

The Current State of Mother's Health

Prospects for renewal of the natural world

Jim Galasyn

NW Naraya 2007

Science and Mystery

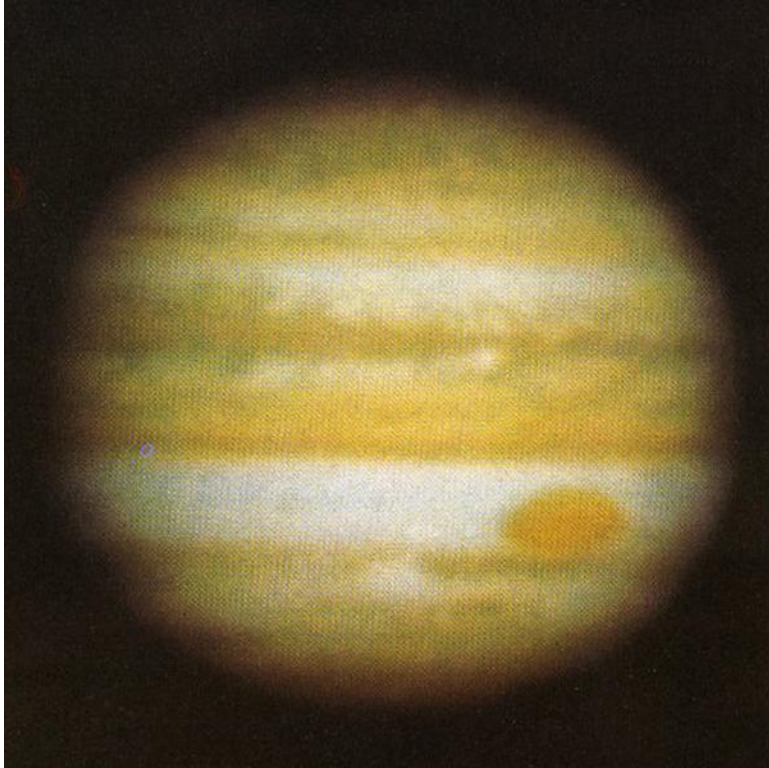
[Hubble Deep Field, 1996](#)

Science and Mystery

The background of the slide is a vast field of galaxies, known as the Hubble Ultra Deep Field. It shows a dense collection of galaxies in various shapes, sizes, and colors, including spirals, ellipticals, and irregular forms, set against a dark cosmic background. The galaxies are scattered across the entire frame, with some appearing as bright, distinct points of light and others as more diffuse, extended structures.

[Hubble Ultra Deep Field, 2004](#)

Improving Our Sight



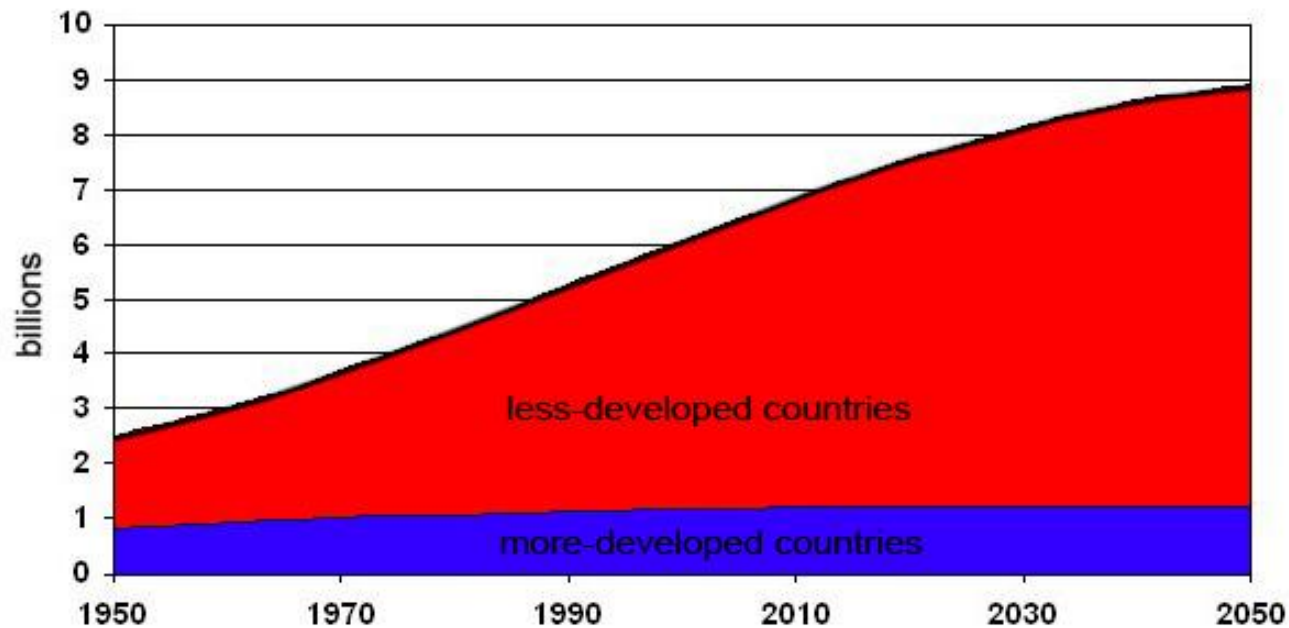
Jupiter from Earth-based telescope, 1977.



Jupiter from *Cassini*, 2005.

Human Population

Population Growth in More- and Less-Developed Countries, 2002.

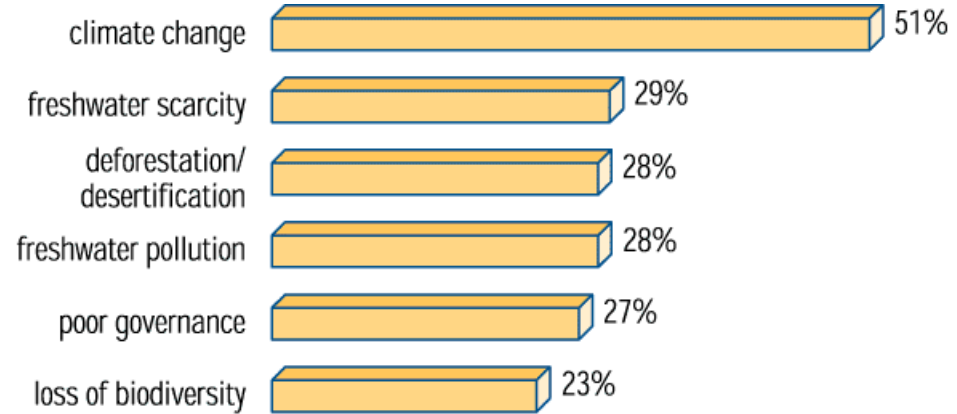
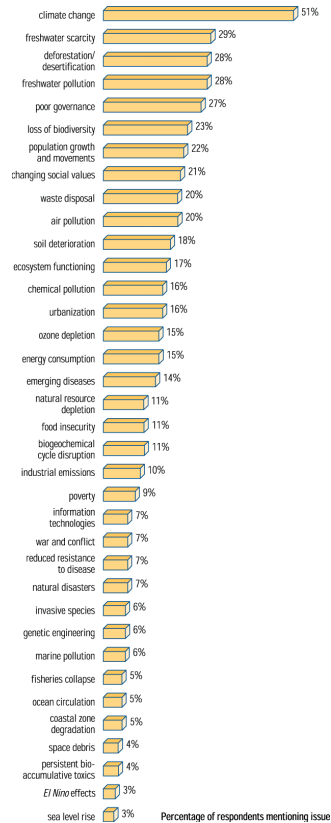


Source: United Nations, World Population Prospects.

Our Biggest Problems (according to me)

- Loss of arable land (topsoil erosion, sprawl)
- Freshwater stress
- Deforestation
- Biodiversity loss (mass extinction)
- Peak Oil
- Global climate change
- Health of the oceans

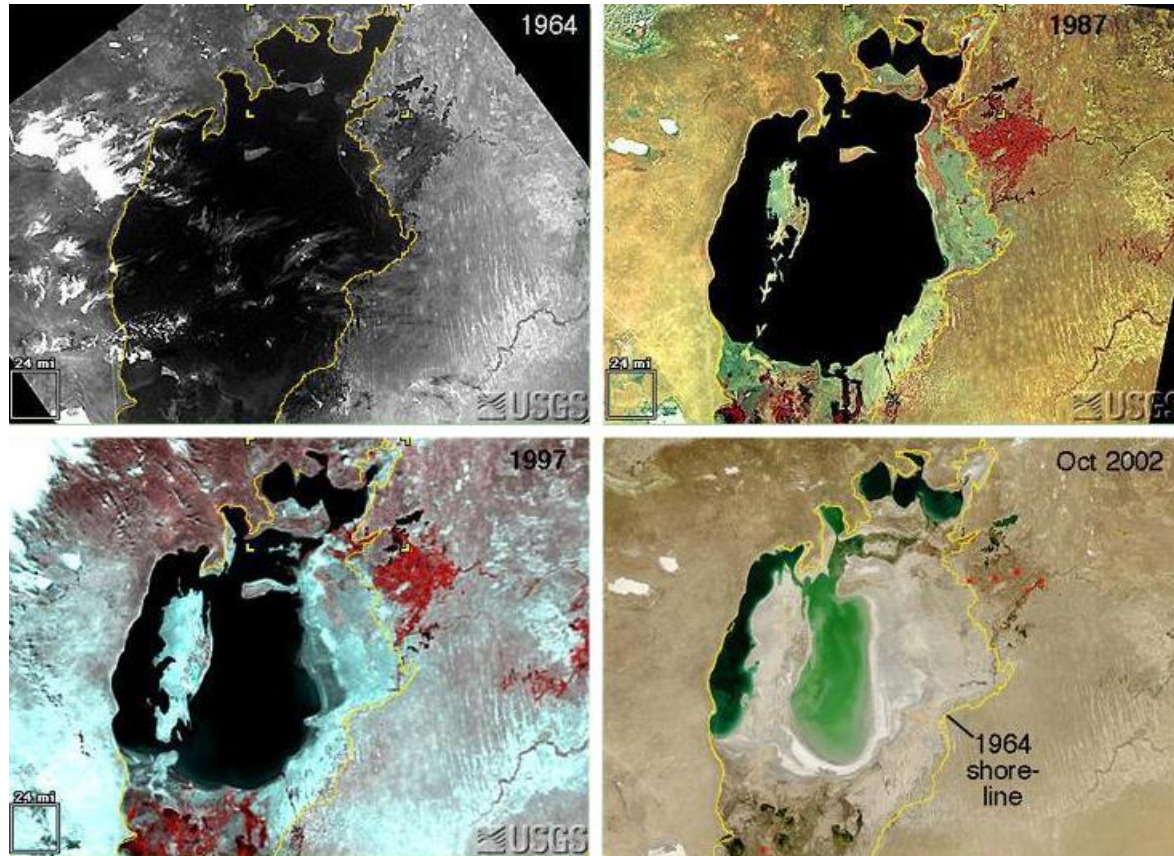
Our Biggest Problems (according to UN scientists)



Freshwater Stress

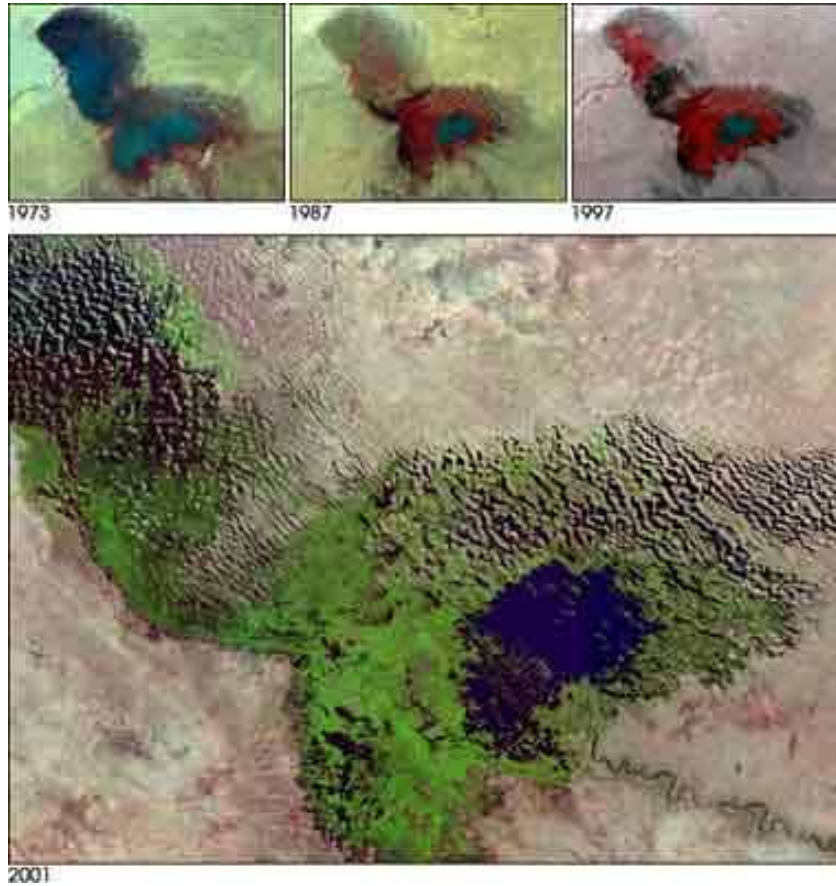
- Water scarcity affects one in three people worldwide
- Threshold crossed 20 years earlier than predicted

Freshwater Stress



Aral Sea, Central Asia, 1964 – 2002 ([A lecture on land use, deforestation, and loss of grasslands and wetlands](#)).

Freshwater Stress



Lake Chad, West Africa, 1973 - 2001 ([Space and Motion](#)).

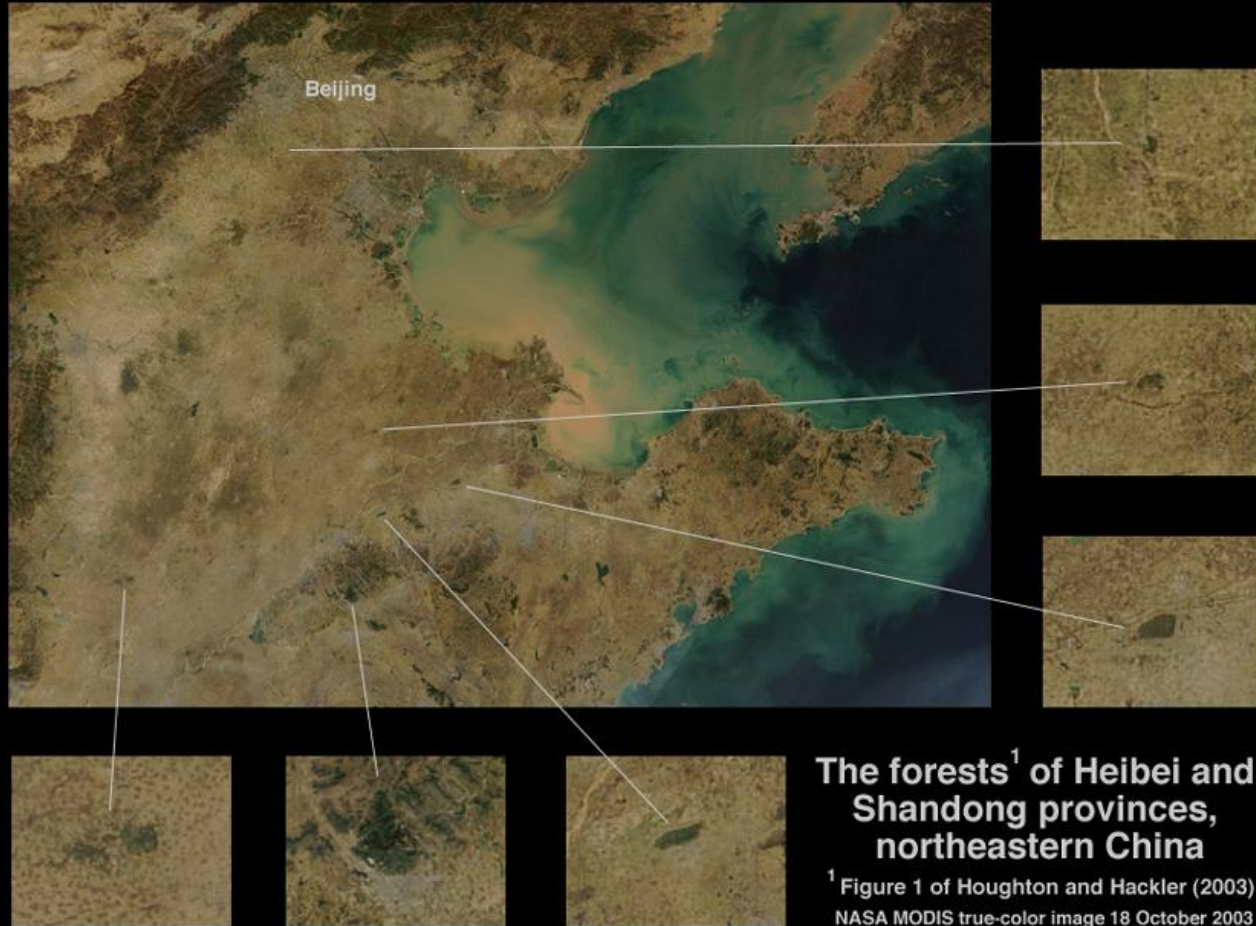
Desertification

- 1.9 billion hectares of land degraded.
- 65% (500 million hectares) of African land degraded.
- Arable land loss is 30-35 times the historical rate.
- Loss is equal to 20 million tons of grain per year.
- 70 percent of the 5.2 billion hectares of drylands used for agriculture are already degraded and threatened by desertification.



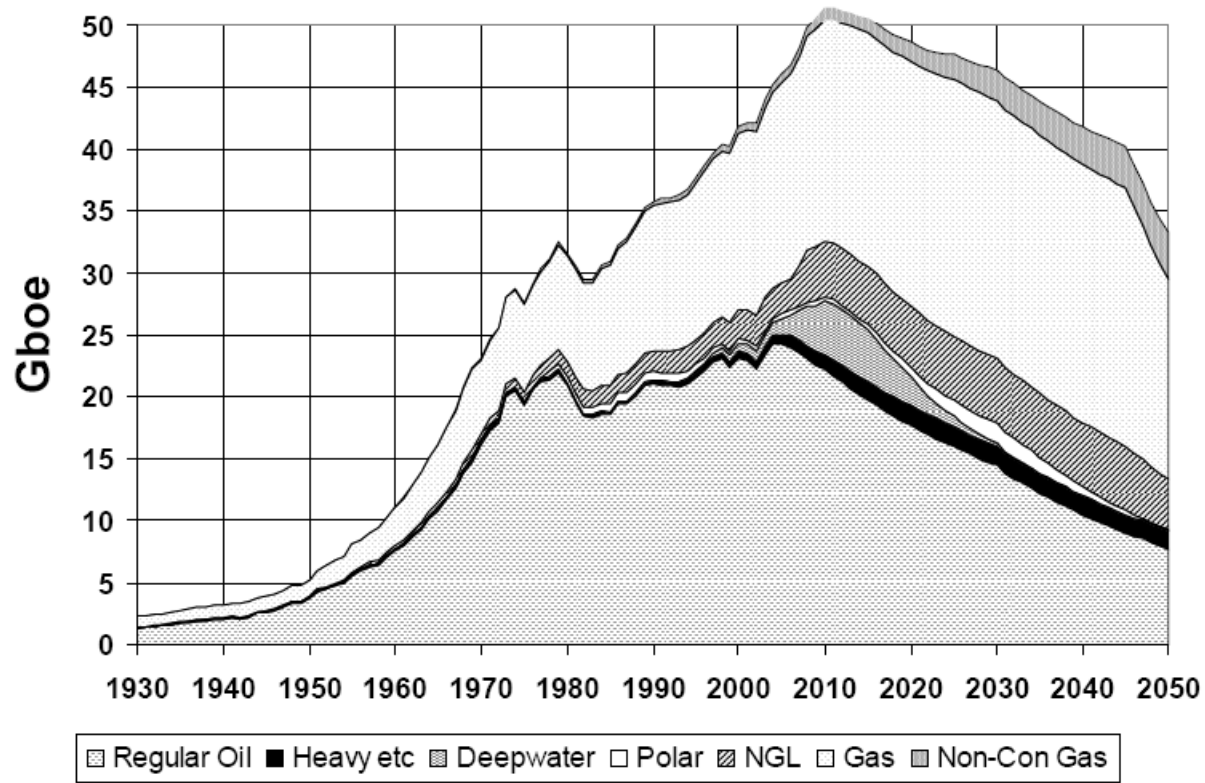
[China Desertification](#)

Desertification

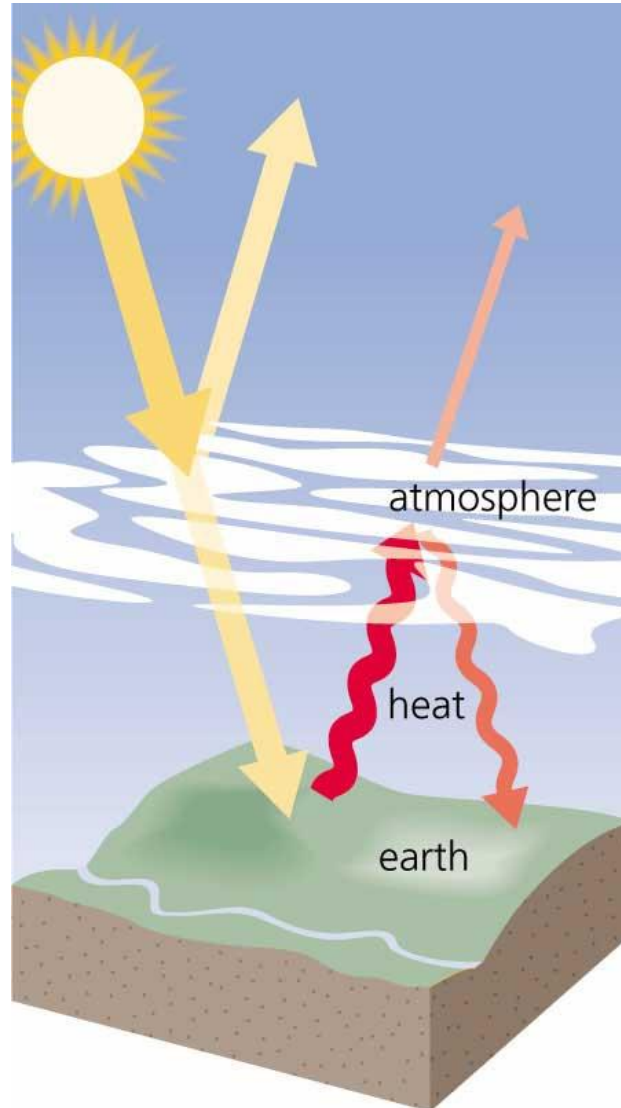


Peak Oil

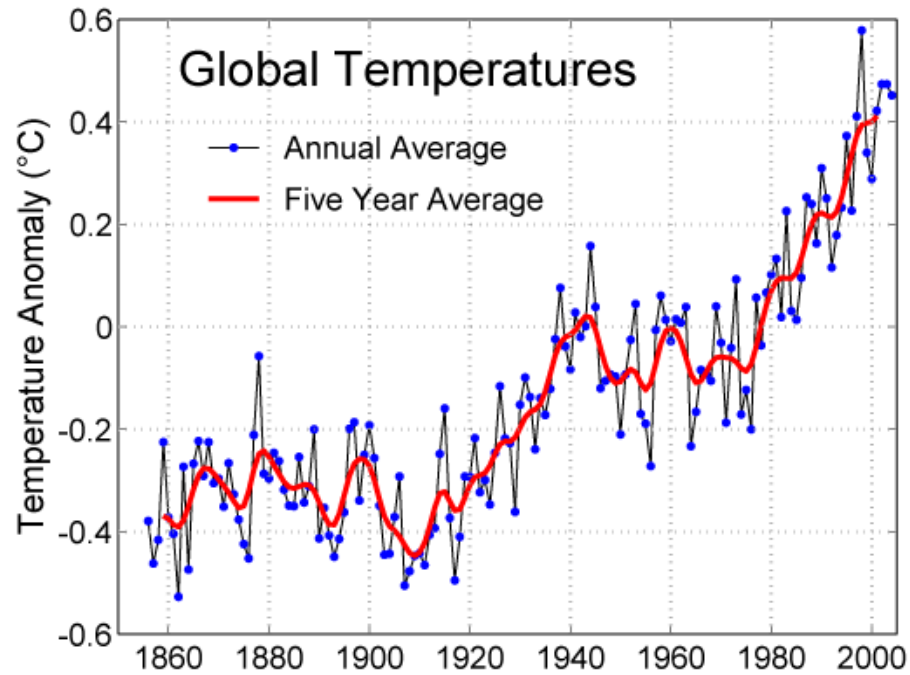
OIL & GAS PRODUCTION PROFILES 2005 Base Case



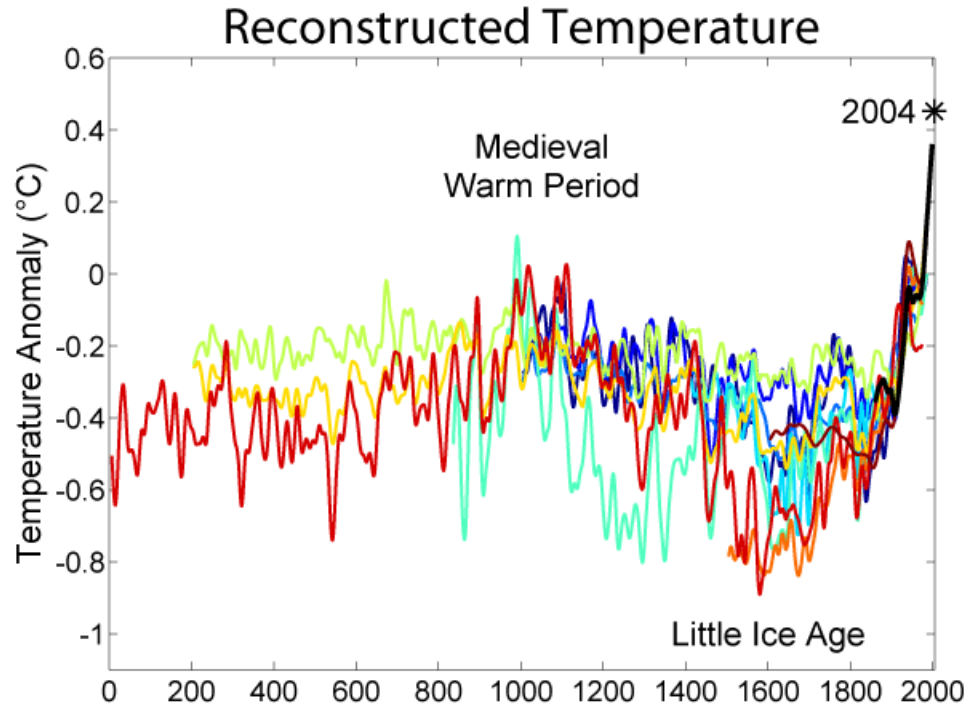
CO₂ and the Greenhouse Effect



Earth Is Warming



Earth Is Warming



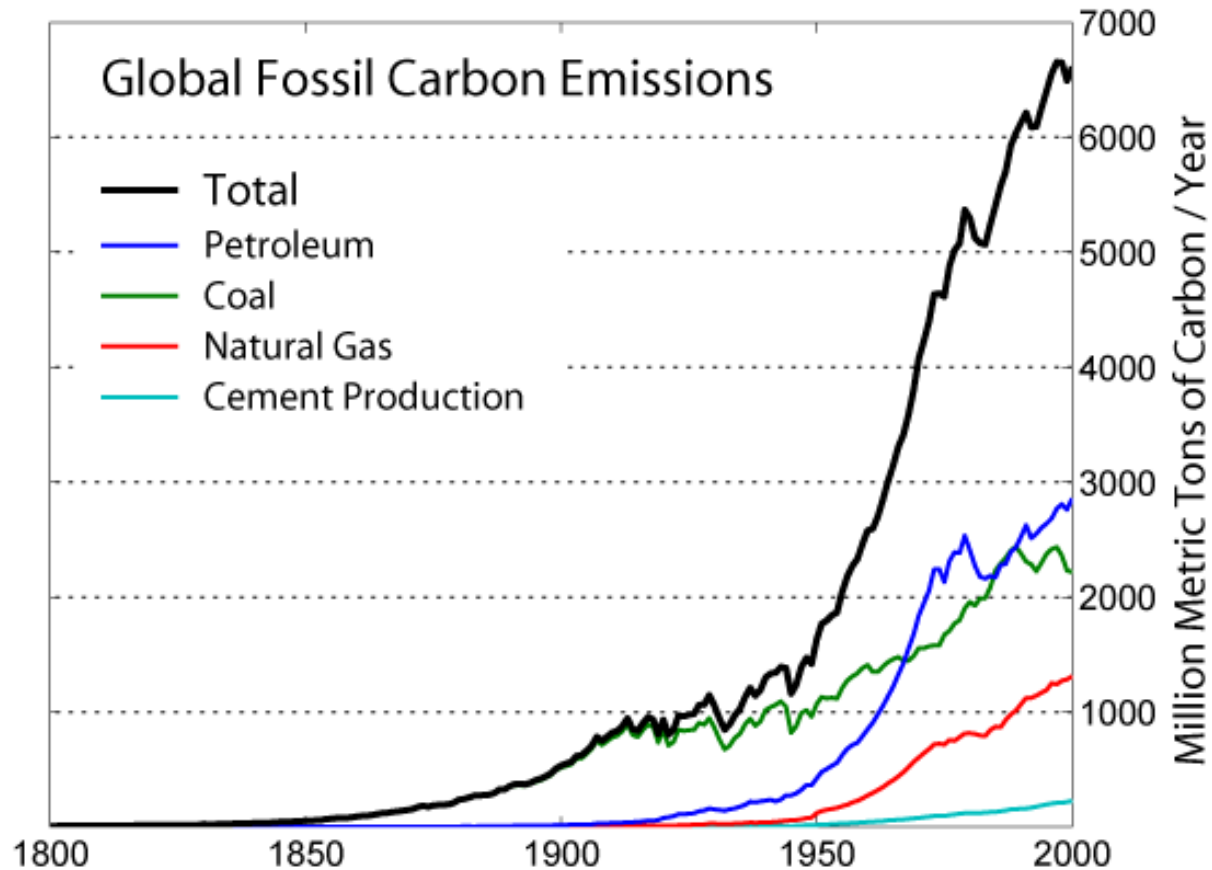


Muir Glacier, August, 1941. Photo by Bruce Molnia. ([Ice Adventures](#))



Muir Glacier, August, 2004. ([Ice Adventures](#))

Fossil Carbon

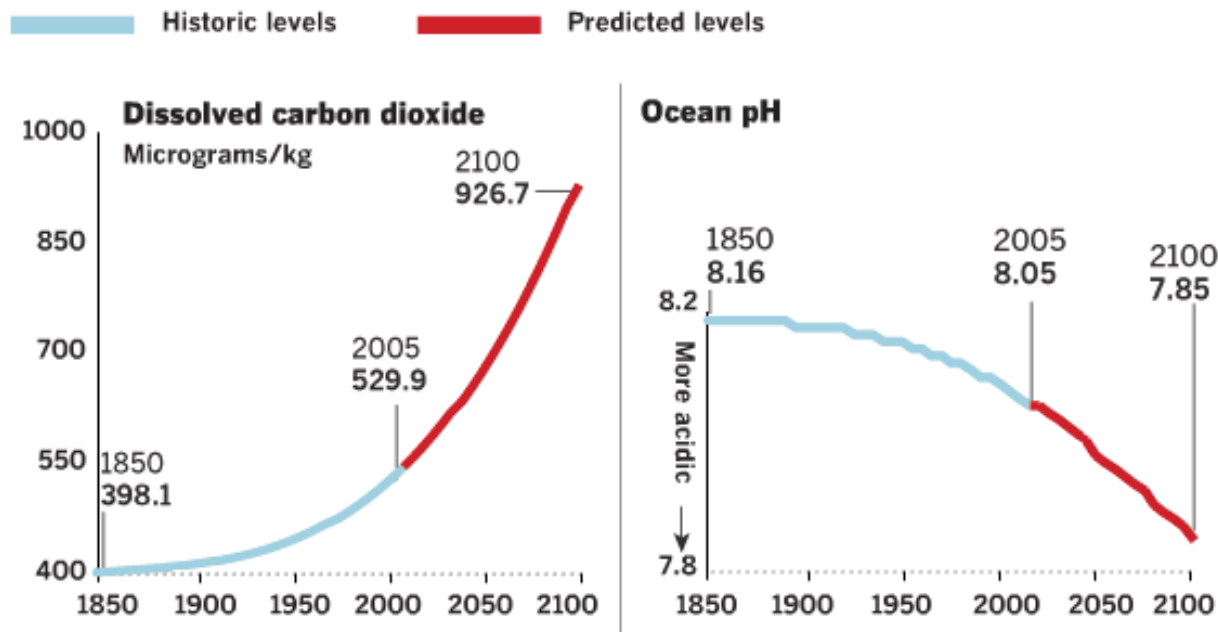


Health of the Oceans

- Acidification
- Coral reef bleaching
- Biomass loss
- Dead zones (Eutrophication)

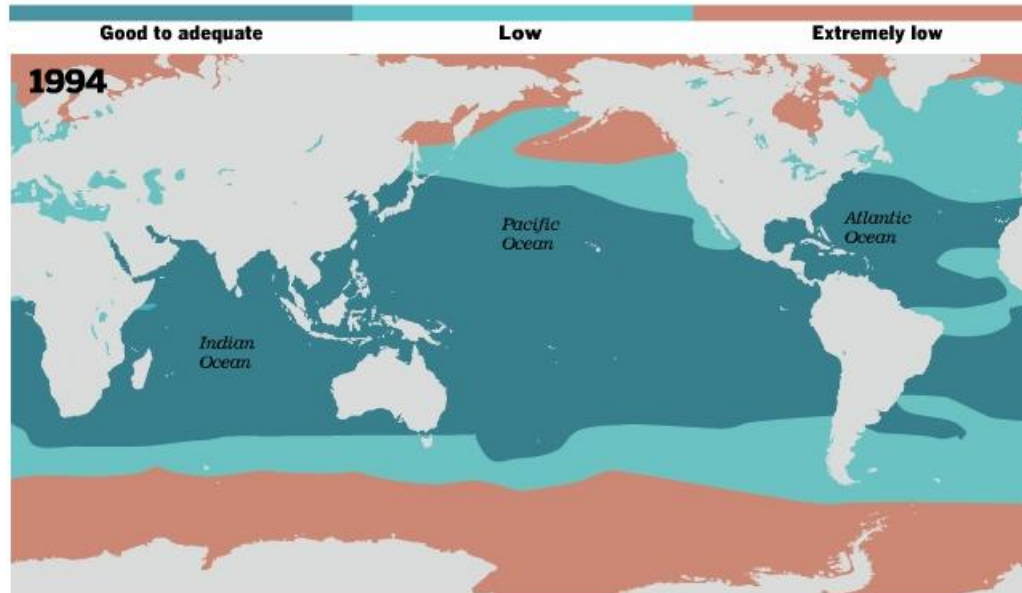
Ocean Acidification

- Ocean chemistry is changing 100 times faster than in the last 650,000 years.



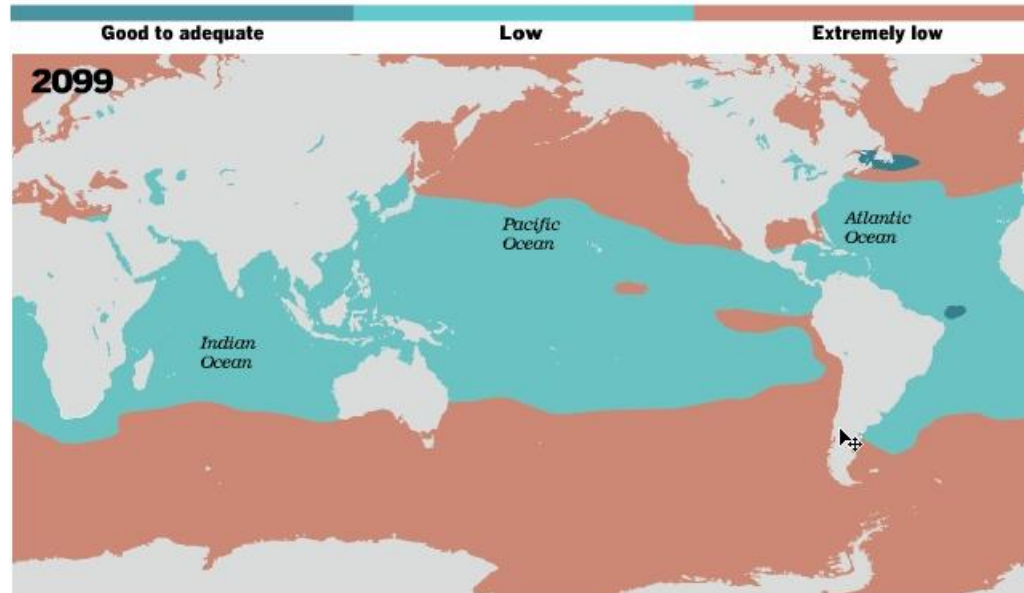
Note: 100 micrograms represents a 10,000th of one gram for each thousand grams of seawater.

Ocean Acidification



Ocean acidity and favorability to coral, measured ([A Chemical Imbalance](#)).

Ocean Acidification



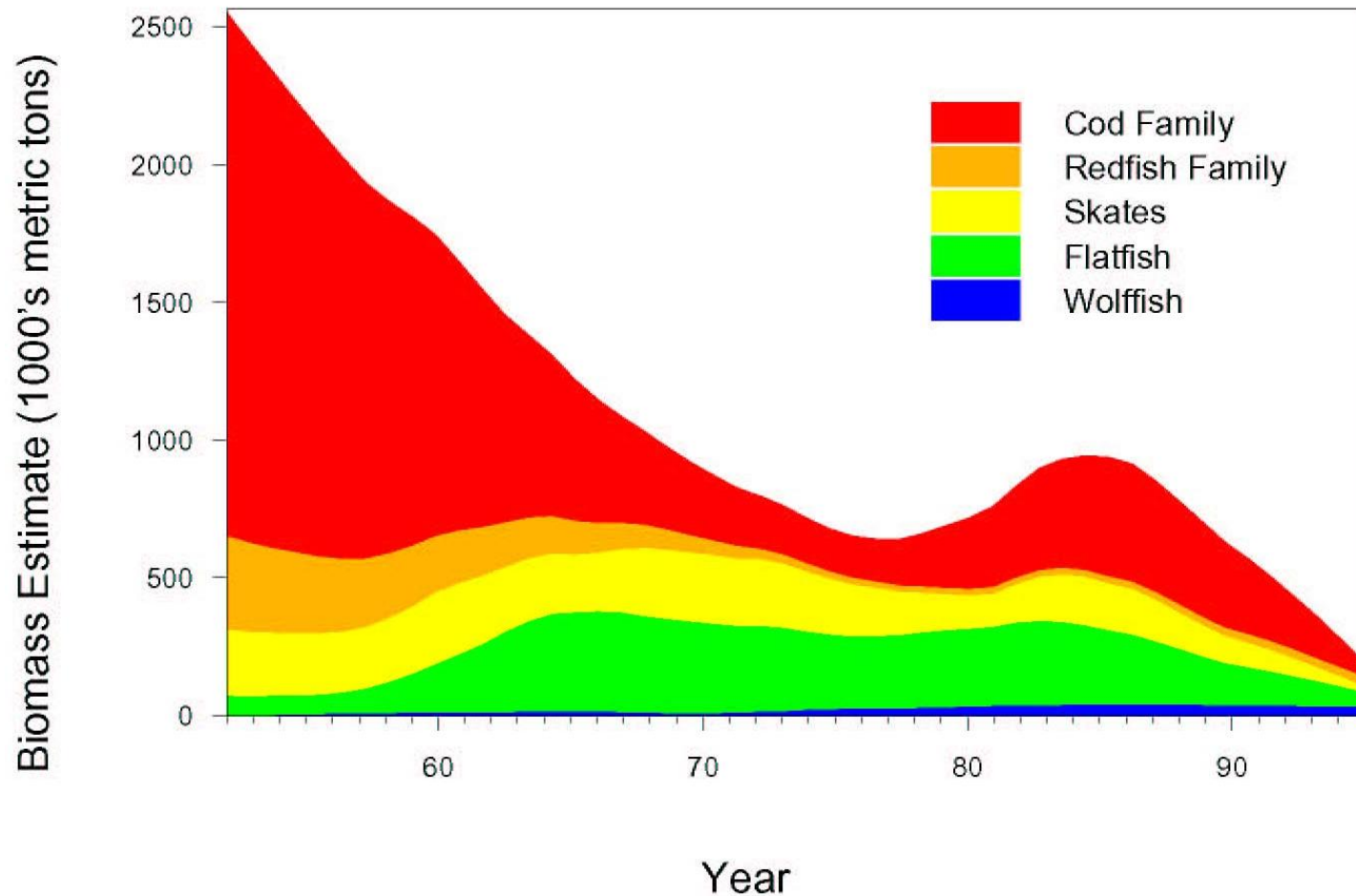
Ocean acidity and favorability to coral, predicted ([A Chemical Imbalance](#)).

Loss of Ocean Biomass

- 97% of Florida's elkhorn and staghorn coral have disappeared since 1975.
- 90% of tuna, cod, and other big fish have disappeared in the last 50 years.
- 650 gray whales have washed up sick or dead on the West Coast in the last 7 years.

Loss of Ocean Biomass

Community Changes on Southern Grand Bank



Coral Reef Bleaching



Montastrea annularis at Sand Key, 6/3/96

Coral Reef Bleaching



[Montastrea annularis bleaching at Sand Key, 10/02/97](#)

The White Desert



Bleached coral on Australia's Great Barrier Reef in 1998 ([Most coral reefs under threat, some resilient](#)).



New bleaching around the Keppel Islands of Australia's Great Barrier Reef include this stand of staghorn corals, photographed on Feb. 22, 2006. Photo by Damian Thomson / Australian Institute of Marine Science ([Part of Great Barrier Reef now 'a white desert'](#)).

Dead Zones



Partially treated sewage from Hollywood, Florida. Photo by Rick Loomis ([Altered Oceans](#)).

Dead Zones



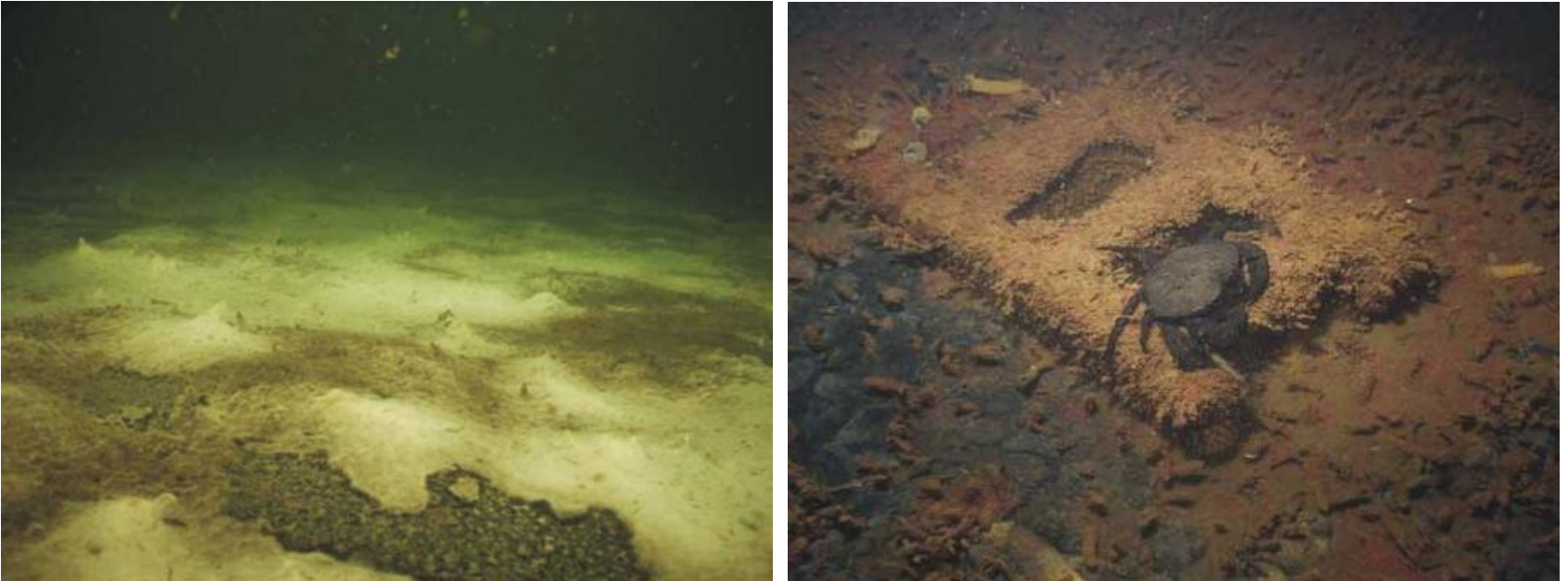
A dark red bloom of *Karenia Brevis* algae at Little Gasparilla Island, Florida.
Photo by Paul Schmidt ([Altered Oceans](#)).

Dead Zones



Diseased brain coral in the Florida Keys. Photo by Rick Loomis. ([Altered Oceans](#))

Dead Zones



Bacterial and algae mats in Hood Canal, 2006. Photos by Shane Miller. ([Mysterious blob may be killing marine life](#))

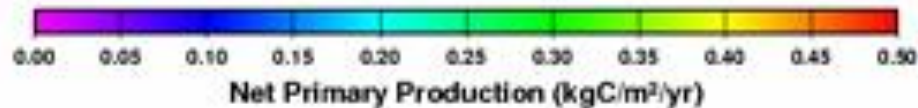
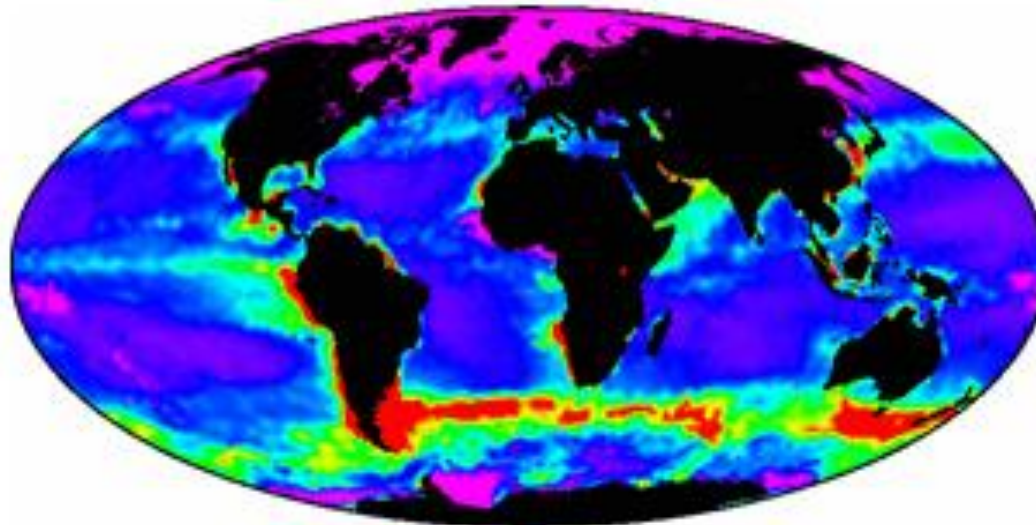
Why Biodiversity Matters

- Global climate is regulated by biology



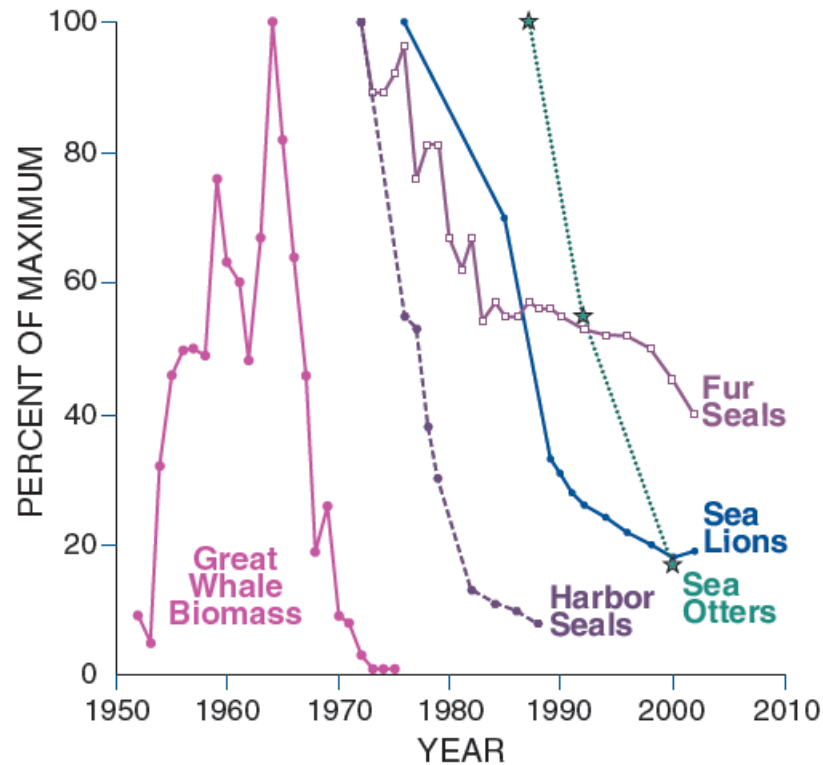
Why Biodiversity Matters

- Deepwater upwelling driven by animal muscle energy.
- Biosphere invests 1 terawatt of energy in marine animal muscle motion.
- Loss of ocean biomass has grave implications for ocean convection.
- Ocean convection controls global climate.
- Permian-Triassic extinction followed failure of thermohaline convection.



Unforeseen Consequences

Whaling and the destruction of the North Pacific kelp forests

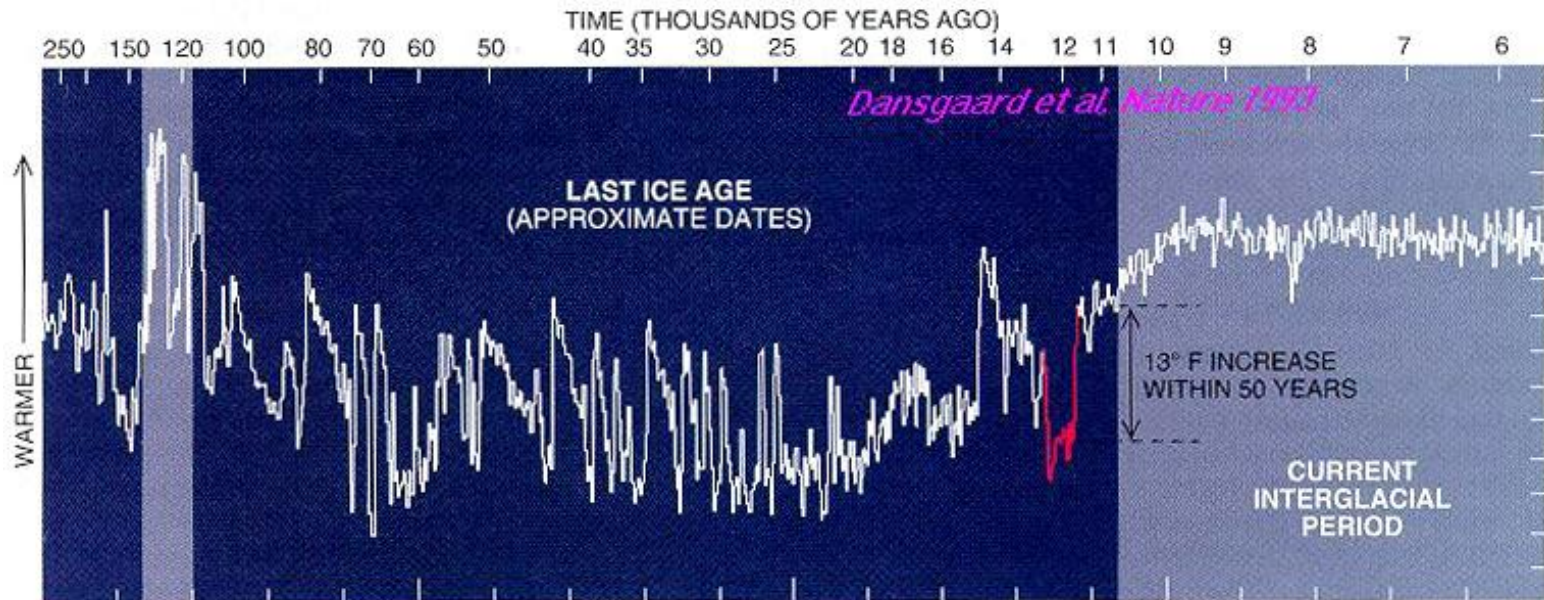


[Sequential collapse of marine mammals in the North Pacific Ocean and southern Bering Sea](#)

The History of Climate Change

- Five great extinction events
- Eemian interglacial era
- Paleocene-Eocene Thermal Maximum
- Permian-Triassic extinction

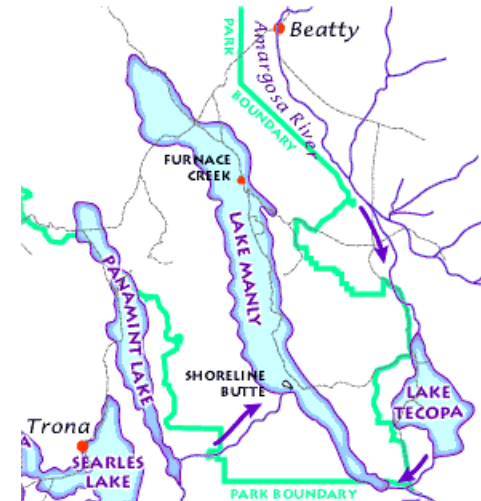
Climate Since the Last Ice Age



[The Great Climate Flip-flop, Mechanisms that can cause abrupt climate change](#)

Eemian Interglacial

- 131,000 years ago
- Habitable zones expanded northward.
- Large mid-latitude areas such as the Southwest US that were previously productive became deserts.
- The epoch started with large lakes in many areas of the world that are now arid.

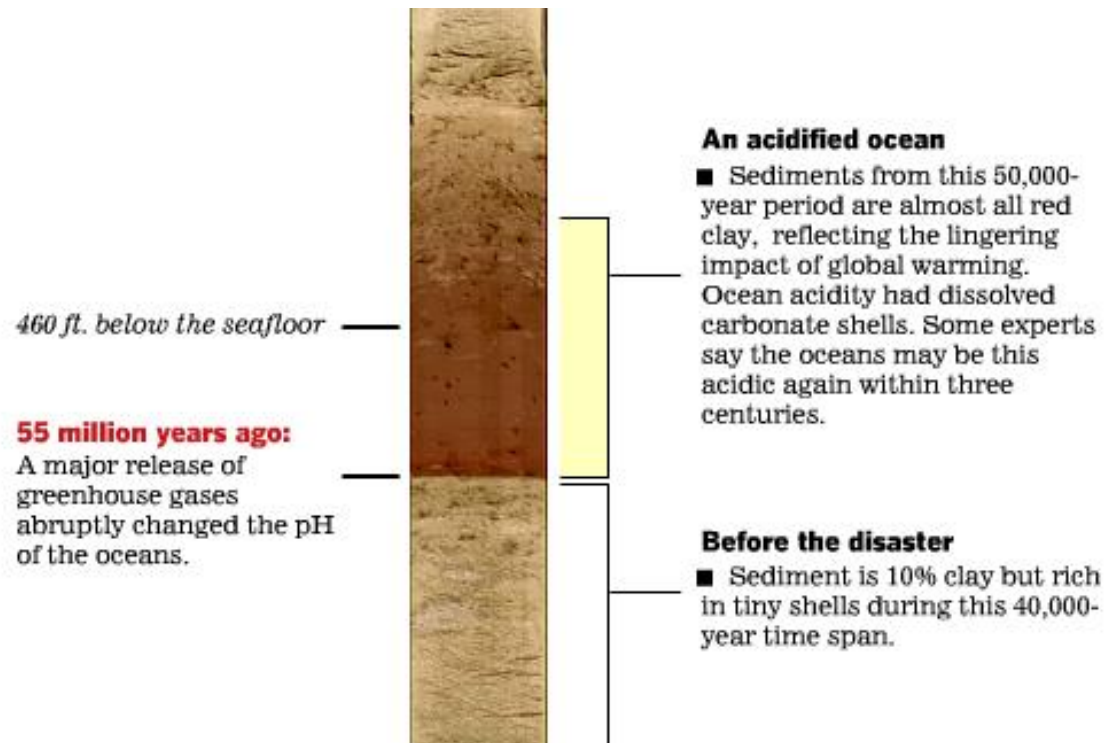


Paleocene-Eocene Thermal Maximum

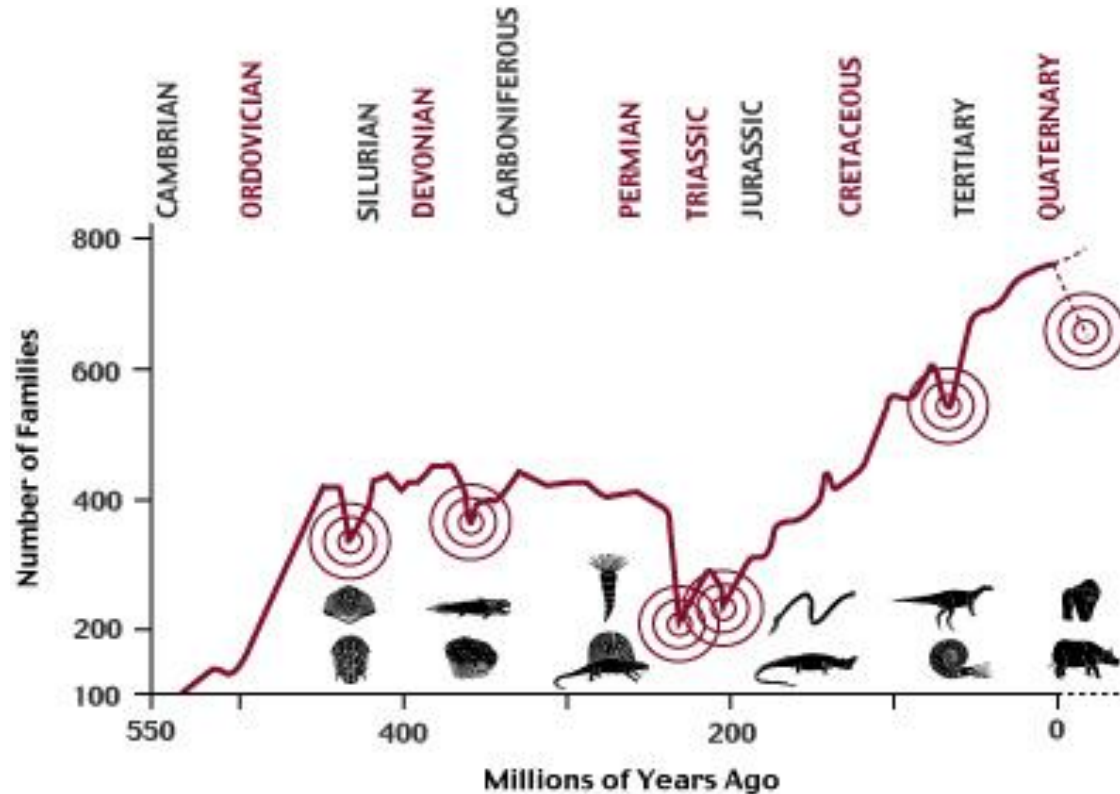
- 55 million years ago
- Lasted 50,000 to 100,000 years
- CO₂ concentration doubled or tripled to 1,000 ppm
- 10-12 F rise in temperature
- Most severe extinction in the last 90 million years
- Humans will add as much carbon to the atmosphere in 500 years (1800 to 2300) as the PETM did over 10,000 years

Paleocene-Eocene Thermal Maximum

Ocean Acidification

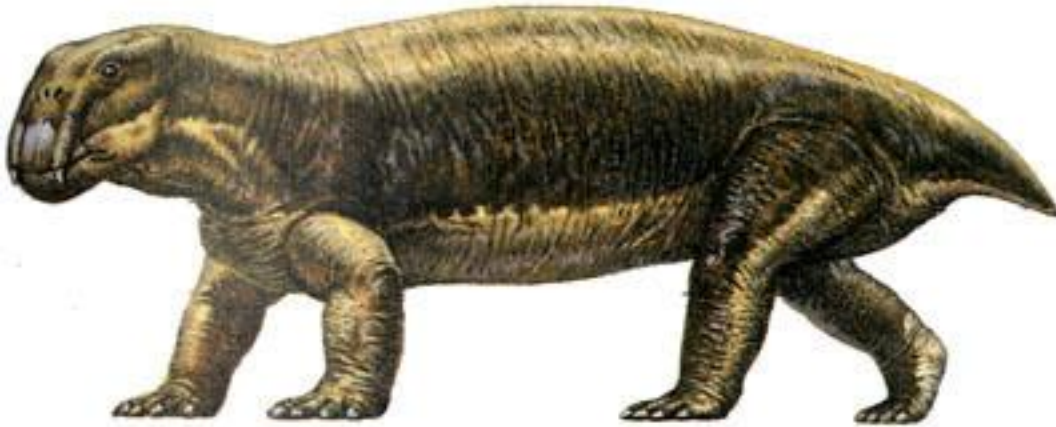


The Five Great Extinctions

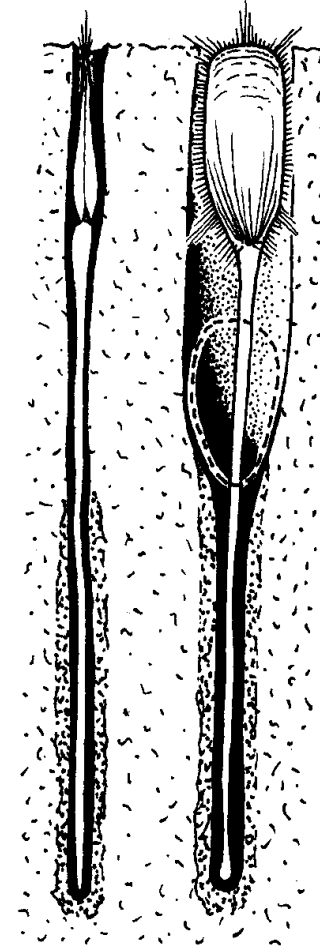


Permian-Triassic Extinction

- 251 million years ago
- CO₂ just above 1,000 ppm
- 90% of ocean dwellers extinct
- 70% of plants, animals, insects, on land
- Largest disaster life on Earth has faced

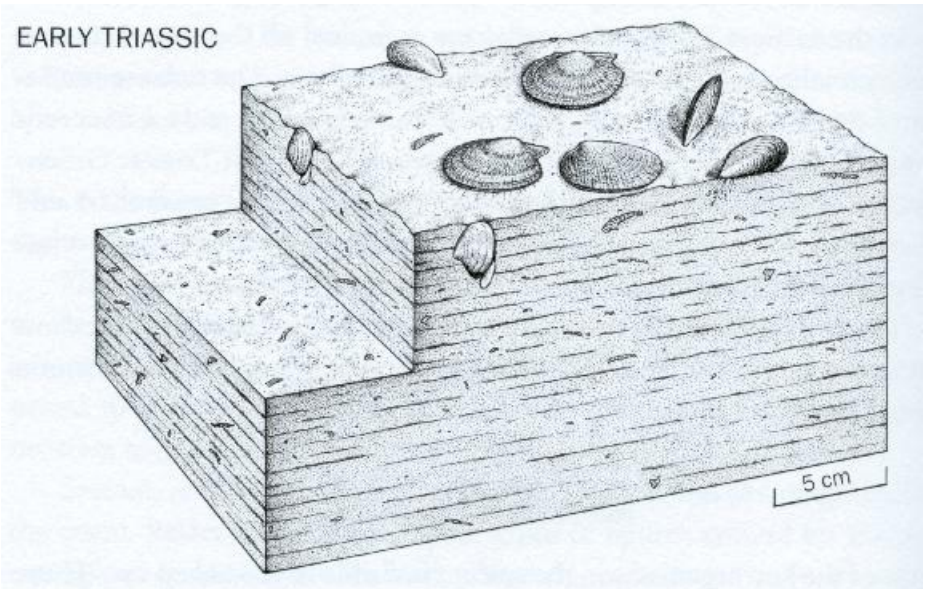
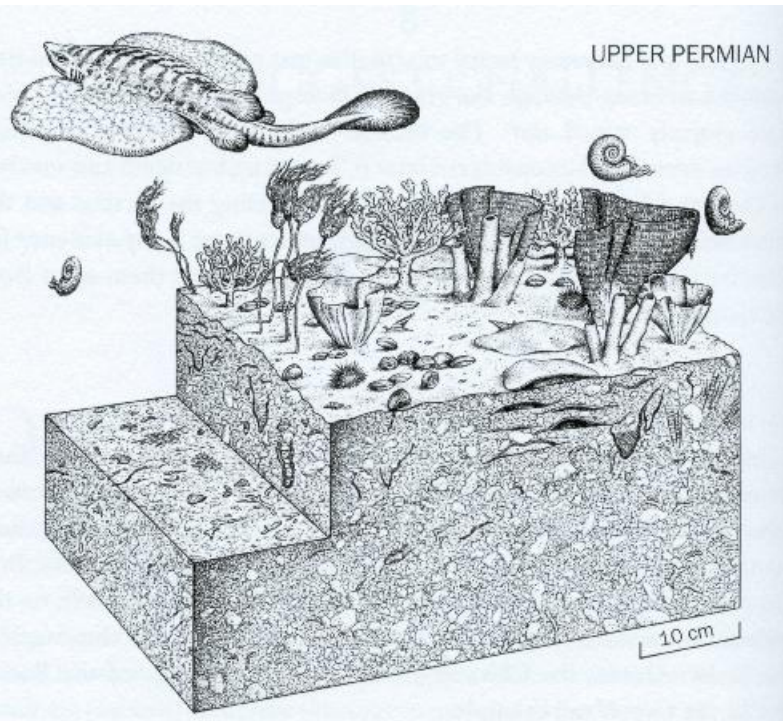


[Lystrosaurus](#)



[Lingula](#)

Permian-Triassic Extinction

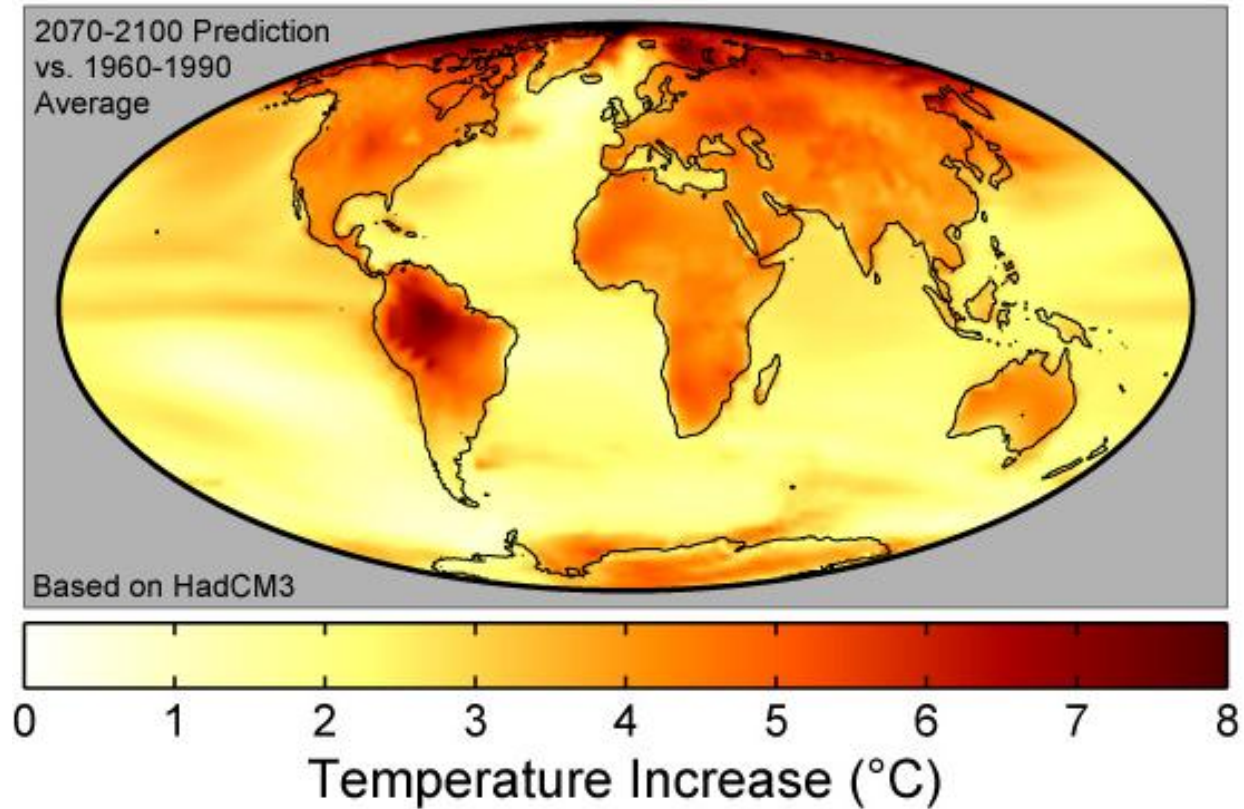


Seabeds near China, before and after the extinction event ([Extinction](#)).

What Might Happen?

- Computer models
- The sixth great extinction
- Greenland ice sheet collapse
- Gulf Stream failure
- Ocean-wide anoxia
- Amazon Winter

Predicted Temperature Rise



The Sixth Great Extinction

- 100 - 1000 times higher than background rate
- Half of bird and mammal species extinct in 200 to 300 years
- 5,000 to 25,000 species per year (Benton)
- 50,000 to 100,000 species per year (Leahey)

Greenland Ice Sheet Collapse

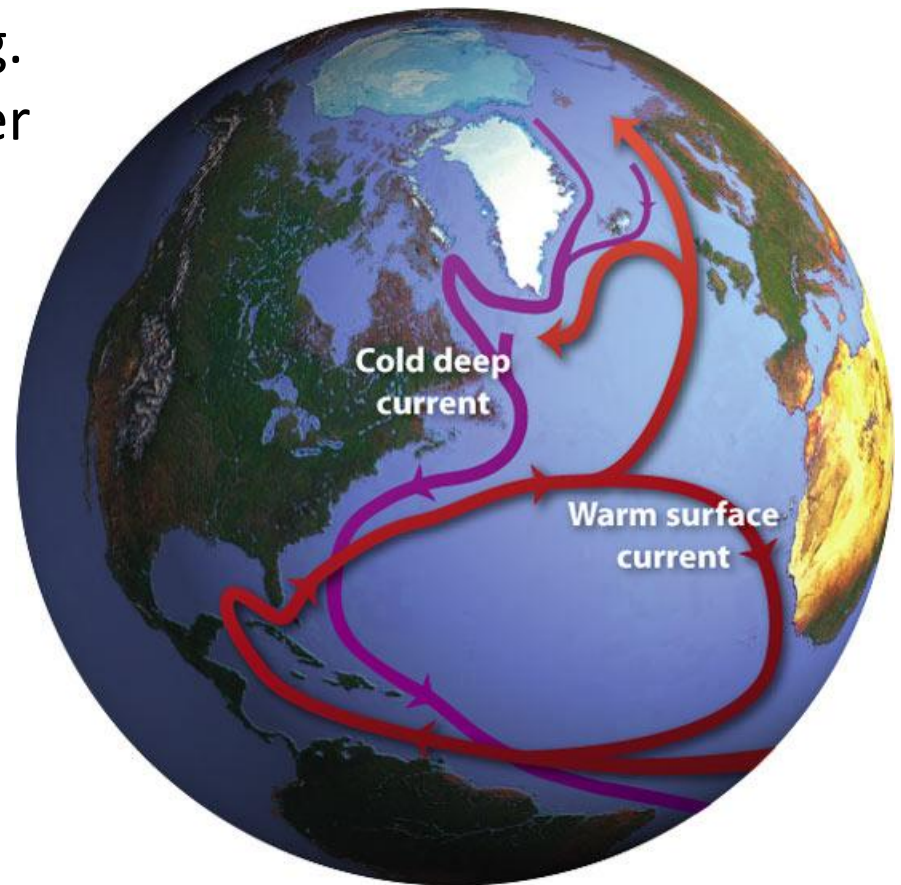
- Losing 41 cubic miles/year.
- 3x faster than early estimates.
- Sudden increase in 2004.
- Sea level would rise 20 feet.



[Issues in Risk Science 5: Dangerous Climate Change](#), [Ice sheet melting faster than ever](#), [Greenland Ice Sheet on a Downward Slide](#)

Gulf Stream Failure

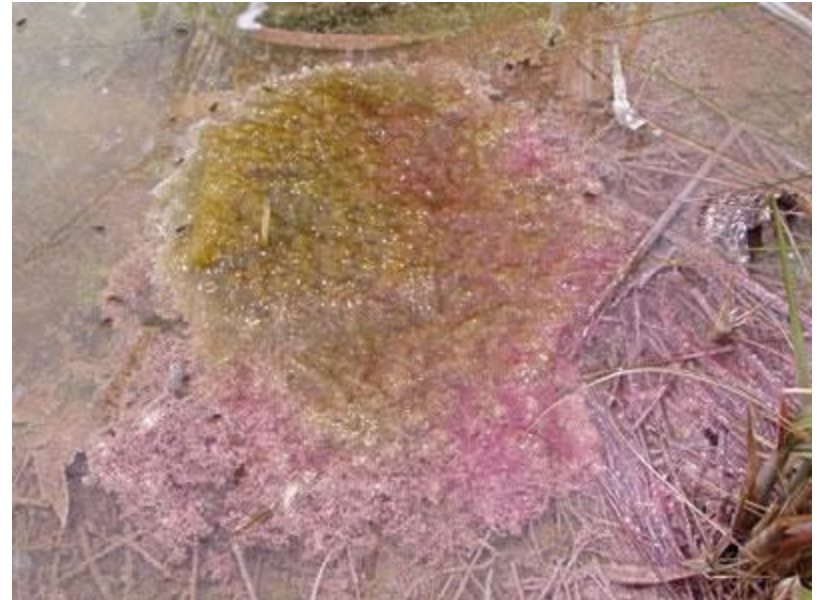
- N. Atlantic salinity decreasing.
- N. Atlantic Drift is 30% weaker since 1992.
- Convection chimneys have disappeared.
- Effects not visible yet.



[Failing ocean current raises fears of mini ice age](#) , [Gulf Stream slowdown?](#) , [The Great Climate Flip-flop](#) , [Abrupt Climate Change](#)

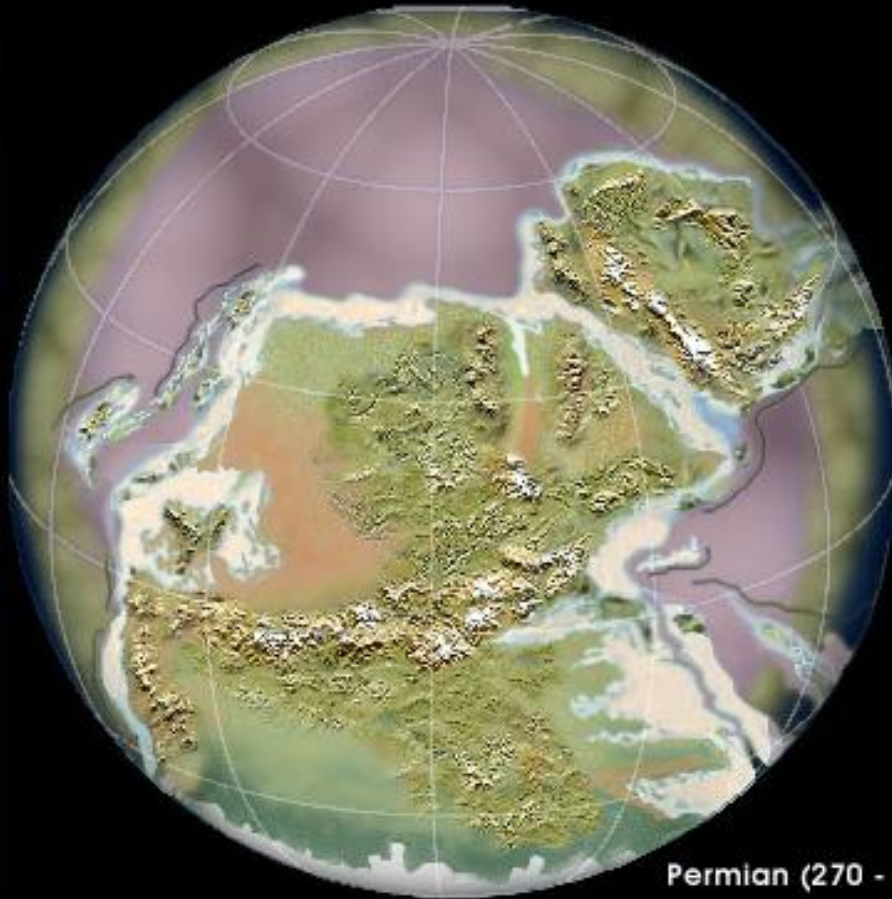
Ocean-wide Anoxia

- Likely cause of Permian-Triassic extinction.
- CO₂ was just above 1,000 ppm.
- Ocean O₂ dropped, deep-sea anaerobic bacteria proliferated and produced more H₂S.
- Ocean-wide bloom of H₂S-consuming bacteria.
- Giant bubbles of toxic H₂S gas erupt into the atmosphere.
- H₂S also attacks ozone layer.



Green cyanobacteria grow over purple sulfurs in saltmarsh panne by Chapman's Landing in Stratham, NH. The white film around the edges is a *Beggiatoa* bacteria. In the mud below these, anaerobic decomposer bacteria are releasing hydrogen sulfide ([Kingdom Monera](#)).

Ocean-wide Anoxia



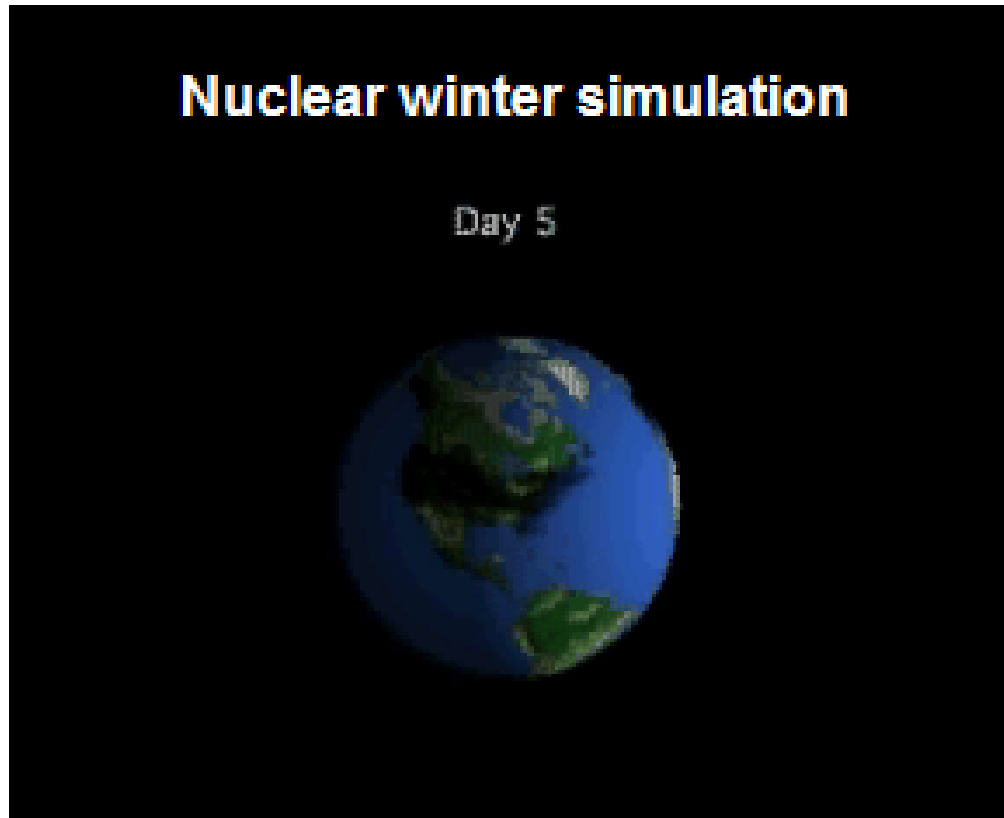
Permian (270 - 260 Ma)



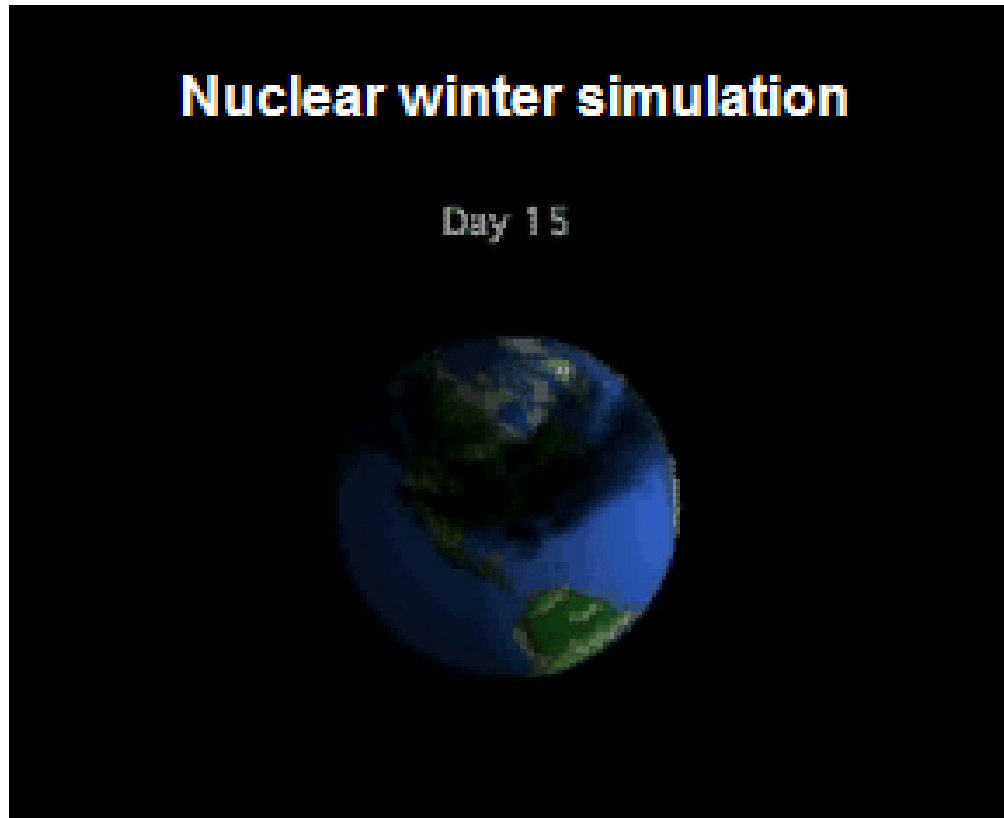
Amazon Winter

- Selective logging opens forest canopy.
- Rainforest can withstand 3-5 years of drought.
- Mega-fires could destroy entire forest within weeks.
- 90 gigatons of carbon released at once.
- Soot injected into upper atmosphere.
- Catastrophic cooling followed by catastrophic warming.

Amazon Winter



Amazon Winter



Amazon Winter



Renewal of the Natural World

- Preserving the world in which humans evolved
- Global problems require global-scale effort
- Local solutions are crucial
- Preserve biodiversity
- Sequester atmospheric carbon
- Preserve oceans

Technological Solutions

- Alternative energy sources
- Carbon sequestration technologies
- Carbon fuel cycle
- Organic farming
- Permaculture
- Arcology
- Sulfate pollution
- Genetic engineering

Solar Towers



Prototype 50 kW solar tower in Manzanares, Spain, 1982-1989 ([Enviromission](#)).

Solar Thermal



[Parabolic trough solar](#)



[Stirling Energy Systems](#)

Ocean Energy

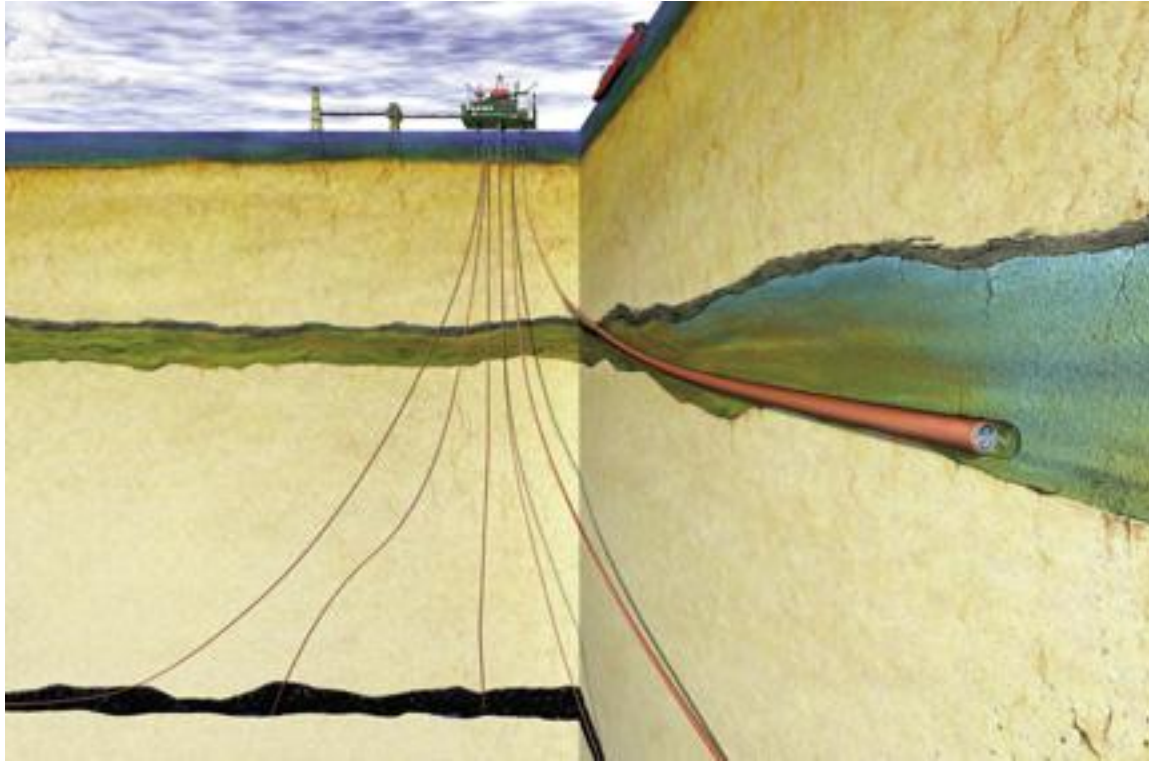


[Ocean Current Turbines](#)



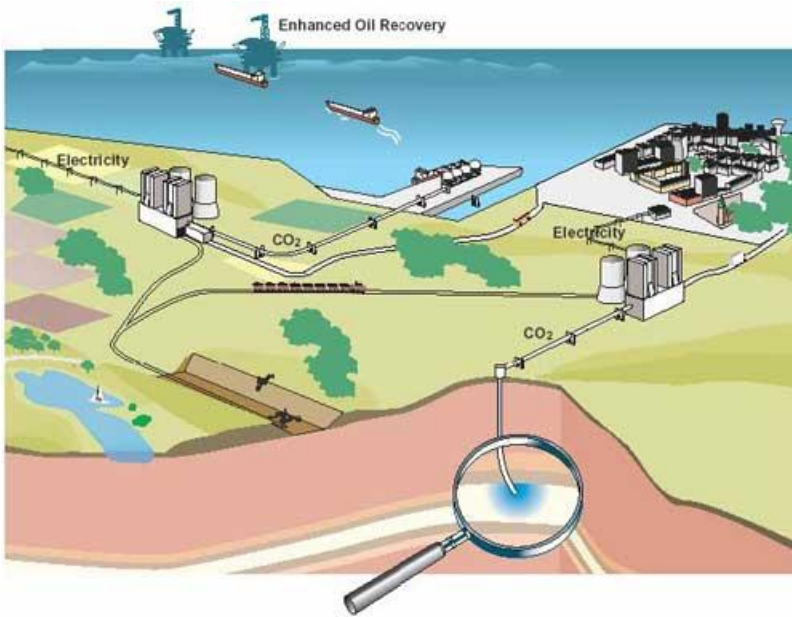
[Archimedes Wave Swing](#)

Carbon Sequestration

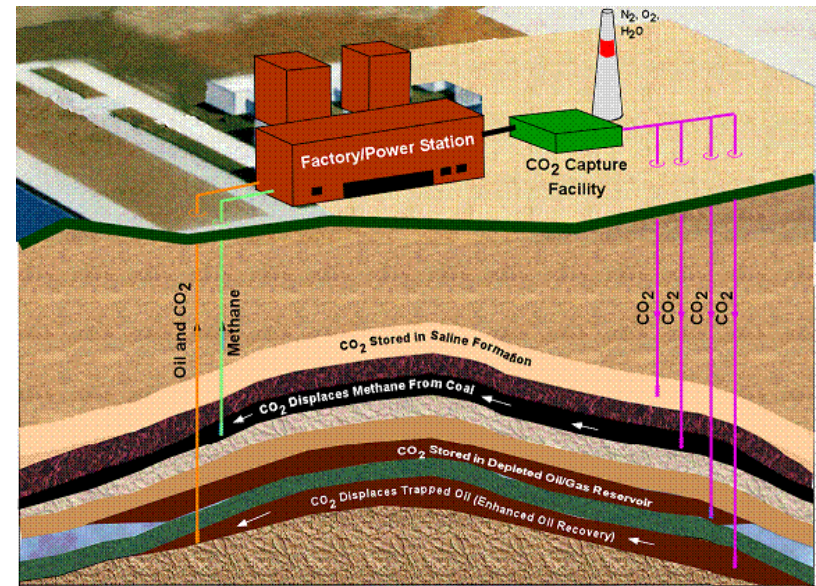


CO₂ is buried in a saline aquifer beneath the Sleipner West natural gas field in the North Sea. Photo courtesy of Statoil ([Demonstrating Carbon Sequestration](#)).

Carbon Sequestration



[EU GeoCapacity](#)



[CO₂ Capture Project](#)

Carbon Sequestration



Klaus Lackner's synthetic trees ([Earth Institute News](#)).

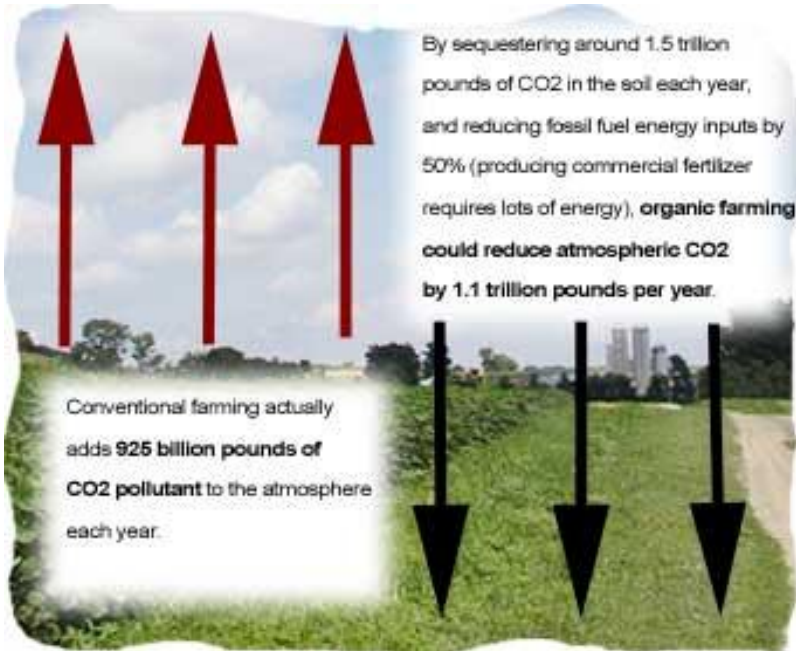
Carbon Fuel Cycle



A 5 HP Electrical Generator powered by the BingoFuel Reactor v1.1 - test by Jean-Louis Naudin
April 15th, 2003 - (c) 2003 JL Naudin - Email: Jnaudin509@aol.com - <http://www.jlnlabs.org>

[AquaFuel reactor](#)

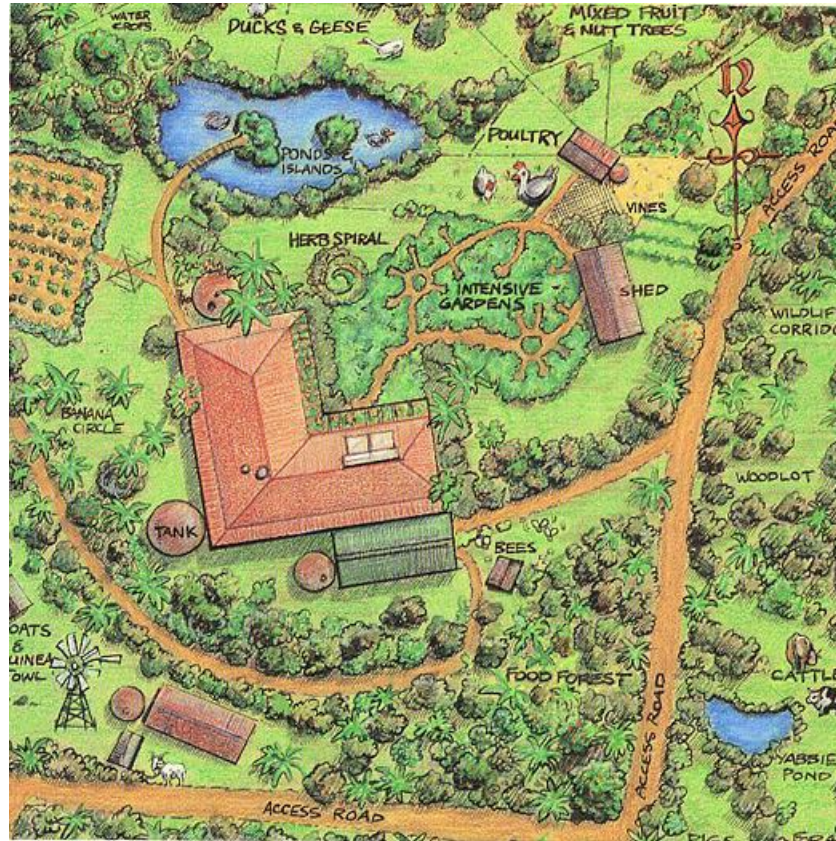
Organic Farming



[Organic farming combats global warming](#)

Permaculture

“The problem *is* the solution”



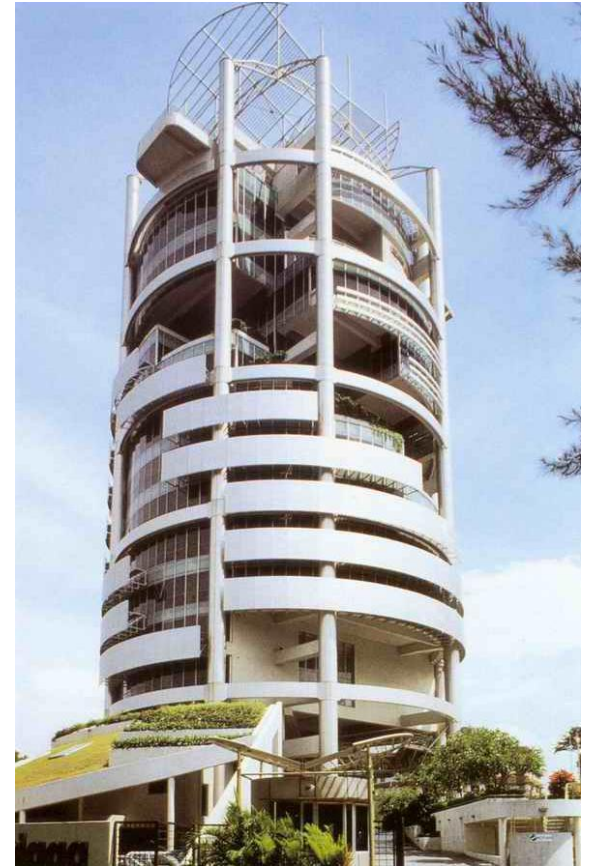
Green Building Design



Swiss Re Tower, London.
Photo by Keith Thomson.

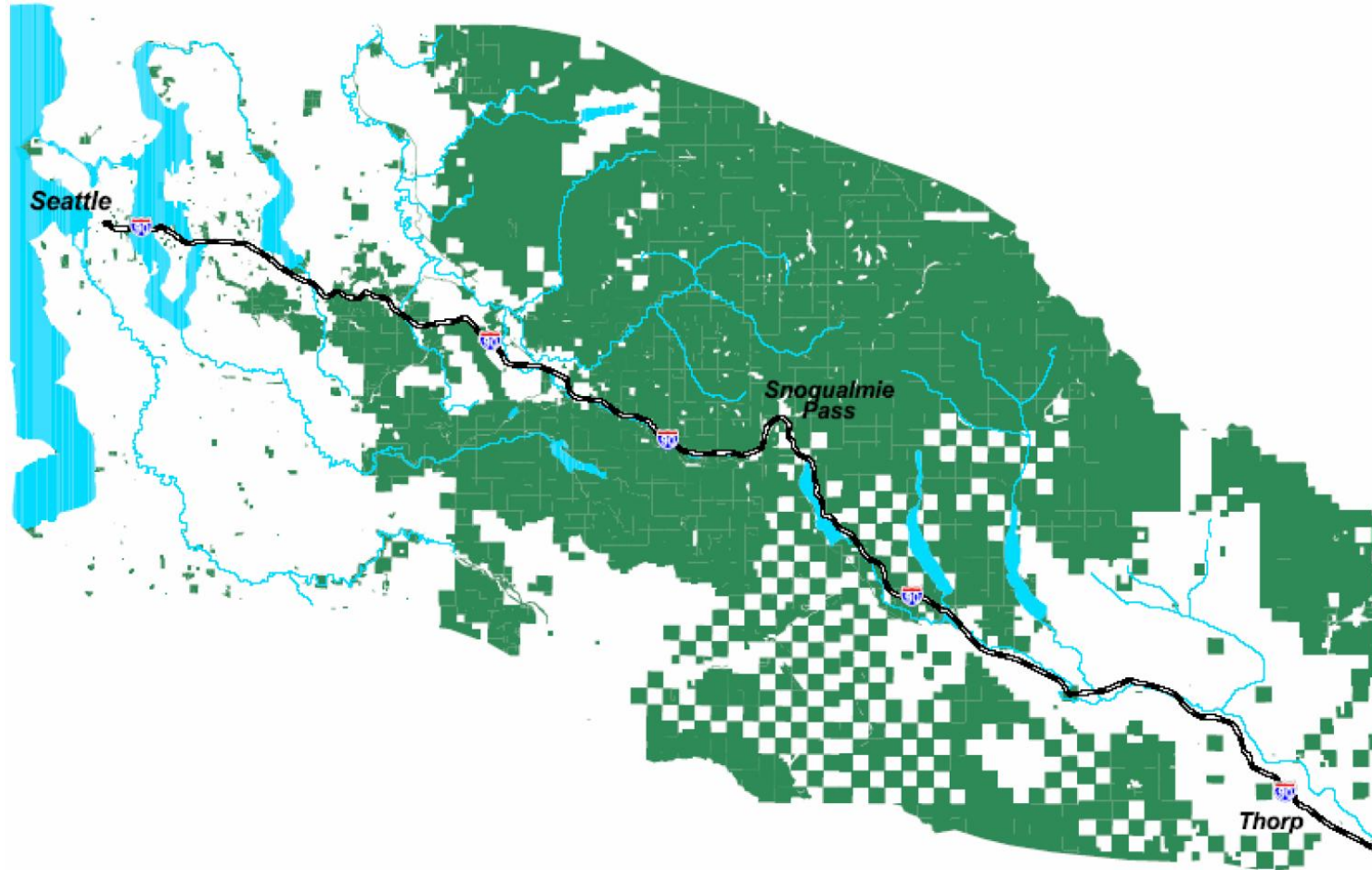


Szencorp headquarters,
Melbourne



Menara Mesiniaga, Malaysia.

Wildlife Corridors



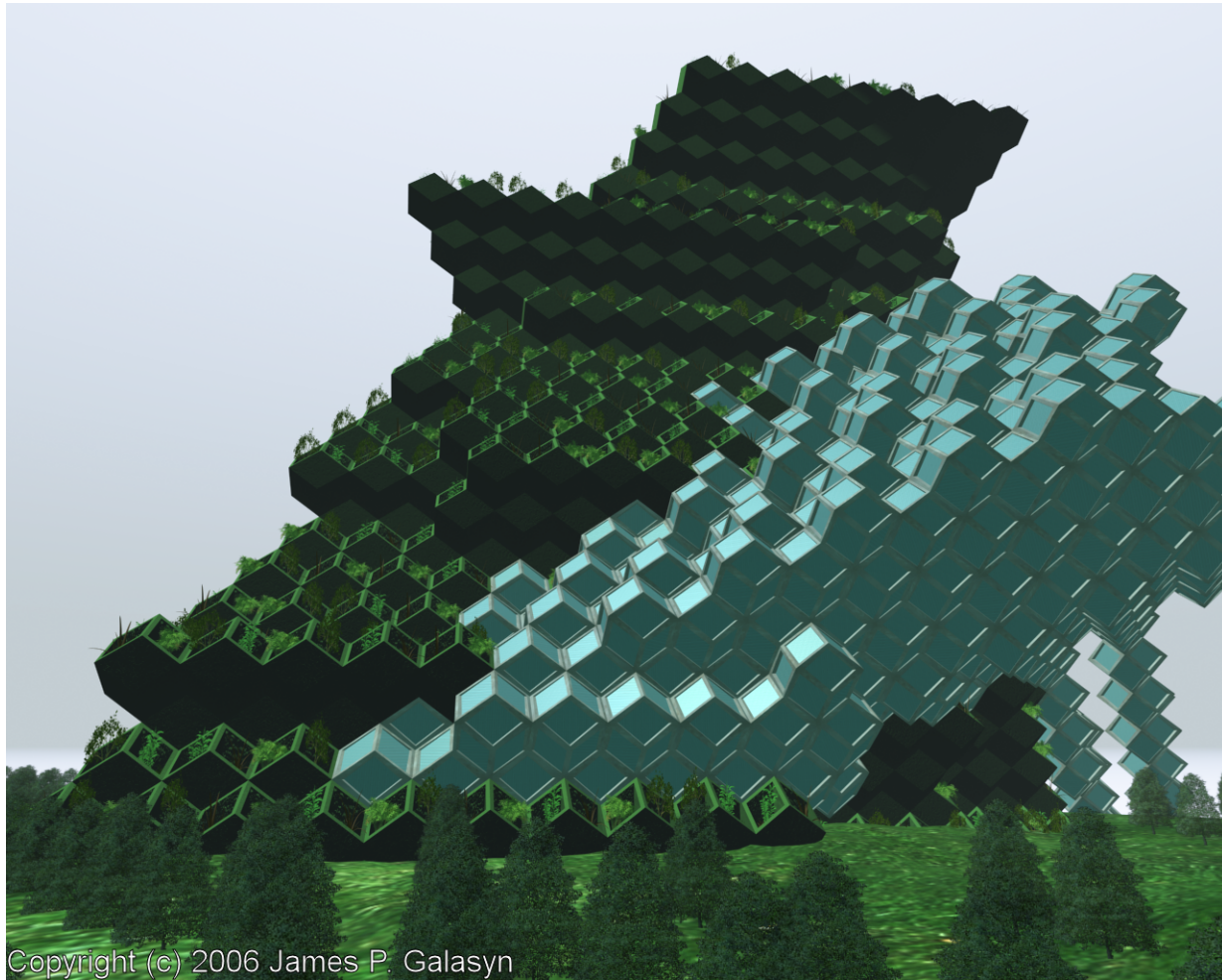
Mountains to Sound Greenway ([Green Infrastructure](#)).

Wildlife Corridors



Planned I-90 wildlife overpass ([Green Infrastructure](#)).

Arcology



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Social and Cultural Solutions

- Powerdown
- Re-localization
- Market mechanisms (Bill Clinton's Green Fund)
- Tradable Energy Quotas (TEQs)
- Evangelical Christians

Powerdown

Rimini Protocol

- Oil producing countries do not produce oil in excess of their current national depletion rate.
- Oil importing nations stabilize imports at existing levels.
- Avoids profiteering from shortage; oil prices remain reasonable relative to production cost.
- Allows poor countries to afford their oil imports.
- Encourages consumers to conserve.
- Stimulates development of alternative energy.

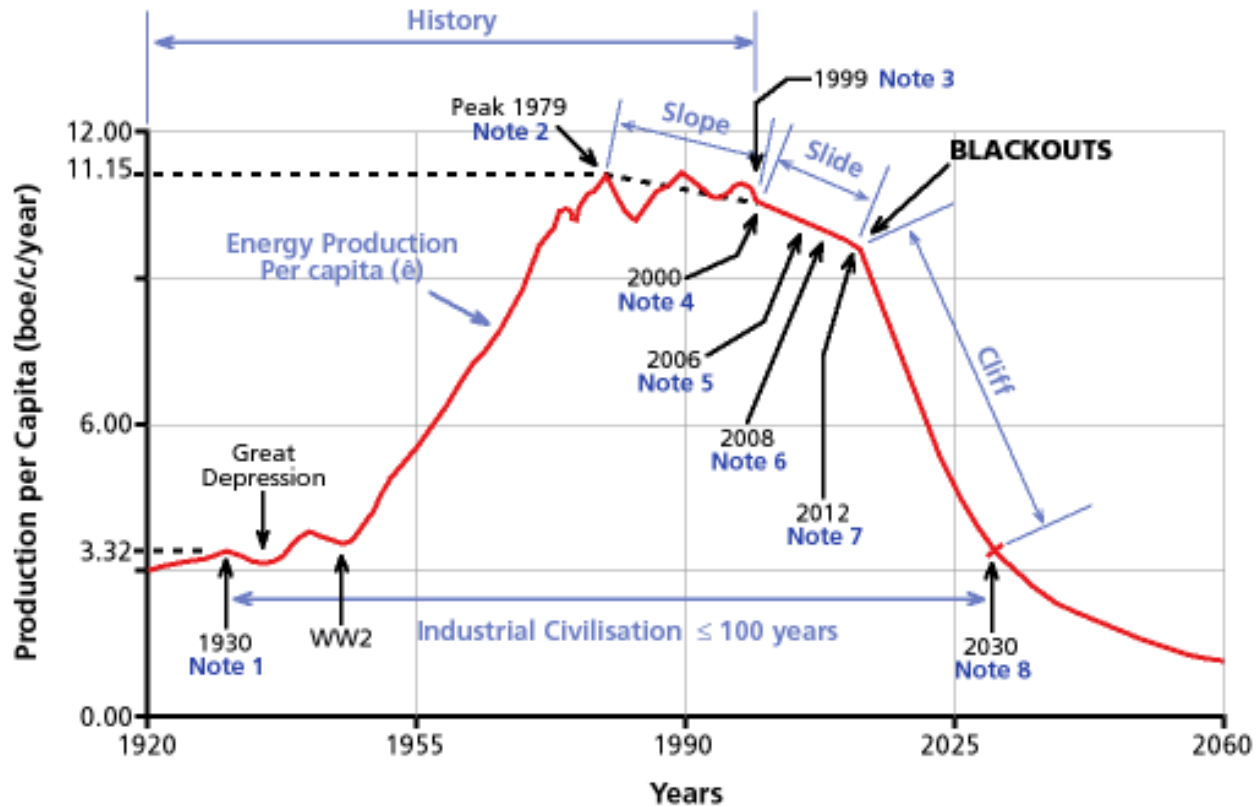
Relocalization

- A response to global reliance on cheap energy
- Aims to build societies based on the local production of food, energy and goods, and the local development of currency, governance and culture.
- A strategy to
 - increase community energy security
 - strengthen local economies,
 - dramatically improve environmental conditions and social equity.

Evangelical Climate Initiative

- 86 evangelical Christian leaders
- 39 evangelical colleges
- Creation Care
- Evangelical Environmental Network
- Republicans traveled to Alaska and Antarctica, came back convinced

Olduvai Theory



Resources

- The Current Mass Extinction (<http://www.well.com/user/davidu/extinction.html>)
- Species Alliance (<http://www.speciesalliance.org/>)
- BigSky Carbon Sequestration Partnership (<http://www.bigskyco2.org/terrestrial.htm>)
- Sequential collapse of marine mammals in the North Pacific Ocean and southern Bering Sea (<http://soundwaves.usgs.gov/2003/10/SW200310-300.pdf#search=%22Sequential%20collapse%20of%20marine%20mammals%20in%20the%20North%20Pacific%20and%20southern%20Bering%20Sea%22>)
- [Issues in Risk Science 5: Dangerous Climate Change](#)
- Ocean and Climate Change Institute, [Abrupt Climate Change](#)
- [Greenland ice cap as climate archive](#)
- [A lecture on land use, deforestation, and loss of grasslands and wetlands](#)