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Creating an international brownfields collaborative

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ABSTRACT

Introduction. Brownfields and blighted sites are present in all countries and represent significant environmental, public health, economic, and spatial planning challenges. Military, war, and post-war brownfields are becoming increasingly important in the context of contemporary armed conflicts and post-war recovery, particularly in Ukraine. In response to these challenges, experts from the United States, Canada, Romania, and Ukraine established the United States – Eastern European Brownfields Working Group in 2015 to promote community-engaged land reuse and public health-oriented redevelopment approaches. The purpose of this study is to analyze the formation and development of the International Brownfields Collaborative as an interdisciplinary platform for addressing military, war, and post-war brownfields through international cooperation, sustainable redevelopment, environmental security, and public health-oriented approaches.

Methods. The study applies a qualitative collaborative case-study approach based on workshop activities, expert discussions, educational initiatives, and interdisciplinary knowledge exchange conducted within the framework of the NATO Advanced Research Workshop (ARW) Achieving Sustainability in Ukraine through Military Brownfields

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Redevelopment. The research examines the evolution of the initial working group into the International Brownfields Collaborative and analyzes its scientific, educational, and organizational activities related to sustainable land reuse and post-war recovery.

Results. The ARW became a platform for expanding the initial working group of five experts from four countries into the International Brownfields Collaborative, which currently includes more than 20 members from 15 countries. The Collaborative united researchers, planners, environmental and public health professionals, educators, and practitioners working in brownfields redevelopment, environmental security, sustainable development, urban resilience, and spatial planning. The study highlights the growing significance of war and post-war brownfields as distinct categories of degraded territories formed by military activity, infrastructure destruction, environmental contamination, and socio-spatial transformation. The Collaborative contributed to disseminating interdisciplinary approaches to brownfields revitalization through workshops, publications, educational initiatives, and Environmental Health and Land Reuse (EHLR) training activities implemented at V. N. Karazin Kharkiv National University. These activities strengthened international academic cooperation, knowledge exchange, and sustainability-oriented competencies among graduate students and young researchers.

Discussion and Conclusions. The experience of the International Brownfields Collaborative demonstrates the importance of interdisciplinary international networks in addressing environmental, socio-spatial, and public health challenges associated with military, war, and post-war brownfields. The study emphasizes the need to integrate sustainable development principles, environmental security, public health, and resilience-oriented spatial planning into post-war recovery strategies. The findings may support policymakers, planning institutions, and academic communities in developing integrated approaches to sustainable redevelopment and environmental recovery in conflict-affected territories.

Keywords:

brownfields; military brownfields; war brownfields; post-war brownfields; contamination, sustainable redevelopment; environmental security; public health; urban resilience; international collaboration.

Introduction

Brownfields and blighted sites are present in all countries, posing public health, environmental, and economic impacts. In 2012, a group of colleagues with expertise in land reuse and community revitalization launched the Brownfields & Opportunity Working Network (BROWN). At the time, a federal public health agency facilitated BROWN. Since that time, BROWN has evolved into its own independent network, hosted by a nonprofit in the United States. The original goal of BROWN was to assist communities with brownfields. BROWN partners include planners, public health professionals, academics, engineers, and many others. As BROWN developed, we began to look at differences between brownfields regulation and policies in the United States, Canada, and Eastern Europe. We created the United States – Eastern European Brownfields Working Group as a vehicle for exploring and comparing brownfields redevelopment globally.

As a working group, we explored ways to create shared resources and best practices, including funding for research and site visits. We have a common interest in community-engaged land reuse that can improve community health. This health-focused approach to redevelopment broadens the typical economic drivers of redevelopment. For example, drawing on the expertise of community members who know their community's needs and visions may lead to a more robust and successful redevelopment project. In addition, by engaging a wide array of community members and partners from multiple sectors, such as education, environmental regulation

and science, and health agencies, a sustainable redevelopment plan can develop and flourish.

One common thread is that brownfields are present in all countries. We are most interested in military brownfields, as they pose various challenges and offer large-scale opportunities for health-focused, sustainable redevelopment models. Through our United States – Eastern European Brownfields Working Group, we explored and researched brownfields definitions, contaminants of concern, regulatory and policy guidance, and funding for redevelopment of both brownfields and military brownfields. We envisioned growing our small working group in our four home countries – United States, Canada, Romania, and Ukraine – into a broader, International Brownfields Collaborative.

To reach our goal, we participated in several activities. We visited brownfields in Romania and the United States. We also published a 3-part series about brownfields redevelopment in Europe and the United States. In this series, we explored sustainable brownfields redevelopment through regulatory, policy, funding, and visual lenses [3, 4, 12]. In 2023, we were awarded NATO funding to host an Advanced Research Workshop (ARW), Achieving Sustainability in Ukraine through Military Brownfields Redevelopment. The ARW provided the opportunity to expand and launch our International Brownfields Collaborative.

Brownfields: Contaminants of Concern. The United States Environmental Protection Agency defines brownfield sites as “properties that contain or may contain a hazardous substance, pollutant or contaminant, complicating efforts to expand, redevelop or reuse them” [19]. In Europe, the concept of “brownfields” does not have a common

or legal definition. The term brownfields refers to “contaminated land” in general [6, 8].

The Agency for Toxic Substances and Disease Registry’s (ATSDR’s) review of United States Environmental Protection Agency brownfields data indicated common contaminant categories of brownfields. From the most to least frequent, these are: Lead, chromium, cadmium, mercury, arsenic, volatile organic compounds (VOCs), petroleum, polycyclic aromatic hydrocarbons (PAHs), and asbestos [5, 20]. These contaminants are found globally in blighted or former industrial sites. Many of these contaminants are found in all types of brownfields, including military brownfields.

Military Brownfields. Globally, there are thousands of military brownfield sites that include bases, munitions or arsenal sites, small sites such as lighthouses, and sites with complex pollution profiles. In Europe, military brownfields include war-damaged properties. The Eastern Bloc and historic wartime activities throughout Europe created military brownfields and war-scarred lands, contributing to the European brownfields burden. Military brownfields may contain typical contaminants found at brownfields in general, such as lead-based paint and petroleum compounds. Military brownfields also may contain the following [23]:

- Military vehicles (tanks)
- Unsafe buildings, structures, or debris
- Hazardous, toxic, and radioactive waste, which may include arsenic, certain paints, some solvents, petroleum and related products
 - Toxic pollutants from landfills
 - Radioactive waste, including wastes in underground and aboveground storage tanks.

In the United States, the Base Realignment and Closure (BRAC) Process determines and identifies if sites are military brownfields [21]. There are 136 BRAC sites and 9,300 Formerly Used Defense Sites (FUDS) in the United States and its territories [21, 24]. As of September 2021, 5,400 FUDS sites required investigation and cleanup. Of this total, 3,800 were cleaned up. There are 1,600 additional FUDS that required a cleanup response [24].

Military brownfields contamination is often more extensive than contamination at other types of brownfields. For example, in the United States, BRAC site contamination may be severe enough to list the site on the National Priorities List (NPL). The NPL is the list of sites of national priority among the known or threatened releases of hazardous substances, pollutants, or contaminants throughout the United States and its territories. The NPL is intended primarily to guide the EPA in determining which sites warrant further investigation. In 2024, 34 BRAC

sites were listed on the NPL [22]. The majority of brownfields are not listed on the NPL or comparable state lists [7].

The complex chemical signature found globally in military brownfields may pose real and potential danger and hazards to nearby populations and the natural environment. Contaminants from military brownfields degrade the environment, public health, and the economy. For example, civilian and military fire fighters in the United States used fire-fighting foam for many years. This led to water contamination with per- and polyfluoroalkyl substances (PFAS) [18]. Exposure to contamination at military brownfield sites by inhalation, ingestion, or dermal contact exposure routes may cause adverse impacts on population health. Associated health issues may include respiratory and systemic illness, cancer, and skin irritation. Site contaminants may be present in:

- Surface and subsurface soil
- Groundwater aquifers
- Outdoor air
- The indoor environment of buildings or adjacent facilities
 - Surface water bodies
 - Sediments
 - Biota, such as fish and game

Developers may view redevelopment of former military brownfields for beneficial re-use as risky investments. This may delay or prevent redevelopment, which can increase the exposure duration and health risks for the populations affected. Furthermore, contamination may be unknown due to lack of knowledge about site history. Site investigation efforts are expensive and create uncertainty in terms of economic investment and economic productivity.

The former Soviet Union and Ukraine contained more than 3,000 military bases of different sizes. After the fall of the Soviet Union in the early 1990s, military reform reduced the number of military units and weapons in the Ukrainian Armed Forces. This contributed to an economic decline in the regions of the former military facilities, leading to various social and environmental problems [9]. Recent crises in Ukraine may have contributed to the development of new brownfields as well as potentially added to contamination at existing brownfield sites. Reconstruction planning may consider the pre-existing vulnerable status of Ukraine and how this vulnerability developed. An important lesson is to avoid further brownfields and environmental harm in the global reconstruction efforts of Ukraine.

In the context of contemporary armed conflicts, particularly the Russian invasion of Ukraine, the concept of brownfields has expanded beyond traditional post-industrial and military

sites. Researchers increasingly emphasize the emergence of war brownfields and post-war brownfields as a distinct category of degraded territories formed directly or indirectly through military actions, destruction of infrastructure, environmental contamination, and forced transformation of urban and rural landscapes [11]. War brownfields include territories damaged during active hostilities, such as destroyed industrial enterprises, military facilities, residential districts, transport infrastructure, energy systems, and contaminated urban spaces [15]. The emerging concept of war and post-war brownfields extends traditional brownfields discourse by incorporating conflict-related environmental degradation, urban destruction, and post-war spatial transformation into sustainable redevelopment frameworks. Unlike conventional brownfields, these territories are characterized not only by physical degradation and economic decline, but also by complex environmental risks associated with explosive remnants of war, damaged industrial facilities, fuel spills, heavy metals, construction debris, and potential chemical contamination. In many cases, war brownfields emerge rapidly and simultaneously across large territories, creating unprecedented challenges for environmental security, spatial planning, and public health. Post-war brownfields represent the longer-term legacy of armed conflict and military destruction. They reflect territories requiring remediation, environmental assessment, functional transformation, and reintegration into regional development systems. As noted in studies focused on Ukraine, military aggression has intensified the formation of new brownfields while simultaneously transforming existing industrial and military brownfields into more complex and hazardous socio-environmental systems [15]. The scale of destruction in Ukrainian cities demonstrates that post-war reconstruction cannot be limited to physical rebuilding alone but must incorporate principles of sustainable development, environmental restoration, resilience, and community-oriented planning.

Recent research on Ukraine emphasizes that war and post-war brownfields should be considered not only as degraded spaces but also as territories of potential transformation and sustainable redevelopment. Their regeneration creates opportunities for implementing green infrastructure, nature-based solutions, renewable energy systems, sustainable mobility, and innovative urban planning approaches. In this regard, brownfields redevelopment becomes closely connected with broader processes of urban resilience, ecological recovery, and post-war regional transformation [13, 15].

Despite growing international attention to brownfields redevelopment, limited research has examined the role of transnational interdisciplinary collaborations in addressing military, war, and post-war brownfields through integrated public health, environmental security, and sustainable development approaches. The International Brownfields Collaborative represents an emerging platform that combines expertise from geography, urban studies, environmental sciences, public health, and spatial planning to support knowledge exchange, capacity building, and sustainable redevelopment strategies in both NATO and NATO-partner countries.

The purpose of this study is to analyze the formation and development of the International Brownfields Collaborative as an interdisciplinary platform for addressing military, war, and post-war brownfields through sustainable redevelopment, environmental security, and public health-oriented approaches. The object of the study is international cooperation in the field of brownfields redevelopment and sustainable land reuse. The subject of the study includes interdisciplinary collaborative practices, educational initiatives, and knowledge exchange mechanisms related to military and post-war brownfields redevelopment within the framework of the International Brownfields Collaborative.

Methods. We used the ARW as a springboard to build our small United States – Eastern European Brownfields Working Group of five people from four countries – United States, Canada, Romania, and Ukraine – into an International Brownfields Collaborative. The study applies a qualitative collaborative case-study approach based on international workshop activities, expert discussions, educational initiatives, and interdisciplinary knowledge exchange conducted within the framework of the NATO Advanced Research Workshop. During the ARW, we focused on Ukraine as a NATO-partner country to assist efforts to preserve and sustainably rebuild the country's assets and military brownfields. The ARW participants have expertise in urban planning, brownfields redevelopment (i.e., geography and tourism), and environmental public health.

The ARW presentations and brainstorming sessions occurred over four days organized into three panels. The brownfields topics included decision making, socio-economic aspects, and sustainable development, as described below.

Panel 1: Scientific Support for Decision Making in the Environmental Security Sector. Presentations in this panel emphasized international cooperation on assessing, surveying, and developing mitigation plans to prevent environmental hazards from defense-related

activities and installations. Each country relies on environmental regulations, policies, and multiple funding strategies to redevelop brownfields. By incorporating a public health focus, we emphasized the need to engage communities in brownfields redevelopment. Such engagement occurs by collaborating with regulatory and planning sectors, using community engagement techniques, and measuring environmental and health change. During Panel 1, we included a 2-hour Environmental Health and Land Reuse Training module: Evaluating Environmental and Health Risks [1]. The training provided an overview of environmental health topics, including toxicology and risk assessment. The training also described Phase I and Phase II environmental site assessments used in the United States, as well as ATSDR's public health assessment process [2].

Panel 2: Socio-Environmental Aspects of Reusing Former Military Lands. This panel focused on collaboration on the social and environmental aspects of reusing former military lands. The panel featured the most practical and cost-effective remediation techniques while raising public awareness about the benefits of brownfields reuse. Presentations in this panel focused on engaging communities and assessing environmental characteristics of military lands, including types of contamination and risk assessment approaches.

Panel 3: Global Approach to Brownfields Reuse – Sustainable Communities: A Special Focus on NATO-Partner Countries. Presentations in this panel described various aspects of brownfields redevelopment, including the similarities and differences in regulations, practices, and policies among NATO and NATO-partner countries. Several presentations examined varying aspects of sustainable redevelopment and military brownfields redevelopment as models for NATO-partner countries. For example, one presentation focused on reusing military brownfields as areas for recreation and landscape protection in the Czech Republic. Other presentations highlighted successful transformation of military brownfields in different regions of Ukraine.

Results and Discussion. Academics, graduate students, and municipal agency representatives attended the ARW. Through the workshop, our United States – Eastern European Brownfields Working Group developed into the International Brownfields Collaborative. The early goals of the International Brownfields Collaborative included

- 1) Developing and disseminating novel approaches and community-based solutions for brownfields site characterization, restoration, and revitalization.

- 2) Disseminating best practices for brownfields assessment and reuse to the scientific

and regulatory community; policymakers; environmental groups; and local communities. This activity will raise awareness about brownfields.

The collaborative has over 20 partners from 15 countries. These include Albania, Bosnia and Herzegovina, Canada, Czech Republic, Germany, Hungary, Italy, Macedonia, Poland, Romania, Serbia, Spain, Turkey, Ukraine, and the United States. The International Brownfields Collaborative includes environmental public health practitioners; professors and students in public health, city planning; and geography and tourism.

The ARW showcased presentations on a wide array of brownfields redevelopment. The ARW presentations and brainstorming sessions raised awareness about brownfields in general and led to new collaborations among participants and our newly formed International Brownfields Collaborative. One area of interest was the increasing number of brownfields in Ukraine. Participants acknowledged Ukraine's vulnerabilities for future reconstruction efforts.

Since the December 2023 workshop, members of the International Brownfields Collaborative worked jointly on several projects. They formed new and strengthened existing international partnerships. They also built knowledge and capacity through environmental health training. Additionally, members shared best practices through collaboration and education. Some highlights of the International Brownfields Collaborative are described below.

Publications: Workshop participants submitted 35 manuscripts based on their ARW presentations and research for publication in a Springer book, supported by the NATO Science for Peace and Security Program. These included co-authored manuscripts developed through new collaborations of our International Brownfields Collaborative and a special section featuring the work of doctoral students and young researchers. Springer published the manuscripts in 2024 in the book, *Achieving Sustainability in Ukraine through Military Brownfields Redevelopment* [11].

2025 Workshop: In 2025, V. N. Karazin Kharkiv National University hosted the international scientific and practical seminar *Interdisciplinary Research of Urbanized Spaces in the Context of Sustainable Development* and the workshop *Urban Kharkiv: Planning a Sustainable Urban Future*. These events brought together researchers, graduate students, practitioners, representatives of public authorities, business, and civil society organizations from Ukraine and several European countries. The discussions focused on interdisciplinary approaches to sustainable urban development in the context

of contemporary environmental and socio-political challenges. Particular attention was paid to post-war urban recovery in Ukraine, urban resilience, renaturalization, green transition strategies, GIS and remote sensing applications in urban studies, sustainable mobility, cultural heritage preservation, and European integration perspectives for Ukrainian cities and regions. The workshop also served as a platform for strengthening cooperation among members of the International Brownfields Collaborative and expanding dialogue between academia, local authorities, and community stakeholders. In addition, students and young researchers presented innovative concepts and practical solutions related to energy efficiency, renewable energy, smart city technologies, urban memorialization, and sustainable waste management within a special EXPO exhibition [10, 25].

Environmental Health and Land Reuse (EHLR) Training: Another important outcome of the International Brownfields Collaborative was the implementation of the Environmental Health and Land Reuse (EHLR) Training initiative at V. N. Karazin Kharkiv National University in 2025 [17]. The training, developed under the leadership of Laurel Berman and colleagues from the Agency for Toxic Substances and Disease Registry (ATSDR), was delivered virtually as a specialized mini-course for 46 faculty members and doctoral students. The initiative reflected the Collaborative's broader objective of strengthening international cooperation in the fields of environmental security, sustainable redevelopment, and public health-oriented approaches to brownfields revitalization.

The EHLR training integrated interdisciplinary approaches to brownfields redevelopment, environmental health assessment, public participation, sustainability, and community resilience. The mini-course combined theoretical foundations with practical case studies and international experience related to land reuse and contaminated site redevelopment. Particular attention was devoted to the integration of environmental and health considerations into planning and redevelopment processes, especially in territories affected by industrial decline, military activity, and war-related destruction.

The training program incorporated five thematic modules: Engaging with Your Community, Evaluating Environmental and Health Risks, Communicating Environmental and Health Risks, Redesign with Health in Mind, and Measuring Success: Evaluating Environmental and Health Change. These modules addressed methods of community engagement in redevelopment planning, approaches to environmental and

health risk assessment, communication strategies for vulnerable populations, principles of health-oriented redevelopment, and systems for monitoring environmental and public health changes during long-term revitalization processes.

The implementation of the EHLR initiative contributed to strengthening institutional and educational capacity at V. N. Karazin Kharkiv National University and expanded opportunities for integrating international expertise into educational and research activities. The initiative also facilitated the dissemination of public health-oriented redevelopment approaches among young researchers and academic staff working in geography, urban studies, environmental sciences, and spatial planning. The International Brownfields Collaborative envisages further development of joint educational activities, specialized courses, and guest lectures involving international experts in sustainable redevelopment and environmental security [17]. The Collaborative also highlights the increasing role of international academic cooperation in advancing education for sustainable development under conditions of environmental, social, and geopolitical instability. Recent studies in geographical and environmental education emphasize that sustainable development-oriented learning should integrate interdisciplinary approaches, spatial thinking, environmental awareness, and community engagement in order to address contemporary global and regional challenges effectively. In this context, geographical education plays an important role in supporting resilience-oriented approaches to environmental management, post-war recovery, and spatial planning [14]. The integration of interdisciplinary educational initiatives, training programs, workshops, and collaborative research activities within the International Brownfields Collaborative contributes to the development of sustainability-oriented competencies, supports knowledge exchange between institutions and countries, and strengthens the capacity of universities to address contemporary challenges related to environmental security, urban resilience, and post-war reconstruction [16].

In the future, members of the International Brownfields Collaborative plan to expand joint educational initiatives through additional trainings, guest lectures, and collaborative academic activities involving international partners.

BROWN Expansion: The United States – Eastern European Brownfields Working Group has grown into the International Brownfields Collaborative, which also expands BROWN's reach and membership. In 2025, BROWN became independently hosted by a nonprofit organization.

This will allow both BROWN and the International Brownfields Collaborative to further develop and collaborate.

As the International Brownfields Collaborative continues to expand, its activities may contribute to the dissemination of interdisciplinary approaches and best practices in health-focused and sustainable land reuse across different institutional and geographical contexts. The Collaborative also provides a platform for strengthening international research partnerships, educational cooperation, and knowledge exchange related to military, war, and post-war brownfields.

Conclusion. Colleagues from 15 different countries attended the ARW. During the workshop, our working group expanded into the International Brownfields Collaborative, growing from five to more than 20 members. The Collaborative brought together researchers, public health professionals, planners, educators, and practitioners working in the fields of brownfields redevelopment, environmental security, sustainable development, and public health. Particular importance was given to the participation of representatives from Ukraine, a NATO-partner country currently facing extensive challenges associated with military, war, and post-war brownfields.

During the ARW, one module of the Environmental Health and Land Reuse (EHLR) training was implemented as part of Panel 1 activities. The subsequent adoption of the EHLR training at V. N. Karazin Kharkiv National University as a specialized seminar for graduate students created new opportunities for expanding international educational cooperation and disseminating interdisciplinary approaches to sustainable redevelopment. Another important outcome of the Collaborative

was the publication of the 2024 Springer book *Achieving Sustainability in Ukraine through Military Brownfields Redevelopment*, which presented research findings, case studies, and collaborative initiatives developed within the ARW framework [11]. Several chapters in the volume focus on sustainable land reuse and post-war redevelopment challenges in Ukraine and other participating countries.

The Collaborative also contributed to supporting graduate students and young researchers in the fields of geography, urban studies, tourism, environmental sciences, and spatial planning by creating opportunities for international academic exchange and interdisciplinary research cooperation. Although the Collaborative is still in an early stage of institutional development, its activities demonstrate significant potential for expanding international research and educational cooperation in the field of sustainable brownfields redevelopment.

The experience of the International Brownfields Collaborative demonstrates the growing importance of interdisciplinary international networks in addressing emerging environmental and socio-spatial challenges associated with military, war, and post-war brownfields. The Collaborative highlights the need to integrate public health, environmental security, sustainable development, and resilience-oriented spatial planning into post-war recovery strategies. The findings may also support policymakers and planning institutions in developing integrated strategies for sustainable redevelopment and environmental recovery in conflict-affected regions. Future research should focus on developing integrated frameworks for environmental assessment, public health monitoring, sustainable redevelopment, and resilience-oriented planning in conflict-affected territories.

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Конфлікт інтересів: автори засвідчують, що, незважаючи на те, що один із авторів статті є членом редакційної колегії цього журналу, процес рецензування, прийняття рішення щодо публікації та редагування проводилися незалежно, без його участі чи впливу; будь-які потенційні конфлікти інтересів були повністю усунені шляхом зовнішнього контролю процесу; автори не мають жодних фінансових чи інших конфліктів; фінансування NATO ARW не використовувалося для підтримки цього рукопису; висновки у цьому звіті належать авторам і не обов'язково відображають офіційну

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АНОТАЦІЯ

Браунфілди та деградовані території є характерними для всіх країн світу й становлять важливі екологічні, економічні, соціальні та просторово-планувальні виклики. Особливого значення набувають військові, воєнні та повоєнні браунфілди, що формуються внаслідок збройних конфліктів і потребують комплексних підходів до післявоєнного відновлення. У 2015 році фахівці зі США, Канади, Румунії та України створили Американсько-Східноєвропейську робочу групу з браунфілдів, яка стала основою для формування Міжнародного консорціуму з браунфілдів (International Brownfields Collaborative). Метою дослідження є аналіз становлення та розвитку цього консорціуму як міждисциплінарної платформи міжнародного співробітництва у сфері сталого відновлення деградованих територій. Проведення ARW стало поштовхом до створення Міжнародного консорціуму з браунфілдів, який нині об'єднує понад 20 фахівців із 15 країн. До його складу входять науковці, фахівці з територіального планування, екології, громадського здоров'я та сталого розвитку. Консорціум сприяє розвитку міждисциплінарних підходів до ревіталізації браунфілдів через наукові дослідження, міжнародні публікації, воркшопи та освітні програми. Важливим результатом стало впровадження навчального курсу Environmental Health and Land Reuse (EHLR) у Харківському національному університеті імені В. Н. Каразіна, що сприяло розвитку міжнародної академічної співпраці та формуванню компетентностей у сфері сталого розвитку. Досвід діяльності Міжнародного консорціуму з браунфілдів демонструє важливість міждисциплінарних міжнародних мереж для вирішення екологічних, соціально-просторових і медико-санітарних проблем, пов'язаних із військовими, воєнними та повоєнними браунфілдами. Дослідження наголошує на необхідності інтеграції принципів сталого розвитку, екологічної безпеки, громадського здоров'я та просторового планування, орієнтованого на забезпечення стійкості територій, до стратегій післявоєнного відновлення. Отримані результати можуть бути корисними для органів державної влади, установ територіального планування та наукової спільноти під час розроблення комплексних підходів до сталого відновлення територій і екологічної реабілітації регіонів, що постраждали від збройних конфліктів.

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