

State of the World's Ecosystems

Implications for Human Development

CAPE Partners' Conference,
Elsenburg, 23 June 2011



Society



Environment

Human wellbeing:

Freedoms of choice and action to achieve:

- Security
- Basic material needs
- Good health
- Good social relations



Socio-economic processes:

- **Underlying drivers:** population, consumption, economic demand, institutions & technology
- **Direct drivers:** land use, resource extraction, pollutants and waste, fertilizers, modifications and movement of organisms

Services (opportunities):

- Ecosystem services
- Abiotic resources (hydrocarbons, minerals & motion, sun & geo energy)



Stress (risks):

- Climate change, diseases & pests
- Natural hazards (radiation, earthquakes, volcanoes)



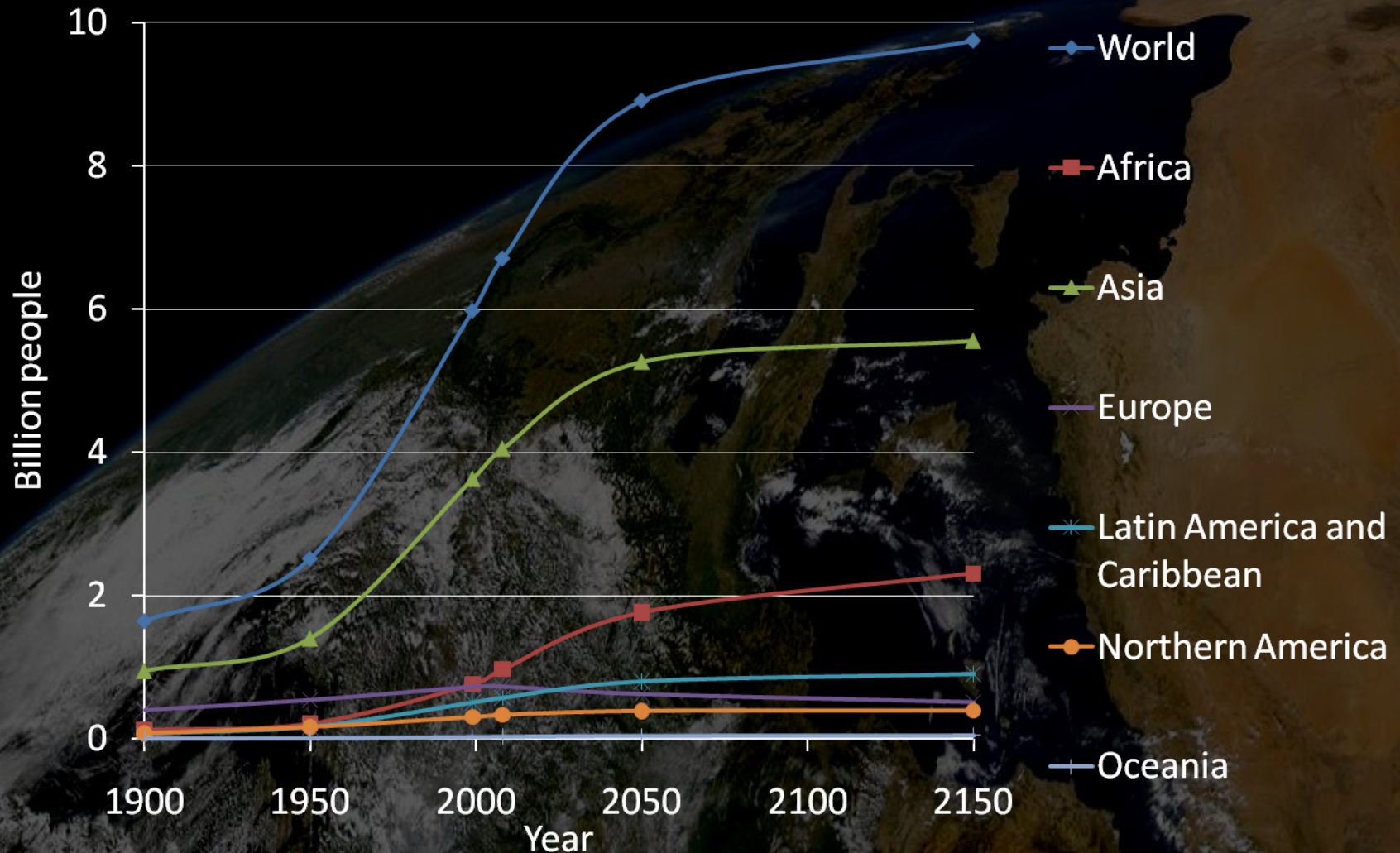
Environmental change:

- Biodiversity loss, degradation of terrestrial and marine ecosystems
- Land degradation
- Global warming, ozone depletion and degradation of air quality
- Freshwater degradation and depletion



Human Population Growth, history and predictions

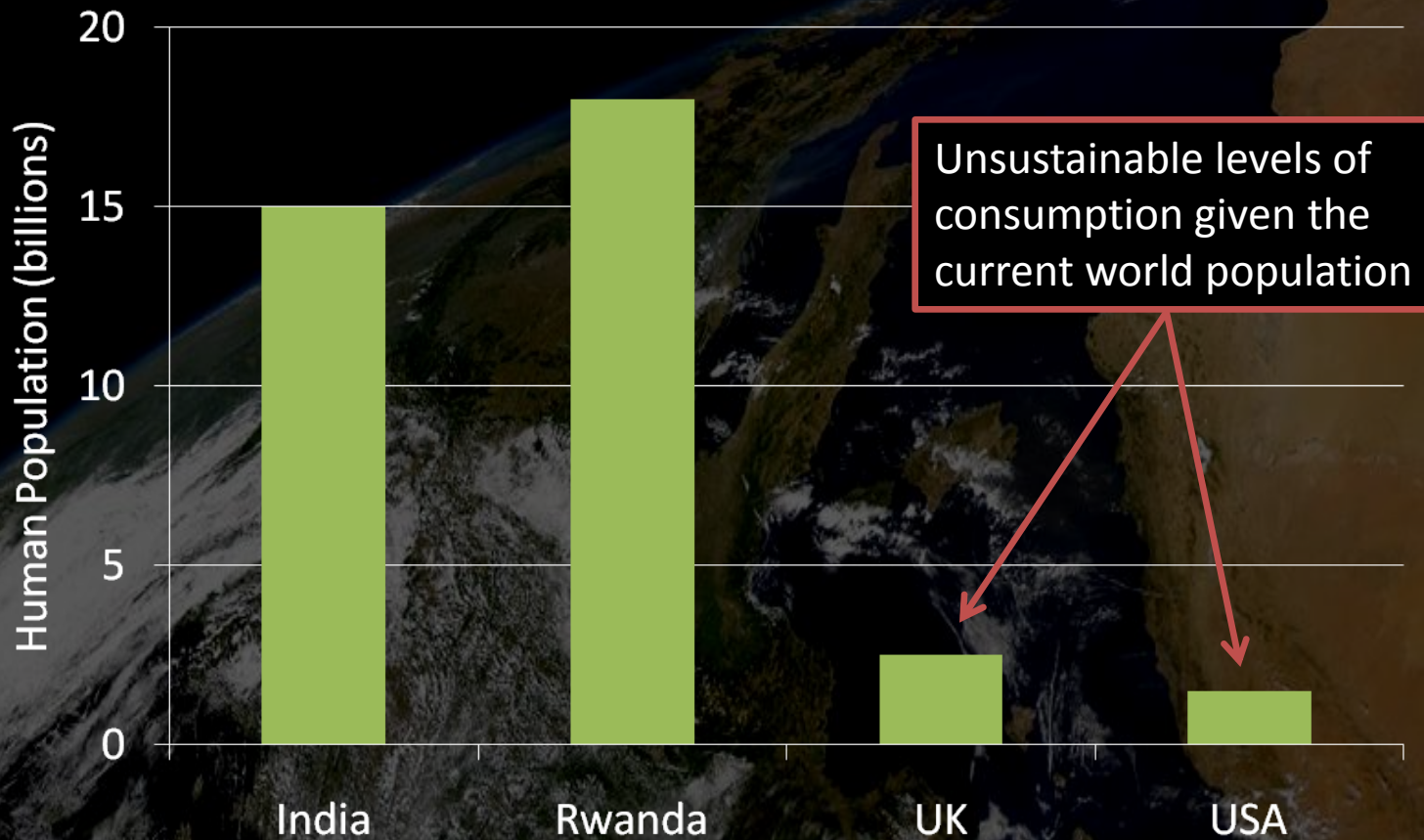
Total world population is predicted to reach nearly 9 billion by 2050



Source: "UN Report 2004 data" <http://www.un.org/esa/population/publications/sixbillion/sixbilpart1.pdf>.

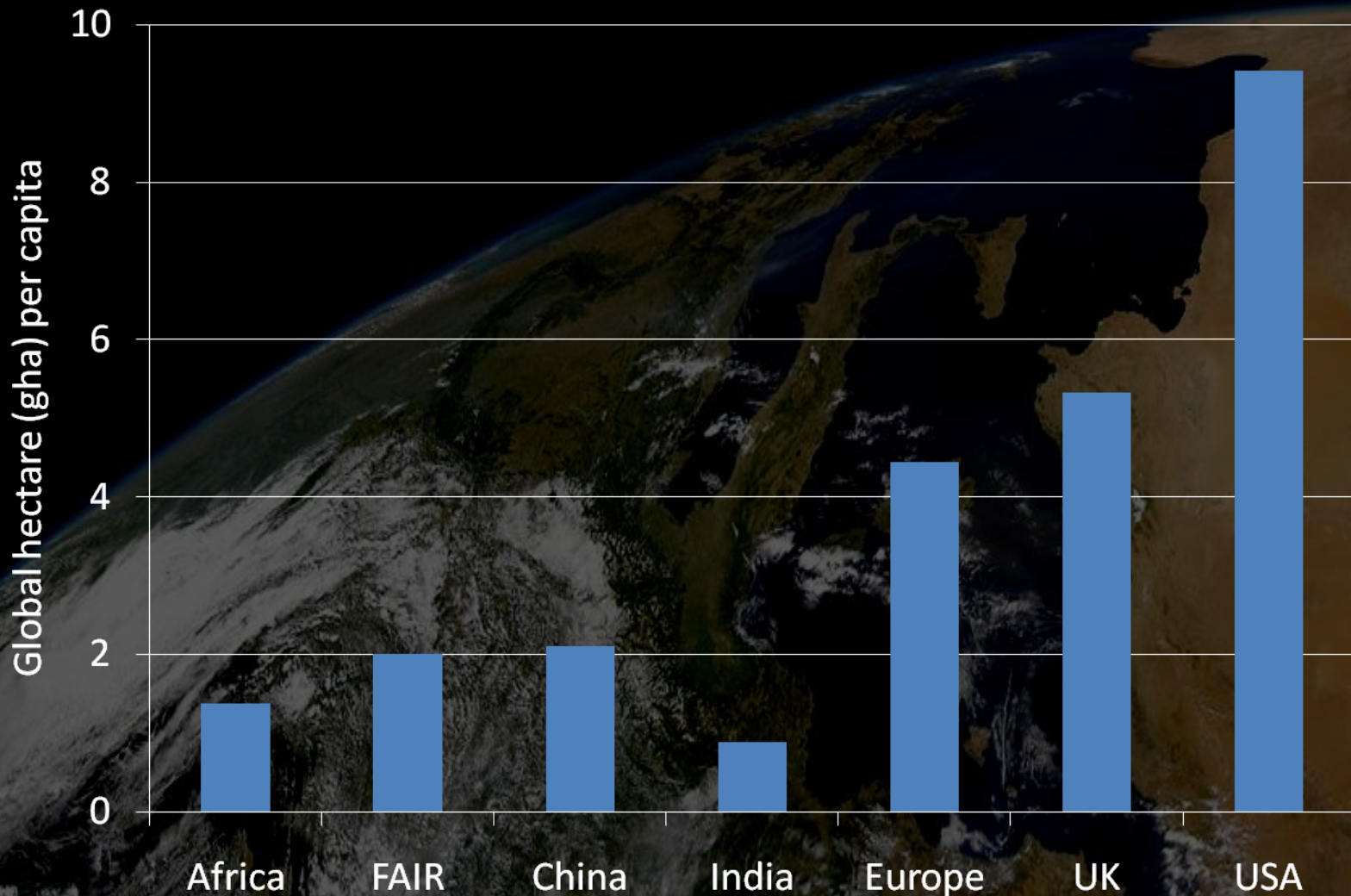
Carrying Capacity of the Earth

Based on the current consumption levels of a given country's people, the Earth could carry...



Global Trends in Consumption

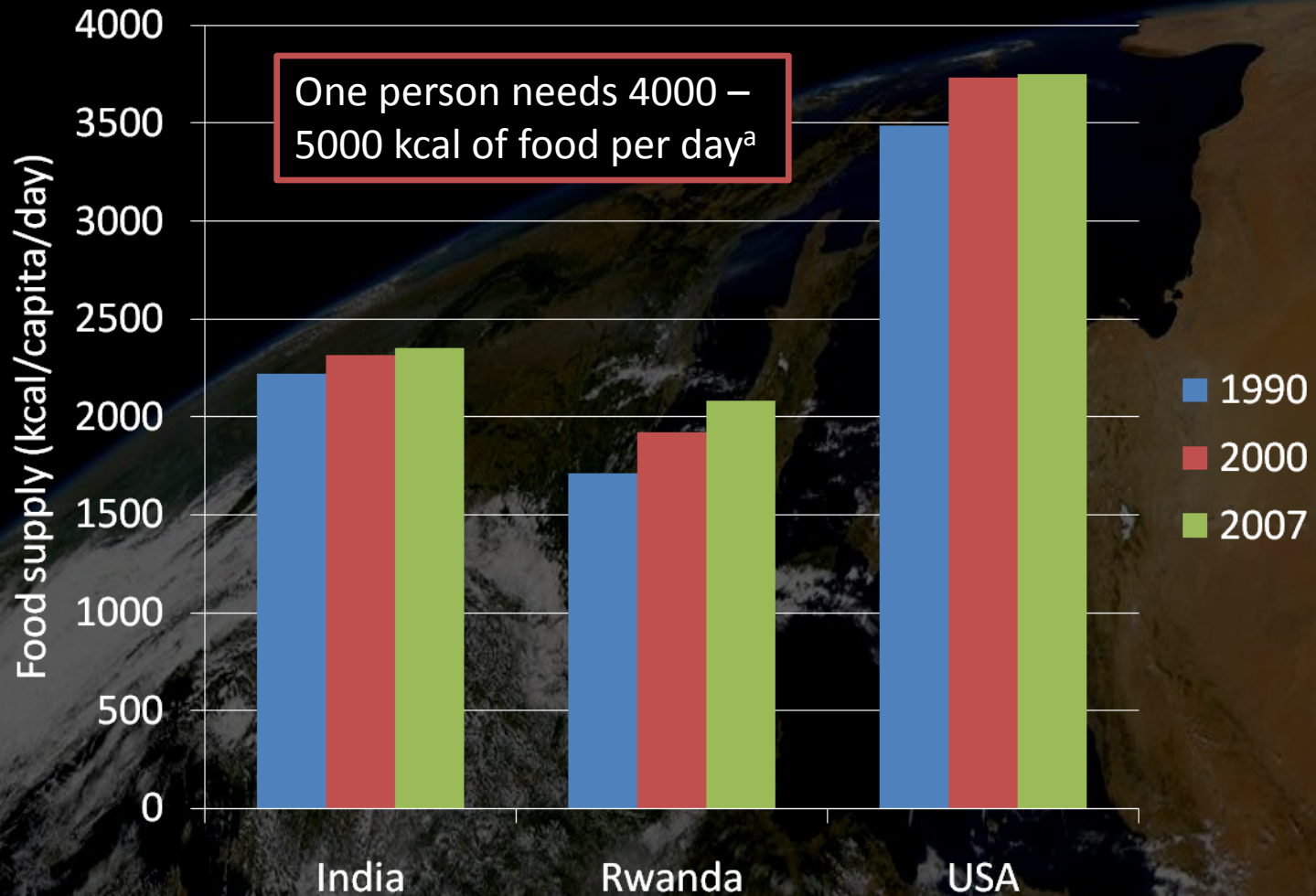
Productive Biocapacity of Regions/Countries, 2009
a function of food, water & energy resources



Source: BBC (2010), "How many people can live on planet Earth?"

Global Trends in Consumption

Food Access in India, Rwanda and USA

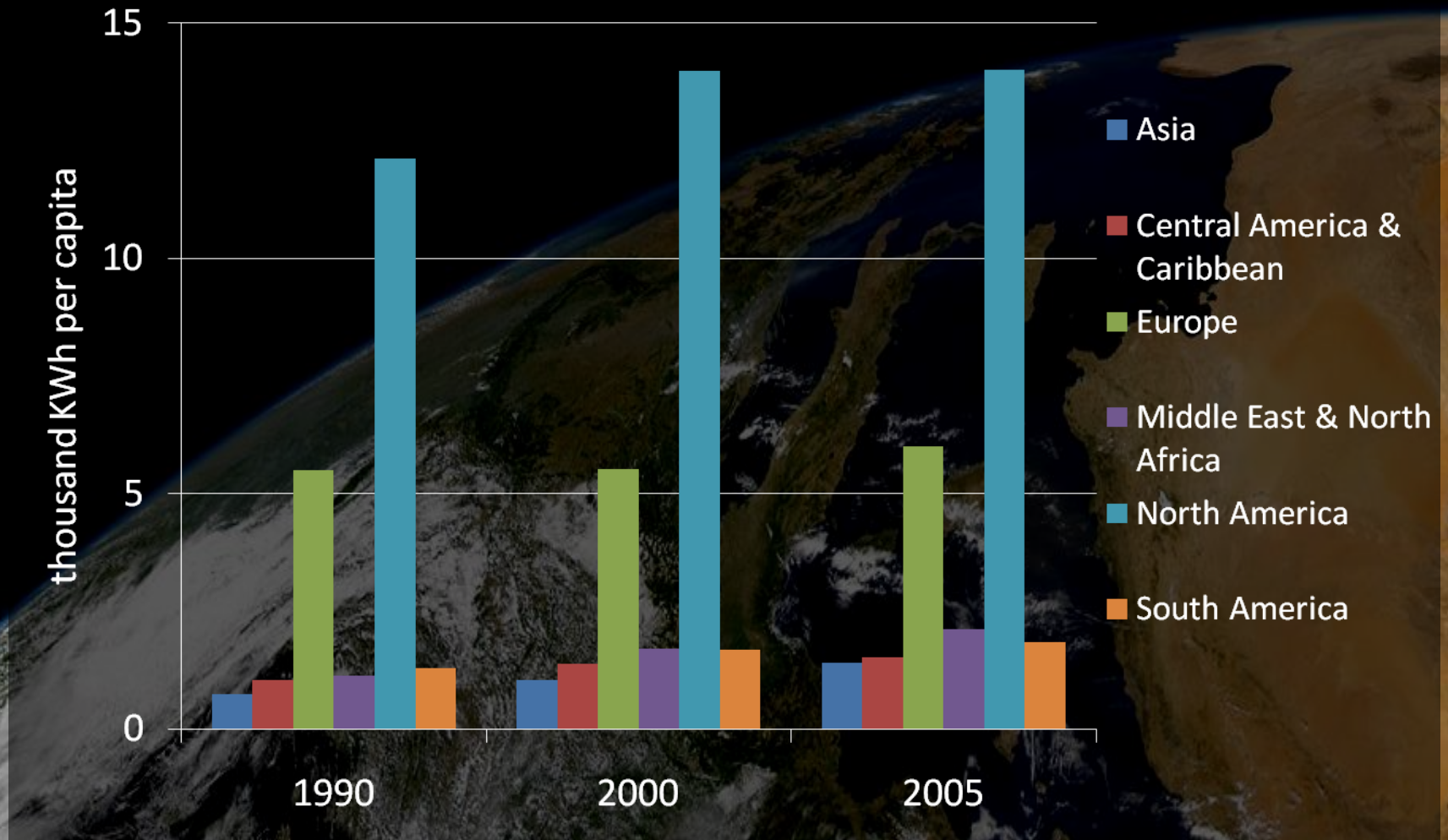


Source (data): FAOSTAT, Crops Primary Equivalent, Food supply

^a Source: BBC (2010). "How many people can live on planet Earth?"

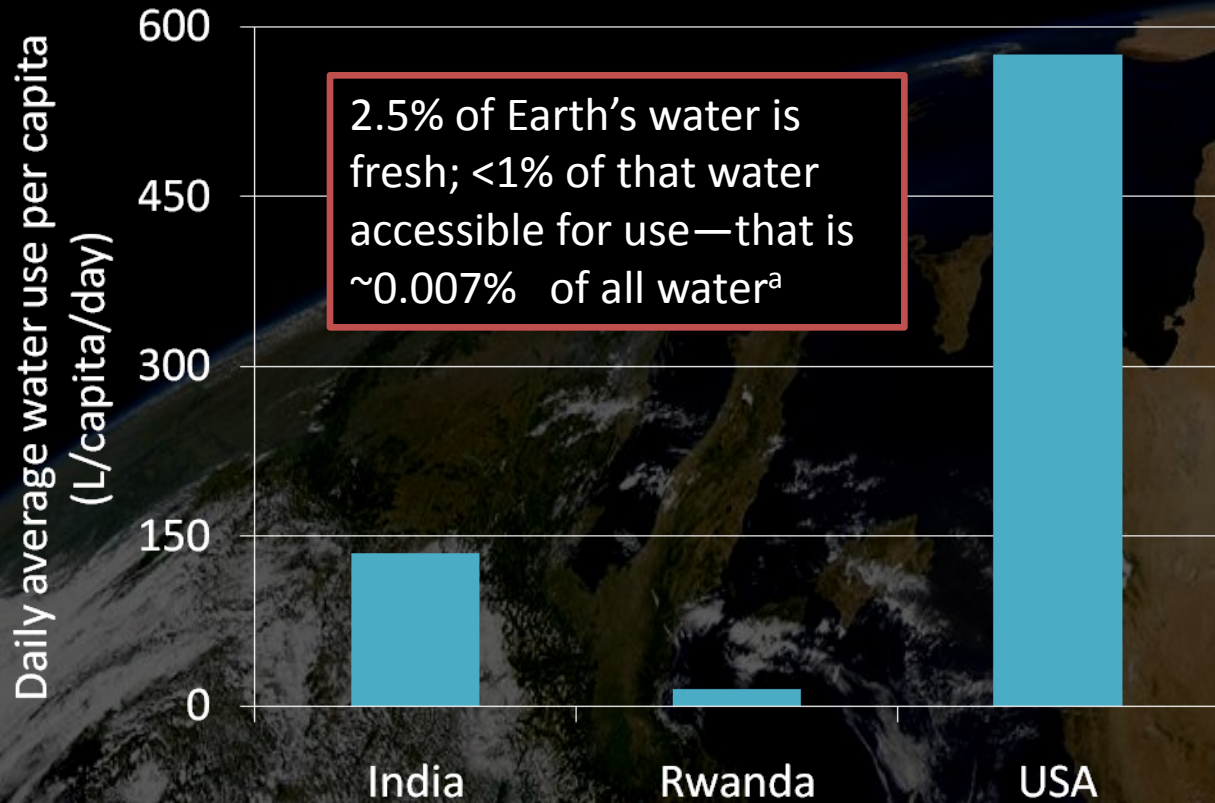
Global Trends in Consumption

Energy Access by World Regions



Global Trends in Consumption

Water Use in India, Rwanda and USA, in 2002

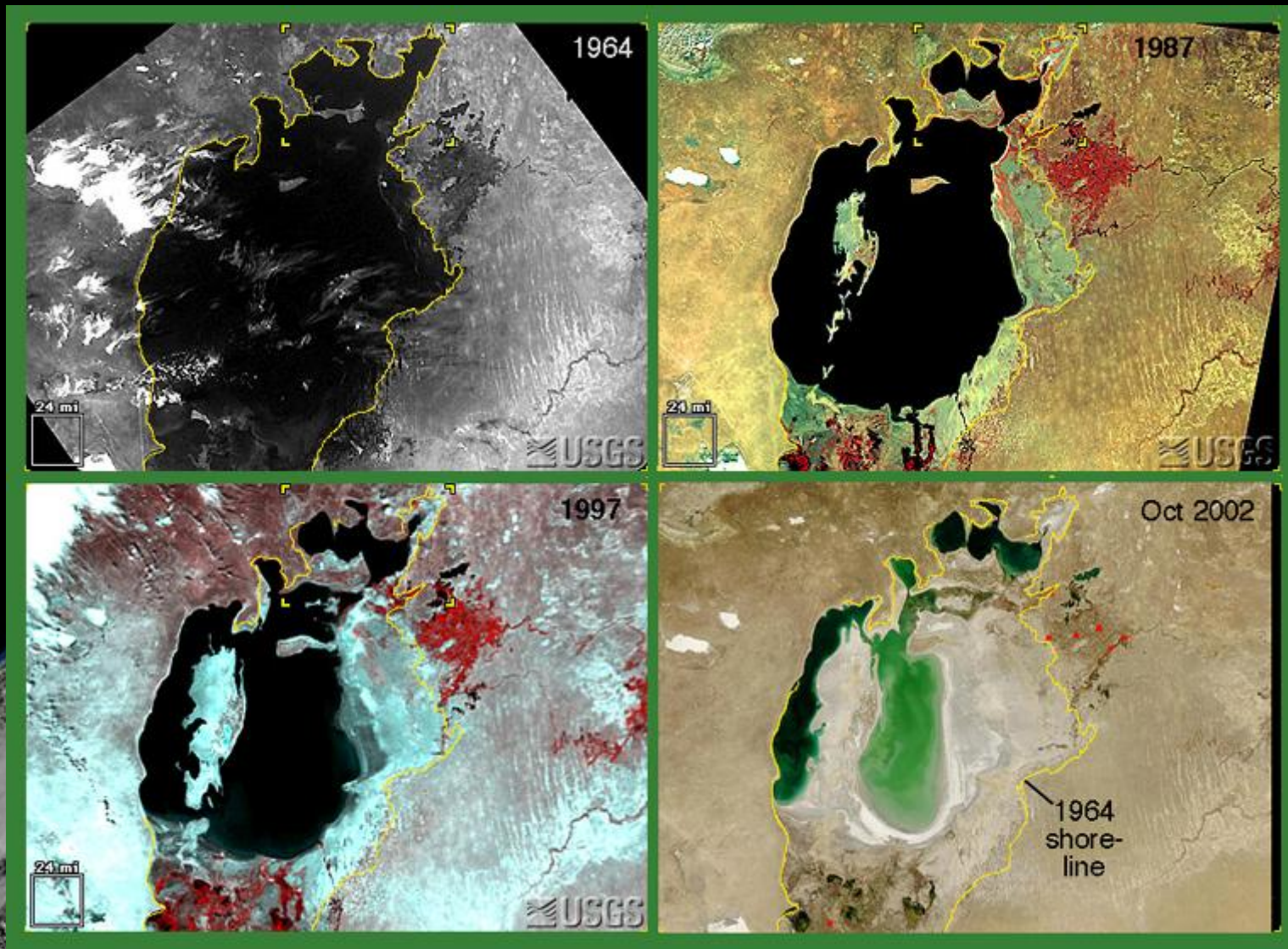


Source for chart: Data360.org (data). http://www.data360.org/dsg.aspx?Data_Set_Group_Id=757

^a Source: http://www.globalchange.umich.edu/globalchange2/current/lectures/freshwater_supply/freshwater.html

Global Trends in Consumption

40 Years of Irrigation on the Aral Sea



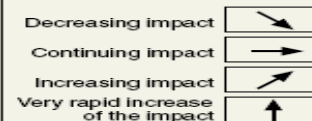
Critical Trends: Ecosystem Status

		Habitat change	Climate change	Invasive species	Over-exploitation	Pollution (nitrogen, phosphorus)
Forest	Boreal	↗	↑	↗	→	↑
	Temperate	↘	↑	↑	→	↑
	Tropical	↑	↑	↑	↗	↑
Dryland	Temperate grassland	↗	↑	→	→	↑
	Mediterranean	↗	↑	↑	→	↑
	Tropical grassland and savanna	↗	↑	↑	→	↑
	Desert	→	↑	→	→	↑
Inland water		↑	↑	↑	→	↑
Coastal		↗	↑	↗	↗	↑
Marine		↑	↑	→	↗	↑
Island		→	↑	→	→	↑
Mountain		→	↑	→	→	↑
Polar		↗	↑	→	↗	↑

Driver's impact on biodiversity over the last century



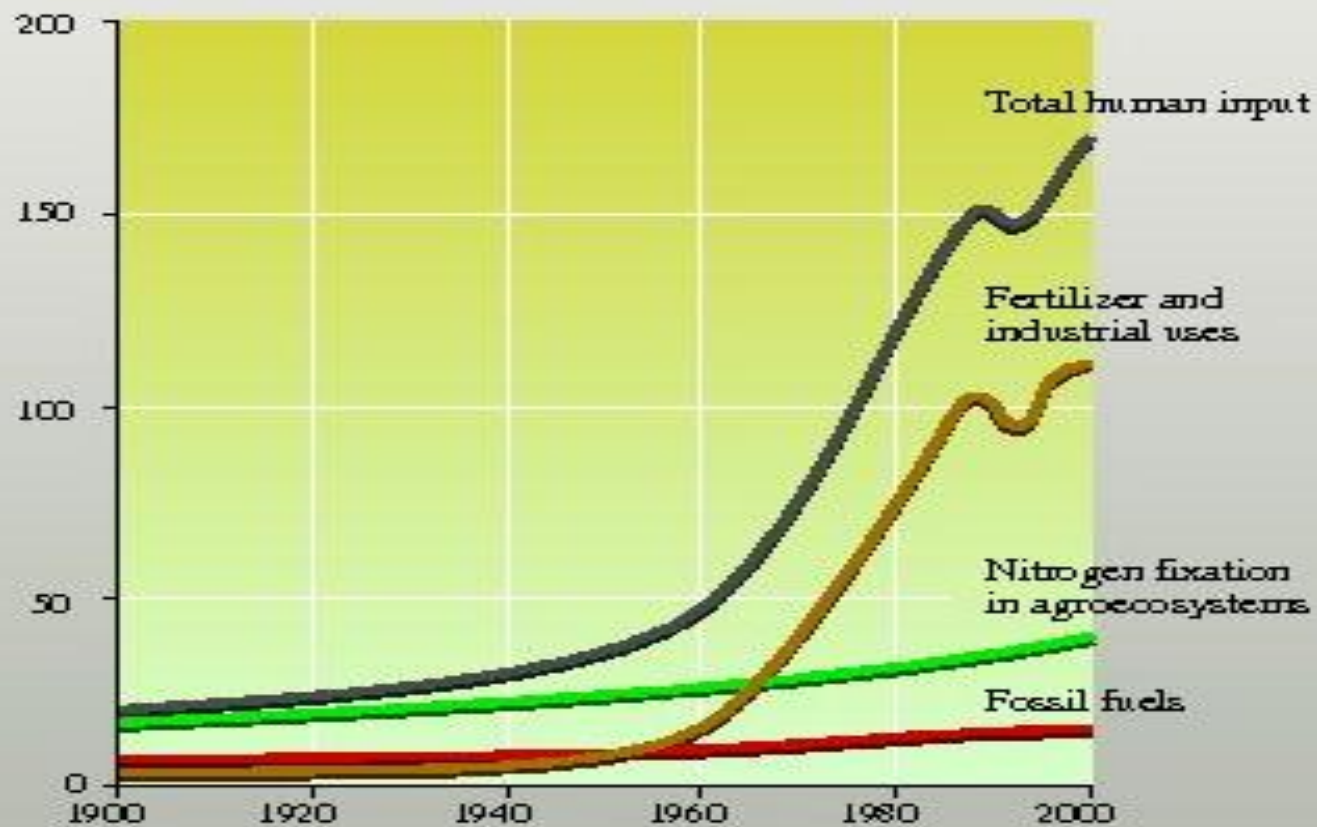
Driver's current trends



Source: Millennium Ecosystem Assessment

Pressures...

Teragrams of anthropogenic nitrogen created per year



Critical Trends: Ecosystem Status

GBO-3 cites multiple indications of continuing decline in BD at the ecosystem, species and gene levels

Ecosystems

❖ Natural habitats in most parts of the world continue to decline in extent and integrity, although there has been significant progress in slowing the rate of loss for tropical forests and mangroves, in some regions.

Species

❖ Amphibians face the greatest risk and coral species are deteriorating most rapidly in status. Nearly a quarter of plant species are estimated to be threatened with extinction.

Genes

❖ Crop and livestock genetic diversity continues to decline in agricultural systems.

Critical Trends: Ecosystem Status

Terrestrial Ecosystems

- ✿ Net loss of forests has substantially slowed in the past decade, largely due to forest expansion in temperate regions.
- ✿ Tropical forests continue to be lost rapidly, however deforestation has recently slowed in some countries.
- ✿ Savannas and grasslands have also severely declined – for example, an estimated 95% of North American grasslands have been lost.
- ✿ Abandonment of traditional agricultural practices may cause loss of cultural landscapes and associated biodiversity.
- ✿ Terrestrial habitats have become highly fragmented.
- ✿ Despite growing PA coverage, 44% of terrestrial eco-regions fall below 10% protection.

Critical Trends: Ecosystem Status

Inland Water Ecosystems

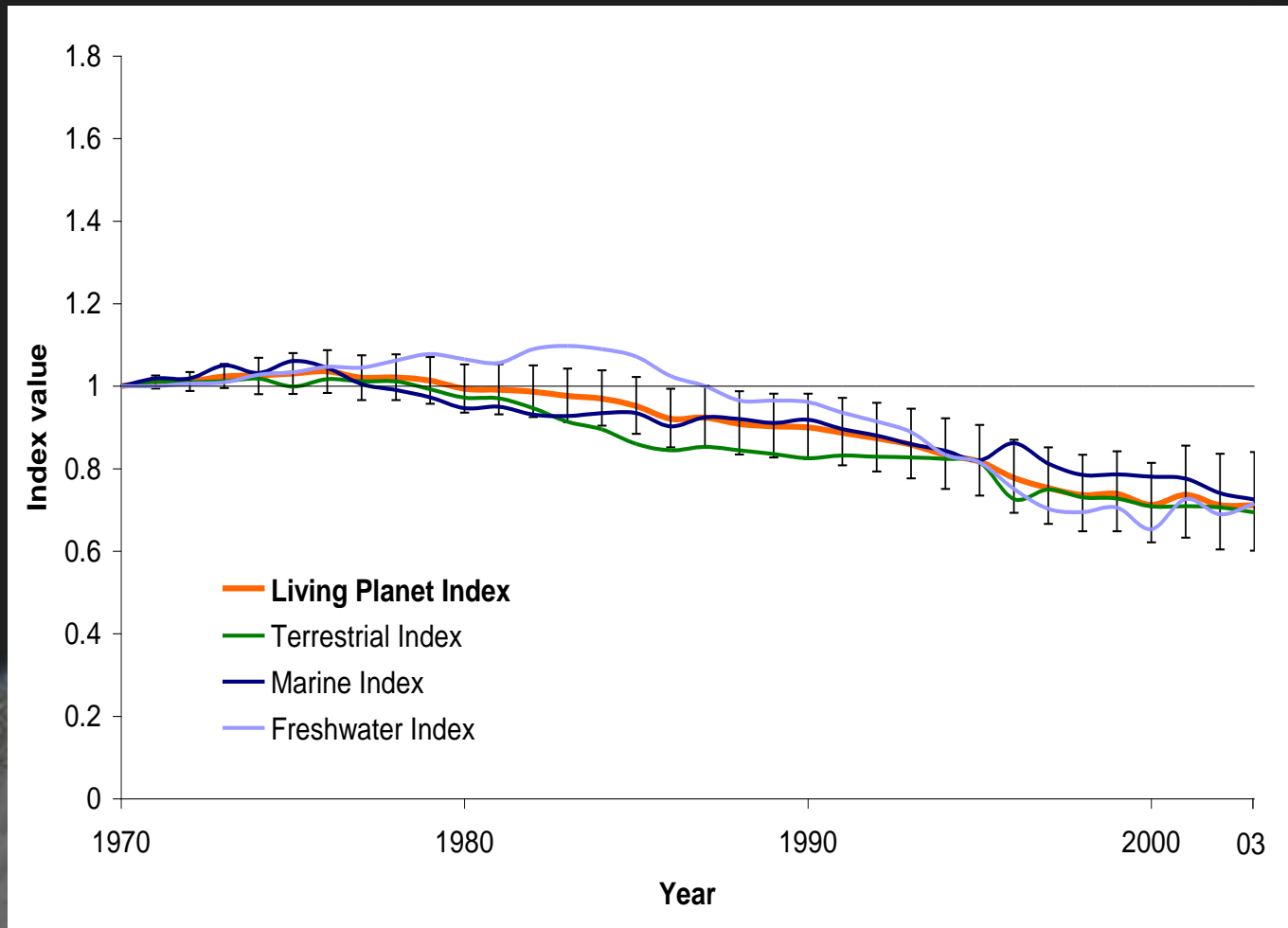
- ❖ Inland water ecosystems have been dramatically altered in recent decades; wetlands around the world have been and continue to be lost rapidly.
- ❖ Trends in water quality vary; some and river basins show improvements, off-set by serious pollution in densely-populated areas.
- ❖ Of 292 large river systems, two-thirds have become moderately or highly fragmented by dams and reservoirs.
- ❖ Inland water ecosystems are often poorly served by the terrestrial PA network, which rarely takes account of upstream and downstream impacts.

Critical Trends: Ecosystem Status

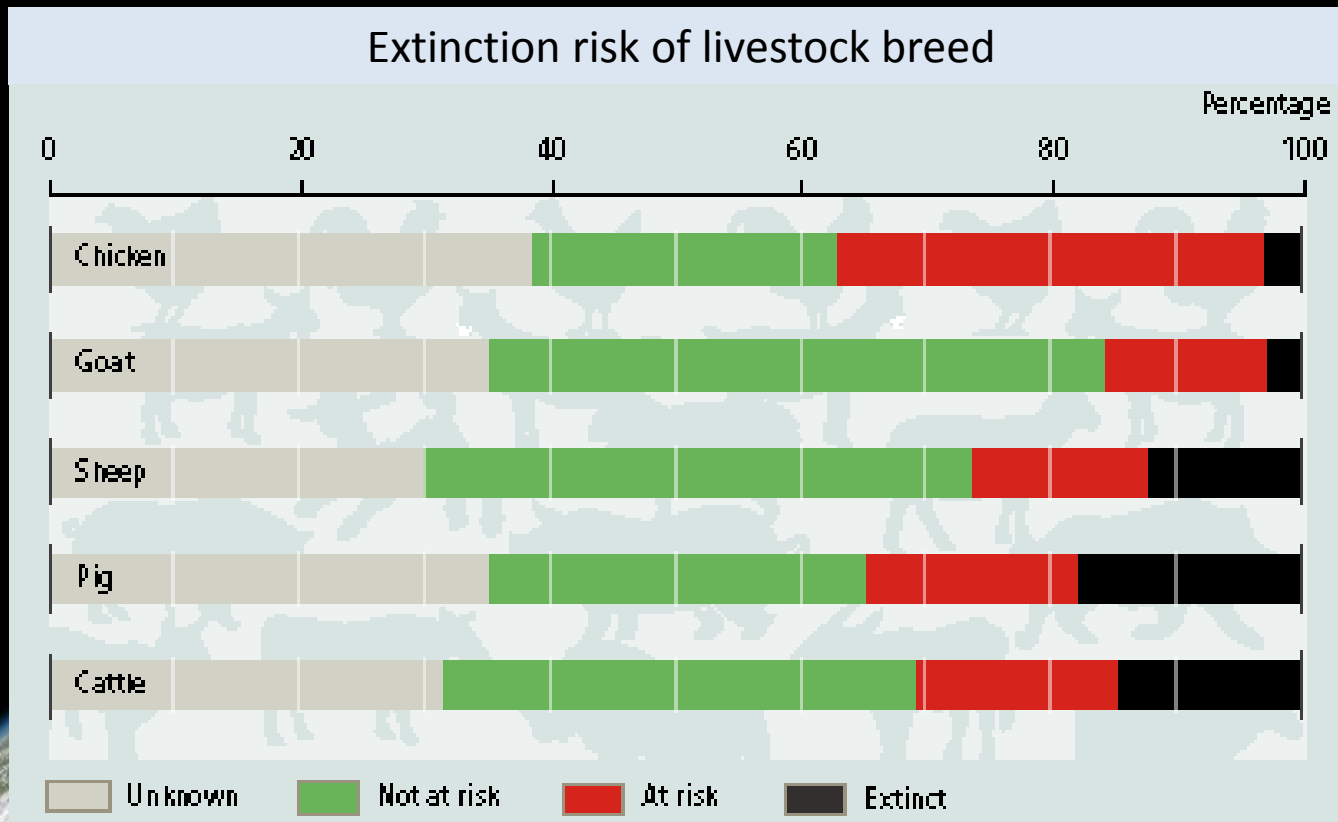
Marine & Coastal Ecosystems

- ❖ **Coastal habitats**—mangroves, seagrass beds, salt marshes—**continue to decline** in extent, threatening highly valuable ecosystem services.
- ❖ There are **increasing grounds for concern** about the condition and trends of biodiversity in **deep-water habitats** (such as sea mounts and cold-water corals), although data are still scarce.
- ❖ About 80% of the **world marine fish stocks** (for which assessment information is available) are **fully exploited or overexploited**.
- ❖ The extent of **marine PAs** has **grown significantly**, yet a small proportion (less than 20%) of marine ecoregions meet the target of at least 10% of their area protected.

Impact on Species...



Critical Trends: Genetic Diversity



❖ Genetic diversity is being lost in natural ecosystems and in crop/livestock production systems.

❖ Important progress is being made to conserve plant genetic diversity, particularly via ex-situ seed banks.

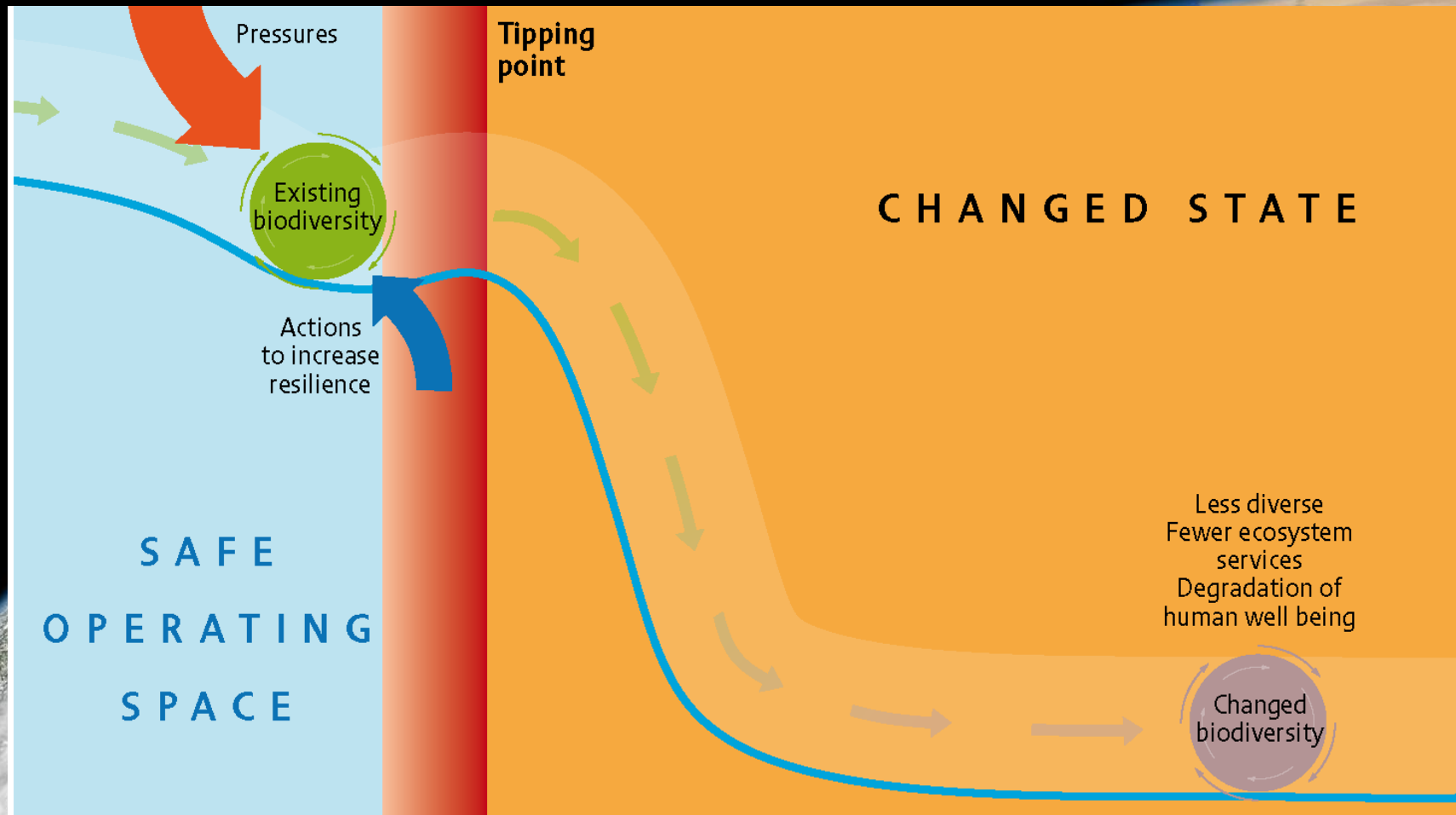
Climate Change: Impacts on Ecosystem Structure and Functions

- ❖ Climate change is **already impacting biodiversity**—and is projected to become a **progressively more significant threat** in coming decades.
- ❖ **Loss of Arctic sea ice** threatens across that entire biome and beyond; the related pressure of **ocean acidification** is already being observed.
- ❖ Worldwide, **changes to the timing of flowering and migration patterns**, and **species distribution** have been observed; such changes can **alter food chains**, and create mismatches within ecosystems among previously-synchronized species.

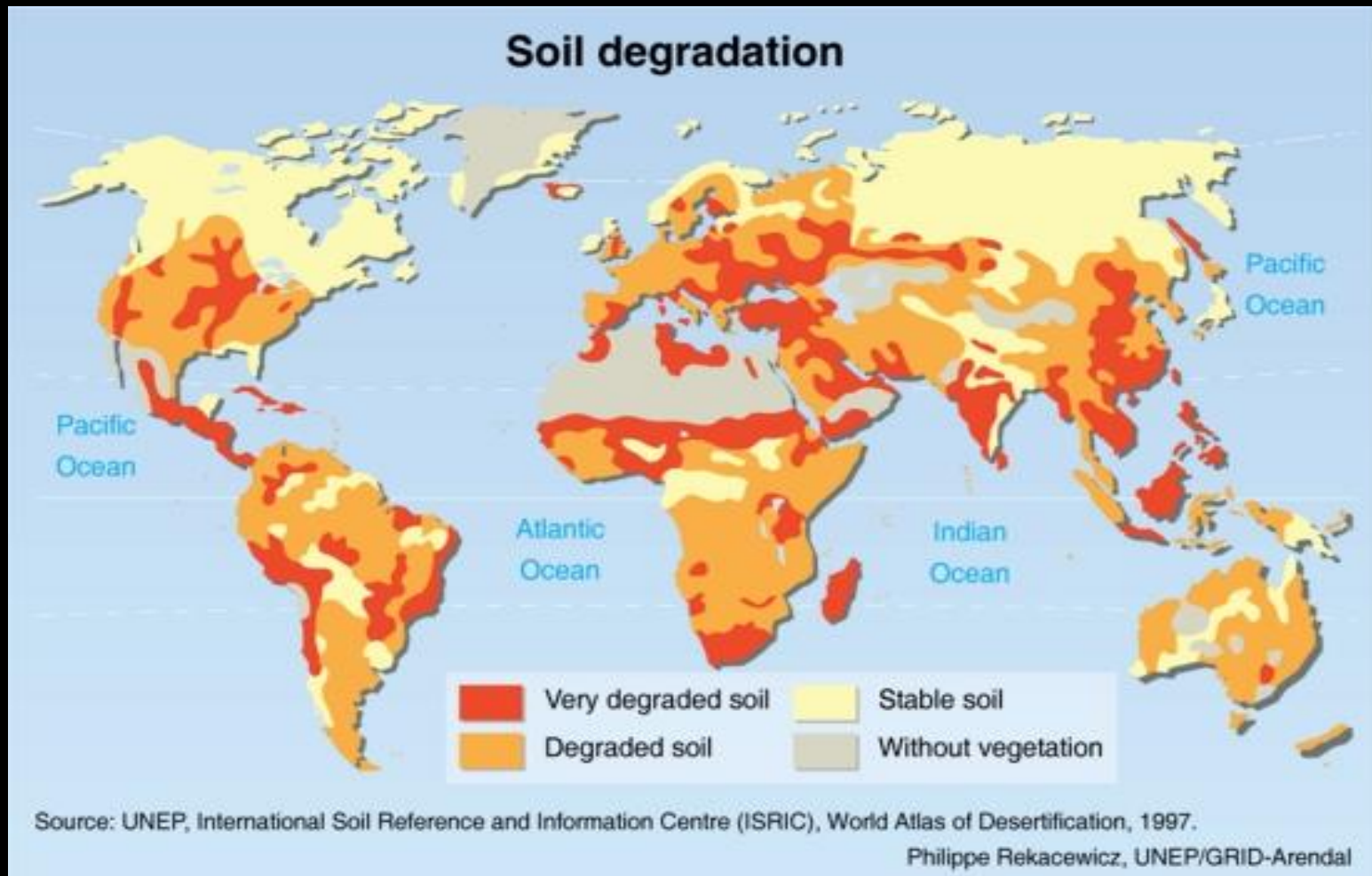
Ecosystems are thus approaching **tipping points**, which are characterized by:

- **changes become self-perpetuating via positive feedback**
- **significant time lag between driving pressures and the impacts**
- **beyond a threshold an abrupt shift of ecological state occurs**
- **changes are long-lasting and hard to reverse**

Climate Change and Other Pressures: Driving BD to Tipping Points



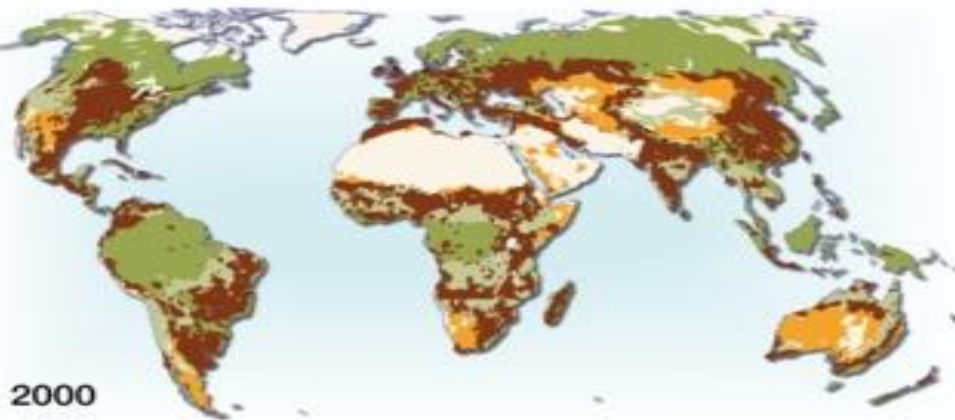
Status of Land Degradation



Source: Degraded soils. (2002). In *UNEP/GRID-Arendal Maps and Graphics Library*. from <http://maps.grida.no/go/graphic/degraded-soils>.

Historic & Projected Land Use Changes: 1700, 2000 & 2050

1700




2000



2050

Landuse and agriculture

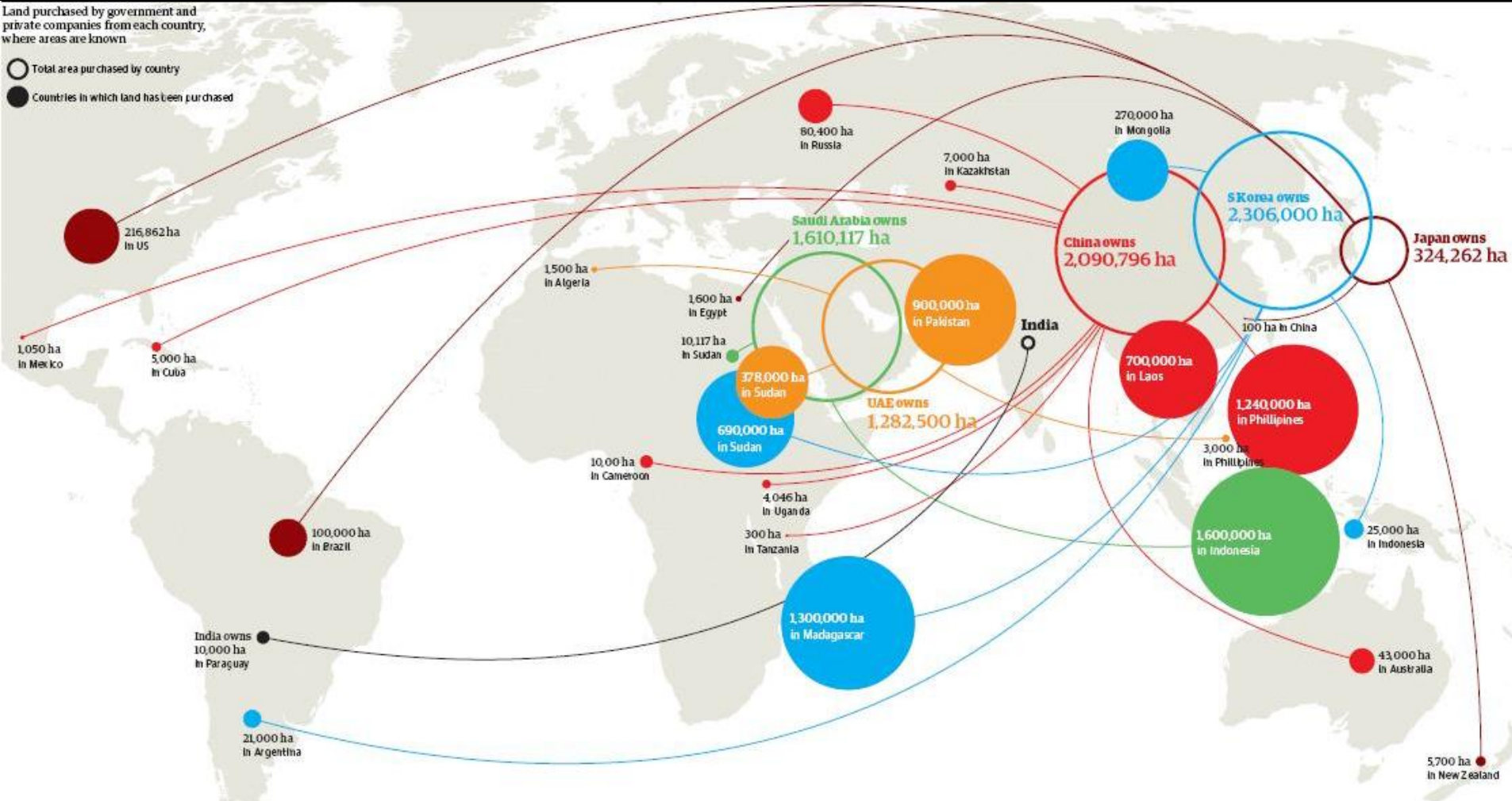
-  Agricultural land
-  Extensive grasslands (incl pasture)
-  Regrowth after use
-  Forests
-  Grasslands
-  Non-productive land

“Closing the yield gap” in agricultural productivity is key in reducing the need for land and, thus, the rate of land loss

Global Land Rush: A Silent Struggle for Arable Land

Land purchased by government and private companies from each country, where areas are known

- Total area purchased by country
- Countries in which land has been purchased



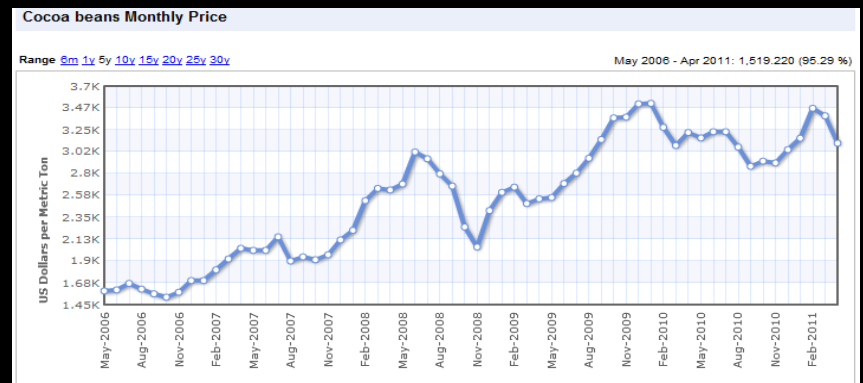
Rising Commodity Prices

- Speculation on commodities markets
- Growing scarcity of arable land

Beef



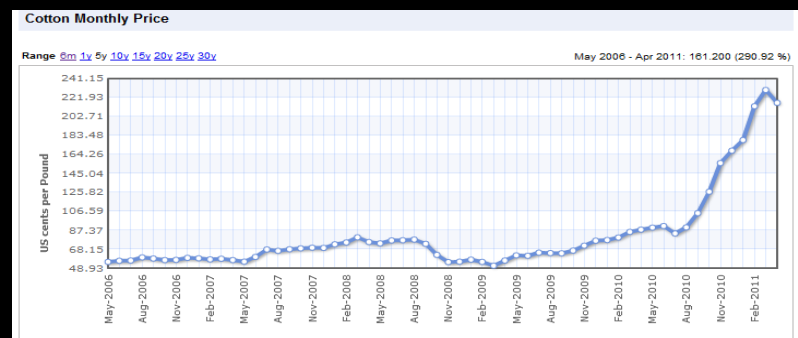
Cocoa



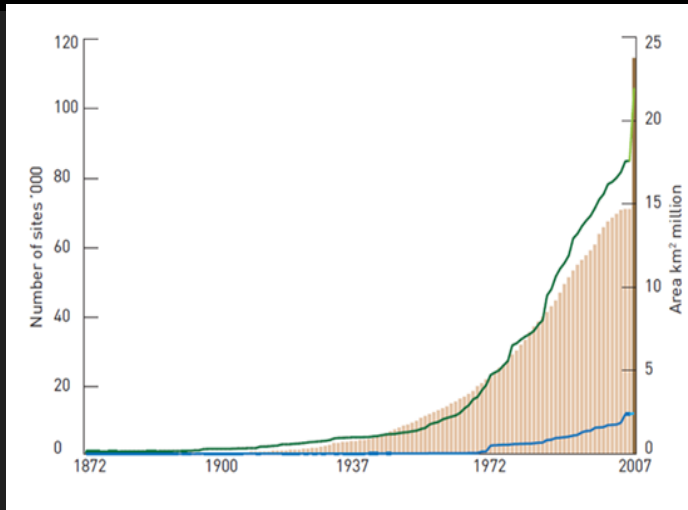
Sugar



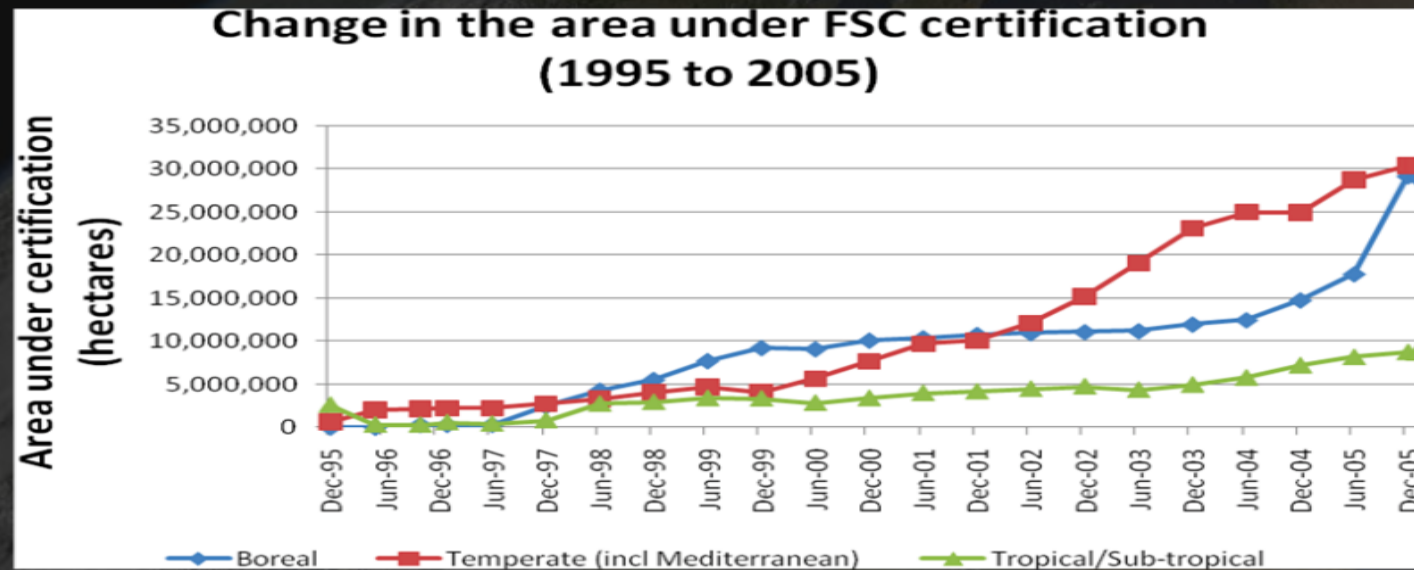
Cotton



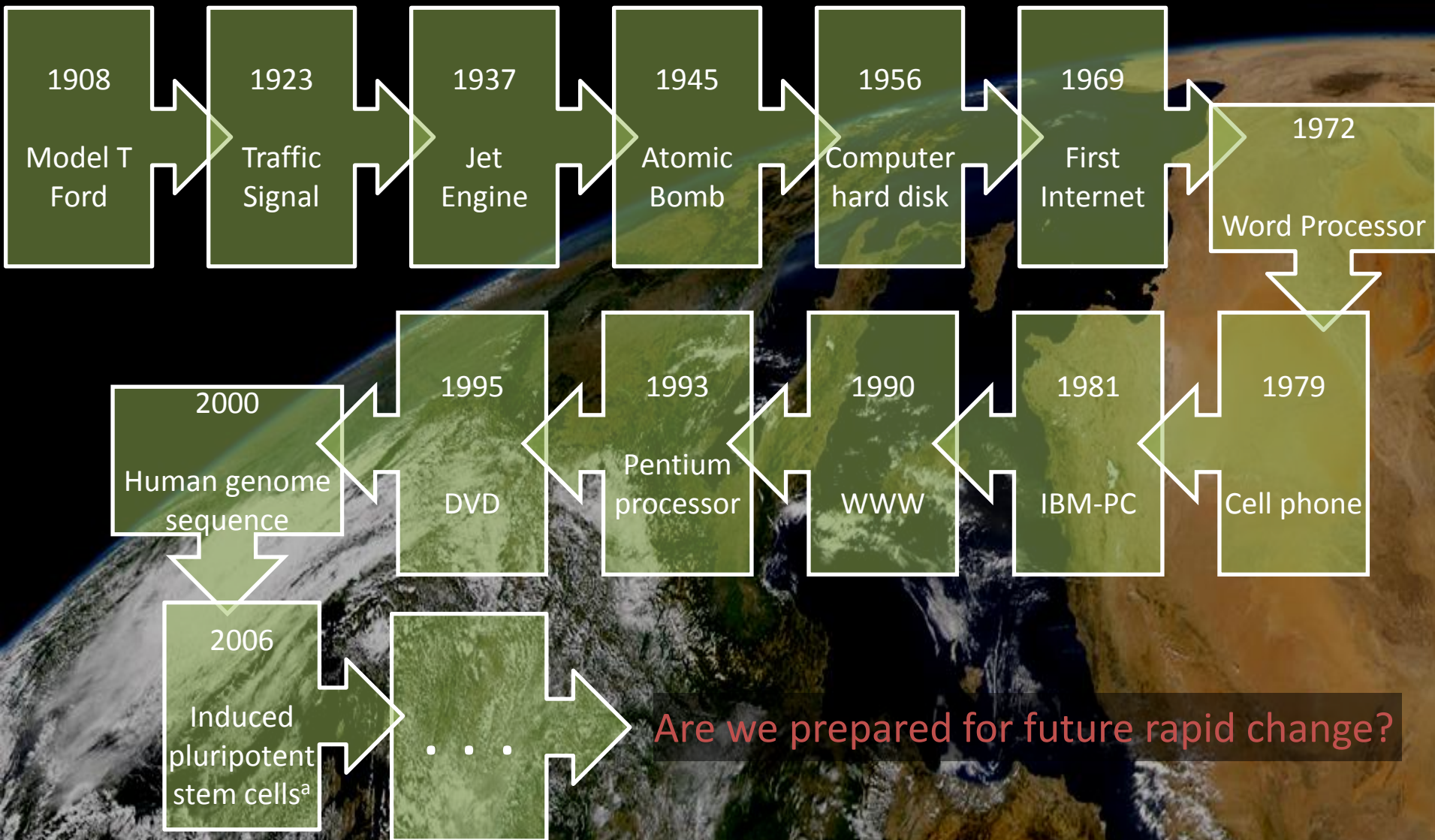
Responses...



- Increase in protected areas
- Increase in sustainable production



A Century of Rapid Technological Change



Source for all but the last: *20th Century Timeline*. <http://inventors.about.com/od/timelines/a/twentieth.htm>

^a Source: http://en.wikipedia.org/wiki/Induced_pluripotent_stem_cells