

LOCAL ENVIRONMENTAL GOVERNANCE IN DVIETE RIVER BASIN: PARTICIPATORY WATER GOVERNANCE TARGETING

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Abstract

The study explores challenges in Latvia's environmental, particularly water governance system, including limited institutional capacities and resource constraints at all administration levels in parallel with comparatively low levels of stakeholders/public engagement and collaboration, but exceptionally growing valuable elements of bottom-up participatory management. The EU HORIZON 2020 project BETTER LIFE based case study aims to explore current small river basin governance and practice management situation using a collaborative qualitative research approach (e.g., developing socially engaged research practice elements) within a research-and-development framework. Dviete River Basin (250 km²) case study area possessing Natura 2000 site and known by especial long-term spring flooding, was investigated using case study research methodology for performing environmental governance and communication audit, management monitoring evaluation, also stakeholder mapping and building a stakeholder consultation and collaboration platform, all assessments based on complementary document and data resources studies, site visits with photo documentation, semi-structured interviews with representatives of all main stakeholder groups. Results show that river basin management system has been not built and is very fractured content-wise with limited horizontal and vertical integration, and insufficient management instrumentation, and also, stakeholder groups are still in the self-establishment process and rarely interact or collaborate within and between the groups and with management. However, there are voluntary experienced non-governmental co-management deeds towards nature and also water management to be studied and disseminated. Three bottom-line preconditions for the participatory co-management are recognized: a complex environmental communication system; a set of national and local acknowledgement and support instruments; development of horizontal collaboration instruments group.

Keywords: local river basins, participatory governance, communication, upgraded Helix stakeholders' model.

Introduction

Contemporary water governance internationally faces ongoing complexity, with some uncertainty and conflict at its basis, and scholars are again emphasizing that the core problem is exactly governance itself – the water governance process, institutions, and stakeholders. Mentioned is prompting again and again, mainly known for its approaches and that have been in place for a good while, but still have not finally led to their successful implementation, actually, **two key governance instruments – integrated water resource management (IWRM) and stakeholders' involvement and participation.**

For over two decades, Latvia's river basin governance system, according to the EU Water Framework Directive (WFD) goals, was initially established and based on focused planning (less management) on the four largest river basins, and with limited resources and capacities available, has achieved certain positive National monitoring and planning results. While **smaller river basins remain un-planned and under-managed due to limited capacities** at all three administration levels in the country – national, planning regions, and local municipal one. Improving general environmental management, e.g., including also surface water status, definitely requires stronger local stakeholders' engagement (e.g., farmer- and NGO-led initiatives) and socio-ecological system (SES) based cross-sectoral and co-management based and integrated basin-level governance system nationally and, especially, locally (Ernsteins et al., 2017b; Konkovs et al., 2022) with clear management responsibilities and capacities.

However, according to various scholars, **IWRM implementation has not been sufficient**, even in Europe after WFD since 2001, and this principle has been known for several decades, requested and promoted, and purposely communicated by various governmental and non-governmental international institutions and platforms; the results world-wide are limited. Also, those diverse success stories in Europe could be widely and target-oriented disseminated, and different other instruments employed.

Unfortunately, also the 2nd water governance key instrument mentioned has not been sufficiently implemented - **public participation in river basin planning and management has been minimal** even across most of Europe, with limited communication and little impact on environmental outcomes (Rimmert et al., 2020), but also citizen science is not sufficiently explored, particularly for multi-thematic monitoring, etc. Public activists could address key challenges of adaptive management by monitoring and stakeholder engagement, improving environmental management (Aceves-Bueno et al., 2015; Halbe et al., 2013). Again there is growing amount of research exploring participation potential to drive transitions toward more sustainable ecological, social, and political regimes (Von Korff et al., 2012).

Similarly, community-based conservation faces a crisis of identity due to weak participatory processes and limited attention to empowerment, but a slow shift toward participatory, collaborative approaches offers promise for linking environmental protection with stronger local institutions (Mulrennan et al., 2012). Various approaches and studies are growing

and recommendations are being designed, e.g., elaborated IUCN Natural Resource Governance Framework principles oriented towards inclusive, equitable, and locally devolved decision-making (Springer et al., 2021)

Environmental governance.

There are existing scholarly proposals as many as diverse for environmental governance defining, but within this paper framework, here shall be stressed first the following keywords to operate with: **systems, processes, institutions, stakeholders, and decision making/implementing, plus also instruments**, etc., as specifically necessary. Environmental governance could refer to the systems of rules, institutions, and practices that enable political stakeholders to shape environmental actions and outcomes (Lemos & Agrawal, 2006). More broadly, the processes, institutions through which society makes decisions affecting the environment (deLoë et al., 2009).

Our approach is comparatively quite similar (Ernsteins, 1999) as understanding environmental governance via governance process (cycle) and a **triple-dimensional governance (TDG) framework system** - governance stakeholder groups (who), governance thematic issues/sectors (what), and governance instruments (how), and all three as a complementary dimension system (Ernsteins et al., 2017b). TDG model, subsequently, is based on the following **three key mandatory principles**:

- applying socio-ecological systems – **SES principle**;
- all stakeholders' involvement and participation towards the **collaboration principle**;
- a whole set of instruments application – **complementary instrumentation principle**.

This applied governance model has been successfully serving in the studies for decades and for both structured governance situation analysis at the municipal and other territorial structures or organizational types and levels, including also state, NGO, business institutions and companies, as well as for elaborating action policies and practice recommendations and guidelines, and their testing/evaluating (Ernsteins et al., 2017a,b; Konkovs et al., 2022; etc.) as often working with research-and-development studies frameworks. Subsequently, we are looking for the process, where governance dimension systems interact inside and outside, and complement, to ensure a balanced governance approach to environmental protection, climate change, and sustainable development.

Governance target/interest groups/stakeholders.

This approach (Ernsteins et al., 2017b) presents a hierarchical framework for all interest groups for necessary collaboration among all 5 **stakeholder groups-built governance segments**. The model is identifying and detailing the following stakeholders' interest groups into their related aggregation forms: state/national level organizations as ministries, agencies, etc., municipalities, businesses, society in

general/households, and nowadays especially and importantly also mediators as actually influential stakeholders – media; formal & non-formal educators; legal and non-formal NGO's, community groups and opinion leaders etc; science/academia, consultancies etc. and particularly locally/regionally.

Governance content. Traditionally, environmental governance relied on a sector-specific approach basically focused on environmental infrastructure and nature protection sites etc. Recent research shows the limits of this approach when used alone. A shift toward new appearing sectors/issues and integrated governance sector models now aligns the environmental dimension with social and economic dimensions up to the fourth governance dimension of sustainable development, using a socio-ecological systems approach. Environmental sectors studies nowadays shall include necessary linkages and eventual integrated planning with health, education, agriculture, forestry, tourism, culture, and other sectors governance, promoting sustainability.

Governance instruments. In 2001, the EU adopted the Water Framework Directive (WFD) requiring the establishment of a river basin management system in the countries mandatorily applying integrated water resource management (IWRM) and necessary public participation, followed in 2004 by guidance on participation implementation. Subsequent reports reveal cultural, historical, and other social etc. aspects in both requirements to implement integrated river basin management and participation across Europe and highlight conditions for social learning and effective WFD implementation. They show that institutional, legal, cultural, geographical, and physical factors must be considered (Pahl-Wostl, 2004). Our study links these factors to **the whole set of governance instrument groups**: infrastructure-technologies, economic - financial mechanisms, communication, institutional - administrative frameworks, planning methodologies, and political-legal regulations (Ernsteins et al., 2017b). Within this framework, particular importance lies in the branch (also, nowadays disciplinary environmental sector (Ernsteins et al., 2017a) of environmental communication instruments, whose effectiveness in **action-oriented collaborative communication model** depends on four mutually reinforcing components, actually, instrument groups complementary necessary: information, education and training, public involvement-participation, and pro-environmental behaviour (Ernsteins et al., 2017a).

Towards water governance: an integrated and participatory system.

There is available wide range of scholar studies in particularly on the comparatively recent concept of water governance, actually starting widely this century and possessing various approaches, definitions, applications, etc. As just one of the most active and impactful actors here could be mentioned OECD,

having elaborated principles on water governance and implementation strategy. OECD is stating that 12 designed principles provide the must-work list for governments to design and implement ‘effective, efficient and inclusive water governance systems’, and for implementation, there was developed also water governance indicator framework, a water governance assessment guide, and a implementation handbook.

12 principles obviously do include innovative governance, monitoring, stakeholder participation, and all main governance principles, mentioned above, also some basic governance approaches as transparency, legal, etc. aspects. Finally, OECD defines **water governance refers to the political, social, economic, and administrative systems that influence water’s use and management**, apparently using the UN Sustainable Development tripple-bottom line and later added political/governance dimension. Also, there can be seen elements of listing some governance instruments and transferring this eventual approach to our set of six governance instruments groups mentioned above, we may also get the following water governance framework definition: political and legal, institutional, planning, economic and financial, infrastructure, and communication systems, complementary used for water governance.

Effective water governance in river basins requires both institutional capacity and a nuanced understanding of stakeholder roles. As shown in research (Hong et al., 2024), stakeholder engagement frameworks offer tools for assessing systemic and structural strengths and gaps. Social network mapping approaches have proven valuable for identifying collaboration gaps, bridging processes, actors, and isolated stakeholders in conservation and water management networks (Vance-Borland & Holley, 2011). Integrating these insights with the mentioned triple-dimensional governance model perspectives as covering sectors, stakeholders, and instruments it enables more holistic and comprehensive planning, coordination, and adaptive management of water resources, balancing ecological protection with socio-economic needs (Konkovs et al., 2022), as for any socio-ecological system as lakes, river basins, etc.

Also, participation could be seen as shaped by three dimensions (Hofer & Kaufmann, 2022): actors (citizens, NGOs, institutions), arenas (spaces for decision-making), and aims (desired outcomes). These dimensions also show that participation occurs in both formal consultations and informal grassroots initiatives. For our governance studies in Latvia, we used a partially similar model (Ernsteins, 1999) with the already mentioned three interrelated governance dimensions - studying and managing these dimensions complementarily, practically enables vertical integration across levels, horizontal integration across sectors, and broad multi-stakeholder collaboration (Ernsteins et al., 2017b).

Various models and practice applications of governance have been outlined in environmental theories, including municipal, governmental, also business etc., governance, then the civil society model - also referred to as the **bottom-up (also participatory community-based, etc.) governance approaches**, emphasising public involvement (but not only) in environmental decision-making. Within this model, change occurs through dialogue and negotiation, placing priority on local interest group engagement. (de Loë et al., 2009). The public takes an active part, participating in discussions with different societal groups before final decisions are reached by communities, civil society representatives, and interest groups (de Loë et al., 2009; Sendzimir, 2013). However, **public participation shall be present at all stages of decision making** and together with all main and local stakeholder groups - **all the governance process cycle stages** (Ernsteins et al., 2017b):

- preparation process for decision making, a particular stage for cycle success (situation analysis);
- decision-making process itself (policy planning);
- planning process to implement (action planning);
- implementation process of decisions (management);
- assessment process of implementation (monitoring);
- concluding decision stage – process evaluation and replanning/preparing next cycle of decision making.

This process enhances responsibility and raises awareness, but it could also be an important contribution to the growth of participatory environmental (also, water, nature, etc.) management capacities and, importantly, in the local areas.

As highlighted in **participatory research models**, societal actors, especially now including all types of mediators, are no longer passive recipients of innovation and management, but active co-creators shaping research agendas and development solutions. In studies related to governance and innovation development, a comparable yet structurally distinct and differently emphasised stakeholder model is utilised – the Helix model of innovation management. The Quadruple Helix and particularly Quintuple Helix model offers a valuable management perspective (Schütz et al., 2019; Varmland County Administrative Board, 2019), expanding the basic traditionally applied Triple Helix framework – focused on necessary collaboration between academia, government, and industry – by including two additional components: civil society and the media.

This broader model emphasises the importance of knowledge exchange, innovation driven by a diverse range of societal actors (Morawska Jancelewicz, 2021), aligning well with the multi-stakeholder approaches needed for inclusive, adaptive governance. Building on this Helix-based conceptual approach, we combined the mentioned stakeholders’ five segments model with the Helix approach, transformed the Quintuple Helix model, for a particular case, into the

Stakeholders Constellation Collaboration Model (Figure 2), designed to illustrate Helix-type stakeholders' necessary stratifications in environmental governance and communication.

This ongoing study's goal for the first research stage is to explore current river basin governance and practice management situation using a collaborative qualitative research approach to study conditions and perspectives for building up a still and crucially missing environmental, esp. water and nature protection sector management capacities, in particular, via a bottom-up participatory governance approach.

Materials and Methods

The current bottom-up participatory governance research case study, elaborated by the EU Horizon BETTER LIFE project, consisted of several research steps and stages with correspondingly chosen methodological approaches and related methods.

To enable analysis for bottom-up participatory governance and its management phase implementation practice, the first phase of the project studies included an overall assessment of the whole cycle of the environmental governance and communication processes, particularly water and nature protection governance in the territory of the Dviete river basin, as well as stakeholder mapping and consultation process with all stakeholder groups, described here below.

1. Projects and partners-based studies frame.

The EU Horizon project BETTER LIFE (BLIFE) coordinated in Latvia by Daugavpils University, have been studying and developing methodological frameworks on research cooperation, named **socially engaged research (SER)**, between life sciences scholars and various societal interest groups, basically including general public interest representatives, entrepreneurship, local and national governance institutions. The SER approach was used to establish the necessary framework and elaborate content and instruments for this particular selected study, summarized in this paper.

Also, scholars from the University of Latvia, in research partnership work with the Daugavpils University specialists, contributed substantially to the current BLIFE project study design, detailed elaboration, and implementation. In the same time, the BLIFE project case study territory chosen for bottom-up governance research case was the same Dviete river basin territory as has been used already for water retention studies and river basin situation modelling case by another EU Horizon project OPTAIN, realized by Daugavpils University. Part of the general data used for this paper was gathered within the initial stage of the OPTAIN project – particularly, implementation work of the multi-actor reference group (MARG).

2. EU BLIFE Project frame and realisation.

The project 'Bringing Excellence to Transformative Engaged Research in Life Sciences through Integrated Digital Centres – BETTER Life' is implemented in line with SER's mission to foster public engagement

in co-creating knowledge and to ensure that life sciences research becomes more impactful, inclusive, and aligned with societal needs. The project aims to bridge the gap between researchers and non-academic sectors by developing tools, standards, and collaboration frameworks implemented at local and regional levels, as well as by building communities of practice to maximize the societal impact of research. It is grounded in the 5x Helix approach, bringing together academia and researchers, industry and business sector, policymakers and public administration, civil society and NGOs, and media and communication channels, ensuring their involvement in pre-research, research, and post-research phases. This approach was the basis for BETTER Life's decision to select the Dviete area as the OPTAIN case study site, where the creation of a MARG (Multi-Actor Reference Group) and the participation of key stakeholder groups were planned from the outset of the Horizon project, combining academic and practical knowledge to co-create sustainable solutions.

3. Case studies research: Dviete River Basin case.

The Dviete River basin was chosen as the study area due to its unique nature-culture and bottom-up experience characteristics. The Dviete River Basin covers a catchment area of 254 km², with an annual runoff of 0.057 km³. The total length of the river is 37 km, with a riverbed slope of 4 m/km in the upper reaches and 0.2 m/km in the lower reaches (Nature Conservation Agency, 2018). The Dviete floodplain experiences extensive spring flooding lasting 1 to 3 months, caused by extensive inflow of the main national river, the Daugava River. Flooding contributes to positive water dilution and natural cleanup processes, but it also affects the local population and economic practices.

The Dviete River Basin has a strong historical memory and lifestyle footprint that must be considered. This natural floodplain territory was extensively meliorated in the 1930s and later for intensive agriculture, shaping a long-standing agricultural tradition for several generations. However, this development also contributed to agricultural pollution of the main national river, the Daugava, and further into the Baltic Sea. Even today, accumulated pollution remains an issue, including within the Natura 2000 site.

After regaining national independence in the 1990s, step-by-step nature protection initiatives began, leading to the establishment of Natura 2000 in 2004. However, the site still lacks an administration, a supervising board, or a broader, stable platform or network. Many national and international projects have been implemented on about 20% (5000 ha) of the river basin, while growing EU environmental legislation affects the rest of the basin. Changes continue to conflict with some agricultural stakeholders and locals.

4. Case study design and implementation planning.

A socio-ecological system (SES) based research-and-development (R&D) framework approach was incorporated into an **integrated case study research**

methodology chosen for BLIFE project, utilising various and complementary realised research methods, including governmental and municipal, as well as research data basis and document studies, local related site visits and photo documentation, and conducting deep semi-structured interviews with key representatives of all stakeholder groups. Also, further elaboration of results from the OPTAIN project performed stakeholders mapping and consultations, and also, multi-stakeholder collaboration platform MARG establishment and running, now for three consecutive years. BLIFE Project research case consisted of the following **subordinated steps of the Dviete river basin case study research:**

- an environmental governance audit,
 - an environmental communication audit,
 - municipal monitoring audit in the river basin,
 - stakeholder mapping and consultations (OPTAIN),
 - stakeholder-based MARG process (OPTAIN).
- deep semi-structured interviews with representatives of all stakeholder groups (helixes) recognized, mapped in the Dviete river basin case, done as overall framing and complementary analysis of all steps done before.

5. Case study's research steps implementation.

The first research steps of the current study for the BLIFE project were environmental governance and communication audits of the Dviete River Basin developments. Initially, governmental, municipal, and research data bases were searched, particularly river basin management research, monitoring, and planning developments, with limited information available. Further studies were based on case territory-oriented document analysis, and legal, policy, and planning frameworks were examined at all three governance levels (national-regional-local municipal) in Latvia. Under the Local Government Law, municipalities are responsible for 22 core (autonomous) functions, including waste disposal, heating supply, water management, sanitation, and resource conservation, while also supporting climate adaptation and mitigation initiatives. The Land Management Law designates municipalities custodians of inland public waters within their jurisdiction, excluding those in national parks, reserves, and other protected sites, which remain under national administration.

The Dviete River basin forms part of the Daugava River Basin, one of four major basins in Latvia, established under the EU Water Framework Directive (2000/60/EC). The Dviete Floodplain Nature Park, established in the delta region of the Dviete river is governed by a Nature Conservation Plan (2020–2032). Particular emphasis was laid upon local municipality development, everyday practice framing **statutory and voluntary documentation studies.** Initially, analysis of the all-statutory municipal planning documents (Sustainable Development Strategy, Development Program, Spatial Plan) and other related documents was performed for the former local Ilukste municipality, as it territorially covered most of the

Dviete river basin, but then the municipality was administratively incorporated into Augsdaugava local municipality following national territorial-administrative reform in 2021. Particularly, **monitoring documentation studies** included the Environmental Report, the Monitoring Report for the Ilukste Territorial Plan (2019–2030) developed under the Strategic Environmental Assessment (SEA) Law requirements, and other documents. The same and more varied documents were studied for the newly expanded Augsdaugava municipality. All document studies were complemented by stakeholder interviews.

6. EU OPTAIN Project frame and realisation.

The Dviete River basin was also the selected study site, where an EU Horizon 2020 project initiative, 'Optimal strategies to retain and reuse water and nutrients in small agricultural catchments across different soil-climatic regions in Europe (OPTAIN)', focuses on conserving and reusing water resources within small agricultural basins (<250 km²) throughout multiple European locations and countries, having 14 case studies altogether in EU countries.

The primary objectives of the OPTAIN study were to identify, engage, and manage consultation with all relevant stakeholder groups, like farmers, tourism companies, NGOs; furthermore, the research sought insights from local government officials, environmental specialists, and local practitioners, aiming to gather academic and practical knowledge on implementing water conservation, reuse practices, and general management in the Dviete basin. A thorough evaluation of these potential water retention measures, along with related modelling at farm and basin levels, will lead to the creation of science-based recommendations for Latvian organisations at different administrative levels, together with policy-focused reviews prepared with the EU project consortium for European partners. The project tasks, local adaptations, earlier research & development models, and existing traditions (Ernsteins et al., 2017b) have been completed.

7. EU OPTAIN studies results evaluation.

Initially the overall situation with all main and most active stakeholders around the case area was considered. **Stakeholder mapping and consultations** (series of short-timing express interviews) were carried out using a design by the University of Latvia (Ernsteins et al., 2017a, b) - **Quintuple Helix Stakeholders Constellation and Collaboration Model** (autonomously designed and tested stakeholders grouping model, being transformed as a revised version of the traditionally known Quintuple Helix model) to identify and detail each of the 5 stakeholders' interest metagroups or stakeholder groups' formed segments (Ernsteins et al., 2017a, b). A total of 50 stakeholders' representative organisations were mapped: state (8), municipalities (10), businesses (6), society (5), and mediators (21). Based on audit results, the specifics and importance of each sub-group's involvement in the project were assessed,

guiding the involvement activities for the MARG platform and selection for deep interviews. Following, the **stakeholder engagement process** was studied and co-organised, being structured through the mentioned **MARG collaboration platform**, established by the OPTAIN project and aimed at strengthening local and regional water retention evaluation & planning in the Dviete River Basin. To date, three annual MARG meetings have been held, with representatives from all target groups, with 10-12 participants per meeting - working with planning and reviewing OPTAIN project progress, analysing the current tasks, and discussing future research directions as in relations to the stakeholders practice interests and perspectives. **Action research approach** elements-based investigations and developments were applied.

8. Complementary stakeholders' interviews.

Finally, but complementary to all above mentioned studies of Dviete case, both for BLIFE project-based list of studies and the OPTAIN project-based produced information, in total 21 **deep semi-structured interviews were conducted**. Interviews were realized mostly in person with representatives of all stakeholder groups as for revised Quintuple Helix Stakeholders model- from state agencies (3 persons), municipalities (5), businesses (3), society (2), and joint group of mediators, including NGOs (2), media (1), educators (1), and academia (2 persons).

Results and Discussion

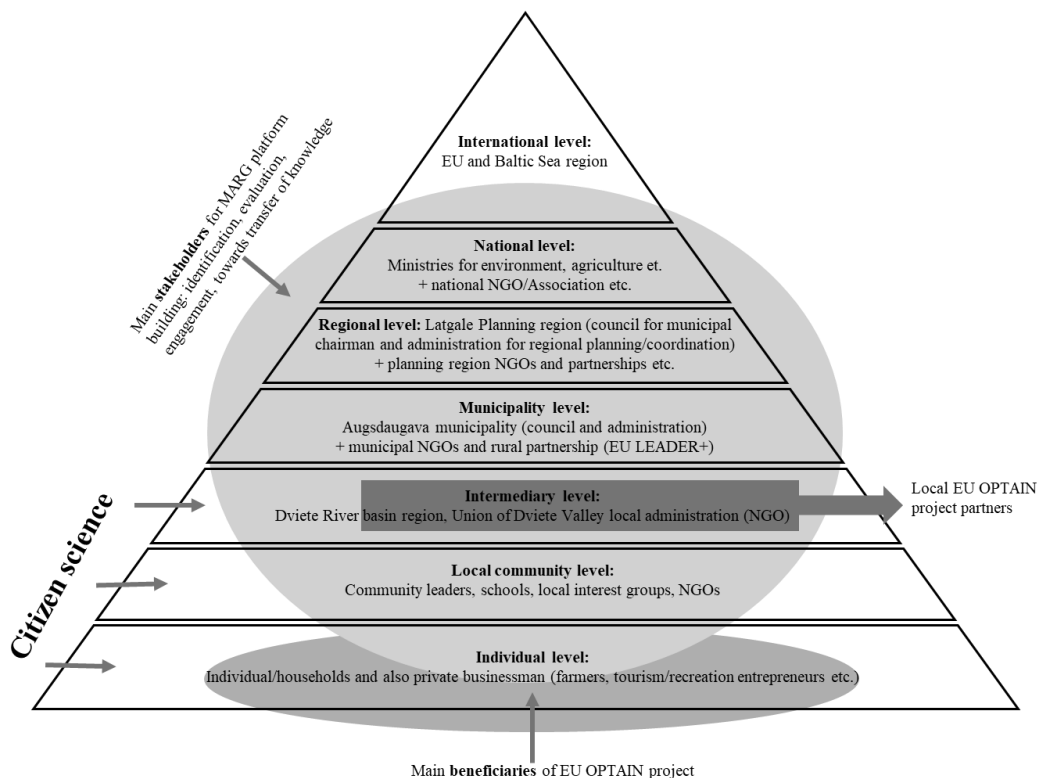
In the results section, we will review the research conducted in the first phase of the study, including all the steps mentioned un methodologies chapter. The results of conducted a whole set of deep semi-structured interviews with representatives of all stakeholder groups (helix) has to be integrated in all research steps realized.

1. Environmental governance audit

At the start of the project, one of the first tasks was to conduct an environmental governance situation analysis within the basin area. This analysis was carried out using **three dimensions of environmental governance: instruments, target groups, and content** (thematic sectors related). The primary focus was on three sectors: water resources, environmental protection, and socio-economic aspects, ensuring a comprehensive assessment of the region's environmental governance and sustainability challenges. A comprehensive approach is adopted, **integrating all groups of management instruments**, namely: Policy and legislative tools; Institutional and administrative mechanisms; Planning strategies; Economic and financial instruments; Infrastructural and technological solutions, and Communication instruments, complementary, emphasising information, education, participation, and environmentally responsible behaviour. Successful environmental and socio-economic projects require a structured, multi-level governance system (Figure 1) as applied for the current study.

Figure 1

Dviete river basin stakeholders: Vertical integration approach for governance levels and towards horizontal integration for governance sectors (Ernsteins, et. al. 2024).



The model links international (EU), national (ministries, NGOs), regional, municipal, and local actors through vertical coordination, while horizontal integration ensures cross-sector cooperation in nature protection, environment, forestry, eco-tourism, agriculture, and socio-economic development.

The framework includes all major stakeholders: municipalities (four levels), state and regional bodies, corporate sector, households, and citizens. It also stresses the role of mediators - NGOs, media, educators, and research institutions - in knowledge transfer and engagement. The model ensures direct benefits for individuals and communities, while local partners strengthen citizen science, collaboration, and sustainable decision-making (Figure 1).

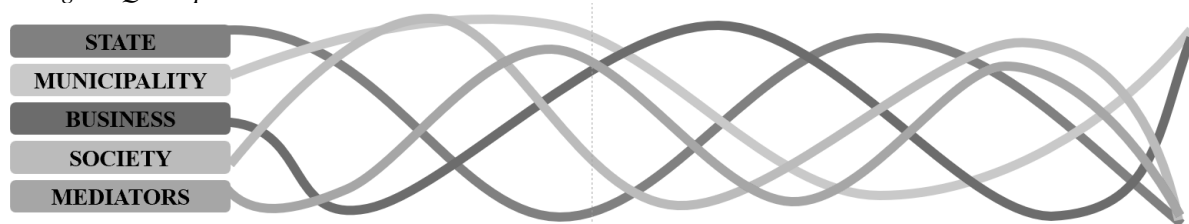
An in-depth assessment of target groups was carried out for this case study, and representatives for detailed interviews were selected using a modified five-spiral collaboration model, which organises interactions within five governance sectors: state, municipal administration, businesses, society, and mediators. This method creates a structured system for examining and defining stakeholder engagement, grouping them into five interconnected collaboration spirals. These spirals illustrate evolving, interlinked relationships, forming a hierarchical cooperation structure that improves governance efficiency (Figure 2).

Unlike Helix models that consider public authorities as a single unit, this framework separates state administration (which includes various, often competing, national-level sectors, e.g., ministries, their agencies, etc) from municipal governance, along with regional administrations and planning bodies in Latvia. Although municipalities officially belong to the broader state administration system, real-world observations reveal that these two groups frequently operate with different information, perspectives, and priorities in various contexts. Consequently, distinguishing these stakeholder categories is crucial. Additionally, mediators play a critical role in governance and communication, divided into four sub-groups: media, educators (both formal and informal), NGOs (including professional and society-based

organisations), and the academic/scientific sector. This model illustrates both the vertical and horizontal dimensions of stakeholder interaction, emphasising the necessity for collaboration to create a fully integrated and complementary nationwide governance system. To ensure effective environmental governance is to be required: engagement across five key segments is state administration, municipal governance, individual/household participants, corporate entities, and mediators. Achieving a balanced and interactive relationship among these sectors is essential for a well-functioning and sustainable governance framework. A variety of instruments are applied in managing the Dviete River basin, supporting efficient governance and long-term sustainability. Regulatory and political measures include the Dviete Nature Park conservation plan, as well as other legislative directives that regulate land use and regional growth. Administrative and institutional mechanisms consist of municipal environmental specialists and natural resource departments, overseeing land management and pollution control, alongside state agency divisions tasked with supervision and inspections across Jekabpils and Augsdaugava municipalities. Planning instruments play a key role in strategic development, with documents such as the Development Program, Ilukste Municipality Territorial Plan (2019–2030), and the Sustainable Energy and Climate Action Plan (until 2030) guiding long-term initiatives. Financial and economic instruments support environmental protection through project funding for conservation efforts, particularly in the Dviete Nature Park, as well as investments in infrastructure improvements. Infrastructure and technological instruments include drainage and stormwater systems, water supply, and wastewater management facilities, ensuring ecological stability. Lastly, communication instruments enhance public awareness and engagement, including the Dviete Valley Information Centre ‘Gulbji’, tourism guides, and educational activities such as environmental classes, fostering knowledge-sharing and sustainable practices.

Figure 2

The Constellation collaboration model of the main stakeholder groups (Ernsteins, 1999) – represented as redesigned Quintuple Helix model



The primary environmental management sectors within the Dviete River basin have been thoroughly examined. In the environmental protection domain, pollution control was evaluated, leading to the

identification of potentially contaminated sites across the region. A total of 14 locations with possible pollution issues were discovered, including former landfills, warehouses, and fuel storage facilities.

Additionally, flood-prone zones and high-risk areas within the basin were mapped, with the Pilskalne administrative territorial unit of municipality at risk from Daugava River floods and the Dviete administrative territorial unit of municipality impacted by Dviete River overflow.

In current conditions as **positive characteristics** shall be mentioned the following territorial development aspects - belonging to the NATURA 2000 network, unique habitats, rich cultural history as one of Latvia's oldest inhabited areas, ecotourism potential, active NGO involvement, and community support for participatory governance. But as negative ones - outdated water and sewage systems, poor waste management and drainage infrastructure, limited National financial support, agricultural pressures, potential pollution sites, weak transport connections, and insufficient intersectoral communication. Also climate change impacts such as ecosystem degradation and increased flood risks, demographic decline due to rural depopulation, and vulnerabilities in agriculture linked to changing climate conditions.

The environmental governance audit in the Dviete River Basin revealed that the necessary better environmental and water governance is currently missing and requires a multi-level governance system - both vertical and horizontal—as well as coordination across sectors such as environment, agriculture, tourism, and socio-economic development. The audit emphasised that under these conditions, the importance of a bottom-up approach is especially widely applicable (besides Dviete Valey municipal society). In terms of water management, the audit found limited planning, technical, and administrative capacities. Although the area is part of the Natura 2000 network and should be actively managed, due to these limited capacities, a local NGO has taken on this responsibility. The audit also highlighted the necessary strengthening of environmental communication.

2. Environmental communication audit

The environmental communication action-oriented model (Ernsteins et al., 2017a) applied, consists of four mutually complementary instruments – environmental information, environmental education, public engagement, and pro-environmental behaviour actions. The audit conducted in the Dviete River Basin revealed the need to strengthen communication among stakeholders. While environmental information is shared through various channels, there is considerable potential to enhance collaboration. Effective bottom-up communication depends on strong engagement, which is currently underdeveloped in the region. Systematic planning and sustained efforts, beyond the voluntary work of NGOs, are required to improve environmental communication, emphasising its crucial role in fostering understanding and cooperation. The environmental communication audit in the Dviete River Basin, based on the action-oriented communication model (Ernsteins et al.,

2017a), identified the need to reinforce cooperation and information flow among stakeholders through four key complementary communication dimensions. The audit stressed that strengthening community involvement beyond the voluntary efforts of a few NGOs requires systematic, continuous planning, even though there is no real coordination or work capacity, is to be taken by municipal administrative-territorial units of particular territories and/or knowledgeable local NGOs supported by local communities.

Environmental information includes municipal websites, e-encyclopaedia, dvietespaliene.lv (LIFE+) and the OPTAIN project, as well as the Dviete Nature Park tourism plan (2009) and recent guides (Augsdaugava 2024, cycling, water tourism, surroundings). Information is provided on stands about the park, restoration works, birds, wild horses and cattle, corncrake habitats, and directional signs. Additional materials include articles, videos, and features on the floodplain and cultural heritage. Information points are provided by the 'Gulbji' centre, Daugavpils tourism centre, Dviete municipal union, the Nature Conservation Agency, and the Regional Environmental Board.

Environmental education is carried out by the 'Gulbji' centre, which organises ecotourism, exhibitions, monitoring, consultations, public education on natural values and lifestyle, and provides a children's classroom. Events include Birdwatching Days, open-air activities, landscape and lichen hikes, and the youth hike 'We Go into Nature!'.

Public participation is reflected in park management with local involvement. The Dviete municipal union works on biodiversity and heritage protection, implementing the park's conservation plan, promoting ecotourism, and preserving the rural landscape.

Pro-environmental behaviour is expressed through conservation and restoration plans, meadow restoration, floodplain management, and aquatic plant studies. Actions include corncrake habitat restoration, improving birdwatching, and reducing human pressure. Tourism and education cover the floodplain development plan, water tourism during low water, and equipment for the nature classroom. The OPTAIN project targets reduced water and nutrient runoff.

Overall, the audit emphasises that enhancing environmental and nature communication of both outer and especially inner as within stakeholder groups and between them, is crucial for fostering collective understanding, towards collaboration and sustainable action in the region, currently being widely developed and applied. Leading role and general model of NGO Dviete Valey municipal society working for public good shall be further supported, utilised, and possibly multiplied. Environmental communication within the agricultural sector is limited, particularly regarding water retention issues, where available information is minimal and communication is virtually non-existent. In contrast, the Nature Conservation Agency engages

in comparatively extensive communication, facilitated by the implementation of several projects, the placement of informational stands, and targeted interaction with youth audiences. At the same time, prolonged and complex communication processes are ongoing between the Ministry of Environmental Protection and Regional Development, the Ministry of Agriculture, and local activists concerning wild animal populations introduced within the Dviete floodplain area as part of a project. Additionally, the Latvian Environment, Geology and Meteorology Centre conducts water monitoring every six years; however, communication with municipalities and local stakeholders in this context is practically absent.

3. Municipal monitoring in Dviete River Basin

The shortcomings identified in the environmental governance, communication audit revealed significant issues in environmental governance generally. Therefore, this chapter examines the development of monitoring in the Dviete River basin, with focus on water and nature protection, as well as public participation. Until the 2021 Administrative Territorial Reform, the territory of the Dviete River basin was part of Ilukste Municipality (647.5 km²; 7,500 inhabitants), which consisted of 8 local territorial administrative units (parishes). After the reform, Ilukste Municipality was merged with Augsdaugava Municipality (2,523.6 km²; >35,000 inhabitants).

In Ilukste Municipality in 2019, within the previous planning period (2014–2021), territorial development plan (2019–2030) was prepared, which was also reviewed together with the Ilukste Municipality Development Program for the new planning period (2020–2026). According to the national supervision of the former Ilukste Municipality's Territorial Planning (Ilukste Municipality, 2019a), the Environment State Bureau of the Republic of Latvia (ESB) has stated in the Environmental Report that the municipality must submit a monitoring report to the bureau at least twice during the next planning period (in 2020 and 2024), which should be prepared based on the list of specific indicators, which was divided in eight key indicator groups, including surface water and air quality, polluted sites, waste and wastewater management, and protected areas.

However, already the 2020 report (Ilukste Municipality, 2019b) showed major data gaps: several indicators lacked any information (e.g., wastewater management, polluted sites), and other data provided were either outdated or generalized, offering limited insight into specific environmental trends. For example, surface water assessments were based on data from 2013, and there was no information on official swimming areas or degraded land. Additionally, it has been noted that the information provided in the report does not directly correspond to the specified indicators.

Similarly, in this report, based on 2013 data, the water quality of the Dviete River was assessed as medium;

however, in the Daugava River Basin Management Plan (2022–2027), the ecological quality of the Dviete River basin is assessed as poor (Nature Conservation Agency, 2018). Furthermore, information on the nature conservation sector in this report is limited.

The Ilukste Municipality Development Program Implementation and Monitoring Document (2020–2026) outlines a total of 72 medium-term development indicators (Ilukste Municipality, 2020). Although these are monitored annually across multiple sectors, none of the 72 indicators fully cover environmental governance sectors, water resource governance, nature conservation governance, or water retention issues. Moreover, the development program (Ilukste Municipality, 2020; 2019b) does not sufficiently integrate the indicators established by the ESB, highlighting a gap between national environmental priorities and local planning frameworks.

Following the 2021 territorial reform, which merged Ilukste Municipality into Augsdaugava Municipality, a new set of general and sectoral development indicators was defined for the newly formed administrative unit. The Augsdaugava Development Program Implementation Monitoring and Evaluation Document (2022–2027) (Daugavpils City & Augsdaugava Municipality, 2021a; 2021b) outlines a total of 85 performance indicators. Of these, 32 are related to environmental governance, though not all environmental sectors are covered. Only two indicators address water management broadly, without directly targeting water governance. In the context of nature protection governance, four indicators are defined, mainly focusing on waste management and invasive species control. Notably, there are no indicators related to water retention. Meanwhile, the new Augsdaugava Territorial Plan and its list of indicators are still in the development phase and are currently unavailable to the public.

Also, the previously required ESB monitoring report was no longer prepared in 2024, as such indicators are not included in the current list for the newly formed municipality, and the Environmental Department in Augsdaugavas municipality is not informed about the need for this monitoring report.

Water retention is not specifically assessed or addressed in key planning documents. Although state-level monitoring of the Dviete River occurs twice every six years, the municipality is unaware of this activity. As a result, the municipal assessment of water quality is rated as 'medium', while the national assessment classifies it as 'poor', indicating a significant gap in information and perception (Latvian Environment, Geology and Meteorology Centre, 2021). The audit highlights the critical need for clearer, more targeted monitoring frameworks that directly address environmental sustainability, particularly water and also nature protection governance, and policy implementation effectiveness in municipal planning, even if municipal capacities are limited – for

this situation, a citizen science approach (local communities-based monitoring) could be widely introduced as such capacities are available.

4. Stakeholder mapping and consultations

During the initial phase of the study, a situational audit of target groups was performed in the Dviete River basin region within the OPTAIN Project frame. The revised upgraded five spiral-type stakeholder grouping recognition and potential collaboration framework functions as a structural model for defining and organising stakeholders, systemically arranging them into five interlinked quintuple Helix spirals (Figure 2). These groups were accordingly classified, segmenting them into five categories: state, municipalities, businesses, mediator groups, and general society.

The state segment includes three ministries: the Ministry of Environmental Protection and Regional Development (with regional environmental boards, the meteorology and geology centre, and the Nature Conservation Agency), the Ministry of Agriculture (forestry, agriculture, fisheries, with regional departments), and the Ministry of Economics (tourism through the Investment and Development Agency of Latvia). These institutions ensure national policy, supervision, and sectoral governance.

The municipal segment consists of Augsdaugava municipality, covering the Dviete river basin and Natura 2000 site, with its institutions and territorial administrations (e.g., Bebrene, Pilskalne, Dviete). It also involves neighbouring Jekabpils municipality. Additionally, tourism centers, development agencies, training centres, and the Latgale Regional Planning Council support local governance and cooperation.

The business segment primarily includes large agricultural enterprises managing this territory, local farmers (livestock, crop, organic farming), and tourism service providers (guesthouses, boat rentals, guiding services). They ensure practical resource management and regional economic development.

The mediator segment is divided into four main sub-segments: media, educators, NGOs, local/regional research-/consultants and wider academia. During the identification of stakeholder groups, with a particular focus on environment-nature-water-agriculture sector interactions (Nexus approach), a total of eight NGOs were identified as being directly connected to this region. Within this segment, NGOs play a particularly significant role, especially the local 'Union of Dviete Valley Municipalities', which is actively involved in managing the area and contributes to environmental governance and public engagement. The society segment encompasses informal civic activities, which can be divided into four main categories: Households; Individuals – local activists and opinion leaders; Social and interest groups – representatives of informal initiatives; Local resident/household communities.

Overall, the Stakeholder mapping revealed a wide/sizeable, also complex and diverse stakeholder

landscape, but also with very limited interconnections between stakeholders and their groups. This very limited interconnectivity is to be seen in both directions – as was expected between sectors, even in closely linked nexus areas like water–nature–agriculture, but also not very much more within each sector. And, a third direction – inside stakeholder groups, between various group members. The number and type of stakeholders within all five groups are sufficiently good for implementing integrated, cross-sectoral water and environmental governance, but a very selective, careful, and stepwise communication and interaction process is crucially necessary to reach such governance process qualities.

Also, a kind of 'crystallisation points' – such as trustworthy organisations or networks, platforms (including e-ones) – are required for the facilitation of communication and, further on, for collaboration developments. Ideally, there should also be some instruments (also financial, of course) as part of supportive mechanisms/environment from the national level, either directly or via municipalities or municipal planning regions, crucial based on the Nexus approach, emphasising collaboration across environment, nature, water, and agriculture sectors.

5. The stakeholder participation: MARG process

The establishment and operation of the Dviete River Basin management Multi-Actor Reference Group (MARG), realized as part of the OPTAIN Project frame, focuses on engaging all key stakeholders within the catchment area. This includes local governments and their services, regional and national agencies for water and nature protection, farmers, agricultural specialists, and advisors, as well as thematic groups like the tourism sector. More local community leaders, interest groups, NGOs (both professional and public), scientists-experts may play an integral role in MARG. This diverse representation benefits stakeholders by enabling them to influence the OPTAIN Project research process, integrating local knowledge and a shared vision for regional progress. It also creates opportunities to explore innovative methods and techniques for improving water and biogenic management in agricultural landscapes. Moreover, by facilitating engagement between farmers, agricultural advisors, and policymakers, MARG contributes to shaping agricultural policy frameworks.

Initially, the project attracted significant interest, with more than 15 participants representing the main stakeholder groups. However, participation declined in subsequent years, with only 8–12 stakeholders regularly attending. This decrease in engagement can be attributed to several factors. First, water retention was not a priority for local farmers and some other stakeholder groups. Second, the project's focus on modelling water retention, rather than the development of physical infrastructure or pilot cases, did not align with the expectations of many local stakeholders, who understandably prioritised tangible outcomes.

Additionally, several early participants cited scheduling difficulties as a barrier to sustained engagement, as it was challenging to find meeting times that suited all stakeholders. Furthermore, the geographical distance to the Dviete basin centre significantly limited the involvement of national and regional stakeholders. In response, hybrid meeting formats — combining in-person and remote participation — were introduced, which improved stakeholder engagement. This flexible approach reduced the time commitment required for participation, with meetings no longer demanding half a day or more, and thereby facilitated broader and more consistent involvement.

The development of MARG (Multi-Actor Reflective Group) progressed gradually as part of the broader social learning and adaptation process, indicating the potential for such an approach to evolve at the local level. However, this development must be considered in light of the contextual factors and conditions described above. A key enabler of future progress is bottom-up interest — particularly when the issues addressed are concrete and timely for multiple target groups simultaneously. Additionally, top-down support is essential: national and regional institutions in water management, nature conservation, environmental protection, agriculture, and tourism sectors need to actively promote stakeholder engagement, especially through information-sharing and interactive communication tools. Furthermore, a locally recognised organisation, such as the Dviete NGO, could play a central role in coordinating these types of MARG instruments at the grassroots level. MARG process strengthens bottom-up water and nature protection governance by actively involving local stakeholders—such as farmers, NGOs, experts, and policymakers—in decision-making and research planning. Through inclusive communication and knowledge sharing, MARG can support the development of context-specific, innovative solutions for agriculture and water retention, etc. This participatory approach may improve understanding of regional challenges and enhance the design of effective policies and measures, but ultimately, it fosters collaboration across levels and sectors to build resilience, ensure sustainable water and land management with one main precondition - selfishly bottom-up coordinated and top-down supported.

The case of the first-time also summer floods in 2025 in the Dviete river basin further underscored the need for flexible, locally adapted water governance in small catchments. As recent research also emphasises, effective river basin management must integrate not only environmental content and instruments, but also governance structures that meaningfully engage stakeholders across all levels and sectors (Ernsteins et al., 2017b; Vance-Borland & Holley, 2011). Related approaches, e.g. Natural Resource Governance

Framework by IUCN, support this by promoting knowledge co-creation and cross-sector integration as essential elements of adaptive governance.

The environmental governance audit in the Dviete River Basin clearly demonstrates that current governance instruments and mechanisms, particularly in water and environmental management, remain fragmented and underdeveloped. Despite part of the Dviete river basin area being designated a Natura 2000 network, national institutional and technical capacities at the regional/local level are insufficient, also missing permanent administration at the Natura 2000 site, resulting in direct or indirect reliance on local civil society actors, such as NGOs, to fulfil essential environmental functions. Particularly, it is to be mentioned again the leading NGO in the Dviete river basin area –the Union of Dviete Valley Municipalities.

Moreover, the governance audit reveals that weak intersectoral coordination and the lack of strategic communication frameworks hinder effective collaboration among key stakeholders, including also between state institutions and municipal authorities. Compared to the traditional Helix models (Schütz, et al., 2019; Morawska Jancelewicz, 2021), the more detailed separation of stakeholder categories done for these studies, e.g., including four mediator groups – not only NGOs, but also regional/local media, formal/nonformal educators, and particularly local/regional research/expertise (esp. academia, also consultancies etc.) - is particularly relevant in this context, as these groups are critical in facilitating communication, knowledge transfer, and public engagement but remain underutilised in practice.

Additionally, while a wide range of governance instruments are formally present - ranging from legislative instruments to various communication mechanisms - their implementation is uneven, not well coordinated, fragmented, and non-complementary. Notably, not only are water retention practices not addressed in municipal planning documents, but also water resources management and protection are barely mentioned, besides traditional sectors of drinking water and wastewater issues.

The environmental communication audit (incl. information, education/training, participation, and pro-environmental behaviour) in the Dviete River Basin revealed critical gaps in stakeholder collaboration, particularly in bottom-up engagement and systematic planning. Also, not only is environmental communication within the agricultural sector very limited, but also in water governance or the whole environmental governance process, thus reflecting broader governance capacity gaps to be addressed via integrated, cross-sector stakeholder engagement. The action-oriented communication model applied for the audit underscores the need to strengthen and complementarily employ all four communication dimensions - information, education, engagement, and

pro-environmental actions - especially beyond the voluntary work of NGOs. A more coordinated approach, supported by municipalities and informed local actors, is essential for fostering sustainable cooperation in the region.

The municipal monitoring system continues to be gradually improved, particularly following the administrative-territorial reform in 2021, when smaller municipalities were merged, which also increased the environmental management capacity of local governments. However, municipalities still lack the resources and capacities to develop and, more importantly, implement a fully functional and sufficiently detailed indicator system - especially in the domain of environmental governance. Environmental governance in contemporary always expanding understanding is still not a priority for municipalities, besides traditional statutory household services as waste, heating, water (supply/wastewater) sectors, even though public interest in environmentally friendly actions is gradually increasing.

Similarly, in the field of water resource management, municipal monitoring of the sector's diverse aspects remains very limited, even though the national river basin management planning system has already been in place for three cycles of seven-year planning. Yet even at the national level, management capacity remains insufficient. For more than two decades, river basin planning in Latvia has prioritised large basins, while small river basins like the Dviete river basin (250 km²) have been largely overlooked due to capacity constraints - both at ministerial and its regional levels, as well as also municipal level, traditionally not involved in river basin monitoring and planning. Also, EU Water Framework Directive-based Consultation Councils, including representatives of national/regional NGO's, are being established at each of the four existing national river basin districts, are financially strictly bound, looking for additional actions and innovations. As a result, this eventual NGO bottom-up impact is clearly limited too.

In this broader context, there is a particular need for bottom-up governance - namely, local community-based co-governance and the development of forms and opportunities for public monitoring. In the studied case of the Dviete River basin, such opportunities can be supported by the local NGO Union of Dviete Valley Municipalities, as well as by the MARG collaboration platform established within the Horizon 2020 project OPTAIN, which shows potential for further participatory governance development.

The stakeholder mapping revealed a wide but weakly connected network across five key stakeholder groups. Despite sufficient existing diversity for cross-sectoral governance, collaboration is limited both between and within sectors. Strengthening communication through trusted actors or platforms and providing supportive instruments - especially at the national or regional level - is essential for enabling effective water-nature-

agriculture nexus-based governance. This aligns with broader theoretical models of environmental governance that emphasise inclusive participation, co-creation of solutions, and decentralisation of authority (de Loe et al., 2009; Lemos & Agrawal, 2006).

The development of the Multi-Actor Reference Group (MARG) in the Dviete River basin has shown that stakeholder involvement in water and nature governance can grow gradually - provided local interest and institutional support align. Initial enthusiasm was high, but participation declined due to the limited relevance of water retention for some stakeholders, lack of visible infrastructure outcomes, and logistical challenges. Hybrid meeting formats improved accessibility, and discussions led to clearer shared recommendations. While the MARG approach has not yet fully matured, it shows potential to evolve into a local coordination instrument. The MARG working sessions contributed directly to research prioritisation, indicator selection, and feedback on proposed water retention measures.

While there is interest in joining MARG, more regular, targeted communication and practical support, such as consultations or training, are needed, as the strictly scientific nature of the OPTAIN project limits local participation despite generally positive perceptions. MARG participants want practical projects like river cleaning and tourism improvements, local activism remains limited, being outside project-based and with very limited state and regional support due to low local management capacity—especially for the NATURA 2000 area, still voluntarily managed by a local NGO with limited municipal assistance.

The issue of water retention has so far not been widely addressed or practically implemented at the municipal level. Water retention is not integrated into municipal strategic and action planning or international and national support programs. Still limited are the communication on retention possibilities and mechanisms, gains, and practice examples available for farmers. Similarly, public awareness of water retention opportunities is very limited or almost non-existent. Additionally, there is a lack of effective monitoring and evaluation systems. Both municipalities and local NGOs lack sufficient capacity to systematically and sustainably address this issue.

This situation began to change in the Dviete region with the launch of the OPTAIN project in 2021, which encouraged local stakeholder groups to recognise the importance and potential of water retention. The project-initiated discussions raised interest in the topic, but significant progress has still not been achieved. Having within the OPTAIN project several diverse and practically working demonstration (piloting) sites would have facilitated the encouragement process, as it was mentioned by almost all stakeholders. However, the availability of governmental financial support programs would still be still limiting factor.

Conclusions

1. The environmental governance audit in the Dviete River Basin highlights major challenges - pollution from particularly wastewater treatment systems, annual long-term flooding, intensive agriculture, Nature 2000 territory management as left for voluntary locals, and water governance (management) process, in general. While various **governance measures exist, they are fragmented and uncoordinated** - stressing the need for a balanced adaptive governance frame.
2. The Dviete river basin, as a socio-ecological system, faces its primary challenge in governance, with insufficient horizontal (cross-sector) and vertical (multi-level) integration – necessary application of **water–nature–environment–agriculture–tourism sectors nexus approach** and strengthening content-wise coordination across stakeholder levels.
3. **A structured, multi-tiered local governance approach** is required, potentially including a three-dimensional governance model. Stakeholders, in general, acknowledge support for step-by-step bottom-up management further implementation, developing trusted platform and supportive institutional mechanisms, which can facilitate collaboration and improve water management, nature and environmental protection, local socio-economic development.
4. After the 2021 territorial reform towards municipal aggregation, water management and environmental governance **municipal monitoring in the Dviete River Basin remains limited**, with virtually no state-based oversight. The lack of local and national-regional multi-thematic data adds uncertainty, making strengthened environmental monitoring, including citizen science approaches and targeted water indicators, essential for stakeholders and informed decisions for sustainable vertically and horizontally integrated water resource management.
5. **A comprehensive set of governance instruments** – policies and legislation, planning, institutional and administration, economic-financial, infrastructure and technology, and all four complementary communication instruments – should be better integrated and applied in a complementary way to enhance practical effectiveness.
6. The environmental communication audit revealed a need for better information sharing, education, public engagement and pro-environmental behavior. **Strengthening this action-oriented environmental communication** is key to improving understanding, encouraging participation, and supporting more effective stakeholder collaboration and governance.
7. Interactive inclusion of all **key stakeholders** – especially mediators - can significantly strengthen collaboration and engagement. Applying the modified five-spiral collaboration model helps structure

interactions and align priorities across governance levels, potentially improving overall efficiency.

8. **The bottom-up approach is still weak** and relies too heavily on NGOs, with conflicting views among interest groups. But there was general stakeholders' interest - especially if bottom-up engagement is sustained and complemented by top-down support, targeted communication, and the active involvement of trusted local actors like the NGO Union of Dviete Valley Municipalities.

9. The establishment of the **Multi-Actor Reference Group (MARG)** in the Dviete River Basin has proven essential for, first, just for non-traditional gathering and meeting option of diverse stakeholders, and second – starting information and experience sharing and discussion. The third - integrating diverse stakeholder perspectives into the project OPTAIN, as for research project planning. By engaging local authorities, farmers, experts, NGOs, etc., MARG fosters eventual collaboration across sectors and scales, enhancing policy dialogue and supporting the co-development of context-specific solutions.

10. There could be recognized **three main instrumental preconditions for bottom-up participatory management** development:

- **Environmental** (nature, water etc.) **communication** precondition - the targeted systemic development and coordinated implementation of all four complementary groups of communication instruments.

- **Acknowledgement and support instruments** precondition, to be developed by national, regional and local governments, for bottom-up and co-work developments, particularly, for Nature2000 and river basin areas missing any administration – various types of instruments, including the existing examples of statutory delegation of management functions, co-financing mechanisms etc., actually all selection of support instruments from each of environmental governance instruments list.

- **Collaboration instruments** precondition, complemented by comparatively new and horizontal type of overlapping instrument's group as such instruments could come from each, several and all existing instruments groups.

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References

Aceves-Bueno, E., Adeleye, A. S., Bradley, D. (2015). Citizen Science: Insufficient Monitoring and Inadequate Stakeholder Buy-in in Adaptive Management. *Ecosystems*, 18(3). <https://doi.org/10.1007/s10021-015-9842-4>

- Daugavpils City & Augsdaugava Municipality. (2021a). *Attīstības programma 2022–2027: Uzraudzība* [Development Programme: Monitoring]. <https://www.daugavpils.lv/assets/upload/manager/AttistibasD>
- Daugavpils City & Augsdaugava Municipality. (2021b). *Attīstības programma 2022–2027: Rīcības plāns* [Development Programme 2022–2027: Action Plan]. <https://www.daugavpils.lv/assets/upload/manager/>
- Latvian Environment, Geology and Meteorology Centre. (2021). *Daugava River Basin Management and Flood Risk Plan for 2022.-2027*. Ministry of Environment and Regional Development, Latvia Republic, 464 pp. Riga.
- deLoe, R. C., Armitage, D. & Plummer, R. (2009). *From Government to Governance: A State-of-the-Art Review of Environmental Governance*. Alberta Environment, Guelph. <https://open.alberta.ca/publications/from-government-to-governance-state-of-art-review-of-environmental-governance-final-report>
- Ernsteins, R. (1999). *Vides komunikācija un videi draudzīga rīcība. Videszinātniskā izglītības attīstība* [Environmental Communication and Pro-Environmental Behaviour. In: Environmental Science Education Development]. Publisher Vide, pp.178-188.
- Ernsteins R., Bringulis T., Konkovs K., Lagzdina E., Skute A. (2024). *Socially engaged research practice developments: Dviete river basin water management*. Report, International research conference, Liepāja University, Liepāja, Latvia, May, 2024 (unpublished material).
- Ernsteins, R., Lontone-Ievina, A., & Stals, A. (2017a). Municipal environmental communication governance development: Complementary disciplinary and integrative approaches and practice. *Proceedings, GeoConference*, Vol. 17, Issue 5-4, pp. 359–370. <https://doi.org/10.5593/sgem2017/54/S23.046>
- Ernsteins, R., Kudrenickis, I., Kaulins, J., & Lontone-Ievina A. (2017b). Pro-environmental municipal governance developments in Latvia: sustainability and integration principles in practice. *Proceedings, International Scientific Conference*, VGTU, Vilnius, Lithuania, pp. 308–317. <https://doi.org/10.3846/cbme.2017>
- European Parliament & Council of the European Union. (2000). Directive 2000/60/EC Establishing a framework for Community action in the field of water policy. *Journal of the European Communities*, L 327, 1–73.
- Halbe, J., Pahl-Wostl, C. & Sendzimir J. (2013). Towards adaptive and integrated management paradigms: governance. *Water Science & Technology* 2013, 67(11), 2651–60, <https://doi.org/10.2166/wst.2013.146>
- Hofer, K. & Kaufmann, D. (2022). Actors, arenas and aims: A conceptual framework for public participation. *Planning Theory* 2022, 0(0), 1–23. <https://doi.org/10.1177/14730952221139587>
- Hong, P., Wei Y. & Bouckaert F. (2024). Assessing stakeholder structure in water governance in the Murray-Darling Basin. *Environmental Science & Policy*, 156, 103746. <https://doi.org/10.1016/j.envsci.2024.103746>
- Ilukste Municipality. (2020). *Attīstības programma 2020–2026: Uzraudzība* [Development Programme 2020–2026: Implementation Monitoring and Evaluation]. https://old.ilukste.lv/images/stories/Dokumenti_pdf
- Ilukste Municipality. (2019ab). *Teritorijas plānojums 2019. – 2030.: Monitoringa ziņojums. Vides pārskats* [Territorial Plan 2019. – 2030.: Monitoring & Environmental Report]. <https://www.eva.gov.lv/lv/media/960/>
- Konkovs K.A., Ikstena R., Zvera I., Ozolins M. & Ernsteins R. (2022). Lake governance developments in Latvia: lake Lubans governing process studies applying governance system framing model. *Proceedings, Conference 'Economic Science for Rural Development'* Jelgava, Latvia, pp.186-202. DOI: 10.22616/ESRD.2022.56.019
- Lemos, M. C. & Agrawal, A. (2008). Environmental Governance. *Annual Review of Environment-Resources*, 31, 297-325. <https://doi.org/10.1146/annurev.energy.31.042605.135621>
- Mulrennan, M. E., Mark, R. (2012). Revamping community-based conservation through participatory research. *The Canadian Geographer* 2012, 56(2), 243–259. <https://doi.org/10.1111/j.1541-0064.2012.00415.x>
- Morawska-Jancelewicz, J. (2021). The Role of Universities in Social Innovation-Quadruple/Quintuple Helix Model: Polish Case. *J. Knowledge Economy*, 13, 2230–2271. <https://doi.org/10.1007/s13132-021-00804-y>
- Nature Conservation Agency, Latvia. (2018). *'Dvietes paliene' dabas aizsardzības plāns 2020. – 2032* [Nature Park 'Dviete Floodplain' Nature Protection Plan 2020 – 2032].
- Pahl-Wostl, C. (2004). *Public Participation in River Basin Management in Europe*. Prepared under contract from the European Commission Contract No. EVK1-CT-2002-00120 Deliverable No. 6.
- Rimmert, M., Baudoin, L., Cotta B., Kochskämper E. & Newig J. (2020). Participation in river basin planning under the Water Framework Directive – Has it benefitted good water status? *Water Alternatives*, 13(3), 484-512.
- Schütz, F., Heidingsfelder M.L. & Schraudner M. (2019). Co-shaping the future in quadruple helix innovation system. *The Journal of Design, Economics, Innovation*, 5(2). <https://doi.org/10.1016/j.sheji.2019.04.002>
- Springer, J., Campese J. & Nakangu B. (2021). *The Natural Resource Governance Framework: Improving governance for conservation*. Gland, Switzerland: IUCN. <https://doi.org/10.2305/IUCN.CH.2021.16.en>
- Vance-Borland, K. & Honey, J. (2011). Conservation stakeholder network mapping, analysis, and weaving. *Conservation Letters*, 20114(4), 278 – 288. <https://doi.org/10.1111/j.1755-263X.2011.00176.x>
- Varmland County Administrative Board. (2019). *A Quadruple Helix Guide for Innovations*. Report. <https://northsearegion.eu/media/11651/a-quadruple-helix-guide-for-innovations.pdf>
- Von Korff, Y., Daniell K.A., Moellenkamp S. & Bots P. (2012). Implementing participatory water management: theory, practice, and evaluation. *Ecology and Society*, 17(1), 30. <http://dx.doi.org/10.5751/ES-04733-170130>