HUMAN IMPACT ON BIODIVERSITY

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What is Biodiversity?

In environmental terms, biodiversity represents the variety of natural life on Earth. It consists of several components:

1) Species Diversity: The variety of species found in natural habitats on Earth.

2) Genetic Diversity: Variety in genetic makeup between and within species.

3) Ecological Diversity: Variety of forests, deserts, grasslands, streams, lakes, oceans, wetlands, and other biological communities on Earth.

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- Diversity of Marine Families Through the Phanerozoic

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The Sixth Extinction

We talked a couple of weeks ago about the Pleistocene extinctions of large land animals, such as the ones now found as fossils at LA’s La Brea Tar Pits. Many of those extinctions seem to coincide with the arrival of hungry Homo sapiens on the scene. Many would contend that the extinctions of the Pleistocene are still continuing, not just through consumption of wild animals by humans, but also through destruction by humans of the habitats in which animals and plants live. This continuing extinction has been referred to as “the Sixth Extinction”.

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- Timing of Extinction of Large Land Animals
Colonization of North America by Europeans

As examples of the continuing destruction of natural species and habitats by humans, we can examine the settlement of North America by people from other continents. Much of the attraction of moving to North America has been the availability of abundant wild resources for the taking, which has motivated people to move from their crowded homelands. When this all began, much of the continent was covered by forests which, when cut, could be converted to agricultural land. The wildlife was abundant, and the markets of 19th century America were full of wild game for sale.

- Settlement and Loss of Old-Growth Forests

Near Extinction of the American Bison

In 1500, before Europeans settled North America, 60-125 million North America bison (buffalo) grazed the plains, prairies, and woodlands over much of the continent. A single herd on the move might thunder past for hours. By 1906, however, the once-vast range of the bison had shrunk to a tiny area, and the species had been driven nearly to extinction.

How did this happen? The most relentless slaughter was caused as the railroads spread westward in the late 1860's. Railroad companies hired professional bison hunters – including Buffalo Bill Cody – to supply construction crews with meat. Passengers on the new transcontinental railroads also gunned down bison from train windows for sport, leaving the carcasses to rot. Commercial hunters shot millions of bison for their hides and tongues, leaving most of the meat to rot.

By 1892, only 85 bison were left. They were given refuge in Yellowstone National Park. Fortunately, the 20th century saw some change in America’s view of its wild resources, so that now there are an estimated 200,000 bison, about 97% of them on privately owned ranches.

- The Historical Range of the North America Bison
Hungry Settlers, Habitat Disruption and Extinction of the Passenger Pigeon

In the early 19th century, inhabitants of the eastern part of North America could observe single flocks of migrating passenger pigeons that would darken the sky for hours. One flock was estimated as containing more than 2 billion birds, with a length of 240 miles long by 1 mile wide.

For settlers of eastern North America, passenger pigeons were good to eat, their feathers made good pillows, and their bones were widely used for fertilizer. They were easy to kill because they flew in gigantic flocks and nested in dense colonies. They fed primarily on things such as acorns, so needed large expanses of forest in which to forage.

Like the bison, there was great slaughter of passenger pigeons. For example, in 1878, one professional pigeon trapper made $60,000 by killing 3 million birds at their nesting grounds in Michigan. Extensive clearing of forests for farms and cities destroyed many of their food sources.

By the early 1880’s commercial hunting had ceased because only a few thousand birds were left. At that point, recovery of the species was doomed, and the last passenger pigeon died in the Cincinnati Zoo in 1914.

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- Passenger Pigeons as Depicted by Audubon

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Extinction of the Carolina Parakeet

We have all seen lots of parrots and parakeets that people keep as pets, and we have seen the escaped parrots that live in LA. But, I think that most of us consider parrots and parakeets to be birds that you do not naturally find in the United States.

However, when Europeans first arrived on the east coast they found vast numbers of a native North American parakeet, the Carolina parakeet, that lived throughout the southeastern U.S. and north up to New York, Pennsylvania, Ohio and Michigan. But, through the 17th, 18th and 19th centuries the effects of settlement took their toll. Deforestation destroyed much of the habitat – typically mature sycamores and cypress trees growing on riverbanks and in swamps – that these parakeets required to live and reproduce. These birds also suffered relentless persecution at the hands of farmers, who feared that voracious flocks would destroy their valuable crops.

By the late 1880’s the few surviving Carolina parakeets were largely confined to the uninhabited regions of Florida. The last known Carolina parakeet died in the Cincinnati Zoo in 1918.
Why Preserve Wild Species?

There are millions of species currently on Earth, and many millions more have vanished over the course of Earth’s long history. So why should we worry about losing a few more? Does it matter that the passenger pigeon, Carolina parakeet, or California condor become extinct mostly because of human activities?

Biologists contend that the answer is yes, based on the following reasons:

1) Economic and medical importance of wild species. Some 90% of today’s food crops were domesticated from wild tropical plants, and about 80% of the world’s population relies on plants or plant extracts for medicines. At least 40% of all medicines, drugs, and pharmaceuticals – worth $100 billion per year – owe their existence to the genetic resources of wild plants.

2) Scientific and ecologic importance of wild species. Wild species supply us with many ecological services – for example, they produce oxygen, recycle nutrients, help regulate water supplies, moderate the Earth’s climate, break down organic wastes, and control pests and disease carriers.

3) Aesthetic and recreational importance of wildlife. Wild plants and animals are a source of wonder, joy, and recreational pleasure for people. Wildlife tourism, sometimes called ecotourism, generates $40 billion per year.

Development of a Conservation Ethic
With all the destruction of nature in 19th century America, characterized by the extinction of the passenger pigeon and Carolina parakeet, and near extinction of the bison, we have witnessed a large change in attitude of people in America in the 20th century. Perhaps beginning with Teddy Roosevelt, and the founding of such organizations as the Audubon Society and the Sierra Club, Americans have changed their view of nature and wildlife as a resource to be destroyed and developed, to something worth saving.

This has led to the development of a conservation ethic and much of the environmental movement in the United States. Notable efforts have been made to save endangered species, such as the peregrine falcon, once almost extinct but now brought back to viable levels so that is has recently been “de-listed” as an endangered species, or a similar program to save the California condor, which almost became extinct in the 1980’s.

Similarly, Americans have been very active in setting aside lands that will continue in their natural state, perhaps best exemplified by our national park system.

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- Federal National Parks, National Forests, and Wildlife Refuges

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**Conservation in Developing Countries**

One of the reasons that conservation is a viable approach in the United States, as well as Europe, is that the people in these areas are relatively rich. In poor, developing countries, people are concerned each day about their next meal, and how they will stay warm. Spreading this conservation ethic to poorer nations is one of humanity’s biggest challenges.

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- The Earth’s Most Biodiverse Countries

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- Annual Rates of Deforestation in the World

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- Tropical Forests are Regions of High Biodiversity
Causes of the Destruction and Degradation of Tropical Forests

- Scarcity of Fuelwood in the World

Hunting, Habitat Loss, and Reduction of Wildlife in the Developing World

The ongoing trends in developing countries mimic the ones seen in 19th century America. The effects of the Pleistocene extinction, the “Sixth Extinction”, are beginning to hit Africa and other areas where such animals have survived until now.

- Reductions in the Ranges of Tigers, Rhinos and Elephants

More Subtle Changes

Activities by humans of widescale hunting and habitat destruction are relatively easy for us to see and to thus appreciate that there might be a different way to treat these biodiversity resources.

But, many scientists have concluded that there are more subtle changes, due to the effects of humans, which are affecting other habitats that we normally don’t see, or animals that are more obscure, but which in many ways are just as important as elephants or tigers.

- Global Threat to Coral Reefs

- Possible Causes for Amphibian Decline
Summary

There was a time when there was a relatively small number of humans, so it was natural to develop cultures and traditions that assumed that the Earth’s living resources were overwhelmingly abundant. As there have become more and more of us we have increasingly realized that these living resources are indeed limited.

As an example, in America the only wild food that most of us eat is seafood. When I was a child we were taught that food from the sea was a limitless resource which could always be exploited for the benefit of humanity. Since then we have fished out many stocks of fish and invertebrates, and have found that food from the sea is indeed limited. The source of seafood may go the way of mammoth protein, and we may in the near future obtain most of our seafood through aquaculture, similar to how we get most of our terrestrial mammalian and avian food, which for the past 100 years has primarily been obtained through agriculture.

Ultimately we will need to become more aware of the links that our behaviors have with the living natural world, and how to best modify our behavior to preserve as much of biodiversity as possible.