The Land-Health Concept and Conservation

Leopold left this extraordinary essay in pencil draft at his death. Written in December 1946, it presents the idea of land health with greater clarity and detail than do any of his other writings. It is published here for the first time. Leopold presents land health not just as a desirable attribute of a landscape but as a much-needed focus for conservation work, and he issues a plea to his fellow ecologists to join him in offering their best guesses about the requisites for land health. The need for action, he says, is urgent, and conservation workers cannot wait until ecologists have all the answers. Leopold also presents here his strongest assertion that landowners, particularly farmers, ought to shoulder affirmative duties to promote the common good He ends the essay with a subject that he often addressed in unpublished manuscripts but never really dealt with in print—the need to stabilize "human density" and the possibility that natural forces might keep human numbers in check if social forces do not.

AUGUSTE COMTE, and later Herbert Spencer, pointed out that there is a natural sequence in the development of the sciences, and that this sequence represents a gradient from the simple toward the complex. Spencer's sequence was: physics—chemistry—biology—psychology—sociology.

According to this sequence, ecology, the sociology of the biota, will be the last science to achieve the stage of predictable reactions. This expectation presents a peculiar dilemma, because there is urgent need of predictable ecology at this moment. The reason is that our new physical and chemical tools are so powerful and so widely used that they threaten to disrupt the capacity for self-renewal in the biota. This capacity I will call land-health.

The symptoms of disorganization, or land sickness, are well known. They include abnormal erosion, abnormal intensity of floods, decline of yields in crops and forests, decline of carrying capacity in pastures and ranges, outbreak of some species as pests and the disappearance of others without visible cause, a general tendency toward the shortening of species lists and of food chains, and a world-wide dominance of plant and animal weeds. With hardly a single exception, these phenomena of disorganization are only superficially understood.

George P. Marsh, in *The Earth as Modified by Human Action* (1874), was one of the first to sense that soil, water, plants, and animals are organized collectively in such a way as to present the possibility of disorganization. His case histories describe many degrees of biotic sickness in many geographic regions. They are probably the ultimate source of the biotic ideas now known as conservation.

One might offer an ironic definition of conservation as follows: Conservation is a series of ecological predictions made by beginners because ecologists have failed to offer any.

Need I stop to prove this? The names of Theodore Roosevelt, Gifford Pinchot, William T. Hornaday, Hugh H. Bennett, and Jay N. Darling seem to spring out of recent American history with an emphatic reply. This paper is, in substance, a plea for ecological prediction by ecologists, whether or no the time is ripe. If we wait for our turn in the Spencerian sequence, there will not be enough healthy land left even to define health. We are, in short, land-doctors forced by circumstance to reverse the logical order of our service to society. No matter how imperfect our present ability, it is likely to contribute something to social wisdom which would otherwise be lacking.

Conditions Requisite for Land-Health

I have no illusion that the thousands of ecological questions raised by modern land-use can all be assessed by ecologists. What I mean by "prediction" is a shrewd guess on just one basic question: What are the probable conditions requisite for the perpetuation of the biotic self-renewal or land-health? This would define a goal for conservationists to strive toward. They now have no basic goal bracketing all component groups. Each group has its own goal, and it is common knowledge that these conflict and nullify each other to a large degree.

I will record my own guess first as a figure of speech. The biotic clock may continue ticking if we:

1. Cease throwing away its parts.
2. Handle it gently.
3. Recognize that its importance transcends economics.
4. Don't let too many people tinker with it.

The Integrity of the Parts

Paleontology teaches us that most land was stable, at least in terms of time scales applicable to human affairs, up to the point at which fauna, flora, soil, or waters were radically modified for human use. Disorganization seldom preceded the wholesale conversion of land with modern tools. It is necessary to suppose, therefore, that a high degree of interdependence exists between the capacity for self-renewal and the integrity of the native communities.

To cite a case: Evolution made few changes in the species list of Europe and America since the last glaciation, nor have the soil or water systems changed materially. Communities were pushed around by climatic cycles, but they did not disappear, and their membership remained intact. The big changes in fauna, flora, soil, and water have all occurred in the last few centuries. We must assume, therefore, that some causal connection exists between the integrity of the native communities and their ability for self-renewal. To assume otherwise is to assume that we understand the biotic mechanisms. The absurdity of such an assumption hardly needs comment, especially to ecologists.

There are, of course, practical limits of both time and space which curtail the degree to which the species list can be returned in settled regions. No one debates the removal of the buffalo or the pigeon from the cornbelt. But we are today extinguishing many species, or relegating them to national parks, on grounds that are ecologically false. Thus the timber wolf, already extinguished over most of the West, is at the point of being extinguished in the Lake States, with official

sanction and in fact subsidy, because he eats deer. The assumption is that rifles can trim the deer herd, but the fact is that in Wisconsin and Michigan at least, the deer herd is trimming us. Not only are deer nullifying the reforestation program, but they are tending to eliminate at least three tree species from the future forest: white cedar, hemlock, and yew. The proportion of white pine is being lowered in many localities. The effect of excess deer on lesser vegetation, on other animals, and ultimately on soil, is not known, but it may be large. It has been suggested that the snowshoe hare, under the impact of overbrowsing by deer, ceases to exhibit cyclic population behavior, and that the ruffed grouse is injuriously affected through depletion of its food and cover plants.

Here then is a chain reaction of unknown length threatening the integrity of the fauna and flora over great areas, and arising from a single error in prediction: that human predation by rifle is the biotic equivalent of wolf predation.

This is one of hundreds of land-use errors, made by laymen-administrators in the name of conservation, and all based on the assumption that we are at liberty to prune the species list of members considered "useless," harmful, or unprofitable.

That we must alter the distribution and abundance of species before we understand the consequences of doing so is taken for granted. These modifications are reversible, and hence not very dangerous. But extirpation is never reversible. It is already too late to restore the wolf to the western deer ranges because the indigenous races are extinct.

Closely related to the needless pruning of species lists is the question of their needless enlargement by the importation of exotics. Space forbids my covering this. I will only say that the idea of preference for natives hardly exists in fish management, agronomy, and horticulture, and has only a tenuous hold in game management, forestry, and range management. Soil management is just discovering that there is a soil fauna and a soil flora.

Violence in Land-Use

All land must be converted, either in its plant successions, topography, or water relations, before it can support an industrial economy. My guess here is that the less violent these conversions, the more likely they are to be durable, and the less likely they are to exhibit unforeseen repercussions.

A veritable epidemic of violence prevails at the present moment in the field of water management. Flood-control dams, hydro electric dams, channelization and dyking of rivers, watershed authorities, drainages, lake outlet controls, and impoundments are running riot, all in the name of development and conservation. I am not wise enough to know which of these conversions are ecologically sound, but the most superficial observer can see that:

1. Most of them deal with symptoms, not with organic causes.
2. Their promoters are innocent of (or oblivious to) the principle that violence is risky.
3. Many of them involve irreversible changes in the organization of the biota.
4. Collectively, their use of economic arguments is naive. In one case, economic advantage is held to supersede all opposing considerations; in the next "intangible" benefit is held to supersede all economics.
5. In all of them, control of nature by concrete and steel is held to be inherently superior to natural or biotic controls.

6. In all of them, the economic products of violence are held to be more valuable than natural products.

The philosophy of violence extends far beyond water management. The reckless use of new poisons in agronomy, horticulture, wildlife control, fish management, forestry, and soil fumigation is well known. Poisons for public health are no novelty. Poisons to offset pollution in lakes and rivers are no novelty. Again I am not wise enough to say which of these violent treatments are sound, but it is obvious that the same doubts arise: They deal with symptoms; their promoters are innocent of probable repercussions; they involve many irreversible changes; because they are quicker than biotic controls, they are assumed to be superior to them.

Esthetics

The biota is beautiful collectively and in all its parts, but only a few of its parts are useful in the sense of yielding a profit to the private landowner. Healthy land is the only permanently profitable land, but if the biota must be whole to be healthy, and if most of its parts yield no salable products, then we cannot justify ecological conservation on economic grounds alone. To attempt to do so is sure to yield a lop-sided, and probably unhealthy, biotic organization.

Herein lies the tragedy of modern land-use education. We have spent several generations teaching the farmer that he is not obligated to do anything on or to his land that is not profitable to him as an individual. We can thank his neglect and inertia, and perhaps the hollow sound of our own voice, for the survival of such useless plants and animals, and such natural soils and waters, as remain alive today.

We have rationalized this fallacy by relegating the conservation of the merely beautiful to the state. We can thank this subterfuge for our national parks, forests, and a sprinkling of wilderness areas, but we can also thank it for a million farmers who year-by-year grow richer at the bank, poorer in soil, and bankrupt in spiritual relationships to things of the land.

The divorcement of things practical from things beautiful, and the relegation of either to specialized groups or institutions, has always been lethal to social progress, and now it threatens the land-base on which the social structure rests. The fallacy has its roots in an imperfect view of growth. All sciences, arts, and philosophies are converging lines; what seems separate today is fused tomorrow. Tomorrow we shall find out that no land unnecessarily mutilated is useful (if, indeed, it is still there). The true problem of agriculture, and all other land-use, is to achieve both utility and beauty, and thus permanence. A farmer has the same obligation to help, within reason, to preserve the biotic integrity of his community as he has, within reason, to preserve the culture which rests on it. As a member of the community, he is the ultimate beneficiary of both.

Human Density

The trend of animal ecology shows, with increasing clarity, that all animal behavior-patterns, as well as most environmental and social relationships, are conditioned and controlled by density. It seems improbable that man is any exception to this rule.

It is almost trite to say that the ecological state called civilization became possible at a certain minimum density-threshold. It seems equally probable that above a certain maximum density its

benefits begin to cancel out, and its mechanisms become unstable. Improvements in organization may raise that maximum, but they can hardly abolish it.

I have studied animal populations for twenty years, and I have yet to find a species devoid of maximum density controls. In some species the control mechanism inheres within the species, and operates by eviction and resultant vulnerability to predation (quail, muskrat). In others the control is external (deer), and consists of predation, or starvation if that fails. In all species one is impressed by one common character: If one means of reduction fails, another takes over.

It is possible to interpret the impending disorganization of land as taking over the reducing job after we foiled the normal mechanism by industrialization, medicine, and other devices. There is a striking parallelism between the present world-wide strife, and the social status of an overpopulated muskrat marsh just prior to catastrophe.

In any event it is unthinkable that we shall stabilize our land without a corresponding stabilization of our density. It is notorious that many of the "undeveloped" regions are already overpopulated.

Conclusion

These then are my personal guesses as to the conditions requisite for land-health. Some of them step beyond "science" in the narrow sense, because everything really important steps beyond it. I do not claim that my guesses are objective. They are admittedly wishful. Objectivity is possible only in matters too small to be important, or in matters too large to do anything about.