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MANAGEMENT, RESPONSE, AND VARIETY

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The idea of caring for small groups of wild animals has been part of the operating equipment of man since before the beginning of recorded history. The earliest purpose was doubtless to domesticate. However, a millennium ago the concept of improving the habitat to provide for a better crop of game was already established in the Orient (Marco Polo). Food, cover, and predation were the aspects of the environment manipulated.

It is significant to note that even the earliest concepts of management developed only where the evolution of human culture had led to an educated segment of society that had established land tenure. In the old world, wildlife management was a practice developed by the aristocrats in temperate and subarctic climates where a few species of wildlife dominated the scene and where there were obvious seasonal changes in the environment. These changes had their impact on man also and thus almost certainly focused his attention on the lives of the creatures around him, leading by logical process to the developing concept of ameliorating the most destructive circumstances.

The origin of the idea of altering the natural circumstances that were controlling the lives of creatures other than ourselves is a major landmark in the flowering of human ideas. It marked a point at which man had gained such mastery of the principles of his own survival that he had developed a confidence in his ability to alter the environment, and to extend this umbrella of understanding and competence beyond the immediate area of self and family.

Once the original concept had been added to our vision of the natural world it was inevitable that it should evolve, becoming at once more complex in its detail and more simplified in its synthesis. The expansion of natural history into ecology, during the scientific revolution on the American continent, saw the principles on which the idea of wildlife management rests added to abundantly, both at the operating level and in concept. The community as a vital entity operating in accord with discernible laws that could yield prediction, the ideas of the limiting factor and of density-dependent feedback between organism and environment were among those hypotheses that provided important new conceptual equipment.

At the same time, the human objective gradually evolved from those of the native predator, through the phases of animal culture for consumption and animal culture for recreation, to the sophistication of a broad and diverse pattern of human interest in the creatures with which he shares the world. Aldo Leopold crystallized the new idea in his definition of the "ecological conscience." Man is seen not as the outright owner of the world or any part of it, but rather the holder of a life rent, and bearing the

* Prof. Cowan, who presided over Session I, is identified in a note on page 9.

responsibility to so order his activities that he turns over to his successors the biological capital with which the world is endowed in at least as good condition as when he got it. This is a powerful and attractive view and one that immediately demands further definition of our precise purpose and of our vision of the ideal human environment.

Evolution is never uniform in rate nor in coverage either in the objectives or in the abstract. It would be unlikely, therefore, that large parts of humanity would arrive at the same point in their ideas simultaneously. Always, however, the high point is an important landmark. The Leopoldian thesis is widely accepted in principle on this continent and in Europe as the operating base of the ecological conservator. There are, however, great diversities in the interpretation that can be and are placed upon the vision of the desirable human environment. These run the gamut from the sordid monoculture of cement and pollution where it profits, to the idealistic, almost escapist "good old world" with some modern conveniences. Ideas and ideals, however, have never changed with greater tempo, and our burgeoning capacity to alter and regulate our environment on a massive scale makes ever more urgent an improved understanding of the ecology of man as the dominant influence in the world's terrestrial ecosystems.

Management is an activity of man. For our purposes I will define it as any planned and purposeful action directed toward altering the environmental impact on an ecotype or on an animal population. It will include the regulation of the direct or indirect impact of man himself on the ecotype or on a wild species, as well as all attempts to influence such other features of the environment as nesting sites, shelter, food, parasites, disease, predation, competition, or distribution. Inherent in the management approach to the occurrence and numbers of a species is the belief that it is within our competence to determine numbers of the species, to detect the critical features of the environment that are influencing the species population, and to alter these in a planned direction.

Our view of ourselves as possessing these capacities finds reflection in a broad spectrum of judgments and attitudes with reference to wild species. One of the most elementary is found in the question heard so often "What good is it?" The implication is that the biological world can be divided into the useful and the useless with obvious corollaries of attitude and action. The objective today, however, is directed toward the provision and maintenance of the maximum of variety. Each living organism is the repository of a unique assortment of biological information gained through the eras via the interplay of opportunity and response. Each offers a potential enrichment of human knowledge, experience, and enjoyment that is limited only by our capacity to appreciate. This capacity will certainly expand to levels yet unimagined and the loss of any single element in the world's store of varied life is an erosion of our potential.

This view of the objective of management in conservation finds general support among ecologists and has already penetrated to the action level in some areas of governmental administrative responsibility. No species, however, lives alone; the majority occur in a variety of different environments, each calling for a different set of responses. Each biotope, therefore, is as unique as the species that compose it and is possessed of a variety of yet another order of magnitude. Today our management abilities are effective where the simple manipulation of one factor influencing a single species is pertinent. Under the more complex circumstances of the biotope, in very few instances do we possess the information

upon which management practices can be designed.

A review of present areas of management and of the responses elicited will orient us in our attempt at projection. In general terms our management efforts are directed to encourage those species we desire to assist, to reduce populations of creatures we consider damaging to our interests, or to maintain the integrity of an entire assembly of plants and animals—that is, to maintain an ecotype for its riches of species and associations. In order to accomplish these ends we concern ourselves with the manipulation of forces that influence mortality, with other conditions that govern distribution, and finally with attempts to increase or decrease the fecundity of the species. It is useful to consider examples of the application of these approaches in three main categories: (1) the management of survival, (2) the management of distribution, (3) the management of numbers.

The management of survival

Here and there throughout the world are species of animals whose numbers and population trends leave them vulnerable to extinction. The disappearance of any one of them is regarded as contributing to the progressive deprivation of our long-term opportunities. Wherever possible, active steps are being taken to circumvent the extinction.

In some instances the population has reached a vulnerable position through the direct action of man. Under these conditions the obvious management action has been to restrict or eliminate human predation. The outcome of this will depend upon whether or not the remaining population is viable in terms of numbers, distribution, and biological structure. The short-tailed albatross has responded, as has the bowhead whale, and both are gradually climbing back from the brink. Great effort is presently directed toward the attempt to manage the whooping crane into a position of safety, but success is far from certain.

In general, management directed toward the survival of an endangered species has greatest likelihood of success with a form of limited migration that confines its movements within a politically stable and sophisticated area, and aggregates during its period of greatest vulnerability. Ease of identification is an additional favorable attribute while highly specific environmental requirements have a negative influence.

Species that are in trouble because of the secondary consequences of human activity have proven more difficult to assist. The ivory-billed woodpecker appears to have vanished with its chosen habitat of mature cypress forest despite efforts at management. The widespread disappearance of the native avifauna of the Hawaiian islands has most probably arisen as an outcome of the combined introduction of avian malaria and a mosquito vector. These conditions resist management correction.

A reasonably recent approach to assisting the survival of wild populations of endangered species is the application of captive-rearing techniques to part of the population, with the objective of later release into the wild. The nene (native goose) of Hawaii is apparently responding to the combined application of this method and field techniques designed to improve the environment and to distribute the population more favorably.

There are several international programs in the planning or early implementation phases that will bring captive rearing to the emergency assistance of endangered species of mammals. It can not be regarded as a panacea because some species are not susceptible to confined rearing and others have been shown to possess a heritable factor for wildness that may be selected against in captive rearing (Spurway, Leopold). It is pos-

sible that this is a major factor in the failure of programs of introduction and reintroduction.

Island populations of bird and mammal endemics have proven particularly difficult to manage in the interests of survival. In general, long periods of evolution out of contact with the specialized competitors, predators, and diseases of the continents leave the insular species most vulnerable. Restoration management has been successful in the few instances in which it was possible to remove the new destructive factor.

A dramatic instance is the rebuilding of the biota of Laysan Island. The island was almost completely devastated by domestic rabbits and guinea pigs introduced in 1903. By 1923 only four species of plants remained of a flora of twenty-six species; of the five species of indigenous birds three were gone, the other two were in danger (Bryan, 1942). The last surviving rabbits were destroyed about 1925, and over the succeeding forty years the flora has largely returned and the two surviving species of land birds have increased, probably to the capacity of the habitat.

In this, as in many other island problems, the destructive element was a single man-made influence and the task of management for survival is simple in principle even if frequently difficult to achieve.

The recognition of the elemental importance of preserving the integrity of the genotype has presented management with a new and important yardstick. The culture of preferred species can easily lead to the unwitting extermination of another species or local form. The widespread transplanting of such species as bobwhite quail and cottontail rabbits may have changed the genotype of local adapted stocks and thus destroyed the peculiar genetic distinction of certain forms. Similarly, it was feared for many years that the liberation of plains bison into the last habitat of the wood bison had eliminated the latter. A relatively uncontaminated herd of the latter discovered recently has provided the source for an important attempt to establish a genetically unaltered herd.

In this connection the campaign by Needham to maintain the genetic integrity of the unique assortment of species and subspecies of California mountain trout offers an important example of this kind of management situation. With hatchery programs burgeoning and becoming steadily more important in the management of game species for large harvests, only the most dedicated appreciation of the principles I have outlined could have preserved these very local and confined endemics from elimination by competition, genetic inundation, or hybrid sterility.

A very special program in management for survival is the European attempt to re-create the lost genotype of the European aurochs by recombining the features isolated by selective breeding to provide the modern breeds of domestic livestock (Street, 1964). It is unlikely that this kind of program can ever be completely successful. Indeed we have no criteria against which to judge the reassembly. However, certain attributes of the re-created stock strongly suggest that it at least closely approximates the original. Of special importance are attributes of hardiness that have appeared in the recombined stock. Such an attempt to reassemble a vanished species would be possible as an endeavor only where several captive derived stocks are available.

It is impossible to foresee the direction that our interests in the biota will take as human tenure of the earth lengthens, as our populations increase, our demands upon the resources expand, and our understanding of the environment becomes ever more sophisticated. Today our orientation and concern is toward the trees, certain more obvious elements in the

flora, and to the birds, mammals, and fishes. Our knowledge of the ecological facts pertinent to the management of most of these species is most inadequate; we are totally innocent of the information that would permit us to manage the populations of most of the living creatures of the world.

It is probable that this situation will continue. This being so, the only tenable approach to the maintenance of the largest part of the biota is the management of ecotypes rather than species.

Where management is to be directed toward the perpetuation of a climax situation, the task, in theory, is relatively simple and would be categorized in the general area of protection. However, the restoration and maintenance of any of the host of complicated evanescent seral stages is a task of the greatest complexity.

We have experimented extensively with the development and manipulation of wet ground for the primary purpose of improving the environment for waterfowl. Many of these aquatic and marsh habitats are biologically rich and the host of associated species prosper along with the waterfowl. The management of such wet-ground areas revolves primarily around the control of water in sufficient amounts and in desirable patterns. This may be supplemented by the introduction of appropriate plants. In general, however, success depends upon the development and maintenance of emergent vegetation. This has proven to be a difficult task in some of the larger impoundments in the Canadian prairie provinces. Here gradual deterioration of the plant-supporting capacity of the shallows occurs unless the water levels are caused to fluctuate appropriately. Marsh management has also encountered the hazard of western duck sickness epizootics. Again the most satisfactory control involves the capacity to change water levels and to regulate water temperatures.

More limited experiments have been devoted to the maintenance of prairie areas in Wiconsin and Minnesota. In general, however, it can be said that greatly expanded research programs in ecology are urgently needed to supply the information upon which successful management of ecotypes must depend.

We are presently relatively powerless to plan successful ecological management of even the smaller of the national parks of this continent. This lack alone is likely to severely hamper the successful implementation of the recommendations of the Leopold Committee (1963) that call for the restoration of the primitive ecology of the park areas.

The usual approach to the management of vanishing habitats has been to create a refuge or park to include it. Here again, though the end result may be the survival of a vanishing biotope, the initial concern is largely with a simple species.

Special reserved areas have been established to maintain stands of climax redwood forests, Douglas fir forests, Monterey cypresses, organ-pipe cactuses or similar species. The preservation of these has necessitated the maintenance of the ecosystem of which they are a part. The truly ecological view of the objective is only beginning to enter into planning and administration. Among the best examples of advanced thinking in this context is to be found in the attitude toward the unique crater flora and fauna in Mount Haleakala National Park, Maui Island, Hawaii.

In general the attitude has been that all requisite action has been taken with the exclusion of fire and the protection from direct attack upon the area or species by man. Gradually the greater complexities of the task are becoming manifest as the problems of the alteration of the environment by human trampling or through the increase of plant-eating mammals are met. These frequently present

the necessity for objective judgments that we resent being forced to act upon and consequently postpone long after the critical point is passed.

There are many examples in the national parks and elsewhere where the basic ideal of the maintenance of maximum variety is being destroyed rapidly by rigidly held dogmas transferred from other areas of land management. We are rapidly losing the early successional stages of the plant communities that culminate in the well-known climax conditions, such as spruce forests, where the terminal stages support relatively sparse biota.

The recent study of changes in the forest cover of Yosemite Park over a century of our stewardship offers an important example (Gibbens and Heady, 1964). Fire has become anathema to the manager of forest areas who consciously or unconsciously harbors as his objective the ideal of a uniform stand of well-shaped trees unmarred by fire, disease, insects, deformity, or senility. But fire has been the great reinitiator of forest areas, the creator of variety of cover type on the large scale, while insects, disease, and senility have instigated diversity of habitat on the smaller scale.

Management of distribution

In general a species becomes less vulnerable as its occurrence becomes distributed more widely. Of special importance is the discontinuity of distribution as this protects against the inadvertent catastrophe that can overwhelm a single small population. This fact poses one of the most difficult decisions faced by those engaged in captive rearing to support the survival of very rare species. A current project sponsored by the World Wildlife Fund offers a pertinent example. An attempt is being made to use a captive-rearing project to save the Arabian oryx from imminent extinction. Wild capture produced two males and a pregnant female. There were others already in captivity in zoos in various parts of the world. Their distribution provided the safety inherent in dispersal, but the isolated pairs offered little likelihood of the establishment of a successful breeding nucleus. The decision requires weighing the dangers inherent in transporting the creatures to a common site, plus the dangers of epizootic disease or some other catastrophe striking the entire group, against the improved chances of successful captive rearing that will arise from the larger group.

A somewhat similar alternative was considered as part of the program to save the California condor. In this instance a proposal by San Diego Zoo to capture some wild birds for confined breeding was rejected on the basis of the minimum viable wild populations (now down to forty birds). Such decisions often involve selecting between the principle of the safety of dispersion and the principle of the minimum viable population. Each instance becomes a special case.

The ideal outcome is to be seen in the handling of the nene project in which the captive birds were divided up into dispersed breeding nuclei as stocks became adequate.

The management of distribution has involved introductions and reintroductions. The distinction between the two is based upon whether the species introduced was in earlier time an indigenous inhabitant of the region. By introduction we can create variety beyond what existed previously and we can theoretically give the introduced species the benefit of the advantage of dispersement. However, we seldom use scarce species for transplant, and this factor is therefore of little consequence.

Large numbers of species have been moved around the world in programs of introduction. In North America such game birds as pheasants, gray partridge, and chukar partridge are well known. In

many areas they occupied hitherto untenanted ecological niches and contributed to the enrichment of variety. Among the nongame species the European sparrow, European starling, rock dove, white-winged dove, English skylark, and a number of others have entered the North American fauna in this way. Certain of them have entered niches either created by man or unexploited by native species. Others have competed with, or displaced, natives and have thus not been of support to our over-all objective.

It is probable, for example, that the introduction of the black-tailed deer to the Queen Charlotte Islands of British Columbia contributed directly to the extirpation of the unique indigenous caribou of the islands.

An examination of the New Zealand fauna provides probably the greatest concentration of ill-advised introductions of any area in the world. These were made without appropriate forethought and in the absence of the necessary biological information on the probable impact of the introductions upon the native biota.

Introductions in North America are frequently difficult; attempts have failed many more times than succeeded. Even after most careful comparative studies of donor and host environments have led to the selection of the most suitable genotype for the transplant, the odds against success have been high. Frequently the liberation of large numbers over a period of several years has led to success. The implication is that a new genotype, developed by local selection, provided the unique adaptive capacity required for success in the new domain.

Reintroduction is a special case that has often directly contributed to desirable objectives. The California bighorn is being reintroduced to parts of its former range in Washington and Oregon from surviving herds in British Columbia. Wapiti have been taken from Yellowstone Park to re-establish vanished populations in British Columbia and Alberta. Other examples could be cited.

Most of the successful reintroductions have been achieved with small numbers of individuals, sometimes by open release, sometimes by a period of captive rearing followed by soft release that provided the animals an opportunity to adapt gradually to the new environment.

Both in introductions and reintroductions too little attention has been paid to the possibility of transporting disease organisms with the host.

A dramatic example of ill-considered transplanting is to be seen in the movement of the Wainright, Alberta, herd of plains bison into the last remaining habitat of the wood bison. The transplanted herd was tuberculous and carried at least this disease into the wildlife on its new range with unfortunate sequelae.

Any such movement of organisms into an environment unoccupied by the species provides an opportunity for the establishment of a disease-free nucleus that should be taken advantage of. Natural extinction has been an active process throughout all of existence. We have few clues to the cause of extinction but a ready possibility is epizootic disease. Thus the existence of disease-free discontinuous populations should have added survival value to the species and will provide additional surety to our objective of management for variety.

Management of numbers

The greatest management effort on this continent has been devoted to maintaining a large population of the varieties of animals that contribute to commerce or to recreation. Millions have been spent managing populations of salmon, trout, grouse, pheasant, quail, turkey, deer, moose, elk, and other species. In general, management activities have fallen into three categories: fact finding, restrictive regulation, and positive management. The fundamental difference between the last

two is that restrictive regulation is oriented toward regulating man as a predator upon the wildlife species, while positive management is oriented toward increasing the production and survival of young and lengthening the life of adults of the managed species. Obviously it is not possible to place all our management practices clearly in one or other of these categories but for most this is appropriate.

It is not necessary to comment at any length upon the various restrictive regulations that have been used with varying success on different species. Open and closed seasons, sex restrictions, bag limits, and weapon specifications are widely used. It has become obvious that the restrictions can be effectively varied from species to species, from place to place, and from time to time if they are to achieve their objective. There is no one tried and true set of rules that will lead to successful management of a species throughout its range and over an extended period of years.

The positive approach has included the destruction of animals known to prey upon the managed species. The biological situation is much more complicated than it was earlier imagined to be. In general, predatory animals are now known to play a role that differs greatly depending upon the relative sizes of the predator and prey populations, the availability of alternative food sources, and the presence in the environment of special features that facilitate the escape of the prey. Predators are now known to serve seldom as the limiting factor. They may, however, serve as the intermediate host of undesirable parasitic organisms or they may compete with man for use of the prey species.

The management of predators has so far consisted, for the most part, of direct killing of the undesirable species by gun, trap, or poison. Recently some control programs have used artificial limitation of input to reduce the population of unwanted species. The chemical treatment of the eggs of gulls and some other sea birds so as to prevent their hatching is an example of the effective use of such a technique.

Disease control has the potential to contribute greatly to the population available for human use; however, it has proven extremely difficult to influence the incidence of disease in wild populations. An outbreak of hoof and mouth disease in deer in California was attacked by an attempt to remove all deer from the affected area. The disease did not become enzootic in the deer, but whether or not the containment program was contributory is not known. Western duck sickness can now be controlled by techniques that are practical upon large and small waterfowl management areas.

The screwworm (a blowfly larva) has been shown to be an important parasitic organism of deer in the southeastern United States. Ingenious biological methods appear to have brought it under control.

Necrotic stomatitis was at one time a disease of local importance among mule-deer populations in California. Improvement of water supplies has done much to reduce losses to this disease.

It is safe to say that we know relatively little yet about the impact of disease upon wild populations. Our capacity to manage the impact cannot even be explored until much more research has been done.

Animal species that have special requirements can often be increased both in numbers and in distribution by practicable measures. The provision of suitably isolated nest sites on artificial islands, or mounds, or in washtubs can increase populations of Canada geese. The hole-nesting species of ducks, such as wood ducks, goldeneye, and bufflehead, frequently respond to the provision of suitable nest boxes.

In the Florida Everglades fluctuation of water levels from year to year can have strong influence upon the population of alligators. The creation by blasting of "alligator holes," in which the animals can survive drouth periods, can extend the distribution, increase the minimum numbers, and accelerate the rate of recovery of the population following a drouth.

There have been many attempts to manipulate the environment so as to improve its capacity to support wildlife species. Cover planting to provide shelter and food during periods of severe weather or to provide safe nesting sites in the early spring has influenced the size of breeding populations and rendered their reproduction more effective.

Management for numbers, inasmuch as it is generally related to some direct form of human use, can be in collision with the broader objective of the maintenance of the greatest variety of species, and the preservation of all existing identifiable genotypes. The fisheries manager is now equipped with chemical means of removing all competitor fishes from waters managed for "sporting" species of fish. South of the glaciated areas of North America there are many species of fish with extremely limited distribution. Unless the facts are known, the rare species and their distribution understood, and the danger recognized, there is an ever-present possibility of the unintentional extermination of a species in the course of management activities devoted to the improvement of stocks of another kind of fish. As a case in point, recent use of piscicides in the Green River exposed to the threat of extirpation several species confined to this river system.

The future of management

It has been shown that we have developed some facility in manipulation of populations where we can identify a single limiting factor that it is within our power to alter. Thus we have been able to maintain some threatened species long after they would have been lost left to their own resources.

We are still struggling to develop our concepts and practices to the level that we can direct our efforts to the maintenance of intact biotopes. The promise of this approach is so great that much new ecological research should be directed toward acquiring the understanding necessary for successful management.

We have been able to diversify either by transplanting species into environments not previously occupied by them or by reintroducing them to areas from which they had vanished.

We have very limited capacity to apply positive management methods designed to improve on unaided productivity or survival. We can, however, contribute to our ideal by controlling human activity on habitats where directly or inadvertently species and communities of species might be destroyed. We can also attempt to assure the survival of a large part of this continent's biota by maintaining enough discrete populations of viable size to protect against the possibility of accidental elimination.

It seems certain that as our populations increase on this continent they will not expand as rapidly as our technological competence. This will soon force a complete reappraisal of the objectives of human living. It is safe to say that the pattern that will emerge on this continent may differ remarkably from the present one. More people with less time spent by each in making a living and more time for nonessential activities of life will change our attitudes toward the living environment.

Transportation patterns for some time to come will be increasingly destructive of the integrity of wild land. Air travel will increase and diversify and impose further problems of conflict between wildlife and machines on airports. We

will develop techniques for altering the habitat on airports so that large species of birds or those smaller species that aggregate into large flocks will be discouraged. Other species that skulk rather than fly and do not flock will probably expand their distribution and numbers.

Intensive agriculture may reduce the area available for the raising of farm wildlife and will produce even larger areas of uniform culture. This again will encourage the seasonal aggregation of species that favor man-made steppe conditions or extensive vegetable and orchard acreage. Demands for control will be met.

At the control level I feel certain that more use will be made of chemical management. The important need is for target-specific chemicals that will avoid secondary effects. These will certainly be developed and used. It is to be hoped that chemicals will be discovered that will act by restricting fecundity so that these can be applied to baits where control is necessary but large-scale slaughter is undesirable.

We can, I think, foresee an increased development of apartment dwellings of large capacity spaced widely apart in landscaped surroundings. With adequate planning these will encourage the close association of urban dwellers with a variety of wildlife species. Here again the plant species used by the landscaper and the plantation forms used will tend toward uniformity and the encouragement of a restricted variety of species.

There will continue to be vast areas of undeveloped land within which most of our species of wildlife will survive. Those that migrate will have a more difficult time than resident species because they will meet a series of changed habitats as they move.

Many waterfowl species will probably decrease to the point that their shooting will be greatly curtailed or terminated; a few highly adaptable and successful species, that respond readily to simple management techniques, will bear the brunt of the harvest. Opportunities for waterfowl shooting will pass more into private hands, and the task and approaches of management will have to change accordingly. The Anseriformes will probably suffer more than any other group from the problems imposed by migrating over a greatly altered land. The demand for publicly controlled refuges will increase and will probably be directed more precisely toward the needs of given species.

In general, one of our most urgent management tasks is to identify biotypes for preservation and to devise successful patterns for managing both the seral and climax ecotypes. If the suggested conceptual change in the management of national parks toward the renewal of primitive states prevails, this will provide the impetus for progressive thinking. It will also stimulate the development of many improved techniques of cover manipulation and animal-population management. Again I see induced temporary sterility as a more desirable management technique than today's unfortunate necessity of killing surplus individuals.

Winter range for the large wild ungulates will become an ever-increasing problem. I see no alternative but reduced populations of some of them, especially wapiti, and along with this, public control over ranges selected and designated to preserve several herds of each of the ungulates. They will probably come to be regarded as state treasures, and states will vie for the privilege of responsibility for such a management unit. Special care will have to be taken to preserve the wild quality of both the herds and the habitat.

Public grazing of sheep and livestock on mountainous pastures will be greatly curtailed so that the wildlife can take more of their annual energy budget from the summer range and demand less from the winter range.

In some areas it may be found that

the mule deer and the moose in their respective habitats are the most effective way of producing edible material from wild-land acres, and these species may be intensively encouraged for that purpose.

Our conservation departments will make much more use of ecologists than they now do, and they will be entirely staffed with men and women educated in the biological and social sciences. The orientation of these departments will no longer be toward a few species of interest to those that hunt. They will be expected to guard and manage the ecology of the wild lands and reserved areas, the suburban conservation regions, and the scientific reserves that will have come into existence as our interest in the variety of wild species and communities of this continent reaches higher levels of sophistication.

As we attempt to look forward and to discern the general outline of problems and the attitudes and understanding that will guide our reactions to them, it would be wrong to ignore one of the deep-seated weaknesses in our basic pattern of social orientation. Many of the most vexing problems of conservation today and in the foreseeable future stem from the disparity between the concept of long-term public benefit as I have dealt with it and the privilege of the individual to convert natural resources for immediate private gain. The relationship between the two values has been evolving rapidly but very unevenly and with frequent violent oscillations. This social conflict remains as one of the most challenging before us and is already emerging as a major frustration to the attainment of our ideals.

Where large resident human populations have developed within public reserved areas and national parks they inevitably view the area as almost solely for their private gain. Because their geographic entity gives them organization and dedication to their purpose, such small groups of individuals have exerted undue influence upon national conservation policy. Searching studies of the social position and political impact of such small towns as Banff and Jasper in the great Canadian Rocky Mountain park system would provide important guidelines for our future reaction to private vested interest within national parks or similar areas. It is not the objective of this discourse to explore the impact of our social organization and principles upon the management of our living wild resources. However, the policy within which our successes and failures will emerge evolves from the interplay of groups with different ideals and objectives. It is acknowledged, therefore, that those who in special knowledge, unique capacity, or accepted responsibility guide the evolution of policy will continue as most important contributors to our success.

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