THE LONG-TERM PATTERN OF ECOLOGICAL DISASTERS RESULTING IN CRUCIAL DEPOPULATION OF A ONCE WELL-DEVELOPED AREA (CASE OF UKRAINE)

Dmitry Nikolaenko
New Euro Vision: exhibitions, marketing, research S.R.O., Brno, Czech Republic
Corresponding author: euukraine@icloud.com

War supplies a new perspective for analyzing a range of issues. The geographical characteristics of specific locations affected by the war require careful examination. They are associated with persistent and notable changes in the environment. Environmental disasters demonstrate a sustained and identifiable trend throughout history. Such occurrences may manifest in both peacetime and wartime contexts. The analysis of long-term land development processes reveals specific locations associated with intentional depopulation in those areas. These instances are often associated with a notable reduction in water supply in the affected regions. Human activity has resulted in a notable alteration of the natural hydrological patterns. Examining such phenomena provides important insights within the framework of military ecotones. The emphasis is on clarifying the environmental consequences of large-scale destructive actions. The lack of a thorough scientific theory and methodology is evident, as it fails to sufficiently address the long-term trends associated with the deterioration of the environmental conditions in a clearly defined region. The length of a process that spans over a century is marked by fragmentation, frequently assessed only through its individual occurrences. The framework of this transformation in nature, leading to a challenging environmental situation, is often neglected.

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Introduction

War provides a fresh lens through which to examine various issues. This presents an alternative viewpoint concerning the ongoing conflict in Ukraine. The geographical characteristics of specific locations that have fallen victim to the war warrant careful examination. They are linked to recurring significant alterations in the environment. Environmental disasters exhibit a prolonged and discernible pattern over time. Such occurrences can take place during both peacetime and wartime. Ultimately, these factors contribute to a scenario in which the environmental conditions in a particular area deteriorate significantly over an extended period. The area is experiencing an enormous drop in population.

The primary factor contributing to mass depopulation frequently involves a significant decline in water supply quality. In specific instances, an area that was once flourishing may experience a prolonged decline in its population. The correlation between changes in the environmental situation and large-scale peaceful or military projects is noteworthy. In essence, they are created by human intervention.

It is also significant to note that all these projects were executed with the understanding that nature requires adaptation to meet human needs. The current situation reflects a significant disregard for the natural environment. It possesses the potential for a wide range of applications. Nature is perceived as an unstructured entity from which the noosphere must be developed.

In recent decades, it has become clear that climate change results in unpredictable, uncontrollable, and extremely serious outcomes. In instances of man-made environmental disasters, a series of consequences emerges that may extend far beyond human control. Notable instances are associated with water supply. Upon occurrence, individuals promptly associate it with "climate change." This represents the conventional understanding; however, the matter at hand extends beyond climate change.

The aggression of the Russian Federation against Ukraine presents numerous examples. The situation has led to a significant decline in the water supply in Ukraine. This has implications for both the territories that are currently occupied and those that remain under Ukrainian governance. The water supply situation in the occupied territories has sharply deteriorated, as evidenced by the cases of Mariupol and Berdyansk. An alternative example pertains to Crimea. The water supply situation in Crimea has evolved into a state that is nearing catastrophe. In the planning of military operations, it appears that the availability of fresh water is often overlooked. The water supply situation in the territory controlled by Ukraine has sharply deteriorated, particularly in the area linked to the former Kakhovka Reservoir.

Materials and Methods

The foundation is established on the methodology of the military ecotones paradigm (Nikolaenko, 2025). This approach focuses on detailing long-term trends in territorial development and shifts in environmental conditions. Timeframes extending over a century or longer are taken into account. Throughout this period, the criteria for state organization may undergo several revisions. Ideological dogmas are transient phenomena. A multitude of actions may appear unrelated, yet there exists the potential to discern prevailing environmental trends. They frequently correlate with a significant decline in the water supply conditions. Soil degradation is evident, along with various other issues. This may result in a decline in population in areas that were once densely populated.

In times of military engagement, the environmental impacts are markedly distinct from those observed during peacetime. The patterns of destructive activity exhibit variability across different geographical contexts. A fundamentally different type of chemical contamination could potentially arise. The study of microelement dynamics allows for a precise analysis. In the context of military ecotones, this is executed in accordance with the NanoGeoScience (NGS) standard (Hochella, 2007; Ju, Y. et al. 2018; Ju, Yiwen & Huang et al. 2017; Ju, Yiwen et al. 2021; Liu, J. et al. 2018; Yang, Yi et al. 2018).

The analysis focuses on the environmental consequences resulting from military conflicts taking place within Ukraine's territory. The majority of the content pertains to Russia's aggressive actions towards Ukraine. Data regarding the environmental impacts of armed aggression has been steadily gathered since 2014. The processing can be conducted with precision according to the established standards of digital cartography. This is essential for the application of GIS. The approach of the military ecotone paradigm facilitates the use of GIS modeling. The significance of experimental work cannot be overstated. This forms the foundation for acquiring precise empirical data regarding military pollution linked to different categories of pollutants.

Results and Discussion

Double-Trouble-Ecological-Site: The Kakhovka Reservoir

An examination of the Kakhovka Reservoir's creation, the events leading to its destruction, and the possibilities for its future restoration.

This is a clear instance that categorically aligns with the Double-Trouble-Ecological-Site (DTES) classification. This area has a significant historical context regarding human habitation. Determining the timeline of habitation in this area presents challenges. It is reasonable to assert that the duration exceeds 1000 years.

This region features a unique blend of fertile soils, alongside a favorable climate. Furthermore, the region possesses an abundance of water resources. A perfect integration.

The establishment of the Kakhovka Reservoir in 1956 can be clearly assessed as an ecological disaster. This represented the sixth phase in the series of hydroelectric power stations along the Dnieper River. The concept of a cascade occurring in a flat area presents significant ecological concerns. The design of the Kakhovka Reservoir exhibits significant deficiencies. This led to the flooding of significantly larger areas.

The establishment of this water reservoir is linked to the relocation of a significant population. A rural settlement system developed over the course of centuries. The rural population exhibited stability. This version closely aligns with the ideal outlined in the Central place theory (Christaller, 1933). Successful agricultural specializations were established. However, in the USSR, there was a necessity for particularity in all aspects. The USSR exhibited a distinct inclination towards gigantomania. This was also apparent concerning the Kakhovka Reservoir.

It is essential to recognize that the concepts associated with mass resettlement of populations were inherently integrated within the framework of the USSR. Throughout the Soviet era, there were significant patterns of migration. A significant number of them experienced some degree of coercion. The situation regarding the resettlement of individuals from the flooding zone of the Kakhovka Reservoir can be characterized as a form of "soft Soviet violence." Individuals were left with no alternatives. There was an absence of discourse regarding protests or an analysis of the practicality of establishing such an extensive reservoir.

Throughout the decades of the Kakhovka Reservoir's existence, a new settlement system and distinct specializations in agriculture and industry have emerged. Their association with the presence of a giant freshwater reservoir is noteworthy.

On June 6, 2023, the dam of the Nova Kakhovka Hydroelectric Power Plant was detonated. The Russian army executed this action. For several days, the situation was exceptionally dire. The exact number of fatalities resulting from the artificial flooding remains uncertain, with various estimates available. Subsequently, a situation of ecological equilibrium emerged. The outcome presents a fundamentally altered ecological scenario, characterized by numerous manifestations, the majority of which are adverse. The sole beneficial outcome is the formation of what is referred to as the "Great Meadow."

Morphology of ecological disasters

This instance illustrates the disruption of the natural land use environment and settlement system, leading to the establishment of a distinctly artificial alternative. Subsequently, it is also eliminated. The following can be articulated:

A. The area exhibited favorable characteristics. Military conflicts occasionally took place within its borders. This resulted in extensive devastation of communities and considerable movement of populations. Nonetheless, the quality of life in this area persisted.
B. *Catastrophe No. 1.* The failure of extensive justification and practical implementation has led to the emergence of an ecological crisis. A large reservoir was established, which subsequently led to various ecological repercussions. The result of its establishment was the dismantling of the pre-existing settlement framework and mandatory displacement of a significant portion of the local population.
C. Throughout the decades of the Kakhovka Reservoir's existence, an entirely new settlement system has emerged. New migration flows appeared. The region has seen an appearance of new agricultural and industrial specializations. The initial orientation towards the existence of a major freshwater reservoir is of significant importance.
D. *Catastrophe No. 2.* The explosion of the dam by the Russian army led to the destruction of the reservoir. The implications have evolved into various dimensions and are evidently extending over a prolonged period. A significant region is confronted with an unprecedented decision that has not been encountered previously. A significant instance of ecocide is occurring on a notably large scale. There is a lack of consensus on the appropriate course of action regarding the situation.
E. It is evident that, irrespective of the decision taken, there has been a significant decline in the water supply within the region. The extent to which this reservoir can be restored and the potential ecological consequences of this process remain highly uncertain.

Military ecotones and the methods to their examination

War involves various multifaceted dimensions. The environmental impacts resulting from military operations represent one of these expressions. The environmental consequences can differ based on the specifics of the military activity. A single model applicable to all wars is neither existent nor feasible.

Due to Russian aggression from 2014 to the present, Ukraine has encountered a variety of new environmental challenges. Understanding them requires a deliberate development of new methodological approaches. Several innovations have been suggested within the paradigm of military ecotones (Nikolaenko, 2025). A concise overview of the methodological and theoretical innovations within this paradigm will be presented (Table 1).

The examination of long-term trends associated with environmental conditions stands out as a central theme within the framework of military ecotones. The application of NGS methodology holds significant importance. The examination of microelement dynamics yields dependable quantitative data and facilitates the resolution of numerous scientific and practical issues at a fundamentally advanced level.

Table 1. Innovations in theory and methodology concerning the paradigm of military ecotones

Advanced spatio-temporal algorithm to investigate sites generated by military ecotones (ASTA-WE-1.0)	The study of the morphology of natural processes related to military ecotones	The multi-dimensionality of the theoretical consideration of the entire array of empirical information related to the environmental consequences of military activities
The use of GIS serves as the foundation for gathering and analyzing the comprehensive set of attribute information associated with military ecotones	Achieving the highest level of precision in identifying all relevant details concerning the outcomes of military operations	A comprehensive assessment of the environmental impacts of military operations necessitates a precisely structured and well-organized database
The examination of military ecotones is distinctly focused on the implementation of an innovative system of taxonomic units	The examination of mono-parametric ecological successions serves as a method for gathering and analyzing empirical data pertinent to military ecotones	An experimental approach is both feasible and essential for elucidating the processes associated with the military ecotone
Modeling is essential for accurately describing the processes occurring in a military ecotone	N-dimensional examination of the complete dataset concerning the environmental impacts of warfare across multiple dimensions	Organizing geomonitoring is essential for accurately describing the long-term processes linked to military ecotones
The paradigm of military ecotones emphasizes the application of NGS methodology to systematically document empirical data regarding military environmental contamination	The study of natural boundaries related to military pollution processes receives considerable focus within the framework of military ecotones	

Discussion of the findings pertaining to the investigation of military ecotones

I welcome constructive feedback and engaging dialogue. Presenting all relevant information convincingly in a concise format poses a significant challenge. The primary focus at this stage is to highlight this particular phenomenon. I have provided a comprehensive description utilizing the example of Crimea's development from 1475 to the present day. The level of detail is reduced for the

area corresponding to contemporary Ukraine. The actions of the Russian Federation towards Ukraine have presented fresh instances of this nature. The geographical aspects of this aggression exhibit a notable selectivity. Through meticulous examination, it becomes evident that the dismantling of the settlement system in Ukraine aligns with one of Russia's strategic objectives. The destruction is further evidenced by a significant decline in water supply across various regions of Ukraine. Subsequently, the process of mass depopulation commences.

Conclusions

In the examination of long-term land development processes, specific locations emerge that are linked to intentional depopulation in those regions. Throughout a century or more, various economic activities may be executed, resulting in ecological disasters and ensuing mass depopulation. The designation we use is Double-Trouble-Ecological-Site (DTES).

Typically, these instances correlate with a significant decline in water supply in those areas. The consequences of human activity have led to a significant disruption of the natural hydrological patterns, resulting in complex and often intractable water supply issues.

Analyzing such phenomena yields valuable insights within the paradigm of military ecotones. The focus is on elucidating the ecological repercussions of extensive destructive activities. Generally, these situations involve armed confrontations between military forces. Nonetheless, it is important to consider that large-scale economic projects may be categorized as such when they are executed without adequate logical reasoning. An illustrative case of these projects is the development history of the Kakhovka Reservoir.

Identifying such DTES requires a thorough examination of land development trends over extended timeframes. Two instances of comprehensive examination are presented. The initial aspect pertains to the historical progression of Crimea from 1475 to the current era. The second pertains to the examination of the development of Donbass and its water supply systems. When analyzing timeframes shorter than fifty years, such trends remain indeterminate.

It can be observed that there is an absence of a comprehensive scientific theory and methodology that adequately accounts for the long-term trends in the decline of the environmental situation within a specifically defined area. The duration of a process extending beyond a century is characterized by fragmentation, often evaluated solely through its discrete manifestations. The structure of this transformation in nature, resulting in a frustrating environmental scenario, is overlooked.

Conflict of interest

The author states no conflict of interest.

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