NEXOGENESIS
STREAMLINING WATER RELATED POLICIES

Policy Brief #3

June 2025

Lessons from 5 case studies to scale-up Smart WEFE Nexus Policies for a green and digital world

NEXOGENESIS is a 4-year (2021-2025) European research and innovation project funded by the European Commission under the H2020 programme. It gathers 20 partners from Europe and South Africa with the aim of enabling the next generation of intelligent water-related policies, using artificial intelligence and machine learning to assess policy impacts on the WEFE nexus and suggest improved policy design for coherence. The project includes four European case studies and one in South Africa.

The European Commission's Water Resilience Strategy (WRS) outlines an ambitious roadmap to enhance water security and adapt to growing hydrological challenges. NEXOGENESIS, through its Nexus Policy Assessment Tool (NEPAT) and multi-country case studies, offers concrete methods and validated pathways to operationalise water-smart, cross-sectoral governance. This brief proposes how specific policy actions from the WRS can be accelerated and deepened using the outputs of NEXOGENESIS, especially for Artificial Intelligence (AI) and data-driven decision support, transboundary governance, and stakeholder co-creation. This policy brief is mainly based on the implementation reports of the different case studies and Water Project Europe session[1] that took place in May 2025.

Main Recommendations

1

Improve the robustness of governance architecture

2

Invest in human capital for water resilience

3

Enhance data governance and interoperability

4

Strengthen transboundary & cross-level governance

1. Water Project Europe on 15th June in Warsaw that places two flagship EU-funded projects – NEXOGENESIS and ARSINOE – at the centre of the debate on water policy transformation and climate resilience. Water Projects Europe 2025, part of Water Knowledge Europe and the Blue Deal Congress. https://watereurope.eu/event/water-projects-europe-2025/

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Improve the Robustness of Governance Architectures

The NExus Policy Assessment Tool (NEPAT) is an interactive simulation tool designed to help users analyse the complex interconnections between Water, Energy, Food, and Ecosystems (WEFE). By simulating different climate and socioeconomic scenarios, NEPAT empowers policymakers, researchers, and stakeholders to assess the potential impacts of policies and make informed decisions for sustainable resource management. Based on the 17 evidence-based recommendations for future WEFE nexus projects[2], the European governance could facilitate a WEFE nexus governance by:

- **Embedding WEFE indicators in national planning frameworks, including the Common Agriculture Policy, Energy Union, and Biodiversity Strategy.** The WEFE Nexus Footprint enables policymakers to visualise trade-offs and synergies across sectors[3].

- **Strengthening the implementation of the Water Framework Directive[4] (WFD) to align and facilitate co-benefits for other EU objectives.** The characteristics of the river basin district (article 5 WFD) as well as the River Basin Management Plan (RBMP) (article 13 WFD) should consider a WEFE nexus approach.

- **Transitioning the NEPAT from a project tool into the EU toolbox.** Its intuitive interface and AI-powered scenario testing enable informed, cross-sectoral decision-making process[5].

  Encouraging deep stakeholder engagement – beyond water-centric ones as shown in NXG[6] – into the RMBP process, using additional platforms relevant to the local contexts. NEXOGENESIS stakeholder engagement showed a power mismatch across WEFE sectoral actors which hampers effective RMB planning and implementation of existing plans. The workshops stressed that there is a gap in the active involvement of all interested parties in the implementation of this Directive, in particular in the production, review and updating of the RBMPs (article 14) which could lead to a loss of trust and understandings between the different stakeholders[7].

- **Scaling proven governance models**:
  - In the **Nestos/Mesta[8],** the stakeholder discussion demonstrates the benefits of a bottom-up governance roadmap, particularly to design, promote and adopt specific strategic and financial plans towards policy implementation.
  - In the **Jiu River Basin[9], moderation** across actors of varying degrees of power helps connecting with governance platforms that can support long-term sustained stakeholder engagement.

2. Glass, J., Dupont, G., Blicharska, M., (2025). *Recommendations, experience, lessons learned from all case studies* (Deliverable 5.7) UU.
3. Nievas, N., Dkouk, C., & Echeverria, L. (2025). *Final version of the self-assessment nexus engine with corresponding validation* (Deliverable 4.5). EUT. NEPAT's GUI and visual tools are specifically designed to mediate cross-sectoral discussions by showing trade-offs and synergies
4. European Union, Directive 2000/60/EC of the European Parliament and of the Council of 23 October 2000 establishing a framework for Community action in the field of water policy, *Official Journal L 327 , 22/12/2000 P. 0001 – 0073.*
5. Nievas, N., Dkouk, C., & Echeverria, L. (2025). *Final version of the self-assessment nexus engine with corresponding validation* (Deliverable 4.5). EUT.
6. Avellan, T, et al. (2025), *Report on stakeholder engagement* (Deliverable 5.1) AVA.
7. Glass, J., Dupont, G., Blicharska, M., (2025). *Recommendations, experience, lessons learned from all case studies* (Deliverable 5.7) UU. and Avellan, T, et al. (2025), *Report on stakeholder engagement* (Deliverable 5.1) AVA.
8. Papadopoulou, C.-A., Papadopoulou, M. P., Kourtis, I., Tsihrintzis, V., et al. (2025). *Implementation report for Nestos Case Study* (Deliverable 5.2). NTUA ; Bremere, I., & Indriksone, D. (2025). *Implementation report for Lielupe Case Study* (Deliverable 5.3). Baltic Environmental Forum (BEF).
9. Nanu, F., Groza, I., & Deaconu, M. (2025). *Implementation report for Jiu Case Study* (Deliverable 5.4). BDG ; Carnelli, F., Cocuccioni, S., & Terzi, S. (2025). *Implementation report for Adige Case Study* (Deliverable 5.5). Eurac Research.

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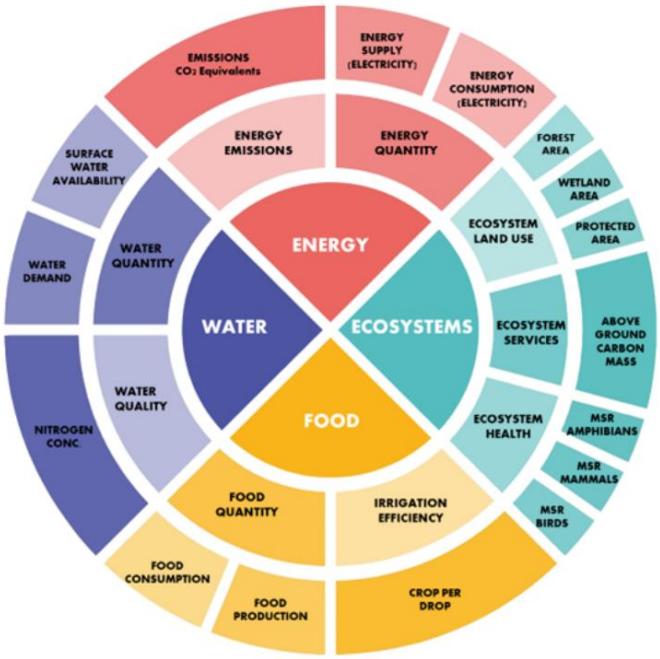
Invest in Human Capital for Water Resilience

Achieving water resilience requires sustained investment in people and institutions that drive cross-sector collaboration. Case studies[10] demonstrate that technical capacity, institutional memory, and effective facilitation of stakeholder meetings and encounters are essential to implement nexus-based governance over time[11]. To build a skilled and resilient governance ecosystem, we recommend to:

- **Integrate WEFE nexus training into higher education and vocational programmes**, with a focus on systems thinking, scenario planning, and cross-sectoral governance. The Water Academy initiative under the WRS should include NEXOGENESIS outputs**,** notably the NEPAT interface and WEFE Nexus Footprint, as training tools for future practitioners[12].

- **Engage policymakers as early as possible by linking nexus goals to their priorities.** In Adige case study, the participation of provincial leaders took place after preliminary results aligned with their water management goals[13].

- **Secure long-term funding or institutional anchoring to prevent post-project disengagement.** Most CSs will sustain SH engagement only through new, related (research) projects while continuing the discussion about institutional anchoring[14].



Nexus Footprint sub-pillars

This approach ensures that the WRS is not only technologically advanced but also socially embedded, with competent actors equipped to manage complexity and sustain engagement beyond political or funding cycles. Investment in human capital in terms of skills and vocational programmes is critical to achieve a nexus-based governance.

10. Particularly the case study from Jiu and Inkomati-Usuthu which deal with international river basin.
11. *Implementation report for Jiu Case Study* (Deliverable 5.4). BDG. ; Haupt, B., & Kristensen, D. (2025). *Implementation report for Inkomati-Usuthu Case Study* (Deliverable 5.6). JAWS.
12. Nievas, N., Dkouk, C., & Echeverria, L. (2025). *Final version of the self-assessment nexus engine with corresponding validation* (Deliverable 4.5). EUT. And Avellan, T, et al. (2025) *NEPAT teaching guide*. AVA.
13. In the Nestos/Mesta case study local municipalities, Gotse Delchev Municipality (BG) and Nestos Municipality (GR), apart from being important stakeholders at local level (local decision-makers), they were also partners of the NXG Consortium something that facilitated the engagement of local stakeholders, strengthened trust building between project partners and local stakeholders, and enabled the process of identifying critical policy priorities concerning the sustainable management of the Nestos/Mesta river basin.
14. Avellan, T, et al. (2025), *Report on stakeholder engagement* (Deliverable 5.1) AVA.

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Enhance Data Governance and Interoperability

Robust, interoperable data systems are essential to identify feedback, synergies and cascading effects across processes and sectors, and drive water-smart decision-making. NEXOGENESIS contributes actionable models for cross-sectoral, multi-scale data integration, aligned with the EU's vision for digital transformation under the WRS's Digitalisation Action Plan[15]. To enable transparent, harmonised, and future-proof data use, we recommend to:

- **Integrate the NEPAT into national and EU-level data platforms as a toolbox for local projects[16].** NEPAT's modular architecture and scenario engine make it ideally suited for cross-policy simulation at relevant scale for decision making, while simplifying visualization for non-technical users as done in the Inkomati-Usuthu River Basin and Lielupe River Basin cases[17]. In the Nestos/Mesta River Basin case, stakeholders expressed interest in further using NEPAT, valuing its realistic, data-driven outputs that reflect specific local conditions and needs.

- **Leverage NEPAT's co-creation workflows to harmonise datasets between local pilots, regional authorities, and central EU institutions.** This methodology has been validated across all NEXOGENESIS case studies[18].

- **Promote open access and semantic interoperability in line with the FAIR data principles, for example through the NEXOGENESIS Knowledge Repository[19],** which consolidates biophysical and socio-economic data streams for climate, water, energy, natural ecosystems and agriculture[20].

- **Integrate gender-disaggregated data and equity analyses in WEFE policy assessments and stakeholder processes.** Gender and equity considerations showed historic legacies of female stakeholders being more strongly present in former soviet countries[21], and showed further that the Inkomati-Usuthu River Basin case was able to increasingly include the voice of female actors[22].

15. Water Resilience Strategy, annex, Action 2.4
16. Glass, J., Dupont, G., Blicharska, M., (2025). *Recommendations, experience, lessons learned from all case studies* (Deliverable 5.7) UU.
17. Nievas, N., Dkouk, C., & Echeverria, L. (2025). *Final version of the self-assessment nexus engine with corresponding validation* (Deliverable 4.5). EUT
18. *Implementation report for Nestos Case Study* (Deliverable 5.2). NTUA ; *Implementation report for Jiu Case Study* (Deliverable 5.4). BDG.
19. Echeverria, L. , Colominas, D., Nievas, N., Dkouk, C., (2025). *Data Lake for data sharing (Deliverable 4.2).* EUT*; Semantic Repository.*
20. Trabucco, A., Rivosecchi, A., Masia, S., Aslam, M. F., Rossi Cervi, W., Linderhof, V., & Terzi, S. (2024). *Future trends and validation of biophysical data for uncertainty assessment* (Deliverable 2.5). Euro-Mediterranean Centre on Climate Change.
21. Avellan, T, et al. (2025), *Report on stakeholder engagement* (Deliverable 5.1) AVA.
22. Glass, J., Dupont, G., Blicharska, M., (2025). *Recommendations, experience, lessons learned from all case studies* (Deliverable 5.7) UU.

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Strengthen Transboundary & Cross-Level Governance

Effective water resilience requires governance models that operate across sectors, scales, and borders. NEXOGENESIS case studies demonstrate the need for structured coordination frameworks that link upstream and downstream actors, and national and sub-national authorities[23]. To institutionalise integrated, cross-border water governance, we recommend to:

- **Establish permanent multilevel governance platforms,** informed by real-time, cross-border uniform data and information. These platforms should connect local and national actors using dynamic scenario analysis and participatory co-creation to support consensus building. For example, encourage the participation of direct and indirect stakeholders in RBM bodies including in the identification of the challenges, the development of solutions and their implementation (article 14 WFD should be strengthened). In the Nestos/Mesta River Basin case, for instance, **two cooperation agreements** were concluded: one Bulgarian agreement signed by the mayors of Gotse Delchev (BG) and Nestos (GR), and one Greek agreement signed by the same mayors, a representative of Greek Civil Protection, and the President of the Nestos Farmers' Association. These agreements formalize the commitment to continue local cooperation and promote the Governance Roadmap policies. They focus on raising local awareness, identifying funding opportunities for implementation, and advancing the case study through future projects.

- **Mandate one joint RBMP for all transboundary river basins**, with no exception for the ones falling entirely within the EU as well as strongly encourage one RBMP cross-boundary cooperation under local and regional leadership (Article 13). The information about interlinkages generated out of NEPAT could support the development and the implementation of the of these RBMPs with a view to understanding potential trade-offs in water use and synergies for water allocation.

- **Apply a source-to-sea approach** to all EU water planning processes, ensuring policy coherence between the WFD and article 6 of the Marine Strategy Framework Directive[1], which calls for coordination across marine and freshwater domains.

23. *Implementation report for Nestos Case Study* (Deliverable 5.2). NTUA. ; *Implementation report for Lielupe Case Study* (Deliverable 5.3). Baltic Environmental Forum (BEF); *Implementation report for Inkomati-Usuthu Case Study* (Deliverable 5.6). JAWS.
24. Directive 2008/56/EC of the European Parliament and of the Council of 17 June 2008 establishing a framework for community action in

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