



# Conservation and Protection

**GEOLOGICAL SURVEY  
CIRCULAR 414-A**

Part A  
Conservation and Protection

By Luna B. Leopold

CONSERVATION AND WATER MANAGEMENT

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GEOLOGICAL SURVEY CIRCULAR 414-A

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PART A

## Conservation and Protection

By Luna B. Leopold

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When I was a child we had a burro I called Gacho. He was a typical burro, omnivorous in his eating habits and prone to streaks of extreme recalcitrance.

Our yard wasn't very large, but it did produce enough grass and weeds to keep old Gacho in good fettle. His first preference was for the native grasses, and he chose to graze the lush patches rather than the shriveled plants on the areas of thin soil. Nevertheless, he was not particular and seemed to graze to some extent all over the yard. He often nibbled in the flower beds and I sometimes wondered whether he did this just for spite.

After a time I arranged some crude fences and a tethering rope to keep him out of the most important flower beds.

The yard was so small that we had a waste problem. To ignore the problem would hardly have been civilized, but, on the other hand, one couldn't follow him around all day with a shovel. So a workable compromise was adopted by keeping him penned up at night in a small enclosure, which, of course, could not be kept immaculate but was at least reasonably clean.

We had the burro and we weren't getting rid of him. He was useful; we enjoyed riding him and hitching him up to our wagons. But he was a bother sometimes.

Here was a simple case of resource use and resource development. The case is incomplete, but it demonstrates a principle.

The resource, represented by the vegetation, was being utilized, or developed if you will, by a small juggernaut which was only partly controllable by my youthful skills. There was no need to urge utilization. That followed as a matter of course. The problem was that the one who utilized the resource, in this case the burro, was not very discerning of relative values. To Gacho the choice of which plant to eat and where to get rid of the waste was governed only by his own interests and convenience.

Now, when a planning body convenes, one may bet that either the burro has lain down in a flower bed or he has messed up the yard. By this time everybody is already in a lather.

An appreciation of the existence of problems usually leads to a period of organizing the facts, assessing the current situation, and surveying the future possibilities. In the New England area such an assessment has recently been completed. Since that stage has been reached, it is logical to discuss the function of a planning unit as a prelude to the next phase. I should like to outline my own thoughts on this matter, but I do so without expecting to convince all others.

I believe that we will not protect the flower bed or clean up the yard by urging the burro

please to confine his eating to the patch over near the gate and his waste disposal to the far corner. Rather, we must concentrate our attention on what needs to be saved and set up some ropes and fences to keep the burro off. We must choose an area where disposal can be tolerated and controlled, accepting the fact that if we have a burro we also have a waste disposal problem.

Now some planning bodies seem to concentrate on urging utilization of resources. Our national community has many organized bodies who urge development, and there is little need for a planning body to do so. A planning unit must see the whole picture, foresee what assets would be lost by uncontrolled development, determine which vulnerable assets should be protected, and take steps to protect them.

Interestingly enough, most planning bodies express concern for the conservation of our natural resources, but they actually concentrate on promoting development. I would like to direct attention to the need for planning as it relates to conservation. The water resource will be used as an example.

The United States is well endowed with water. Out of the 30 inches of rainfall per year which on the average falls over the country, 22 inches, or three-fourths, return to the atmosphere by evaporation and transpiration. This portion grows the forests, the grass, and the crops.

The remaining one quarter runs off in streams or becomes ground water and is available for man's use. This usable part is enough to furnish each man, woman, and child with enough water every day to fill a tank the size of an ordinary dining room. Of this available supply we use about one gallon out of five. We are not short of water as a whole.

Still, because of local climate and topography and year-to-year variations in precipitation, water is very unevenly distributed, and there are obvious areas of shortage. In the Eastern

United States three-quarters or more of water use is for industry. From such geographic and historical facts emerge the water problems of the present day. As matters stand now, most water that is immediately available and inexpensive to use at each individual point is in use already. Further expansion of any individual use must be balanced by a decrease in some other use or by some attendant cost. For example, the growth of the large metropolitan centers in the West depends on increasing supplies of water. To get increased quantities, either some present use must be curtailed or water must be imported from areas which have an excess, to the place where supplies are needed, and at costs far exceeding those for water supplies developed in the past.

If expanding industry in the East is to have the additional water supplies needed, it will generally be necessary to treat that water to improve its quality, and thus the expense will be much greater than in the past when the readily available water was of requisite quality.

So it can be seen that water problems are of three basic types. First, water may be immediately available but it may be of unsuitable quality, and therefore treatment is necessary—treatment that may or may not make the cost prohibitive. The second type is that of a physical shortage of water for the desired uses. This also reduces to a matter of cost, because to increase the supply in an area which is deficient in total amount requires either that the money be spent to import water or that use itself must be moved to the place where water is available. The third type of problem is the legal one of water rights. If a particular use can actually bear the cost of developing a new source or transporting water from a great distance, it may be prevented from doing so because of the fact that others have the legal right to that water. In such an instance the legal owners must be paid to relinquish their right. This

also, then, reduces to a question of economics, presuming that if one can pay a high enough price he can purchase even something dear to the present owner.

I have dealt with these general water problems in a most cursory way, and it should be recognized that in actual practice there are many ramifications. It is nevertheless true, I believe; that poor quality of water, physical shortage of water for all uses, and legal rights to water all have a common economic base. To the man who can pay enough these problems are solvable. Whether the price can be justified by the benefit received is the issue. The economic justification, however, is partly influenced by what we have been accustomed to consider to be the value of water. Only now are people beginning to realize that we have always obtained water for bargain prices. We must steel ourselves to a new conception of what water really is worth. The economy will gradually reflect this realization.

Referring back to the analogy, the way, the place, and the time the burro munched the grass—in other words, utilized the resource—were governed by his own interests and conscience. Similarly, in the complex field of water, the ordinary pressures of utilization have developed the water resource up to the economic limits which have prevailed at each particular time and place.

The problem of conservation and the function of planning are to identify those aspects of the resource which would be depleted or degraded if the economic forces were allowed to operate unhampered. Stream pollution offers a convenient example.

We accept our machine civilization and do not intend to go back to living like the Indian. In accepting this burro, however, we must also accept a problem of waste disposal. In our modern society an essential use of rivers and streams is for the transportation and dilution of

wastes. This does not mean, however, that all streams need to be polluted, but it probably does mean that not all streams can be of virgin cleanliness. We must accept a degree of stream pollution and try to keep that within acceptable limits.

We can, if we will, maintain some streams, or all the water courses in some areas, unpolluted. But we must choose what to protect and actually start protecting before pollution has ruined the values, which once gone are difficult to reestablish. For example, once the biological equilibrium in a stream is seriously upset, it is often quite difficult to get fish, vegetation, and other parts of the biota to function normally again except after a long time.

There is much current discussion of comprehensive plans for river basin development; stress is placed on multiple use, particularly multiple-use dams. Does the existence of a comprehensive plan for resource development necessarily identify those values which are in greatest need of protection?

Comprehensive river basin development implies drawing up plans for guiding resource utilization toward the ultimate goal of obtaining the maximum benefits from the resources. The goal of maximum benefits is sound, but our measure of benefits and our yardsticks of value are still so rudimentary that one wonders whether the results have any real meaning. For example, how do we decide to keep one burro rather than two, and on what basis do we decide what waste is tolerable?

Two aspects of comprehensive development plans need examination for purposes of the present discussion. First, development plans usually pay considerably more attention to encouraging resource development than to workable and realistic measures to protect values which will decline in process of development. I believe that our experience in water-resource development has been that it is relatively sim-

pler to draw engineering plans for construction of reservoirs than to protect recreational, scenic, or other esthetic values from degradation by the proposed development. The approach has usually been to try to demonstrate that construction of some particular reservoir will not only help the fishing but will also offer new and greater opportunities for recreation. These arguments are generally supported by monetary estimates of the value of a mallard, a trout, and other similar assets. The widespread release of liver-fed trout the day before the season opens is, to me, proof enough that trying to express the value of trout fishing in monetary terms based on the volume of business in clothes, gasoline, and tackle, has hardly improved the fishing.

Solution of today's conservation problems must begin with the recognition that esthetic values cannot be assessed in monetary terms. To save such assets is the real conservation problem and this is where planning is vitally needed.

To summarize my first point on comprehensive development plans: Most such plans are concerned primarily with encouraging the burro to eat more grass on an efficient schedule. Given time, he needs no such encouragement, for he will eat whenever and wherever it is most profitable and convenient.

The second point concerns the present procedures for determining what plan of development will maximize the benefits of resource development over a period of time. We speak blithely of a plan for optimum ultimate use of all the resources of a basin. But it is difficult enough to evaluate even a single-purpose project. Even to do this we are already attempting to weigh in monetary terms flood control benefits, land-enhancement benefits, power benefits, public health benefits, recreation benefits, sedimentation benefits, municipal water benefits, pollution-control benefits, navigation benefits,

fishery benefits, wildlife benefits, and drainage benefits, to name but a few. And most of these are purported to have conservation aims.

Each of these benefits is computed on the basis of present monetary value. The procedures are usually complex. Then the future worth is computed by expanding these present values to a level they are supposed to attain 50 years hence.

Apparently we are not only going to urge the burro to make maximum utilization of the resources, but we are also trying to compute what is maximum utilization, and exactly how he should achieve it, not only now but in the future. Our problems arise principally because resource use involves people. Attempts to forecast 50 years in advance what is best for the people is even more difficult than talking logic to the burro.

And now we come to the flower bed. The burro need do but a little nibbling for the flower bed to become a wreck. If an area is lucky enough to have some remnants of original forest, it would be wise to see that there is no nibbling at all.

If you have a canoe country, the distinguishing characteristic of which is primitive portages and no putt-putts to scare away the circling eagle, keep the burro of modern mass recreation away and be glad you still have something which most lake States have already lost.

Protection of values implies identification of values. Let me make it crystal clear that planning units cannot be effective if they define value merely in terms of dollars. There are other values which are of no account to the developer. If left to those whose only god is progress, and whose sole measure of worth is dollars, the esthetic values will be lost in the shuffle.

The value of a piece of wild country is not measured by the hydropower plus the merchantable timber. If the value of a park is expressed as

the sum of income of the hotdog stands, the juke box joints, the filling stations, and the local sporting goods stores, the figure may be high, but it misses the whole point. Park development which measures progress by increasing the monetary value just cited is obviously leading to a poorer and poorer park.

A planning unit then might best assume the job of identifying values which, to be maintained, must be protected from the effects of ordinary expansion of use and development. We need not fear that the insatiable hunger of the machine age will fail to develop resources

when the economic setting makes such development profitable. The burro will continue to eat what and where he finds it convenient and to his individual taste. Rather, the need is for planning units to choose which flower beds ought to be protected. We must fence the flowers with enforceable ordinances and fashion a halter which will not unduly restrict where the burro is allowed to graze, but will jerk him up short when he reaches the limit of the tether. If we fail to do so we may just as well give up growing flowers.