Overpopulation (human):

Of all the problems we've looked at, this is the most serious. Most other things we've talked about can be traced to this one way or another - it underlies most of the other issues.

This lecture may get a little more political than some. We'll try to be careful.

Before we look at some direct effects, let's make sure we understand what overpopulation is all about.

The problem:

- This was recognized quite some time back - most folks in here have heard of Malthus, who in 1798 published a book in which he argued that population growth would eventually lead to much misery.

    - argued that populations grow exponentially, but food supplies grow arithmetically.

    - predicted starvation and environmental degradation.

    - (coincidentally, also influenced Darwin's ideas on evolution).

- His predictions were put off, primarily due to:

    - industrialization and the resulting higher productivity.

    - emigration of people to the New World and elsewhere, allowing other areas to absorb increasing populations.

Nevertheless, the problem is today critical:

- in 1492 (the year Columbus discovered America), the world population was about 250,000,000.

- Some figures:

1492	1650	1950	1985	2004
.25 billion	.5 billion	2.5 billion	4.8 billion	6.3 billion

- most of the increase is coming from the tropics or less well developed countries (Africa is at about 3% per year, Asia, Latin America are just below 2%, the rest of the world is less than 1% (Europe is .2%).

A word on food availability:

- As mentioned, this has increased enormously. In prehistoric times, it took about 2 square miles (estimated) to support a single human being. Today it's down to less than an acre.

- There are about 300 widely used crops, but even so, 90% of edible crops come from just a few plants:

  - rice/wheat/corn/potatoes/soybeans/sorghum/barley/rye/ millet/cassava/sweet potatoes/coconut/banana/plantain.

  - improvements in pesticides, fertilization and irrigation have continued to fuel increased efficiency in agriculture (e.g., rice yields have increased from 710 to 10,000 pounds/acre due to just one strain (IR-8), which does require fertilizer, however).

  - genetically modified crops have huge potential here, though they do not come without some risk.

- So Malthus' predictions were put off.

But obviously, things can not continue like this indefinitely. The Earth does have a carrying capacity.

- some estimates show that we are currently at about 40% carrying capacity.

- this is only true if we ignore such things as waste removal problems, conservation, biodiversity, etc., and focus solely on human populations, one estimate shows the carrying capacity to be about 15 billion. Of course, that means there's no room for anyone/anything else.

Causes:

1) "death" control. The arrival of modern medicine has decreased infant mortality enormously, particularly in the developing world. Many diseases have been eliminated or reduced (one estimate shows that before the advent of modern medicine, parts of Africa had death rates between 25 and 50%).

  - unfortunately, there is still a long way to go. Both malaria and AIDS have made dramatic inroads in some populations, leading to much higher death rates. A recent study shows that death rates are impacting population growth for the first time in about 40 years.

This study lists three reasons::

- AIDS (let's not forget malaria)

- depletion of aquifers

- shrinking cropland / person

all these seem to be affecting different parts of the world and have led to increased mortality.

2) The high death rates were often responsible for the large families. People wanted enough children so that some would survive, both to carry on their family and to help support them as they got older. The only way to do this was through large family sizes.

- it takes a while to realize that large families are no longer necessary.

3) Religion sometimes aggravates this situation:

Catholicism prohibits birth control (the "rhythm" method is not effective):

- Incidentally, in most of the North America and Europe, the teachings of the Catholic church are often disregarded on this issue.

Attempts at controlling growth (or lack thereof):

China's infamous(?) one child per couple policy. This has been quite effective, but not as effective as was hoped (due to the lag effect, it is estimated China's population will continue to grow until about 2025, when it's population will have reached 1.5 billion. But what was the cost of this?

- some rather draconian measures designed to restrict the number of children/family, including heavy fines, required use of contraceptives, etc. (recent laws seem to work more with incentives).

On the other hand, India, by comparison, has not tried very hard to implement any kind of controls, voluntary or otherwise - it's population is due to overtake China and reach 2 billion by 2025. Is this sustainable? Is there a good "answer"??

Family planning:

- in the mid 1980's, estimates were that family planning had reduced world populations by 130 million (i.e., population grew by 130 million less). This resulted in a savings of over $175 billion in food, shelter, etc.

- probably the most effective way to provide education and birth control to families living in poverty.

- nevertheless, this can be a subject of political controversy.

- fairly inexpensive (in the mid 1980's, it was estimated that $4 billion/year could provide everyone with access to family planning - this is about .2% of our current budget - note that it's not a valid comparison since the figures are from the mid 80's, but the point is obvious - it's inexpensive.)

- 1994 U.N. Conference on Population in Cairo resulted in agreement to:

- stabilize human populations at 7.8 billion by 2050, in part by providing access to family planning to everyone.

- also included a number of other considerations, such as environmental factors, providing access to education, women's rights, etc. with the goal of increasing awareness of these issues.

UNFPA - United Nations Population Fund

- supports programs to help the mother, provide access to voluntary family planning, supports education on STD's and AIDS, helps formulate sustainable development policies, reduces unwanted pregnancies and abortions, deaths, and injuries for millions of people.

The impact (globally):

Causes problems due to:

- population growth (directly)

- technical development

- indiscriminate use of technology.

A lot of the things we've talked about in class can be traced to population growth:

- deforestation (often caused by the movement of subsistence farmers).

- dessertification (often caused by improper irrigation, overgrazing, and overuse of marginal areas).

- urbanization (kind of obvious, but even in the third world, city size has exploded.

- dams and irrigation lead to loss of water quality

- evaporative loss from aqueducts

- pollution (due to pesticides, fertilizers, etc., all employed to feed an increasing human population).

- increased levels of CO2 (due to deforestation & increased use of fossil fuels).

- even fertilizer production is now increasingly dependent on fossil fuels!

Note that these problems are not uniformly spread across the world. One of the great problems is that the developed world consumes far more resources than the undeveloped world:

In the U.S., compared to India, the average person consumes:

- 50 times more steel, 56 times more energy, 170 times more synthetic rubber & newsprint, 250 times more fuel, and 300 times more plastic.

Two very important ethical questions (which we've looked at before):

- is this necessary (i.e., do we have to use so much)?

- is it fair? Don't we hope for the rest of the world to catch up to our level of development? But what does that entail for the use of the world's resources?

Some specific examples of the impacts of increasing human populations:

Tigers:

In 1900, there were an estimated 40,000 tigers in India.

By the 1970's, this figure had dropped to less than 2,000.

In 1972, India established "Project Tiger". The main purpose here was to establish reserves for the protection of tigers.

- Starting with eight reserves, there are now 27. These are aimed mostly towards tigers, though of course other species benefit.

- Tiger populations rebounded to 4005 (!) by 1989. Since then have dropped and are currently at about 3770 (seems to have stabilized, though).

- There is some evidence that these figures are wildly optimistic - poaching is on the increase (& see below).

Incidentally, this has also had some beneficial effects for humans living near reserves - dependable river flows, and cleaner water as an example.

So what are the problems?

- Often, to establish a reserve the local people have to be moved.

- As an example, Ranthambore in western India is a nature reserve of about 400 km^2. In 1984, mild monsoons created a fodder shortage for livestock in the surrounding areas.

- intense grazing pressure surrounding Ranthambore has led to increased isolation of the park.

- As population pressure increased, people became increasingly frustrated, and eventually wound up driving 15,000 cattle into the core parts of the reserve. The few park personnel were totally helpless. Reinforcements managed to drive out the cattle a few weeks later.

- But in general, people living near reserves have resorted to poisonings and other methods to prevent tigers from taking their livestock.

- This is, in a way, understandable, if someone's livelihood depends on livestock.

- The main problem is too many people in areas that tigers inhabit.

- Serves as a vivid example of how human population pressures can impact an individual species.

(Some sources even advocate the use of the military to help protect parks, but the fundamental problem won't go away - the people living in the surrounding areas depend on the park, even though they're not supposed to.)

Incidentally, this is true not only in India, but in other countries that are trying to protect tigers.

Kenya.

Still has one of the highest population growth figures in the world.

Mention anecdote.

In 1978, growth rate was 3.8% (some estimates were as high as 4.2%), it has since fallen to 2.5%. There is worry that this might drop below 2% due to AIDS. The current (2001) population is about 30 million people, up from 20 million in 1985, and 9 million in 1890. It's projected to grow to 50 million by 2030.

Nairobi National Park:

- ideally located for visitors, as it's only about ½ hour from the center of town.

- fairly small at 44 km^2. Even though it's small, it has a fairly diverse population of organisms, primarily because it encloses several different kinds of habitat.

- bounded on three sides by a fence, that by an large prohibits most animals from crossing. The city and the main highway to Mombassa are on the other side of the fence.

- the south is open to the Athi plains.

The Nairobi National Park is a little like a miniature Serengeti. It has a resident population of animals, but during certain times of the year, numerous other animals migrate into the park from the plains (wildebeeste, various gazelles, associated predators, etc.).

- realizing the importance of the Athi plains, the WWF together with private donations provided funding for the purchase of a large part of these plains.

- the money disappeared. Kenya was one of the most corrupt countries on earth, and it's only recently that this has improved.

- but there is a new attempt to raise money for a leasing scheme. Perhaps with the better accountability in government now, it might yet succeed.

- but, increasing population pressures have led to an increase in building along the south side of the park.

- numerous farms and livestock have moved into this area, and migration routes are increasingly restricted.

- This may eventually lead to a park closed on four sides, or a sort of open air zoo.

- Cattle and other animals can be seen on occasion in the park, once again indicating that population pressures are having a negative impact.

An aside:

- Some of the best preserved areas in Africa are areas with high concentrations of Tse-tse fly. Humans and livestock are kept out of those areas.

Concluding remarks:

Overpopulation is a serious problem. It drives most of the problems faced by conservationists.

- It's curious that it is so often ignored by conservationists.

- None of this information was available in *any* of the texts that I had available.

- Bluntly, unless something is done to stabilize human populations, the future for wildlife (and biodiversity) is very bleak.