

Preliminary: We are temporarily abandoning our text. It doesn't investigate the ultimate causes of population decline as much (it does, however, do a good job with detecting population decline and treating the problem). Some of what follows is covered in Chapter 8.

(I'm using a variety of sources here, particularly a text I considered for your class entitled "Fundamentals of Conservation Biology" by Hunter (2<sup>nd</sup> edition), 2002, Blackwell Science.)

## **Habitat loss.**

Simply put, habitat refers to the environment an organism (or organisms) lives in; specifically, the environment needed by an organism (or organisms) to survive.

Thus, habitat loss is the removal of that habitat from the availability to that organism.

Some simple examples:

In northern Virginia we live in one of the fastest growing communities in the United States. But, one result of that has been the removal/destruction of vast amounts of habitat.

George Mason University:

- In 1979, GMU consisted (approximately) of the four original buildings, Thompson Hall, Robinson I, the Library, Lecture Hall, Student Union I, a few residence halls (behind the Student Union) a physical education building and a few odd trailers. There might have been a few other buildings like parts of the physical plant, etc.

- In 2004 (25 years later), we have built up most of the campus. Numerous new buildings (King Hall, Johnson Center, Patriot Center, Center for the Performing Arts, Student Union II, Science and Tech I & II, the "Arts(?)" buildings (not sure what the official name is), many more Residence Halls, a second Library tower, the Krachnow (sp.?) institute, aquatic fitness center, police building, Abomination Hall, as well as more trailers).

- Deer (admittedly, not always desirable) used to be common on campus. So were numerous species of snakes, lizards, and salamanders. Numerous birds (e.g. pileated woodpeckers) were often seen nesting on campus. Some things are still around, but if current trends continue, soon it'll be reduced to squirrels and crows.

- Note that not one animal was deliberately killed in all of this.

- Is this good? bad?

Other areas in Northern Virginia:

- How many people drive past a new housing development on their way to work (or GMU)? All these areas used to provide habitat for native (and introduced) organisms.

- Again, is this good? bad? What are the trade-offs?

Let's investigate this phenomenon a little more by looking at some causes:

**Urbanization** - the effect is obvious, pretty much what we discussed above. There's no real need to dig into the details here.

**Deforestation** - Forests are being cut down for lumber, construction, and agriculture. The latter can be rather insidious:

In the tropics, many rain forests are being felled to make room for agriculture. Because of the poor soil, these plots don't last very long, and farmers will move on to other areas, clearing these as well.

Some authors will argue that clear-cutting is not necessarily deforestation, providing the land is allowed to recover naturally. A good point, but still, that area is obviously disturbed for a while.

The consequences include the obvious impact on forest species (e.g., pandas, tigers, etc.), but also some others:

- a carbon sink is removed (those trees were host to a large amount of carbon). It is true that if the wood is used for lumber, the carbon may not make it back into the atmosphere right away, but often the wood from clear cut areas is just burned.

- local climate can be influenced since a major source of evaporation has been removed.

Estimates vary, but one source indicated an area the size of Switzerland is being deforested every year. The tropics are the places hit the hardest.

Of particular concern is the removal of rain-forest. Some estimates are that 50% of all species will be found in this environment, and we are destroying rapidly (this is only an estimate - it is clear that rain forests are diverse, but the extent of the diversity is unknown).

**Desertification** - Areas adjacent to deserts are being converted into desert (not deliberately, but the process is ongoing).

A simple (small scale) example. An aid organization discovers that local tribesmen must cover great distances to water holes to water their livestock. To try to alleviate this, they provide funding for a well in the areas used by the tribesmen. The result is twice as much livestock, with the added effect that wide areas around both the original water hold and the well are denuded due to heavy livestock use. Oops.

But the real problems are much more serious:

Agriculture in dry areas often causes loss of soil and eventual desertification of the habitat.

Livestock in the same areas trample vegetation and uproot/eat what's left. Goats are particularly bad that way and have been implicated in many areas (similar to the example above, but on a much larger scale).

Firewood collection - firewood is an important fuel in many parts of the world. As populations increase, firewood is collected from an ever widening area. This often involves the killing of what trees do exist in drier climates.

Irrigation can cause salinization of the soil. As water evaporates in dry climates, salt is left behind - this increases in concentration until the soil is unusable.

Particularly in sub-Saharan Africa, vast areas bordering the North African Deserts have been turned into desert. There are even dramatic pictures of dunes encroaching on towns and villages, though usually the effects are much more subtle. Usually it's not until years later that one finds that the desert habitat has spread (don't forget - desert IS home for many plants and animals, but this is not the way to "help" these animals.)

Estimates are that as much as 70% of the world's dryland agricultural areas are threatened, and a total of 30% of the world's land surface.

**Loss of wetlands** - Wetlands are some of the most productive habitats. These are often considered "useless" since it's hard to build or do agricultural activities in these areas. The end result had been a vast effort of draining marshes, building dikes and dredging to get rid of these areas.

Estimates are that since the late 1700's, about 53% of the world's wetlands

have been removed.

Wetlands host a unique array of species, are crucial in cleaning pollutants, serve as temporary refuges for numerous species (the young of many fish use these areas), and in terms of sheer biomass production are one of the most productive areas around.

Recent laws in the U.S. have made these areas more difficult to develop. (Though this is under assault).

A small example - the everglades have been adversely affected by a lack of water flowing through the everglades. Much water has been diverted for agriculture, and for draining marshes “upstream” from the everglades. One problem with “protecting” wetlands is that the surrounding areas can have a huge impact on the wetlands.

(Of course, much has been made of water shortages throughout the world - we should keep this in mind as well.)

**Fragmentation** - This is simply the breaking up of habitat into smaller chunks. There are numerous consequences of this:

Obviously, species that need large tracts of undisturbed habitat will be adversely affected as roads and fields bisect their traditional ranges.

Edge effect - species that normally can not penetrate deep into (for example), forests, suddenly find themselves able to exploit numerous areas that they were off limits. Some species were driven to the edge of extinction:

Kirtland’s warbler - two problems, first, it was dependent on fire-disturbed areas, second, with the increasing edge effect cow birds have been able to decimate populations by gaining access to nests they would not normally be able to reach.

(Cow birds are brood parasites - they lay their eggs in another birds nest and let the other bird raise their young - in the process the original young is often killed).

Recent reports show that this bird is recovering due to increased burns and controlling for cow birds.

Isolation - different parts of a population can become isolated, thus reducing genetic diversity in individual sub-populations. It may also make it more difficult to find mates.

Migration patterns can be seriously disrupted.

In general, large “fragments” can support a more diverse population than small populations. One reason for this can be explained by the familiar Island biogeography theory by MacArthur and Wilson (you can review this on your own if you wish).

See page 242 in your text for a nice summary.

A brief word on causes of fragmentation:

As usual, increasing human populations are fundamentally to blame. Typically what happens is that a road is built into new areas. This provides access for people, who come along and clear small areas for living and/or farming. As populations grow, more and more land is cleared, leading to greater fragmentation. As the area becomes saturated, more roads are built....

A few concluding remarks.

Some authors differentiate between habitat loss and habitat degradation. The latter is the case where the habitat is still suitable, but no longer ideal. For instance, a road cutting across a wilderness area can prevent some animals from crossing it (some studies show that even a dirt track through a forested area can prevent some animals from crossing). This “degrades” the habitat. Obviously there are various levels of degradation.

An interesting display is at:

<http://www.co.fairfax.va.us/maps/timeMachine.htm#>

(provides sequence of aerial photographs starting in 1937 up to the late 1990's for several areas in the county).

Habitat loss is probably the single biggest factor causing the world-wide decline of species. It is not at all obvious what can be done about this in the long term.

(The answer is not necessarily “create a reserve”).