Science and Education and the Science of Range Management

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I am pleased to accept the invitation extended to me by Pete Jackson to reflect on science and education aspects of range management. The invitation came following an informative, enthusiastic presentation on rangeland research, education, and extension made by Ed McKinnon, Pete, Dick Whetsell, Alvin Young, and Fee Busby to the Joint Council on Food and Agricultural Sciences. Their presentation was followed by remarks from Andrew M. Fischbach, a Joint Council member, based on his lifetime experience of operating his ranch in the rangelands of South Dakota. All of these discussions were especially personal to me because they brought back memories of my earlier years in South Dakota when my work was more directly connected with rangeland and livestock producers.

Our vast rangeland resource is frequently underrated in its importance to the national and world economy even though rangelands make up some 40 percent of the total U.S. land area. Valuable rangeland resources such as grazing, aesthetic beauty, wildlife, and recreation go largely ignored by urbanites except on rare occasions when they choose to experience them. Even water, the most easily transported resource, may not be attributed to its source of origin in the rangeland watersheds.

The profession of range management grew from the concern over abusive grazing of the open ranges during the latter half of the 19th century. The first goal was to establish proper grazing practices that would sustain both the ranges and the grazing industry. The use of the rangelands has changed immensely since the turn of the century, as have the relative resource values and the goals of the people demanding those resources. Yet, many of the resource problems of concern then are still with us today.

Soil erosion remains a concern. Fragile rangeland soils that contributed to the dust bowl of the 1930's have not been forever stabilized. We must resolve to maintain a permanent, vigorous plant cover for their protection. Ranges whose vegetation has been degraded or destroyed by improper grazing, human activity, or natural events are vulnerable to water and wind erosion. The invasion of weeds is a constant threat to our rangelands. Sometimes the rate of weed encroachment is alarming. Sometimes it is an insidious encroachment, resulting from improper management, imperceptible changes in the environment, or some previous, maybe even more obscure, event. Exotic plant introductions tend to dominate the former category. We once talked about weed eradication but have come to realize that control is sometimes impossible. Therefore, we now think more in terms of management. This change in our perception of the problem has not diminished the detrimental impact that undesirable plants have on the rangeland.

Water, both quantity and quality, is of national concern. Good range management leads to increased infiltration, improved onsite water use, improved water quality, and reduced soil erosion. Silt remains the greatest polluter of water. Rangelands occupy a central position in the hydrologic cycle of this continent. Geographically they provide huge watersheds, strategically located to supply water for industrial and domestic use by a rapidly growing, urban population in arid regions of the West and Southwest, where water is, undoubtedly, the most valuable rangeland resource.

Of course the rangeland vegetation itself, as forage for livestock and food and habitat for wildlife, is an essential commodity for American agriculture, for the economic well-being of dependent communities, and for the very existence of many wildlife species. That resource can only increase in importance as expanding human populations place greater pressure and demands on our limited land and resource base.

Range science and education has made immense progress over the past 40 years in addressing these problems. You have a right to be proud of your accomplishments. In the course of daily tasks, it is easy to overlook the progress that has been made, and to fail to recognize how far you have come. Furthermore, you are continuing to make incremental progress in the resolution of these and other problems. I remind you of the past as a point of departure to share with you my observations on recent trends, and my views for the role of agricultural science and education in these trends.

The first trend is toward a more holistic view of agriculture. This is not news to you! Range science pioneered this trend in its early ecosystem approach, and later through the mathematical modeling of ecosystems. Integrated pest management and, more recently, integrated reproduction management are extensions of the same concept—a concept acknowledging that any action taken to solve a problem is selected from an array of possible actions. Frequently an action is selected without a rational basis for selecting among the choices, and without recognizing that many actions have unforeseen, and sometimes undesirable, consequences far beyond their intent. The number of variables and their possible interactions are astronomical. Even in a small, simple system it boggles the mind.

Progress in the holistic or systems approach is a relatively recent development made possible in part by the rapid advances in computer technology. Interestingly enough, a holistic approach often breaks down subject-matter barriers because it is essential to have knowledge across many dif-

ferent subject matters to develop models that will predict the outcome of an action or select the most effective or economical action. It also removes activity barriers. The roles of research and extension blend together.

The second trend now underway is the emphasis on biology at the gene and molecular level. A broad, major international effort is underway to understand biological organisms at this level. The tools being developed allow scientists to learn more about the functioning of organisms than has previously been possible. These tools also have the potential to help agriculturalists develop improved plants, animals, and biological control techniques which all lead to improved biological efficiency. This trend also breaks down subject-matter barriers because, at the molecular level, the biological language is the same for all organisms.

A third trend relates to the ever-increasing demand for information and more rapid communication. Needs fall generally into two categories. The first is the transfer of technology and essential scientific information among resource managers, agribusiness, and researchers. The second is effective communication among agriculture and natural resources professionals, policy makers, and the general public to provide the information necessary for rational policy decisions for building and maintaining governmental and economic systems that support sound resource programs. Computer technology provides the system for accessing, analyzing, and distributing information to meet the demand. The Cooperative Extension Service has a vital role in making these systems and the information they contain available to those who need them, when they need them.

I have identified three seemingly disparate trends. The first strives to include all parameters and their interactions. The second strives to understand organisms at the level of one of the smallest entities—the molecule. The third strives for effective information management and communications. The only way that science and education can cope with disparity of this magnitude is by focusing on fundamental principles. We must train our students, scientists and managers in the basic scientific principles that will enable them to move with ease and comfort from genes to ecosystems, from computers to conference tables, and from the laboratory to the land. These are the forces that cause scientists to coalesce around the subject of advancing scientific knowledge, and extension workers to mobilize to incorporate this knowledge into farming and ranching systems.

To accomplish this, we must provide the incentive and the opportunity for those interested in rangeland to participate in resource management and the advancement of plant and animal sciences. The U.S. Department of Agriculture is accomplishing this goal through its base programs of range research in the Agricultural Research Service, Cooperative State Research Service and the Forest Service, and its base programs of information and education in the Extension Service. These programs allow the flexibility necessary to meet regional and local needs, continuation of long-term projects, development of basic knowledge, and the ability for extension to communicate research problems from the field to the scientific community. Ranchers and range managers can contribute by making their concerns known through the extension system.

The competitive research grants program supports basic biological research in plant and animal sciences. Some range scientists are already participating in this program. We encourage all of them to join with other scientists and become full participants in the competitive research grants program. Range biologists can join the greater community of science and contribute to the advancement of scientific knowledge while developing new plant, animal, and microbial technologies applicable to rangeland. Everyone will benefit by focusing the competition and resources on scientific advancement. ●