Current and Emerging Threats to Crops Innovation Lab

USAID
FROM THE AMERICAN PEOPLE

FEED THE FUTURE
The U.S. Government's Global Hunger & Food Security Initiative

PennState

PlantVillage

dream team
AGRO CONSULTANCY

CIMMYT

CIP
INTERNATIONAL POTATO CENTER

icipe

iDE

Massachusetts Institute of Technology

MICHIGAN STATE UNIVERSITY

UNIVERSITY of MARYLAND EASTERN SHORE

ZAMORANO

To fix the future, you must fix the present
- Winnie Onyango

The present is broken

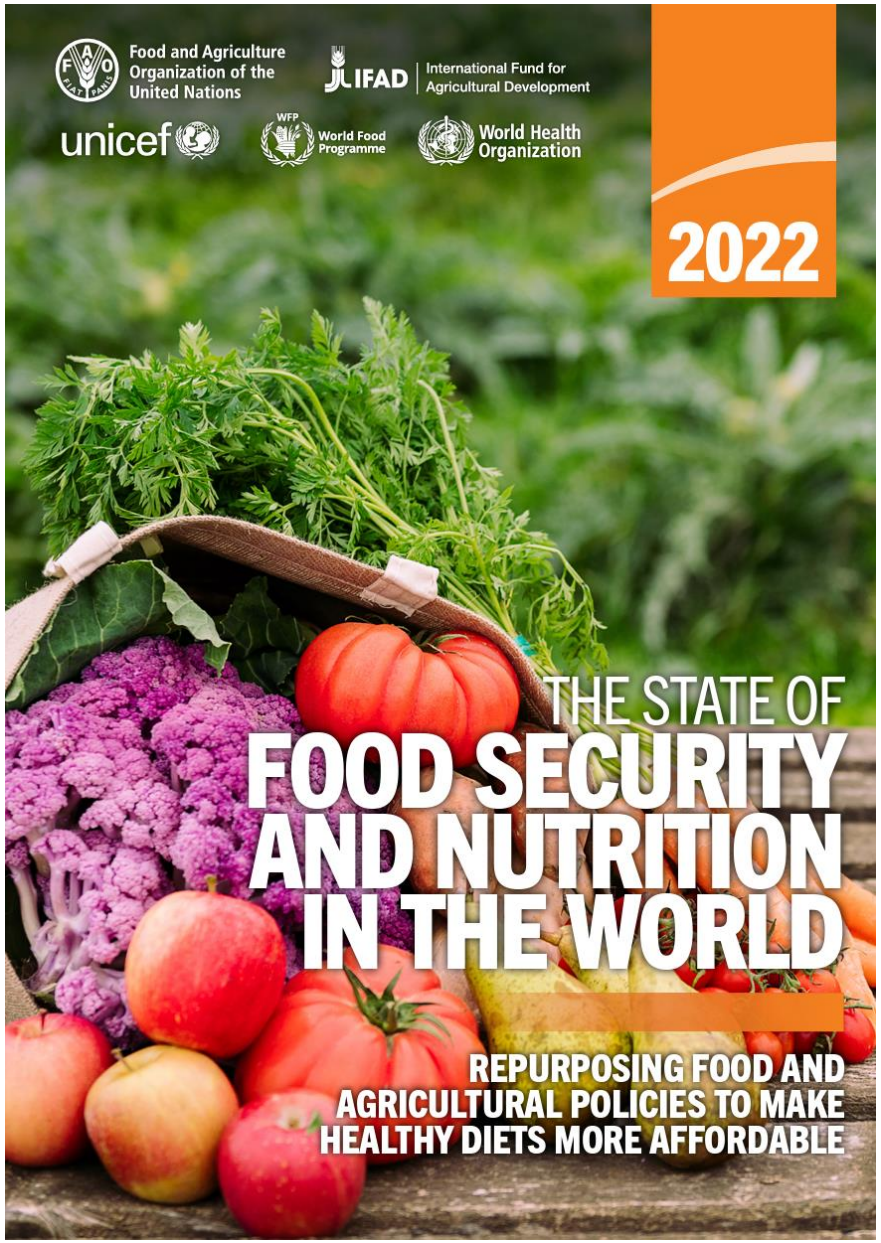
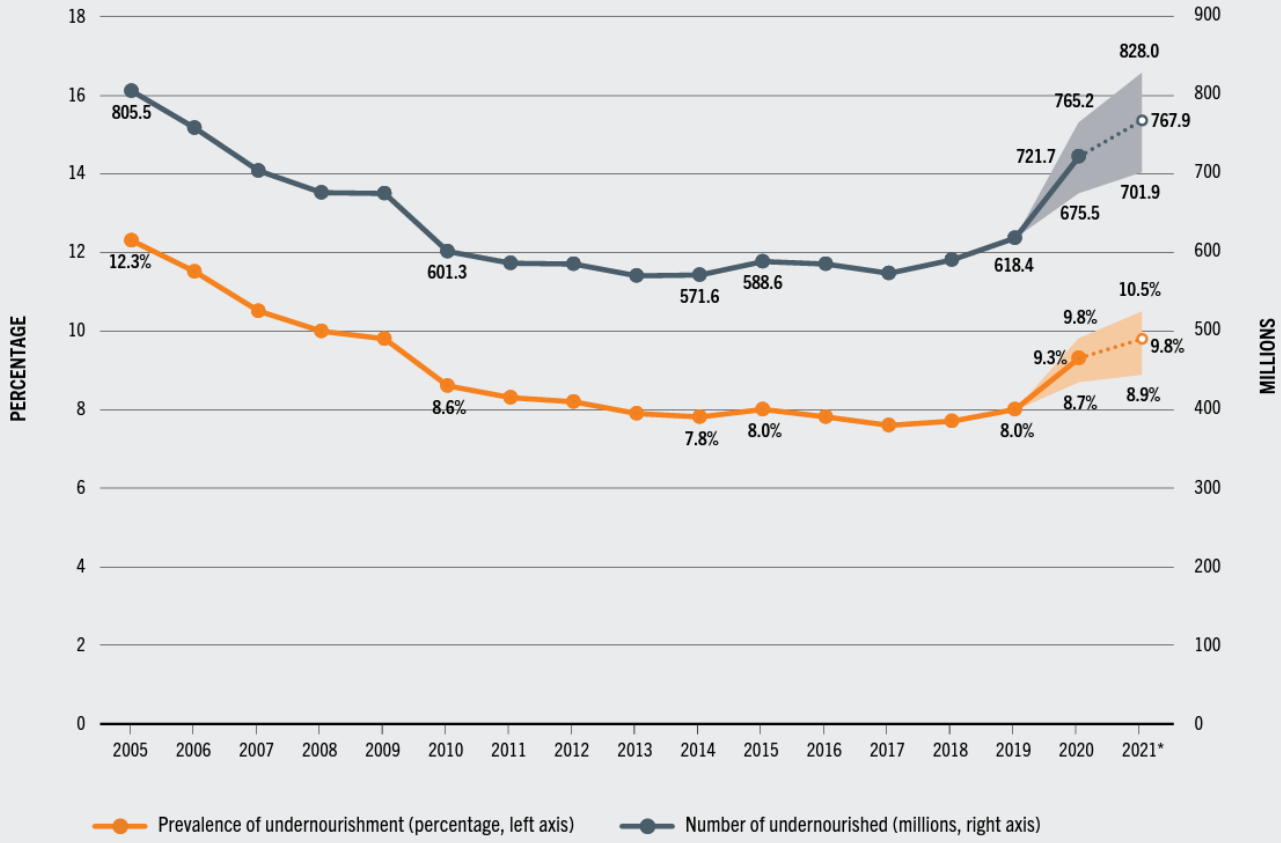


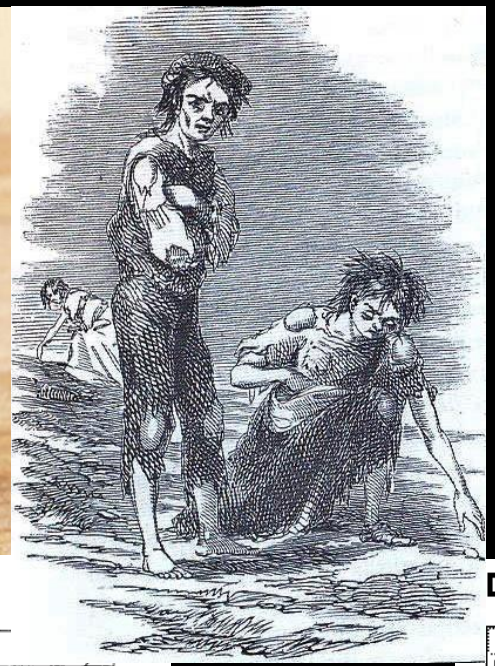
FIGURE 2 BETWEEN 702 AND 828 MILLION PEOPLE IN THE WORLD FACED HUNGER IN 2021. CONSIDERING THE MIDDLE OF THE PROJECTED RANGE (768 MILLION), HUNGER AFFECTED 46 MILLION MORE PEOPLE IN 2021 COMPARED TO 2020, AND A TOTAL OF 150 MILLION MORE PEOPLE SINCE 2019, BEFORE THE COVID-19 PANDEMIC



NOTES: * Projected values for 2021 are illustrated by dotted lines. Shaded areas show lower and upper bounds of the estimated range.
SOURCE: FAO.

What is a threat?

Late Blight- *Phytophthora infestans*



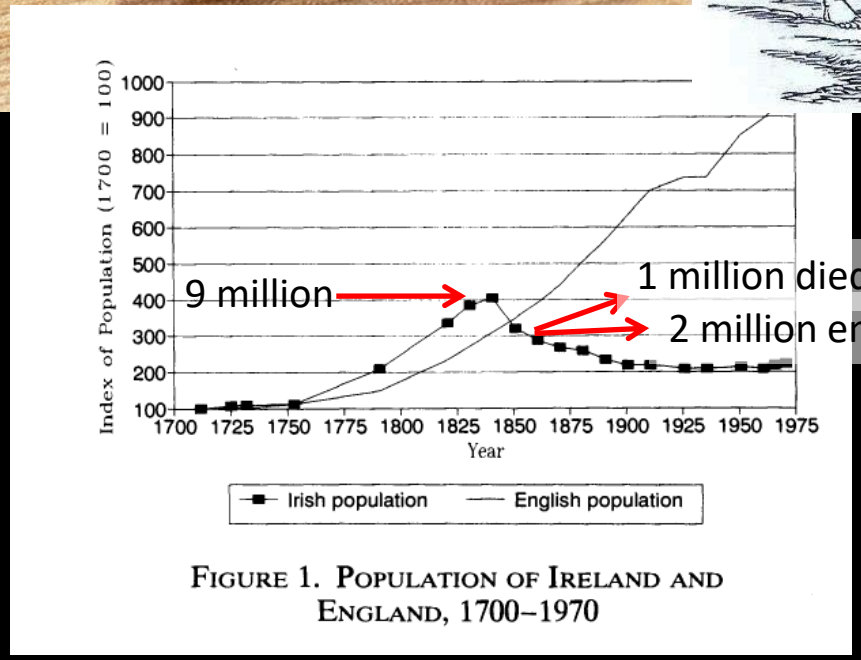
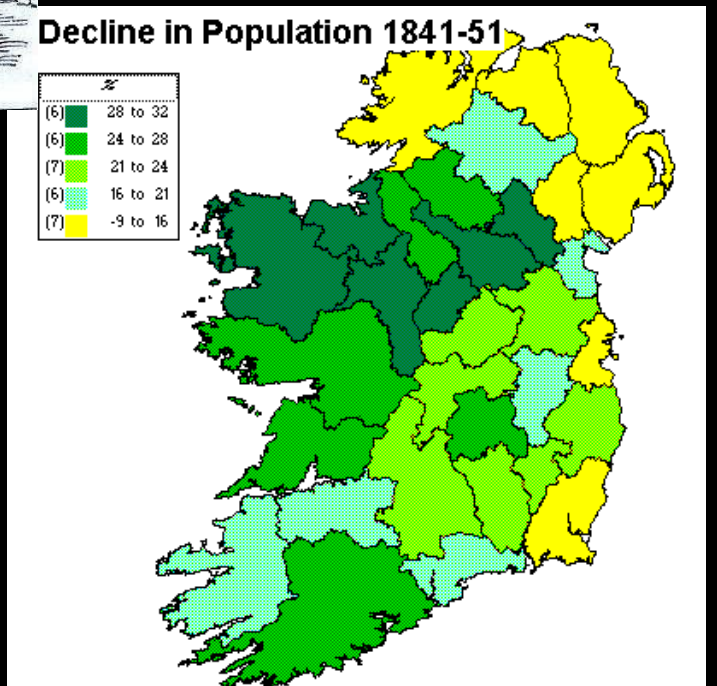


FIGURE 1. POPULATION OF IRELAND AND ENGLAND, 1700–1970

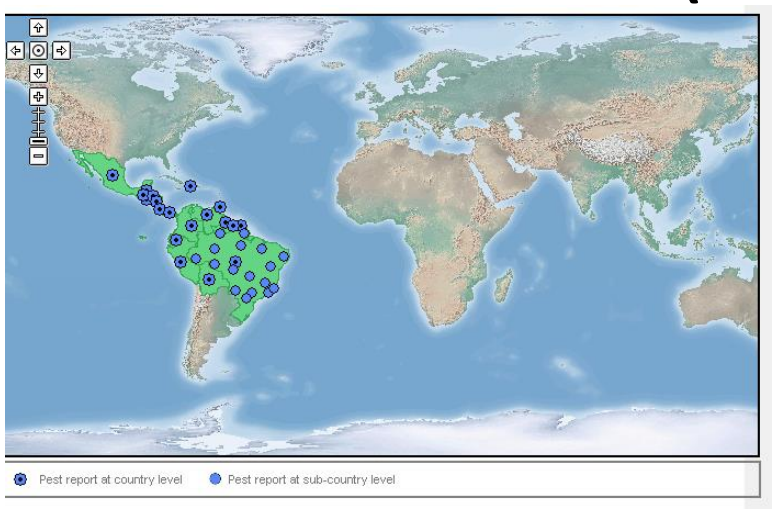
9 million

1 million died

2 million emigrated

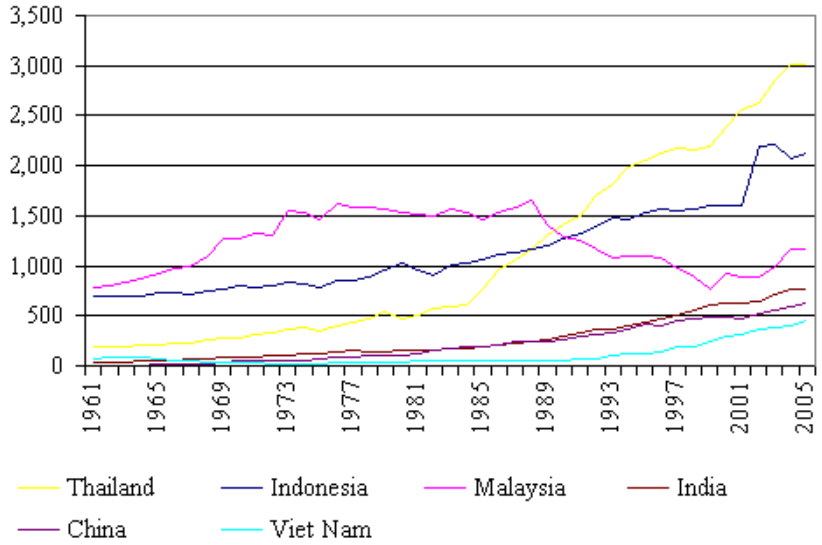


The Threat of South American Leaf Blight (*Microcyclus ulei*)



Between 1920-1940, Henry Ford planted >20, 000 acres with hundreds of thousands of trees: all failed

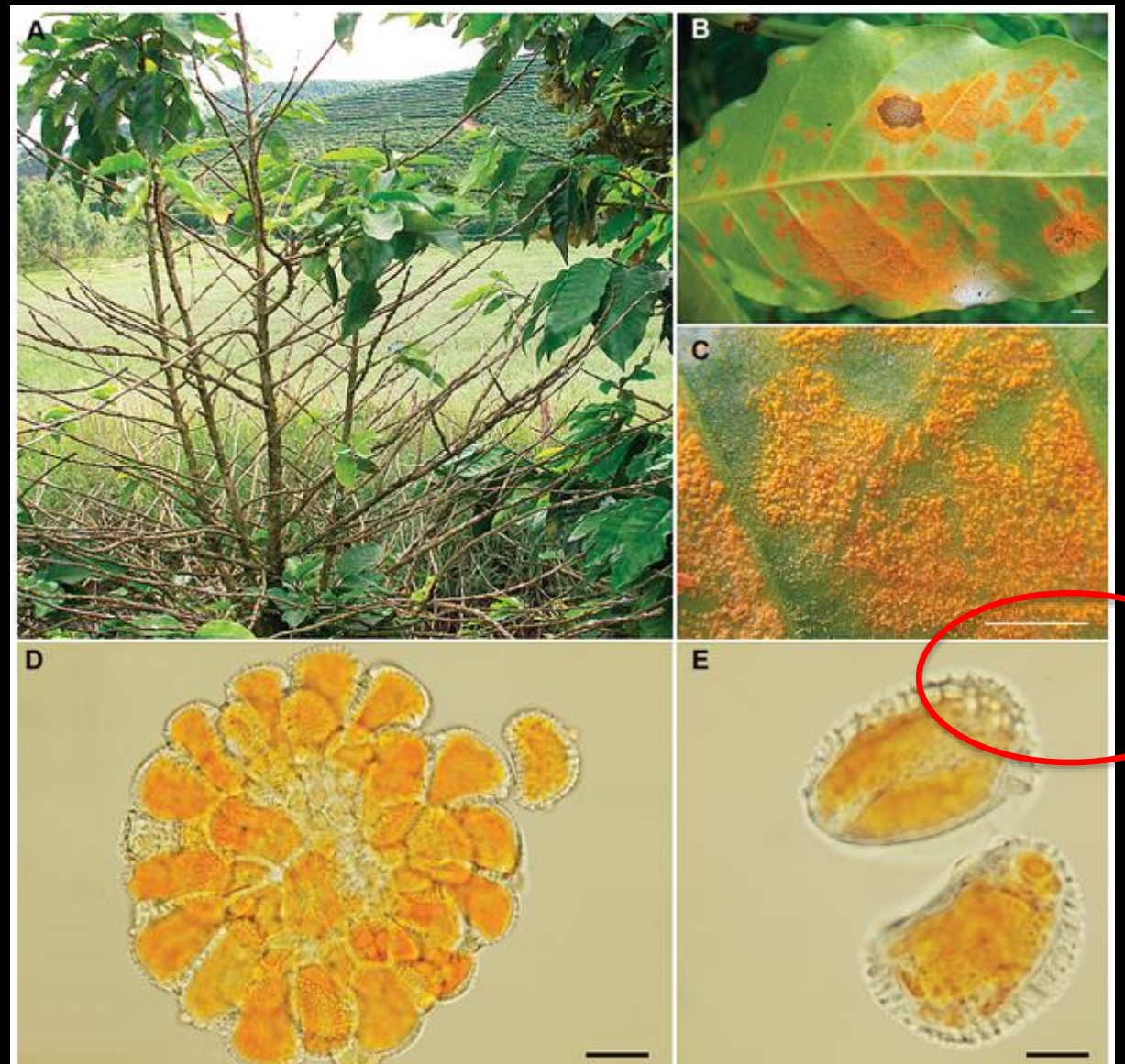
Hevea brasiliensis accounts for 40% of world's rubber...and all the best stuff



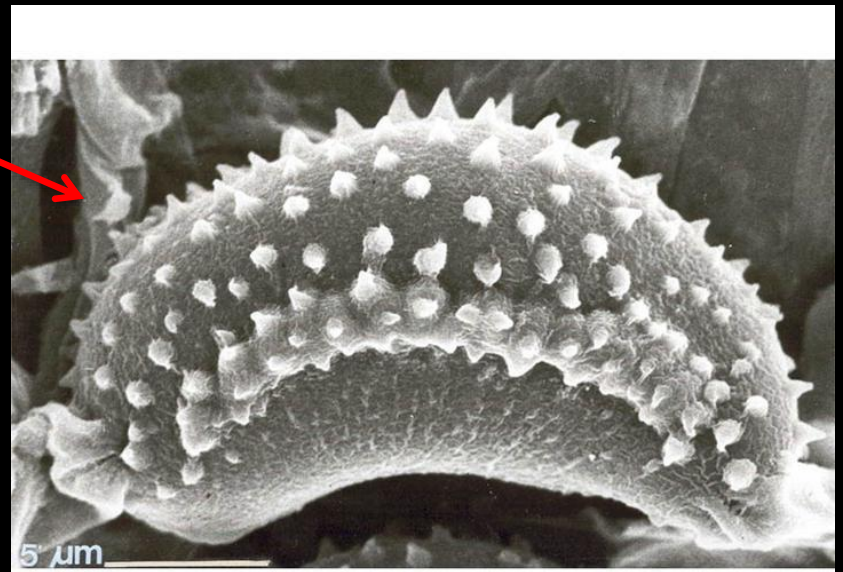
Source: UNCTAD secretariat (Data: FAOSTAT database)


A
B
F
G
H
D
H

Coffee Rust *Hemileia vastatrix*,



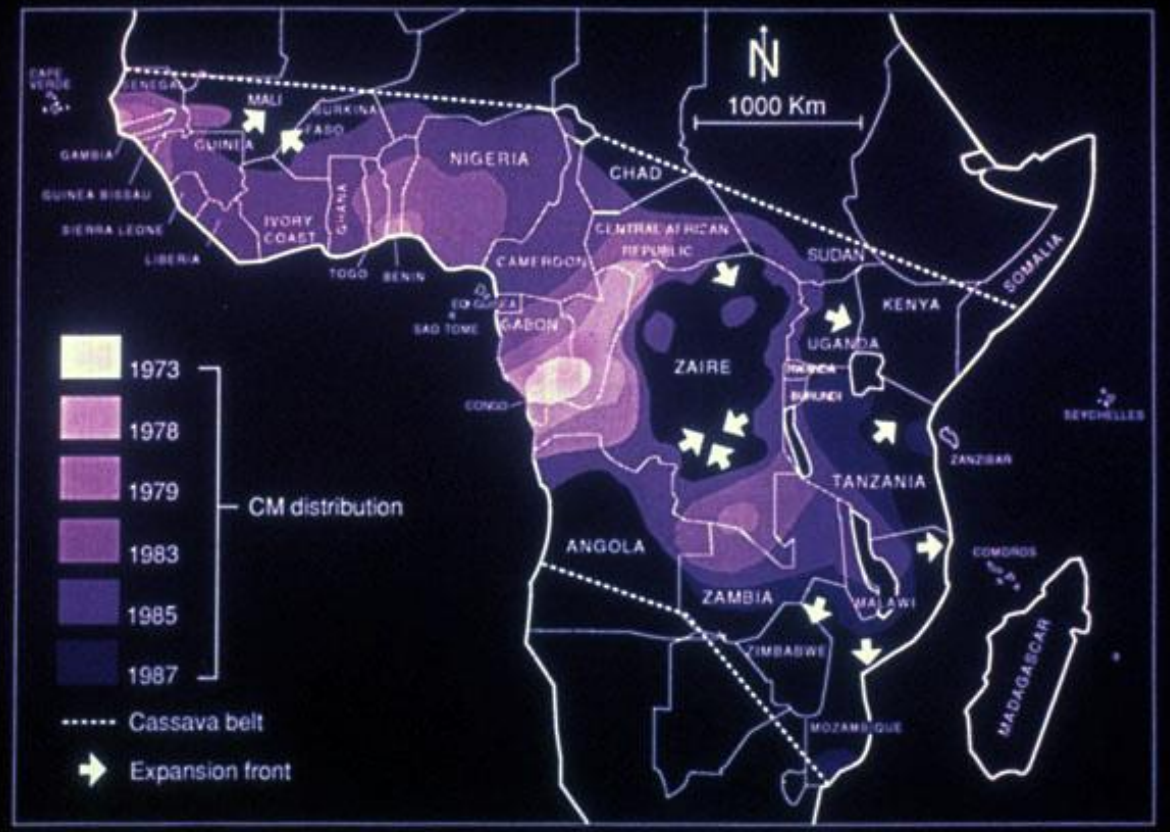
(**A**) Defoliation in a coffee plantation, Coimbra, Minas Gerais, Brazil; (**B**) Leaf symptoms on abaxial surface (bar = 0.5 cm); (**C**) Detail of suprastomatal uredinial pustules coalescing over lower leaf surface (bar = 0.5 cm); (**D**) Uredinium showing arrangement of spores (bar = 20 µm); (**E**) Urediniospores - showing the thickened, heavily-ornamented or verrucose upper wall – containing carotenoid lipid guttules imparting the yellow-orange colour (bar = 10 µm). From Carvalho, Harry Evans et al 2011, PloS One



Cassava

Daily food of 250 people in Africa and 800 Million Africans eat it.
Introduced to Africa 300 years ago from South America without any pests

1973 Disaster: Accidental introduction of Cassava Mealybug and Green Mite from Sth America



Distribution and spread of the cassava mealybug in Africa

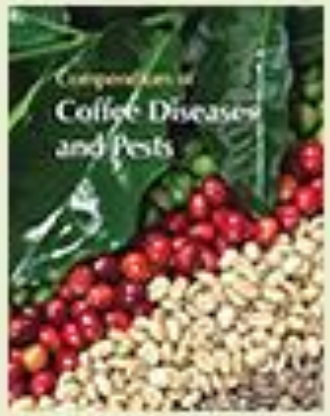
Green mite
Mononychellus tanajoa

Mealybug
Phenacoccus manihoti

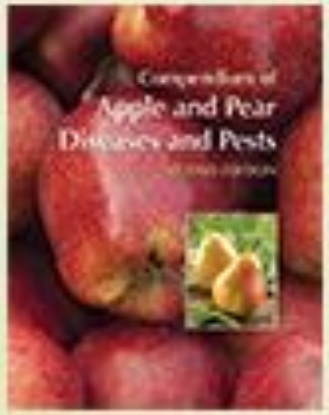
Both mealybug and mite travelled across 27 countries reducing cops by 80-100%

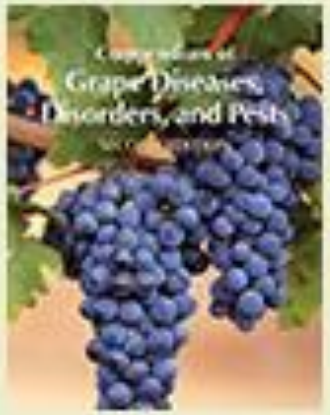
The Locust Crisis in East Africa: 2020/21

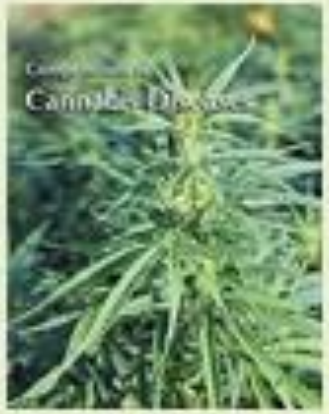

Cucurbit Diseases
and Pests

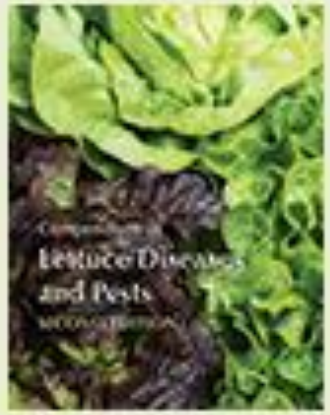

Coffee Diseases
and Pests


Bedding Plant
Diseases and Pests


Apple and Pear
Diseases and Pests


Grape Diseases,
Disorders, and Pests


Cannabis Diseases

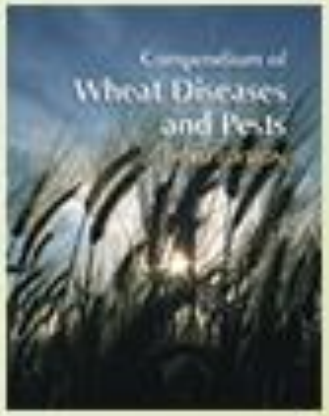

Lettuce Diseases
and Pests


Chickpea and Lent
Diseases and Pest


Raspberry and
Blackberry Diseases
and Pests


Conifer Diseases


Corn Diseases


Wheat Diseases
and Pests

PlantVillage @plantvillage · Oct 28

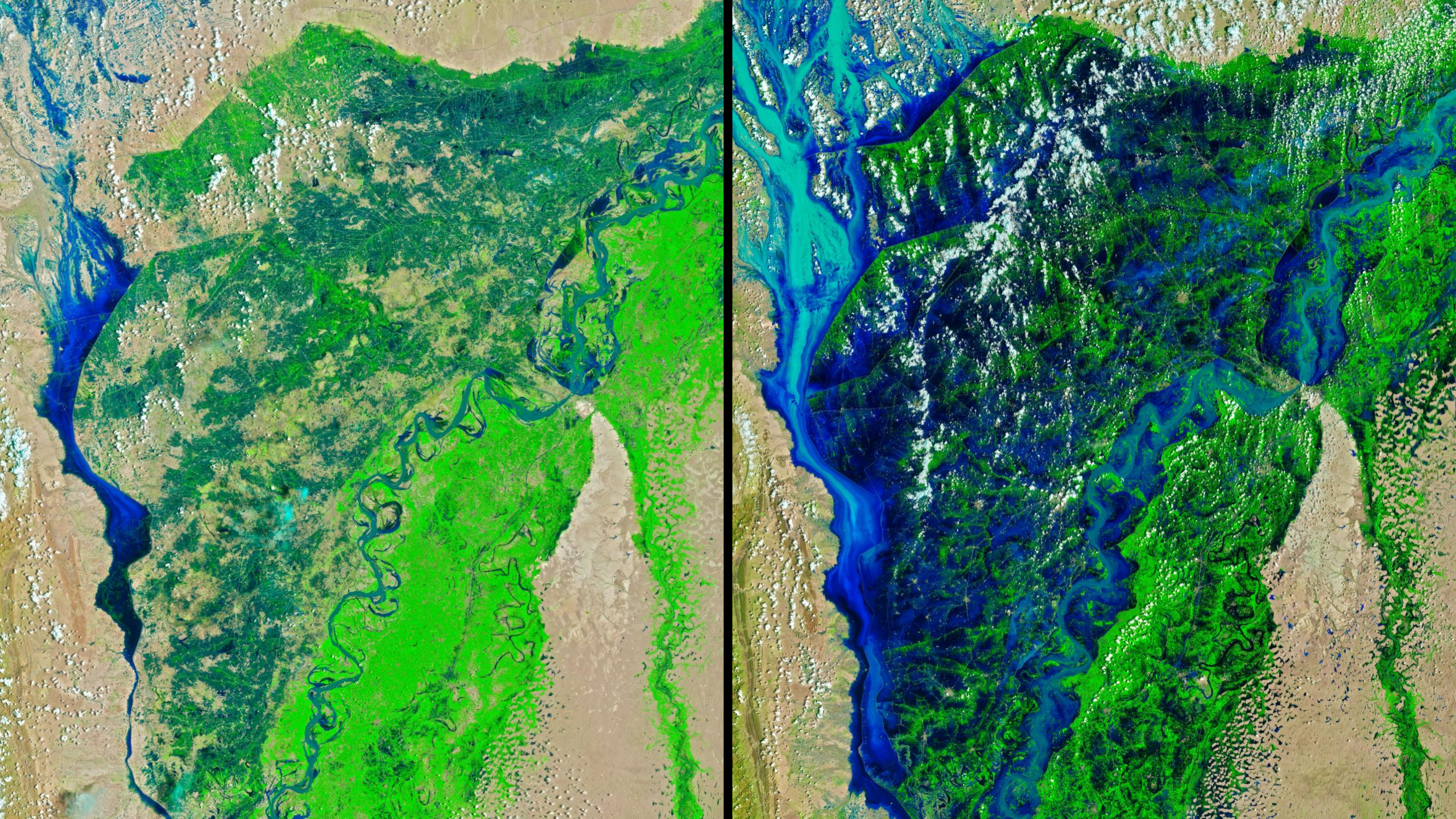
Urgent and long-lasting intervention is needed to help curb the **drought** crisis in East Africa, which has now run for four successive seasons and left at least 21 million people deprived of food and water. This is what we are doing to save the situation 👇

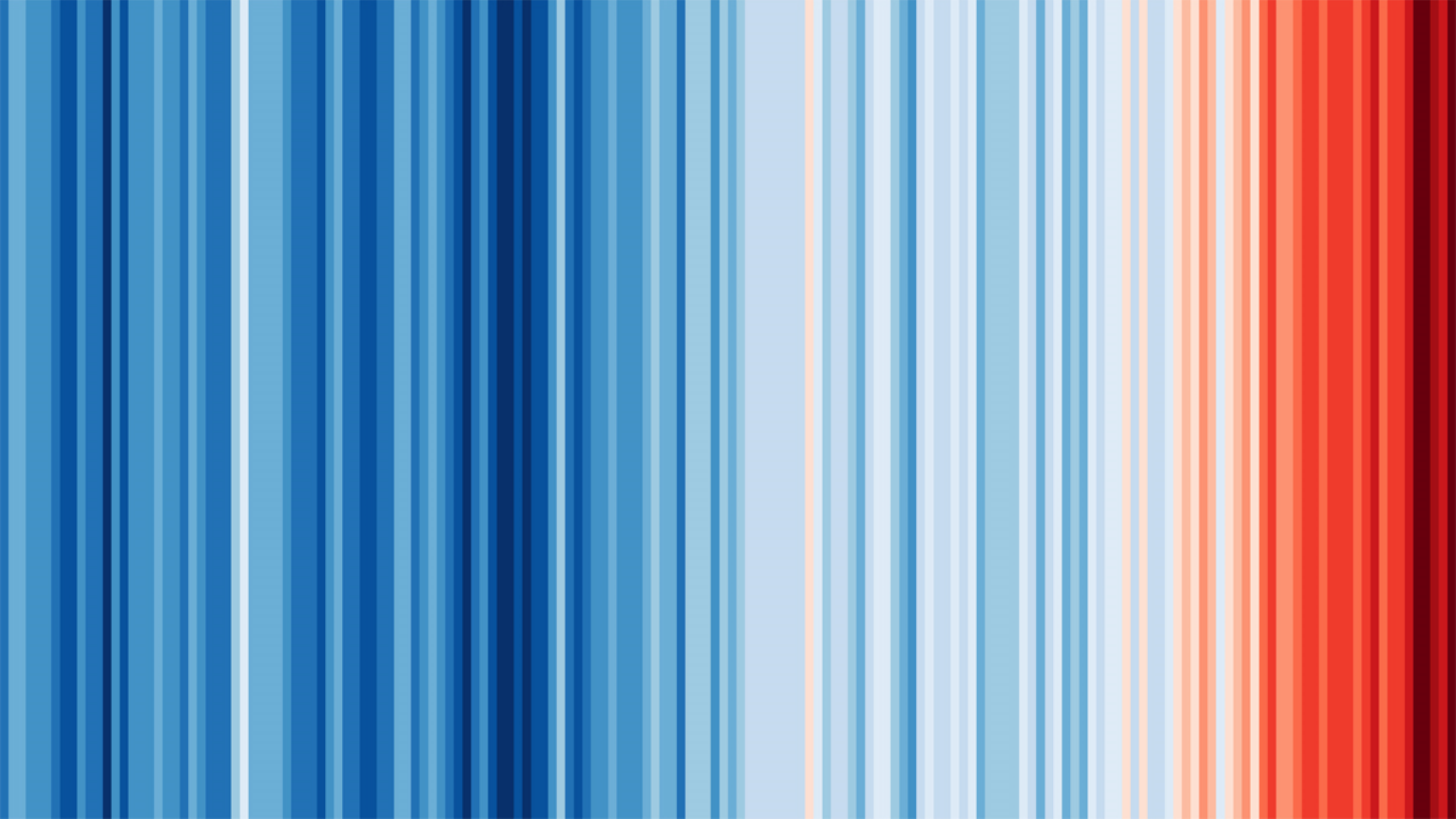
plantvillage.psu.edu/blogposts/207-...

Link

“ The dogmas of the quiet past are inadequate to the stormy present. The occasion is piled high with difficulty and we must rise with the occasion. As our case is new, we must think anew, we must act anew. We must disenthrall ourselves.”

Abraham Lincoln, Dec 1st 1862





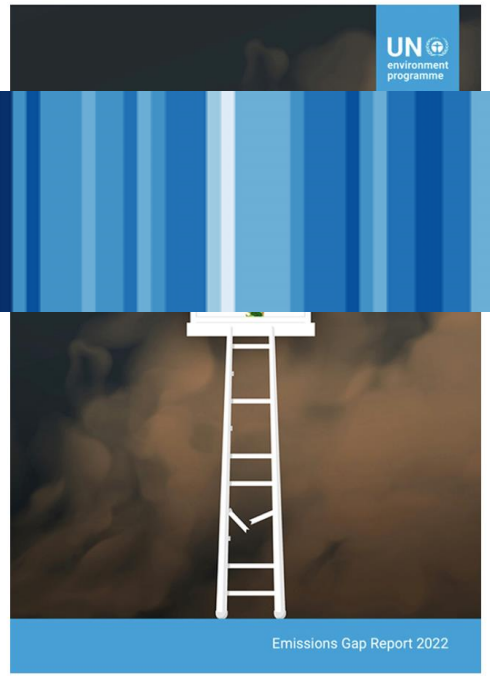
UN environment programme

Who we are | Where we work | What we do | Publications & Data

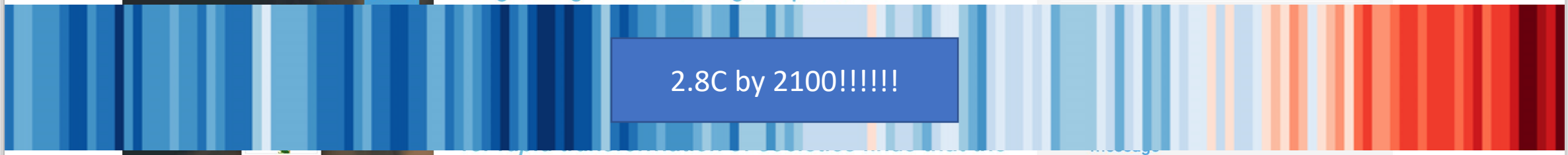
27 OCTOBER 2022 | REPORT

Emissions Gap Report 2022

Authors: UNEP



As growing climate change impacts are



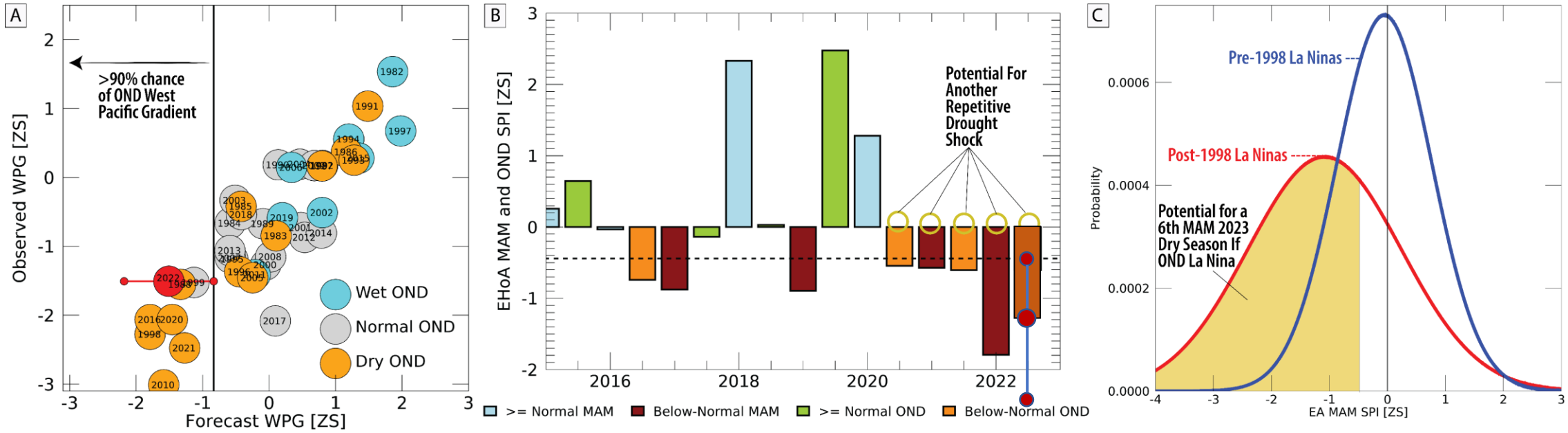
international community is falling far short of the Paris goals, with no credible pathway to 1.5°C in place. Only an urgent system-wide transformation can avoid climate disaster.

DOWNLOAD THE FULL REPORT

FURTHER RESOURCES

Press release

Context – A fifth and six dry OND and MAM season appear likely



Caption: Concerns for more potential dry seasons in OND 2022 and MAM 2023. **A**. Scatterplot showing NMME-based May forecasts of OND 2022 West Pacific Gradient values. The 2022 forecast is shown in red, along with 80 percent confidence intervals. Below-normal, normal and above-normal OND rainy seasons are denoted with orange, gray and cyan circles (source: FEWS NET CHC). Based on the COLA-RSMAS-CCSM4 NASA-GEOSS2S NCEP-CFSv2 CanCM4i-IC3 and GEM-NEMO NMME Models. **B**. Observed MAM and OND SPI values for the eastern Horn of Africa, along with an OND 2022 analog-based forecast for OND 2022. The MAM 2022 drought follows three poor rainy seasons, and a fifth drought is likely in OND 2022. Orange circles indicate repetitive dry seasons. **C**. Probability density functions for pre- (blue bell curve) and post-1997 (red bell curve) MAM dry region rains in years with La Niñas. If a La Niña event occurs in OND 2022, a sixth dry season in MAM 2023 may be likely (see also Figure 4B in December multi-agency alert). 2 All time-series were standardized with a 1981-2010 baseline.

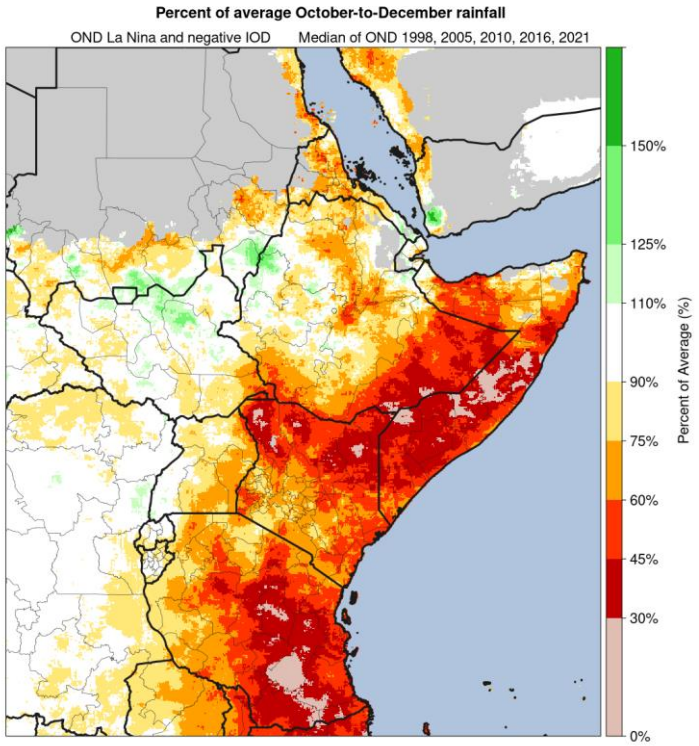
Figure 2 from June 9 multi-agency alert: **Unprecedented drought brings threat of starvation to millions in Ethiopia, Kenya, and Somalia**

Climate change and La Niña have caused an unprecedented multi-season drought, punctuated by one of the worst March-to-May rains in 70 years

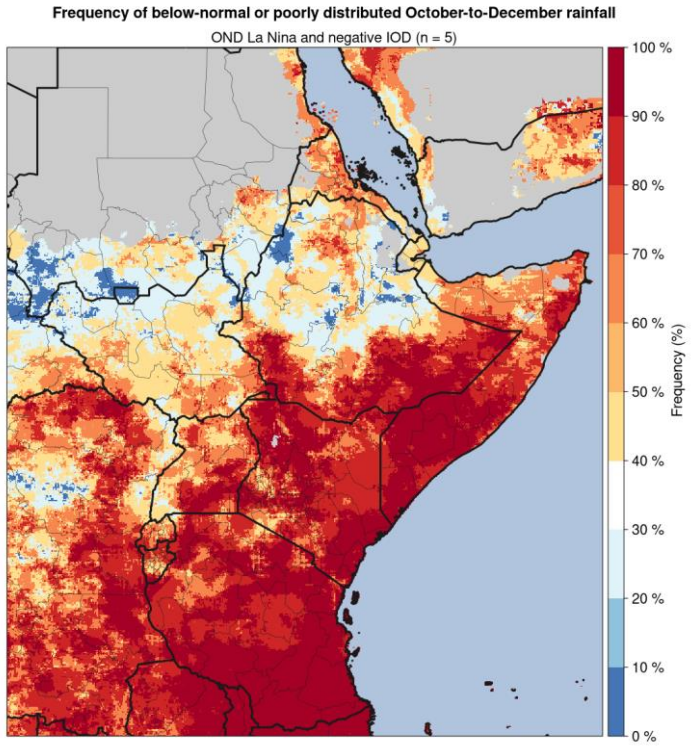
OND rainfall performance during past seasons with La Niña and negative Indian Ocean Dipole conditions

This composite shows CHIRPS rainfall outcomes during OND seasons with both La Niña and negative Indian Ocean Dipole conditions. Forecasts indicate that both will likely be present during OND 2022. There are 5 years since 1981 when this occurred: 1998, 2005, 2010, 2016, 2021

Percent of average OND rainfall



Frequency of poor OND rainfall performance



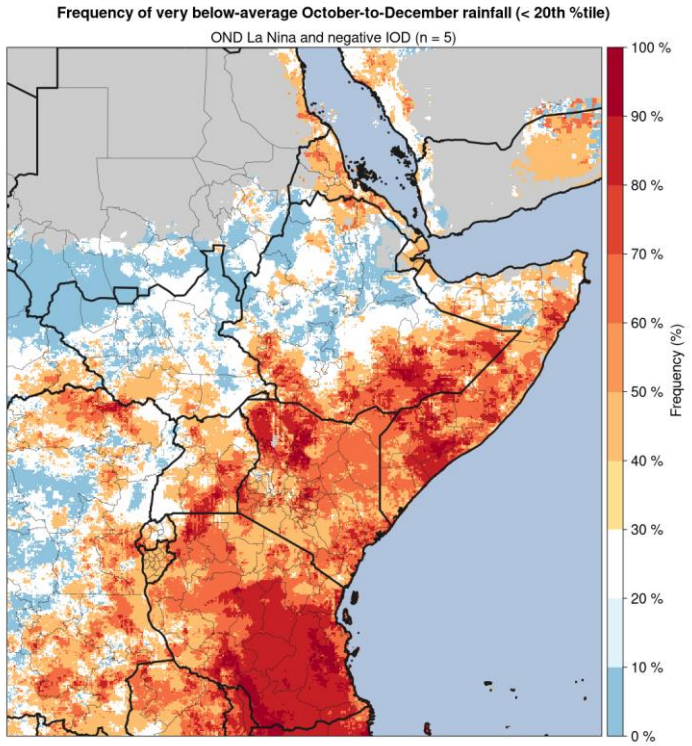


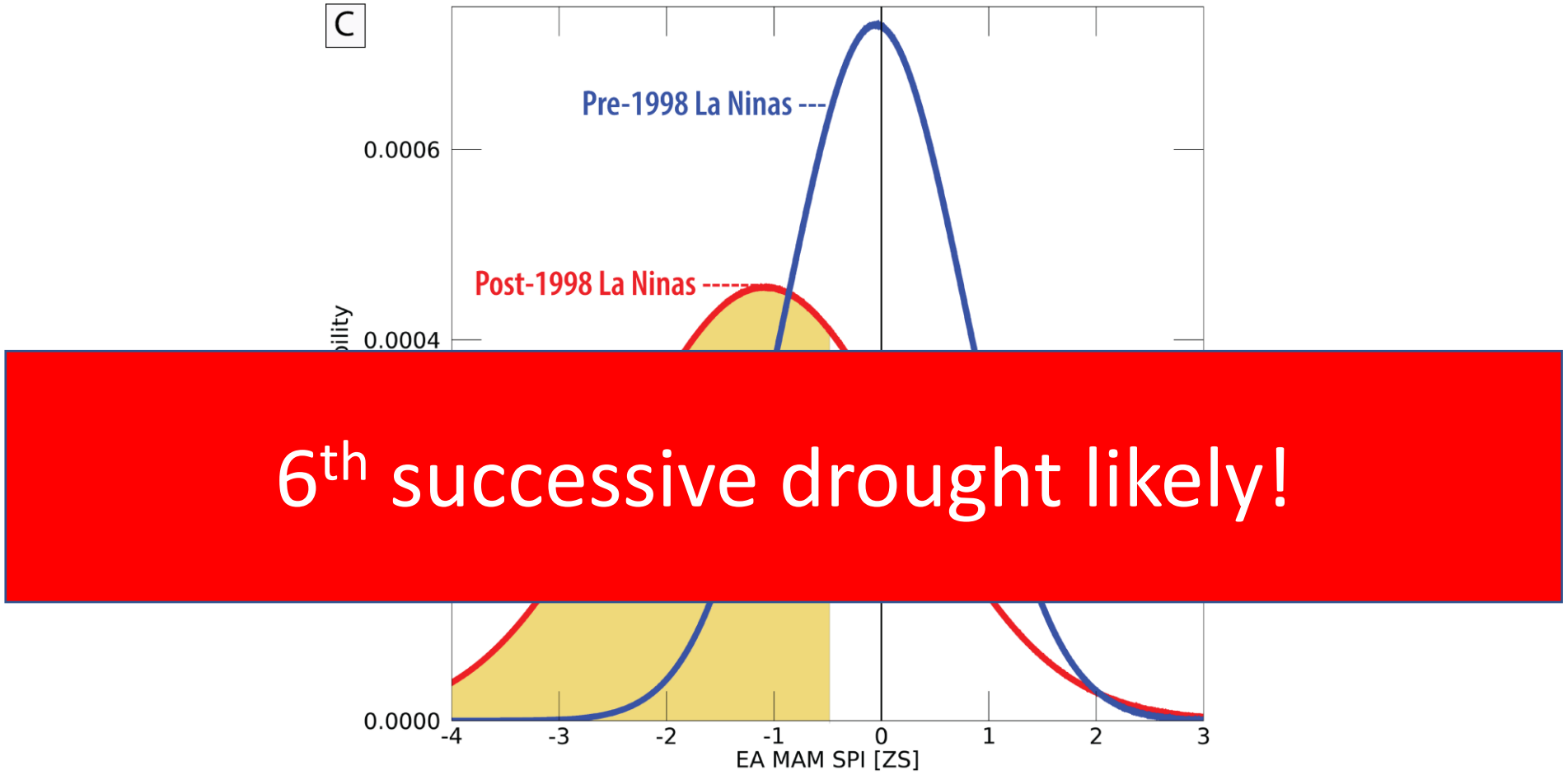
Figure description

Left: Median value of OND rainfall during these years, shown as a percent of the 1981-2021 average. **Middle**: Frequency of below-normal Oct-Dec or Oct-Nov rainfall; the latter represents "poorly distributed" OND season rainfall. **Right**: Frequency of much lower than average Oct-Dec rainfall. Below-normal and very below average refer to totals that are in the lowest one third and one fifth of 1981-2020 seasons, respectively. Gray areas: Dry mask. Data: CHIRPS.

Acknowledgement: Produced by Laura Harrison, Thanks to Andy Hoell/NOAA for his OND La Nina + -IOD composite map, these maps use the same years and design.

We should also be concerned about MAM 2023

- Since 1998, when an OND season has exhibited La Nina conditions, the following MAM season has been below-normal 75% of the time.
- FEWS NET research attributes this to the influence of a warming Warm Pool



6th successive drought likely!

PDFs of East African MAM SPI following OND La Nina Seasons
from June 9 multi-agency alert

East Africa

Ethiopia

Presence Country

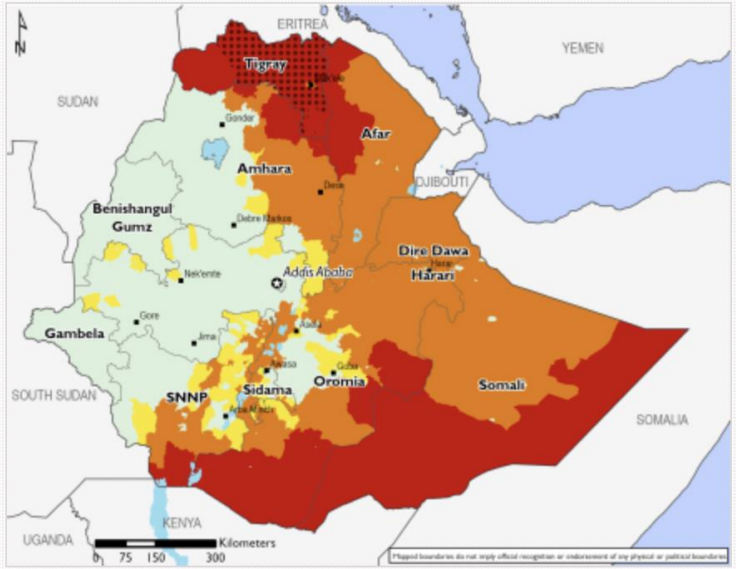
Key Message Update

Archive

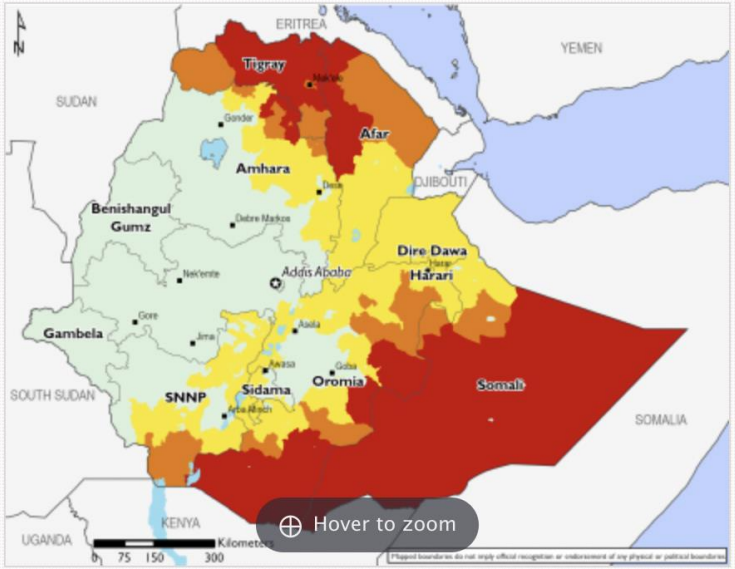
Large-scale humanitarian assistance is needed to prevent further deterioration in food security

September 2022

September 2022



October 2022 - January 2023



IPC v3.1 Acute Food Insecurity Phase

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

Outcomes may be worse than mapped, but available evidence is insufficient to confirm or deny

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.

“four interconnected and gargantuan challenges confronting the world at this moment”
Ambassador Samantha Power,
Senate Hearing, March 23, 2021

Covid
Conflict
Climate Change
Democratic Backsliding

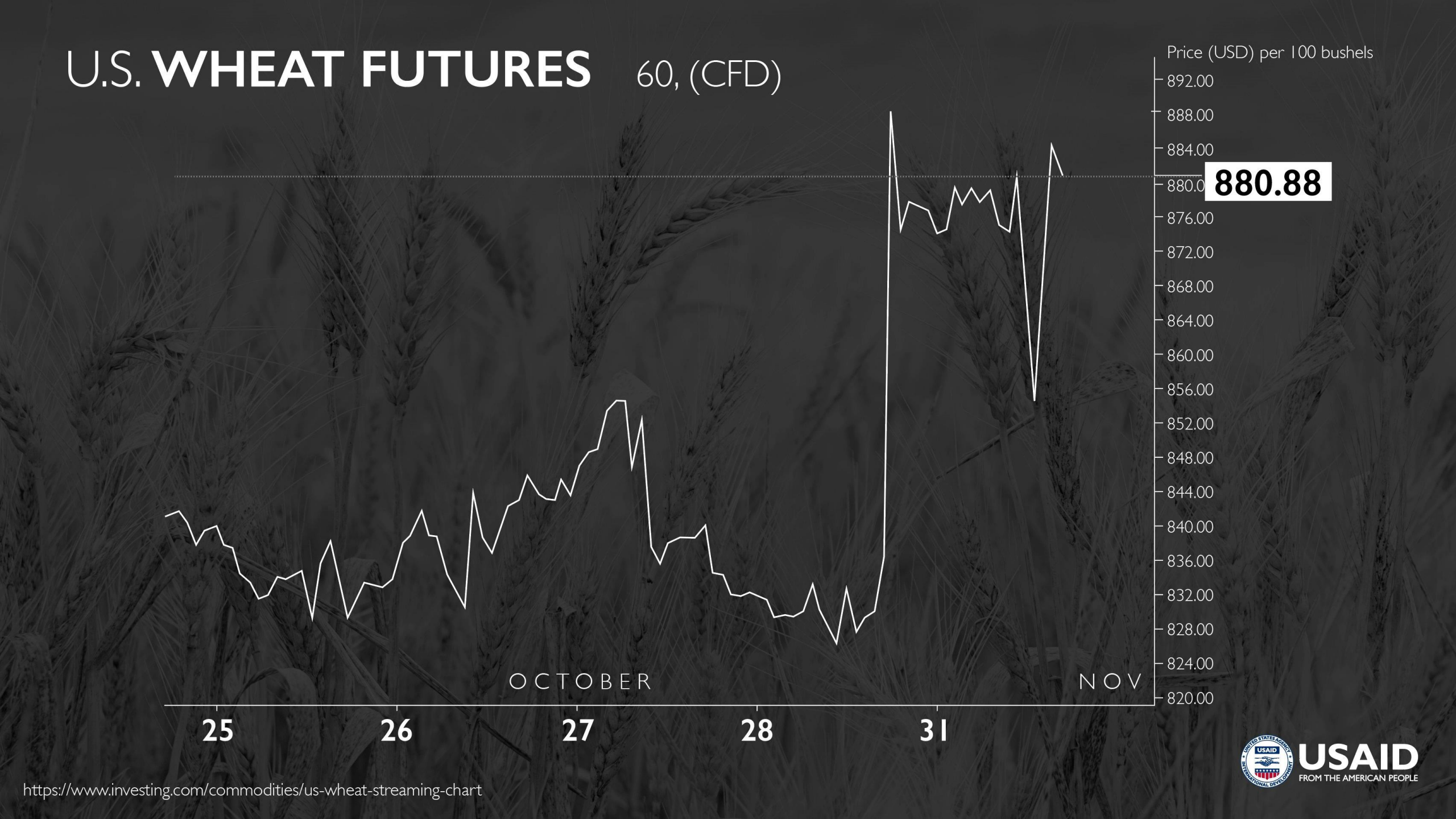
The New York Times

Russia-Ukraine War

Russia Says It's Suspending Participation in Grain Deal With Ukraine

Published Oct. 29, 2022 Updated Oct. 30, 2022

U.S. **WHEAT FUTURES** 60, (CFD)



https://www.investing.com/commodities/us-wheat-streaming-chart

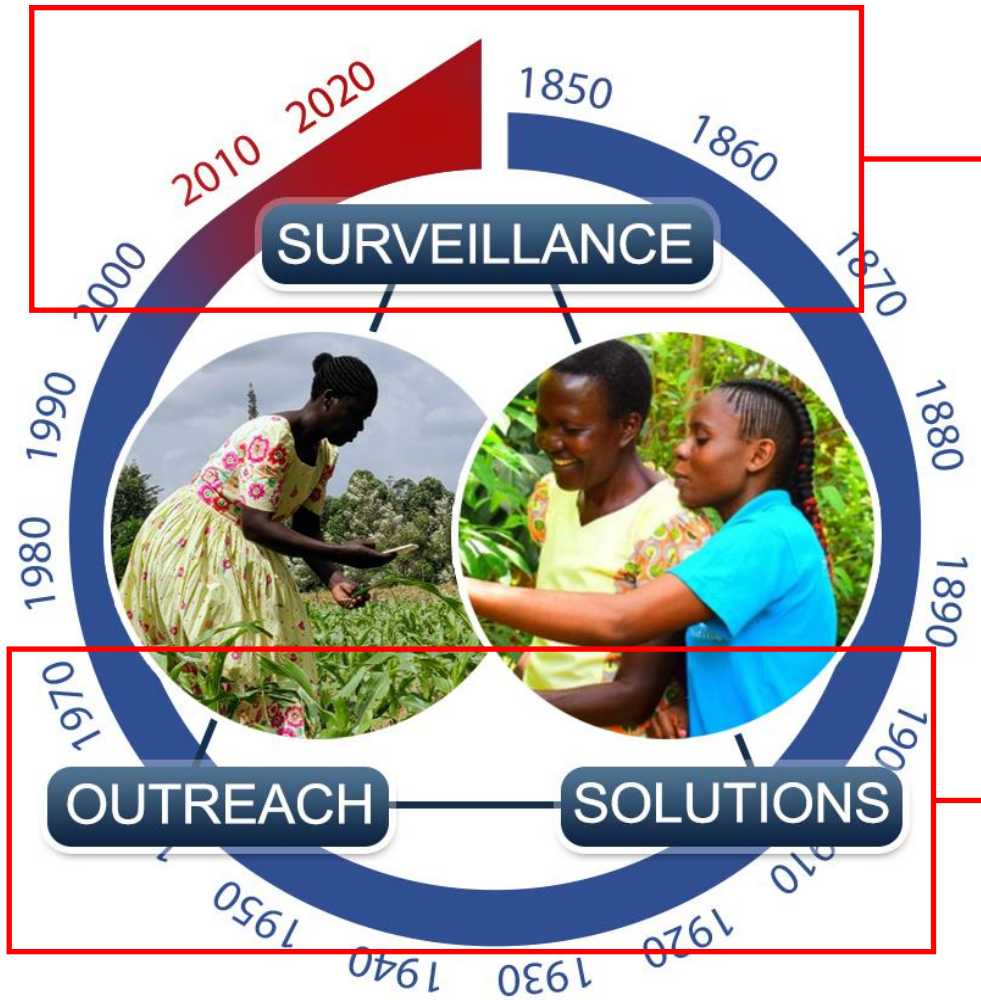
USAID
FROM THE AMERICAN PEOPLE

Fertiliser prices hit new highs

CRU Fertiliser price index (Jan 2006=100)

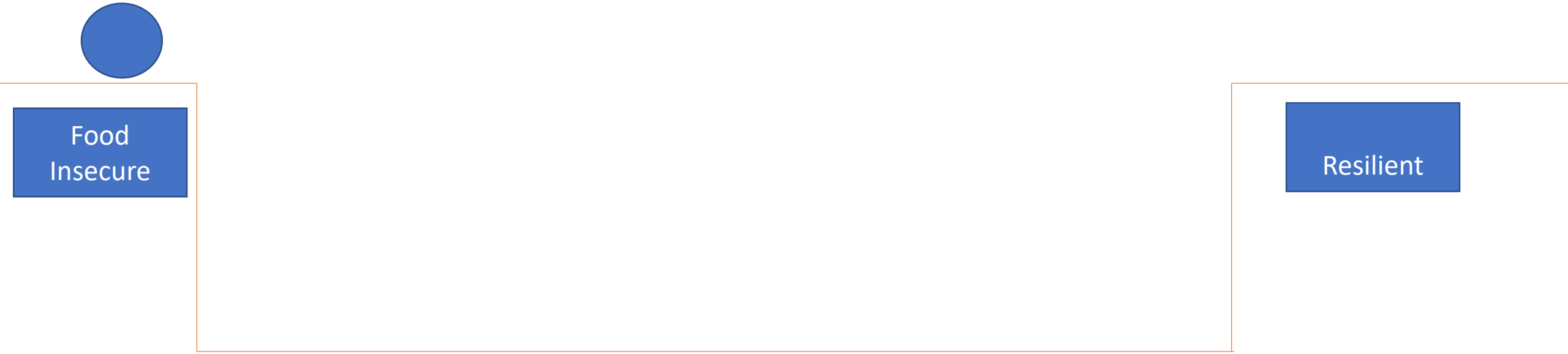
Source: CRU

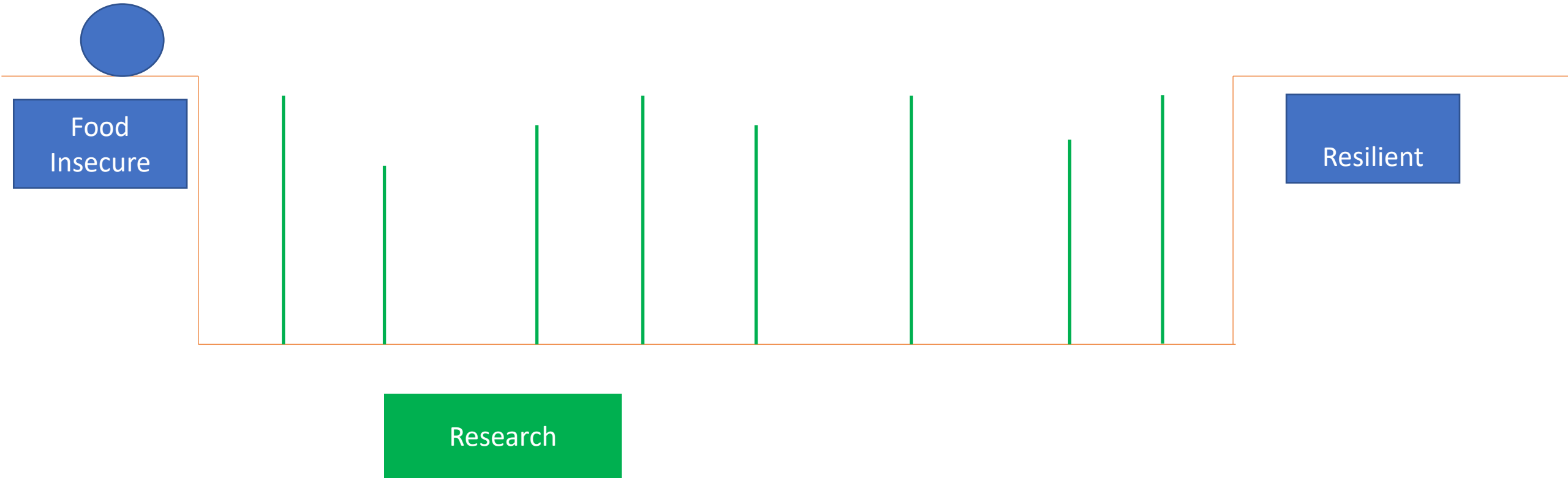
S.O.S.

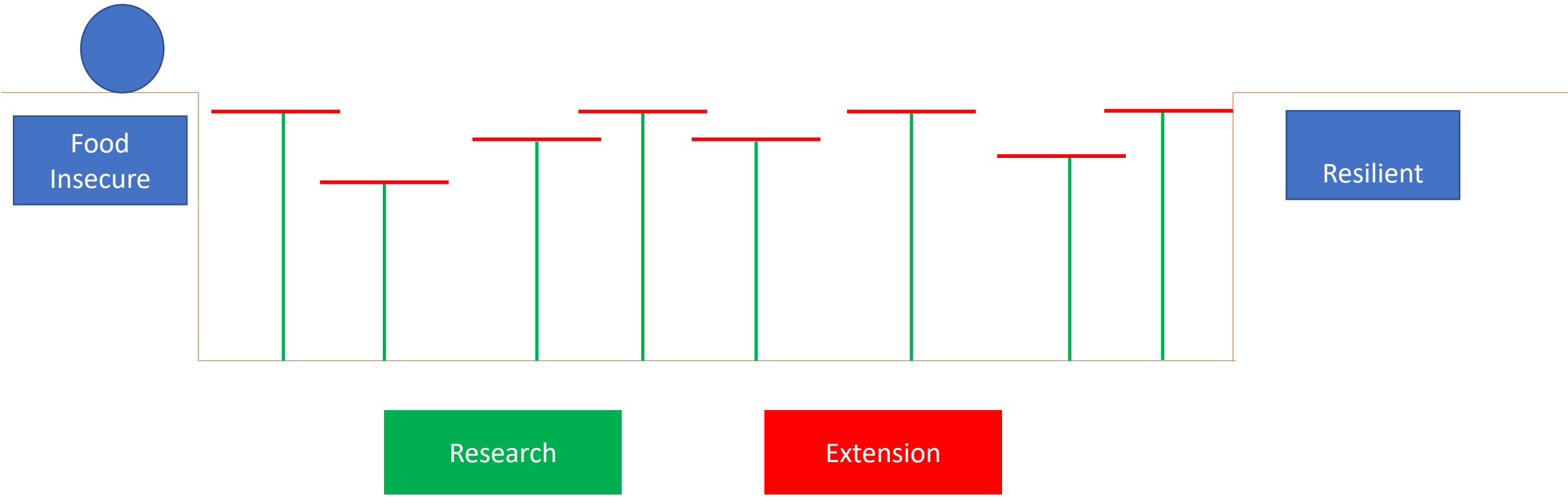


Surveillance needed in a climate changed world

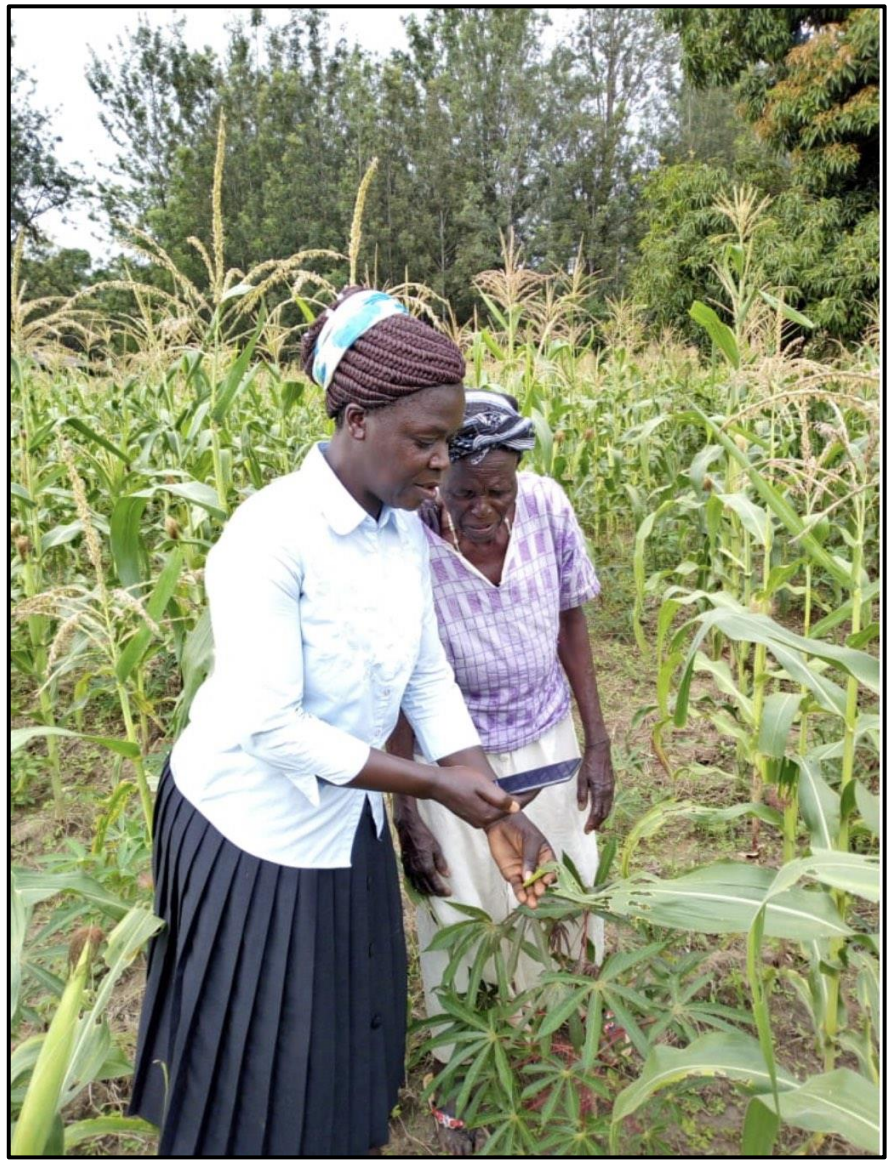
Research needed for solutions and reaching hundreds of millions of farmers

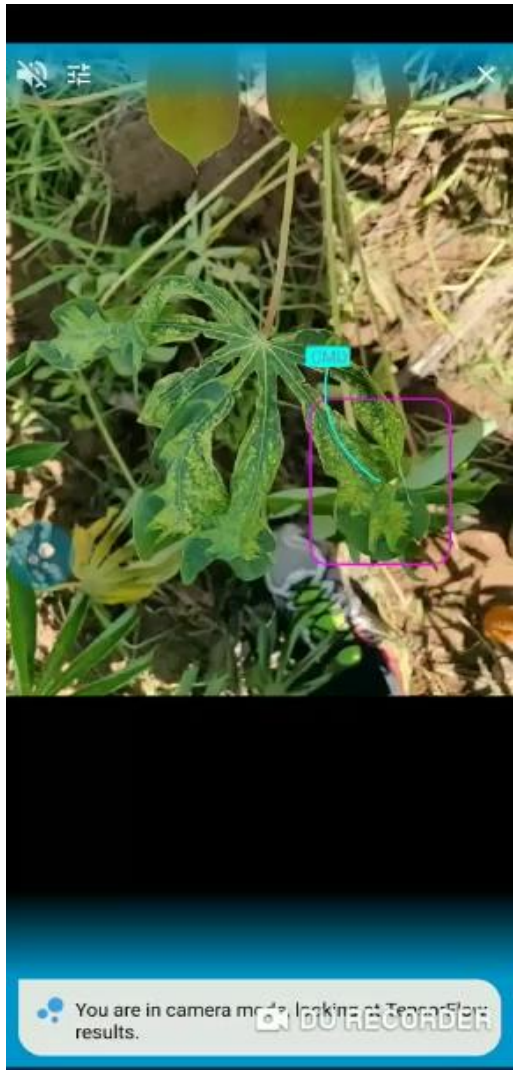

Food Insecure
Resilient


Food Insecure
Resilient
Research

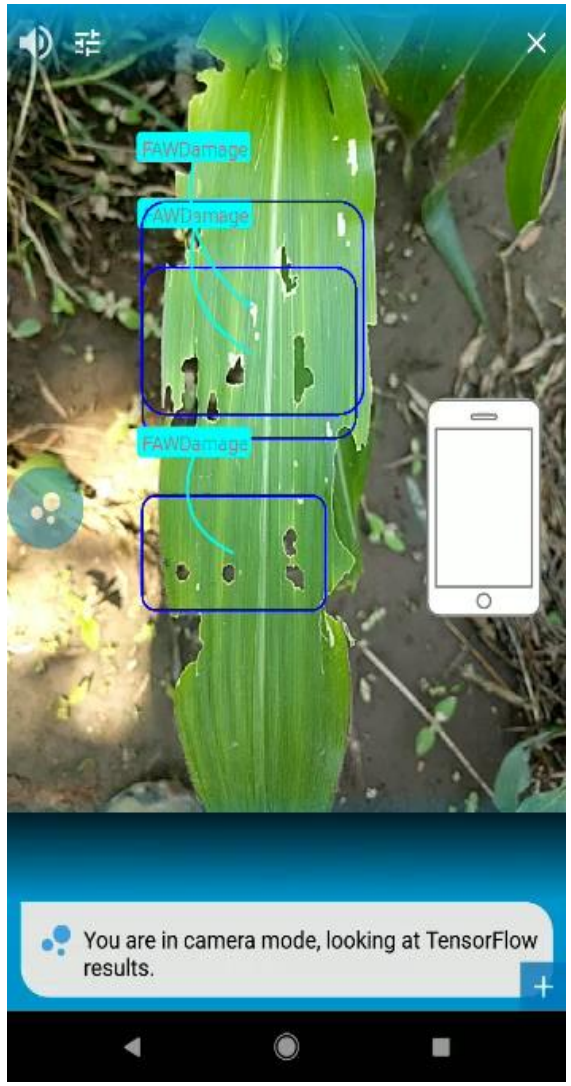

Food Insecure
Resilient
Research
Extension

PlantVillage: Extension via AI





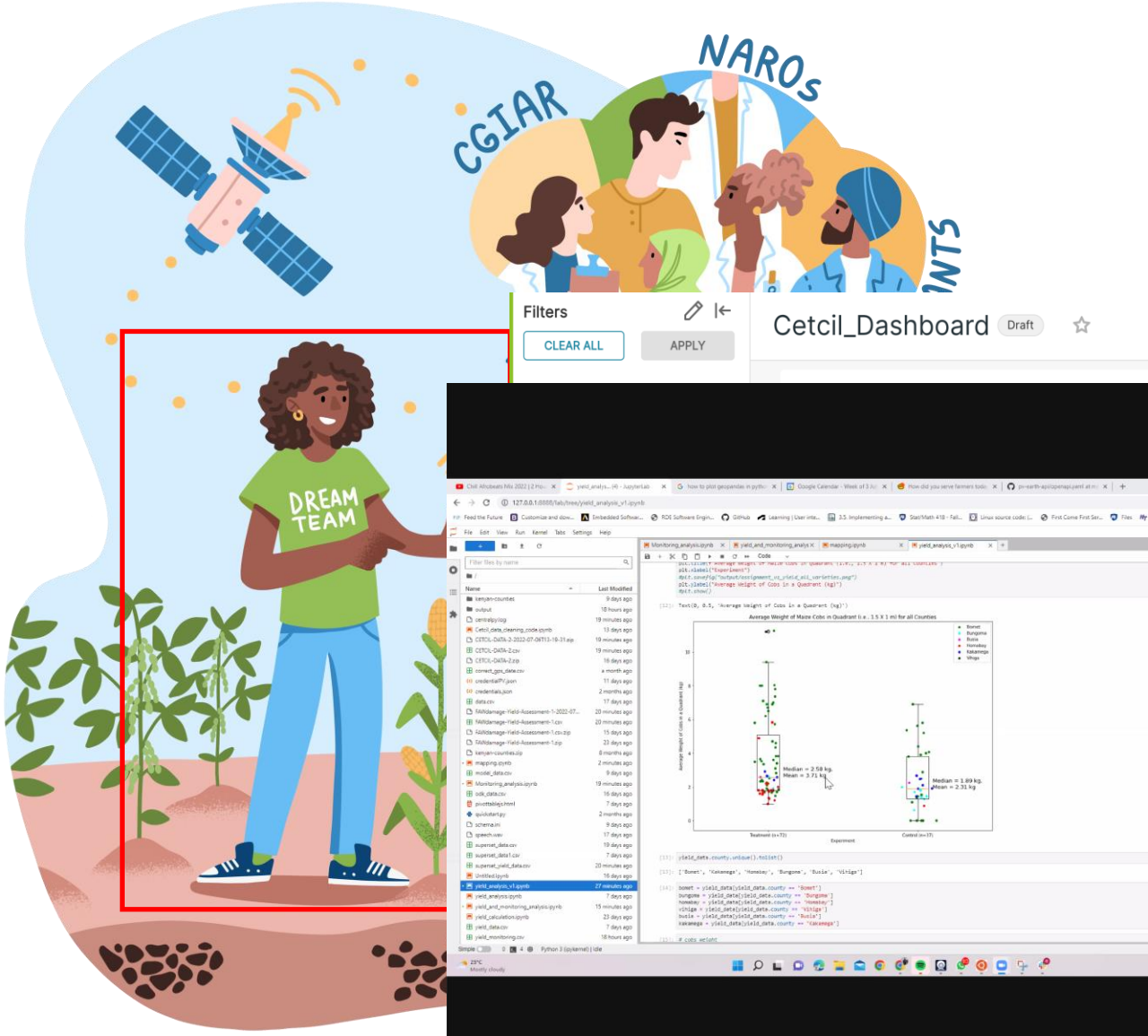
Cassava Diseases (virus and mites)



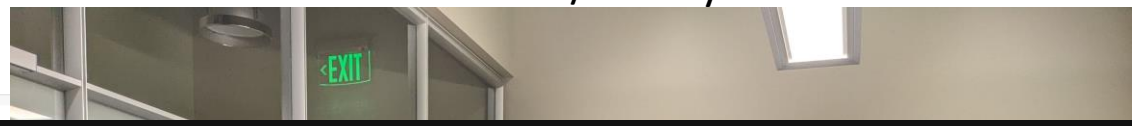
Fall armyworm

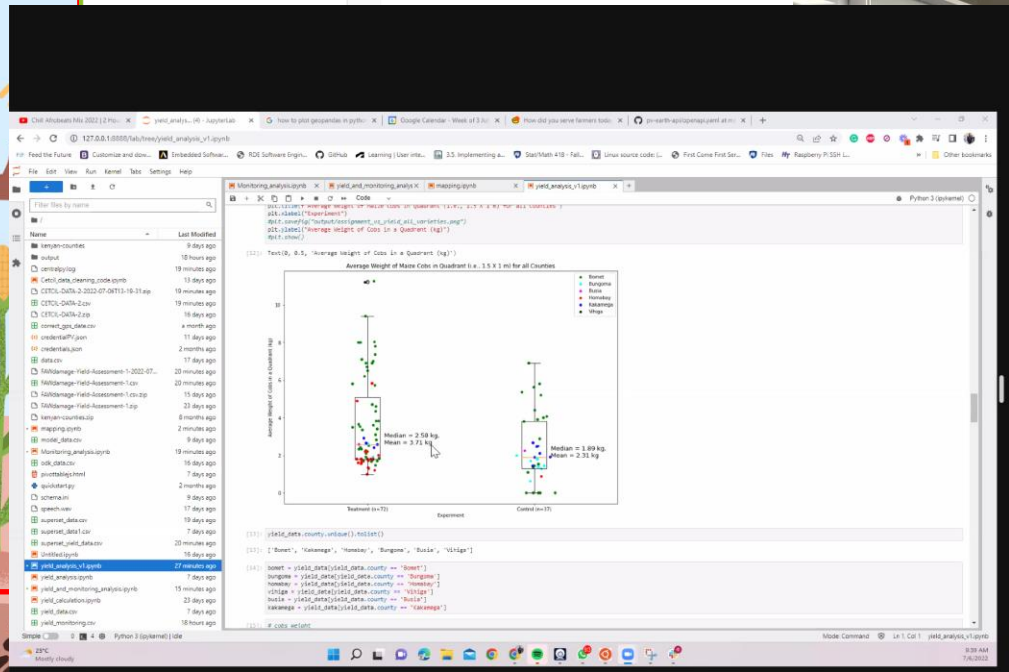
Led by Pete McCloskey, our lead AI engineer with James Legg, IITA and FAO

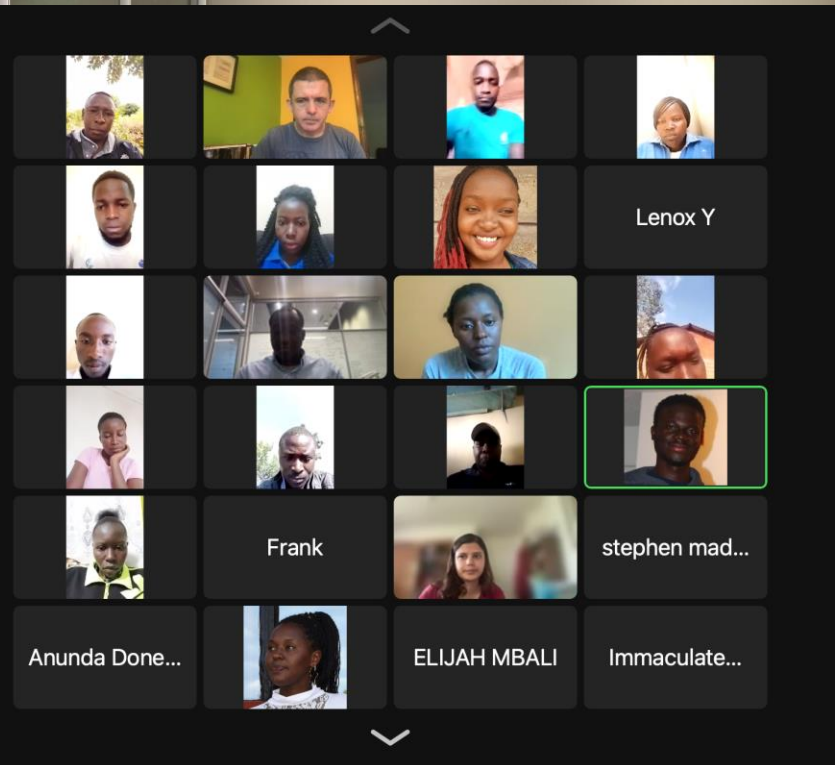
Youth & gender research for a “broken, sludgy” world



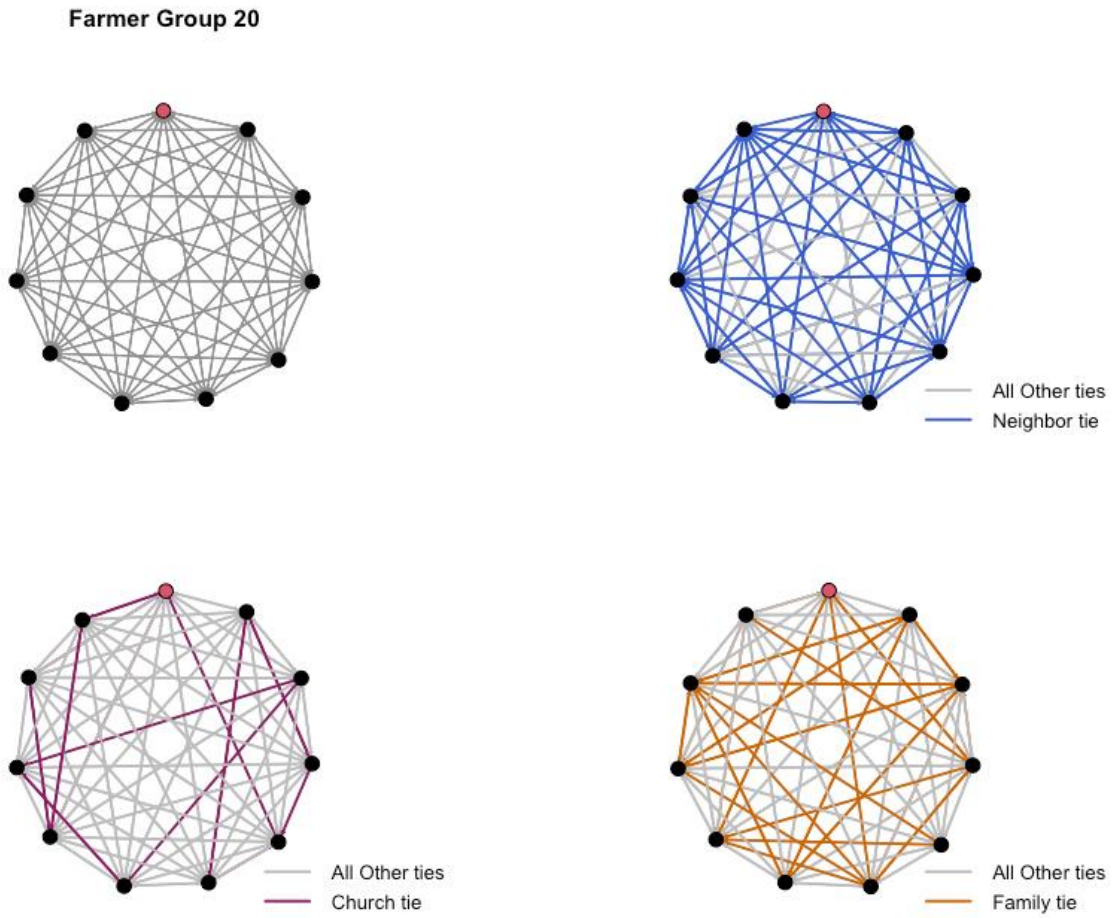
Four Dream Team members/county



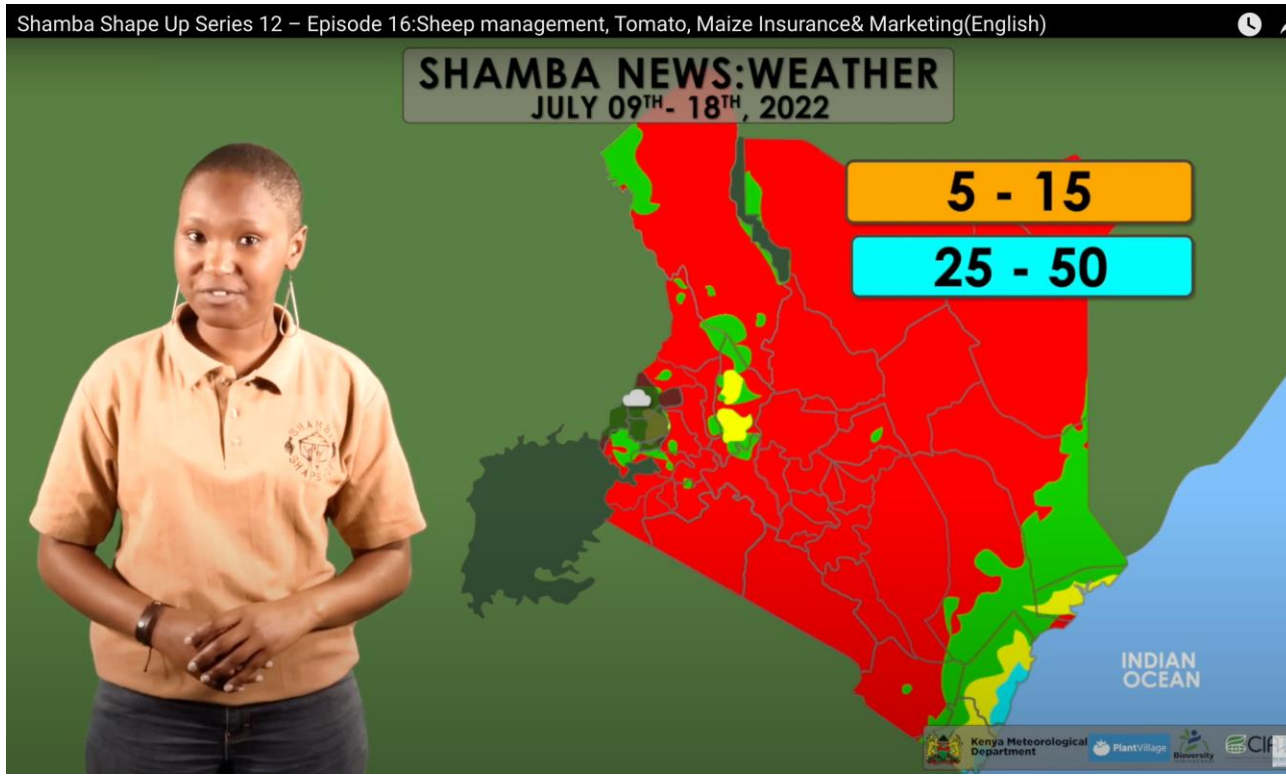




Behavioral economics



Medha Uppala & Dream Team



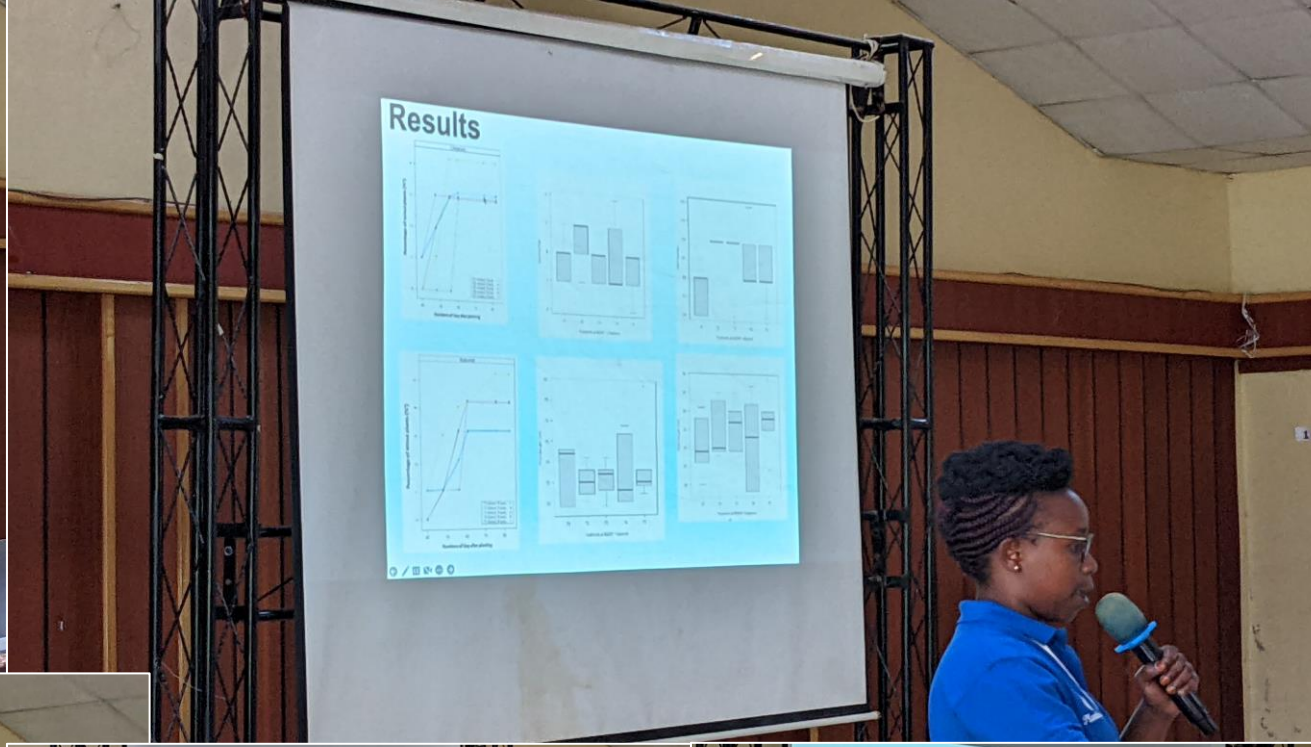
USAID FEWSNET data to:

- 14 Million on TV, Radio and in person in 9 countries
- >500,000 on SMS each week

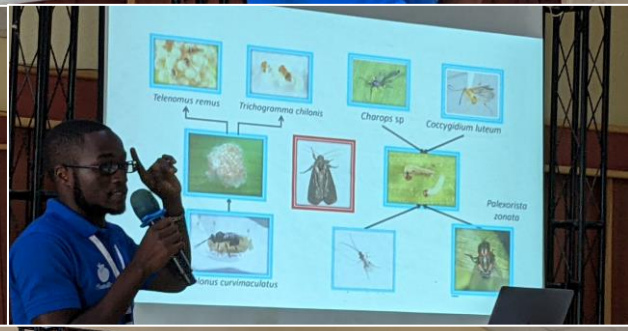
AI Research

The Dream Team: 87 young Kenyans (160 globally)


The Dream Team


Results


Beans intercropping
Biochar application in Zai pits
Striga affected field

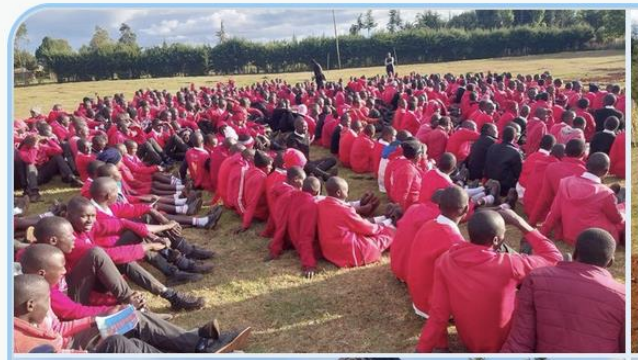

Telenomus remus
Trichogramma chilonis
Charops sp
Coccygidium luteum
Polexorista zonata

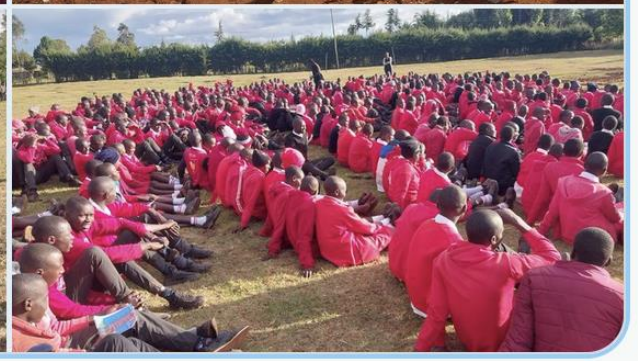

Process


ANIMALVILLAGE
(Pastoralist Team

Scaled up parasitoid production to 35 million in Long Rains and now selling them in the short rains (9 months)

Climate Change Clubs



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We need to conduct the largest experiment in the history of agriculture