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LOSS OF ECOLOGICAL AND RECREATIONAL VALUES OF LANDSCAPES IN UKRAINE'S NATIONAL NATURE PARKS DUE TO MILITARY ACTIONS

Abstract: This article investigates the loss of ecological and recreational values in Ukraine's national nature parks (NNPs) due to Russian aggression. The study aims to conduct a spatial analysis of the NNP network representativeness and justify the loss of value of their landscapes within combat and occupied zones. Covering 56 NNPs, the research reveals that 21 parks sustained significant damage, with 10 under temporary occupation. The work (2014–2025) employs data from DeepStateMap, the "EcoZagroza" and "EcoSystema" platforms, and official reports from individual NNP websites. Although warfare and occupation do not alter the legal boundaries of the parks, they withdraw these territories from functioning. This leads to a reduction in the ecological and recreational value of the entire region. The conclusions emphasise the necessity of international documentation of these losses to develop strategies for the post-war restoration of Ukraine's NNP network.

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Key words: Ukraine, national nature park, administrative-territorial representativeness, ecological and recreational value, Russian war against Ukraine

INTRODUCTION

In international practice, there is a clear distinction between the concepts of a "national park" and a "nature park". The International Union for Conservation of Nature (IUCN) has developed principles for the organisation and differentiation of functions between national and nature parks worldwide. The primary objective of national parks is nature conservation, while recreational and tourism activities within them play a subordinate and restricted role. Conversely, the main function of nature parks lies in organising conditions for recreation and tourism (Definition of National Parks 1969). National Parks have been defined by the IUCN as areas managed for ecosystem protection alongside the promotion of education and recreation (Bosworth, Curry 2020). Internationally, while protected areas designated

as national parks primarily correspond to Category II protected areas, their classification depends on specific management goals and can occasionally align with other categories such as Category V. These large natural areas are dedicated to protecting ecosystems and species while providing compatible spiritual, scientific, and recreational opportunities (Dudley 2008).

According to IUCN recommendations of the International Union for Conservation of Nature (IUCN), the following functional zones should be designated within a national park: strict protection, wilderness, "managed protection", and tourism-administrative (*Categories, objectives and criteria for protected areas: a final report* 1978). In European countries, parks are generally characterised by zones including strictly protected, regulated recreational use, restricted land use, economic land use, and active management (Mishchenko 2017). To contextualise the Eastern European framework, Poland serves as a relevant comparative model, having aligned its national park governance with both IUCN and European Union conservation standards. In Poland, the Nature Conservation Act defines ten main categories, where national parks hold the highest position among forms of nature protection. Poland has adopted the definition of a national park approved by the IUCN. While the territory of these parks is accessible to visitors, tourist movement occurs exclusively along designated trails. Within Poland's national parks, three primary zones are distinguished: a so-called "strict protection" zone where any human interference in the ecosystem is prohibited, an active conservation zone, and a landscape protection zone (*Ustawa z dnia 16 kwietnia 2004 r. o ochronie przyrody*, Dz.U. 2004, nr 92, poz. 880).

In Ukrainian legislation, two concepts are combined within a single conservation category, and the term "National Nature Park" (NNP) is used. According to the *Law of Ukraine On the Nature Reserve Fund of Ukraine*, national nature parks are conservation, recreational, cultural-educational, and research institutions of national importance, established topreserve, restore, and effectively utilize natural complexes and objects that possess special environmental, health-related, historical-cultural, scientific, educational, and aesthetic value (*The Law of Ukraine on the Nature Reserve Fund*, 1992, № 34, st. 502). The same law distinguishes four functional zones within NNPs: the protected zone, the zone of regulated recreation, the zone of stationary recreation, and the economic zone. Conceptually, this multifunctional approach aligns Ukrainian NNPs primarily with IUCN Category II principles, although in international databases their status is mostly listed as "Not Reported". National nature parks represent a form of protected area organisation that best reflects the modern concept of combining conservation and social functions (Mishchenko 2014). Within these territories, it is essential to develop tourism that does not lead to the degradation of valuable conservation complexes (Mishchenko 2012; Shovkun et al. 2023). Tourism within geoparksand protected natural areas promotes the popularisation of natural heritage as well as the development of local communities (Trihas, Tzouliadaki 2024). Strategy for sustainable tourism development constitutes a dynamic process of continuous evolution and adaptation until a balance is reached among economic efficiency, social equity, and environmental protection (Coccosis, Tsartas 2019).

However, these delicate balances between conservation, socio-economic integration, and recreation are severely disrupted during times of armed conflict. The entanglement with nature in twentieth century warfare (Breithoff 2020) was well known by those who endured appalling battlefield conditions (Das 2008; Fussell 2000; Leonard 2019). The conflict's ferocity forced soldiers closer to the natural world, remembering their place within it rather than abstract from it (Leonard 2024). Historically, armed conflicts have severely damaged protected areas; for example, the protracted war (1980–1992) in Mozambique led to the widespread destruction of national parks (Hatton et al. 2001). Similarly, when the United States entered the Second World War, the National Park Service (NPS) faced dual responsibilities: protecting and preserving systems for present and future generations, while providing maximum support for the war effort (McDonnell 2015). As documented by C. Pearson (2012), both World Wars caused extensive deforestation, tactical landscape alteration, and the militarisation of natural spaces across Europe. A prime example is the World War I "Zone Rouge" in northeastern France, where trench warfare and shelling destroyed topsoil, created cratered landscapes, and caused severe long-term chemical contamination (Bausinger et al. 2007). The modern ecological

and recreational losses in Ukraine's National Nature Parks – caused by fortifications, landmining, and infrastructure destruction – mirror these historical patterns of European landscape degradation, albeit on a far more intensified scale.

Recent scholarship highlights the severe ecological footprint of the Russian war against Ukraine on protected areas. I. Hartmane et al. (2024) note that military actions have impacted over a third of Ukraine's Nature Reserve Fund, driving soil degradation and habitat loss, while D. Rawtani et al. (2022) emphasize irreversible transboundary consequences. Furthermore, M. Zheleznyak et al. (2022) stress catastrophic fires, toxic contamination, and radiation risks. However, specialized scientific studies focusing specifically on the structural landscape degradation and the combined loss of conservation and recreational potential within National Nature Parks (NNPs) remain virtually absent. Our study fills this critical gap by providing a comprehensive spatial framework to evaluate landscape transformations and value loss across Ukraine's NNPs.

During the ongoing aggression against Ukraine, a significant proportion of NNPs have been located directly within active combat zones. Consequently, they are unable to perform their conservation, educational, and recreational functions. The full-scale war has caused an unprecedented degradation of these territories[1]. Therefore, the issue of protected landscape transformation today requires not only the recording of physical damage but also a profound geographical analysis of the territorial losses within the nature reserve fund.

The relevance of this study is driven by the urgent need to systematise data on the status of 21 NNPs affected by the war. Particular attention is required for the 10 occupied sites, where direct scientific monitoring is currently impossible. In this paper, the author draws upon official reports from the Ministry of Environmental Protection and Natural Resources of Ukraine and the State Environmental Inspectorate, which record damages based on the *On approval of the Methodology for Determining the Amount of Damage Caused to Territories and Objects of the Nature Reserve Fund Due to the Armed Aggression of the Russian Federation* (2022).

The scientific novelty of this article lies in conducting a comparative geographical analysis of NNP representation across regions and providing a detailed spatial account of the landscape transformation of 10 specific occupied parks. Such an approach enables a critical comparisonbetween the national experience of recording environmental war crimes and international standards developed by UNEP (*The Kosovo Conflict…* 1999) and the UN Compensation Commission (*Report and recommendations made by the Panel of Commissioners concerning the fifth instalment of "F4" claims* 2005), which is critically important for the future restoration of protected areas.

The aim of the article is to analyse the administrative-territorial representativeness of the NNP network (expressed through the ATR index across regions) and to substantiate the loss of value of their landscapes within combat and occupied zones. National nature parks of Ukraine are not only a national asset but also an integral part of the European and global conservation networks. Along with nature reserves, these categories of the nature reserve fund are key elements of the ecological framework. They can serve as model territories for sustainable development and, therefore, require focused attention from scientists to develop and implement effective measures for their protection, management, and post-war restoration.

RESEARCH METHODOLOGY

The methodological framework of the study is based on a comprehensive combination of general scientific and specialized geographical methods. The research was conducted in several sequential

[1] https://igu.org.ua/node/463 (accessed: 12.01.2026).

stages, including theoretical investigation, cartographic and statistical analysis, monitoring the status of NNP territories, analysis of official state data, and comparative geographical evaluation.

The theoretical stage involved examining the regulatory framework of Ukraine, alongside international academic literature, to define the concept and functional characteristics of national nature parks in Ukraine.

The application of cartographic and statistical analysis methods allowed for the calculation of indicators representing the distribution of national nature parks across the administrative oblasts of Ukraine and the visualisation of their spatial structure. For this purpose, the administrative-territorial representativeness index (ATR) was calculated using the following formula:

$$\text{ATR} = (Pr/Pp) \times 100$$

where: *Pr* – the total area of national nature parks within a given administrative oblast; *Pp* – the total area of the administrative oblast in which the NNPs are located.

In the context of this study, the term "representativeness" is applied in a spatial-administrative sense, reflecting the spatial coverage and density of the NNP network within an administrative oblast.

Given the primary functions of Ukraine's national nature parks, there is a direct relationship between the total area of parks in a region and its recreational and ecological value. The ATR indicator establishes the baseline share of NNPs in the spatial structure of an oblast. While military actions and occupation do not alter the legal boundaries of the parks, they effectively remove these protected territories from active management. This leads to the loss of the functional ATR share and, consequently, to a critical reduction in the ecological and recreational value of the entire region.

Official websites of Ukraine's national nature parks and peer-reviewed academic publications served as primary information sources regarding the natural and recreational value of the NNPs (including unique natural features species assemblages and recreational infrastructure).

Monitoring the status of NNP territories was conducted using an Open Source Intelligence (OSINT) approach to document their current operational status (territory controlled by Ukraine, a combat zone, or temporarily occupied territory). The interactive platform resource DeepStateMap/Map of the War in Ukraine was utilized for spatial verification[2]. This tool enabled the temporal and spatial verification of front lines in relation to the boundaries of national nature parks as of 01 January 2026. Based on a retrospective spatial analysis of changes on DeepStateMap, 10 national nature parks were identified whose landscapes are under occupation and subjected to uncontrolled anthropogenic and military impact.

The analysis of official state data allowed for a systemic assessment of NNP landscape degradation. Data were collected using a multi-source integration approach, synthesizing official reports and satellite monitoring data from the "EcoZagroza" and "Ecosistema" information resources (Ministry of Environmental Protection and Natural Resources of Ukraine[3]) with operational updates published by individual NNP administrations. Damage data, evaluated according to the state *On approval of the Methodology…* (2022), served as the empirical foundation for characterization of landscape transformations.

The typology of landscape degradation within National Nature Parks was defined through four key indicators of structural change:

– mechanical damage: shell craters, fortification construction (including trenches and dugouts), and the heavy machinery movement that destroys the topsoil cover;
– chemical pollution: Contamination by heavy metals (notably lead, antimony, and nickel), explosive residues, and fuel and lubricants leak into the soil and groundwater;

[2] https://deepstatemap.live/#6/49.4383200/32.0526800 (accessed: 12.01.2026).

[3] https://mepr.gov.ua/ (accessed: 12.01.2026).

– pyrogenic impact: large-scale forest and steppe fires triggered by shelling, which frequently remain unextinguished due to landmines or ongoing active hostilities;
– hydrological changes: the destruction of critical water infrastructure (notably the Kakhovka Hydroelectric Power Plant dam), which induced catastrophic flooding severe desiccation of vast wetland ecosystems.

Finally, the comparative geographical method was applied to contrast the findings with international precedents of documenting the environmental consequences of warfare (such as UNEP and UNCC frameworks). This comparison enabled the classification of these landscape alterations as systemic, long-term degradational processes.

To enhance analytical clarity and scientific rigor, this study strictly differentiates between documented empirical evidence of warfare impacts and subsequent evaluations of their ecological consequences. Direct impacts (such as remote sensing data, satellite-verified fire extent, fortification footprints, and physical infrastructure destruction) are presented as verified factual evidence. Long-term ecological transformations, ecosystem service losses, and biodiversity degradation risks are explicitly framed as scientific interpretations and evaluative projections.

GEOGRAPHICAL FEATURES OF THE FORMATION AND DISTRIBUTION OF NATIONAL NATURE PARKS IN UKRAINE

The network of national nature parks in Ukraine began to take shape in 1980. As of 01 January 2026, a total of 56 NNPs have been established (Table 1), covering an aggregate area of 16,354.7 km² which accounts for approximately 2.7% of Ukraine's total land area. A period of slow growth was recorded between 1980 to 1998, during which only 8 NNPs were created. From 1999 to 2008, a slight upward trend in the number of national nature parks in Ukraine was observed. In 2009–2010, the network expanded rapidly, with the establishment of 27 new parks. Finally, between 2013 and 2022, an additional 8 national nature parks were designated (Fig. 1).

Table 1. National Natural Parks of Ukraine (01 January 2026)

National Natural Parks of Ukraine		
1. Shatskyi	20. Mezynskyi	39. Prypiat-Stokhid
2. Iavorivskyi	21. Ichnianskyi	40. Nyzhnodnistrovskyi
3. Pivnichne Podillia	22. Pyriatynskyi	41. Synohora
4. Kremenetski hory	23. Bilooozerskyi	42. Meotyda
5. Dermansko-Ostrozkyi	24. Buzkyi Hard	43. Karmeliukove Podillia
6. Halytskyi	25. Nyzhnosulskyi	44. Zacharovanyi krai
7. Skolivski Beskydy	26. Hetmanskyi	45. Dnistrovskyi kanion
8. Uzhanskyi	27. Slobozhanskyi	46. Tsumanska Pushcha
9. Synevyr	28. Homilshanski lisy	47. Oleshkivski pisky
10. Karpatskyi	29. Dvorichanskyi	48. Male Polissia
11. Cheremoskyi	30. Siversko-Donetskyi	49. Nyzhnodniprovskyi
12. Verkhovynskyi	31. Sviati hory	50. Kamianska Sich
13. Hutsulshchyna	32. Velykyi luh	51. Boikivshchyna
14. Vyzhnytskyi	33. Biloberezhzhia Sviatoslava	52. Korolivski Beskydy
15. Khotynskyi	34. Pryazovskyi	53. Nobelskyi
16. Podilski Tovtry	35. Dzharylhatskyi	54. Kuialnytskyi
17. Holosiivskyi	36. Azovo-Syvaskyi	55. Kholodnyi Yar
18. Zalissia	37. Tuzlovski lymany	56. Pushcha Radzyvila
19. Desniansko-Starohutskyi	38. Charivna havan	

Source: own elaboration based on Ministry of Environmental Protection and Natural Resources of Ukraine.

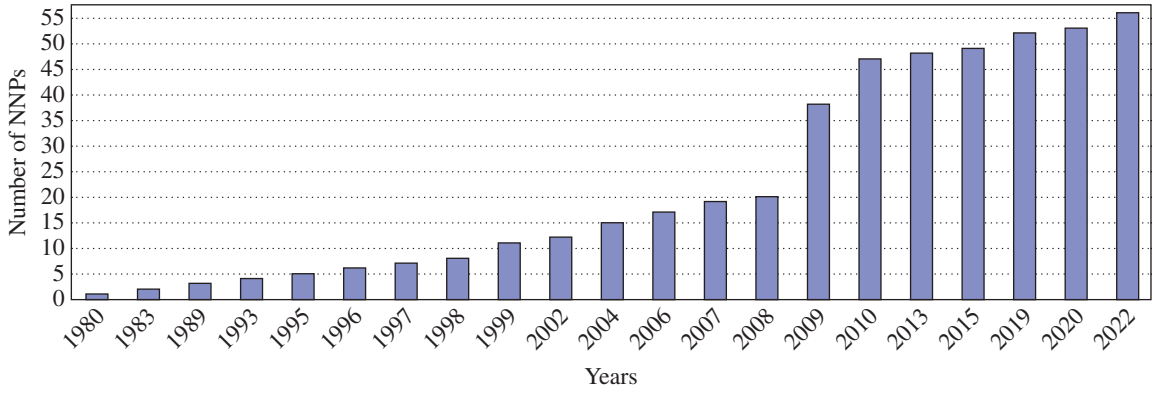


Fig. **1**. Dynamics of the Development of Ukraine's National Nature Parks Network
Source: compiled by the author based on data from the Ministry of Environmental Protection and Natural Resources of Ukraine.

The spatial expansion of the NNP network was primarily governed by regional conservation priorities and national policy cycles, rather than a single geographic trajectory over time.

In the context of this study, we calculated the administrative-territorial representativeness index (ATR) across the administrative oblasts of Ukraine (Fig. 2).

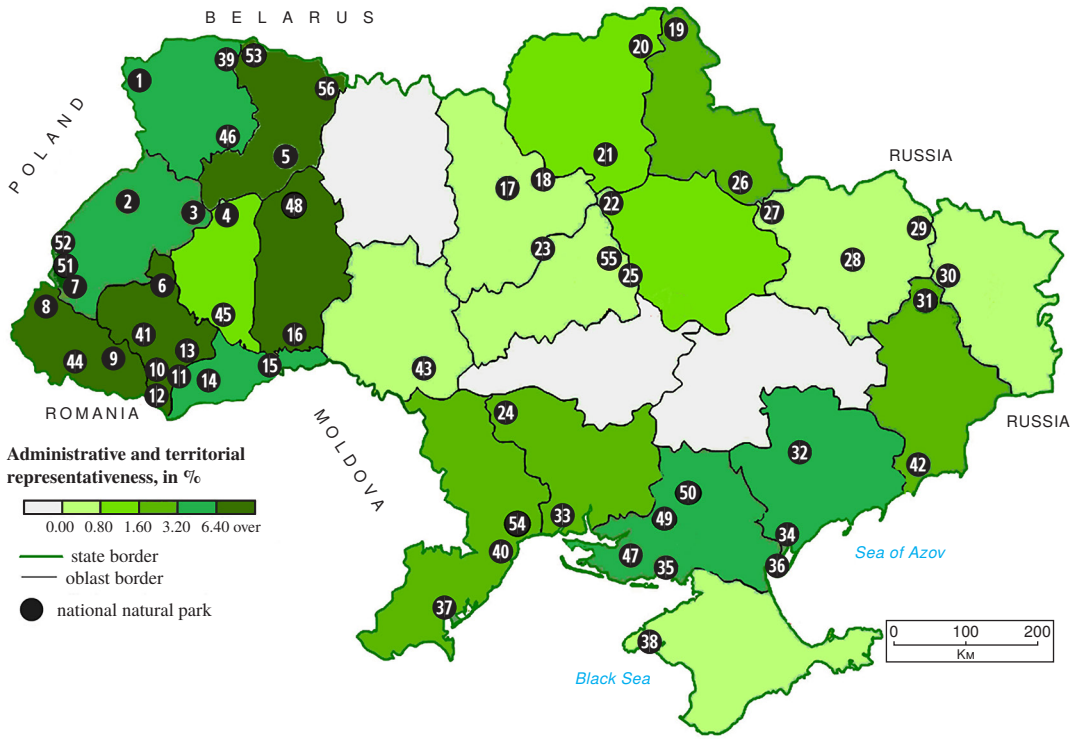


Fig. **2**. Administrative-territorial representativeness (ATR) of national nature parks across Ukraine's regions
Source: own elaboration based on Ministry of Environmental Protection and Natural Resources of Ukraine.

The highest coefficients of administrative-territorial representativeness are found in Rivne (14.4%), Khmelnytskyi (12.7%), Ivano-Frankivsk (8.6%), and Zakarpattia (6.9%) oblasts. High values of the studied indicator (3.20%–6.4%) are observed in Volyn (6.0%), Kherson (5.7%), Lviv (3.7%), Zaporizhzhia (3.5%), and Chernivtsi (3.4%) oblasts. An administrative-territorial representativeness coefficient of national nature parks between 1.60% and 3.20% is recorded in Donetsk (2.3%), Odesa (1.8%), Mykolaiv (1.7%), and Sumy (1.7%) oblasts. Relatively low indicators, ranging from 0.8% to 1.60%, are shown by Ternopil (1.3%), Chernihiv (1.4%), and Poltava (0.8%) oblasts. Values of up to 0.8% were determined for Vinnytsia (0.7%), Kharkiv (0.7%), Kyiv (0.7%), Cherkasy (0.4%), and Luhansk (0.3%) oblasts, as well as the Autonomous Republic of Crimea (0.4%).

The largest number of NNPs is observed in Western Ukraine. Five NNPs have been established in each of Ivano-Frankivsk, Lviv, and Kherson oblasts. There are three NNPs in each of Volyn, Zakarpattia, Chernivtsi, Kharkiv, Odesa, and Rivne oblasts. This is explained not only by the high landscape-aesthetic value of these oblasts but also by their preserved authenticity compared to other territories of Ukraine. In oblasts with relatively high levels of urbanisation and anthropogenic landscape transformation – driven by significant population density and industrial and agricultural development – there is a few of national nature parks. For instance, Ternopil, Chernihiv, Sumy, Donetsk, Mykolaiv, Zaporizhzhia, and Khmelnytskyi oblasts have two parks each. In Poltava, Vinnytsia, Cherkasy, and Luhansk oblasts, there is only one NNP each, while in Zhytomyr, Kirovohrad, and Dnipropetrovsk oblasts, there are none. As of 01 January 2026, the configuration of the NNP network remains officially unchanged, but actual management is constrained by the war.

STATE AND FUNCTIONAL DESTRUCTION OF NATIONAL NATURE PARK LANDSCAPES IN OCCUPIED ZONES AND AREAS OF ACTIVE COMBAT

The Russian war against Ukraine, which began in 2014, led to substantial territorial losses for Ukraine, including the illegal annexation of the Autonomous Republic of Crimea and the temporary occupation of parts of the Donetsk and Luhansk oblasts (the Donbas). Following Russia's full-scale invasion of the sovereign territory of Ukraine in 2022, parts of the Mykolaiv, Kherson, Zaporizhzhia, and Kharkiv oblasts were occupied. The annexation and seizure of Ukrainian territories are not recognised or supported by the international community, including the UN, PACE, and OSCE PA. Out of 56 national nature parks in Ukraine, 21 have sustained damage due to the war, and 10 of these are located in temporarily occupied territories.

The conducted analysis indicates that the most critical transformations have occurred in the landscapes of national nature parks situated under temporary occupation or directly within active combat zones. These sites are characterised by complete functional destruction, manifested in the impossibility of implementing conservation regimes and the physical destruction of recreational infrastructure.

To systematize and compare the 10 occupied NNPs, the analysis of each case study follows a consistent structure: 1) characterization of the baseline ecological and recreational value of the park prior to military aggression (natural values of ecosystems, availability of recreational infrastructure, and tourist routes prior to 2014 or 2022); and 2) analysis of the drivers of destructive impacts of the Russian war against Ukraine on NNPs protected landscapes (shelling-induced wildfires, fortification construction, landmining, destruction of valuable natural complexes as well as protected plant and animal species, and heavy metal contamination of land and water bodies). Based on monitoring data from "EcoZagroza" and "EcoSystema", as well as official reports from individual NNP websites, it has been established that the destruction of ecosystems in these parks is either irreversible or of a long-term nature.

The conservation value of the Azov-Syvash NNP (Kherson oblast, Ukraine) lies in its diverse landscapes and its role as a critical site for the nesting, wintering, and stopovers of migratory birds. Prior to 2022, the park conducted recreational activities on Byriuchyi Island, offering approved maritime and overland excursion routes and providing accommodation for tourists[4]. This park has been occupied since the beginning of the full-scale Russian invasion of Ukraine and is currently situated within a zone of active combat. This situation makes proper maintenance and animal care impossible, including the delivery of feed and water. Animals are perishing due to the hostilities; they have ceased breeding, are being killed by landmines, and young offspring are failing to survive. The war has disrupted natural corridors and animal migration routes, destroyed natural habitats, and either completely eliminated or severely restricted the food base for many species.

The "Biloberezhia Sviatoslava" National Nature Park (Mykolaiv oblast, Ukraine) was established to preserve a unique wetland ecosystem. Occupying the central and western parts of the Kinburn Peninsula, it is washed by the waters of the Dnieper-Bug Estuary, the Black Sea, and Yahorlyk Bay. The Kinburn Spit was one of the few places in Europe where areas of pristine steppe remained, hosting rare steppe plant species and Europe's largest field of wild orchids. Within the park's stationary recreation zone, social infrastructure locations for vacationers and tourists were situated, including the Rymbivskyi and Pokrovsko-Khutorivskyi recreational and tourist centres (Stetskyi, Skryl 2020). Prior to the full-scale war (2022), visitors could stay in private bungalows or designated camping sites. Between 2022 and 2024, in addition to massive fires, irreparable damage was caused to the park's biodiversity by the construction of fortifications, the movement of heavy military vehicles, and the destruction of the Kakhovka HPP dam by Russian forces. Earth observation data monitoring fires resulting from military actions during the Russian war against Ukraine attest that 96% of the park's land area has been destroyed by fire (Fig. 3)[5].

The "Velykyi Luh" National Nature Park (Zaporizhzhia oblast, Ukraine) was established to preserve, restore, and ensure the sustainable use of typical and unique natural-landscape and historical-cultural complexes of the steppe zone.

Prior to the war, this territory held significant conservation, scientific, and aesthetic value, as well as recreational and health-improving importance. Following the destruction of the Kakhovka Hydroelectric Power Plant (6 June 2023), the natural landscape of the "Velykyi Luh" park underwent severe transformations. This led to the loss of two international wetlands within its boundaries: the "Velyki and Mali Kuchuhury Archipelago" (7,674.25 ha) and the "Sim Maiakiv Floodplain" (2,140 ha). The destruction of the Kakhovka HPP resulted in the drainage of the territory: waterfowl have abandoned the area, and spawning grounds, wintering holes, and habitats for aquatic flora and fauna have been destroyed. Furthermore, Russian forces have constructed lines of defence across the park's territory, leaving it excavated, mined, and littered with debris[6].

The "Dvorichanskyi" National Nature Park (Kharkiv oblast, Ukraine) is unique due to its landscapes formed on chalk deposits. Chalk outcrops on the surface were formed from the shells of molluscs that inhabited the bottom of an ancient sea 70 million years ago[7] (Photo 1).

This is the only location in Ukraine with such a high degree of untouched nature regarding chalk outcroppings. The natural and climatic features of this territory facilitated the development of tourism and recreation. The park contains springs of therapeutic chloride-sodium mineral water; the sandy

[4] https://wownature.in.ua/azovo-syvaskyy-natsionalnyy-pryrodnyy-park/ (accessed: 12.01.2026).

[5] https://arcg.is/0SuW (accessed: 12.01.2026).

[6] https://eco.gov.ua/ (accessed: 12.01.2026).

[7] https://wownature.in.ua/parky-i-zapovidnyky/natsionalnyy-pryrodnyy-park-dvorichanskyy/ (accessed: 12.01.2026).

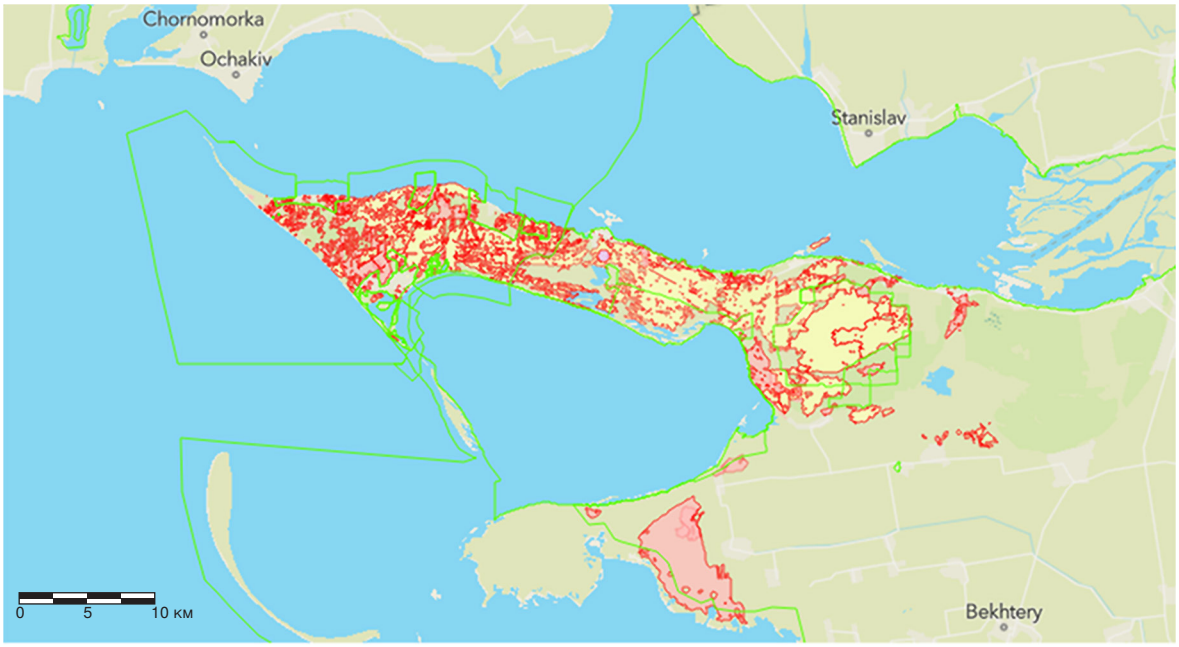


Fig. 3. Spatial distribution of warfare-induced wildfires across the "Biloberezhia Sviatoslava" National Nature Park
Source: own elaboration based on The Economist's War Fire Model and NASA FIRMS data.



Photo 1. Chalk massifs of the "Dvorichanskyi" National Nature Park
Source: "Dvorichanskyi" National Nature Park (June 2020).

beaches of the Oskil River provided opportunities for swimming and heliotherapy; and there are designated camping sites[8]. The park's landscapes have undergone substantial changes as a result of the full-scale Russian war against Ukraine. Its northern part borders Russia; consequently, from the first days of the invasion by Russian forces, the park fell under occupation. Since 2022, it has been situated on the front line. All park staff have been evacuated; therefore, there is no one left to conduct scientific environmental observations. Currently, active hostilities are ongoing within the territory.

The "Dzharylhachskyi" National Nature Park (Kherson oblast, Ukraine) is a territory of Ukraine's Emerald Network and partially forms part of the "Karkinytska and Dzharylhachska Bays" wetland of international importance, serving as a critical nesting site for birds. Rare species of flora and fauna, listed in the Red Data Book of Ukraine, are recorded here. To promote recreational activities, the park established several ecological and educational trails – "Zapovidna", "Maiaky", "Slidamy Akhilla", and "Mariin Hai" – as well as tourist routes such as "Dzharylhachskyi Weekend", "From West to East", "Safari Dzharylhach", and "Maiaky Dzharylhacha"[9].

Since 2022, the NNP has been completely occupied by Russian forces. Access to this territory for monitoring research is impossible; data collection is only feasible through remote sensing methods. Fires are the primary factor impacting the park's ecosystems. According to data from the Dzharylhachskyi National Nature Park, in 2023, the establishment of a military training ground and weapons testing by Russian forces resulted in 36 fires. These fires destroyed 2,095.95 hectares, including 1,588 hectares of the strictly protected zone. Furthermore, fortifications have been constructed, and heavy military vehicles are being operated across the area[10]. Even after de-occupation, the park's conservation and recreational activities can only resume following comprehensive demining.

The "Kreminski Lisy" (Kreminna Forests) National Nature Park (Luhansk oblast, Ukraine) was established to preserve, restore, and effectively utilise natural resources within the Siverskyi Donets River valley. Of particular value are its unique forest massifs, which are the largest in Eastern Ukraine. Additionally, the "Kreminski Lisy" NNP has preserved several historical, archaeological, and cultural monuments. For tourists, several holiday homes were established within the park. Since 2022, the park's territory has been situated within a zone of active combat, where numerous trenches and dugouts have been recorded. Military actions result in frequent fires and the destruction of valuable forest complexes.

The "Meotyda" National Nature Park was established on the coast of the Sea of Azov (Donetsk oblast, Ukraine). This territory is characterised by significant biological diversity, particularly its avifauna. Within the "Meotyda" NNP, there are four ornithological sanctuaries and reserves[11]. The primary recreational resource of the park is the Sea of Azov and its sandy beaches. Furthermore, there are therapeutic muds on the coast near the urban-type settlement of Yalta, which could be utilised for the rehabilitation of Ukrainian military personnel after the war (Kniazieva 2023). A significant portion of the "Meotyda" NNP has been occupied since 2014. Currently, this territory is subject to constant artillery shelling. As a result of the Russian military's bombardment of the Azovstal Iron and Steel Works (Mariupol, Ukraine), hazardous substances were released into the sea[12].

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[8] https://www.calameo.com/read/00519149480db7cd6af09 (accessed: 12.01.2026).

[9] https://nppd.com.ua/ohorona/ (accessed: 12.01.2026).

[10] https://epl.org.ua/announces/onovlennya-danyh-shhodo-vplyvu-voyennyh-dij-na-terytoriyu-natsionalnogo-pryrodnogo-parku-dzharylgatskyj/ (accessed: 12.01.2026).

[11] https://uncg.org.ua/wp-content/uploads/2019/05/2017NPP-Meotyda.pdf (accessed: 12.01.2026).

[12] https://ecopolitic.com.ua/ua/news/bombarduvannya-azovstali-zagrozhuie-ekologichnoju-katastrofoju-svitovogo-rivnya/ (accessed: 12.01.2026).

The "Oleshkivski Pisky" National Nature Park was established on a territory that is one of the largest sand massifs in Europe, spanning an average of 16 km from north to south and nearly 12 km from west to east[13]. An important feature of the park's flora is the significant percentage of endemic species (Hetman 2017). Prior to the start of the full-scale Russian war against Ukraine, the park was equipped with tourist routes and observation towers[14]. Currently, the park's territory is temporarily occupied. Intensive hostilities are ongoing here, and military (anthropogenic) activities are being implemented, which pose a major obstacle to the full and positive development of its biota.

The establishment of the "Pryazovskyi" National Nature Park was driven by the need to ensure the protection, restoration, and sustainable use of typical and unique natural ecosystems of the steppe and water areas located in the north-western part of the Azov coast. The park's floral diversity includes 163 species of vascular plants that hold special conservation status and are protected at international, state, and regional levels[15]. The park's territory is vital for preserving populations of rare birds, particularly wetland and water-associated species. The region's geographical location, rich in river estuaries and marine bays, grants it the status of a major transit route for birds during seasonal migrations.

The park's territory was occupied in 2022. The activities of the armed formations of the Russian Federation within the park have caused catastrophic environmental consequences: landscapes have been ruined by live-fire exercises, and forest stands have been destroyed for the construction of fortifications. Instances of the extermination of wildlife and aquatic bio-resources have been recorded. Notably, an island that served as a nesting site for rare pelican species with international protected status has been irretrievably lost[16]. As a result of hostilities, Russian artillery shells land in the liman (estuary), which serves as a spawning ground for fish of the Gobiidae family. Prior to the full-scale war, popular recreational activities in the park included hiking and cycling along tourist routes, kitesurfing, windsurfing, kayaking, fishing, swimming, and heliotherapy. Naturally, due to the war, these recreational activities are currently impossible within this territory.

The "Charivna Havan" (Magic Harbour) National Nature Park is located in the western part of the Crimean Peninsula. The purpose of establishing this protected area was to ensure the preservation, restoration, and sustainable use of typical and unique steppe and maritime natural complexes of significant conservation, scientific, aesthetic, recreational, and health-improving importance. Within the park, the sections of the Dzhangul landslide coast and the "Atlesh" marine coastal rock formations are of particular value, providing a habitat for over 25 plant species and more than 70 animal species protected at state and local levels[17]. The pristine sea and unique beaches are recreationally attractive for diving enthusiasts and other forms of leisure.

The "Charivna Havan" NNP is situated in Crimea, which has been occupied by the forces of the Russian Federation since 2014. International organisations have recognised the occupation and annexation of Crimea as illegal, condemned Russia's actions, and imposed sanctions. The Russian authorities downgraded the status of the "Charivna Havan" park to that of regional significance, which significantly reduces the level of its protection and management, although its Ukrainian status remains valid[18]. Legally, the park remains part of the *Nature Reserve Fund of Ukraine*; however, in practice, its natural complexes continue to degrade due to the lack of proper protection and changes in land-use designation

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[13] https://www.nationalparks.in.ua/pryrodni-parky/herson/oleshkivski-piski/ (accessed: 12.01.2026).

[14] https://mepr.gov.ua/wp-content/uploads/2023/04/Polozhennya-Oleshkivski-pisky.pdf (accessed: 12.01.2026).

[15] https://mepr.gov.ua/documents/pro-zatverdzhennya-polozhennya-pro-pryazovskyj-natsionalnyj-pryrodnyj-park/ (accessed: 12.01.2026).

[16] https://ecozagroza.gov.ua/ (accessed: 19.12.2025).

[17] https://zakon.rada.gov.ua/rada/show/v0438737-11#Text (accessed: 12.01.2026).

[18] https://meco.rk.gov.ru/documents/cc282f13-7589-4de7-adbc-3bf397f7febb (accessed: 12.01.2026).

DISCUSSION

National parks were part of the war effort during WWII. In many parks, roads and facilities once crowded with tourists hosted military equipment and personnel[19]. Throughout the war, the National Park Service (NPS) struggled to balance its commitment to preserving the parks' natural and cultural resources with the requirements to support the war effort (McDonnell 2015). However, unlike the US experience where parks were primarily used for training and logistics, Ukrainian national parks today serve as direct theatres of combat. This results not only in functional restrictions but also in the total destruction of unique ecosystems. During modern wars occurring within the territories of national parks, unique species of flora and fauna are destroyed, and there is a profound threat that natural landscapes may never recover[20]. This article outlines the current state of the landscapes of ten national nature parks located in territories not currently controlled by Ukraine. Consequently, it is undeniably impossible to conduct comprehensive on-site environmental monitoring under such conditions. Such monitoring is performed through remote sensing methods, including the use of satellite imagery and drone data.

Analysis of the collected data demonstrates an unprecedented scale of landscape transformation within Ukraine's national nature parks. Unlike natural disturbances, war-induced impacts are complex and multiplicative in nature. The application of the *On approval of the Methodology…* (2022) has allowed for the first time in Ukraine's history to translate ecological losses into a clear financial equivalent, which, as of 2025, exceeds 3,351 billion UAH[21].

However, the completeness of damage documentation in occupied territories and active combat zones remains a subject of debate. Currently, official bodies, notably the Ministry of Environmental Protection and Natural Resources of Ukraine, rely primarily on remote sensing data. Although the "EcoZagroza" platform integrates satellite imagery to verify fires and mechanical destruction, and DeepStateMap allows for the precise localisation of impacted zones, these tools cannot fully assess the chemical contamination of soil and groundwater by heavy metals. The inability to conduct on-site field research, further evidenced by the limited operational updates on the official websites of the respective NNPs, creates a significant information gap in the comprehensive assessment of ecological damage.

The destruction of the Kakhovka Hydroelectric Power Plant, which the Office of the Prosecutor General classifies as ecocide, has led to a radical transformation of landscape facies: from floodplain meadows to anthropogenic wastelands[22]. This presents the scientific community with a dilemma regarding future restoration strategies: renaturalisation versus active intervention.

Comparing domestic methodologies with international standards, it can be argued that Ukraine is setting a unique precedent by integrating environmental monitoring with the legal documentation of war crimes. However, as experts from the Ukrainian Nature Conservation Group point out, there remains a risk of underestimating the loss of ecosystem services, which are currently difficult to monetise under existing legislation[23].

The degradation of ecological and recreational values observed in Ukraine's National Nature Parks reflects a broader, systemic pattern of military impacts on protected areas documented in global literature. Modern warfare fundamentally alters the relationship between society and nature, triggering what A. Westing (2013) describes as a long-term ecological footprint that disrupts both the structural

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[19] https://www.nps.gov/subjects/worldwarii/parksatwar.htm (accessed: 12.01.2026).

[20] https://virungaparkcongo.com/information/impact-of-congo-war-on-virunga-national-park/ (accessed: 12.01.2026).

[21] https://www.dei.gov.ua/post/3421 (accessed: 12.01.2026).

[22] https://gp.gov.ua/ua/posts/za-faktom-pidrivu-okupantami-kaxovskoyi-ges-rozpocato-rozsliduvannya-za-statteyu-ekocid (accessed: 12.01.2026).

[23] https://uncg.org.ua/vijna-i-pryrodno-zapovidnyj-fond-prost-analiz/ (accessed: 12.01.2026).

integrity and biophysical functions of landscapes. In the case of Ukrainian NNPs, this footprint is manifested through direct tactical damage and, more severely, through the institutional collapse of conservation frameworks.

This dual pressure aligns with the global meta-analysis by K. Gaynor et al. (2016), which underscores that armed conflicts degrade wildlife habitats not only through kinetic impacts (such as shelling and mining) but also via institutional paralysis, the suspension of anti-poaching enforcement, and the loss of baseline environmental monitoring. In Ukraine, the restriction of access to park territories severely undermines their recreational value, while the presence of explosive remnants of war forces a shift from managed conservation to forced neglect.

Furthermore, the disruption of these landscapes constitutes a profound loss of ecosystem services. As conceptualized by P. Pereira et al. (2022) in the context of the current Russian-Ukrainian war, military actions cause a cascade of degradation across the "total environment". In protected areas, this cascade leads to the immediate impairment of provisioning and regulating services – such as soil erosion control, water purification, and carbon sequestration. Concurrently, the cultural and recreational ecosystem services of these parks, which are vital for public well-being, ecotourism, and mental rehabilitation, are severely depleted.

Resolving these complex ecological crises will require integrating environmental restoration into the broader post-conflict recovery framework. As argued by C. Bruch et al. (2016), transparent and robust environmental governance is a prerequisite for sustainable peace building. Restoring the lost ecological and recreational capital of Ukraine's national parks must therefore transcend local remediation, becoming a core pillar of international post-war recovery and resource management strategies. A comparison of Ukrainian methodology with international experience indicates a transition from descriptive assessment to precise mathematical calculations. In the context of the conflicts in the Balkans, reports by UNEP and UNCC (*The Kosovo Conflict: Consequences for the Environment and Human Settlements* 1999) focused primarily on identifying "hot spots" of chemical contamination, without offering a mechanism for full monetary compensation for the loss of biodiversity. Conversely, the experience of the United Nations Compensation Commission (UNCC), established after the Gulf War, demonstrated the possibility of recovering funds for environmental damage. However, the assessment process spanned decades due to the lack of standardised formulas at the time the aggression began (*Report and recommendations…* 2005).

The *On approval of the Methodology…* (2022) not only integrates the experience of the Global Environmental Damage Assessment framework but also introduces differentiated coefficients specifically for protected areas.

As researchers of the environmental consequences of wars in Iraq and Afghanistan emphasise, one of the primary challenges was the failure to account for long-term landscape changes (Bruch et al. 2016). In Ukraine, through the integration of national standards with satellite monitoring under the Copernicus programme, the documentation of structural landscape changes within NNPs occurs in quasi-real-time. This represents a significant methodological step forward compared to the retrospective analysis typical of conflicts at the end of the 20th century[24].

CONCLUSION

Analysis of the formation of the national nature park network has revealed an uneven representation across Ukraine's regions. The southern and eastern regions, which host unique steppe and

[24] https://www.eli.org/vibrant-environment-blog/preventing-environmental-exploitation-armed-conflict-how-ukraine (accessed: 12.01.2026).

maritime landscapes, have proven to be the most vulnerable due to their direct proximity to combat zones and temporary occupation.

It has been established that nearly 38% of Ukraine's national nature parks have suffered significant functional destruction as a result of hostilities. This situation has led to substantial degradation of their conservation and recreational value. The condition of the 10 NNPs currently located in territories not controlled by Ukraine is particularly critical.The suspension of formal state management limits systematic protection and increases risks of ecosystem degradation.

Based on the analysis of the *On approval of the Methodology…* (2022) and international experience (UNCC, UNEP), it is substantiated that documenting losses for the 10 occupied parks is currently possible only through remote sensing methods. This carries a risk of underestimating the scale of chemical and mechanical landscape damage, which can only be fully verified following de-occupation and humanitarian demining.

The research results confirm the necessity of developing a specialised state strategy for the renaturalisation of landscapes for the occupied national nature parks. Crucially, this strategy relies on clearly distinguishing documented empirical evidence of warfare impacts (such as physical damage and fires recorded via platforms like "EcoZagroza" and "EcoSystem") from evaluative projections of long-term ecological consequences. This framework should adopt adaptive management principles, accounting for both direct structural damage and reduced ecosystem services to support future environmental risk assessments and international legal claims.

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