

MODULE

1



BASIC SCIENCE ON CLIMATE CHANGE





Learning objectives

By the end of this module, the trainees should be able to:

- 01** Define basic concepts and definitions under climate change
 - 02** Understand how climate change affects agro-ecosystems and how agricultural sectors contribute to climate change through greenhouse gas emissions.
 - 03** Understand the climate risk framework and scenarios.
- 



Basic definitions of terms



Climate Vs Weather

Weather

Weather is the summary of temperature, rainfall, wind, humidity, sunshine, cloudiness or storms patterns in a specific place on a specific day or over a short period such as a season. They also include extreme events such as tornadoes, droughts and tropical cyclones.

Thus, weather is what we see/hear/feel every day in each location, which is the state of the atmospheric conditions at a particular place and time. Weather is dynamic and can change within a very short time, even within the same day (ELRP Training Manual).

Climate Vs Weather

Climate

Climate refers to average weather conditions (taken over a period not less than 30 years), including statistical description of its variations. Several factors contribute to the definition of climate, including long-term averages of temperature and precipitation, but also the type, frequency, duration, and intensity of weather events such as heat waves, cold spells, storms, floods and droughts. Climate is a complex natural process that involves the interaction of the air, the water, and the land surface (ELRP training manual)



What is Climate Change?



UNFCCC, Article 1:

Climate change: a change of climate which is attributed directly or indirectly to human activity that alters the composition of the global atmosphere and which is in addition to natural climate variability observed over comparable time periods.





IPCC, 3rd Assessment Report:

Climate change: a statistically significant variation in either the mean state of the climate or in its variability, persisting for an extended period (typically decades or longer).

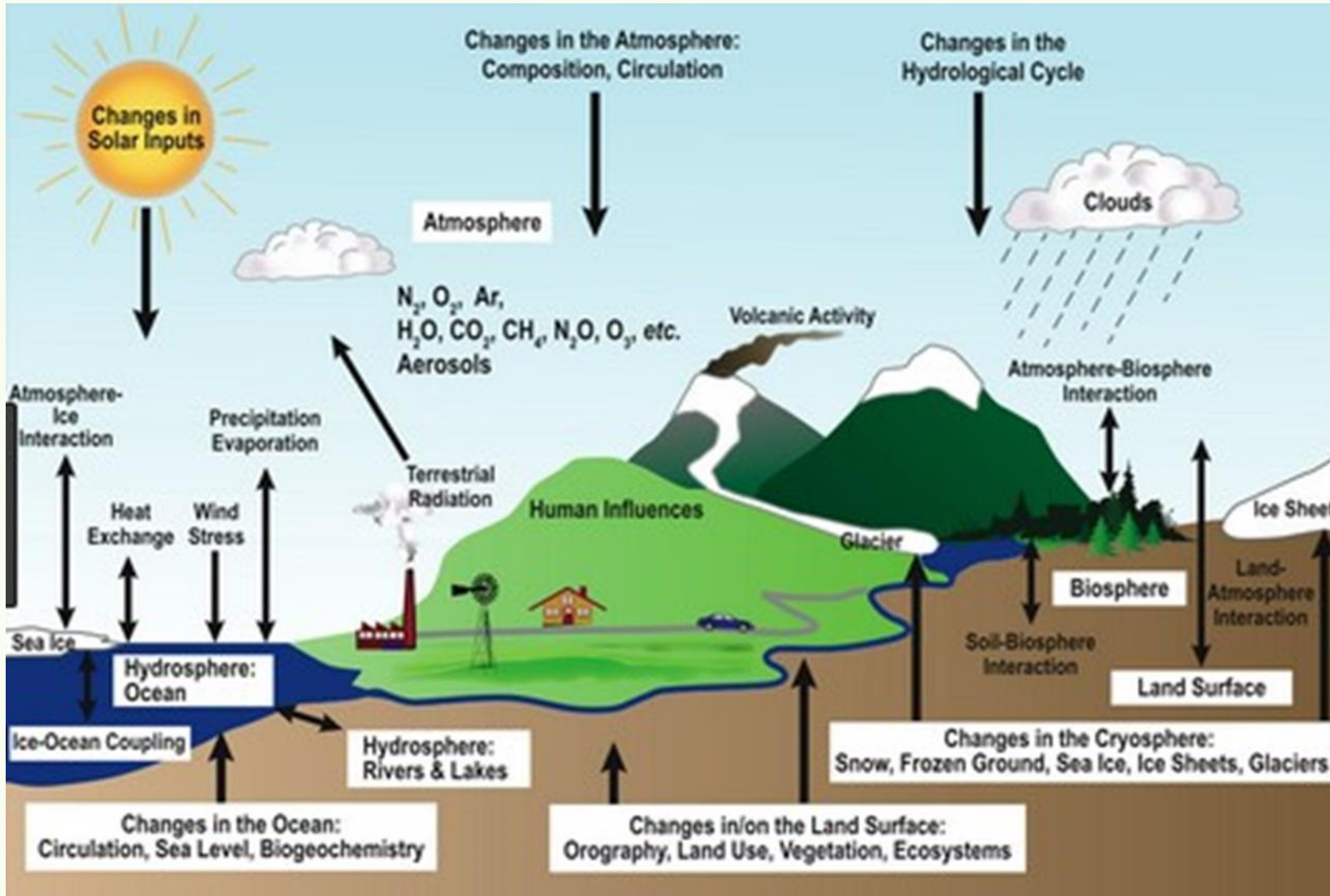
Climate change: may be due to natural internal processes or external forcings, or to persistent anthropogenic changes in the composition of the atmosphere or in land use .





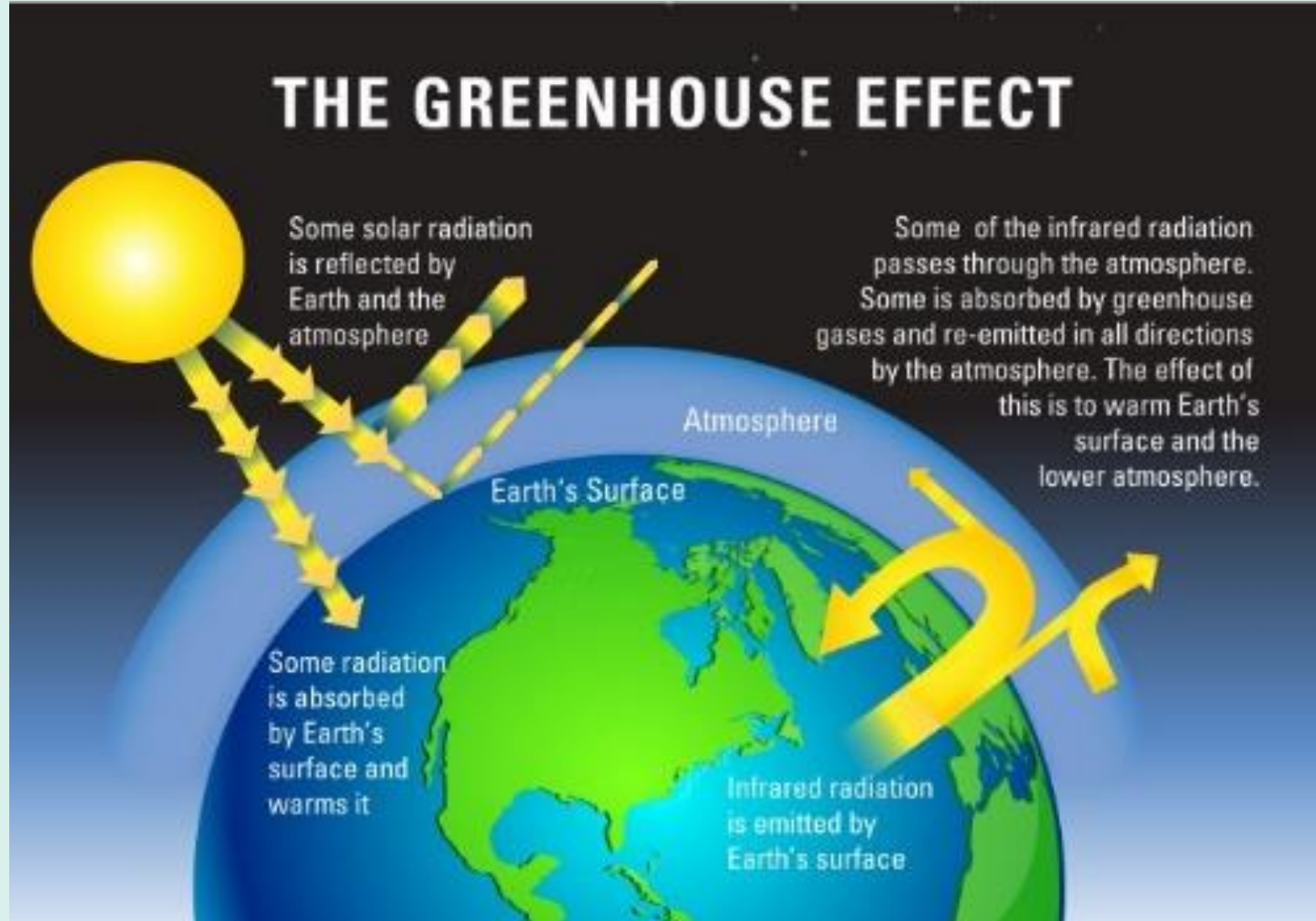
Causes of Climate Change

Climate change causes



- Changes in hydrological cycles
- Changes in Land Surfaces(in/on)
- Human influences
- Changes in Ocean

We live in a Greenhouse

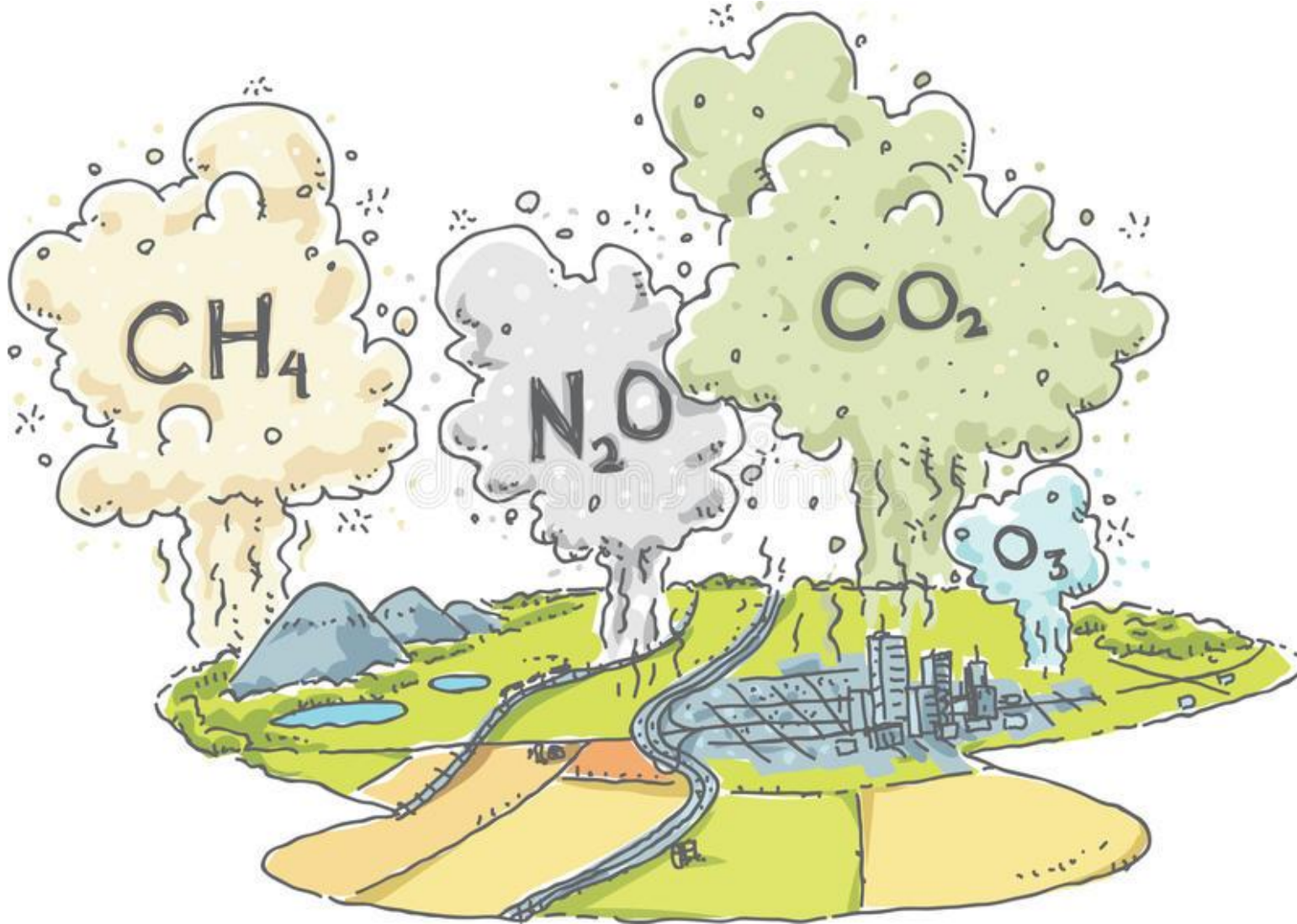


Most of the heat is absorbed by Greenhouse gases and reflected in all directions, warming the earth.

Is the sun to blame?

Solar irradiance changes cannot plausibly account for more than 10 percent of the 20th century's warming.

Main Greenhouse Gases



A **greenhouse gas (GHG)** is any gas in the atmosphere which absorbs heat, and thereby keeps the planet's atmosphere warmer.



Climate Change Impacts

Climate Change and Agriculture

Climate change risks and hazards are:



Heavy Rainfall



Erosion Risk



Moisture Stress



Drought



Heat Stress



Floods

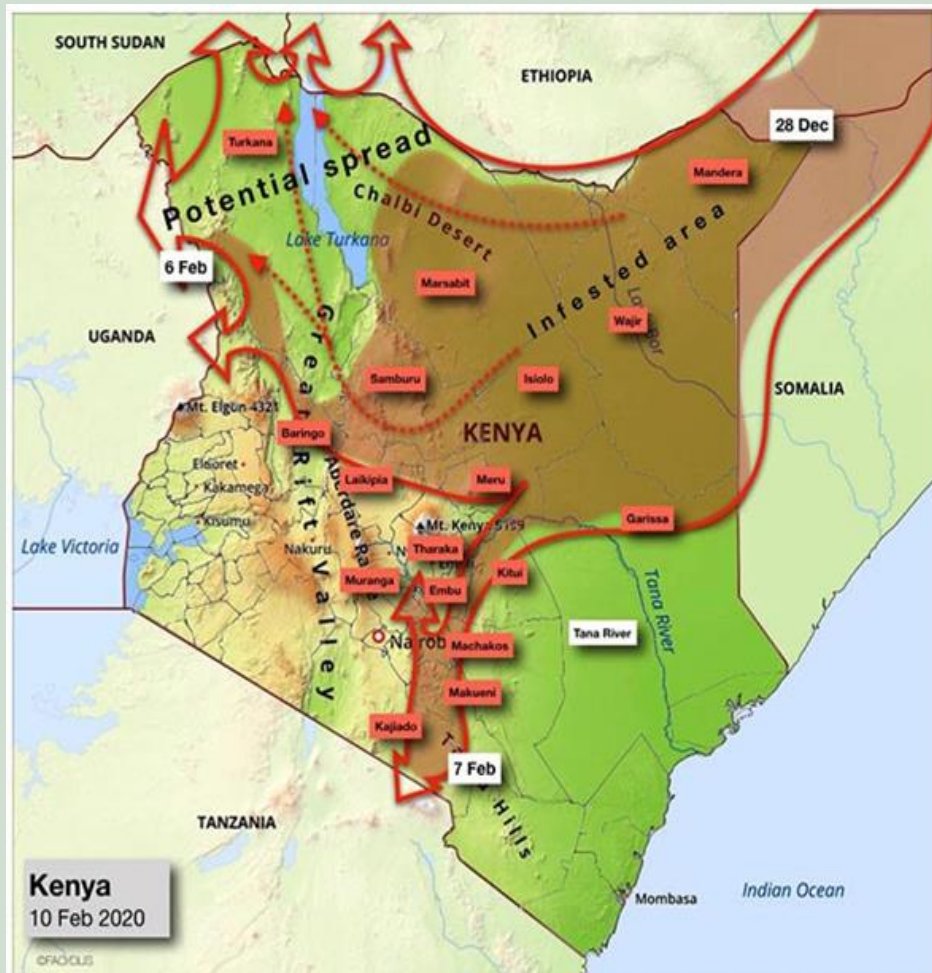


Which (in the short or long term) lead to:

- Reduced water availability
- Increased weeds, pests, and fungi
- Lower livestock and crop productivity
- Increased cost of production
- Reduced yields and quality of produce
- Food and nutritional insecurity
- Etc.

Examples of climate change impacts

Kenya in 2020 | Locust



A map dated February 10, 2020 showing Desert Locust spread from Kenya to Uganda and Tanzania. Source: FAO Locust Watch



A group of young men attempt to fend off a swarm of desert locusts flying over grazing land in Lemasulani, a village in Kenya's Samburu County.

[Image Credit: Njeri Mwangi/Reuters]

Examples of climate change impacts

Kenya in 2021 | Drought

News | Climate Crisis

'We will all die': In Kenya, prolonged drought takes heavy toll

Absence of rainfall pushes pastoralists and their livestock to the brink of disaster, with 2.4 million people predicted to struggle to find food.



Since September, much of Kenya's north has received less than 30 percent of normal rainfall - the worst short rain season in decades [Virginia Pietromarchi/Al Jazeera]

Impacts of Drought

- People have been compelled to trek longer distances to find water in **87 percent** of ASAL counties.
- Access to water for livestock is deteriorating, with above-average hiking distances reported in **91 percent** of ASAL counties.
- In **65 percent** of counties, maize prices are higher.

Drought has for decades been the single most disastrous natural hazard in Kenya. The country lost **KES 1.2 trillion** over the 2008-2011 period.

(OCHA, 2021)

Kenya: Drought hunger crisis 2021

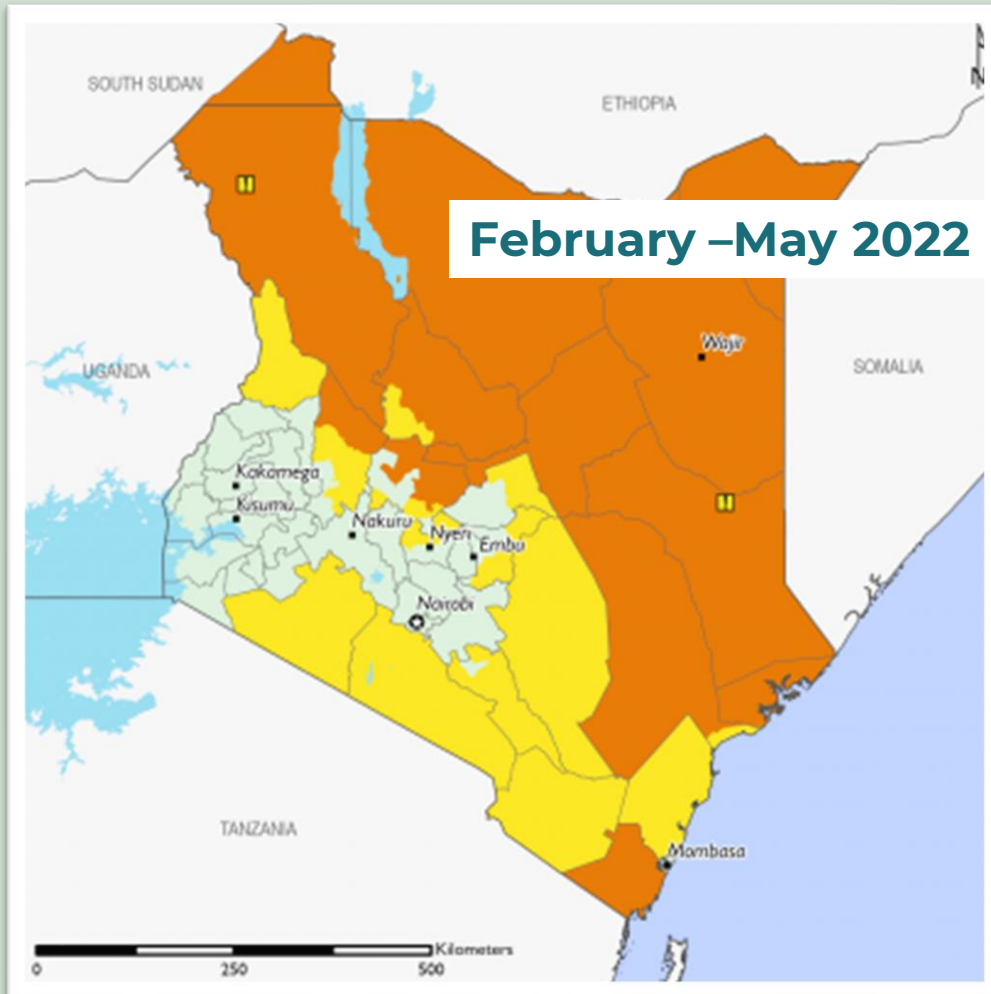
An estimated 2.1 million people in the Arid and Semi-Arid Lands (ASAL) of Kenya are severely food insecure following two consecutive poor rainy seasons that have hampered crop production. This appeal will enable the IFRC to support the Kenya Red Cross Society to deliver humanitarian assistance to 500,000 people over 18 months to address the current drought crisis.

[Read more about droughts](#)



Examples of climate change impacts

Kenya in 2022 | Reduced rainfall



In February 2022, the short rains harvest is expected to be up to 70 percent below average following the poor and significantly delayed short rains in the marginal agricultural areas.

There is strong concern that food insecurity may increase in severity and magnitude in 2022, due to the chance that the March to May 2022 long rains, may be below-average season.

Approximately 3-4 million people will be in need of humanitarian food assistance.

IPC v3.0 Acute Food Insecurity Phase

- 1: Minimal
- 2: Stressed
- 3: Crisis
- 4: Emergency
- 5: Famine

□ Concentration of displaced people



! Would likely be at least one phase worse without current or programmed humanitarian assistance

FEWS NET classification is IPC-compatible. IPC-compatible analysis follows key IPC protocols but does not necessarily reflect the consensus of national food security partners.

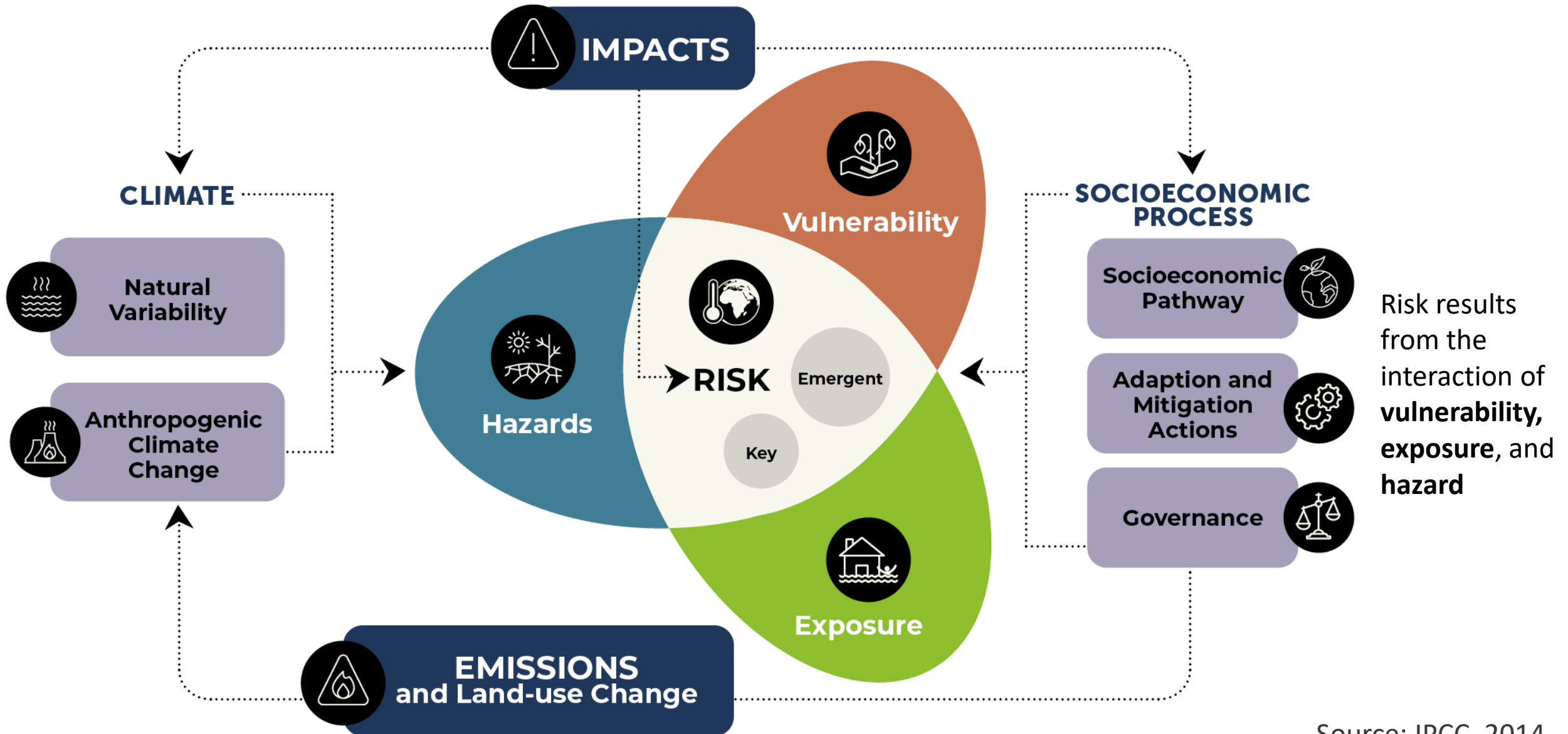
Source: FEWSNET



Climate Risk Framework

Determinants or Risk: Hazard,
Exposure, Vulnerability

Understanding Risk in relation to climate change





Hazard –The potential occurrence of a natural or human-induced physical event or trend or physical impact that may cause loss of life, injury, or other health impacts, as well as damage and loss to property, infrastructure, livelihoods, service provision, ecosystems, and environmental resources.



Vulnerability –The propensity or predisposition to be adversely affected. Vulnerability encompasses a variety of concepts and elements including sensitivity or susceptibility to harm and lack of capacity to cope and adapt.

- A broad set of factors such as wealth, social status, and gender determine vulnerability and exposure to climate-related risk.



Climate Risk Framework



Vulnerability = Exposure + Sensitivity + Adaptive capacity

Exposure

The presence of people, livelihoods, environmental services and resources, infrastructure, or economic, social, or cultural assets in places that could be adversely affected.

Adaptive capacity

The ability of systems, institutions, humans and other organisms to adjust to potential damage, to take advantage of opportunities, or to respond to consequences

Sensitivity

The degree to which a system or species is affected, either adversely or beneficially, by climate variability or change. The effect may be direct (e.g., a change in crop yield in response to a change in the mean, range, or variability of temperature) or indirect (e.g., damages caused by an increase in the frequency of coastal flooding due to sea level rise).



Climate hazards of concern



Magnitude



Extent



Rate of change

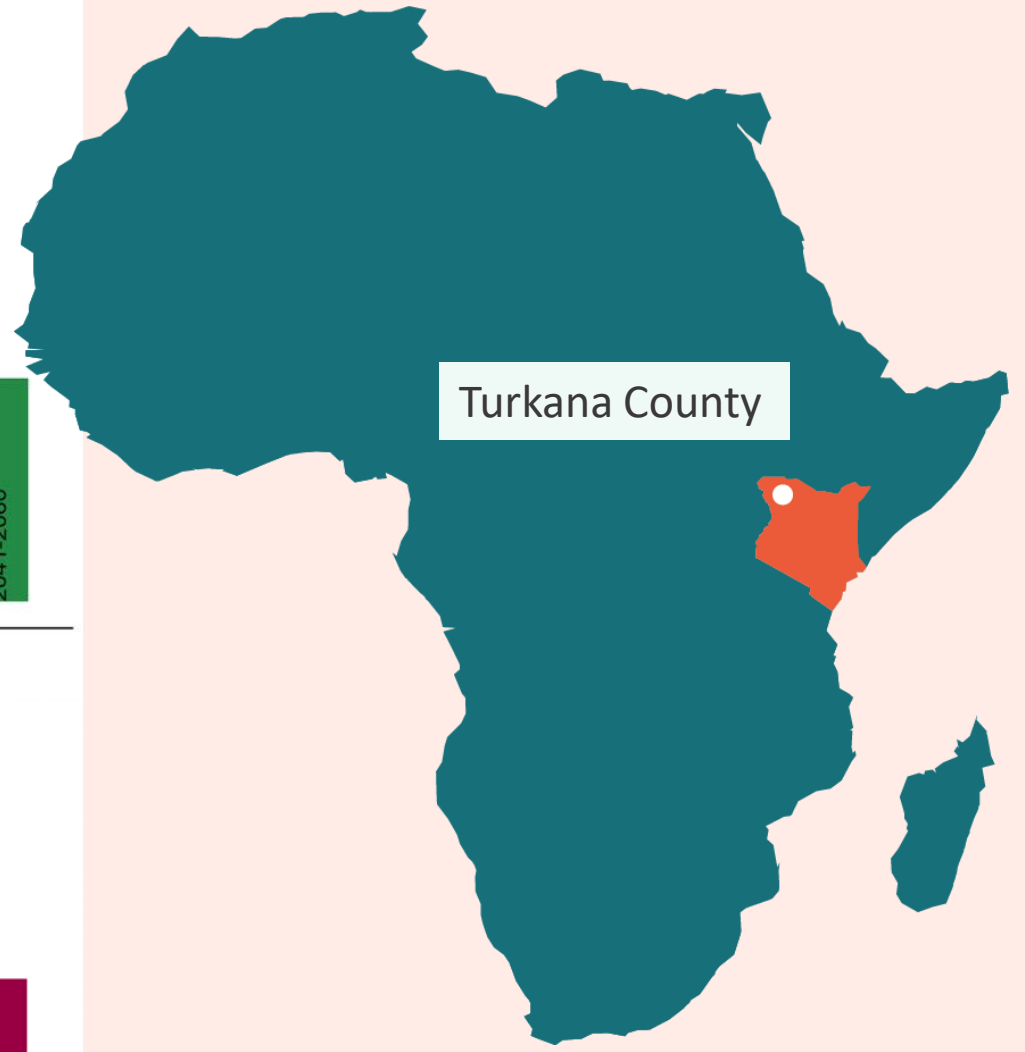
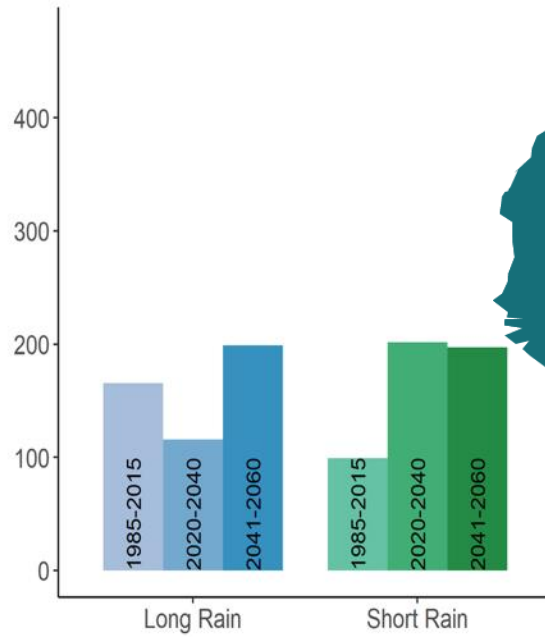
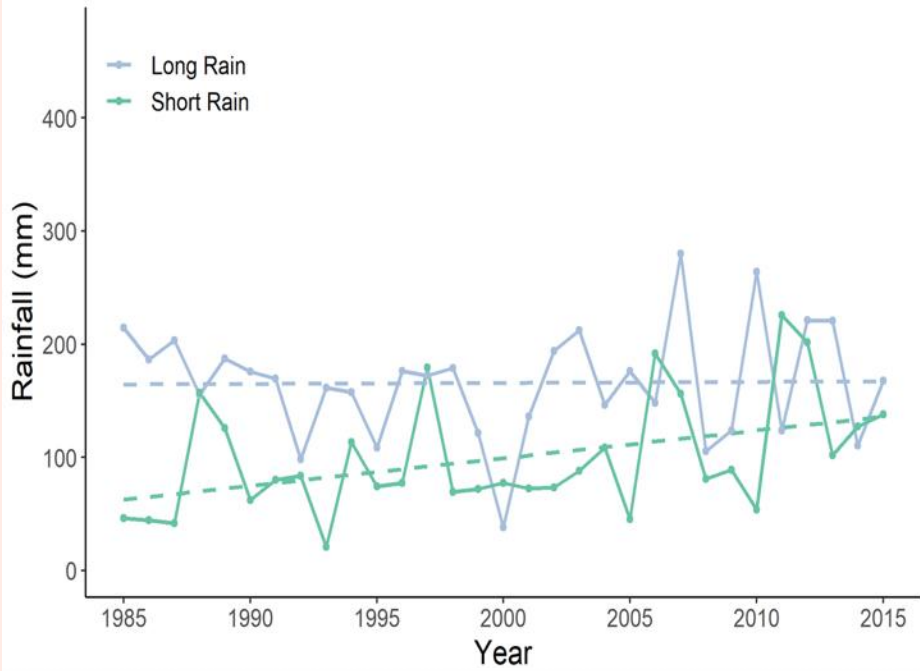
- Floods
- Droughts
- Tropical cyclones and strong winds
- Storm surges
- Extreme temperatures
- Forest fires
- Sand or dust storms
- Landslides
- Sea level rise
- Temperature changes
- Changes to seasonal patterns

Africa as a whole has the highest mortality-related vulnerability coefficients for droughts and very high coefficients for cyclones and volcanoes. Drought and floods account for 80 per cent of loss of life and 70 per cent of economic losses linked to natural hazards (WB 2010).

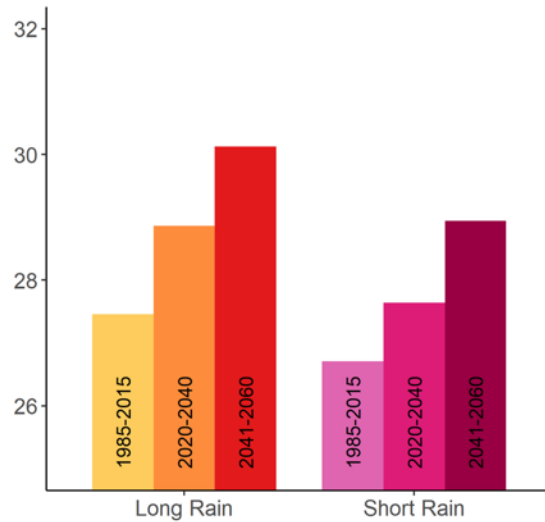
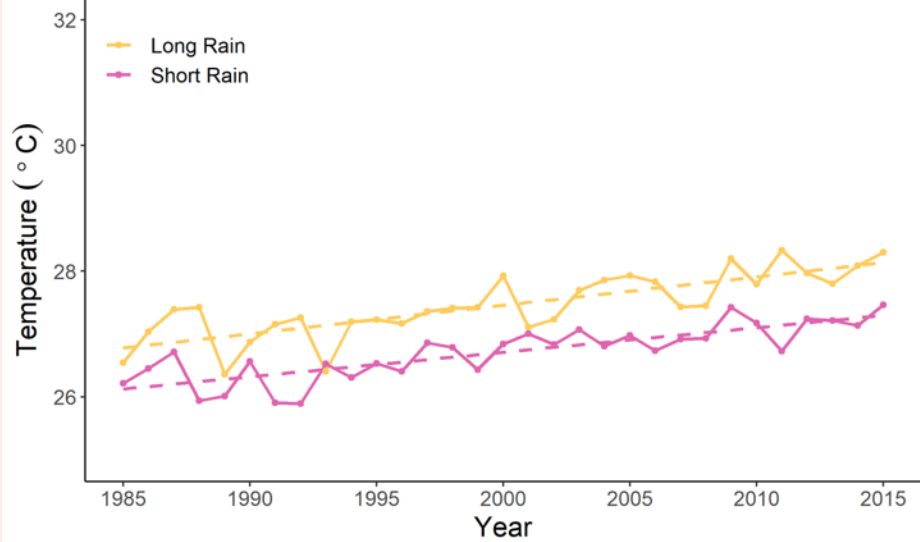


Climate Scenarios: Historic and Future trends

Annual Total Rainfall Trends



Annual Mean Temperature Trends

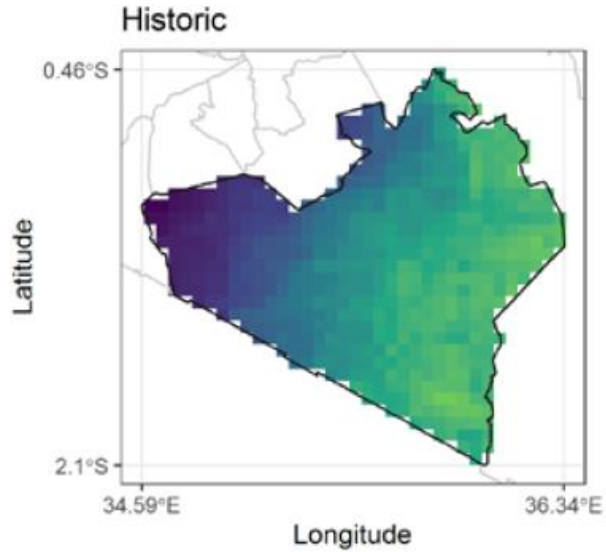


Average Monthly Temperature and Precipitation from the Last 30 Years (1985-2015)

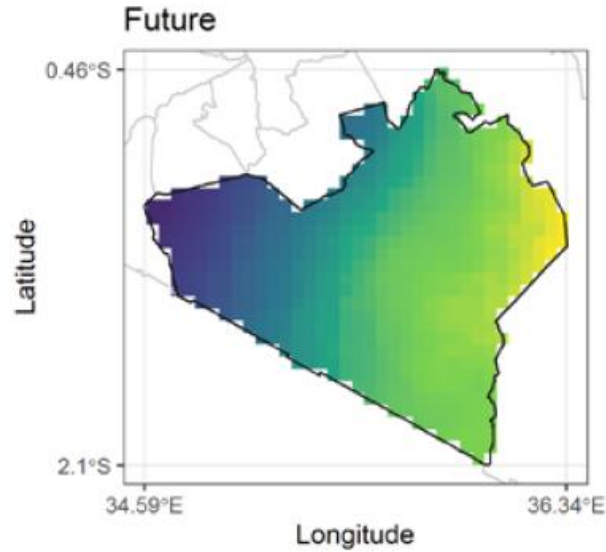
Future projections (2020-2040s) (2040-2060s)

Long Rains: Drought

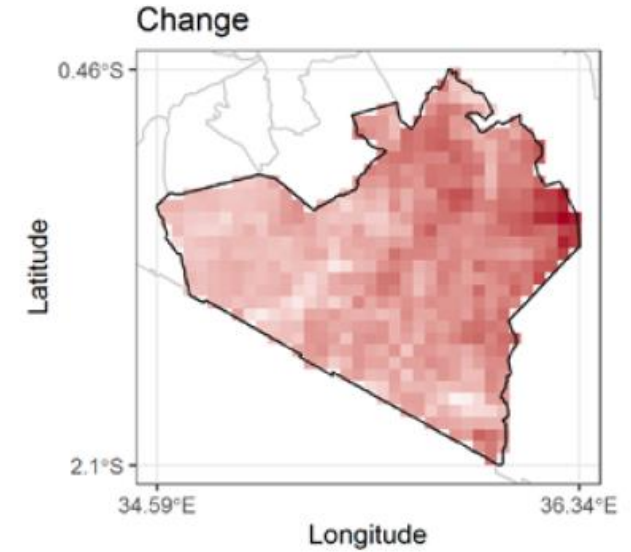
1 Narok County



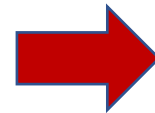
Historic (1981-2011)



Future (2020-2050)



Drought caused by many number of consecutive dry days (<30 days) throughout the growing season



Spatial trends will remain the same. More incidences of drought, extremely dry areas will be drier

Minor

Moderate

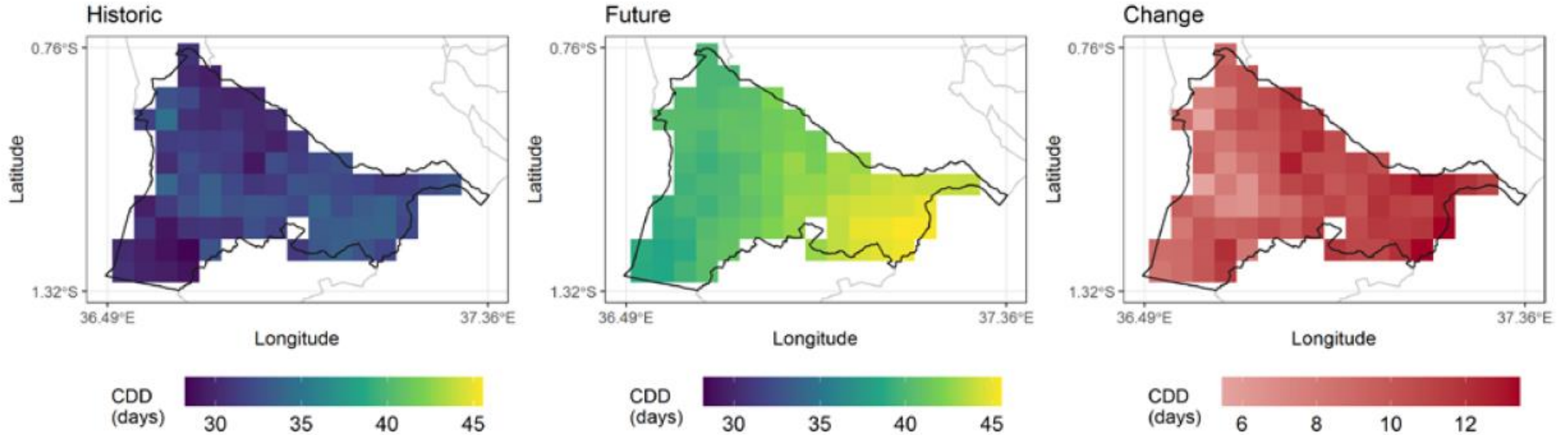
Major

Severe

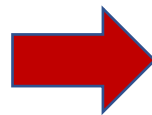
Long Rains: Drought

2

Kiambu County



Historically experienced CDD below 35 days, with the eastern regions experiencing more CDD compared to the southern and western regions



Dry spells are projected to become 6-12 days longer by 2050.

Minor

Moderate

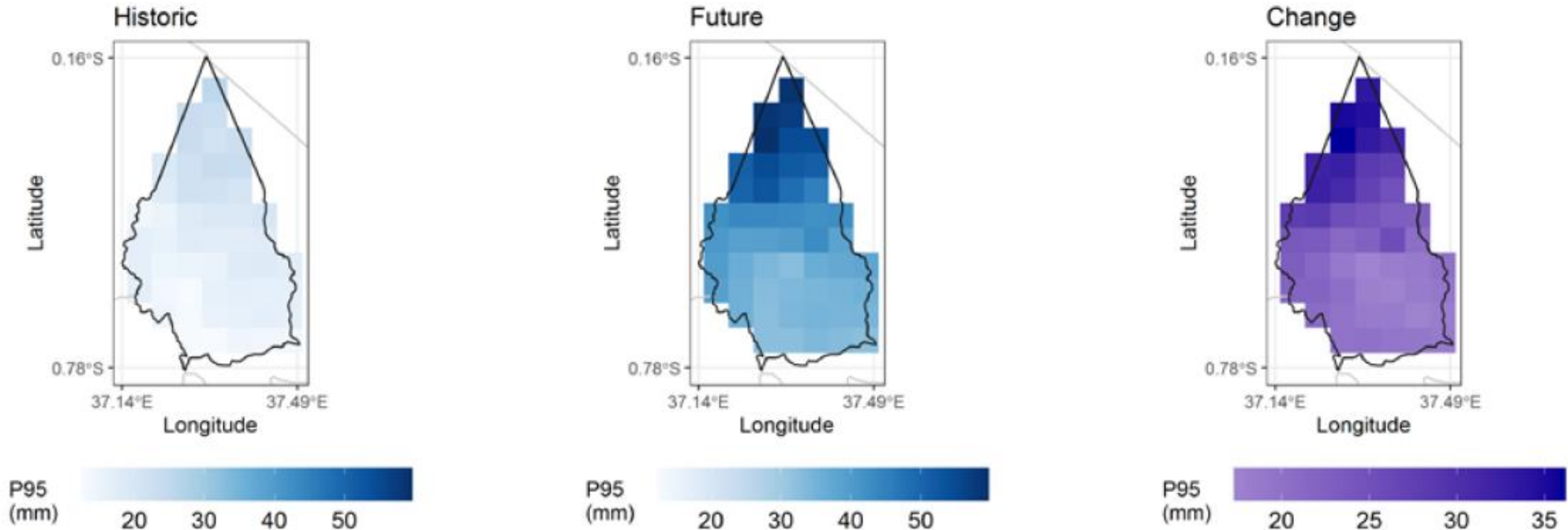
Major

Severe

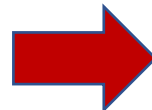
Short Rains: Heavy Rainfall (Erosion risk)

3

Kirinyaga County



P95 has historically been <math>< 20\text{ mm}</math> with scattered larger values in the North.



95th percentile intensity will mainly concentrate in the northern regions, suggesting increasing localized erosion risk

Minor

Moderate

Major

Severe

Hazard Selection



Heavy Rainfall



Erosion Risk



Moisture Stress



Drought



Heat Stress



Floods

Kiambu

% of people engaged in the value chain



Banana

21-40%



Dairy
(cow)

21-40%



Irish Potatoes

1-20%



Chicken
(local)

21-40%



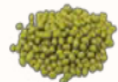
Kitui

% of people engaged in the value chain



Mango

81-100%



Green Grams

61-80%



Chicken
(local)

81-100%



Goat

61-80%



Narok

% of people engaged in the value chain



Sheep
(mutton)

81-100%



Maize

61-80%



Chicken
(local)

81-100%



Dairy
(cow)

81-100%





Group Activity

1

Highlight **three major value chains** in your locality.

2

Identify the **hazards, risks, and adaptation strategies** along these value chains.

3

Investigate **gaps, challenges, and opportunities** along the three value chains.



THANK YOU!

