

ІV. ПРИРОДНИЧО-ГЕОГРАФІЧНІ ДОСЛІДЖЕННЯ

УДК 502.131.1:620.92]:338.246.8(477-192.7:4-6726С)
DOI: <http://doi.org/10.17721/1728-2721.2025.92-93.5>

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OPPORTUNITIES OF TRANSBOUNDARY ENVIRONMENTAL COOPERATION IN THE CONTEXT OF THE EUROPEAN INTEGRATION AND POST-WAR GREEN RECOVERY OF UKRAINE

Background. The article emphasizes the relevance of transboundary environmental cooperation for Ukraine in the context of new reality caused by Russian aggression: accelerated integration into the European Union (EU) against the backdrop of recovery process. Given Ukraine's geopolitical location and shared borders with 4 EU countries (Poland, Slovakia, Hungary and Romania) and 1 EU candidate (Moldova), transboundary cooperation presents significant opportunities.

Methods. The following methods were employed in this study: analysis, synthesis, observation, and comparison to identify current trends and model prospects of environmental transboundary cooperation.

Results. It was analyzed the state of Ukraine's transboundary environmental cooperation before the war. The role of Euroregions established with 4 EU neighboring countries and Moldova ("Carpathians," "Bug," "Upper Prut," and "Dniester") and the European Grouping of Territorial Cooperation (EGTC) with Hungary ("Tisza") as organizational forms of cooperation for implementing joint ecological initiatives is highlighted.

The study examines the impact of Russia's full-scale invasion on transboundary environmental collaboration, including shifts in priorities, emerging challenges, and, at the same time, new opportunities for cross-border environmental partnerships.

The new opportunities are considered in the context of recovery process, particularly through Ukraine's participation in the European Green Deal and integration into European environmental standards.

Conclusions. Transboundary cooperation within Euroregions and the EGTCs is identified as a key element in achieving sustainable development and environmental security in the region. Ukraine's integration into the EU offers opportunities for joint projects in monitoring environmental threats, energy efficiency and biodiversity conservation. The latter is a key basic for green recovery of Ukraine.

For large-scale and strategic green recovery projects, EGTCs offer advantages due to their legal personality and ability to directly attract EU funds. Euroregions can be effective for smaller-scale projects focused on networking and experience exchange. Combining different formats of cooperation can be beneficial for achieving various goals in green recovery projects.

The article concludes that Ukraine has significant potential for producing "green" hydrogen using renewable energy sources, which can help meet the EU's import needs.

Keywords: Euroregion, European Grouping of Territorial Cooperation (EGTC), green recovery, green hydrogen.

Background

The geopolitical configuration of Ukraine, characterized by shared borders with 7 countries, including 4 European Union (EU) Member States (Poland, Slovakia, Hungary, Romania) and 1 EU candidate country (Moldova), as well as 19 out of 25 regions designated as border regions, creates a significant basis for the development of transboundary cooperation (TBC).

This geographical reality inherently creates favorable conditions for Ukraine to engage in cross-border initiatives. The Law of Ukraine "On International Territorial Cooperation of Ukraine" defines transboundary cooperation as cooperation between subjects and participants within the regions adjacent to the state border of Ukraine (On International Territorial Cooperation of Ukraine, 2024). Such cooperation aims at establishing and deepening economic, social, scientific, technological, cultural, environmental, and other relations between relevant entities and participants in Ukraine and neighboring states (Hrynokh, et al., 2019), operating within the legal frameworks defined by national legislation.

Fundamentally, transboundary cooperation serves to establish good-neighborly relations to develop regions economically and strengthen their cultural ties, but in the context of environmental cooperation it is more about promoting joint solutions to local environmental problems that require the consolidation of efforts of border regions.

These common environmental problems relate primarily to such areas as: monitoring the level of pollution and

assessing the state of the environment; control of local, regional and transboundary pollution of atmospheric air and water; restoring the ecosystems; sustainable, efficient and environmentally safe production and use of energy; recycling and safe disposal of waste; determining the impact of soil erosion and chemical pollution on the environment and agriculture; preserving the biological diversity of protected areas, as well as rational use and management of biological resources. In addition, an important area of the environmental TBC remains the provision of mutual assistance in emergency situations, in particular, organizing and implementing joint monitoring of dangerous man-made and natural phenomena, predicting their occurrence and assessing potential consequences to the environment and public health (Yevchak et al., 2020, pp. 13–14).

The strategic importance of transboundary cooperation has increased significantly considering the recent geopolitical agenda, mainly due to the full-scale Russian invasion, which has shifted the focus from regional cooperation with states that are now recognized as aggressors, while increasing the critical importance of cooperation with EU member states or candidates as a cornerstone of national resilience and cohesion.

It is the idea of economic and social cohesion, which eliminates disproportions and underdevelopment of regions, that has been a significant factor in European integration and the creation of a Europe without internal borders, which now fully corresponds to the political priorities of Ukraine

(Yevchak et al., 2020; Prytula, 2019). At the same time, environmental TBC allows remote border regions of Ukraine not to feel alone with their environmental problems, but instead to overcome them together with foreign partners, who often have more experience and resources for this. In addition, in the context of Ukraine's recovery, environmental transboundary cooperation with EU countries makes it possible to transform environmental challenges into opportunities for greater energy efficiency and lower resource consumption, which, in turn, is the key to the transition to a circular economy model, which is a cornerstone of the European Green Deal – a large-scale transformation program of the EU on the path to environmental neutrality.

The *aim* of the article is to identify optimal forms of transboundary environmental cooperation to realize the potential of post-war green recovery within the framework of the integration into the European Union.

Literature review. Transboundary cooperation has been a subject of academic inquiry since the mid-20th century, with early studies primarily emphasizing its economic dimensions (Hansen, 1976; van Houtum, 1998). Subsequent research has additionally focused on its role in regional policy implementation within border regions (Lux, & Horváth, 2017; Basboga, 2020; Mikula, 2004; Mikula, & Zasalko, 2014; Ivanov, 2012; Grushko, 2015; Hrynokh et al., 2019; Prytula, 2019; Yevchak et al., 2020; Hakman, 2020; Holovchanska, 2024).

However, the environmental facets of transboundary collaboration have received comparatively less attention in the existing literature (Gulac et al., 2019). A recent scholarly trend has emerged focusing on interdisciplinary investigations that integrate the ecological component with the economic underpinnings of transboundary cooperation (Melnyk, 2022; Sobolieva, & Ivanova, 2023).

Nevertheless, there remains a discernible gap in comprehensive interdisciplinary analyses that thoroughly examine the current state and prospects of transboundary cooperation amidst the challenges posed by the ongoing conflict and the opportunities presented by Ukraine's integration into the European Union. This article endeavors to address this specific research lacuna.

Methods

The research methodology is based on the collection and analysis of open-source information on the state of transboundary environmental cooperation in Ukraine before the Russian military aggression, as well as its change in focus following the onset of the war. It also includes forecasting potential risks and modeling the opportunities for environmental cooperation in the context of post-war recovery and simultaneous integration into the European Union.

Results

The study found that currently the most effective transboundary environmental cooperation is carried out within two forms that are common in the European Union: the Euroregion and the European Grouping of Territorial Cooperation (EGTC).

Euroregions represent a historically significant and fundamental organizational form of transboundary cooperation. Originating in Western Europe in 1950s along national frontiers, such as the border between Germany and the Netherlands, they were established to foster collaboration across diverse domains, including economic, social, and ecological spheres (Ivanov, 2012).

Euroregions serve as crucial platforms within the European integration process, providing an environment for the operationalization and testing of integration mechanisms

and instruments, and for analyzing their implications – both positive and negative – on regional dynamics, thereby informing the testing of these findings on national integration trajectories (Mikula, 2004).

There are *two main models of Euroregions in the EU*: Central European and Scandinavian (Northern European). Their main difference is the different focus of their activities. In the Central European model, Euroregions are the institutional basis of the processes of European integration, mainly in the political and legal spheres. In contrast, the Scandinavian model of Euroregions provides for a more extensive system of cooperation between regions – primarily in terms of economic relations, but also in terms of environmental issues (Mikula, & Zasadko, 2014, p. 48).

The Association of European Border Regions (AEBR) identifies the following types of Euroregions by organization and legal structure (Otočan, 2010, p. 5):

- association of local and regional authorities on both sides of the national border, sometimes with a assembly like leadership structure;
- transfrontier association with a permanent secretariat and a technical and administrative team with own resources;
- organization of private law nature, based on non-profit-making associations or foundations on either side of the border in accordance with the respective national law in force;
- organization of public law nature, based on inter-state agreements, dealing among other things, with the participation of territorial authorities.

Euroregions with Ukraine's participation belongs to the latter type. Most of them were created on a "top-down" basis. This explains the large scale of influence of Euroregions, especially the Carpathian Euroregion, and the inefficiency of their activities due to the complex coordination and cooperation of many participants (Prytula, 2019, p. 48).

Commencing in the 1990s, Ukraine embarked on a strategic trajectory towards establishing Euroregions with its neighboring countries. In total, 10 Euroregions were constituted along Ukraine's borders with its participation. 4 of these were formed exclusively with the involvement of Ukraine, Russia, and/or Belarus ("Donbas" (Ukraine, Russia), "Slobozhanshchina" (Ukraine, Russia), "Yaroslavna" (Ukraine, Russia), and "Dnipro" (Ukraine, Russia, and Belarus)). Consequent to the aggressive policies pursued by Russia and Belarus, these Euroregions progressively lost their operational relevance and began to cease functioning since 2014. The enactment of the Law "On International Territorial Cooperation of Ukraine" in 2024 formalized limitations on the transboundary cooperation with aggressor states and states deemed to support terrorism (On International Territorial Cooperation, 2024).

In total, 5 Euroregions have been established along Ukraine's borders with EU member states, encompassing both terrestrial and maritime frontiers. However, in 1 of these entities, the *"Black Sea"* Euroregion, officially formed by Bulgaria and Romania, Ukraine de facto does not currently participate, despite having been actively involved during the initial phase of this transboundary formation's establishment. Another Euroregion, *"Bug"* is currently in a state of suspension. Established in 1995 with the participation of Ukraine, Poland, and Belarus, its functionality has been significantly restricted since 2022 due to Belarus' involvement in the Russia's military aggression against Ukraine. In 2024, the Volyn Oblast Council adopted a resolution regarding the liquidation of the communal institution "Euroregion "Bug" Development Agency," which signifies Ukraine's withdrawal from this transboundary entity.

Consequently, at present, 3 Euroregions actively function along Ukraine's borders with the EU, involving Ukraine's participation. These include the *Euroregion "Carpathians"*, established in 1993, which encompasses Ukraine, Poland, Slovakia, Hungary, and Romania. Additionally, 2 "active" Euroregions operate between Ukraine, Romania, and Moldova: the *"Lower Danube"* (established in 1998) and the *"Upper Prut"* (established in 2000). Another entity, the *"Dniester" Euroregion*, was formed in 2012 between Ukraine and Moldova. While both Ukraine and Moldova currently hold official candidate status for accession to the EU, incumbent EU member states are not presently engaged in this entity.

Ukraine is actively engaged in the implementation of environmental projects within the framework of Euroregions established along its borders with EU member states. These initiatives are strategically aimed at environmental protection, fostering sustainable development, and enhancing the quality of life for residents in border areas.

Within the *Euroregion "Carpathians"*, a range of ecological projects have been executed. The "ProtectWater – Improving the quality of water resources" project aimed to enhance and preserve the quality of surface and groundwater resources, involving monitoring, the implementation of early warning systems for pollution, and the development of water management recommendations, with specific focus on Lake Solina, the San River, and the Skhidnychanka River. Key measures included the construction of wastewater treatment plants, expanded water monitoring, and public awareness campaigns. Other initiatives included "RoveLove Roztocze" (promotion of ecological and bicycle tourism), "Protection of waters of Lake Solina and medicinal waters of Skhidnytsia resort" (water resource conservation, monitoring), "Nature without borders" (protection of ecosystems, recreational routes), "Clean River" (water quality improvement) and SUMCITYNET (sustainable urban mobility). Joint within initiatives the Euroregion "Carpathians" also aim at enhancing the safety of border territories against ecological and chemical disasters, including the project "Joint protection of people and the environment by creating a Ukrainian–Polish disaster prevention and response system in the Carpathian Euroregion" focused on improving emergency response capabilities and ecological resilience (Poland–Belarus–Ukraine CBC Programme, 2021, p. 23–63).

The *"Upper Prut" Euroregion* has implemented projects promoting environmentally safe development, water resource monitoring, and early flood warning systems (Hakman, 2020). The East Avert project specifically aimed to enhance the flood warning and response system in the Prut River basin (Grushko, 2015).

Within the *Euroregion "Bug"*, projects have been implemented to improve water quality in the western part of the Bug River, including the modernization of treatment facilities and the implementation of ecological monitoring systems (Mazurets, 2011).

However, the effective utilization of Euroregion as an organizational form is constrained by several factors, including disparities in administrative-territorial structures, variations in the scope of competence among participating entities, inadequate or absent dedicated financial resources (including guaranteed national funding) (Yevchak et al., 2020, p. 15).

A distinct challenge persists due to the absence of a precise legal definition and a well-defined statutory status for Euroregions within the applicable national legal framework. Despite the adoption of the Law of Ukraine №3668-IX (On International Territorial Cooperation of Ukraine, 2024), which partially regulates mechanisms for international

territorial cooperation and provides for the possibility of establishing cooperation bodies as legal entities, the legal status of Euroregions remains insufficiently defined. The Law does not contain a dedicated section that regulates the specifics of establishment, purpose, areas of activity, and institutional structure specifically of Euroregions as distinct forms of transboundary cooperation.

Specifically, there is still a lack of clear provisions regarding their legal capacity: the ability to possess their own budget, enter contracts, acquire property, or undertake legal actions. This complicates the effective functioning of Euroregions in Ukraine and highlights the necessity for legislative improvement, considering the European model of the European Grouping of Territorial Cooperation (EGTC), where such issues are clearly regulated.

The ***European Grouping of Territorial Cooperation (EGTC)*** represents a significant organizational form within the landscape of transboundary cooperation. Distinct from Euroregion, the EGTC is specifically designed to facilitate and promote cooperation among its members with the overarching objective of strengthening economic and social cohesion. Its operational scope encompasses various domains, including environmental protection, nature conservation, and the provision of mutual assistance in emergency situations. The core function of EGTC involves the joint implementation of transboundary initiatives, activities, projects, programs, and strategies.

In the European Union, the legal framework governing EGTCs is primarily defined by Regulation (EC) No 1082/2006 (European Union, 2006) and the subsequent amending Regulation (EU) No 1302/2013 (European Union, 2013). These regulations establish the EGTC as a legal entity capable of uniting members from at least two EU member states and potentially third countries, including Ukraine. Members typically comprise local and regional authorities, associations of such authorities, and other public law bodies, all possessing legal personality according to their respective national legislations. EGTCs operate based on founding agreements and statutes consistent with EU law, allowing them to establish their own organs, plan activities, manage budgets, and control implementation (Mikula, Zasadko, 2014, pp. 51–52).

A key advantage of the EGTC framework is the potential for co-financing of their activities through the EU budget, leveraging instruments such as the European Regional Development Fund, the European Social Fund, the Cohesion Fund, and the European Neighborhood Instrument (European Union, 2006).

Ukraine's engagement with the European Grouping of Territorial Cooperation (EGTC) framework is now enabled and regulated by the Law of Ukraine № 3668-IX (On International Territorial Cooperation of Ukraine, 2024). The Law recognizes the EGTC as an association involving Ukrainian entities and their counterparts from neighboring EU member states, with the EGTC possessing legal personality according to the national law of the EU state where it is registered. Consequently, Ukrainian entities engaging in EGTCs must adhere to the relevant legislation of the neighboring EU member state (e.g., Polish, Slovak, Hungarian, or Romanian law), while ensuring compliance with Ukrainian legislation.

A notable advantage of the EGTC is its clearly defined legal status and capacity within the EU framework in contrast to the less defined legal status of Euroregions under Ukrainian law (On International Territorial Cooperation of Ukraine, 2024).

An illustrative example of an actively functioning EGTC with Ukrainian participation is the *Tisza EGTC*, established in October 2015 between the Zakarpattia Oblast Council (Ukraine) and the General Meeting of Szabolcs–Szatmár–Bereg County and the local government of Kisvárda (Hungary). Environmental initiatives constitute a distinct programmatic priority within the operational framework of Tisza EGTCs. Illustrative examples of such initiatives are provided by the following 2 projects (Yevchak et al., 2020, pp. 89–97):

1. **ZeroWaste:** This project (HUSKROUA/1701/LIP/006) with a total value of 5.5 million EUR, focused on waste management. It includes the construction of a biogas plant in Kisvárda, Hungary, and a solid waste landfill and sorting plant in the village of Yanoshi, Berehovo Raion, Zakarpattia Oblast. The project aligns with the Waste Management Strategy for Zakarpattia Oblast until 2030, aiming to improve living standards through a systemic approach to waste management, reducing waste generation, and increasing recycling, in accordance with EU and national regulations.

2. **REVITAL I:** This project (HUSKROUA/1702/6.1/0072) with a total value of 1.2 million EUR, addresses environmental issues related to the former salt mines in Solotvyno, Ukraine. Historically significant but closed by 2013, these mines cause saline water to leach into the Tisza River, posing a risk of surface degradation and further pollution impacting Romania and Hungary. The REVITAL I project, involving experts from Ukraine, Romania, Slovakia, and Hungary, commenced in 2019. It entails analyzing the situation at the mines, establishing a monitoring system, and developing a future development strategy, with plans for subsequent phases to support the revival of the entire transboundary region around Solotvyno.

The ongoing military aggression in Ukraine has profoundly impacted the environmental landscape of border regions and the dynamics of transboundary cooperation, including the activities of Euroregions and the European Grouping of Territorial Cooperation (EGTCs).

The conflict has inflicted extensive environmental damage across ecosystems. As of late 2022, environmental damage was estimated at approximately \$35 billion (United Nations Development Programme, 2023). By September 2024, the total environmental damage caused by the war had risen to an estimated \$62.9 billion (Top Lead, 2024). This includes substantial damage to atmospheric air (\$17.7 billion), land resources (\$27.9 billion), and water resources (\$2.1 billion). The destruction also encompasses the nature reserve fund, with damages assessed at \$15.2 billion. Over 20 % of protected areas were under threat in late 2022 (United Nations Development Programme, 2023), and by September 2024, 79,300 hectares of forests and other plantations had been burned, with 30 % of Ukraine's territory potentially mined. This environmental degradation, a direct consequence of hostilities and military operations, extends beyond Ukraine's borders, affecting neighboring countries through shared ecosystems, such as river basins and migratory routes (UWEC Work Group, 2024).

The war has necessitated a significant reorientation of transboundary cooperation priorities. Initially, the urgent need for humanitarian assistance and support for displaced populations became paramount, temporarily overshadowing environmental concerns. This reorientation, coupled with the disruption of established contacts and partnerships between Ukrainian and European environmental entities, has complicated the continuation and initiation of environmental collaboration (Bomprezzi et al., 2025; Belis et al., 2025).

Specific structures have faced distinct challenges. In the "Dniester" Euroregion, environmental cooperation has experienced a slowdown due to security risks and limitations in funding, although some projects focused on water quality monitoring and biodiversity conservation persist with international support. Examples such as the "Nature Without Borders" project in the Euroregion "Carpathians", water quality monitoring in the "Upper Prut" Euroregion, and the "Ekovarta Dnistra" project in the "Dniester" Euroregion have all experienced disruptions, temporary suspensions of activities, or hindrances in implementation due to the war's impact (UWEC Work Group, 2022; Cabinet of Ministers of Ukraine, 2023; OSCE, 2024).

The *Tisza EGTC* has adapted its operational focus, prioritizing security concerns and aid to war-affected communities. While environmental initiatives remain a crucial component of the EGTC's work, their implementation now requires additional resources and enhanced coordination (CESCI, 2022; 2023; European Parliament, 2023).

Nevertheless, the conflict has generated novel challenges that demand intensified environmental cooperation. These include the critical tasks of assessing and liquidating environmental damage caused by hostilities, restoring destroyed environmental infrastructure, preventing ongoing pollution, and monitoring the transboundary movement of pollutants. The substantial contamination from mines and unexploded ordnance across large areas, including protected nature reserves, represents a particularly complex, long-term environmental and safety issue requiring international assistance for demining and land restoration.

For effective integration of Ukraine into the European environmental space and ensuring sustainable recovery, a key factor is the adaptation of existing forms of transboundary cooperation, such as Euroregions and EGTCs, to new environmental needs. Given the political realities and the environmental consequences of military aggression, the following steps are needed to revitalize their activities:

Euroregion "Bug": considering the current geopolitical situation, the primary step is the exclusion of Belarus from the Bug Euroregion and its subsequent revitalization, focusing cooperation with Poland. This will allow for the relaunch of joint environmental projects aimed at the restoration and protection of the Bug River and adjacent territories, including through the creation of infrastructure for waste collection and sorting and the elimination of illegal landfills, as well as the modernization of water supply and sewage systems in border communities.

Euroregion "Dniester": cooperation should be intensified, considering the environmental consequences of the war in Ukraine. Concrete proposals include expanding projects for the environmental restoration of small rivers and scaling up initiatives for household waste management for a larger number of communities from Ukraine and Moldova, developing comprehensive strategies and methodologies.

Euroregion "Black Sea": it is important for Ukraine to fully participate in cooperation within the "Black Sea" Euroregion for the implementation of joint environmental projects aimed at preserving marine biodiversity, monitoring water quality, and combating marine pollution, which is relevant considering the military actions and their consequences for the marine ecosystem.

Tisza EGTC: it can play a key role in the implementation of transboundary environmental projects on the borders with Hungary, Slovakia, and Romania, focusing on integrated water resource management of the Tisa River basin, flood prevention, and preservation of the Carpathian region's ecosystems.

In addition to established frameworks such as Euroregions and EGTCs, to effectively address the environmental imperatives of EU integration and mitigate the ecological consequences of conflict, Ukraine can explore and implement alternative modalities of transboundary collaboration, notably the cluster model.

The creation of transboundary environmental clusters, uniting authorities, businesses, research institutions, and the public from Ukraine and neighboring EU countries, will enable:

- joint development and implementation of innovative green technologies for cleaning territories contaminated by hostilities, disposal of destroyed buildings, and waste processing;
- attracting funding from European funds and international programs, such as Interreg, for the implementation of large-scale environmental projects, including the restoration of polluted ecosystems, creation of environmental monitoring systems, and development of environmental infrastructure;
- developing cross-border value chains in the green economy, particularly in the production of environmentally friendly building materials for reconstruction, the development of renewable energy, and ecological tourism.

• Transboundary cooperation in the indicated forms creates the necessary institutional and organizational framework for implementing ambitious environmental and economic projects. Some of the most promising areas of transboundary cooperation with a pronounced economic and environmental effect are the development of "green" hydrogen production and its export, as well as the stimulation of green tourism. These sectors not only align with the goals of the European Green Deal but also have significant potential for attracting investment, creating new jobs, and fostering the sustainable development of border territories.

Ukraine possesses significant potential for "green" hydrogen production, which is highlighted by implementing the European Green Deal. This, in turn, opens unique opportunities for integration into the European energy market through transboundary cooperation. Specific areas for utilizing the potential of "green" hydrogen in transboundary projects include (Melnyk, 2022; Sobolieva, & Ivanova, 2023; Ivanok, 2024):

• *Creation of transboundary hydrogen valleys:* combining the efforts of border regions of Ukraine and EU countries to create territorial networks that integrate "green" hydrogen production capacities based on renewable energy sources (RES) in border regions of Ukraine and the EU with infrastructure for its storage and transportation, as well as end-users. This will optimize logistics and create stable supply chains.

• *Modernization of the Gas Transmission System (GTS):* joint projects for adapting the Ukrainian GTS to transportation of hydrogen or its mixtures with natural gas. Given the challenges associated with the condition of Ukraine's GTS pipes, cross-border cooperation with the involvement of European experience and funding is crucial to ensure the necessary tightness and safety of transportation.

• *Development of hydrogen transport:* implementing environmentally friendly transport in border regions by implementing joint projects for converting public transport fleets to hydrogen fuel cells and establishing a cross-border network of hydrogen refueling stations.

Ecological tourism is another important element of the sustainable development of border territories that can be actively developed through transboundary cooperation. Within Euroregions and EGTCs, the following concrete steps are possible (Dubovich et al., 2024):

• Creation of joint transboundary ecological routes: development and promotion of unified tourist routes passing

through nature reserves, national parks, and other attractive ecological sites on both sides of the border. This will increase tourist flow and enhance the region's recognition.

• *Harmonization of standards and certification:* collaborative work on aligning quality standards for services in ecological tourism and implementing certification systems that comply with EU norms. This will increase tourist confidence and facilitate the integration of the Ukrainian tourism product into the European market.

• *Involvement of local communities:* active inclusion of the local population in the planning and development of ecological tourism, conducting educational programs to raise awareness about the principles of sustainable tourism and environment protection.

The implementation of these proposals in close cooperation with European partners will allow for utilizing the potential of green tourism as an important factor in economic growth and preserving the unique natural and cultural heritage of border regions in the context of post-war recovery.

Discussion and conclusion

It can be concluded that transboundary cooperation, particularly within the framework of Euroregions and EGTCs, plays a key role in ensuring the sustainable development and environmental security of Ukraine's regions in the context of European integration and post-war green recovery.

The adaptation and revitalization of these structures, considering the new challenges posed by Russian military aggression, is critically important for the effective implementation of environmental projects with economic effect. Despite the challenges of the war, including significant environmental damage and the reorientation of cooperation priorities, Ukraine's integration into the EU opens new opportunities for joint initiatives in monitoring threats, energy efficiency, and biodiversity conservation, which is the basis for green recovery. The use of instruments such as transboundary clusters can further strengthen this process, promoting the implementation of green technologies and attracting funding.

Despite the identified opportunities, open questions that require broad discussion remain:

1. Does Ukraine need a unique model of transboundary environmental management adapted to the consequences of the war? To answer this crucial question, the specific challenges of war must be considered, including assessing and liquidating environmental damage, restoring infrastructure, and demining, and, at the same time, integrate these aspects into cooperation with EU countries to ensure effective green recovery and harmonization with European environmental standards.

2. How to balance the need for rapid recovery of critical infrastructure with the need to protect cross-border ecosystems and implement environmental transboundary projects? The effective answer on this substantial question will finally define the success of Ukraine's recovery in general, as it requires integrating green recovery principles at all stages of infrastructure project planning and implementation. This includes environmental impact assessment, application of sustainable construction technologies, consideration of ecosystem services, and development of comprehensive recovery plans.

Nevertheless, despite the difficulties and challenges, joint cross-border projects should be a priority for attracting EU funding and expertise, ensuring both economic recovery and environmental preservation, which in turn can become a catalyst for full and rapid integration into the European Union.

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Отримано редакцією журналу / Received: 02.05.25
Прорецензовано / Revised: 15.05.25
Схвалено до друку / Accepted: 26.05.25

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МОЖЛИВОСТІ ТРАНСКОРДОННОГО ПРИРОДООХОРОННОГО СПІВРОБІТНИЦТВА В КОНТЕКСТІ ЄВРОПЕЙСЬКОЇ ІНТЕГРАЦІЇ ТА ПІСЛЯВОЄННОГО ЗЕЛЕНОГО ВІДНОВЛЕННЯ УКРАЇНИ

Вступ. Наголошується на актуальності транскордонного природоохоронного для України в контексті нової реальності, спричиненої російською агресією: прискореної інтеграції до Європейського Союзу (ЄС) на тлі процесу відновлення. Враховуючи геополітичне положення України та спільні сухопутні і морські кордони з чотирма країнами ЄС (Польщею, Словаччиною, Угорщиною та Румунією) та одним кандидатом на вступ до ЄС (Молдовою), транскордонне співробітництво відкриває значні можливості.

Методи. У цьому дослідженні використано такі методи: аналіз, синтез, спостереження та порівняння для виявлення сучасних тенденцій та моделювання перспектив природоохоронного транскордонного співробітництва.

Результати. Проаналізовано стан транскордонного екологічного співробітництва України до війни. Висвітлено роль Єврорегіонів, створених з чотирма країнами-сусідами ЄС та Молдовою ("Карпати", "Буг", "Верхній Прут" і "Дністер"), та Європейського об'єднання територіального співробітництва (ЄОТС) з Угорщиною ("Тиса") як організаційних форм співпраці для реалізації спільних екологічних ініціатив.

У дослідженні розглянуто вплив повномасштабного вторгнення Росії на транскордонне природоохоронне співробітництво, включаючи зміни пріоритетів, нові виклики та, водночас, нові можливості для транскордонного екологічного партнерства.

Нові можливості розглянуто в контексті процесу відновлення, зокрема через участь України в Європейському зеленому курсі, а також інтеграцію в європейські екологічні стандарти.

Висновки. Транскордонне співробітництво в рамках Єврорегіонів та ЄОТС визначено як ключовий елемент у досягненні сталого розвитку та екологічної безпеки в регіоні. Інтеграція України до ЄС відкриває можливості для спільних проєктів у сфері моніторингу екологічних загроз, енергоефективності та збереження біорізноманіття. Останнє є ключовою основою для зеленого відновлення України.

Для масштабних та стратегічних проєктів зеленого відновлення ЄОТС пропонує переваги завдяки своїй правосуб'єктності та здатності безпосередньо залучати кошти ЄС. Водночас Єврорегіони можуть бути ефективними для менш масштабних проєктів, спрямованих на мережеву взаємодію та обмін досвідом. Поєднання різних форматів співпраці може бути корисним для досягнення різних цілей у проєктах зеленого відновлення.

У статті визначено, що Україна має значний потенціал для виробництва "зеленого" водню з використанням відновлюваних джерел енергії, що може допомогти задовольнити потреби ЄС в імпорті.

Ключові слова: Єврорегіон, Європейське об'єднання територіального співробітництва (ЄОТС), зелене відновлення, "зелений" водень.

Автор заявляє про відсутність конфлікту інтересів. Спонсори не брали участі в розробленні дослідження; у зборі, аналізі чи інтерпретації даних; у написанні рукопису; в рішенні про публікацію результатів.

The authors declare no conflicts of interest. The funders had no role in the design of the study; in the collection, analyses or interpretation of data; in the writing of the manuscript; or in the decision to publish the results.