

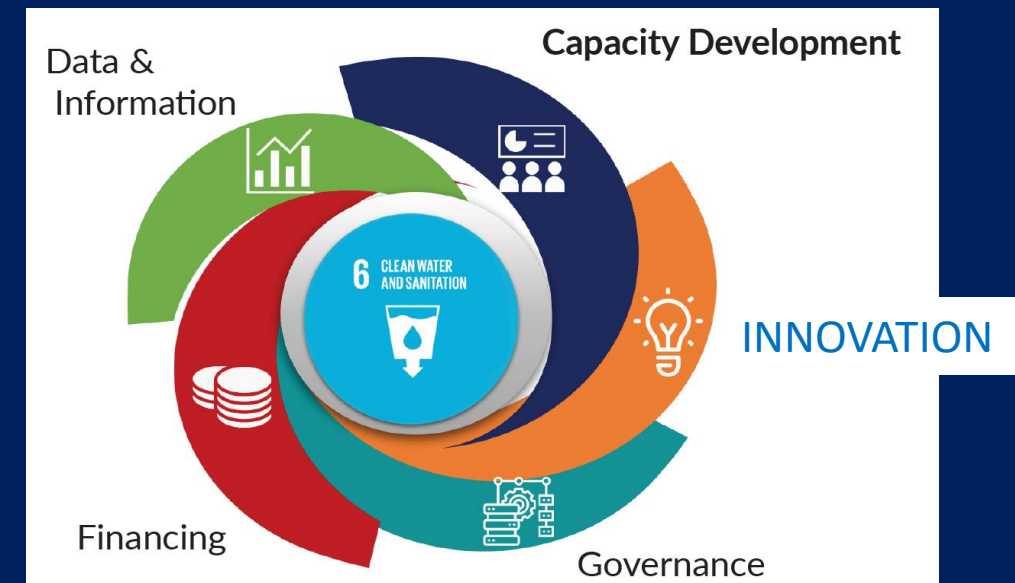
Transdisciplinary Ecohydrology for Acceleration S D G – Methodology of Science and Patterns of Implementation

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Editor in Chief International Journal „ECOHYDROLOGY & HYDROBIOLOGY” Elsevier

Vice Chairman „Water4All” European Commission



Conclusions from the New York Water Conference for acceleration of SDG as a reference point for Water4All



UN
2030 WATER
CONFERENCE

NEW YORK
22-24
MARCH
2023

SIDE EVENT TRANSDISCIPLINARY ECOHYDROLOGY FOR ACCELERATION OF SDG – METHODOLOGY OF SCIENCE AND PATTERNS OF IMPLEMENTATION





ERCE

European Regional
Centre for Ecohydrology
Under the auspices
of UNESCO



unesco

Centre
Under the auspices
of UNESCO

<https://doi.org/10.1038/s44221-023-00078-5>

The water crisis does not stop in New York

Check for updates

Although the events at the United

water governance that moves away from the

it is also highlighted by Gert Jan Veldwisch in

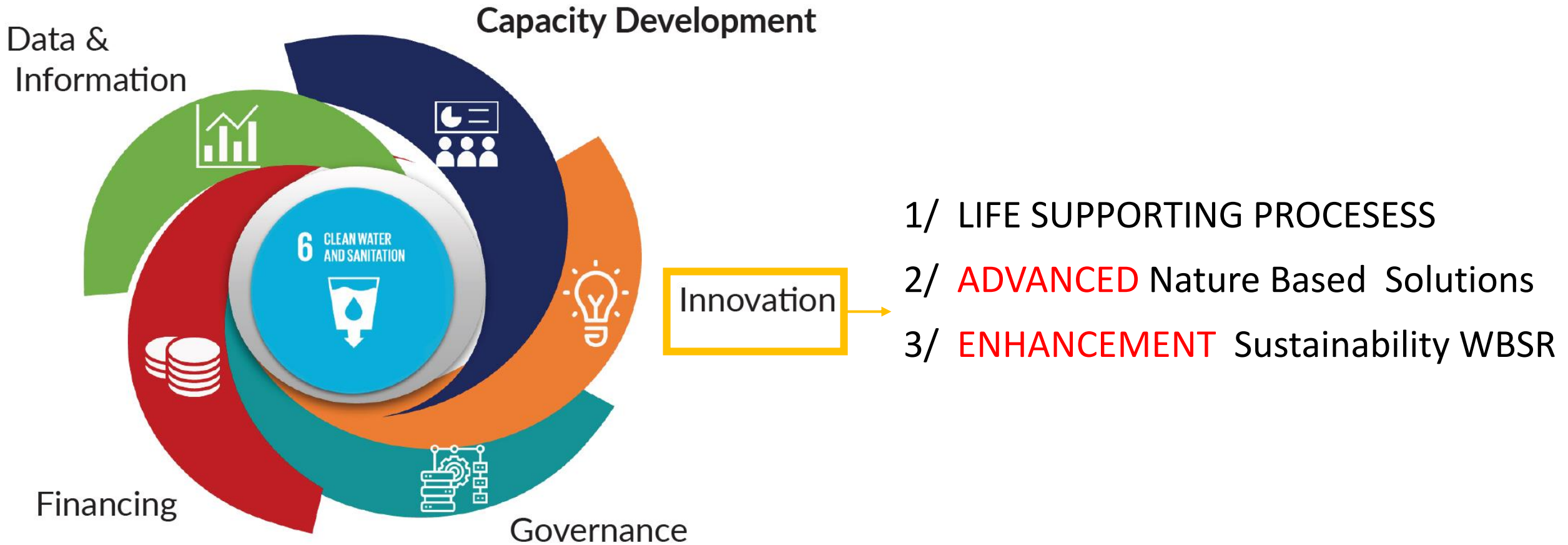
1/ GOVERNANCE „a radical reshaping of the water governance that moves away from the current fragmentation”

„Climate and water actions must be coordinated „ „ reduction in subsidies for water and agriculture that create overconsumption and aquifere depletion

2/ ECOHYDROLOGY „...it is essential better understand and use the relationships between hydrological and ecological processes... „Ecohydrological Nature-Based Solutions, which use or mimic these proces, play a key role in enhncing biodiversity, reducing risks associted with hydroclimatic extremes, and ensuring water-food-nergy security and carbon cycling”

3/ SOCIETY „...necessity of involving in the decision-making processes those groups that can potentially be most affected by the water crisis..”

WHY ECOHYDROLOGY - Game Changer for SDG ?

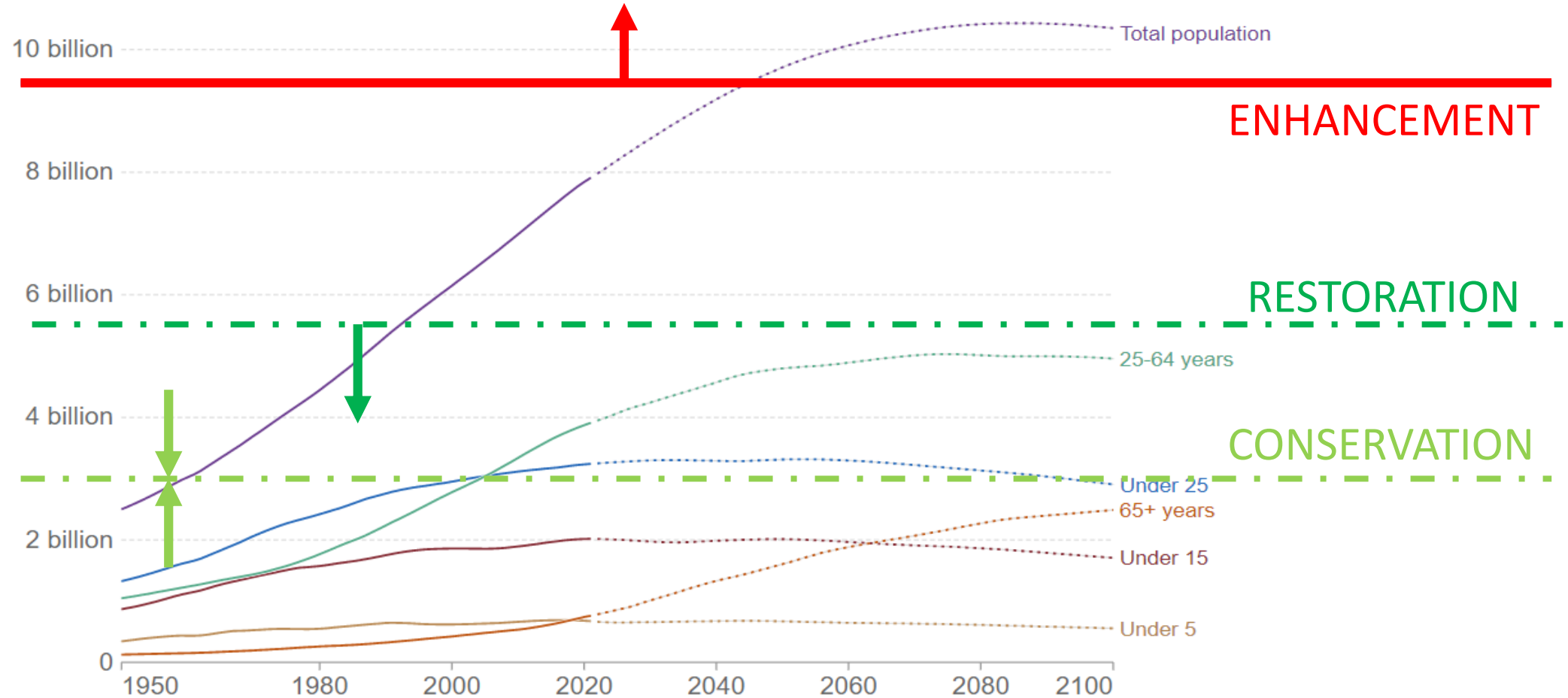


WHY ENHANCEMENT SUSTAINABILITY POTENTIAL ?

Population by age group, including UN projections, World

Future projections are based on the UN's medium-fertility scenario. This is shown for various age brackets and the total population.

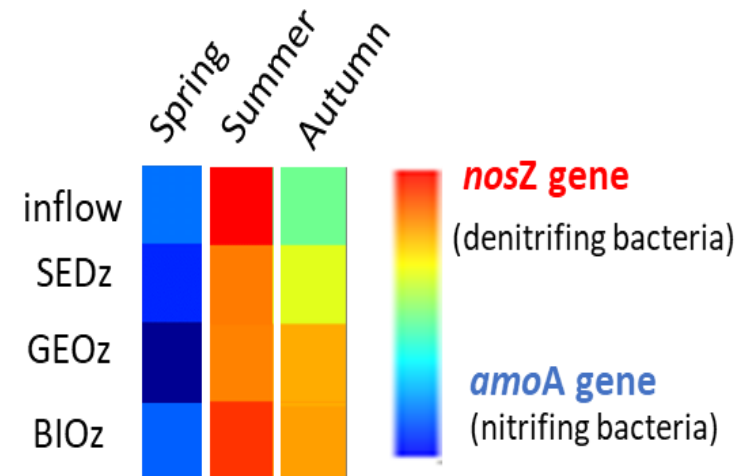
Our World
in Data



Source: United Nations - Population Division (2022)

OurWorldInData.org/world-population-growth • CC BY

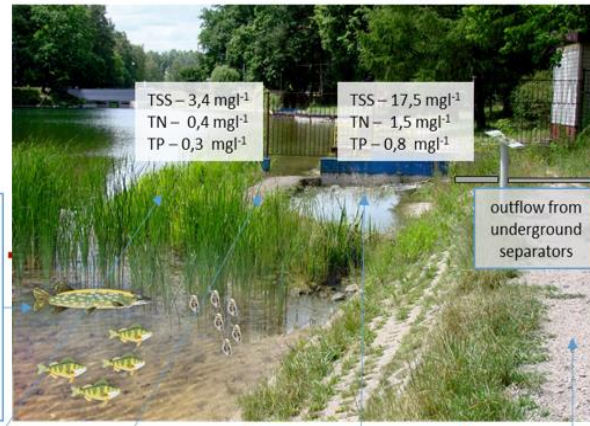
Nature Based Solutions vs. Advanced Nature Based Solutions



TSS-3.4 mg/l

REGULATION OF BIOLOGICAL PROCESSES
Enhancement of filtering zooplankton by predatory fish stocking

BIOFILTRATION ZONE
Assimilation of nutrients (N, P) into plant biomass



GEOCHEMICAL BARRIER
Reduction of nutrients by dolomite structure

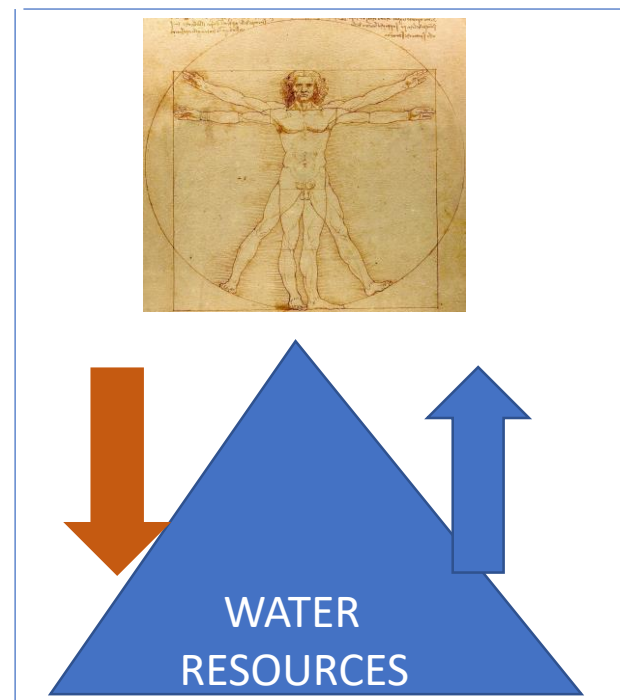
SEDIMENTATION ZONE
Reduction of suspended solids

Interception of surface stormwaters by infiltration through dolomite/gravel bed

UNDERGROUND SYSTEM SEPARATORS
Reduction of oil substances and suspended solids



DIAGNOSIS – Man, Water and Sustainability – „QUANTUM ENTANGLEMENT”



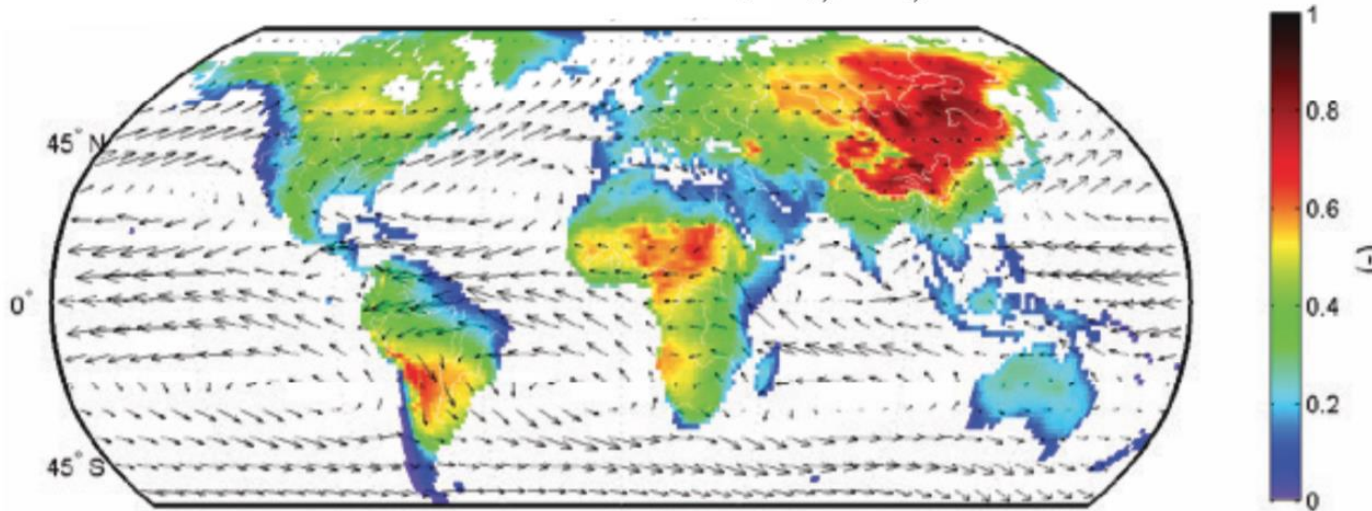
ECOHYDROLOGY - LIFE SUPPORTING PROCESSES – THE IMPORTANCE TERRESTRIAL VEGETATION FOR WATER RESOURCES

ECOSYSTEMS – WATER „RECYCLERS” RETAINERS AND FILTERS-
Evaporation from the vegetation and soils from terrestrial ecosystems can be a very important source of precipitation for other areas

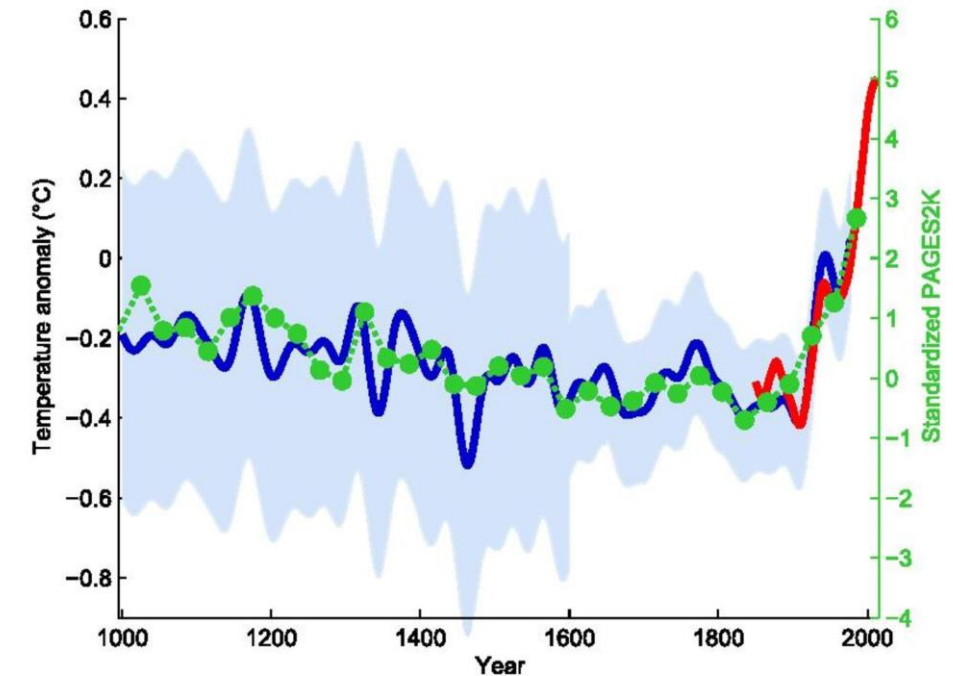
Role of ecosystems in stabilization of hydrological cycle will be increasing with climate change

Continental precipitation recycling ratio $\rho_c = \rho_{c,i} + \rho_{c,t}$

(a)



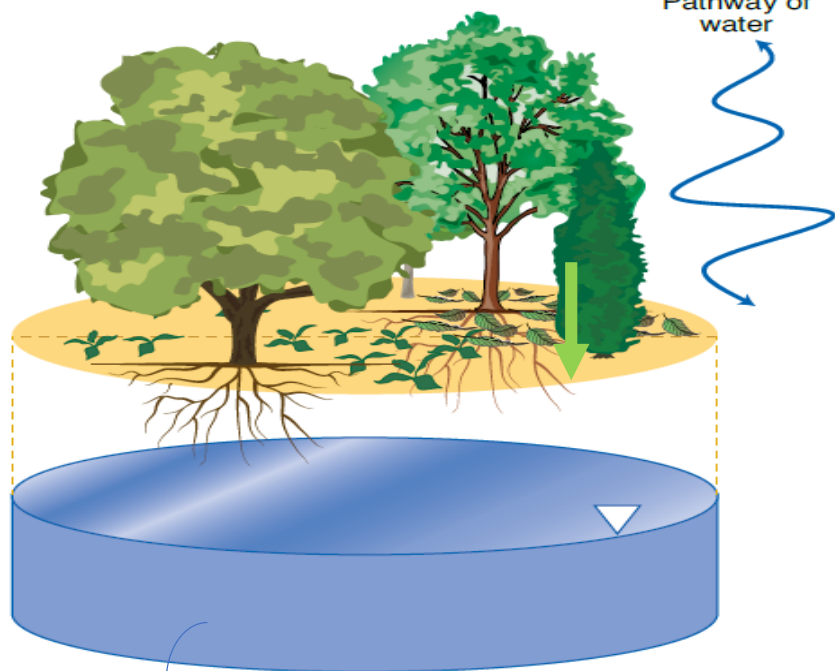
Source: Van der Ent et al., 2014



WATER and BIOECONOMY : Industrial agriculture ???

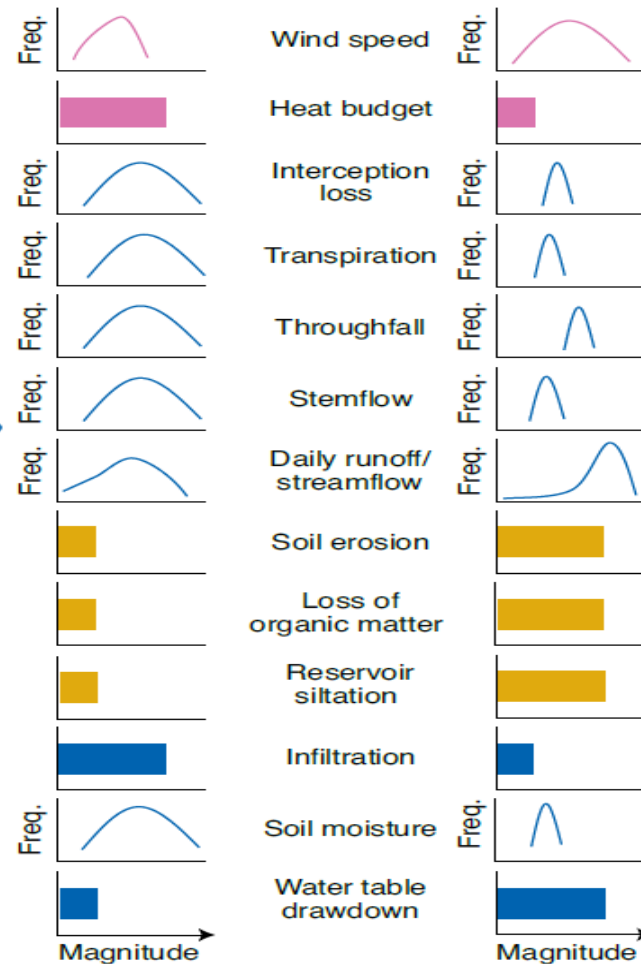


Natural vegetation

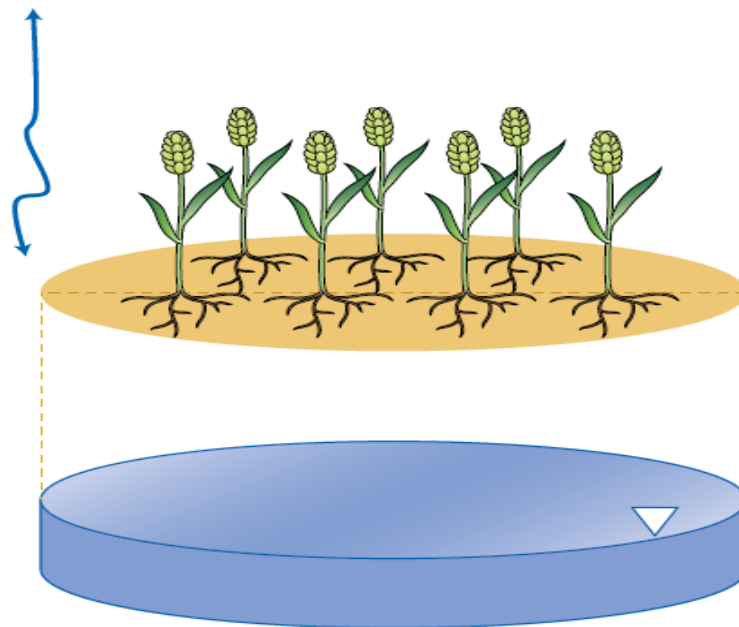


3x B

BIOPRODUCTIVITY
BIODIVERSITY
BIOCOMPLEXITY



Pathway of water



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

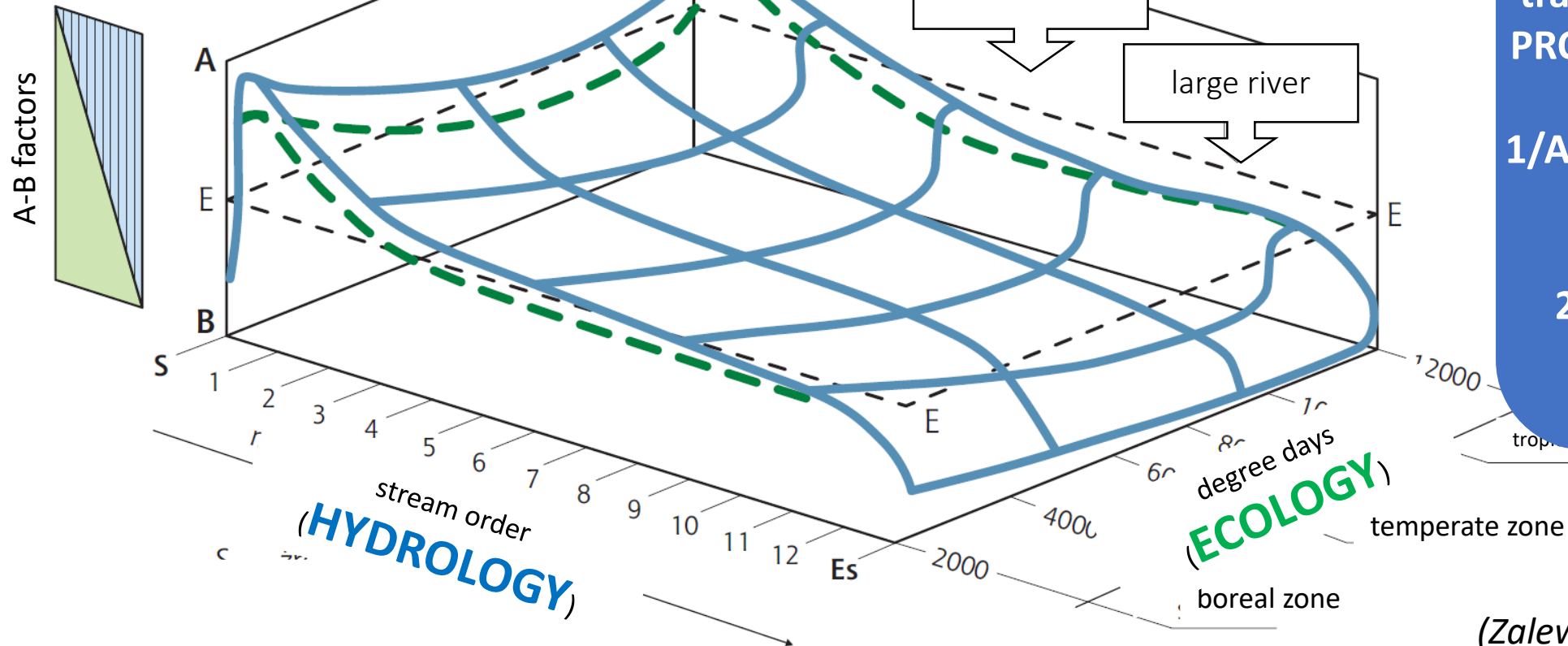
Anticipatory model - INTEGRATION OF HYDROLOGY AND ECOLOGY for identification hierarchy of drivers LIFE SUPPORTING PROCESSES

Input (E+H) – Model – Effectors - System

A – abiotic factors

B – biotic factors

E – equilibrium level of A-B



Understanding hierarchy of
drivers (ABIOTIC vs. BIOTIC).
Its is fundamental for
translating LIFE SUPPORTING
PROCESSES into innovations:

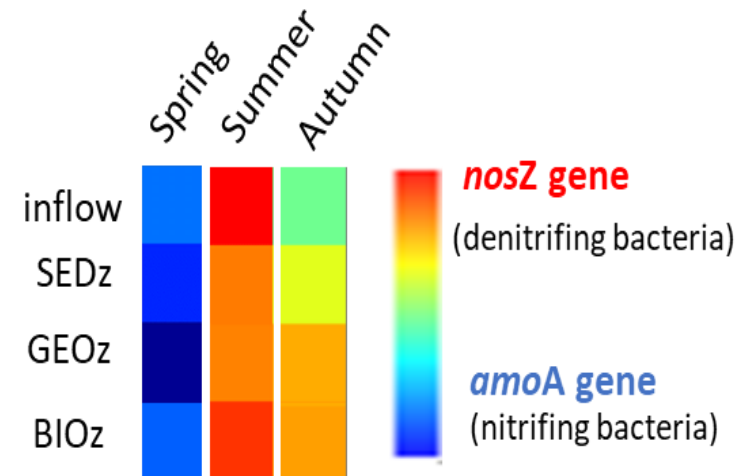
1/ADVANCED NATURE BASED
SOLUTIONS

2/SYSTEMIC SOLUTIONS.

(Zalewski i Naiman 1985)

RIVER SYSTEM

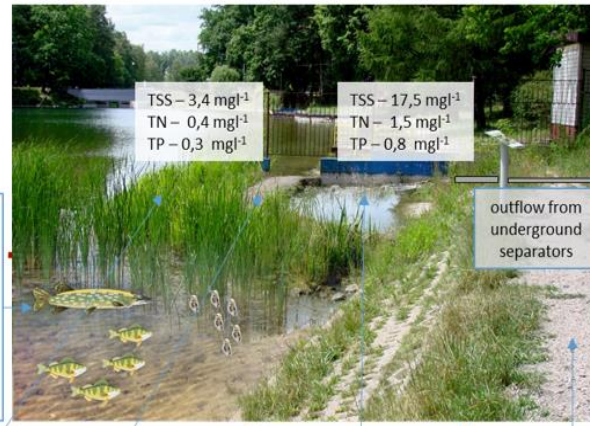
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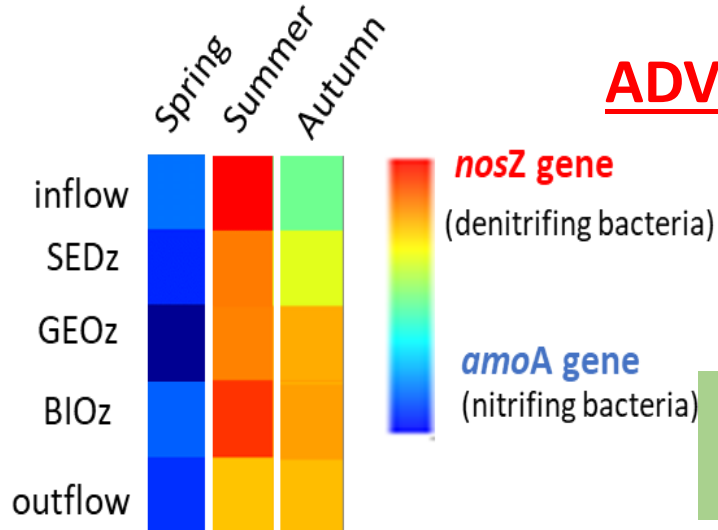
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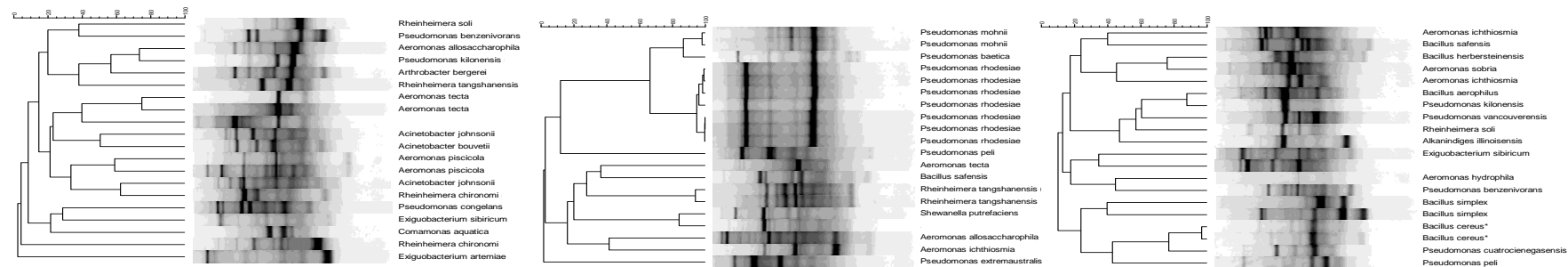


ADVANCED NATURE BASED SOLUTIONS for urban stormwater purification

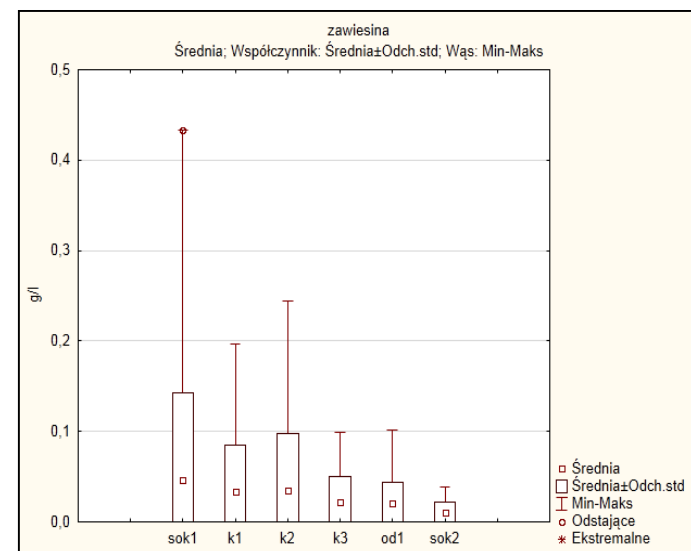
EC Project SWITCH

Bacterial diversity and functionality in different zones of the Stormwater Purification System

(Font-Nájera, Serwecińska, Szklarek S, Mankiewicz-Boczek J.
2021. *Int. Biodeterioration & Biodegradation*)



Reduction of suspended matter



Sedimentation zone (SEDz)



Biogeochemical zone (GEOz)



Biofiltration zone (BIOz)

Sequential Sedimentation-Biofiltration System (SSBS) for urban storm water purification

(Zalewski M., Wagner I., Fratzak W., Mankiewicz-Boczek J., Parniewski P. 2012. *The Parliament Magazine – Politics, Policy and People*)

ADVANCED NATURE BASED SOLUTIONS HYBRID SYSTEM (HYDROENGINEERING + ANBS) for elimination of toxic blooms

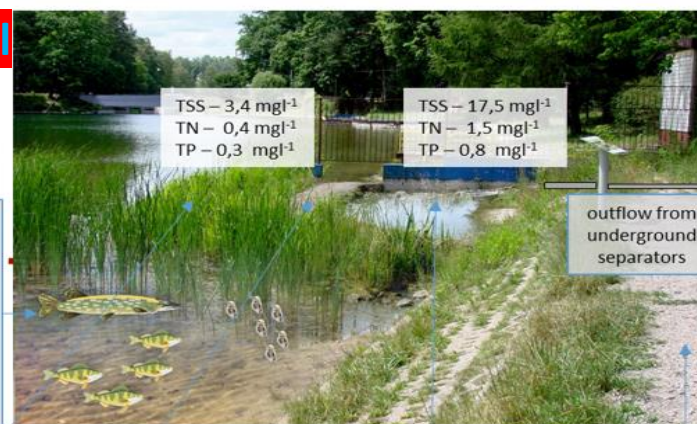
(Jurczak, Zalewski 2018)



LIFE08 ENV/PL/000517
RESTORATION OF RESERVOIRS IN THE
UPPER BZURA CATCHMENT



TSS-3.4 mg/l



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Stormwater from roads, roofs, parking, bicycle/walking pass

TSS-165.0 mg/l

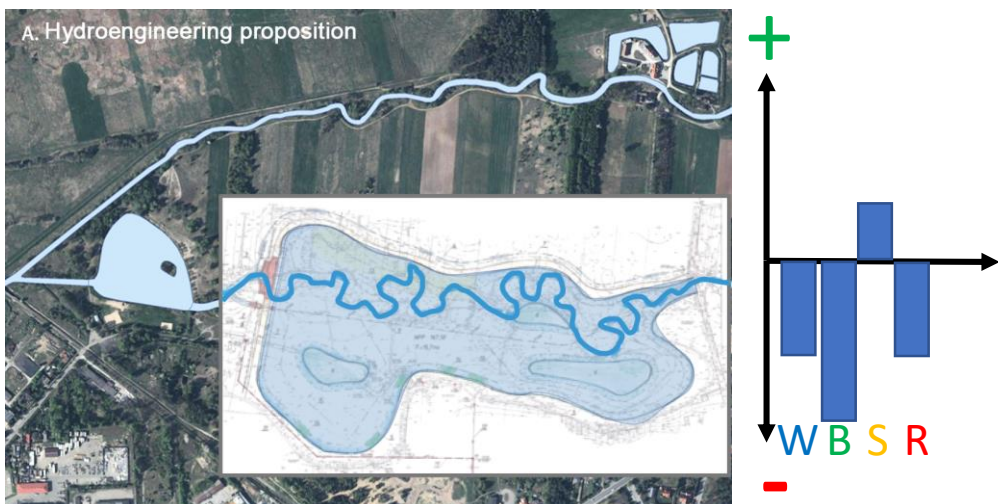
TSS – 165,0 mg/l⁻¹
TN – 4,2 mg/l⁻¹
TP – 3,0 mg/l⁻¹



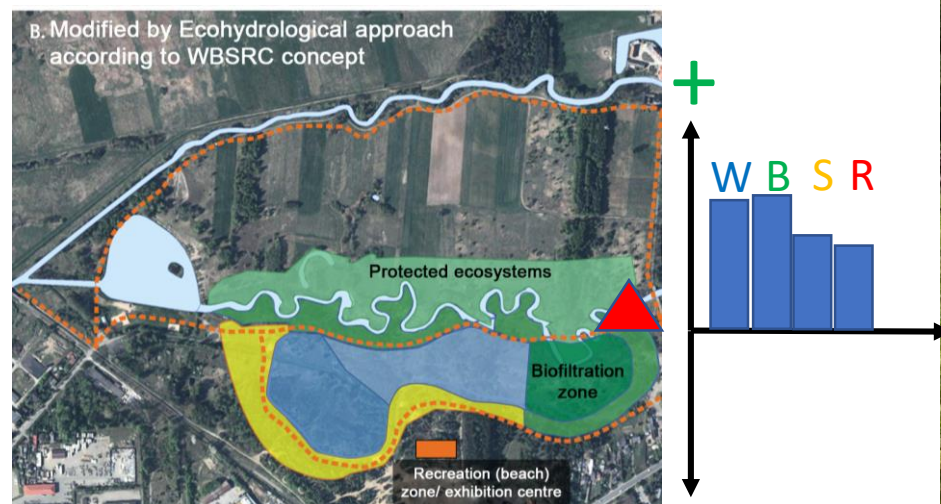
Best of the Best LIFE + 2018

ADVANCED NATURE BASED SOLUTIONS for **ENHANCEMENT** Sustainability potential of catchment WBSR

Hydroengineering



EH Advanced Nature Based Solutions- LATERAL RESERVOIR



(Zalewski 2020, Kiedrzyńska et al. 2021)

Science of the Total Environment 799 (2021) 149427



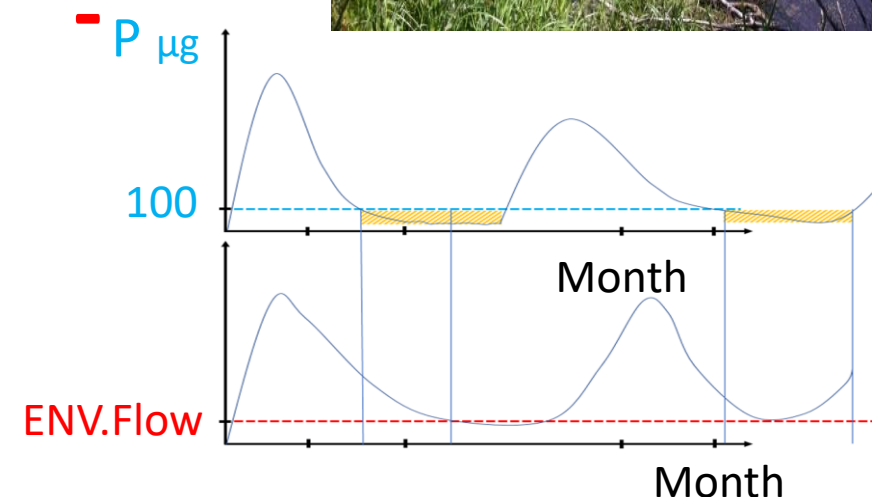
The enhancement of valley water retentiveness in climate change conditions

Edyta Kiedrzyńska^{a,b,*}, Kamila Belka^a, Paweł Jarosiewicz^{a,b}, Marcin Kiedrzyński^c, Maciej Zalewski^{a,b}

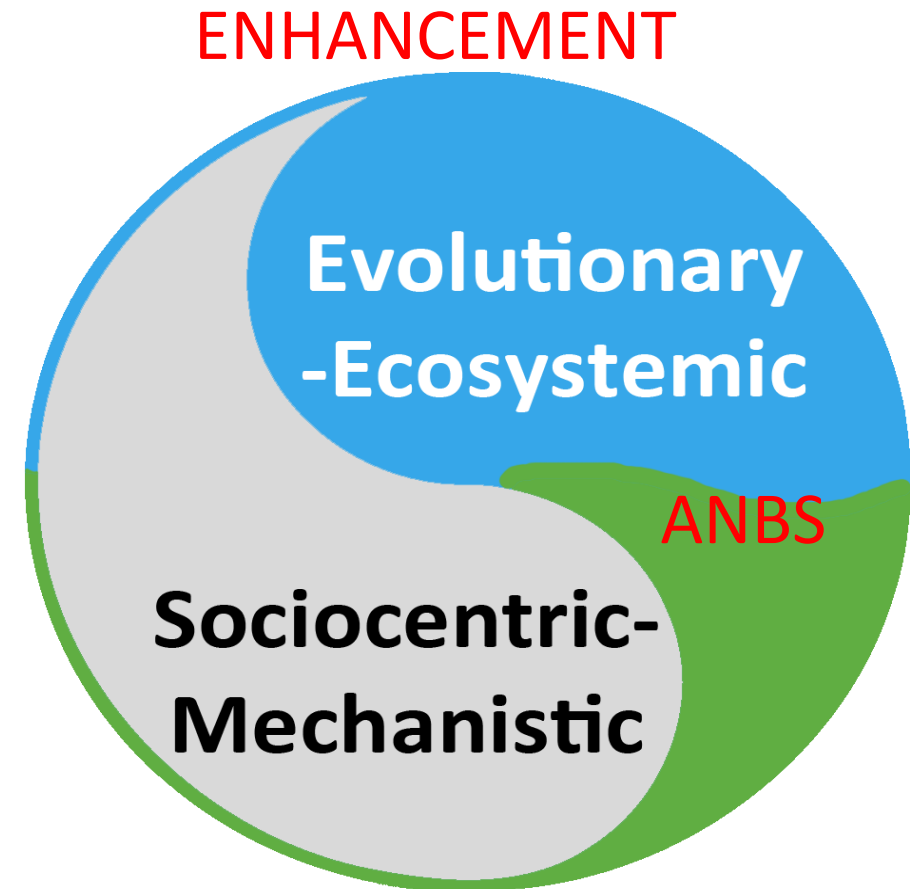
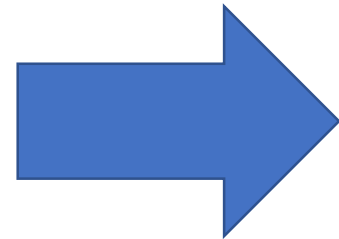
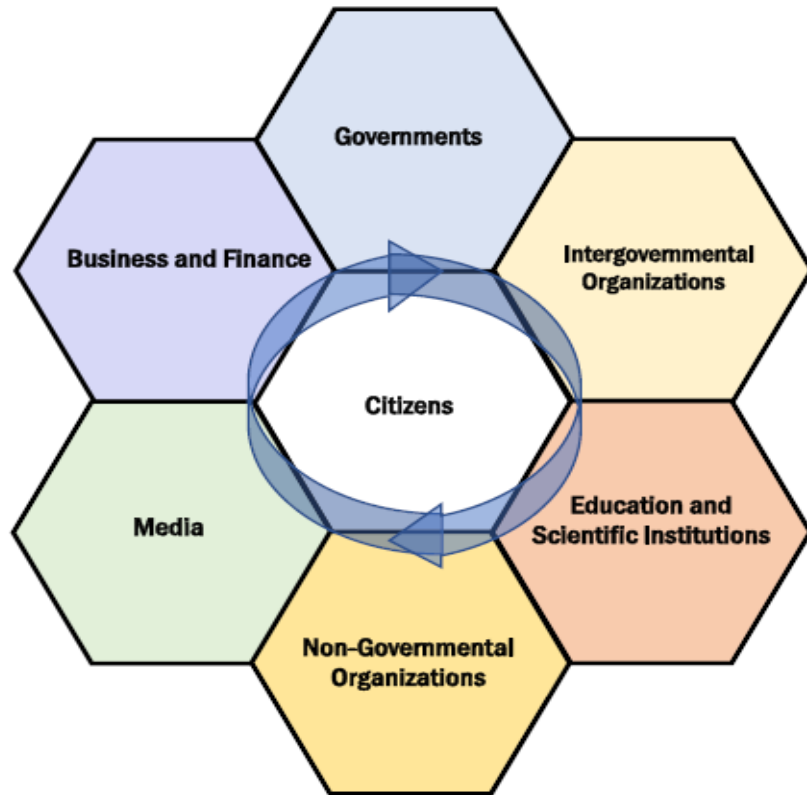
^a European Regional Centre for Ecohydrology of the Polish Academy of Sciences, Tylna 3, 90-364 Łódź, Poland

^b University of Łódź, Faculty of Biology and Environmental Protection, UNESCO Chair on Ecohydrology and Applied Ecology, Banacha 12/16, 90-237 Łódź, Poland

^c University of Łódź, Faculty of Biology and Environmental Protection, Department of Biogeography, Paleocology and Nature Conservation, Banacha 1/3, 90-237 Łódź, Poland



Methodology of Science **Paradigm change for acceleration of SDG ,** **Sociocentric-Mechanistic to Evolutionary Ecosystemic**



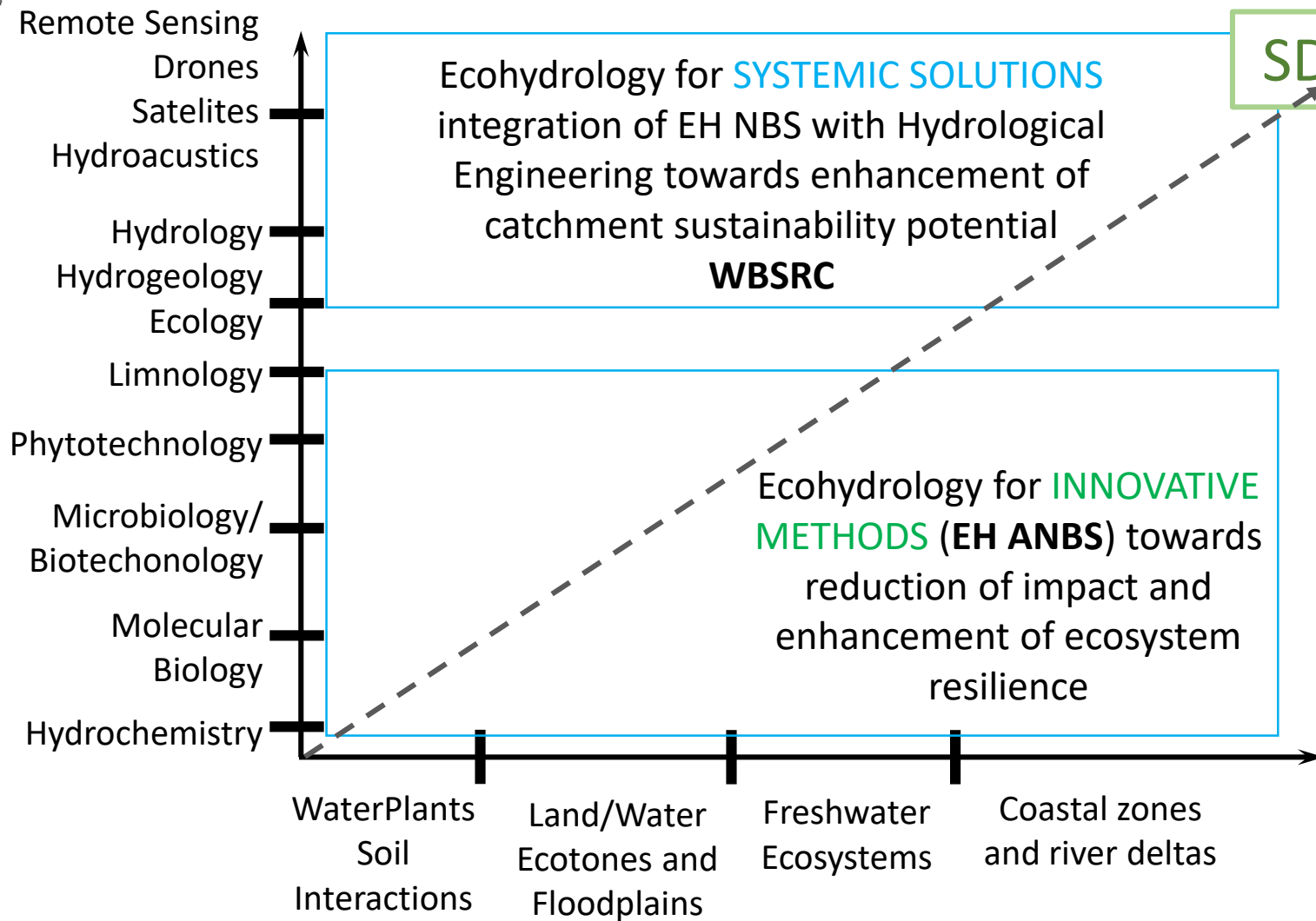
SOCIOCENTRIC /MECHANISTIC approach – believe
that technology and society will solve
all the problems created by Men.

Watson, Kundzewicz, Borrell-Damián 2022,
Science of The Total Environment

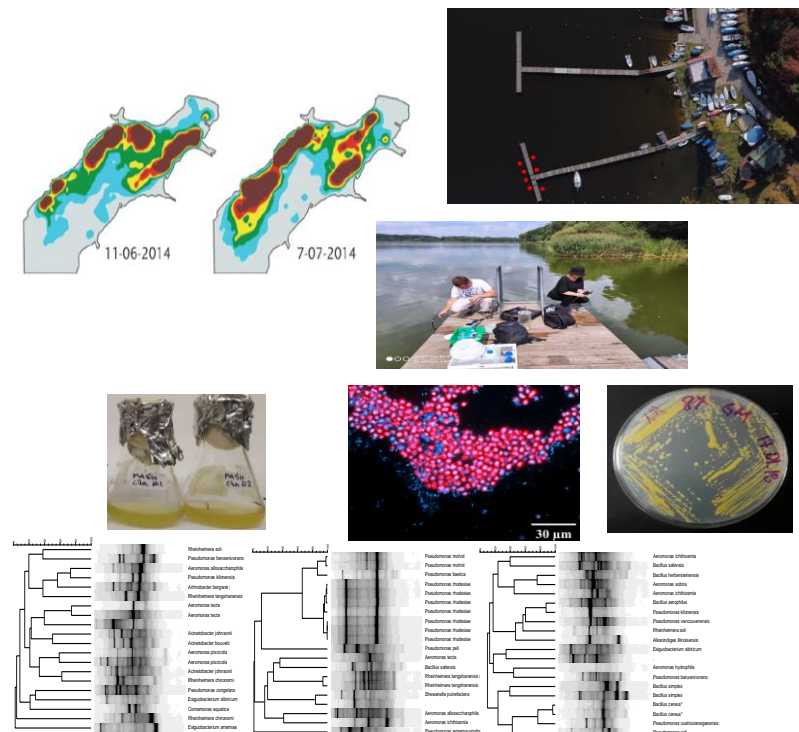
*Te extension of the Sociocentric /Mechanistic
by the Evolutionary /Ecosystemic paradigm*
(Zalewski 2023, in press)

ECOHYDROLOGY Methodology of Transdisciplinary Science

ENVIRONMENTAL SCIENCE



SDG - ENHANCEMENT (WBSR)



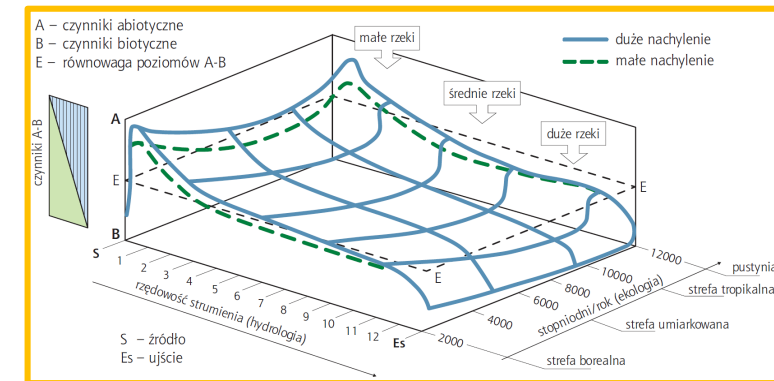
(Zalewski 2023)

ECOHYDROLOGY SUBDISCIPLINES



Implementation and adaptive
community based management in
other catchments (e.g. Ethiopia;
(Zalewski Zerihun, 2018)

PURE SCIENCE –
Water + Ecosystems +
Engineering + Society



Systemic solutions
implementation in
catchment scale -
EH/**ANBS** + HEG + Digital
techniques + AAM

ANTICIPATORY -
Holistic models of
processes E+H
(np. ABRC)

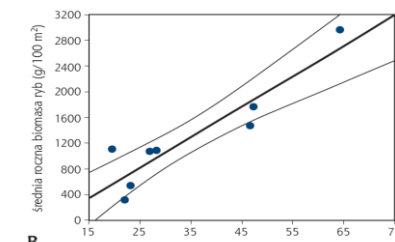
**Ecohydrology
and ANBS -
transition to
transdisciplinary
science**

Development
Ecohydrological **ANBS** +
integration with hydro
engineering (HENG)
e.g. SWITCH; EHREK

Testing of EH models in
the catchment scale for
discovering EMERGING
PROPERTIES

Mean annual
fish biomass
(g/100m²)

River Selfpurification



Calcium
concentration (mg/L)

Zalewski 2020, changed)



sedime
nts

Adaptation of urban stormwater system
SSBS (Zalewski at al..2012) for
improvement of water quality in a small
reservoir in Ethiopia (sediments used as
fertilizer – Circular Economy)
(Polish AID Programe)

GAME CHANGERS FOR SDG -UNESCO IHP ; WATER4ALL

SYSTEMIC SOLUTIONS FOR ENHANCEMENT SDG

Transdisciplinary science

WISDOM

Use of information and
knowledge for problem solving –
Formulation of principles for action

Experimental testing -interdisciplinary science

KNOWLEDGE

Understanding patterns
and processes,

Monitoring – sectoral science

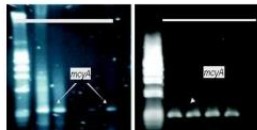
INFORMATION

Understanding structure,
states and relationships

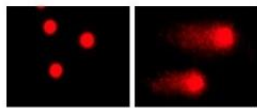
Application of molecular methods for risk assessment and an early warning system



Blue-green algae blooms due to reservoir eutrophication

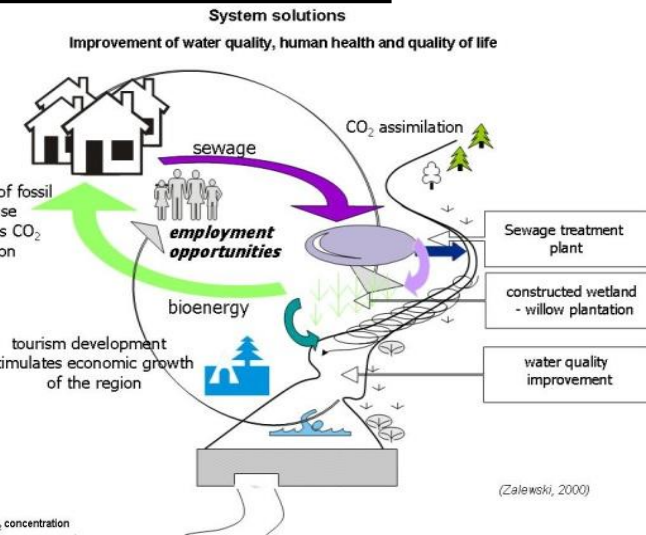
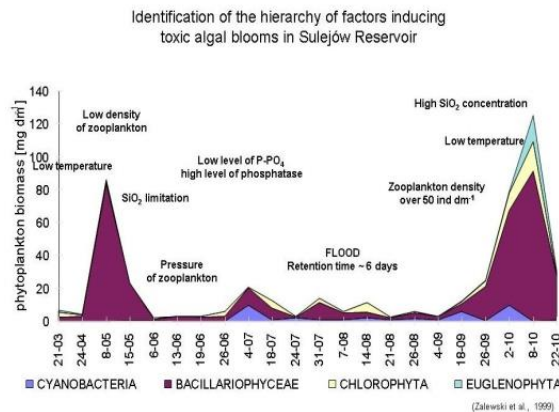


Molecular monitoring as an early warning system against toxic blue-green algae blooms



Damaged DNA in human lymphocytes
Cells after green algae toxins treatment

(Zalewski 1999, Markiewicz et al., 2009)



ADVANCED NBS

ASSESSMENT

Problem identification

Problem solving

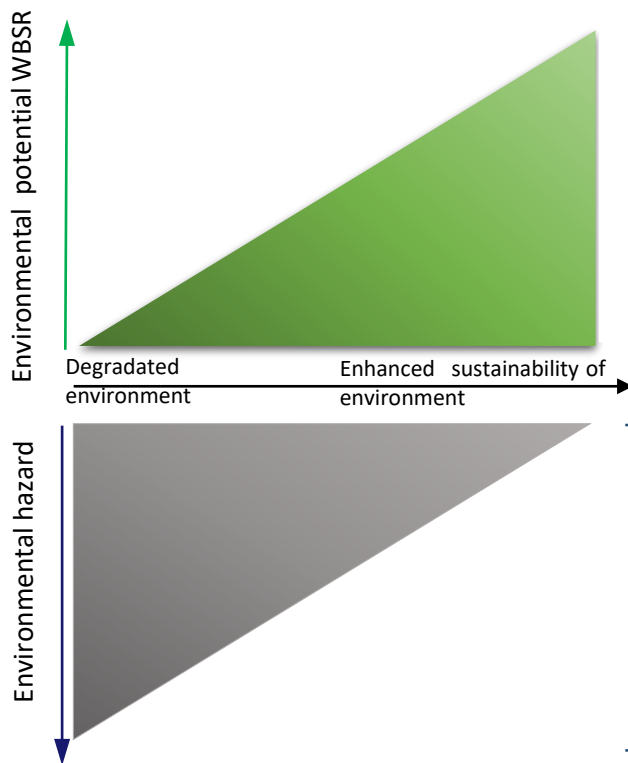
(Zalewski 2011)

Why ECOHYDROLOGY in framework of UNESCO IHP and „Water4All” becoming Game Changer for SDG

- 1/ LIFE SUPPORTING PROCESSES - highlighted by integration
 - Hydrology and Ecology
- 2/ ECOSYSTEMS FOR WATER, - retaining, recirculating water and
 - biogenic substances purifying water
- 3/ NEW PARADIGM Sociocentric/Mechanistic + Evolutionary/Ecosystemic ;
- 4/ ADVANCED NATURE BASED SOLUTIONS - Integration Hydrology +Ecology +
 - Hydroengineering + Molecular biology, + Biotechnologies,+Phytotechnologies –
 - New tools for Water Management , Circular Economy and Bioeconomy
- 5/ ENHANCEMENT of Catchment Sustainability Potential -WBSR
 - (Water ; Bioproductivity/Biodiversity ;Services for Society ; Resilience)
- 6/ HARMONIZATION of society's needs with enhanced ecosystem potential (WBSR)
 - by Culture,Education +Law, Policy, Governance.(WBSR+CE+LPG)
- 7/ FORESIGHT -shaping desirable sustainable future - Ecohydrology – framework for long term catchment scale **ENHANCEMENT**

Enhancement catchment/Biosphere Sustainability Potential WBSR by Advanced Nature Based Solutions

Acceleration SDG & GREEN DEAL

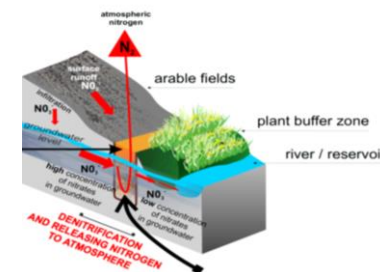


**Ecohydrological Advanced
Nature-Based Solutions
for enhancement
catchment sustainability
WBSR**

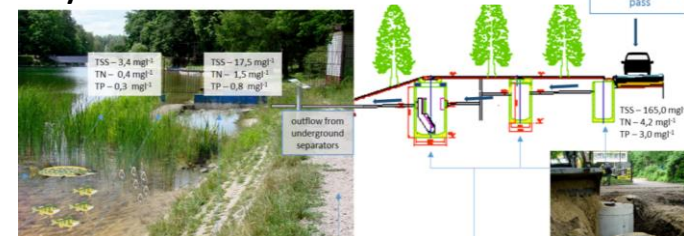
**Reduction : resource use,
emission of pollutants,
habitats degradation
*Technologies, Circular
Economy, Bioeconomy***



Land water ecotone



Hybrid for stormwater



Sewage
treatment
plant



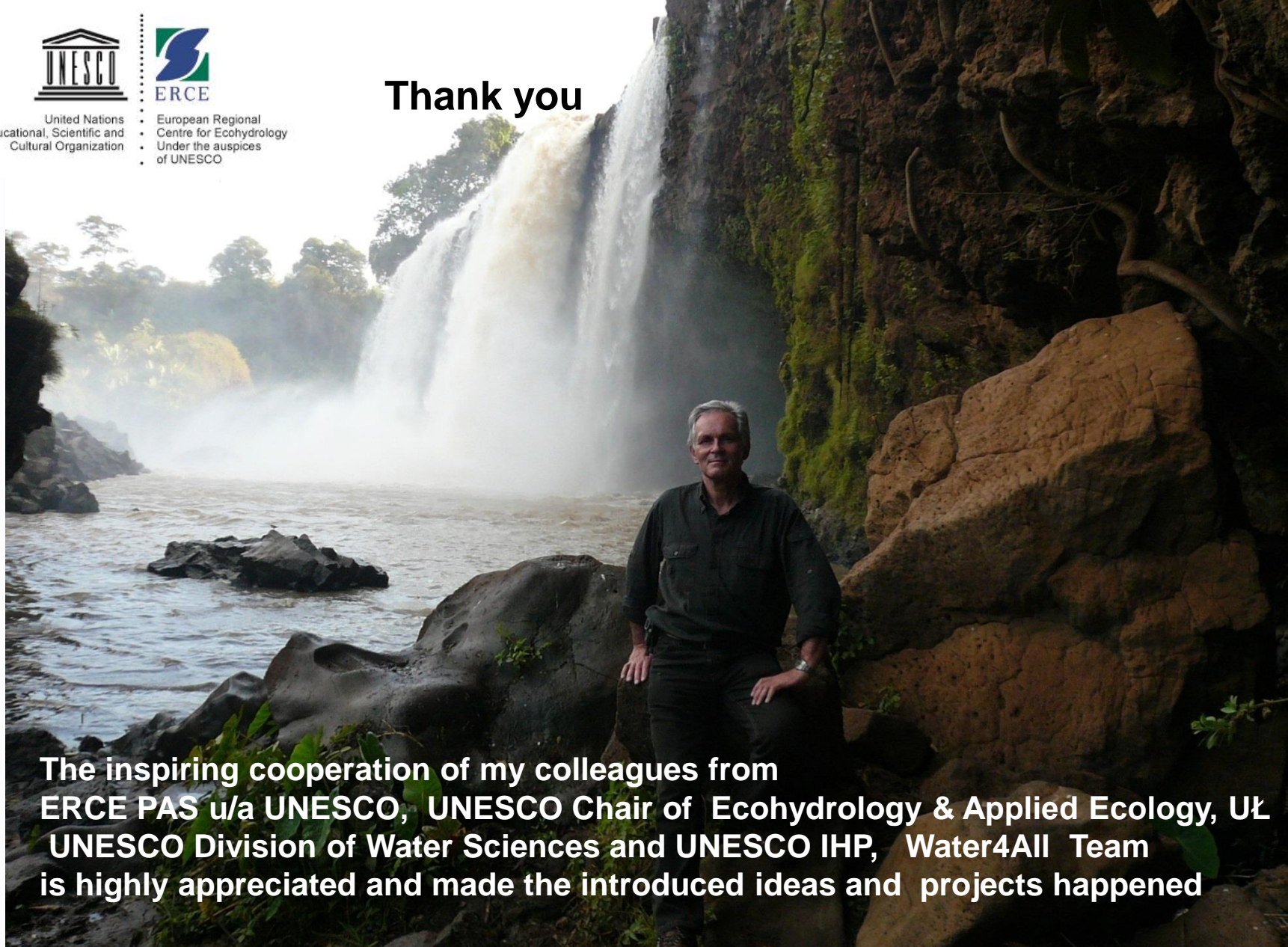


United Nations
Educational, Scientific and
Cultural Organization



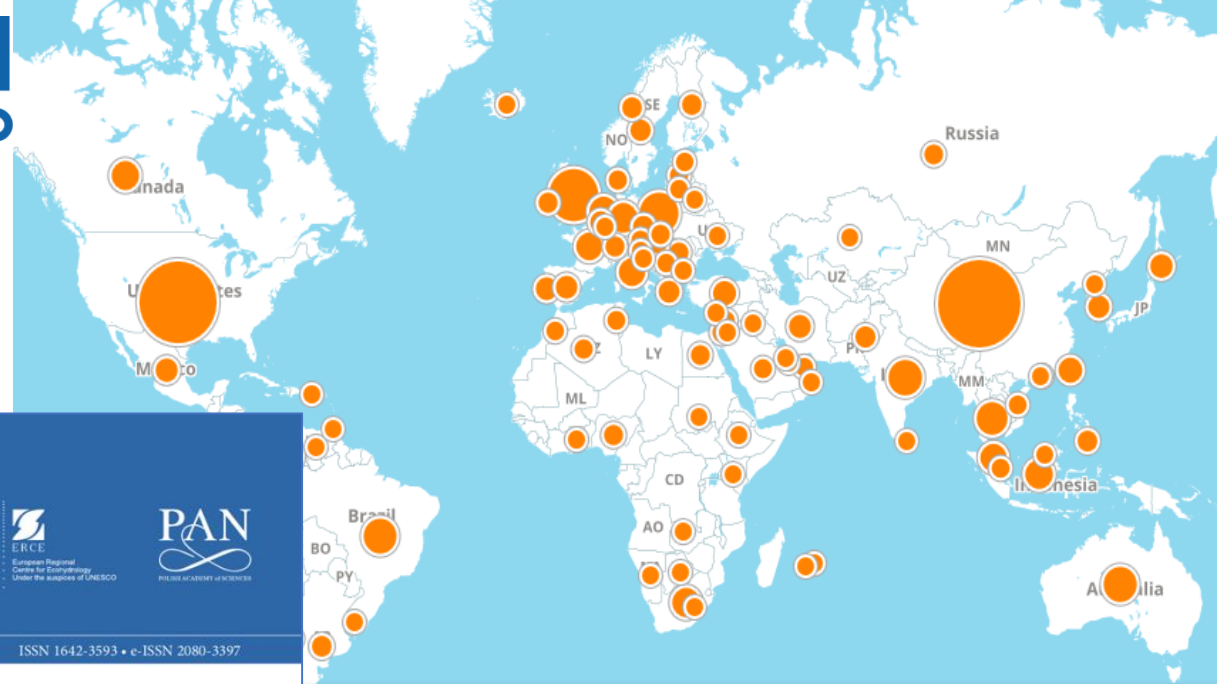
European Regional
Centre for Ecohydrology
Under the auspices
of UNESCO

Thank you



**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, Water4All Team
is highly appreciated and made the introduced ideas and projects happened**

Thank you!



INVITATION to publish
research and concepts on SDG
Game Changing
ECOHYDROLOGY in
International Journal
Ecohydrology&Hydrobiology

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