

Research and Management in Wildlife Conservation

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Resource conservation, like education, religion, or government represents an idea. Like them it is a concept or an attitude. We cannot perceive any of these in themselves through our sensory system, yet we can feel their force and we can perceive their effects. While the idea of conservation, therefore, is an abstraction, its force and its effects nevertheless are real. To grow in proper forcefulness and in effectiveness, conservation requires continuous and enlightened cultivation. This is dependent upon the establishment of a scientifically sound foundation combining research, management, and education.

Research and management in resource conservation, however well conceived, cannot be expected to thrive in an environment wanting in any important requisites. Among these, it does not strain the imagination to recognize the importance of adequate scientific and management personnel. Perhaps not so generally recognized, however, is the importance of a properly sympathetic public. Such a public is one which has a regard for conservation similar to that which generally they already have for education, religion, or for that matter, for material gain! To reach such breadth and depth of appreciation, it is suggested that conservation will have to be identified in terms of significance with cultural *ethos*. Since the cultural *ethos* of a people is the result of conditioned behavior, in other words a contribution of environment, the matter of identifying conservation with culture plainly seems feasible. This, moreover, becomes an ethical responsibility when its importance is viewed in relation to a destiny of greatly enhanced human welfare (Ruthven, 1931; Sears, 1953; Leopold, 1949). Without a recognition of the social welfare significance, conservation fails to gain *status* culturally. Until this is established, conservation does not appear to be destined to become a broadly appreciated social endeavor.

Wildlife conservation, a particular kind of resource conservation, is the subject of concern here. This is an activity important not only for the sporting values it treasures, but also because of its important bearing, hardly at all appreciated today, upon man's material and spiritual well-being in their broader aspects (Leopold, 1953; Emerson, 1947; Thoreau, 1919).

Organized endeavor in wildlife conservation, while not an old human activity in any historic sense, until comparatively recent years was restrictive in character (Leopold, 1933). It was aimed at making the then existing game supply, one seemingly destined to oblivion, last as long as possible. The idea of considering it as the source of a harvestable surplus had not yet come into being. So there came to be closed seasons, reductions in bag limits, and game preserves established to save certain named species in their then *status quo*.

Toward the close of the first decade of this century, Theodore Roosevelt introduced the concept of "*renewable organic* resources, which might last forever if they were *harvested scientifically and not faster than they*

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reproduced." Wildlife was included in this resource category along with forests. The idea of "conservation through wise use" thus come into being (Leopold, 1933).

With the passing of time, it has become more and more widely recognized among scholars that ecology, itself a relatively new science, provides the scientific basis for resource conservation (Pearse, 1926; Elton, 1927; Ruthven, 1931; Taylor, 1936; Sears, 1937; Allee, *et al.*, 1949; Dice, 1952; Odum, 1953; Park, 1954; and Woodbury, 1954). Through continuing and expanding interest, the body of ecologic knowledge is making increasingly steady and significant growth. Older concepts are undergoing re-evaluation, new concepts are being derived, and new understandings constantly are being reached as a result of the continuing re-factoring of the entire body of man's knowledge in the light of new discoveries. The interpretations stemming from this activity have their specific and their general bearing upon the broad problem of wildlife conservation. Where such relationship may seem obscure, it is due more likely to a lack of sufficient understanding than to any lack of significance.

Collectively the body of concepts comprising the science of ecology represents not only its area of interest but also its theoretical structure. It is by means of "evolving conceptual" systems, not the accumulation of data, that progress is carried forward in ecology as in all science (Conant, 1951; Dice, 1952). This is the germ plasm of knowledge. Contrary to a popular notion, there is nothing impractical about theory of itself. There must be relevant theory of some kind before there can be practice. A particular practice is improved — made more effective — as its supporting theory is refined.

Among the many ecologic concepts with which the practicing wildlifer should be concerned, those following are mentioned for the sake of discussion at this time: habitat, niche, homestead, population process, productivity, homing, sociality, competition, natural regulation of numbers, biologic systems, life-form, and distributional pattern. Arrayed like this, these terms do not appear particularly intelligible. They do become so when those pertinent to a particular problem are applied and integrated into an order which will lead to a reasonable explanation of the problem.

In wildlife conservation, as in biology or any of its discrete divisions (Egler, 1942), it is helpful to recognize a central concern, that is, a basic question. This provides helpful mental orientation, and contributes to purposeful and productive endeavor. For wildlife conservation, it is suggested here that the central concern is the problem of: "The Species Population, And Its Welfare." Population process combined with habitat is the common denominator of wildlife problems.

As compared with a cell, a tissue, or an individual of a multi-cellular species, the species population represents a complex level of biologic organization. It is a biologic system which not only combines the characteristics of these as to organization and properties, but does so at an advanced level. This suggests a definite and basic ordering or patterning in the world of nature, and that these are repeating biologic systems regardless of the level of organization. An understanding of this concept is important to biologists, because much can be learned concerning the phenomenon of population by comparative study of its properties with those of the less complex biologic systems: Population thus is seen, for example, to have organization in terms of age, sex, sociality, and pattern of distribution; to be limited in numbers as a consequence of both self regulation and regulation due to environmental influences; to regenerate its parts; to be a self-sustaining level of biologic organization; and to exert both additive and subtractive influences within its habitat. Popula-

tion also has dimension in terms of time and space, and history in terms of ontogeny and phylogeny. These are not idle abstractions. Rather they are valuable mental tools by means of which to consider the phenomenon of population.

Habitat is of fundamental importance to the welfare of a species population. No species can exist in its absence. It is the *place* where the species lives, for it is here that such vital needs as food, shelter and living space are provided. It is here, too, where the special grounds, the display grounds of the prairie species of grouse for instance, which lead to reproduction also are provided. Habitat, therefore, can be likened to a compound — a mixture of ingredients essential to the satisfaction of vital needs (Stebler and Schemnitz, 1955).

The ingredients or components an animal uses to satisfy its vital needs may be called niches. These are the items within the habitat of a species which are used for food, for shelter, and in certain instances for the very specialized environmental situations leading to successful reproduction. These niches must also form the basis by means of which habitat is selected by the dispersing individuals of a species, or by the individuals of an introduced exotic species. So conceived, this idea of niche varies from older views summarized by Dice, (1952), but is somewhat similar to the recent view of Linsdale (1957).

A habitat thus is ordinarily comprised of a number of food niches. For a carnivorous species of rather specialized food habitats like the timber wolf feeding as it does mainly upon big game species (Murie, 1944), the number of food niches is relatively few. But for an omnivorous species like the bobwhite quail, the number of food niches is abundant (Baumgartner, *et al.*, 1952; Korschgen, 1952). Food niches vary not only from one species to another, they usually also vary from season to season, and according to whether the food is used by young or by adults.

Similarly a habitat also is comprised of a number of different kinds of shelter niches. These vary, of course, from species to species, and according to the kind of shelter sought, whether for sleep, for a short rest, for leisure, for hibernation or estivation, for protection from the weather, from predators, or even from competitors, for the birth of young, and which may vary also from season to season.

Since it is not uncommon to find terrestrial vertebrates living in areas embracing more than one type of habitat, and since a single species occupies but a single habitat, habitat and species being ecologic reciprocals, it becomes difficult if not impossible to define the habitat of a particular species upon a floristic basis alone. This is because frequently a niche as a taxonomic entity does not extend from one habitat type to another (Peterson, 1942). To perceive the binding influent — the common denominator — a classificatory category other than taxon then becomes helpful. This is provided by the concept of life-form (Peterson, 1942; Stebler and Schemnitz, 1955).

Particular life-forms often transcend the boundaries of a number of habitat types. For instance, a certain species of shrub might be greatly restricted in geographic distribution, while the shrub life-form generally is widely distributed. The one or several an animal species uses as a vital niche then becomes useful in defining with an increased degree of precision the niche composition of the animal's habitat. The more extensive the geographic distribution of a species, the more variable in terms of taxonomic entities can be expected to become the niche components of its habitat. Where the taxa comprising the niches is of essential importance locally, life-form, therefore, becomes the binding influent extensively. This is one reason why it is not necessarily repetitious to study the ecology

of geographically wide-ranging species first in one region then another, and why it is of practical importance to study a species throughout its geographic range. A critical knowledge of habitat and of its included vital niches as essential particulars, therefore, is indispensable to an enlightened approach to the problem of habitat management.

The adequacy of these niches as to sufficiency and quality to satisfy the several vital needs of a species presumably provides a basis by means of which the carrying capacity of a habitat can be measured and evaluated. Much of the difficulty associated with the principle of carrying capacity stems from its relative intagibility. Recognition of the concept of vital niches, as conceived above, offers promise of a concrete approach to the problem of habitat management, which has for its aim either the maintenance of present carrying capacity or its increase.

Intimately related to the problem of habitat also is the further problem of how a population is distributed through a habitat. Long ago the idea was advanced (Grinnell, 1928; Seton, 1929) and still is (Miller, 1942; Dice, 1952) that animals do not roam about at random. Increasingly evidence is indicating that they live on relatively restricted home grounds. The work of Murie and Murie (1931) and of Stickel (1949) demonstrate a positive orientation or attraction on the part of animals to a particular area. This is homing to the extent that homing is a positive orientation to the use of a particular place. Behavior of this sort is manifest not only in the return of pigeons to their home cote, but in the use of a homestead as well. This interpretation appears consistent with Allee, *et al.* (1949) and with Dice's (1952) definition of home range [homestead]. In recent years, too, many works have been accomplished concerning home range of a number of different species (Bradt, 1938; Blair, 1940; Burt, 1943; Stebler, 1951), which offer further support of this idea. Homing and home range appear intimately interdependent, resembling a sort of cause and effect relationship. Perhaps enough work has been accomplished concerning spatial behavior generally to permit the statement that the individuals of a species, except those in the process of dispersal, do not roam freely throughout the extent of the species' habitat. It is becoming increasingly evident that each individual or group, depending upon whether the species lives solitarily or gregariously, is limited to a restricted part of the habitat usually called the home range, but which is here called the homestead. The term "homestead" appears more appropriate for both historic and linguistic reasons (Oxford English Dictionary; Mills, 1923).

Homesteads vary in area not only from species to species, but also for a given species as well. Since areal variation for a particular species occurs irrespective of the number of individuals residing therein (Thomas, 1955; Schemnitz, Ms.), which in itself points to the usefulness of this unit as a basis for census, it is suggested that the habitat area covered by an individual homestead is related to its carrying capacity. For the given species then, large homestead areas suggest relatively low carrying capacity, while conversely, small homesteads suggest relatively high carrying capacity. When the establishment of a reserve for a particular species is being considered, knowledge concerning the upper and lower limits of its homestead areas can be helpful in resolving the question as to how large an area to set aside.

Variation in homestead area in relation to comparative density of the resident population, so far as a particular species is concerned, is also of essential importance to management dealing with the problem of improving habitat. This, of course, assumes that a basic aim of such endeavor is to attempt an increase in carrying capacity. With a sufficient knowledge of the food, shelter and other vital niches used by a species in a regional part of its habitat, a knowledge which can be gained

by comparative measure of the abundance, distributional pattern and year-around adequacy of these niches as they occur on several adjacent homesteads, it should be possible to learn in what niches a homestead may be deficient. Habitat improvement then can be aimed at the elimination of specific deficiencies. Work recently completed by Downing (1957), for example, suggests that the addition of trees, conforming to the orchard type in general form, to the landscape of western Oklahoma shows promise of increasing the regional productivity of the environment in terms of mourning doves. Recognition of specific deficiencies as indicated above certainly should lead to a more enlightened approach than the haphazard setting out of nursery stock or the establishment of food patches without regard either for homestead areas or niche deficiencies.

Homesteads serve another important function for a species. It is the means by which the individuals or groups are spaced in the habitat. This is important, for it reduces intra-specific competition for vital needs. It is important further, since it indicates the distributional pattern, which is spatial ordering, of the species. A habitat thus becomes the sum of its contained homesteads. These become the means for depicting the real ecologic distribution and its pattern for a species.

A map based upon the data of homestead areas and their contained vital niches and depicting the entire ecologic distribution of a species, while probably impossible at this time, can be expected to look quite different from the conventional ones portraying geographic distribution. Maps showing the ecologic distribution of species would be most useful. They would not only depict actual distribution at a given time, but they would serve also as a gauge by means of which to ascertain changes in distribution in terms of both direction and rate in a manner more satisfactory than now is possible with maps of the conventional geographic type. For species distribution, as is well known, is not a static phenomenon. Ecologic implications, which are lacking in geographic maps, would be one of their useful inherent features.

Such maps might have other uses. A composite of habitat maps for a regional population of gallinaceous birds, for instance, might show the manager faced with the problem of introducing an exotic fowl just where appropriate combinations of unused vital niches might exist. The conventional expression "unoccupied habitat niches" is meaningless in view of the concept of niche as developed above, for a niche is something used, not occupied. If there should be appropriate combinations of unused vital niches available, which to any significant extent seems doubtful, introduction attempts could then be directed to making use of these provided they were suitable and sufficient for the bird being considered.

All of the possible vital niches present in a particular homestead may not be used by the resident individuals. Some may not be vital niches at all for the species represented by these individuals. It is likely, however, that they are vitally useful to individuals of other species resident in the region. There comes to be, therefore, overlap in the homesteads of individuals of two or more species. A turkey homestead thus might contain the homesteads of several deer mice and several colonies of ants. In this way, perhaps, most if not all the niche resources of a region get to be used by a number of species. This may explain also why introductions of exotics have been generally so unsuccessful in relatively undisturbed natural environments, and why they have been successful in several instances, ring-necked pheasants and Hungarian partridges for example, in rural areas where the natural environment has been drastically modified.

Since homesteads appear to be in intimate relation to carrying capacity, they also effect a limitation upon intra-mural population growth. Those individuals which are surplus to existing carrying capacity, or which

exceed the characteristic density of the social group, sooner or later are obliged to seek a living elsewhere. The coyote apparently exemplifies this latter condition. The young of the year with this species leave the parental homestead during the late fall immediately following their birth. The parents then appear to live alone as a mated pair until a new litter arrives (Stebler, 1951). The departed individuals become dispersants, and until they find an area suitable for homesteading, or where they may find and fill a vacancy within an established homestead, they are more than ordinarily vulnerable to such mortality agents as predators, competitors, accidents, or perhaps even want. Emerson long ago observed that: "Each animal out of its *habitat* would starve," (Lindeman, 1947). Among game species, this fraction of the population safely can be made available for sport hunting. Dispersed individuals may explain the very noticeable local population losses some observers have noted among quail, for instance, in the spring about the time the winter coveys disassociate (Emlen, 1939). Among those game species where this happens, it suggests the possibility of permitting an increased harvest either by allowing a greater *per diem* bag, or by an extension of the open season.

This brief discussion, perhaps, may indicate the complexity, as to conditions and variables, of the task of wildlife conservation, as well as its basis in ecologic science. Each of the concepts considered here, together with some of its interrelations, and management applications or implications was developed through research endeavor. Perhaps, too, the intimacy of the bearing of research upon management may be clearer. While it is true that research is the source of nourishment for increasingly effective management, it is also recognized that in its turn management suggests many lines of activity to research. The two are in harmony when they are effectively supporting each other as a smoothly coordinated team. The task of wildlife conservation plainly is a complicated one, and one requiring a considerable background of appropriate and continuing education.

An interpretive synthesis of several ecologic concepts as they apply to the practice of wildlife management has been attempted here. It is recognized that other integrations, depending upon the purpose or view, also may be made. For the sake of increasingly effective endeavor in wildlife conservation, it is essential that intelligence does not fall prey to deadening routine, for as Sears (1937) has pointed out: "Whenever intelligence becomes polarized into routine, the human animal is in danger of doing what the chestnut blight fungus has done to itself by destroying all of the native chestnut trees in the eastern United States."

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