This paper is a "snapshot" of a work in progress: a progress report, with impressions and tentative conclusions based upon the research that has preceded, and with anticipations of work to come. Qua "tentative," I will set down here some ideas that are insufficiently documented and defensible for me to willingly send this out for peer review and publication. In a sense, these are "promissory notes" conveying an intention to supply supporting evidence and argument "to put up or shut up." To be sure, as research continues, these ideas will at the very least be refined, perhaps revised, while the possibility remains forever open that they might be abandoned. "Falsifiability" is both a basic criterion of scientific inquiry and a controlling disciplinary rule of my scholarly work.

I gratefully acknowledge the support of the National Science Foundation (Grant number: SES-9819617). The views and conclusions are those of the author.

1. Introduction.

2. Can Nature be Harmed?

3. Is Everything Natural?

4. Is Nothing (on the surface of the earth) Natural?

5. Defining "Wildness"

6. Values in Nature
1. INTRODUCTION

This research project began as an exploration of "the implications of disequilibrium ecology for environmental ethics and public policy" (the title of the project funded by the National Science Foundation). It expanded into an examination of a more fundamental underlying issue: the analysis of the concept of "nature" in general, and of ecosystems in particular, and the normative question of how natural areas and ecosystems might be "graded" as in some sense "better" or "worse" -- or, as some have put it, more or less "healthy," or "integrated."

The "grading" question is fundamental to environmental ethics and policy, for if ecology, ("disequilibrium" or otherwise), is to have "implications for environmental ethics and policy," it must offer insight and direction for policy decisions regarding, among many other things, resource management (e.g., of forests, wildlife and fisheries), wilderness preservation, and ecological restoration. Because these are all goal-oriented enterprises, evaluations of existing conditions and of end-state objectives are essential. Values are implicit in the identification of environmental "problems" and in the determination of success or failure in dealing with these problems. In particular, if ecosystems are deemed worthy of protection, or if damaged areas are judged to be in need of "ecological restoration," the evaluations of the ecosystems are implicit in the recognition of these policy issues, and in the assessments of the success of the policy implementations.

"Disequilibrium ecology," as some interpret it, might complicate these policy assessments. For if nature and ecosystems are in constant flux, then there would seem to be no optimal and identifiable "end states" of protection or restoration toward which management policy should be directed.

To take a familiar example, what condition of Yellowstone National Park should be worthy of "preservation," if the conditions are constantly changing? Is the "natural condition" best preserved by fire suppression or by fire tolerance? Is a "natural" ecosystem enhanced by artificially introducing wolves and grizzly bears, and is it damaged by allowing snowmobiles? Given the history of human impacts in the Park, and along its boundaries, is a "natural condition" at all attainable? In general, how is one to judge successful management of the ecosystem of the Park?

"Disequilibrium ecology," then, will be evaluated in the context of concept analyses and evaluations of the basic concepts of "nature," "wildness" and "ecosystems."
The reader’s journey through this essay might be made less burdensome if I were to offer, at this outset, a sketch of the destination.

About "Disequilibrium ecology."

- Disequilibrium ecology is much more a challenge to popular conceptions of ecology and ecosystems (held, for example, by environmental activists and some policy-makers), than it is an active controversy amongst trained ecologists.

- Ecosystemic "equilibrium" is (a) never perfectly exemplified in nature, and (b) is more likely to be found (imperfectly) as a second-order phenomenon.

- Were perfect equilibrium to exist in an ecosystem (which it never does), evolution would virtually cease.

- Were ecosystems totally chaotic, random and arbitrary, organisms could not survive -- hence, of course, no ecosystems.

- Disequilibrium is not chaos. Rather, it is wholly consistent with ecosystemic complexity and stability. Thus disequilibrium ecology need not undermine most varieties of environmental ethics or established environmental policies.

- Disequilibrium ecology must not be confused with "ecological nihilism" -- the assertion that life communities are without system, are chaotic, and are arbitrary.

About ecosystems:

- Ecosystems can be identified as more or less "healthy," according to identifiable criteria of "health."

- Ecosystemic "health" is analogous to the life sequence of a healthy human. Constant change in the first order: infancy > childhood > adolescence > maturity > old age. Stability at the second order: vital signs (temperature, blood pressure, blood pH, etc.) remain within strict limits, organs and immune systems remain fully functional, etc. Similarly, ecosystems can be said to remain "healthy" while undergoing constant change. Ecosystemic "health" is a difficult and highly controversial concept, which will be examined at length in this essay.

- The paradigm of a "healthy" ecosystem is a "natural" ecosystem in a climax stage (no anthropogenic influences past or present, with production and respiration equal and a rate of structural and functional change diminished though not static). The concepts of "totally natural" and "climax stage" are "ideal types" (like perfect vacuum and frictionless machine in physics) -- approximated but nowhere found in "the real world."

- Artificially affected ecosystems -- regenerated or restored or maintained -- can be evaluated as "healthy" or "unhealthy" to the
degree that they exhibit the qualities of mature "natural" communities -- sustainability, self-maintenance, self-repair, etc.

- Ecosystems can be graded better or worse, along several dimensions: aesthetic, ethical, economic, and intrinsic ("naturally"). "Ecosystemic health" is an empirical concept, based upon the model (above) of a natural ecosystem at climax stage.

- Ecology is more than a collection of particular "natural histories." It is a "loose science," grounded in exact sciences, and with a vocabulary of general concepts, with laws, with confirmable predictions, and with falsifiable propositions. (This issue was briefly dealt with in an earlier publication, "Reconstructing Ecology," and will be examined much more thoroughly in an expansion of this current essay).

- Therefore: what we do to ecosystems matters -- in ways that can objectively determined and evaluated. One ecosystem in not just as good as another.

- Environmental ethics and policy may be "grounded" in both scientific descriptions of ecosystems and ethical evaluations of ecosystems.

### 2. CAN NATURE BE HARMED?

Can natural areas be degraded, or conversely, can "damaged" areas be "improved" and even "restored" to a "natural condition"?

To both untrained ordinary citizens and professional conservation biologists, these questions are "no-brainers." Of course natural areas can be harmed. Life communities -- ecosystems -- can be judged to be "stable," "healthy," "integrated," and conversely, "endangered," "injured" and "disintegrated."

The very concepts of "environmental protection," "wilderness preservation," and "conservation biology" presuppose that environments -- ecosystems, landscapes, wilderness areas, lakes and rivers, the ocean -- can be judged to be in "better" or "worse" condition, and thus, in identifiable instances, worthy of "protection," or in need of "restoration."

It was once believed that "optimally natural" environments and ecosystems are, in their final "climax" stages, stable, balanced, capable of self-repair, and thus in a state of "equilibrium." This last concept, "equilibrium," means that once-disturbed, the system has the "internal mechanisms" to restore it to its previous condition.

As I will explain later in this essay, the concept of "ecosystemic equilibrium" survives in the literature and rhetoric of environmental activists, but not in the published work of the scientifically informed. Among professional and academic ecologists, the equilibrium paradigm has been almost universally rejected.

Examples of environmental destruction are apparent to any who pay even casual attention to national and world news.
The annual loss of tropical forests, the habitat of most of the earth's biodiversity, is estimated to be from 1% to 4% annually. The land thus acquired is useful for agriculture for 3 to 5 years, after which it is abandoned. In the Amazon forest, the soil is poor and most of the nutrients are contained in the abundant biomass. Thus after the forest is cleared and briefly farmed or ranched, the soil hardens to a brick-like laterite, and an empty wasteland remains.

The biotically abundant prairie in the mid-west United States was transformed in a few short decades into the desolate "Dust Bowl," and only with sustained effort and investment restored to productive agriculture.

Passengers flying over the Pacific Northwest will find a checkerboard pattern of forests and clear-cuts, the latter in various stages of recovery and regrowth. On close-up inspection, the clear-cut are found to be cluttered with snags, stumps, and brush.

Acid rain has severely reduced biodiversity of lakes in northeastern United States and in Eastern Canada.

In the Great Lakes, pollution from agricultural fertilizers, sewage, and numerous other industrial and residential sources, cause a "nutrient overload" which in turn causes algae blooms followed by decomposition by anaerobic bacteria. The resulting loss of dissolved oxygen makes these areas uninhabitable by fish and other aquatic life.

The Aral Sea of central Asia, which once supported a thriving fishing industry, has shrunk to a third of its original size and is barren. A desert of salt-tolerant grasses now grow on what was once the lake-bed.

The hills of Lebanon, on which the fabled cedars of Lebanon once grew, are now barren. The Mediterranean shore of North Africa, the orchards and fields of which once exported food to the Roman Empire, are now deserts.

In all these cases, and many more, thriving ecosystems have been destroyed and replaced by simpler and less abundant ecosystems.

In all these cases, and many more, most individuals would observe that nature (or "the environment") had suffered a loss, and that the areas described deteriorated into a "worse" condition.

How could anyone conclude otherwise? And yet, it appears that some do.

Consider the comments to two respected eco-philosophers:

"Nature, having neither design nor direction, is not the sort of thing that can suffer harm." (Mark Sagoff)

[N]ature is going nowhere, has no "integrity" or "well-being" of its own, and is utterly devoid of any meaning, order, purpose, or
end. ... Nature does not know ...and Nature does not care. (Sagoff)

"It is not clear (apart from human interests) how we ought to define the good for ecosystems... [It] would be very difficult, in every case, to specify purely ecological or solely non-anthropocentric, criteria for praising or blaming moral actions that have effects on ecosystems." (Kristin Shrader-Frechette)

Does it then follow that ecosystems can not be "harmed," for example, by the introduction of virulent exotic species, such as the zebra mussels to the Great Lakes, the Chestnut blight to the eastern hardwood forests, water hyacinth to the Florida rivers, rabbits to the Australian outback?

All these caused profound and irreversible changes to the ecosystems. But can they, in any sense, be said to have "harmed" these systems themselves -- apart from how they might have harmed human interests in these systems?

Further: Was the ecosystem of Prince William Sound in Alaska "harmed" by the Exxon Valdez oil spill of 1989? Or was it merely "changed" to a different system? Can the ecosystem of the Arctic National Wildlife Refuge (ANWR) in any sense be "damaged" by oil exploration and extraction, which admittedly will permanently alter the permafrost under and alongside the construction, and will significantly disrupt the migration routes of caribou and wild birds? Or would such exploration merely replace one ecosystem with another -- neither better or worse, since, as alleged above, ANWR, as a "natural" area, is not the sort of thing that can suffer harm." (Sagoff).

On the other hand, if, as is generally (if intuitively) believed, ecosystems can be "harmed," in what sense can they be "harmed" -- i.e., what are the criteria of "ecosystemic harm?" In other words, how are we to distinguish ecological "harm" from harmless ecosystemic change?

Conversely, if a project is undertaken to "restore" a damaged ecosystem to a "healthy" (or "integrated") state, what constitutes success or failure in such an enterprise?

Underlying all such questions is the foundational issue: can natural ecosystems be recognized, and can they be "graded" -- i.e., evaluated as "better" or "worse" -- in terms of their identifiable characteristics, and not merely in terms of the human "uses" that might be gained from them.

Must ecosystems be static, "settled" and in equilibrium to be valued, or are they of less (or even no) value if they are in a state of constant flux and disequilibrium.

These questions, and challenges, strike at the very heart of environmental activism, ethics and public policy.

As I have noted above, it is easy to recognize, to our personal satisfaction, "better" and "worse" states of nature -- "healthy" and "disturbed" ecosystems -- success and failure in "protecting the environment," "preserving wilderness," and "restoring" damaged areas to their "natural" condition. However, giving an explicit account of "better" and "worse," which is to say, the "good" for natural areas and systems, is quite another matter.
As Ludwig Wittgenstein observed, we are all too often capable of using words "correctly" without being able to define them. A paradox to be sure, but nonetheless true. We easily speak of "virtue" and "justice" and "loyalty" and "beauty" and the like and are readily understood. And yet when asked to define these words, we soon find ourselves deep into perplexing philosophical reflection. Plato attempted in his dialogs to define all these concepts and many more. Philosophers ever since have carried on Plato's quest, indicating that none have come up with compelling and final answers.

Similarly, the task of supplying an analysis (i.e., a list of defining characteristics) of such concepts as ecosystem "health" and "integrity," or even the concept of "nature," will not be an easy task, even though we freely use these words in conversation and are generally well-understood when we do.

We begin with an examination of the concept of "nature."

3. IS EVERYTHING NATURAL? 1

"Nature changes the environment every day of our lives - why shouldn't we change it? We're part of nature." (173) This remark of Floyd Dominy (ex-Commissioner of Reclamation), recorded by John McPhee in his book, Encounters with the Archdruid, typifies an evasion familiar to most environmental activists and scholars. "Human beings are natural," goes the argument, "therefore everything humans do is 'natural.'" It then follows that human projects cannot "harm nature," and thus the qualms of the environmentalists are without meaningful foundation.

No less an environmental philosopher than Baird Callicott has been enticed by this ploy, as he writes: "we are part of nature, so our recent habit of recycling sequestered carbon [i.e., through the consumption of fossil fuels] is not unnatural." (In fairness to Callicott, we must also note that he acknowledges that some human interventions in "nature" are clearly immoral).

In an identifiable sense of the word "natural," both Dominy and Callicott are entirely and indisputably correct. But this is not the only, or even the most relevant sense of "natural" found in environmental debates. And this equivocation is at the root of a great deal of rhetorical mischief in environmental debates and policy.

The sense of "natural" apparently intended by Dominy and Callicott in the above citations is this: "a condition in accordance with natural law." By implication, "unnatural" can only mean "contrary to natural law," which is to say physically impossible. (When a scientist encounters a validated "exception" to an assumed "natural law" he has in fact proven that the putative "law" was no such thing).

It follows, as Dominy suggests, that everything that human beings create and do is "natural," including transuranic elements, DDT and chlorofluorocarbons, atomic reactors, genetically modified organisms, exponential population growth, etc. The "unnatural" includes perpetual-motion machines, time travel, faster-than-light velocities - unless and until, that is, these sci-fi notions are found to be possible, whereupon they are acknowledged to be "natural."
"Artificiality" is thus abolished by semantic fiat, and with it all cause for concern about the warnings of the environmentalists. "If it can be done, go ahead and do it - don't worry, be happy, after all it's natural." To repeat Dominy's cheerful reassurance, "nature changes the environment every day of our lives - why shouldn't we change it? We're part of nature."

This argument, which I have heard from numerous students throughout my thirty years of teaching Environmental Ethics, has a superficial plausibility, accompanied by a suspicion that there is some sort of logical hocus-pocus at work at a deeper level.

There is indeed, as I now propose to explain.

The "all-is-natural" argument is reminiscent of another, familiar to most students who have taken an introductory course in ethics: psychological egoism. This theory is simplicity itself: All human action is selfishly motivated. The immediate rejoinder is obvious: what about saints and heroes? - what about the soldier who falls on a live grenade to save his buddies, or of a Martin Luther King or Mohandas Gandhi who willingly accept imprisonment? Surely their voluntary acts were not selfish!

"Oh yes they were," replies the psychological egoist. "King and Gandhi and all the rest, did what they did because they wanted to - these were their preferences."

The dissolution of this nasty bit of sophomore ideology is simple: the maxim, "all voluntary human acts are selfishly motivated" is "true" because it is a plain tautology - i.e., it is "true by definition," and thus devoid of any empirical content. "Selfish motivation" is defined by the egoist as equivalent to "preferred by the agent" which is equivalent to "voluntary." Ergo: by substituting equals with equals, we find that psychological egoists simply state that "all voluntary acts are voluntary." Big Deal!

The capper then is straightforward: Ask the psychological egoist, "if what you say about human motivation is true - 'all acts are selfish' - then what would it be like, contrafactually, to encounter an unselfish act?" If, as we contend, psychological egoism is a tautology, there is no answer to that challenge because the theory is empty of empirical content. In other words, because all imaginable behavior is so indicated (denoted), no particular behavior is described (designated). In the jargon of the Philosophy of Science, Psychological Egoism is empirically meaningless because it fails "the falsifiability test."

The crucial challenge to the egoist is this: "what is to be gained, and what is to be lost, by abolishing the distinction between "selfish behavior" and "unselfish behavior" Do we gain or lose moral insight by examining and contrasting, for example, the motives and behavior of a self-serving scoundrel on the one hand, with lives and ideals of saints and heroes on the other hand? I suggest that if the lives of Buddha, Jesus of Nazareth, Galileo, Jefferson, Gandhi, King, Mandela, Sakharov and endlessly more, have nothing to teach us (since, allegedly, their lives were entirely "selfishly motivated"), then we are in a sorry moral state indeed.

(Incidentally, "psychological egoism" is not a mere ideological curiosity, of interest only to Philo.1 students and their professors. It has, in fact, infected and captivated much of a major academic discipline, "neo-classical economics," and through it much of public policy theory.) (See my
Time now to "cash in" our comparison between psychological egoism ("all human motives are selfish") with the naturalism evasion ("all human activities and products are natural").

In a similar mode, we should ask such technocrats as Floyd Dominy, "what is to be gained by abolishing the distinction between "artificial" (conditions and substances of human origin) and "natural" (conditions and substances not of human origin)?" Granted, all human acts and products are "natural" in the sense of being constrained by natural law (call it "natural_1"). But within this category of "all-things-possible" there is a distinction, essential to science, technology and public policy, not to mention common sense - a distinction between conditions and substances of human origin (e.g., antibiotics, genetically modified organisms, nuclear waste, CFCs, etc.) and conditions and substances not of human origin (e.g., old-growth forests, plate tectonics, solar flux, DNA, thermodynamic laws, etc. - call it "natural_2").

"All human acts and products are natural" is true - but trivially true, if it is understood to mean "constrained by natural law" (i.e., physically possible). But it is a mischievous truth if it leads us to overlook another sense of "natural," namely "not of human origin."

It is true that Dominy's triumph, Lake Powell of the Colorado, along with genetically modified organisms and atomic power, is "natural_1"). So too was the Black Plague which consumed one third of the European population, as well as any and every ecological devastation that we might bring upon ourselves and our planet. If, like the dinosaurs, we are annihilated by a collision with a comet or asteroid, this too will be a "natural" event. "Natural_1" makes no moral or value distinctions.

It is within the semantic domain of this second sense that the environmental scientists and activists make their warnings - the sense that utilizes the familiar distinction between the artificial ("of human origin") and "natural_2" (not of human origin). With this essential distinction as part of our conceptual arsenal, we can meaningfully raise questions about the practical and moral implications of our "artificial" interventions in "nature_2," and thus make informed choices among the alternative futures before us.

Environmental scientists tell us that global population growth, atmospheric carbon loading, loss of biodiversity and tropical forests, are all proceeding at unsustainable rates. All this activity is "natural_1" - namely, according to natural law. But are these anthropogenic alterations any less worrisome, if we choose to ignore the common-sense "natural/artificial" distinction?

These interventions are no less worrisome to informed and morally concerned earth-citizens, well-aware that "artificial" interventions into, and alteration of, the natural order that created and sustained us, are qua "artificial" our moral responsibility.

4. IS NOTHING (ON THE SURFACE OF THE EARTH) NATURAL?
The very idea seems outlandish on its face. And yet, on reflection, it is not easily dismissed.

The contention that there is nothing natural on the surface of the earth follows directly from the assertion that the earth's atmosphere is not "natural" -- that it is an artifact. And if the atmosphere is an artifact, then so too is climate. Thus, if that "artificial" atmosphere touches and interacts with the entire surface of the earth, then nothing on that surface is entirely "natural."

What, then is "natural?" Isolated ecosystems at the thermal vents at the deep ocean floor are completely natural. Strata below the surface of the earth are natural. Events totally independent of human control -- e.g., earthquakes, tsunamis, volcano eruptions -- are natural.

But life forms and life communities at the surface? None of these are "totally natural."

This, briefly, is the contention of Bill McKibben in his popular book *The End of Nature*.

In the years since the Civil War, and mostly in the years since World War II, we have changed the atmosphere -- changed it enough so that the climate will change dramatically... [Formerly] man's efforts, even at their mightiest, were tiny compared with the size of the planet -- the Roman Empire meant nothing to the Arctic or the Amazon. But now, the way of life of one part of the world in one half-century is altering every inch and every hour of the globe. (45-46)

The atmosphere an "artifact?" How can this be? This is so, simply because industrial civilization has changed the chemical composition of the atmosphere. The amount of CO$_2$ in the pre-industrial atmosphere is believed to have been about 280 parts per million. Today it is in excess of 370 ppm. Methane, a greenhouse gas more than twenty times more potent than CO$_2$, has increased in concentration from 730 parts per billion in 1750 to 1843ppb in 2003. Add to that chemicals unknown 250 years ago, notably the ozone depleting chloro-fluorocarbons (CFCs).

Not even the oceans are unaffected, for ultra-violet radiation, increased by ozone depletion, is deleterious to phytoplankton, the base of the oceanic trophic pyramid.

Accordingly, McKibben concludes:

> The idea of nature will not survive the new global pollution -- the carbon dioxide and the CFCs and the like... We have changed the atmosphere, and thus we are changing the weather. By changing the weather, we make every spot on earth man-made and artificial. We have deprived nature of its independence, and that is fatal to its meaning. Nature's independence is its meaning; without it there is nothing but us. (58)

"Every spot on earth man-made and artificial?" Perhaps, but equally so? Does the "touch" of the artificial atmosphere render every spot on earth totally artificial -- just as the law of the State of Mississippi once classified as "negro" anyone with "a drop of negro blood" (i.e., any negro ancestry whatever)?
Surely not. The center of the Amazon rain forest, the tundra of the Arctic National Wildlife Reserve, the interior of the Australian outback -- all these are surely more "natural" than an abandoned and eroded farm in southeastern United States, a clear-cut forest in the Pacific Northwest, or the saline wasteland that was once the lake-bed of the Aral Sea.

Totally pure and pristine nature is gone -- the artificial atmosphere and climate have accomplished that much. In that "wildest" of regions, the central Amazon forest, the increased atmospheric carbon dioxide has variously altered the growth rates of the flora, resulting in a different composition of the forest community. So too the altered acidity of the rainfall and the changes in numbers and types of the in-migrating and colonizing species -- changes brought about by advancing edge of deforestation and settlement.

And yet it is surely more "wild" than the cut, tilled, and abandoned laterite wasteland beyond the forest border, that was once a part of that forest.

By identifying all of the earth's surface as "equally artificial," we stipulate the abolition of a concept and a distinction that is essential to science, public policy, and ordinary discourse. (Not unlike the abolition of the concept of "artificial" by stipulating that "natural" is to mean according to natural law. See above).

Far better that we treat "artificial" and "natural" as end-points of a continuum. McKibben's point, then, is that the extreme totally "natural" end of that continuum, due to the consequences of industrialization, no longer exists on the face of the earth.

Nonetheless, landscapes and ecosystems can be more or less "natural" -- or, as I would prefer now to call it, "wild."

Our next task, then, is to present and defend criteria of "wildness" -- properties by which we might assess the degree of wildness of a landscape, region, or ecosystem.

My proposal will be startlingly obvious, even simple-minded. But I can think of nothing better.

5. DEFINING "WILDERNESS"

Based upon what we know from the physical and life sciences:

A wild area is a place where natural forces are allowed to act and evolve, undisturbed by artificial interference.

By "natural forces" I mean action describable by innumerable physical and chemical laws: gravity, precipitation, erosion, oxidation and reduction, the conduction, convection and radiation of energy, and most fundamentally to life, photosynthesis.

The solar flux provides abiotic energy and its consequences: wind, precipitation, flowing and collected water (streams and lakes). Photosynthesis provides "life energy" -- by which, I urgently add, I do not mean a Bergsonian elan vital. I posit no metaphysical entities. "Life energy" is nothing more than solar energy captured by photosynthesis and...
bonded into complex organic molecules -- combining the simple molecules of free oxygen, free nitrogen, carbon dioxide, water plus other elements from the atmosphere, soil and water (in solution or suspension) into hydrocarbons which "fuel" the trophic pyramid that rises "above" basic biotic "production" -- the "producers," which feed the herbivores, then the primary carnivores, then the higher-order carnivores, then the decomposers, back to the producers.

The fundamental distinction between abiotic activity and biotic activity is that the former is entropic and the latter is negentropic. Abiotic activity leads to chemically simple and "probable" substances -- it is entropic. Biotic activity produces chemically complex and improbable substances -- it is negentropic. (An apparent exception: atmospheric nitrogen and oxygen, biotic products, are both the simplest forms of these elements and improbable -- their "natural tendency" is to combine with other elements. These free elements exist in the atmosphere as both the byproducts of and the resources for biotic activity). Biotic substances, and the energy contained within, fueled by the solar flux and fed by chemical nutrients, evolve into ever-more complex and improbable life forms and life communities. Life, in short, is an "entropy pump" and life communities are "entropy eddies," locally reversing the universal entropic flow toward disorder and "heat-death."

The energy in ecosystems "drives" the system toward complexity. This phenomenon is evident in all regions that recover naturally from devastation, for example from fire, flood (tsunami), or volcanic eruption. Complexity and diversity are the result of the struggle for survival, as organisms evolve or immigrate to occupy and sometimes create viable niches (ecological functions). Failing that, they become locally extinct. The proliferation of ecological niches, and reciprocally of species, manifests the negentropy -- the evolution from simplicity to complexity, from probability to improbability -- that is driven, ultimately, by the energy of solar radiation.

Regions that are recovering from catastrophic "setbacks" (fire, flood, earthquakes, volcanoes -- very rarely, asteroid impacts) pass through a succession of staged development to achieve a stable and persistent state, called a "climax" stage, at which the pace of further evolution of the ecosystem composition and structure would radically diminish -- given, of course, constant climate, no migrations, and no further natural disruptions. But, as disequilibrium ecologists persistently and correctly remind us, these "constants" never occur in nature. Thus, like the concepts of perfect vacuum and absolute zero in physics, the "climax stage" is an "ideal type" -- a theoretical abstraction, possibly approximated but never fully achieved in nature.

And why do these natural forces, in various chemical (nutrient) and climatic environments, develop in one direction rather than another? Why deserts rather than hardwood forests in Nevada? Why prairie rather than desert in South Dakota? Why forest rather than prairie in Amazonia?

Were mankind not to interfere, what life community (rather than another) might arise from the lateritic wasteland at the exploited and abandoned outskirts of the Amazon forest? What life communities might similarly arise from artificial wastelands of the Pacific Northwest clear-cuts, and the similar and adjacent natural wasteland of the north slope of Mt. St. Helens?

Given the climate, geomorphology, and available nutrient resources of a region, what options of community development are open, and what other
options are closed -- and for what reasons? Just what is the meaning of "community development"? Presumably, this would include proliferation of life forms, patterns of interaction (competition, symbiosis, co-evolution, etc.), paths of energy flow and nutrient recycling.

These questions suggest a response to those who are disinclined to regard ecology as a science.

The foundational "natural forces" are described and measured by the "exact" sciences of physics and chemistry. Photosynthesis is similarly studied by the science of biochemistry.

Ecology is the study of the life communities: of the life forms that proliferate from the base of photosynthesis and that interact with each other and with their abiotic environment. The above phrase, "rather than another," indicates that ecological science is comprised of falsifiable propositions -- a logical requirement of all empirical science. Generalizations ("law-like statements") drawn from field and laboratory studies, that simultaneously describe and exclude conditions in life communities, predict confirming or refuting conditions in unexamined communities. (For more on "falsification" and the scientific status of ecology, see my "Reconstructing Ecology").

Thus, for example, ecological science can predict the succession of life communities that will take place on the devastated northern slope of Mt. St. Helens, given a constant climate. But how was an account of this particular succession arrived at? This was accomplished by examining the stages of restoration found today on the slopes of other Cascade Range volcanoes, the past eruptions of which are accurately dated by volcanologists. And how is this account of ecological succession at Mt. St. Helens confirmed when, in fact, it must take place over many centuries? By predicting what sequences will be found in other, yet unexamined, successional sites, as well as by "paleo-ecological" examination of soil strata -- some, no doubt, at Mt. St. Helens, which will yield evidence of successions following previous eruptions. (For an outstanding example of paleo-ecological study of succession in the Boundary Waters region of Minnesota/Ontario, see Daniel Botkin's "Discordant Harmonies.").

6. VALUES IN NATURE.

We digress now to examine the problem of the status of values in nature. The product of this analysis will have bearing upon the later development and the conclusion of this essay.

Because I have published elsewhere an argument in support of my position on "natural axiology," I will let a brief, and essentially undefended, statement of that position suffice.

To the familiar question, "are values in nature objective or subjective," my answer is "not one or the other, but both." Values in nature arise out of transactions between subjective "evaluators" and the natural objects of evaluation. Qua "subjective," there are no values without an evaluator. (The evaluator must be minimally sentient, while an evaluator that is sentient, conscious and reflective has a vastly larger inventory of values). Qua "objective," values in nature are discovered, not invented. (But not all values about nature. Arguably, aesthetic values are largely, and possibly is some instances entirely, subjective. But aesthetic values are not the
Natural values are thus similar to Lockean "secondary qualities" such as color, or taste. The perception of blue requires both an "objective" propagation of light waves (4700-5100 Angstrom units), and a "subject's" normally functioning retina and brain. Absent the "subject," there is no color blue. Absent the light waves of the prescribed wave-length, there is no perception of blue. The subjective component of "blue" does not allow the subject to "will" the perception of another color. Ask someone (with normal color perception) to bring you the only blue book in the next room, and you will get what you asked for. Natural values (some at least) are like this: once again, they are discovered, not invented, yet they presuppose a subjective evaluator.

The implications of this axiological theory can be disquieting to an environmental ethicist (as, quite frankly they were to me -- and still are). It suggests that we can be totally indifferent to the fate of an undiscovered planet, teeming with life that is entirely insentient; similarly, that the fate of the earth, once sentient life has departed, need be of no concern to us.

Suppose, for example, due to nuclear war or a pandemic, all sentient life disappears from the face of the earth. Does it matter that great cultural and architectural treasures, like the Taj Mahal, will fall into ruin? Those who are discomforted by such a thought, "cheat" by importing themselves into the landscape through their imaginations. But the ghostly presence of the hypothetical evaluator evokes, not value, but "hypothetical value." The transactionalist view that I accept insists that we take the stipulation and challenge seriously: no sentient or intelligent beings are to observe or be affected by these events or circumstances. In such a case, do values apply? To whom? If values are alleged to "apply," but to no one, then just what might this mean? Can we make sense of this assertion?

In defense of objective, "inherent" (and subject-less) values, Tom Regan cites the example of a gardenia:

A luxuriant gardenia, one with abundant blossoms and rich, deep, green foliage is a better gardenia than one that is so deformed and stunted that it puts forth no blossoms at all, and this is quite independently of the interests other beings happen to take in them. 11

If the flower in question is to be found in a florist shop, it is worth noting that it is an artifact -- an artificial creation, by a botanist, "assembled" from natural (genetic) "media," and designed to appeal to human tastes. As such, the "better" gardenia must mean "better for us," since we (or better, "our horticulturists") selected these qualities for us. Another plant with less blossoms and foliage might produce more pollen -- better for a bee. Or more seeds -- better for a finch. It might be "better for" the gardenia and/or its species (whatever that means) if it were allowed to go to seed and reproduce!

And would this cultivated plant survive in the wild as well as it's wild relatives? Probably not. Does that mean that it is not, after all, a "better gardenia"? Note that these alternative "evaluations" apply differing contexts to our analysis of the gardenia "per se." Without context, and a relatum, it just makes no sense to talk of something as blankly "better."

Summing up: The issue in question amounts to this: Does nature, by itself, have value? Can there be "natural values" without at least a sentient, and
better still a personal, evaluator? But when someone asks: "Does nature, ‘by itself,’ and/or apart from persons or sentient beings, have value significance?", the next, crucial responsive question might be: "Who Asks?! Of course a person asks. That the question of "the inherent value of nature" be asked at all means that a person is part of the landscape, if only in imagination. In a sense, then, inquiring, morally conscious persons have a "Midas touch" in that by simply inquiring about the value significance of an object or a landscape, that object or landscape gains at least potential value significance -- whether the inquiry by a potential beneficiary, or simply by a disinterested "value spectator."

In a direct response to my paper, "Values in Nature," Holmes Rolston writes:

Partridge has a light-in-the-refrigerator theory. Nothing inside is of value until I open the door and the light comes on. Put a little differently, we humans carry the lamp that lights up value, although we require the fuel that nature provides. In Partridge's metaphor, humans have "the Midas Touch;" nothing is worth anything until our touch turns it into gold. Actual value is an event in our consciousness, though natural items while still in the dark of value have potential intrinsic or instrumental value.... But in nature a great deal is going on in the dark, outside of our evaluating consciousness...

The "no value without a valuer" account can seem persuasive, just as there are no thoughts without a thinker, no tickles without somebody there. The claim is indeed true of some kinds of value. But values are not always felt, unlike tickles; and values do not always have to be thought about. Insentient organisms are the holders of values, although not the beholders of value.

I replied that I have rarely felt more troubled while composing a paper, than I felt while at work on "Values in Nature," for that analysis of the concept of "value" led me toward a conclusion that I dearly wished to avoid, and away from positions that I cherished -- positions defended and expounded by first-rate eco-philosophers such as Holmes Rolston.

And yet, how could I make any sense of a "value" without an "evaluator" that was in any significant sense different from a simple "property"? Try as I might, I could not. And so, what remained was a steadfast attempt to avoid the traps of anthropocentrism and subjectivism that seemed to be entailed by the [transactional view] to which my argument apparently led me. If I was to avoid those "traps," it would be by insisting that a sentient "evaluator" was not the center of evaluation but rather a necessary ingredient thereof; in other words, that nature is indeed rich in valu-able things, properties, potentialities and events, ready to be discovered -- all of great worth, once an evaluator enters the picture, even if only hypothetically and in contemplation.

If values in nature are as I describe them, then they exist all around us, in (by definition) all the nature that we can ever encounter, think about, imagine and cherish. What more value could we possibly need to totally involve our environmental concern, our commitment, and our love?

7. ECOSYSTEMIC HEALTH

What word might best apply to an ecosystem that is stable, robust, and...
sustainable -- albeit (as disequilibrium ecologists insist), in constant flux?

In addition to the words just enumerated ("stable," "robust," "sustainable"), the words "integrity" and "health" have been suggested. Of these, "health" appears to have "caught on" more than the others, and so I will use it.

In June, 1994, a meeting was convened in Ottawa, Canada, to examine the concept "ecosystem health." The gathering of nearly 900 individuals included scientists, policy makers, and resource management professionals. Not surprisingly, they conference did not come up with a clear and unanimous agreement as to the meaning of "ecosystem health."

The following year, the journal *Ecosystem Health* commenced publication.

As Kristin Shrader-Frechette reports, while ecosystem health "is an important policy concept" there are several reasons while it will not do as a scientific concept. She continues:

... ecologists cannot specify a precise reference point against which to measure loss of ecosystem health. Also, because there is no precise consensus on what constitutes vital signs of ecosystems, there are no agreed-upon state variables and therefore no simple rigorous models for measuring the ecosystem health.

Obviously, it is unclear whether ecosystem health can be applied to the precise degree that some scientists and policymakers would like. Consensus is not yet possible, in part, because there is disagreement about the extent to which ecosystem health is a qualitative as well as quantitative concept, art as well as science. (457).

As Shrader-Frechette suggests in her critique of Westra's similar concept of "ecosystem integrity," the concept of "ecosystem health" suffers from the problem of "stipulation. Ask a few ecologists, or resource managers, or educators, or activists, how they would prefer to define "ecosystem health," and you would get as many different answers, likely more or less drawn from a medical analogy of personal health. And, of course, there are no available "objective" grounds for choosing among these stipulations.

Here is a sample of some of those stipulations.

Ecologist, James Karr:

Webster's dictionaries define health as a flourishing condition, well-being, vitality, or propensity. A healthy person is free from physical disease or pain; a healthy person is sound in mind, body, and spirit. An organism is healthy when it performs all its vital functions normally and properly, when it is able to recover from normal stresses, when it requires minimal outside care. The country is healthy when a flourishing economy provides for the well-being of the citizens. And environment is healthy when the supply of goods and services required by both human and nonhuman residents is sustained. Health is short for "good condition." (Karr, 211).

A biological system, whether individual or ecological, can be considered healthy when its inherent potential is realized, its condition is stable, its capacity for self repair when perturbed is preserved, and minimal external support for management is
Bryan Norton:

...an ecological system has maintained its integrity -- a stronger concept that includes the conditions of health -- if it retains (1) the total diversity of the system -- the sum total of species and associations that have held sway historically -- and (2) the systematic organization with maintains that diversity, including, especially, the systems multiple layers of complexity to time.

Complexity is directly related to self-organization, and these characteristics are the essence of ecosystem health and integrity.

Finally (and my favorite), Robert Costanza:

An ecological system is healthy and free from "distress syndrome" if it is stable and sustainable -- that is, if it is active and maintains its organization and autonomy over time and is resilient to stress. Ecosystem health is thus closely linked to the idea of sustainability, which is seen to be a comprehensive, multi-scale, dynamic measure of system resilience, organization, and vigor. This definition is applicable to all complex systems from cells to ecosystems to economic systems (hence it is comprehensive and multi-scale) and allows for the fact that systems may be growing and developing as a result of both natural and cultural influences. According to this definition, the diseased system is one of that is not sustainable and will eventually cease to exist. The time and space frame are obviously important in this definition. Individual organisms are not sustainable indefinitely, but the populations and ecosystems of which they are apart may be sustainable indefinitely. Distress syndrome refers to the irreversible process of system breakdown leading to death. To be healthy and sustainable, a system must maintain its metabolic activity level as well as its internal structure and organization.

Prominent in my definition of a "healthy ecosystem" would be these properties: self-organization, self-repair, self-maintenance, robustness (strong defense), stability and sustainability.

But which to choose? They are all, as noted, stipulations -- personal preferences.

Perhaps our elaborated account of "wildness" might provide an empirical grounding, with which we might sort these out and identify the most prominent criteria, or "markers," of ecosystem health -- the means, that is, by which we might "diagnose" the state of health of "disease" of the next ecosystem that we encounter and study.

I propose, then, that we call "ecosystemic health" the condition attained by natural ("wild") ecosystems (with no anthropogenic influences, past or present), at the "climax" stage (production and respiration equal and a rate of structural and functional change diminished though not static), in a constant abiotic (climatic and geomorphological) environment. Once again, these are "ideal types," approximated but never fully attained in the natural world.

Given this "model" of ecosystemic health, "the stipulation problem" is
avoided, as the question of additional characteristics -- complexity, robustness, stability, inter-relatedness, etc. -- becomes an empirical question: Do these "wild" areas have these putative additional qualities, or do they not?

How then are we to evaluate the "health" of artificial ecosystems -- in particular, three types of artificial ecosystems:

- **Recovered**: The area has been severely damaged by human activity, and is allowed to regenerate undisturbed, as natural processes "take over." (Examples: Abandoned and eroded farms in temperate climates, forested tropical agricultural plots that "give out" and are abandoned, some clear-cut forests).

- **Restored**: The damaged area is "nurtured," as species are "planted" and successional stages "sped up." (Examples: other clear-cut forests and abandoned farms, "dust-bowl" prairie regions).

- **Managed**: Areas maintained in a steady state by human interventions. (Examples: farm wood lots, some national parks).

Such systems can be judged to be "healthy" if they exemplify conditions, noted above, that are found in natural ecosystems.

However, there is a paradox here: "natural recovery" and "natural restoration" might be impossible, due to area and boundary conditions. For example, mega-fauna (large top carnivores, such as grizzly bears and lions, or large ungulates such as moose) can only survive in expansive habitats. In addition, the boundaries of the area may be settled, and may contain exotic species that "invade" the protected area. (Yellowstone Park is an excellent example).

Thus, although "self-management" is a condition of paradigmatic "wild ecosystems," managed introduction and protection of some species, and managed culling of others, may be necessary to maintain an apparently "wild" ecosystem.

But would this be "wild," or merely what Robert Eliot calls a "faking" of wildness.

This opens large bundle of issues, which I can't explore here. Perhaps later, as this project develops.

**8. THE CHALLENGE OF "DISEQUILIBRIUM ECOLOGY"**

It is past time to identify "disequilibrium ecology."

We might best approach this task by identifying the polar opposite concept: "equilibrium."

In the simplest terms, a system in "equilibrium," when disturbed, will return to its condition prior to the disturbance. By implication, an "equilibrial" system contains self-correcting and self-repairing mechanisms.
The simplest example of an equilibrium would be a ball-bearing in a bowl. At rest, the ball is in the center. When jostled, it moves off-center, only to return to the exact same spot where it was before the disturbance. The shape of the bowl is the "self-correcting mechanism."

Another example: The dyadic thermostat-furnace system. The sequence is both simple and familiar: furnace heats the air > thermostat shuts down furnace > air cools > thermostat turns on furnace > furnace heats the air ... *moto perpetuo*. Assuming constant external temperature, endless fuel supply, no mechanical failure, the system would continue forever. But of course, all external factors do not remain constant. When the season changes and the outside temperature rises, the duration of the "on" cycles of the furnace diminish until, eventually, the "system" shuts down.

Finally: The desert lake (with no outlet). Input by streams, output by evaporation. This is another "negative feedback" system. The amount of evaporation is a function of the surface area of the lake. Assume constant climate. The spring runoff expands the lake surface, evaporation increases until high inflow and evaporation are in balance (equilibrium). Then the dry season begins and inflow drops, followed by a reduction in the size of the lake surface and with it the amount of evaporation until a new point of balance is obtained between inflow and evaporation. But again, climate is never constant. If annual precipitation rises permanently, the lake may rise to the level at which it "finds" an outlet. If annual precipitation falls dramatically, the lake may disappear.

Early ecological theorists posited similar mechanisms in life-communities. Given a constancy in all external factors (parameters), the population of a species is held constant by its food supply and its surplus reproductive rate. Above the optimum (the "carrying capacity"), starvation brings the numbers down. Below the optimum, "feeding opportunity" allows growth up to carrying capacity.

This is the simplest type of equilibrium, involving a single species and assuming all other factors constant. The early theorists, however, went much further. The ecosystem as a whole, when disturbed, would return to its previous state, and this hypothesis involved numerous species and populations.

"Disequilibrium ecologists" reject the central premise of equilibrium theory: return to the previous state. Instead, they point out, disturbance in the system results in a new state. Still worse, there is no "perfect balance" in nature to be disturbed. The "natural condition" of an ecosystem is imbalance, and hence constant change.

Furthermore, says the disequilibrium ecologist, while natural laws are (by definition) constant, the natural (and now the artificial) contexts of ecosystems are in perpetual flux. Climate changes, species migrate in, endemic species are decimated by pathogens, mutations lead to novel modes of adaptation, etc.

Thus the equilibrium ecologist's theoretical frame of "all else being constant" is so far-fetched and unrealistic as to make the theory of ecosystemic equilibrium utterly inapplicable to "the real world."

And so the defender of equilibrium theory is led to repeat the lament of the theoretical economist: "The theory is beautiful; its reality that has me baffled."
These, in stark contrast, are the two theories. Too stark, for they are more caricature than an accurate description of the "competing" theories.

To put the matter more bluntly, the disequilibrium ecologists are hard-pressed to find any active and practicing "targets" of their critique of equilibrium theory, at least among those who are scientifically informed. Admittedly, however, the "equilibrium" concept persists with some naive activists and popular writers.

For example, in their excellent textbook, *Principles of Conservation Biology*, Gary Meffe and Ronald Carroll repeatedly defend disequilibrium (they call it "dynamic" and "nonequilibrium") ecology against the "classic ... equilibrium paradigm:" "the idea that ecological systems are in equilibrium, with a definable stable point such as a climax community." This paradigm they write, "implies closed systems with itself regulating structure and function, and embraces the popular "balance of nature" concept." (P. 16).

But in their several descriptions and critiques of "the classic paradigm," they never cite a source -- a defender of the "paradigm."

Or consider Daniel Botkin's characterization of "traditional ecological wisdom:"

... nature undisturbed by human influence is characterized by a certain kind of harmony, balance and order... [W]ilderness is presumed to have three attributes: (1) ... [it] remains in a constant state; (2) when disturbed and then left to its own devices, wild nature returns to that original state..., and (3) finally, an ethic is attached to this natural state [which is] assumed to be preferable to all others." ...

"this view of nature is espoused in textbooks on ecology and in popular environmental literature. It is the basis of twentieth century scientific theory about populations and ecosystems. It is the basis of our Federal and state laws and international agreements that control our use of wild lands and wild creatures."

Regarding some "popular environmental literature, Botkin is no doubt correct. We've all encountered "green" rhetoric about "defending the 'balance of nature.'" As for "this view" being "the basis of our Federal and state laws and international agreements, I am less certain -- though the assertion is worthy of some study.

But as for the "traditional ecological wisdom" being espoused in ecological textbooks and the basis of twentieth century scientific theory -- at least late twentieth century it -- appears that Botkin is clearly in error. At least this seems so, as I examine my own personal library.

Of the half dozen standard ecological texts before me (Raven-Berg-Johnson, G. Tyler Miller, Meffe and Carroll, Odum, among them) I find no defense of "the equilibrium paradigm," while there is undisputed acceptance of disequilibrium theory. Nor is "equilibrium theory conspicuously defended in my large file of articles about ecology (from such publications as Nature and Science). Among the hundreds of articles in the recently published five-volume Encyclopaedia of Biodiversity, none contain either "equilibrium" or "dis-equilibrium" in the title. Admittedly, the textbook sample is small, and so Botkin's assertion deserves testing...
But these are contemporary sources. What about a generation ago, at about the time of the first Earth Day (1970)? The best sellers at the time were Rachel Carson's *Silent Spring* and Barry Commoner's *The Closing Circle*. A prominent text of the time was the Ehrlichs' *Population, Resources, Environment*. No "equilibrium" or "disequilibrium" in the indexes. And Barry Commoner's famous "four laws of ecology" in no way presuppose ecosystem equilibrium.

On closer inspection, the alleged proponents of "the old ecology" that I cited in my funding proposal, Frederick Clements, Charles Elton, and Eugene Odum, are not completely "sold" on the equilibrium paradigm. Clements: "Even the most stable association is never in complete equilibrium, nor is it free from disturbed areas in which secondary succession is evident. Elton: "The 'balance of nature' does not exist and perhaps never has existed. The numbers of wild animals are constantly varying to a greater or less extent, and the variations are usually irregular in period and always irregular in amplitude." And Odum: "An ecosystem is a thermodynamically open, far from equilibrium, system... In hierarchical organization of ecosystems, species interactions that tend to be unstable, nonequilibrium, or even chaotic are constrained by the slower interactions that characterize large systems..."

And so it appears that among active ecologists, or even their predecessors, there really isn't all that much "competition" between the concepts of equilibrium and disequilibrium. Furthermore, it is doubtful that any working ecologists believe in anything close to "perfect equilibrium" in natural ecosystems.

And so, I must confess now, that when I wrote my original proposal, I may have been seduced by the proud and apparently exaggerated announcement by Botkin and others, that they had "triumphed" over the "reigning" ecological paradigm of ecosystemic equilibrium and "natural balance," and further, that there may have been enough of a live contest remaining, that some essential issues of environmental ethics and public policy might still be in the balance.

If I were thus misinformed, then I was not alone. Consider this July 31, 1990 report in the *New York Times*, by William K. Stevens (my emphases):

In a revision that has far-reaching implications for the way humans see the natural world and their role in it, many scientists are for forsaking one of the most deeply embedded concepts of ecology: the balance of nature.

*Ecologists have traditionally operated on the assumption that the normal condition of nature is a state of equilibrium, in which organisms compete and coexist in an ecological system whose workings are essentially stable....*

*This concept of natural equilibrium long ruled ecological research and governed the management of such natural resources as forests and fisheries. It led to the doctrine, popular among conservationists, the nature does best and human intervention in it is bad by definition.*

Now the accumulation of evidence is gradually led many ecologists to abandon the concept or declare it irrelevant, and
others to alter drastically. They say that nature is actually in a continuing state of disturbance and fluctuation. Change and turmoil, more than constancy and balance, is the rule. As a consequence, say many leaders in the field, *textbooks will have to be rewritten and strategies of conservation and resource management will have to be rethought*....

This was a dispatch from a battlefield, after the battle was over and the armies had departed.

In addition, I was apparently obsessed with Mark Sagoff's extreme but nevertheless carefully and extensively argued refutation of the scientific status ecology, and even of the coherence and validity of the ecosystem concept -- what I will call "ecological nihilism." (Sagoff: "The terms 'eco' and 'system,' when conjoined, constitute an oxymoron"). This Sagoff- obsession was due, no doubt, to the circumstance that I prepared the proposal immediately after completing a thorough examination and meticulous criticism of Sagoff's dismissal of "theoretical ecology." (That paper, "Reconstructing Ecology," was published the following year).

I have since learned that Sagoff's views are essentially *sui generis*, and have failed to factor significantly in ongoing discussions of either ecological science or environmental policy. His position is a thing apart from disequilibrium ecology, which most assuredly does not agree with Sagoff's conclusion that "the ecosystem ... is just a pointless hodgepodge of constantly changing associations and organisms," and that "there are no general truths about ecosystem organization." And, of course, from my perspective, I feel that I answered Sagoff sufficiently in "Reconstructing Ecology." But that is for others to judge.

This radical disconnection between "disequilibrium ecology" on the one hand, and ecological nihilism on the other, is essential. Once that disconnection is accepted, it becomes plausible for the disequilibrium ecologist to engage in the valid and productive study of life communities. Consider again, Daniel Botkin, who, as we have seen, is a conspicuous and influential proponent of the "new" disequilibrium paradigm. But does "disequilibrium" incline Botkin to abandon the concept of the *ecosystem* -- a vulnerable "web" of interdependent parts -- in favor of Sagoff's "hodgepodge." Not in the least. Rather, Botkin observes:

"We are accustomed to thinking of life as a characteristic of individual organisms. Individuals are alive, but an individual cannot sustain life. Life is sustained only by a group of organisms of many species -- not simply a horde of mob, but a certain kind of system composed of many individuals of different species -- and their environment, making together a network of living and nonliving parts that can maintain the flow of energy and the cycling of chemical elements that, in turn, support life."

Meffe and Carroll concur: "our emphasis on non equilibrial processes does not imply that species interactions are ephemeral or unpredictable, and therefore unimportant. Communities are not chaotic assemblages of species; they do have structures.... change at some scale is a universal feature of ecological communities."

Despite the "triumph" of the dis-equilibrium paradigm, there remains a lively ghost of "the old paradigm," that is worthy of some respectful attention.

For while the "steady-state" equilibrial ecosystem may be a dead issue, on
the other hand, it is equally doubtful that any ecologists believe that ecosystems are totally chaotic -- that, as Mark Sagoff claims, "the terms 'eco' and 'system,' when conjoined, constitute an oxymoron." Species and populations (if not individual organisms) in fact interact dynamically to mutual advantage (which means "systematically"). Symbiosis, mutualism, competition, co-evolution, "keystone species," etc. are established facts. Species that do not fit into an ecosystem, either evolve to establish viable niches, migrate out, or become locally extinct.

In fact, "equilibrium," or much better, its successor concepts "self-regulation" and "self-repair," seem to be indispensable components in ecological theory. Disequilibrium ecology acknowledges that mechanisms of self-regulation and self-repair are constantly at work in "healthy" ecosystems. True, they never completely restore the system to a previous state. However, these mechanisms "drive" the system to new states. Without such mechanisms, the system would unravel and collapse.

The overkill of the "challenge" of disequilibrium ecology is well exemplified by Daniel Botkin's research into the Boundary Waters region of northern Minnesota and western Ontario. It is a brilliant study that has significantly advanced the science of ecology. But as a refutation of "old ecology," it is less successful, for what it "proves" -- constant change -- is not seriously disputed by any ecologists, old or new.17

"Wherever we seek to find constancy," Botkin writes, "we discover change." Perfect equilibrium and balance are nowhere to be found in nature. "Nature is in constant flux."

But of course nature is in constant flux. What self-respecting biologist would deny this -- "old" or "new"? It's called "evolution." But this does not preclude us from recognizing significant differences in the pace and scale of change. After all, species change through evolution. But this does not forbid biologists from utilizing the concept of species, nor to develop a taxonomy of species. In fact, without that taxonomy, the theory of evolution might never have been developed.

Botkin then gives this account of the biotic history of the history of the "Boundary Waters" region:

... the last glaciation was followed by a tundra period in which the ground was covered by low shrubs now characteristic of the far North, as well as reindeer moss and other lichens and lower plants. The tundra was replaced by a forest of spruce, species that are now found in the boreal forests of the North, where they dominate many areas of Alaska and Ontario. About 9,200 years ago the spruce forest was replaced by a forest of jack pine and red pine, trees characteristic of warmer and drier areas. Paper birch and alder immigrated into this forest about 8,300 years ago; white pine arrived about 7,000 years ago, and then there was a return to spruce, jack pine, and white pine, suggesting a cooling of the climate. Thus every thousand years a substantial change occurred in the vegetation of the forest, reflecting in part changes in the climate and in part the arrival of species that had been driven south during the ice age and were slowly returning. Which of these forests represent the natural state. If one's goal were to return the Boundary Waters Canoe Area to its natural condition, which of these forests would one choose? Each appears equally natural in the sense that each dominated the landscape for approximately 1,000 years, and each occupied the
Botkin asks, rhetorically, "which of these forests represents the natural state," as if to suggest that, due to the multiplicity of states thus described, there is no so-called "natural state." But this very passage suggests a non-rhetorical rebuttal: following our account above of "wildness," "the natural state" is that which is brought about by the climatic (and other) conditions that prevail at the time. That "state" is established by (relatively) undisturbed abiotic nature, and then is succeeded when natural circumstances change.

Put bluntly, I suggest that a critical examination of this passage will yield us less here than meets the eye, and less than Botkin intended. For what is Botkin asserting that any informed "old ecologist" would deny? All ecologists are well aware that North America undergoes periodic recurrences of ice ages and other climatic changes, measured in tens of thousands of years. But "balance," "equilibrium" and "resilience" are "ideal type" concepts posited within stable abiotic (e.g., climatic) conditions -- or as the popular phrase has it, "all else being equal." However, as all ecologists agree, "all else" is never "equal," and so ecologists write of "tendencies" toward balance, equilibrium and resilience. Still, these ecosystemic concepts are quite enough guide us as we seek explanations of the past and predictions for the future.

No one suggests that "balance, equilibrium and resilience" are ever perfectly exemplified in nature. Nor is a "climax community" ever completely static. These concepts, after all, describe "tendencies." The difference in succession between "recovery" stages and a "climax" stage is pace of change, and growth (in recovery) vs. steady-state (in climax stage). Surely these concepts, albeit approximate, are scientifically useful, as they describe significant conditions and differences. True, there is no "perfect balance and equilibrium" in nature. Still there is a significant difference between the "imbalance and disequilibrium" of the slowly evolving Pacific Northwest forests of, say, four hundred years ago, and that of the same forest today as it is assaulted by Weyerhauser's chainsaws. The former is measured on a time scale of millennia, while the latter is measured in years.

To further complicate matters, the term "equilibrium" is vague and ambiguous. In some interpretations, ecology is well rid of it. In other senses, it remains a useful concept.

To put it another way, equilibrium "versus" disequilibrium might be regarded as a "glass half-full / half-empty" sort of "dispute" -- in fact, no dispute at all, but rather two sides of the same coin. The "equilibrium perspective" focuses on self-maintenance and self repair -- mechanisms that draw the system toward (but never achieving) balance. The "disequilibrium perspective" deals with forces that constantly throw the system off-balance and in need of "repair." A complete ecological theory blends both perspectives.

To illustrate this point, consider the act of walking. When a person walks, he "falls forward" off-balance, whereupon the extended foot recovers balance, only to have the balance "lost" again, and recovered again, etc. -- all the while, forward motion is accomplished. "Tripping" occurs when the recovering foot is prevented from being in its "recovery place."

A healthy ecosystem proceeds "at a walk" -- off-balance > recovery > off-
Disturbances (climate, species imports, fire, etc.) throw the system off-balance, then it recovers -- into a new system. But not any new system. Importing species and mutations succeed or die, depending on the state (the "hospitality") of the system -- i.e., on the presence or absence of "open" niches or competitive advantages.

Walking also illustrates two logically stratified "orders" of equilibrium/disequilibrium -- an essential qualification, as we will discover.

A person who is walking is in a repeated state of disequilibrium, rhythmically interrupted by recoveries. This is first-order disequilibrium. But the (second order) activity of walking is stable, and the (first-order) fall-recovery sequence is secure, progressive and confidently goal-oriented. Thus a walk exhibits second-order equilibrium.

Consider now the sequence in a chaparral ecosystem. The system requires fire to release the chaparral seeds from their pods. No fire, no regeneration, and the chaparral community will be succeeded by a different community. So if the chaparral community is to persist through time, it must "walk" through a sequence of inflammable maturity, fire, regeneration, maturity, etc. Clearly no equilibrium at the first level, but there is an equilibrium at the second level -- a constant, repeated sequence. In this sense, it is like the "equilibrium" of the furnace/thermometer: constant change (first order) according to a constant pattern (second order).

Perhaps such a realization has finally led the National Forest Service to retire Smokey Bear, and to treat fire as a natural recurring phenomenon. The consequences are often not very pretty, as anyone who has seen the aftermath of the Yellowstone fires will testify. Moreover, the reign of Smokey has led to an "unnatural" build-up of fuel, so that fires that might "naturally" "clear the ground," now threaten the entire forest.

Summing up: First-order equilibrium -- a return of a disturbed ecosystem to the prior structure, and species population and inventory -- is at worst a myth, and at best an "ideal type" (like a "frictionless machine" in physics), never exemplified in nature. Few ecologists have believed otherwise in the past, and none believe this today. Unfortunately, this understanding has not been universally acknowledged by environmental activists, popular writers, educators, and even policy-makers.

Second-order equilibrium -- the return of an ecosystem to a state of "health" and "integrity," though with an altered structure and component species -- this remains a tenable ecological concept, with the constant caveat that even this (higher order) sense of "equilibrium" is also never completely exemplified in nature.

9. IMPLICATIONS FOR ENVIRONMENTAL ETHICS AND POLICY

On the merits, "disequilibrium ecology" leaves environmental ethics and public policy essentially as they were. However, what skillful propagandists might make of it, is quite another matter.

An apologist for the economic exploitation of the natural environment might
draw the inference from "disequilibrium" (i.e., constant change) to the conclusion that there is no "natural" state of nature, no state that is "better" or "worse," just "one damn thing after another."

Extreme? Recall what Sagoff had to say about "ecosystems" and "nature:"

- nature is going nowhere, has no "integrity" or "well-being" of its own, and is utterly devoid of any meaning, order, purpose, or end.

- If [as Sagoff affirms] ecological systems and communities are just random, accidental, contingent, and purposeless collections of biological flotsam and jetsam, then there is no general instrumental reason to preserve them.

- No prima facie, general, or theoretical reason can be given, then, to suppose that the extinction of species now feared will in any meaningful way harm nature, because nature, having neither design or direction, is not the sort of thing that can suffer harm.

Sagoff, to be fair, does not condone exploitation, and in fact is, in his own unique way, a conservationist. But his moral attention is directed toward species and individual organisms, not ecosystems.

"... the unlikelihood -- not the perfection -- of the living world amazes us; the improbability of every plant and animal leads us to treasure its existence. Species -- even those not yet named -- command our moral attention because they have emerged through a billion year old toil of evolution." [966]

Well and good, but it is a very flimsy justification for environmental ethics or a policy of conservation.

So we ask once more: what might a promoter of exploitative industry do with an ecological nihilism, such as that defended by Mark Sagoff. No need to speculate, it's already happened.

Faith Bremner of the Seattle Times (September 1, 2002) writes:

The man chosen to head the Bush administration's wildfire prevention program doubts the existence of ecosystems and says it would not be a crisis if the nations' threatened and endangered species became extinct.

Allan Fitzsimmons has named yesterday to be in charge of reducing fire danger on lands managed by the Interior Department. But Fitzsimmons' background as a free-market policy analyst and his writings for libertarian and conservative think tanks have alarmed environmental groups across the West....

In "The Illusion of Ecosystem Management," published in 1999 by the Political Economy Research Center, ... Fitzsimmons says ecosystems exist only in the human imagination and cannot be delineated. Federal policies, therefore, should not be used to try to manage or restore them, he wrote.

In the "Reconstructing Ecology," I believed that I foresaw such a possibility:

The implications of "the new ecology" for public environmental
policy are profound. Gone is a justification for wilderness preservation, much less of wilderness restoration. For if ecosystems are in constant but aimless flux, then attempts to "preserve" (i.e., protect from change) an allegedly "pristine" state, are "contrary to nature." And proposals to "restore" wilderness raise the question, "restore to what condition?" If there is no definable "baseline" condition that describes "wilderness," then that question has no answer and thus "restoration" policy has no foundation or meaning. Finally, endangered species legislation loses its justification for, according to Sagoff, extinction is of no great practical significance. After all, he writes, "... no extinction of any species in the United States seems thus far to have altered the capacity of the ecosystems to provide these services. The reason may be that for any species that is lost, tens, hundreds, or thousands of others are ready, willing, and able to perform the same functions and services valuable to human beings." And, human beings aside, "no prima facie, general, or theoretical reason can be given, then, to suppose that the extinction of species now feared will in any meaningful way harm nature, because nature, having neither design or direction, is not the sort of thing that can suffer harm."

I see now that this was a colossal blunder. These were not "implications of the new ecology;" they were implications of Sagoff's ecological nihilism. In the most important correction that I have acknowledged since I submitted the proposal, I have determined that there is a total logical and empirical disconnection between "disequilibrium ecology" and "ecological nihilism."

This is a point that cannot be over-stressed.

After all, Daniel Botkin, Eugene Odum, Gary Meffe, Ronald Carroll, Stuart Pimm, Stewart Picket, all these ecologists and more, are both dedicated conservationists and proponents of disequilibrium ecology. Are they all simply confused and inconsistent? Of course not! Meffe and Carroll, for example, are totally committed to disequilibrium ecology, and have succeeded in integrating this paradigm into their outstanding textbook, *Principles of Conservation Biology*. It is a long and comprehensive book (673 pages) in which one finds no hint of incoherence between the "nonequilibrium paradigm" (as they call it) and conservation biology.

These "new ecologists" all recognize the "systems" in ecosystems -- the dynamic and mutually advantageous interactions among organisms. (Advantageous for species, that is, not for individual organisms. "The wolf is the enemy of the deer, and the friend of the deer species").

However, these ecologists are *conservationists*, not *preservationists*. They believe in preserving conditions that facilitate ongoing processes and change; they do not condone the permanent preservation of natural and wild conditions "as they are now." This has clear implications for the management of wild areas, such as National Parks. Meffe and Carroll write:

The conservation implications of the nonequilibrium paradigm include the following: (1) a particular unit of nature is not easily conservable in isolation from its surroundings, and therefore the matrix must be incorporated into conservation planning; (2) reserves will not maintain themselves in a stable and balance configuration over long periods of time; and (3) reserves will
incur natural disturbances (as well as human disturbances) and are likely to change state as a result. The nonequilibrium paradigm tells us that reserves will not succeed simply by being locked up and protected from humans; disturbances and influences from the matrix, including human societies, will affect reserves, resulting in changing species compositions and changing rates and directions of natural processes. This dynamism needs to be accommodated when managing conservation reserves.

Application of the nonequilibrium paradigm makes conservation and reserves a more difficult because reserves must be able to incorporate often unpredictable magnitudes and directions of change and still maintain species diversity and ecological processes. The nonequilibrium paradigm should be the underlying model and motivation for all decisions affecting selection and management of conservation reserves. (309)

And so, when I noted above that "proposals to 'restore' wilderness raise the question, 'restore to what condition?,' I posed a problem for nihilism, not for disequilibrium ecology. The answer of the latter is straightforward: "the point is not to search for a frozen 'condition' of wilderness, but rather to restore and/or protect, as much as possible, the natural dynamic forces and contexts that bring about the "flux" we call wilderness. Put simply, to the "old ecology," or more accurately the naive popular conception of ecology, "wilderness" is a noun -- it denotes a state of being. To today's informed ecologists, "wilderness" is a verb -- it denotes a bundle of processes. When those processes are "naturally" active, the region may be said to be "wildernessing."

As with environmental policy, so too with environmental ethics: the implications of ecological nihilism (to most, not all, varieties of environmental ethics) are profound; while the implications of disequilibrium ecology, are minimal.

In "Reconstructing Ecology," I listed these implications:

- Most vulnerable is "the land ethic" of Aldo Leopold, who, in that most quoted of all environmental maxims, wrote: "a thing is right when it tends to preserve the integrity, stability and beauty of the biotic community. It is wrong when it tends otherwise."(7) From this, Sagoff would strip integrity, stability and community, leaving only beauty -- but a beauty, not of the whole, but of the component organisms and species.

- Gone too is "Muir's maxim:" "You cannot disturb a pasque flower without disturbing a star" -- an affirmation that "all things are connected." Instead, we have a disconnected "hodge-podge" of independently co-existing organisms.

- Furthermore, "the new ecology" challenges the notion that "integrity" is a recognizable condition in ecosystems, and thus a meaningful goal of environmental policy. "An ecosystem in a state of integrity," writes Laura Westra, "comprises self-organizational processes both in its internal relations and its external ones with adjacent ecosystems." (9) To the contrary, Sagoff rejoins, "nature has no 'integrity' or 'well-being' of its own, and is utterly devoid of any meaning, order, purpose, or end." [923]
- And if Sagoff is correct, the attention of conservationists and preservationists should be directed, not to ecosystems, but to individual organisms and to species. In particular, "wilderness preservation" is a meaningless and pointless enterprise.

If one reviews these items carefully, it should become clear that it is Sagoff's ecological nihilism, not disequilibrium ecology, that bears these implications. Meanwhile, "the new ecology," which embraces fully the established acknowledgment of the complex interdependence of the component organisms of and ecosystem, along with the fundamental concepts of energy flow, nutrient recycling, and so forth, leaves these maxims of environmental ethics essentially untouched.

Also untouched is the unresolved environmental ethical problem of "grading" -- of establishing criteria of "ecosystemic health" and "integrity" is a practically urgent enterprise. And yet this issue is implicit in all environmental activism and policy-making -- a point that we stressed at the very beginning of this essay.

It is the issue that I will be most concerned with in the continuing work on this project.

In sum: the "threat" to established perspectives in environmental ethics, and progressive principles of environmental policy, comes from "ecological nihilism," not "disequilibrium ecology." The disconnection between the two must be emphasized, if exploitative mischief is to be held at bay.

10. LOOKING AHEAD

Several topics have been bypassed in this paper which clearly belong here. Among them:

Are "nature" and "wildness" social constructs? Here we address challenges brought forth by "post-modernists" -- in particular, the degree to which we can get outside our cultural "skins" and achieve authentic "objectivity."

This is how I perceived the issue in the supplement to the project proposal: "whether concepts such as "wildness" and "natural ecosystems" refer to conditions that are objectively defined and determinable, or whether, on the other hand, they reflect historical and cultural factors, or even political agendas. In other words, the issue is whether "wild" and "natural" ecosystems are "discovered" and identified, or whether they are "constructed" from our biases and norms. Or (still more likely) whether such concepts as of "wildness" and "naturalness' somehow combine both objectively identifiable conditions and cultural constructions. If so, [then] what is the mode of this "combination"?

"This is a significant issue, for it goes to the heart of policies of wilderness preservation, of land and aquatic restoration and management, of species protection, as well as numerous other environmental issues. This issue involves no less than the question, "just what are we attempting to preserve, protect, and manage, and how do we identify and assess success or failure in these endeavors"?
What is the scientific status of ecology? If, as I intend, this paper serves as the scaffolding of an eventual book, my published papers "Values in Nature" and "Reconstructing Ecology" will be incorporated (revised and expanded, of course). Because the latter paper has addressed Sagoff's challenge to theoretical ecology, I will turn to another serious challenge: that of Shrader-Frechette and McCoy who argue, in their book, *Method in Ecology*, that ecology fails as grand and comprehensive theory, since it can not predict events, nor can it explain deductively -- i.e., "down" from general theory to particular events. They observe that "... ecologists have defined and used two of the concepts most basic to community ecology -- "community" and stability" -- in ambiguous and often inconsistent ways... Ecologists are likewise divided on what structures communities or holds them together." Accordingly, they argue, we are thus best advised to confine our ecological attention to empirical "natural -history knowledge" and "individual case studies." I am not convinced. First of all, contrary to their allegation, there appear to be too many "deductively useful" hypotheses and theories that are put to work by ecologists; and second, "natural history" is not simply a "first stage" that comes "before" a mature theoretical science. Instead, theory and observation are iterative: without theory supplying criteria of "relevance" in observation, field work is random and unproductive. Theory guides observation, which in return enriches theory, etc.

These topics, and more, will be incorporated into the work in progress.

The largest task before me is to analyze, clarify, and if possible establish an empirical foundation for "the wildness criterion" -- the suggestion that the structure and functioning of "finished" natural ecosystems are the best available models of ecosystemic "health" (or whatever term one chooses to refer to an objectively "good" ecosystem). Some of the most recent work of E. O. Wilson promises to be very useful for this purpose. A serious complication to this enterprise is the difficulty in finding suitable "samples" of undisturbed ecosystems, in a world that is becoming ever-more "artificialized." "Pristine nature" is an ideal that can only be approximated. It is an open question whether or not a study of the "most wild" areas can provide sufficient data to reconstruct a conceptual model of "nature before and apart from humans."

This paper has turned out to be both more and less than I anticipated when I began it. I had hoped to come up with one or two publishable papers, and to have them submitted soon after completion of this paper. I have failed to accomplish this goal -- perhaps fortunately, for this paper may be a "seedbed" for many papers to follow. It has defined several topics worthy of exploration and refinement, it has assembled the work that I have done on these topics, clarified and organized my thoughts about these issues, and it has clearly indicated the work remaining. That is a worthy accomplishment.

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**NOTES**

1. Incorporating my unpublished essay of the same name, found at The Online Gadfly.
   [www.igc.org/gadfly/eds/envt/natural.htm](http://www.igc.org/gadfly/eds/envt/natural.htm)
2. J. Baird Callicott, “Do Deconstructive Ecology and Sociobiology Undermine Leopold’s Land Ethics?” *Environmental Ethics* 18 (1996), p. 371. In the Summer, 1999 issue of the same journal, Max Oelschlaeger replies with an argument similar to mine (“On the Conflations Humans and Nature”). However, the ideas that I express in this piece, and have routinely presented to students over the past twenty years, extend back at least to the publication of McPhee’s book in 1971.

3. Psychological Egoism (“all acts are selfishly motivated”) should not be confused with Ethical Egoism (“one’s primary moral obligation is to oneself”), notoriously championed by Ayn Rand. The arguments against Ethical Egoism are subtle and complicated, and far beyond the scope of this piece. While I have not published lengthy arguments against this ethical theory, my dissent is evident in “Why Care About the Future?,” (in Partridge (ed), *Responsibilities to Future Generations*, Buffalo: Prometheus Books, 1981), and Sections V - VII of “Nature as a Moral Resource.” (*Environmental Ethics*, 6:2 (Summer, 1984).

4. A similar argument may be made against George Berkeley’s subjective idealism, also familiar to most students of Introductory Philosophy: “to be is to be perceived,” i.e. all that exists are mind and their ideas - matter is illusory. But that too is beyond the scope of this brief essay.

5. [http://gadfly.igc.org/liberal/alchemy.htm](http://gadfly.igc.org/liberal/alchemy.htm)


13. The remainder of this section is taken, word for word, from my “Discovering a World of Values: A Response to Rolson,” Pojman, op. cit., 91-2.

14. Similarly, Karr defines biological integrity as “the capacity to support and maintain a balanced, integrated, adaptive biological system having the full range of elements (genes, species, and assemblages) and processes (mutation, demography, biotic interactions, nutrient and energy dynamics, and meta-population processes) expected in the natural habitat of a region.” Karr and Chu, 1995. (See Westra, Miller, Karr – Integrity, p. 23).


17. Due to time constraints, I am “importing” the following six paragraphs, with some alterations, from my published paper, “Reconstructing Ecology” (pp. 82-3).

18. “In 1969, Eugene P. Odum set out an energetic model for succession by concentrating on the general features of the process. Energy balance in the ecosystem progressively changes, with ecosystem respiration lagging behind production. When the two eventually coincide, equilibrium -- climax -- is attained. Biomass is generally greatest at this equilibrium stage, nutrient imports to the ecosystem are equaled by exports, and species richness and general complexity are at their peaks. The model has been attractive and useful features, although the final stage of equilibrium of the still be regarded as a dubious ideal.” (Moore, 565)

19. Mark Woods (1998) expresses this view (of which he is critical) with admirable clarity: "We cannot identify what can harm wilderness because there is no such thing as a static, baseline wilderness against which harm can be measured, and we cannot identify what can disturb wilderness because everything can. Further, it may be impossible to characterize what wilderness is (as it now exists) because wilderness is in perpetual change."

20. This point “hits close to home” – literally. As I write this at my home, about 200 feet to the east of me, at my property line, is the edge of “the Old Fire,” which burned 91 thousand acres of the San Bernardino mountains, including the poorly managed San Bernardino National Forest. Only the determined voluntary effort of the fire-fighters saved my home and that of my neighbors. It was a very close call. See “If it burns, it earns.”

REFERENCES


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Nature provides for almost all of our needs and it is as diverse as the stars in the sky. But there is a dark side too. Nature also contains some of the. But there is a dark side too. Nature also contains some of the most awful things you can imagine worse than anything conjured up by Stephen King! This list looks at ten of those things. 10. Honey Badger. Most Vicious Animal. The honey badger is usually found in Africa and Western and Southern Asia. For a number of years the Guinness Book of Records has named it the most fearless creature. For Better or For Worse is a comic strip by Lynn Johnston that ran originally from 1979 to 2008 chronicling the lives of the Patterson family and their friends, in the town of Milborough, a fictitious suburb of Toronto, Ontario. Now running as reruns, For Better or For Worse is still seen in over 2,000 newspapers throughout Canada, the United States and about 20 other countries. Many times over, and most of it happened before man was on earth. Wildlife getting better or worse? That goes back to whether or not the wildlife can adapt. Man adapts because he can create things that will help him survive where he would normally not be able to survive. Heaters to live in Antarctica. AC in the Sahara. Other wildlife will do things like migrate away from the equator to stay in a climate that agrees with that animal, or the animal adapts to the warmer or colder weather. 17 views. Related Questions. More Answers Below. What is the best thing in the world about climate change? Nature is responding by becoming greener; but sadly wildlife is having great difficulty in competing with humans for resources and this seems to be getting worse. 10 views Â· View 1 Upvoter. Many of the findings listed are perfectly understandable traits and absolute requirements for primitive humans to survive as a species in a savage world, and over time evolve into civilized tribes and modern civilization. The finding that actually amused me the most is We favour ineffective leaders with psychopathic traits!, then uses an example the modern e-v-i-l one: Trumpâ€™s overt aggression and insults have a primal appeal, and that his incendiary tweets are like the charging displays of an alpha male chimp, designed to intimidate. All of these human traits have been recognized and well understood for 10,000 years. Thank goodness we now have academic studies to prove what we already know! See more ideas about Nature, Amazing nature, Wild weather. In this fourth solo exhibition that Camera Obscura dedicates to Pentti Sammallahti, the Camera Obscura Gallery shows unpublished works, as well as a choice of bird images, a theme that is widely present in his work, and which is the subject of a monograph to Global Warming Myth Winter Weather Advisory Cold Weather Large Waves Winter Survival National Weather Service My Kind Of Town Early American Lake Michigan.