

#EU  
GREEN  
WEEK

JUNE 4, 2025

EU Green Week Partner Event

## Integrating “Nature” in the Water-Energy-Food Nexus: Current Perspectives and Future Directions

Enrico Lucca, **Dimitris Kofinas**, Tamara Avellán, Janina Kleemann, Caro E. Mooren, Malgorzata Blicharska, Claudia Teutschbein, Anna Sperotto, Janez Sušnik, Sarah Milliken, Marianela Fader, Dejana Đorđević, Tina Dašić, Violeta Vasilić, Bamgboye Taiwo, Aziza Baubekova, Rocío Pineda-Martos, Alexandra Spyropoulou, Gösta F.M. Baganz, Jerome el Jeitany, Hasan Volkan Oral, Mohammad Merheb, Giulio Castelli, Alessandro Pagano, Beatrice Sambo, Monika Suškevičs, Mona Arnold, Tamara Rađenović, Alexander Psomas, Sara Masia, Isabelle La Jeunesse, Henry Amorocho-Daza, Sherin S Das, Elena Bresci, Stefania Munaretto, Floor Brouwer, Chrysi Laspidou

# THE WATER-ENERGY-FOOD NEXUS: BUILDING RESILIENCE TO GLOBAL CHALLENGES

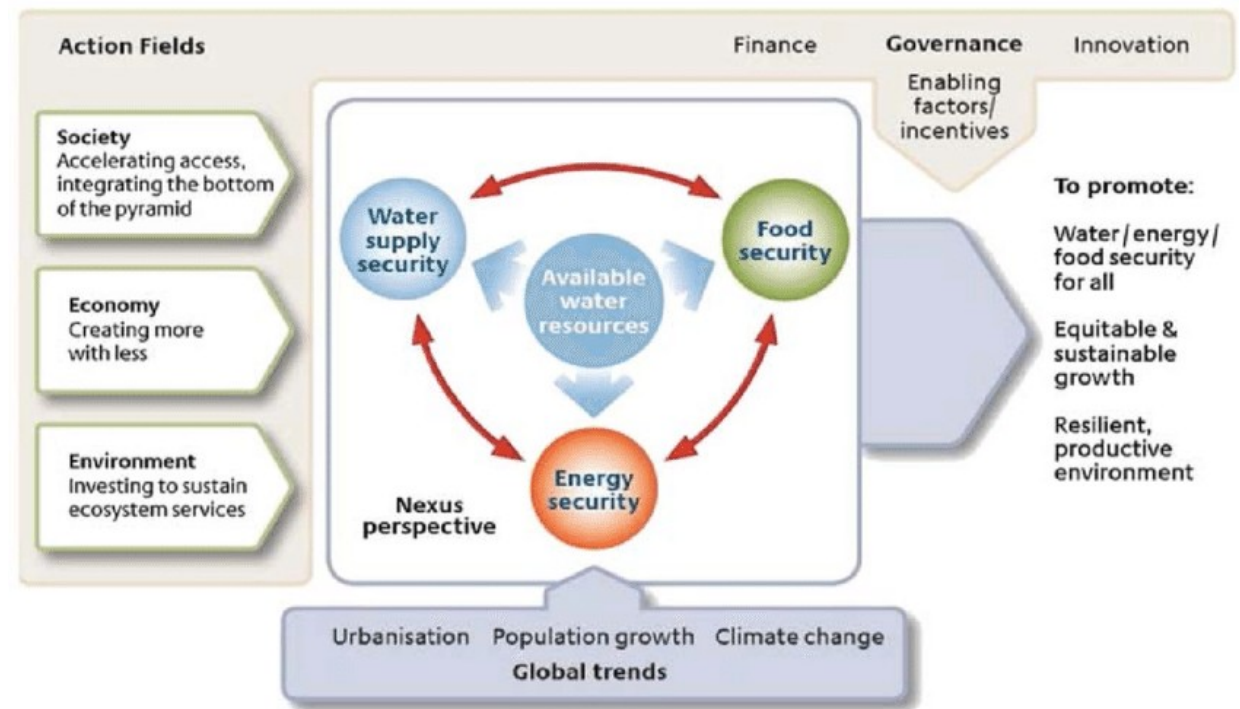


# nexus concept and evolution of ecosystems integration

water centered resources security nexus and ecosystems as an externality

*WEF Framework: Bonn 2011 Nexus Conference (Hoff, 2011)*

- three dimensions defined as **resource securities**
- bidirectional connections of securities
- responds to unsustainable development models that violate natural resource constraints
- focuses on the interconnections of water, energy, and food sectors
- centered on water resources
- considers global trends, environment, economy, society, investments, and innovation as externalities



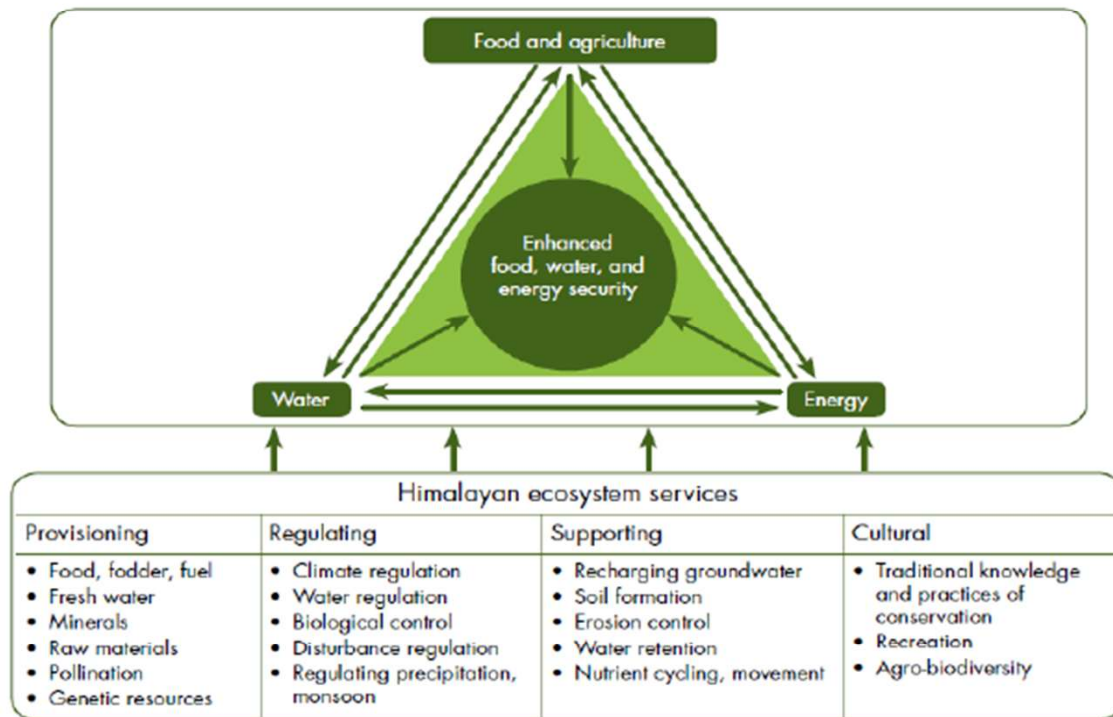
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# nexus concept and evolution of ecosystems integration

resources nexus aiming at resources security, based on the ecosystem services

ICIMOD, 2012

- an equal framework with respect to the three dimensions
- the three dimensions are defined as resources
- bidirectional connections between the WEF
- externalities: the ecosystems
- goal: resource security



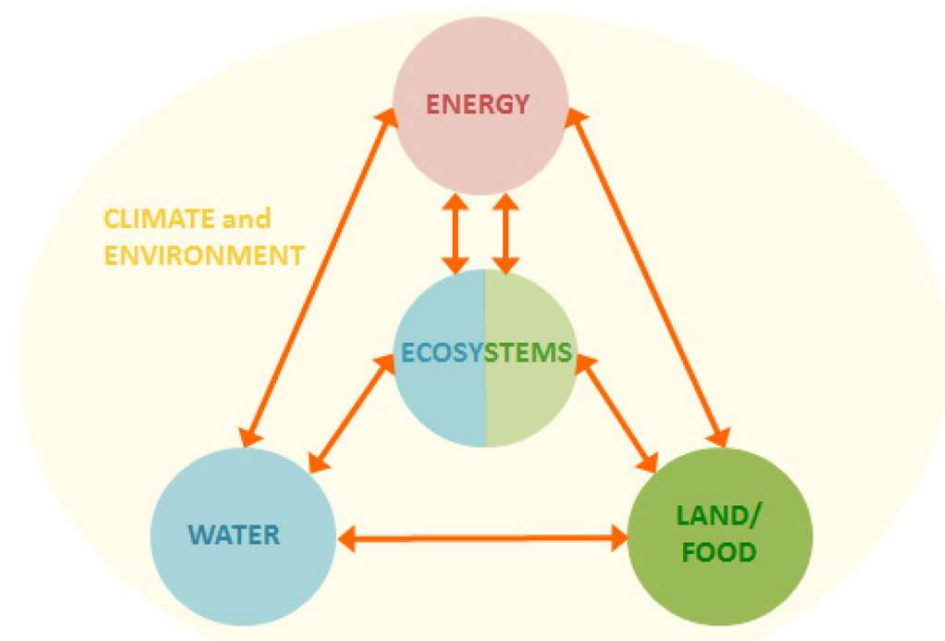
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# nexus concept and evolution of ecosystems integration

nexus of sectors and ecosystems as a central nexus component

*United Nations Economic Commission for Europe, 2015*

- Ecosystems are active components, not passive recipients
- Provide essential services (water purification, flood control, soil fertility)
- Sustainable resource management requires integrating ecosystem considerations
- Coordinated cross-sector and transboundary strategies ensure long-term resilience

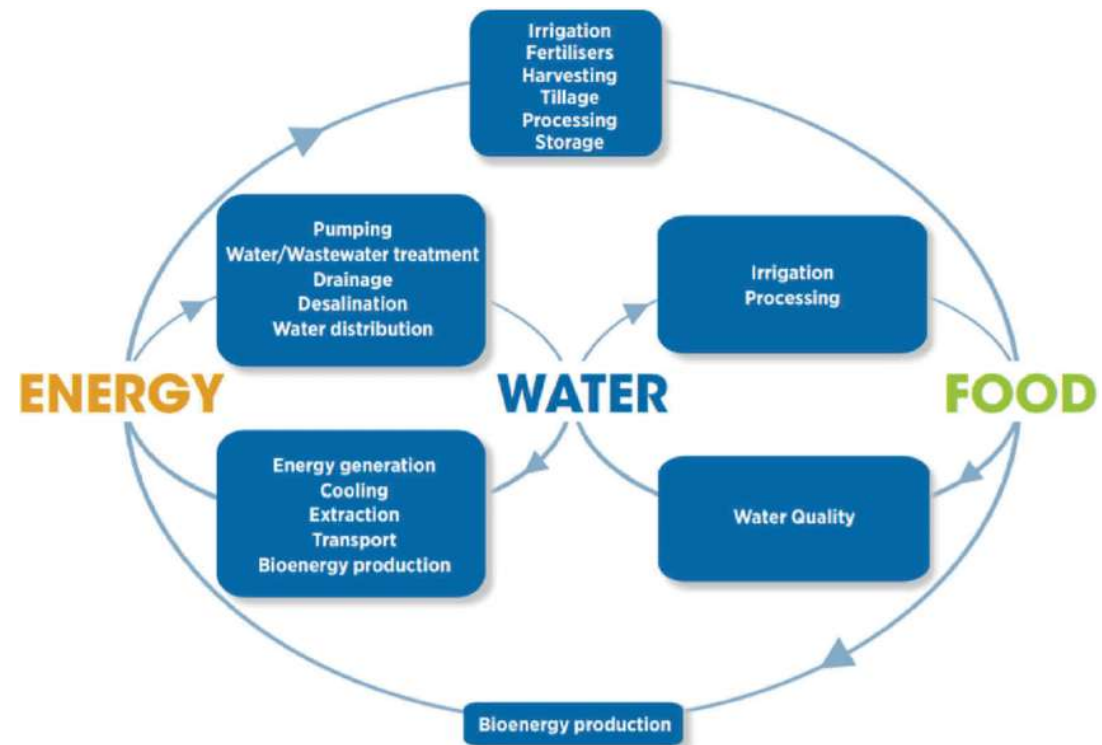


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# nexus concept and evolution of ecosystems integration

sector nexus of defined interlinkages



*Mohtar et al., 2015 and Albrecht et al., 2018*

define nexus interlinkages

which describe positive or negative interactions, flows of mass and energy, or effects related to infrastructure

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# nexus concept and evolution of ecosystems integration

sector nexus implying different layers of analysis acknowledging ecosystems as an additional component

*Sim4Nexus, 2017*

## three threads of Nexus analysis

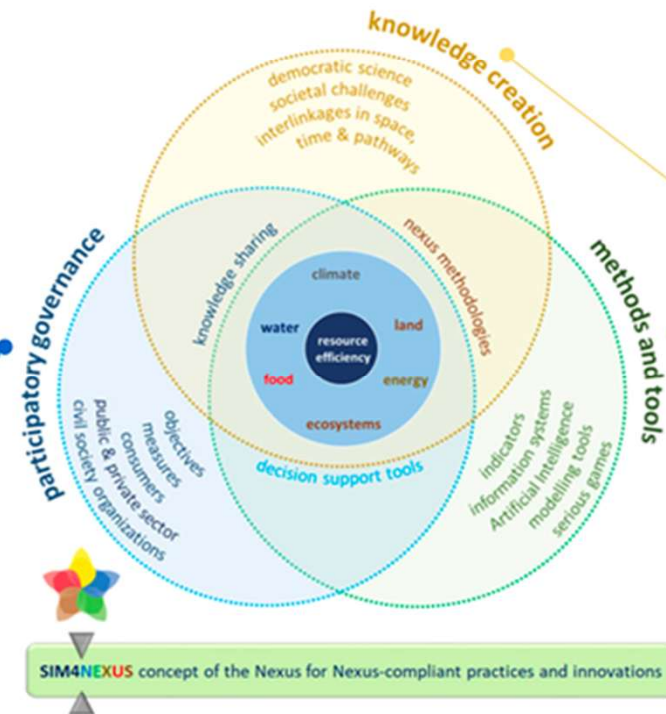
- bio-physical/bio-chemical analysis
- socio-economic analysis
- policy analysis

## three operating spheres for the Nexus

- knowledge creation
- participatory governance
- methods and tools

## SIM4NEXUS Nexus Concept and its three operating spheres

Represents the interactions with stakeholders in the case study and the transdisciplinary approach of the Nexus.



Knowledge is created when developing a nexus analysis, as well as new methods or assessment processes. It is an ever-evolving characteristic of the Nexus approach resulting from democratic science processes and dialogues between actors involved in a Nexus assessment.

Represents all analytical processes required for a nexus analysis. It highlights the importance of quantitative practices in Nexus assessments to inform decision-making.

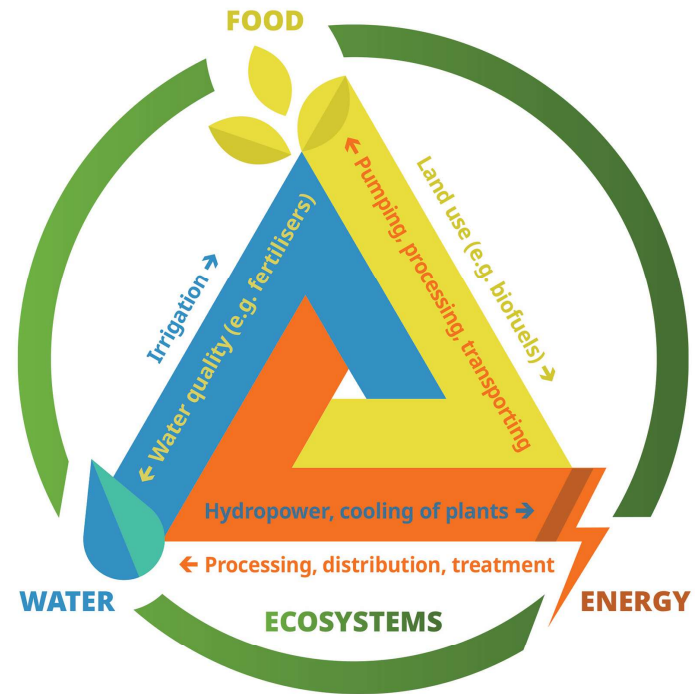
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# nexus concept and evolution of ecosystems integration

integration of ecosystems into the WEFE Nexus is not optional but fundamental

*Global Water Partnership, 2019*

Healthy ecosystems are indispensable  
for the resilience and sustainability of water, energy, and food systems,  
and their consideration must be central in nexus planning and implementation.



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# nexus concept and evolution of ecosystems integration

interconnectedness of crises and solutions

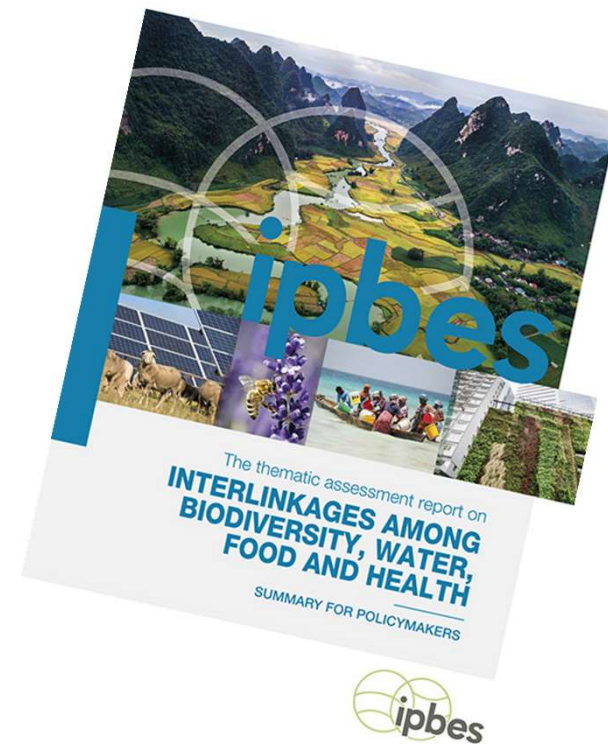
*IPBES, 2024*

biodiversity, water, food, health, and climate

Interconnected Crises Require Integrated Solutions

Biodiversity Underpins Human Well-being

Transformative Change is Essential



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# adding “Nature” to the Water-Energy-Food Nexus

- ❖ How is «nature» represented in the Water-Energy-Food Nexus?
- ❖ What is the role attributed to «nature» in the Water-Energy-Food Nexus?
- ❖ How is «nature» conceptually integrated in the Water-Energy-Food Nexus?



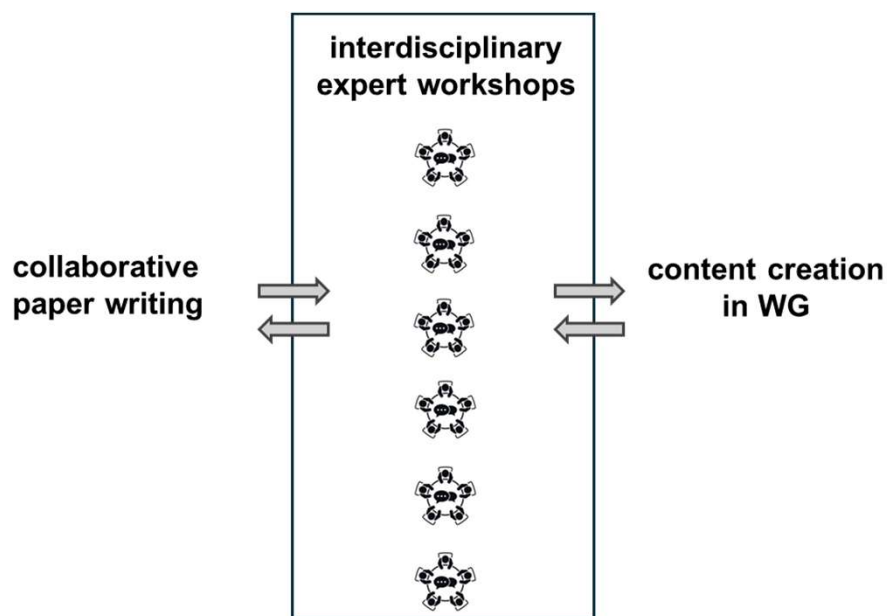
Search query	Number of publications
WEF Nexus AND Ecosystem*	400
WEF Nexus AND Environment*	1271
WEF Nexus AND Biodiversity	100
WEF Nexus AND Ecolog*	331
WEF Nexus AND Natur*	578

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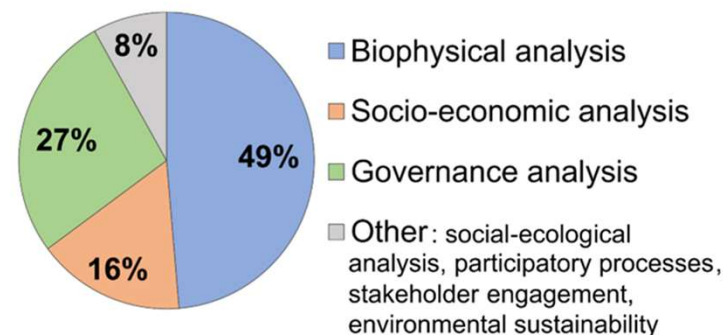
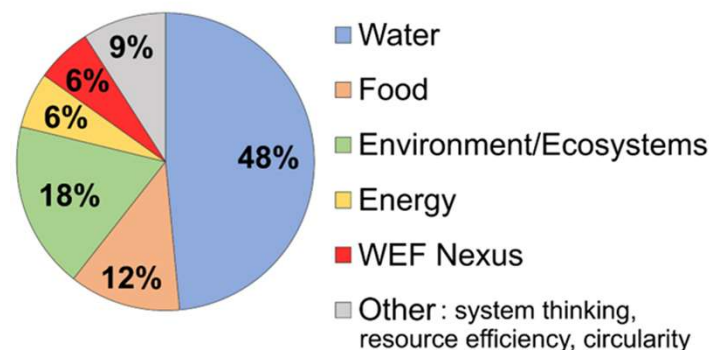
# interdisciplinary process of knowledge creation



*Network on water-energy-food nexus for a low-carbon economy in Europe and beyond*



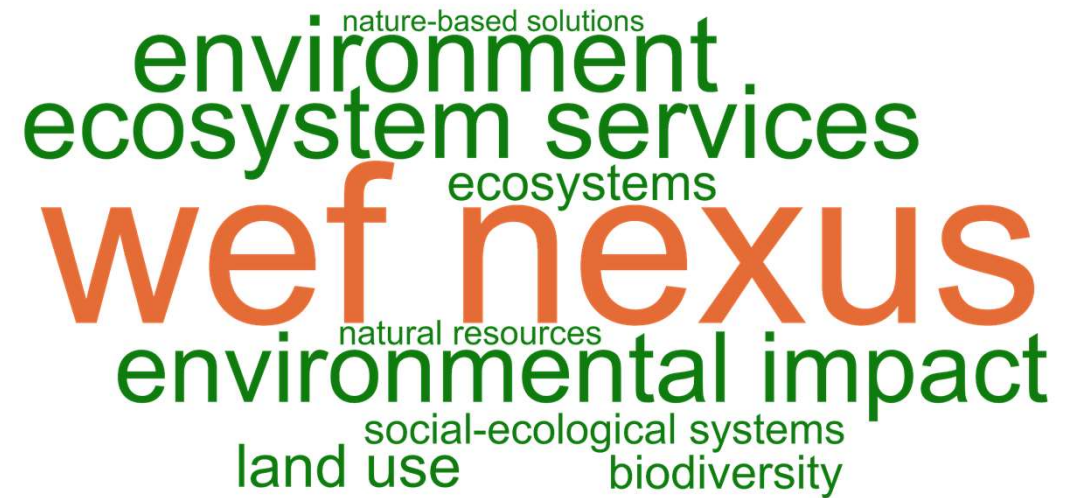
## 35 experts



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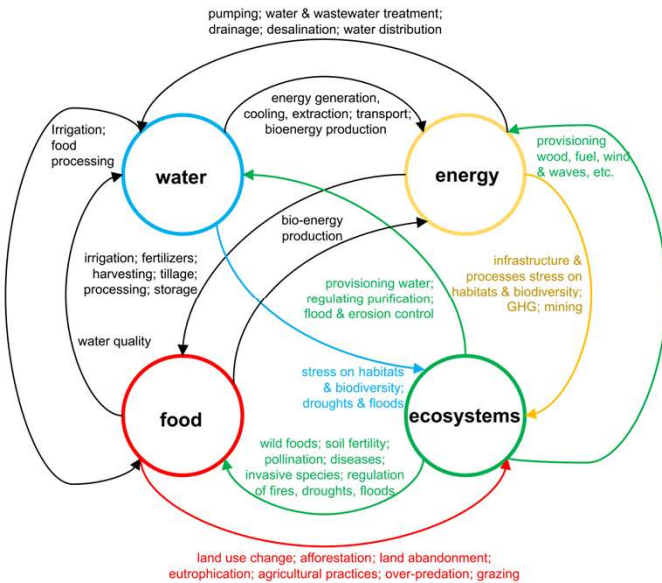


# navigating terminologies

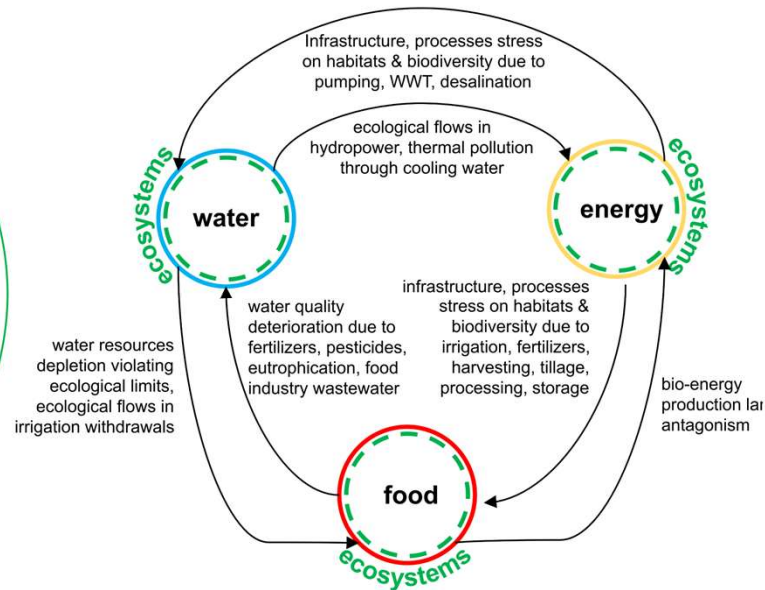


higher frequency of terminologies that have a human connotation, over terms such as ecosystems, environment and biodiversity, highlights an inherent human-centred perspective to the nature component

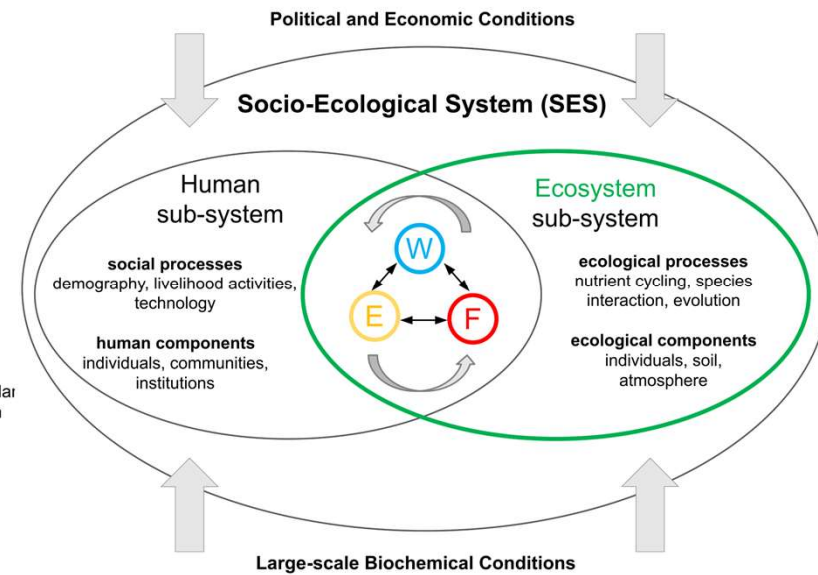
# paradigms on the integration of “nature”



*Nature as a separate node*

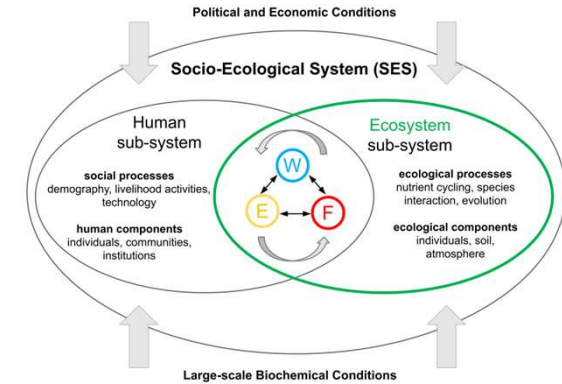
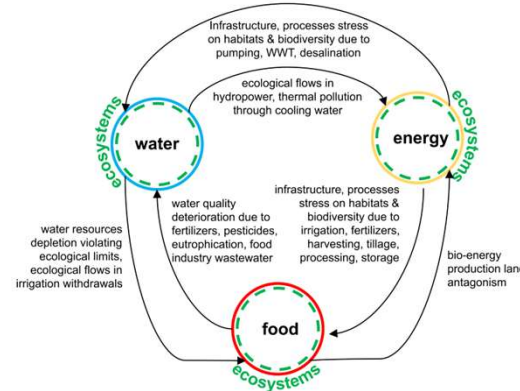
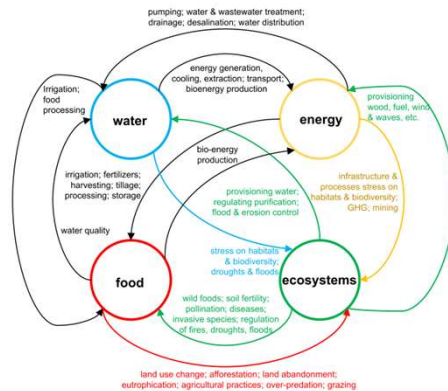


*Nature as an underlying supporting layer*



*Nexus in wider social-ecological dynamics*

# paradigms on the integration of “nature”



Level of knowledge creation  
desired or needed

+

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Facilitates creation of  
knowledge of the system

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+

Supports transformative  
change

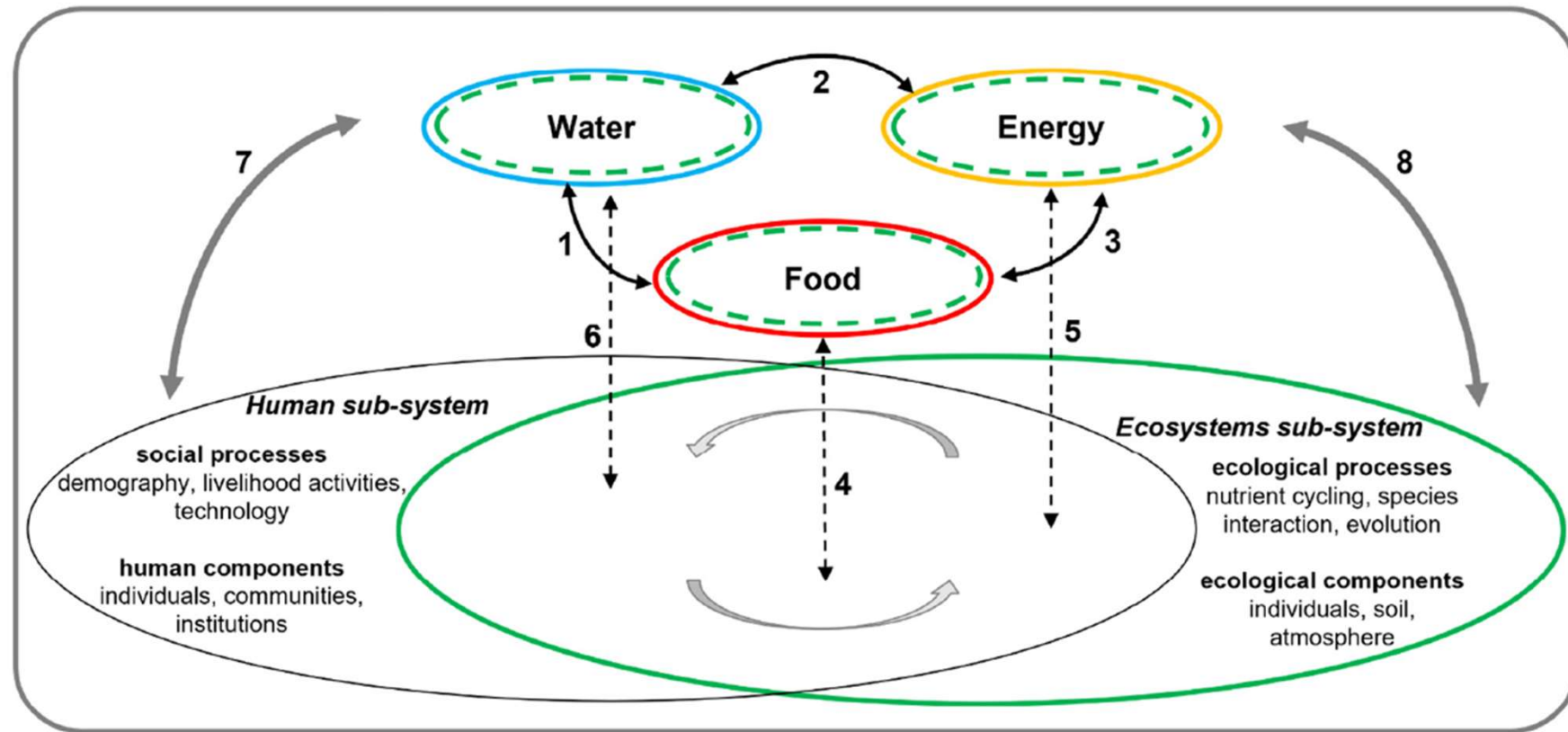
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# homogenising WEF-Nature Nexus paradigms



# concluding remarks

## Key messages

- Go beyond the optimisation of the WEF-Nature Nexus
- Recognise the intrinsic value of nature beyond the benefit to the WEF Nexus

**Insights** on how the WEF-Nature Nexus paradigm may be **operationalised** in case studies:

- Flexible, iterative, dynamic work plan (knowledge, governance, tools)
- Interdisciplinary approach + harmonized language & awareness phase
- Ex-ante policy coherence + ex-post impact evaluation
- Governance structures for cross-sector collaboration
- Robust ontologies & semantics → interoperability & data integration
- Wise choice of simulation methods (complexity science, resilience)
- Living Labs → co-creation, real-world testing, innovation
- Digital Twins → real-time data, simulation, visualization, decision support



Dimitris Kofinas, PhD  
Department of Civil Engineering,  
University of Thessaly



thank you  
for the attention

 [dimitristheokofinas@gmail.com](mailto:dimitristheokofinas@gmail.com)

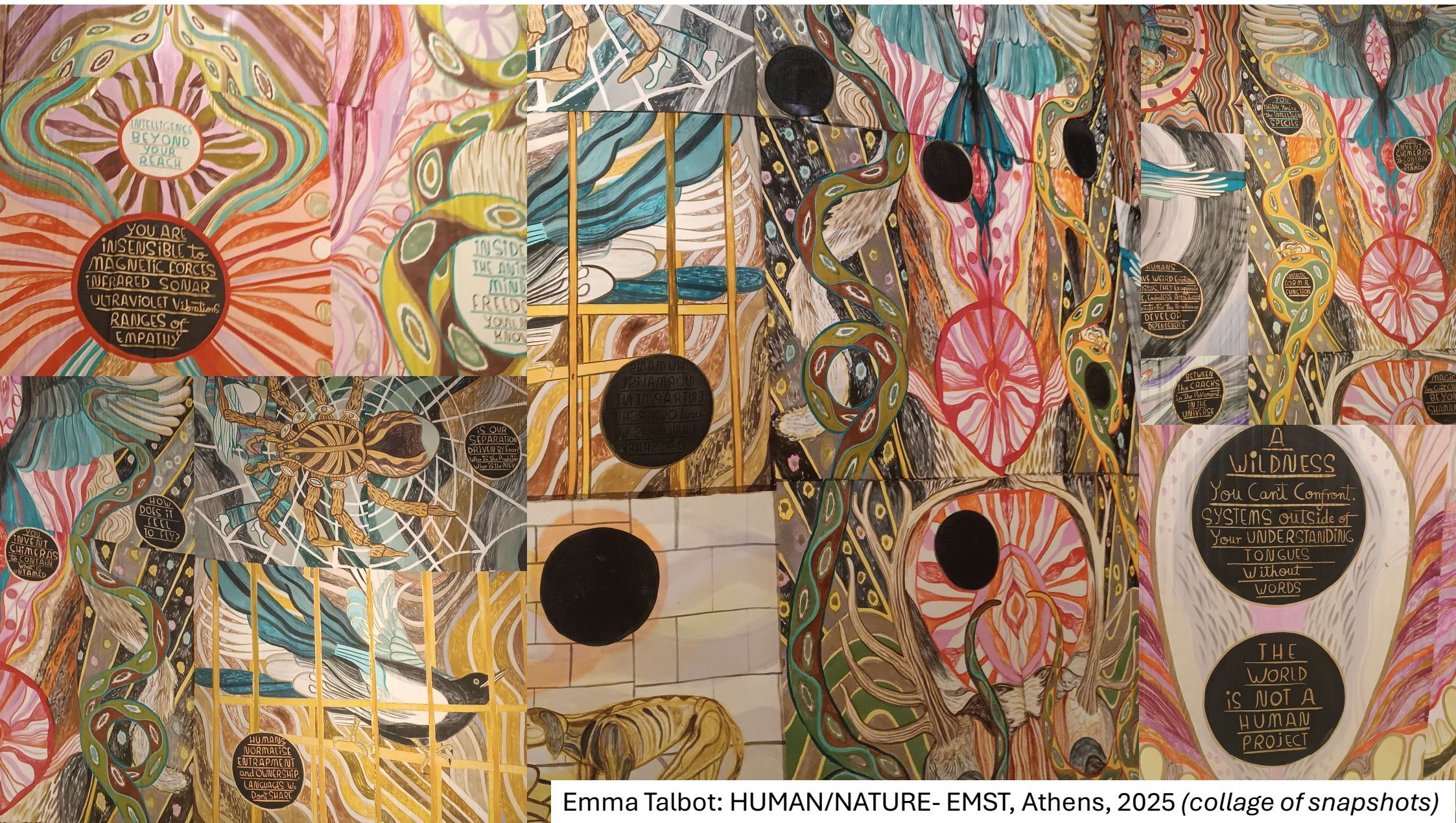
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 Dimitris Kofinas

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Emma Talbot: HUMAN/NATURE- EMST, Athens, 2025 (collage of snapshots)