

Syria

1. Country overview

The Syrian Arab Republic, or Syria, is located in Western Asia and borders Lebanon, Iraq, Israel, Jordan and Turkey, and is east of the Mediterranean Sea. The capital of Syria is Damascus, located in the south-west of the country.

Syria is currently in the grip of a civil war that has affected millions of people. This conflict started in 2011 and estimates indicate that more than 13 million Syrians have been displaced, of which half internally (United Nations High Commission for Refugees (UNHCR) 2021).

Syria ranks 146 out of 181 countries in the Notre Dame Global Adaptation Initiative (ND-GAIN) index. The ND-GAIN index summarizes a country's vulnerability to climate change and other global challenges in combination with its readiness to improve resilience. This ranking indicates that Syria has high vulnerability levels and low levels of readiness to adapt to climate change (ND-GAIN 2020).

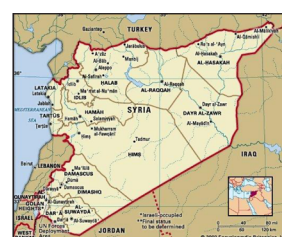


Figure 1: Map of Syria.
Source: [Encyclopædia Britannica](https://www.britannica.com/place/Syria)

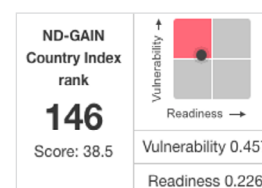
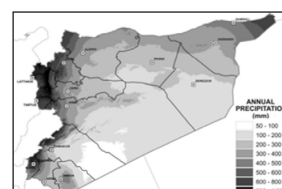


Figure 2: Syria's ND-GAIN Ranking (ND-GAIN 2021).

1.1 Climate

Syria has a combination of arid and semi-arid environments. The total country area is 185,880 square kilometres (km²), the majority of which is covered by the Syrian desert. Natural forests cover approximately 2 per cent of the landscape, and water covers less than 1 per cent of it (Food and Agriculture Organization of the United Nations (FAO) 2014). Groundwater is known to take hundreds to thousands of years to replenish in arid and semi-arid environments (FAO 2014). Most of the country receives very little rainfall; about 60 per cent of the country averages less than 250 millimetres (mm) of rain annually. In the Syrian desert, situated in the central and south-east parts of the country, it is common for annual precipitation levels to fall well below 100mm



(United States Agency for International Development (USAID) 2017). Nonetheless, some areas near the Mediterranean Sea receive up to 1,000mm of rain per year.

In spring (March–May) and less often in autumn (September–November), Syria is sometimes affected by strong southerly winds that cause massive sandstorms that raise the temperature considerably. These sandstorms damage vegetation and prevent livestock from grazing. Contributions to frequent sandstorms include the degradation of green terrestrial cover, which is caused by overgrazing, desertification, soil erosion and salinization, and unsustainable irrigation practices (Soniak, 2017).

1.2 Climate change

Historical Climate

Projected climate

Temperature

Average temperatures have been rising in Syria, and the country is now approximately 0.8°C hotter today than it was 100 years ago (World Bank Group 2014; International Research Institute for Climate and Society (IRI) n.d).

Temperatures will continue to rise in Syria and are expected to be at least 2°C higher by 2050 (World Bank Group 2014; World Bank Group n.d.). This will be associated with a decrease in the number of frost days and an increase in heat extremes.

The country has experienced heatwaves in the recent past, with temperatures 8–10°C higher than usual (USAID 2017).

Warming is expected to be more dramatic in the interior regions compared to the coast. Models predict that extreme temperatures will increase and the hottest day of the year could be 4–10°C hotter by the end of this century, depending on the magnitude of global climate change (World Bank Group n.d.).

Precipitation and water

There has been a trend towards warmer and drier conditions in the Eastern Mediterranean, and this is seen as the main reason behind the intensity of the 2006–2011 drought (Kelley 2015), however this has been contested (Selby *et al.* 2017).

Several studies suggest that both the frequency and intensity of droughts, especially near the Mediterranean Sea, will increase as global temperatures rise. “With much of the infrastructure in ruin and minimal governance because of the civil war, Syria is more vulnerable than ever to future climate-influenced shock” (USAID 2017).

While there have been more frequent droughts in the recent past, some seasons have also seen extra rainfall or flooding (USAID 2017).

While a few climate models show a possibility of increased rainfall, most of them show an overall decrease, especially in the winter (World Bank Group n.d.). Precipitation has been projected to decrease by 11 per cent over the next three decades, especially in the winter, spring and fall (USAID 2017).

Globally, sea levels have risen by approximately 21 centimetres (cm) since 1880 (Church and White 2011). This has impacts on coastal areas, with inundation risk, displacement of lowlands, and increased vulnerability from coastal erosion, coastal flooding and damage, and salinity of aquifers (Faour and Fayad 2008).

Globally, sea levels are projected to rise by an additional 20–30cms by 2050 and from 50–200cms by 2100, depending on levels of emissions; with at least one study ranging as high as 280cms (Kulp and Strauss 2019). Therefore, sea level rise poses a significant threat to coastal communities and infrastructure, and increases the risk of saltwater intrusion along the coast of Syria.

Dust storms are a regular phenomenon in Syria, with a particularly large storm causing destruction in 2015 that was likely caused by a period of very hot and dry weather (Parolari *et al.* 2016). These storms can originate from deserts across the region and have different microbes and characteristics (Gat *et al.* 2017).

Since dust storms happen during times of extreme heat and dryness, it is likely that climate change exacerbates the conditions that allow large dust storms to form (Parolari *et al.* 2016).

2. Humanitarian sectors and climate change

2.1 Water and habitat

Water

There are seven main hydrographic basins in Syria: Al Jazeera, Aleppo, Al Badia, Horan or Al Yarmook, Damascus, Asi-Orontes and Al Sahel. In addition, there are 16 main rivers in Syria, six of which are international. The main groundwater aquifers are those of the Anti-Lebanon, the Alouite Mountains and the Damascus plain (FAO AQUASTAT 2008). Syria has agreements with some of its neighbouring countries allocating how much, and from which river, water resources may be used. Water is defined as a 'public good' by Syrian law and is, therefore, not treated according to market forces (Salman and Mualla 2008).

Due to slow recharge and high depletion rates, reliance on groundwater and rain has pushed Syria to be at a high risk of drought. Over-withdrawal of groundwater in Syria's north-east has resulted in the drying up of the Khabur River; which, in turn, has created an even greater reliance on groundwater (Hole 2009). In some conflict-affected areas, much of the water supply systems have been interrupted or are out of service, while other places receive water from a main water station during an allotted time once a week (ICRC 2020). Lastly, relying on transboundary rivers adds an extra level of complexity in terms of negotiations with neighbouring authorities (FAO AQUASTAT 2009).

Desertification and land degradation can be attributed mainly to the drying and overexploitation of natural resources (water, mostly), ever-increasing population growth, and deforestation (Abahussain 2002). Other natural factors are those attributed to pre-existing climate change effects that have already started to manifest in the form of floods, forest fires and drought.

Syria has experienced a long-term drying trend, which is likely to continue with increased climate change (Terink *et al.* 2013). The main issues include a depleting groundwater table and a decline overall rainfall (USAID 2017). Expected salinization of farmland soil and bore-wells will make them unfit for drinking or agricultural purposes. Research suggests that previously rare severe multi-year droughts are two to three times more likely due to warming and drying trends (USAID 2017). In addition, river runoff is expected to decline as precipitation in the Syrian and Turkish mountains reduce, "likely increasing dependence on groundwater and rainwater" (USAID 2017).

Energy

Most of the energy consumed in Syria is from fossil fuels, complemented by a very small amount of hydropower (WorldData n.d.). Increased temperatures cause an increase in water evaporation, which can have implications for the availability of surface water and the operation of hydropower facilities (Blackshear *et al.* 2011).

Infrastructure

More than 11 per cent of Syria's population lives in the Mediterranean Sea coastal zone. The zone takes up a mere 2 per cent of Syria's landmass. Coastal cities have largely been untouched by the war and provide a relatively stable environment (USAID 2017). The coastal plains are an extremely important part of the country's economy.

With a coastline on the Mediterranean Sea, there are several potential risks related to sea level rise. Rising sea levels threaten erosion, critical coastal infrastructure and agricultural areas. Additionally, saltwater intrusion and contamination can impact groundwater sources in the area, further threatening the region's agricultural productivity (Faour and Fayad 2008).

Urban planning should take climate change into account when designing spaces and infrastructure. Ensuring that urban dwellers have access to water and wastewater systems by repairing and upgrading infrastructure to be resilient to climatic hazards will help essential services to continue operating. Climate change adaptation needs include repairing infrastructure such as roads, dams, water-catchment areas, and irrigation systems. Increased temperatures affect the durability of construction materials; for example, the asphalt used for roads can buckle during a heatwave if not designed with rising temperatures in mind (Willway *et al.* 2008).

Furthermore, increased temperature extremes, especially for extended periods, can result in increased morbidity and mortality. This necessitates the promotion of passive cooling strategies in building design and construction (Singh *et al.* 2019).

2.2 Economic security

The agriculture sector in Syria employs 17 per cent of the total workforce and contributes 20 per cent of the country's gross domestic product (GDP) (CIA 2021). Syria mainly produces cotton, wheat, olives and barley. Although Syria's main cash crop cotton is water intensive, the country faces extensive land degradation and reduced water supply due to the continuous clearance of natural forest, excessive livestock grazing, agricultural expansion into natural environments, unconventional irrigation practices, and soil salinization. These in turn limit the country's agricultural productivity (FAO AQUASTAT 2008).

Climatic factors such as unequal and limited rainfall, changing temperatures and wind, and human population growth and urbanization have all affected the quality of soil. Since the mid-80s, forest fires have affected more than 8,000 hectares (ha) of land in the Syrian mountainous region, which further contributed to water erosion in a region that was already susceptible to it (Almohamad 2020). Research indicates that climate change has already caused decreases in the agricultural production of rice (by 30 per cent), maize (by 47 per cent) and wheat (by 20 per cent) in the Middle East and North Africa (United Nations Framework Convention on Climate Change (UNFCCC) 2010).

Another study by NASA found that the 2006–2011 drought in the Middle East was the worst in 900 years, and its aftereffects can still be felt today (Cook *et al.* 2016). Before the drought, agriculture accounted for at least one-quarter of Syria's GDP, one-third of all land use, and 90 per cent of its water use. Most crops are rainfed in Syria and only one-third of the farmers rely on an irrigation system or groundwater. Approximately 75 per cent of Syria's wheat crop comes from drought-affected areas in the north-eastern region. Since a majority of the farmers rely on rain or groundwater, and the seeds require moist soil to germinate, dryness during the planting

period often results in a failed crop cycle (Faour and Meslmani 2010). The Syrian government also subsidizes crops that are water-intensive (such as cotton and wheat), however, they are much harder to grow due to the unpredictable precipitation patterns.

Warming and drying in Syria also threatens livestock. The 2006–2011 drought was responsible for killing up to 85 per cent of livestock in some regions (Shank and Wirzba 2013). One climate change adaptation strategy for livestock is to grow and maintain a fodder bank for community use. Additional supports could include high-quality farming supply and seeds and expanding farmer skillsets by providing on-the-ground training.

Future projections show a good chance of rainfall declining below current levels, and groundwater table levels will not only continue to decline, but could also become contaminated in some regions. Combined with an additional decrease in water runoff from the mountain snow, rivers will flow at lower levels, leaving even less water available for agriculture (Faour and Fayad, 2014).

Beyond agricultural producers themselves, people who work for wages are vulnerable to price spikes in food staples, both from climate events that affect local production as well as climate events in the rest of the world that affect global supply chains and international food prices (FAO 2015).

2.3 Health

Syria has long had severely strained (and damaged) health institutions, especially since the civil war began. In 2013, the World Health Organization (WHO) reported that approximately 35 per cent of Syria’s hospitals are out of service; and, depending upon the region, up to 70 per cent of healthcare professionals have fled the country. The country has not been able to refill most of these positions. Cases of diarrhoea and hepatitis A have increased dramatically (WHO 2013). Syria, many health facilities are either functioning at half capacity or have been forced shut (ICRC 2020).

Frequent sandstorms across the country have resulted in an increase in the number of people with diagnosed respiratory issues in addition to obscured visibility and general disruption to daily life. As sandstorms increase in the future because of increased dryness and hot temperatures, this may cause an increase respiratory illness (World Bank Group 2019).

As droughts become longer and more intense, incidences of nutritional deficiencies are expected to increase, too. At the height of the 2006–2011 drought, there was a large increase in nutrition-related diseases in children (USAID 2017). Drought-tolerant rodents can also be vectors of disease (WHO 2008). While droughts are associated with waterborne and vector-borne diseases, flood events can also cause an increase in waterborne diseases, especially in places with poor facilities for sanitation. Waterborne diseases such as typhoid and severe diarrhoea can flare up with irregular rainfall (Centers for Disease Control and Prevention (CDC) n.d.).

Lastly, climate-related disasters such as heatwaves, floods, droughts and dust storms all have an effect on an already strained public health infrastructure (Gleick 2014). Extreme heat can increase morbidity and mortality in the most vulnerable such as older people, especially those above 65 years of age; people with pre-existing health conditions, such as heart disease, respiratory illness and diabetes; young children; and people who are homeless or have inadequate housing, such as those living in camp settings (Singh *et al.* 2019).

Vulnerable populations may require physical rehabilitation, primary healthcare, comprehensive hospital care, and other healthcare. Millions of people in the north-east of Syria are coping with fighting, destroyed infrastructure and lack of critical basic services, on top of the global COVID-19 crisis (ICRC 2020). Additionally, it is important and imperative to address the mental health of people living through grave civil unrest.

2.4 Protection

Among the most vulnerable population in Syria are the roughly 6.7 million Internally Displaced Persons (IDPs) as well as the combined hundreds of thousands of asylum seekers, refugees and returned IDPs, among others (United Nations High Commissioner for Refugees (UNHCR) 2021). Displaced people, including IDPs and refugees, are often particularly vulnerable to climate extremes. This includes flood events that can quickly destroy the limited infrastructure in camps, as well as heatwaves that leave people with few options for cooling and shelter. In 2019, heavy rainfall in north-east Syria affected IDPs who had recently relocated to Al-Hasakeh Governorate (Glide 2019).

In addition, people in detention frequently have heightened vulnerability to natural disasters due to: spatial marginalization resulting from prison locations on hazard-prone land and/or isolation from emergency evacuation services; limited to no connections to social networks, which are crucial aspects to hazard resilience; and political marginalization, including lack of policies and services to prevent disaster impacts on imprisoned populations (Gaillard and Navizet 2012). These vulnerabilities, coupled with more frequent and intense disasters due to climate change, may leave prison populations in especially precarious positions to hazards such as extreme heat and flooding.

2.5 Policy

Syria ratified the Paris Agreement in 2017. It also submitted its first Nationally Determined Contribution (NDC) under the UNFCCC in 2018, which outlines the country's climate change mitigation and adaptation commitments. Syria has committed to greenhouse gas reduction strategies across energy, land management, transport, industry, solid waste and the housing sector.

Syria's adaptation priorities include water resource management, biodiversity conservation, combating desertification, coastal management planning and early warning system development. The water resource management component of this commitment prioritizes: water resource protection, reducing water losses, efficient irrigation schemes, water harvesting, wastewater treatment, and improved agricultural practices. The biodiversity priorities include propagation of endangered species, rehabilitation of nature reserves, assessment of degraded forests, and fostering sustainable ecosystem livelihood benefits. Land degradation priorities include improved land management practices, programmes to rehabilitate soil, and deploying strategies to reduce dust-storms. Coastal management priorities include protection of coastal infrastructure, and marine restoration (by Israel). Finally, early warning system priorities are centred on drought, extreme rain, floods and dust-storms (Syrian Arab Republic 2018).

The Ministry of State for Environment Affairs (MSEA) "is responsible for enacting all environmental laws in Syria and is the national agency responsible for climate change issues. They focus on four main issues: identifying national circumstances; create and maintain an inventory of

greenhouse gas emissions; develop and maintain programs to measure climate change adaption; and develop and report on programs that measure the mitigation and reduction of greenhouse gas emissions” (UNFCCC 2010).

There is a need for science-informed policy on water supply, water use, irrigation practices, and land use. Development and maintenance of interactive, integrated resource policy will be key, along with the promotion of conservation measures and disaster risk management. In Syria, the responsibility for dealing with water resources management lies with a number of ministries, which are all represented under the Council of General Commission for Water Resource Management (FAO AQUASTAT 2008).

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