

## Unit 4 Lecture 7

### Threats to biodiversity

Extinction is a natural event and, from a geological perspective, routine. We now know that most species that have ever lived have gone extinct. The average rate over the past 200 million years is 1-2 species per million species present per year. The average duration of a species is 1-10 million years (based on the last 200 million years). There have also been several episodes of mass extinction, when many taxa representing a wide array of life forms have gone extinct in the same blink of geological time.

In the modern era, due to human actions, species and ecosystems are threatened with destruction to an extent rarely seen in Earth history. Probably only during the handful of mass extinction events have so many species been threatened, in so short a time.

What are these human actions that threaten biodiversity? There are many ways to conceive of these; let's consider two.

First, we can attribute the loss of species and ecosystems to the accelerating transformation of the Earth by a growing human population. As the human population passes the 6 billion mark, we have transformed, degraded or destroyed roughly half of the world's forests. We appropriate roughly half of the world's net primary productivity for human use. We appropriate most available fresh water, and we harvest virtually all of the available productivity of the oceans. It is little wonder that species are disappearing and ecosystems are being destroyed.

### Over-hunting

Over-hunting has been a significant cause of the extinction of hundreds of species and the endangerment of many more, such as whales and many African large mammals. Most extinctions over the past several hundred years are mainly due to over-harvesting for food, fashion, and profit. Commercial hunting, both legal and illegal (poaching), is the principal threat.

### Habitat loss, degradation, fragmentation

Habitat loss, degradation, and fragmentation are important causes of known extinctions. As deforestation proceeds in tropical forests, this promises to become the main cause of mass extinctions caused by human activity.

All species have specific food and habitat needs. The more specific these needs and localized the habitat, the greater the vulnerability of species to loss of habitat to agricultural land, livestock, roads and cities. In the future, the only species that survive are likely to be those whose habitats are highly protected, or whose habitat corresponds to the degraded state associated with human activity.

Tropical forests are so important because they harbour at least 50 percent, and perhaps more, of the world's biodiversity. Direct observations, reinforced by satellite data, document that these forests are declining. The original extent of tropical rain forests was 15 million square km. Now there remains about 7.5-8 million square km, so half is gone. The current rate of loss is estimated at near 2 percent annually (100,000 square km destroyed, another 100,000 square km degraded). While there is uncertainty regarding the rate of loss, and what it will be in future, the likelihood is that tropical forests will be reduced to 10-25 percent of their original extent by late twenty-first century.

Habitat fragmentation is a further aspect of habitat loss that often goes unrecognized. The forest, meadow, or other habitat that remains generally is in small, isolated bits rather than in large, intact units. Each is a tiny island that can at best maintain a very small population. Environmental fluctuations, disease, and other chance factors make such small isolates highly vulnerable to extinction. Any species that requires a large home range, such as a grizzly bear, will not survive if the area is too small. Finally, we know that small land units are strongly affected by their surroundings, in terms of climate, dispersing species, etc. As a consequence, the ecology of a small isolate may differ from that of a similar ecosystem on a larger scale.

Pollution from chemical contaminants certainly poses a further threat to species and ecosystems. While not commonly a cause of extinction, it likely can be for species whose range is extremely small, and threatened by contamination.

### **Climate change**

A changing global climate threatens species and ecosystems. The distribution of species (biogeography) is largely determined by climate, as is the distribution of ecosystems and plant vegetation zones (biomes). Climate change may simply shift these distributions but, for a number of reasons, plants and animals may not be able to adjust. The pace of climate change almost certainly will be more rapid than most plants are able to migrate. A changing climate will have many other effects. Agricultural production likely will show regional variation in gains and losses, depending upon crops and climate. Some coral reefs will expand, and others will contract or die off. Ecological changes due to an altered climate are difficult to forecast, but expected to be serious.