Rangeland Research: An Assessment of Future Needs and Proposed Research Priorities

Background

The Research Affairs Committee, SRM, met in Denver, Colorado on December 17 and 18, 1984. The Committee considered and discussed at length the long-range goals for range research, the immediate economic plight of agricultural enterprises dependent upon rangelands, environmental concerns arising from real and perceived perturbations to rangelands, declining Federal funds, the immense wealth of rangeland resources, and attempted to project future demands for those resources.

Following a consensus on long-term goals, the committee "brainstormed" and listed appropriate short-term research activities (5 to 10 years) activities under each goal. Duplications were eliminated, similar activities grouped and the remaining activities were placed in hierarchical order by use of a technique for comparing and evaluating activities for which cost and benefit analysis are unavailable. The report identifies some of the short and long range concerns of the committee and lists the research activities developed by the Research Affairs Committee.

A major thesis developed by this committee—and the basis of this report—is that projections of long-term demand for specific range resources are tenuous at best. But increased demand for many of these resources, such as water, is as certain as any projection can be. Therefore, the range research goal should be to understand the biological and physical mechanisms of range ecosystems well enough to predict with reasonable confidence the result of alternative resource uses. Understanding and protecting the fundamental soil and germplasm resources will provide future generations the maximum number of options into perpetuity.

Research Affairs Committee	Other Participants
Ardell Bjugstad	Robert Barnes
Jeanne Edwards	Fee Busby
Chuck Jarecki	Gary Evans
Bill Laycock	Pete Jackson
Pat Reardon	Dave Kathman
Wilson Scaling	Charles Rumburg

Dick Whetsell, Board Representative
Robert Williamson, Chairman
Gale Wolters
Ben Zamora

Preface

This is a report on range research, but it is actually a report about change. Change is frequently perceived as a contemporary phenomenon. Perhaps the rate has been accelerated in modern times—but it is sobering to remember that it was the Athenian Heraclitus who, over 2,500 years ago, wrote "nothing endures but change. . . You could not step twice into the same river: for other waters are ever flowing over you."

Range ecologists recognize the dynamics of biological communities, and project both the direction and the rate of their change based upon ecological principles. Geologists and astronomers now recognize predictable patterns of perturbation to natural communities vary from events causing long-term extinction of species to sudden, catastrophic events like the one that caused the disappearance of the dinosaurs.

The Research Affairs Committee, of the Society for Range Management, made some short- and long-term projections of changes potentially impacting rangelands and established priorities for a program of rangeland research. The committee understands that this is the first approximation. It is the initiation of the process that is important. The dialogue is engaged, it needs to continue, and priorities need to be updated. Range research and a research agenda is, like an ecosystem, a dynamic process.

The Society believes that rangeland opportunities are more likely to be limited by our imagination than by the marvelous diversity of the rangeland systems with which we work.

Introduction

Rangeland, one of the most extensive kinds of land in the world, comprising 40 percent of the land surface of the earth, contributes immeasurably to the quality of life of its citizens. Many of the uses derived from these extensive rangeland resources are not traded in a market where monetary value can be readily determined. Therefore, these resources are often considered to be of little value to society, yet, they contribute resources as essential to life as water, and as fulfilling to the quality of life as recreation and wildlife.

In North America, the use of rangeland, both private and public, for solely traditional agricultural enterprises is rapidly changing. Demand for recreation, high quality and quantity of water, wildlife, and other environmental resources, is increasing in importance and must be factored into the returns attributable to rangelands.

Future Rangeland Outlook

Short- to Intermediate-Term Outlook

Livestock grazing, wildlife, water quality and quantity, and recreation are likely to remain the most important uses of rangeland. One projection of future demands for red meat and livestock products suggests that increased forage capacity will not be needed.[1] However, forces are at work which will increase the demand for forage without any appreciable change in demand for red meat. For example, a shift to the feeding of less grain will increase demand for range grazing; furthermore, demand for range grazing increases as a result of increased allocation to wildlife and the declining base resulting from the loss of range to other land uses. There is a continuing need for research and technology development to enhance productivity (efficiency of production) and to prevent permanent site deterioration. Range science needs to continue monitoring supply and demand trends and forecast the implications to range.

Technology is available to help ease the immediate economic plight of the livestock industry. Many ranchers are capitalizing on wildlife and recreational resources to supplement livestock income. Additional research in wildlife habitat, fish production, and other recreational opportunities will be needed. The research affairs committee is aware of the generalization that many technological improvements presently available are not being adopted and practiced. The consensus of the Society supports this view, but despite extended discussion, the committee did not identify or endorse particular programs that research might undertake to enhance technology adoption.

We manage and profess to understand a treasure chest of rangeland plant resources. Plant resources are being studied at the organism and community level but, except for a few forage plants, are essentially unknown at the genetic and molecular level. Range science is preparing to assume an active role in the application of biotechnology to rangeland

[1] Demand for Red Meat and Range Grazing. A presentation by John Fedkiw to the SCS National Range Workshop, June 1984. (see page 100, this issue of *Rangelands*).

organisms. With the developing human resource base, range science will no longer remain a spectator in this evolution.

Long-term Outlook

The risks associated with wildly vacillating market demand, interest rates, world economics and environmental concerns is resulting in a reevaluation of the future of agriculture by many individuals and organized groups. One plausible scenario of this perceived agriculture renaissance is greater diversification. Another is that production may be based on crops and livestock that are better adapted to the environment rather than making major environmental modifications to conform to the needs of unadapted crops and animals. Both scenarios are consistent with the philosophy of rangeland research and management.

The mining of fossil fuels and underground water reserves forcast that long-term adjustments will be necessary in both agricultural and material production. The basic food and material needs of mankind can be met in many different ways. The choices are largely determined by custom and economics. What is the role for range research in such an adjustment?

Opportunities abound. Certainly, forage and browse for livestock and game, feed and habitat for wildlife will remain important, but what about agricultural products of industrial importance? Guayule and jojoba are native range plants with excellent industrial potential, and there must be many others. Range science needs to play a larger role in developing rangeland materials of industrial importance. Our behavior to date has been that of a spectator.

Rangelands offer potential for food producing plants such as buffalo gourd, several adapted legumes, and who knows how many others. And what about the development of native range plants for decoration and urban landscaping? This may be an important resource as the cost of irrigating and general maintenance of mesophytic plants in xerphytic environments escalates. Who knows range plants and their management requirements better than range scientists?

Water will be the rangeland resource of greatest potential future value in certain areas. Rapidly developing population centers in the Southwest depend almost totally on rangeland watersheds for surface water and underground aquifer recharge. Policies and laws relating to water use, cost, and benefits are complex, they vary among political subdivisions and they are subject to change. Range science is ready to assist in policy development by having the information to project the implications of changes in water use, watershed manipulations to conserve or harvest water, and the impacts of alternative rangeland uses on water yield, water quality, and soil erosion.

Range science must continue to reevaluate its role in developing all rangeland resources, and is exploring new and alternative ways in which rangeland resources may contribute to present and future societal needs, while conserving the soil and germplasm resources to met unforeseen future needs.

Rangeland Research Goals

I. Characterize and understand the organization, structure, function and development of the range landscape in order to predict with reasonable confidence, the response of these communities to management.

II. Characterize and understand the total value to society of rangeland resources and provide knowledge for the controlled development of those resources.

III. Develop management information which enables owners, managers, and other land users to make informed decisions about alternative management practices and strategies.

Research Priorities

Short-term Highest Priority Activities

(1) Maintain, restore, or increase, through cost effective measures, rangeland ecologic unit output of multiple rangeland resources; e.g., wildlife, livestock, water, recreation, hunting rights, clean air, scenic vistas, minerals, open space. Emphasis should be on plant community manipulation through biological mechanisms, including, but not limited to:

- Allelopathy
- Germplasm improvement
- Stress response
- Leguminous species
- Livestock
- Introduced competition
- Others

(2) Better knowledge of secondary succession:

- Improve the ability to predict stages of secondary succession following community change.
- Define secondary succession to meet contemporary range management needs.
- Develop catastrophic (disturbance) theory for rangeland.
- Broaden the theory of landscape ecology to encompass rangeland.

(3) Characterization of rangeland ecologic units.

(4) Understanding inherent primary production in ecologic units under:

- Secondary succession,
- Succession on altered units,
- Introduced successsion.

(5) Basic knowledge about fundamental processes of individual plants in relation to soil, water, biota, light, temperature, etc., necessary to meet many of the other rangeland research priorities.

(6) Hydrologic characteristics

Other Research Activities

(7) Maintain, restore, increase range site productivity through cost effective measures; e.g., new or improved plants, fire methods, chemical methods, mechanical methods, and water use efficiencies.

(8) Characterization of rangeland ecologic units; inherent site potential for primary production, hydrologic characteristics.

(9) Better knowledge of secondary succession (including undesirable plants).

(10) Determine interactions of plant communities under stress.

(11) Understanding plant community dynamics as affected by livestock manipulation, hoof action, and herding effects.

(12) Population dynamics of individual plants.

(13) Loss of organic matter, accelerated erosion and soil stability.

(14) Livestock behavior.

(15) Ecological effect of fire or lack of fire.

(16) Pest management strategies.

(17) Improve and maintain multiple resource outputs from rangeland by developing alternative management strategies through risk management and optimization techniques.

(18) Multiple product values derived from rangeland management; e.g., wildlife, water, recreation, hunting rights, clean air, scenic vistas, minerals and energy, open space (solitude), livestock, fuelwood, wood products.

(19) Role of natural biological components on plant community.

(20) Impact of range pests on plant community dynamics.

(21) Long-term effects on range ecologic units from changing land use.

(22) Early identification of trend in ecological status of range.

(23) Energy flow and nutrient cycling.

(24) Develop methodologies for evaluating rangeland products.

(25) Herd-health and nutrition related to proper rangeland management.

(26) Define changing social demands affecting rangeland use allocation.

(27) Ownership structure of rangeland industry. •

The Effects of Horn Flies on Cattle

R.H. Robertson

Horn flies causes visible stress to cattle. Untreated animals spend less time grazing and drinking and significantly more time resting, walking about and twitching their tails than treated ones. High fly populations can elicit almost constant quivering of skin, a sign of discomfort. Further evidence of stress is the secretion of a stress hormone in the urine.

Horn flies overwinter as pupae in dung and emerge in the spring. The population increases to a peak in mid-August and then decreases as more and more of the pupae go into diapause with the onset of shorter days.

Adult horn flies only leave the cattle to lay their eggs in fresh dung where the larvae develop. The adults feed only on blood which they obtain in localized areas along the midventral line, usually between the brisket and navel. The "armpits," teats, and scrotum may be attacked. The flies feed 24-38 times a day, repeatedly inserting and withdrawing their mouthparts. The lesions thus formed are usually round or oval and may be quite large on older cattle. During the fly season, the lesions may be covered with flakes of dry skin, crusted over with dried serum or oozing blood. Th lesions are sometimes misdiagnosed as ringworm or sarcoptic mange.

After the flies are killed by autumn frosts, the lesions heal and appear as raised smooth, dry, thickened areas. In the spring, when horn flies reappear, individual red spots where the flies have fed can readily be observed on the greyish lesions.

These lesions may contain filarial worms, a fly parasite. The female worms deposit microfilaria in the lesion and the adult horn flies ingest them while feeding. The microfilaria grow through three stages in the abdomen of the fly; the third stage migrates to the head and is deposited into the lesions when the fly feeds. The filarial worm goes through two more stages in the lesion. Females reach a length of 6 mm and the males 3 mm. Filarial worms stimulate production of antibodies that cause allergic reactions in cattle.

At the Lethbridge Research Station, we are determining how cattle react serologically and immunologically to the flies and filaria in order to eliminate some of the stress and pathological effects that decrease productivity.

Also, we are investigating new methods of biological control, as an alternative to chemicals, because horn flies have already developed resistance to insecticides in the United States and may do so in Canada.—*Weekly Newsletter*, Research Station, Lethbridge, Alta.