

EEB 2208: TOPIC 20

CONSERVATION IN THE MATRIX

Background for this topic

Primack: Chapter 18

Sodhi and Ehrlich: Chapter 13

1. Existing reserve networks can only provide so much protection

A) HUMAN FOOTPRINT

- i) Studies have attempted to quantify the magnitude of humanity's impact across the globe.
- ii) A clear result is that both on land and in the oceans, there is essentially nowhere that is not affected by human actions.
- iii) These impacts in non-protected areas both affect what can be done within reserves and influence what can be done to complement the work done through land protection.

B) TARGETS

- i) As discussed in previous lectures, the CBD aims to increase protection both globally and within individual nations.
- ii) To meet these goals means approximately doubling the protected area worldwide.
- iii) Even then, some things will fall between the cracks. Additionally, do we really want biodiversity to be limited only to isolated protected areas – many of which might be a long way from where we live?

C) CONCLUSION

- i) Reserves alone cannot meet conservation goals.
- ii) Consequently, it is important to pay attention to ways of providing conservation benefits in the “matrix” habitat in which reserves are embedded. Finding ways to conserve nature, while also using land for other purposes, therefore, is an important component of conservation biology.

2. Conservation in agricultural settings

A) AGRICULTURE IS A DOMINANT LAND USE

- i) Almost a third of the Earth's land surface is under some form of agriculture and about 11% is under annual cultivation.
- ii) The amount of farmland continues to increase annually.
- iii) Agriculture tends to be concentrated in areas that are biologically rich. Wetland habitats are often targeted, at least in part because they tend to have good soil and a good water supply.
- iv) If conservation activities are going to take place outside of reserves, it is likely that we are going to need to find ways to make agriculture compatible with conservation goals.

B) EXAMPLE 1: BIRDS IN RICE FIELDS

- i) Rice is one the world's most important crops – for example it has been estimated that over half of the world's human population gets the bulk of their calories from rice.

- ii) Rice paddies make up close to 10% of all cropland in the world, and rice is grown throughout the tropics and in many warm temperate areas too.
- iii) Rice is unusual in that it is typically (not always) grown in flooded conditions. This means that it can potentially provide habitat for wetland species – this is not so for most crops.
- iv) In California, about 90% of the wetlands that were present 200 years ago have been drained. California is also one of the most important areas in North America for wintering waterbirds: 20 to 40 million ducks, geese and swans are thought to have spent the winter in the region historically (today the number is about 4-6 million).
- v) Rice is an important crop in California, which has some of the most productive rice lands in the world. Many farmers in the region have switched from the practice of burning residual straw and stubble after harvest, to flooding their fields so that the straw decomposes. This change came about because of legislation to phase out stubble burning because of the air pollution that is created.
- vi) The result of this activity is greatly increased use of fields by waterbirds – three times as many waterbirds occur in fields that farmers have intentionally flooded than in fields that are just left alone during the winter. For many species the difference in use is much greater.
- vii) There also is evidence that the presence of waterbirds in flooded fields helps increase the rate of straw decomposition – hence, there is a potential economic benefit to farmers to having the birds in the fields.
- viii) Globally, similar patterns exist – 100s of waterbird species occur in rice fields, including some endangered species.

C) EXAMPLE 2: SHADE COFFEE

- i) Another example of the way in which agricultural methods can be modified to make them more compatible with wildlife conservation is shade-grown coffee.
- ii) This type of coffee is grown in areas where many of the tropical forest trees are left standing – the coffee forms an understory layer in the forest (normally forest is cleared and coffee is grown under direct sunlight).
- iii) Shade coffee has many benefits – it keeps the forest somewhat intact and supports a much wider variety of organisms than sun coffee. It also has other environmental benefits, including reducing the amount of soil erosion relative to sun coffee. Fewer agricultural chemicals are typically used on shade coffee too.
- iv) As in the rice example, there appear to be benefits to the farmers to managing coffee in a way that is compatible with nature conservation.
- v) For example, recent studies have shown that the number of pollinators visiting coffee flowers, and the subsequent amount of pollination, both decline farther away from the forest edge – suggesting a potential economic benefit of planting coffee near to (or in) the forest.
- vi) Another study has shown that the presence of insectivorous birds and bats has a clear effect on the number of arthropods on coffee plants – whether this would translate into an effect on crop damage (or revenue) was less clear.

D) LAND SPARING VS. LAND SHARING

- i) For these examples (and others like them), it is important to realize that agricultural habitats do not generally substitute for more natural habitats – for many species, farmed land only provides habitat for part of their lives and some species do not use these habitats at all.
- ii) Agricultural land should not be considered a wasteland and there is increasing evidence that clever management approaches can improve the

- quality of agricultural land for wildlife while also allowing productive farming to occur.
- iii) But, if yield is reduced, there is a trade-off, especially in a world with a billion or so people suffering from malnutrition.
 - iv) This trade-off has led to a debate about whether it is better to “share land” or to “spare land”.
 - v) Land sharing = modify methods to benefit wildlife, e.g., by reducing pesticide use, leaving patches of native habitat (field borders, tree lines), etc. Typically, incentive (payment, tax benefit) programs are created to encourage farmers to take this approach. This approach basically amounts to paying farmers to farm inefficiently, so there is often a reduction in yield.
 - vi) Land sparing = farm as intensively as possible (e.g., increase chemical use, cultivate all land in farming areas, develop genetically-modified crops, etc.). This approach aims to increase yield so that not as much land is needed for agriculture. In theory this would allow more land to be set aside for biodiversity.
 - vii) To date, most studies suggest that – all else being equal – land sparing is the better approach. In practice, though, many things complicate the issue. E.g., sparing only works if land is truly protected over the long term, or if it does not lead to increased agricultural production. Also, in some cases, there is no undisturbed land to set aside.
 - viii) Both approaches could be used in tandem if we can identify ways to increase wildlife use of farmland that does not reduce crop yield. In parts of the world where farming is currently very inefficient, this seems like a plausible option.

3. Urban biodiversity

A) URBAN HABITATS

- i) Cities clearly have limited natural habitat, but many have implemented biodiversity programs to protect nature while also giving humans a place where they can experience it.
- ii) City parks are probably the most obvious habitat, but not the only one. River corridors are often the focus for “greening” activities. Sometimes these involve manicured gardens, but often they involve wilder, more natural, habitats.
- iii) Gardens (in cities, and elsewhere) also support a lot of biodiversity and studies in the last ten years have attempted to better understand what role they play.
- iv) Even habitats that may not obviously contain much biodiversity can be beneficial. For example, peregrine falcons regularly nest on tall buildings in downtown Hartford.

B) CONNECTICUT BIOBLITZ’S

- i) Over the past decade, UConn has partnered with other organizations to hold “BioBlitz” events centered on city parks around the state. These events involve a big group of scientists attempting to find as many species as possible within a single 24-hour period at a single park and its immediate surroundings.
- ii) These events have resulted in the discovery of between ~1700 and ~2200 species at each event. Each year at least a few rare or endangered species are also discovered. And, in at least a couple of years, species were found that had never been seen in Connecticut before.
- iii) For more BioBlitz information, go here <http://web.uconn.edu/mnh/bioblitz/>.