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## **The impact of war on the environment and health: implications for readiness, response, and recovery in Ukraine**

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Since the Russian invasion began on Feb 24, 2022, Ukraine has suffered a dramatic escalation of a humanitarian, health, and environmental emergency, spurring the most rapid forced population movement within Europe since World War 2.<sup>1-3</sup> By Aug 10, 2022, there had been 12867 civilian casualties in Ukraine, including 5401 deaths; more than 6 million people had registered as refugees in Europe alone; and an estimated 6.6 million people had been internally displaced.<sup>4</sup> The war has devastated much of Ukraine's infrastructure, disrupting essential services in many parts of the country. This damage has affected the provision of and access to energy, water, food, sanitation and hygiene, waste management, health care, education, housing, transport, and agricultural and industrial products. In addition to environmental contamination, including toxic chemical releases resulting from damage to industrial facilities, there are concerns about nuclear hazards given the presence of 15 reactors at four operational nuclear power plants, and multiple radioactive sources at other sites in Ukraine.<sup>5,6</sup>

The consequences of the war have detrimentally impacted the environment and people's health and wellbeing beyond the direct harms of conflict.<sup>7</sup> These effects in Ukraine have further disrupted the country's already fragile environmental health systems.<sup>8,9</sup> Increased short-term and long-term risks to health and wellbeing include the spread of communicable diseases through outbreaks of waterborne, foodborne, and vector-borne diseases; conflict-related injuries; and mental health impacts.<sup>10,11</sup> Non-communicable diseases pose an

increased risk to the population, for example through exposure to contaminated water, food, air, soil, and damaged building materials, such as those containing asbestos.<sup>12,13</sup> Exposure to outdoor and indoor air pollution caused by the unsafe burning of fuels, further compounded by often overcrowded living situations, poses a health risk.<sup>12,14</sup> Extreme weather events, such as heatwaves, cold winters, and floods, could further amplify many of these risks, increasing demands on the already overstretched health system and on the reduced human resources available to provide health care, repair, rescue, clean-up, and operate and monitor the safety of essential services needed to save lives. Destruction of ecosystems as a result of fires, clearing of natural habitats, and chemical spills could result in additional pressure on wildlife and the natural environment, ultimately affecting human health.

The war's impact on the environment and health has effects internationally, worsening global energy and food crises and adding to environmental pollution.<sup>13,15</sup> Efforts to address the climate emergency and reduce air pollution have been set back globally by the revival of burning coal in response to gas supply shortages and the increase in fires and destruction of natural resources.<sup>8</sup> The massive humanitarian toll of the war in Ukraine, as in other conflicts, is thus compounded by an environmental health crisis. Local and global environmental repercussions and effects of war can be anticipated, prevented, and mitigated if appropriate and swift action is taken.

More than 6 months into the conflict, the situation remains volatile. However, looking ahead to the recovery phase while reflecting on lessons learned from the COVID-19 crisis presents an opportunity to plan investments in healthy, sustainable, climate-friendly recovery strategies.<sup>16,17</sup>

Effective responses to the complex, inter-related, and multidimensional effects of the war on both the environment and health require methodological approaches that account for such complexities. Systems approaches, using tools such as causal loop diagrams, can provide novel insights that go beyond the multiple discrete elements of the problems that are faced to take account also of the interactions and relations between these factors. An appreciation of these kinds of interactions can help to identify potential opportunities to

disrupt harmful synergies, as well as supporting more effective prioritisation of both immediate actions and long-term recovery efforts in ways that will save lives and promote health and wellbeing.<sup>18,19</sup> These approaches could provide directions for accelerated investment by the government, as well as the donors and partners that support the immediate and longer-term response, in new infrastructures and services in Ukraine, grounded in a focus on environmental recovery, health, and wellbeing. These priorities can then be addressed using existing tools and guidance adapted to the health and environmental hazards, risks, and impacts.

Measures to prevent, prepare for, respond to, and recover from the health consequences of the conflict should include concrete environmental actions. The wounds and injuries to the people caught up in the conflict and to the environment will require a long process of healing. Robust preventive and restorative action, such as tailoring communicable disease prevention to displaced population groups and focusing on maintaining essential infrastructure (eg, water supply and sanitation or electrical facilities, particularly in urban areas),<sup>20,21</sup> has the potential to accelerate that recovery. WHO stands ready to continue supporting efforts to address the war-related impacts on the environment and health, working closely with the Ukrainian Government, partners, and donors in the context of the WHO Ukraine Crisis Strategic Response Plan for June–December, 2022, and in the spirit of the WHO European Programme of Work “United action for better health in Europe”.<sup>22,23</sup>

At the time of writing, the war in Ukraine is far from over. While efforts continue to end the health and humanitarian crisis and restore peace to the region, there is an equally urgent need to raise awareness about the concomitant imperative to protect and restore vital environmental health infrastructure. This is essential to avert an even deeper environmental crisis that will persist long after the war has ended, and to provide the fundamentals of a healthy and environmentally sound recovery.

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