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Psychological and Recreational Dimensions of Coastal Areas

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ABSTRACT

The ecological sustainability of riverine areas is key to mental stability, especially in stressful situations such as post-traumatic stress disorder, which is widespread due to the ongoing war in Ukraine. Access to stable, restored natural coastal landscapes provides critically important ecosystem services for psychological recovery. These spaces act as natural "restorative environments" that help reduce anxiety, restore cognitive functions, and promote a sense of security [1]. Studies show that observing water and being near it has a profound therapeutic effect. Why do we love to look at water? Scientists explain this phenomenon ("blue mind") by a decrease in the stress hormone cortisol, a slowing of the pulse, the activation of a state of calm attention in the brain, and the release of neurotransmitters associated with a sense of well-being [2]. However, this vital resource for the psychological rehabilitation of society is under powerful double pressure: climate change and the consequences of military action on the territory of Ukraine.

Keywords: Coastal Areas; Climate Change; Adaptation; Blue Mind; Urbanism; Recreational Framework; Basin Management

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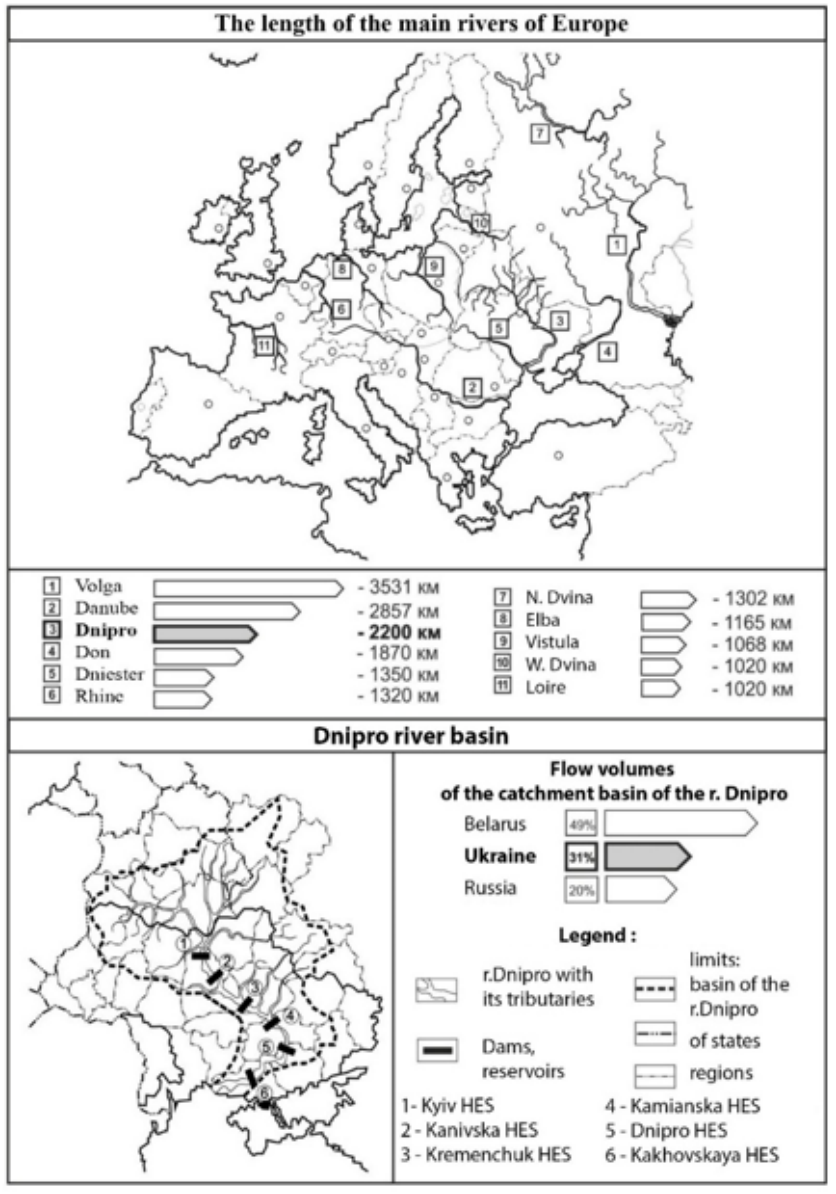
Presentation of the Main Material

Climate change is a critical challenge for sustainable development. In Ukraine, the water sector is recognized as one of the most vulnerable to its effects, according to the Concept of State Policy in the Field of Climate Change until 2030. Climate change has a multifaceted impact on riverine areas and leads to hydrological and geomorphological transformations and environmental consequences [3]. Changes in the water regime of rivers (extreme floods, low water levels) lead to fluctuations in water levels, which threatens to flood some areas and dry up water bodies in others. Changes in runoff and erosion form new landforms (old river beds, shoals, lakes), alter the coastline (increased or decreased erosion, accumulation of sediments), and change the riverbed [4]. Disruption of river ecosystems affects biological systems, leading to changes in species composition, the disappearance of local species, and the loss of biodiversity. Changes in the hydrological regime can lead to the loss of key areas for recreation and socialization due to flooding, drying up, or deterioration of water quality. This deprives communities of natural "sanitizers" during periods of collective trauma [5]. According to the Concept for Reforming Urban Development and Territorial Planning in Ukraine (until 2025) and the State Strategy for Regional Development for 2021-2027, rivers are recognized as key structural elements in the organization of urban space.

The principle of mandatory integration of river systems into the urban structure of settlements is fundamental. This involves the formation of a "sustainable development framework" based on river corridors and their coastal zones. Priority is given to the restoration and development of embankments as public, environmentally stable, and recreational spaces. An important aspect is the preservation and restoration of the ecological connection between the waterway and the surrounding areas. Integration of the basin principle of water resource management into territorial planning documents at various levels (national, regional, local) [Law of Ukraine "On the Fundamentals of National Spatial Data Infrastructure," 2020]. Russia's war

against Ukraine has caused catastrophic damage to cities located on river banks. The vast majority of Ukraine's population (over 85%) lives within large river basins. The cities most affected are those in the Dnipro, Siverskyi Donets, and Azov Sea basins (river mouths):

- Dnipro Basin: has a high level of urbanization and population density, with over 32 million people (almost 75% of the country's population) [6]. Key agglomerations: Kyiv, Dnipro, Zaporizhzhia, Kremenchuk, Cherkasy. The illustrations reflect the importance of the Dnipro River basin and a comparison of the level of urbanization of the Dnipro basin in Europe (Figures 1 & 2).
- Southern Bug basin: Over 4 million people. Key cities: Vinnytsia, Khmelnytskyi, Mykolaiv.
- Dniester basin: Over 3 million people. Key cities: Lviv, Ivano-Frankivsk, Chernivtsi, Odesa.
- Danube Basin: Over 1.5 million people. Key cities: Izmail, Reni, Uzhhorod (partially).
- Siverskyi Donets Basin: Over 6 million people. Key cities: Kharkiv, Luhansk, Donetsk, Severodonetsk, Lysychansk.



Note: Source: author.

Figure 1: Significance of the Dnieper River basin.

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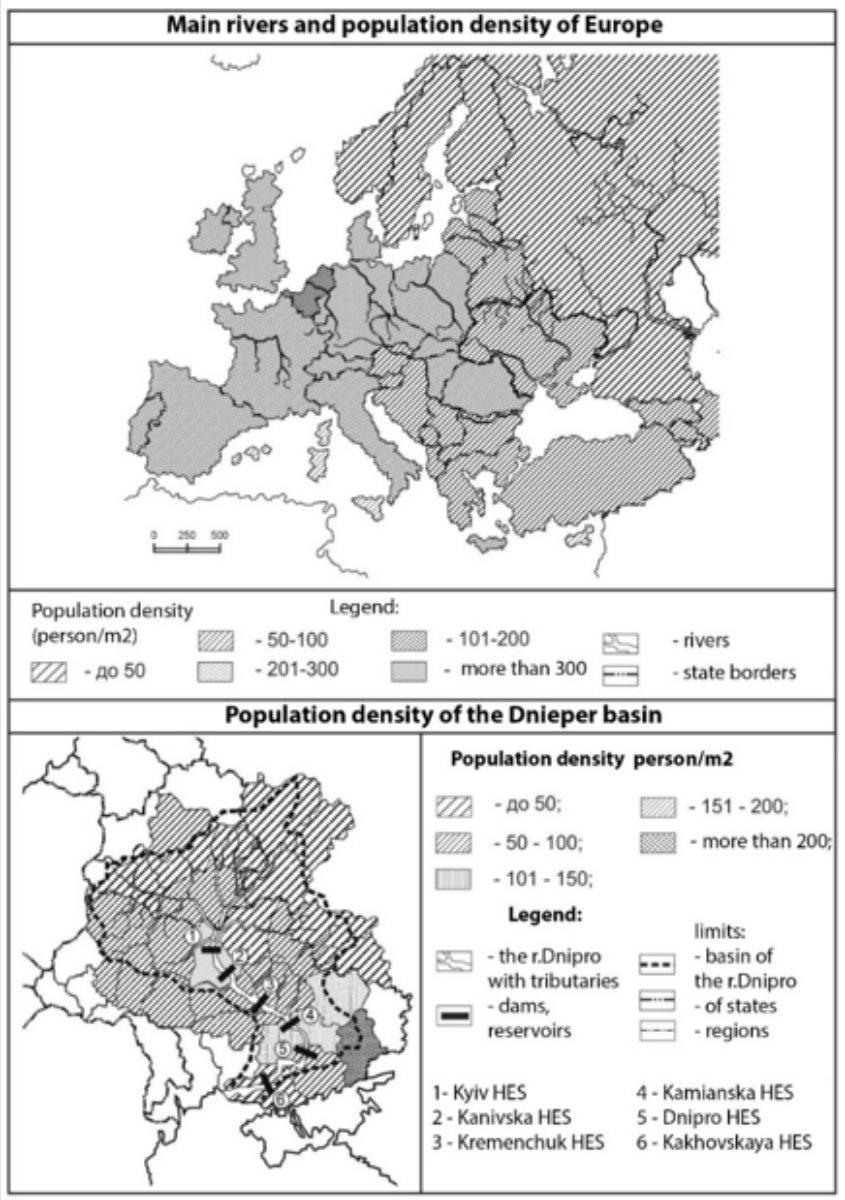

Note: Source: author.

Figure 2: Comparison of the level of urbanization of the Dnieper basin in Europe.

The war in Ukraine is becoming a new catalyst for uncertainty and pollution of water resources. The current conflict in Ukraine imposes an additional layer of anthropogenic impacts on river systems that is extremely difficult to predict. The full extent of the consequences for the hydrological regime of rivers, in particular runoff, water quality, and morphology, remains unknown. Direct destruction of hydraulic structures, massive use of heavy equipment, destruction of industrial facilities and infrastructure are leading to unprecedented pollution of the surrounding aquatic environment. Direct destruction of infrastructure within cities, discharge of untreated wastewater due to damage to treatment facilities, contamination of water and shores with heavy metals, petroleum products, and explosives as a result of the destruction of industrial enterprises, warehouses, and gas stations [7], as well as the mining of coastal areas, make these areas not only inaccessible but also dangerous to life and health. The disaster at the Kakhovka Hydroelectric Power Plant [8] clearly showed how the sudden loss of a large water facility causes not only ecological but also profound psychological damage to a society already suffering

from trauma. Changes in hydrography and an increased risk of landslides due to coastal erosion, explosive soil disturbances, and flooding of areas within the affected zone have caused disruptions in seasonal flow dynamics and, in general, the destruction of regulation systems.

These military factors pose unique and potentially long-term threats to the hydroecological stability of basins, interacting with existing climate stresses. It is currently impossible to accurately predict how this combination will affect long-term river flow, flood formation, water quality, and ecosystem recovery in post-conflict conditions. Urgent interdisciplinary research is needed to assess the extent of pollution, model possible scenarios for the spread of pollutants in basins, and develop strategies for remediation and adaptation of water management infrastructure to these new, war-induced conditions [9]. Thus, the degradation of riverine areas under the influence of climate change and war not only exacerbates environmental risks but also deprives Ukrainian society of a key natural mechanism for psychological healing and social reintegration. The restoration and adaptation of these territories, in particular through the implementation of environmental and urban planning protection measures, are not only an ecological necessity but also a priority of the national mental health and social resilience program in the context of the dual crisis. To effectively counter these interrelated threats, innovative and integrated approaches that go beyond traditional methods are needed:

Development of Advanced Monitoring and Forecasting Systems

Implementation of remote sensing by satellite systems and drones to assess the condition of inaccessible or dangerous coastal areas, detect pollution and changes in riverbeds. Development of hybrid climate-hydrological models that integrate data on military impacts, such as dam destruction, pollution, and climate scenarios, for more accurate forecasting of runoff, flood risks, low water levels, and pollutant spread. Creation of digital platforms, such as a "Digital Twin" of a river basin, for data aggregation, scenario modeling, assessment of the effectiveness of adaptation measures, and real-time decision support, taking into account uncertainty [10].

Adaptation and Strengthening of ICZM and Basin Management Principles

Through the integration of military risk and impact assessments into river basin management plans and climate change adaptation programs. It is important to develop special protocols for emergency response to water pollution caused by military operations or man-made accidents. It is also important to strengthen the role of basin councils as platforms for coordinating actions between authorities, scientific institutions, the public, and international partners in the context of military conditions and reconstruction.

Innovative Environmental Engineering Solutions for Restoration

Implementation of nature-based solutions for floodplain restoration, creation of green infrastructure to combat erosion and treat wastewater, and construction of adaptive "soft" coastal protection structures using natural materials. This will increase the resilience of ecosystems and improve their recreational and therapeutic potential [3,5]. Use of biotechnology and phytoremediation to clean up water and soil contaminated with petroleum products, heavy metals, and explosives [6]. Psychological rehabilitation and social vector. The priority decision should be to include the function of "psychological recovery" in the design and reconstruction of coastal areas: therapeutic landscape design, safe accessible areas for relaxation near the water. Developing "ecological therapy" programs using restored riverside landscapes to help veterans and war victims. Promoting community participation in monitoring and restoring local water bodies, which will contribute to social cohesion and a sense of control.

Conclusion

Overcoming the complex challenges facing Ukraine's riverine areas requires not only strengthening existing ICZM and basin management mechanisms, but also actively seeking and implementing innovations. This includes the development of advanced monitoring technologies, the adaptation of management tools to military realities, the widespread use of nature-based and biotechnological solutions for restoration, and the thoughtful integration of the psychological and rehabilitative function of water landscapes into regional sustainable development strategies. Only a comprehensive, scientifically sound, and innovative approach will ensure the ecological stability of water resources, which is the foundation of both the physical and mental well-being of society in the context of a double crisis—climate and war. Water heals not only ecosystems but also the human psyche, making the preservation and restoration of riparian zones even more of a priority for public health, especially in times of collective trauma.

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