Control of Jack Rabbits and Prairie Dogs on Range Lands

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IT seems clear that changes in populations of wild animals occur as effects of both natural and artificial causes. Apparently much less clear, or largely ignored, have been the possibilities (1) that increases in populations of unwanted species may be the natural results of man's abuse of the land, (2) that some artificially induced changes may inevitably serve naturally to trigger further changes, and (3) that these further effects may be of such compensatory nature as to obviate the values claimed for the changes initially forced by artificial means, i.e., by so-called control programs.

Changes in wild populations have been described frequently and sometimes well by field biologists. Some students of wildlife are expressing the conviction, however, that the usefulness of such descriptive information in the designing of management operations may be approaching a plateau. They believe that sound methods for the manipulations of populations of some species will be built only upon an understanding of the causes and methods of the population changes that can be seen, measured, and described. They further believe that such essential knowledge can be disclosed only by virtue of intensive considerations of fundamental biological functions of the individual animal in relation to population forces. It might be said that these biologists are not letting the fact of population changes dim a growing conciousness that the methods of change are not now clearly comprehended; they have not become so enamored of effects that they can comfortably continue to ignore the need for exploration into the realm of prerequisite causes. They have felt the challenge voiced by the late Aldo Leopold when he called for deeper-digging research.

Probably no phase of wildlife management has suffered from less deep-digging research than that which has come to be known as control. It may be that more preconception, more appeasement, more rat-hole dollars, and less data have gone into control programs than into any other government-promoted attempts at manipulating populations of wild animals.

Some Fundamentals

Contemplation of jack rabbits and prairie dogs, their relations to range lands, and the biology of man's attempts to control those relations in such a way as to benefit his interests, reveals certain manifestations which appear to be basic to any serious exploration of the problems presented by these so-called range forage pests. That these manifestations are all identifiable as phenomena of the biotic community seems to be significant. Of far greater significance, however, is the resultant concept that the solution of such problems will be found in compre-

hension and application of the natural laws which govern those community phenomena. The ultimate objective of this exploration, therefore, must be a common meeting ground for fundamental ecological truths, as we may come to understand them, and man's economic demands upon western grazing lands.

That there is in almost any given area of the earth's surface an aggregation of living things is self-evident. That such collections of individuals and species are mutually interdependent because they have become organized into self-sustaining entities, is somewhat less apparent. Wherever observations on natural history are made, it is found that plants and animals—rarely plants or animals alone—are not segregated into dissociated units, but form natural groups. Upon this universality of natural assemblages of organisms rests, in large measure, the community concept of modern ecology (Allee, Emerson, Park, Park, and Schmidt, 1949).

The community concept seems to be well established in the thinking of biologists, both academicians and field men. It is in keeping with a binding principle of many phases of biology, namely, the integration of individual units into larger entities, and is looked upon as one of the most fruitful ideas contributed by biological science to modern civilization—and especially to the practice of land management. The security of terrestrial communities is dependent upon the soil, that dynamic system the existence of which, in turn, is dependent upon the communities of plants and animals that live within and upon it. The existence of any species population comprising part of the community "is possible only by the continued existence of other species populations of the community, since the life of each organic member of a species depends upon the fulfillment of two necessities", food and shelter (Allee *et al.*, 1949).

Competition among animals is one function which helps to "determine both the species and the number of individuals" in a given community. "There is a general balance" in "the whole composition of a biotic community", i.e., in kinds and numbers of plants and animals, so that the changes continually occasioned "by death or increase cause only relatively slight fluctuations about a mean. This equilibrium, however, is unstable. It is disturbed through the variations in the habitat conditions themselves, which undergo fluctuations. *When the numbers of a single species change, the intimate nature of the internal relations within a community causes the other members to change.*" The members of a biotic community are, in other words, "conditioned by their biotic interrelationships." (Hesse, Allee, and Schmidt, 1951). (Italics mine.)

Competition with livestock for forage is frequently stated as justification for what are known as control measures against prairie dogs and jack rabbits—and convincing proof is available (Taylor and Lotfield, 1924; Kelso, 1939; and also see correspondence referred to under Acknowledgments.) Competition in its fundamental, ecological sense begins when mutual requirements of any combination of living things associated in a biotic community exceed the capacities of the environment to supply those needs. Competition occurs between populations of different species and between individuals of the same species—between jack rabbits and prairie dogs, between prairie dogs and whitefaces, between jack rabbit and jack rabbit, between sheep and sheep, between cow and cow. The chief prerequisite of competition is demand in excess of the supply. The intensity of competition is determined by the amount by which the

demands exceed the supply—the amount being the function of (1) relative population weights and densities, and (2) in the case of competition for food, the degree of overlapping of food preferences. It is generally conceived that the struggle for existence, i.e., competition, is keener the more nearly identical the demands, and hence that competition is usually greatest between individuals of the same species. The results of competition are, in turn, determined largely by its intensity and its duration (Allee *et al.*, 1949; Clements and Shelford, 1939; Oosting, 1948).

Little detailed information is available regarding the course and outcome of competition between animals under native conditions. It seems obvious, however, that overstocking with domestic mammals has forced a pattern of competition upon many biotic communities that is progressively harmful in its effects. Those effects we call damage, depletion, or deterioration. Deterioration of plant cover with its many attendant and expensive evils, is the consequence of disbalance in the biotic community. In the semi-arid regions of the west, where use of the land depends on careful utilization of whatever water is available, climax vegetation maintains its structure by a very narrow margin. Here a delicate balance exists between the biotic community and the physical factors of the environment and here man's use of the land is most precarious (Graham, 1947).

Under original conditions, say Taylor, Vorhies, and Lister (1935), such species as prairie dogs and jack rabbits "were in fluctuating equilibrium with the range forage, which they were powerless to injure seriously." The introduction of livestock replaced the large, native, grazing, wild mammals with a weight of herbivores in many cases out of all proportion to the carrying capacity of the range. Man's demands upon the land brought an increasingly intensified and continuing competition to the grassland, and in many areas deterioration was under way, through the process of retrograde replacement of the vegetation. This reversal in succession was marked by reduction in or complete elimination of climax vegetation, the appearance of "an abundance of annual, weedy forbs and short-lived, unpalatable perennials" (Weaver and Clements, 1939), the opening of cover, denuding of soil, a decrease in humus and infiltration capacity, increased water loss, erosion, invasion of plants of variable and even dangerous quality as cover and forage, and the prosperity of jack rabbits and certain species of rodents, including prairie dogs.

Indicator Values

Bond (1945) and Norris (1950) have pointed out that several investigators have furnished evidence which indicates that these small vegetarian mammals tend to be more numerous on ranges depleted under impact of overgrazing by livestock than on ranges in climax or near climax condition, i.e., that large populations of these "range pests" are more often an effect rather than a primary cause of range deterioration, and are therefore symptoms of poor range conditions.

Taylor and Davis (1947) state that "there is almost universal agreement that after its range was used by domestic livestock, the prairie dog increased in numbers." Osborn and Allen (1949) have summarized the indications offered by several earlier authors that the numbers of prairie dogs increased and the species spread eastward as an invader of true prairie under conditions created by overgrazing by livestock following settlement by the white man.

It has also been shown that jack rabbits increase with grazing, apparently

reaching their maximum numbers (in the southwest, at least) on grazed areas where "a moderate amount of forage still is available," but decrease in numbers when overgrazing goes so far that there is but little valuable forage left (Taylor, Vorhies, and Lister, 1935).

Two reasons for such increases in both prairie dogs and jack rabbits have been suggested: (1) Removal of the taller grasses by grazing, allowing greater visibility which apparently has some survival value for both species, and (2) the increase of preferred food plants on depleted and weedy range. These range relationships have been reviewed in some detail by Bond (1945).

As a member species of the natural community, and as the only thinking animal, what has been man's responses to these functions of disbalance? We have blamed the rabbits and rodents for the obvious range depletion for which our exploitation has been responsible. We have been quick to look about for a scapegoat. We have assigned certain effects to prairie dogs and jack rabbits which might have been attributed with more ecological honesty to our ignorance of or refusal to obey a few fundamental laws of the natural community. And out of this confusion has come the stop-gap magic of artificial control, prompted by the fuzzy logic that "they are rodents; therefore they are destructive; therefore we should kill them," as stated by Vorhies (1936), perpetuated by the naive notion that treating a symptom will cure the disease, and given impetus by Compound 1080.

Certain readily discernible differences between jack rabbits and prairie dogs contribute importantly to the patterns of pressure exerted by these animals, and to the patterns of attempted control of those pressures. The gregarious habit of the prairie dog, on the one hand, localizes its pressure on the range and makes drastic decimation of its numbers by artificial measures relatively simple. Evidence is convincing that pressure by this animal can be reduced effectively and economically by poison, and its populations kept low indefinitely by periodic light follow-up.

The picture of jack rabbit pressure on range lands and its control is strikingly different. This more mobile, wider-ranging mammal, although not evenly distributed over any large area of range land, and showing definite, albeit shifting concentrations, is markedly less vulnerable to significant destruction by poison bait techniques than is the colonial prairie dog. Any allegation of control of jack rabbit damage to range forage is open to question. Damage to field and row crops, orchards, and windbreaks by jack rabbits is usually well circumscribed and readily discernible and definable; control in these instances by artificial methods is not without promise. Pressure on forage over endless miles of range, and control of that pressure, is another story.

The need of the range and of the rancher transcends control of the apparently offending animal; their need is control of damage by the potential pests. An example of data offered as proof of damage control is the report of 43,000 rabbits "by actual count" killed by poison in 35 days on five ranches in Harney County, Oregon. I submit that the numbers of jack rabbits killed is not *prima facie* evidence of damage control. There is good reason to question the assumption that artificially induced reductions of any range forage pest, abundance of which may be primarily an effect rather than a cause, will categorically and universally increase the quantity and quality of forage, wool, and T-bone steaks.

Vorhies (1936) has beautifully epitomized this situation. If there is merit in the view that injurious increases in jack rabbits and some species of rodents are in many instances an effect rather than a cause, then to attempt restoration of ranges, i.e., damage control, by artificially "destroying those animals is precisely like attempting to improve the range by sending out men with hoes to chop the weeds from thousands of square miles. The weeds, as we all know, will reappear so long as overgrazing is continued, and so will rabbits and rodents." Any assertion that control of damage to range by jack rabbits can be effected by artificial campaigns needs examination because such programs fail to consider fundamental functions of the biotic community.

Failure to comprehend the function of disbalance or the assumption that poison can eliminate disbalance, i.e., that it can eliminate a cause by being directed at the effect, has given artificial control measures a perennial pattern that suggests that they are self-perpetuating. It is not news that one artificial control program is often followed by the need for another. Artificial control of rodents and rabbits on numerous ranges of the Ft. Collins area of Colorado is reported to have apparently precipitated predation on lambs by golden eagles which, before the control program, preyed on jack rabbits and prairie dogs. What now?

It is interesting, if not significant, to note in passing that the protagonists of poison repeatedly declare that natural predation does not effect populations of jack rabbits to an extent that forage is benefitted, but that artificial predation does!

The Answer

What is the answer? Range management has begun to find it!

"No jack rabbit problem on ranges in good to excellent condition," reports a southwestern informant. "Depleted range lands recover to good and excellent condition without rabbit control, through range management. Result: Rabbits decline." Studies by Taylor and Lay (1944), Taylor, Vorhies, and Lister (1935), and Vorhies and Taylor (1933) indicate that jack rabbits are of no concern to the rancher in well managed grasslands. Osborn and Allen (1949) have published data indicating that plant succession, following reduction of grazing pressure, may eliminate prairie dog colonies, under certain conditions.

Here is evidence that ecologically sound land use—i.e., maintenance of livestock pressure within the biological limits of the land—will not only permit a good stand of perennial grasses with consequent reduction in erosion and production of better lambs and calves, but may force a decrease in population densities of range forage pests. These indications rest firmly upon the concept of equilibrium in the community of plants and animals, and point with some promise to ecological, or biological, or natural control of organisms potentially inimical to our economics.

Here is evidence that feeding relations must be maintained in equilibrium to insure the total economy of the community. In the light of ecology we have begun to comprehend the significance of increased numbers of rabbits and rodents as frequent indicators of our misuse of the land. With this incipient understanding of certain natural laws, we can recognize the presumptuousness of rodent control programs; we can turn our attention to a critical analysis of the control of competition and productive (instead of destructive) utilization of the phenomena of biotic succession. Here is the beginning of a practical comprehension of the complex interdependencies among the

several associated species of a biotic community—but it is only the beginning.

The Future

It appears that conservative management of range lands will tend to obviate difficulties with jack rabbits and certain rodents. Environmental conditions are varied, however, across the plains and prairies and up the mountain valleys; there is no fixed pattern; the status of jack rabbits on range lands undoubtedly varies from region to region and from time to time. Rather than an effect they may at times be a cause, in still other instances neither cause nor effect. The exact degree to which populations of potentially injurious animals (and plants) can everywhere be controlled by careful regulation of livestock pressure remains to be determined (Taylor, Vorhies, and Lister, 1935). "The role of rabbits and rodents in the ecology of modern agriculture and range use is far from being fully understood" (Kalmbach, 1948). From a practicing plant ecologist with many years of field experience on western grazing lands, comes this unsolicited comment: "There is need for appraising more intensively and extensively the role of both prairie dogs and jack rabbits in range economy." Following a nine-year study on the effects of rodents, rabbits, and cattle on two vegetation types in semidesert range land, Norris (1950) writes: "More information is needed on rodent and rabbit populations, methods of control," etc. One of my informants, an old-timer whose opinionnaire reflected the knowledge of western wildlife and the cautious judgment for which he is universally respected, wrote: "Probably we will continue to control with poison. Yet thinking is turning more and more to biological or ecological controls. I feel we have not given biological control a fair trial, or enough thought and study."

Some severely depleted ranges may require relief from both livestock and range pests before recovery can be effected. The re-establishment of equilibrium on overgrazed range lands will probably, in most instances, involve the removal of cattle or sheep. "Too drastic! Uneconomical!" says the stockman. Admitting that the "fast buck" is something to reckon with, let us look at some economics. Norris (1950) reports that "in spite of increased forage production" in mesquite-snakeweed types in New Mexico, as a result of protection from rodents and rabbits, it is believed that "the profits will not offset control costs." A comparison by Vorhies (1936) of livestock values with the cost of some artificial control operations against jack rabbits and certain rodents in Arizona, furnishes some interesting figures. The estimated cost of killing 12,280 jack rabbits was $3885.92, or about 32 cents per jack rabbit. Vorhies and Taylor (1933) have shown that it takes 74 antelope jack rabbits or 128 black-tailed jack rabbits to eat as much valuable forage as one cow. To remove one antelope jack rabbit-equivalent of one cow cost $23.68; to remove one black-tailed jack rabbit-equivalent of one cow cost $47.36. The livestock was, at that time, worth possibly $20 to $25 per head. Economical?

That expenditure—and millions more—for a stop-gap measure that fails to recognize fundamental and inevitable population mechanisms of the biotic community. Compensatory responses apparently occur in residual populations (of some animals, at least) by which excessive population losses, imposed by whatever device, tend to be made up through the operation of increased productivity; the less dense the breeding population, the greater number of young brought to maturity

per breeding adult. Errington (1946) has comprehensively reviewed the evidence upon which is based this concept of inversity. There are indications that such inverse ratios in reproductive success may be of fundamental population significance. Biologists in Colorado report (correspondence) finding production in mule deer greater on areas where the highest percentages of population are removed by hunting. Could it be that, where population removals are annually effected by artificial means of drive and poison, jack rabbits are responding with sustained high production ratios which quickly refill the habitat in which survival is obviously enhanced for them by our continuing misuse of the land? Could it be that popular methods of control are perpetuating damage? If excessive losses in population serve to increase the ratio of breeding success, what is the relationship of allegedly effective artificial control to the more or less regularly recurrent or cyclic highs in jack rabbit populations?

The Choice

Do we want to know the truth? Do we want a search for the answers to these questions and legions more? The people on the land must choose. Do we want to comprehend the natural laws of the biotic community into which we turn our sheep and cattle? Do we want the self-sustaining yield of a healthy land, or do we prefer the "fast buck"regardless of the costs it imposes upon the land? Will we choose the preventive medicine of natural control of potential pests, through our application of those natural laws—or will we continue calling upon the perennial pattern of poison baits and paternalism to treat the sick land's symptoms while the illness lingers on?

Does man want to know that in Texas, jack rabbits feed heavily on juniper berries during the winter without injury to the seeds, and have thereby helped implement the spread of the conifers into a vast area of grassland—but only where "overuse of the range" has made possible the success of dissemination by the rabbits? Investigation by Simon E. Wolff of the Soil Conservation Service brings this to light (Anonymous, 1948). Bond (1945) has offered as a working hypothesis the carefully conditioned suggestion that rabbits and some rodents, "under some conditions, may assist in the recovery of range ... by feeding on 'weeds' "—i.e., by exerting differential pressure because of preferences for food plants typical of the disturbed areas, rodents and rabbits may actually speed the return of climax grasses. Do we want to learn whether small native vegetarian mammals have any community relationships that are beneficial to rangeland?

Although, as Kalmbach (1948) has declared, it is under field conditions that we must appraise the role of potential forage pests and the economy of their control, the findings on experimental plots may, nevertheless, be indicative. For example, plot studies on the Santa Rita Experimental Range, Arizona, have shown that jack rabbits have not prevented growth of a considerable volume of grass where areas have been given protection from livestock, and that there is no evidence of elimination of grass climax by jack rabbits or rodents independent of livestock. There is reason, says Kalmbach, to believe that facts important to concurrent and economic use of range by small mammals and livestock are yet to be disclosed. Do stockmen want those facts disclosed, or do they choose the presumptuousness of a bureaucracy that, as Vorhies (1936) said, "can more readily find funds for investigation and improvement of the methods of killing" rabbits and rodents than they can find "resources to finance fundamental research to de-

termine whether wholesale destruction" of such animals is biologically and economically sound. Habitat manipulation as a means of bringing about more or less permanent decreases in rabbit and rodent populations has been reviewed in some detail by Allan (1949) who emphasizes "that we do not know how to control rodents by use of natural defenses" and that "in studies for the improvement of range management, the rodent factor has been overlooked or dismissed with recommendations for artificial control."

Surely the possibilities of recovery of valuable forage, improvement in livestock production, and lessening of range pest problems by reduction of grazing pressure, will someday stimulate the intellectual curiosity of the people on the land.

In Brief

The fundamental problem of land use and misuse is man's unawareness that he is inescapably a member species of the natural community. Being a thinking species, he has the unfortunate notion that the wild community is one thing, the human community another and therefore divorced from the natural order of the earth. He is unaware of or refuses to accept the universality and significance of natural laws by virtue of which both he and the biotic community have come to have their very being.

Man must learn that any "culture premised upon the destructive dominance of a single species can have but short duration" (Leopold, 1942). He must learn (1) that there is increasing evidence that the populations of many unwanted species of wildlife are closely correlated with the manner in which we have used and are still using the land (Graham, 1947); (2) that competition between native vegetarian mammals and introduced livestock of western ranges begins when forage production fails to supply the demands of all forage consuming species populations present (and that implies the indirect demands of man)—in other words, when either or both wild and domestic herbivores exceed the carrying capacity of the land; (3) that just as an abundance of brush, annual weedy forbs, and short-lived, unpalatable perennials indicate over-grazing, so may an over-abundance of either jack rabbits or prairie dogs be a symptom of sickness in the land; (4) that primary damage to range, in the words of Kalmbach (1948), usually has its origin and persistence in excessive use by livestock and that the damage may be aggravated by small, vegetarian mammals which increase as a natural consequence and, therefore, as indicators of our misuse of the land; (5) that the perennial pattern of attempts to reduce jack rabbit pressure by artificial techniques in the face of continued disbalance on the ranges, is not a program conducive to land-health and sustained maximum economy; (6) that it is time to find out the total effects of artificial control measures—to study very carefully the intimate relation between land use and populations of rodents and rabbits before we spend millions more on poison campaigns.

Acknowledgments

A mimeographed summary of the status of damage to range lands by jack rabbits and prairie dogs, and of current measures of control against these mammals, was handed to those in attendance at the Boise meeting of the American Society of Range Management. That summary was based upon completed questionnaires (referred to in this paper as correspondence) returned by 38 men distributed among the agricultural colleges, the Bureau of Land Management, the Fish and Wildlife Service, the Forest Service, the Soil Conservation Service,

and the state wildlife management agencies throughout 17 western states. I am grateful to those men for their help. Thanks are also extended to Norman Berg, District Conservationist, Soil Conservation Service; L. A. Dremolski, Supervisor, Caribou National Forest; and George W. Kerr, Manager, Pocatello Supply Depot of the Fish and Wildlife Service, all of Pocatello, for their special efforts on behalf of this report.

Opinionnaires were sent to and returned by 16 men variously identifiable as wildlife biologists, mammalogists, and ecologists in the same 17-state area. Much of this paper, in both context and philosophy, reflects the responses of these men to whom I am especially indebted.

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