Human Population 2018

Lecture 15
Collapse

Collapse, topics

- **Lecture 15 Collapses in human history**
  - Africa before the diaspora
  - Ice age Europe
  - Greenland Norse
  - Black death
  - Smallpox in the Americas
  - Rwanda 1994
  - Current collapses? (Yemen, Venezuela, Syria, Myanmar)
- **Lecture 16 Modeling hyperexponential growth**
 - Equations
    - Linearly decreasing doubling time.
    - The Doomsday model.
    - Hyperexponential growth.
  - Modified Lotka-Volterra systems
  - Predictions
    - Euphoria before collapse?
    - Are we unified or fragmented?
    - How can collapse be avoided?
    - How can collapse be survived?
    - How does climate change factor in?
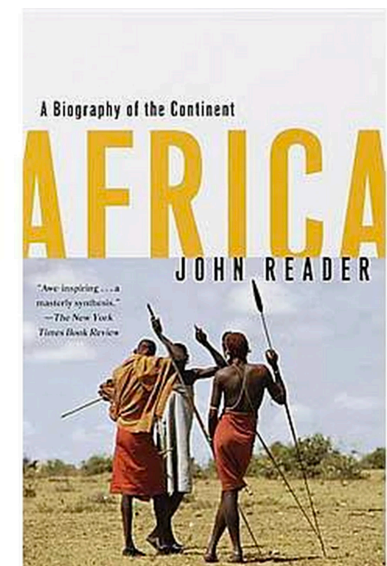- **Lecture 17 Ethics and Resilience**

Collapses in Human History
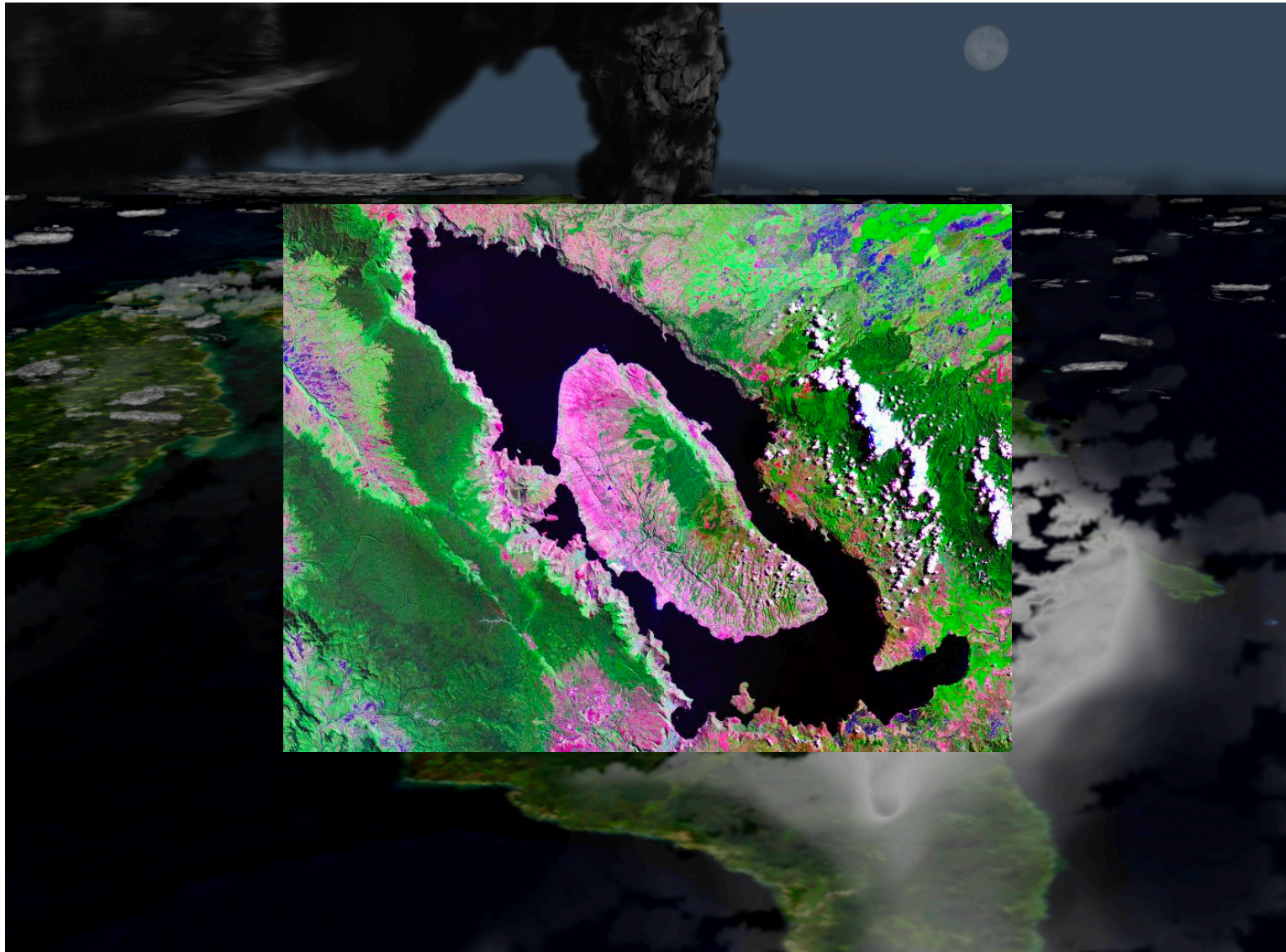
Population spikes in pre-diaspora Africa

- Dates from isotopic and geological dating of human remains are "clustered" in time, suggesting periods of peak population separated by long periods of sparse population.

time--->
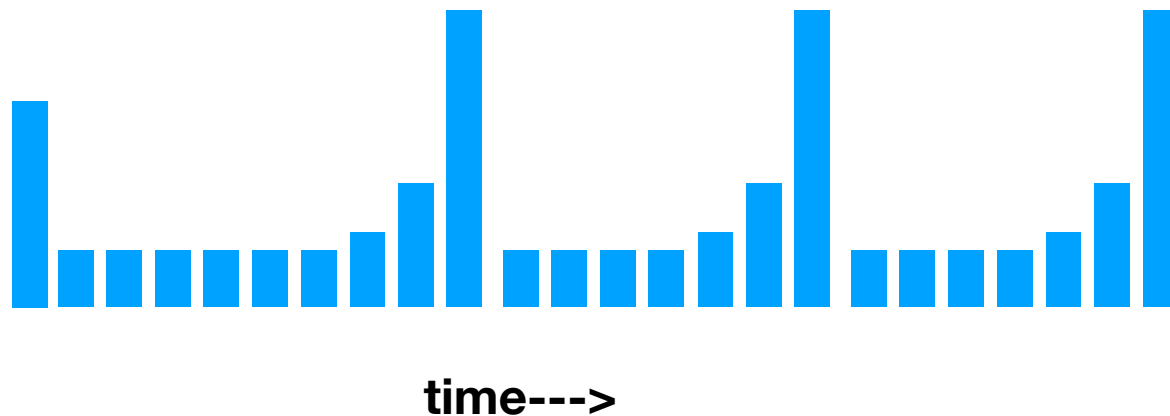
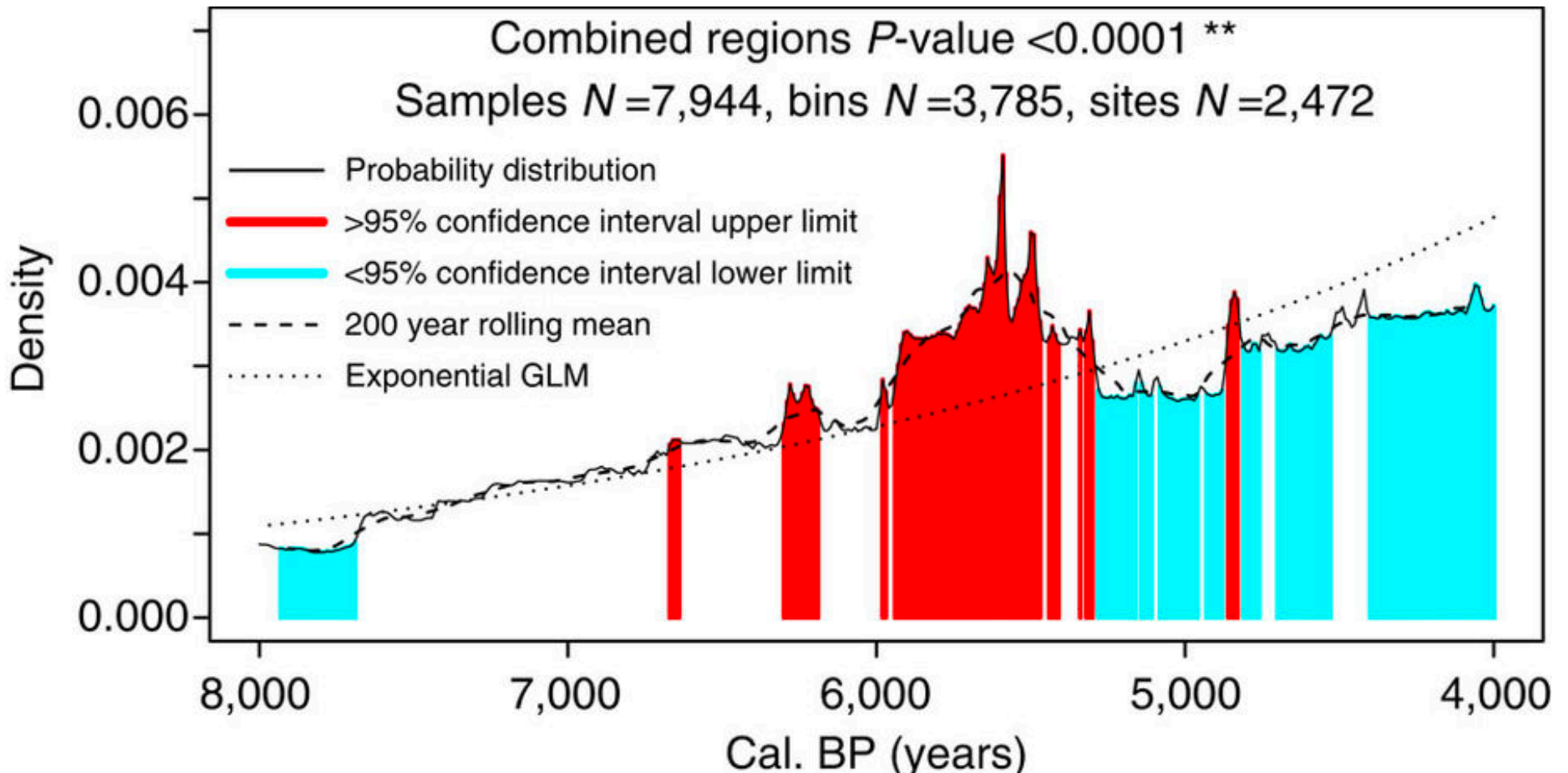John Reader "Africa: A Biography of a Continent"

Toba climate catastrophe, 75,000 BCE

Eruption of a supervolcano in present-day Sumatra caused a 1000-year volcanic winter, reducing global human population to 10,000 - 30,000 individuals.
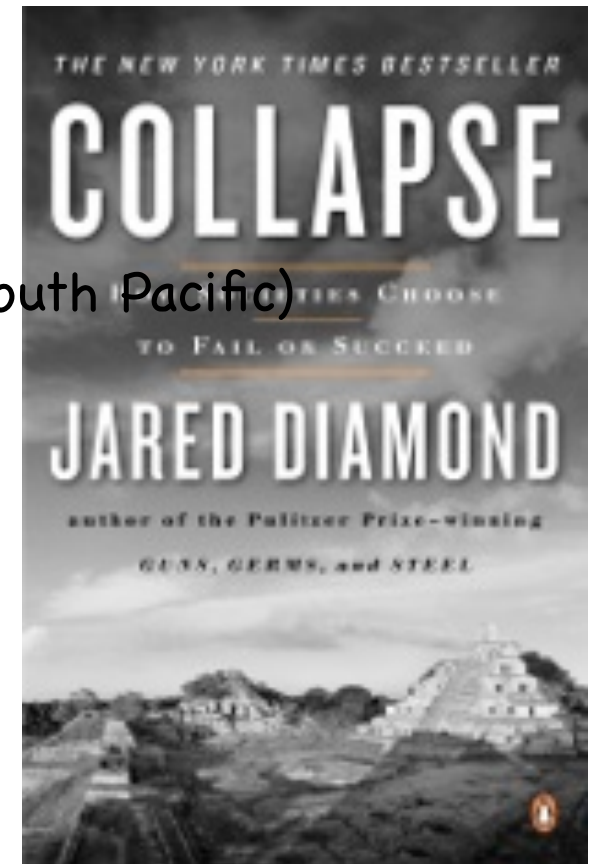
Dawkins, Richard (2004). "The Grasshopper's Tale". *The Ancestor's Tale, A Pilgrimage to the Dawn of Life*. Boston: Houghton Mifflin Company. p. 416. ISBN 0-297-82503-8.

Population spikes in ice age Europe

Combined regions P-value <0.0001 **
Samples $N = 7,944$, bins $N = 3,785$, sites $N = 2,472$

— Probability distribution
— >95% confidence interval upper limit
— <95% confidence interval lower limit
- - - 200 year rolling mean
······ Exponential GLM

Superposed on exponential growth are numerous boom/bust events on subcentury and multicentury timescales.

Rhone Languedoc

Shennan, S., Downey, S. S., Timpson, A., Edinborough, K., Colledge, S., Kerig, T., ... & Thomas, M. G. (2013). Regional population collapse followed initial agriculture booms in mid-Holocene Europe. Nature Communications, 4.

Ancient societies that collapsed, and reasons

- **Easter Island** (South Pacific)

    Deforestation, erosion

- **Pitcairn and Henderson Islands** (South Pacific)

    Loss of trading partner

- **The Anasazi** (Northern Mexico)

    Deforestation, climate change

- **The Maya** (Central America)

    Erosion, violence

- **The Greenland Norse**

    Erosion, deforestation, violence

the Viking era

Vinland
1000

Greenland
982

Iceland

Faroer

Shetland

Scandinavia

Staraya
Lagoda

820

854

Novgorod

Dublin
795

793

York

820

Rhine

Volga

Kiev 882

Dnieper

Don

Dniester

880

Normandy
911

860

Danube

941

844

Miklagard
839

Atlantic
Ocean

Territories and voyages
of the Vikings

Bogdan Giușcă / Wikipedia
2005

Probable landscape of Greenland, A.D.984

(scene from Alaska coast)

before arrival of Norse...

Viking technology

Stone, wood and turf construction

longships

cows

sheep

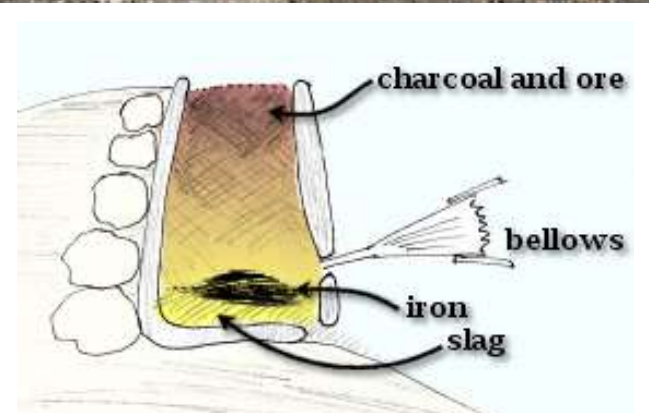
goats

Viking iron-making

bog iron

smelting

iron sponge

forge

charcoal and ore

bellows

iron

slag

Iron tools were essential for Greenland Norse life, but making iron consumed wood they didn't have.

http://www.hurstwic.org/history/articles/manufacturing/text/bog_iron.htm

Viking diplomacy

Internal violent struggles among Vikings as described in <u>Collapse</u>. "A typical week in the life of a Greenland Bishop" Read it! p.237.

Greenland Norse were doomed because...

- Iron production required enormous quantity of wood.
- Livestock culture too crop intensive.
- Soil erosion exacerbated by deforestation, farming.
- Internal violent struggles.
- Exclusionist religion.
- Shipping lanes often blocked by ice.
- Didn't learn from the Inuit.
- Didn't eat fish.
- It got cold.

Inuit survived because....

harpoon
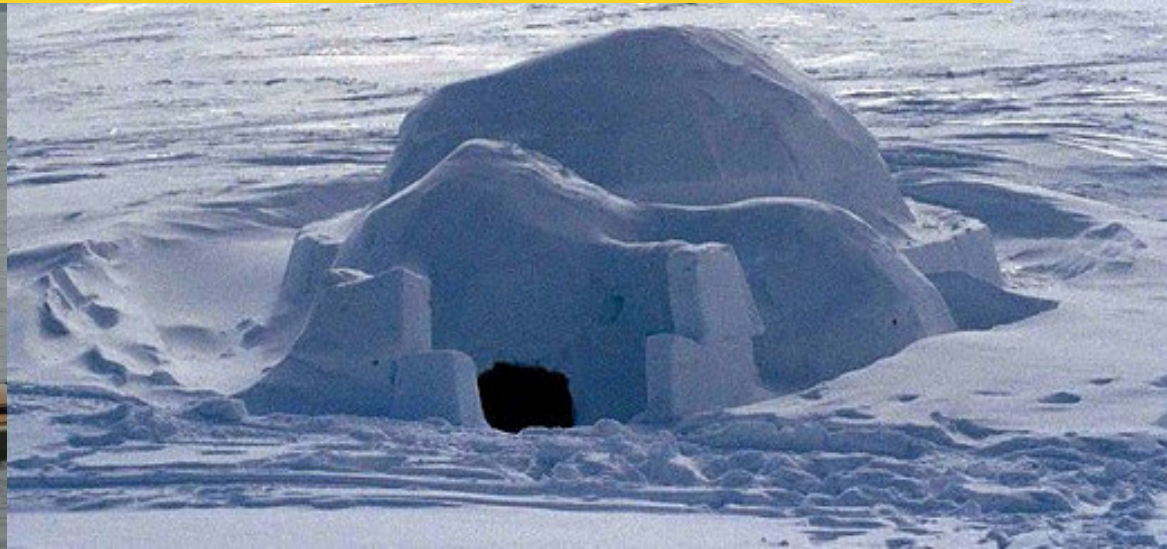
kayak

umiak

- **Hunted where food was plentiful (the ocean)**
- **Peaceful (mostly)**
- **Not dependent on the land, animals.**
- **Used no iron.**
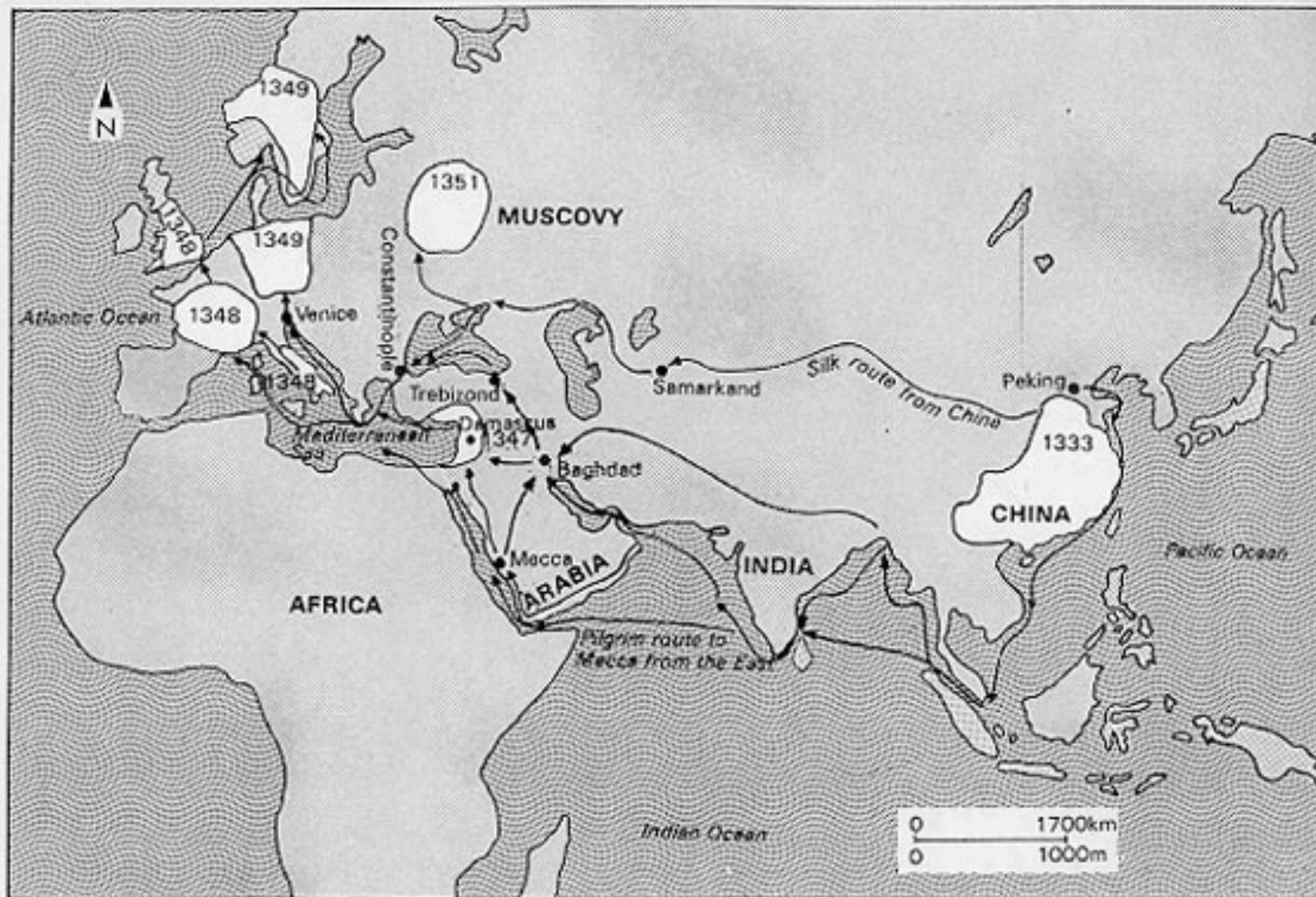
Last stages of Greenland collapse

- "Outfields" were eroded, barren.

- People ate the dogs, newborn calfs.

- Knives were sharpened down to small nubs.

- Communication with homeland cut off.

- They still didn't eat fish.

- Attack by Inuit.

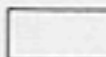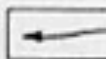- Collapse was sudden (between 1410-1435, after 450 years in existence.)
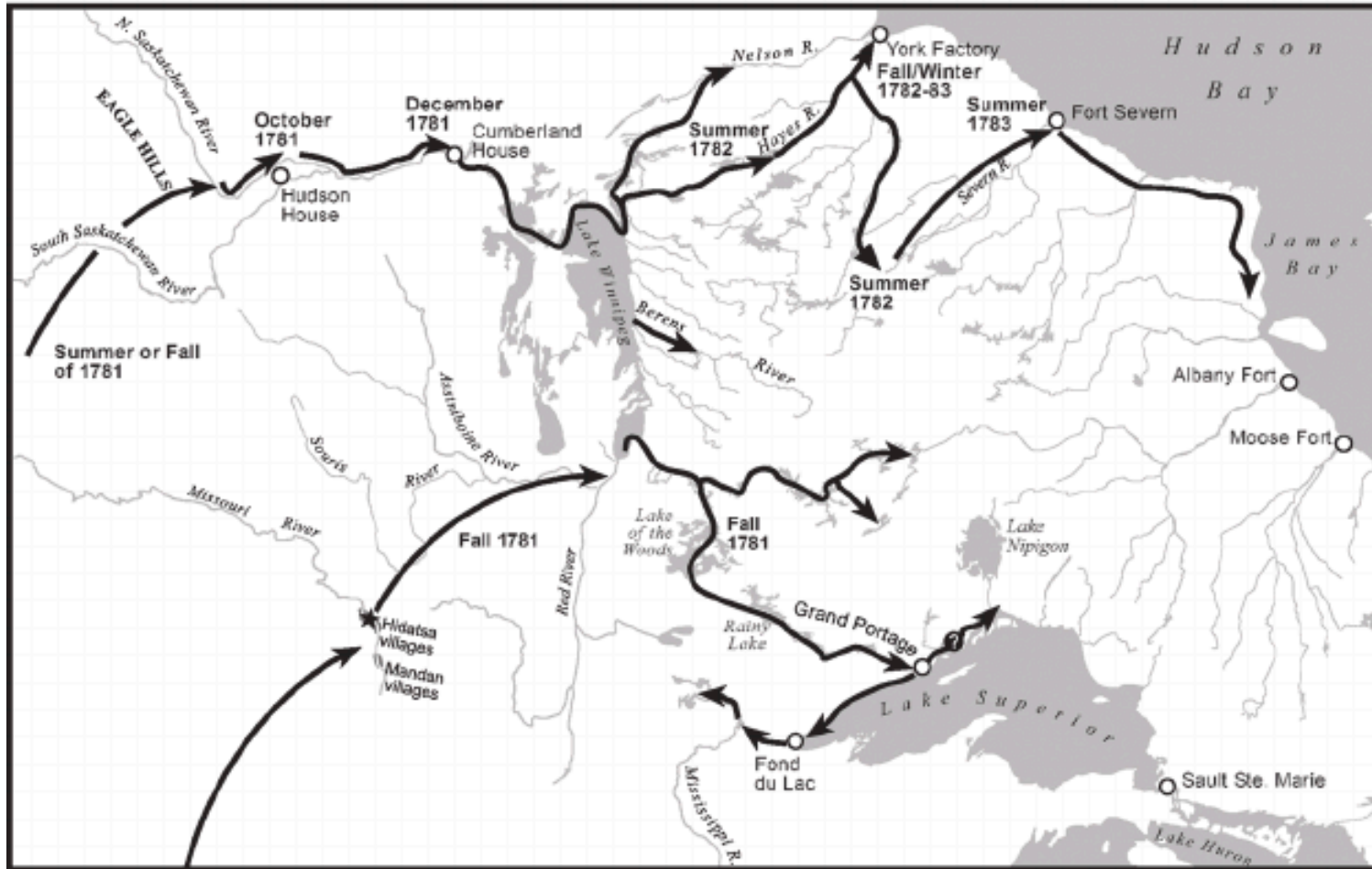
FAILED TO ADAPT

Black death kills one-third of Europe in 1340's

First Incidence of Black Death
in Europe and Asia, 1333–1369

1349
N
1351 MUSCOVY
1349
1348
Constantinople
1349
Atlantic Ocean 1348 Venice
1348
Trebizond
Mediterranean Sea Damascus
1347
Baghdad
Silk route from China
Samarkand
Peking
1333
CHINA
Pacific Ocean
Mecca
ARABIA
INDIA
AFRICA
Pilgrim route to
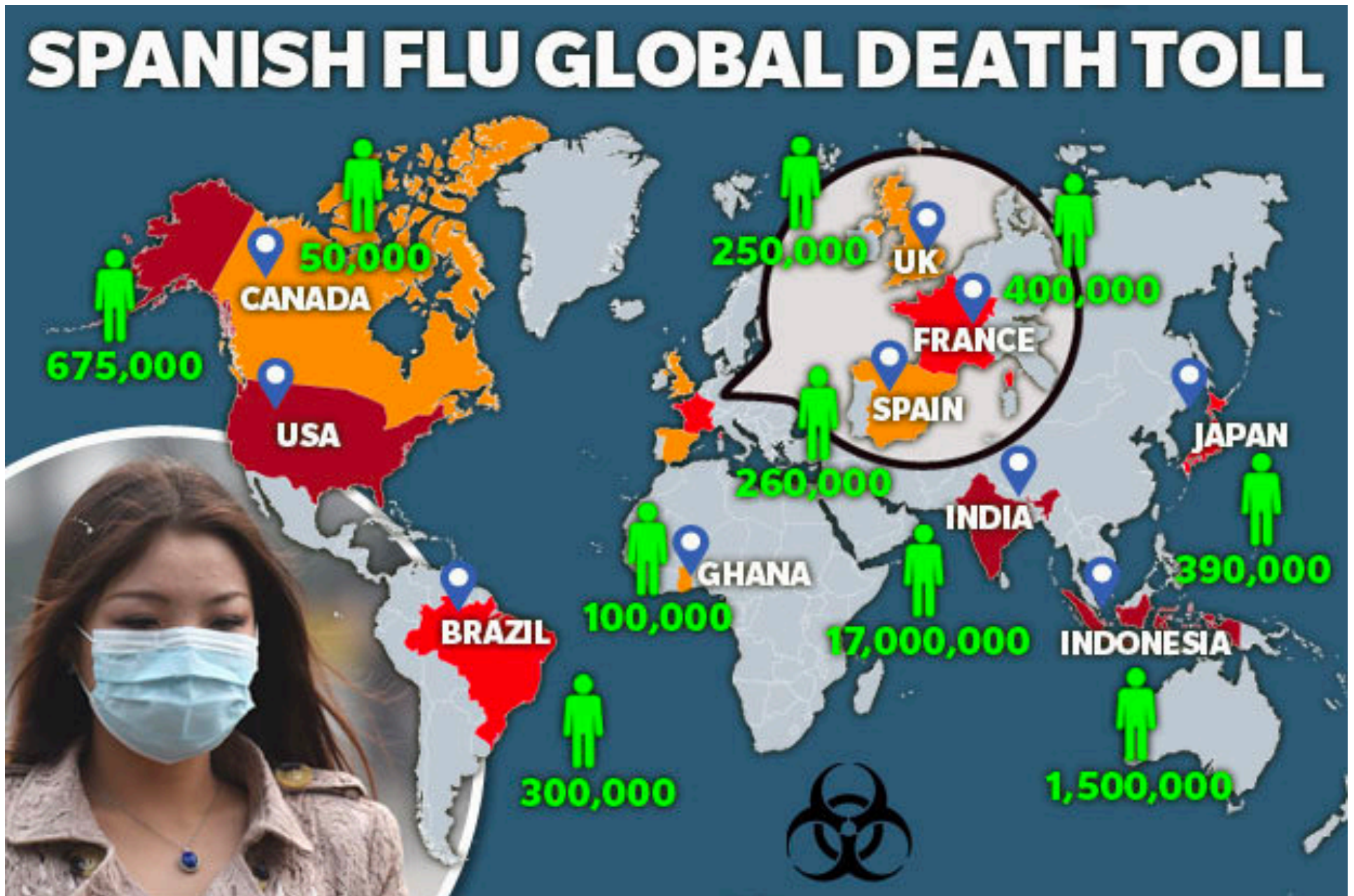Mecca from the East
Indian Ocean
0   1700km
0   1000m

Areas of outbreaks of plague, with first known dates

Trade routes along which the Black Death spread from China

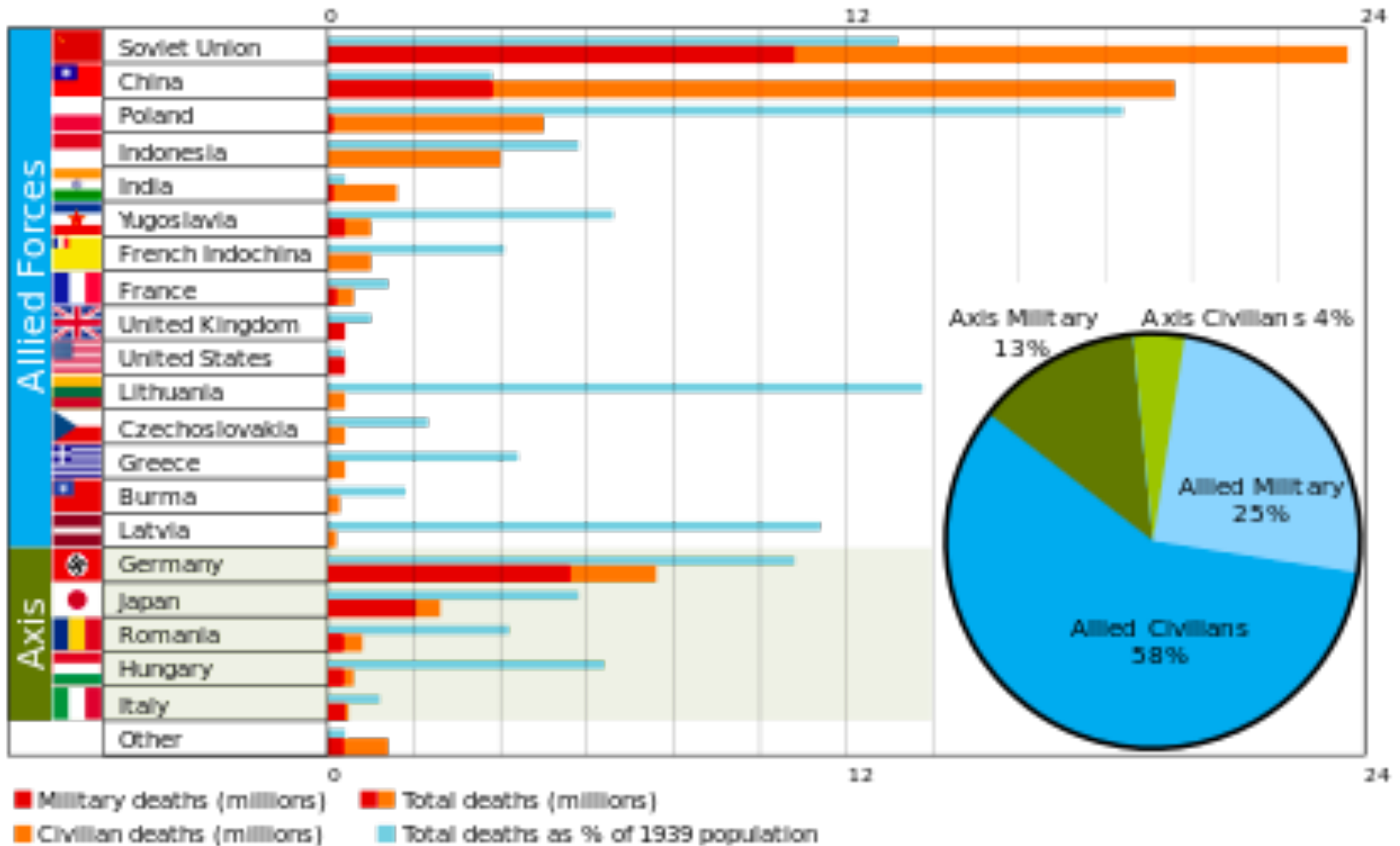# Small pox in the Americas, 1500-1800, killed millions.

Influenza, 1918, everywhere.

SPANISH FLU GLOBAL DEATH TOLL

- 50,000 — CANADA
- 675,000 — USA
- 250,000 — UK
- 400,000 — FRANCE
- 260,000 — SPAIN
- 100,000 — GHANA
- 300,000 — BRAZIL
- 17,000,000 — INDIA
- 390,000 — JAPAN
- 1,500,000 — INDONESIA

Wars

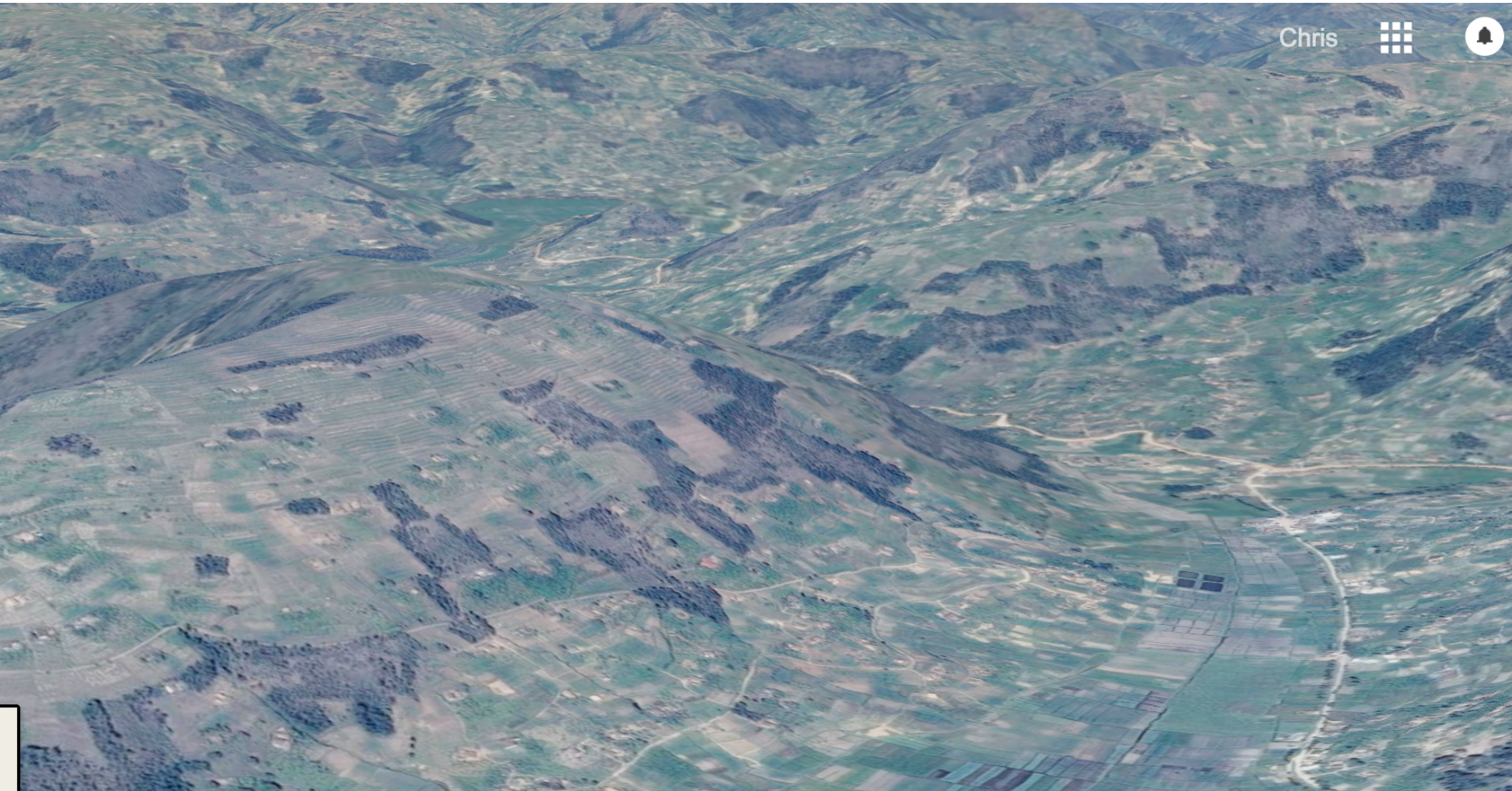
World War II Deaths

Rwanda 1994

- **Population pressure**

    - 760 people / sq mi in 1990

    - A "sea of children"

    - unmechanized, unmodernized agriculture

    - forests cleared, wetlands filled. slopes farmed.

    - drop in coffee prices, 1989.

    - emergency selling of land to buy food.

High population density. Deforestation.

Farming on slopes. Erosion.

Northern Rwanda farms occupy valleys, hilltops, slopes, except for the steepest.

www.google.com/maps   2016

from Hopfenberg & Pimentel

This future crisis may be the direct result of increasing the human population beyond the carrying capacity of the environment. In other words, the higher the ceiling, the more serious the crash. Robson (1981) suggested that famines do not occur divorced from intensive agricultural production

Why?
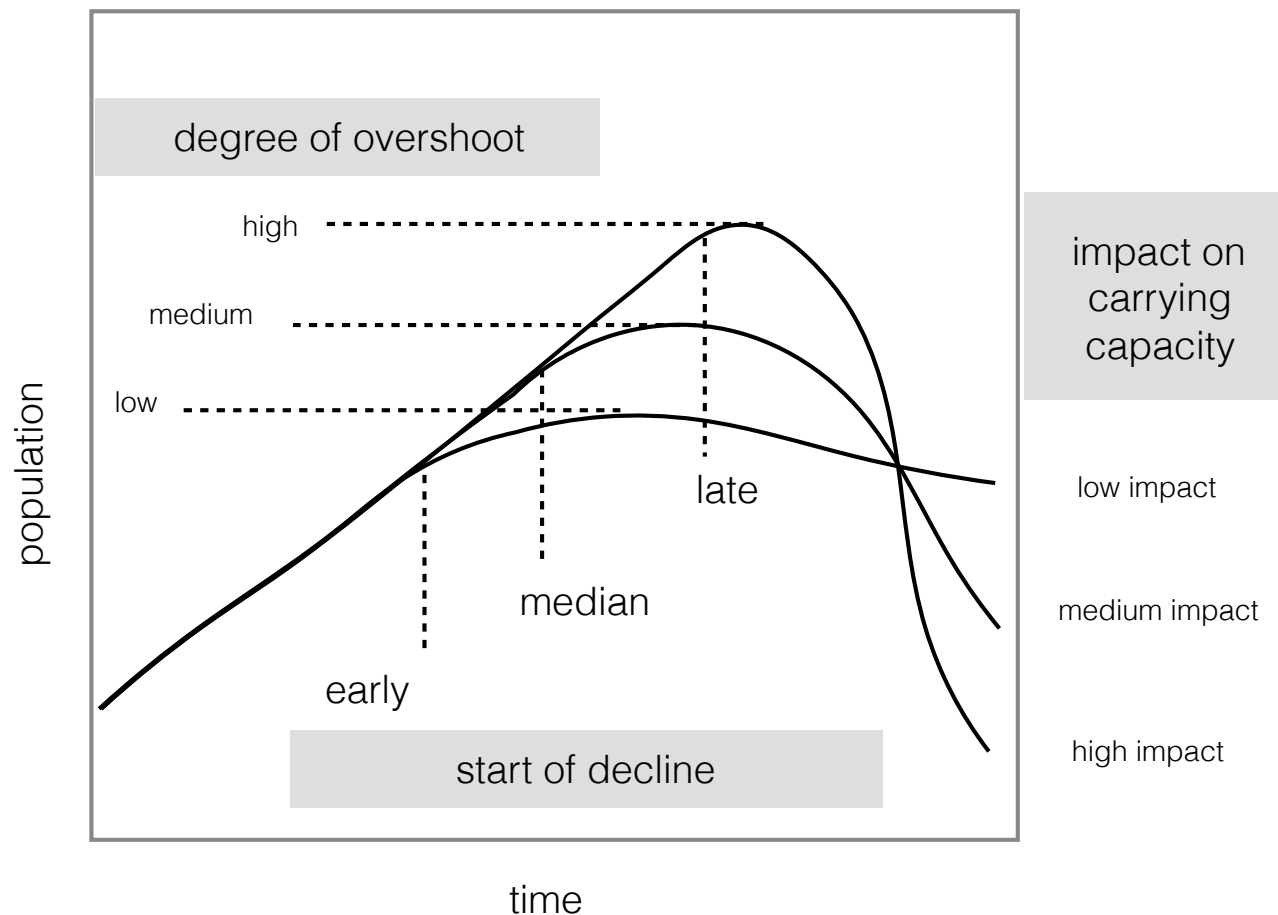
- Euphoria precedes the crash

Rwanda: the story we heard

Juvénal Habyarimana, alias "kinani" (invincible). Re-elected with 98.9% (1978), 99.97% (1983) and 99.98% (1988) of the vote.

Killed Apr 6, 1994 sparking genocide.

https://en.wikipedia.org/wiki/Juvenal_Habyarimana

"get out of the way and let us work". [i.e. killing Tutsis]

--Prov Pres. Théodore Sindikubwabo. Radio address April 19, 1994.

https://en.wikipedia.org/wiki/Theodore_Sindikubwabo

- April–July 1994:
  - International groups stand aside.
  - As much as 1/3 of civilian population involved in killings.

Paul Kagame, current President of Rwanda. Previously commanded the rebel force (RPF) that ended the 1994 Rwandan Genocide
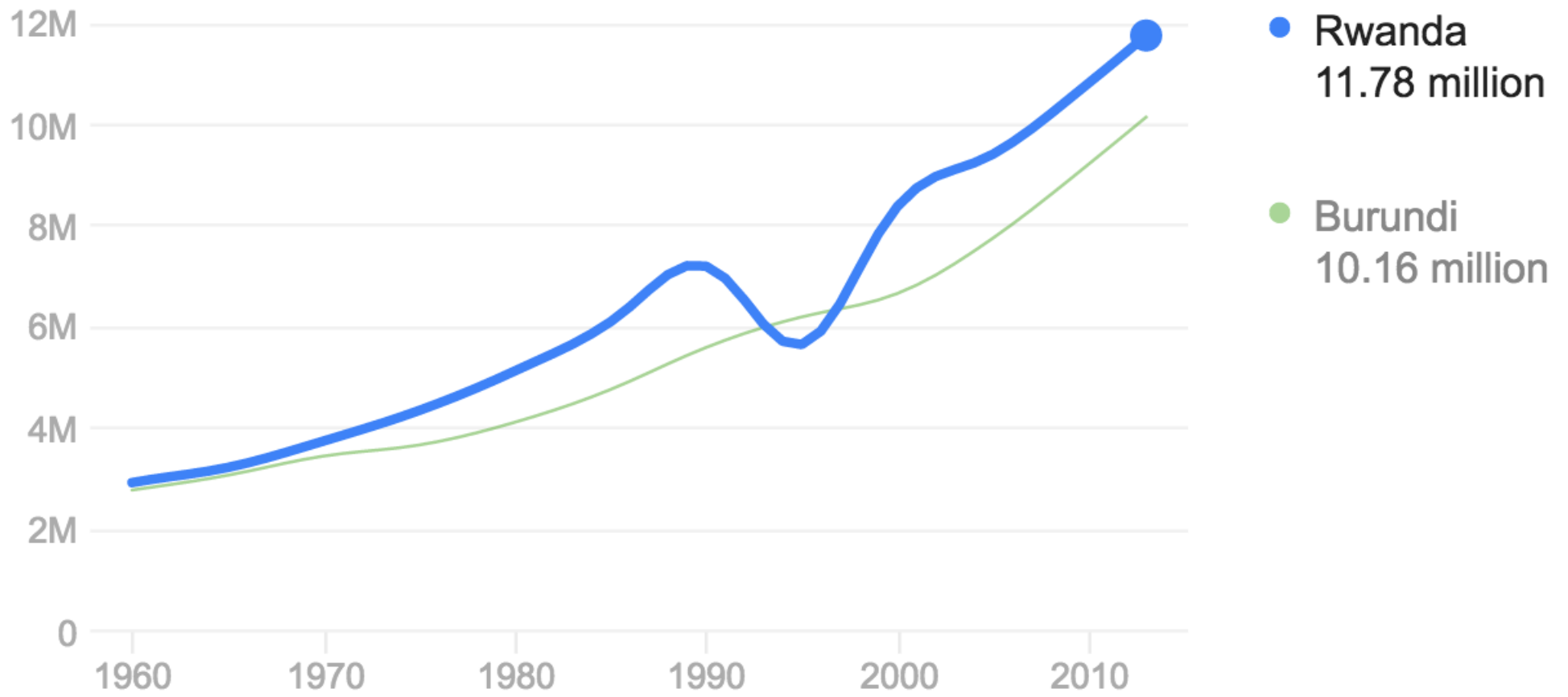
Rwanda 23 years later. Peaceful. Prosperous.

http://www.voanews.com/content/years-after-genocide-rwanda-prospers-but-political-freedom-remains-elusive/1889977.html

"The decision to kill was of course made by politicians, for political reasons. But at least part of the reason it was carried out so thoroughly by the ordinary rank-and-file peasants in their ingo was feeling that there were too many people on too little land, and that with the reduction of their numbers there would be more for the survivors."

Gerard Prunier, a French scolar of East Africa.
in J. Diamond "Collapse" p.326

Was Rwanda a Malthusian trap?

population

food production

-- Thomas Malthus
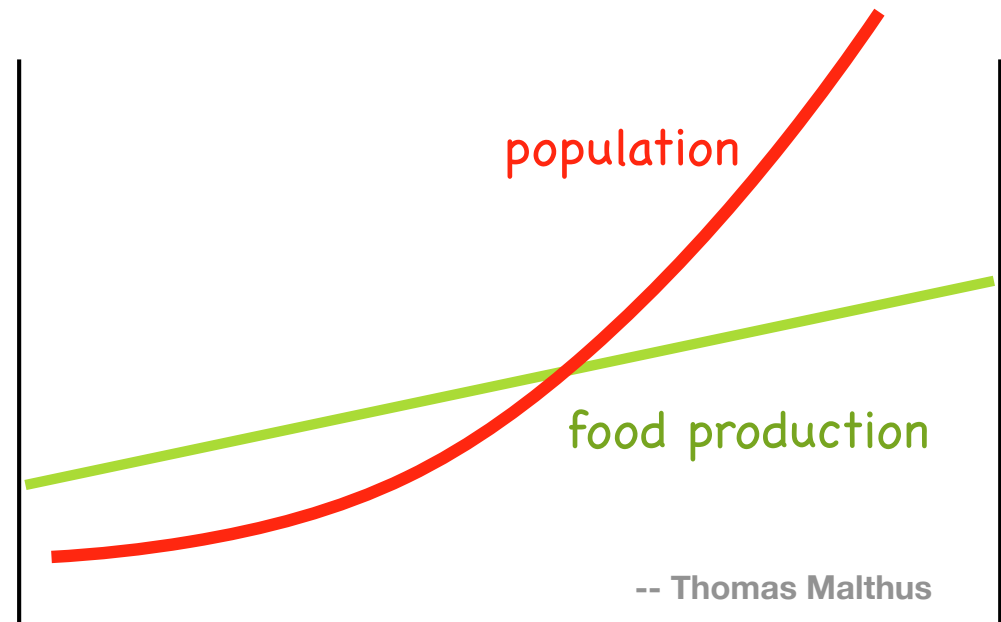
"...It is not rare, even today, to hear Rwandans argue that a war is necessary to wipe out an excess population and to bring numbers into line with available land resources."

C. Andre and JP Platteau "Land relations under unbearable stress: Rwandans caught in a Malthusian trap." J. of Econ. Behaviour and Organization 34:1-47 (1998)

Current crises (the short list)

Syria

Yemen

Venezuela

Myanmar

[1]Johansen & Somette (2001): The case for simplifying.

Material scientists often analyse in exquisite details the wave forms of the acoustic emissions or other signatures of damage resulting from micro-cracking within the material. However, this is of very little help to predict the overall failure which is often a cooperative global phenomenon [19] resulting from the interactions and interplay between the many different micro-cracks nucleating, growing and fusing within the materials. In this example, it has been shown indeed that aggregating all the acoustic emissions in a single aggregated variable is much better for prediction purpose [13].

Historical collapses are <u>not necessarily predictive</u> of future events.

Not when. Not where. Not how.

Like trying to predict bridge failure based on cracks.