



Lecture 1
Global Environmental Change

GEOLOGIC TIME

The earth is approximately 4.6 billion years old and has undergone large changes throughout its lifetime. The earliest forms of life may have appeared as early as about 4 billion years ago, with bacteria and algae-like creatures appearing about 2.5 billion years ago. Evidence has emerged recently that about 600-700 million years ago, the earth was probably completely ice-covered more than once (**snowball earth**). Then, about 540 million years ago, the **Cambrian Explosion** occurred. This marks the first appearance of creatures with hard skeletons and is associated with an striking increase in biological diversity.

The period since the Cambrian explosion is known as the **Phanerozoic** and is divided into three eras: the **Paleozoic**, the **Mesozoic**, and the **Cenozoic**. These eras are further subdivided based on discontinuities in the fossil record (i.e. extinctions). In class today, we will examine the most recent mass extinction event, which marks the boundary between the Mesozoic and Cenozoic periods.

The earth and its climate toward the end of the reign of the dinosaurs.

Earth's most recent major ecological catastrophe...
 ...occurred 65 million years ago.

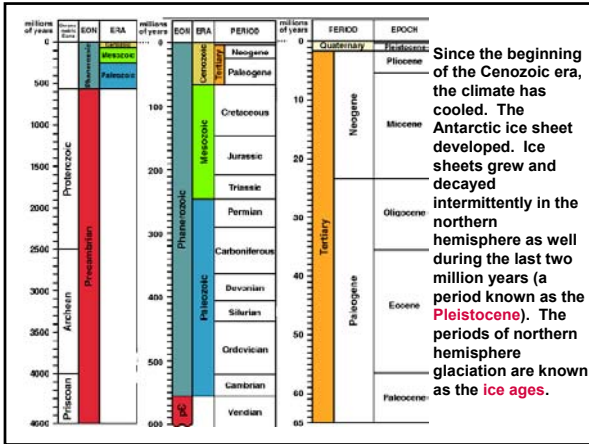
The fossil record changes abruptly before and after this moment. It indicates that the dinosaurs disappeared at this time. In addition, the majority of other ocean and land animals went extinct.

What happened? The evidence supports the idea that the earth was struck by an asteroid. Asteroids are constantly colliding with planetary bodies, as evidenced by craters on their surfaces.

Other heavenly bodies are bombarded by asteroids: Phobos, moon of Mars

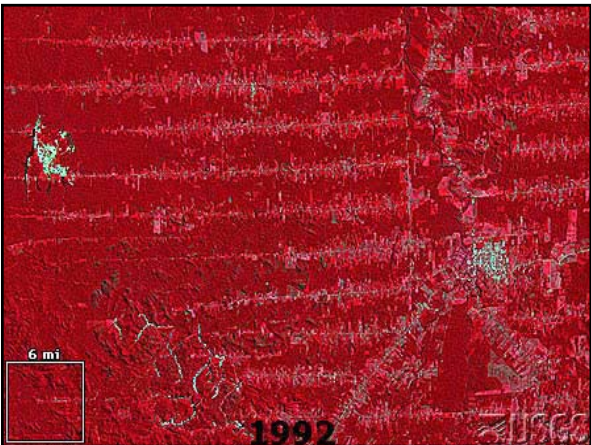
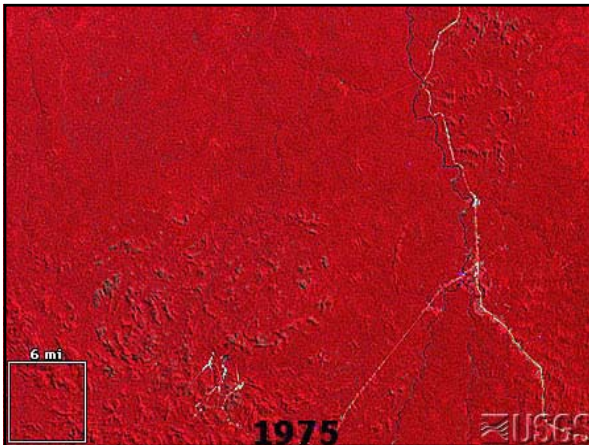
Crater in the Yucatan peninsula is about 300 km (200 miles) across

Sedimentary rock 65 million years ago contains unusually high amounts of **IRIDIUM**, which has higher concentrations in extraterrestrial matter.



Contemporary Global Change: The Human Impact

- Ecosystem Destruction
- Ozone Destruction
- Climate Change



Facts about DEFORESTATION

Deforestation occurs at a rate of 150,000 square km per year worldwide (every 2.5 years, an area equivalent to the state of California disappears).

Tropical forests once occupied 16 million square kilometers of the earth's surface, but now cover only 9 million.

It is estimated that Latin America and Asia have already lost 40% of their original forest; Africa a little more than half.

In many countries the rate of deforestation is accelerating. For example, most of the forested areas of Bangladesh, India, the Philippines, Sri Lanka and parts of Brazil's rain forest could be gone by the end of the century.

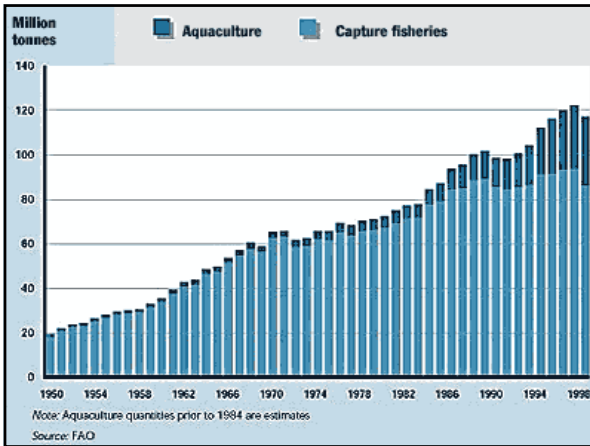
Only in the Congo Basin and some of the more isolated areas of the Amazon Basin does the forest remain largely intact.

Implications of DEFORESTATION

Species loss--The majority of earth's species live in the tropics. The majority of the species in the tropics have very limited ranges, increasing the importance of small patches of land for overall biodiversity.

Local climate change--The loss of rain forest alters precipitation and cloud patterns.

Global carbon cycle--The burning of the forests releases carbon dioxide into the atmosphere, contributing to the increase in greenhouse gas concentrations.



OZONE is a 3-atom oxygen form of oxygen found in both the troposphere and the stratosphere. Ozone in the stratosphere occurs naturally and shields the earth's surface from harmful ultraviolet radiation. Ozone in the troposphere is a pollutant associated with automobile exhaust.

Ozone can be destroyed in the stratosphere by CFCs, a chemical used in air conditioners, and aerosol spray cans.

TOMS Ozone (DU): Oct 1989 TOMS Ozone (DU): Oct 1991

Because of peculiar meteorological conditions, ozone destruction is particularly severe over Antarctica, giving rise to an "Ozone Hole"

