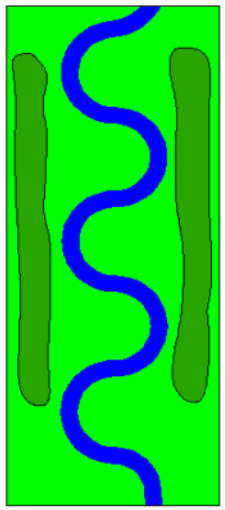
Numerical Model 2D



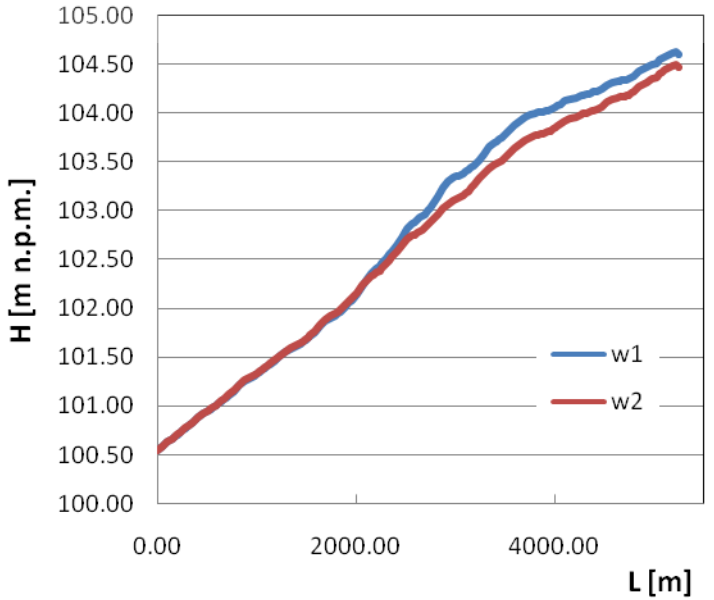


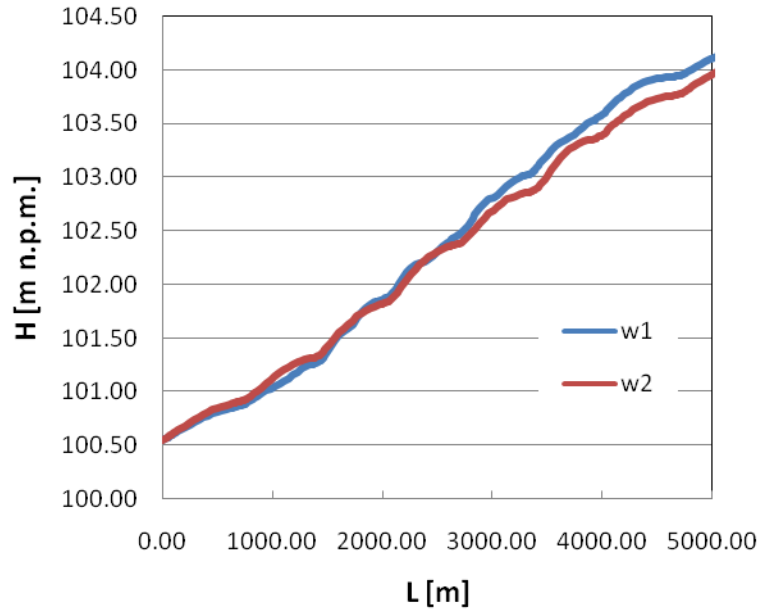
W1 W2





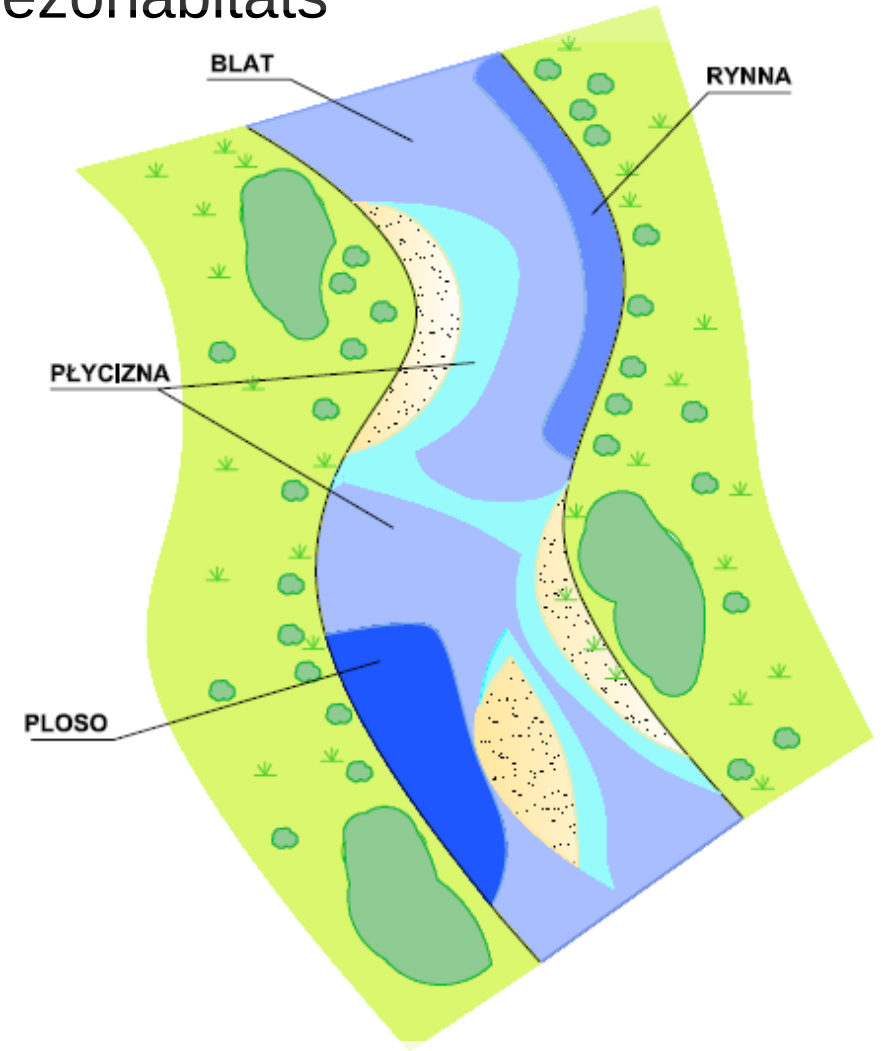
koryto cieku - n = 0.025
terasa zalewowa n = 0.040
drzewa i krzewy n = 0.150





7. Summary

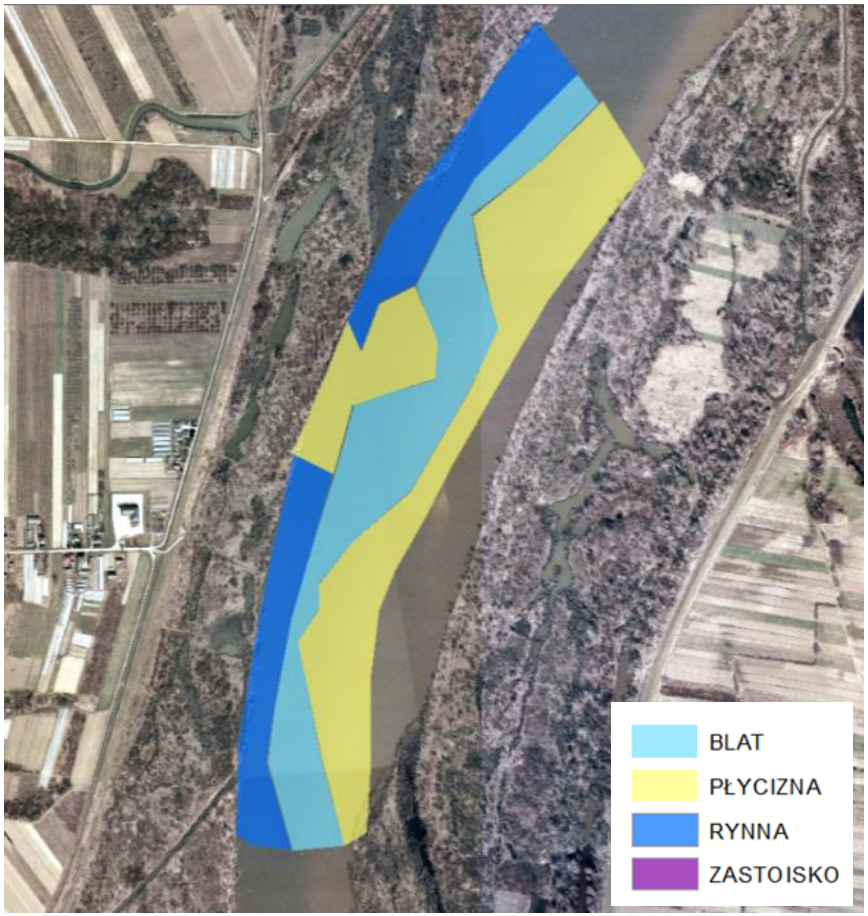
Mezohabitats



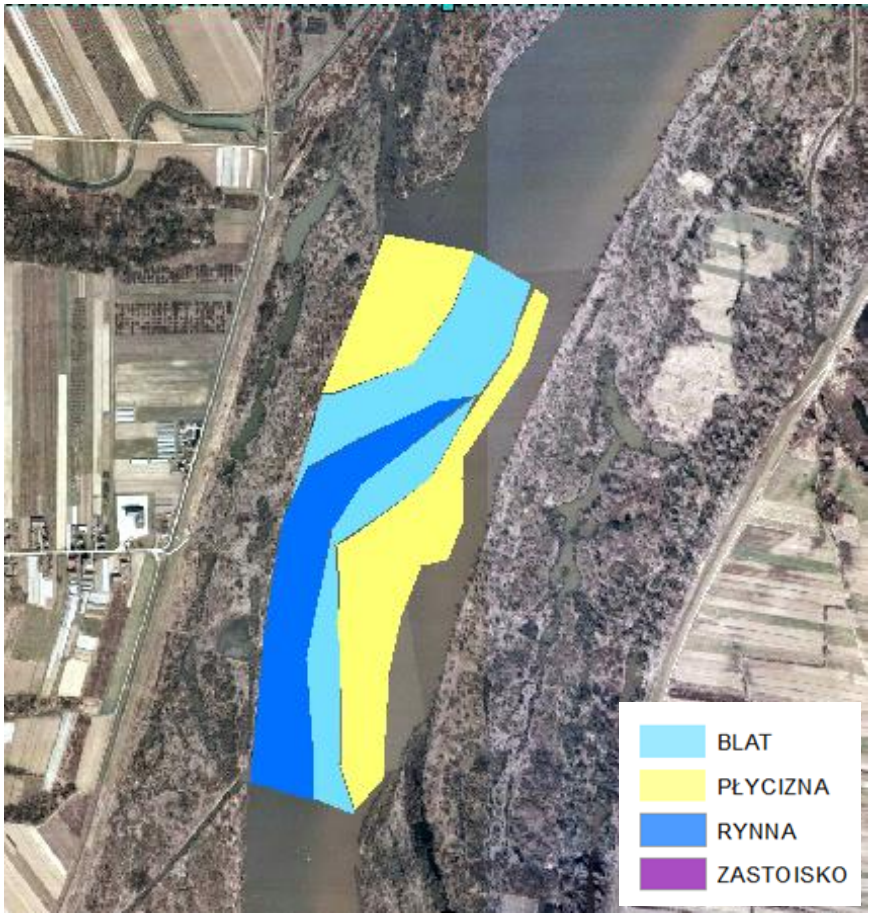
Habitats – the living space of the water organisms, the zone on the river bed characterise by relatively constant flow parameters
Mezo – scale/dimension

7. Summary

Spatial distribution of mezohabitat, island 1, Kępa Chwałowska



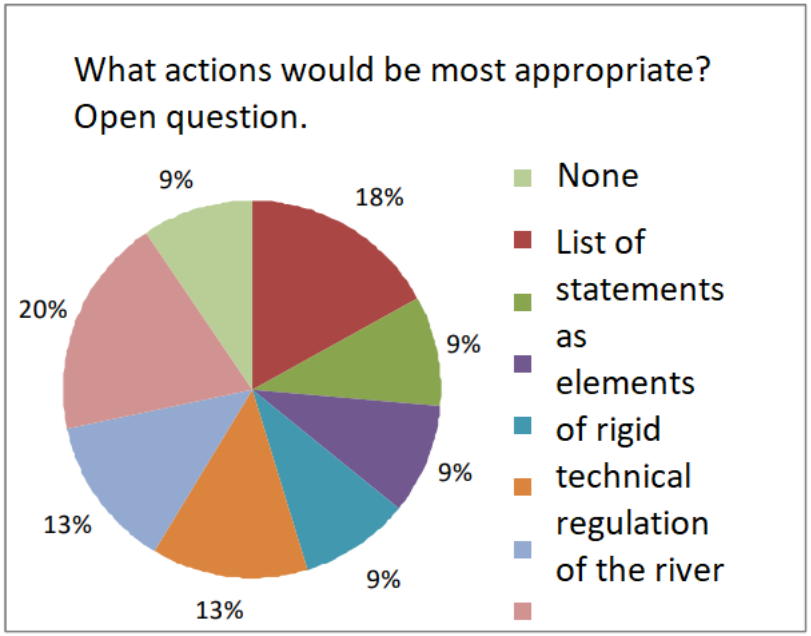
July 2015 r.



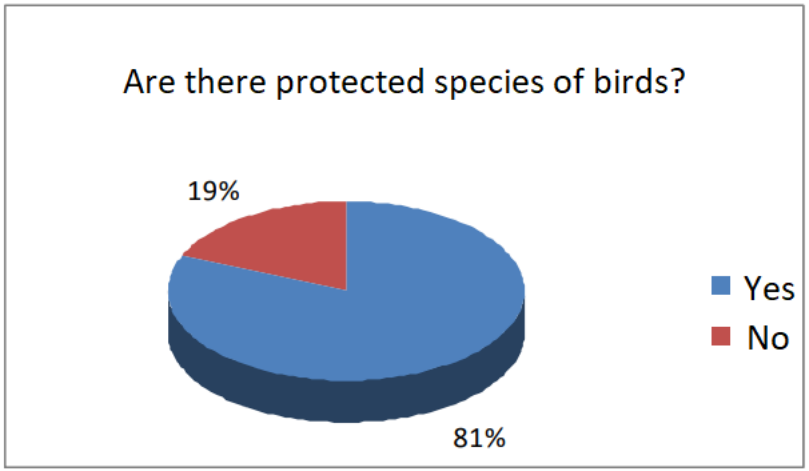
November 2015 r.

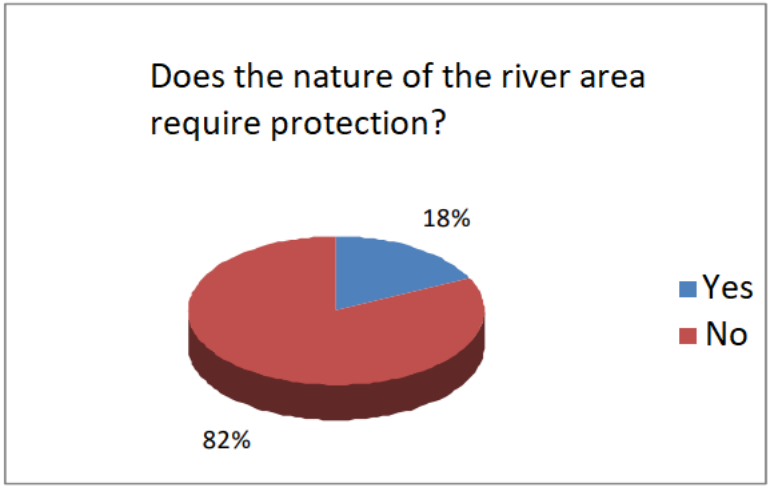
7. Summary

Flood protection

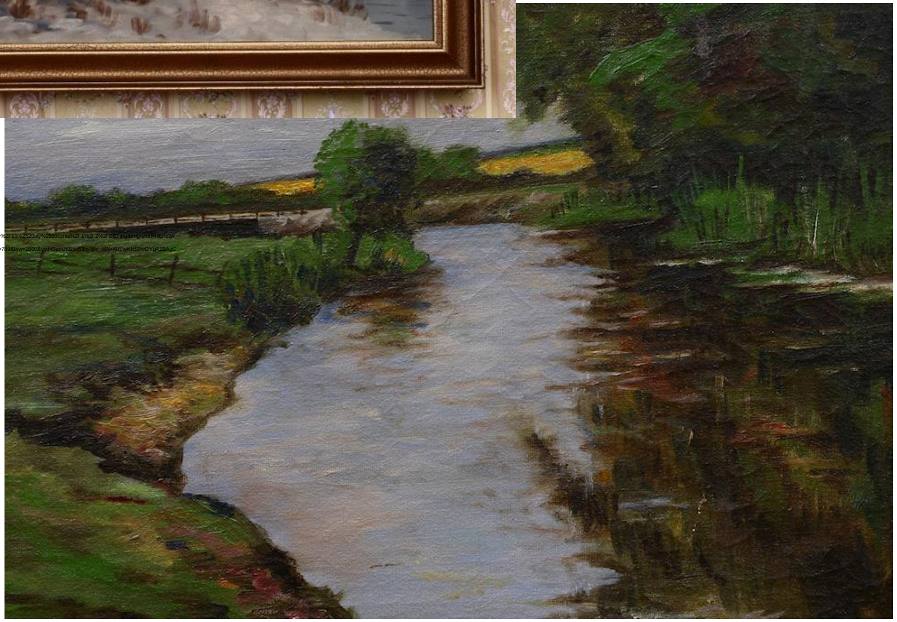


Environment protection





River from the past



ZIMA Zielona Góra

https://www.google.pl/imgres?imgurl=http%3A%2F%2Fserwer1566710.home.pl%2Fpub%2Fobrazy…
%2F%2Fallegro.pl%2Fzima-piekny-cenny-obraz-znakomite-malarstwo-
i5926017789.html&docid=lyvTFVvf5PL6EM&tbnid=ZS_DFQLS6EBNqM%3A&w=989&h=730&bih=7…
E4oSzBL&iact=mrc&uact=8

RZEKA 1936 Żagań

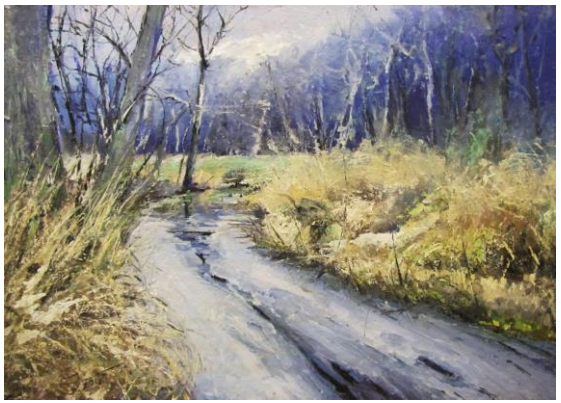
https://www.google.pl/imgres?imgurl=http%3A%2F%2Fserwer1566710.home.pl%2Fpub%2Fobrazy%2F28%2520lipca%2F332.jpg&imgrefurl=http%3A%2F%2Farchiwum.allegro.pl%2Foferta%2Frzeka-1936-piekny-stary-obraz-olejny-na-plotnie-i5573075196.html&docid=JB9a_x8r7PuMMM&tbnid=QSNs437pHxhNMM%3A&w=984&h=683&bih=789&biw=1600&ved=0ahUKEwi53by98c_MAhXIlSwKHS0wDYg4ZBAzCCkoJjAm&iact=mrc&uact=8

VAN HOESCH, XVII
http://www.markizantyki.pl

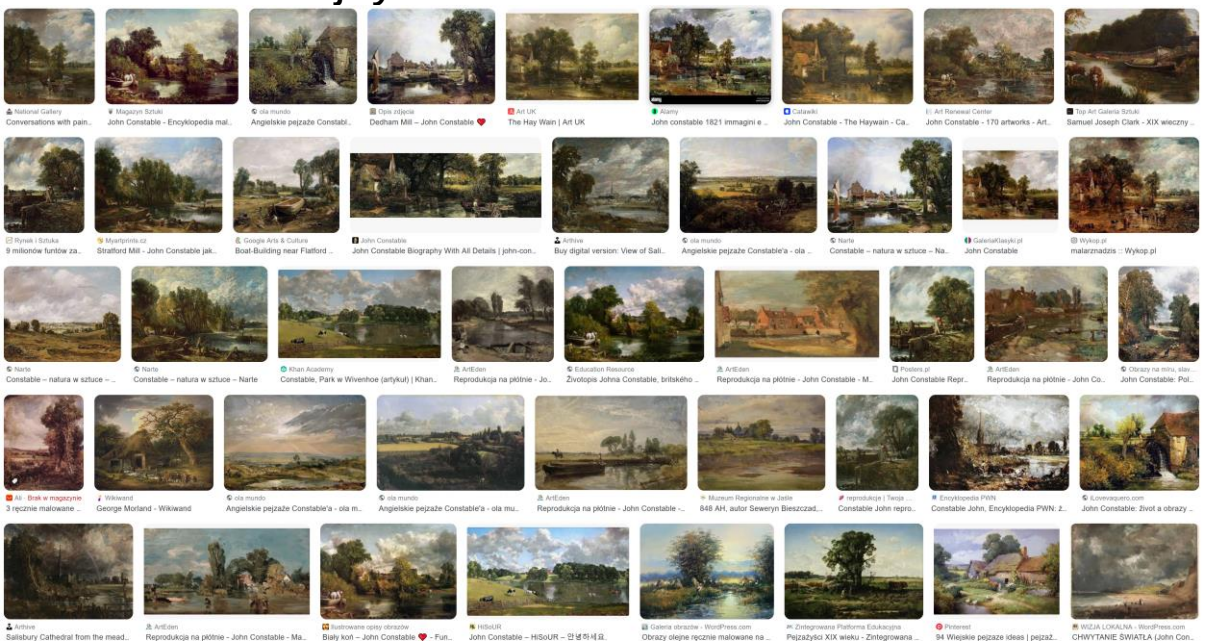
AXELA JOHANSENA (1885-1955)

River from the past

Gemäldegalerie Alte Meister, Staatliche Kunstsammlungen Dresden, Foto: Elke Estel/Hans-Peter Klut
https://muzeon.pl/galeria-obrazow-starych-mistrzow-prezentuje-prace-canaletta/



https://galeria-mad.pl/produkt/obraz-olejny-



And so on...

River Vistula 2023

Thank you
Dziękuję za uwagę

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