Rise and fall of the ecological superorganism

1. Introduction

The last few lectures identified a few problems for a standard defense of the Land Ethic. We saw that biotic communities differ from social communities in ways that impact our moral assessment. Far from comprising a cooperative alliance of psychological peers, biotic communities are composed of very dissimilar organisms that usually benefit from killing and eating one another. So, even if we have reasons to expand our moral horizons to include everyone in our social communities, it doesn't follow that they should be pushed all the way to the edges of our biotic communities. Nor would biotic communities deserve this kind of consideration if evolution equipped us to sympathize with anyone or anything that falls under the community label. Indeed, this might even serve as an additional reason for caution. Any proposal to extend moral consideration to a non-sentient organism requires justification.

My lectures this week explore such a proposal, the view known as **ecoholism**. In a nutshell, ecoholism assigns moral standing to ecosystems (considered as a whole) on the grounds that they are structurally and functionally similar to individual organisms. The Gaia hypothesis is an extreme example of this view. It portrays the entire planet as a highly integrated, delicately balanced system of chemical and biological processes. Gia is usually accorded some degree of moral standing simply in virtue of its organism-like nature. Just to be clear, we can think of ecoholism as consisting of both a normative claim and a descriptive claim. The normative claim states that any individual deserves moral consideration provided that it possesses biological interests. The descriptive claim is that, according to the discipline of ecology, biotic communities possess biological interests.

In these lectures I will have relatively little to say about the normative component of ecoholism. It will be introduced briefly in Section 2. My focus will be the idea that biotic communities qualify as higher-level organisms (or superorganisms). For reasons that will hopefully become clear, the superorganism view became popular in ecology during the first half of the 20th Century. Although ecoholism remains influential in certain environmentalist circles, most ecologists now reject it and for good reason. My aim in these lectures is to help students see why ecologists have changed their minds on this issue and to point out some of the implications for the Land Ethic.

2. Beyond sentience: biological interests as a morally relevant property.

In previous lectures we considered Peter Singer's argument for deciding whether a given type of individual (a person, a plant, an ecosystem, or whatever) really ought to be regarded as morally significant. Recall that sentience served as the fulcrum for this argument. Most people accept without question that unnecessary pain and suffering is inherently bad. This principle provides leverage for expanding our moral horizons to include other species of organisms, on the grounds that they likewise are sentient (i.e. share the capacity to suffer).

We also noticed that this argument draws a moral line in the sand at the point where sentience stops. Plants, bacteria, fungi, indeed most other organisms presumably lack sentience and are not morally significant on this view. In other words, we can treat them as we wish without violating any kind of moral principle.

Now, some students balk at the suggestion that it is morally permissible to treat non-sentient organisms *in any way that we wish*. Allow me to clarify what this means. There remain, on this view, all sorts of prudential reasons to preserve certain plants, bacteria, fungi, or other non-sentient organisms. For example, some of them are bound to provide essential “ecosystem services” such as medicines or food (more on this idea later in the course). So sentientism shouldn’t be understood as a license for wholesale destruction. It is also important to note that some disruptions to biotic communities are bound to cause suffering in sentient organisms. Destruction of pine trees in the boreal forests, for instance, might cause widespread starvation in Cariboo, wolves and other animals. In that case, such actions would be morally prohibited because of the indirect effects on sentient beings. Aside of these prudential and indirect considerations, however, there are no guidelines governing our treatment of ecosystems—at least, not as far as the sentientist is concerned. Some forms of large scale disruption might even turn out to be compatible with this framework. Some aspects of climate change, for example, are not obviously bad for sentient organisms. This will depend on whether they have the capacity to change location, modify their habitat, or accommodate to temperature increases. Smaller scale changes, such as forestry or even mining, could conceivably be carried out without harm to sentient organisms. Again, although potentially quite destructive of the land, such transformations might turn out to be morally okay under the sentientist framework.

Of course, Leopold would not have countenanced this approach. For him, the entire community was to be regarded as a morally significant entity. Like many environmentalists today, he would have even considered it permissible to sacrifice some sentient organisms for the good of the biotic community. To morally justify such actions, a broader conception of ethical significance (beyond just sentience) is required.

This brings us to a new idea in this course. Some philosophers propose that the very possession of an **interest** qualifies an entity for moral consideration. The concept of a morally significant interest is supposed to provide a sort of fulcrum for extending moral significance beyond the restricted human domain. Let’s start with the basic notion of a biological interest and then turn to the question of whether such interests are indeed morally relevant.

It is fairly standard to describe organisms as having interests or goals even when they lack mental states. It is in a sunflower’s interest to maximize exposure to sunlight. This is why it orients towards the sun over the course of a day. Army ant colonies are likewise interested in obtaining resources. This is why, in times of scarcity, the entire colony picks up and mobilizes to a new location. Neither sunflowers nor insect colonies have mental states. They can’t form goals in the psychological sense. But they do possess interests which have been encoded into their DNA by natural selection.

You might stop and ask why are we describing these behaviours in terms of "goals" or "interests"? Aren't we in danger of anthropomorphising here? Anthropomorphism, as in the Ikea-lamp example, involves the ascription of psychological states where they do not exist. It is important to note that one can ascribe an interest to an organism without implying anything about its psychological capacities. There is a purely biological sense of interest that refers merely to an organism's capacity for *self-correcting behaviour*. In the case of the sunflower, when the sun moves across the sky the plant adjusts its orientation accordingly. I have no idea how sunflowers manage this. But as an observer of this behaviour it makes perfect sense to posit an interest or goal on behalf of the sunflower. There is something that it is literally striving towards. Likewise, if a troop of army ants encounters an obstacle, such as a stream, they will form ant-bridges out of their own bodies to cross it. This is another example of self-correcting behaviour. I suspect that similar examples exist across the tree of life, from colonian insects to single celled bacteria.

Getting back to the problem of anthropomorphism, it is helpful to have some terminology to distinguish the two different types of interest that have been described so far. Let me propose the term **biological interest** to identify the kind of goal that arises whenever an organism engages in self-correcting behaviour. We can then use the term **psychological interest** to refer to the more complex representational capacity that is found, for example, in organisms with a sophisticated nervous system.

Let's now turn to the more difficult question: why might biological interests matter morally? What is it about the capacity for self-correction, in other words, that qualifies an organism for moral consideration?

I have to admit that I find this idea difficult to defend. Perhaps the strongest argument I can think of attempts to follow in the footsteps of Singer's argument for sentientism. Recall how that argument relied on a premise that almost no one can sincerely deny: that the experience of pain and suffering is inherently bad. With this assumption in place, the next step was to establish that certain other (non-human) organisms also have a capacity to experience pain and suffering. Let's see if we can do something similar for interests.

A key philosophical question is whether it is inherently bad when an organism is prevented from pursuing its interests. By the same token, we might ask whether it is inherently good when an organism is permitted to pursue its interests. If either claim manages to command widespread agreement, then the concept of a biological interest could be made to do the same work as the concept of sentience. Only, the argument from interests would apply to a much broader range of organisms.

What kind of biological interest is sufficiently general that it applies to all manner of organism? The only possible candidate that I can think of is the continued survival of a lineage. Every living organism is the descendant of a linage that managed to survive. Hence, it must possess traits that assist it in this capacity. This is not news. The more difficult question, it seems to me, is whether these property are morally relevant. Is it morally wrong for one organism to prevent the survival of another? I worry that this idea is self-defeating. Most organisms, unless they are capable of generating their own nutrients from solar or chemical energy, must consume others in order to survive. There is an important sense in which some beings must die in order for others to persist. So, there seems to be no way of placing positive moral value on survival without also placing positive moral value on destruction. To put the point differently, suppose that it were morally wrong to prevent an organism from pursuing its biological interest of survival. Then it would be morally wrong to prevent it from consuming other organisms, if it needs to do so in order to survive. But the consumption of other organisms involves impeding them from pursuing their interests. So, the idea that interests are morally significant leads to a contradiction (as long as are in a world where not everything is an autotroph!)

Maybe I have simply failed to identify the appropriate interest here. Instead of survival, perhaps some other biological interest is a better candidate for bestowing moral significance on organisms. Ancient philosophers like Aristotle thought that each organism possesses and essence, that is, a set of instructions that specify how it is "meant" to be. It is morally wrong, he thought, to interfere with an organisms inner objective or goal. Now, as I shall explain at the end of this chapter, this essentialist picture of the world has been gradually eroding ever since Charles Darwin revolutionized our understanding of biology. Some philosophers nonetheless cling to essentialism in an almost desperate attempt to preserve their cherished ethical theories. This devote has the predictable effect of isolating them from the broader majority of thinkers who embrace a Darwinian framework.

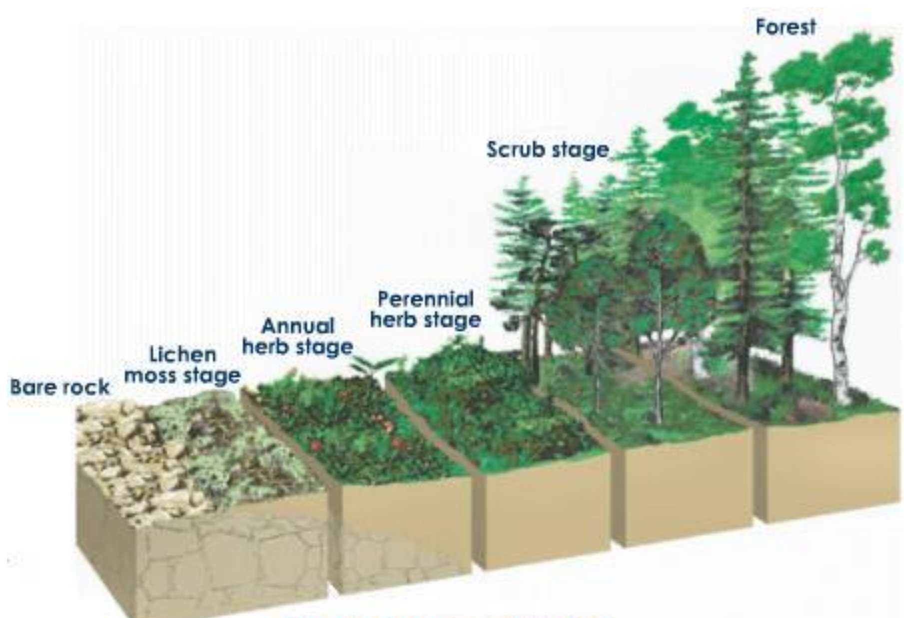
That said, let is play along with the Aristotelian picture for the sake of argument. Perhaps there is some kind of morally significant biological interest (an essence, or whatever) that is possessed by non-sentient organisms. I now want to consider whether biotic communities as a whole would qualify as morally significant under this picture.

3. Rise of the superorganism concept in ecology

During the first half of the 20th Century, ecological science seemed to be converging on a new and exciting understanding of nature. At the core of this science was the observation that biological communities tend to remain stable unless they are disturbed. In the 1920s, ecologist Frederick Clements drew a logical connection between species diversity and community-level stability. In his experiments, Clements would mow down different types of grassland community and observe how long they required before returning to their former state. He noticed that more diverse grassland communities rebounded better monocultures. This led him to propose a connection between diversity and stability.

These ideas were later taken up by another ecologist, Arthur Tansley, who coined the term "ecosystem" to describe multispecies assemblages. An ecosystem for Tansley was a highly interconnected system of feedback loops through which energy was transmitted. These loops were taken to account for the stability of the system. For example, a carnivorous population of wolves is in synch with a population of Cariboo because when the wolves become too abundant the Cariboo decline, resulting in a die-off of the predator. The Cariboo population might, in turn, be synched up with a population of moss. So, when the Cariboo population was on the decline, moss reserves would gradually build up in preparation for a Cariboo population rebound. Tansley had a name for this relationship between connectivity and stability, he called to The great Universal Law of Equilibrium. As Adam Curtis points out in his excellent documentary on this topic, the idea of a balance of nature goes back a long way in Western culture. However, Tansley was the first to propose that this idea might actually be grounded in scientific evidence. Ecologists were quick to scramble onto the balance of nature bandwagon.

Perhaps the culmination of this idea involved the publication of Eugene Odum's (1969) paper, "The Strategy of Ecosystem Development." Odum used North American forest ecosystems as his central example. These systems had been observed by Clements and others to follow a regular pattern of *ecological succession*, as it was called. After disturbance, a patch of ground is first colonized by so called "pironeer" species whose functional role is (apparently) to enrich the soil. These species are capable of establishing themselves even in soil with poor nutrients, partly through a symbiotic relationship with nitrogen-fixing bacteria. The next stage of succession involves the establishment of fast growing trees, such as alter and birch. They adopt a grow-fast, die young strategy. By discarding leaves and limbs they further enrich the soil while also providing shelter for slower growing trees. This process culminates in the so-called "climax" community: hardwood forests which will remain stable, it was thought, unless the system is again disturbed.



Xerarch Succession on Bare Rock

Odum, in his fanous 19699 paper, took the extra logical step of arguing that these forests systems are literally a kind of organism. His argument relied on the fact that they seem to possess a biological interest. The fact that a disturbed ecosystem will self-correct, returning to its previous climax state, was considered by Odum a sufficient condition for viewing these ecosystems as organisms. Or, as he called them, superorganisms.

Like Tansley, Odum thought that an ecosystems' capacity for self-correction (or balance) was achieved through a high degree of interconnectedness among its parts. Likewise, any decay in those connections was thought to destabilize the system as a whole. Here is an illustrative paragraph from his famous paper:

> This brief review of ecosystem development emphasizes the complex nature of processes that interact. While one may well question whether all the trends described are characteristic of all types of ecosystems, there can be little doubt that the net result of community actions is symbiosis, nutrient conservation, stability, a decrease in entropy, and an increase in information. The overall strategy is, as I stated at the beginning of this article, directed towards achieving as large and diverse an organic structure as is possible within the limits set by the available energy input and the prevailing physical conditions of existence (soil, water, climate, and so on). As studies of biotic communities become more functional and sophisticated, one is impressed with the importance of mutualism, parasitism, predation, commensalism, and other forms of symbiosis. Partnership between unrelated species if often noteworthy (for example, that between coral coelenterates and algae, or between mycorrhizae and tree). In many cases, at least, biotic control of grazing, population density, and nutrient cycling provide the chief positive-feedback mechanisms that contribute to stability in the mature systems by preventing overshoots and destructive oscillations. The intriguing question is, Do mature ecosystems age, as organisms do? In other words, after a long period of relative stability or *adulthood*, do ecosystems again develop unbalanced metabolism and become more vulnerable to diseases and other perturbations? (Odum, 1969)

This viewpoint resonates with the Land Ethic as articulated by Leopold, who often encouraged his readers to think of biotic communities in holistic terms. Right up until the 1970s, ecological science seemed to be providing scientific support for these ideas. Ecologists no longer had to invent "subterfuges" (as Leopold had called them) to justify conservation of the species that they loved. If all species are united as an interconnected whole, there are obvious prudential reasons for wanting to maintain the balance of nature. Perturb nature too much and all hell is bound to break loose. The effects are likely to backfire in large and unanticipated ways. In addition, this new scientific ideology seemingly lent support to Leopold's call for an *ethical* relationship with nature. If ecosystems are literally organisms that possess interests, and if interests are morally relevant, then it would seem that we have been morally ignorant, like Odysseus, neglecting to recognize the morally significant superoganism whose biological interests we routinely violate.

4. The fall of the superorganism concept

Ecoholism is an appealing doctrine for anyone who seeks an ethical solution to the principle of rational depletion. The idea of mother earth, previously a mere metaphor, was now a legitimate concept with scientific credentials. People could literally talk about the health of an entire ecosystem, thus borrowing normative concepts that had previously been restricted to humans and a few other species. This framework also provided a moral basis for judging one another's actions. If someone decides to act against their own self-interest, we have little or no grounds for condemnation. Perhaps we feel slightly more entitled to say something in the name of future generations, if someone's actions stand to cause a distant harm. But that argument presupposes a kind of omniscience our part. We must be confident that future generations will indeed suffer. By contrast, the idea that someone is harming mother earth – a genuine organism of immense proportion and significance- is much more powerful reason to intervene in someone's actions. Ecoholism provides a platform for moral condemnation that is potentially more effective than anything that had preceded it. Hence, it is no surprise at all that this idea has been so difficult to shake, even in the face of mounting scientific evidence.

In these lectures I am touching on just three general reasons why ecologists have abandoned (reluctantly, I might add) the superorganismic view of ecological communities. It is not an exaggeration to say that the balance of nature idea has been scientifically discredited. Though, I expect it will be some time yet before popular culture becomes attuned to this adjustment in scientific thinking.

The first line of evidence comes from empirical studies in ecology. The film by Adam Curtis (All Watched Over by Machines of Loving Grace) does a nice job of summarizing this evidence. What the evidence suggests is that ecological relationships among species are nowhere near as strong as the super-organism theorists had assumed. As Kricher mentions in the reading for this week: "The loss during this century of the American Chestnut as a numerically dominant tree species throughout eastern North America resulted in negligible ecological effect on the forest as a whole" (Kricher, 1998). Such effects have been widely documented and they are as striking as they are surprising. How could it be that the removal of a dominant species in a community has only negligible effects on the species around it? In a moment, I will present (briefly) some theoretical developments that help us understand such observations. But before doing so, let me address a potential concern that expect some students would rant to raise at this point.

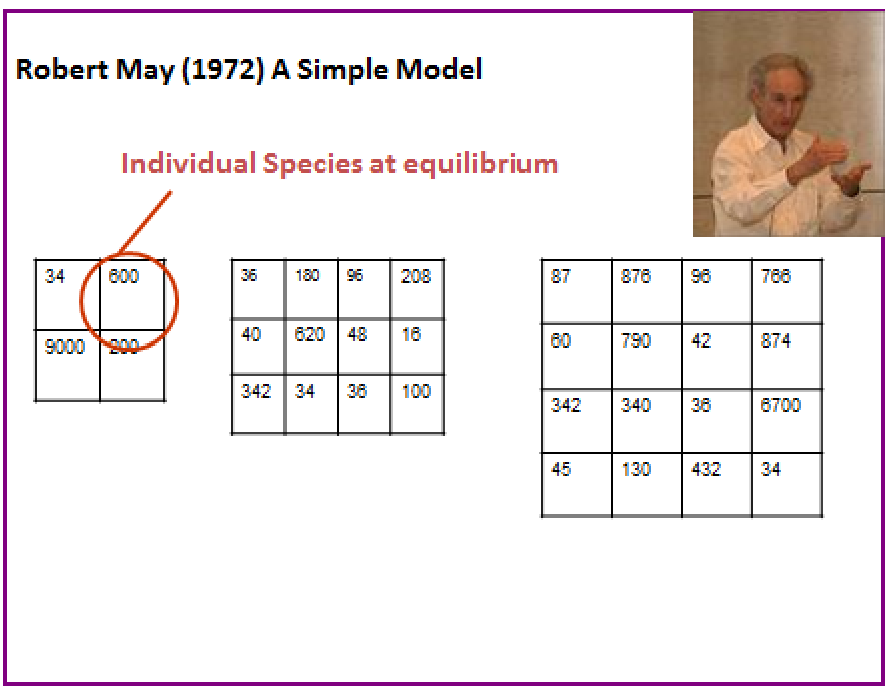
The concern is that we are all aware of cases where the ecoholist prediction seems to have come true. These are cases where a relatively small disturbance to an ecosystem had a profound and devastating effect. Perhaps the most popular examples involve so called *invasive* species. Cane toads were brought to Australia with the best intentions. Who could have predicted that, a few decades later, various reptiles, amphibians and even some mammals would be pushed to the verge of extinction by this rapidly expanding pest? Doesn't this tell us that ecosystems are highly interconnected?

No, I don't think it tells us any such thing. The moral we might draw from such invasions is that some species can have devastating effects on many others. This is better understood as a property of those species than it is a reflection of the ecosystems' overall interconnectedness. Cane toads and an exceptionally hardy species. They possess an efficient toxin that deters predation. They reproduce prolifically, develop quickly, and compete vigorously throughout their lives. The effects of Cane Toads on Australia can be understood, alas retrospectively, as being due to their particular efficiency as a colonizing species.

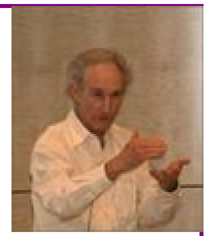
This brings me to the broader theoretical result that I discussed in class: Robert May's (1972) work on model ecosystems. This work is fairly detailed and it is not my aim to describe it in detail here. In a nutshell, here is what May found. He created a number of model ecosystems of different size and "connectance." Then he perturbed those model systems to see how they respond to small changes. I have attempted to depict May's studies in the diagrams below. Each matrix represents a community. Each cell in a matrix represents a population of size N. All things being equal, a given population is in an equilibrium state. So, if you were to disturb a population by increasing or lowering N, the population would return to its equilibrium level at a certain rate.

In order to determine the effects of connectedness on model ecosystems, May established positive and negative relationships among cells. A positive relationship is like a mutualism in nature, where increase in the abundance (N) of one species causes the abundance of another to increase. A negative relation is like predation, where increase in one species causes its "prey" to decline. May allowed that these connections could be relatively strong or weak. A weak relation meant that change in the abundance of one species has only a small effect on the change in another. Conversely, a strong relation meant that change in one species has a larger or more direct effect on the species to which it is linked.

May defined the "connectance" of a given ecosystem as a function of the number of connections multiplied by their strength. He represented this as a percentage of total connectance. So, a maximally connected ecosystem is 100%. The final step in his experiments was to vary the connectance level of different sized ecosystems. Then, May would perturb them by changing the abundance of a randomly chosen species, and see how long it takes for the entire system to return to equilibrium. Here is a cartoon diagram of the setup.



Robert May (1972) A Simple Model



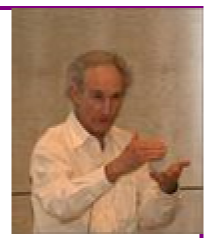
34	600
9000	200

36	180	96	208
40	620	48	16
342	34	36	100

87	876	96	766
60	790	42	874
342	340	36	6700
45	130	432	34

'Dependencies' (positive and negative)
of varying **strengths** and varying magnitudes.

Robert May (1972) A Simple Model

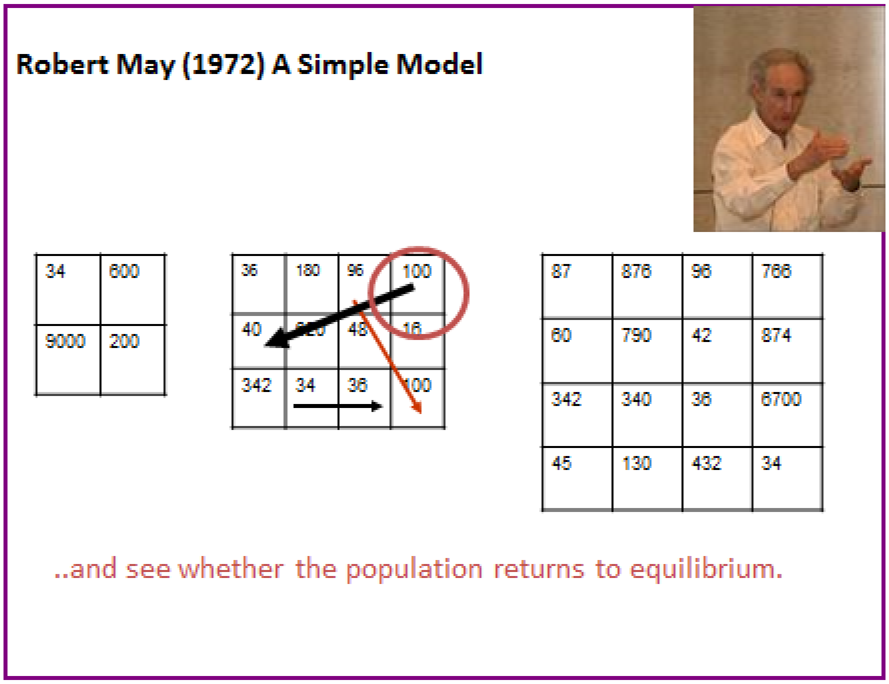


34	600
9000	200

36	180	96	208
40	620	48	16
342	34	36	100

87	876	96	766
60	790	42	874
342	340	36	6700
45	130	432	34

Then perturb the system at random



What May discovered came as a dramatic surprise to ecology. Rather than finding that connectance enhances stability, May found quite the opposite. A community of just 4 species becomes unstable at just 35% connectance. This means that the perturbation of a randomly chosen cell (spcies) tended to send the entire system into chaos. Other species never returned to their equilibrium points. At only 12 species, stability disappears at just 15% connectance. Larger communities were even less robust. This finding was important because natural ecosystems contain far more than just 12 species. Yet they rarely experience such dramatic collapse. The obvious conclusion seems to be that natural biotic communities are far less interconnected than anyone had previously supposed.

As with many theoretical results, what comes at first as a surprise can later seem rather obvious. In retrospect, we can easily understand that a higher degree of connectivity means a greater degree of fragility overall. Without a way to contain the effects of a change in one species, the effects would ripple continuously throughout the system. I say that this point is obvious in retrospect, but I sometimes wonder if contemporary society has really internalized May's insight. A quick glance at our economic systems seems to suggest otherwise. But that is a topic for another day.

The final piece of scientific evidence against ecoholism comes from the active field of paleo ecology. This sub-discipline of ecology uses pollen grains, fossil evidence, geological data, and other sources to reconstruct ecological systems over geological periods of time. As kricher explains in the reading for this week, there has never been a point at which North American deciduous forests were stable. As he puts it, the only constant factor is change. In the remainder of this lecture, I want to elaborate on some of the themes that appear in the Kricher article. I think that there is a deep lesson to be learned about the limitations of a human perspective on biological systems in general.

5. Rethinking essentialism about species

Let's begin by considering some of the reasons cited by John Kricher (1998) for rejecting the super-organismal view of ecosystems. He begins by noting that prior to Darwin, people viewed species as static or unchanging. This was due partly limitations in human experience. Most of us observe species over just a few years or perhaps decades, whereas noticeable change often occurs over millennia. I add the word "noticeable" here because scientists have begun to notice smaller evolutionary changes in certain species that can occur over just a few years. Many scientists are starting to revise previous ideas about the rate of evolution (see Jonathan Weiner's Pulitzer Prize winning book, Beak of the Finch for details). But most lay people are not so closely attuned to subtle kind of variation and change that takes place over generations. As a result of our human perceptual limitations, Kricher explains,

> the process [evolution] is non-intuitive, and thus the apparent stasis of species is largely illusionary. It is a matter of time scale, somewhat like watching an hour hand on a clock: it does not appear to move when watched constantly but only "moves" when examined at appropriate intervals. (1998, p. 166)

Kricher notes a further apparent similarity between species and ecosystems is that they seem to be in balance. It is a bit challenging to figure out what it means to say that a species is in balance. Kricher mentions the "complexity and adaptiveness" of species that was apparent to the Ancient Greeks (166). I think that Kricher is here referring to the Aristotelian idea that members of species have a common essence. On this view, each organism contains an inner set of instructions – an essence- that specifies its physical and behavioural phenotype. This is a bit like the contemporary idea of a genotype, which contains the "code" or "recipe" for building an organism. But with a very important difference: The idea of an essence is more rigid. It specifies the way that any member of a given species is "meant" to be. This is very different from the Darwinian view, where species undergo gradual change in response to environmental changes. To a Darwinian, it sounds odd to suggest that members of a species are "supposed" to take a particular form. What is this "supposed to" and where does it come from? We know that a species will be constrained to some extent by its ancestry. This is why bats, humans, and whales have the same number of bones in their forelimbs: because their basic body plans are derived from a common ancestor. Evolutionary ancestry constrains a lineage in the kinds of forms it can take, but it doesn't specify how they "should" look. Organisms also adapt to their environments. So, whales evolved flippers, bats evolved, wings, and so on. In a sense, we might say that these traits are "supposed" to perform certain functions. But this depends entirely on the environment that a population inhabits at a point in time. When the environment changes so do selection pressures. No species is "supposed" to look or act in any way because species lack an immutable essence. Aristotle was just mistaken about what species are.

There is second important difference between the Atristotelian (or essentialist) view of species and the Darwinian view that we now adopt. Kricher doesn't emphasize this point, but I consider it fairly important. Have you ever stopped to wonder why it took so long for humans to discover the principle of natural selection? People have been living with animals for millennia. We have been studying the seriously for centuries. But the principle of natural selection is barely 150 years old. How come it took so long?

Part of Darwin's discovery can be credited to a new way of thinking about the small differences that we often see among members of the same species- what biologists call phenotypic variation.. Prior to Darwin, phenotypic variation was viewed as a kind of corruption. It was due to the failure of an individual organism to fully realize its essential form. All organisms vary to at least some degree. Some zebras have longer manes, for example, or slightly longer legs than others. Occasionally those deviations are even more dramatic, like when an albino zebra is born without stripes. Aristotle would have seen these deviations, small or large, as deviations away from the ideal form that were due to its incomplete realization in matter. Basically, he thought of the zebra-form (the essence) as exerting a kind of force on the animal over the course of development. Typically the physical matter puts up only a small amount of resistance, resulting in small deviations from the ideal form. Occasionally, the whole thing really gets derailed, resulting in "monstrosities" like the albino zebra. As a result some individuals are closer to the ideal form (the way that they are "supposed" to be) than others.

This way of thinking was at the center of everyone's understanding of the biological world until Darwin came along, in 1859, and turned the entire picture on its head. At some point Darwin realized that variation is not to be seen as deviation away from some ideal type; *variation itself is the norm*. It is possible that he came to this realization as a result of his deep interest in barnacle morphology. Darwin was a keen student of barnacles. Whenever friends of his were to be travelling around England he would ask them to collect samples and to note the habitats from which they came. It soon became apparent that there is no such thing as "the" ideal type of barnacle. Members of the same species varied considerably. Moreover, Darwin observed that some of those differences were suited to the habitats from which they came. Barnacles collected from the outer coast were thick-shelled and squat, as one might expect in a habitat with considerable wave action. Specimens collected from calmer waters tended to be thin-shelled and much longer. This morphology is perhaps advantageous for an individual in a low-current environment. The point is that there is no such thing as an ideal barnacle or even a general shape that a given barnacle is "supposed" to take. Variation is the norm; ideal types are an abstraction.

Putting these ideas together, we can see that the essentialist picture is flawed in its basic ontology- that is, in its basic understanding of what a species is. It views species as static entities defined by a common essence that specifies how each individual's form. In reality, species are dynamic lineages whose change can only be understood by viewing them as populations of varying individuals.

6. Rethinking essentialism about Ecosystems

Returning to Kricher, we can now understand the origin of the balance of nature idea. The same essentialist story about species has been bumped up to the level of ecological communities. We thus tend to assume that ecosystems have been static. Or, at least that they were in a more or less static or "pristine" state prior to the arrival of humans. Large changes to the composition of an ecosystem are likewise seen as a form of corruption – a deviation away from the way it is "supposed" to be. Just consider the language people use to describe introduced species. They are usually described as “invasive” and this alone is usually presented as a reason for their eradication. We humans often see ourselves as both the source of corruption and as the agent of restoration, whose duty it is to return the ecosystem to its ideal state.

Kricher is critical of these ideals, associating them with a short-sighted and fictional understanding of nature. Following his lead, we can think of the temperate eastern North American forests over a geological time scale. Going back several million years, this region would have been covered mostly in cattails and other ferns. Reptiles and insects were the dominant fauna. A major asteroid collision caused severe disruption to this system. But this event also gave rise to mammals and flowering plants. Over the past few hundred thousand years, large glaciers have come and gone from the North American landscape. Each period would have involved a very different complement of plants and animals, first retreating from the onset of ice, then colonizing the swampy terrain as the glaciers retreated. Of course, some species adapted to the colder conditions, and they would have interacted with the colonizing plants and animals. At some point near the end of the most recent glaciation, humans arrived in North America. This caused another change to the landscape, with some species being cultivated and others driven to extinction. The past 15,000 or so years have seen several major waives of human migration to North America, each time involving certain modifications to the land.

The point is simply that at to stage in this process can we identify a static sate – a fixed point where the biotic community was fixed. Environmentalists, following Leopold, are often encouraged to see the most recent arrival of humans (this time from Europe rather than Asia) as the point at which things started to become unnatural. On this view, the state of North America prior to European arrival is arbitrarily chosen as the “ideal” or “pristine” state. How incredibly Eurocentric this view seems, when we view the region on a geological rather than a historical time frame. But aside of that, it is simply arbitrary to select any point in this process and call it “natural.” Ecosystems, like species, are dynamic entities constantly changing over time.

If this is true, then it would seem to likewise be mistaken to view modifications to an ecosystem as a form of corruption. If there is no ideal type, then there is no way that the community is supposed to be. The picture that begins to emerge is of a system that is constantly receiving new species, some of which have a larger impact than others. But there is no obvious room in this picture for the idea that some of those introductions are inherently destructive or bad. The removal of some species from an ecosystem is usually followed by the introduction of others. We have fewer bison in North America, but more cattle. We have fewer walleye in our lakes, but more rainbow trout. These are changes, the thinking goes, and change in ecosystems (like variation in species) is normal.

7. Conclusion

Biological communities, it seems, are not the only things that turn out to be less stable that we previously assumed. My sense is that most students take for granted that there is such a thing as the balance of nature. This concept serves for many of us as the magnetic north pole for our environmental moral compass. What does it even mean to suggest that this idea is just false?

This is perhaps the most challenging question that we all face as environmentally-minded thinkers. In the coming week, I will present two ways of reacting to the news that, according to ecological science, ecoholoism is grounded on an essentialist fiction. One response has been to turn against ecology. Indeed, one often finds among members of the contemporary environmental movement a certain distrust in science. Things are fine so long as science confirms what every environmentalist already knows that: human modifications to the environment are bad, usually having unexpected consequences on economically important species. But as soon as scientists report the opposite, that some human impact is benign or even beneficial, their work is viewed with the utmost suspicion.

After the reading break, we will be discussing in more detail the factors that contribute to public distrust in science, as well as those which help to build and maintain it. But before doing so, it is helpful to briefly mention an environmental movement which seems to have capitalized on this distrust. The discipline known as Deep Ecology is predicated on the assumption that first-hand experience, not science, is the more authoritative source of knowledge about the tree nature of biotic communities.