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From EU Objectives to Slovak Action: Biodiversity Governance Across Scales

Od celów Unii Europejskiej do działań Słowacji: wielopoziomowe
zarządzanie bioróżnorodnością

Abstract: The study examines multi-level biodiversity governance with an emphasis on reflecting biodiversity protection priorities at the local level. The literature review emphasises the importance of multi-level governance of biodiversity, considering both the strategic implications of biodiversity loss and the need to protect biodiversity. The research focusses on priority areas of biodiversity protection, which are identified by the eight regional cities in Slovakia through their strategic development documents. At the same time, in this context, the study also examines the interrelationships between local strategies of selected cities and biodiversity protection priorities at the national and European levels, as well as selected documents. The primary benefit of this research is the mapping of priority areas for biodiversity protection at the local level in the Slovak regional cities. The research also confirms the need for continuity of priority areas across scales. The study highlights the interconnectedness of priority areas in the strategies of Slovak cities at both the national and European levels.

Keywords: biodiversity, multi-level governance, strategies, municipalities and cities, Slovakia

Abstrakt: Celem artykułu jest analiza wielopoziomowego zarządzania bioróżnorodnością, ze szczególnym uwzględnieniem priorytetów ochrony bioróżnorodności na poziomie lokalnym. Przegląd literatury ujawnił znaczenie wielopoziomowego zarządzania bioróżnorodnością, uwzględniającego zarówno strategiczne konsekwencje utraty bioróżnorodności, jak i konieczność jej ochrony. W artykule skoncentrowano się na priorytetowych obszarach ochrony bioróżnorodności, które zostały zidentyfikowane przez osiem miast regionalnych na Słowacji w ich dokumentach strategicznego rozwoju. Jednocześnie analiza obejmuje relacje pomiędzy lokalnymi strategiami wybranych miast a priorytetami ochrony bioróżnorodności na poziomie krajowym i europejskim, a także wybrany mi dokumentami strategicznymi. Główną wartością badania jest mapowanie priorytetowych obszarów ochrony bioróżnorodności na poziomie lokalnym w słowackich miastach regionalnych. Wyniki potwierdziły również konieczność zachowania ciągłości priorytetów pomiędzy różnymi poziomami zarządzania. Badanie uwydatniło powiązania priorytetowych obszarów w strategiach słowackich miast regionalnych z priorytetami na poziomie krajowym i europejskim.

Słowa kluczowe: bioróżnorodność, zarządzanie wielopoziomowe, strategie, gminy i miasta, Słowacja

1. Introduction

The growing interest in protecting biodiversity is a result of long-term negative factors that have contributed to biodiversity loss, including intensive human activity, climate change, urbanisation and many others. Since biodiversity makes an undeniable contribution to the proper functioning of ecosystems, it is natural that several strategies are dedicated to biodiversity protection at different levels of societal governance, i.e. global, European and national, as well as local.¹

The study examines multi-level biodiversity governance and emphasises biodiversity protection priorities at the local level. It focusses on priority areas of biodiversity protection, which are identified by the eight regional cities in

¹ Biodiversity, <https://www.who.int/news-room/fact-sheets/detail/biodiversity>, [access: 10.06.2025]; L. Groen, *Explaining European Union Effectiveness (Goal Achievement) in the Convention on Biological Diversity: The Importance of Diplomatic Engagement*, "International Environmental Agreements: Politics, Law and Economics" 2019, vol. 19, p. 70, <https://doi.org/10.1007/s10784-018-9424-y>.

Slovakia through their strategic development documents. In this context, the study aims to address the research question: What priority areas of biodiversity protection are defined by Slovakia's regional cities in their long-term strategic documents? At the same time, the study also examines the interrelationships between local strategies of selected cities and biodiversity protection priorities at the national and European levels.

The intention behind the content analysis was not to exhaustively examine all biodiversity documents existing at the European, national and local levels; it was instead to explore the content of selected strategic documents, focussing on the priorities declared by public institutions at various levels of governance, specifically at the European, national and local levels. A prerequisite for such use is also a theoretical examination of biodiversity protection through a literature review, primarily focussed on identifying the positive and negative connotations of biodiversity, the role of various stakeholders and the importance of multi-level governance in biodiversity protection.

2. The role of biodiversity in ecosystem services

Biodiversity is a vital aspect of our ecosystems and the environment worldwide. It can be described as critical to the functioning of the global ecosystem.² Biodiversity is threatened by intensive urbanisation, as well as agriculture and deforestation.³ As a result, the integrity of biodiversity is being degraded by human-driven activities.⁴ An international consensus has been reached that preserving ecosystem integrity can be a key response to the current biodiversity crisis.⁵

² M. Hirschmann, Ch. Fisch, S. Farny, *Biodiversity Loss and Entrepreneurship: Empirical Evidence on Threat Perceptions Among Primary-sector Entrepreneurs in 28 European Countries*, "Journal of Business Venturing Insights" 2025, vol. 23, p. 1–27, <https://doi.org/10.1016/j.jbvi.2025.e00529>.

³ J. Köninger, P. Panagos, A. Jones, M.J.I. Briones, A. Orgiazzi, *In Defence of Soil Biodiversity: Towards an Inclusive Protection in the European Union*, "Biological Conservation" 2022, vol. 268, p. 1–12, <https://doi.org/10.1016/j.biocon.2022.109475>; P. Theodorou, *The Effects of Urbanisation on Ecological Interactions*, "Current Opinion in Insect Science" 2022, vol. 52, p. 1–9, <https://doi.org/10.1016/j.cois.2022.100922>.

⁴ S. Díaz, J. Settele, E.S. Brondízio, H.T. Ngo, J. Agard, A. Arneth, P. Balvanera, K.A. Brauman, S.H.M. Butchart, K.M.A. Chan, L.A. Garibaldi, K. Ichii, J. Liu, S.M. Subramanian, G.F. Midgley, P. Miloslavich, Z. Molnár, D. Obura, A. Pfaff, S. Polasky, A. Purvis, J. Razzaque, B. Reyers, R.R. Chowdhury, Y.-J. Shin, I. Visseren-Hamakers, K.J. Willis, C.N. Zayas, *Pervasive Human-driven Decline of Life on Earth Points to the Need for Transformative Change*, "Science" 2019, vol. 366, p. 1–11, <https://doi.org/10.1126/science.aax3100>.

⁵ Y. Feng, Y. Cao, M.Y. Chan, Z. Ye, Z. Zhao, L. Yu, Y. Liang, S. Carve, R. Yang, *Assessing Ecosystem Integrity in Protected Areas: A Systematic Review of Methods and Applications*, "Biological Conservation" 2025, vol. 305, <https://doi.org/10.1016/j.biocon.2025.111057>; R. Lemoine-Rodríguez,

2.1. Negative and positive connotations of biodiversity

Academics, politicians and practitioners discuss biodiversity in various ways, from different perspectives and with different meanings and scopes. Biodiversity is often discussed in the professional literature with negative connotations that reflect primary biodiversity loss or a lack of protection. The primary aspect of the widespread discussion on biodiversity at various levels of governance is biodiversity loss,⁶ which is caused not only by climate change, but also by economic activity.⁷

The impact of human activity on ecosystems' biodiversity is directly connected to the quality of life of the local inhabitants.⁸ Low biodiversity and the resulting reduced ecosystem services in states, regions and cities negatively impact residents' well-being and resilience to climate change.⁹ In general, as biodiversity declines, the loss could threaten the quality of life of all humans; thus, urban biodiversity conservation should be considered an essential public health investment.¹⁰

However, biodiversity is also researched and often discussed in terms of its positive impacts on the functioning of ecosystems and human society, e.g. in the context of energy governance, primarily about the transition from fossil fuels to

M. García-Arroyo, Miguel A. Gómez-Martínez, M. Back, T. Lindeman, I. MacGregor-Fors, *Unveiling Urban Ecological Integrity: Spatially Explicit Assessment in Contrasting Environments*, "Urban Ecosystems" 2024, vol. 27, p. 1168, <https://doi.org/10.1007/s11252-024-01517-1>; B. Mackey, E. Morgan, H. Keith, *Evaluating Forest Landscape Management for Ecosystem Integrity*, "Landscape Research" 2023, vol. 49, no. 2, p. 247, <https://doi.org/10.1080/01426397.2023.2284938>.

⁶ R.A. Baquero, D. Ayllón, F.J. Oficialdegui, G.G. Nicola, *Tackling Biological Invasions in Natura 2000 Network in the Light of the New EU Biodiversity Strategy for 2030*, "Management of Biological Invasions" 2021, vol. 12, no. 4, p. 787, <https://doi.org/10.3391/mbi.2021.12.4.01>; A. Kok, E.M. de Olde, I.J.M. de Boer, R. Ripoll-Bosch, *European Biodiversity Assessments in Livestock Science: A Review of Research Characteristics and Indicators*, "Ecological Indicators" 2020, vol. 112, p. 1–10, <https://doi.org/10.1016/j.ecolind.2019.105902>.

⁷ P. Dasgupta, S. Levin, *Economic Factors Underlying Biodiversity Loss*, "Philosophical Transactions B" 2023, vol. 378, p. 1–15, <https://doi.org/10.1098/rstb.2022.0197>; A. Dobson, Z. Rowe, J. Berger, P. Wholey, T. Caro, *Biodiversity Loss Due to More Than Climate Change*, "Science" 2021, vol. 374, p. 699, <https://doi.org/10.1126/science.abm6216>.

⁸ F. Vasco, J. Perrin, B. Oertli, *Urban Pondscape Connecting People with Nature and Biodiversity in a Medium-sized European City (Geneva, Switzerland)*, "Urban Ecosystems" 2024, vol. 27, p. 1118, <https://doi.org/10.1007/s11252-023-01493-y>.

⁹ M. Pedersen Zari, M. MacKinnon, K. Varshney, N. Bakshi, *Regenerative Living Cities and the Urban Climate-biodiversity-wellbeing Nexus*, "Nature Climate Change" 2022, vol. 12, p. 601, <https://doi.org/10.1038/s41558-022-01390-w>.

¹⁰ M.R. Marselle, S.J. Lindley, P.A. Cook, A. Bonn, *Biodiversity and Health in the Urban Environment*, "Current Environmental Health Reports" 2021, vol. 8, p. 150, <https://doi.org/10.1007/s40572-021-00313-9>.

renewable energy sources.¹¹ At the same time, biodiversity is closely connected to blue and green infrastructure of national, regional and local significance.¹²

From a long-term perspective, biodiversity is a crucial driver of sustainable urban development¹³ and ecological security,¹⁴ and it is a vital element in the resilience of cities and communities.¹⁵ Well-managed biodiversity can also promote human health and well-being,¹⁶ as well as ecosystem services for local stakeholders.¹⁷

Protecting biodiversity is a complex and never-ending process. Governments cannot be the only ones involved in this process through public policies; relevant stakeholders must also be involved in their creation, implementation and evaluation. This tendency and necessary practice create opportunities for diverse urban nature voices to co-create a case for biodiversity, which can be supported through existing local networks, global city networks and platforms.¹⁸ The interactions between urbanisation, humans, biodiversity and ecosystems are perceived as key issues for cities.¹⁹ Subsequently, biodiversity at the local level requires co-management and community-based actions, including

¹¹ A. Hausmann, T. Väisänen, T. Toivonen, G. Cortés-Capano, *Climate and Biodiversity Perceptions Amid the European Energy Crisis: Shifting Social Media Narratives*, "Sustainability Science" 2025, vol. 20, p. 920, <https://doi.org/10.1007/s11625-025-01639-1>.

¹² C. Hyseni, J. Heino, L.M. Bini, U. Bjelke, F. Johansson, *The Importance of Blue and Green Landscape Connectivity for Biodiversity in Urban Ponds*, "Basic and Applied Ecology" 2021, vol. 57, p. 138, <https://doi.org/10.1016/j.baae.2021.10.004>.

¹³ C. Hernandez-Santin, M. Amati, S. Bekessy, Ch. Desha, *Integrating Biodiversity as a Non-human Stakeholder Within Urban Development*, "Landscape and Urban Planning" 2023, vol. 232, <https://doi.org/10.1016/j.landurbplan.2022.104678>.

¹⁴ M. Kostić, *Ecology of Crime and Ecological Explanations in Criminology*, "Proceedings of the Twelfth International Scientific Conference «Social Changes in the Global World»" 2022, vol. 1, no. 9, p. 245, <https://doi.org/10.46763/SCGW221235k>.

¹⁵ M. Pedersen Zari, M. MacKinnon, K. Varshney, N. Bakshi, *Regenerative Living Cities...*, p. 602.

¹⁶ X. Sun, C. Liddicoat, A. Tiunov, B. Wang, Y. Zhang, Ch. Lu, Z. Li, S. Scheu, M.F. Breed, S. Geisen, Y.-G. Zhu, *Harnessing Soil Biodiversity to Promote Human Health in Cities*, "NPJ Urban Sustainability" 2023, vol. 3, no. 5, p. 1–8, <https://doi.org/10.1038/s42949-023-00086-0>.

¹⁷ J.P. Kachanova, S.B. Steppe, S.E. Hobbs, *Urban Orchards Provide Important Biodiversity and Ecosystem Services*, "Urban Ecosystems" 2025, vol. 28, p. 1–12, <https://doi.org/10.1007/s11252-025-01739-x>.

¹⁸ C. Oke, S.A. Bekessy, N. Frantzeskaki, J. Bush, J.A. Fitzsimons, G.E. Garrard, M. Grenfell, L. Harrison, M. Hartigan, D. Callow, B. Cotter, S. Gawler, *Cities Should Respond to the Biodiversity Extinction Crisis*, "NPJ Urban Sustainability" 2021, vol. 1, no. 11, p. 1–4, <https://doi.org/10.1038/s42949-020-00010-w>.

¹⁹ I. Kowarik, *Urban Biodiversity, Ecosystems and the City. Insights from 50 Years of the Berlin School of Urban Ecology*, "Landscape and Urban Planning" 2023, vol. 240, <https://doi.org/10.1016/j.landurbplan.2023.104877>.

mainly supportive organisational policies and strategies, community support and integrative human–nature designs.²⁰

The protection of biodiversity requires the engagement of all stakeholders who influence and are affected by changes in biodiversity. In this regard, the roles of entrepreneurs,²¹ communities²² and higher education institutions²³ are more than beneficial for biodiversity protection. Greater engagement from policymakers and planners, as well as partnerships between public bodies and private households to coordinate local initiatives, is constructive for improving biodiversity.²⁴

2.2. Biodiversity as a multi-level governance issue

In the European Union, biodiversity requires multi-level governance for the creation, implementation and evaluation of relevant public policies.²⁵ To achieve targets determined by biodiversity policies, it is essential to complement the understanding of biodiversity indicators.²⁶ The issue of biodiversity has been a long-standing focus of attention at the European Union level. Politicians and experts at EU institutions perceive biodiversity as a key component of

²⁰ L. Taylor, C.J. Maller, K. Soanes, C.E. Ramalho, A. Aiyer, K.M. Parris, C.G. Threlfall, *Enablers and Challenges When Engaging Local Communities for Urban Biodiversity Conservation in Australian Cities*, “Sustainability Science” 2022, vol. 17, p. 788, <https://doi.org/10.1007/s11625-021-01012-y>.

²¹ M. Hirschmann, Ch. Fisch, S. Farny, *Biodiversity Loss and Entrepreneurship...*, op. cit.

²² N.M. Dawson, B. Coolsaet, A. Bhardwaj, F. Booker, D. Brown, B. Lliso, J. Loos, A. Martin, M. Oliva, U. Pascual, P. Sherpa, T. Worsdell, *Is It Just Conservation? A Typology of Indigenous Peoples’ and Local Communities’ Roles in Conserving Biodiversity*, “One Earth” 2024, vol. 7, no. 6, p. 1009, <https://doi.org/10.1016/j.oneear.2024.05.001>.

²³ R. Ali, A. Naz, M. Azhar, *Eco-citizens of Academia: Unravelling Students’ Behavior Toward Biodiversity Management in Higher Education Institutions*, “International Journal of Sustainability in Higher Education” 2025, vol. 26, no. 4, p. 736, <https://doi.org/10.1108/IJSHE-11-2023-0541>; P. Tiago, A.I. Leal, I.T. Rosário, S. Chozas, *Discovering Urban Nature: Citizen Science and Biodiversity on a University Campus*, “Urban Ecosystems” 2024, vol. 27, p. 1619, <https://doi.org/10.1007/s11252-024-01526-0>.

²⁴ R.J. Delahay, D. Sherman, B. Soyalan, K.J. Gaston, *Biodiversity in Residential Gardens: A Review of the Evidence Base*, “Biodiversity and Conservation” 2023, vol. 32, p. 4170, <https://doi.org/10.1007/s10531-023-02694-9>.

²⁵ M. Alda-Fernández, A. De la Peña Varona, *Multilevel Governance of the Commons and Environmental Sustainability*, “Gestión Y Análisis De Políticas Públicas” 2024, vol. 34, p. 8, <https://doi.org/10.24965/gapp.11353>; G. Ferraro, P. Failler, *Biodiversity, Multi-level Governance, and Policy Implementation in Europe: A Comparative Analysis at the Subnational Level*, “Journal of Public Policy” 2024, vol. 44, no. 3, p. 568, <https://doi.org/10.1017/S0143814X24000072>.

²⁶ A. Kok, E.M. de Olde, I.J.M. de Boer, R. Ripoll-Bosch, *European Biodiversity Assessments...*, op. cit.

policies, which has resulted in biodiversity being reflected in EU funding and programmes during the current programming period. In a broader context, biodiversity – as an essential component of environmental protection – is often viewed as a complementary goal to the digital transformation of our society, aligning with the concept of a twin transition.²⁷

At the European level, halting the loss of biodiversity has been noted as a high-level political priority over the last decade.²⁸ The European Union Biodiversity Strategy for 2030, as part of the European Green Deal, is the basis for building biodiversity resilience and strengthening the protection of nature.²⁹ In general, EU policies under the European Green Deal call for improvements such as adapting to climate change, slowing biodiversity loss and enhancing social cohesion.³⁰

However, the European Union has failed to reverse biodiversity loss; thus, more evidence-based actions are needed.³¹ In the EU Member States biodiversity planning and the implementation of measures are realised under limited and uncertain budgets; thus, more funds and management plans, together with

²⁷ S. Ručinská, M. Fečko, O. Mitaľ, *Municipalities and Cities in the Center of the Digital and Green Transition*, in: R. Lisowski, L. Scholz, Ch. Trüe (eds), *Academia, Administration, Digitalization and Sustainability: Change and Transformation the EU Way*, Nomos Verlagsgesellschaft, Baden-Baden 2025, p. 32, <https://doi.org/doi.org/10.5771/9783957104434-19>; I. Kawka, *E-government and Environmental Protection Towards Greater Sustainability*, in: A. Sikora, I. Kawka (eds), *The European Green Deal and the Impact of Climate Change on the EU Regulatory Framework: Searching for Coherence*, Presses universitaires Saint-Louis Bruxelles, Bruxelles 2024, p. 55, <https://doi.org/10.4000/12kfd>.

²⁸ J. Cortina-Segarra, I. García-Sánchez, M. Grace, P. Andrés, S. Baker, C. Bullock, K. Decler, L.V. Dicks, J.L. Fisher, J. Frouz, A. Klimkowska, A.P. Kyriazopoulos, D. Moreno-Mateos, P.M. Rodríguez-González, S. Sarkki, J.L. Ventocilla, *Barriers to Ecological Restoration in Europe: Expert Perspectives*, “Restoration Ecology” 2021, vol. 29, p. 1–18, <https://doi.org/10.1111/rec.13346>.

²⁹ M.M. Kenig-Witkowska, *The EU Biodiversity Strategy for 2030: Building Nature Resilience in the Wake of the Post Pandemic COVID-19 Socioeconomic Recovery*, “Studia Iuridica” 2022, vol. 91, p. 149, <https://doi.org/10.31338/2544-3135.si.2022-91.8>.

³⁰ R. Hansen, M. Buizer, A. Buijs, S. Pauleit, T. Mattijssen, H. Fors, A. van der Jagt, N. Kabisch, M. Cook, T. Delshammar, T.B. Randrup, S. Erlwein, K. Vierikko, H. Nieminen, J. Langemeyer, C.S. Texereau, A.C. Luz, M. Nastran, A.S. Olafsson, M.S. Møller, D. Haase, W. Rolf, B. Ambrose-Oji, C. Branquinho, G. Havik, J. Kronenberg, C. Konijnendijk, *Transformative or Piecemeal? Changes in Green Space Planning and Governance in Eleven European Cities*, “European Planning Studies” 2022, vol. 31, no. 12, p. 2402, <https://doi.org/10.1080/09654313.2022.2139594>.

³¹ G. Pe’er, J.A. Finn, M. Díaz, M. Birkenstock, S. Lakner, N. Röder, Y. Kazakova, T. Šumrada, P. Bezák, E.D. Concepción, J. Dänhardt, M.B. Morales, I. Rac, J. Špulerová, S. Schindler, M. Stavriniades, S. Targetti, D. Viaggi, I.N. Vogiatzakis, H. Guyomard, *How Can the European Common Agricultural Policy Help Halt Biodiversity Loss? Recommendations by Over 300 Experts*, “Conservation Letters” 2022, vol. 15, p. 1–12, <https://doi.org/10.1111/conl.12901>.

stakeholder participation, can help enhance biodiversity more effectively.³² The successful implementation of the EU Biodiversity Strategy for 2030 will require transformative actions across several sectors to address both nature and climate change.³³

In Europe, there is currently no comprehensive, unified governmental framework strictly devoted to biodiversity conservation.³⁴ Thus, the Member States must concretise long-term documents adopted by the European institutions. In this regard, struggles in implementing European environmental protection strategies are not new to the European administrative area.³⁵ Although biodiversity protection needs to be viewed as a complex global and European problem, its concretisation in the specifics of individual countries is crucial to devising practical applications. National policies focussed on biodiversity are primarily based on key policies and documents adopted at the EU level. These include the European Green Deal, the EU Biodiversity Strategy for 2030 and the Convention on Biological Diversity.

Research indicates that states draw inspiration from documents of a supranational and international nature when developing their national policies, as well as when implementing and evaluating them.³⁶ Because biodiversity protection at the national level is also still evolving, monitoring to optimise

³² V. Hermoso, S.B. Carvalho, S. Giakoumi, D. Goldsbrough, S. Katsanevakis, S. Leontiou, V. Markantonatou, B. Rumes, I.N. Vogiatzakis, K.L. Yates, *The EU Biodiversity Strategy for 2030: Opportunities and Challenges on the Path Towards Biodiversity Recovery*, "Environmental Science & Policy" 2022, vol. 127, p. 269, <https://doi.org/10.1016/j.envsci.2021.10.028>.

³³ F. Burns, M.A. Eaton, I.J. Burfield, A. Klvaňová, E. Šilarová, A. Staneva, R.D. Gregory, *Abundance Decline in the Avifauna of the European Union Reveals Cross-continental Similarities in Biodiversity Change*, "Ecology and Evolution" 2021, vol. 11, no. 23, p. 16647, <https://doi.org/10.1002/ece3.8282>.

³⁴ R. Sousa, T. Zając, D. Halabowski, O.V. Aksenova, Y.V. Bepalaya, F. Carvalho, P. Castro, K. Douda, J.P. da Silva, N. Ferreira-Rodríguez, J. Geist, C. Gumpinger, A.M. Labecka, J. Lajtner, I. Lewin, M. Lopes-Lima, A. Meira, K. Nakamura, J. Garrido Nogueira, P. Ondina, M. Özgo, J. Reis, N. Riccardi, S. Shumka, M.O. Son, A. Teixeira, F. Thielen, M. Urbańska, S. Varandas, N. Wengström, K. Zając, A. Zieritz, D.C. Aldridge, *A Roadmap for the Conservation of Freshwater Mussels in Europe*, "Conservation Biology" 2023, vol. 37, p. 1–5, <https://doi.org/10.1111/cobi.13994>.

³⁵ M. Bryk-Zwolska, *The EU ETS and the European Green Deal – the Struggle for Compromise*, in: A. Sikora, I. Kawka (eds), *The European Green Deal and the Impact of Climate Change on the EU Regulatory Framework: Searching for Coherence*, Presses universitaires Saint-Louis Bruxelles, Bruxelles 2024, p. 165, <https://doi.org/10.4000/12kfd>.

³⁶ P.R. Whitehorn, L.M. Navarro, M. Schröter, M. Fernandez, X. Rotllan-Puig, A. Marques, *Mainstreaming Biodiversity: A Review of National Strategies*, "Biological Conservation" 2019, vol. 235, p. 161, <https://doi.org/10.1016/j.biocon.2019.04.016>; S. Sarkki, R. Tinch, J. Niemelä, U. Heink, K. Waylen, J. Timaeus, J. Young, A. Watt, C. Neßhöver, S. van den Hove, *Adding 'Iterativity' to the Credibility, Relevance, Legitimacy: A Novel Scheme to Highlight Dynamic Aspects of Science-policy Interfaces*, "Environmental Science & Policy" 2015, vol. 54, p. 511, <https://doi.org/10.1016/j.envsci.2015.02.016>.

existing observation efforts, harmonising data and enhancing the ability to predict and respond to key challenges are crucial.³⁷ The role of EU Member States is to support the ambitious goals outlined in EU documents and strategies; thus, states' attitudes are crucial to the sustainable multi-level governance of biodiversity protection.³⁸

At the local government level, it is essential to manage human well-being and biodiversity in an optimal and complementary manner.³⁹ Biodiversity at the local level is a crucial aspect that contributes to the provision of ecosystem services and facilitates sustainable urban development.⁴⁰ Biodiversity in cities continues to expand, and multidisciplinary is becoming increasingly important in a rapidly urbanising world, which could help pave the way to healthier, liveable cities.⁴¹ Understanding how populations and communities respond to specific pressures and how the interactions among urban environments function may lead to a deeper understanding of urban biodiversity, informing cities' planning strategies to maintain biodiversity in a rapidly changing world.⁴² Biodiversity research and its importance at the local level are underlined by various studies: in Geneva, Switzerland,⁴³ Lahti in Finland, Xalapa in Mexico,⁴⁴ in 290 Swedish

³⁷ H. Moersberger, J. Valdez, J.G.C. Martin, J. Junker, I. Georgieva, S. Bauer, P. Beja, T.D. Breeze, M. Fernandez, N. Fernández, L. Brotons, U. Jandt, H. Bruelheide, W.D. Kissling, C. Langer, C. Liqueste, M. Lumbrieres, A.L. Solheim, J. Maes, A. Morán-Ordóñez, F. Moreira, G. Pe'er, J. Santana, J. Shamoun-Baranes, B. Smets, C. Capinha, I. McCallum, H.M. Pereira, A. Bonn, *Biodiversity Monitoring in Europe: User and Policy Needs*, „Conservation Letters” 2024, vol. 17, p. 1–12, <https://doi.org/10.1111/conl.13038>.

³⁸ M. Baran, *Towards EU Nature Restoration Law: A Boost for Biodiversity and Climate?*, in: A. Sikora, I. Kawka (eds), *The European Green Deal and the Impact of Climate Change on the EU Regulatory Framework: Searching for Coherence*, Presses universitaires Saint-Louis Bruxelles, Bruxelles 2024, p. 113, <https://doi.org/10.4000/12kfd>.

³⁹ F. Vasco, J. Perrin, B. Oertli, *Urban Pondscape...*, p. 1118.

⁴⁰ E. Ranta, M. Rosario Vidal-Abarca, A.R. Calapez, M. João Feio, *Urban Stream Assessment System (UsAs): An Integrative Tool to Assess Biodiversity, Ecosystem Functions and Services*, „Ecological Indicators” 2021, vol. 121, p. 1–11, <https://doi.org/10.1016/j.ecolind.2020.106980>.

⁴¹ C.C. Rega-Brotsky, M.F.J. Aronson, M.R. Piana, E.-S. Carpenter, A.K. Hahs, A. Herrera-Montes, S. Knapp, D.J. Kotze, C.A. Lepczyk, M. Moretti, A.B. Salisbury, N.S.G. Williams, K. Jung, M. Katti, I. MacGregor-Fors, J.S. MacIvor, F.A. La Sorte, V. Sheel, C.G. Threfall, C.H. Nilon, *Urban Biodiversity: State of the Science and Future Directions*, „Urban Ecosystems” 2022, vol. 25, p. 1083–1096, <https://doi.org/10.1007/s11252-022-01207-w>.

⁴² M. Alberti, T. Wang, *Detecting Patterns of Vertebrate Biodiversity Across the Multidimensional Urban Landscape*, „Ecology Letters” 2022, vol. 25, p. 1029, <https://doi.org/10.1111/ele.13969>.

⁴³ F. Vasco, J. Perrin, B. Oertli, *Urban Pondscape...*, p. 1118.

⁴⁴ R. Lemoine-Rodríguez, M. García-Arroyo, M.A. Gómez-Martínez, M. Back, T. Lindema, I. MacGregor-Fors, *Unveiling Urban Ecological Integrity...*, p. 1172.

municipalities,⁴⁵ in Valencia, Spain,⁴⁶ in 15 Italian cities⁴⁷ and in five Australian capital cities.⁴⁸

3. Methods

The study examines multi-level biodiversity governance and emphasises biodiversity protection priorities at the local level. The research focusses on priority areas of biodiversity protection, which are identified by the eight regional cities in Slovakia through their strategic development documents. In this context, the study aims to answer the research question: What priority areas of biodiversity protection are defined by the Slovak regional cities in their long-term strategic documents?

As biodiversity positively impacts society and ecosystems, the literature review focusses on biodiversity and emphasises strategic frameworks and contexts related to its broader impact on states, cities and communities. More precisely, it explored the importance of multi-level governance of biodiversity, considering both the strategic implications of biodiversity loss and the need to protect biodiversity.

Content analysis was used to examine the content of selected strategic documents, with a focus on the priorities established by public institutions at various levels of governance, specifically at the European, national and local levels. Content analysis enabled individual documents to be examined in terms of the priority given to biodiversity and the contexts in which individual long-term strategic documents perceive biodiversity. The intention behind the content analysis was not to exhaustively examine all documents connected with biodiversity at the European, national and local levels. The deliberate selection of documents for content analysis reflects the basic strategic frameworks for

⁴⁵ H.I. Hanson, J. Alkan Olsson, *Uptake and Use of Biodiversity Offsetting in Urban Planning – The Case of Sweden*, “Urban Forestry & Urban Greening” 2023, vol. 80, p. 1–10, <https://doi.org/10.1016/j.ufug.2023.127841>.

⁴⁶ V.B. Durà, E. Meseguer, C. Hernández Crespo, M.M. Monerris, I.A. Doménech, M.E.R. Santamalia, *Contribution of Green Roofs to Urban Arthropod Biodiversity in a Mediterranean Climate: A Case Study in Valencia, Spain*, “Building and Environment” 2023, vol. 228, p. 1–10, <https://doi.org/10.1016/j.buildenv.2022.109865>.

⁴⁷ F. Bartoli, V. Savo, G. Caneva, *Biodiversity of Urban Street Trees in Italian Cities: A Comparative Analysis*, “Plant Biosystems – An International Journal Dealing with All Aspects of Plant Biology” 2021, vol. 156, no. 3, p. 649, <https://doi.org/10.1080/11263504.2021.1906347>.

⁴⁸ L. Taylor, C.J. Maller, K. Soanes, C.E. Ramalho, A. Aiyer, K.M. Parris, C.G. Threlfall, *Enablers and Challenges...*, p. 791.

biodiversity at the EU, state and local government levels in Slovakia. This includes the European Union Biodiversity Strategy for 2030: Bringing Nature Back into Our Lives at the EU level. At the national level, this aligns with Slovakia's National Biodiversity Protection Strategy until 2030. Given the fragmentation of local governments, the eight strategic documents of Slovakia's eight regional cities were selected to represent the local level, since they can be perceived as centres of development in Slovakia. The research sample therefore consists of strategies adopted by the regional cities of Bratislava, Banská Bystrica, Košice, Nitra, Trenčín, Trnava, Prešov and Žilina, which primarily cover development measures from 2014 to 2032. These are strategic documents required by the legal framework from a city's perspective. Therefore, they are development plans that outline the basic frameworks for long-term development. Conducting the content analysis in this manner enabled the identification of intersections between the priorities for supporting biodiversity protection and mitigating biodiversity loss across multiple levels of biodiversity governance, including the European, national and local levels.

4. Results

The research revealed different scales of priorities and key areas in the documents at different levels of governance. This tendency confirms the importance and necessity of biodiversity topics in our contemporary society. The EU's Biodiversity Strategy for 2030 is a comprehensive, ambitious and long-term plan to protect nature and reverse the degradation of ecosystems, primarily reflecting the European Green Deal and international negotiations, as well as supporting a green recovery following the COVID-19 pandemic.⁴⁹

The EU Biodiversity Strategy for 2030: Bringing Nature Back into Our Lives includes three key policy areas: (1) protecting and restoring nature in the European Union, (2) enabling transformative change and (3) an ambitious global biodiversity agenda.⁵⁰ The actual biodiversity strategy is to formulate and disseminate the importance of biodiversity protection as a framework for states.

⁴⁹ Communication from the Commission to the European Parliament, the Council, the European Economic and Social Committee and the Committee of the Regions, *EU Biodiversity Strategy for 2030. Bringing nature back into our lives*, COM/2020/380 final.

⁵⁰ *Biodiversity Strategy for 2030*, https://environment.ec.europa.eu/strategy/biodiversity-strategy-2030_en#implementation [access: 10.06.2025].

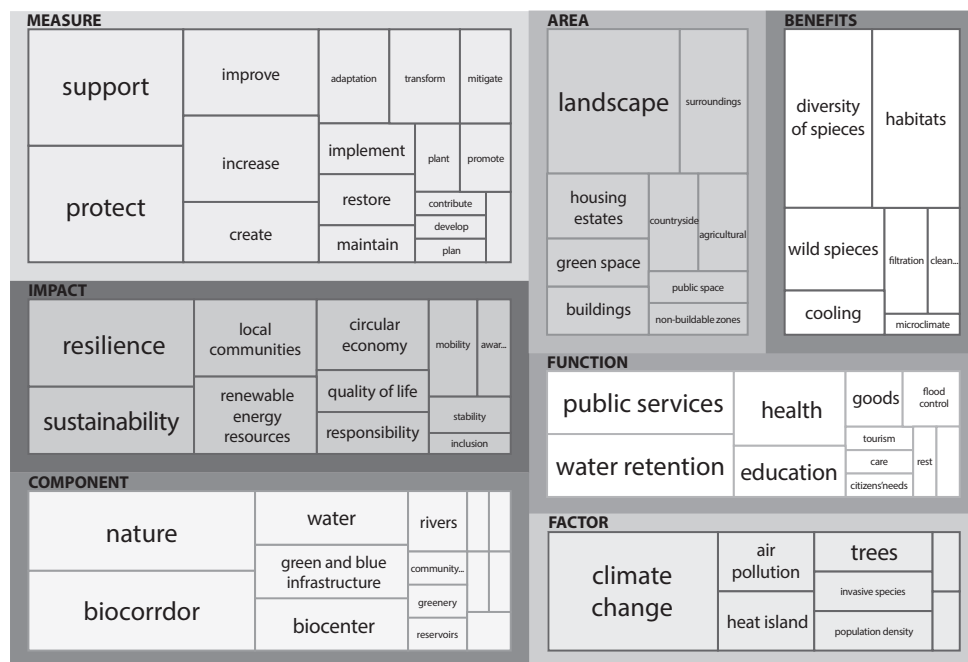
At the same time, this document aims to define the European Union as a territory where biodiversity is an integral part of environmental and green policies.

In Slovakia the key strategy for biodiversity protection is the National Biodiversity Protection Strategy until 2030. The current national strategy is not a new strategic document in its own right, but an update to previous national strategies and evaluations of previous action plans, which are anchored in the framework of the Convention on Biological Diversity from Rio de Janeiro, aiming to protect biodiversity by 2030.⁵¹ The National Biodiversity Protection Strategy until 2030 defines key areas in biodiversity protection in more detail than documents at the EU level: 1) protection of nature, 2) conservation and enhancement of ecosystems and their services, 3) protection and mainstreaming of biodiversity in the state policy of agriculture, forestry, water management and fisheries, 4) mitigating the negative impact of invasive alien species on biodiversity, health and the economy, 5) mitigating pressure on biodiversity and the rational use of genetic resources and 6) improving environmental and sectoral policies for measures aimed at reducing the ecological footprint in terms of international cooperation and supporting education, training and research in this area.

At the local level, cities and municipalities in Slovakia do not typically adopt strategic documents that are primarily and exclusively focussed on biodiversity protection. This important environmental topic is therefore partially incorporated into the basic long-term strategies of cities and municipalities, which include development plans and other relevant initiatives.

Given the selection of the eight regional cities, which can be attributed to the high fragmentation of territorial self-government in Slovakia, eight different development plans dedicated to biodiversity have been enacted in these cities. Based on the content analysis, the selected regional cities have set different priorities and key areas for biodiversity protection. The summary overview of individual priorities includes Figure 1, which illustrates biodiversity protection in the context of the eight regional cities using a tree diagram.

⁵¹ *National Biodiversity Protection Strategy until 2030*, <https://www.enviroportal.sk/eia/detail/narodna-strategia-ochrany-biodiverzity-do-roku-2030>, [access: 10.06.2025].

Figure 1. Biodiversity priorities and key areas of the regional cities in Slovakia

Source: Own work

The measures related to biodiversity and implemented by the selected cities consistently included support and protective activities. The cities also often used the terms “improve”, “increase”, “create” and “transform” in connection with the measures. Especially in the context of climate change, both “adaptation” and “mitigation” were identified as key activities. However, activities such as “expanding”, “contributing”, “restoring” or “reducing” were also identified.

These activities have an impact on the functioning of cities and local communities. The positive impact of biodiversity on resilience and sustainability was most often noted in the analysed city strategies. However, the positive impact on renewable energy sources and the circular economy was no less important. The cities also highlighted as positive impacts improved quality of life, stakeholders’ responsibility and the support of mobility and the stability of the ecosystem.

Of course, the individual components of biodiversity serve to achieve positive impacts, as defined by the selected cities. The key elements of the cities’ strategies were nature itself and biocorridors. The cities placed less importance on water, green and blue infrastructure and biocentres in terms of the occur-

rence of individual components. They also viewed rivers, community gardens, greenery and reservoirs as essential components of biodiversity.

Selected Slovak regional cities highlighted the positive impacts of biodiversity and its individual components in their strategies, including in the context of biodiversity functions within ecosystems. From their perspective, the greatest benefits of biodiversity protection are the diversity of species and the support of their natural habitat. They also counted the support of wild species among the benefits of biodiversity. Another benefit was cooling in cities, which improves air quality and microclimates. Biodiversity helps to fulfil ecosystem functions. Based on the analysis, biodiversity contributes primarily to the provision of public services. It significantly helps with water retention and flood control. It also supports public health and environmental education and awareness, helping to care for citizens and meet their needs.

The benefits and functions of ecosystems that result from strengthening biodiversity are linked to various strategies, particularly in the landscape and surroundings. However, the approach of the selected cities also supports biodiversity in housing estates, green spaces, buildings, public spaces, the countryside and non-buildable zones.

All measures related to biodiversity are implemented in the selected cities – and essentially worldwide – due to negative factors that cause biodiversity loss. The analysed strategies of the regional cities primarily pointed to climate change as a negative factor affecting biodiversity, which is a key priority. Factors with a negative impact on biodiversity include air pollution, the existence of heat islands in cities and the loss of trees. Less frequent factors negatively affecting biodiversity have also been identified, such as population density, seasonal droughts or the increase in invasive species.

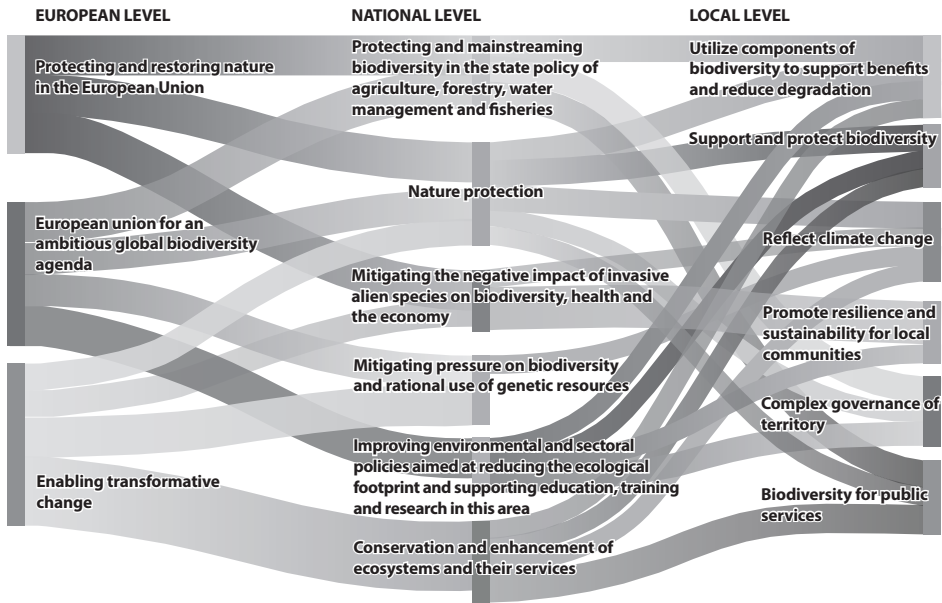
5. Discussion

Given the complexity of biodiversity protection, it is essential to note at the outset that all subcategories of biodiversity are interconnected and interdependent. The priorities set within the framework of multi-level governance of biodiversity must therefore be fulfilled simultaneously. Otherwise, it is unrealistic to expect the fulfilment of biodiversity functions and services within ecosystems in the European, national and local contexts.

Our content analysis has shown that European and national strategies must be broken down and specified through city-level strategies. Figure 2. illustrates

the specifications of European and national goals for biodiversity in the context of Slovakia's regional cities. Reflecting the content analysis conducted for this study, it is possible to define locally specific priorities that are based on superior documents at the European and national levels, but are also given priority due to the character of the environment and ecosystem of the city in question.

Figure 2. Intersections of multi-level governance priorities and key areas in biodiversity protection at the European, national and local levels



Source: Own work

Regional cities in Slovakia reflected the goals primarily in the context of support and protection of biodiversity, strengthening biodiversity for public services, climate change, promotion of resilience and sustainability for local communities, for the complex governance of the territory and also for utilising biodiversity components to support biodiversity and reduce biodiversity degradation.

In the context of the European Union's objectives, cities enable transformative change by addressing climate change and promoting resilience and sustainability for local communities. At the same time, they implement national objectives into practice at the local level, particularly in terms of mitigating

pressure on biodiversity and promoting the rational use of genetic resources; reducing the negative impact of invasive alien species on biodiversity, health and the economy; and enhancing environmental and sectoral policies. In addition, these priority areas identified at the local level make significant contributions to the national objective of protecting nature.

Cities also focus on supporting and protecting biodiversity. The main idea is to break down the objectives of conserving and enhancing ecosystems and their services and to improve environmental and sectoral policies, as outlined in the National Biodiversity Protection Strategy until 2030. At the same time, however, it is also necessary to identify the link to the national objective of protecting nature in the context of this local priority.

Cities, in support of biodiversity, implement complex governance systems for their territories. The result is the implementation of national objectives, particularly nature protection and mainstreaming biodiversity within state policy, as well as mitigating the negative impact of invasive alien species on biodiversity, health and the economy. In this context, practically all European objectives related to biodiversity are implemented in practice at the local level. Because biodiversity contributes to ecosystem services, from the perspective of cities we can consider these services public services. In this sense, it is a direct implementation of nature protection, conservation and the enhancement of ecosystems and their services. The result is a local implementation of the first two objectives of the EU Biodiversity Strategy for 2030.

The cities' strategies also aimed to utilise biodiversity components to support biodiversity and reduce biodiversity degradation. To this end, they are primarily related to the conservation and enhancement of ecosystems and their services, the protection of nature and the protection and mainstreaming of biodiversity in state agriculture, forestry, water management and fisheries policies. This aim also requires a connection with improving environmental and sectoral policies on education, training and research at the national level.

6. Conclusions

Biodiversity in today's ecosystems is becoming more important, mainly due to the growing factors that intensify negative impacts on biodiversity. At the same time, various levels of society's governance are increasingly understanding the role of biodiversity in ecosystem services, which serve primarily to support the functioning of the ecosystem and the local communities.

The primary benefit of this research is the mapping of priority areas for biodiversity protection at the local level in Slovakia's regional cities. The research also confirmed the need for continuity of priority areas across scales. The study highlighted the interconnectedness of priority areas in the strategies of the eight Slovak regional cities at both the national and European levels.

The limits of the research need to be seen primarily in the context of the deliberate selection of the research sample, leading to a limited number of selected city strategies constituting the subject of the research. Future research may explore the reflection of biodiversity priorities among cities in different countries, or compare cities across different size categories. At the same time, it may be essential for researchers to examine how priority areas for biodiversity conservation reflect global trends related to climate change.

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