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ECOLOGICAL ANALYSES AND DECISION-MAKING PROCEDURES

How are ecological concepts applied to management decisions? In the past, decisions were made concerning field-management practices and population changes were then noted. This is useful, but present-day technology permits the addition of intermediate steps that utilize more information and permit the testing of effects of different management decisions by simulation.

20-1 THE SIMULATION OF MANAGEMENT PRACTICES

Biologists and resource managers have spent many hours measuring characteristics of populations before and after a hunting season. They measure the characteristics of animals that are brought to check stations and debate the relative merits of different kinds of seasons. Once a season is set, the biologist or resource manager usually has to wait until it is over to see what effect it has had on a population and whether or not the hunt accomplished the purposes for which it was designed. Often there are circumstances that upset the plans, such as a snow storm or other natural event that affects the success of the hunters.

The simulation of different management practices prior to their implementation in the field provides the resource manager with an opportunity to see the effects of his decisions and of natural events before they occur. This use of simulations or models for testing the effects of different hunting seasons adds an exciting dimension to this phase of resource management. Hunting success can be superimposed on the basic biological foundations within a population model. The effect of variation in the success of hunters can be simulated. This technique permits

the resource manager to demonstrate the possible effects of different hunting regulations in different biological situations. At that time, the establishment of regulations becomes more analytical and less emotional.

The need for *realistic* biological models cannot be emphasized too strongly. Models used in population dynamics and resource management must be built on a sound theoretical base rather than on an assemblage of facts, figures, and fiction. Computers programed realistically can aid rational analyses, but unrealistic programs will only compound experimental errors and faulty conclusions.

BIOLOGICAL CONSIDERATIONS. A realistic model can be built only if functional biological relationships are considered. In such a model, it becomes readily apparent that some variables can be controlled by the resource manager whereas others are completely beyond his control. Food quality, for example, may be increased by various management practices such as fertilization or burning. As food quality is analyzed in relation to animal requirements, it may be found that a more important variable is the time of spring dispersal. This depends on snow conditions and weather in late winter and early spring, quite beyond the control of the resource manager.

It is the responsibility of the manager to understand the effects of these natural forces on a population or on the ecosystem. He must also explain these relationships to the public. This can do much toward changing the public's attitudes toward the management of natural resources, although the changing of attitudes through educational processes is always a gradual one. It is vital that the professional resource manager has a firm understanding of the biological system, so that both his management suggestions and his explanations of the effects of variables deserve the public's confidence.

SOCIAL AND ECONOMIC CONSIDERATIONS. The wildlife biologist is interested academically and professionally in the same things that interest many other persons for recreation. Just as every baseball fan in the stand is in a position to second-guess the team's manager, the various publics that are interested in natural resources are in a position to second-guess the resource manager. The manager and publics are both in a position to be heard through the simple expediency of writing to political representatives, assuming positions of leadership in local organizations, giving money to causes of their own choosing, and other similar activities. *However, no amount of democratic action, no amount of money, no amount of sympathy for one cause or another can be productive if the basic characteristics of a biological system are ignored.* The resource manager appears to be in a difficult spot when he must reconcile differences of opinion between himself and the various publics, but he also has the opportunity to establish himself on the firmest base of all—the biological one.

The public has a keen interest in wild animals, including both hunters and those that simply enjoy watching the animals in the field. Sometimes it does not matter much to those watching deer whether they see a small, underweight deer or one in its prime. As more small deer than large deer can be supported on

a given quantity of resources, a program aimed at a higher population of small deer may be more desirable from a human sociological point of view.

The relationships between deer and their environment are such that small deer are at some distinct biological disadvantages, however. The impact of severe weather, low food quality, and other environmental forces on high populations of small deer is greater than on lower populations of larger deer. Populations of small deer have a greater potential for variation. An understanding of these fundamental biological relationships is necessary for the decision-making process since social considerations should not be made beyond the biological limits present in a particular habitat.

Many social functions are dependent on the elastic unit of trade called the dollar. The amount of hunting that is done, the proceeds from hunting, the amount of research that is conducted, the quality of the research done, the number of publications that are made available, the quantity of information and educational programs, and many other important interactions between humans and their environment all depend to a large extent on the amount of money that is available.

Money is an elastic kind of analog to energy and matter; its elasticity with time is its greatest liability since it is difficult to predict just what its value will be at some future date. Resource economists build models based on the dollar, and these models are more complex than the models of an ecosystem simply because, ideally at least, the economist's model must contain not only the biological components of the ecosystem—the resources themselves—but their representative, the dollar, as well.

The important thing for the resource manager to realize is that dollars cannot successfully buy a violation of basic natural laws. For example, the rumen capacity of a deer is genetically determined. Low-quality forage, limited by the fertility of the soil, might cause the physical capacity of the rumen to be exceeded before the nutrient requirements of the animal can be met. Under these conditions it may be virtually impossible to improve a population regardless of the amount of money spent on management practices.

POLITICAL CONSIDERATIONS. Political considerations in resource management have the greatest potential for rapid changes and may even result in complete reversal of policy. Political considerations interact with social and economic ones, making it difficult to plan resource management on a long-term basis. *In the final analysis, the only hope for long-term resource planning depends on the quality of the biological foundation that has been established. This quality must be high enough so that political considerations are not in a position to affect the important functional characteristics of the biological system.* Thus the resource manager must direct his responsibility toward the biological system first. It is essential that every effort be made to establish realistic analyses of the biological system.

20-2 CONCLUSION

Technological capabilities available today make it possible for the resource manager to assume an analytical role in the management of natural resources. Through the use of models, the effects of a variety of management decisions can be analyzed

before the decisions are made. These models are of value only if they are biologically realistic, so the resource manager must understand biological relationships as well as be able to synthesize them.

These demands extend a person's abilities to the limit. In fact, an individual cannot comprehend the entire ecosystem in all of its detail. Teams of scientists are necessary for the formation of meaningful and detailed representations of the ecosystem. Resource managers can then use these models as a base for decision-making. The manager should have a working relationship with the analysts so that the results from the use of models can be discussed in preparation for further refinements and improvements.

If strong efforts are not made to develop such biological models, the management of natural resources will be even more subject to social, economic, and political considerations without an understanding of the basic biological functions. Although this approach may be partially successful for short periods of time, the long range use of natural resources in a wise manner can be accomplished only with an understanding of the basic mechanisms involved.

The analyses in this book of the relationships between animals (primarily wild ruminants) and their environments are examples of the kind of analyses that can be made for any organism. Life, in an ecological sense, can be analyzed successfully within the framework of energy expenditure and the redistribution of matter. Both are limited and all life is subject to natural laws describing energy and matter relationships. The focal point for these analyses is the individual organism that is subject to the problems of daily existence; its success in meeting those problems determines whether it remains a productive member of its own population and of the ecosystem as a whole or whether the nutrients in its own body are recycled through the ecosystem.

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