

Climate Change and Food Security

What are the risks, and what can we do?

Janet M Lewis, PhD



<https://www.flickr.com/photos/77917153@N00/8206234109/>

Overview

- My Story – Why do I care?
- Climate Change
- What can we do?



I've always had food



Guatemala 1995



“The people live for the corn. If they have not had corn, they feel they have not eaten.”

Bernice, Catholic nun



Wheat

- PhD Plant Breeding (MSU)
- Postdocs (U of MN, CIMMYT)
- Academia – MSU
- Corporate – Bayer

...

Need for something more

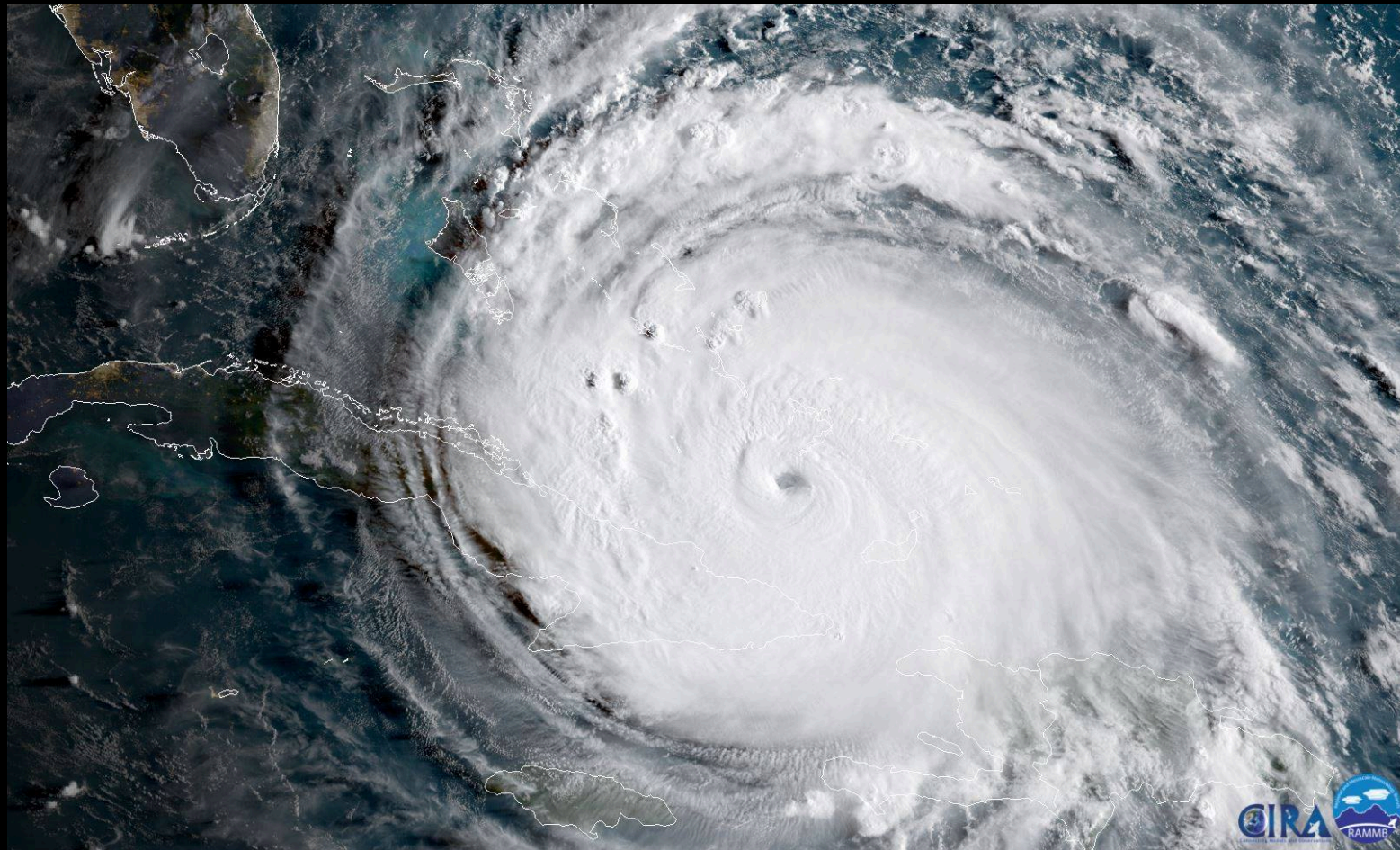
Need a change



Florida – Long term goal, short term reality?



...then Irma



<https://www.nasa.gov/image-feature/geocolor-image-of-hurricane-irma>

...then Maria



<http://whnt.com/2017/09/20/hurricane-maria-makes-puerto-rico-landfall-wednesday-morning/>

Puerto Rico

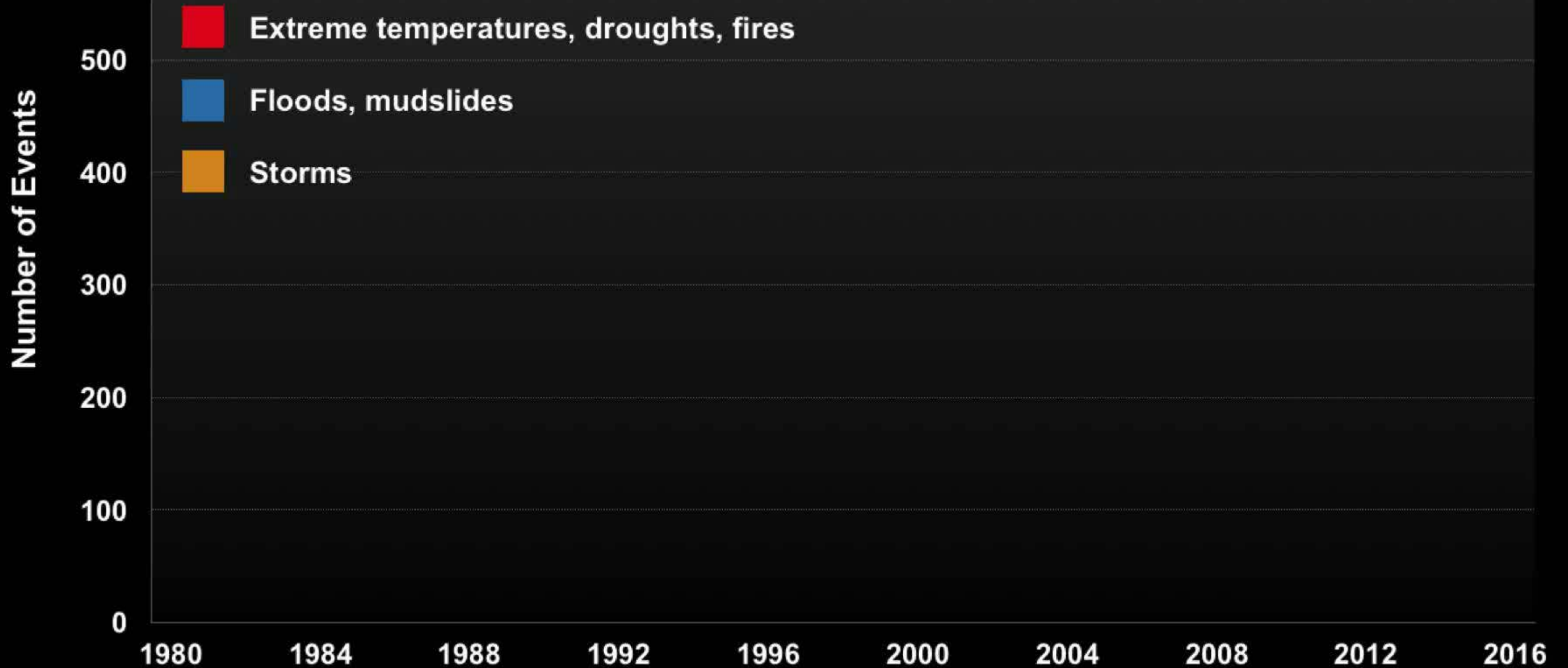


**Plants can't
...swim in a flood
...run from a fire
...water themselves
in a drought**

**How do we feed
ourselves in an
increasingly volatile
environment?**

Worldwide Extreme Weather Catastrophes

1980 – 2016



Climate Change - General Effects?

- **Warming**

- Species adaptation
- Chemistry

- **Sea level rise**

- **Ocean acidification**

- Shells dissolve

- **Water displacement**

- Warm air holds more water
- Stronger storms

- **Changes in jet stream**

- Slower moving storms
- Different patterns

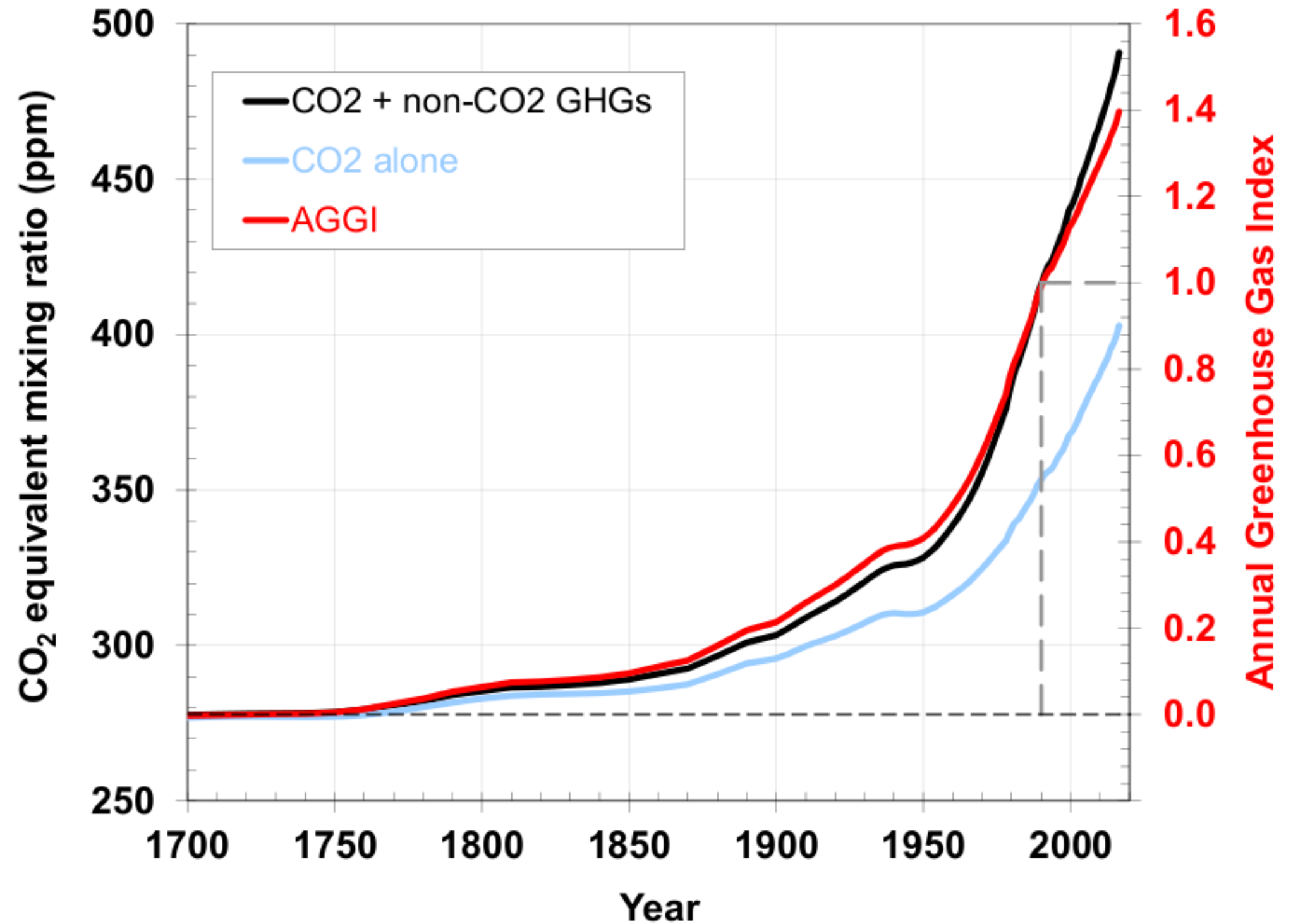
- **Increased droughts**

- **Increased wildfires**

- **Increased floods**

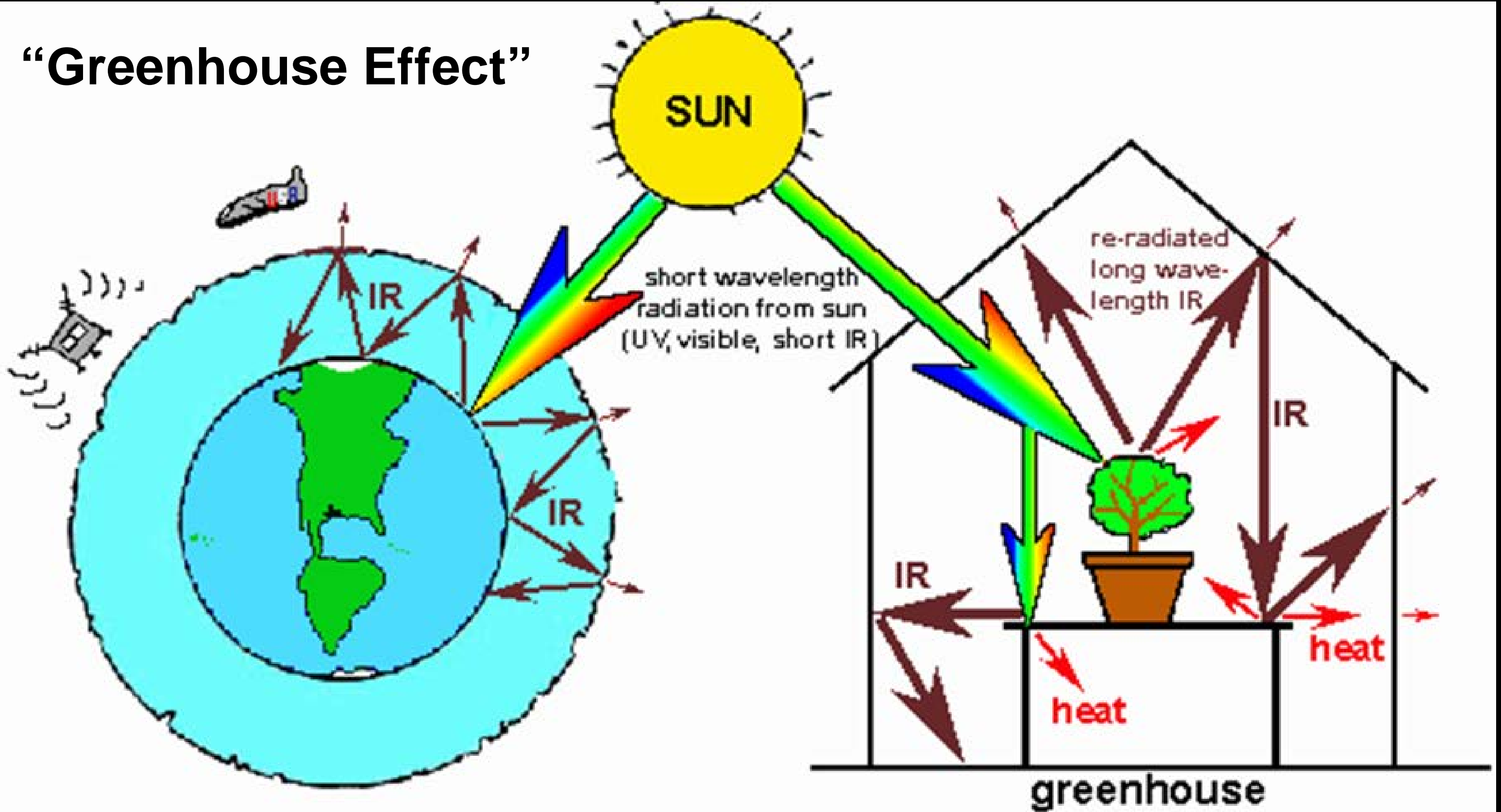
- ...

Annual Greenhouse Gas Index (AGGI)



<https://www.esrl.noaa.gov/gmd/aggi/>

“Greenhouse Effect”



Although the sky looks endless,...



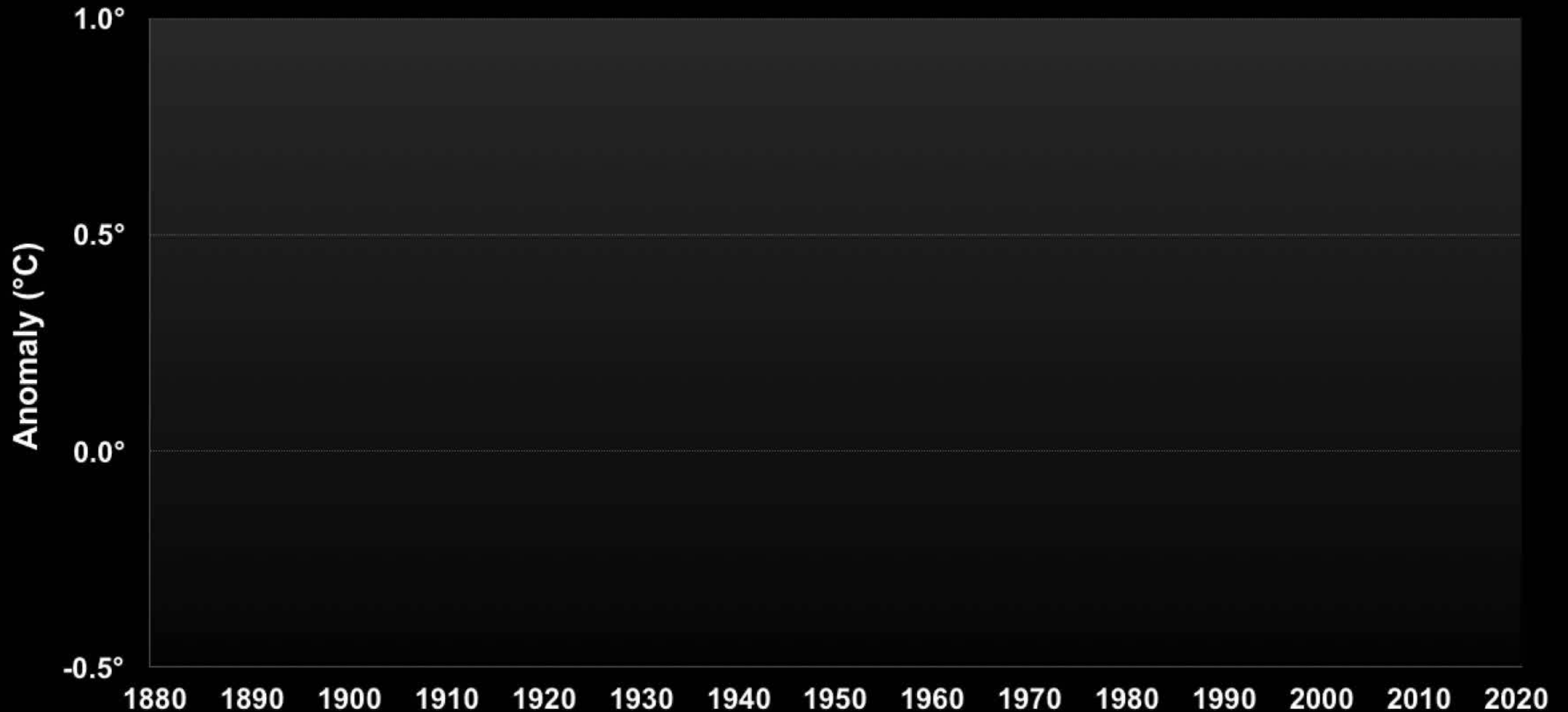
https://commons.wikimedia.org/wiki/File:Cloud_sky_over_Brest.jpg

...the **atmosphere** is just a thin layer around the earth.



Global Surface Temperature – Departure from Average

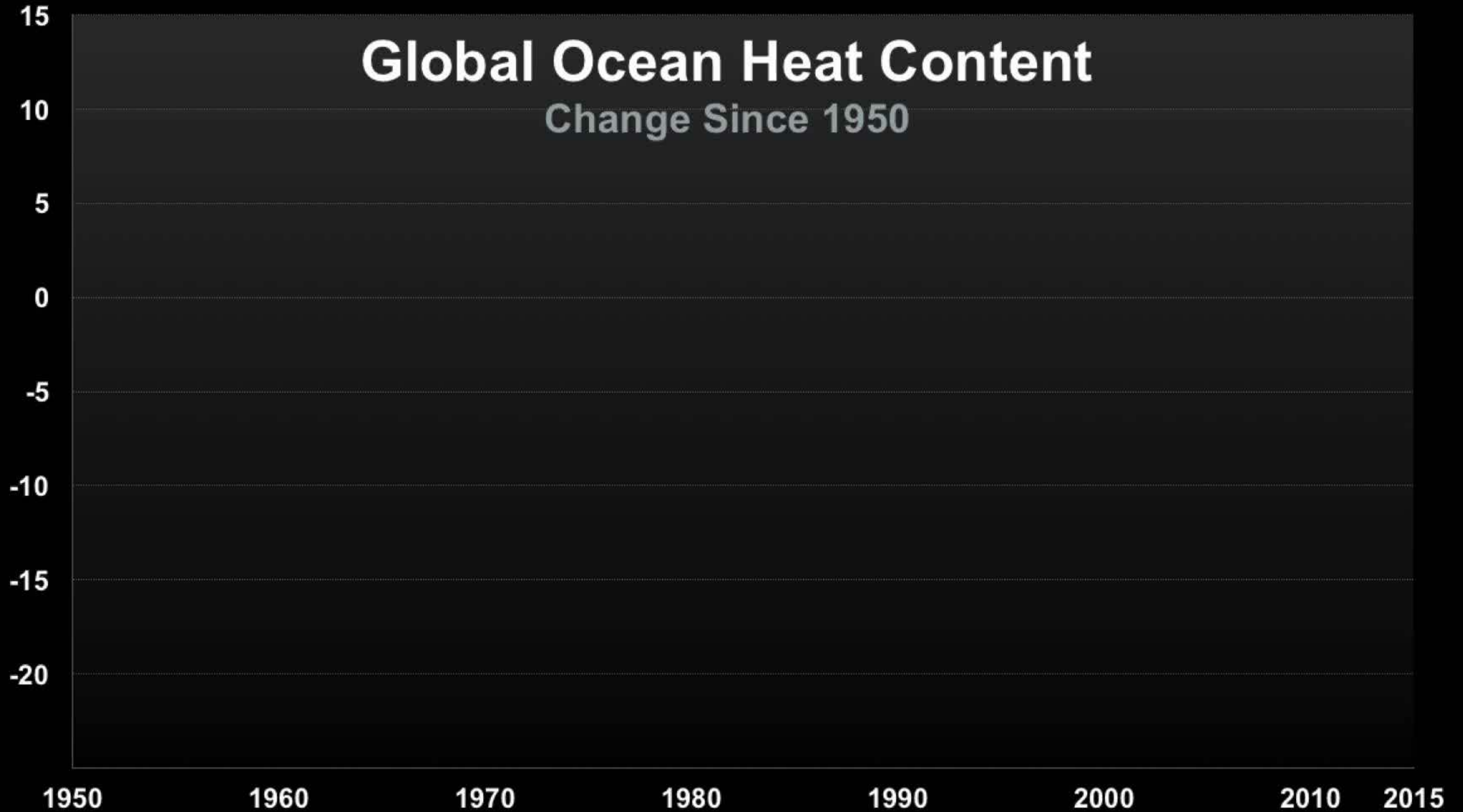
1880 – 2016



Global Ocean Heat Content

Change Since 1950

Ocean Heat Content (10^{22} J)



Data: L. Cheng, K. E. Trenberth, et al., "Improved estimates of ocean heat content from 1960 to 2015," *Science Advances*, 10 March 2017

Slide source: Climate Reality Project

São Paulo State, Brazil



Houston, 2017



<https://theharwoodinstitute.org/richs-blog-posts/2017/8/31/the-houston-lesson-we-have-an-obligation-to-help>

**We are all
connected**



Food, famine and social upheaval

Bible

100+ mentions of
famine

- Migration
- Fear
- Dependency
- etc.



<https://www.flickr.com/photos/oxfam/8655300366>

Syria



“Starting in 2006, Syria suffered its worst drought in 900 years”

“Imagine a conflict that killed off everyone in Atlanta, wounded every single person in San Francisco and Dallas and led everyone in Chicago and Houston to leave the country in search of safety.”

<https://www.pbs.org/newshour/economy/making-sense/a-major-contributor-to-the-syrian-conflict-climate-change>

<http://marketbusinessnews.com/112635-2/112635>

2007-2008 Global food crisis



<http://cominganarchy.com/2008/07/17/food-crisis-global-review-part-1-stratfor-on-global-implications/>

“As the prices of food and energy soared to new heights between 2007 and 2008, many countries were confronted with major social and political crises. Food riots and protests threatened Governments as well as social stability in Africa, Asia, the Middle East and Latin America and the Caribbean. Massive public protests in response to higher food prices erupted in very diverse countries, such as Burkina Faso, Cameroon, Egypt, Guinea, Haiti, Indonesia, Mauritania, Mexico, Morocco, Nepal, Peru, Senegal, Uzbekistan and Yemen”

<http://www.un.org/esa/socdev/rwss/docs/2011/chapter4.pdf>

Climate Change - Food Systems?

- **Plant and animal adaptation?**

- Locations
- Seasons

- **Pathogen changes?**

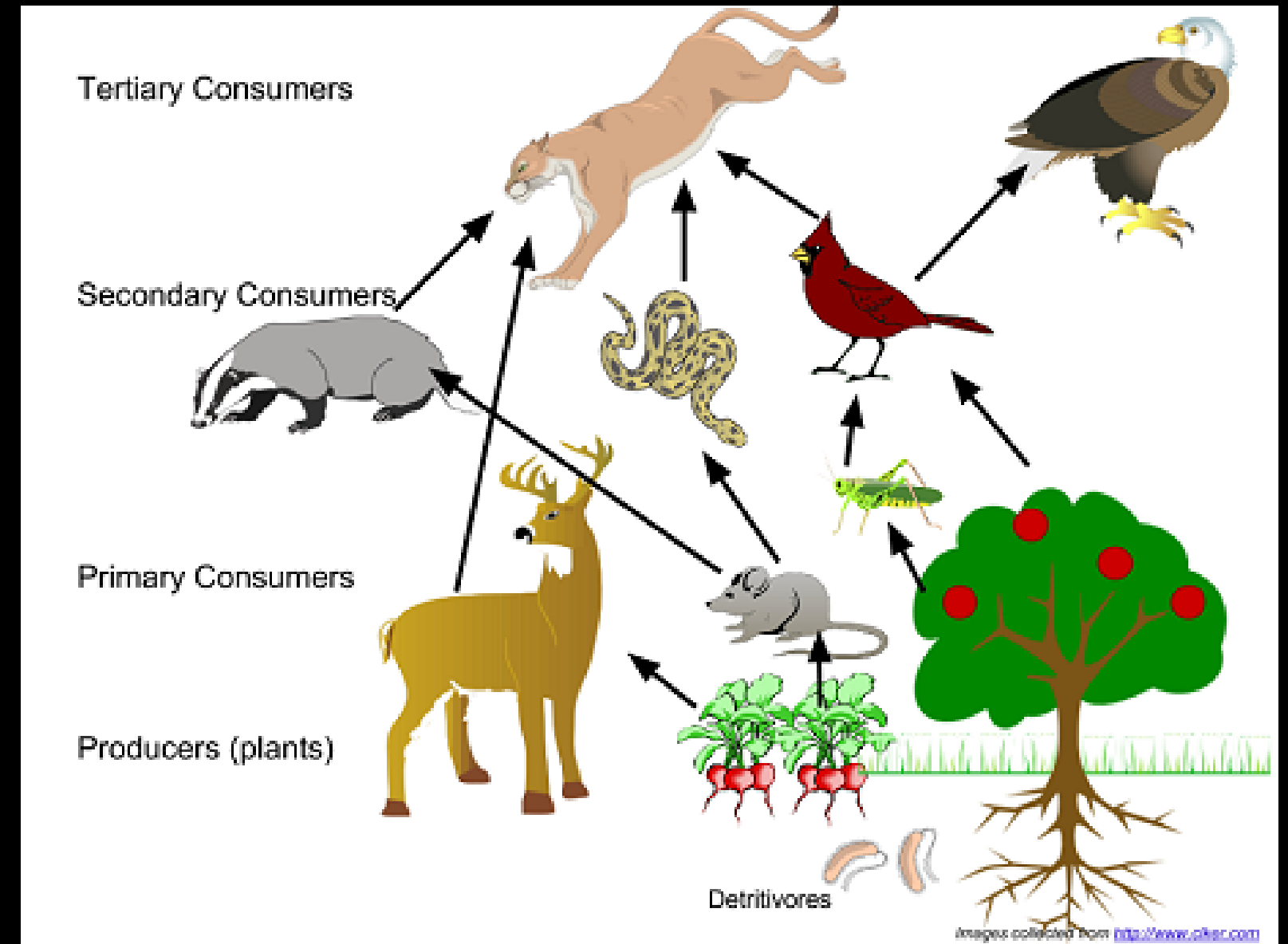
- and hosts more susceptible

- **Water?**

- Too much / Not enough / Timing?

- **Soil health?**

- **Other?**



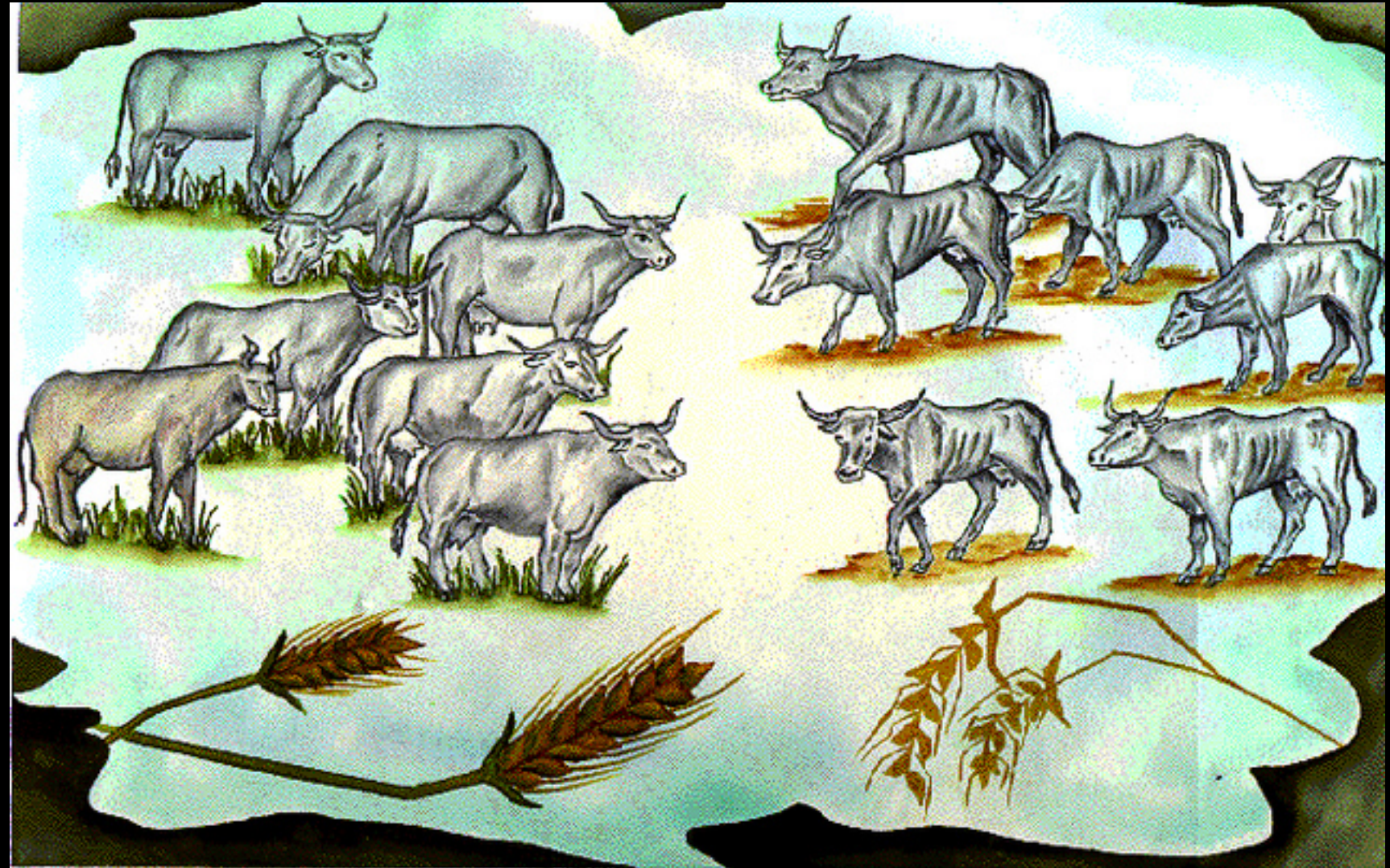
https://www.biologycorner.com/APbiology/ecology/ch48_ecosystems.html

What can we do?

Joseph, son of Jacob ...famine in Egypt



<http://sunshinescreations.vintagethreads.com/2011/09/josephs-coat-is-done.html>



Interpreted the dream
Made preparations

<https://www.flickr.com/photos/49102781@N03/4500702034/>

What can we do?

- **Food:**

- Production
- Distribution
- Storage

- **Community Resilience:**

- Social connections
- Strengths, weaknesses



- **Risk Management:**

- Scenarios
- Processes, missing pieces

My Example: Plant Breeding

- Genetic stocks are in the field
- Risks:
 - Drought?
 - Flood?
 - Hail?
 - Tornado?
- Where will the seed come from?
- Logistics of planting/storing extra



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