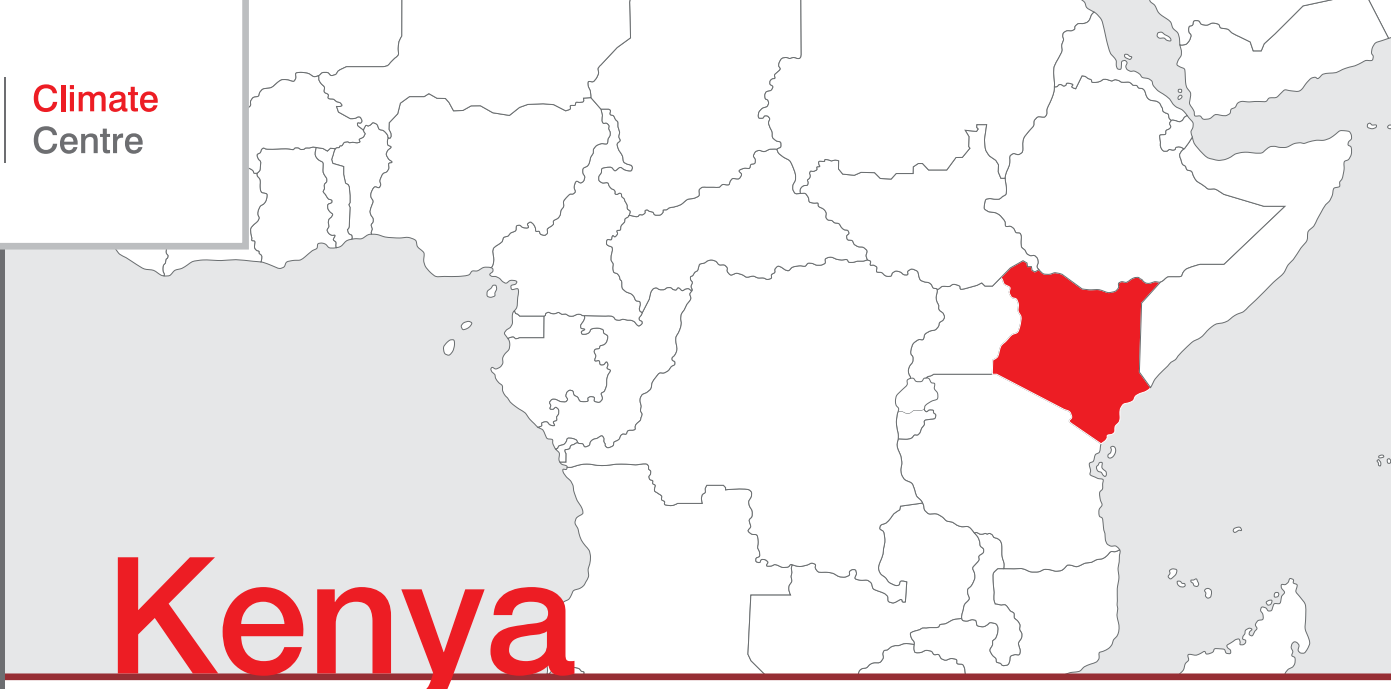
Climate Centre

Country-level | Climate fact sheet



Kenya

1. Country overview

Figure 1: Map of Kenya. Source:CIA Factbook, 2021

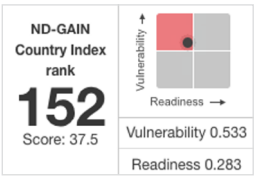


Figure 2: Kenya's ND-GAIN Ranking (ND-GAIN 2021).

Kenya is located along the east African coastline, it is geographically varied and experiences a number of seasons and climates. The northern part of the country is arid and dry, contributing to the 80 per cent arid or semi arid classification. There are a number of higher mountain regions with glaciated peaks, notably Mount Kenya, which rises to 5199m. The eastern part of the country is made up of coastline that runs south to north on the Indian Ocean for 1,586 km, predominantly made up of mangroves, coral reefs, sea grass, and rocky, sandy and muddy shores (Brown 2010).

Demographically, Kenya comprises approximately 52,574,000 people (UN Population Division 2019), a population that has been steadily increasing at a steady rate, and projected to reach 125,424,000 by 2100. As of 2018, the GDP stood at 4,521 International USD per capita (World Bank 2021) and the GINI coefficient at 40.8, indicating a large disparity in wealth and high inequality. While only just over a quarter of the population is urban, urbanization is rapidly growing due to a growth rate of over four percent (CIMA & UNISDR 2018).

Over the past decade, Kenya has actively been driving political, economic, and structural changes. When coupled with a young and growing demographic (with a median age of 19 years old), this positions Kenya to be able to build robust economic growth and pursue sustainable development (CIMA & UNISDR 2018).

1.1 Climate

Kenya's climate changes significantly between the coastal to the inland areas. Coastal areas are characteristically hot and humid, while the majority of inland areas are temperate. The north and north east of the country is typically very dry (The Netherlands Ministry of Foreign Affairs 2018). Most of the country is classified as arid or semi-

2021

with support from the ICRC

arid, with 80 per cent of the country receiving less than 700mm of rainfall per year on average. This figure varies across the country; the northwest and east receive on average 200mm/rainfall/year while the Lake Victoria and central highlands can see up to 1200-2000 mm/rainfall/year (Parry *et al.* 2012).

1.2 Climate change

Historical Climate

Climate Projections

Temperature

- Since 1960, Kenya's mean annual temperature has increased by 1.0°C, at an average rate of 0.21°C per decade (World Bank 2021; McSweeney *et al.* 2010.)
- The Government of Kenya reported that while average increases were 1.0C, the driest areas saw an increase of 1.5C during the same period (GoK, 2018).
- Kenya;s mean annual temperature has increased by 1C since 1960, averaging 0.21C increase per decade (World Bank 2021).
- This rate of growth increases in the months of March to May, and slows from June through September (World Bank 2021).

- Temperature increases across models show similar trends: Between the years of 2000-2050, an increase of up to 2.5C is expected in the country, with 1.2 as the most likely range (Odera et al 2013).
- Other models indicate a projected increase between 1.2 - 2.2 C (USAID 2018).
- By 2100 a warming range between 1.3C to 3.9C is expected, with some extremes showing in models to be up to 4C by 2100. These high increases are projected for the northern and western areas of the country (CIMA & UNISDR 2018; Government of the Netherlands 2018).
- Climate change is projected to increase the intensity of dry spells and drought, and to prolong heat waves (CIMA & UNISDR 2018; USAID 2018).
- Semi-arid counties face an exacerbated effect of global warming; it has been estimated that with global warming of 2°C, warming of 3.2-4°C has been estimated for drylands (Huang et al 2017).

Water Distribution

- In the past few decades, the frequency of March-May drought in East Africa has increased (Lyon and DeWitt 2012, Liebmann et al 2014)
- There was a sea level rise of 5.8 cm observed between 1932-2001 (USAID 2018).
- Rainfall intensity along the coastline has increased causing significant challenges such as floods.
- There has been a loss in glacial volume of more than 66% in the last century, with Lewis Glacier on Mt. Kenya losing 90% (USAID 2018).

- Water distribution is projected to change in the future with expectations of increased frequency and intensity in rainfall, causing floods and associated hazards (such as landslides) (Parry *et al.* 2012; USAID 2018). This change will largely be present along the coast and in the highlands (CIMA & UNISDR 2018).
- The frequency of extreme positive Indian Ocean Dipole and El Niño events are expected to increase under greenhouse warming (Cai et al 2014a, Cai et al 2014b): these events are associated with very heavy rainfall during the October-December rains and so an increased frequency of very wet short rains seasons (such as 1997 or 2019) is anticipated, with associated risk of pluvial flooding
- Water deficits are also predicted to increase in frequency, leading to prolonged drought periods. These will predominantly affect the eastern and northern areas of the country (Parry *et al.* 2012).
- Rising sea levels are predicted to cause issues of coastal erosion, loss of coastal wetlands, and saltwater intrusion (SEI, 2009, The Netherlands MoFA, 2018). Sea levels are expected to rise between 16-42 cm (USAID 2018).

with support from the ICRC

1.3 Climate vulnerability

Kenya has contributed less than one percent of global GHG emissions and as such has "little historical or current responsibility for global climate change" (NCCAP 2018). Yet for climate vulnerability, Kenya ranks 151 out of 181 countries in the ND-GAIN index. Kenya is the 31st most vulnerable country and the 37th least ready country – meaning that it is very vulnerable to, yet unready to combat climate change effects (ND-GAIN Index 2021).

Kenya's most vulnerable areas to climate change are the Arid and semi-arid lands (ASALs) in the north and east, where both crop and livestock production are expected to suffer increasingly from droughts (The Netherlands MoFA). Sectors which are especially vulnerable include biodiversity, infrastructure, health, agriculture, and water (Potsdam & GIZ 2021). The ways in which climate impacts affect and exacerbate sector vulnerabilities is outlined in the following sections.

with support from the ICRC

2.Humanitarian sectors and climate change

2.1 Water and habitat

Climate change will have a growing impact on water resources in Kenya, which are already experiencing stress due to burgeoning population growth and deforestation (USAID 2018). Key drivers of reduced access to water include: glacial loss, increased rainfall variability, temperature increases leading to increased evaporation rates, and increasing contamination of water sources due to flooding and/or drought (USAID 2018). Cumulatively, this will lead to reduced access to surface water for critical uses such as household use, livestock production, and industry (NCCAP 2018). In 2010 water availability in Kenya was 586m^3; this is projected to decrease to just 293m^3 by 2050 (the acceptable threshold is 1000m^3 per person) (USAID 2018).

Floods impact an average of 75 000 Keyans annually, with concentrations in urban areas such as the Nyanza, Western, Rift Valley and Nairobi provinces (CIMA & UNISDR 2018). In coastal areas, flooding from sea level rise will affect an estimated 10,000 to 86,000 people a year by 2030 (across the scenarios). The rise– projected at 40cm under RCP6.0 – will also cause coastal wetland loss, saltwater intrusion, and coastal erosion (Potsdam Institute & GIZ 2021). The associated economic costs in 2030 are estimated to be $7–58 million per year (current prices, no discounting) including flooding. By 2050, these costs could increase to $31–313 million per year (SEI 2009). The biggest economic losses due to increasing floods are anticipated to be close to Lake Victoria (CIMA & UNISDR 2018). Rising sea levels and an increasing frequency and severity of flood events will also threaten transportation and energy infrastructure (USAID 2018).

Conversely, droughts impact an average of 6.5 million Kenyans annually (13 per cent of the population); this is projected to rise to 34per cent of the population in the future (CIMA & UNISDR 2018).

Hydropower potential is expected to maintain relative stability due to geographic variability in rainfall patterns, with production predicted to increase in some areas and decrease in others (CIMA & UNISDR 2018). Nevertheless, hydropower production has been shown to drop by up to 40per cent in drought years, increased energy insecurity and shifting reliance to petroleum-based energy production (USAID 2018).

with support from the ICRC

2.2 Economic Security

Climate change is expected to affect the economic outlook of Kenya through impacting key sectors of the economy such as agriculture, tourism, and ecosystem services. Models project that climate change will lead to losses "equivalent to 2.6per cent of the GDP annually" by 2030 (USAID 2018).

Ecosystem services are integral to the Kenyan economy and underpin large parts of GDP, foreign revenue, and export earnings, as well as sustaining a very large proportion of the population (SEI 2009). They are also vital to the country's thriving tourism industry, estimated to be worth $2.5 billion USD (nearly four percent of the GDP) (USAID 2018). They are jeopardized by climate change, which is driving increased coastal erosion, increased prevalence of wildfires, increased coral bleaching, and increased displacement of elephants, lions, and buffalo – key draws in the tourism sector (USAID 2018).

Staple crops and livelihoods are also at risk. Increasing droughts are projected to jeopardize economic growth, with 42per cent of the GDP expected to be exposed to drought (currently just 16 per cent is) (CIMA & UNISD R 2018). Those who live below the poverty line and those dependent on agriculture are particularly vulnerable (Waithaka *et al.*, 2013); almost two thirds of Kenyans (60 per cent) work in agriculture, which is primarily rainfed (98 per cent) and as is threatened by climate shocks (USAID 2018). Agricultural losses will increase by 50 per cent, with the biggest drops anticipated to be for staple crops such as cassava, sweet potato, wheat, and cabbage, as well as key exports such as tea and coffee (CIMA & UNISDR 2018; NCCAP 2018). Livestock exposure to drought will double (CIMA & UNISDR 2018); higher temperatures will increase heat stress, disease prevalence, and death in livestock while also lowering production (NCCAP 2018). Crops such as beans and maize will need to shift to higher elevations, and lowland crops will experience yield decreases of 20 per cent (USAID 2018). Geographic impact will spread from concentrations in the west to country-wide (CIMA & UNISDR 2018).

Further climate-related threats include pest infestations such as locusts. In 2020, Kenya experienced its worst locust infestation since the 1940s, destroying staple crops and jeopardizing the food security of more than three million Kenyans. The threat of locusts is growing as cyclones increase in intensity, bringing strong winds that carry locusts across vast expanses where they were previously less of an issue (Voegele 2021).

with support from the ICRC

2.3 Health

Climate change associated rises in temperature could increase the rural population at risk for malaria by up to 89 per cent by the 2050s affecting an extra 2.9 to 6.9 million people (across the range of temperature projections) (NCCAP 2018). It will also drive a geographic shift in malarial distribution to the highlands (NCCAP 2018), which are home to 70 per cent of the population; due to low historical exposure to malaria these populations will have lower resistance (USAID 2018). The economic costs associated with health related issues are estimated at $45 to $99 million USD annually in terms of direct costs, but rise to $144–$185 million USD if full economic costs are considered (SEI 2009).

Another emergent public health hazard which has been linked to warming temperatures from climate change is the projected increase in arbovirus transmission, leading to wider prevalence of viruses such as dengue and chikungunya (Mordecai et.al. 2020).

Rising temperatures will also drive an increase in morbidity and mortality related to heat stress. Urban areas such as Nairobi and Mombasa will be particularly vulnerable due to the urban heat island effect. Heat-related deaths among elderly populations will rise from 2 per 100 000 in 1990 to 45 by 2080 (USAID, 2018). Amongst the general population, the percentage of people affected by heat waves each year will rise from 0.6 per cent in the year 2000 to 6.0 per cent annually by 2080 (Potsdam Institute & GIZ 2021). Increases in drought are projected to decrease crop yields and increase locusts, which in turn will amplify food insecurity (FEWS-Net 2020; USAID 2018) and increase stunting in a country where currently 29 per cent of children in rural areas are stunted (WFP 2021). Heat stress will also curtail livestock growth (Hansen 2009) and milk production (Habeeb et al 2018).

Finally, decreased quantity and quality of water will contribute to an increase in waterborne diseases such as cholera, typhoid, diarrhea, and Hepatitis A (IDMC 2018). The burden of this increase will be borne by the millions of Kenyans who do not have access to improved water sources (constituting fully 40 per cent of the rural and 11 per cent of the urban population) (CIA 2021).

with support from the ICRC

2.4 Protection

Climate change has been labelled a "threat to Kenya's security" due to its potential to drive increases in disasters, gender inequality, environmental degradation, multidimensional poverty, and conflicts over natural resources (NCCAP 2018).

It is estimated that climate change will exacerbate environmental hazards and disasters, which will increase the number of people experiencing displacement; both internally and internationally. The IDMC (2018) outlines the ways in which Kenya has experienced and will continue to see the effects of droughts and flooding on communities. In 2018, 120,000 people were displaced as a result of flooding, resulting in health-related concerns such as waterborne and vector borne diseases (IDMC 2018). Increased incidences of flooding are projected to lead to increased displacement (USAID 2018). Rising food insecurity associated with climate change is also projected to disproportionately impact refugee populations, who already live in isolated, food-insecure areas (WFP 2021).

Kenya is also a host country for a number of refugees and internally displaced populations (IDPs). As of January 2021, the UNHCR reported 508,033 registered refugees and asylum seekers in Kenya, most of these originating from Somalia (54 per cent) and South Sudan (24 per cent) (UNHCR 2021). These numbers are coupled with the IDPs resulting from both conflict and environmental hazards. The Internal Displacement Monitoring Centre (IDMC) reported 1400 new people living in internal displacement in 2019 as a result of environmental disasters, and 162,000 more people newly living in internal displacement as a result of conflicts in the same period (IDMC, 2018).

Increasing temperatures and unpredictability of rainfall will also affect the mobility of communities who already practice migration as a form of livelihood. The IDMC technical report on assessing drought displacement risk (2018) highlights several key findings related to the interactions between climate risks and conflict (IDMC 2018). The evidence points to regional conflicts between pastoralist groups; in theory pastoralist groups utilise communal land ownership tenure systems, but in practice regulate the use of grazing areas between and within tribes. Kaimba et al (2011) found that drought related migration from one regulated area into another was a source of conflict, both amongst pastoralists and between pastoralists and settled farmers (Kaimba *et al.* 2011).

with support from the ICRC

2.5 Policy

Kenya is active in the climate policy space and is considered a leading country in Africa in terms of policy implementation spurring climate action (USAID 2018). However, key work is still ongoing, and developments emergent. In late 2020, Kenya submitted a revised NDC, with targets increased to 32 per cent (from 30 per cent) emissions reduction by 2030 and the introduction of some unconditional targets (Ministry of Environment and Forestry 2020).

Watchdog organizations such as Climate Tracker give Kenya a rating of '2C Compatible (one of the few countries to receive this rating) and project that the country is on track to meet or exceed their Paris Agreement commitments. However, they also highlight contradictions in Kenya's climate plans. For example, Kenya now relies on 85 per cent renewable energy and is forging ahead with plans for construction of two additional coal plants, and COVID-19 recovery plans lack green measures (Climate Tracker 2020).

1. Key climate legislation includes the following:
2. National Climate Change Action Plan (NCCAP) from 2018-2022, which outlines Kenyan climate commitments (Republic of Kenya 2018).
3. National Adaptation Plan (NAP) (2015-2030) establishes priority actions and includes an overview of climate vulnerability and hazard (Republic of Kenya 2015).
4. Paris Agreement: Kenya signed the Paris Agreement and established a Nationally Determined Contribution (NDC) which outlines mitigation and adaptation measures (Ministry of Environment and Forestry 2020).
5. Climate Change Act: Signed in 2016, this framework established the National Climate Change Council, Directorate, and Fund (Republic of Kenya 2016).
6. Kenya Climate Smart Agriculture Strategy (2017-2026), which includes objectives such as increasing adaptive capacity and resilience of farmers, pastoralists, and fisher-folk, minimize agricultural emissions, and provide support through institutional frameworks (Republic of Kenya 2017).

Key institutions in Kenya's climate governance include the following (CIA World Factbook 2021):

Ministry of Energy	(specifically the Directorate of Renewable Energy) is mandated to lead the energy transition towards renewables.
Ministry of Environment and Forestry	(specifically the Climate Change Directorate) is the lead agency for the implementation of climate change plans.
Ministry of Transport, Infrastructure, Housing, Urban Development and Public Works	is tasked with lowering GHG emissions.
National Climate Change Council	tasked with mainstreaming climate change and overseeing NCCAP.
National Environment Management Authority	tasked with evaluating and enforcing climate targets.

with support from the ICRC

References

Brown, S,. Kebede, A, & Nicholls, R,. (2009). *Sea-Level Rise and Impacts in Africa, 2000 to 2100*. Southampton, UK. Retrieved from https://research.fit.edu/media/site-specific/researchfitedu/coast-climate-adaptation-library/africa/regional---africa/Brown-et-al.--2009.--SLR--Impact-in-Africa.pdf

Chaudhury, M., Summerlin, T., & Ginoya, N. (2020). *Mainstreaming Climate Change Adaptation in Kenya: Lessons from Makueni and Wajir Counties*. Retrieved from https://reliefweb.int/sites/reliefweb.int/files/resources/mainstreaming-climate-change-adaptation-kenya_0.pdf

Cai, W., Santoso, A., Wang, G., Weller, E., Wu, L., Ashok, K., Masumoto, Y. and Yamagata, T., 2014a. Increased frequency of extreme Indian Ocean Dipole events due to greenhouse warming. *Nature*, 510(7504), pp.254-258. Retrieved from https://www.nature.com/articles/nature13327.

CIA (Central Intelligence Agency). (2021). *Kenya - The World Factbook.* Retrieved March 9, 2021, from https://www.cia.gov/the-world-factbook/countries/kenya/

CIMA & UNISDR (International Centre on Environmental Monitoring and UN Office for Disaster Risk Reduction). (2018). *Disaster Risk Profile Kenya*. Savona. Retrieved from https://www.preventionweb.net/files/64257_kenyareportreviewedweb.pdf

Climate Action Tracker. (2020). *Kenya | Climate Action Tracker.* Retrieved April 21, 2021, from https://climateactiontracker.org/countries/kenya/

FEWS-Net. (Famine Early Warning Systems Network) (2020). *Kenya - Food Security Outlook.* Retrieved March 17, 2021, from https://fews.net/east-africa/kenya/food-security-outlook/june-2020

Government of Kenya. (2018). *National Climate Change Action Plan 2018-2022*. Nairobi.Retrieved from https://www.lse.ac.uk/GranthamInstitute/wp-content/uploads/2018/10/8737.pdf.

Government of Kenya. (2010). *National Climate Change Response Strategy.* Retrieved from http://www.environment.go.ke/wp-content/documents/complete%20nccrs%20executive%20brief.pdf.

Habeeb, A.A., Gad, A.E. and Atta, M.A., 2018. Temperature-humidity indices as indicators to heat stress of climatic conditions with relation to production and reproduction of farm animals. *Int J Biotechnol Recent Adv*, 1(1), pp.35-50. Retrieved from https://www.researchgate.net/publication/329232536_Temperature-Humidity_Indices_as_Indicators_to_Heat_Stress_of_Climatic_Conditions_with_Relation_to_Production_and_Reproduction_of_Farm_Animals.

Hansen, P.J., 2009. Effects of heat stress on mammalian reproduction. Philosophical Transactions of the Royal Society B: Biological Sciences, 364(1534), pp.3341-3350.Retrieved from https://www.ncbi.nlm.nih.gov/pmc/articles/PMC2781849/.

Huang, J., Yu, H., Dai, A., Wei, Y. and Kang, L., 2017. Drylands face potential threat under 2 C global warming target. *Nature Climate Change*, 7(6), pp.417-422. Retrieved from https://www.nature.com/articles/nclimate3275.

IDMC (Internal Displacement Monitoring Centre). (2018). *Drought Stricken Communities Hit By Destructive Floods in the Horn of Africa.* Retrieved April 21, 2021, from https://www.internal-displacement.org/expert-opinion/drought-stricken-communities-hit-by-destructive-floods-in-the-horn-of-africa.

Kaimba, G. K., Njehia, B. K., & Guliye, A. Y. (2011). Effects of cattle rustling and household characteristics on migration decisions and herd size amongst pastoralists in Baringo District, Kenya. *Pastoralism: Research, Policy and Practice*, 1(1), 18. https://doi.org/10.1186/2041-7136-1-18. Retrieved from https://www.researchgate.net/publication/257883567_Effects_of_Cattle_Rustling_and_Household_Characteristics_on_Migration_Decisions_and_Herd_Size_Amongst_Pastoralists_in_Baringo_District_Kenya.

Liebmann, B., Hoerling, M.P., Funk, C., Bladé, I., Dole, R.M., Allured, D., Quan, X., Pegion, P. and Eischeid, J.K., 2014. Understanding recent eastern Horn of Africa rainfall variability and change. *Journal of Climate*, 27(23), pp.8630-8645. Retrieved from https://journals.ametsoc.org/view/journals/clim/27/23/jcli-d-13-00714.1.xml.

Lyon, B. and DeWitt, D.G., 2012. A recent and abrupt decline in the East African long rains. *Geophysical Research Letters*, 39(2). Retrieved from https://agupubs.onlinelibrary.wiley.com/doi/10.1029/2011GL050337.

McSweeney, C.; New, M.; Lizcano, G. (2010). *UNDP Climate Change Country Profiles: Kenya.* Retrieved from http://country-profiles.geog.ox.ac.uk/.

with support from the ICRC

Ministry of Environment and Forestry. (2020). Re: *Submission of Kenya's Updated Nationally Determined Contribution*. Retrieved April 21, 2021, from https://www4.unfccc.int/sites/ndcstaging/PublishedDocuments/Kenya First/Kenya%27s First NDC (updated version).pdf

Mordecai, E. A., Ryan, S. J., Caldwell, J. M., Shah, M. M., & LaBeaud, A. D. (2020). Climate change could shift disease burden from malaria to arboviruses in Africa. *The Lancet Planetary Health,* 4(9), e416–e423. https://doi.org/10.1016/S2542-5196(20)30178-9

ND-GAIN (Notre-Dame Global Adaptation Index). (2021). *Kenya | ND-GAIN Index*. Retrieved March 9, 2021, from https://gain-new.crc.nd.edu/country/kenya.

Parry, J.-E., Echeverria, D., Dekens, J., & Maitima, J. (2012). *Climate Risks, Vulnerability and Governance in Kenya: A Review*. Retrieved from https://www.iisd.org/system/files/publications/climate_risks_kenya.pdf.

Potsdam Institute & GIZ (German Society for International Cooperations). (2021). *Climate RIsk Profile: Kenya.* Retrieved April 25, 2021, from https://www.adaptationcommunity.net/wp-content/uploads/2021/01/GIZ_Climate-risk-profile-Kenya_EN.pdf.

Republic of Kenya. (2017). *Kenya Climate Smart Agriculture Strategy 2017–2026*. Retrieved April 21, 2021, from https://www.adaptation-undp.org/sites/default/files/resources/kenya_climate_smart_agriculture_strategy.pdf.

Republic of Kenya. (2018). *National Climate Change Action Plan 2018-2022*. Retrieved from https://www.lse.ac.uk/GranthamInstitute/wp-content/uploads/2018/10/8737.pdf

Republic of Kenya. (2016). *Climate Change Law.* Retrieved April 21, 2021, from http://kenyalaw.org:8181/exist/kenyalex/actview.xql?actid=No. 11 of 2016

Republic of Kenya. (2015). *Kenya National Adaptation Plan 2015-2030.* Retrieved from https://www4.unfccc.int/sites/NAPC/Documents NAP/Kenya_NAP_Final.pdf

SEI (Stockholm Environment Institute). (2009). *Economics of Climate Change in Kenya*. Stockholm, Sweden. Retrieved from https://mediamanager.sei.org/documents/Publications/SEI-ProjectReport-Downing-EconomicsOfClimateChangeKenya-2009.pdf%0A

The Netherlands Ministry of Foreign Affairs. (2018). *Climate Change Profile Kenya*. The Hague. Retrieved from https://www.government.nl/documents/publications/2019/02/05/climate-change-profiles.

UNHCR (United Nations High Commissioner for Refugees). Kenya. (2021). *Kenya: Registered Refugees and Asylum Seekers.* Nairobi. Retrieved from https://www.unhcr.org/ke/wp-content/uploads/sites/2/2021/02/Kenya-Infographics-31-January-2021.pdf.

USAID (United States Agency for International Development). (2018). *Climate Risk Profile - Kenya.* Retrieved from https://www.climatelinks.org/sites/default/files/asset/document/2018_USAID-ATLAS-Project_Climate-Risk-Profile-Kenya.pdf.

Waithaka, M,. Nelson, G. Thomas, T., & & Kyotalimye, M. (2013). *East African agriculture and climate change A comprehensive analysis*. https://doi.org/10.2499/9780896292055.

WFP (World Food Programme). (2021). *Kenya |*. Retrieved March 17, 2021, from https://www.wfp.org/countries/kenya.

World Bank. (2021). *World Bank Climate Change Knowledge Portal.* Retrieved from https://climateknowledgeportal.worldbank.org/country/kenya.