1. [J. Lubchenco](#)2. [P. List](#)3. [B. Callicott](#)4. [C. Anderson](#)6. [D. McCullough](#)6. [G. Snyder](#)7. [L. Westra](#)8. [J. Boyle](#)9. [F. Leibowitz](#)10. [K. Peters](#)11. [E. Leopold](#)

OF PARADIGMS AND PHILOSOPHIES: ALDO LEOPOLD AND THE SEARCH FOR A SUSTAINABLE FUTURE

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GROWTH OF THE ALDO LEOPOLD LEGEND

Aldo Leopold was, beyond question, the most influential thinker about wildlife, land, and nature conservation of this century. He was central to the establishment of the wildlife management field. He was instrumental in preserving wilderness, the first specific step on the road to conservation of all species, not just those of game or recreational value. His lyrical writings on nature and the value of things wild and free have been a pleasure and inspiration to people from many walks of life. *A Sand County Almanac* is a classic that will endure. Along with Thoreau's *Walden Pond*, it is certain to be a land-mark work of literature down through the ages. More than any other work, it is the bible of the environmental movement.


In an obituary, Paul Errington (1948), one of the people who knew him best, expressed his concern about how history would treat Leopold. He stated:

"Let no one do him the disservice of fostering Leopoldian legends or Leopoldian dogmas. Knowing him as I have, I can say that he would

not wish them to arise from his having lived. He would not wish to have imputed to him any qualities or abilities that he did not possess. He was only a mortal man, but a highly civilized and intelligent one.

Regrettably, fostering of legends and dogmas has come to pass. Leopoldiana is a small cottage industry that has churned out innumerable books, articles, and retrospectives, and spawned a continuing number of symposia, conferences, anniversaries, and memorials. Some of the more important published works include Flader (1974), Callicott (1987a), McCabe (1987), Tanner (1987), Meine (1988), Brown and Carmony (1990), Flader and Callicott (1991), Lorbiecki (1996), Knight (1998), Callicott and Freyfogle (1999), and Meine and Knight (1999). This extensive, and growing, literature gives an unusually detailed record of the life and times of Aldo Leopold. Most are scholarly works, reasonably objective, and cover both the good and not so good. Still, because the authors choose the topic because of their admiration for Leopold, they usually emphasize the former and downplay the latter. Most of us were raised by good mothers who taught us that if we couldn't say something nice, to say nothing at all. Furthermore, we Americans like our heroes to be larger than life and devoid of human failings. As recent events attest, we feel betrayed, somehow, when they are revealed to be less than heroic in all aspects of their lives.

Historical understandings are shaped not only of the activities and accomplishments of the person considered, but also the accretion of biographers working within a context of affirmation of a social group's views of itself and its values. Often the ego of the biographer intrudes, because for the biography to be important, the historical figure must be made to seem important. Consequently, balanced treatment of historically important people is difficult to achieve. Biographies tend, therefore, to fall into two camps and two time periods, those that extol and those that deconstruct. Because Aldo Leopold has been aggrandized, my review of him may seem to be a deconstruction. As an admirer of Leopold and his work, I regret if this is the case. I tried to fairly assess the evidence, and give him his full due. Furthermore, it needs to be remembered that the myth was created not by Aldo Leopold himself, but by his less circumspect followers.



Crawford (1998), in her analysis of the Nobel Prize phenomenon, discussed how the winners of the prize became famous and were lionized by society. The researchers who didn't receive the prize, but whose achievements arguably were as important as the winners (Nobel Prize selections contain a large element of arbitrariness, and are shaped by the membership of the selection committees), declined into obscurity, and typically were largely overlooked in the history of achievement. At best, they are footnotes to the winners. Crawford wrote, "**Myths are necessary for the cohesion of institutions and groups.**"

Singling out notable people serves the needs of society by institutionalizing people's sense of themselves, and empowering their belief in the quality and importance of their being. It establishes beginnings and formulations in the collective memory, whereas, in reality, progress tends to be more a continuation, and such demarcations are largely arbitrary. Crawford notes that myths are innocent enough in fostering the impression that discovery is the work of an individual scientist working alone. However, in their winner-take-all mentality, myths are not so innocent when they mask the important contributions of many workers.

As with the Nobel Prize winners discussed by Crawford (1998), the myth about Leopold is innocent in many ways. Nature conservation needs heroes and wise men to validate the cause. The practical importance of Leopold's writings in bringing the message about decline in the quality of the environment-and consequent quality of human life-to the masses can hardly be overstated. The problem with the Leopold legend, however, is twofold. First, people who read the material on Leopold will get the impression that he was the only important historic figure in the development of nature conservation-give or take a few asides to minor characters-and that he did everything of any importance. Although there is little question that Leopold was the preeminent figure, he was certainly not the only person, and aggrandizement of his role has come at the expense of a fair assessment of the contributions of his contemporaries. Second, he is perceived as one who unerringly homed in on truth because he possessed a unique genius and a deep scientific skill. The evidence will not sustain this view of Leopold's capabilities.

The contributions of Leopold's contemporaries can be

determined directly from the historical record, and I will address that topic first. The question of genius and scientific skill is more subjective, but can be derived from a retrospective analysis of Leopold's thinking as expressed in his writings and actions. Finally, I will assess Leopold's land ethic as an answer to the world's environmental problems. Is it the route to a better world as is so often claimed by environmentalists?

LEOPOLD'S WORLD

From Boy to Man. Aldo Leopold was born into a wealthy family in Burlington, Iowa in 1887, and grew up in a life of privilege. His family spent summers on Les Cheneaux Islands in Lake Huron, Michigan, as was the practice of many wealthy families of the time. Most of his education was in elite private institutions (Lawrenceville Preparatory School in New Jersey and Yale University). It was based on the tradition of western civilization and a Judeo-Christian view of man as steward of nature. He enjoyed the out-of-doors, especially natural history, and he hunted and fished throughout his life. Much is made of Leopold's skill as a hunter, but the frequent misses and wounding recorded in his hunting journals (Leopold 1953) is not reassuring. Early on he settled on a career in forestry which he pursued in the first North American program in Forestry at Yale University where he was awarded a master's degree in 1909. He was an early disciple of the wise-use philosophy of Gifford Pinchot.

After graduating from the Yale School of Forestry he took a job with the U. S. Forest Service working in Arizona and New Mexico. When he first joined the Forest Service he treated the work as an adventure. Upon his arrival in the southwest he "duded" himself out in celluloid cowboy fashion-ten-gallon hat, chaps, and six-gun on the hip-and rode off into the mountains the bad guys to defeat. His acting out of his romantic notions probably furnished a goodly amount of humor to the hard-bitten cowboys of that time and place. However, for the forest survey crew working under him, his romantic inclinations were detracting from the job at hand, and they had little respect for the eastern dandy. He was in charge of a land and forest survey crew, but he neglected supervision of the crew in order to explore the countryside. Furthermore, his poor math skills resulted in major errors that he subsequently spent a long time

correcting. His supervisor found him to be too sure of his opinions, and noted that his head was in the clouds: he was careless and didn't pay enough attention to details (Lorbiecki 1996). He finally buckled down when his job was in jeopardy.

Leopold possessed youthful arrogance, which repeatedly got him into trouble as a student and early in his career. We can excuse the quixotic young Leopold because of his youth; no wolf is born wise. Later in life Leopold wore his privilege more modestly. As he matured, like Benjamin Franklin, he learned to conceal his pride. We can all empathize with Franklin (1944:104) who wrote that of all his vices, pride was the most difficult to conquer, and that if he ever achieved humility, he would probably be proud of it. This struggle with pride applied to Leopold throughout his life. For example, Albert Hochbaum, in response to an early draft of Leopold's Sand County essays, noted a lack of humility in his writing (Meine 1988:456). He stated "**...your way of thinking is not that of a genius, but that of any other ordinary fellow trying to put two and two together...**". I think that Leopold probably was piqued by this observation because he would have liked to be thought of as a genius.

Leopold eventually achieved success in the southwest with the Forest Service, and justified the confidence of loyal supervisors who saw promise in the brash young man. He met and married Estelle Bergere of a wealthy prominent family with ancestral connections to royalty in Santa Fe, New Mexico, a match that remained strong throughout their lives. In 1924 he took a job as associate director of the Forest Products Laboratory in Madison, Wisconsin, under the expectation that he would soon become director, which did not happen. In frustration he resigned from the Forest Service in 1928 and began a survey of wildlife management for a non-governmental organization, the Sporting Arms and Ammunitions Manufacturer's Institute (later the Wildlife Management Institute). The survey originally was national in scope, but later more realistically reduced to a regional coverage of the North Central states.


Near the end of the game survey he began to discuss a possible position in Game Management with the University of Wisconsin, Madison, a negotiation that extended over a long time and suffered many setbacks. Leopold faced the likelihood

of unemployment with few prospects when a five-year temporary appointment finally came through in 1933 (A. Starker Leopold, personal communication). It was during this interval (in 1935) that he bought the farm in Sauk County that became the center point of much of his philosophic writing. For living accommodation he renovated a chicken house that became the famous as the "shack". Leopold's appointment at the University of Wisconsin became permanent in 1939. He went on to establish a department and program of distinction in wildlife management, a history recorded in great detail by his first and only assistant, Bob McCabe (1987). He died in 1948 at age 57 while fighting a grass fire near his farm.

Privilege and Point of View. The Great Depression had a devastating impact on Americans, and especially rural people in the mid-western U. S., who suffered simultaneously from an extended drought. Many farm families lost everything. During those times things were tighter for the Leopold family, but still, they lived in a different realm from most people (Meine 1987:34, 1988:291). Most people were concerned with putting food on the table. In contrast, Meine reported that with careful planning, the Leopold family was able to retain their live-in maid. Although they ordinarily lived within their means they also had a safety net not available for most people. In necessity they could always fall back on the wealthy Leopolds of Burlington and Bergeres of Santa Fe.

Thanks to his economic status, Leopold could use his Sauk County farm for recreation and relaxation. Leopold had the luxury of not having to get any return from his land other than personal satisfaction. Hunting was the real purpose for which he bought it-restoration was secondary and only came later (Flader 1987:52). Furthermore, for him restoration was recreational labor because he never had to make a living, or even a profit, off the land. (He subsidized his farm with income from other sources.) Honest labor seems far less romantic when forced by necessity, and viewed down the handle of a pitchfork. No less a paragon than John Muir reached this conclusion from his boyhood spent laboring on a marginal farm in Wisconsin (Muir 1916). Muir's love of wilderness never got in the way of his preference for being wealthy.

When Sunday night came, Leopold returned from the shack to




Madison and his comfortable house-with domestic help-and his regular job. In similar fashion, after a year roughing it at Walden Pond, Thoreau moved back to the comfort of town, and John Muir lived in a mansion in Martinez, California. It sometimes seems there may be a connection between discretionary income and conservation puritanism. The environmental movement, even today, continues to be largely a middle to upper-middle class avocation. People with empty stomachs make poor conservationists (Hardin 1977).

Leopold should not be judged adversely because he had a privileged life. In fact, he lived his adult life in unpretentious style. Nevertheless, it is important to recognize that his economic status allowed him to view the human relationship to the land in far different terms than was realistic for common folk. Clearly one can say he was right about the robber barons abusing their lands and resources for excessive profit. But people trying to make a living on a family farm at that time were not robber barons. We hear from Leopold that the previous owner of his farm was a bootlegger who abused the land, but we don't know if this was because of negligence or desperation. There were a great many desperate people during the Great Depression and concurrent dustbowl in the Midwest. Their plight did not trace to abuse of their land. It was due to the depression and drought, both of which were completely beyond their control. If they could have saved themselves by abusing the land, they probably would have in their desperation. But nothing they could have done would have made much difference. Dustbowls didn't begin with European farming methods. The biggest dust storms in North America occurred prior to European contact, indeed, to arrival of any humans, as can be verified by picking up a soils textbook and looking up *loess*.

Leopold himself discovered the overwhelming influence of the drought on his farm. He planted thousands of pines during the drought, virtually all of which died despite his best efforts to water, mulch, etc., and this failure continued for years until the rains finally returned. Still, he did not connect his failure to establish trees to the widespread occurrence of wind-blown soil erosion because farmers could not grow crops. That he blamed on land abuse.

While Leopold was spending leisure time at the shack, many



people in rural areas lost their farms, savings, jobs, hope, and personal dignity. Many survived because of WPA, CCC, and other New Deal programs. Leopold was critical of such public works programs. Meine (1987:36) noted that Leopold was no New Dealer. Leopold never seemed to grasp that government public works programs were primarily a means of getting money to people who, unlike him, needed it badly. Conservation was a secondary goal. Although some CCC programs were counterproductive as conservation measures (as Leopold was quick to point out), much restoration did occur during the period.

If Leopold had to depend on his farm for a livelihood, say an income from the sale of pines, or growing his own food, his views may well have been different. He could afford to buy his food, fuel, etc. from elsewhere. This allowed him to avoid guilt with reference to his own actions. The question is, does this absolve him of responsibility for the consequences that his food and fuel had to come from elsewhere? It is likely that Leopold's needs were met by poor people just trying to survive. Was Leopold's moral position purer than the people who, in satisfying his needs, may have ended up abusing their land because they had no alternative?

On one level Leopold was empathetic with the poor. He wrote much about a poor boyhood friend, who shared his love for nature, and at Yale he befriended a poor Jewish boy. But these attempts did not much exceed the *noblesse oblige* which was current at the time, and so far as can be told, he did nothing monetarily to assist these people. Their ultimate ends were in their own hands or the whims of fate. Throughout his life Leopold met people with respect and without regard to their station in life. Nevertheless, when he wrote about the human relationship to the land, he wrote as if all humans were on a plane similar to his own.

Leopold's views carried an implicit landed gentry assumption-as if everyone had wealth, lived in the rural countryside-and that Jeffersonian democracy held sway. Poverty, cities, industrial jobs, labor strife, minorities, woman, poor nations, war, and similar issues were absent from his frame of reference. These things were simply not part of Leopold's land ethic paradigm. Consequently, as a blueprint for the human relationship to nature and environment, the land ethic is a pale answer, because it

leaves out most of the human enterprise, and applies directly to less than 10% of our current population that lives in rural areas. For the other 90%, the land ethic is what we think others on the land should do for conservation-all the while complaining about farm subsidies and lamenting the rampant spread of corporate farming. Leopold was not alone in having his philosophies disconnected from the realities of rural life.

Environmental justice is a major issue, then and now. On a national level, Western nations complain about the weak environmental records of third-world nations when, in fact, Western nations control the world economy and receive most of the benefits from exploitation of third-world resources. It is easy for the wealthy to complain about the poor. Blaming the victim has had a long and successful history. Does this make wealthy people or wealthy nations bad? No, not necessarily. But, do they have moral status to condemn the poor for doing what they have to do in order to survive? Can any ethical system have validity if it ignores environmental justice? I think not. If anything, the greater guilt lies with the rich people and wealthy nations with options. They have no claim to morally superiority because they conserve their lands and neighborhoods while masking their culpability by exploitation elsewhere and through agents.

Leopold's Spirituality. A simple review of the facts of Leopold's life fails to capture the essence of his work. Why is it that his writings transcend the subject being covered, and carry a particular resonance-a familiarity of obscure origin? Why does Leopold inspire appellation such as "prophet" and his Sand County essays the "Bible" in so many biographies (e.g., Nash 1987:75)? He is called an American Jeremiah (Tallmadge 1987:122), and an American Isaiah (Stegner 1987:233). Is our recourse to spiritual allusions simply a failure of imagination in use of language, or is there an unexplored area in Leopold's personal philosophy deserving of greater consideration? With these questions in mind, I revisited the nature of Leopold's spirituality.

On the face of it, Leopold was not a religious man. He often made disparaging remarks about churches and conventional religion. He respected his wife Estella's Catholicism, but due more to his fondness for the woman than the religion. Despite his antipathy for organized religion, he was a serious student of

the Bible. At times, he revealed his spirituality in unexpected ways. Leopold (1948:6) wrote in *Sand County Almanac* about the "**spiritual dangers of not owning a farm**". I was startled when I first read his comment (*Round River*:171),

"I heard of a boy once who was brought up an atheist. He changed his mind when he saw that there were a hundred-odd species of warblers, each bedecked like to the rainbow, and each performing yearly sundry thousands of miles of migration about which scientists wrote wisely but did not understand. I dare say this boy's convictions would be harder to shake than those of many inductive theologians."

Meine (1987: 23) notes that this boy was a lot like Leopold, without going so far as suggesting that the passage was autobiographical. Whatever the case, this reaction bespeaks Leopold's antipathy for Darwin's theory of natural selection, for he surely had read *The Origin of Species* before that time.

Similarly confronted with a diverse radiation of birds, the reaction of a biologist steeped in natural selection and evolutionary theory would be to be intrigued by the natural selection processes and evolutionary pathways that resulted in such diversity. Ironically, Darwin realized that creationism was incorrect, and formulated his theory of evolution largely because of a similar radiation of birds, the Galapagos finches. During the voyage of the *Beagle* Darwin was fooled, initially, by this group of birds, that he thought were grosbeaks, warblers, etc., species with which he already was familiar. This mistake was largely presaged by his creationist beliefs, for if God created all species in an immutable fashion, then the only point of science was to identify the species correctly. Later, Robert Gould, an ornithologist at the British Museum, informed him that based on internal anatomy, they unquestionably all were finches. Only then did it dawn on Darwin that an initial stock of finches had reached the isolated islands, and subsequently evolved into an array of forms occupying separate niches (Sulloway 1982, 1984). Contrary to the boy cited by Leopold, Darwin's belief in creationism ended because of a radiation of birds.

During Leopold's days at Lawrenceville School and Yale

University he commented on how much he enjoyed Darwin's *The Voyage of the Beagle* and *The Formation of Vegetable Mould through the Action of Worms*-two natural history works. However, he failed to mention *The Origin of Species*, the most fundamental book in all of biology. From Leopold's writings it is obvious that he had read *The Origin of Species*. But when he refers to evolution it is in a context of the beauty and intricacy of communities, and the soil-plant-animal system being a super-organism. Thus he imputed to evolution a directed endpoint, always moving towards greater perfection in the workings of communities. Of course communities and ecosystems have processes that are larger than the sum of the organism parts (emergent properties), and these can be fruitfully studied in their own right. There may be value also in super-organism as a metaphor. Nevertheless, it is prudent to avoid implying that communities and ecosystems are the result of design, and that only one particular configuration is functional.

Perfect communities are not the grand plan of evolution. The point of Darwin's *The Origin of Species* was the role of natural selection in evolution, the process by which species arose from other lineages, and changed over time. Note the subtitles: *By Means of Natural Selection, Or the Preservation of a Favored Race in the Struggle for Life*. Evolution per se was a much older idea. Selection theory contradicts Leopold's belief that communities had a larger reality, and that they could be literally considered super-organisms; selection does not operate on that level. Decades of research have established that natural selection operates primarily at the level of the individual, and even if one accepts the group selection arguments such as Sober and Wilson's (1998), this operates at the level of the species, a much lower level of organization than the community.

Leopold seems to have spent more time on Darwin's *The Descent of Man and Selection in Relation to Sex*, probably because in this book Darwin considered ethics towards animals. But note that this book was Darwin's attempt to deal with issues that at first glance seemed to contradict natural selection (including the possibility of group selection), but which more careful study usually showed did not, as Darwin argued. Whereas *Origin* emphasized survival, *Descent* emphasized reproductive fitness, the more fundamental aspect of NeoDarwinism (which added genetics to the theory), and

Sociobiology (which added behavior). I believe that in discussing ethics, Darwin was more concerned about exploring human culture-which seemed to deny natural selection by its altruism-than to formulate a Leopoldian-like philosophy. Nevertheless, Darwin also may have intended this chapter to say that knowing about natural selection should not be license for humans to be rapacious towards nature.

It is true that the grasp of Darwin's theory by scientists of Leopold's time was generally poor. Yet, others who espoused the super-organism concept-Clements (1916) for example-were forced into early abandonment of the literal interpretation of the idea by the challenges of Gleason (1926), Fisher (1930), and others, and subsequently use it more as a metaphor. It was not as if alternate views were not current during Leopold's time. As early as 1925 Forbes (1925) wrote about lake communities:

"...competitions are fierce and continuous beyond any parallel in the worst period of human history; where they take hold, not on goods of life merely, but always upon life itself; where mercy and charity and sympathy and magnanimity and all the virtues are utterly unknown; where robbery and murder and deadly tyranny of strength over weakness are the unvarying rule; where what we call wrongdoing is always triumphant, and what we call goodness would be immediately fatal to its possessor-even here, out of these hard conditions, an order has been evolved which is the best conceivable without a total change in conditions.... In a system where life is the universal good, but the destruction of life the well-nigh universal occupation, an order has spontaneously arisen which constantly tends to maintain life at the highest limit..."


Forbes' understanding of the community processes could hardly be more contrasting with those of Leopold. Furthermore, Leopold's acquaintance and contemporary, Charles Elton, built his work around Darwinian theory. Leopold was familiar with Elton's influential book (1930:17) in which he stated that stability of communities was an illusion:

"The balance of nature does not exist, and perhaps has never existed. The numbers of wild animals are constantly varying to a greater or lesser extent, and the variations are usually irregular in period and always in amplitude. Each variation in the numbers of the species causes direct and indirect repercussions on the numbers of the others, and since many of the latter are themselves independently varying in numbers, the resultant confusion is remarkable."

More surprising is that one of the major early opponents of the idea that a community was an integrated unit of uniquely interacting parts was the botanist, John Curtis, one of Leopold's closest colleagues at the University of Wisconsin, with whom he worked extensively at the University Arboretum. Studies by Curtis and McIntosh (1951) and Curtis (1955) showed that plant species were not distributed in coordinated patterns as would be the case if they occurred in discrete communities. This work was subsequently continued by Whittaker (1951; see Whittaker 1975 for a review of the topic)) with similar results. Leopold, however, retained the concept of the community as a discrete entity to the last of his writings, the essays in *Sand County Almanac*.

According to Leopold's daughter, Estella, who questioned him late in life, "**...he believed there was a mystical supreme power that guided the Universe. ...this power was not a personalized God. It was more akin to the laws of nature. ... His religion came from nature.**" (Meine 1988:506).

Thus, although not religious in the conventional sense, Leopold clearly was spiritual in the "natural theology" sense commonly referred to as Pantheism. Below I explore the lack of theoretical constructs in Leopold's work, and use this to explain his lack of empathy for natural selection theory. In view of his spiritual beliefs, however, it may be due also to the conflict between the harsh dog-eat-dog aspect of natural selection (with its lack of creative direction) and his personal belief in the essential harmony of nature. Leopold seemed to have difficulty accepting the astringent pill of Darwin's theory of natural selection, and its



denial of the guiding hand of an all-powerful being. Like the nineteenth century European parson-naturalists pursuing theology through natural history, Leopold searched for God's wisdom and benevolence in the variety and beauty of God's creations. Viewed in this light it is more understandable why Leopold took so readily to the metaphysical writings of Ouspensky (Nash 1987:77) (that imbued all living things with spirits), which otherwise are aberrant, if not a little balmy.

Reread in the light of Leopold's spirituality, the individual responsibility and moralistic tenor of the *Sand County* essays take on new meaning. Furthermore, the resonance of the message becomes recognizable because it is familiar from religious teachings imbued with mystery, sanctity, and moral authority derived from a higher power. Tallmadge (1987:111) notes that Leopold wrote in parables. One can hardly fail to note his repentant sinner in the killing of the wolf. It is important to recognize, however, that Leopold's conversion about predators came not at the time of the demise of this wolf, but many years later. It is not the death of a wolf that bothered Leopold—he remained an active hunter throughout his life, and never repented that activity. Nor is it his admission of being wrong in understanding about the role of predators in natural systems. He used killing of the wolf as a metaphor for the transgressions of humans against the sanctity of nature. Indeed, as discussed below, there may not have been any such wolf at all. It may have been no more than a literary device—in biblical terms, a parable. In a sense, in *Sand County Almanac* Leopold did write a testament. The Old Testament relates man to God. The New Testament relates man to man. In *Sand County Almanac* Leopold tried to write a missing testament—one relating man to nature. *Sand County Almanac* is rather like a Book of Psalms for natural theology. Its intent was not so much to relate science to conservation as it was to relate morality to conservation.

Leopold's spiritual views still have natural appeal to the mindset of many ecologists. Observe the striking parallel of current ecological doomsday predictions and religious teachings. Religious prophets for centuries have proclaimed "repent, the end is near". Ecological prophets have proclaimed the same now for about fifty years. Still, so far, so good. The current quality of life is no worse and, for most people, better than before. According western religions, God created humans in his own

image, and put them in the Garden of Eden. They sinned against Him and were driven from the garden into a life full of pain and suffering. Only by repentance can individual humans be saved from eternal damnation. The world will end in a cataclysm. Ecological dogma specifies that humans inherited a natural paradise. Through their own avarice and ignorance they despoiled this paradise. Redemption can be achieved only through drastic reduction in human numbers and a return of the earth to its original condition. Otherwise, the world and human life will end in an environmental cataclysm.

LEOPOLD WITH REFERENCE TO HIS CONTEMPORARIES

As Errington (1948) stated in an obituary for Leopold, **"Without belittling in any way his numerous contemporaries, it may be said that he, more than anyone else, has been responsible for the expansion and refinement of wildlife management as such is known today"**. This, I think, is a fair assessment—one with which most of Leopold's contemporaries would have agreed. But most of those contemporaries suffer from the lack of their own biographers. They remain obscure in the shadow cast by Leopold as illuminated by his biographers. I, too, grew up in the wildlife profession being taught that Leopold was the main, if not sole, fountain of wisdom, and that all the other biologists of the time were hard working and dedicated, but rather aimless until Leopold marked the main paths. I subsequently learned that this was a distortion. In fact, many others pioneered and articulated the original ideas that Leopold later adopted pretty much as whole cloth. I also discovered that Leopold marked false trails as well as correct ones.

Although much of the submersion of Leopold's contemporaries was inadvertent, some of it was purposeful. He had his champions. Notable in this regard was Robert McCabe (deceased), Leopold's faculty assistant at University of Wisconsin. Bob McCabe defined his own career as a "disciple" of Leopold. As such he defended Leopold's reputation like the grand inquisitors of old; any criticism was not only wrong, it was the work of infidels. McCabe's (1987) book, a rich source of detail about Leopold's later career, was at the same time an

unvarnished paean to Leopold. He idolized Leopold to the point of embarrassment. In McCabe's (1987:158) words, **"In a conversation with someone who did not know A. L., but was interested in him as a person commented that she was overwhelmed by the constant adulation. She asked, "Did this man have no faults?" What could I say? If he had any flaws in his make-up they must have been minor, since I never saw any that caused me to stop and reflect"**. Given his lifetime spent aggrandizing Leopold's reputation one can only shrug at his statement (page 159), **"I have no desire to canonize A. L., in fact it would be repugnant to me if this were ever attempted."**

Although Bob McCabe was the most obvious, there was a large contingent of Leopold admirers and loyalists who shared the same views. The Leopold family, to their credit, was circumspect. Certainly they appreciated the accolades, but I know of no instance in which they purposefully contributed to aggrandizement of Aldo's reputation. I was well aware that my mentor, A. Starker Leopold, revered his father, but when he spoke of him it invariably concerned his human characteristics, and not his accomplishments. He always discussed him in a matter-of-fact manner.

Did loyalty to Leopold by his supporters lead to suppression of contrary views? I think so. One example will illustrate the point. In his book McCabe (1987:154) notes that an author, who he declined to name, claimed that University of (X) had a program in wildlife management that predated by four years Leopold's hiring at the University of Wisconsin. McCabe obviously was outraged at the audacity of this claim. The unnamed author was Paul Dalke, a retired wildlife professor and researcher who was a contemporary of Leopold, and unnamed "university X" was the University of Michigan. I break no confidences because anyone can go to a library and look up Dalke's (1983) note. Dalke was an old-fashioned gentleman of the first order, and had not a mean bone in his body. He meant no slight to Leopold. He thought that, in good faith, people were erroneously crediting Leopold with being the first professor in the wildlife management field, and the University of Wisconsin with having the first program. Because Dalke had been the first Ph.D. graduate student in a wildlife management program (labeled Forest Zoology) at the University of Michigan at an earlier date,

he knew it had predated Leopold's program at the University of Wisconsin.

This he stated in a brief, matter-of-fact, half-page note in the *Wildlife Society Bulletin* (Dalke 1983). I am sure that Dalke thought that people would read it and think, "Oh, that's an interesting bit of history", and that would be it. Most readers probably did just that. But Bob McCabe fired off an irate and intemperate reply to the *Bulletin* editor, with a cover letter that berated not only Dalke for writing the note, but the editor and anonymous referees for letting it be published. Interspersed with side comments that this was a matter of no importance and hardly worth anyone's attention, McCabe mustered a spirited case that Leopold was first. Everyone was a bit embarrassed by the whole matter.


The *Bulletin* editor sent McCabe's reply to Dalke, and suggested that it and a response from Dalke be published together in a future issue. However, Dalke was elderly, suffered from Parkinson's disease, and his health had taken a turn for the worse; he was scheduled to go in for surgery. He was physically unable to reply to McCabe. So, he asked me to respond. How could I say no to a kindly old man, who wrote to me in a hand squiggly from Parkinson's, and whose prospects for further life were so much in doubt? Thus it was that I, a student of Leopold's son, A. Starker Leopold, and thus a direct academic descendent, found myself in the infidels' camp. I'm sure this turn of events appalled Bob McCabe.

Dalke turned to me because, upon joining the faculty at Michigan in 1966, I had discovered the history of the wildlife program there, and was greatly surprised that it predated Aldo Leopold's hiring at Wisconsin (1927 vs. 1933). Furthermore, it involved three professors (Howard Wight, Ned Dearborn, and Earl O'Roke) versus only one at Wisconsin. Thus, it was a substantial program. Over time I met most of the surviving graduate students of the program, including Paul Dalke, and we talked at length about the early history of the wildlife field. Furthermore, I had encouraged Dalke to put this bit of history on the record, because the original players who had lived the history were growing old, and were not likely to be around much longer. I saw the issue as correcting the historical record, not a contest between the Badgers and the Wolverines, or any of the

individuals involved. I could not see that it belittled Aldo Leopold in any way.

McCabe's arguments reduced to two main points: 1) it was the title rather than the substance of the program that was important; and 2) Michigan's program was not really wildlife. On the first point I noted that Dalke in his original note acknowledged that Aldo Leopold was the first to carry the title of Professor of Game Management (not of Wildlife Management as usually is stated: Leopold apparently gave himself the latter title in about 1937). Professors in wildlife at Michigan carried the title of Forest Zoologist. At the time it seemed strange to me to emphasize titles over substance, and it still does some fifteen years later. I can only guess that McCabe choose to emphasize titles because, on the record, it was the only argument that would sustain a claim of Leopold's professorship and the Wisconsin program being first. I noted that by this criterion, A. Starker Leopold would have been excluded from the ranks of the wildlife field because the University of California, Berkeley gave him the title Professor of Zoology until 1968, and Professor of Wildland Resource Science after that date. Starker's program was never recognized by a formal name.

On the second point, I noted that early research in the Michigan program focused on ring-necked pheasants and Hungarian partridge in farmlands of southern Michigan, hardly quintessential forest birds in forest environments-quite the contrary. Aldo Leopold was very aware of the Michigan program, because he worked with all of these Michigan graduate students and faculty in putting together his *Report on a Game Survey of the Northcentral States* (Leopold 1931). He even helped to get scholarship money from his employer, the Sporting Arms and Ammunition Manufacturers' Institute, for a graduate student at Michigan, Ralph Yeatter, to study Hungarian (gray) partridge. When he was hired at Wisconsin, Leopold modeled his research program in many ways after the program at Michigan. The farmer-hunter-researcher cooperative he established in the Riley and Faville Grove areas, an innovation Leopold's biographers give him credit for, was a direct mimic of the Williamston Project (Wight 1931) in Michigan. Michigan foresters had recognized problems in regeneration of cut-over northern forests (Forestry having been established at the University of Michigan in 1903; Dana 1953). One forester at




Michigan, Sam Graham, recognized the value of aspen as a commercial tree and as wildlife habitat years before Leopold did. Similarly, the wildlife biologists at Michigan confronted over-populations of deer—a major emphasis in Leopold's career at Wisconsin and the well-springs of his *Thinking Like a Mountain* essay—well before Leopold did. Late in life Leopold still pursued the unrealistic goal of re-establishing white pine forests (what with deer everywhere ready to consume this highly palatable species), and he was still thinking of aspen as a weed tree that was a starvation food for deer.

Even Leopold's biographers state that the infrastructure for natural resource conservation and management in the state of Michigan was well ahead of that in Wisconsin. Although Leopold gave credit sparingly to his contemporaries, he acknowledged the influence of P. J. Lovejoy of the Michigan Conservation Department on matters of land management and the appropriate relationship of human society to the natural world (Leopold 1943a). Many of Leopold's ideas about conservation and ethics of humans towards nature—which Leopold put into elegant prose—originated with Lovejoy.

In his critique of Dalke's note Bob McCabe stated that the barometer of the wildlife profession was the Wildlife Society and its publication, the *Journal of Wildlife Management*. Had Bob consulted Volume One, he would have discovered two articles co-authored by William H. Marshall, and one each by Paul D. Dalke and Lee E. Yeager, all Michigan students. Four of eleven articles (36%) in the first volume of the journal were authored by Michigan students. Furthermore, Warren W. Chase, later a professor at Michigan, was treasurer of the Wildlife Society, and Samuel A. Graham, still another professor associated with the wildlife program at Michigan (who was not even included in Dalke's comment) was Region 3 (north central) representative. Dalke, Marshall, Reuben E. Trippensee, and Yeatter all attended the meeting in Washington, D. C. on 3 February, 1936 to organize the Wildlife Society (*Journal of Wildlife Management* 2:61).

The important point was not the parochial argument of Michigan versus Wisconsin, but rather that history was giving a disproportionate amount of credit to Aldo Leopold—whose real contributions were beyond doubt—while overlooking the



significant contributions of his contemporaries. The beginning of wildlife management was not isolated to Michigan and Wisconsin. Review of issues of *American Game*, and *Proceedings of the International Association of Game, Fish and Conservation Commissioners* for the late 1920s and early 1930s shows that the movement was broadly based. Training and research in wildlife were being done by Arthur Allen at Cornell, Rudolph Bennitt at Missouri, Logan Bennett and Paul Errington at Iowa State, Ralph T. King at Minnesota, Joseph Grinnell at California, Walter P. Taylor at Texas A&M, Clarence Cottam and W. L. McAtee at the U. S. Biological Survey, and Herbert Stoddard, an independent, to mention only a few of the better known figures. Clearly the time for the birth of wildlife as a separate profession had arrived.

If Aldo Leopold was not the original, and certainly not the only person establishing the wildlife field, why was he such a dominant figure? First of all, Leopold was creative, energetic, and especially, a prolific and talented writer. Other conservationists of the time were abundantly supplied with the first two attributes; it was the last skill that particularly set Leopold apart from his contemporaries-both in his inclination and ability. Many of his contemporaries, like professionals today, were not inclined to put to paper anything that could be avoided or diverted to someone else. They were content to think about ideas, talk about ideas, meet about ideas-but write them out only if required.

Leopold was singular in his practice of writing things out as a way to think about them, a skill he practiced from his early days as a schoolboy at Lawrenceville School. His activities and thoughts were recorded in an immense correspondence, particularly with his mother, with whom he was an admitted favorite. Consequently, Leopold laid down an abundant paper trail for his biographers to follow. Biographers of his contemporaries will not find such easy going. Leopold was, from long practice, a masterful wordsmith. He could articulate ideas in ways that captured the salient points-rather like precursory sound bites-in ways that most of his contemporaries could not.


During his career, because he had written down the ideas about conservation and management, Leopold's writings became the context in which the issues of the day were discussed, evaluated,

and debated. He received feedback, revised papers, and sent them off to be published. Whether consciously or unconsciously, he increased his own role by seldom explicitly acknowledging the source of ideas or citing the contributions of others. He was primarily an essayist. Leopold's writings are notable for their lack of acknowledgments, citations, or references. Thus, he was credited with the ideas in his papers, no matter who the original source was, or the input of other contributors along the way. For the most part, although he did have his detractors, his contemporaries seemed satisfied with this arrangement.

LEOPOLD AS INTELLECTUAL LEADER AND FOLLOWER

Resource Management. Leopold's ideas about management remained pretty much in the tradition of wise use and prudent removal of sustainable harvests of natural resources. He took great pains to point out that these resources were much more than their economic or recreational values, but he never much doubted that the requirements of human society for natural resources must be met. In this arena there is little doubt that the major source of thinking was that of Gifford Pinchot about forests, which Leopold and others applied to game, livestock grazing, and other products, whether obtained from forests or other ecosystems. This area has been covered in detail by others (e.g., Allen 1954, Gabrielson 1941, Graham 1944).

Principles of Wildlife Management. Most people assume that the ideas in *Game Management* (Leopold 1933) were original with Leopold. The philosophical material was original to him, but the technical material, I believe, was very largely derived from others. Consider the history of the book. During his time in the southwest, Leopold was quite isolated intellectually, and by necessity, he worked mostly alone. The product of this period was his proposed book, *Game Management in the Southwest*, in which he intended to present the principles of game management. Ultimately, he dropped this project. The only material that was carried over into *Game Management* was mainly philosophical, not technical. Why would he have not simply expanded his southwestern book into *Game Management*? The record is not clear on this point, and I can only speculate. Isolated in the southwest, he was dependent



largely on his own ideas. But with travels during his survey of game in the north central states he came into contact with some of the best researchers and managers of wildlife of the time—e.g., Charles Stoddard, Paul Errington, Howard Wight, and others. In this report he only surveyed other people's work. He did not do any independent research during this period. So why start anew with his text book project? I think it likely that upon encountering the work of others he discovered his original technical material was not particularly strong. Whatever the case, he did start over, and without doubt, *Game Management* had a broad base of reference that greatly transcended Leopold's own contributions.

There is no doubt that Leopold's concepts of breeding potential and environmental resistance as presented in Chapter II of *Game Management*, the fundamental principles of the book, came from Chapman (1928). In fact, however, Chapman laid out these ideas in a far more elegant fashion, most of which Leopold did not adopt. Curiously, Leopold cited Chapman (page 26) only as the source of the term "environmental resistance". Perhaps this was an oversight, and Leopold did not intend to slight Chapman; but anyone who reviews Chapman's paper will probably conclude that this work would have been better cited at the beginning of Chapter II, and a more generous attribution would have been appropriate. Later on (page 172) Leopold cites Chapman again and more completely, but for use as a tool rather than as an integrating principle. In the rest of the book, Leopold develops his own theory of hunting and other population manipulations without reference to the principles put forward in Chapter II.


But the problem is deeper. Principles, even for the time, were rudimentary in development, and were not unified in the book. Rather the principles were scattered as bits and pieces in what is a compendium of descriptive material. Some of the material was Leopold's own, but most was from the work of contemporaries. He was much better about giving credit for descriptive material, which was more frequently cited.

Leopold's work, and subsequent wildlife science, was handicapped because theoretical and analytical approaches were ignored as the field pursued descriptive studies lacking a unifying conceptual framework. Being a naturalist, Leopold was much more comfortable with descriptive biology. The reason,

probably, was Leopold's discomfort with theoretical constructs including, as noted above, a Darwinian view of evolution. His lack of theory may further account for his denigration of narrow disciplinarians and reductionist scientists in academe, including statements that resonate with overtones of defensiveness. One wonders if Leopold's lack of a Ph.D. in an institution filled with Ph.D.s such as the University of Wisconsin may not have colored his perception of his academic colleagues.

Contributing to his descriptive approach may have been his poor mathematical skills, an Achilles' heel throughout his career. It is not so much that formal mathematics per se is required; it is the mode of thinking that mathematics requires that is valuable to a scientist. Lack of theory and mathematical skills were not unique to Leopold; they were general in the wildlife and ecology fields at the time. Still, other early workers such as Charles Elton (1927, 1930), although similarly relying on the evidence of natural history studies, examined them in the light of theoretical constructs. Elton employed no more formal mathematics than Leopold. Yet, while still a young man Elton was recognized as being exceptional because theory gave coherence to his work. Evolution, the most basic of all theories in biology, was prominent in Elton's work. Due to his interest in animal cycles, Leopold knew and admired Elton whose interests overlapped his own. Nevertheless, Elton's theoretical approach did not permeate Leopold's *Game Management*. Leopold's citations of Elton's work pertained to descriptive results, not theoretical threads.

Wilderness. Leopold's contribution to wilderness was primarily in the achievement of wilderness designation and protection of the landscape on the ground, particularly in the Gila National Forest. This was a tremendous accomplishment. The conception of wilderness and its values, however, can be attributed to Leopold's predecessors, most notably Henry David Thoreau, George Perkins Marsh, and John Muir (Nash 1982, 1987). Few ideas put forward by Leopold were new. Most were re-justification in specific cases of ideas long in circulation. In matters of wilderness, Leopold was much influenced by contemporaries such as Arthur Carhart and Bob Marshall. Indeed, others were clearly in the leading role in creating the Wilderness Society, but they recognized the need for Leopold's stature to give the movement legitimacy, and of Leopold's writing ability to articulate the values of wilderness in ways that




captured the public imagination and obtained government notice.

Leopold wrote much about the democratic ideal of wilderness, but this may have been inspired by Marshall, who was a socialist. Leopold's own ideas of democracy tended to be elitist, at least intellectually. This is apparent from his derogatory writings about mass recreation (to him, tourist was a bad word) in the U. S. National Parks. He had little good to say about the national parks, and was particularly incensed by tourism as practiced at the Grand Canyon National Monument (now park) and Yosemite National Park (Meine 1988:159, 252). That the popularity with the masses of this way of experiencing the out-of-doors was a more egalitarian form of democratic expression than the one he espoused either did not occur to him, or did not carry much weight. Although he recognized that wilderness areas had to be open to everyone, he hoped that most people would stay away so that those with the right values and rituals (like him) could experience wilderness in solitude.

A most telling incident in this regard was when Leopold was challenged about his attitudes toward people using the Quetico-Superior National Forest for recreation (Meine 1988:245). Leopold responded defensively, saying that those people paid to be taken in rather than going in with their own sweat, and guided by their own outdoors skills. A check of his journals in *Round River*, showed that Leopold's indictment was more general to all people, including Indians who, presumably, were there not there for the pleasure of camping out, but to make a livelihood (*Round River*:42). Furthermore, he ignored the contradiction that his forays into the mountains of Mexico involved paying someone else who knew the country to take him in with horses.

Nor was he consistent in his attitudes about wilderness being a place for only pristine things; for example, his use of horses. He noted that he did not think much of a man who did not enjoy working with horses and dogs (*Round River*:172), a feeling shared by gentlemen hunters of the time in nearly all parts of the world. Native Americans had dogs, so at least dogs could be entertained as a part of pristine America. But it did not seem to bother Leopold that the horse had not been a part of the North American fauna since the Pleistocene, having been reintroduced to the continent only in the sixteen century by the Spanish. Leopold's acceptance of the horse was probably due to his early




experiences with the Forest Service in the southwest when a horse was virtually a necessity of life. Much later in life when his disciple, Bob McCabe, embarked on writing an essay about horses having no place in wilderness, what with bad smells, horse manure, broken down trails, and all, Leopold disagreed strongly (McCabe 1987:93). McCabe, who apparently thought his essay was in tune with Leopold's aversion to modern accouterments in wilderness areas, clearly was taken aback. At first he resolved to stick with his guns, but in characteristic fashion, eventually acceded to "The Professor's" superior wisdom and sensibilities. Nevertheless, it is apparent that "The Professor's" dictums didn't always apply to his personal behavior.

Soil Erosion. This is an area that, so far as I can tell, Leopold developed nearly on his own. Although H. H. Bennett and M. W. Talbot were pursuing the same topic, Leopold seemed to have independently recognized erosion in the southwest, and connected it with the impacts of livestock. He further recognized that the conventional wisdom that removal of trees was the source of the problem overlooked the more fundamental importance of the herbaceous layer in the uplands, and willow along riparian courses. He also recognized that fire was a complicating factor.

Fire Ecology. Recognition of the importance the herbaceous layer for stabilization of soils carried Leopold into rethinking of the role of fire. In the Forest Service, fire was viewed as a totally bad thing, but Leopold recognized that the actual case was much more complex. Fire could be good or bad depending on time and place, and was not so simple as the policies the Forest Service implied. This is still a problem for the agency today. Also, Leopold recognized that fire was necessary for the maintenance of some natural communities.

LEOPOLD'S SCIENCE

Leopold's biographers, who for the most part were not scientists, make much of his scientific abilities. They usually remark that his success occurred because he combined the understanding of a scientist with the sensitivities of a poet. Certainly he had a wide understanding of natural history, and to the extent that



encyclopedic knowledge is considered science, the conventional view is correct. But at a deeper level, science is not a collection of "facts". It is a way of knowing. It is the process of deriving sound knowledge by identifying competing hypotheses, and designing critical tests to systematically attempt to eliminate one or more of them. Absolute truth cannot be known because accepting a hypothesis carries the hazard that correlation does not prove cause and effect, and that other possible hypotheses may not have been recognized. A scientist tentatively retains those hypotheses that have not been rejected. Many treatises have been written—indeed whole careers spent—on the essence of science. Perhaps the most cogent statement is Platt's (1964) paper on Strong Inference. In the wildlife field, Romesburg (1981) stated the basic premises of this approach.


Like moral perfection, this way of defining science is stating an ideal that seldom can be achieved in practice. This kind of science is most readily applied to controlled (i.e., reductionist) experiments in the laboratory. Nature, with its myriad of connections and endless variation is not very amenable to experiments, and those that are attempted usually lack adequate control, sufficient replication, and are not on a great enough scale. Still, ideal science, as a way of thinking, is important to all research and, especially, field research. Knowing what constitutes a good experiment is necessary to the design of the best field study that can be achieved within the constraints imposed by reality.

In this sense, Leopold was not a particularly good scientist. He searched for what he hoped to find. Absence of theoretical underpinning for his thinking resulted in excessive reliance on "word models" that were so imprecise that they made it nearly impossible to reject any hypothesis. The consequence was a lack of critical testing. Although some 500 papers are listed in his bibliography, none involved a hypothesis test; and only four or five can be accepted as being based on systematically collected data. The rest are incidental natural history observations or essays. His natural history observations were insightful, but disconnected from larger relevance. Joseph Grinnell, whose method was also natural historic in approach, pursued science according to a systematic scheme by vegetation type, elevation, etc., that was informed by evolutionary theory. Even Leopold's more in-depth work (for example, his phenological studies) was

essentially descriptive (with correlation thrown in at times) because it had no theoretical construct, and no hypothesis or fundamental question involved.

Of course, it is unfair to judge Leopold by modern standards, and his faults are not rare among researchers even yet today. Nevertheless, among his contemporaries there were good scientists who would have been successful by today's standards. They include Joseph Grinnell, Charles Elton, Howard Wight, and Herbert Stoddard, all of whom were Leopold's colleagues, and Paul Errington, and Albert Hochbaum were within Leopold's inner circle at Wisconsin. Is it accidental that his plans to co-author manuscripts both with Errington and Hochbaum fell through because he could not agree with them on interpretations of data? And is it symptomatic that these two individuals, although appreciating Leopold's many sterling qualities, argued with him, and forced him to alter his thinking in ways that probably were better for him than the admiration of those who deferred to his greater wisdom?


Leopold's philosophical beliefs-including his spiritual tenets-got in the way of his objective thinking, and led him astray in a number of instances. Flader (1974) and Meine (1988) note several cases, and I will outline a few others that seem particularly relevant. Leopold was the chief architect of the ungulate "irruption" paradigm, which made its way into ecological theory as fact. Leopold's views were conditioned by his belief in the super-organism, and that nature's checks and balances achieved harmony. This led to the conclusion that all land health problems were due to human influence. He is best known for the Kaibab Plateau deer story, which Caughley (1970) debunked by showing that the "data" in this case were wild guesses at best, and entirely invented in some cases. Lack of data was transformed into data points with repetition of the story, and they ended up as an elegant graph in the influential text by Allee et al. (1949). Furthermore, a number of variables changed on the Kaibab besides predator removal, and Leopold did not take them into account. Indeed, Leopold actively searched for evidence that would support his views. There was no pretense about an objective test of the proposition, and little systematic attempt to find contradictory evidence. Thus, Leopold was prone to fixate on what he considered the right explanation, and advocate it with little consideration of alternate possibilities.



Another example of ungulate-vegetation interactions that Leopold used was the white-tailed deer on the George Reserve in southern Michigan. Unlike the Kaibab case, this case is characterized by abundant data (McCullough 1979). Leopold (1943b) projected from early data the trajectory he expected in the future. In his ideas about irruptions, Leopold was convinced that vegetation damage was inevitable (thus harming biotic health), and that the recovery period was either long or never. As part of my studies on this deer herd, I examined the proposition that carrying capacity was reduced by over-abundance. Despite some very prominent effects of deer feeding on vegetation-for example, plant form and species composition-the overall deer carrying capacity remained essentially unchanged over 50 years (McCullough 1982, 1983, 1987, 1997). This result points to redundancy in the plant component and resilience in the ecosystem on the George Reserve.

Leopold was convinced-probably because of his acceptance of the super-organism view of communities, and an idealized balance of nature-that unbalanced relationships in communities were invariably due to human impacts. Leopold cited predators to account for a balance of deer populations with vegetation in undisturbed nature and he was convinced that predator control by humans upset this balance. Thus he wrote his most famous essay, "Thinking Like a Mountain". The character of this essay is unique because Leopold, in a roundabout way, acknowledges his change of mind about predators.

This confession was forced by the insistence of his former graduate student, Albert Hochbaum, that Leopold admit his short comings in *A Sand County Almanac*. For his confession, which he softened by making it a conversion, Leopold used a metaphor, the green fire in the eye of a dying wolf. **"I realized then, and have known ever since, that there was something new to me in those eyes-something known only to her and to the mountain."** Of all of Leopold's essays, "Thinking Like a Mountain" is my favorite, and I have on many occasions quoted from it. Nevertheless, one must note that Leopold's claim in this statement is false. This putative wolf was killed in 1909 (Meine 1987) whereas in subsequent years Leopold led the quest to eradicate wolves and other predators from the southwest with self-assured zeal. Leopold's conversion about the inherent value



of predators didn't come until the middle of the 1930s, some 20 years later. Leopold held the widely accepted view that predators were "bad", and need to be reduced, if not eradicated for the benefit of game, a view that held even within the National Parks (Prichard 1999). Nevertheless, the change in attitude about predators (even the name is pejorative-more correctly they should be referred to as carnivores) came late to Leopold. As early as 1916 Joseph Grinnell and Tracy Storer (1916) advocated that predators be retained in the national parks as part of the balance of system, and for years the American Society of Mammalogists had opposed government programs to eliminate large predators.

Is the wolf incident a fictional device of Leopold the essayist? Meine (1987:27, 1988:94) notes that he found no mention of the killing of this wolf in any of Leopold's journals or other writings of the time, or in the writing or remembrances of any of Leopold's colleagues. It is surprising that the arrogant young Leopold of that life period did not make known to his family in Burlington the fact that he had chalked up a wolf. I remember A. Starker Leopold showing me a Winchester lever-action .30-.30 that he said was the rifle his father used in that incident, and he told me that marks on the butt stock were from the teeth of that same wolf. I looked at the marks with great interest, having looked at wolf teeth a lot while trying to identify the source of another mysterious wolf (McCullough 1967), but I could find no similarity of the marks on the stock to what I would have expected a wolf's teeth to make. I knew this rifle was a treasured heirloom, primarily because of the story, so I made no comment about my doubts. Some stories are best accepted at face value.

Another surprising thing about Aldo Leopold, is that whereas wolves, bears and mountain lions eventually rose in his mind to become icons and indispensable regulators of deer numbers, the coyote remained a villain. Coyotes simply were not an acceptable part of Leopold's super-organism communities. Throughout Leopold's writings the poor coyote remained the odd cog out, an invader who tailed man, and helped him screw up sensible communities. **"There are no coyotes in the mountains, whereas with us there is universal complaint from Alaska to New Mexico that the coyote has invaded the high country to wreak havoc on both game and livestock."** (Leopold 1937: 120). The mountains referred to as

lacking coyotes were in the Gavilán River area in Mexico, the place Leopold chose as his ideal of land health. Certainly the historical distribution of the coyote included that area. It is too bad that Leopold did not see a green fire in a coyote's eye. This survivor of systematic pogroms should have been one of his icons; it stayed on the job trying to save the mountain from deer long after the wolf, mountain lion, and bear were forced to retire to a few remote communities.

Leopold's beliefs (and many of our own) about the stability of natural predator-prey relationships-i.e., not disrupted up by humans-were put to the test by an instructive case history, the moose-wolf interaction on Isle Royale National Park, an island in Lake Superior. Moose and wolves both naturally dispersed to Isle Royale, and neither species was manipulated by humans. Early work suggested that a balance between wolves, moose, and vegetation indeed was being achieved (Allen 1979, Mech 1966). But this was only nature perversely fiddling with our minds, and raising our hopes that such systems were in fact a finely orchestrated waltz. Since then the moose and wolves have gone on an improvised rag, the outcome of which no one can predict (Peterson and Page 1988, Peterson et al. 1998). At least we can eliminate stability, and with it, a fine balance of nature as perceived by Leopold. Reviews by Egerton (1973), Davis (1986), Betancourt et al. (1990), Botkin (1990), Pimm (1991), and Shrader-Frechette and McCoy (1993), Pickett et al. (1992) and Pickett and Ostfeld (1995) among others, challenge the belief that natural communities have a balance in the Leopoldian sense. A recent compendium of long-term studies of over a decade or longer (Cody and Smallwood 1996) shows how few species maintain stable numbers in natural communities.

What Leopold needed to bolster his views on land health was a pristine place where humans had not altered the integrity, stability, and beauty of nature. He concluded that the Gavilán River in northern Mexico was just such a place. He took no measurements and did no research. He concluded simply from looking at the landscape. A search of his journal in Round River shows that his party hunted the area for parts of 17 days. In this time they saw one wolf track, and found one deer carcass covered by a mountain lion. From this Leopold (1937:120) wrote,

"Whitetail deer are abundant in the Sierras, but not excessive. So are wild turkeys. In nine days of hard hunting, two of us saw 187 deer, fifty of them bucks of two or more prongs. Deer irruptions are unknown. Mountain lions and wolves are still common. I doubt whether the lion-deer ratio is much different from that of Coronado's time."

But an even more amazing fact is that this pristine community in the not-too-distant past supported a high population of Indians (*A Sand County Almanac*:159):

> **"There once were men capable of inhabiting a river without disrupting the harmony of its life. They must have lived in the thousands on the Gavilán, for their works are everywhere. Ascend any draw debouching on any canyon and you find yourself climbing little rock terraces or check dams, the crest of one level with the base of the next. Behind each dam is a little plot of soil that was once a field or garden, subirrigated by the showers which fell on the steep adjoining slopes."**

How long ago were all of these people there? In 1937 (Leopold 1937:120) Leopold says that the oldest tree in these works was 200 years old, but in *A Sand County Almanac* (page 159) he stated the age as 300 years. Apparently these were guesses based on tree size unsupported by counts of annual rings. How did this high human population and their fields coexist harmoniously with the abundant deer, turkeys, wolves and lions? Leopold (1937:120) concluded that the Indians must have raised deer-resistant plants. This conclusion is so illogical and contrary to everything known about Indians that surely this interpretation was influenced by Leopold philosophical beliefs. Could it just be that those Indians might have hunted the wildlife to gain meat and protect crops at the same time? And how can we assume that the presence of thousands of Indians-from all descriptions erecting artificial earthworks like the modern engineers whom Leopold so disdained-might not have changed the character of the wildlife just as they had the land? Leopold could not have told whether the Indians lived peaceably with wildlife or with an extreme alternative of having driven all wildlife to local extinction. Nor could he have known if the community changed once again with the disappearance of Indian populations. Which was the healthy state, while the Indians were there or after they


were gone? Is it possible that both states were equally healthy, a conclusion that seems to contradict Leopold's usual belief that there is only one healthy state?

Martin (1978), Martin and Szuter (1999), Krech (1999) and others have reviewed the evidence about Indians and wildlife, and generally debunked the notion that they were ecologically sound stewards of wildlife. The history of this topic is reminiscent of the myth of the noble savage. The debates about the actual role of American Indians will be hotly debated for some time. But the simple acceptance that they maintained healthy balances with their resources is based more on romanticism than fact. Pre-Columbian humans greatly altered the North American continent by hunting, building, draining, channeling, cultivating, cutting, and burning, including Leopold's own Eden, the Gavilán River. Yet we perpetually think that the first Europeans arrived to a pristine environment. This was not the case, for the pre-contact aboriginal population was much higher before Europeans brought exotic diseases that caused a large decline (Cook 1999, Krech 1999). Denial by modern humans of the impact of native peoples on the environment is prevalent. The wildest continent, Africa, was the cradle of humanity, and humans have interacted with the environment for at least two million years. As pointed out in *The Myth of Wild Africa*, wildness there was more a European perception than a reality (Adams and McShane 1992). Much the same can be said of pristine North America.

There are, without further belaboring the point, huge stretches of imagination in Leopold's conclusions about the Gavilán River. It is apparent that all three traits of community health-beauty, integrity, and stability-were more in his mind rather in the actual dynamic functioning of the community. Leopold's approach to science, I believe, was particularly prone to this problem.

NATURE'S RULES


The earth has undergone continuous changes whether viewed over time scales of millions of years (Martin and Klein 1984, Miller et al. 1987, Ward 1994, Garstang et al. 1997, millennia (Quinn et al. 1987, Betancourt et al. 1990), centuries (Walters and Meier 1990, Whitlock 1992, Wright et al. 1993, Whitlock et



al. 1995, Diaz and Pulwarty 1994), or decades (Engstrom et al. 1991, Redmond and Koch 1991, Balling et al. 1992,). The NATO Advanced Science Institute has published over 50 volumes on global environmental change. Over the last one million years the earth has oscillated between cold periods with ice accumulation and warm periods of ice melting; these cycles of 100 thousand years (Croll/Milankovitch cycles) have been characterized by 90 thousand years of cold alternating with 10 thousand years of warm climates (Muller and MacDonald 1997, Petit et al. 1999). All indications are that we are currently coming to an end of the recent warm period (the Holocene), and the shifts usually are relatively abrupt. Even within cycles these changes are not simply gradual trends over long periods of time. Betancourt et al. (1990) reported that packrat middens showed that new plant species appeared and others disappeared from local communities repeatedly over the Holocene. There is now clear evidence that El Niño-Southern Oscillation events have influenced climate over the globe in oscillatory patterns for at least the last 4.5 centuries, and that between 1803 and 1987 such events occurred on average every 3.8 years (Quinn et al. 1987).

If one assumes that communities are a kind of super-organism as Leopold did, then it follows that the whole is dependent on the correct workings of each part. Each cog, wheel, and spring is essential. Leopold stated that the first rule of intelligent tinkering was to save all of the pieces. Still, what is the evidence for this view? Consider the fate of the dinosaurs, or note that the worst case of soil erosion in North America is the Grand Canyon. And although human activity certainly contributed to the dust bowl, this were not the cause-drought was. Wind-blown dusts did not originate with technological man. The prairie pothole region exists because of the influence of a great continental glacier that destroyed everything in its path. The potholes remain there despite their shallow depths and high productivity because of periodic drought during which decomposition or fires reduced accumulated organic matter.

Longer-term records from pollen cores and similar sources show that change was a universal characteristic of nature. We know that many species have gone to extinction. We probably do not adequately credit the recuperative powers of nature. If the community is a more amorphous aggregation of independent entities as would be expected from Darwin's theory of natural



selection, and a globe driven by plate tectonics, geomorphology, and climate, then parts become interchangeable, and there is redundancy and compensation. Reduction or removal of component parts results not in total loss of function but rather its conduct by expansion of other organisms in response to the opportunity.

Change in environments is ubiquitous. Some change is gradual, but other is sudden. The asteroid thought to have ended the age of dinosaurs occurred in an instant, and changed things for ever (Ward 1994). Fire, storms, floods, virulent disease, arrival of exotic competitors and predators are less dramatic, but have similar consequences. Many natural changes are abrupt, and sometimes catastrophic. We can anticipate similar occurrence of natural catastrophic change in the future.

Probably our biggest problem in ecology is not the unknown, but the things we think we know that are wrong. A problem for all scientists is seeing what our minds project onto nature. This is probably true of all fields of human endeavor, and simply reflects the power of paradigms. Paradigms are like optical filters that we unconsciously set, rather like prescription glasses, so that as long as we wear that pair we perceive the colors and definition inherent in their design. Because Leopold assumed that nature was near-perfect, it followed that modern humans had to be the source of all adverse effects in nature. Certainly there was no shortage of harm caused by humans-then or now-although Leopold was unforgiving of some quite sustainable human-altered systems. He viewed them as unhealthy only because they didn't support some other value he appreciated.

We must recognize that integrity, stability, and beauty are the human ideal for communities. As guides to human behavior they are useful and prudent. However, they are not laws of nature. If nature has a rule, it is that there are no rules. Obviously some changes exceed the resilience of the community to adjust. But most losses are more equivocal, and whether they are good or bad relates more to the human value system than to biological sustainability. But nature has rung all manner of changes in the past, and more-and not necessarily gradually over time. The asteroid that ended the age of dinosaurs changed things in an instant, and fires, hurricanes, floods, earthquakes do their changes in a short time.


Science will not be the handy referee we would like it to be for human behavior. One can not point to the past and say this is what is acceptable according to nature's rules, because nature has played just about every imaginable experiment in the past. So, how does one anchor an ethic using scientific criteria?

Arbitrarily, I think, which by definition is not scientific. Even a slow rate of change, as proposed by Callicott (1996) is not definable. In the absence of clear direction from nature, the arguments about acceptable rates of change always come back to human values.

Some people might suggest that this situation is license to humans to do whatever they want without censure. Not at all-no more than the ideal of freedom stated in the U. S. Constitution was intended to encourage crime, or free will in religious teaching was to encourage sinning. Because I note that the earth is resilient doesn't mean that I advocate trashing it and polluting it. We can all agree that human-caused changes have potential to be bad for human welfare, and it is only wise to be cautious about stressing natural systems. This prudence is necessary because our understandings are still so rudimentary and there is risk in change, not that human-caused changes are different than those of nature. I agree that we should do every thing we can to slow the rate of change to retain as many options as possible. But science will not support this opinion over others, so the decision will be debated through the human value system.

WHERE DO WE GO FROM HERE?

The Land Ethic Paradigm. The land ethic espoused by Leopold is an individual-based morality that is relevant mainly within the paradigm in which it was developed. Leopold was a gentleman farmer in the heartland of the U.S. where the Jeffersonian tradition of democracy, based on a landed gentry fit better than most places. However, Leopold's writings, even for his time, have abstractness shorn of complexity. Curiously lacking are connections to drought, depression, war, cities, labor strife, women's rights, and racial inequities-to mention only some of the large issues that Leopold lived through-all of which have had profound consequences for natural resource conservation.



Viewed in the harsh light of these realities, Aldo Leopold's admonishments, although moving and uplifting to read, are nostalgic longings for a world that does not now exist—indeed, previously existed only for a privileged few. To assume the land ethic is sufficient to address the environmental problems of today's world is a quaint, archaic illusion. These admonishments are as probable of effecting an equitable, sustainable relationship of humans to the environment in the modern world as the admonishments of the Bible have been in bringing about morality in the relationships between humans. **"People usually don't do what they believe in. They do what they want and then they repent"** (Bob Dylan in *Brownsville Girl*). Even in personal economics, Leopold's bugaboo, people usually fail their ideals. Ben Franklin (1944) writing as Poor Richard tells about an old man exhorting a crowd to be frugal, **"Thus the old gentleman ended his harangue. The people heard it, and approved the doctrine, and immediately practiced the contrary, just as if it had been a common sermon"**.

I disagree with Meine's statement (Callicott 1987: 34) that **"Leopold was skeptical of large-scale government efforts to solve widely dispersed problems not as a consequence of any strong ideological opinion, but as a matter of practicality"**. I think ideology was the reason. Leopold gave up on governmental regulation when it failed after only 30 years. Why did he assume individual morality would succeed for environmental matters when it has failed for 2,000 years in human matters? He stated, **"I have no illusions about the speed or accuracy with which an ecological conscience can become functional. 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."** (Meine 1988: 499). One can not help but wonder about Leopold's apparent acceptance of 2,000 years for the land ethic to be achieved. Even the slower rate of change of his era would not support so sanguine a view of the time available to save the natural world as he saw it. The reason, perhaps, is because it fit his spiritual paradigm and political conservatism.

In fact, his ideas were far more accepted in the Forest Service than they ever were in the private sector. Despite the Sand County essays, Leopold recognized that the western lands would have been trashed if they had been in private hands. Yet today

conservation is easier to achieve on public than on private lands. He didn't change any more minds-indeed fewer-in his work on private lands in Wisconsin than institutional minds in the bureaucratic Forest Service in the southwest. Ultimately, Leopold's beliefs prevailed over results when he opted for modification of individual behavior over regulation as the best route to conservation. Actually, our modest effectiveness in achieving conservation by any means dictates that we use both.

Science and Ethics. Obviously, Leopold's concept of communities as super-organisms is not a useful basis for an ethic (Callicott 1996, Shrader-Frechette 1998). Callicott (1996) proposed that human-caused changes to the environment should be small and incremental to comply with Leopold's land ethic, but I think this approach will fail because it doesn't account for the inevitability of sudden changes. In the absence of clear lessons from nature, standards by which ethical behavior of humans to the environment can be judged will be ambiguous. We will of necessity have to depend on the human value system, and that will inevitably lead to moral ambiguity.

We also know that selfish behavior is not going to disappear, either among animal species or among humans. Recent evolutionary thought turns on the natural tension between cooperative versus competitive behavior. Where some individuals see the long-term benefit of cooperation (conservation) for the common good, other individuals see short-term opportunity to be exploited for personal gain. Bad behavior, both between humans and of humans to the environment, is deeply rooted in human nature, and is more traceable to our evolutionary origins than to a failure of moral codes. Neither religious teachings nor laws have eliminated anti-social behavior. For example, theft continues despite laws and their enforcement, and the commandment that thou shall not steal. We say crime does not pay but, in fact, the commission of a theft is more likely to succeed than the establishment of a new business. At a higher level, religious beliefs are a major source of conflict between societies, perhaps with the end of the cold war, the most common source. Selfish behavior persists, not despite being evil, but because it is often successful.


The new ethic must take into account that humans are competitive. Economic status is the antlers, and social position

the iridescent plumage of humans. Will and Ariel Durant (1968: 19) wrote, "**Animals eat one another without qualm; civilized men consume one another by due process of law.**"

Since philosophers discovered Leopold's writings in about 1970, they seem to have been looking to science for models of morality. This is a natural place to look since science has usurped so much of the explanation of causality previously attributed to God. In our own way we biologists have had a similar quest in other animals for models of a better human society. This traced to our biased assumptions that humans, through the complexity of culture, had lost the ordinary social mechanisms for harmony and thus, were exceptional in their capriciousness and anti-social behavior: crime, racism, genocide, and war. Jane Goodall's (1971) early work on chimpanzees hailed how peacefully and harmoniously the non-human apes lived. Since then, of course, we have learned that her peaceful chimpanzees rape, murder, steal, and cheat in a manner to make humans proud (Bygott 1972, Goodall 1986, Wrangham and Peterson 1996, Stanford 1999). This led to the conclusion that they were a lot like us (in fact, we share 98% of our genes)- which obviously reverses the order for it is we who are like them. Next we found out that lion prides and hyena clans carry on aggressive strife, killing each other at every chance, behavior that can best be described as warfare. In fact, most large mammalian carnivores readily kill each other, not only within species, but between species. Bears kill wolves which kill mountain lions, both of which kill coyotes, which kill foxes and bobcats: woe be to the smaller and weaker.

Then we were surprised that DNA studies showed that all of those upstanding passerine (song) birds, so faithfully engaged in stable monogamous pairs, were producing offspring that commonly were sired by males other than the male of the pair bond (Birkhead and Møller 1992). We rather expect males to cheat, but not females. Nevertheless, DNA work on humans is showing similar results (Ridley 1993: 226). The gap between the birdhouse and the White House is not that wide.

As an anatomical adaptation, a big brain is no more impressive than antlers, fins, wings, etc. But it is different from every other adaptation because it conveys the ability to think and reason. No one expects deer or tigers or elephants, or chimpanzees to

A decorative background on the left side of the page featuring a large yellow leaf with a detailed vein pattern, surrounded by several smaller yellow triangles of varying sizes, all set against a light yellow background.

behave ethically towards each other, much less to other animals and the environment. Beavers can cut down all of the trees, wolves can reduce caribou to near extinction, elephants can destroy forests and create grasslands on a large scale without censure; humans cannot. Like the man without a country we are a species in limbo-too human to be just an animal and too animal to be independent of the natural world. This is the conundrum that the moral philosopher will always confront. We have passed laws that specify human rights, and we can pass laws that specify rights for animals. But never can we force an animal species into the same ethical category as humans until the day the first chimp leans over and says, "Jane, we really must do something about this outrageous chimpanzee monkey business".


Philosophers concern themselves with equality of ethical covenants. According to Kenneth Goodpaster (as cited by Callicott 1987b:197) philosophical concepts of ethics arose from egoism-what one wants for himself-and the moral requirement to grant the same consideration to all others of the same standing. Philosophers reviewing Leopold's land ethic take him to task for the unequal status of the human and the natural in the land ethic. But does Leopold's land ethic need to conform to the strict logic of ethics or do ethics have to be expanded to include unequal relationships? Over time has not ethical inclusion been expanded to previously unequal human groups? Otherwise, slavery, bondage, subjugation of women, etc. would never have been addressed. This, of course, did not change the philosophy of ethics so much as include these groups in the human category. Still, it suggests that an even greater ethical obligation must govern the stronger among unequal parties. Any ethic that does not counter bad behavior seems inherently unethical. In an ideal world, humans should be moral beings in all aspects of their lives, not just in interactions with other humans.

But isn't the larger issue empathy, which leads to moral obligation? The key philosophical issue is not inclusion of animals or soil in the human category; it is requiring responsibility from humans. Acceptance by humans of responsibility is what makes the act altruistic. That takes it beyond natural selection and into the realm of ethics-that is, cooperating when selfish behavior would be the more rewarded by natural selection. (That humans in the modern world compete more for bank accounts than children does not alter the process.)

To forego personal fitness for the good of the larger society could evolve biologically only under reciprocal altruism (Trivers 1971). The fact that reciprocity is subject to cheating under any condition, and certainly not enforceable in the modern situation, means that altruistic behavior towards nature is an expression not of biological self-interest, but instead a uniquely human idealism. Surely this falls in the realm of ethics.

Culture, Religion, and Environmental Ethics. Some people suggest that indifference towards the environment is a western trait, and that other cultures and religions are protective of nature. Nevertheless, Gary Snyder has pointed out that Buddhism did not save China's forests. I have worked extensively, and lived for awhile in Asia, and I can attest that it did not save wildlife either, or prevent massive pollution. The poor can wreck an environment quite as thoroughly as the rich, and worse, they lack to wherewithal to correct the damage done. It is often pointed out that Native Americans exploited the continent less over a long time than European over a short time. This is true. But attributing this to the superiority of their religious and cultural beliefs is debatable. The consensus is that it was a lack of technology, not culture that limited Native American impacts on the environment.

If the cultures of these people were so robust, why did technology introduced by Europeans so easily undermine their cultures? Inuit given firearms killed wildlife indiscriminately. The horse reached the plains Indians before Europeans did, and changed tribal warfare and hunting. Martin and Szuter (1999) suggested that large wildlife became scarce outside of the territorial boundaries between tribes (where it was dangerous to be) because of over-exploitation. There is strong evidence of Pleistocene overkill when humans first arrived, and these people apparently wiped out any wildlife susceptible to their technology (Martin and Klein 1984, Ward 1994). When first contacted by European people, they presumably possessed religions and cultural norms similar to those of their ancestors. All of this suggests that people at these times were no better or worse ethically than people at other times. Only the level of their technology, and thus their capacity to alter natural landscapes changed. Their ethics then were not sufficient to prevent over-exploitation just like our own ethics now.



▶ We have idealized native religions, Buddhism, etc., but objective evidence shows that undesirable environmental impacts have occurred around the world independent of religion, culture, economic or political system. Having been in Vietnam and Far East Russia recently, I know that communism was an environmental disaster. The worst environmental disasters I saw in Vietnam, however, were not attributable to communism. They were created by aboriginal hill tribes in the most remote mountains where slopes were cleared of the last shred of natural vegetation to bare ground in order to plant corn and other crops. Soil erosion over the whole of western part of northern Vietnam was beyond belief. Even a small rain results in thick deposits of soil across the roads. Obviously this situation is not sustainable. It would be interesting to know why these groups migrated to this area from southern China. Were they driven out because of their resistance to central authority, as conventional anthropology has it, or did they move because they exhausted the ecological potential of the landscape in their previous home? Slash and burn, and graze and move are viable strategies of land use when there are few people and a large landscape. It is a recipe for disaster when there are many people, and no place to move. The consequences can be easily seen in Asia, Central America, and Africa.

For environmental conservation, an ethic is not sufficient. Government regulation is not sufficient. I advocate a combination of both ethics and regulation, but suspect the outcome will be insufficient. I fear the real truth is that we simply do not and can not control these things on a global scale. It is scientifically sound for rich people and rich nations to follow Hardin's (1974) lifeboat analogy (i.e., protect our own interests). But I don't think it is ethical. Is it better to ethically share equally and all go down with the ship? Do we outlaw immigration? Do we create an environment-oriented Orwellian government? Do we fool the people through the media? Will anything work? This is where science ends and philosophy begins.

This message is pretty grim, and it disturbs me as much as anyone. However, if I am right about the evidence, then ignoring the message will be of little avail. If I am wrong, then bring forth the contrary evidence. Perhaps one reason I fall back on the resilience of the earth, and the shortness of the human view is

that it gives a ray of hope in a dismal situation, and a reason to continue to work on trying to solve the problems.

Many people think that Leopold's land ethic is the route to a sustainable future. I think the land ethic is an attractive moral statement, useful as far as it goes, but inadequate as a paradigm for sustainability because it makes naïve assumptions about the perfectibility of humans and simplicity of the problem. Meanwhile, the human population continues to grow, rural private lands are dominated by corporate farms and developers, habitats on public lands are badly fragmented, most people are concentrated in cities, toxic chemicals and global changes proliferate, resource demand and use is global in scope, and there are extreme inequities in distribution of benefits and costs of resource uses between have and have-not nations and peoples.

Does this dark view of the human condition appeal so strongly to ecologists because it strikes a cord deep with our psyches, embedded there by direct or subliminal exposure to religious influences? Both views seem to me to be articles of faith. Questioning either is likely to result in one being labeled a heretic. Nevertheless, we need to consider the possibility that ecologists will turn out to be no better prognosticators than priests. The world will change. But perhaps the story line—there has to have been a beginning, and there will be an end—is wrong. Perhaps life, including that known as human, is a continuation that simply goes on and on like the rest of the universe. Accepting that reality may be the means by which humans become one with nature.

It is time to consider alternative paradigms. The remaining testament to be written is the Environmental Testament that connects people everywhere, not just to a rural landscape, but to the total environment, including cities, technology, and political-economic systems. I can not articulate this paradigm in a useful way. However, morality based on individual responsibility will not suffice. Such a paradigm cannot be based only on the perfectibility of human nature. We humans did not come from Paradise and we are not headed towards Nirvana. What is required is a testament that integrates law and morality; that melds individual responsibility, government regulation, land ownership, social equity, and economic incentives and disincentives into a workable whole. The goal is to alter both

human behavior and institutions to conserve nature as best we can in what will always be an imperfect world. We must realize that we are not truly in control of things. Previously (McCullough 1994) I proposed the analogy that we are being carried along by a mighty river, too big to dam and too fast to swim against. It is hopeless to try to stay in the same place. Only by looking down stream can we anticipate what is coming, and try to influence our place in the current.

LEOPOLD IN PERSPECTIVE

Beyond doubt, Aldo Leopold's contributions were profound and impressively varied. He does not require mythmakers. His greatest contribution was as a prophet, who like the biblical prophets was not one who set things right, but rather someone who exhorted humans to be more than themselves in a selfish and imperfect world. More than any other historical individual he put forward an alternate vision of the relationship of humans to the natural world to which ordinary people responded. That Aldo Leopold was less than his legend is no reason to fault him. In fact, he is much more appealing in his human dimensions than in his mythical recreation. In his human form we can all personally relate to him in our own struggles to make the world a little bit better place for things wild and natural. He was a man who struggled with the challenges of his time as he understood them. He searched for a better integration of the human enterprise into the workings of nature, and persisted in the quest despite normal human failings, serious mistakes, and disappointments along the way. This is all that can be asked of any person. Leopold's life is admirable not so much because his answers were always right, but that his intentions were.

This critique, therefore, is a deconstruction not of Leopold the person, but of the legend created about him. It is further only fair to admit to our own culpability. We wanted so much to believe the legend. In so doing we may have perceived the wrong legacy. It was not so much received wisdom, that Leopold gave us as it was a model of creative thinking, hard work, and hope enough to carry on the struggle-despite personal limitations. We should have idolized him less and emulated him more. There is much to be done. So while paying tribute to his life and giving thanks for his wonderful writings, we must move on with life after Aldo Leopold in the continually changing world.

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LITERATURE CITED

Adams, J. S., and T. O. McShane. 1992. *The Myth of Wild Africa: Conservation without Illusions*. W. W. Norton, New York.

Allee, W. C., A. E. Emerson, O. Park, T. Park, and K. P. Schmidt. 1949. *Principles of Animal Ecology*. W. B. Saunders Company, Philadelphia.

Allen, D. L. 1954. *Our Wildlife Legacy*. Funk & Wagnalls Company, New York.

Allen, D. L. 1979. *Wolves of Minong: Their Vital Role in a Wild Community*. Houghton Mifflin, Boston, Massachusetts.

Anonymous. 1938. Notes. *Journal of Wildlife Management* 2:61.

Balling, R. C., Jr., G. A. Meyer, and S. G. Wells. 1992. Climate change in Yellowstone National Park: Is the drought-related risk of wildfires increasing? *Climatic Change* 22:34-35.

Betancourt, J. L., T. R. Van Devender, and P. S. Martin (editors). 1990. *Packrat Middens*. University of Arizona Press, Tucson.

- Birkhead, T. R., and A. P. Møller. 1992. *Sperm Competition in Birds: Evolutionary Causes and Mechanisms*. Academic Press, London.
- Brown, D. E., and N. B. Carmony. (editors) 1990. *Aldo Leopold's Wilderness: Selected Early Writings by the Author of A Sand County Almanac*. Stackpole Books, Harrisburg, Pennsylvania.
- Botkin, D. B. 1990. *Discordant Harmonies: A New Ecology of the Twenty-first Century*. Oxford University Press, New York.
- Bygott, J. D. 1972. Cannibalism among wild chimpanzees. *Nature* 235:410-411.
- Callicott, J. B. (editor). 1987a. *Companion to A Sand County Almanac: Interpretive and critical essays*. University of Wisconsin Press, Madison.
- Callicott, J. B. 1987b. The conceptual foundations of the land ethic. Pp. 186-217 in *Companion to A Sand County Almanac* J. B. Callicott (editor). University of Wisconsin Press, Madison.
- Callicott, J. B. 1996. Do deconstructive ecology and sociobiology undermine Leopold's land ethic? *Environmental Ethics* 18:353-372.
- Callicott, J. B., and E. T. Freyfogle. 1999. *For the Health of the Land: Previously Unpublished Essays and Other Writings*. Island Press, Covello, California.
- Caughley, G. 1970. Eruptions of ungulate populations, with emphasis on Himalayan tahr in New Zealand. *Ecology* 51:54-72.
- Chapman, R. N. 1928. The quantitative analysis of environmental factors. *Ecology* 9:111-122.
- Clements, F. E. 1916. *Plant Succession. An Analysis of the Development of Vegetation*. Carnegie Institution of Washington Publication No. 242:1-512.
- Cody, M. L., and J. A. Smallwood (editors). 1996. *Long-term Studies of Vertebrate Communities*. Academic Press, San Diego, California.
- Cook, N. D. 1999. *Born to Die: Disease and New World Conquest (1492-1650)*. Cambridge University Press, Cambridge, U.K.
- Crawford, E. 1998. Nobel: Always the winners, never the losers. *Science* 282:1256-1257.

Curtis, J. T. 1955. A prairie continuum in Wisconsin. *Ecology* 36:558-566.

Curtis, J. T., and R. P. McIntosh. 1951. An upland forest continuum in the prairie-forest border region of Wisconsin. *Ecology* 32:476-496.

Dalke, P. D. 1983. Setting the record straight. *Wildlife Society Bulletin* 11:190.

Dana, S. T. (editor). 1953. *History of Activities in the Field of Natural Resources-University of Michigan*. University of Michigan Press, Ann Arbor.

Davis, M. D. 1986. Climatic instability, time lags, and community disequilibrium Pp. 269-248 in *Community Ecology*. J. Diamond and T. J. Case, (editors). Harper and Row, New York.

Diaz, H. F., and R. S. Pulwarty. 1994. An analysis of the time scales of variability in centuries-long ENSO-sensitive records in the last 1000 years. *Climatic Change* 26:317-342.

Egerton, F. N. 1973. Changing concepts of the balance of nature. *Quarterly Review of Biology* 48:322-350.

Elton, C. 1927. *Animal Ecology*. Sidgwick and Jackson, Ltd., London, United Kingdom.

Elton, C. 1930. *Animal Ecology and Evolution*. The Clarendon Press, Oxford, United Kingdom.

Engstrom, D. R., C. Whitlock, S. C. Fritz, and H. E. Wright, Jr. 1991. Recent environmental changes inferred from the sediments of small lakes in Yellowstone's northern range. *Journal of Paleolimnology*. 5:139-174.

Errington, P. L. 1948. In appreciation of Aldo Leopold. *The Journal of Wildlife Management* 12:341-350.

Fisher, R. A. 1930. *The Genetical Theory of Evolution*. The Clarendon Press, Oxford, United Kingdom.

Flader, S. L. 1974. *Thinking like a Mountain. Aldo Leopold and the Evolution of an Ecological Attitude toward Deer, Wolves, and Forests*. University of Missouri Press, Columbia.

Flader, S. 1987. Aldo Leopold's sand country. Pp. 40-62 in *Companion to A Sand County Almanac*. J. B. Callicott (editor). The University of Wisconsin Press, Madison.

- Flader, S., and J. B. Callicott (editors). 1991. *The River of the Mother of God and Other Essays*. University of Wisconsin Press, Madison.
- Forbes, S. A. 1925. The lake as a microcosm. *Bulletin of the Scientific Association (Peoria, Illinois)* 1887:77-887.
- Franklin, B. 1944. *The Autobiography of Benjamin Franklin & Selections from His Writings*. The Modern Library, Random House, New York.
- Gabrielson, I. N. 1941. *Wildlife Conservation*. The Macmillan Company, New York.
- Garstang, M., P. D. Tyson, H. Cachier, and L. Radke. 1997. Atmospheric transports of particulate and gaseous products by fires. Pp. 207-250 in *Sediment Records of Biomass Burning and Global Change*. J. S. Clark, H. Cachier, J. G. Goldammer, and B. Stocks (editors), Springer-Verlag, Berlin.
- Gleason, H. A. 1926. The individualistic concept of plant association. *Torrey Botanical Club Bulletin* 53:7-26.
- Goodall, J. 1971. *In the Shadow of Man*. Houghton Mifflin, Boston, Massachusetts.
- Goodall, J. 1986. *The Chimpanzees of Gombe: Patterns of Behavior*. Harvard University Press, Cambridge, Massachusetts.
- Graham, E. H. 1944. *Natural Principles of Land Use*. Oxford University Press, London, United Kingdom.
- Grinnell, J. and T. Storer. 1916. Animal life as an asset. *Science* 44:375-380.
- Hardin, G. 1974. Living on a lifeboat. *BioScience* 24:561-568.
- Hardin, G. 1977. *The Limits of Altruism: An Ecologist's View of Survival*. Indiana University Press, Bloomington.
- Knight, R. R. (editor). 1998. A Sand County Almanac and Aldo Leopold's legacy. *Wildlife Society Bulletin* 26:695-766.
- Krech, S., III. 1999. *The Ecological Indian: Myth and History*. W. W. Norton, New York.
- Leopold, A. 1931. *Report on a Game Survey of the Northcentral States*. Sporting Arms and Ammunition Manufacturers' Institute, Madison, Wisconsin.
- Leopold, A. 1933. *Game Management*. Charles Scribner's Sons, New York.

- Leopold, A. 1937. Conservationist in Mexico. *American Forests* 43(3):118-120; 146.
- Leopold, A. 1943a. Obituary: P. S. Lovejoy. *The Journal of Wildlife Management* 7:125-128.
- Leopold, A. 1943b. Deer irruptions. *Wisconsin Academy of Science, Arts, and Letters* 35:351-366.
- Leopold, A. 1949. *A Sand County Almanac. With Essays on Conservation from Round River*. Sierra Club/Ballantine Books, San Francisco/New York.
- Leopold, L. B., ed. 1953. *Round River. From the Journals of Aldo Leopold*. Oxford University Press, New York.
- Lorbiecki, M. 1996. *Aldo Leopold: a Fierce Green Fire*. Falcon Publishing Company, Helena, Montana.
- Martin, C. 1978. *Keepers of the Game: Indian-animal Relationships and the Fur Trade*. University of California Press, Berkeley.
- Martin, P. S., and C. R. Szuter. 1999. War zones and game sinks in Lewis and Clark's west. *Conservation Biology* 13:36-45.
- Martin, P. and R. Klein (editors). 1984. *Quaternary Extinctions*. University of Arizona Press, Tucson.
- McCabe, R. A. 1987. *Aldo Leopold. The Professor*. Robert A. McCabe, Madison, Wisconsin.
- McCullough, D. R. 1967. The probable affinities of a wolf captured near Woodlake, California. *California Fish and Game* 53:146-153.
- McCullough, D. R. 1979. *The George Reserve Deer Herd: Population Ecology of a K-selected Species*. University of Michigan Press, Ann Arbor.
- McCullough, D. R. 1982. Population growth rate of the George Reserve deer herd. *Journal of Wildlife Management* 46:1079-1083.
- McCullough, D. R. 1983. Rate of increase of white-tailed deer on the George Reserve: A response. *Journal of Wildlife Management* 47:1248-1250.
- McCullough, D. R. 1987. North American deer ecology: fifty years later. Pp. 115-122 in *Aldo Leopold: The Man and His Legacy*. T. Tanner (editor). American Soil Conservation Society, Ankeny, Iowa.

- McCullough, D. R. 1994. Importance of population data in forest management planning. *The Forestry Chronicle* 70:533-537.
- McCullough, D. R. 1997. Irrupective populations of ungulates. Pp. 69-98 in *The Science of Overabundance-Deer Ecology and Population Management*. W. J. McShea, H. B. Underwood, and J. H. Rappole (editors). Smithsonian Institution Press, Washington, D.C.
- Mech, L. D. 1966. The wolves of Isle Royale. Fauna of the National Parks of the United States Fauna Series 7. USDI/National Park Service, Washington, D. C.
- Meine, C. 1987. Aldo Leopold's early years. Pp. 17-39 in *Companion to A Sand County Almanac*. J. B. Callicott (editor). The University of Wisconsin Press, Madison.
- Meine, C. 1988. *Aldo Leopold. His Life and Work*. The University of Wisconsin Press, Madison.
- Meine, C., and R. R. Knight (editors). 1999. *The essential Aldo Leopold: Quotations and Commentaries*. University of Wisconsin Press, Madison.
- Miller, K. G., R. G. Fairbanks, and G. S. Mountain. 1987. Tertiary oxygen isotope synthesis, sea level history, and continental margin erosion. *Paleoceanography* 20:1-19.
- Muir, J. 1916. *The Story of My Boyhood and Youth*. Houghton Mifflin Co., Boston.
- Muller, R. A., and J. G. MacDonald. 1997. Glacial cycles and astronomical forcing. *Science* 277:215-218.
- Nash, R. 1982. *Wilderness and the American Mind*, 3rd ed., Yale University Press, New Haven.
- Nash, R. 1987. Aldo Leopold's intellectual heritage. Pp. 63-88 in *Companion to A Sand County Almanac*. J. B. Callicott (editor). The University of Wisconsin Press, Madison.
- Peterson, R. O., and R. E. Page. 1988. The rise and fall of Isle Royale wolves, 1975-1986. *Journal of Mammalogy* 69:89-99.
- Peterson, R. O., N. J. Thomas, J. M. Thurber, J. A. Vucetich, and T. A. Waite. 1998. Population limitation and the wolves of Isle Royale. *Journal of Mammalogy* 79:828-841.
- Petit, J. R., J. Jouzel, D. Raynaud, N. I. Barkov, et al. 1999. Climate and atmospheric history of the past 420,000 years from the Vostok ice core, Antarctica. *Nature* 399:429-436.

Pickett, S. T. A., and R. S. Ostfeld. 1995. The shifting paradigm in ecology. Pp. 261-278 in *A New Century for Natural Resources Management*. R. L. Knight and S. F. Bates (editors). Island Press, Washington, D. C.

Pickett, S. T. A., T. Parker, and P. L. Fiedler. 1992. The new paradigm in ecology: Implications for conservation biology above the species level. Pp. 65-88 in *Conservation Biology: The Theory and Practice of Nature Conservation Preservation and Management*. P. L. Fiedler and S. K. Jain (editors). Chapman and Hall, New York.

Pimm, S. L. 1991. *The Balance of Nature?* University of Chicago Press, Chicago.

Prichard, J. A. 1999. *Preserving Yellowstone's Natural Conditions: Science and the Perception of Nature*. University of Nebraska Press, Lincoln.

Platt, J. R. 1964. Strong inference. *Science* 146:347-353.

Quinn, W. H., V. T. Neal, and S. E. Antunez de Mayolo. 1987. El Niño occurrences over the past four and a half centuries. *Journal of Geophysical Research* 92(C13):14,499-14,461.

Redmond, K. T., and R. W. Koch. 1991. Surface climate and streamflow variability in the western United States and their relationship to large-scale circulation indices. *Water Resources Research* 27:2381-2399.

Ridley, M. 1993. *The Red Queen. Sex and the Evolution of Human Nature*. Macmillan, New York.

Romesburg, H. C. 1981. Wildlife science: gaining reliable knowledge. *The Journal of Wildlife Management* 45:293-313.

Shrader-Frechette, K. S. 1998. Ecological sense and environmental nonsense. *Reflections*, Special Issue 3 (On line), Department of Philosophy, Oregon State University, Corvallis.

Shrader-Frechette, K. S., and E. D. McCoy. 1993. *Method in Ecology: Strategies for Conservation*. Cambridge University Press, Cambridge.

Sober, E., and D. S. Wilson. 1998. *Unto Others: The Evolution and Psychology of Unselfish Behavior*. Harvard University Press, Cambridge.

Stanford, C. B. 1999. *The Hunting Apes*. Princeton University Press, Princeton, New Jersey.

- Stegner, W. 1987. The legacy of Aldo Leopold. Pp. 233-245 in *Companion to A Sand County Almanac*. J. B. Callicott (editor). The University of Wisconsin Press, Madison.
- Sulloway, F. J. 1982. Darwin and his finches: the evolution of a legend. *Journal of the History of Biology* 15:1-53.
- Sulloway, F. J. 1984. Darwin and the Galapagos. *Biological Journal of the Linnean Society* 21:29-59.
- Tallmadge, J. 1987. Anatomy of a classic. Pp. 110-127 in *Companion to A Sand County Almanac*. J. B. Callicott (editor). The University of Wisconsin Press, Madison.
- Tanner, T. 1987. *Aldo Leopold: The Man and His Legacy*. Soil Conservation Society of America, Ankeny, Iowa.
- Trivers, R. L. 1971. The evolution of reciprocal altruism. *Quarterly Review of Biology* 46:35-57.
- Walters, R. A., and M. F. Meier. 1990. Variability of glacier mass balances in western North America. Pg. 365-375 in *Aspects of climate variability in the Pacific and western Americas*. D. H. Peterson (editor). Geophysical Monograph Series 55, American Geophysical Union, Washington D. C.
- Ward, P. 1994. *The End of Evolution: On Mass Extinctions and the Preservation of Biodiversity*. Bantam, New York.
- Whitlock, C. 1992. Vegetational and climatic history of the Pacific Northwest during the last 20,000 years: implications for understanding present-day biodiversity. *Northwest Environmental Journal* 8:5-28.
- Whitlock, C., P. J. Bartlein, and K. J. Van Norman. 1995. Stability of Holocene climate regimes in the Yellowstone region. *Quaternary Research* 43:433-436.
- Whittaker, R. H. 1951. A criticism of the plant association and climatic climax concepts. *Northwest Science* 25:17-31.
- Whittaker, R. H. 1975. *Communities and Ecosystems* (second edition). Macmillan, New York.
- Wight, H. M. 1931. Learn about pheasants from the Williamston Project. *American Game*, May-June 1931:37-38; 44-45.
- Wrangham, R. W., and D. Peterson. 1996. *Demonic Males. Apes and the Origin of Human Violence*. Houghton Mifflin, New York.

Wright, H. E., Jr., J. E. Kutzbach, T. Webb, III, W. F. Ruddiman, F. A. Reet-Perrott, and P. J. Bartlein. 1993. *Global Climates Since the Last Glacial Maximum*. University of Minnesota Press, Minneapolis.

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