

Re-examining the Darwinian Basis for Aldo Leopold's Land Ethic

Roberta L. Millstein
Department of Philosophy
University of California, Davis
RLMillstein@UCDavis.edu

Abstract:

Many philosophers have become familiar with Leopold's land ethic through the writings of J. Baird Callicott, who claims that Leopold bases his land ethic on a "protosociobiological" argument that Darwin gives in the *Descent of Man*. On this view, which has become the canonical interpretation, Leopold's land ethic is based on extending our moral sentiments to ecosystems. I argue that the evidence weighs in favor of an alternative interpretation of Leopold; his reference to Darwin does not refer to the *Descent*, but rather to the *Origin of Species*, where Darwin discusses the interdependencies between organisms in the struggle for existence.

Forthcoming in *Ethics, Policy & Environment*. There may be small differences between this version and the published version.

Re-examining the Darwinian Basis for Aldo Leopold's Land Ethic

It is interesting to contemplate a tangled bank, clothed with many plants of many kinds, with birds singing on the bushes, with various insects flitting about, and with worms crawling through the damp earth, and to reflect that these elaborately constructed forms, so different from each other, and dependent upon each other in so complex a manner, have all been produced by laws acting around us (Darwin 1876, 430).

1. Introduction

Aldo Leopold – well-known forester, wildlife manager, conservationist, and professor – has been extremely influential in environmental ethics. This is due in large part to the writings of J. Baird Callicott, who has been called the “leading philosophical exponent of Aldo Leopold’s land ethic” (Norton 2002, 127). In the widely-reprinted essay, “The Conceptual Foundations of the Land Ethic” and elsewhere, Callicott mounts a spirited and insightful campaign to elaborate and defend Leopold’s views, in large part based on Leopold’s essay “The Land Ethic,” which was written towards the end of Leopold’s life. (Leopold died in 1948; *A Sand County Almanac*, in which “The Land Ethic” appeared, was published posthumously). Since that time, Callicott’s position has been critiqued on a number of fronts; in some cases, he has modified his position in response (e.g., Callicott 1999).

However, no one to my knowledge has seriously challenged Callicott’s reading of the *Darwinian basis* for Leopold’s land ethic¹. According to Callicott, Leopold “unmistakably (if elliptically)

¹ The closest I am aware of is Westra, who asserts that “Leopold’s references to Darwin in the land ethic are primarily to his science; Darwin’s insights are used in support of the interconnectedness that provides the main reason to abandon purely anthropocentric and economic determinations of value” (2001, 263). What I argue for in this paper is in sympathy with Westra’s claim; what I provide that Westra’s essay lacks is defense of this thesis, based on

alludes” to Charles Darwin’s views on ethics, which in turn were drawn from David Hume and Adam Smith; Callicott further suggests that Leopold draws on Darwin’s “protosociobiological perspective on ethical phenomena” (Callicott 1987, 191). I will argue that this interpretation is mistaken – that Leopold was not drawing on Darwin’s *ethical* views, but rather, Darwin’s *ecological* views. This, as I will show, changes the ethical basis for Leopold’s land ethic from Humean moral sentiments to the interdependencies within biological communities.

Before beginning, it is worth considering why we ought to re-examine the Darwinian basis for Leopold’s land ethic. After all, *Callicott* is certainly free to base his version of the land ethic on Darwinian ethics even if Leopold himself did not. So, why does it matter? There are at least three reasons. First, Leopold was an intelligent, thoughtful, and influential man who developed the land ethic after a lifetime of experiences in wildlife management and related endeavors. It seems to me that if his ideas are worth citing and discussing at all (and I think they are), it is worth the effort to get his views right. Second, and relatedly, a re-examination might turn up new ideas that are worthy of consideration, a point emphasized by scholars involved in the history of the philosophy of science (HOPOS). Third, the Darwinian/Humean reliance on moral sentiments has been challenged; sociobiology and altruism are likewise controversial topics. An alternative basis would avoid these challenges, although a new set of challenges may be opened up – I will discuss these briefly at the end.

passages from Leopold’s writings as well as those of Darwin and others. Furthermore, whereas Westra elaborates a Leopoldian “ethics of integrity,” I am less certain than she is that “integrity” plays the most central role in Leopold’s thinking. More precisely, I think it plays an important role, but not as important as stability and land health; in the essay “The Land-Health Concept and Conservation,” Leopold discusses integrity as a defeasible yet important condition for land health, implying that “land health” is the more central term. I will discuss “stability” and “land health” further below.

My essay is structured as follows. I will begin by summarizing Callicott's interpretation of the land ethic, followed by my reinterpretation, followed by a discussion of the consequences of my reinterpretation.

2. Callicott's Interpretation of the Land Ethic

Callicott takes the following passage to be the "summary moral maxim" of Leopold's land ethic:

A thing is right when it tends to preserve the integrity, stability, and beauty of the biotic community.² It is wrong when it tends otherwise (Leopold 1949, 224-225).

Indeed, many philosophers have followed Callicott in focusing on this passage and in taking it to be a summary statement of the land ethic. Much discussion has gone into understanding and analyzing the meaning of the key terms, "stability," "integrity," and "beauty" – but especially stability. Callicott also highlights the term "biotic community," suggesting:

The land ethic not only provides moral considerability for the biotic community per se, but ethical consideration of its individual members is preempted by concern for the preservation of the integrity, stability, and beauty of the biotic community. The land

² "Ecosystem" seems closer to (although probably not identical to) contemporary terminology than "biotic community," given that Leopold clearly meant to include abiotic components such as soils and waters and that he refers to an "energy circuit" within the biotic pyramid. Other authors have freely equated "biotic community" with "ecosystem," and the Land Ethic is referred to as a form of "ecocentrism." However, I will use Leopold's language throughout most of this essay, except when discussing other authors who use the term "ecosystem."

ethic, thus, not only has a holistic aspect; it is holistic with a vengeance (Callicott 1987, 196).

Thus, on Callicott's reading, the land ethic would consider it wrong to allow populations of deer (for example) to increase unchecked and threaten the integrity, stability, and beauty of the biotic community of which they are a part. This seems to be a point of contrast between the land ethic and traditional ethical theories; whereas traditional ethical theories hold *individuals* to be morally considerable, the land ethic seems to hold the *community as a whole* to be morally considerable (thus, the assertion that it is "holistic"). And again, many other philosophers have followed Callicott in reading Leopold this way.³

But how can this holistic shift be defended? As Callicott notes (drawing on Goodpaster), traditional ethical theory starts with the view that each of us may be taken to hold, namely, that each of us is intrinsically valuable or that our interests are deserving of moral consideration. However, if *I* am intrinsically valuable or my interests are deserving of moral consideration, why is that? Presumably, it is because of some psychological capacity that I have, such as rationality (Kant) or sentience (Bentham) – but then other beings have these capacities, too, and so those individuals (by pain of consistency) are also intrinsically valuable or have interests that are deserving of moral consideration. In contrast, biotic communities, taken as a whole, lack any

³ In my opinion, the philosophical literature has placed too much emphasis on this one passage out of essay out of one of Leopold's books. As my discussion of "stability" below suggests, Leopold's views must be understood in the context of his other writings, life experiences, and influences. Note that Callicott has since recanted his view that the land ethic is "holistic with a vengeance," and rightly so; Callicott now suggests that Leopold never meant the land ethic to completely override all of our duties to other humans (Callicott 1999).

Draft version: Please do not quote without permission

such psychological properties.⁴ So on what grounds could we say that biotic communities are morally considerable?

According to Callicott, Leopold draws on Darwin's evolutionary account of the origin and development of ethics, thus inheriting Darwin's view (itself derived from Hume and Smith) that ethics rests on feelings or "sentiments." Callicott's evidence for this claim is as follows.

Leopold begins the essay, "The Land Ethic" by noting that in the time Odysseus's Greece, ethics included wives but did not extend to "slave-girls"; Leopold uses this example to illustrate the claim that "During the three thousand years which have since elapsed, ethical criteria have been extended to many fields of conduct, with corresponding shrinkages in those judged by expediency only" (Leopold 1949, 202). Leopold then asserts (in a passage that is central to Callicott's interpretation):

This extension of ethics, so far studied only by philosophers, is actually a process in ecological evolution. Its sequence may be described in ecological as well as in philosophical terms. An ethic, ecologically, is a limitation on freedom of action in the *struggle for existence*. An ethic, philosophically is a differentiation of social from anti-social conduct. These are two definitions of one thing. The thing has its origin in the tendency of interdependent individuals or groups to evolve modes of co-operation. The ecologist calls these symbioses (Leopold 1949, 202; emphasis added).

From Leopold's reference to "struggle for existence," Callicott plausibly infers that Leopold

⁴ That is, the individual members of the community may have those properties, but the community qua community does not.

meant to invoke Darwin. But then, saying that Leopold “manages to convey a whole network of ideas in a couple of phrases,” Callicott claims,

The phrase ‘the struggle for existence’ unmistakably calls to mind Darwinian evolution as the conceptual context in which a biological account of the origin and development of ethics must ultimately be located. And at once it points up a paradox: Given the unremitting competitive “struggle for existence” how could “limitations of freedom of action” ever have been conserved and spread through a population of *Homo sapiens* or their evolutionary progenitors? (Callicott 1987, 189).

...according to Darwin—who had tackled this problem “exclusively from the side of natural history” in *The Descent of Man*—the answer lies in society. And it was Darwin’s classical account (and its divers variations), from the side of natural history, which informed Leopold’s thinking in the late 1940s... Darwin turned to a minority tradition of modern philosophy for a moral psychology consistent with and useful to a general evolutionary account of ethical phenomena. A century earlier, Scottish philosophers David Hume and Adam Smith had argued that ethics rests on feelings or “sentiments”—which, to be sure, may be both amplified and informed by reason. And since in the animal kingdom feelings or sentiments are arguably far more common or widespread than reason, they would be a far more likely starting point for an evolutionary account of the origin and growth of ethics (Callicott 1987, 189-190).

Callicott then explains how, on Darwin’s account, advantages could have been conferred on

Draft version: Please do not quote without permission

communities composed of parents and offspring who had bonds of “affection and sympathy” that could be extended to less closely related individuals; such communities might be able to defend themselves more successfully or provision themselves more efficiently. If so, “moral sentiments”⁵ would spread through a population.

In short, from Leopold’s brief comment that an ethic is a limitation on freedom of action in the struggle for existence, together with Leopold’s emphasis on extending ethics to societies and communities, Callicott infers that Leopold not only accepts and refers to Darwin’s explanation of the origin of ethics, but also that Leopold accepts and refers to the whole Darwinian account of ethics, including its basis in Humean/Smithian ethics.

It is certainly possible that Leopold meant to do this. But Callicott’s interpretation seems to be based on scanty evidence at best. Leopold was not a casual or dilettante writer. In the course of his career, he published about five hundred distinct items (Aldo Leopold Papers). “The Land Ethic” was written shortly before his death, although it was based on several earlier essays (Meine 1987), and like all the other essays he published, it went through multiple drafts that others commented on. There are no references to “moral sentiments” (much less Hume or Smith) or the evolutionary benefits conferred to societies composed of individuals who have them. The predecessor essays do not contain such references either. If Leopold had meant to invoke these as the basis for his land ethic, why would he have done so, to use Callicott’s term, “elliptically?” Is it plausible to think that Leopold meant his audience—and this essay, unlike many of his others, was meant for a general audience—to understand “limitation on freedom of

⁵ Callicott claims that Darwin uses the phrase “social sentiments.” I could not find evidence of that.

action in the struggle for existence” as an elliptical reference to the evolutionary role of moral sentiments? It is not even clear that Leopold was familiar with Darwin’s *Descent of Man* – he never cites the book in his writings, as far as I can tell – and it seems unlikely that he would expect a general audience to be familiar with it. Admittedly, Leopold does refer to affections and love in relation to ethics, but they appear in lists with other mental states that he thought were relevant to ethics, such as loyalty, conviction, understanding, respect, and admiration. It seems plausible that Leopold was simply inferring from his own experience, that love of the land tends to go hand in hand with a desire to treat it with respect. If emotions such as love and affection were supposed to play a *special* role in grounding ethics, Leopold gives no indication of that.

3. An Alternative Reading of Leopold

There is, however, another reading we can give to Leopold, one that is less strained, more direct, and more plausible. As a jumping off point, note that Callicott’s reading of Leopold emphasizes the reference to “struggle for existence” and thus, Callicott seems to infer, evolution. But the struggle for existence isn’t just about evolution, it’s also about ecology; following Ernst Haeckel (who coined the term ‘ecology’) ecology can be viewed as the science that studies the struggle for existence (Haeckel 1866, Cooper 2003). And there is reason to think that Leopold endorsed this view; in a document written for the Ecological Society for America, Leopold credits Darwin with having planted the seeds for the science of ecology and cites Haeckel explicitly (Leopold 1947). Furthermore, note that there are repeated references to *ecology* in the passage where Leopold invokes the struggle for existence; surely those are significant for interpreting Leopold’s

Draft version: Please do not quote without permission

meaning. Finally, it is important to recall that the “struggle for existence” is discussed in detail in the *Origin of Species*, not the *Descent of Man* where Callicott draws his interpretation from. In what follows, I will show that by shifting our attention from the *Descent* to the *Origin* and from evolution to ecology, we will gain a better understanding of the ethical basis for Leopold’s land ethic.

In the passage in question, Leopold states that ethics has “its origin in the tendency of interdependent individuals or groups to evolve modes of co-operation,” noting that “[t]he ecologist calls these symbioses.” In ecology, these “modes of co-operation” may be between members of *different* species as well as between members of the same species. Such interdependent relationships are examined in at least three places in Chapter 3 of the *Origin*, importantly, the chapter that is entitled “Struggle for Existence.” First, Darwin points out that while organisms are engaging in a struggle for existence with members of the same species or closely related species, they often “depend” on organisms of more distantly related species; for example, mistletoe is dependent on the various trees on which it lives as well as on birds that disseminate mistletoe seeds. Second, he points out that the numbers of prey “depend” on the numbers of predators; for example, the numbers of partridges, grouse, and hares depend on the numbers of “vermin” (i.e., predators) that are in the area. Third, Darwin maintains that “plants and animals, remote in the scale of nature, are bound together by a web of complex relations” (1876, 57).⁶ For example, Darwin describes two pieces of land, one where Scotch fir trees had been planted and a fence built to keep cattle out and one without fir trees and a fence; the two areas were otherwise identical. Yet the area with the Scotch firs and the fence had twelve more

⁶ I refer to the 6th (i.e., final) edition of the *Origin of Species* throughout this essay on the assumption that that is the edition that Leopold is most likely to have read.

plant species and six more bird species than the area without the fir trees and the fence.

According to Darwin, this difference is due to the complex relationships between the different species; the presence of fir trees and the absence of cattle enable other species to flourish.

My suggestion here is that these three cases all illustrate the existence of interdependence within the struggle for existence; they all illustrate the sort of interdependence that Leopold was referring to when discussing the origin of ethics. Now granted, it might seem like a bit of a stretch to say that any of these cases exhibit the “co-operation” or even “symbiosis” that Leopold refers to when he invokes the struggle for existence. However, these are, in fact, the sorts of interdependence that Leopold discusses elsewhere in the essay. For example, Leopold mentions the “interdependence of the forest and its constituent tree species, ground flora, and fauna” (1949, 212). He also describes a “land pyramid” or a “biotic pyramid” where the bottom layer is soil, on which rests a layer of plants, on which rest a layer of insects, on which rests a bird and rodent layer, and through various animal groups to the apex where the largest carnivores are; he then asserts that “each successive layer *depends* on those below it for food and often for other services, and each in turn furnishes food and services to those above” (1949, 215; emphasis added). And, tellingly, Leopold says that the functioning of the land pyramid “depends on the *co-operation* and competition⁷ of its diverse parts” (1949, 215; emphasis added). Similarly, as a member of the Citizen’s Deer Committee, Leopold presented the Majority Report that was created in response to large deer herds overbrowsing and starving in the absence of predators to control their numbers, stating: “There is no doubt in our minds that the prevailing failure of most

⁷ That competition and predator-prey interactions are important elements of interdependence within the biotic community also tells against the view that Leopold was invoking social sentiments between individuals as a basis for extending them to the community at large. (Thanks to John Beatty for pointing this out).

Draft version: Please do not quote without permission

states to handle deer irruptions decisively and wisely is that our educational system does not teach citizens how animals and plants live together in a *competitive-cooperative system*” (Leopold 1943; emphasis added). In “A Biotic View of Land,” Leopold speaks of a biota so complex that it is “conditioned by interwoven cooperations and competitions” (1939, 727). Cooperation for Leopold is thus metaphorical and not literal; importantly, it does not require sentiment or any conscious thought whatever.⁸

It also appears that Leopold associated the idea of an ecological *community* with Darwin. In an unpublished manuscript from 1935, Leopold states:

Just as important, however, as the origin of plants, animals, and soil is the question of *how they operate as a community*. Darwin lacked time to unravel any more than the beginnings of an answer. That task has fallen to the new science of ecology, which is daily uncovering a *web of interdependencies* so intricate as to amaze – were he here – even Darwin himself, who, of all men, should have the least cause to tremble before the veil (quoted in Meine 2010, 359; emphasis added).⁹

In this passage, we see Darwin credited with some of our earliest ideas of how ecological communities operate; moreover, the phrase “web of interdependencies” seems to echo Darwin’s “web of complex relations” and the examples of organisms who are dependent on one another in

⁸ This does not imply that a bee “cooperating” with a flower is acting ethically, as it would under a Humean/Smithian picture of ethics. However, it might mean that there is a relationship between the bee and the flower that has value and is worthy of preservation. On the view I am sketching here, cooperation is simply one form of interdependency.

⁹ Callicott quotes a similar version of this at the outset of “The Conceptual Foundations of the Land Ethic.” However, that version lacks the key sentence, “Darwin lacked time to unravel any more than the beginnings of an answer,” showing that Leopold is referring to Darwin’s *ecological* ideas.

the *Origin*.

Now, to be clear, I am not claiming that Leopold pored over Chapter 3 of the *Origin* (although he may have done so, being a widely read man). But we do know that Leopold was familiar with Darwin's work and cited him often (though again, I have yet to find any reference to the *Descent*, only to the *Origin*).

We also know that Leopold was quite familiar with the work of Charles Elton, an ecologist who Leopold met in 1931 (Meine 2010, 283). In the book *Animal Ecology*, Elton discusses Darwin's struggle for existence and places an even greater emphasis on the relations between organisms and the dependence of organisms on other organisms than Darwin did. Indeed, Leopold seems to have drawn his discussion of the land pyramid and food chains, and, more generally, the emphasis on *community*, directly from Elton. So, in addition to the Darwinian-ecological influence on Leopold's thinking about the origin of ethics, there is a very extensive Eltonian-ecological influence.¹⁰

How does this discussion of ecological influences on Leopold affect our understanding of the land ethic? To answer this question, note that Leopold believed that human history exhibits an accretion of ethics; he suggests that the earliest ethics dealt with relations between individuals (he gives the Ten Commandments as an example of this) whereas later, expanded ethics dealt with relations between individual and society (the Golden Rule, Leopold says, relates the individual to society, whereas democracy relates society to the individual). His land ethic is

¹⁰ Callicott acknowledges Elton's influence, but sees its role elsewhere in Leopold's thinking. See Newton (2006) for further discussion of Elton's influence on Leopold.

Draft version: Please do not quote without permission

supposed to be a third accretion, with ethics extended to include the biotic community as a whole, with its soils, waters, plants, and animals. On Callicott's reading, each of these accretions is supposed to be accompanied by an extension of our *moral sentiments* to larger and larger groups; thus, Callicott suggests that these moral sentiments toward the biotic community would be "automatically triggered" by an awareness of ecology's "social representation of nature" – in other words, becoming ecologically literate (1987, 194).¹¹

On the alternative picture that I have been painting here, this ethical accretion works differently, although I agree that Leopold thinks that a proper understanding of ecology is required to make this shift. He states that a land ethic "presupposes the existence of some mental image of land as a biotic mechanism" because "[w]e can be ethical only in relation to something we can see, feel, understand, love, or otherwise have faith in" (1949, 214). Again, for Leopold, that proper understanding consists of a proper understanding of the *land pyramid*. However, learning of our interdependence with other members of the biotic community is only the first step. Our extension of ethics to the land is, in large part, an *intellectual* process:

I have purposely presented the land ethic *as a product of social evolution* because nothing

¹¹ Even if Callicott is right that Leopold is relying on a Humean/Smithian view of moral sentiments, it is unlikely that Leopold thought that familiarity with ecology would "automatically trigger" moral sentiments towards biotic communities. Leopold was very aware of how difficult the ethical shift he was arguing for is, and certainly not all ecologists that he interacted with shared it (Meine 2010). However, Callicott does state this less strongly and more plausibly elsewhere in the same essay: "The simplest reason...should, therefore, tell each individual that he or she ought to extend his or her moral sympathies to all the members of the biotic community though different from him or her in appearance or habits" (1987, 195; see also Callicott 1989). Although I still don't agree that Leopold is relying on Humean/Smithian moral sentiment, it is more plausible that such an extension would occur upon rational reflection – although probably *extended* rather than "simple" rational reflection along with (I think Leopold would say) extensive time in the wilderness. As Leopold notes: "It has required 19 centuries to define decent man-to-man conduct and the process is only half done; it may take as long to evolve a code of decency for man-to-land conduct" ([1947] 1991, 345).

so important as an ethic is ever 'written.' Only the most superficial student of history supposes that Moses 'wrote' the Decalogue; it *evolved in the minds of a thinking community*, and Moses wrote a tentative summary of it for a 'seminar.' I say tentative because evolution never stops. The evolution of a land ethic is *an intellectual as well an emotional process*. Conservation is paved with good intentions which prove to be futile, or even dangerous, because they are devoid of critical understanding either of the land or of economic land-use. I think it is a truism that as the ethical frontier advances from the individual to the community, *its intellectual content increases* (1949, 225; emphasis added).

So, yes, Leopold sees the accretion of ethics as part of an evolutionary process, but it is a process of *social* (i.e., cultural) evolution,¹² not biological evolution, and not an “automatic triggering” of sentiment towards the land upon learning of our interdependence with it, as Callicott maintains. Granted, emotions are part of the process too, but the emphasis in this passage is clearly on the intellectual process; “it evolved in the minds of a thinking community,” “it is an intellectual as well as an emotional process,” and as the accretion occurs, “its intellectual content increases.” Thus, sentiments are not the *basis* of the land ethic; rather, the intellectual recognition of ourselves as part of a biotic community is. As Leopold says, “All ethics so far evolved rest upon a single premise: that the individual is a member of a community of interdependent parts” (1949, 203). Just as we learned that we were interdependent with other humans and thus needed ethics to guide our dealings with them, now, upon recognizing our interdependence with the land we

¹² Meine also interprets Leopold as seeing ethics as part of a process of cultural evolution (Meine 1987).

Draft version: Please do not quote without permission

should recognize that we need to expand our ethics further.¹³ Similarly, Leopold suggests that just as we have come to recognize that our human communities are intrinsically (and not just instrumentally) valuable, we should come to recognize that the biotic community is intrinsically valuable (that it has “value in the philosophical sense”) as well.¹⁴

Moreover, this intellectual process is an ongoing one. Leopold suggests that it is not just an increase in the *volume* of education that we need. In addition to teaching ecology and teaching the way that human history has been influenced by the land (both of which are discussed extensively in “The Land Ethic”), we need to teach an “ecological conscience”; we need to teach that we have obligations towards the land, obligations that will involve sacrifice and thus go beyond “enlightened self-interest.” We also need to experience the land, and *A Sand County Almanac* seems geared toward providing that experience in literary form (although of course it cannot substitute for the real thing).

Indeed, the accretion of ethics that Leopold describes is not consistent with a Darwinian picture of *biological* evolution. According to Darwin, humanity’s ancestors evolved capacities for moral sentiment:

... the social instincts lead an animal to take pleasure in the society of its fellows, to feel a certain amount of sympathy with them, and to perform various services for them. The services may be of a definite and evidently instinctive nature; or there may be only a wish

¹³ Here I set aside the meta-ethical question of whether we are developing such ethics or discovering them.

¹⁴ Callicott also sees Leopold as maintaining that the biotic community has intrinsic value; on this point, we are in agreement. See Norton (2005, 2011) for an alternate view.

and readiness, as with most of the higher social animals, to aid their fellows in certain general ways. But these feelings and services are by no means extended to all the individuals of the same species, only to those of the same association (Darwin 1882, 98).

Thus, there was no point in time when humans were *not* social and did not have moral sentiments toward other human beings. Humans surely developed various explicit rules to govern the relations among individuals, and we might consider the Ten Commandments to be among those, but relations among individuals on a Darwinian picture were already governed by the capacity for moral sentiments that was inherited from species ancestral to humans. So, either Leopold thought that there was a time when humans were not social (which seems doubtful, but if true, it is not a Darwinian picture), or, more plausibly, the accretion that Leopold is discussing is over and above biological evolution, i.e., it is cultural evolution.

To summarize this section: I've argued that Leopold's allusion to Darwin refers to Darwin's arguments in the *Origin* concerning the interdependence of organisms and not to Darwin's arguments in the *Descent* referring to Hume's and Smith's ideas about moral sentiment. There is no real evidence for the *Descent* interpretation.¹⁵ On the other hand, there *is* evidence that

¹⁵ Concerning his approach to interpreting Leopold, Callicott states:

In the "Conceptual Foundations of the Land Ethic" I am as little concerned with material historical influences as with how Leopold synthesized earlier papers to produce his nomothetic essay. It is certain that Leopold read Darwin, whose influence on his moral philosophy is most pronounced... Whether Leopold read David Hume, Adam Smith, and the other philosophers whose ideas in one form or another I find in "The Land Ethic" is an open question. The ideas of great philosophers become part of our intellectual vocabulary; and broadly educated people, like Leopold, tune them in, in any number of ways (Callicott 1987, 10).

I have taken a different a different approach in this essay, finding the "material historical influences" to be essential for understanding Leopold's views. Moreover, Hume's and Smith's moral views were not prominent in the early 20th century, so it is unlikely they would have been "in the air." Leopold could conceivably have picked them up from reading Darwin's *Descent*, but as I have suggested above, there is

Draft version: Please do not quote without permission

Leopold's allusion refers to the Darwin of the *Origin*. The "extension of ethics" passage focuses on ecology, the subject of Chapter 3 of the *Origin* where Darwin discusses interdependence within the struggle for existence; Leopold invokes the same sense of interdependence throughout "The Land Ethic" and his other writings, just as he invokes a Darwinian/Eltonian ecological conception of community. Even cooperation is understood by Leopold to be a function of the interdependent relations between different species in the biotic pyramid. And the extension of ethics that Leopold proposes is more plausibly interpreted as a primarily an intellectual process, not an extension of moral sentiment.

In short, the *Origin* interpretation is simpler – it does not attribute any new views to Leopold – and more consistent with the discussion in "The Land Ethic," a discussion that emphasizes interdependence.

But other than interpreting Leopold correctly, which I do think is important to do, why does this reinterpretation matter? What are the consequences of this shift for the understanding and defense of the land ethic? I will provide a preliminary sketch of answers to these questions in the next section of the paper.

4. Implications of the re-interpretation

Probably the most immediate and straightforward consequence of jettisoning

Darwinian/Humean/Smithian moral sentiment as a basis for the land ethic is that the criticisms of

no reason to think that he did. Furthermore, the *Descent* was not widely read and endorsed by American scientists during this time period, either (Thomson 2012).

that basis immediately become moot. For example, Kristin Shrader-Frechette (1996) argues that basing the land ethic on moral sentiment risks moral relativism because one person may feel bonds of “affection and sympathy” towards the land whereas another does not, with no way to adjudicate between those different feelings. When Callicott asserts that natural selection has produced *uniformity* in human feelings, Shrader-Frechette replies that Callicott has overcome relativism only to lose the normative force of the land ethic; it becomes purely descriptive. Of course, Callicott has responded to these and other challenges (Callicott 1999, Ouderkirk and Hill 2002), but perhaps not to the satisfaction of most ethicists; although Humean ethics has recently gained more adherents with the rise of “evolutionary ethics,” it is still a minority position in ethics. To be clear, though, I am *not* trying to suggest that a Darwinian/Humean/Smithian account of ethics is inviable. Rather, I am simply pointing out that these problems are entirely avoided if moral sentiment does not form the ethical basis for the land ethic after all.¹⁶

Even so, *new* issues arise if the new foundation for the land ethic lies merely in the Darwin of the *Origin*, i.e., the interdependence between organisms in forming a biotic community. Here it is important to acknowledge that on Callicott’s account, interdependence plays a role in the land ethic; my point here is that on the reinterpretation of Leopold I have argued for, it assumes a *stronger* role. Thus, it is important to gain a thorough understanding of interdependence: What does it mean? Are humans really interdependent with other species? Are all species equally interdependent? Can the idea that communities are deserving of moral consideration be defended on the basis of their interdependencies? I will discuss each of these in turn.

¹⁶ And to be clearer still, I am *not* suggesting that avoiding a Darwinian/Humean/Smithian account of ethics is a reason to accept the interpretation of Leopold that I have offered here. Rather, in the previous section I offer an argument as to why the *textual evidence* supports the interpretation that Leopold’s land ethic is based on the Darwin of the *Origin* rather than the Darwin of the *Descent*; whether this interpretation can be well defended on moral grounds remains to be seen, as I discuss in this section.

On the question of what interdependence amounts to, Leopold states:

The lines of dependency for food and other services are called food chains. Thus soil-oak-deer-Indian is a chain that has now been largely converted to soil-corn-cow-farmer. Each species, including ourselves, is a link in many chains. The deer eats a hundred plants other than oak, and the cow a hundred plants other than corn. Both, then, are links in a hundred chains. The pyramid is a tangle of chains so complex as to seem disorderly, yet the stability of the system proves it to be a highly organized structure. Its functioning depends on the co-operation and competition of its diverse parts (Leopold 1949, 215).

There are several important things to note about this passage. One, humans and their agricultural products are interdependent with other biotic and abiotic elements; interdependence is not just for organisms “out there” in the wilderness. Two, while Leopold places great emphasis on the transmission of nutrients (or “food”) within the biotic community, other “services” count as interdependence as well; in an earlier essay,¹⁷ Leopold mentions services such as shelter or shade. Three, note the tight connection between the concepts of “stability” and “interdependence”; this will be discussed further below.

However, some philosophers have questioned whether *interdependence* is too strong a word for our role in ecosystems:

¹⁷ “Biotic Land Use,” written around 1942.

We are undoubtedly dependent on them, but in what ways are ecosystems dependent on us? Their independence from us is not like the independence of parents from offspring who can later reciprocate love and other mutual activities that can develop into interdependency. We play no such role in any ecosystem; we seem genuinely superfluous to ecosystem functioning. If so, however, then mutuality, a necessary constituent of community, is missing; and the call to treat the environment as a community reduces to self-interest (Ouderkirk 2002, 6).¹⁸

In responding, it is again important to recall that Leopold did not limit his land ethic to “natural” communities. The corn we grow, the sheep we raise, and the soil we fertilize are clearly dependent on us, and these dependencies are just as relevant as the dependency between deer and wolves. Furthermore, there are many other species that have flourished in the presence of human modifications: various species of squirrel, rat, and pigeon come to mind. To be clear, I am not saying that human actions that have led to the increase in these species is a *good* thing; those populations often threaten other members of the community and the stability of the biotic community (in the sense described below) as a whole. But those species are, for better or for worse, dependent on us, and our future actions will affect their future. Perhaps most importantly, Leopold wanted to highlight the ways in which our actions could benefit the soil (e.g., using crop rotation) or harm the soil (e.g., allowing overgrazing), and the often serious downstream consequences of those actions for other species. Thus, I think that “interdependence” reasonably characterizes our roles in a number of ecosystems (although “interrelationships” might in fact do just as well and be less troublesome). Indeed, given that our actions have affected nearly every

¹⁸ Taylor makes a similar claim, asserting that the ecological soundness and health of plant and animal communities “does not in the least depend on human well-being” (1981, 208).

other species on this planet, it seems fair to say that most other species are dependent on us. This dependency does not mean that all of our potential actions will improve the situations of other species any more than deer browsing improves the situations of tree seedlings, shrubs and forbs.¹⁹

Still, one might reasonably ask whether certain species are more crucial than others, and thus question whether all dependence relations are equally strong. Species that are particularly important for the integrity and stability of the rest of the community are known as “keystone” species (Paine 1969). Keystone species are often predators, but not always; for example, pollinators are also seen as keystone species. However, biologists have shown that whether a particular species acts a keystone species depends crucially on the environment (e.g., Lubchenco and Menge 1978). For example, one study showed that in an intertidal zone, predators play a large role in protected areas but a small role in areas with large waves. Given that global warming is leading to climate change, and given that species interactions seem to be an important proximate cause of extinction in response to climate change (Cahill et al. 2013), it would be hasty to conclude that any particular species everywhere and always plays a greater (or a lesser) role than others. It is also worth pointing out that Leopold himself urged us to recognize our limited understanding of ecological systems and to act with caution.

Interdependence is not eliminated or lessened by our identification of some species as keystone species in a particular environment at a particular time.

¹⁹ As Callan et al. (2013, 839) state, “...tree seedlings, shrubs and forbs are highly preferred by white-tailed deer and collectively respond negatively to high browsing pressure. In contrast, ferns, grasses and sedges are generally avoided by white-tailed deer and thought to respond positively (though indirectly) to high browsing pressure, because they are released from competition with preferred species.” The deer are interdependent with both sets of species, those that they affect positively and those that they affect negatively.

So, if Leopold is right that “each species, including ourselves, is a link in many chains,” then we are a fairly tight-knit biotic community. Can the idea that a community is deserving of moral consideration be defended on the basis of such interdependencies?²⁰ I cannot hope to answer this question here. However, it seems reasonably intuitive to see a community as having value above and beyond the sum of its members, with the *relations* between community members making the community what it is. Moreover, there are philosophical precedents. A number of authors have argued that relationships such as kinships and friendships matter morally (see summary in Tanner 2008) or that the human species is a community that matters morally (Becker 1983, Scanlon 1998). The question is whether such ideas can be extended to relationships between members of different species, and further, to relationships between biotic and abiotic entities. Warwick Fox (2006) argues for such an account, based on “responsive cohesion” as the foundational source of value in ethics. But again, there is surely more to be said here.

Turning from issues surrounding interdependence per se, it is important to note that an increased emphasis on interdependence is consistent with an alternative and superior reading of what Leopold meant by “stability,” which the land ethic tells us we ought to act to preserve. As Eric Freyfogle (2008) points out, commentators such as Callicott took Leopold to mean what other authors of his time meant by stability, namely, static or unchanging. Today, ecological models

²⁰ In the unpublished essay, “Some Fundamentals of Conservation in the Southwest,” Leopold toys with the idea that the moral basis for the land lies in the possibility of its being a living organism, acknowledging the difficulties with the term “life” but insisting that “the interdependent functions of the elements” is the essential characteristic. Callicott (1987) suggests that this view of nature is only vestigially present (albeit still present) in “The Land Ethic,” with Leopold following the ecological views of his time in shifting emphasis from the organism analogy to the community analogy. Assuming this is correct, my suggestion is that we pursue the question of whether the interdependence of humans, other living beings, and abiotic elements on its own is sufficient for the legitimate attribution of moral status. However, it might be interesting to pursue a land ethic based on Leopold’s original vision of land as an organism.

Draft version: Please do not quote without permission

often reject the assumption that ecosystems are static (Botkin 1990, Worster 1990), emphasizing ecosystems that are continually changing due to fires, storms, droughts, etc. (Hettinger and Throop 1999, 7). This makes the land ethic look out of date. However, Leopold was well aware that ecosystems are not static, and he studied the effects of fire and drought in particular (Meine 2010). Moreover, in essays such as “Marshland Elegy” (also in the *SCA*), Leopold contrasts the sorts of human-induced changes that were sustainable to those changes that were unsustainable and problematic. He was not *completely* opposed to humans changing ecosystems; rather, he was opposed to certain *sorts* of changes. In the essay “The Land Ethic,” he points out that “[w]hen a change occurs in one part of the circuit, many other parts must adjust themselves to it”; what he wanted to emphasize was that some human-induced changes may be so rapid and “violent” that it is difficult for the rest of the ecosystem to adjust. In some places, such as Western Europe, the biotic community was able to adjust, whereas in others, such as the Southwestern U.S., the biotic community did not (recall the “Dust Bowl” and the dust storms of the 1930s, which Leopold lived through and wrote about).

So then, what *did* Leopold mean when he said that we ought to act to preserve the stability of the biotic community? Julianne Newton (now Warren) argues persuasively that in order to understand what Leopold meant by “stability,” one must understand the closely related term “land health”; the terms are so closely related that Leopold sometimes uses “stability” interchangeably with “land health” (Newton 2006).²¹ Newton states:

²¹ For example, in “Biotic Land Use,” written around 1942). Newton asserts that Leopold did not intend for “stability” and “land health” to be synonyms (2006, 444); I am not so sure. She has suggested to me (personal communication) that “stability” was the more scientific term, whereas “land health” contains a normative element. This seems plausible.

Land was healthy when it retained over long periods of time its ability to cycle nutrients efficiently and continuously. When land could accomplish this feat it was, in Leopold's vocabulary, stable. "Stability," Leopold explained in "Biotic Land-Use," "is the continuity of this organized circulatory system. Land is stable when its food chains are so organized as to be able to circulate the same food an indefinite number of times." Erosion, floods, pest irruptions, species loss, and other land symptoms without directly visible cause were expressions of instability. They provided evidence of breakdowns in the circulatory system; they emerged because of simplification and derangement of the land pyramid, or degradation of the land's capacity to sustain and renew itself over time (Newton 2006, 338).

Indeed, Leopold emphasizes such issues in the essay "The Land Ethic" itself,²² discussing the ways in which humans have shortened food chains and affected energy circuits, leading to instability or "disorganization" in many parts of the world. This loss of stability is a loss of *function*, i.e., the loss of the ability of land to circulate the "same" food an indefinite number of times. For the purposes of this essay, the important point to note is how essential interdependence between members of the biotic community is to stability; interdependencies are the means through which nutrients cycle throughout the land. Without interdependence, there is no nutrient cycling; without nutrient cycling, there is no stability. Interdependence is key. Moreover, the importance of interdependence can be seen even more clearly in one of Leopold's characterizations of the related term "land health." According to Leopold, "Health expresses the cooperation of the interdependent parts: soil, water, plants, animals, and people; it implies

²² And in other places in the SCA, e.g., "Odyssey," "Wilderness."

collective self-renewal and collective self maintenance” (Leopold [1942] 1991: 300).

Thus, an additional benefit of the shift to emphasizing Darwin’s arguments in the *Origin* – a shift to a greater emphasis on interdependence in Leopold’s thinking – is that it is consistent with, and supports, a highly plausible and well-supported understanding of what Leopold meant by “stability.” Or, to put the point more pragmatically: if we want to preserve stability, which preserves nutrient cycling and goes hand-in-hand with land health, we need to focus on preserving the interdependencies between members of the biotic community. These relationships, whether predator/prey, pollinator/pollinated, or other sorts of relationships, are the key to the land ethic.

Finally, authors have asked whether the land ethic, in its holistic emphasis on ecosystems, sacrifices the individual for the sake of the whole and is therefore “fascist” (e.g., Regan 1983).²³ This certainly does not seem to have been Leopold’s intent, given that he states explicitly that the land ethic implies respect for *fellow members* of the biotic community as well as respect for the community as such. But if we are supposed to respect both individual members and the community as a whole, isn’t that a pluralist theory? And don’t pluralist ethical theories run into trouble when their different aspects conflict – when obligations to the individual conflict with obligations to the community? Callicott answers these questions by arguing that the Humean/Smithian umbrella makes the land ethic a unified, monist view (1999). However, since my interpretation has jettisoned that umbrella, the pluralist worries resurface. I have some

²³ For philosophical defenses against the “fascism” charge, see, e.g., Nelson (1996), Marietta (1999), and Callicott (1999). Meine’s (2010) thorough discussion of Leopold’s life and work, political beliefs and activities, and familial and ethical background, makes clear that there is no historical substance to the fascism charge.

preliminary thoughts on these issues. For example, I do not believe that ethical pluralism entails being “a utilitarian in one situation, a deontologist in another, an emotivist in a third, and so on,” as Callicott (1999) suggests. Rather, one can be an ethical pluralist by seeking to assess the ethical concerns of both individuals and communities in a given situation and then to address both to the greatest extent possible, given the particular details at hand. To do otherwise is, as Don Marietta (1999) suggests, to ignore relevant sources of value by arbitrary fiat. I realize this is sketchy; I hope to discuss this form of pluralism further in future work. Possibilities to examine include describing an ideal process by which such decisions could be made, perhaps similar to the one that Helen Longino describes for balancing competing values in science, with criteria such as diversity of views and community response to critical discussion (Longino 1990), or the rational choice theory approach of Jouni Paavola (2008).

5. Conclusion

I have argued that there is little to support Callicott’s claim that Leopold was drawing from Darwin’s views about the evolution of moral sentiment in the *Descent of Man*. I have argued instead that, rather than drawing on Darwin’s ethical views in the *Descent of Man*, Leopold was drawing from Darwin’s ecological views in the *Origin of Species*. This reinterpretation of Leopold shifts our focus away from moral sentiments and emphasizes more strongly the interdependencies between members of the biotic community. This shift in focus has a number of consequences. On the one hand, we need no longer be concerned with problems surrounding a Humean/Smithian account of ethics. Furthermore, we gain additional support for an alternative reading of the concept of “stability,” one that does not run as seriously afoul of contemporary

Draft version: Please do not quote without permission

ecological models that emphasize changing ecosystems. On the other hand, new questions are raised about the ethical basis for attributing value to communities, and concerns about ethical pluralism are reawakened. These are important issues to explore before accepting the land ethic, but there is reason to think that those explorations may be fruitful. Given that they stem from a thinker as experienced in land conservation as Leopold, they are at least bound to be interesting. As Leopold himself suggests, the land ethic is a product of social evolution – and evolution never stops. In that spirit, we should continue to elaborate and modify Leopold's ideas and see where they take us.

Acknowledgements: Thanks to the Departments of Philosophy at the University of British Columbia and the University of Cincinnati as well audiences at the APA Pacific 2013 and IAEP 2013 for helpful comments on various versions of this paper. I also want to thank the Griesemer/Millstein Lab for constructive discussion and suggestions; Antoine C. Dussault, Clement Loo, Curt Meine, Kenneth Blake Vernon, and Julianne Warren for extremely helpful comments on an earlier draft; and last but not least, Curt Meine for his wonderful biography of Aldo Leopold, to which this paper is very much indebted.

References

- Becker, L. 1983. The priority of human interests. In *Ethics and Animals*, edited by H. Miller and W. Williams. Totowa, NJ: Humana Press.
- Botkin, Daniel. 1990. *Discordant Harmonies*. New York: Oxford University Press.
- Cahill, Abigail E. , Matthew E. Aiello-Lammens, M. Caitlin Fisher-Reid, Hua Xia, Caitlin J. Karanewsky, Hae Yeong Ryu, Gena C. Sbeglia, Fabrizio Spagnolo, John B. Waldron, Omar Warsi, and John J. Wiens. 2013. How Does Climate Change Cause Extinction? *Proceedings of the Royal Society B* 280 (1750).
- Callan, Ramana , Nathan P. Nibbelink, Thomas P. Rooney, Jane E. Wiedenhoef, and Adrian P. Wydeven. 2013. Recolonizing wolves trigger a trophic cascade in Wisconsin (USA). *Journal of Ecology* 101:837-845.
- Callicott, J. Baird. 1987. The Conceptual Foundations of the Land Ethic. In *Companion to A Sand County Almanac*, edited by J. B. Callicott. Madison, WI: University of Wisconsin Press.
- . 1987. Introduction. In *Companion to A Sand County Almanac*, edited by J. B. Callicott. Madison, WI: University of Wisconsin Press.
- . 1989. Hume's *Is/Ought* Dichotomy and the Relation of Ecology to Leopold's Land Ethic. In *In Defense of the Land Ethic: Essays in Environmental Philosophy*, edited by J. B. Callicott. Albany: State University of New York Press.
- . 1999. *Beyond the Land Ethic: More Essays in Environmental Philosophy*. Albany: State University of New York Press.
- Cooper, Gregory. 2003 *The Science of the Struggle for Existence: On the Foundations of Ecology*. Cambridge: Cambridge University Press.

Draft version: Please do not quote without permission

Darwin, Charles R. 1874. *The Descent of Man, and Selection in Relation to Sex*. Second ed.
London: John Murray.

---. 1876. *The origin of species by means of natural selection, or the preservation of favoured
races in the struggle for life*. 6th edition, with additions and corrections ed. London: John
Murray.

Digital Collections, U.W. *Leopold Papers*. Available from
<http://digital.library.wisc.edu/1711.dl/AldoLeopold>.

Fox, Warwick. 2006. *A Theory of General Ethics: Human Relationships, Nature, and the Built
Environment*. Harvard: MIT Press.

Freyfogle, Eric T. 2008. Land Ethic. In *Encyclopedia of Environmental Ethics and Philosophy*,
edited by J. B. Callicott and R. Frodeman: Macmillan Reference USA.

Haeckel, Ernst. 1866. *Generelle morphologie der organismen: Allgemeine Grundzüge der
Organischen Formen-Wissenschaft, mechanisch begründet durch die von Charles
Darwin reformirte Descendenz-Theorie*. Berlin: Reimer.

Hettinger, Ned, and Bill Throop. 1999. Refocusing Ecocentrism: De-emphasizing Stability and
Defending Wildness. *Environmental Ethics* 21:3-21.

Leopold, Aldo. [1923] 1991. Some Fundamentals of Conservation in the Southwest In *The River
of the Mother of God and Other Essays by Aldo Leopold*, edited by S. L. Flader and J. B.
Callicott. Madison, WI: University of Wisconsin Press.

---. [1939] 1991. A Biotic View of Land In *The River of the Mother of God and Other Essays by
Aldo Leopold*, edited by S. L. Flader and J. B. Callicott. Madison, WI: University of
Wisconsin Press.

- . [1942] 1991. Land-Use and Democracy In *The River of the Mother of God and Other Essays* by Aldo Leopold, edited by S. L. Flader and J. B. Callicott. Madison, WI: University of Wisconsin Press.
- . [1942] 1999. Biotic Land Use. In *Aldo Leopold: For the Health of the Land: Previously Unpublished Essays and Other Writings*, edited by J. B. Callicott and E. T. Freyfogle. Washington, DC: Island Press.
- . (WCD) *Citizens' Deer Committee: 1942 - 1944*, pp. [959]-[978] , p. 968 1943. Available from <http://digital.library.wisc.edu/1711.dl/AldoLeopold>.
- . [1946] 1999. The Land-Health Concept and Conservation. In *Aldo Leopold: For the Health of the Land: Previously Unpublished Essays and Other Writings*, edited by J. B. Callicott and E. T. Freyfogle. Washington, DC: Island Press.
- . *Ecological Society - 1947*, pp. [731]-[891], p. 743 1947. Available from <http://digital.library.wisc.edu/1711.dl/AldoLeopold>.
- . [1947] 1991. The Ecological Conscience. In *The River of the Mother of God and Other Essays by Aldo Leopold*, edited by S. L. Flader and J. B. Callicott. Madison, WI: University of Wisconsin Press.
- . 1949. *A Sand County Almanac and Sketches Here and There*. New York: Oxford University Press.
- Longino, Helen. 1990. *Science as Social Knowledge*. Princeton: Princeton University Press.
- Lubchenco, Jane, and Bruce A. Menge. 1978. Community Development and Persistence in a Low Rocky Intertidal Zone. *Ecological Monographs* 48 (1):67-94.
- Marietta Jr., Don E. 1999. Environmental Holism and Individuals. In *Environmental Ethics: Concepts, Policies, Theories*, edited by J. DesJardins. Mountain View: Mayfield.

Draft version: Please do not quote without permission

Meine, Curt. 1987. Building 'The Land Ethic'. In *Companion to A Sand County Almanac*, edited by J. B. Callicott. Madison, WI: The University of Wisconsin Press.

---. 2010. *Aldo Leopold: His Life and Work*. Madison, WI: University of Wisconsin Press.

Nelson, Michael P. 1996. Holists and Fascists and Paper Tigers... Oh My! *Ethics and the Environment* 1 (2):103-117.

Newton, Julianne Lutz. 2006. *Aldo Leopold's Odyssey: Rediscovering the Author of A Sand County Almanac*. Washington, DC: Island Press.

Norton, Bryan. 2002. Epistemology and Environmental Values. In *Land, Value, Community: Callicott and Environmental Philosophy*, edited by W. Ouderkirk and J. Hill. Albany: State University of New York Press.

---. 2005. *Sustainability: A Philosophy of Adaptive Ecosystem Management*. Chicago: University of Chicago Press.

---. 2011. What Leopold Learned from Darwin and Hadley: Comment on Callicott et al. *Environmental Values* 20:7-16.

Ouderkirk, Wayne. 2002. Introduction: Callicott and Environmental Philosophy. In *Land, Value, Community: Callicott and Environmental Philosophy*, edited by W. Ouderkirk and J. Hill. Albany: State University of New York Press.

Ouderkirk, Wayne, and Jim Hill. 2002. *Land, Value, Community: Callicott and Environmental Philosophy*. Albany: State University of New York Press.

Paavola, Jouni. 2008. Science and social justice in the governance of adaptation to climate change. *Environmental Politics* 17 (4):644-659.

Paine, R. T. 1969. A Note on Trophic Complexity and Community Stability. *The American Naturalist* 103 (929):91-93.

- Regan, Tom. 1983. *The Case for Animal Rights*. Berkeley: University of California Press.
- Scanlon, T. M. 1998. *What We Owe to Each Other*. Cambridge, MA: Harvard University Press.
- Shrader-Frechette, Kristin. 1996. Individualism, Holism, and Environmental Ethics. *Ethics and the Environment* 1 (1):55-69.
- Tanner, Julia. 2008. Species as a Relationship. *Acta Analytica* 23:337-347.
- Taylor, Paul. 1981. The Ethics of Respect for Nature. *Environmental Ethics* 3:197-218.
- Thomson, Keith. 2012. *Sermons and Reviews: Darwin's The Descent of Man in America*. American Philosophical Society, Darwin-Valentine collection 20122012]. Available from <http://www.amphilsoc.org/library/valentinedarwin/thomson>.
- Westra, Laura. 2001. From Aldo Leopold to the Wildlands Project: The Ethics of Integrity. *Environmental Ethics* 23:261-274.
- Worster, Donald. 1990. The Ecology of Order and Chaos. *Environmental History Review* 14:1-18.