



Aldo Leopold, 1928. (Leopold Collection, UW Archives)

The River of the Mother of God

AND OTHER ESSAYS
BY ALDO LEOPOLD

Edited by
Susan L. Flader
and J. Baird Callicott

THE UNIVERSITY OF WISCONSIN PRESS

The University of Wisconsin Press
1930 Monroe Street
Madison, Wisconsin 53711

3 Henrietta Street
London WC2E 8LU, England

Copyright © 1991
The Board of Regents of the University of Wisconsin System
All rights reserved

9 8 7 6

Printed in the United States of America

Library of Congress Cataloging-in-Publication Data
Leopold, Aldo, 1887-1948

The river of the mother of God and other essays / by Aldo Leopold
edited by Susan L. Flader and J. Baird Callicott.

400 pp. cm.

Includes index.

1. Nature conservation. 2. Natural history—Outdoor books.

I. Flader, Susan. II. Callicott, J. Baird. III. Title.

QH81.L557 1991

333.9516—dc20 90-45491

ISBN 0-299-12760-5 ISBN 0-299-12764-8 (pbk.)

Contents

PREFACE / ix

ALDO LEOPOLD: A BRIEF CHRONOLOGY / xiii

INTRODUCTION / 3

A Tramp in November (1904) / 33

The Maintenance of Forests (1904) / 37

The Busy Season (1911) / 40

To the Forest Officers of the Carson (1913) / 41

The Varmint Question (1915) / 47

The Popular Wilderness Fallacy: An Idea That Is

Fast Exploding (1918) / 49

Forestry and Game Conservation (1918) / 53

Notes on the Behavior of Pintail Ducks in a Hailstorm (1919) / 60

Wild Lifers vs. Game Farmers: A Plea for Democracy

in Sport (1919) / 62

"Piute Forestry" vs. Forest Fire Prevention (1920) / 68

The Forestry of the Prophets (1920) / 71

The Wilderness and Its Place in Forest Recreational

Policy (1921) / 78

Standards of Conservation (1922) / 82

Conservation: In Whole or in Part? [1944]

Leopold wrote this report, dated November 1, 1944, for a University of Wisconsin committee on postwar agricultural policies. The typescript, labeled "rough draft," is virtually clean. As its title suggests, the report is a direct and comprehensive statement of a holistic conception of land and a correspondingly integrative approach to conservation. It contains Leopold's most sustained analysis of land health, a concept that figures prominently in "The Land Ethic."

There are two kinds of conservationists, and two systems of thought on the subject.

One kind feels a primary interest in some one aspect of land (such as soil, forestry, game, or fish) with an incidental interest in the land as a whole.

The other feels a primary interest in the land as a whole, with incidental interest in its component resources.

The two approaches lead to quite different conclusions as to what constitutes conservative land-use, and how such use is to be achieved.

The first approach is overwhelmingly prevalent. The second approach has not, to my knowledge, been clearly described. This paper aims to sketch the concept of land-as-a-whole.

Land-Health

Conservation is a state of health in the land.

The land consists of soil, water, plants, and animals, but health is more than a sufficiency of these components. It is a state of vigorous self-renewal in each of them, and in all collectively. Such collective functioning of interdependent parts for the maintenance of the whole is characteristic of an organism. In this sense land is an organism, and conservation deals with its functional integrity, or health.

This is almost, but not quite, the same as the familiar "renewable resource" concept. The latter tells us that a particular resource may be healthy or sick, but not that the sickness of one may undermine the health of all.

Conservation is usually thought of as dealing with the *supply* of resources. This "famine concept" is inadequate, for a deficit in the supply in any given resource does not necessarily denote lack of health, while a failure of function always does, no matter how ample the supply. Thus erosion, a malfunction of soil and water, is more serious than "timber famine," because it deteriorates the entire land community permanently, rather than one resource temporarily.

Attitudes

Mass man is unconscious of land-health for three reasons.

First he was, until recently, unable to injure it. He lacked the tools.

Secondly, European civilization developed on a landscape extraordinarily resistant to disorganization, i.e., one which endures very rough usage and severe modification without derangement of function. Thus the oak forests of England became closely grazed sheep downs without losing their soil. The fauna and flora shifted, but did not disintegrate.¹

Thirdly, science could not, until recently, distinguish fact from fancy in the reaction of land to human use. Thus the Mediterranean countries were permanently deteriorated by overgrazing and erosion before their inhabitants knew what was happening, or why.

As a result of these three historical accidents, the European races acquired machines for dominating land before they had evolved the social inhibitions requisite for their safe use.

In short, the power to injure land-health grew faster than the consciousness that it can be injured.

Land, to the average citizen, is still something to be tamed, rather than something to be understood, loved, and lived with. Resources are still regarded as separate entities, indeed, as commodities, rather than as our cohabitants in the land-community.

Diversity and Stability up to 1840

The Wisconsin land was stable, i.e., it retained its health, for a long period before 1840. The pollens imbedded in peat bogs show that the native plants comprising the prairie, the hardwood forest, and the coniferous forest are

1. E. P. Farrow, *Plant Life on East Anglian Heaths* (Cambridge University Press, 1925).

about the same now as they were at the end of the glacial period, 20,000 years ago. Since that time these major plant communities were pushed alternately northward and southward several times by long climatic cycles, but their membership and organization remained intact. Thus, in one northward push the prairie once reached nearly to Lake Superior; in one southward push the Canadian forest reached to Indiana.

The bones of animals show that the fauna shifted with the flora, but its composition or membership likewise remained intact. The soils not only remained intact, but actually gained in depth and fertility with wind-deposits of loessial soils. With this came a gain in the volume of plant and animal life.

The native Wisconsin community which thus proved its ability to renew itself for 200 centuries was very diverse. It included 350 species of birds, 90 mammals, 174 fishes, 72 amphibians and reptiles, roughly 20,000 insects, about 1500 higher plants, and an unknown but very great number of lower plants and lower animals.

All these creatures were functional members of the land, and their collective activities constituted its inner workings from the glacial epoch to 1840.

These "inner workings" of the community included, as everyone knows, a high proportion of tooth and claw competition, varying in degree from mere jostling to murder. It is hard for the layman, who sees plants and animals in perpetual conflict with each other, to conceive of them as cooperating parts of an organism. Yet the fact remains that throughout geological time up to 1840, the extinction of one species by another occurred more rarely than the creation of new species by evolution, and that occurred very rarely indeed, for we have little evidence of new species appearing during the period of recorded history. The net trend of the original community was thus toward more and more diversity of native forms, and more and more complex relations between them. Stability or health was associated with, and perhaps caused by, this diversity and complexity.

Diversity and Stability since 1840

Since 1840 some members of the native community have been removed. Familiar examples include the buffalo, wild turkey, passenger pigeon, Carolina parakeet, wolverine, marten, and fisher.

Others have been added. These include not only imported birds and mammals like English sparrow, starling, pheasant, Norway rat, and house mouse, but also many wild plants (most weeds are European or Asiatic), many insects good and bad, and many diseases. Domesticated plants, mammals and birds have also been added, and constitute the bulk of the new

community. In one measured sample in Columbia County the domestic plus imported wild birds and mammals constitute 99 per cent of the weight of the total present bird and mammal community.²

Most of the native species which persist have undergone changes in numerical status or distribution, or both, since 1840. The prairie flora and fauna occupied the best soils, and hence were supplanted early. Later pressures severely curtailed and modified the marsh, bog, forest, and aquatic floras and faunas. Everybody knows of these changes, hence they need not be described.

Losses and Gains

It is necessary to state at this point that this paper is not a nostalgic rehearsal of the glories of primeval Wisconsin. It is an attempt to approach objectively a case of land-illness which nobody understands. The changes we have made in the Wisconsin land are not all inherently or necessarily wasteful. Many of them have enriched and expanded certain elements in the native fauna and flora whilst shrinking others. There is no doubt at all that the introduction of agriculture has increased the numbers, if not the diversity, of many native animals and some native plants. A sketch of these changes has been published.³

Symptoms of Illness

Coincident with this period of man-made change in the land community, many symptoms of impaired land-health have become apparent. Most of these are familiar individually, but they are seldom viewed collectively, or as possibly related to each other and to the land as a whole.

Of the various symptoms of illness, soil erosion and abnormal floods are by far the most important. Most critical observers agree that both are getting worse. Much is known of the superficial causes of both, but little of the underlying "physiology" of soil and water.

Less familiar are some of the qualitative deteriorations in land crops. In farm crops, it appears that better varieties and better cultural methods have just about offset the decline in the productivity of the soil. The reason seems

2. Aldo Leopold and Paul L. Errington, "Limits of Summer Gain and Winter Loss in Bobwhite Populations at Prairie du Sac, Wisconsin, 1923-1945," unpublished manuscript, 32 pp. [Later emended to "Prairie du Sac Area, Columbia County, unpublished manuscript."]

3. Committee on Wildlife Conservation (Aldo Leopold, Chmn.; L. J. Cole, N. C. Fassett, C. A. Herrick, Chancey Juday, and George Wagner), *The University and Conservation of Wisconsin Wildlife*, Bulletin of the University of Wisconsin Science Inquiry Publication no. 3 (Madison, Feb 1937), 39 pp.

to be plain loss of fertility. It has been discovered recently that decline in soil fertility reduces not only the gross yields of crops, but the nutritional value of the crops, and the welfare of animals which eat them.⁴

The qualitative deterioration of crops applies to trees as well as to agronomic plants. We used to grow 4-log pines; now we do well to grow 2-log pines on the same sites. What, besides fire, has happened to soil? Similar deteriorations have occurred in Europe,⁵ and are by no means understood.

All too familiar are those symptoms of land-illness caused by the importation of exotic diseases and pests. There is no mystery about such pains and ailments as the white pine blister rust, chestnut blight, gypsy moth, Dutch elm disease, the corn borer, the Norway rat, the starling, the house mouse, the Canada thistle, and the creeping jenny or German carp. Their ultimate effect on the land, however, presents many unsolved problems, including the damage done by control operations.

Less familiar are the many instances in which native plants and animals, heretofore presumably "well-behaved" citizens of the land community, have assumed all the attributes of pests. The white grub, the cankerworm, the meadowmouse, the fire blight of oaks, and the spruce bud-worm are cases in point.

One of the very recent instances of pest behavior by a heretofore "well-behaved" member of the native community is the irruption of deer in Wisconsin and many other states.⁶ While the superficial "causes" of this phenomenon are well known to be a coincidence of lumbering, law enforcement, fire-control, predator-control, and selective harvesting through buck laws, nevertheless it remains a deep mystery why equivalent coincidences never (as far as we know) produced irruptions of hoofed mammals previous to human interference. In all probability some as yet unknown causes lie behind the more superficial ones; possibly fluctuations in the vitamin content of foods.

New plant and animal diseases are now appearing so rapidly that we do not yet know whether they represent some native organism "gone outlaw," or some newly imported pest. Thus the new pine disease, now obliterating plantations of Norway and Jack pine in Oconto and nearby counties, has an unclassified causative agent of unknown origin.

Native members of the community sometimes simply disappear without visible cause, and often despite protective efforts. Prairie chickens, spruce grouse, and certain wildflowers probably belong in this class. Im-

4. W. A. Albrecht, "Soil and Livestock," *The Land* 2:4 (1943), 298-305, and other papers by the same author.

5. Aldo Leopold, "Deer and *Dauerwald* in Germany," *Journal of Forestry* 34:4-5 (1936), 366-375, 460-466.

6. Aldo Leopold, "Deer Irruptions," *Wisconsin Conservation Bulletin* 8:8 (1943), 1-11.

ported species may likewise disappear: the Hungarian partridge seems to be on the decline in Wisconsin, after an initial success, without visible cause.

Finally we have unexplained changes in the population behavior of plants and animals; these behaviors are often of considerable economic importance. Thus there is more than a presumption that population cycles have tended to become more violent in all hares and rabbits, in all grouse, and in foxes. Cyclic population behavior has perhaps spread to pheasants and bobwhite quail.

The conservationist who is interested in land as a whole is compelled to view these symptoms collectively, and as probable maladjustments of the land community. Some of them are understood superficially, but hardly any are understood deeply enough to warrant the assertion that they are separate phenomena, unrelated to each other and to the whole. In point of time, nearly all of them are probably new, and fall within the post-1840 period of violent change in the land community. Are they causally related to the period of change, or did the two coincide by accident?

To assert a causal relation would imply that we understand the mechanism. As a matter of fact, the land mechanism is too complex to be understood, and probably always will be. We are forced to make the best guess we can from circumstantial evidence. The circumstantial evidence is that stability and diversity in the native community were associated for 20,000 years, and presumably depended on each other. Both are now partly lost, presumably because the original community has been partly lost and greatly altered. Presumably the greater the losses and alterations, the greater the risk of impairments and disorganizations.

This leads to the "rule of thumb" which is the basic premise of ecological conservation: the land should retain as much of its original membership as is compatible with human land-use. The land must of course be modified, but it should be modified as gently and as little as possible.

This difference between gentle and restrained, as compared with violent and unrestrained, modification of the land is the difference between organic and mustard-plaster therapeutics in the field of land-health.

There are reasons for gentle land-use over and above the presumed risk to the health of the land. Sauer⁷ has pointed out that the domesticated plants and animals which we use now are not necessarily those we will need a century hence. To the extent that the native community is extinguished, the genetical source of new domesticated plants and animals is destroyed.

This general concept of land-health as an attribute of the original native community as a whole, and of land-illness as probably related to violent

7. Carl O. Sauer, "Theme of Plant and Animal Destruction in Economic History," *Journal of Farm Economics* 20:4 (1938), 765-775.

changes and consequent disorganization, may be called, for short, the "unity concept."

Unity and Land-Use

If the components of land have a collective as well as a separate welfare, then conservation must deal with them collectively as well as separately. Land-use cannot be good if it conserves one component and injures another. Thus a farmer who conserves his soil but drains his marsh, grazes his woodlot, and extinguishes the native fauna and flora is not practicing conservation in the ecological sense. He is merely conserving one component of land at the expense of another.

The conservation department which seeks to build up game birds by extinguishing non-game predators, or to retain excessive deer populations at the expense of the forest, is doing the same thing.

The engineer who constructs dams to conserve water, develop power, or control floods is not practicing conservation if the actual regimen of water which results, either above or below the dam, destroys more values than it creates. I know of no single impoundment of water in which all of the land values affected were weighed in advance. (Unfortunately it must be stated in the same breath, that ecologists competent to weigh all of them do not yet exist.)

Lop-sided conservation is encouraged by the fact that most Bureaus and Departments are charged with the custody of a single resource, rather than with the custody of the land as a whole. Even when their official titles denote a broader mandate, their actual interests and skills are commonly much narrower. The term "land" now brackets a larger span of knowledge than one human mind can compass.

Ironically enough it is the farmer who is, by implication at least, left to unify, as best he can, the conflicts and overlaps of bureaudom. Separatism in bureaus is probably a necessary evil, but this is not the case in agricultural colleges. If the arguments of this paper are valid, the agricultural colleges have a far deeper responsibility for unification of land-use practice than they, or the public, have so far realized.

I will sketch later some of the practical applications of the land-unity concept to land-use and land-users.

Unity and Economics

Some components of the land community are inherently of economic importance (soil, forests, water) while others cannot possibly be, except in a very indirect sense (wildflowers, songbirds, scenery, wilderness areas).

Some components are of economic importance to the community, but of dubious profit to the individual owner (most marshes, most cover on streambanks and steep slopes, most windbreaks).

Some are profitable for the individual to retain if they are still in a productive state, but of dubious profit if they have to be created *de novo*, or if they have to be rebuilt after being damaged (woodlots).

It follows that if conservation on private lands is to be motivated solely by profit, no unified conservation is even remotely possible. Community welfare, a sense of unity in the land, and a sense of personal pride in such unity, must in some degree move the private owner, as well as the public. Conservation cannot possibly "pay" except when the meaning is restricted to components that happen to be profitable. Conservation often pays in the sense that the profitable components can carry the unprofitable ones, just as in any industrial enterprise, a unified purpose involves carrying profitable and unprofitable component enterprises, each necessary to the functioning of the whole.

The fallacious assumption that each separate act of conservation can or must be profitable before its practice can be recommended to farmers is possibly responsible for the meagre fruits of forty years of education, extension, and public demonstration in the conservation field. It is undoubtedly responsible for many dubious claims of profit which are commonly made, or implied, in presenting the subject to the public. It is presumably axiomatic that any "program" saddled with over-claims will backfire in the long run.

Sound conservation propaganda must present land health, as well as land products, as the objective of "good" land-use. It must present good land-use primarily as an obligation to the community. Many constituent parts of it are indeed profitable, and where this is the case, the fact can and should be emphasized. But many constituent parts of it are not, and failure to assert this at once subverts legitimate education to the intellectual level of a cheap "sales" campaign in which only virtues are mentioned.

No one need harbor any illusion that the farmer will immediately undertake the unprofitable components of "good" land-use. But it is probably not illusory to assume that fractional truth is no truth, and that one-resource conservation programs are inherently fractional.

Acts vs. Skills; Law vs. Education

Conservative land-use consists of a system of acts, motivated by a desire, and executed with skill.

Laws and policies must deal almost exclusively with acts, because desires and skills are intangible, and cannot be defined in law, nor created by

law. Acts without desire or skill are likely to be futile. Thus, during the CCC epoch many Wisconsin farmers were induced, by subsidy, to perform the acts of soil conservation, but those who lacked desire and skill dropped the acts as soon as the subsidy was withdrawn.

This limitation of conservation law and policy is inherent and unavoidable. It can be offset only by education, which is not precluded from dealing with desires and skills.

Whether education can create these desires and skills is an open question. Certainly it can not do so in time to avoid a much further disorganization of land health than now exists. This paper does not claim to assess the chances for success of the unity concept. It claims only to assess the basic logic of the conservation program.

Farm Practice

Some of the attitudes toward farm land implied in the unity concept have already been set forth in popular form.⁸ Summarized in terms of causation, these implications add up rather simply to this: the farmer should know the original as well as the introduced components of his land, and take a pride in retaining at least a sample of all of them. In addition to healthy soil, crops, and livestock, he should know and feel a pride in a healthy sample of marsh, woodlot, pond, stream, bog, or roadside prairie. In addition to being a conscious citizen of his political, social, and economic community, he should be a conscious citizen of his watershed, his migratory bird flyway, his biotic zone. Wild crops as well as tame crops should be a part of his scheme of farm management. He should hate no native animal or plant, but only excess or extinction in any one of them.

Cash outlays for unprofitable components of land are of course not to be expected, but outlays of thought, and to a reasonable extent of spare time, should be given with pride, just as they are now given to equivalent enterprises in human health and civic welfare.

Summary

Conservation means land-health as well as resource-supply. Land-health is the capacity for self-renewal in the soils, waters, plants, and animals that collectively comprise the land.

Stable health was associated geologically with the full native community which existed up to 1840. Impairments are coincident with subsequent

8. Aldo Leopold, *Wildlife Conservation on the Farm* (Racine, Wis.: Wisconsin Agriculturist and Farmer, 1941), 24 pp.

changes in membership and distribution. The "inner workings" of land are not understood, but a causal relation between impairments and degree of change is probable. This leads to the rule-of-thumb that changes should be as gentle and as restrained as compatible with human needs.

Land-use is good only when it considers all of the components of land, but its human organization often tends to conserve one at the expense of others.

Some components of land can be conserved profitably, but others not. All are profitable to the community in the long run. Unified conservation must therefore be activated primarily as an obligation to the community, rather than as an opportunity for profit.

Acts of conservation without the requisite desires and skills are futile. To create these desires and skills, and the community motive, is the task of education.