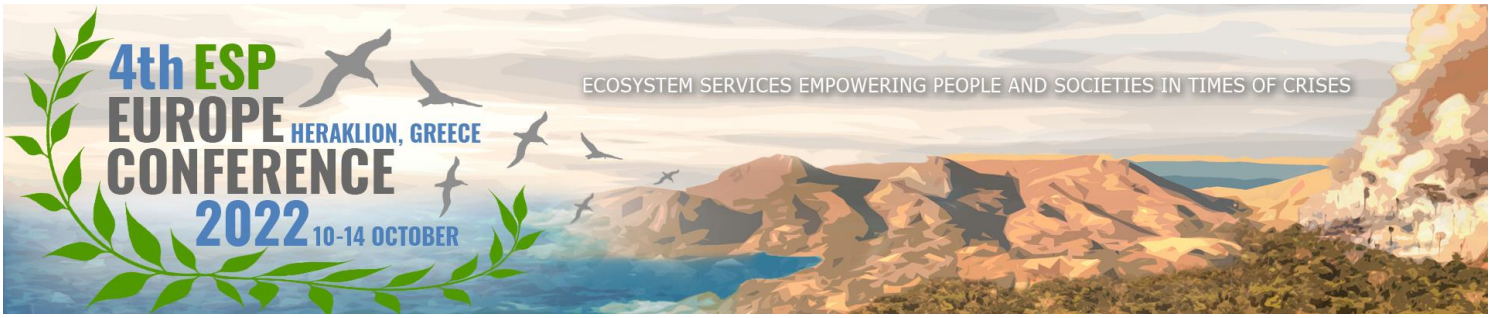


BOOK OF ABSTRACTS

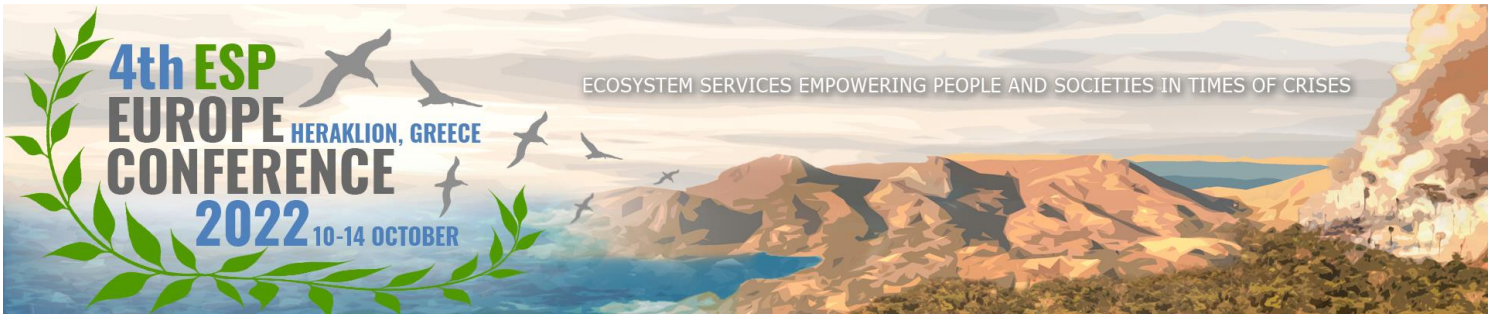
I. SESSION DESCRIPTION

ID: T5b

Emerging research on current trends and future scenarios of the nature-water-food-health-climate nexus in the context of the IPBES Nexus Assessment

Hosts:

	Title	Name	Organisation	Email
Host:	Dr	Zuzana Harmackova	CzechGlobe & Stockholm Resilience Centre	harmackova.z@czechglobe.cz
Co-host(s):	Prof	Mark Rounsevell	Karlsruhe Institute of Technology (KIT)	mark.rounsevell@kit.edu
	Dr	Odirilwe Selomane	Centre for Sustainability Transitions (CST), Stellenbosch University	odirilwe.selomane@gmail.com
	Prof	Paula Harrison	UK Centre for Ecology & Hydrology	PaulaHarrison@ceh.ac.uk
	Prof	Ralf Seppelt	Helmholtz-Centre for Environmental Research (UFZ)	ralf.seppelt@ufz.de
	Dr	Ernest Molua	Center for Independent Development Research (CIDR)	emolua@cidrcam.org
	Dr	Paula Prist	EcoHealth Alliance	prist@ecohealthalliance.org



Abstract:

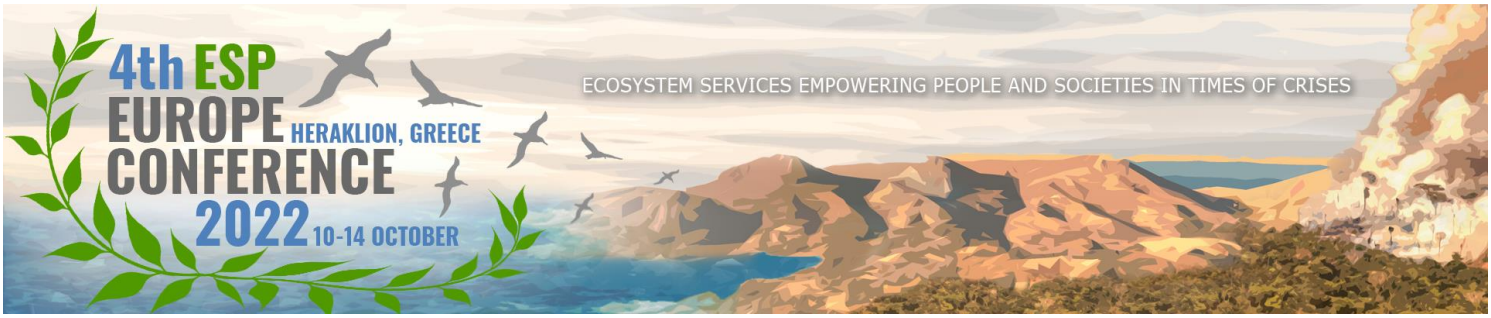
Threats to biodiversity and ecosystem services are entwined with threats to our climate, food and water systems, and human health. However, actions taken to address such threats are frequently considered in silos and thus can undermine each other leading to trade-offs or unintended consequences. Siloed approaches also fail to take advantage of co-benefits or synergies between policies/decisions.

Recent science-policy assessments (e.g. the IPBES Global Assessment) have highlighted the need for holistic solutions when addressing current societal and environmental sustainability challenges. They have highlighted the nexus thinking as a useful lens to consider multiple interactions in both global and local social-ecological systems. In particular, the nexus between biodiversity/nature/ecosystem services, food production and consumption, water provision and human health has been highlighted as a key one, including its interactions with climate, energy production and other driving forces.

In this respect, the currently developed IPBES Nexus Assessments (https://ipbes.net/nexus) seeks to synthesise available knowledge on the nature-water-food-health Nexus, its role in sustainable development, potential threats and options for policy responses.

This session aims to collect novel and emerging research on the current trends and potential future development of various nexus interactions. The session will include presentations that describe, review, synthesise and/or evaluate nexus interactions (between biodiversity and ecosystem services, water provision, food systems, human health and climate change) in terms of their environmental, social and economic costs and benefits, including any synergies and trade-offs among the multiple dimensions of the nexus. Presentations that attribute trends in important nexus interactions to drivers, particularly in terms of how actions or policies have affected or can affect elements of the nexus relative to the SDGs, will also be welcome.

The session will include studies focusing on recent and current trends in the nexus interactions, and studies (including integrated modelling studies) exploring potential future development of the nexus interactions. We particularly invite contributions addressing three or more nexus elements. In order to capture a variety of resources, the session welcomes both quantitative and qualitative studies, including studies originating from non-scientific sources (e.g. indigenous and local knowledge, practitioners' knowledge). The session will be summarised in a perspective article co-authored by the session co-hosts and the presenting authors.



Goals and objectives of the session:

The session has three main goals:

1. To showcase and discuss emerging research on current and future interactions within the Nexus.
2. To establish a collection of available and forthcoming studies on current and potential future nexus interactions.
3. To draft a perspective piece on the current frontiers in Nexus research.

Planned output / Deliverables:

1. Discussion minutes
2. Publicly available database of collected studies
3. Perspective piece outline

Session format:

Other (Speed talk/lightning session)

Voluntary contributions accepted

Yes, I allow any abstract to be submitted to my session for review

Related to ESP Working Group/National Network:

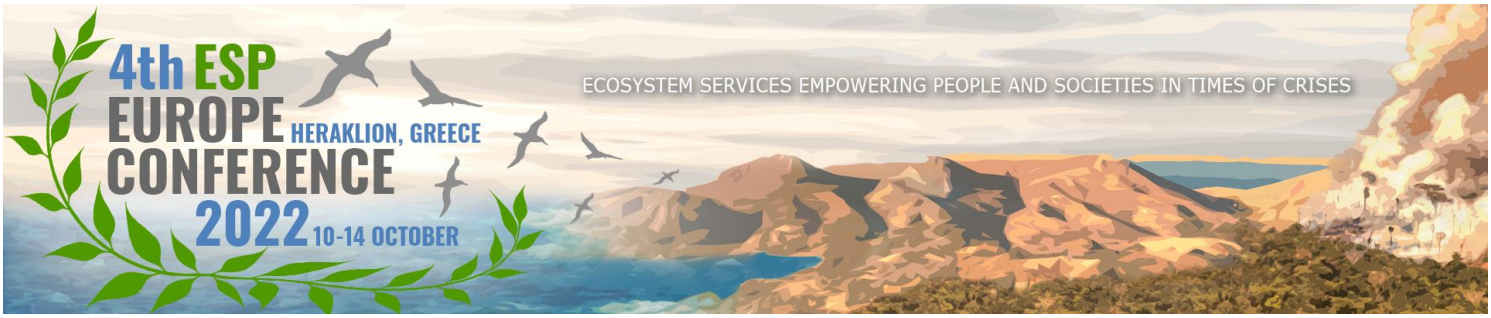
Thematic Working Groups: TWG 5 – Modeling ES

II. SESSION PROGRAM

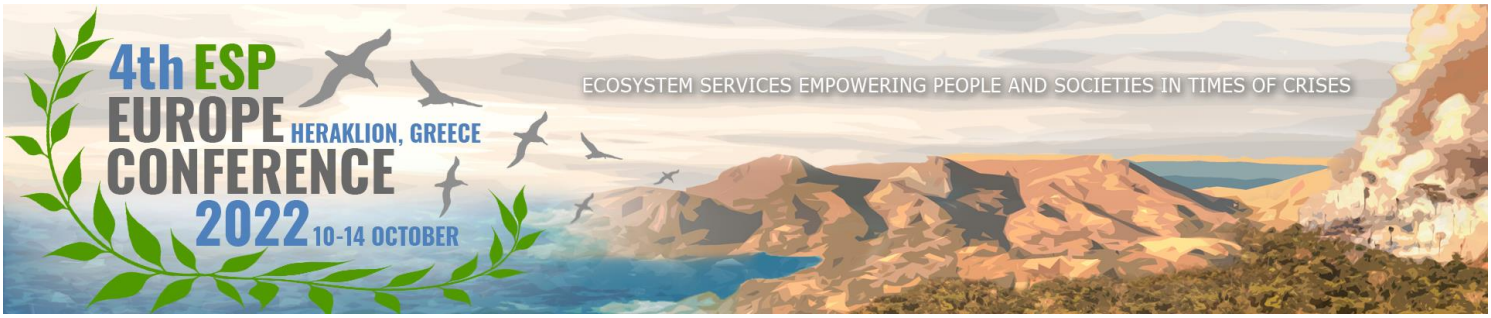
Date of session: 11 October 2022
Time of session: 16:00 – 17:30

Timetable speakers

Time	First name	Surname	Organization	Title of presentation
16:00 – 16:10	Paula	Harrison	UK Centre for Ecology and Hydrology	Introduction to the session and the IPBES Nexus Assessment
	Zuzana	Harmáčková	CzechGlobe & SRC	



Time	First name	Surname	Organization	Title of presentation
16:10 – 16:20	Beatrice	Sambo	University of Ca' Foscari, Euro-Mediterranean Center on Climate Change (CMCC), EURAC Research	A literature-based review on methodologies and models for the Water- Energy- Food- Ecosystem Services (WEFE) nexus assessment in the context of climate change.
16:20 – 16:30	Diana	Sietz	Thünen Institute of Biodiversity	Tailored pathways to inspire agroecological action and policy
16:30 – 16:40	Pankaj	Kumar	Institute for Global Environmental Strategies	Nexus approach to evaluate the interlinkages between water, food, health, economy and climate change: A case study from Sundarban delta, Bangladesh
16:40 – 16:50	Geula Michael	Bitton	University of Haifa	Water-Energy-Food-Ecosystem (WEFE) Nexus Analysis of River Rehabilitation under Different Development Scenarios: Israel as a case study
16:50 – 17:00	Ana Paula	Turetta	Brazilian Agricultural Research Corporation (Embrapa)	Agriculture beyond food production: The Food-Water-Energy Security Nexus in Atlantic forest biome – southeast of Brazil
17:00 – 17:10	Anna	Sperotto	Basque Centre for Climate Change	Putting nature in the Nexus: an ecosystems services-based approach for Water-Energy-Food interactions assessment
17:10 – 17:20	Edmundo	Barrios	Food and Agriculture Organization of the UN (FAO)	Harnessing the multiple dimensions of agroforestry contributions to agroecological transitions using nexus analysis and visual narratives
17:20 – 17:30				Discussion & wrap-up



III. ABSTRACTS

Abstracts are ordered based on the session program. The first author is the presenting author unless indicated otherwise.

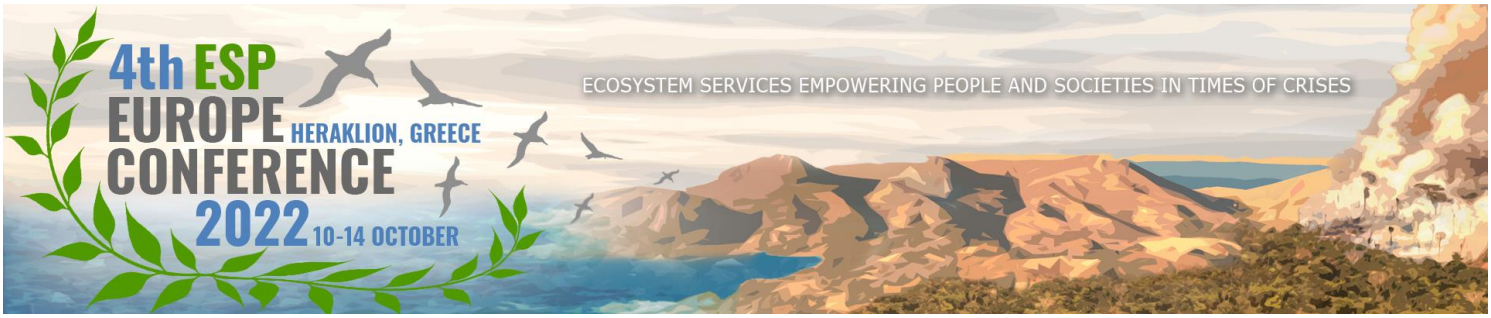
1. Type of submission: Abstract

T. Thematic Working Group sessions: T5b - Emerging research on current trends and future scenarios of the nature-water-food-health-climate nexus: Informing the IPBES Nexus Assessment

Nexus approach to evaluate the interlinkages between water, food, health, economy and climate change: A case study from Sundarban delta, Bangladesh

Presenting author: Pankaj Kumar
Other author(s): Yasuo Takahashi, Koji Miwa
Affiliation: Institute for Global Environmental Strategies, Japan
Contact: kumar@iges.or.jp

In the face of rapid global change, the downstream of world's largest delta faces a significant high number of extreme events, especially hydrometeorological hazards. This makes life of people miserable and center of this vulnerability associated with the water resources like water availability in terms of both quality and quantity for household, agriculture, industries etc. For the last few decades, researchers and policymakers are focusing on silos or two-way interactions to address issue of water resource management and human well-being. Most of the works were focused towards prioritizing the existing and future trends of the water demand-resource relationship acknowledging the multifaceted policies on the management of water resources. However, the complex nature of interlinkage between water, food, health, economy and climate change makes it hard to address the future interaction between human and water systems. Hence this work focuses on deciphering the interlinkage between water-health-economy-climate change through a nexus lens in Sundarban delta of Bangladesh. An integrated approach of numerical simulation and household survey was used. Result suggests physical and mental illness along with occupational shifting are the final outcome controlled by multifarious factors starting from the resource availability due to



rapid population growth, ecosystem vulnerability, and socio-economic status of the area. It also calls for a nexus approach, which will be helpful to sketch projections of alternatives that explicitly account for plausible and co-evolving trajectories of the socio-hydrological system, which will yield both insights into cause-effect relationships and help stakeholders to identify safe functioning space.

Keywords: Socio-hydrological approach; Nexus; Bangladesh

2. Type of submission: Abstract

T. Thematic Working Group sessions: T5b - Emerging research on current trends and future scenarios of the nature-water-food-health-climate nexus: Informing the IPBES Nexus Assessment

Putting nature in the Nexus: an ecosystems services-based approach for Water-Energy-Food interactions assessment

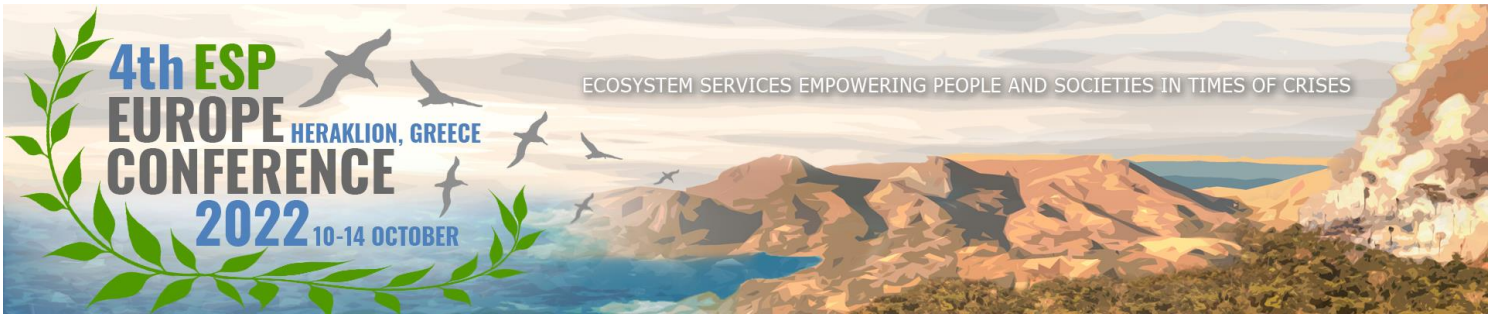
Presenting author: anna sperotto
Other author(s): Ferdinando Villa, Stefano Balbi
Affiliation: Basque Centre for Climate Change, Spain
Contact: anna.sperotto@bc3research.org

Managing water, energy and food adopting a nexus approach (WEF nexus) is crucial to guarantee the sustainable use of resources, particularly in light of global changes.

Ecosystems represent the bio-physical foundation of the nexus as they provide multiple services upon which each of the three WEF sectors ultimately depends. On the other hand, anthropogenic pressures originated from nexus sectors can negatively impact on ecosystems process and functions altering or inhibiting the capacity to deliver their services.

Despite being rarely explicitly addressed in current nexus analysis, Ecosystem Services (ESs) constitute a useful perspective to look at WEF interactions as they can be used as common assessment endpoints permitting to better disentangle and manage cross-sectoral synergies and trade-offs.

An innovative ecosystem services-based approach was adopted to the Secchia River basin (Italy) to investigate possible conflicts between water, energy and food security and to identify opportunities for delivering integrated solutions towards the achievement of multiple Sustainable Development Goals (SDGs).



Starting from the nexus framing, a participative approach was applied for engaging local stakeholders' representative of different nexus sectors in identifying existing conflicts in water use and prioritizing ESs they value the most.

Later, ARIES (Artificial Intelligence for Environment and Sustainability), an Artificial Intelligence modeler based on the semantic web, is used to develop an integrated model to spatially-temporally represent most relevant ESs and flows exchanged through the WEF nexus building on available and accessible sectoral data and models.

The proposed approach permits to map critical areas for multiple ESs provision to WEF and thus to identify where synergies and trade-offs between sectors are likely to arise.

Based on this results, different scenarios describing multiple combinations of social, economic and climatic pathways are tested serving as the basis for the definition of a shared management strategy for long-term nexus sustainability.

Keywords: nexus, Ecosystem Services, Artificial Intelligence, global changes, participative approach

3. Type of submission: Abstract

T. Thematic Working Group sessions: T5b - Emerging research on current trends and future scenarios of the nature-water-food-health-climate nexus: Informing the IPBES Nexus Assessment

Tailored pathways to inspire agroecological action and policy

Presenting author: Diana Sietz
Other author(s): Sebastian Klimek, Jens Dauber
Affiliation: Thünen Institute of Biodiversity, Germany, Germany
Contact: diana.sietz@thuenen.de

The current farmland biodiversity crisis undermines the very basis of agroecosystems' productivity and hence sustainability of food systems with negative implications for accomplishing several Sustainable Development Goals (e.g. SDGs 2, 3, 13, 15). Transforming our global agricultural land and food systems toward agroecological production principles, i.e. fundamentally changing nexus interactions at the interface between agriculture, food, climate and health, is a widely acknowledged necessity. However, applying the same agroecological principles everywhere is inappropriate, since interactions between agriculture

and farmland biodiversity differ according to the level of agricultural production and pressures imposed on biodiversity.

Using empirical evidence, we conceptualised tailored future pathways along which agricultural land systems can best contribute to the overarching vision of restoring and maintaining farmland biodiversity while fostering healthy diets and empowering people. The future pathways are based on the current interplay between agricultural production and farmland biodiversity to which we fitted farming approaches based on agroecological principles depicting a transformative vision. The pathways shift the focus away from maximised production toward optimised effectiveness of biodiversity and ecosystem service enhancement while maintaining productivity, ensuring the affordability of healthy diets and building resilience. They provide strong impetus to phase out the use of agrochemicals, re-organise agricultural management and re-establish landscape structure, all essential elements for achieving the vision of sustainable food and agriculture.

The tailored pathways provide differentiated insights well suited to inform integrated modelling to explore possible future development of nexus interactions. Moreover, they enable a systematic refinement of existing biodiversity and agricultural policies so that they can have most impact benefitting people and nature.

Keywords: Transformative change, agrobiodiversity, food production, sustainable agriculture, policy

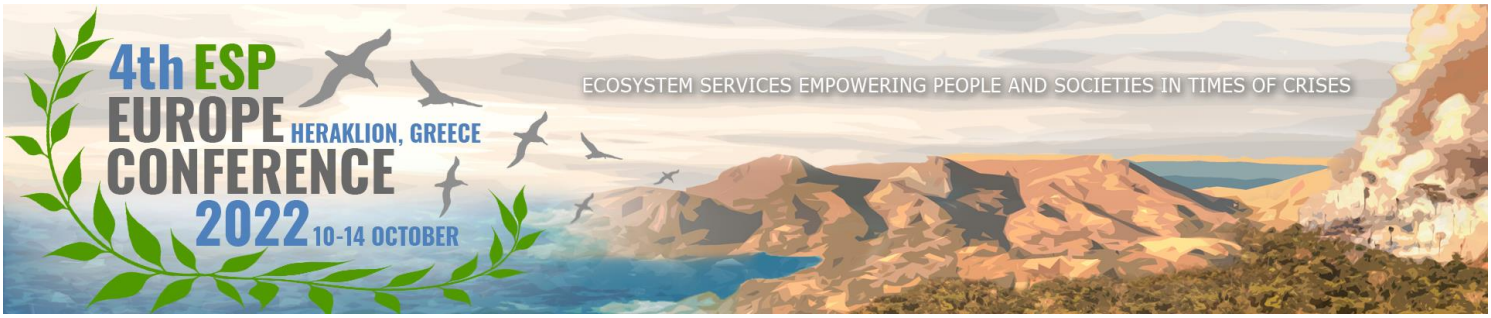
4. Type of submission: Abstract

T. Thematic Working Group sessions: T5b - Emerging research on current trends and future scenarios of the nature-water-food-health-climate nexus: Informing the IPBES Nexus Assessment

Agriculture beyond food production: the Food-Water-Energy Security Nexus in Atlantic forest biome – southeast of Brazil

Presenting author: Ana Paula Turetta
Other author(s): Gabriela Teixeira Duarte, Julia Camara Assis
Affiliation: Brazilian Agricultural Research Corporation (Embrapa), Brazil
Contact: ana.turetta@embrapa.br

Global agricultural production is on a trajectory to double by 2050 due to both increases in the global population and the dietary changes associated with growing incomes. This also



means more pressure on water resources, as agriculture accounts for 70% of global water withdrawal, and for energy production as the whole food supply chain accounts for about 30% of total global energy consumption. Although there are ongoing discussions related to the sustainability of food, water and energy sectors, the integration of all three are still rare and challenging. We investigated the interconnections of the Food, Water and Energy (F-W-E) security systems through the evaluation of agricultural practices impacts on this nexus. Focusing on the Brazilian Atlantic Forest biome as study case, our main goals are 1) to elucidate the impacts of rural conservation practices on food, water and energy production based on literature analysis, 2) to propose F-W-E attributes and evaluate how they are addressed by rural practices. Our findings demonstrated, in general, a positive impact of conservation agricultural practices on attributes that affect the F-W-E security; some agricultural practices, such as “no tillage” are very well documented specially regarding their effects on soil quality parameters; few results were found connecting agricultural practice and energy aspects. These are key elements that corroborate with the agriculture multifunctionality approach and the results can better guide strategies planning in the agricultural sector and subsidize decision making.

Keywords: soil functions, multifunctional agriculture, food security, water security, energy security

5. Type of submission: Abstract

T. Thematic Working Group sessions: T5b - Emerging research on current trends and future scenarios of the nature-water-food-health-climate nexus: Informing the IPBES Nexus Assessment

Water-Energy-Food-Ecosystem (WEFE) Nexus Analysis of River Rehabilitation under Different Development Scenarios: Israel as a case study

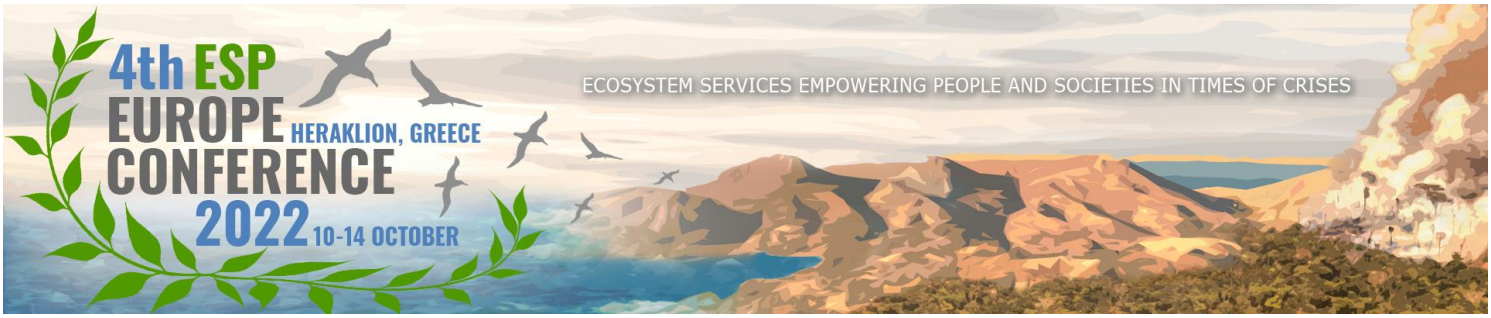
Presenting author: Geula Michael Bitton

Other author(s): Prof. Boris Portnov, Dr. Shiri Zemah-Shamir

Affiliation: Department of Natural Resources and Environment Management, University of Haifa, Israel, Israel

Contact: geula_b@inter.net.il

The way human society consumes natural resources puts enormous pressure on the environment. The concept of the water-energy-food-ecosystem (WEFE) nexus aims to



integrate resource management across the different production sectors while maintaining ecosystems intact and as healthy as possible, thus helping to meet future challenges.

In the WEFE nexus, freshwater plays a pivotal role, acting simultaneously as a production input and aquatic ecosystem, for which it is critical to maximizing synergies, optimizing trade-offs, reducing negative externalities, and encouraging positive externalities. Due to this vital role, we focus on rivers and streams for which the WEFE nexus will be explored. In this study, the term "river' refers to rivers, streams, and springs.

This research aims to construct and test a river index using Israel as a case study. It will integrate the WEFE nexus, ecosystem services approach, and ecological functioning by focusing on the services provided by healthy and functioning rivers and trade-offs, synergies, and externalities. The index will comprise primary indicators and weights to analyze the rivers' state, the need, and the ecological and economic contribution of rehabilitation programs.

To our best knowledge, this study is one of a few studies worldwide that consider externalities, ecosystems, and ecosystem services in the WEFE nexus, with a particular focus on rivers. Moreover, the study will be the first to implement the WEFE nexus concept in Israel by applying it to freshwater ecosystems.

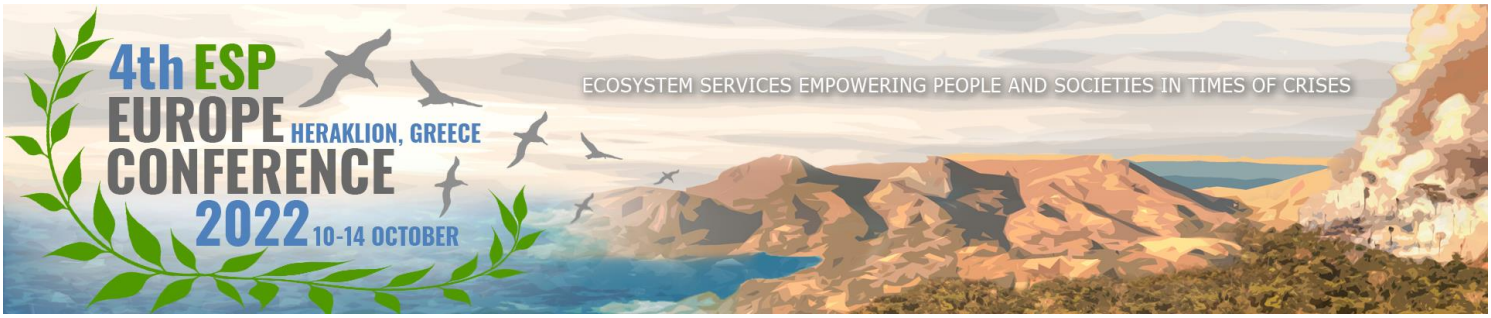
The study will provide policy-makers with a holistic economic assessment and complementary resource management tool that will pave the way for sustainable water, energy, and food management, by focusing on a nexus of natural water resources and ecosystem services.

Keywords: river rehabilitation index, water-energy-food-ecosystem (WEFE) nexus, sustainability, resource management, ecosystem services.

6. Type of submission: Abstract

T. Thematic Working Group sessions: T5b - Emerging research on current trends and future scenarios of the nature-water-food-health-climate nexus: Informing the IPBES Nexus Assessment

A literature-based review on methodologies and models for the Water- Energy- Food-Ecosystem Services (WEFE) nexus assessment in the context of climate change.



Presenting author: Beatrice Sambo

Other author(s): Andrei Munteanu, Anna Sperotto

Affiliation: University of Ca' Foscari, Euro-Mediterranean Center on Climate Change (CMCC), EURAC Research,

Contact: beatrice.sambo@unive.it

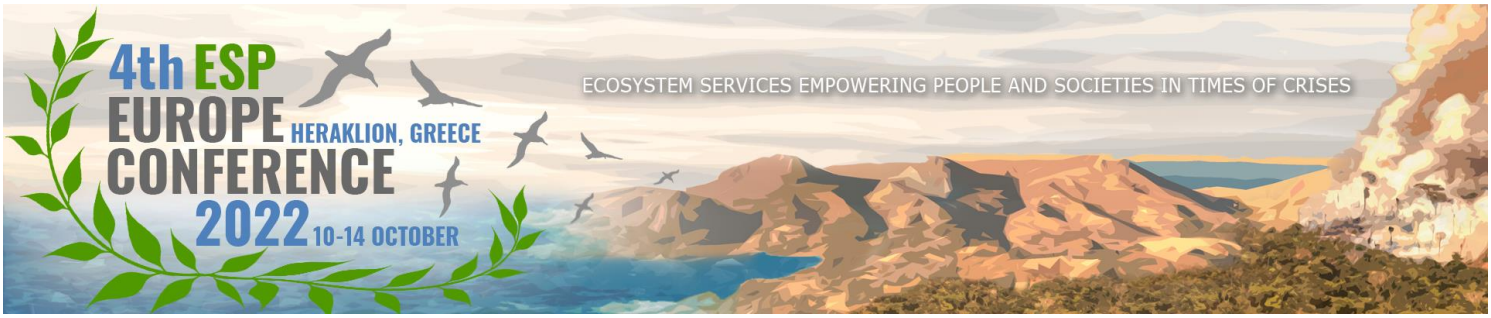
The interrelations' analysis of the Water-Energy-Food-Ecosystem Services (WEFE) nexus is becoming a significant matter in the academic and policy debate. A nexus system thinking allows to consider dynamics and feedbacks among water resources management, climate change adaptation, food security, supporting the achievement of Sustainable Development Goals and the coherence among sectorial EU policies. Existing studies are still focused on assessing dual interactions not considering the WEFE whole structure. The recent methodologies are encountering challenges related to how to deal with large, sector-specific data and how to integrate them. Despite the importance of Ecosystem Services (ESs) within the WEFE nexus is recognized, they are still difficult to be integrated within the mainstream nexus frameworks, commonly centered on WEF sectors' interlinkages.

To bridge these gaps, an in-depth state-of-the-art review on the main methodologies to integrate ESs and climate change effects within the nexus approach was undertaken. The review focused on i) how complex interlinkages between the sub-sectors of the WEF nexus and ESs are modelled and operationalized in current conceptual frameworks; ii) how the spatial and temporal dynamics of nexus are changing under future climate and socio-economic scenarios; iii) which are the recent applied tools and methods allowing to operationalize the WEFE nexus behaviors and to support decision making policies.

The results show that the interrelations among the WEFE sectors within conceptual frameworks are mainly modelled by qualitative methods (e.g. causal loops, multi-criteria decision analysis); while the spatio-temporal dynamics are mainly assessed by quantitative approaches (e.g. System Dynamics, Bayesian Networks). Furthermore, ecosystem services and climate change are mainly considered as external drivers influencing the WEF nexus sectors rather than a nexus component.

Finally, promising research studies are exploring the potential role of new technologies, (e.g. complex sciences, Artificial Intelligence and Machine Learning) to assess ecosystem services within the nexus.

Keywords: WEFE nexus, ecosystem services, complex sciences, climate change



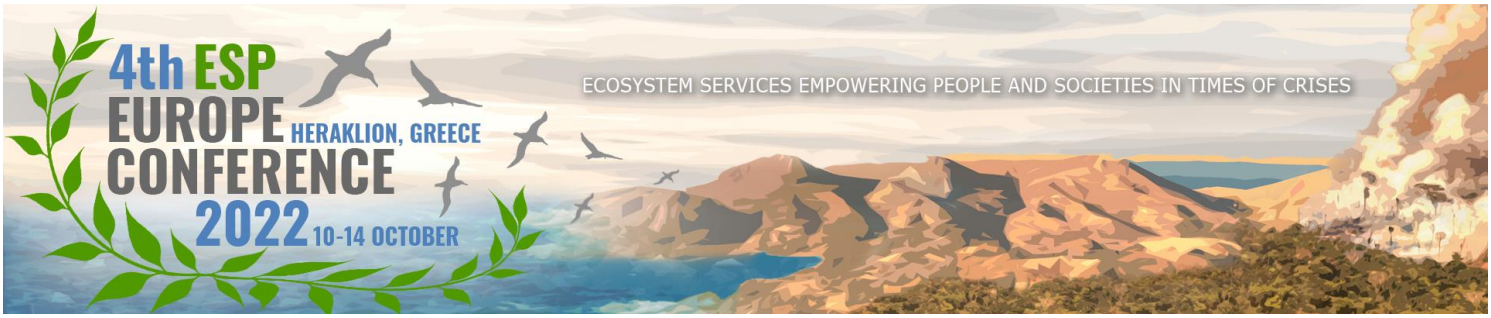
7. Type of submission: Abstract

T. Thematic Working Group sessions: T5b - Emerging research on current trends and future scenarios of the nature-water-food-health-climate nexus: Informing the IPBES Nexus Assessment

Harnessing the multiple dimensions of agroforestry contributions to agroecological transitions using nexus analysis and visual narratives

Presenting author: Edmundo Barrios
Other author(s): Ronnie Brathwaite,
Affiliation: Food and Agriculture Organizations of the UN (FAO), Italy
Contact: edmundo.barrios@fao.org

The magnitude and urgency of the challenges facing agriculture and food systems demand profound modifications in different aspects of human activity to achieve real transformative change and sustainability. The disconnection between food production and consumption, and between local practices and global commitments is a significant restriction to the implementation of the SDGs by limiting the capacity for alignment of single actors and collective action towards positive economic, environmental or social impacts. Successful transitions to sustainable agriculture and food systems would likely benefit from holistic and people-centred approaches that embrace a long-term vision, such as agroecology, which is increasingly acknowledged for its potential to bring about transformative changes required to meet the SDGs. Agroecology is an integrated approach that simultaneously applies ecological and social concepts and principles to the design and management of food and agricultural systems. Recognizing that the inherent complexity of achieving sustainability is commonly seen as a deterrent to decision-making, the 194 member countries of FAO approved the 10 Elements of Agroecology as an analytical framework to support the design of differentiated paths for agriculture and food systems transformation. We will highlight the important contributions of agroforestry to the biodiversity, consumers, education and governance entry points and build a structured process using visual narratives that rely on the 10 Elements of Agroecology icons to graphically dissect prospective social-ecological transition trajectories and guide integrated policy design. Visual narratives will explore the biodiversity-nutrition-climate change nexus and the consumers-markets-health nexus. It will be shown that this type of structure can allow different stakeholders to articulate challenges faced, build consensus towards desired goals, use a common language when sharing information on the status of implementation, and encourage collective action and alignment towards achieving the greatest possible impact.



Keywords: Agroecology, Agroforestry, Nexus, Sustainability, Transitions