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Ecohydrology from Theoretical Background to Cost Efficient Advanced Nature based Solutions

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Professor MACIEJ ZALEWSKI

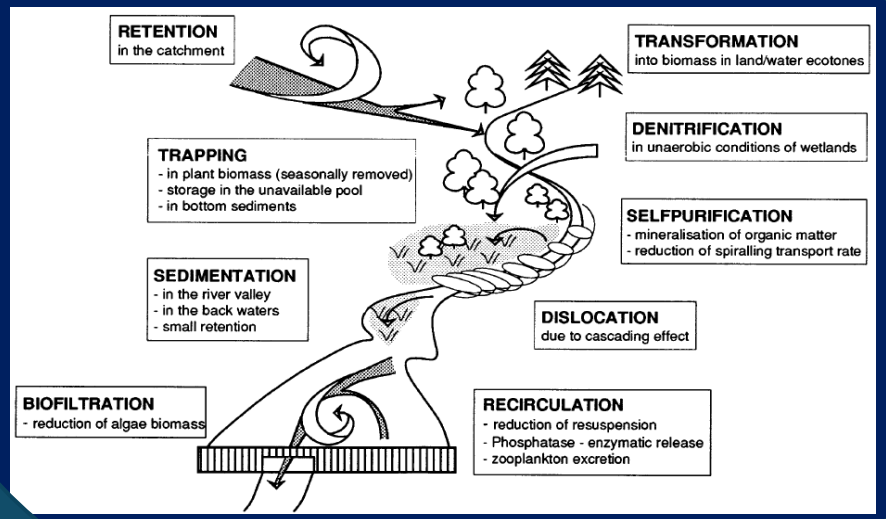
European Regional Centre for Ecohydrology PAS u/a UNESCO

Editor in Chief International Journal „ECOHYDROLOGY & HYDROBIOLOGY" Elsevier

Chairman „Ecohydrology and Water Quality" UNESCO IHP IX

Vice Chaiman „ Water4All" European Comission

DUAL REGULATION



Advanced NbS

Sustainable Future !!!

Challenges for WATER Management

1/ Accelerating global changes

2/ Increasing complexity of the interplay „water-ecosystems –society”

3/ **Fragmentation of knowledge, values and efforts**

4/ „Finacial gap” between needs and possibilities

5/ Necessity for devlopment Low cost Advanced NBS and systemic solutions

6/ Unequal potential for creation and adaptation to local specific

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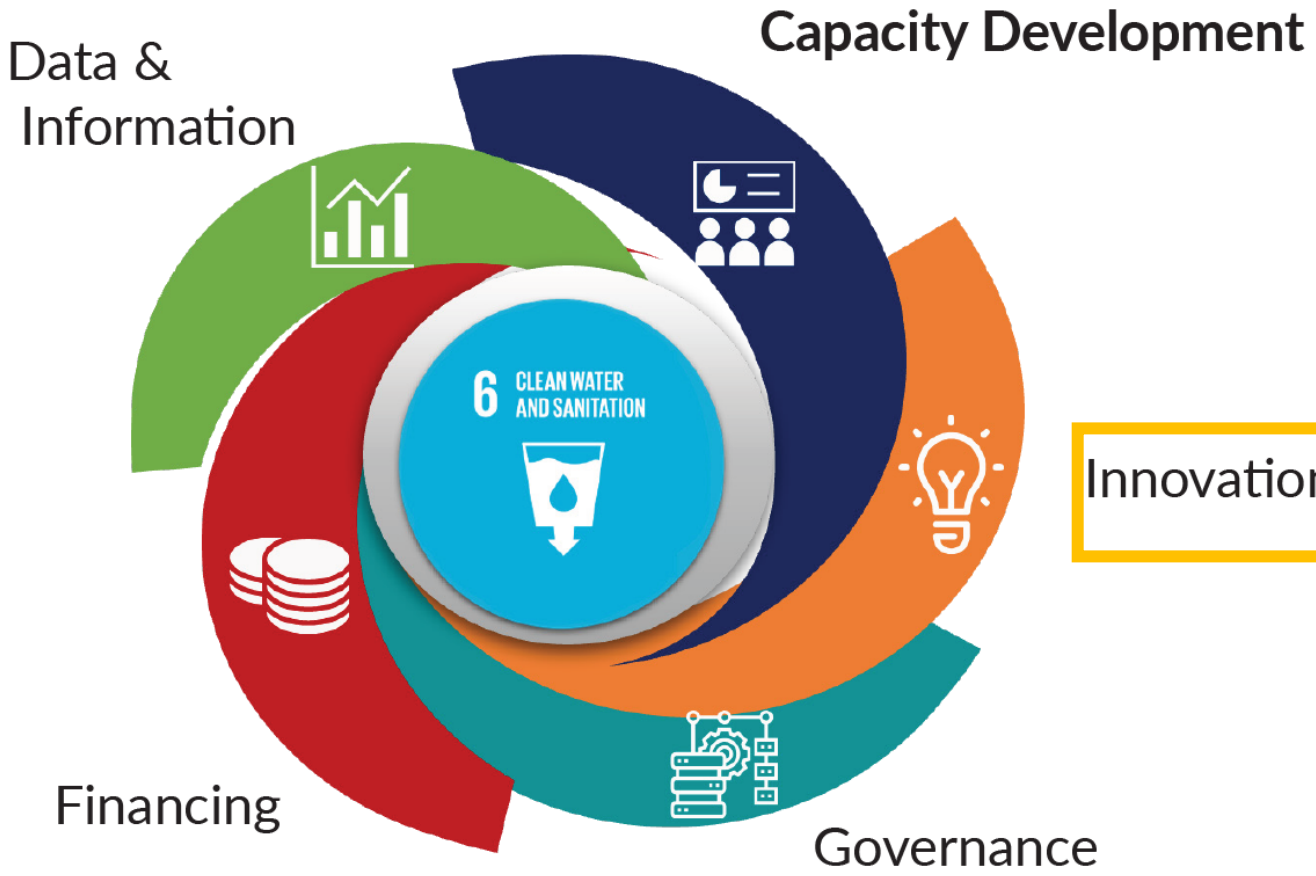
Why TRANSDISCIPLINARY ECOHYDROLOGY become one of the major Game Changers for acceleration of SDG ?

(„ Nature" Synthesis NY Conference on WATER March 2023



Innovation →

1/ Paradigm change

2/ LIFE SUPPORTING PROCESESS

2/ ADVANCED Nature Based Solutions

3/ ENHANCEMENT Sustainability **WBSR**

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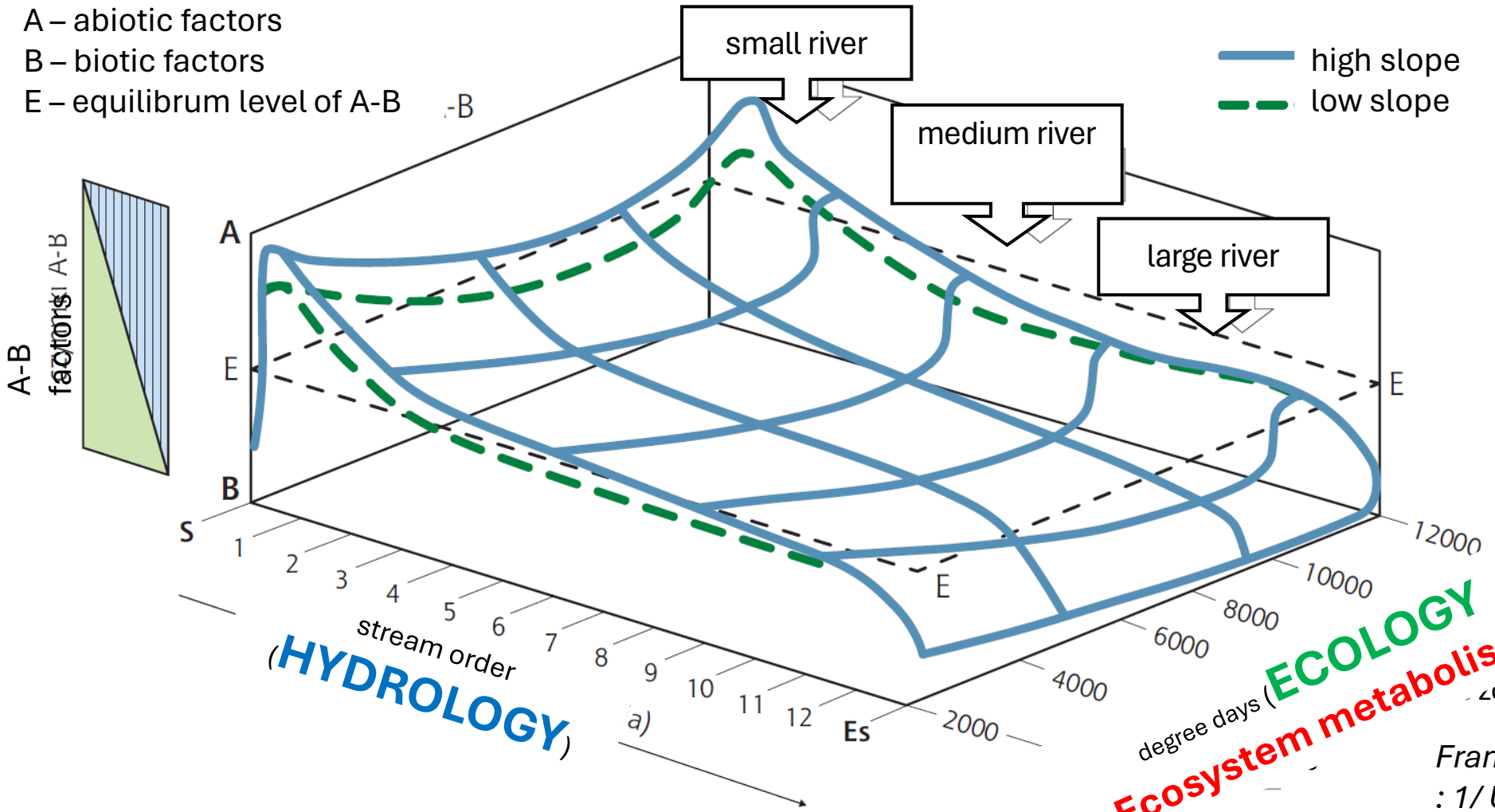
UNESCO Chair on Ecohydrology and Applied Ecology, University of Lodz, Poland

Model of Abiotic-Biotic Regulation of Riverine Ecosysem – initial framwork for Ecohydrology

(Zalewski i Naiman 1985)

A – abiotic factors
B – biotic factors
E – equilibrum level of A-B



RIVER SYSTEM

ABRC Model :
1/Integration river continuum hydraulics with river metabolism

2/Understanding hierarchy of drivers (ABIOTIC vs. BIOTIC) necessery for:

-ADVANCED NBS

- SYSTEMIC SOLUTIONS.

Framwork for
: 1/ UN FAO „Habitat Modification and Freshwarter Fisheries" 1984-2004
2/UNESCO IHP „ECOHYDROLOGY"

EH Process oriented thinking - Industrial agriculture and its effect on WATER MEZOCYCLE

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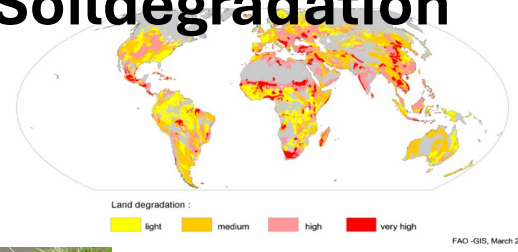
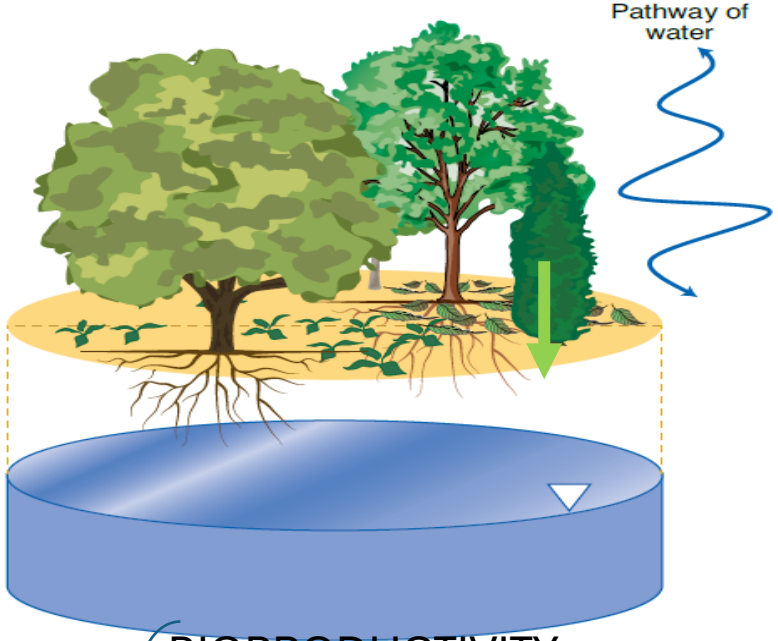
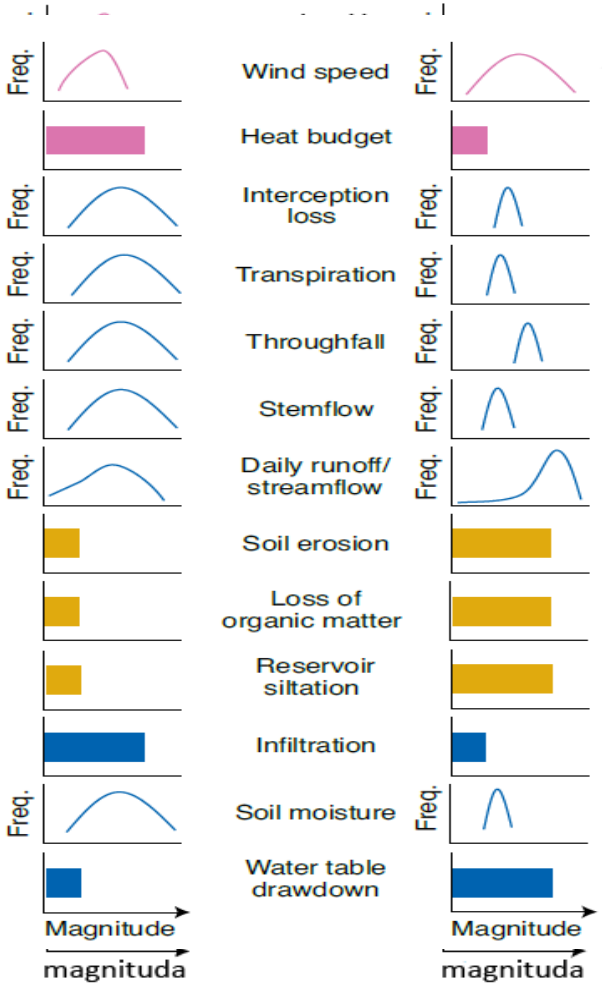
Homogenisation of agricultural landscape and high efficency buffering denitrification zone

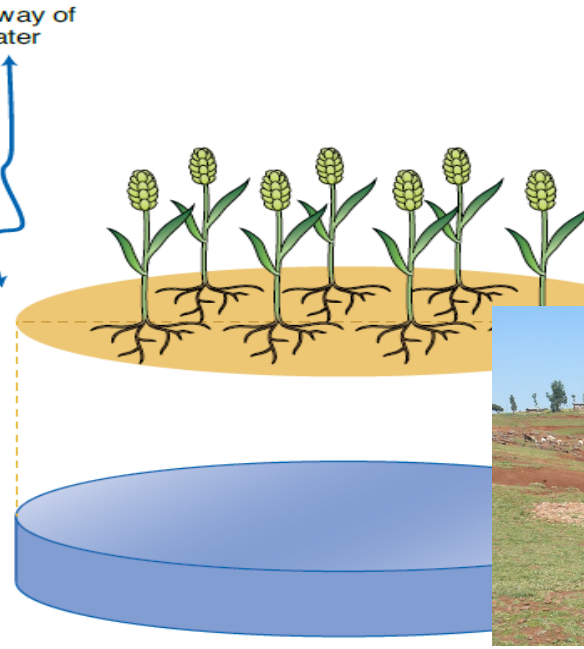
Soildegradation

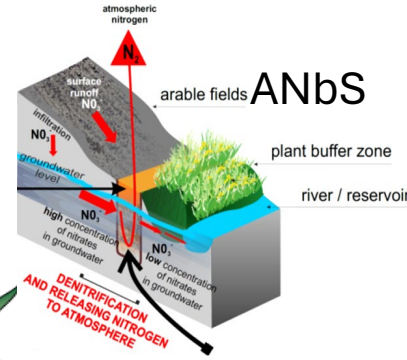


Natural vegetation









ANbS

3x B
- BIOPRODUCTIVITY
- BIODIVERSITY
- BIOCOMPLEXITY

NATURE (Levia..... Zalewski. 2020)

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Nature based Solutions vs. Ecohydrological Advanced Nature Based Solutions

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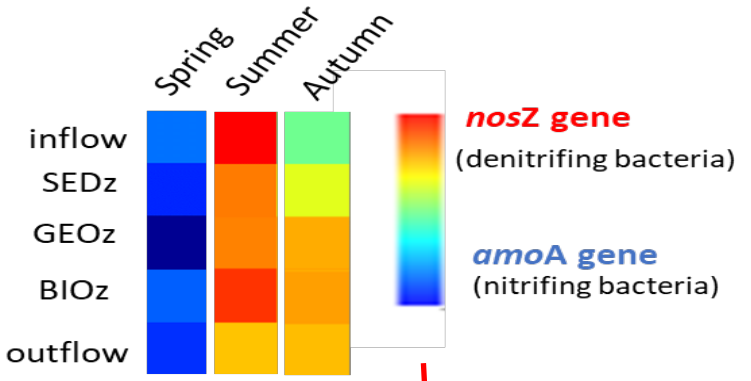
NbS



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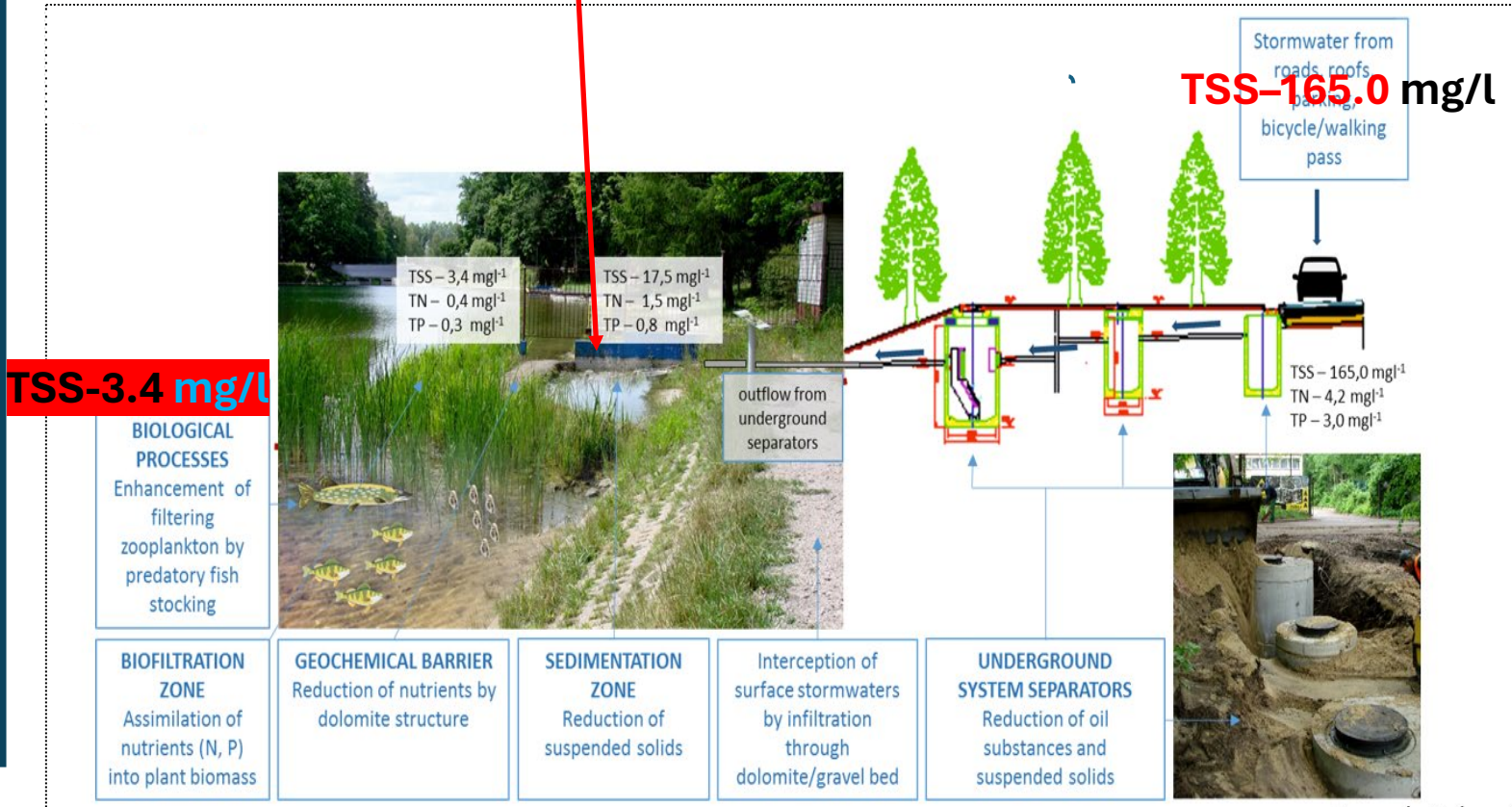

Jurczak, Zalewsk

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How to mantain river continuum, enhance the retention of water in river valley, avoiding toxic algal blooms in reservoir ?

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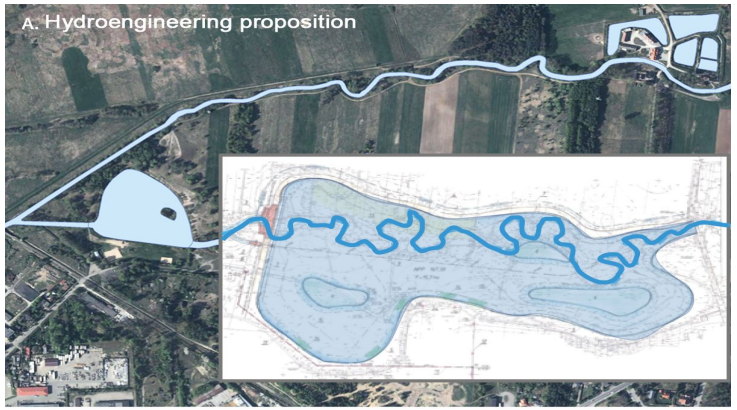
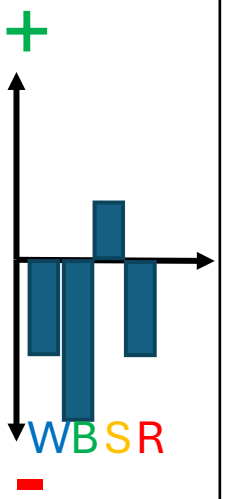
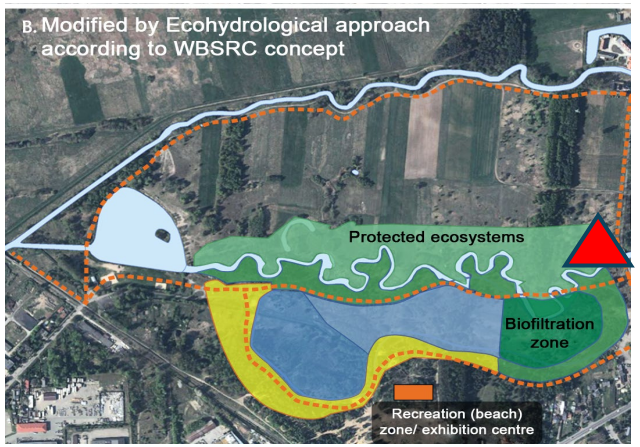
EH - Advanced Nature Based Solutions-

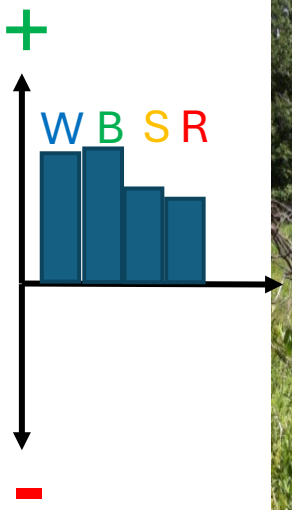
LATERAL RESERVOIR





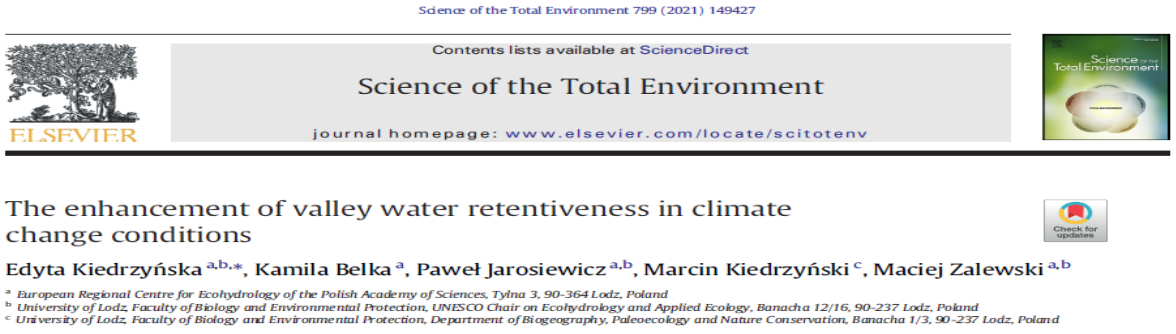
HYDRO ENGEENERING





EH LATERAL RESERVOIR

(Zalewski 2020, Kiedrzyńska et al. 2021)



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The enhancement of valley water retentiveness in climate change conditions

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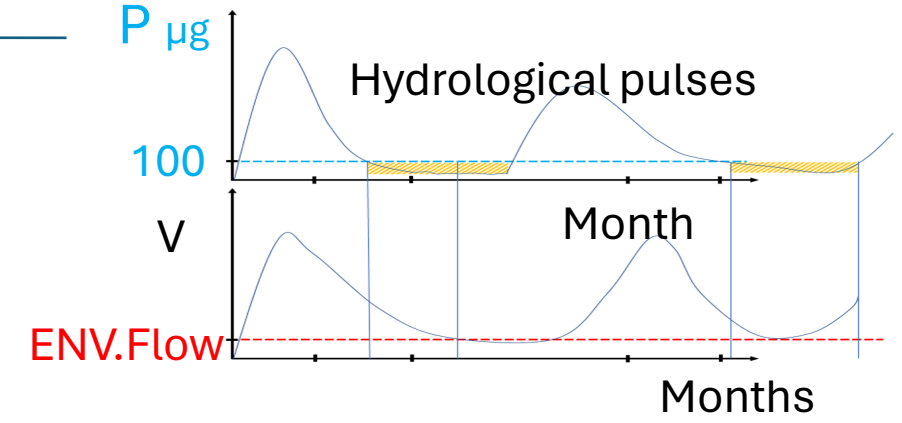
[c] University of Lodz, Faculty of Biology and Environmental Protection, Department of Biogeography, Paleoecology and Nature Conservation, Banacha 1/3, 90-237 Lodz, Poland



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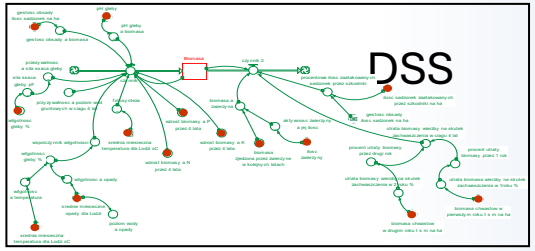
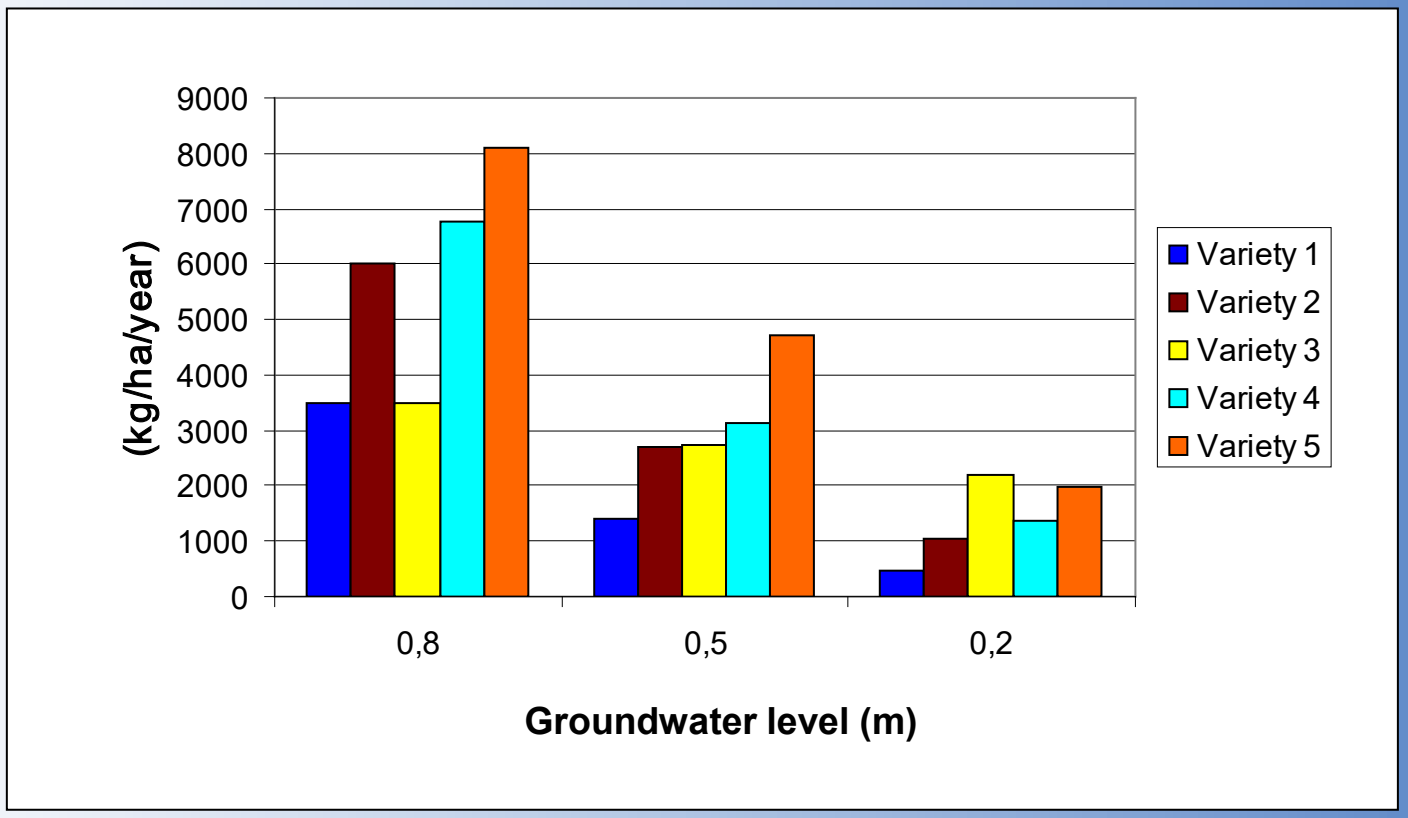
Conversion of sewage sludge in to bioenergy - circular economy

Integration of knowledge

Groundwater level + reduction of toxicity of sludge + optimal selection of willow variety can increase economic effciency **up to 20 times**





Min.

470

Max.

8100

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Supporting technology for Advanced Nature based Solutions - High efficency absorbent for nutrients and pollutants

BIOKER for the removal of pollutants

Reduction of phosphates up to 70% in the semi-natural field experiment in the Tresta Research Station of the Departemtn of Applied Ecology UŁ

Concours Lépine International
Paris 2018

Innovation Voucher (PL: Bon na Innowacje) founded by the Polish Agency for Enterprise Development (PARP) for the development and optimisation of the BioKer (budget 497 000 PLN)

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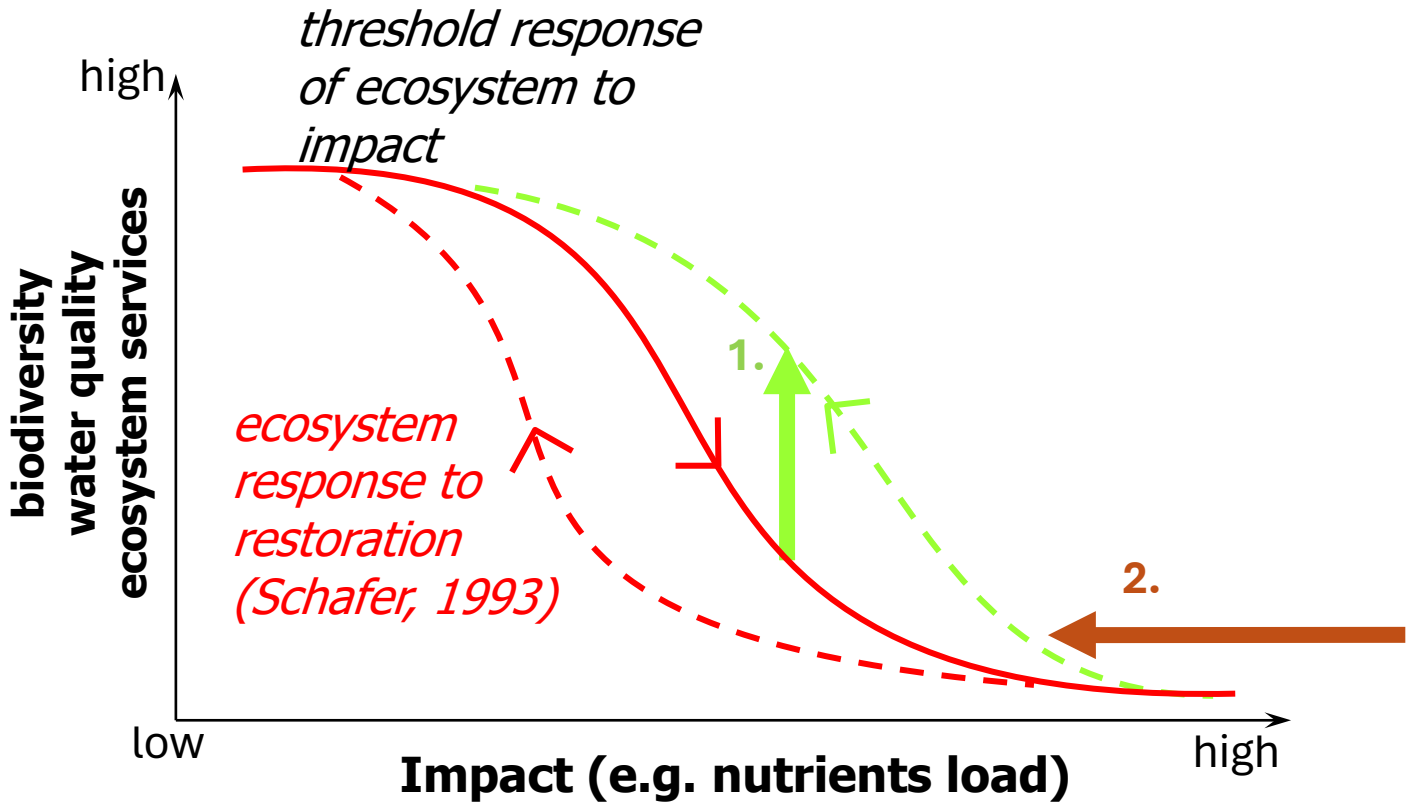
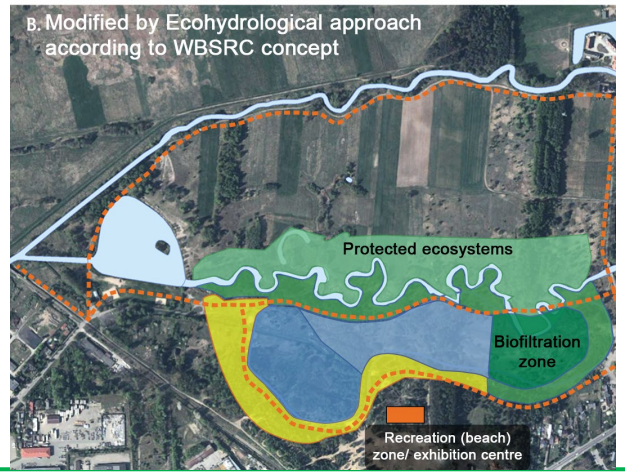
UNESCO Chair on Ecohydrology and Applied Ecology, University of Lodz, Poland

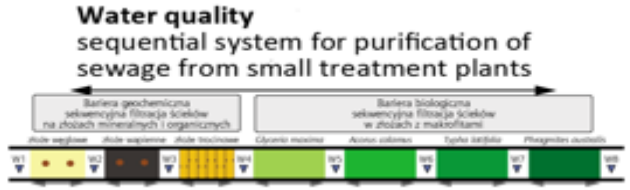
Ecohydrology ANbS :

1/ impact reduction
2/ resilience enhancement
3/ reduction of costs,
4/ Enhancement of WBSR

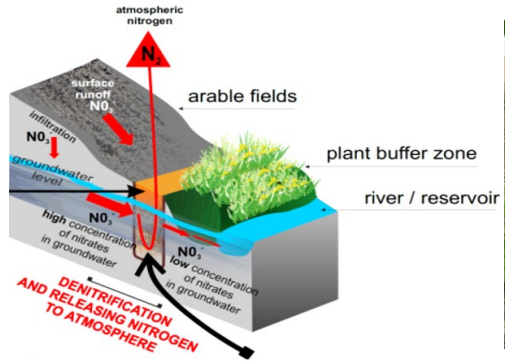


1 Enhancement of ecosystem resilience





2. Non source pollution reduction by ecotone



Ecohydrology Lab Network u/a UNESCO IHP –

Proposal (Stafano Fazi NRCI & Pawel Jarosiewicz (ERCE)

Tiber River demo-site, Italy

Field implementation in progress

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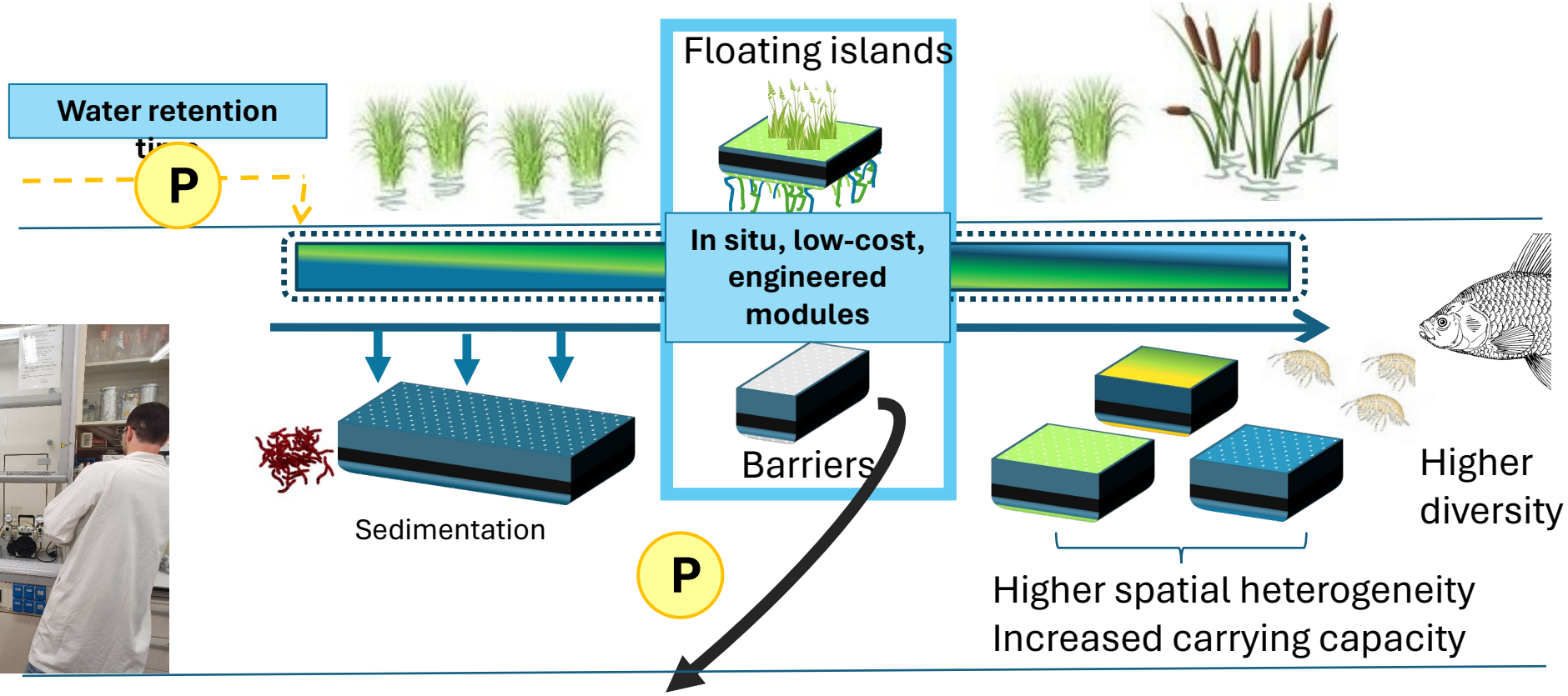
Pilica River and Radom demo-sites, Poland

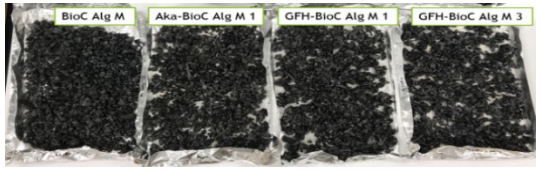
Advanced education MEH (financed by European Comission Universities and UNESCO Centres :Algarve,Lodz,Delft Antverpen (Leader: Prof. Luis Chicharo)

Advanced Ecohydrological Nature-based Solutions for water purification and integration with Circular Economy (Jarosiewicz, Fazi and Zalewski, 2022)



New materials to close the loop of nutrients

Iron coated materials (e.g. Biochar)

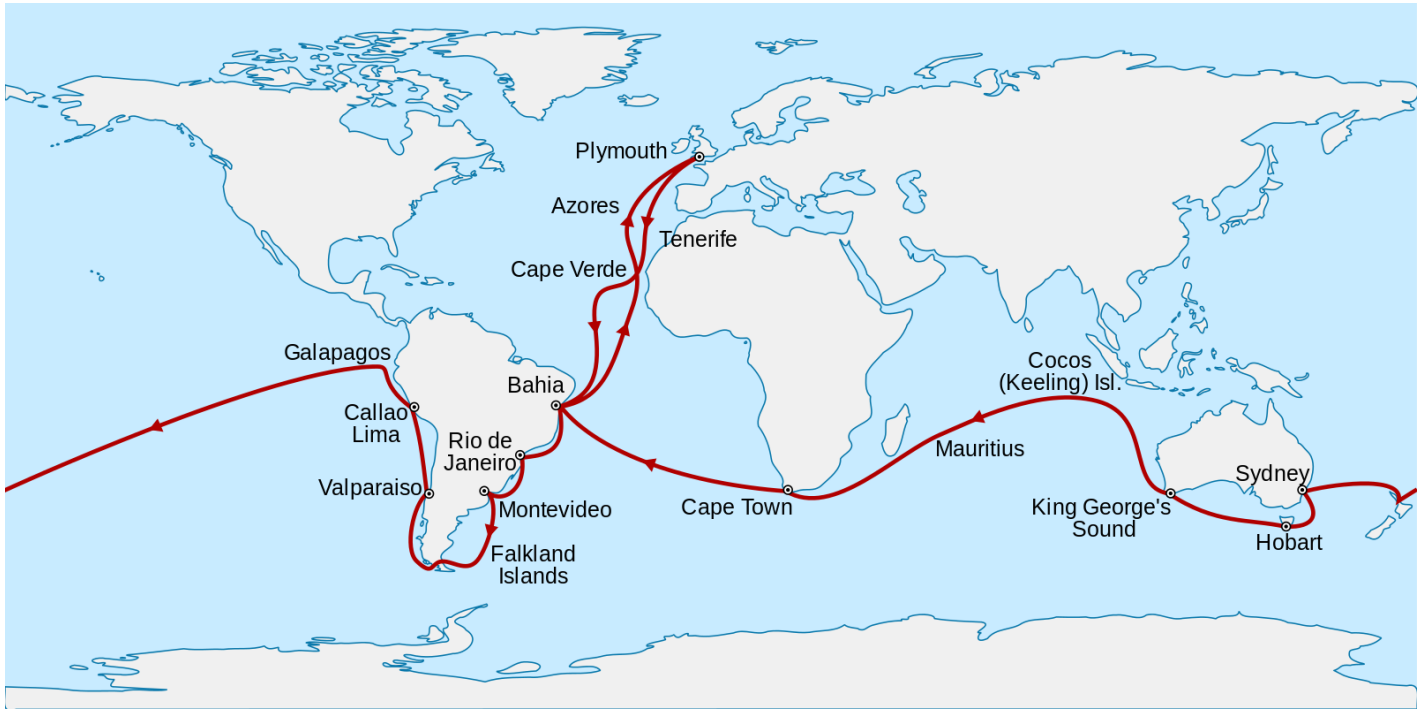


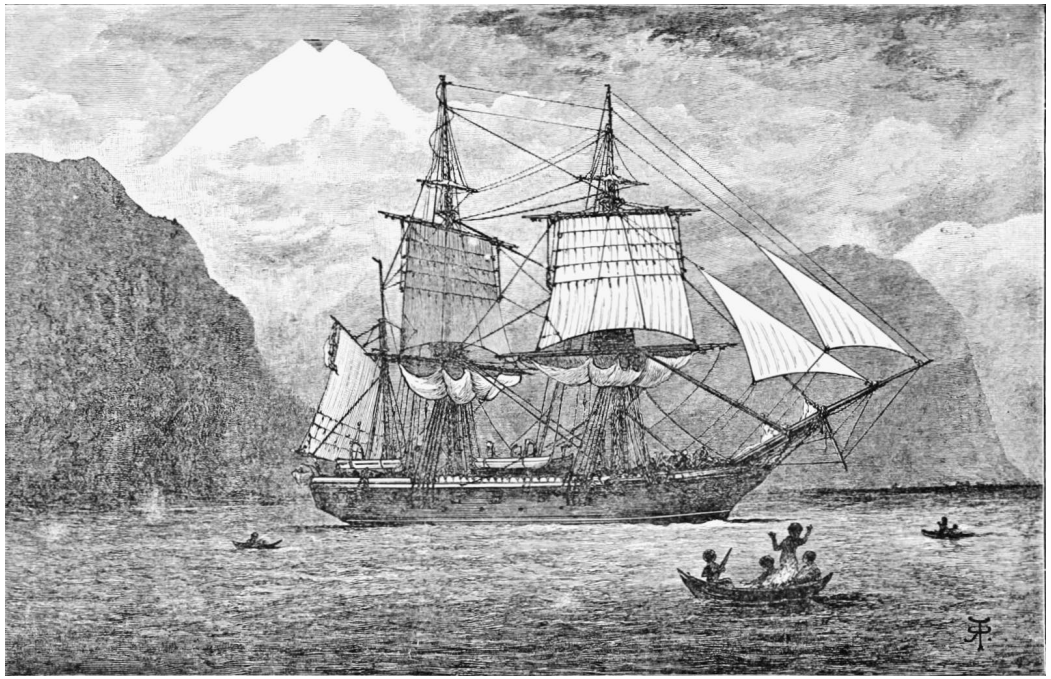
P

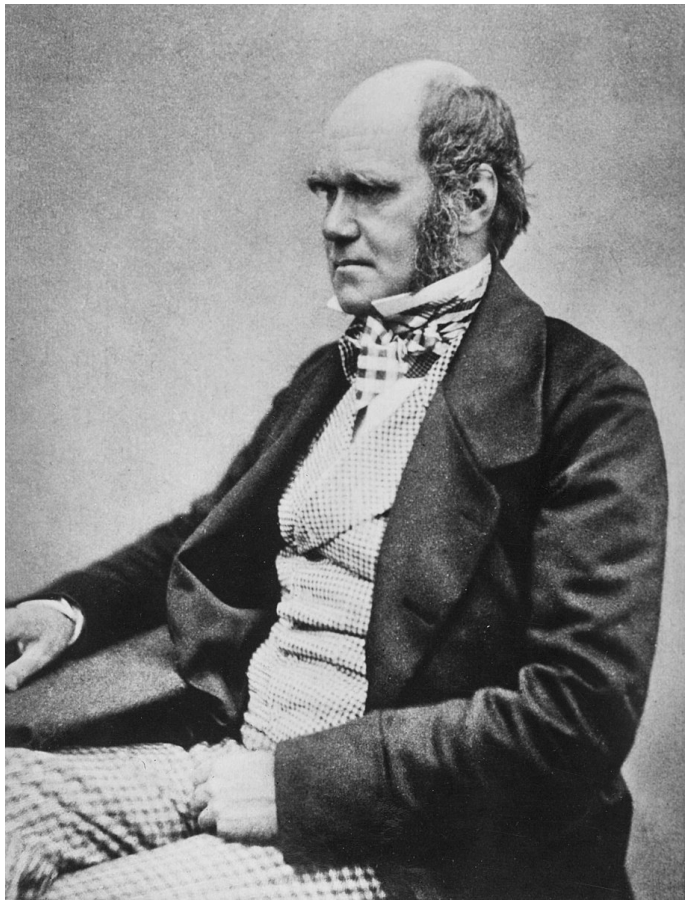
Slow release fertilizers

Recovery of P (critical raw material)

Darvinian Voyage of the „Beagle”, the inspirations for transdisciplinary dialog for Sustainability Science and Culture







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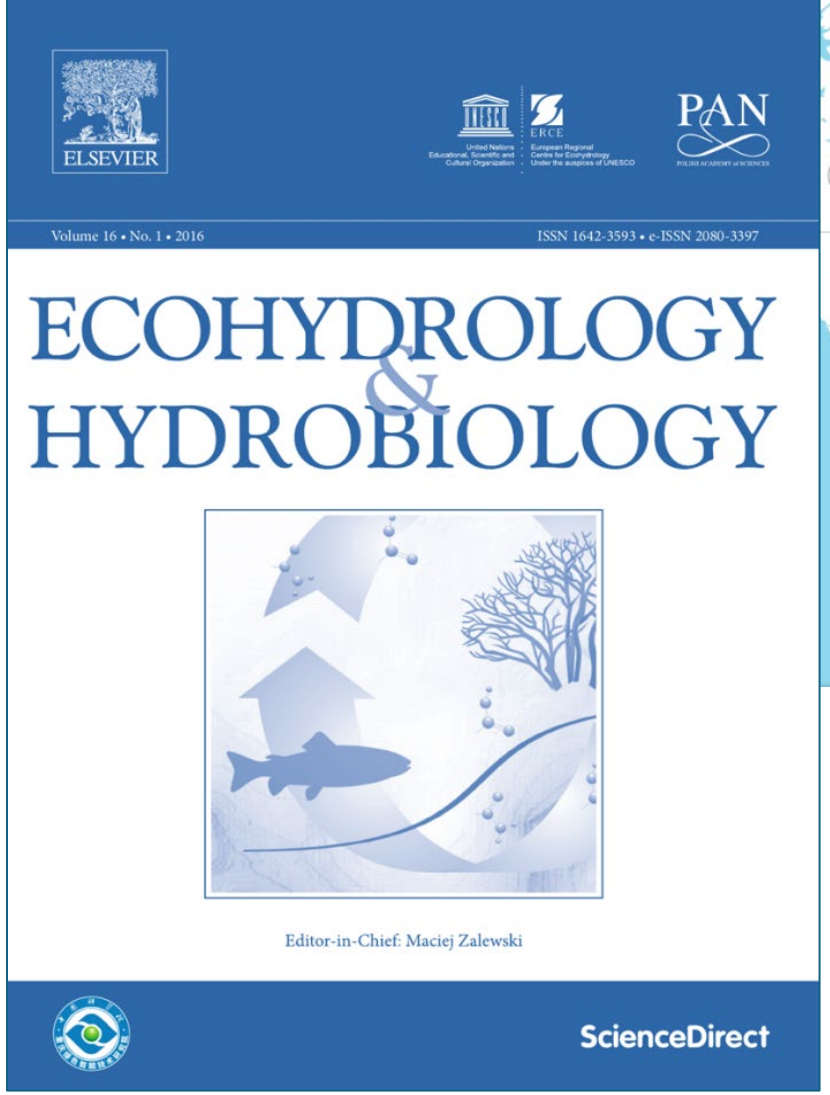
Thank you!



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The inspiring cooperation of my colleagues from ERCE PAS u/a UNESCO, UNESCO Chair of Ecohydrology & Applied Ecology, UŁ UNESCO Division of Water Sciences and UNESCO IHP, European Comission Programe Water4All Team, is highly appreciated and made the introduced ideas and projects happened