AMBER

Work Package 2

Impacts of Barriers on Stream Habitats and Natural Capital

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Objectives

1. Develop a conceptual framework for estimating barrier effects on fluvial processes at different spatial scales, and under different scenarios of climate change

2. Assess the nature of barrier effects for a range of aquatic biota

3. Develop and field test a rapid barrier assessment toolkit for assessment of connectivity of multiple taxa

4. Quantify the impact of stream barriers on ecosystem services and the benefits of restoring connectivity for natural capital.

Tasks WP2

- T2.1. Pan-European assessment and predictive modelling of stream barrier effects on connectivity and local biodiversity

- T2.2. Assessing stream barrier effects on geomorphology and habitat structure
  - T2.2.1. Bench-marking reference conditions for assessing barrier impacts on fluvial habitats
  - T2.2.2. Rapid stream habitat mapping from high resolution low-cost drone platforms
  - T2.2.3. Pan-European assessment of barrier impacts on sediment connectivity

- T2.3. Modelling stream barrier effects under different scenarios of climate change

- T2.4. Developing European standards for a barrier passability rapid assessment tool

- T2.5. Developing a molecular metric of stream connectivity at the community level
  - T2.5.1. Optimisation and validation of eDNA metabarcoding protocols
  - T2.5.2. Integration of eDNA results and data analysis

- T2.6. Evaluation of Ecosystem Services affected by stream barriers
  - T2.6.1. Identification of ecosystem services and their users
  - T2.6.2. Scoping of natural capital into management goals

Task 2.1 Pan-European assessment and predictive modelling of stream barrier effects on connectivity and local biodiversity

- Database of existing raw stream survey data of ecological assemblages (aquatic plants, benthic macroinvertebrates and fishes),

- EU-wide models of spatio-temporal effects of barriers on local biodiversity and community structure (PREDICTS - hierarchical spatial mixed effects models)

Task 2.2 Assessing stream barrier effects on geomorphology and habitat structure

T2.2.1.Benchmarking reference conditions for assessing barrier impacts on fluvial habitats
- Fish biological targets
- Fish community habitat model

T2.2.2. Rapid stream habitat mapping from high resolution low-cost drone platforms

T2.2.3. Pan-European assessment of barrier impacts on sediment connectivity

CASCADE model

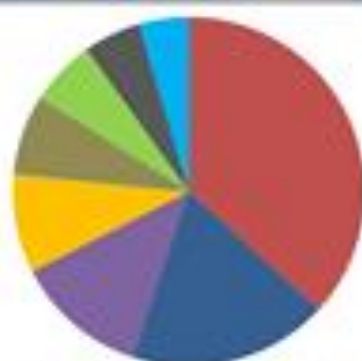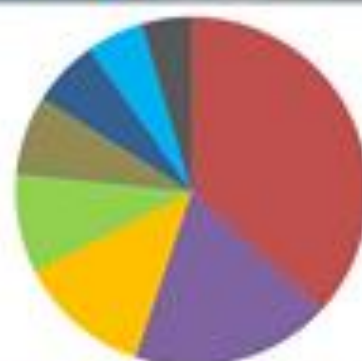# Target Fish Communities

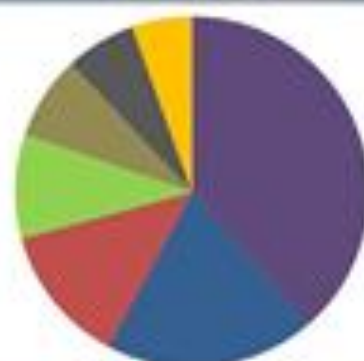1: mountain rivers and streams

2: flysch rivers

3: lowland streams

4: lowland rivers

5: lake connectors with salmonids

6: river connecting lakes, peat bogs and estuaries

- Strongly rheophylic
- Rheophylic – gravel bed
- Sand- detritus bed
- Associated with sand and mud
- Rheophylic sand-gravel bed
- Generalist
- Associated with macrophytes
- Deep water body

Task 2.2.1 Databases
Intercalibration – Fish 2011 Large Rivers 2016

Country_Intercalibration_Fish			
Country	Country_code	Agreement by e-mail	Non disturbed sites (NDS)
Austria	AT	OK.	27
Belgium - Flanders	BF	OK.	0
Belgium - Wallonia	BW	OK.	48
Czech Republic	CZ	OK.	14
Germany	DE		18
Denmark	DK		0
Spain	ES	OK.	102
Estonia	ET		13
England & Wales	EW	OK.	7
Finland	FI		95
France	FR		88
Greece	GR		55
Ireland	IR		256
Lithuania	LT	OK.	49
Luxembourg	LU	OK.	5
Latvia	LV		0
Northern Ireland	NI		2
Netherlands	NL	OK.	0
Norway	NO	OK.	4
Portugal	PT		31
Romania	RO		34
Scotland	SC	OK.	42
Sweden	SE	OK.	172
Slovenia	SI	OK.	28
Slovakia	SK	OK.	37
Sum	25	14	1127

Country	Country_code	Agreement by e-mail	Non disturbed sites (NDS-selected No, Low, Slight)
Austria	AT	OK.	0
Bulgaria	BG	OK.	0
Croatia		OK.	
Czech Republic	CZ	OK.	0
Germany	DE		4
Spain	ES		0
Hungaia	HU	OK.	0
Lithuania	LT	OK.	8
Netherlands	NL	OK.	0
Poland	PL	OK.	5
Romania	RO		5
Slovakia	SK	OK.	0
Sum	11	6	22

Task 2.2.2 Rapid stream mapping

- Drone pictures, movies, digital terrain models
- Spherical photography
- Bathymetric, hydraulic surveys
- Field survey App
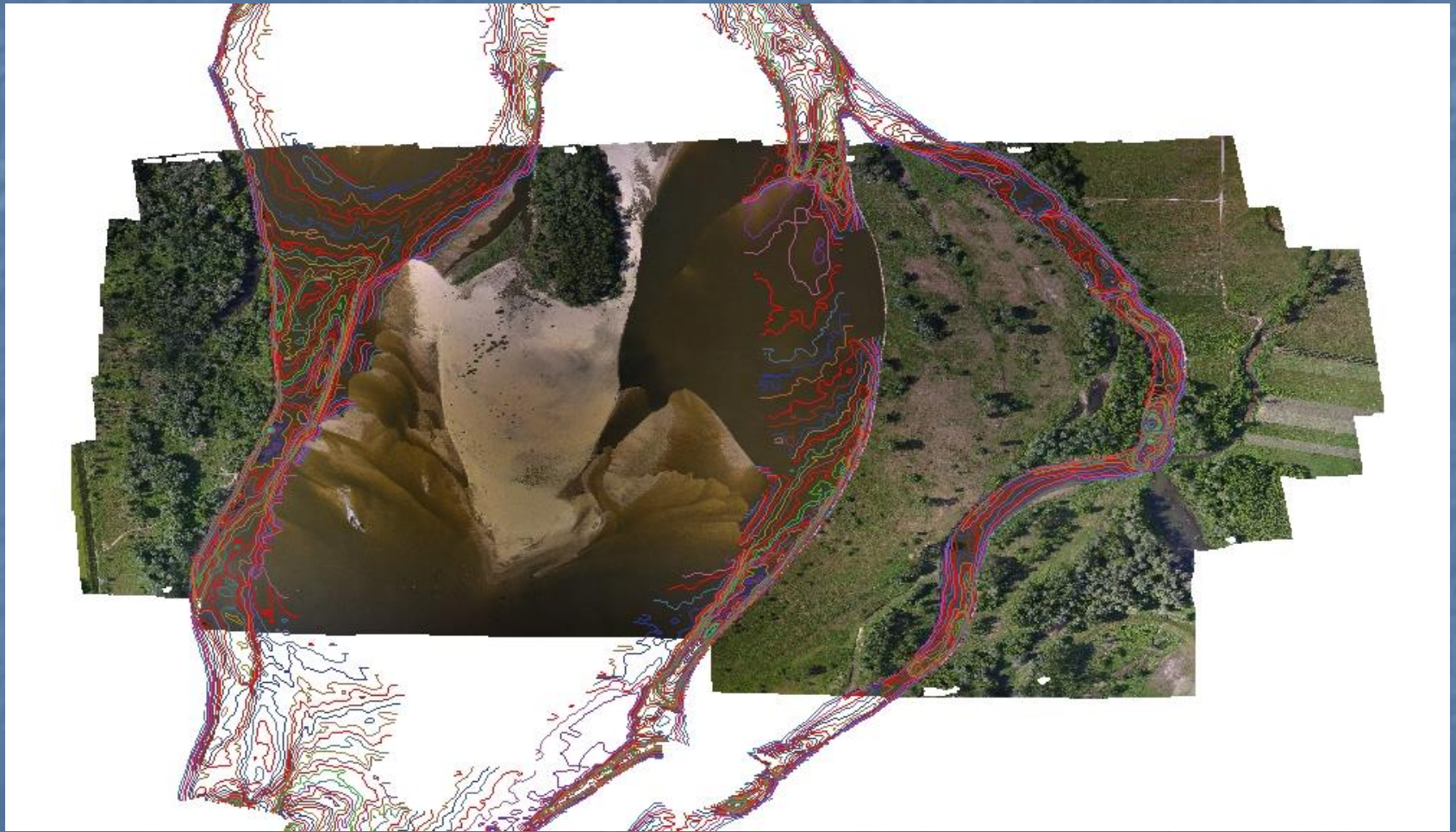
Mapping of large rivers
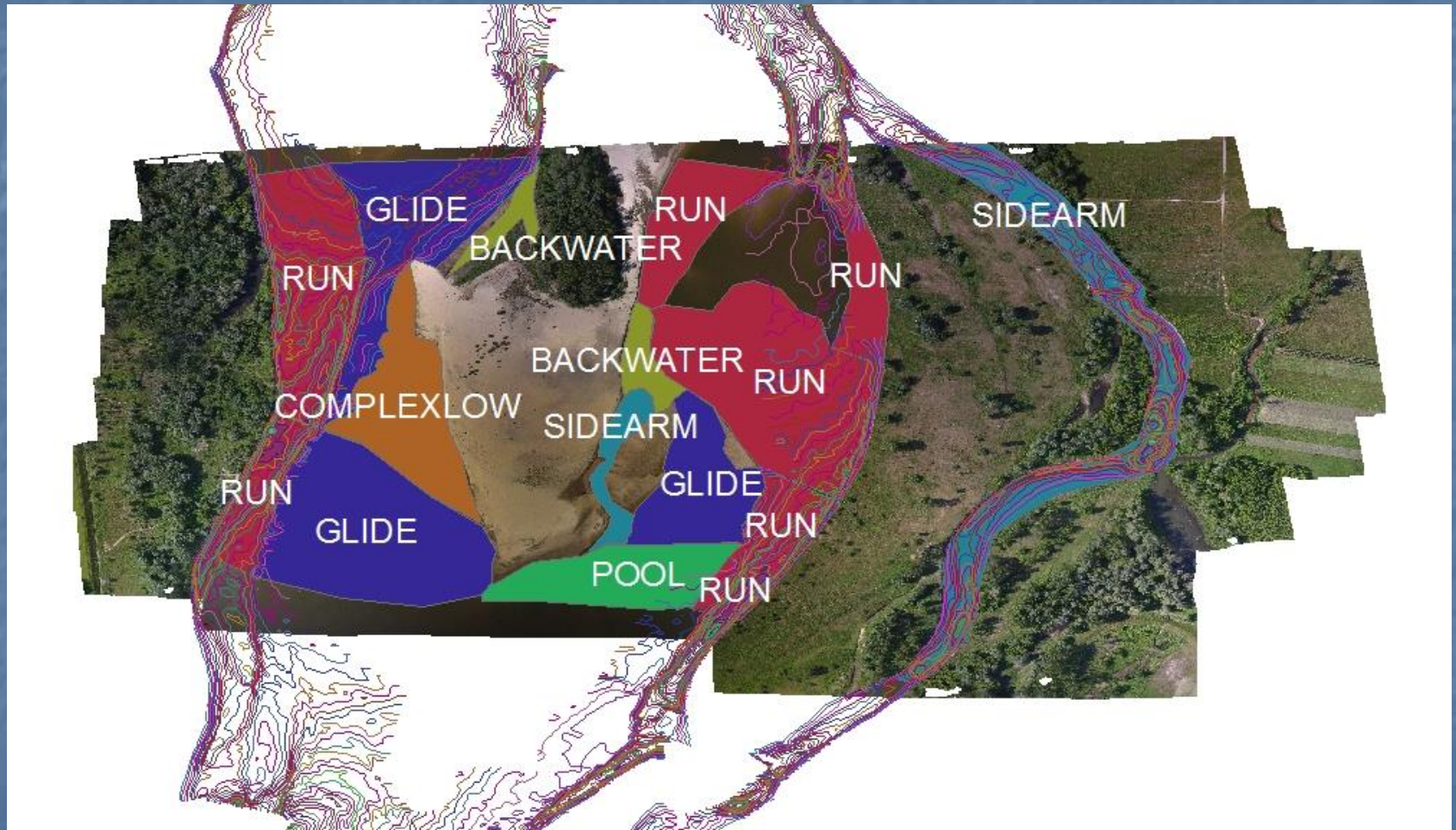

Middle Vistula River, 2016

Wisła River UAV photos

Wisła River UAV photos + bathymetry

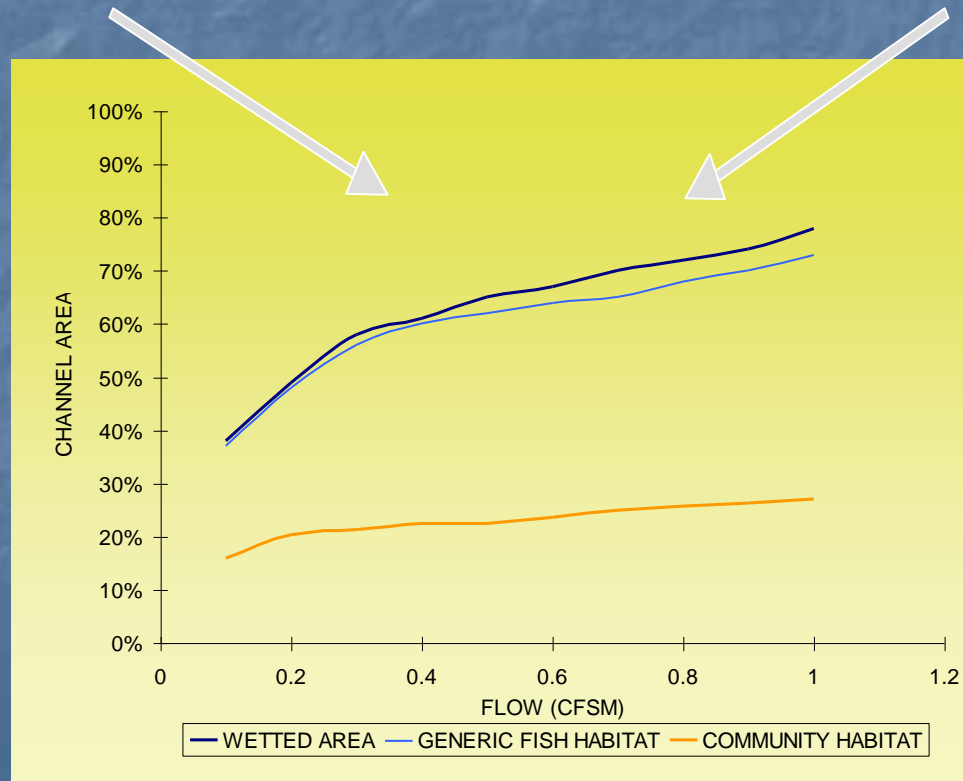# Wisła River UAV photos + bathymetry + HMU
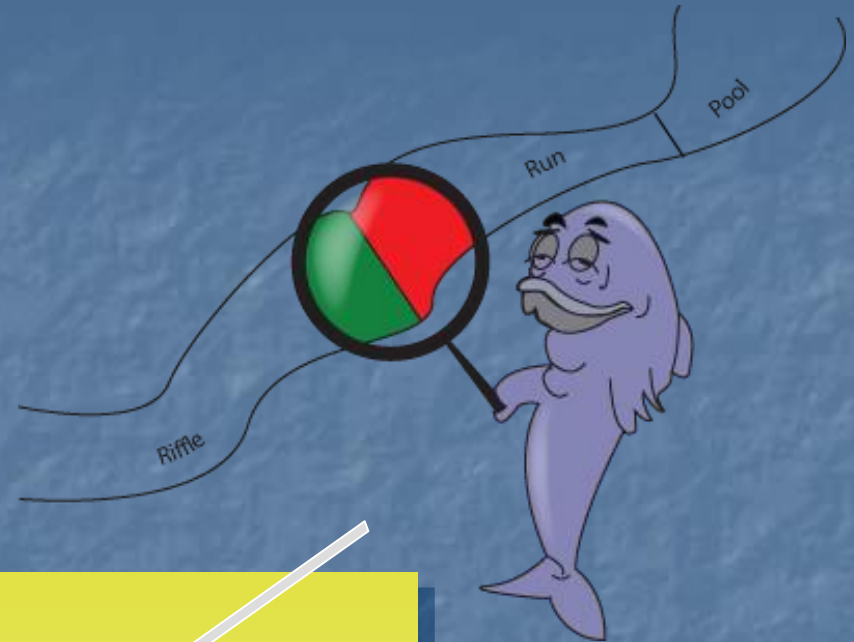
Remote areas

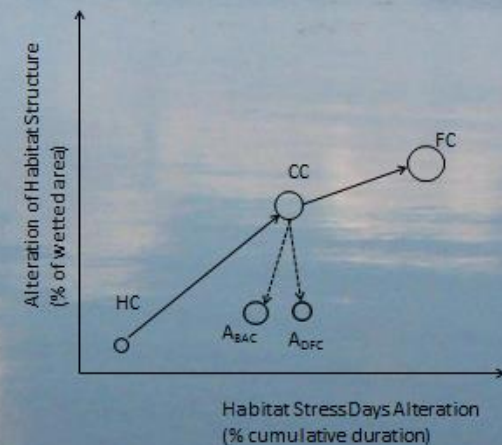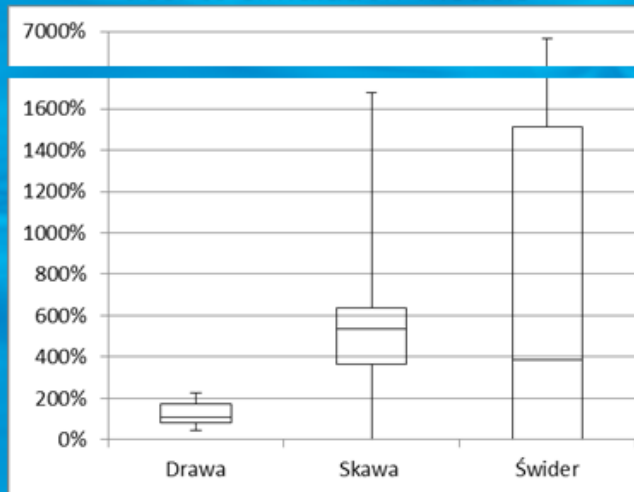# Jegrznia River Marshland

Jegrznia River Marshland

MesoHABSIM

T 2.2.3 Pan-European assessment of barrier impacts on sediment connectivity

- CAtchment Sediment Connectivity And DElivery (CASCADE) model
- Accounts for the nexus between sediment delivery and connectivity
- Based on remote sensed data
- Exploratory tool to project the impact of barriers on sediment connectivity

T 2.3 Modelling stream barrier effects under different scenarios of climate change
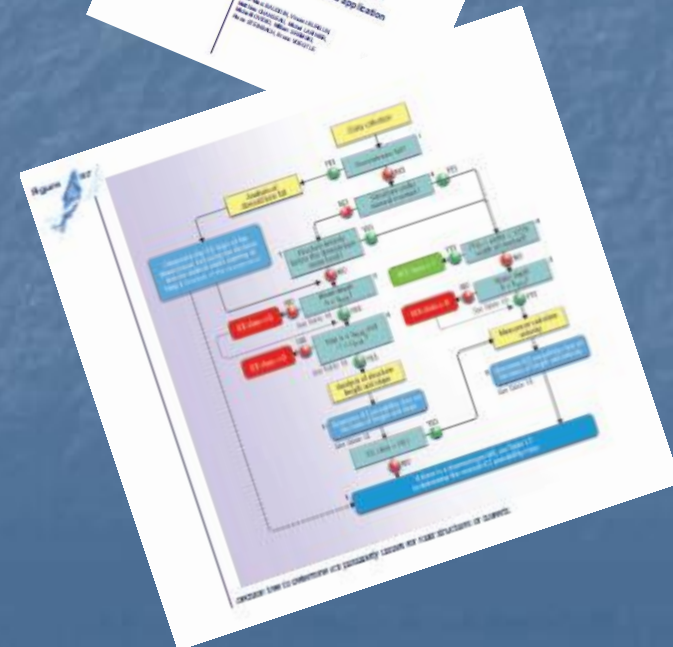
- Develop scenarios for impact of climate change on fragmentation in representative watersheds

- Habitat time series analysis

- Test model validity

- Apply Restoration Alternatives Analysis

Frequency increase of rare habitat deficits acc. to simulation models

Task 2.4 Development of European standards for barrier passability rapid assessment tool

- Critically review the current methods of barrier assessments in the EU and elsewhere.
- Advice from end users and industry partners:
    - Barrier assessment workshop Correspondence with academics associated with government agencies
- Assessment tool (MATLAB) – currently based on the French ICE protocol.

- Plans in place to:
    1) Test the ICE protocol using existing data at 200+ barriers in Ireland.

    2) Test all the key existing protocols in Europe (ICE , SNIFFER, ICF, SNIFFER v2) at barriers for which previous empirical passability data is available
    - i.e. mark-recapture / telemetry studies

- Combined results will allow formulation of a European standard for barrier passability assessment.
    - Stand-alone software with GUI

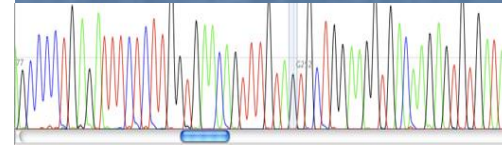# Task 2.5 Molecular toolkit: development of primers, protocols and pipelines

Organisms exude DNA – present in water samples

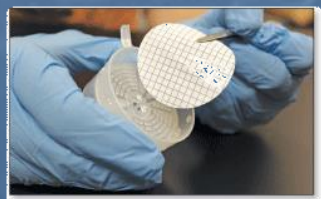Water filtered to capture DNA molecules

DNA extracted from the filter

PRIMERS

PCR PROTOCOLS

Conventional PCR

Next Generation Sequencing

Real Time PCR

Invasive species

Native macroinvertebrates
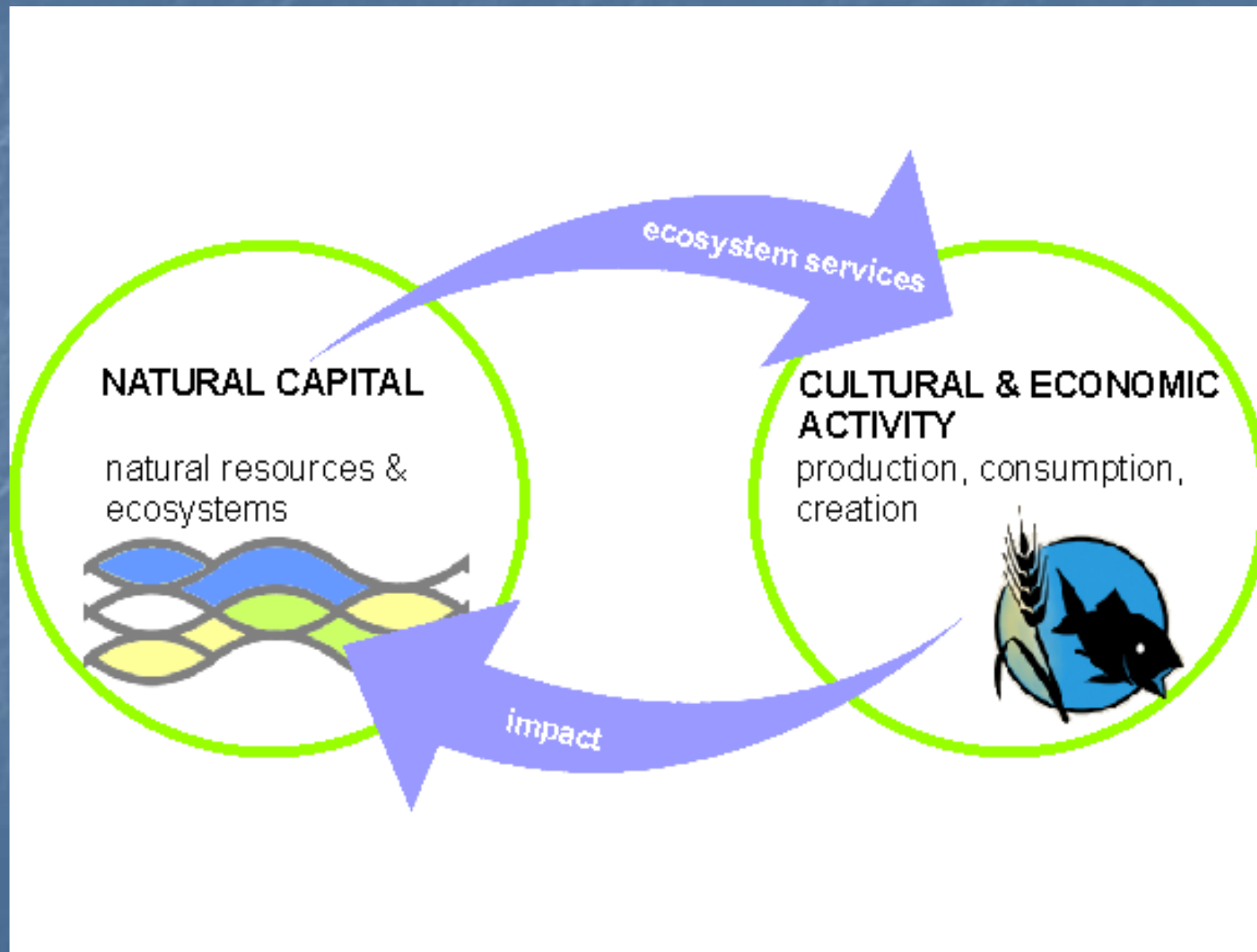
Native & exotic fish

T 2.6. Evaluation of Ecosystem Services affected by stream barriers - analytical framework

NATURAL CAPITAL

natural resources & ecosystems

ecosystem services

CULTURAL & ECONOMIC ACTIVITY

production, consumption, creation

impact

Area defined according to dam's EIA

T 2.6. Evaluation of Ecosystem Services affected by stream barriers - preliminary outline of methods

NATURAL CAPITAL

GIS analysis of superimposed: habitat location / vegetation / land use

Assessment of the existing value of the environment, and the places were it can potentially be enhanced / decreased with barriers.

FOCUS: aquatic / terrestrial biodiversity, water regulation, nutrient cycling, provision

ECOSYSTEM SERVICES

1-2 workshops with representative stakeholders

To define key ES in case study

To associate ES with land use types

To identify location of hot-spots of key ES delivery

To identify bundles of ES & trade offs

CONFLICTS

1 workshop with stakeholders

To define (fuzzy cognitive mapping) dependencies of stakeholders groups upon ES
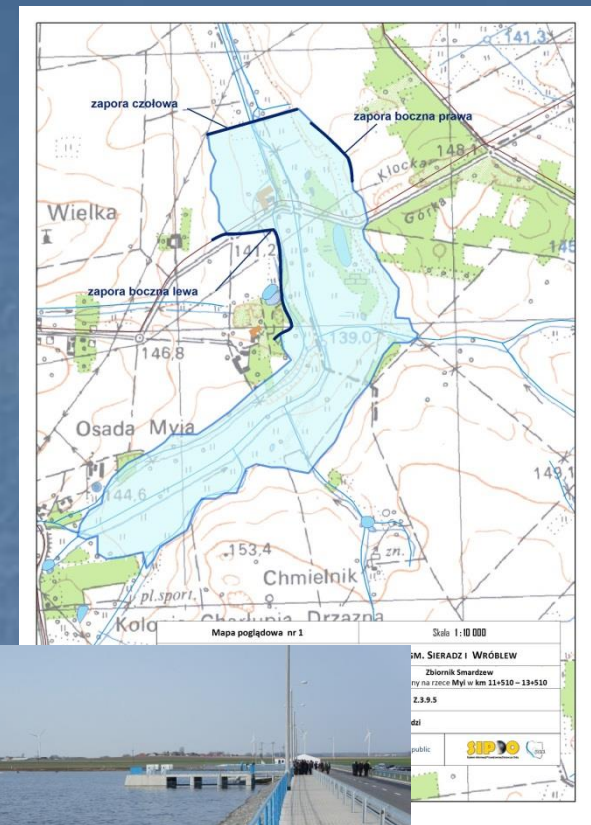
To identify stakeholders depending on conflicting ES

Collective analysis of decision options to reconcile critical ES needs (MCDA)

The Polish test case study – the Smardzew Reservoir on the Myja River

- The newest reservoir (2013): ability to use local „memory" for assessment of changes in ES delivery, and related conflicts;
- purpose: flood protection, small retention, irrigation;

- Basin: **Oder**
- The length of the reservoir: **2,4 km**
- The surface of the reservoir: **65 ha**
- The capacity of the reservoir: **1,4 mln m³**
- The area of the catchment: **ca. 93,8 km²**
- Average depth: **ca. 2,5 m**
- Maximum depth: **3,8 m**

Foreseen stakeholder groups for ES analysis:
Farmers, foresters, tourist service, environmentalists, traders, decision makers

Next steps

- Tasks 2.2., 2.4., 2.5 and 2.6 aim towards establishing joint Application Manual
- Training for WP4 (case studies) teams.
- Task 2.6 – feasibility check of documentation on small test areas