

Restoration of the Danube River Basin for ecosystems
and people from mountains to coast



Four dimensions of river continuity and the first ECOSTAT assessment on the Danube River Basin

Free-flowing Rivers Restoration Conference

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CIVITTA



DANUBEPARKS
network of protected areas

Deltares



PML | Plymouth Marine Laboratory



UNIVERSITY of STIRLING

viadonau



WORLD FISH MIGRATION FOUNDATION








Strategy for connectivity assessment










Connectivity types

Dimensions

-  ▶ Longitudinal
-  ▶ Lateral
-  ▶ Vertical
-  ▶ Temporal

Aspects

-  ▶ Flow
-  ▶ Sediment
-  ▶ Biota
-  ▶ Physicochemical
-  ▶ Nutrient












AI-generated image



Connectivity assessment matrix

Complex picture, yet to be understood.

X – the commonly investigated perspectives

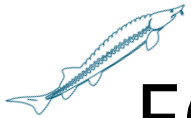
		Aspects				
						
Dimensions		X	X	X		
						
						
						



FREE-FLOWING RIVER METHODOLOGY

Connectivity assessment by ECOSTAT developed methodology





ECOSTAT – FFR method

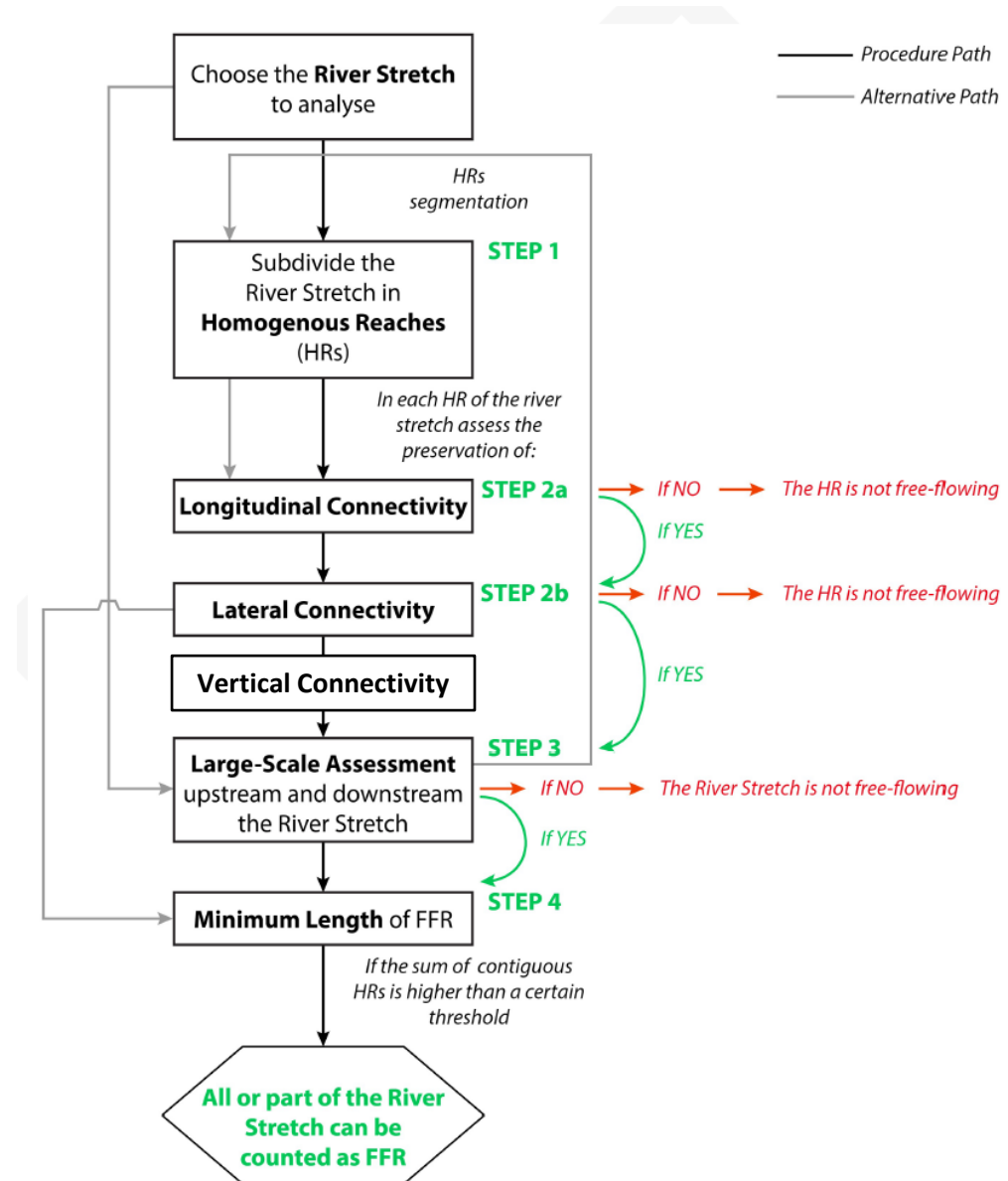
It follows the next four steps, not necessarily in the following order:

Step 1 – Identification of **homogenous river reaches** within the potential FFR stretch

Step 2 – Homogeneous reach assessment
Addressing longitudinal connectivity
Addressing lateral connectivity
Addressing vertical connectivity

Step 3 – Large-scale assessment of upstream and downstream pressures

Step 4 – Minimum length of FFR stretch





Connectivity assessment in Danube4ALL










Basis: application of **ECOSTAT - FFR method**

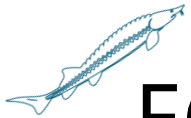
Specific: project extension of **ECOSTAT – FFR** focusing on sediments

- **Improved longitudinal assessment**
- **Improved vertical assessment**

Specific: demonstration of **Earth Observation (EO) products** to for connectivity assessment

Specific: conceptualization of temporal connectivity assessment

					
	x ⁺	X ⁺	X	x	
	x ⁺	X	X	x	
	x ⁺	X ⁺			
	x	x	x	x	x



ECOSTAT – FFR method

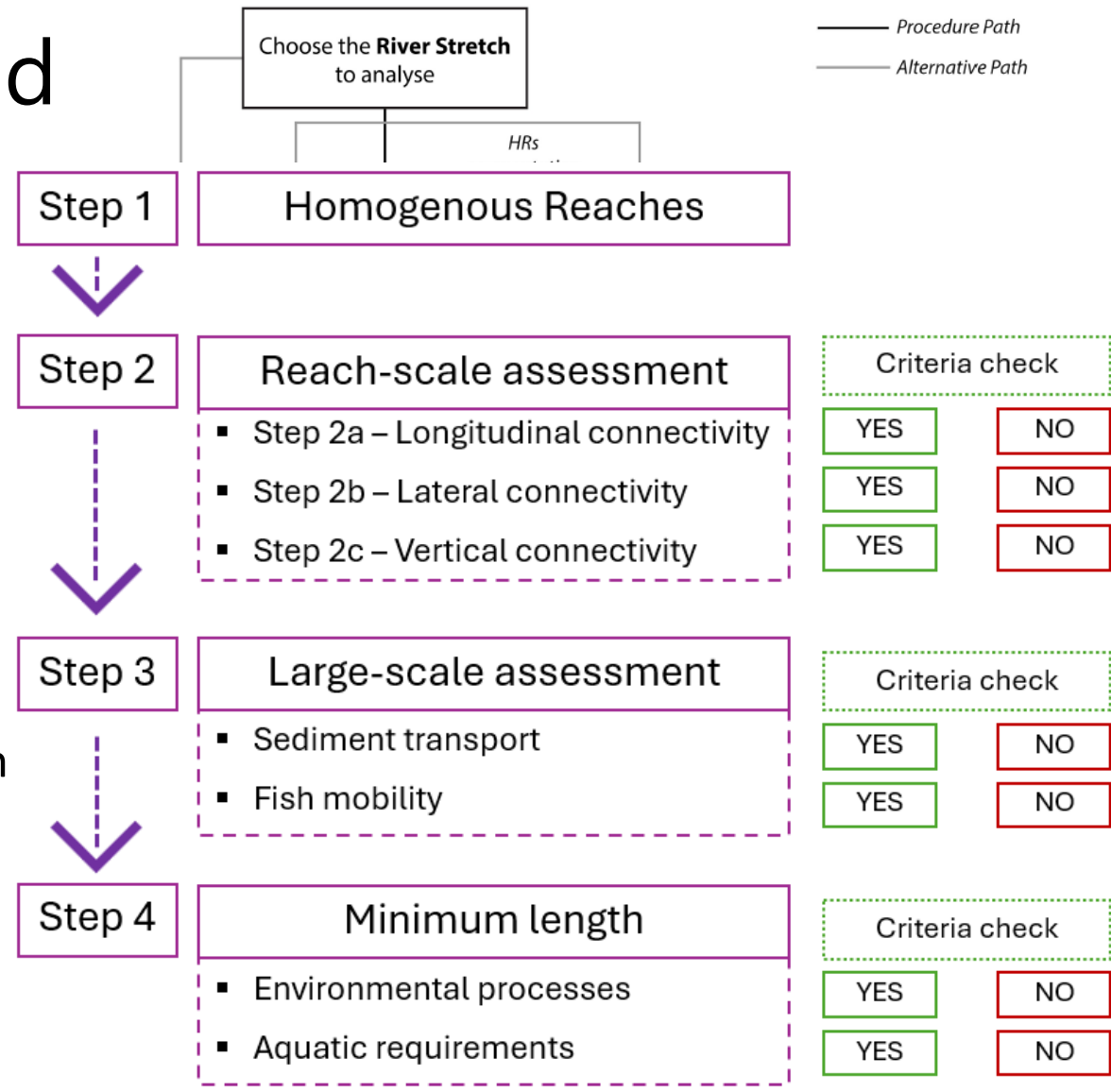
It follows the next four steps, not necessarily in the following order:

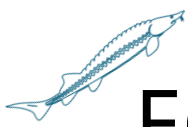
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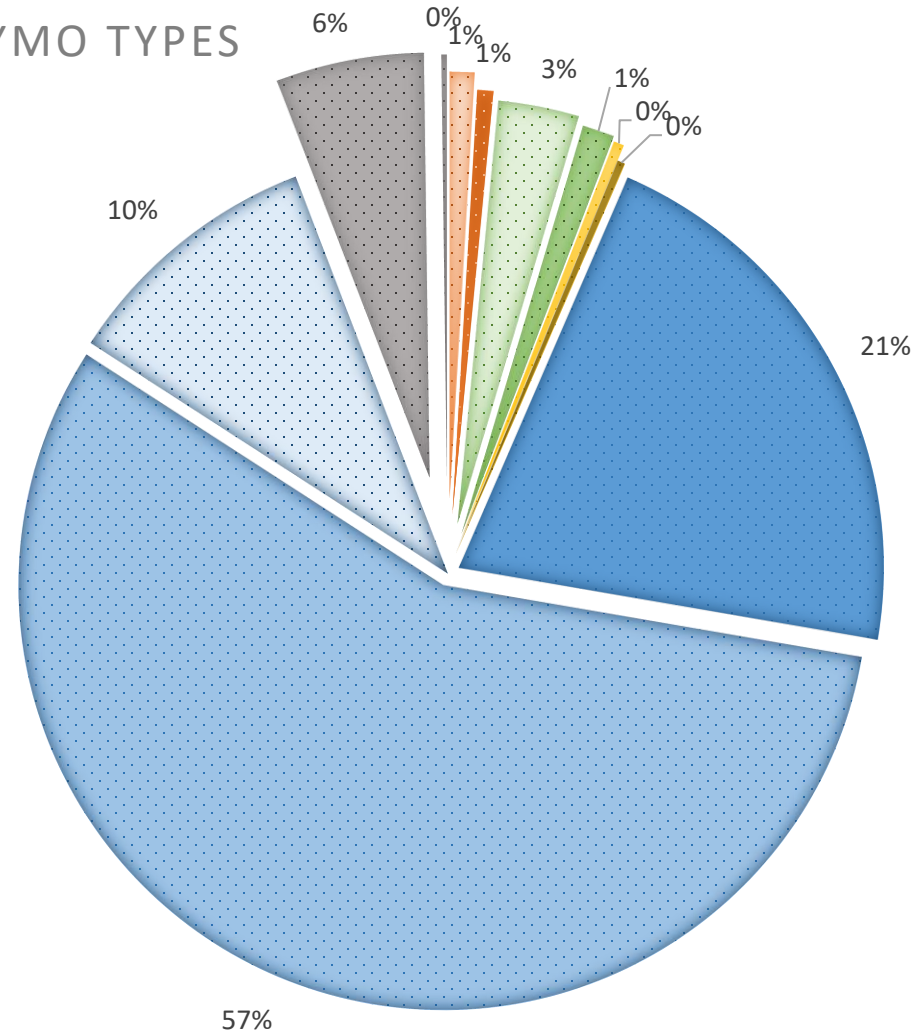


ECOSTAT FFR – Preparatory work

Hydro-morphological classification of river reaches

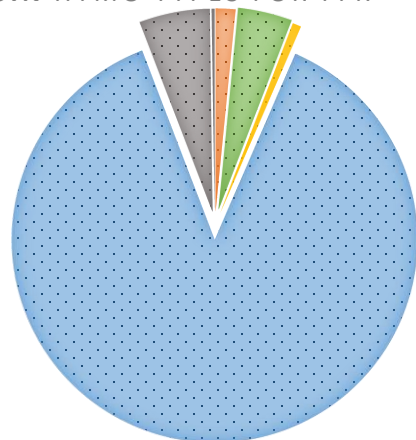
DANUBE RIVER BASIN HYMO TYPES

- Braided
- Island-Braided
- Wandering
- Pseudo-meandering
- Anabranching (high energy)
- Anabranching (low energy)
- Straight
- Sinuuous
- Meandering
- Impoundment



DANUBE RIVER BASIN HYMO TYPES FOR FFR

- Braided
- Transitional
- Anabranching
- Single-thread
- Impoundment
- Artificial

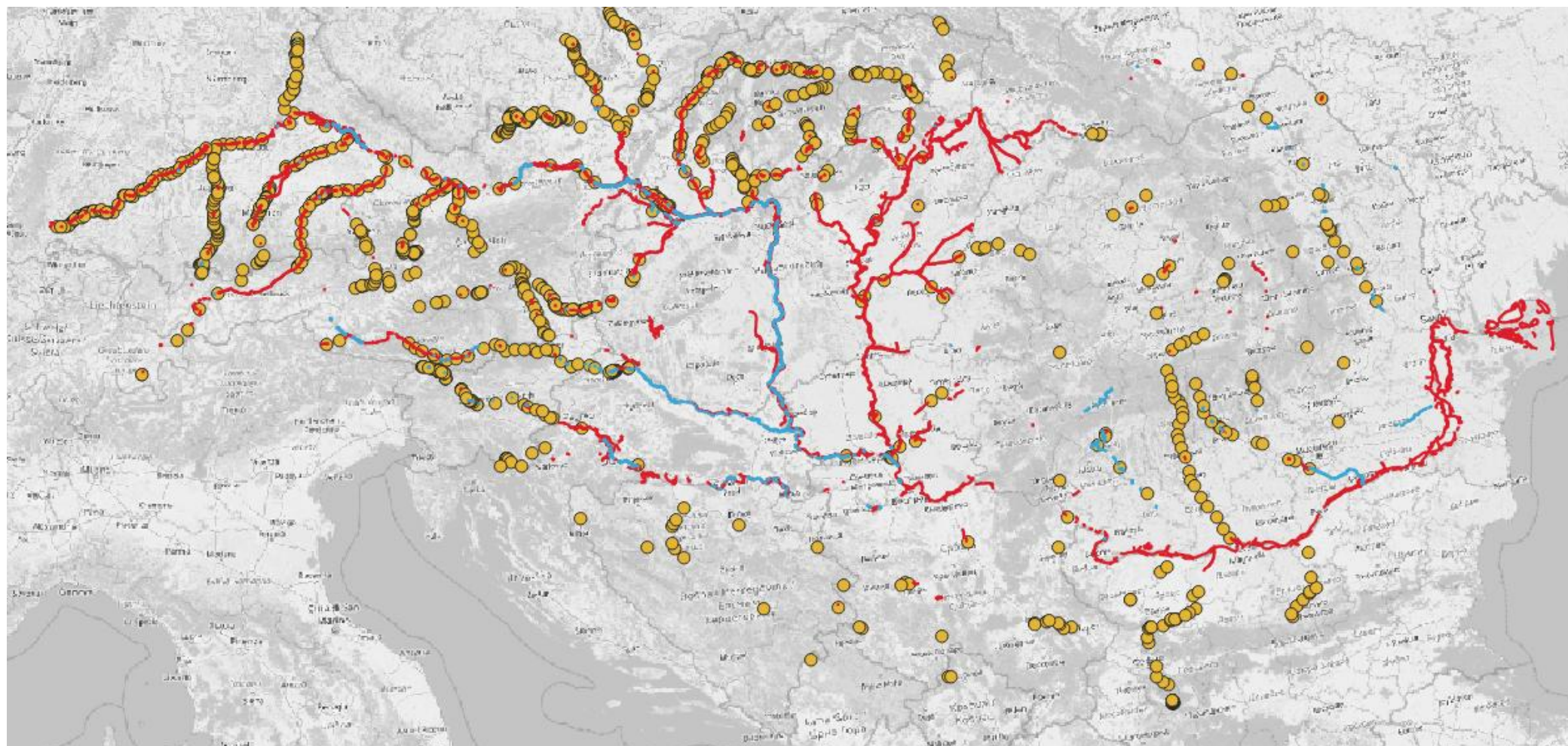


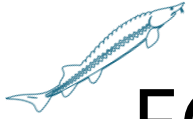


ECOSTAT FFR – Preparatory work

Assembling barrier dataset

- Danube Sediment dataset,
- Danube GIS (ICPDR),
- Global Dam Watch,
- Electronic Navigational Charts, ...





ECOSTAT – FFR: preliminary results

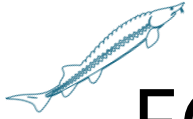
Reach-scale assessment on fish mobility

FFR Step 2a - Addressing longitudinal connectivity: Fish mobility check



Note: the presented results are not finalized, and as such they do not represent the consensus of the partners, yet!





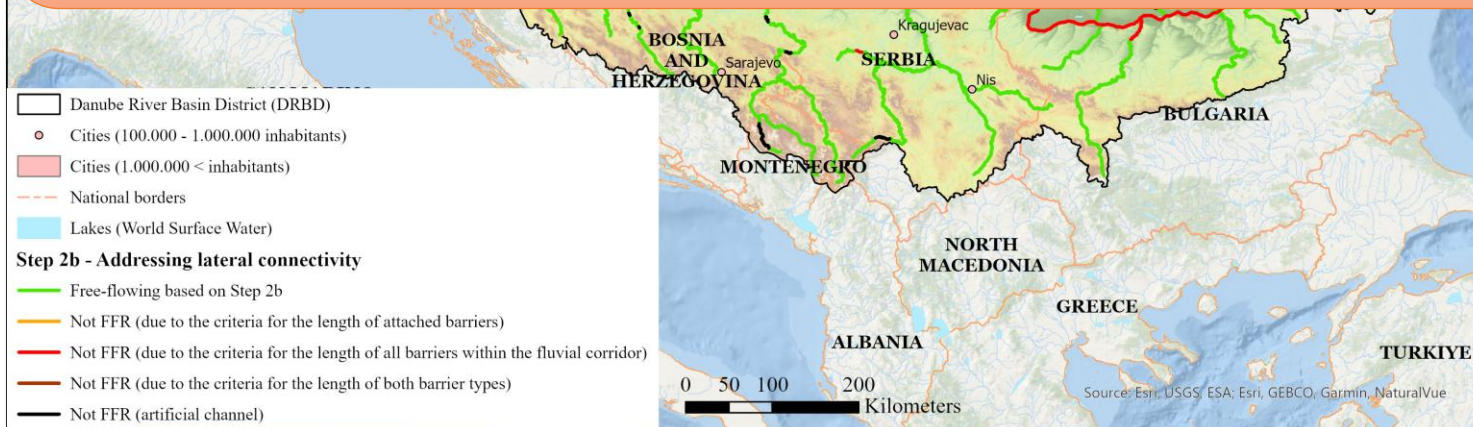
ECOSTAT – FFR: preliminary results

Reach-scale assessment on lateral connectivity

FFR Step 2b: Large-scale assessment of lateral connectivity



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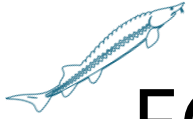
- Danube River Basin District (DRBD)
- Cities (100.000 - 1.000.000 inhabitants)
- Cities (1.000.000 < inhabitants)
- National borders
- Lakes (World Surface Water)
- Step 2b - Addressing lateral connectivity**
- Free-flowing based on Step 2b
- Not FFR (due to the criteria for the length of attached barriers)
- Not FFR (due to the criteria for the length of all barriers within the fluvial corridor)
- Not FFR (due to the criteria for the length of both barrier types)
- Not FFR (artificial channel)

0 50 100 200 Kilometers

Source: Esri, USGS, ESA, Esri, GEBCO, Garmin, NaturalVue



SOURCE: ECOSTAT EC, 2024



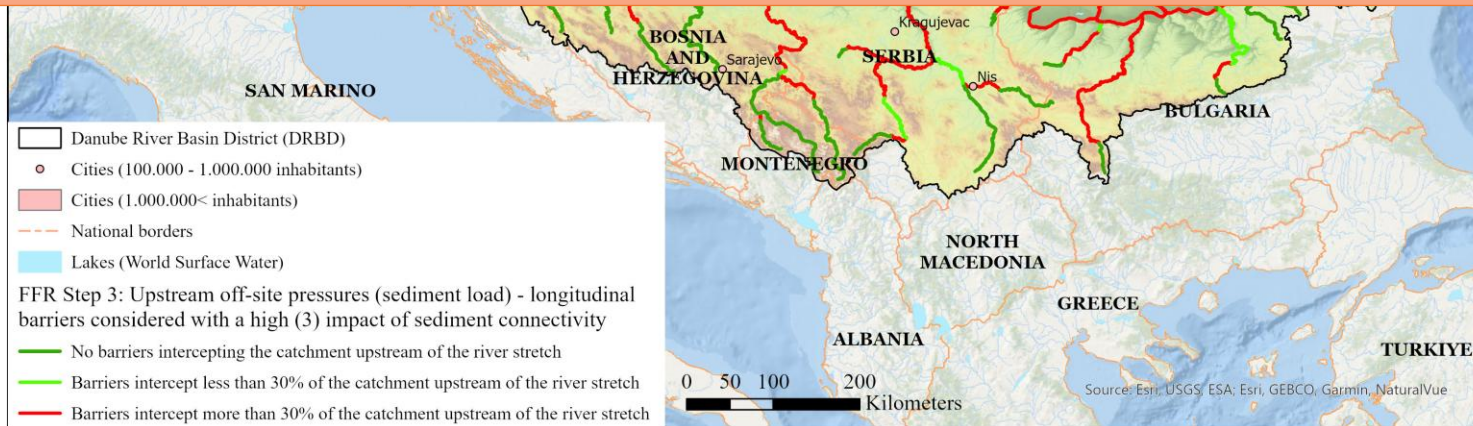
ECOSTAT – FFR: preliminary results

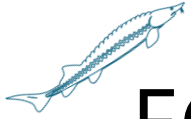
Large-scale assessment of sediment transport

FFR Step 3: Large-scale assessment of upstream off-site pressures (sediment load)



Note: the presented results are not finalized, and as such they do not represent the consensus of the partners, yet!





ECOSTAT – FFR: preliminary results

Overall assessment

Free flowing river reaches in the Danube River Basin



Across the assessed river network, there are:

Impounded: ca. 6%

FFR: ca. 9%

Not FFR: ca. 85%

Note: the presented results are not finalized, and as such they do not represent the consensus of the partners, yet!



A wooden boardwalk with railings leads from the foreground towards a large body of water. The water is blue with patches of bright green algae or vegetation. In the background, there are hills under a clear blue sky. A teal rounded rectangle is overlaid on the top left of the image, containing the text 'TAKE HOME MESSAGES' in white, bold, uppercase letters.

TAKE HOME MESSAGES

- ▶ River connectivity is a multi-dimensional topic
- ▶ ECOSTAT FFR method provides a novel basis for connectivity assessment
 - ▶ still under development
- ▶ Applications across riverbasins are challenging but they are able to provide exceptional insights on current status



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EU MISSIONS
RESTORE OUR OCEANS & WATERS
Concrete solutions for our greatest challenges

Thank you!

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