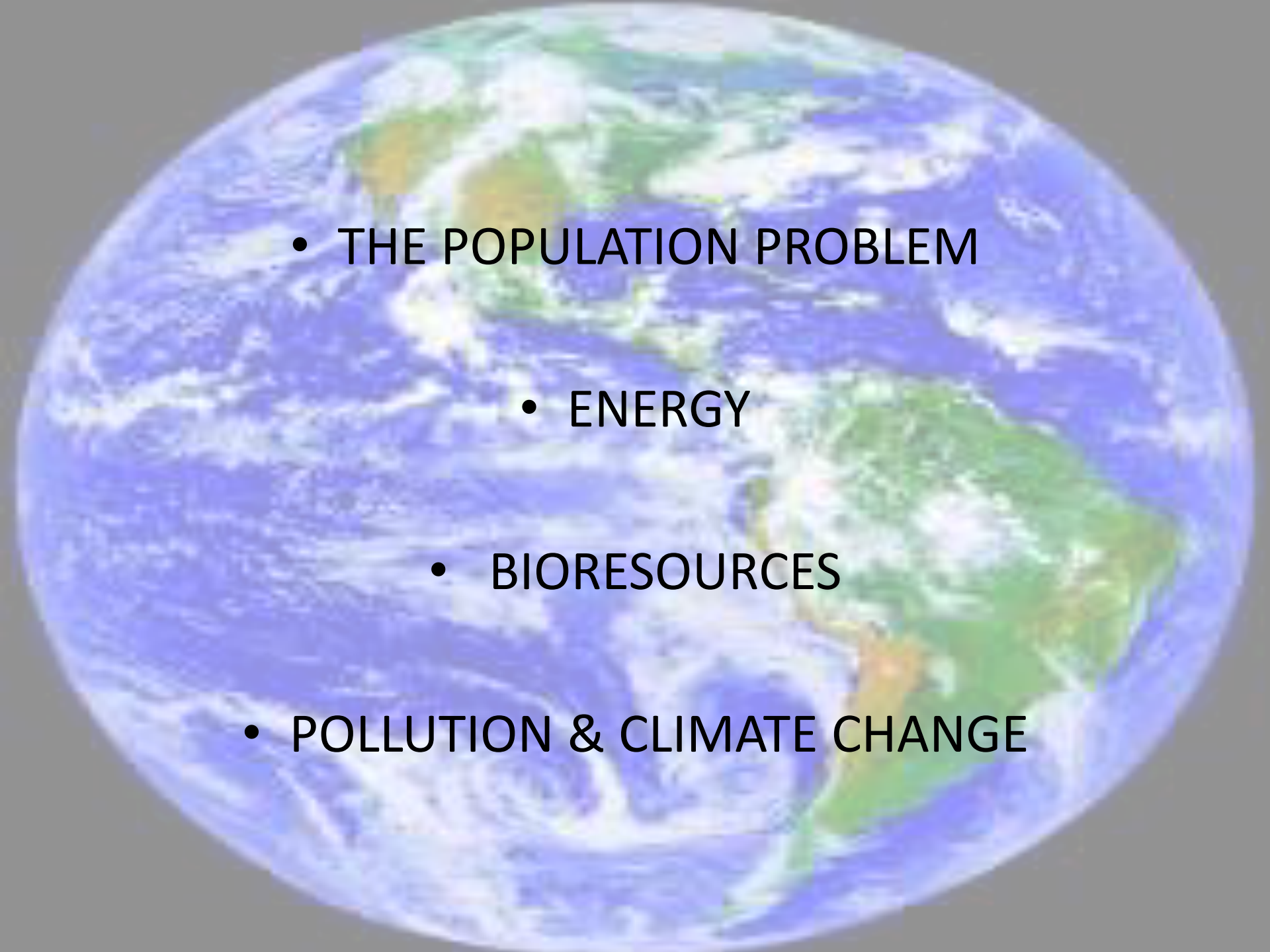


**OUR BIOSPHERE:
CONTEMPORARY ISSUES &
INTERVENTIONS**

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- 
- A satellite-style image of Earth showing the Americas and surrounding oceans. The image is centered on the Western Hemisphere, with North and South America visible. The oceans are a deep blue, and the landmasses are green and brown. The text is overlaid on the image in a bold, black, sans-serif font.
- THE POPULATION PROBLEM
 - ENERGY
 - BIORESOURCES
 - POLLUTION & CLIMATE CHANGE

POPULATION GROWTH



- **1Bn** **1804**
- **2 Bn** **1927 (123 years)**
- **3Bn** **1960 (33 years)**
- **4Bn** **1974 (14years)**
- **5Bn** **1987 (13 years)**
- **6Bn** **1999 (12 years)**
- **7Bn** **2013(14 years)**
- **8Bn** **2028 (15 years)**
- **9Bn** **2050 (22 years)**

THE POPULATION DILEMMA

Carrying capacity estimated to vary between 4-16 Bn. (UN, 2001)

Technological developments in energy and agriculture and healthcare have resulted in increase of carrying capacity to an estimated 10Bn.

Disparity is because of Rich (North) and Poor (South)

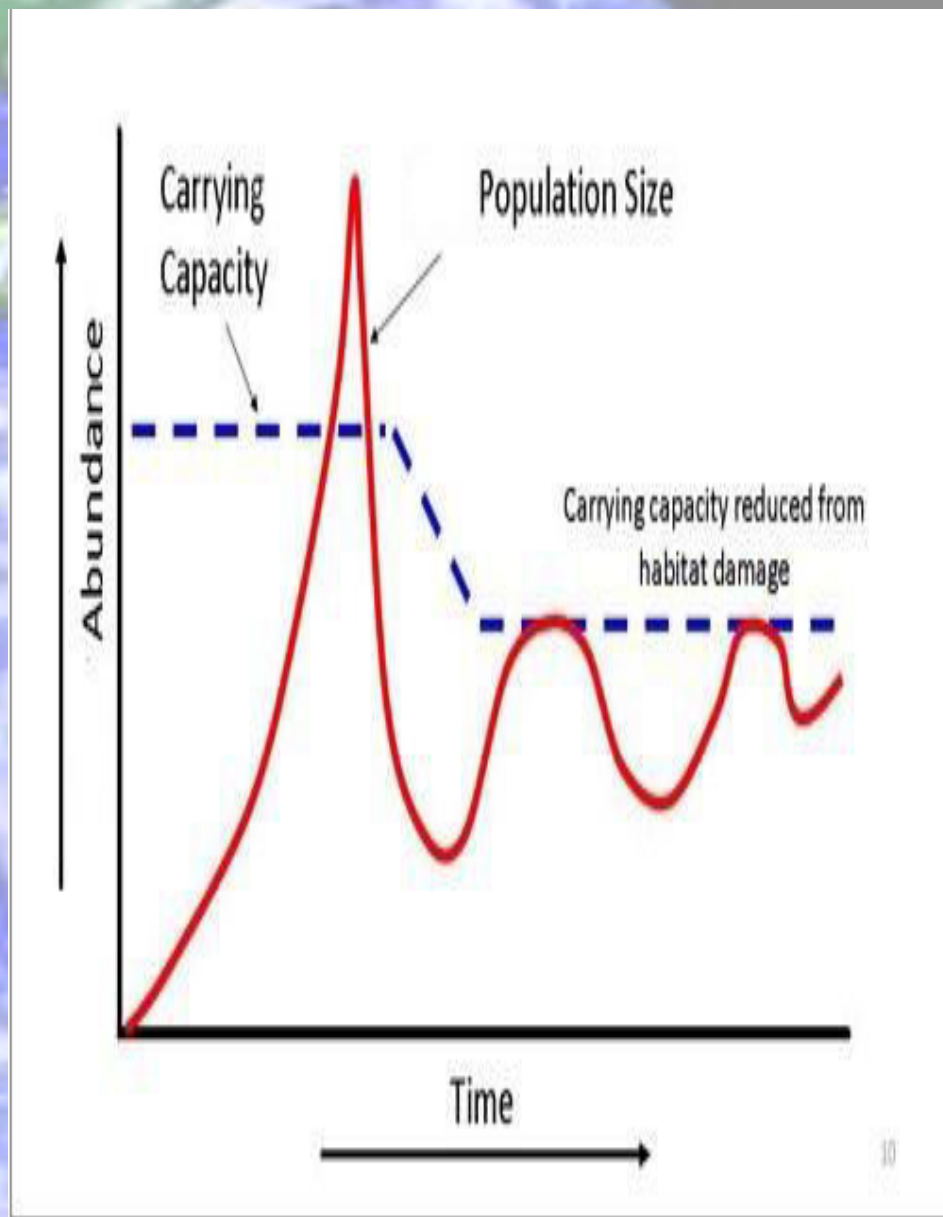
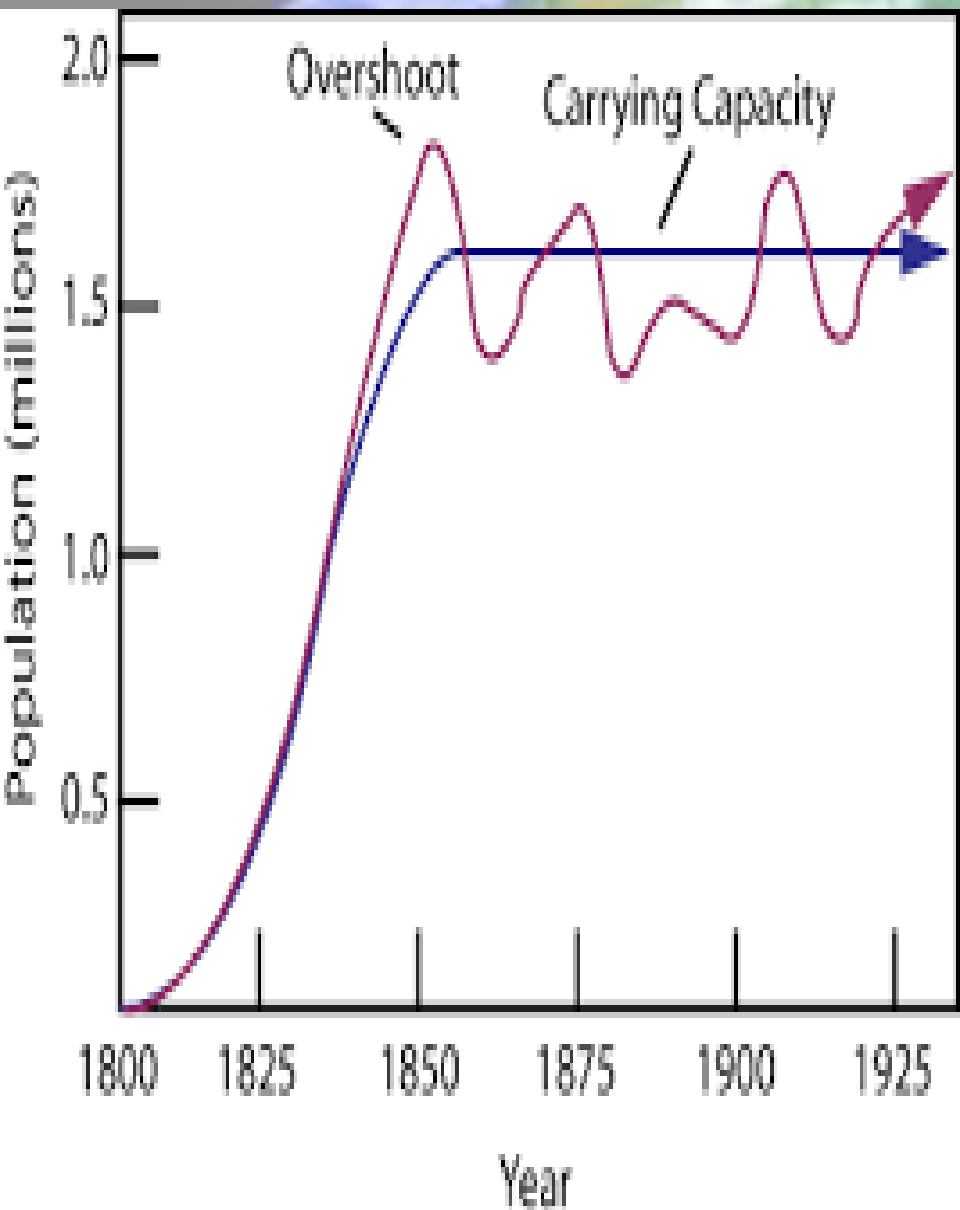
The west consumes 3.3 times the sustenance level requirements of food and 250 times the requirements of clean water. (Luxury consumption)

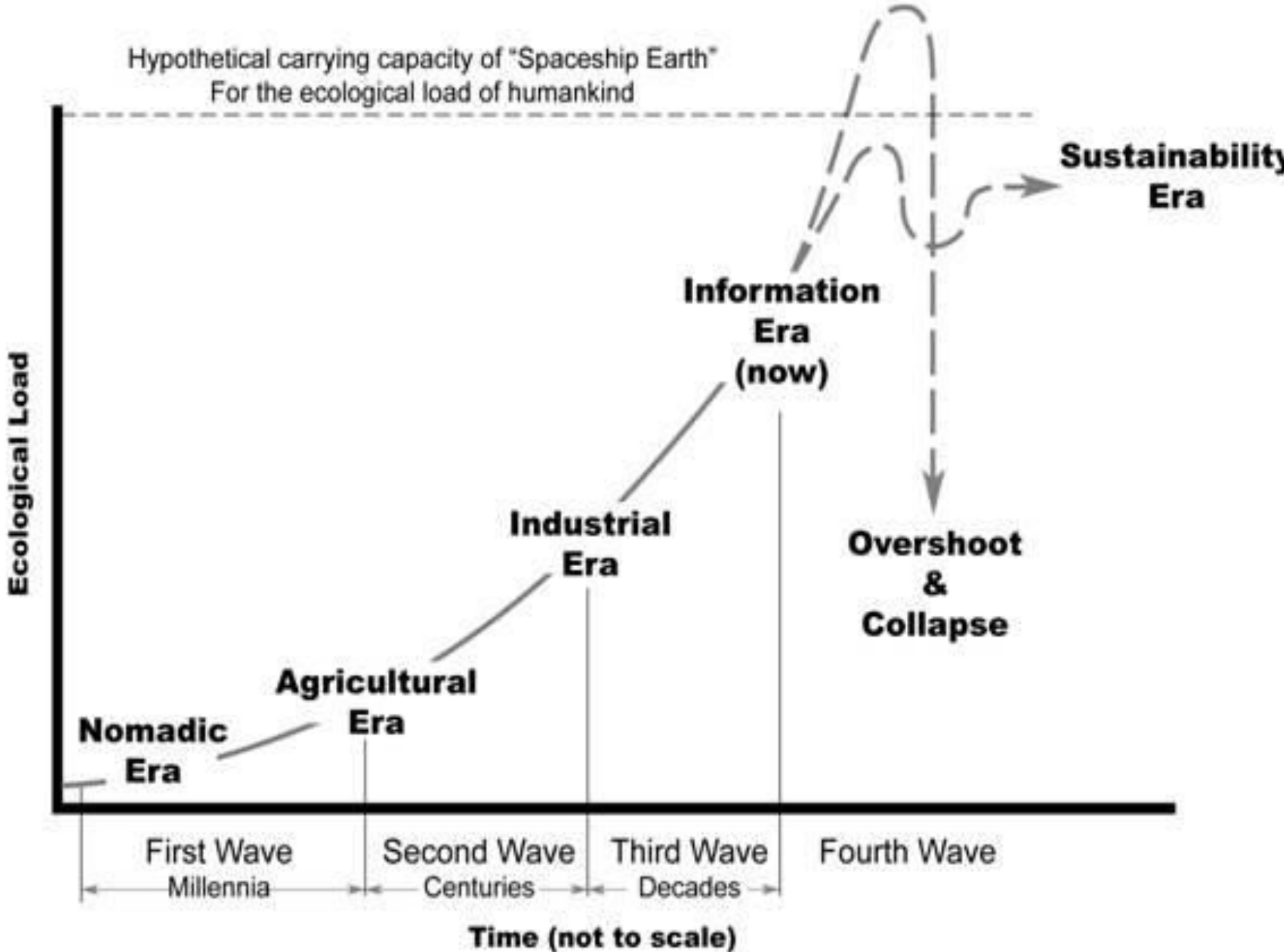
25% have alls & 75% have not

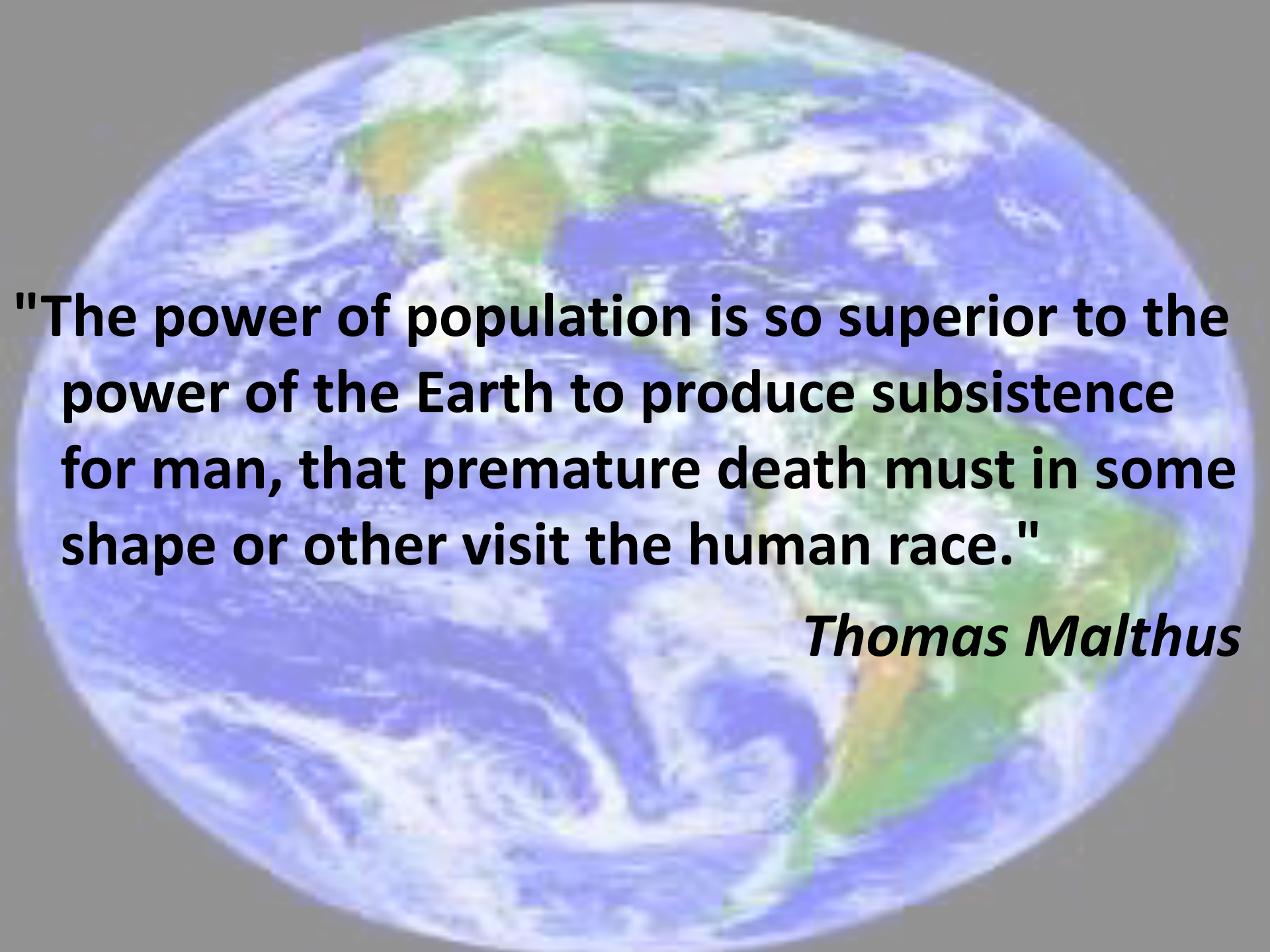
An average American uses 10 times more resource than an average Indian

1.2 Billion persons (20%) living in developed world use 88% of natural resources and generate 75% of waste

CARRYING CAPACITY





A satellite-style image of the Earth, showing the Americas (North and South America) in green and brown, surrounded by blue oceans and white clouds. The image is centered on the Western Hemisphere.

"The power of population is so superior to the power of the Earth to produce subsistence for man, that premature death must in some shape or other visit the human race."

Thomas Malthus

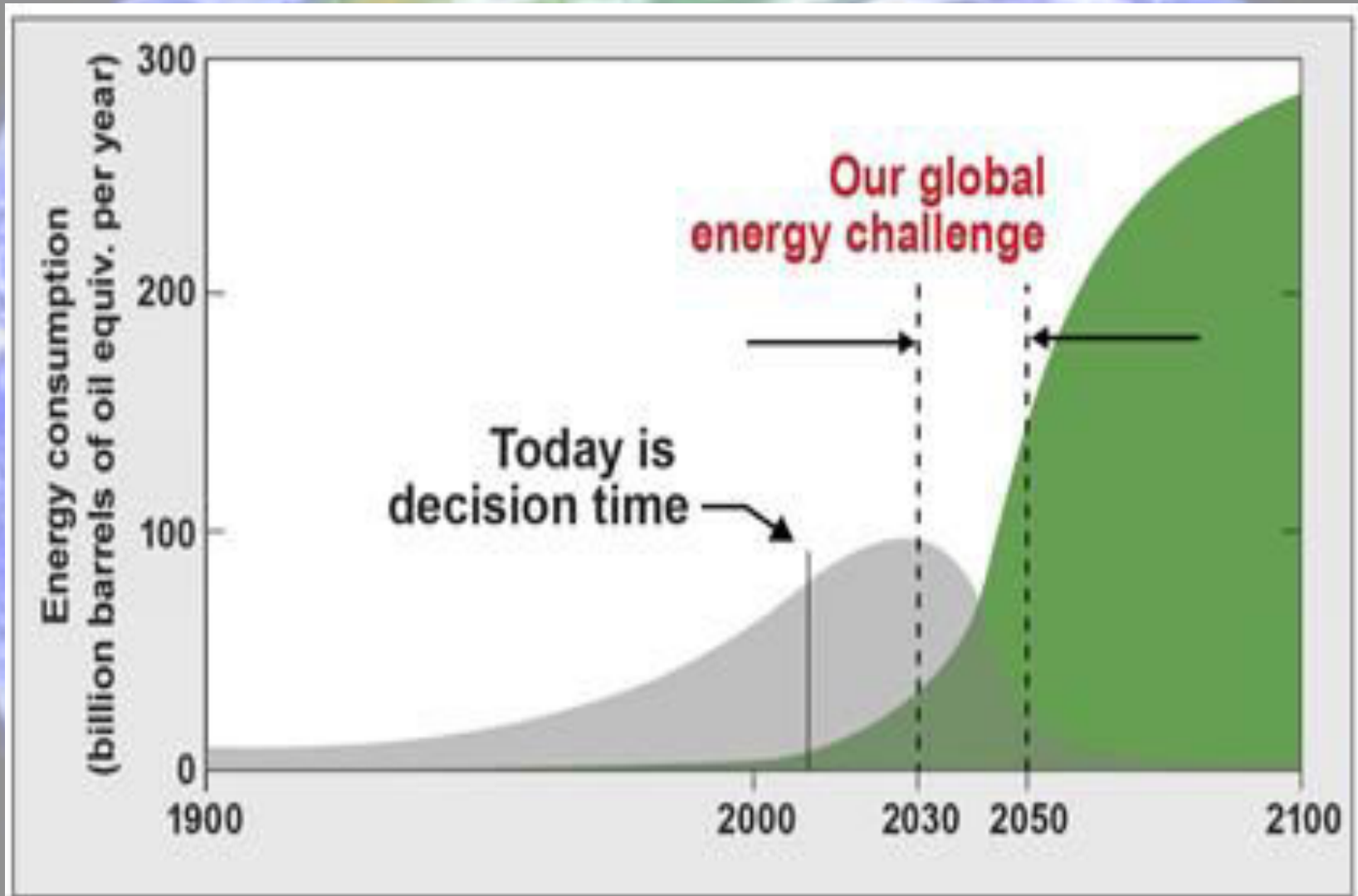
The Human Capital

- Urban lifestyle has induced **diabetes, hypertension, obesity and spinal problems** in the **productive population** (25-45)
- Incidence of **coronary diseases** are on the rise
- **Obesity** is recognized as an **urban lifestyle** disease
- Concept of **“Family”** as a unit under threat
- **Aberrant behavior** especially in children & adolescents.
- **Conflict situations** on the rise at local, regional & global levels.
- Both **“human values”** and **“value of humans”** are under severe threat

INTERVENTIONS

- Controlling population growth is a function of education and awareness, and governmental interventions/ incentives.
- It is a sensitive issue and hence is not often deliberated at the political level.
- European fertility rates fell drastically during the 1930s
- US grows @1% (0.6% natural increase)
- Asian rates have come down by 1.1 child/family (excluding China)

ENERGY

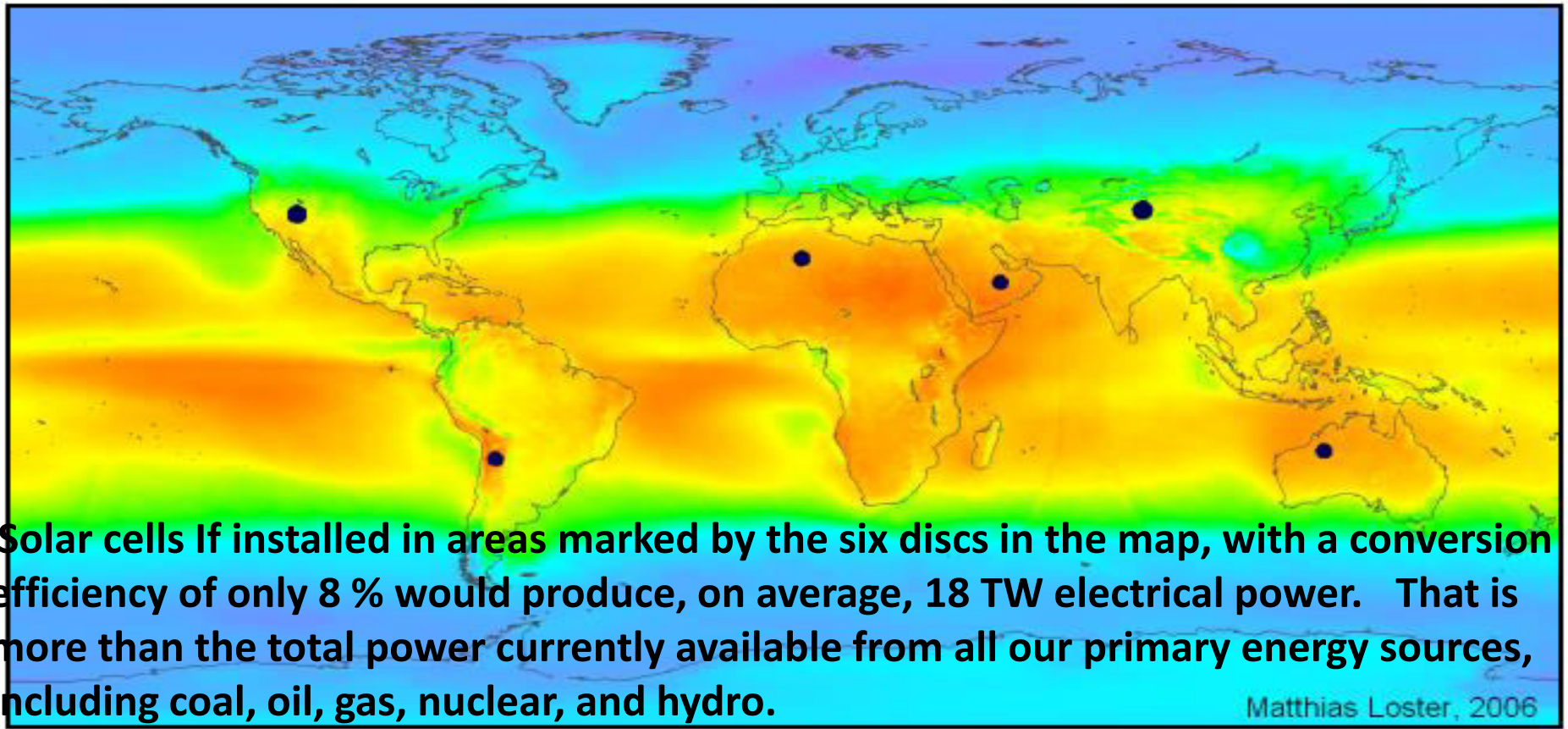


ENERGY USE

- Scale of energy use has increased 20 fold since 1850
- >80% of energy requirements are still satisfied by fossil fuels.
- Energy demand grows by 37%
- China dominates energy demand growth until the mid-2020s.
- Technological progress and improved energy efficiency allow a higher level of energy services to be satisfied per unit of energy.
- Oil demand in 2040 would be 23 mb/d (or 22%) higher, gas demand 940 bcm (or 17%) and coal demand 920 Mt (or 15%) higher

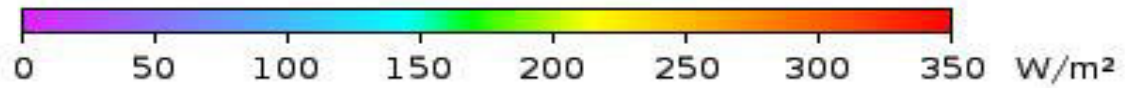
INTERVENTIONS

SOLAR



Solar cells If installed in areas marked by the six discs in the map, with a conversion efficiency of only 8 % would produce, on average, 18 TW electrical power. That is more than the total power currently available from all our primary energy sources, including coal, oil, gas, nuclear, and hydro.

Matthias Loster, 2006



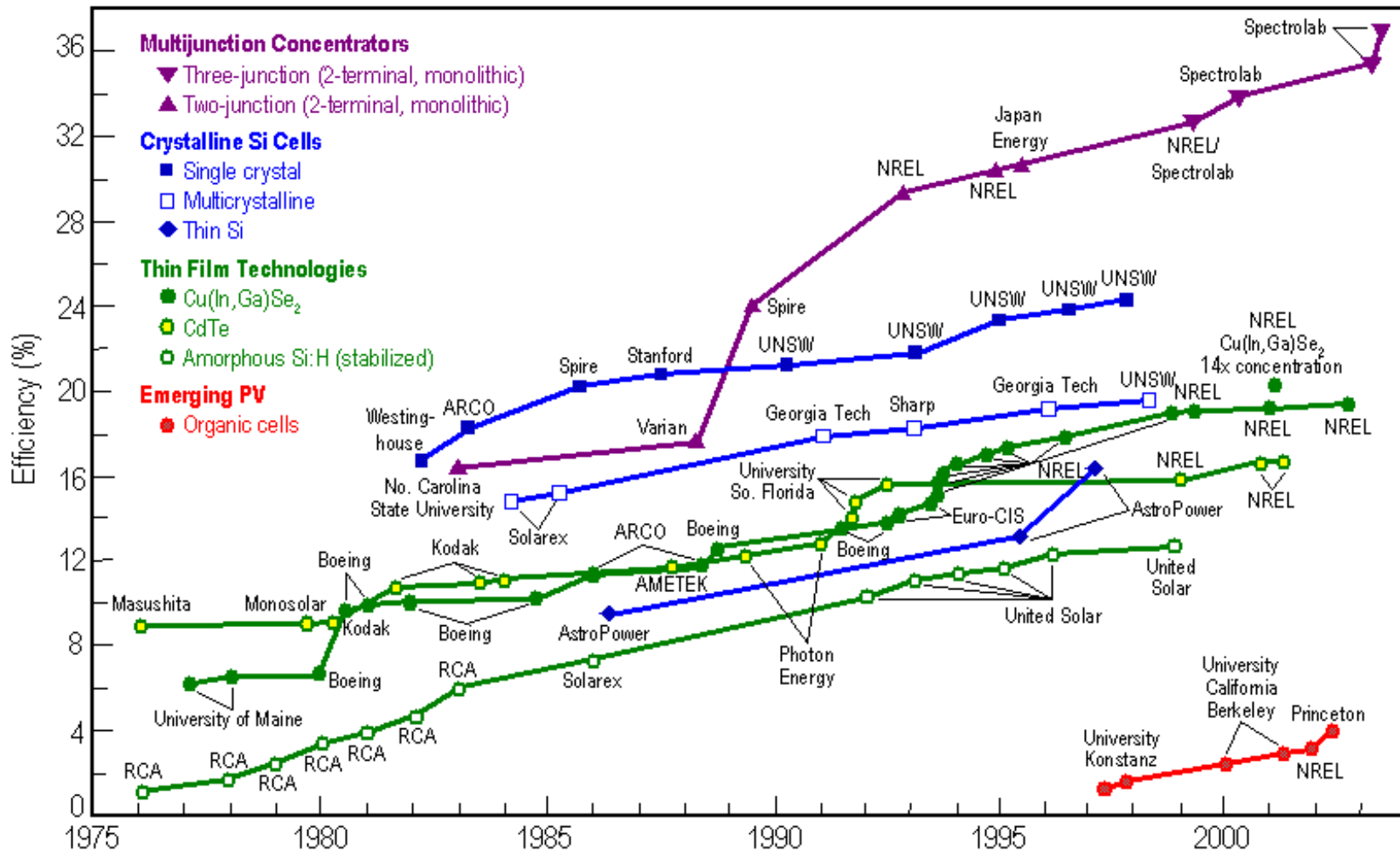
$\Sigma \bullet = 18 \text{ TWe}$

Solar efficiency



Best Research-Cell Efficiencies

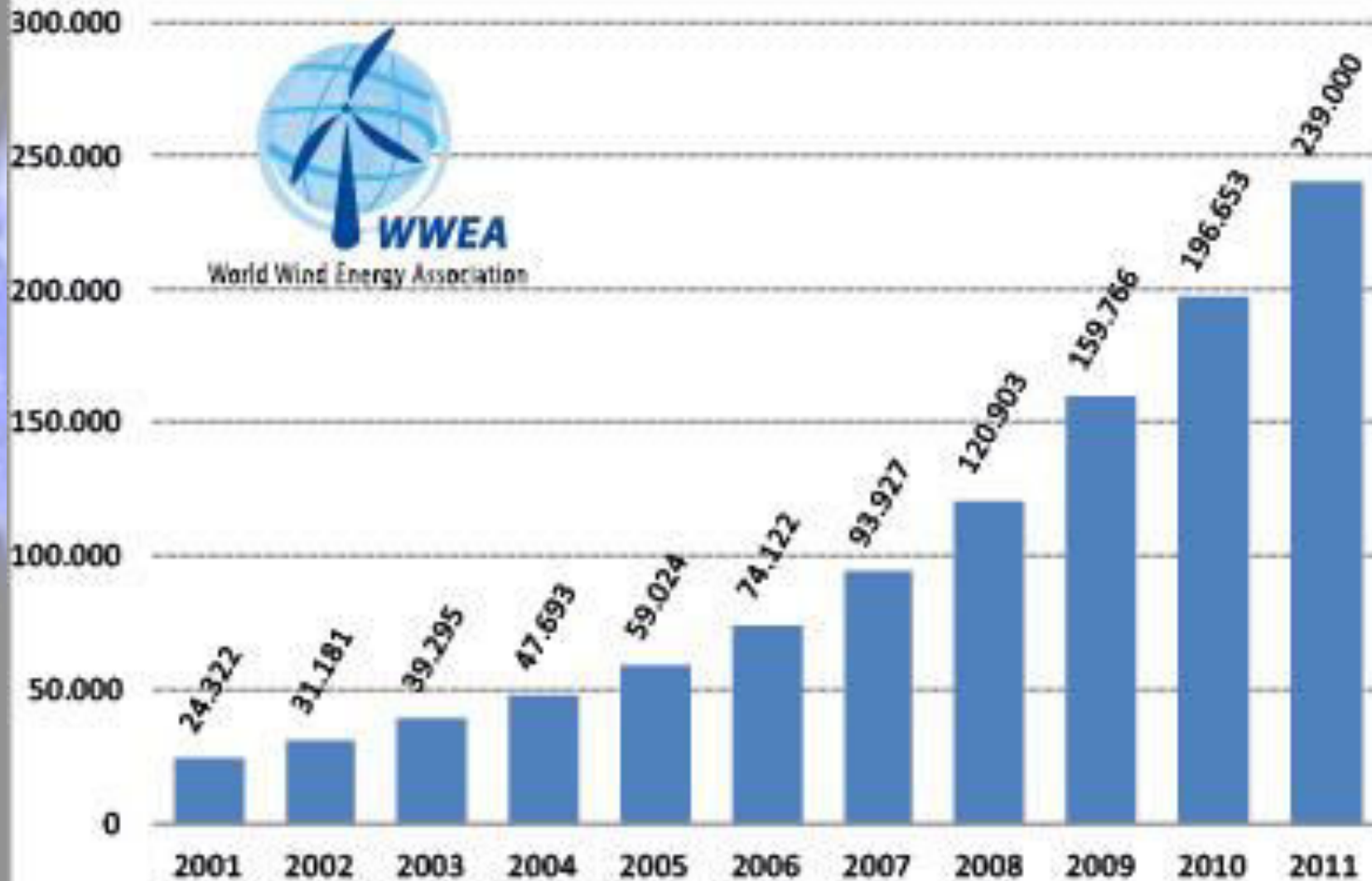
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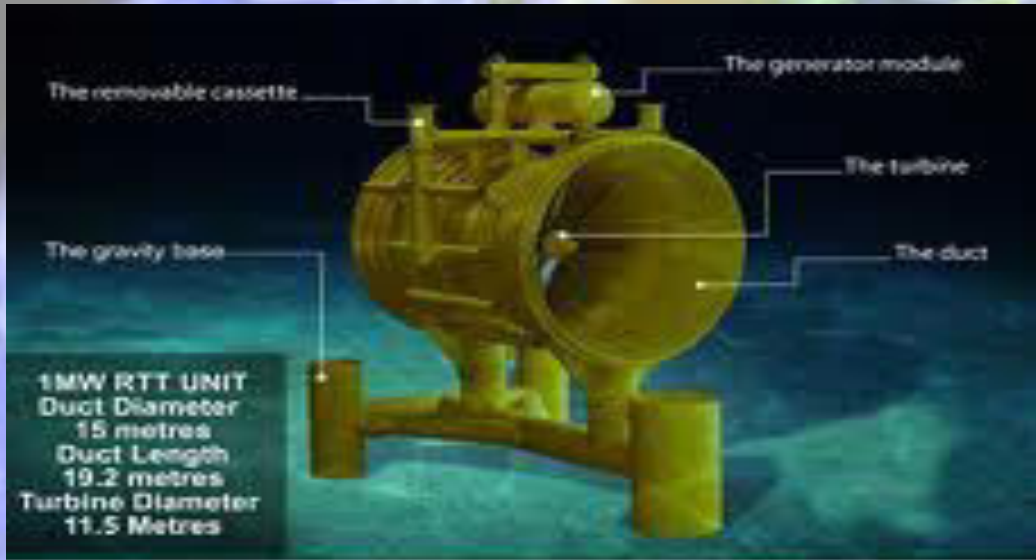
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WIND

World Total Installed Capacity [MW]

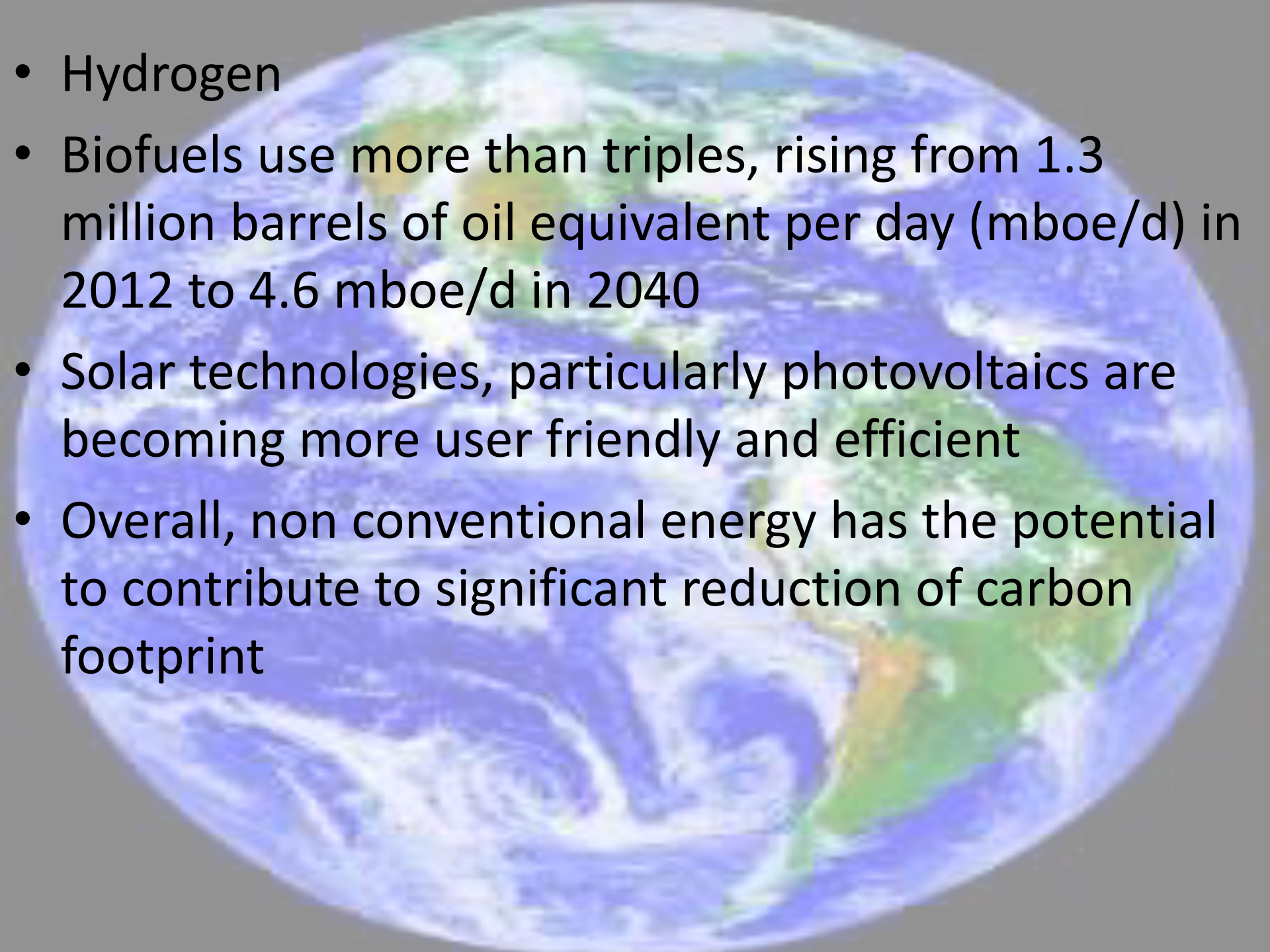


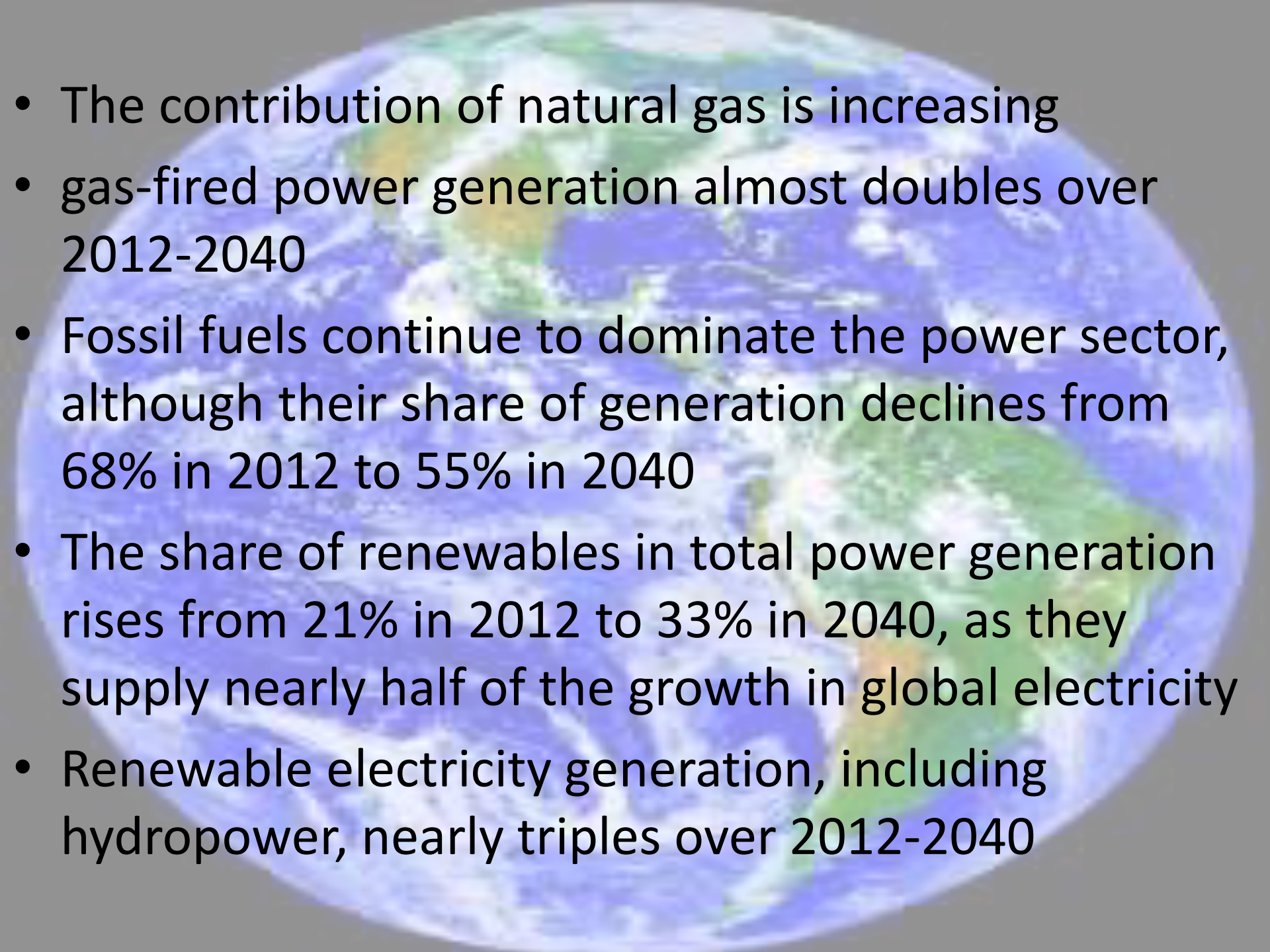
WAVE ENERGY



PLASMA

- Fourth state of matter
- Could be reproduced at scales to suit different applications
- Plasma arc torches used for conversion of PVC to biofuels
- Plasma fusion technology has the potential to produce huge amounts of green energy
- Plasma propulsion has the potential to make intergalactic travel a reality

- 
- A satellite-style image of Earth, showing the Americas and surrounding oceans. The image is slightly blurred and has a soft, ethereal quality. The text is overlaid on the left side of the image.
- Hydrogen
 - Biofuels use more than triples, rising from 1.3 million barrels of oil equivalent per day (mboe/d) in 2012 to 4.6 mboe/d in 2040
 - Solar technologies, particularly photovoltaics are becoming more user friendly and efficient
 - Overall, non conventional energy has the potential to contribute to significant reduction of carbon footprint

- 
- The contribution of natural gas is increasing
 - gas-fired power generation almost doubles over 2012-2040
 - Fossil fuels continue to dominate the power sector, although their share of generation declines from 68% in 2012 to 55% in 2040
 - The share of renewables in total power generation rises from 21% in 2012 to 33% in 2040, as they supply nearly half of the growth in global electricity
 - Renewable electricity generation, including hydropower, nearly triples over 2012-2040

NATURAL CAPITAL

A satellite-style image of the Earth, showing the Americas (North and South America) in green and brown, surrounded by blue oceans and white clouds. The text is overlaid on the image.

- **Resources**
- **Air**
- **Water**
- **Soil**
- **Energy**
- **Minerals**

Services

Population Control
Nutrient Recycling
Climate Control
Pollution Control
Biodiversity Maintenance
Pest & Disease Control

Ecological Capital
(One time gift to Humans)
Old Growth Forest
Ground Water
Fossil Fuel
Minerals
Biodiversity

BIORESOURCES

- Diminishing natural resources :
 - Land : Deforestation- tropical forests reduced from 20% to 7% in a century.
 - Extinction rates have been enhanced by >200%
 - Soil fertility is lost @ 1 m²/ yr as against 1m² regenerated in >100 yrs.
 - Reduction of agrobiodiversity
 - Globalization of economy further reducing agrobiodiversity and cultural diversity



AIR POLLUTION

Combustion of fossil fuels release **20 toxic metals** into the environment including As, Be, Cd, Pb and Ni.

Monoaromatic (benzene) and diaromatic (naphthalene). **Benzene is carcinogenic**. Non carcinogenic effects are impairment of detox enzymes to **liver damage and aberrant reproductive behavior**

PAH and benzo(a)pyrene (carcinogen) is mutagenic.



INDUSTRIAL

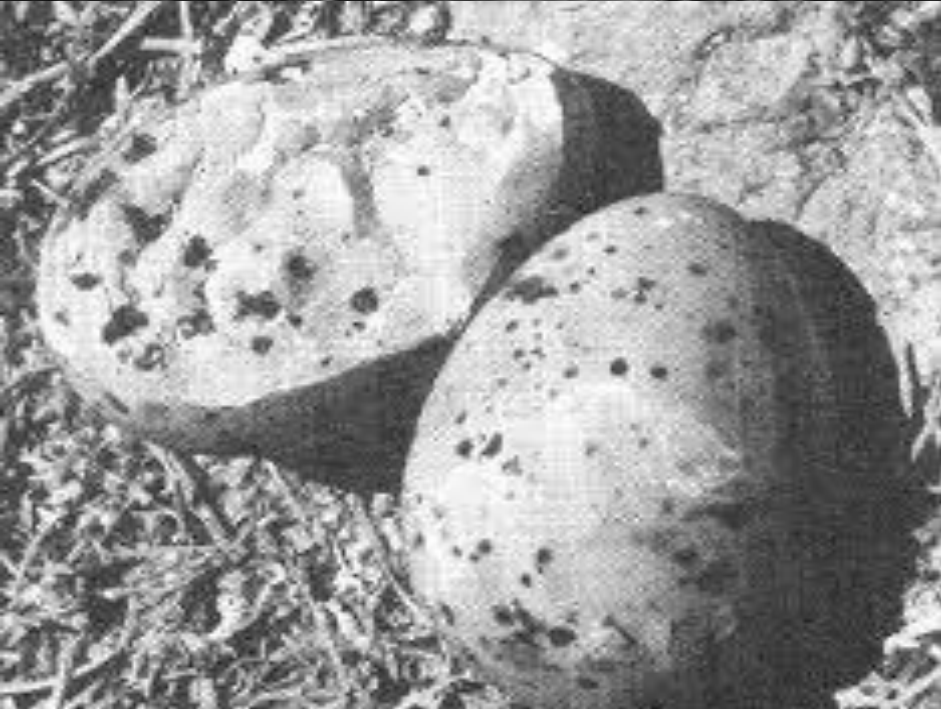
- Chemical agents:
- 64,000 compounds used in Industry
- 5,000 food additives
- 4,000 medicinal drugs
- 1,200 household products
- **> 1000 pesticides**
- **700 new chemicals that are identified or introduced each year, MOST OF WHICH ARE SYNTHETIC**

PERSISTANT ORGANIC POLLUTANTS

Definition : Pesticides which retain their activity for a long period of time (**long residence period/Long half life**)

- Malaria & Typhus: DDT was used to control body lice (typhus) in soldiers during world war II
- WHO embarked upon a malaria eradication program in 1945 in selected countries
- Till the 1980s it is estimated that 40000T was used annually.
- **Worldwide 3 MT of pesticides used annually (EPA,2003)**





13.8 ppm →



Tertiary consumers

2.07 ppm →



Secondary consumers

0.23 ppm →



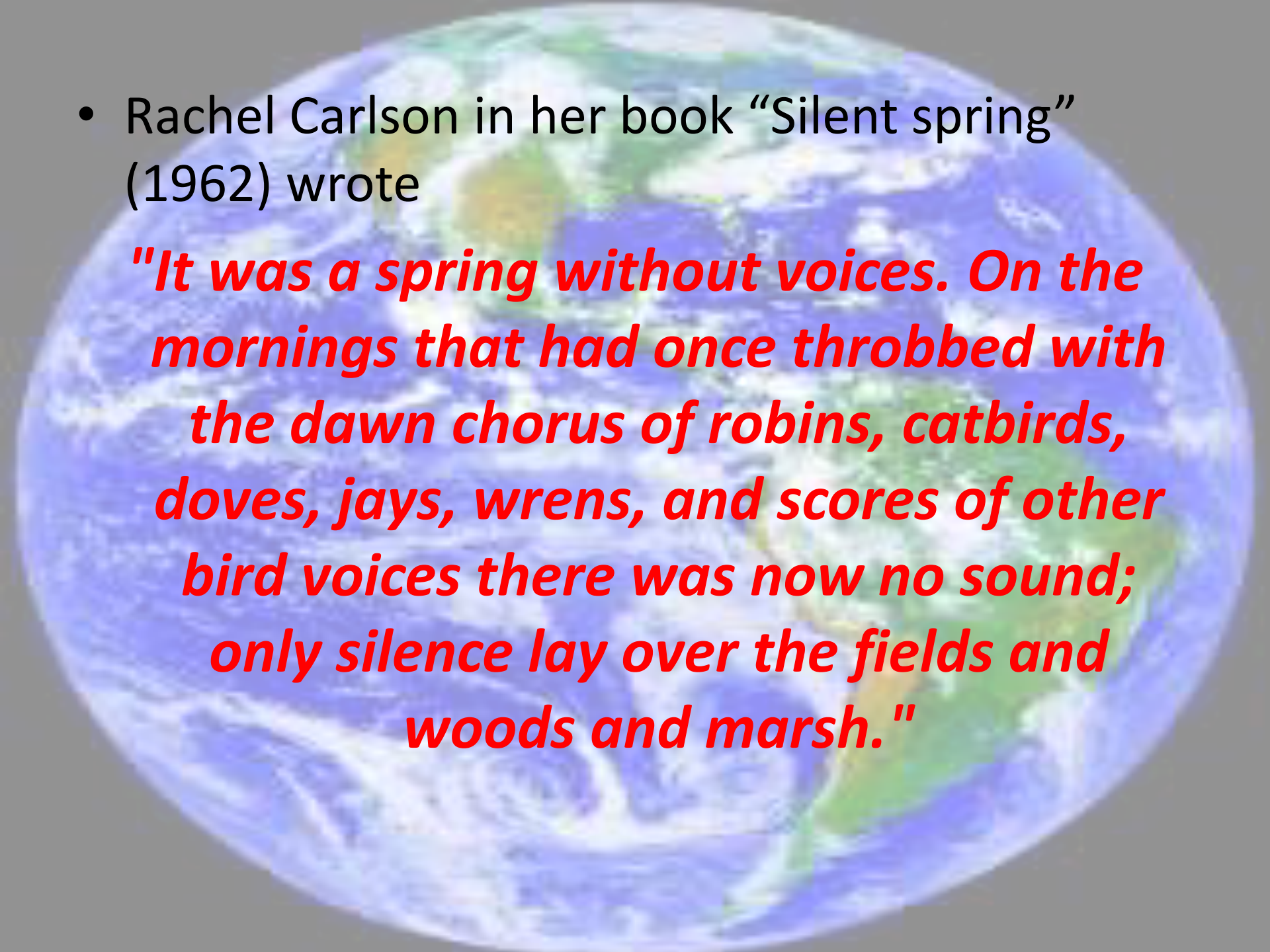
Primary consumers

0.04 ppm →



Producers

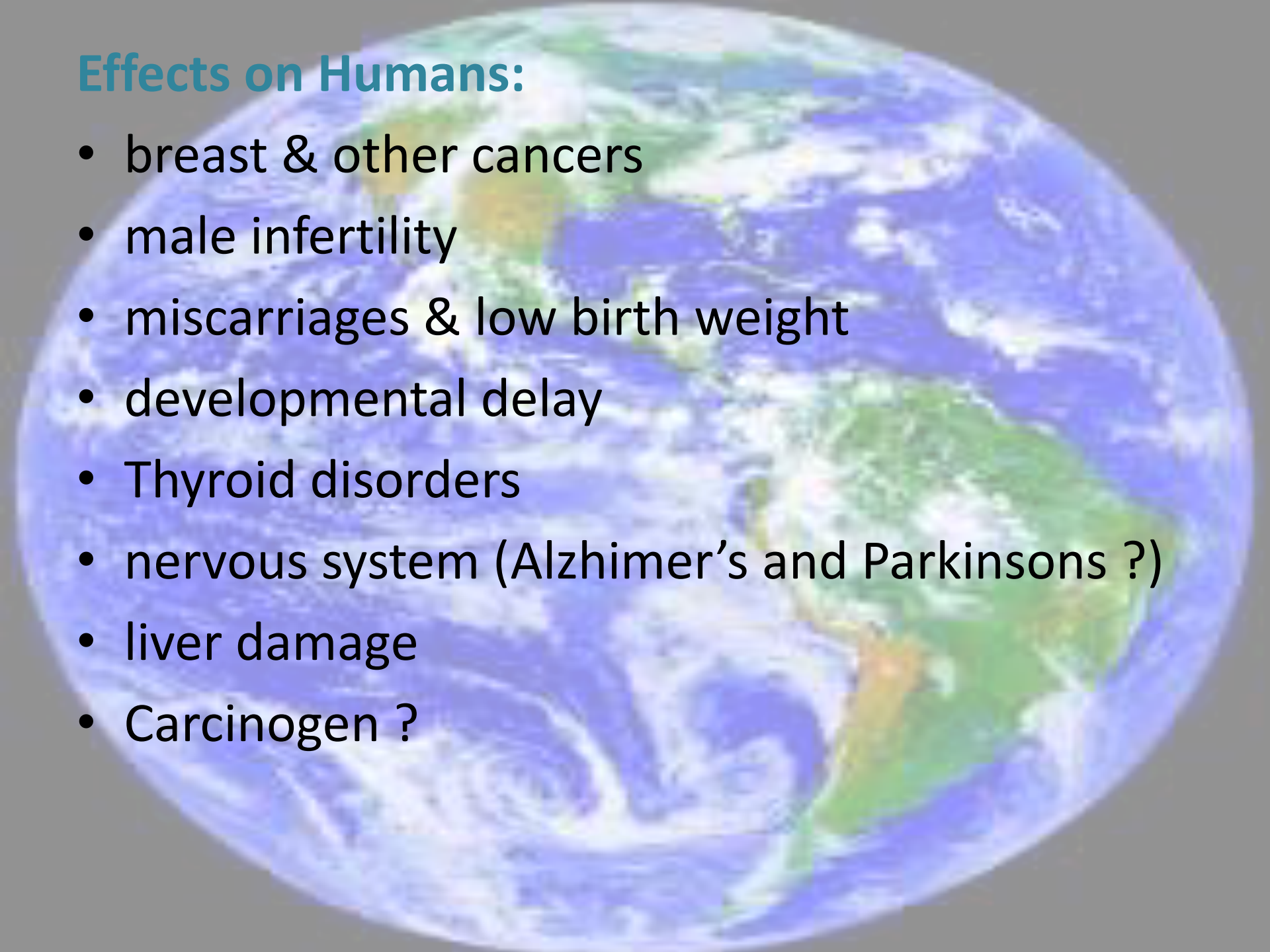
[http://users.rcn.com/jkimball.ma.ultranet/BiologyPages/D/D
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- 
- Rachel Carlson in her book “Silent spring” (1962) wrote

"It was a spring without voices. On the mornings that had once throbbed with the dawn chorus of robins, catbirds, doves, jays, wrens, and scores of other bird voices there was now no sound; only silence lay over the fields and woods and marsh."

Effects on Humans:

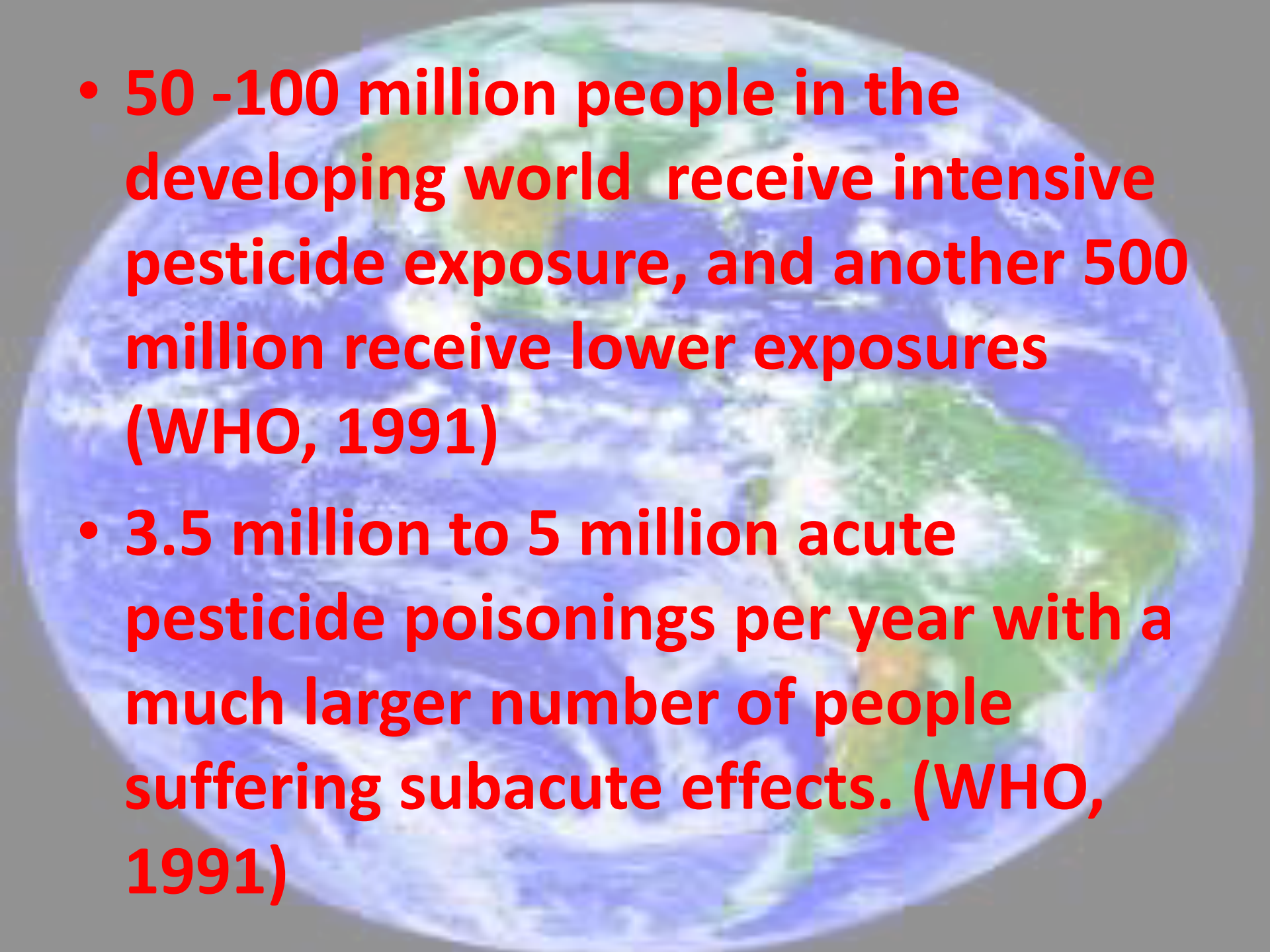
- breast & other cancers
- male infertility
- miscarriages & low birth weight
- developmental delay
- Thyroid disorders
- nervous system (Alzheimer's and Parkinsons ?)
- liver damage
- Carcinogen ?

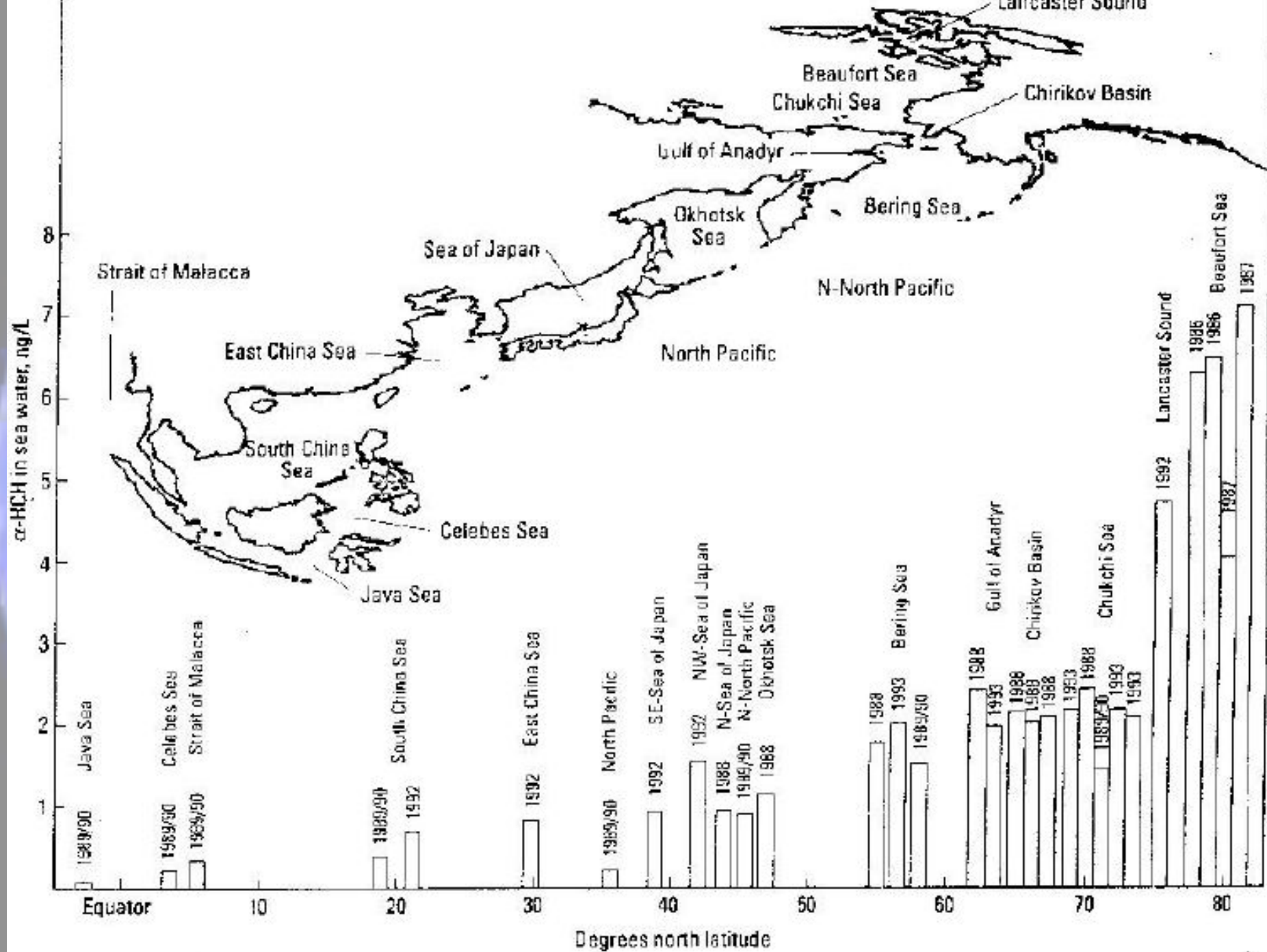


ENVIRONMENTAL FALLOUT



- **DDT banned in US in 1972**
- 40 years later....(2012)
 - **DDT_breakdown_products**
 - in 60% of heavy cream samples, 42% of greens, 28% of carrots and lower percentages of many other foods.
 - In blood of 99% of the people tested

- 
- **50 -100 million people in the developing world receive intensive pesticide exposure, and another 500 million receive lower exposures (WHO, 1991)**
 - **3.5 million to 5 million acute pesticide poisonings per year with a much larger number of people suffering subacute effects. (WHO, 1991)**

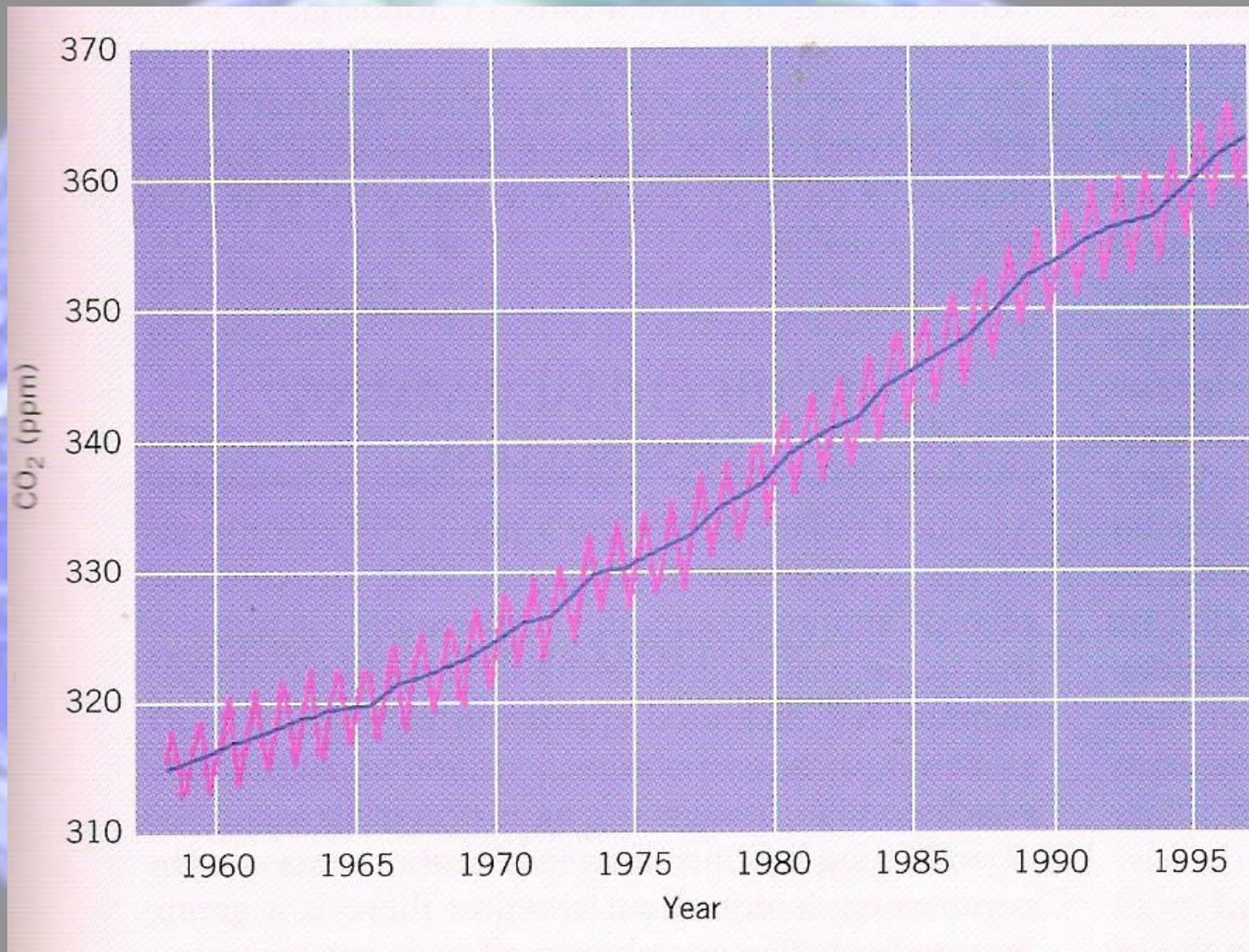


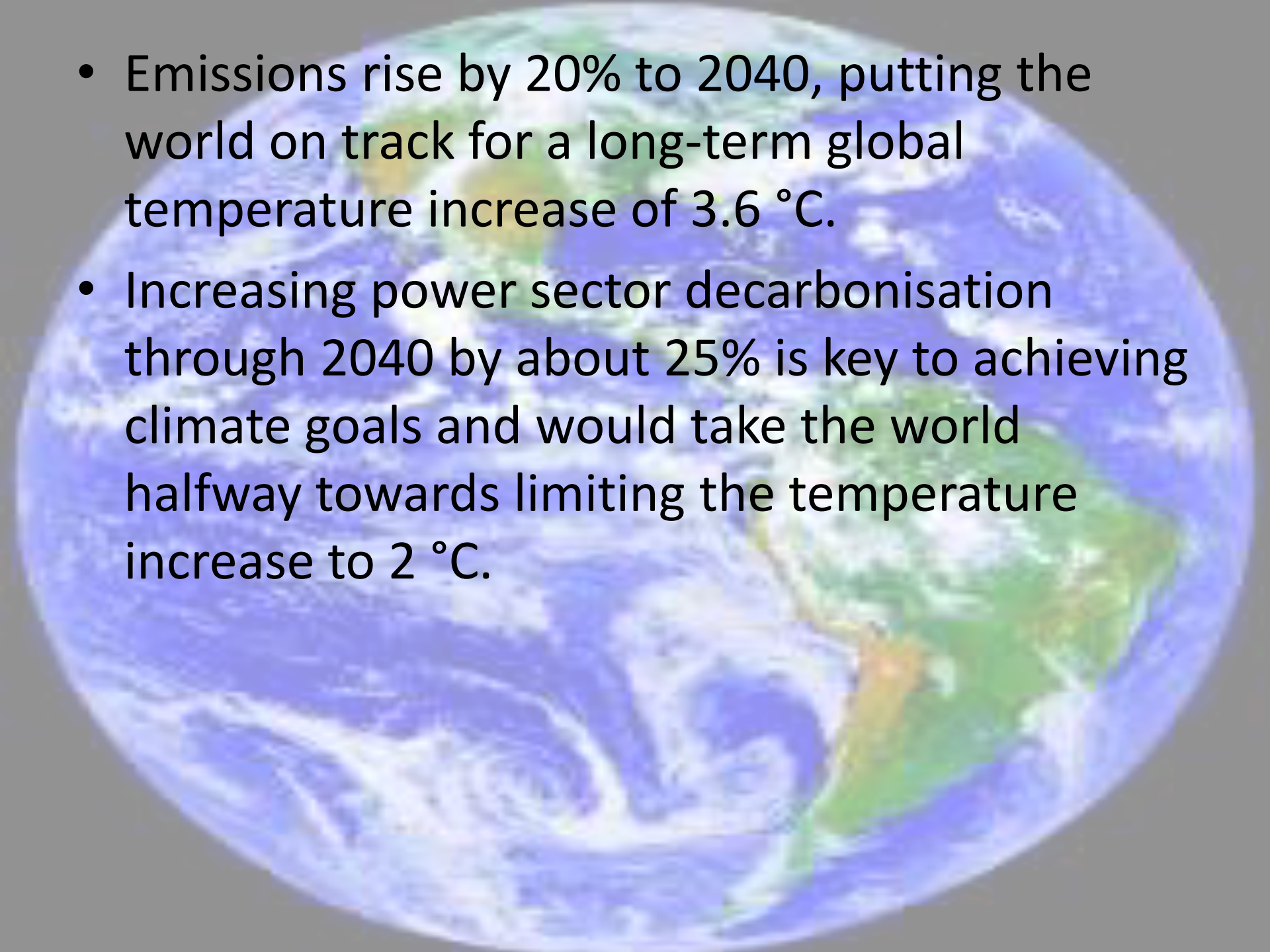
INTERVENTIONS

- The global community recognized the problem of POPs
- It was realized that individual state bans is not enough
- UNEP Governing Council in 1997 initiated international negotiations following recommendations by the Intergovernmental Forum on Chemical Safety (IFCS) for international actions to reduce the risks to human health and the environment arising from a first list of twelve POPs **(THE DIRTY DOZEN)**
- Negotiations on a global, legally binding instrument to reduce and/or eliminate releases of POPs started in Montreal, Canada in 1998 under the auspices of UNEP.
- In May 2001 126 countries and the EU agreed and adopted the text of this global treaty, referred to as the Stockholm Convention on **Persistent Organic Pollutants**.

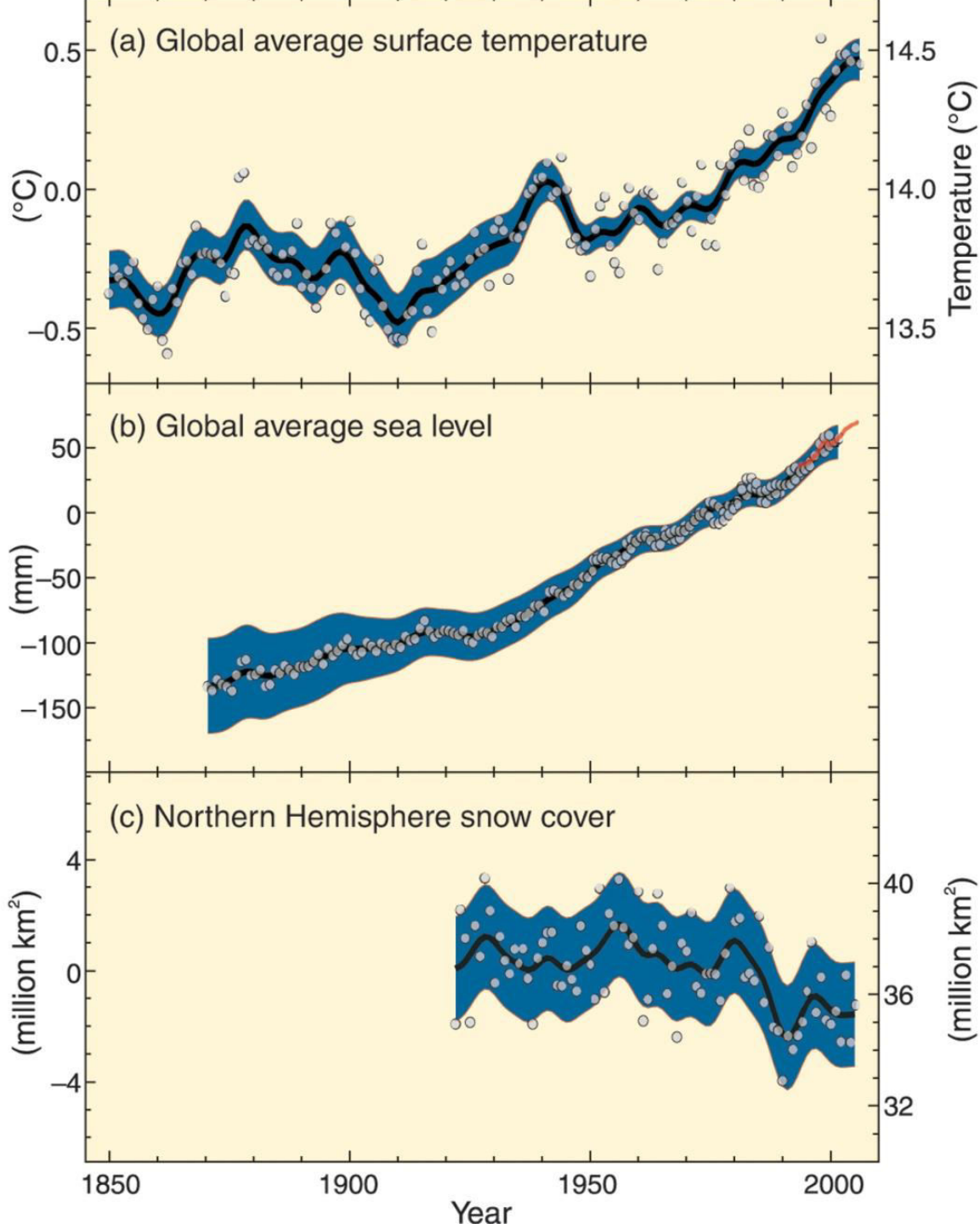
CLIMATE CHANGE

- The gases produced through anthropogenic processes (CO_2 , CFCs, methane, NO_x & O_3) have increased significantly
- Burning fossil fuels add 5.4 b tons carbon to the atmosphere & deforestation adds another 1.6b tons carbon every year.
- CFCs, methane, NO_x & O_3 produced through human activities, some of them having a high residence time (> 100 yrs), therefore activity.



- 
- A satellite-style image of Earth, showing the Americas (North and South America) in green and brown, surrounded by blue oceans and white clouds. The image is slightly tilted and has a soft, glowing border.
- Emissions rise by 20% to 2040, putting the world on track for a long-term global temperature increase of 3.6 °C.
 - Increasing power sector decarbonisation through 2040 by about 25% is key to achieving climate goals and would take the world halfway towards limiting the temperature increase to 2 °C.

Difference from 1961–1990



POTENTIAL EFFECTS

- Will significantly affect the weather patterns, rainfall, soil moisture etc. all of which have a bearing on agriculture.
- Cloudbursts, storms and hurricanes and floods may become either more frequent or more intense.
- The overall hydrologic cycle will be disrupted.
- Polar ice will recede, and sea levels will rise (2-3mm/yr) affecting 50 % of world population

Central North America

Warming will vary from 2° to 4°C in winter and 2° to 3°C in summer. Precipitation increases will range from 0% to 15% in winter, but there will be decreases of 5% to 10% in summer. Soil moisture will decrease in summer by 15% to 20%.

Southern Europe

Warming will be about 2°C in winter and will vary from 2° to 3°C in summer. There is some indication of increased precipitation in winter, but summer precipitation will decrease by 5% to 15%, and summer soil moisture by 15% to 25%.

Sahel

Warming will range from 1° to 3°C. Area mean precipitation will increase and area mean soil moisture will decrease marginally in summer. However, throughout the region, there will be areas of both increase and decrease in both parameters.

Southern Asia

Warming will vary from 1° to 2°C throughout the year. Precipitation will change little in winter and generally will increase throughout the region by 5% to 15% in summer. Summer soil moisture will increase by 5% to 10%.

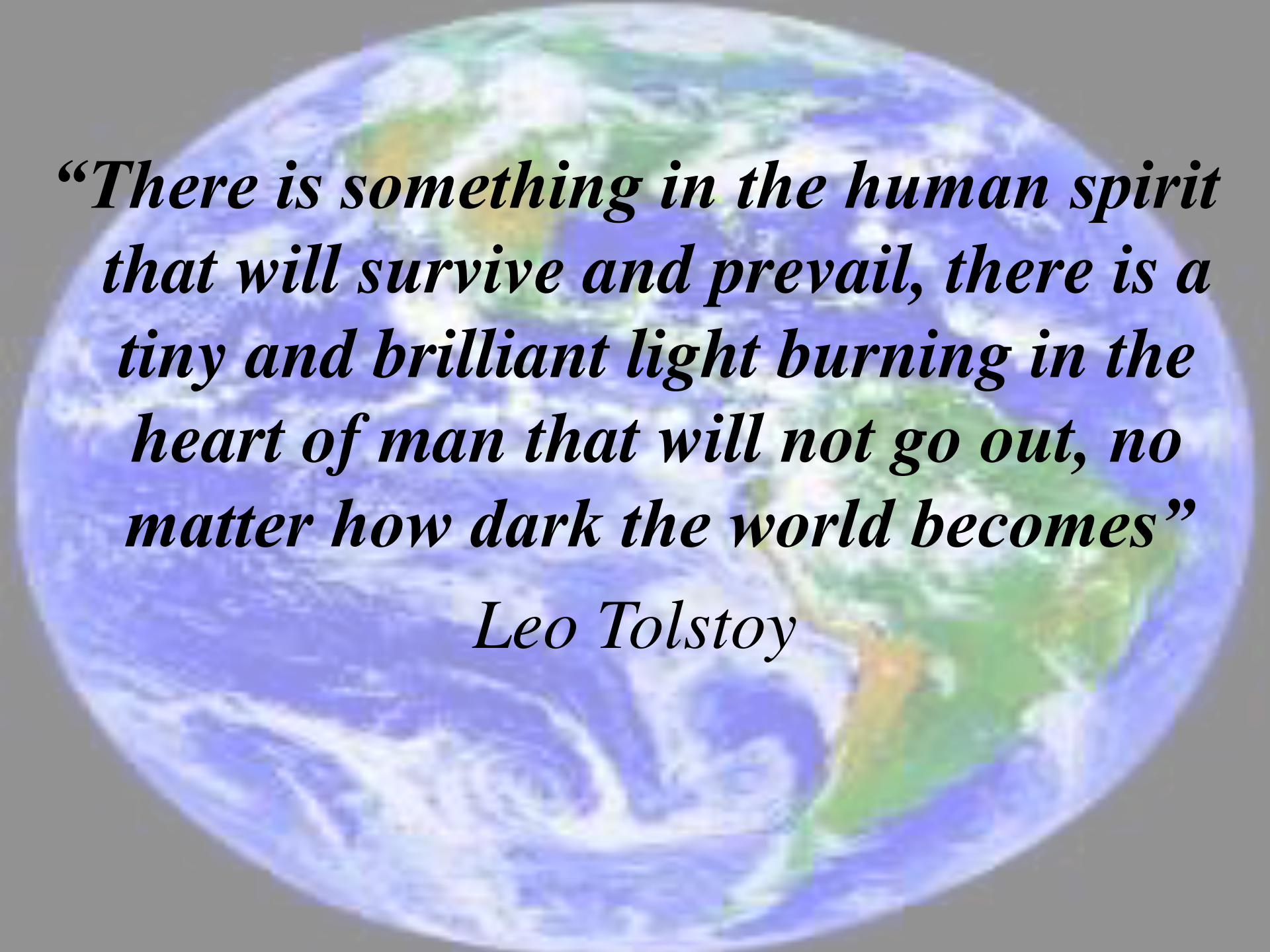
Australia

Warming will range from 1° to 2°C in summer and will be about 2°C in winter. Summer precipitation will increase by around 10%, but the models do not produce consistent estimates of the changes in soil moisture.



MITIGATION & ADAPTATION

- Augmenting carbon sinks and reducing carbon emissions
- Adapting against sea level rise related land encroachment
- Adopting alternate crops under changes of temperature and precipitation
- Identifying crops/varieties resilient to temperature and water stress
- Adapting against extreme weather conditions like droughts, floods, hurricanes

A satellite-style image of Earth, showing the Americas and surrounding oceans. The image is slightly blurred and has a soft, ethereal quality. The text is overlaid on the image in a bold, italicized font.

***“There is something in the human spirit
that will survive and prevail, there is a
tiny and brilliant light burning in the
heart of man that will not go out, no
matter how dark the world becomes”***

Leo Tolstoy