

Ukraine

1. Country overview

Ukraine is a large and diverse lower-middle income country of Eastern Europe with rich natural resources, high agricultural potential, and developed industrial infrastructure (United States Agency for International Development (USAID) 2016a). Since 2000, the country has been facing negative population growth; its current population is 44 million people (July 2020 estimate), of which 70 per cent are urban dwellers (Central Intelligence Agency (CIA) 2018; World Bank Group n.d.).

The gross domestic product (GDP) economic drivers are the service sector (60 per cent), industry sector (28 per cent) and agricultural sector (which comprises 12 per cent of the national GDP and 6 per cent of the employed workforce) (CIA 2018). Economic growth faced a significant decrease following the onset of the armed conflict and Russia's annexation of Crimea in 2014 (-6.6 per cent growth) (World Bank Group n.d.). Although Ukraine ranks in the high human development category countries (88 out of 189 countries) (United Nations Development Programme (UNDP) n.d.(a)), social gaps between rural and urban areas remain wide, with poverty twice as high in rural areas (World Bank Group 2016 and 2018).

Ukraine has been experiencing significant impacts from climate change, with more severe events (such as droughts) drastically impacting agricultural production (causing losses estimated at 3 billion euro (3.5 billion US dollars) in 2003 and 2007 alone) and floods that impact an average of 600,000 people every year (Shevchenko *et al.* 2014; Walz *et al.* 2018).

Ongoing armed conflict since 2014 over the declaration of independence of the Donetsk and Luhansk regions in eastern Ukraine created more than 2 million Internally Displaced Persons (IDPs) and increased the vulnerability of 600,000 people living



Figure 1: Map of Ukraine.
Source: [ZOI Environmental Network, 2011](#)



Figure 2: Ukraine's ND-GAIN Ranking (ND-GAIN 2021).

within 5 kilometres (km) of the line of conflict (United Nations Office for the Coordination of Humanitarian Affairs (OCHA) 2020).

1.1 Climate

Most of Ukraine is located in a temperate zone derived from the moderately warm and humid air from the Atlantic Ocean, with the exception of a small subtropical Mediterranean zone on the southern coast of Crimea (Yerofeyev and Hajda 2020). Plains and steppe cover 95 per cent of the country, and the remaining areas are covered by the Polissya mixed forest in the north, the Carpathian Mountains in the west, and the Crimean Mountains in the south (Ministry of Economic Development, Trade and Agriculture of Ukraine n.d.; USAID, 2016).

Ukraine experiences a summer and winter season where the west and north-west experience milder and more humid seasons, and the south and south-east experience less precipitation and greater temperature variability across seasons (Yerofeyev and Hajda 2020). For most of the country, summer (May–August) annual mean temperature ranges from 18–22°C, and winter (December–March) annual mean temperatures range from -4.8–2°C (World Bank Group n.d.). Crimea enjoys mild and rainy winters (annual mean temperature of 4°C), and dry and hot summers (annual mean temperature of 24°C). Precipitation distribution decreases moving north-west to south-east, with an annual mean of 1,200 millimetres (mm) in the western mountains, 400–600mm across most of Ukraine, and less than 400mm in Crimea and the lowlands of the Black Sea (Yerofeyev and Hajda 2020).

Although not well documented, climatic annual variability in Ukraine is influenced by El Niño Southern Oscillation (ENSO), with El-Niño (warmer and dryer years) associated with droughts across the country (Food and Agriculture Organization of the United Nations (FAO) and World Bank 2019).

1.2 Climate change

Historical Climate

Temperature

Annual mean temperature has increased by 0.8°C (compared to 1961–1990 averages), with the highest increase of 2°C in January (Shevchenko *et al.* 2014).

Frequency and duration of summer heat periods increased between 1991–2010 (Nikolayeva *et al.* 2012).

Changing onset of spring and autumn up to 6 days earlier compared to 1961–1990 (Shevchenko *et al.* 2014).

Projected climate

Projected increase in annual mean temperature of 4.7°C (Representative Concentration Pathway (RCP) 8.5) and 2.5°C (RCP 4.5) by 2100 (World Bank Group n.d.).

By 2100, the number of very hot days (over 35°C) is projected to increase by 12 (under RCP 4.5) and 33 (under RCP 8.5) (World Bank Group n.d.).

Changes in seasonal onset with shorter winters and earlier springs (Shevchenko *et al.* 2014); it is projected that spring and summer months will become warmer and the country's subtropical zone is likely to expand (World Bank Group n.d.).

Precipitation

Little variability in total annual precipitation, but significant change in the number of extreme precipitation events and their nature; heavy snowfall events tripled in recent years (Shevchenko *et al.* 2014).

Frequency of drought doubled during the period 1989–2010 and extended to new areas not affected historically (Nikolayeva *et al.* 2012).

Frequency of extreme weather events increased by 1.5–2 times during the period of 1990–2010 (Nikolayeva *et al.* 2012).

Projected increase of precipitation in northern and northeastern regions, and 5–10 per cent rainfall reduction in southern and southeastern regions by 2050 (World Bank Group n.d.). Significant precipitation variability in eastern regions by 2100 (50 per cent decrease in summer and 60 per cent increase in autumn) (Gnatiuk *et al.* 2013).

Annual severe droughts are projected to be 46 per cent more likely by 2100, compared to the period 1986–2005 (RCP 8.5) (World Bank Group n.d.).

Flash floods and landslides will be more likely due to extreme events, but reduced snow coverage will lower the frequency and intensity of early spring floods (USAID 2016a).

1.3 Climate vulnerability

Although Ukraine is facing significant impacts from climate change, according to the Notre Dame Global Adaptation Initiative (ND-GAIN) index, the country has a ranking of 50.1 and is considered to be facing a relatively low to medium vulnerability with a medium to a high level of readiness compared to other countries (ND-GAIN n.d.). Agricultural capacity, projected increases in flood risk and dependency on imported energy are identified as key vulnerability components; whereas political instability and control of corruption significantly affect its readiness (ND-GAIN n.d.). Ukraine's climate vulnerabilities are reflected by:

1. a projected increase in the risk of flooding, which already affects 600,000 people annually (Shevchenko *et al.* 2014)
2. predominance of rainfed agricultural crops with production fluctuation of up to 75 per cent depending on weather conditions (World Bank Group n.d.)
3. depletion of freshwater stock with projected river runoff reduction up to 50 per cent in eastern regions by 2100, combined with increasing water contamination from industrial and agricultural activities (Climate Change Post 2020; Organization for Security and Co-operation in Europe (OSCE) 2017);
4. ongoing armed conflict causing more than 2 million IDPs and leaving 3.4 million more people in need of humanitarian assistance (OCHA 2020).

2. Humanitarian sectors and climate change

2.1 Water and habitat

Although Ukraine has a vast hydrological network of over 63,000 rivers and reservoirs, inadequate protection, increased withdrawal rate and climate-induced reduction in water availability make Ukraine a water vulnerable country (FAO AQUASTAT n.d.). Climate-induced changes in the frequency of extreme precipitation and extended periods of drought, combined with increasing temperature and evaporation, are having significant and growing impacts on surface water quality and quantity, rainfed agriculture and safe drinking water accessibility (Shevchenko *et al.* 2014).

Climate models project that Ukraine will continue to face increasingly significant precipitation variability, with the south and south-east regions projected to experience an annual mean rainfall reduction of 5–10 per cent by 2050 (World Bank Group n.d.). More importantly, seasonal variability will continue to exacerbate risks of floods and droughts; wetter months will become wetter and summer months drier (Blunden and Arndt 2013). It is estimated that recent aggravated flooding patterns affect 27 per cent of Ukraine territory and one-third of its population (Shevchenko *et al.* 2014).

In addition, Ukraine's water security and reliance on surface water extraction are at growing risk of a substantial decrease of river runoff, which is projected to reach up to 50 per cent by 2100 in the south and southeastern regions (Climate Change Post 2020). Over the last 20 years, the frequency of droughts has doubled in Crimea, and the likelihood of a 100-year severe drought event is expected to double by 2070 (Climate Change Post 2020). Climate-induced water scarcity will increase existing seasonal water shortages and water quality issues, and changes in spatial distribution will increase the vulnerability of additional regions that previously had sufficient access to water (Nikolayeva *et al.* 2012).

Diminishing accessibility of safe drinking water will continue to increase pressure on ageing distribution infrastructure (Adamenko *et al.* 2016). Water, sanitation and hygiene needs are particularly at risk in rural areas, where 70 per cent of households are unable to pay communal service bills. Further, the number of settlements having access to centralized services has dropped significantly since the independence of Ukraine, as has sewerage supply (Adamenko *et al.* 2016). Due to reduced precipitation this year (2020), Ukraine may need to restrict water use for the first time in 120 years (Hurska 2020).

Additionally, the ongoing conflict in the Donbas region exacerbates climate-induced vulnerability to water shortages and floods as critical water infrastructure suffered heavy shelling damage and continues to interrupt the water supply to 400,000 people (OCHA 2019).

The intensification of extreme cold and extreme heat events is increasing peak stress on power distribution systems, which rely heavily on non-renewable energy (Shevchenko *et al.* 2014). Ukraine's ambition to address energy scarcity in remote rural areas and increase its share of sustainable hydropower production will be greatly affected by the climate-induced reduction of river flows (Nikolayeva *et al.* 2012).

2.2 Health

With a projected increase in the frequency and duration of heatwaves, Ukraine is facing additional health complications and morbidity within vulnerable populations such as elderly people, children and people with cardiovascular problems (Nikolayeva *et al.* 2012). With cardiovascular problems being the leading cause of 60 per cent of all deaths in Ukraine, the growing impacts of intensified heatwaves (particularly in urban areas) are likely to cause significant pressure on medical facilities (Climate Change Post 2020). In addition, extreme heat and decreased precipitation during hot months is likely to exacerbate respiratory, heart and blood vessel diseases – Ukraine already faces unsafe levels of air quality due to its ageing industrial infrastructure, polluting power generation and increasing numbers of forest fires (International Association for Medical Assistance to Travellers (IAMAT) 2020; World Bank Group, n.d.).

Food-borne and waterborne diseases are also more likely to escalate with temperature increases and could cause an additional 50 per cent spike in salmonella infections by the period 2071–2100 (World Health Organization (WHO) 2013). Additionally, the transmission area of vector-borne diseases such as *dirofilaria* will extend by 15 per cent due to increased temperature (Kartashev *et al.* 2014).

Health infrastructure damage and increasing medical needs linked to armed conflict are already estimated at 184 million US dollars; therefore, Ukraine's health system is vulnerable to additional pressure caused by climate-induced events (Global Facility for Disaster Reduction and Recovery (GFDRR) 2016). It is estimated that 2.2 million people affected by the conflict currently require the provision of essential healthcare services. This number will continue to grow as climate impacts increase (WHO 2018).

Health infrastructure is inadequately equipped to deal with growing climate-driven demand. Energy insecurity from high dependency on imports and demands during severe winters are coupled with inefficient hospital buildings; the energy demand of hospitals in Ukraine is double that of those in Germany (G7 Kitakyushu Energy Ministerial Meeting 2016). This gap has been recognized and addressed insofar as six hospitals were renovated in 2018 and 2019 (UNDP 2019a; Twigg 2020).

Since 2015 the Ministry of Healthcare of Ukraine has been working closely with UNDP to implement a planetary healthcare initiative. In explicit recognition of the links between human health and the natural environment (UNDP 2017), this project aims to combat greenhouse gas (GHG) emissions by increasing the sustainability and transparency of medicine procurement (UNDP n.d.(b)). This is an important step, given that Ukraine has one of the highest GHG emissions globally (USAID 2016b).

Health impacts which climate change is contributing to indirectly include increased stressors on social determinants of health; for example, increased poverty levels, more mental health stressors, and food stress from projected 'significant decreases' in the diversity and quantity of staple crops (Government of Ukraine 2017).

Finally, the confluence of climate change and conflict in Ukraine has created a series of cascading and interrelating impacts. Armed conflict has contributed to deteriorating water quality and topsoil; increased pollution; significant damage to industrial facilities; flooding in mines; weakened environmental protection; increased biodiversity loss; and decreased 'agricultural and epidemiological security' (OSCE 2017). This erosion of governance capacity and increase in threats to environmental health in turn has the potential to jeopardize human health, especially if climate-driven impacts amplify or reinforce conflict zones (OSCE 2017).

2.3 Economic security

Ukraine's economic vulnerabilities to climate change are primarily derived from significant potential agricultural losses; increased pressure on water resources required for industrial production; disruption of the production and transport of Ukraine's energy sector; and declines in coastal environments suitable for tourism and fisheries (USAID 2016a).

Although agriculture only represents 12 per cent of Ukraine's GDP, agricultural land covers 70 per cent of the territory and the sector employs one-quarter of the working population (Nikolayeva *et al.* 2012). Increased seasonal variability of precipitation and frequency of extreme events are having increasingly significant impacts on important cash grain production, which can fluctuate up to 50 per cent during winter and 74 per cent during summer, based on the weather conditions (World Bank Group n.d.). With only 5 per cent of grain crops having access to irrigation, the agricultural sector is not equipped to face the increasing frequency and severity of projected droughts and water shortages (Climate Change Post 2020). In 2000–2010, 80 per cent of grain production has already been impacted by five different drought events, causing losses estimated at 3 billion euro (3.5 billion US dollars) in 2003 and 2007 alone (Walz *et al.* 2018).

Although projected temperature increases could extend productive areas in northern regions, the increasing likelihood of extreme cold spells and snowfall events could destroy and destabilize important winter grain production (70 per cent of crops were destroyed in 2003 due to an alteration in thaws and cold spells) (Nikolayeva *et al.* 2012). Climate-induced impacts on agriculture are projected to have severe impacts in eastern regions that are experiencing ongoing conflict and have high vulnerability to drought and precipitation decreases (Walz *et al.* 2018; Gnatiuk *et al.* 2013).

Additionally, Ukraine has already been facing significant soil degradation due to water and wind exposure, with the annual economic impact of soil loss estimated at one-third of the agricultural GDP (USAID 2016a). Floods and the increasing frequency and intensity of extreme precipitation are projected to further exacerbate agricultural land degradation (Nikolayeva *et al.* 2012).

Climate-induced stressors on agricultural production pose a significant threat to local food security, with particular concerns about food availability in conflict zones where 1.2 million Ukrainians already face food insecurity (Thomson Reuters Foundation 2017). Additionally, grain nutritional value is projected to decrease due to changes in meteorological conditions (Boychenko *et al.* 2013).

Ukraine's coastal environments are vulnerable to sea-level rise of the Azov and Black Seas induced by global warming (Nikolayeva *et al.* 2012). Projected sea-level rise of 22–115 centimetres (cm) will intensify soil salinization and waterlogging, as well as flooding of coastal lowlands, impacting settlements near estuaries and potentially leading to the complete destruction of many tourism resorts (Nikolayeva *et al.* 2012).

Ukraine has the largest energy market in Europe due to high energy consumption (International Energy Agency (IEA) 2020). The projected impacts of climate change on Ukraine's energy sector include an increase in demand for electricity to face warmer summer months, thus increasing pressure on old power units (of which 95 per cent have reached the end of their lifespan) (Climate Change Post 2020).

2.4 Protection

The ongoing armed conflict, caused by Russia's annexation of Crimea and the Donetsk and Luhansk regions' proclamation of independence, triggered an internal displacement crisis, which has compromised people's ability to adapt to climate change impacts and caused significant disruption to the accessibility of essential services (Cazabat and Tucci 2019; OSCE 2017).

The armed conflict caused over two million IDPs, from which only 800,000 are located in the government controlled territory ((Cazabat and Tucci 2019). In addition to lacking access to governmental services and aid, 2.7 million people live in the eastern regions of Ukraine which, in addition to exposure to the armed conflict, are identified as particularly vulnerable to climate-induced drought and disruption of precipitation patterns (Gnatiuk *et al.* 2013; Waltz *et al.* 2018). On top of environmental stressors, farmers in conflict zones continue to face increased income insecurity as they have lost access to their traditional markets along the conflict line and non-government controlled areas (Rozwadowski *et al.* 2018).

Half the economic impact of the conflict is linked to loss of livelihoods, with only 40 per cent of IDPs employed (Cazabat and Tucci 2019). One-third of the people requiring humanitarian assistance are over 60 years old and pensioners; they are required to cross the conflict line to the government side to withdraw pension and assistance, waiting in a queue at checkpoints exposed to seasonal environmental conditions including extreme heat or cold (Bacchi 2017a).

2.5 Policy

When Ukraine joined the European Union (EU) in 2014, it committed to working to align national policies with EU laws surrounding climate change, waste management, GHG emissions, energy efficiency and renewable energy. Its commitment to mainstreaming climate mitigation and adaptation grew with the approval of the country's Nationally Determined Contribution (NDC) in September 2015, and being among the first to ratify the Paris Agreement in July 2016. In December 2016, these were followed by the 'concept of realization of the state climate change policy for the period up to 2030' and Ukraine's Intended Nationally Determined Contribution (INDC). Highlights from these policies include a commitment to reduce GHG emissions by 60 per cent of 1990 levels; increasing institutional capacity to combat climate change; and building stronger climate resiliency and GHG absorption (Government of Ukraine 2017; Ministry of Environmental Protection and Natural Resources of Ukraine 1998; Government of Ukraine n.d.).

Conflict factors in the climate policy of Ukraine to such an extent that critics cited the Russo-Ukrainian War as a reason for these 'unambitious' climate commitments, with the government at the time agreeing to strengthen policy "after the restoration of [Crimean] territorial integrity and state sovereignty" (Climate Change News 2015). Since then, climate policy has been burgeoning, with a host of new laws introduced to work towards climate commitments. To date, there has been a strong focus on mitigation measures, although climate adaptation is gaining traction. Notable legislation includes:

1. Ukraine 2050 Low Emission Development Strategy (approved in 2015; published in 2017) outlines a vision for a low carbon future vis-à-vis: decarbonizing the energy sector, reducing non carbon dioxide (CO₂) emissions (by reducing inefficiencies and leaks in the extraction and transportation of fossil fuels, improved waste treatment, and optimization of agricultural practices); and increasing the carbon sink capacity of forests (Government of Ukraine 2017).
2. Ukraine Law Number 605 '2035 Energy Strategy: Security, Energy Efficiency, Competitiveness' (2017), which pledges to increase renewable energy to 25 per cent of energy supply and 'reduce GDP energy intensity' (Government of Ukraine 2017).
3. National Transport Strategy of Ukraine to 2030 (2018), which outlines four priorities: an enhanced transport system; development of the transport industry; increased energy efficiency in transport; and interregional integration (Ministry of Infrastructure of Ukraine n.d.).
4. Since 2018, Ukraine has worked to combat land degradation and desertification by 2030; "Preservation and protection of arable land against land degradation and desertification is a national priority in Ukraine and is essential for ensuring the sustainable development of agricultural landscapes and the reduction of rural poverty," (FAO 2018).
5. Collaboration with the EU and UNDP on the EU4Climate project (2019–2022), from which Ukraine should be able to develop forward-looking mitigation and adaptation strategies for climate change (UNDP 2019b).
6. Further commitments to adaptation are found on the Government of Ukraine's government portal, which states that "preventing and adapting to climate change" are key components of good governance reform, and outlines plans for the development of a national strategy of adaptation to climate change (added emphasis) (Cabinet of Ministers of Ukraine n.d.).

Despite this progress on the policy front, there remain critical gaps in implementation. The EU–Ukraine Civil Society Platform released a report in 2018 reviewing Ukraine's progress to date and outlined major areas to address, including the need for institutional capacity building; the need for increased focus on adaptation (especially as it relates to water management); and more progress towards low carbon development (EU–Ukraine Civil Society Platform 2018). While Ukraine is making progress towards domestic targets, as of August 2020 Climate Action Tracker has warned that Ukraine's efforts are trending towards 'critically insufficient' to reach the Paris Agreement target of limiting global warming to 1.5°C (Climate Action Tracker 2020).

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