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RECONCILING ECOLOGY, LAW AND GOVERNANCE: SCENARIOS FOR BIOREGIONAL DEVELOPMENT

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The legal regulation of bioregions is gaining growing relevance within the contemporary discourse on environmental, economic, and regional policy. In the face of climate change, resource scarcity, and increasing public environmental awareness, the question of how to ensure effective and adaptive territorial governance—capable of promoting both sustainability and regional development—has become particularly salient. This article offers a theoretically and conceptually grounded analysis of the principal dilemmas shaping the legal regulation of bioregions in Latvia and outlines potential future development trajectories. The study adopts two complementary methodological approaches: dilemma analysis and scenario modelling. First, it identifies and examines three structural dilemmas: (1) the trade-off between ecological protection and economic development, (2) the tension between centralized governance and local community autonomy, and (3) the challenge of reconciling legal rigidity with the need for flexibility in response to evolving ecological dynamics. These dilemmas are analysed within the context of Latvian and European Union legal frameworks, policy instruments, and governance practices, highlighting both theoretical contradictions and practical implementation challenges. Building upon these analytical axes, the second part of the article develops three future scenarios: a pessimistic scenario ("Stagnation and Conflicts"), a realistic scenario ("Cautious Progress"), and an optimistic scenario ("Sustainable Transformation"). Each scenario projects potential developments in the legal and institutional landscape through 2030, incorporating dimensions such as public participation, governance effectiveness, and environmental protection. The comparative assessment of the scenarios elucidates divergent pathways and identifies critical tipping points that may either facilitate or hinder the transition toward a more resilient and sustainable model of governance. The article concludes that the effectiveness of legal systems in bioregional governance is contingent upon their ability to address complex dilemmas in a dynamic, context-sensitive manner. Scenario analysis emerges as a valuable tool not only for diagnosing the current state but also for articulating and exploring alternative futures. The article provides governance implications, emphasizing the need to empower local initiatives, enhance legal adaptability, and embed principles of sustainable governance in order to establish a robust and resilient bioregional management system in Latvia.

Keywords: *bioregions, rural development, sustainable regional governance, green transformation, environmental planning.*

INTRODUCTION

The concept of bioregions has, over the past decades, become an essential approach linking discourses on sustainable development, ecosystem services, and local governance. It is grounded in the idea that territorial planning and economic specialization should be designed in accordance with natural boundaries and cultural–historical identity (Wearne et. al., 2023; Hubbard et al., 2023). Bioregions offer the potential to overcome the limitations of traditional administrative borders and to establish multi-level governance systems that align human activity more closely with ecological foundations.

In the European Union, the bioregional discourse is reinforced by initiatives such as the European Green Deal, the Common Agricultural Policy (CAP), the New European Bauhaus, Research and Innovation Strategies for Smart Specialisation (RIS3), and Cohesion Policy, all of which indirectly promote regional sustainability and the development of the bioeconomy (European Commission, 2019; European Commission, 2020; Burns, 2020; Kok et al., 2019; van Zanten & van Tulder, 2021). However, these policies are often implemented in a fragmented manner, generating dilemmas between ecological protection and economic growth, centralized regulation and local autonomy, as well as between cultural heritage preservation and innovative development projects (Gustafsson, 2019).

In the Latvian context, the bioregional approach is particularly relevant in relation to the Bioeconomy Strategy 2030, which emphasizes efficient resource use, the adoption of innovative technologies, and the advancement of green growth potential. Latvia is also part of the Baltic Sea Region, where bioregional cooperation is promoted through cross-border programmes (e.g., Interreg, Horizon Europe). At the same time, research indicates that at the municipal level there is no unified understanding of the bioregional concept, and significant coordination challenges persist among national ministries, planning regions, and local municipalities.

The object of the study is bioregional development as a governance and policy coordination framework in Latvia.

Despite increasing references to bioregions in sustainability, bioeconomy, and territorial development policies, their legal and institutional grounding remains fragmented. Existing regulatory frameworks often pursue partially

contradictory objectives, creating dilemmas between ecological protection, economic development, and governance arrangements across different levels.

Research conducted by Latvian academic institutions in agriculture, landscape ecology, and rural development demonstrates that bioregions can serve as an important instrument for fostering sustainable specialization and regional development. Of particular importance is the identification of dilemmas among diverse policy and societal objectives, which can provide a foundation for scenario modelling and structured analysis of alternative development pathways (Pot et al., 2020; Hedlund et al., 2022).

The aim of this study is to analyse how institutional and legal dilemmas shape possible pathways of bioregional development in Latvia, using dilemma analysis and scenario modelling. The objectives of the study are:

1) to map regulatory acts and policy programmes with direct and indirect relevance for bioregional development in Latvia;
2) to identify key institutional and policy dilemmas arising from interactions between these documents;
3) to develop alternative future scenarios based on different ways of addressing these dilemmas;
4) to discuss the implications of the identified scenarios for policy coordination and governance of bioregions.

This study thus provides both a theoretical and analytical contribution by positioning bioregions as a prospective governance framework in which environmental, economic, and social goals are balanced. It contributes to the literature on bioregionalism and multi-level governance by linking institutional dilemma analysis with scenario-based exploration of future development pathways.

RESEARCH METHODS

1. Institutional system mapping

Institutional system mapping was applied as the first analytical step to identify regulatory acts, policy instruments, and programmes influencing bioregional development in Latvia. The purpose of this method is to provide a structured overview of how different institutional frameworks interact and jointly shape governance conditions for bioregions (Peters, 2020). The analysis focused on documents operating at four governance levels: European Union, national, regional/municipal, and local/community.

Policy documents were selected based on their relevance to environmental protection, territorial development, agriculture, bioeconomy, and regional governance. The selection included both legally binding regulatory acts and development-oriented strategies, as well as horizontal initiatives that indirectly influence governance practices and territorial identity. This approach ensures that the institutional environment of bioregional development is analysed comprehensively, taking into account not only formal legal constraints but also strategic and contextual influences.

To ensure analytical clarity, the identified documents were classified according to the type of influence they exert on bioregional development. Direct regulatory influence refers to legally binding acts that define mandatory rules, restrictions, and obligations, such as environmental protection laws, land-use regulations, and conservation frameworks. Direct developmental influence includes strategic and policy documents that set development priorities, funding directions, and innovation objectives, for example bioeconomy strategies, rural development programmes, and cohesion policy instruments. Indirect influence encompasses non-binding initiatives, cooperation programmes, participatory mechanisms, and cultural or educational activities that shape governance practices, institutional learning, and local engagement without imposing formal legal obligations.

Table 1 presents the typology of policy documents and programmes by hierarchical level and type of influence.

Table 1. Typology of policy documents and programmes by hierarchical level

Level	Direct regulatory influence	Direct developmental influence	Indirect influence
EU	EU Habitats Directive (Directive 92/43/EEC, 1992); EU Birds Directive (Directive 2009/147/EC, 2009); Natura 2000 framework (Directive 92/43/EEC, 1992)	Common Agricultural Policy (European Parliament & Council, 2013); European Green Deal (European Commission, 2019); Farm-to-Fork Strategy (European Commission, 2020); Cohesion Policy (European Commission, 2019)	Horizon Europe (European Commission, 2021); New European Bauhaus (European Commission, 2021); Interreg BSR (Interreg Baltic Sea Region Programme, 2021–2027)
National	Law on Specially Protected Nature Territories (Parliament of the Republic of Latvia, 1993); Law on Protective Zones (Parliament of the Republic of Latvia, 1997); Law on Environmental Protection (Parliament of the Republic of Latvia, 2006); Forest Law (Parliament of the Republic of Latvia, 2000)	Latvia's Bioeconomy Strategy 2030 (Cabinet of Ministers of the Republic of Latvia, 2018); Updated National Energy and Climate Plan 2021–2030 (Cabinet of Ministers of the Republic of Latvia, 2021); Rural Development Programme (European Parliament & Council, 2013)	Regulations on the procedure for state funding of vocational arts, music and dance education programmes (Cabinet of Ministers of the Republic of Latvia, 2011); Education Policy Outlook: Latvia (OECD, 2017)
Regional / Municipal	Binding land-use regulations; Regional spatial plans (Ministry of Environmental Protection and Regional Development, 2022)	Regional development strategies; Municipal development programmes (Ministry of Environmental Protection and Regional Development, 2020); LEADER initiatives (European CAP Network)	Regional NGOs and citizen participation platforms (Ministry of Environmental Protection and Regional Development, 2025)
Local / Community	Local regulations on nature areas and land use	Local development strategies (European Commission, 2019); cooperative and farm-based initiatives	Community initiatives; cultural events; civil society activities

The table illustrates that at all governance levels regulatory, developmental, and indirect instruments operate simultaneously. This coexistence creates both synergies and tensions: binding environmental regulations may constrain development-oriented strategies, while indirect initiatives influence local participation, territorial identity, and institutional capacity. The overlaps and interactions identified through institutional mapping provide the analytical foundation for the subsequent dilemma analysis, allowing systematic examination of conflicts and trade-offs embedded in multi-level governance of bioregional development.

2. Dilemma analysis methodology

Dilemma analysis was conducted as the second analytical step, building directly on the results of the institutional system mapping. This approach is used to identify situations in which policy objectives and regulatory frameworks generate competing or partially incompatible demands, particularly in complex governance systems where multiple actors and levels interact (Rayner, 2012; Van Asselt & Renn, 2011).

Based on the classification of documents presented in Table 1, dilemmas were identified through systematic comparison of regulatory, developmental, and indirect policy influences across governance levels. The analysis focused on contradictions between policy goals that are difficult to reconcile in practice, such as ecological protection versus economic development, centralized regulation versus local autonomy, and legal rigidity versus the need for adaptive governance. Such tensions are widely discussed in the literature as characteristic of multi-level and polycentric governance arrangements (Nilsson et al., 2012; Hooghe & Marks, 2020).

Dilemmas were formulated as pairs of competing objectives and organised into an interaction matrix, which illustrates how conflicts emerge between different types of policy influence (regulatory–developmental, regulatory–indirect, and developmental–indirect) and across governance levels. This matrix-based approach allows structural policy conflicts to be identified and analysed systematically, rather than treating them as isolated implementation problems (Van Asselt & Renn, 2011).

Expert literature and previous studies on policy coherence, environmental governance, and long-term institutional change were used to support the relevance and plausibility of the identified dilemmas (Rayner, 2012; Pot et al., 2020; Hedlund et al., 2022). This step ensured that the dilemma analysis reflects not only the Latvian policy context but also broader theoretical debates on governance challenges in sustainability transitions.

Table 2 presents the interaction matrix of key dilemmas identified across governance levels.

Table 2. Analytical approach to dilemma analysis

Method / Tool	Description
Comparative document analysis (content analysis)	Comparing the objectives, priorities, and provisions of documents.
Institutional logics analysis	Assessing the dominant values and normative frameworks of each document.
Interaction matrix	Mapping dilemmas according to how they emerged across different types of influence (e.g., regulatory–developmental, regulatory–indirect).
Expert assessments	Supplementing dilemma formulations with insights from literature and previous studies.

The resulting analytical framework highlights that dilemmas are most pronounced at the interfaces between governance levels, where binding regulatory frameworks intersect with development-oriented strategies and local practices. These structurally embedded tensions provide the analytical foundation for subsequent scenario development, in which alternative pathways of addressing or exacerbating the identified dilemmas are explored.

3. Scenario development methodology

Scenario development was employed as the third analytical step to explore alternative pathways of bioregional development arising from different ways of addressing the dilemmas identified in the previous stage. Scenario analysis is widely used in policy and governance research as a qualitative and exploratory method for examining complex, uncertain, and value-laden decision contexts (Börjeson et al., 2006; Amer et al., 2013).

In this study, scenarios are understood as analytical constructs rather than forecasts. Their purpose is not to predict future developments, but to systematically explore how different institutional choices and governance arrangements may shape possible trajectories of bioregional development. This approach is particularly suitable for analysing governance dilemmas, where outcomes depend on interactions between legal frameworks, policy priorities, and actor behaviour across multiple levels.

The scenario development process was structured around the dilemmas identified through institutional mapping and dilemma analysis. Each scenario was constructed by:

1) selecting one or more key dilemmas as the analytical starting point;
2) defining a scenario logic based on how these dilemmas are addressed, partially resolved, or remain unresolved;
3) outlining the potential social, economic, ecological, and governance implications associated with each pathway.

Following the typology proposed by Börjeson et al. (2006), the scenarios combine normative and alternative elements. Normative components reflect objectives articulated in strategic and policy documents, such as sustainability targets, bioeconomy goals, and governance principles. Alternative components explore plausible developments that may occur if dilemmas are addressed inconsistently or if certain policy objectives dominate over others. This combination allows both policy intentions and governance constraints to be examined within a single analytical framework.

Table 3 presents the methodological structure of scenario development, including the main scenario types and analytical steps applied in this study.

Table 3. Scenario methods and tools

Method / Tool	Description
Normative scenarios	Based on objectives set in policy documents (e.g., climate neutrality by 2050).
Alternative scenarios	Modelled to show what happens if dilemmas remain unresolved or are addressed contrary to policy intentions.
Expert discussions and literature analysis	Ensure plausibility of scenarios and their linkage to existing research.
Visualization tools	Tables, diagrams, and narratives used to present scenarios in a structured and comparable manner.

Expert literature and previous studies on sustainability transitions, policy coherence, and multi-level governance were used to ensure the plausibility and internal consistency of the scenarios (Amer et al., 2013; Loorbach et al., 2017; Geels et al., 2017). The resulting scenario framework provides a structured basis for comparing alternative development pathways and for identifying critical governance "tipping points" that may either facilitate or hinder sustainable bioregional development.

RESEARCH RESULTS AND DISCUSSION

4.1. Results of institutional and dilemma analysis

The results of the institutional system mapping demonstrate that bioregional development in Latvia is shaped by a complex and multi-layered governance environment. At all governance levels—European Union, national, regional/municipal, and local/community regulatory, developmental, and indirect policy instruments operate simultaneously. While this multiplicity of instruments creates opportunities for integrated governance, it also generates structural tensions and coordination challenges.

The dilemma analysis reveals that conflicts are not isolated implementation issues but emerge systematically at the intersections of governance levels and policy domains. The most prominent dilemmas identified include:

1) ecological protection versus economic development,
2) centralized governance versus local autonomy,
3) legal rigidity versus the need for adaptive and context-sensitive governance.

These dilemmas reflect broader challenges discussed in the literature on policy coherence and multi-level governance, where competing objectives are embedded within institutional architectures rather than arising from individual policy failures (Nilsson et al., 2012; Hooghe & Marks, 2020).

Table 4 presents the dilemma matrix summarising the key dilemmas identified across governance levels and policy domains.

Table 4. Dilemma matrix by document levels

Document level	Main dilemmas	Possible risks	Possible opportunities	Example
EU level	Conservation vs. production increase	Conflicts between environmental and agricultural sectors	Bioeconomy innovations, sustainable production	CAP vs. Natura 2000
National level	Centralized planning vs. local autonomy	Limited decision-making capacity of municipalities	Policy coordination, local innovations	Bioeconomy Strategy 2030 vs. Protection Zone Law
Regional level	Investments vs. ecological boundaries	Unequal distribution of resources	Public participation, territorial specialization	Regional development plans vs. Rural Development Programme
Municipal/local level	Development projects vs. community values	Social conflicts, project delays	Community identity, strengthening local resources	Development programmes vs. community initiatives

The dilemma matrix illustrates that the most persistent conflicts occur at the interfaces between binding regulatory frameworks and development-oriented strategies, particularly where EU-level environmental and agricultural objectives intersect with national implementation mechanisms and local governance practices. These results indicate that the main constraints on bioregional development arise not from a lack of policy instruments but from their fragmented interaction across governance levels.

4.2. Scenario results

The scenario results synthesise patterns identified across European Union and national policy frameworks—including environmental regulation, bioeconomy strategies, and territorial development instruments—as mapped in the previous institutional and dilemma analysis. Rather than reflecting individual policy documents, the scenarios represent integrated analytical constructs that capture recurring configurations of governance responses to identified dilemmas.

Building on this synthesis, three analytically distinct scenarios were developed to illustrate alternative pathways of bioregional development. These scenarios constitute the results of the scenario analysis, not predefined assumptions, and are used as comparative devices to explore how different approaches to dilemma resolution shape governance outcomes.

Scenario 1: Sustainable Transformation.

This scenario represents an integrated governance pathway in which ecological protection, economic development, and social objectives are actively balanced. Institutional coordination is strengthened across governance levels, and regulatory frameworks are adapted to support innovation within ecological boundaries. Public participation mechanisms are institutionalised, contributing to higher levels of trust and governance legitimacy. In this scenario, bioregional development becomes an operational governance framework rather than a symbolic policy concept.

Scenario 2: Cautious Progress.

The second scenario depicts a fragmented yet partially functional development pathway. While certain sectors, regions, or projects demonstrate innovation and progress, coordination across governance levels remains uneven. Ecological constraints are formally acknowledged, but economic priorities frequently dominate implementation decisions. Public participation exists in procedural terms but lacks consistency, resulting in incremental rather than transformative change.

Scenario 3: Stagnation and Conflicts.

The third scenario illustrates a pathway characterised by unresolved dilemmas and governance deadlock. Short-term economic interests prevail over ecological considerations, leading to environmental degradation and declining public trust. Institutional rigidity and weak coordination hinder adaptive responses to emerging challenges. In this scenario, bioregional development remains largely rhetorical, with limited practical implementation and increasing social and territorial conflicts.

For analytical clarity, the three scenarios—Integrated, Polarized, and Unresolved—are hereafter referred to as optimistic, realistic, and pessimistic pathways, respectively.

Table 5 presents a comparative overview of the three bioregional development scenarios across governance, social, economic, and ecological dimensions.

Table 5. Scenario comparison

Element/scenario	Sustainable Transformation (Integrated scenario)	Cautious Progress (Polarized scenario)	Stagnation and Conflicts (Unresolved scenario)
Key dilemmas	Balancing ecological protection and economic growth; centralization vs. autonomy	Ecological limits vs. production intensification; uneven sectoral coordination	Economic priorities overriding environmental protection; unresolved governance tensions
Development logic	Integrated compromise: aligning bioeconomy development with environmental protection and strong institutional coordination	Partial coordination: fragmented progress with some niche innovations and uneven governance capacity	One-sided development: dominance of short-term economic interests, policy deadlock
Social outcomes	High citizen participation; trust in institutions grows	Divided public opinion; moderate participation	Declining trust; social conflicts intensify
Economic outcomes	Stable bioeconomy growth; export opportunities	Medium growth rate; uneven regional development	Short-term profit from intensification; long-term instability
Ecological outcomes	Improved ecosystem protection; enhanced biodiversity	Partial reduction of ecosystem degradation	Severe degradation; biodiversity loss
Risks	Insufficient financial resources for coordination	Policy fragmentation; uneven municipal capacity	Social unrest; resource depletion; ecological collapse
Opportunities	Sustainable growth; international competitiveness	Development of innovative niche solutions	Potential for reforms under external pressure

The scenario comparison table illustrates that dilemmas may lead to markedly different development pathways. The optimistic scenario demonstrates that when compromises are achieved between economic and environmental goals, sustainable growth and increased public trust in institutions become possible, corresponding to the literature on transformative governance (Loorbach et al., 2017). The realistic scenario reflects a mixed pathway in which policy fragmentation persists, but niche innovations emerge, aligning with research on transition pathways (Geels et al., 2017). By contrast, the pessimistic scenario highlights that prioritising a single dimension—economic growth—can result in ecosystem degradation and social conflicts, echoing warnings about lock-in risks in sustainable food and bioeconomy policies (Levidow et al., 2011).

4.3. Comparative discussion and governance implications

The comparative discussion highlights that the future of bioregional development depends not on individual policy instruments or governance levels, but on how institutional dilemmas are addressed over time and across scales. The scenarios demonstrate that similar policy objectives may result in markedly different outcomes depending on coordination

mechanisms, institutional flexibility, and the capacity of governance systems to reconcile competing priorities. These findings align with research emphasising that policy coordination challenges and institutional misalignments play a central role in shaping governance outcomes in multi-level systems (Borrás & Edler, 2020).

Across all scenarios, several governance tipping points emerge as particularly influential. These include decisions related to land-use regulation, the implementation of bioeconomy strategies, and the design of public participation mechanisms. Choices made at these critical junctures shape institutional trajectories and determine whether governance systems evolve towards greater adaptability or remain locked into fragmented arrangements. This observation is consistent with the literature on polycentric and participatory environmental governance, which highlights how critical decision moments can have long-term effects on institutional change and sustainability outcomes (Morrison et al., 2019).

The scenarios further illustrate that adaptive governance capacity is a key factor in mitigating conflicts between environmental protection and economic development objectives. Governance systems that enable institutional learning, experimentation, and cross-sectoral coordination are better positioned to respond to complex sustainability challenges. This reinforces insights from the adaptive governance literature, which stresses the importance of learning-oriented and flexible institutional arrangements in navigating environmental and societal transformations (Chaffin et al., 2016).

At the same time, the persistence of implementation gaps across governance levels underscores enduring challenges of policy coherence. Even where strategic objectives related to sustainability and bioeconomy development are formally aligned, inconsistencies in implementation and coordination may limit their practical effectiveness. The scenario analysis reflects broader findings in recent governance research, which point to the difficulty of translating integrated policy goals into coherent action across institutional contexts (Runhaar et al., 2024).

Overall, the discussion suggests that bioregional development should be understood as a dynamic governance framework rather than a fixed territorial model. Its success depends on the ability of governance systems to manage institutional dilemmas, recognise critical tipping points, and foster coordination and learning across levels. By situating the scenario results within established governance literature, the analysis contributes to a deeper understanding of how bioregional approaches may evolve under different institutional conditions.

CONCLUSIONS

This study examined bioregional development in Latvia as a governance and policy coordination framework shaped by interactions between regulatory, developmental, and indirect policy instruments across multiple governance levels. By combining institutional system mapping, dilemma analysis, and scenario development, the research demonstrates that bioregional development is constrained less by the absence of policy instruments than by persistent challenges of policy coherence and multi-level coordination.

The analysis shows that key governance dilemmas—such as ecological protection versus economic development, centralized regulation versus local autonomy, and legal rigidity versus the need for adaptive governance—are structurally embedded within existing institutional arrangements. Scenario analysis illustrates that these dilemmas may lead to markedly different development pathways depending on how they are addressed over time. In particular, integrated and adaptive governance arrangements can mitigate conflicts and enhance institutional resilience, while unresolved tensions increase the risk of fragmentation and policy lock-in.

The main contribution of this study lies in providing a structured analytical framework that links institutional mapping, dilemma analysis, and scenario development to explore complex governance challenges related to bioregional development. Rather than offering prescriptive solutions, the framework supports systematic comparison of alternative pathways and highlights governance tipping points that are critical for long-term sustainability.

Several limitations should be acknowledged. The study is based on qualitative interpretation of policy documents and employs scenario analysis as an exploratory method. While this approach ensures analytical transparency and conceptual clarity, it does not provide empirical validation of the identified scenarios. Future research may build on the proposed framework by integrating quantitative indicators, in-depth case studies, or comparative cross-regional analyses to further examine how governance dilemmas and tipping points shape bioregional development outcomes in practice.

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