EEB 2208: LECTURE TOPIC 21

HABITAT RESTORATION

Reading for this lecture
Primack: Chapters 19, 4.

1. Introduction
A) WHAT IS RESTORATION?

i) This is the formal definition, according to the Society for Ecological Restoration (see also text book): "… the process of intentionally altering a site to establish a defined, indigenous, historic ecosystem. The goal of this process is to emulate the structure, function, diversity and dynamics of the specific ecosystem."

ii) Note, that the key components of the definition involve (a) the named characteristics of the ecosystem to be created (it should be something that is indigenous to the area and occurred at the site historically – and it should be specifically defined ahead of time, such that there is a clear goal), and (b) the goal of creating something that acts in the same way as the target ecosystem.

iii) Note that although all restoration is a form of management, not all management involves restoration – management can have many goals other than restoring historic habitat to an area.

B) FOUR APPROACHES TO RESTORATION

i) In a broad sense, the term restoration is used to refer to a variety of different approaches. In the text book these are divided into four categories. You might want to think about whether each of these approaches meets the definition of restoration given above.

ii) **Approach 1: don't do anything.** Depending on the circumstances, this approach could result in continued degradation or in a return towards the original ecosystem (e.g., through succession). The regrowth of forested habitats in much of Connecticut can be thought of as a "no-action" form of restoration, since the habitat is returning to something approximating the historic conditions without active management. (Though note that the forest is in no way identical to what would have been in place historically – based on earlier lectures can you think of a specific reason why not?).

iii) **Approach 2: rehabilitation.** Sometimes the options for restoration are limited and people try to create something that roughly approximates the historic ecosystem, but that is in significant ways different (e.g., it has substantially fewer species, or is missing key species, etc.). For example, in a lot of places people have attempted to rehabilitate land that had been cleared for strip mining, or where there had been a landfill. Sometimes there is an attempt to restore the habitat to its historic conditions, but often this is not possible. One reason for this might be that the soil is no longer able to support the species that occurred historically (e.g., because of erosion, or high concentrations of heavy metals), or because there is no source of seeds to plant native species. In these cases, non-native vegetation might be planted, on the basis that a non-native plant community is better than no plant community.

iv) **Approach 3: partial restoration.** Most restoration projects probably involve partial restoration, whereby some (often much) of the historic species and ecosystem functions are restored, but where some differences between the restored site and the historic conditions remain.

v) **Approach 4: complete restoration.** The ultimate goal of many projects is to return a site to its historic conditions. Achieving this, however, is exceedingly difficult and in most cases complete restoration is probably not achieved. Partial restoration, however, is a substantial achievement, and can contribute enormous conservation benefits.

C) MITIGATION

i) Frequently, restoration is used as a way to create habitat that will replace a piece of habitat that is going to be destroyed (e.g., for development).

ii) Such mitigation is often legally mandated, especially when wetland habitats are to be destroyed.

iii) Ideally, a mitigation project should be completed and shown to be effective before the original piece of habitat is destroyed. One (of many) reasons for this is that all the organisms that lived in the original piece of habitat may die when it is destroyed, making it difficult or impossible to repopulate the mitigation site. Usually however this does not occur – and it is generally not part of the legal mandate.

iv) Ideally, any restoration project, and especially those that involve mitigation, should be followed by post-restoration monitoring to assess how well the restoration worked. Again, this often does not happen.

2. Key considerations

A) COMPARISON SITES

i) When conducting a restoration project it is useful to have two types of sites against which the restoration sites can be compared – these two types of comparison site represent the start point and end points of the proposed restoration.

ii) Reference sites are places that have the target conditions that it is hoped will be created on the restoration sites. Having reference sites is crucial if one wants to fully evaluate whether restoration has been successful.

iii) If possible, control sites, which start out in a similar condition to the restoration sites but that do not receive any restoration, should also be identified. These sites allow one to determine how much progress has been made. They also allow one to evaluate how much of the change that is seen is actually due to the restoration management – in some cases this is important, because some communities are able to recover on their own, e.g., through natural plant succession. (In fact, in some cases, it is possible that restoration will proceed more effectively if a site is left alone; having a control allows one to evaluate this possibility.)

B) IS RESTORATION FEASIBLE?

i) In some cases, restoration may not even be worth attempting. For example, it may be pointless to try to recreate the original habitat unless the cause of habitat degradation has been removed.

ii) A second problem can arise when an area has been so fundamentally altered that it is not possible for the historic ecosystem to exist at the site. For example, if there has been extensive soil erosion, it may be impossible for some of the native plants to grow there.

iii) Yet another hurdle is the availability of materials needed for restoration. This can include things like a sufficient supply of seeds or plants for transplantation in order to replant an area.

C) HOW LONG WILL RESTORATION TAKE, AND IS IT POSSIBLE TO SPEED UP THE PROCESS?

i) One big limit on the speed with which restoration occurs, is the ability of native species to disperse to the site. Often dispersal is facilitated to speed up the process – e.g., seed or plants are brought in and planted to recreate the plant community. Sometimes animal communities are also brought in – e.g., the soil fauna and flora can be recreated by importing soil from sites that have the target conditions. Large animals might have to be translocated into the site if they lack the dispersal ability to get there on their own.

ii) Another thing that can slow down restoration is that certain events may have to occur in a given order – e.g., in sand dune restoration, certain species often need to become established to help stabilize the dunes with their root systems, before other species are able to grow at the site. Again, managers can speed up the process if they have an understanding of these processes and can either ensure that initial events happen rapidly, or develop techniques to mimic those events.

D) RESTORATION IS INTERDISCIPLINARY

i) Finally it is useful to remember that biology is only one of the key disciplines that influences the success of a restoration project.

ii) In addition to the involvement of biologists, effective restoration can require the involvement of civil engineers (to create habitat features, such as ponds), hydrologists (to help restore original physical conditions to an area), horticulturists (to develop methods for growing and planting vegetation), toxicologists (e.g., if chemical clean up is required at the site), etc. etc. etc.

3. Case studies

A) COSUMNES RIVER PRESERVE, CALIFORNIA (http://www.cosumnes.org/)

In the final part of the lecture, I will show you some pictures from a wetland restoration project at the Cosumnes River Preserve in California. The Cosumnes River is 80 miles long and flows from the Sierra Nevada mountains to the San Joaquin Delta (which eventually flows into San Francisco Bay). It is the only river without any dams on the west side of the Sierras. A major goal of the Preserve is to safeguard and restore the riparian and wetland ecosystems that historically were found along the river.

B) READ ABOUT OTHERS IN THE TEXT BOOK

Many other examples of different types of restoration project are described in the text book readings.