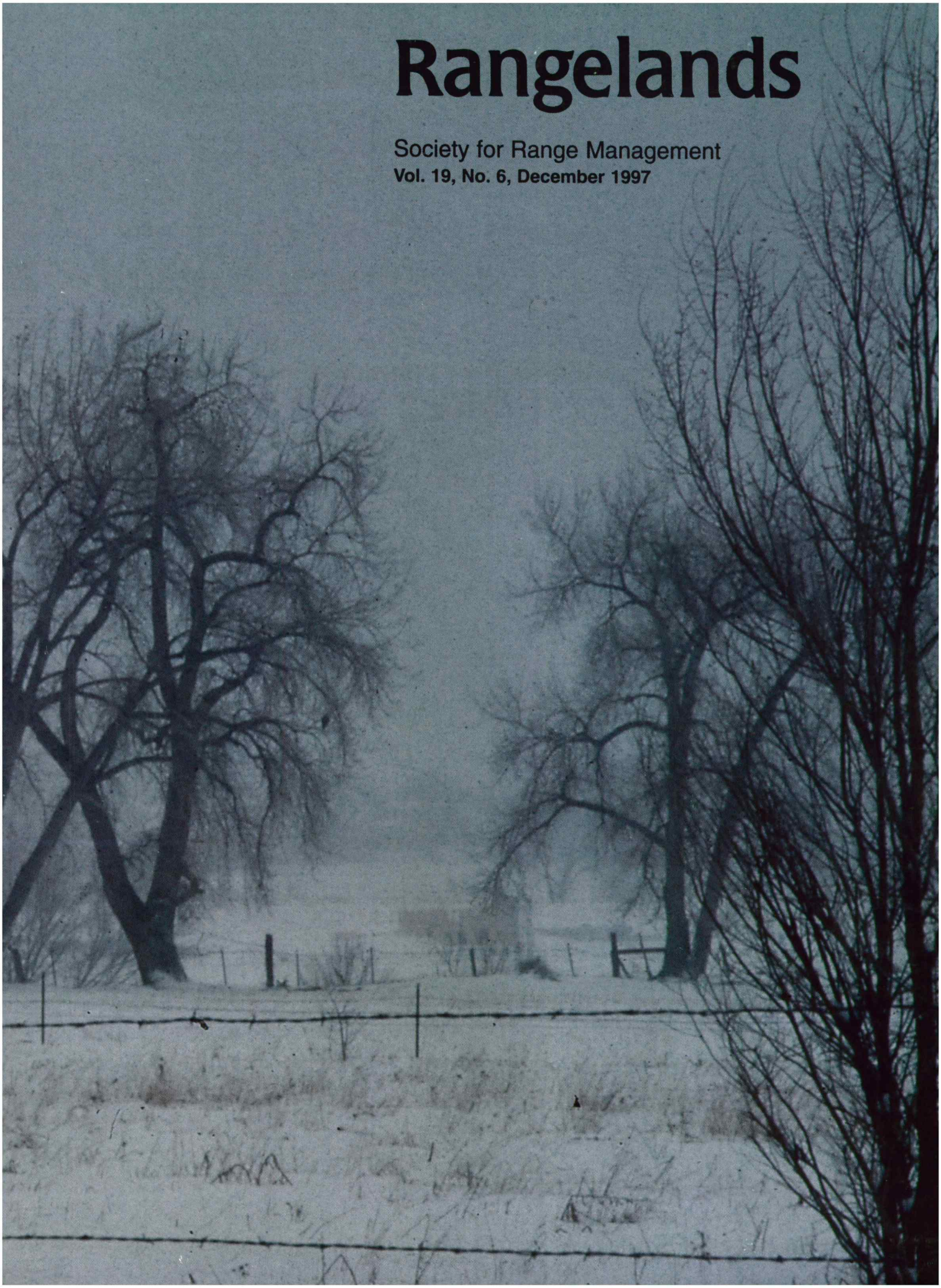

Rangelands

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Barn in eastern Colorado. Photo taken by Mike Bonar, Aurora, Colorado.

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THE TRAIL BOSS

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The objectives for which the corporation is established are:

—to properly take care of the basic rangeland resources of soil, plants and water;

—to develop an understanding of range ecosystems and of the principles applicable to the management of range resources;

—to assist all who work with range resources to keep abreast of new findings and techniques in the science and art of range management;

—to improve the effectiveness of range management or obtain from range resources the products and values necessary for man's welfare;

—to create a public appreciation of the economic and social benefits to be obtained from the range environment;

—to promote professional development of its members.

Membership in the Society for Range Management is open to anyone engaged in or interested in any aspect of the study, management, or use of rangelands. Please contact the Executive Vice-President for details.

Rangelands serves as a forum for the presentation and discussion of facts, ideas, and philosophies pertaining to the study, management, and use of rangelands and their several resources. Accordingly, all material published herein is signed and reflects the individual views of the authors and is not necessarily an official position of the Society. Manuscripts from any source—nonmembers as well as members—are welcome and will be given every consideration by the editors. ***Rangelands*** is the nontechnical counterpart of the ***Journal of Range Management;*** therefore, manuscripts and news items submitted for publication in ***Rangelands*** should be in nontechnical nature and germane to the broad field of range management. Editorial comment by an individual is also welcome and, subject to acceptance by the editor, will be published as a "Viewpoint."

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Executive Vice-President's Report

The Membership Dilemma

We are currently in the midst of our most active membership renewal period of the year. Since membership has become such an important issue for our continued success, I would like to take the opportunity to offer a few of my initial observations on the subject.

For the period ending this past September 30, our membership was down an average of 10 percent compared to the same period a year ago. This is a continuation of the trend that has been going on for several years. The reasons for this decline are many and complex. It's really not possible to point to one major cause, nor is it possible to dismiss any of the many concerns which have been discussed in recent years as not being part of the problem. Obviously, we haven't been sitting idle and doing nothing during these years of decline. Our leadership and membership committees at both the international and section levels have worked diligently at the recruitment and retention issue. We are currently in the midst of a two-phase program. The recruitment phase just ended September 30, and the retention phase began October 1. The results of the recruitment effort will be announced at the Guadalajara meeting. Obviously, recruitment will go on even though this event, sponsored by the Membership Committee has concluded.

We need to pursue solutions to the concerns which cause people to discontinue their membership and participation in SRM. At the same time, I feel we need to place much of our emphasis on a good answer to a simple question. Why would someone join the Society for Range Management? Before I take a shot at the question, let me review a few of the reasons why some don't join.

One reason is that there is a lot of competition from other similar though more specialized societies and organizations. This is a fact of life, and our response to this challenge should be to make SRM a rewarding experience within our parameters and not try to be something we are not. Cost of membership is another reason given for not retaining or recruiting members. I'm sure it is true that some don't feel comfortable with our dues structure. However, after taking a quick look at similar natural resource and other related organizations, we rate as comparable or even a bargain. It would cost me twice as much to be a member of the Colorado Society of Association Executives for instance. The big one that I hear most often is that SRM is "not meeting my needs." I can't suppose to know what everyones needs are since we are a very diverse profession. I do feel personally that "nobody does it better" when you consider the constant flow of valuable information and knowledge. Just in the last 2 months I have gained new knowledge in such areas as coastal marsh ecology and management in Louisiana, eco-tourism in Florida, wilderness management, noxious weeds, wildlife habitat management, and rangeland monitoring in Colorado.

To more directly try and answer the above question, I would begin by saying that we must be more than a magazine and a chance to go to a meeting. We need to make potential members understand that we offer an outstanding value for those concerned and interested in any natural resource associated with rangelands. I have heard Pete Jackson say many times that he has never attended an SRM meeting that he didn't learn valuable information. (Actually I think he said he picked up information which made him money). Anyway, Pete is not alone in his message of what SRM can offer. A couple of years ago a new member made the comment to me on two different occasions that we have a tremendous product to offer and we seem to constantly sell ourselves short. This happened to be a rancher member, and just recently I had exactly the same experience from another relatively new member who made the same observation. Those of us who have been around awhile should take stock.

I have felt for several years that SRM Sections should place a priority on meeting the need for the professional enhancement of our members. This isn't new, it's what we already do, but during this period of declining membership, and questions about meeting needs, it is a good idea to give the subject careful thought. Here are my thoughts are so far.

Sections provide the key to providing meaningful value to members. They do that through the opportunity for information by such means as meetings, seminars, field trips, newsletters, and in some cases, websites. Next, since this is already happening in various degrees, we need to consider what I call a "value added" concept. How can we do these things even better so members and potential members will have no doubt that SRM is or will meet their needs? Some ideas I have, which I'm already seeing many Sections doing, are as follows.

Newsletters are a Sections first line of communication. We need to continue to add value to the content and efficient delivery. The effect is minimized if communication is out of date by the time its received. The second simple step is to make one additional educational opportunity available each year. Sections usually have a fall meeting and maybe a summer or spring tour. Going to the effort to make an extra seminar available is adding value. Other ideas I have seen lately include making educational credit available for our seminars and workshops, presenting certificates at the completion of workshops, and cosponsoring workshops with other organizations. I will continue to think on this issue. I hope you will too.

Finally, an area of decline in our membership which is especially bothersome to me is the category of public land

(Continued on page 33).

Teaching Old Dogs New Tricks-An Educational Training Project for County Extension Agents in Texas

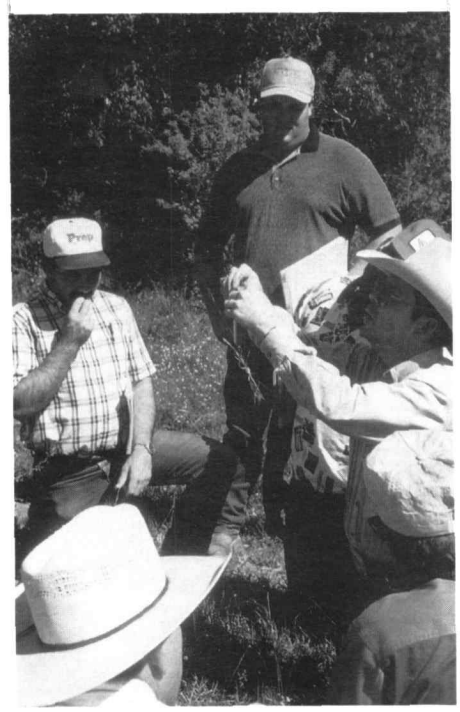
Richard R. Riddle and J.F. Cadenhead, III

County Extension Agents-Agriculture (CEAs) are generally well qualified for their jobs, and usually have strong, well-rounded agriculture backgrounds; however, most receive their college degrees in the Animal Science and Agricultural Education disciplines. Therefore, many have little or no formal training in rangeland management and may be unprepared to effectively help producers with land management problems. The **Environmentally and Economically Sustainable Use of Rangelands** project was developed by the Texas Agricultural Extension Service (TAEX) to provide training and education for extension agents in rangeland management. The objectives were: 1) provide CEAs with a course that introduced the skills necessary to be able to understand and develop ecologically sound and economically sustainable range management practices affecting livestock and wildlife enterprises on the ranch and 2) then evaluate the courses for further refinement.

The Workshops

A series of three, 3-day training workshops were held in July and October, 1995 and in March, 1996. These workshops were attended by 19 county extension agents from five extension districts across the state of Texas. Instructors for the workshops included personnel from the Texas Agricultural Extension Service (TAEX), the Texas Agricultural Experiment Station (TAES), the Natural Resources Conservation Service (NRCS), Holistic Resource Management (HRM) of Texas, and an adult education specialist from Colorado.

The July and October sessions were held at the Krooked River Ranch near Haskell, Texas. This is a large North Texas working guest ranch and was was chosen because of its central location and conference facilities. The Waggoner Ranch near Vernon, Texas was the site of the third session and was selected because of its cooperative work with the Texas Agricultural Experiment Station in Vernon on prescribed burning and rotational grazing systems.



Range management specialist clipping and weighing forage to determine range condition. Krooked River Ranch, October 1996.

The **first** of the three workshops was held in July 1995. The material presented during this three day workshop was based on concepts similar to the Holistic Resource Management and Total Ranch Management programs. These concepts included goal setting, communication and team work, facilitation skills, and biological and economic resource allocation. Our specific goals were to emphasize and introduce to the CEAs the importance of 1) setting goals and objectives for ranch management planning and 2) inventorying economic and biological resources as a means of accessing and monitoring ranch and range conditions.

The **second** workshop was held in October, 1995. The participants were taught some of the basic techniques and applications of range and wildlife management. These methods included: range site delineation, determining range condition, trend, and use, estimating forage supply and demand, calculating stocking rates, identification of plants and recognizing their forage value for both livestock and wildlife, wildlife habitat assessment and population surveys. The concepts for these techniques were first introduced in a classroom type setting and then reinforced by field experiences relating to how these techniques were applied on two separate ranches.

The **third** workshop was held in March, 1996. The purpose of this workshop was to emphasize the integration of a prescribed burning program into a grazing management system as a means for more economical brush management. The agents were

Discussion on the importance of grass identification. Krooked RIver Ranch, October 1997.

Prescribed burning on Waggoner Ranch near Vernon, Texas. March 1996.

exposed to the different types of grazing systems and how burning was implemented in each system. The agents were also taught basic fire ecology, safety considerations for prescribed burning, and how to develop a fire plan. The agents concluded the workshop by constructing a fire plan for a pasture and implementing an actual burn.

Participant Feedback

The success of the program was measured through the use of workshop evaluations. At the end of each workshop, participants were asked to evaluate and critique the programs and instructors. In addition, an adult education specialist served as an instructor and critic of our program. This specialist taught several sections dealing with adult education techniques and the development of action-oriented lesson plans. It was demonstrated to participants how they might utilize the information gained from the workshops to better serve the producers within their own counties. This instructor also helped design our evaluation format.

Evaluations determined that participants responded much more favorably to a "hands on" learning approach as opposed to classroom-style lecture sessions. As a result, our first workshop was the least favorite of the three. Although the agents recognized the value of the material being presented, it was an unpopular workshop due to presentation methods. Suggestions and criticisms from the evaluations were incorporated into the second and third workshop and included more field exercises, ranch visits, and realistic ranching problems. The improved learning environment created for the last two workshops produced a very positive response from all participants and instructors. A large percentage of participants indicated that they had definitely acquired an understanding of new range management technology and, **more importantly**, that they now planned to share certain knowledge gained with producers upon returning to their respective counties.

A three-ring binder was provided to participants for compilation of all teaching materials. As a direct result of training materials utilized during these three workshops, a manual containing various handouts along with other Extension publications has been compiled. This manual, the *Texas Range Management Handbook*, has been used in 1995 and 1996 for a state-wide agent training effort for County Extension Agents with less than 5 years of service. The handbook is now available to all clientele on a cost basis. Another three-day agent training workshop for three more Extension districts is planned for the fall of 1997, and all of these participants will receive and use a copy of this handbook. Current plans call for transferring the entire handbook onto a CD that could be more easily accessed with selected portions printed as needed.

The participants of this project were able to gain a better understanding of how to assist ranchers with developing ecologically sound and economically sustainable range management practices affecting their livestock and wildlife enterprises. The evaluations of each training session served as our own best critic. Suggestions by participants allowed for modifications that greatly improved the quality of the program and assured its continuance as a beneficial training program for CEAs. This project also appears to have been successful in helping other Extension districts establish similar training programs for their agents. The *Texas Range Management Handbook* will continue to serve as a training manual and is now available for fee based distribution. The long term benefits of our program will be that more Extension personnel are better qualified to assist Texas landowners with decisions involving range management practices.

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The Natural Heating and Cooling of Water

Larry Larson and Patricia A. Larson

In accordance with an Environmental Protection Agency (EPA) mandate established by the Clean Water Act (1972), many states of the Pacific Northwest are establishing water temperature standards and regulations to protect their most sensitive beneficial uses of water.

In application, a number of state regulations are being established that apply equally from head waters to state borders, regardless of stream or river location. This approach has raised questions about the appropriateness of the standards and whether they take into account 'natural' temperature fluctuations.

If the intent of a regulation is to maintain water temperatures within the range of natural temperature fluctuations and prevent heating by anthropogenic sources, then the natural pattern of heating and cooling must be established. The purpose of this paper is to provide a perspective regarding factors that must be taken into consideration to determine 'natural' temperature fluctuations for water bodies.

Climate as a Driver of the Thermal Environment

The first step in this process is to recognize the influence of global climate on the thermal environment of a stream. From a global perspective the Earth's atmosphere gains energy from the ocean and land masses. Differential heating of these surfaces by the Sun creates pressure systems, climatic patterns, and ocean currents that circulate over the globe redistributing energy and water. As a result, the rise of average surface-air temperatures typically lag 4 to 8 weeks behind the period of maximum solar radiation (summer solstice), shifting the period of maximum summer heating from June into July and August (Trewartha 1968).

On a watershed scale, both air and soil serve as large thermal reservoirs that are directly influenced by these global patterns of heating and cooling. These reservoirs are large in comparison to flowing streams. In many respects their relationship resembles a narrow layer of water flowing between two hot water bottles. In this situation one would anticipate that the temperature of the layer of water would be dependent upon, not independent of the temperature of these thermal reservoirs, and would provide a direct influence on the upper and lower temperature limit that water can achieve.

Energy Exchange and Natural Systems

Energy exchange is described by The First and Second Law of Thermodynamics (Halliday and Resnick 1988). These laws state that we can transform but not create nor destroy energy and that energy exchange occurs from areas of high temperature toward areas of lower temperature.

Table 1 provides an illustration of the temperature patterns that can be observed in Northeastern Oregon in the summer between a stream and its associated soil and air mass. During summer, air typically warms during the day to temperatures that are greater than the temperature (62°F) maintained beneath the soil surface (1 ft. depth). The water and soil, having a lower temperature receives energy from the air and sun as a day progresses. The daily temperature pattern of the water in a stream then is determined by its initial temperature at sunrise, the volume of water (depth), surface area, and how long it is exposed to the sun, air and soil.

Table 1. Temperature pattern of the air, water, and soil (1 ft. depth) in a riparian environment in NE Oregon at 3,000 ft. elevation in August.

Time	Air °F	Water °F	Soil °F
7 AM	57	57	60
8	55	57	60
9	58	58	60
10	61	59	60
11	64	60	60
11:30	63	61	60
NOON	63	61	60
1	67	62	60
2	68	63	60
3	70	65	60
3:30	72	67	61
4	72	67	61
5	73	67	61
6	74	67	61
7 PM	68	66	61
7:30	64	66	61
8	61	65	61
9	56	64	62
10	54	63	62
11	50	62	62
12	48	62	62

Air temperature can be used as an indicator of the thermal environment surrounding the layer of water. If the difference between the air temperature and the water temperature is large we can expect the rate of water heating to be more rapid than when the difference is small. Table 1 illustrates the daily pattern of warming that occurs in the thermal environment that surrounds a stream and the lag time that exists between daily peak solar radiation and maximum air, water, and soil temperature. Throughout the day, water temperature increases at a rate that is influenced by

the temperature of the air mass. This phenomenon occurs on all streams at all elevations. The size of the difference between air temperature and water temperature (the gradient) influences how fast water will heat and cool.

Should Streams Heat as You Move to Lower Elevations?

The daily temperature range of a stream is influenced by the environment through which it flows. Streams originating at high elevations in mountainous regions, flow through a warming environment as the water flows to lower elevations. For most people this warming trend is observed in changes in air temperature. The rate of air temperature change typically ranges between 3.2°F and 5.5°F per 1,000 feet of elevation (Satterlund and Adams 1992) and is described as the adiabatic rate of heating and cooling. Similarly a pattern of temperature change can be observed in the soil (1 ft. depth) as you travel from high to low elevations.

Figure 1 shows daily low water temperatures at two elevations on the same stream. These water temperatures were recorded each day at 6 am during August. Water temperatures taken at 6 am have stabilized with the thermal environment of the watershed overnight and approach ambient conditions. In this example the differences between the water temperatures observed at the two elevations on a daily basis, fall within the anticipated differences of the adiabatic rate. The differences between the recorded low temperatures, are between 3.2°F and 5.5°F per 1,000 feet of elevation difference.

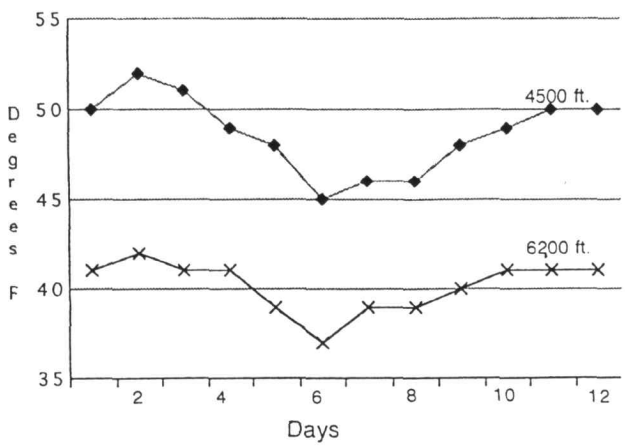

Fig. 1 *Daily low water temperatures measured at two elevations for 12 consecutive days in August at 6 am.*

Combining Elevation and Flow

Figure 2 shows water temperature data taken on the same stream as it drops approximately 1,700 feet in elevation and travels 4.1 miles. If a tennis ball was maintained in the current of the stream at 6,200 feet it would take 4 hours for it to reach the 4,500 ft. elevation with a stream flow of 1.5 ft/sec. In this example air temperature increased at a rate that falls within the anticipated adiabatic rate of 6.4°F to 11°F during the 4 hour time period.

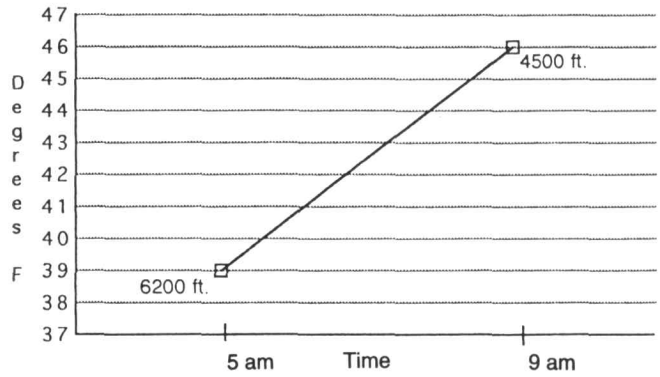

Fig. 2. *Water temperature increase over a 1,700 ft. elevation drop and a 4 hr. flow period. Temperatures were recorded at 5 and 9 am with air temperature differences of 47°F and 58°F respectively.*

If we were to continue to observe the pattern of air temperatures, we would find that the top and bottom locations increase 10°F and 20°F between 9 and 10 am respectively. Water during that same period increased only 1 degree at each location. This is a daily phenomena that occurs on clear summer days. At 10 am the sun reaches an altitude in the sky when maximum solar heating begins to take place.

Generally air heats slowly between 5 am and 10 am while the water remains fairly constant. By 10 am when air temperature increases 10°F to 20°F due to the increased solar angle, a steep gradient is established between the air and water temperatures. During the next 5 hours the water temperature increases 2–3 degrees each hour depending on the increase in the thermal environment as indicated by air temperature during the same time period.

Water temperature data collected at a single site can only describe a volume of water at a specific time as it flows over the thermometer's location. To understand how much that volume of water heats during a day, at least 2 sites must be monitored. The natural heating and cooling of water within a watershed can then be described using rate of flow to estimate the influence of the thermal environment on water during a time period.

Time and Temperature Gradients

At any point along the stream the gradient between air temperature and water temperature will vary from hour to hour. Maximal heat transfer occurs when the gradient is steepest.

Generally water at higher elevations accumulates energy at a different rate than those at lower elevations (Fig. 3). Higher elevations have lower water temperatures at sunrise and greater average gradients during the day. This might

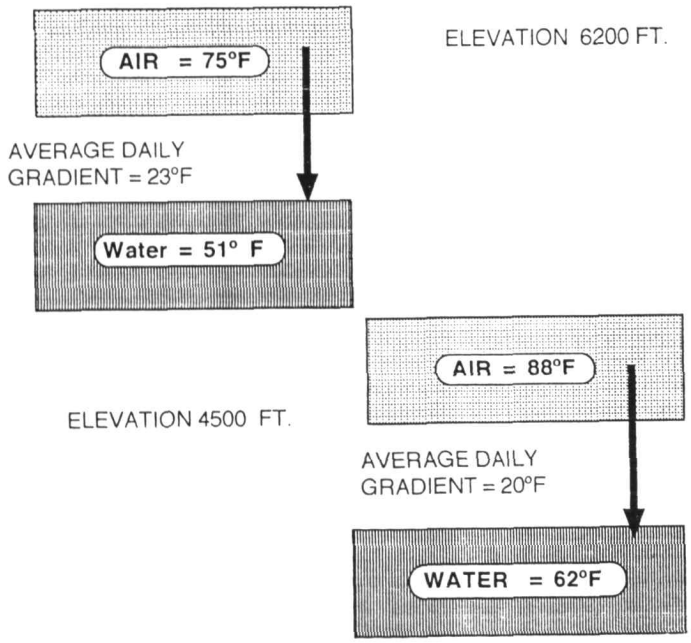

Fig. 3. *Gradients of the difference between air and water temperature at 2 elevations. The arrows represent the thermal gradient from air to water at 2 pm. The average daily gradient is the average of the air and water temperature differences measured at hourly intervals.*

suggest that the water temperatures would be higher than a similar body at lower elevations. This is not the case. Water heating at higher elevations is restricted to a short time period. This is due to a rapid thermal cycling of the local environment which results in less energy accumulation. Given this, water temperatures at lower elevations will have a greater increase in temperatures than those at higher elevations.

When all these processes are combined (elevation, time, rates of heating and cooling, and the difference between air temperature and water temperature) the framework of the thermal environment in which a stream is flowing is described. However, as recognized in the principles of thermodynamics and the examples provided in this paper, modification of one or more of the thermal sources will result in a different rate of heating or cooling.

Observations

1. Climates produce weather systems that determine the patterns of heating and cooling within a watershed environment.

2. Water temperatures are influenced by the thermal reservoir that surrounds the water body. Air temperature can be used as an index of that thermal environment. Air and stream temperatures, at a minimum, must be measured at each data collection site to establish the relationship between the stream and its environment.

3. A portion of stream temperature change can be associated with the thermal environment and rates of adiabatic temperature change. The lower elevations not only have warmer water, but they have warmer air temperatures on a daily basis. The adiabatic rates of air mass temperature change is 3.2°F to 5.5°F difference for each 1,000 ft. of elevation.

4. The difference between the air temperature and the water temperature influences the rate at which the water will warm or cool. The smaller the differences are between air and water temperature the longer it will take for the water to heat or cool.

5. The rate of flow of a stream must be determined to understand the entire process of how a stream heats and cools. Flow determines how long a body of water is influenced by a particular thermal environment. Downstream air temperatures are warmer than upstream because of lower elevations. Flow rates must be monitored during each sample period, between each monitoring site to establish how long the water is exposed to a thermal environment.

6. Two measurements are required at a minimum to estimate the thermal evolution of a stream: 1) the flow rate and, 2) the gradient between air and water temperature. The rate of flow determines how long the water is exposed to a particular air mass (at a specific temperature). The gradient determines the rate at which heat energy is transferred.

Literature Cited

Halliday, D. and R. Resnick. 1988. Fundamentals of physics. 3rd ed. John Wiley & Sons Inc., New York.

Satterlund, D.R. and P.W. Adams. 1992. Wildland watershed management. 2nd ed. John Wiley & Sons Inc. New York.

Trewartha, G.T. 1968. An introduction to climate. McGraw-Hill. New York.

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Improving the Monitoring of Rangelands

Neil E. West and E. Lamar Smith

Monitoring the "health" of rangelands is a "hot" topic both within the rangeland and environmental communities. We will consider why this is so and provide some suggestions of how the profession should participate in resolving the concerns being expressed.

Early Monitoring

During earlier decades in the history of rangeland management, monitoring of rangeland conditions was informal. On private lands, the rancher visually assessed the total amount of available forage and perhaps the balance between growth forms within the vegetation, particularly if "weeds" were increasing, but put more attention on the performance of his/her livestock. In the U.S., the rancher could get technical assistance from the Soil Conservation Service (now the Natural Resource Conservation Service) or the local extension agent, but seldom made written or photographic records. On public lands, grazing permits were administered and the range conservationist made some written and photo records from a few small plots on "key areas" located within each pasture. A map showing utilization may have been made by riding over the pasture shortly after the livestock were removed. If the range conservationist concluded, during consultation with local administrators, that conditions were unacceptable, more intensive monitoring would be done to see if conditions stabilized or improved. If not, use was adjusted (in terms of numbers and kind of livestock and/or season of use) until trend was determined to be stable or upward. Only occasionally did the permittee and government officials disagree strongly enough such that the issue had to be settled judicially.

Recent Monitoring

During recent decades a much wider set of interest groups has emerged, especially in regard to publicly-owned rangelands. These various interest groups focus on rangeland "health" at many different scales in space and time (Fig. 1). If conditions are deemed unacceptable by any interest group and the agency doesn't reduce livestock use, the issue can easily end up in court. Various interest groups are also lobbying Congress and federal agencies for better regional and national accounting of rangeland "health." This broadened interest is causing agencies historically not associated with rangeland issues to launch new initiatives [e.g., the Environmental Protection Agency's attempts at developing an Environmental Monitoring and Assessment Program (EMAP)]. The agencies who have been monitoring for decades are also trying to react to national level critiques of past rangeland monitoring practices, e.g., the National Research Council (1994). The Society for Range Management (1995) is also pressing for uniform national standards of reporting rangeland condition and trend.

In addition to changes in socio-economic context, scientific advancements and technological progress have modified the ways in which we view the dynamics of ecosystems. Societal influences, scientific advances, and technological progress act in concert (Fig. 2), along with current fiscal constraints, to alter the ways we will have to deal with rangeland monitoring in the coming century. Since the influences of socio-economic trends have been well covered here before (e.g., Kennedy et al. 1995), we will turn to how scientific advancements and technological progress already have and probably will continue to modify the ways we go about monitoring rangeland "health," functioning or integrity.

New Sci-tech Influences

The scientific and technical communities have provided both new concepts and new instruments to help obtain, organize, analyze, summarize, and present data. Most of the advances that now alter our options for

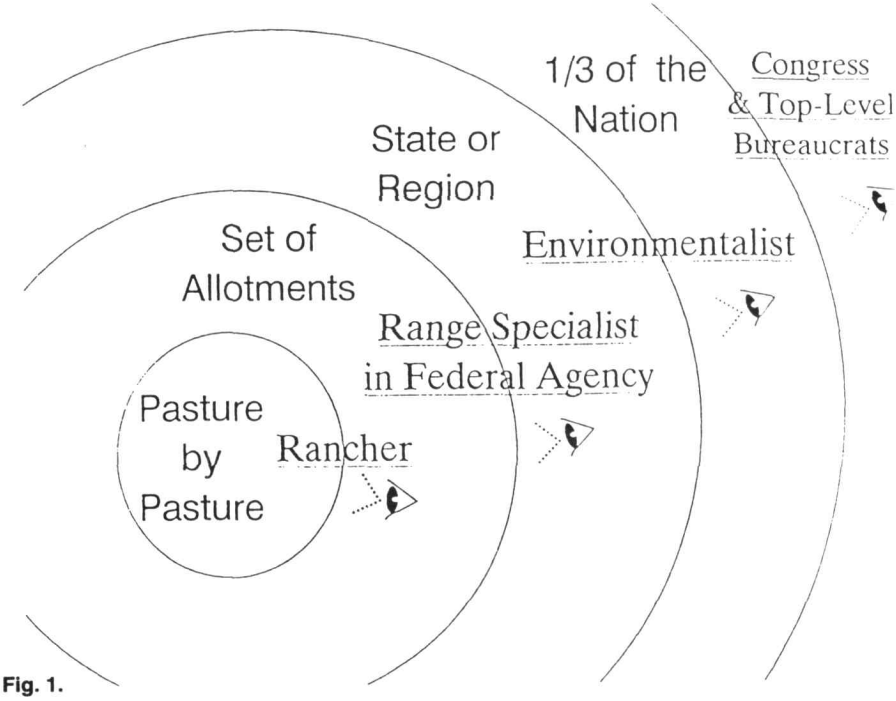

Fig. 1.

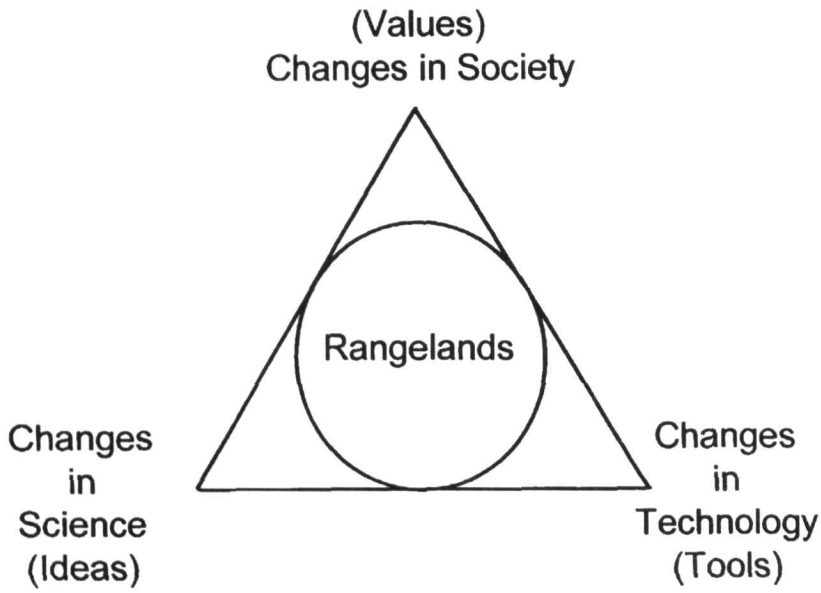

Fig. 2.

rangeland monitoring have come from the Cold War-era, security-related investments in education and research on a wide front, little of which has been directly related to rangeland management. Examples of relevant technology are computers, satellites (remote sensing, RS) and their many new kinds of sensors, global positioning systems (GPS), and geographic information systems (GIS).

Some relevant advances involve completely new ideas. For instance, research in fluid dynamics and climatology led to the quantification of chaos, a concept now beginning to be applied to describe the dynamics of some rangeland ecosystems (e.g., Lockwood and Lockwood 1993). The mathematicians' contribution of catastrophe theory is also now being used to explain rangeland development (e.g., Rietkerk et al. 1996). Geomorphologists (e.g., Renwick 1992) have shown us how different positions on a landscape show variation in inherent stability or instability to soil erosion that vegetation can only temporarily alter. Paleoecologists have shown us how flora and fauna have changed enormously over time, even before humans arrived on the scene (e.g., Tausch et al. 1993). Anthropologists (e.g., Kohler 1992) and historians (e.g., Denevan 1992) have demonstrated how the western rangelands encountered by the first Europeans were far from stable, pristine systems. Even philosophers, mainly through their expansion of hierarchy theory (e.g., Ahl and Allen 1996), have provided us with more useful ways to view the dynamic interactions within ecosystems.

All of these advances in thinking are leading us away from earlier assumptions of equilibrium and balance, which were machine-like models that prevailed during the Industrial Age. These earlier views ignored the historical and chance elements in ecological systems that we are now beginning to acknowledge.

Changing Views of Ecological Succession

Ecology probably provides the most important scientific underpinning of rangeland management. Enormous changes have occurred recently in our ecological understanding. We will briefly review but one particularly relevant ecological phenomenon—succession of plant communities.

Nearly all plant ecologists once believed in a slow, gradual, linear, deterministic, and reversible progression toward a single, self-regenerating endpoint (climax). The mechanism by which this was universally thought to occur was called facilitation; the modification of microclimate and soils through replacement by different plant species favored by these changing microenvironments over successional time. The range profession developed condition classes based on departures from the one presumed climax for each ecological site. Data were collected and interpreted by range conservationists for decades based on this Clementsian model. Few within the range profession noticed that academic ecologists had begun to abandon Clement's model in the late 1950's. The new models replacing the gradual, linear, deterministic successional trajectories instead display nongradual starts, jumps forward, reversals, crossing of thresholds and passing into new domains or alternate seemingly stable states (Laycock 1995).

Using the New Ecology

The new notions of successional patterns require some practical developments before we can apply them to land management. For instance, rather than using the one presumed climax as the reference point, many now advocate use of the desired plant community (Laycock et al. 1995). That is, we can now choose one of the possible vegetation configurations that is projected to be sustainably maintained through management. This vegetation still has to be sufficiently protective of the soil such that accelerated soil erosion will not occur (SRM 1995). Conceivably, a lightly to moderately grazed portion of a pasture could serve as a benchmark, if it were judged to be under a sustainable level of management (West 1991, West et al. 1994).

Using the above new approaches will involve developing consensus answers to six important questions during public land management. These questions are: 1) What is ecologically possible? 2) What is economically and logistically feasible? 3) What collection of successional states across a management unit will optimize the value of range-

land resources? 4) Whose values among the stakeholders around the current table will be accommodated and in what order? 5) How will that compromise affect other potential rangeland users (including those offsite, not now at the table, and in the future)? 6) Is that collection of states arrived at following a few decades of management sustainable? Monitoring is absolutely required to address the last question.

Collision with Other Interest Groups?

We do not foresee the desired plant community or sustainably grazed benchmark concepts as being easily accepted for public rangelands by conservation biologists (e.g., Noss and Cooperrider 1994). Desired plant communities are frequently early seral stages where more productive herbaceous plants, including some exotics, thrive. Conservation biologists, exemplified by Noss and Cooperrider (1994), will accept no exotics in management objectives. Furthermore, their view of acceptable conditions excludes human influences as much as possible. Most of their "umbrella" or "flagship" species whose abundance are used as indicators of overall environmental "health" functioning or integrity are those favored by "climax" conditions. Only data on populations of these selected species will satisfy their monitoring demands (Table 1, Column 4). Other interest groups that are watch dogs of particular selected variables (e.g., air quality, water quality, scenic quality, etc.) will also probably not be satisfied with monitoring data on only vegetation and soils within a few selected plots.

A possible strategy to avoid some of the anticipated disagreement is to follow the implications of hierarchy theory. Allen and Hoekstra (1992) point out that the scale of any data-gathering must be matched closely with the relevant scale of the question(s) being asked. Basic ecologists have already begun to follow this logic. Some rangeland professionals, however, continue to use methods mismatched to the often unstated major question; what is the condition of this entire pasture or allotment? In the case of monitoring, rangeland professionals have usually measured change in plant species composition in a few small plots located on subjectively chosen "key areas" and assumed that information applied to entire pastures. Attributes that are best monitored on small plots are plant population and patch dynamics, not changes in vegetation or soils within a mosaic of ecological sites scattered over an entire pasture. We now have better alternatives to the limited practicalities and traditions of the past.

We cannot simply aggregate detailed plot data upward to represent conditions over pastures, allotments, ranger districts or regions, without some means to convert the local data

Table 1. Monitoring and assessment under five generalized styles of environmental management (from Shear 1996).

	FRONTIER ECONOMICS	RESOURCE MANAGEMENT	SUSTAINABLE DEVELOPMENT	SELECTIVE ENVIRON-MENTALISM	DEEP ENVIRON-MENTALISM
Motivation	what is there?	what is there? what is changing?	what is there? what is changing? why is it changing?	what is there? what is changing?	what is there?
	facilitate resource exploitation	conserve renewable resources	ensure ecological security	protect environment	curiosity discovery
	single purpose	single or multi-purpose	multipurpose	single or multi-purpose	single purpose
Scope	resource-based	resource-based	systems-oriented	nature-based	nature-based
	narrowly focused	multidisciplinary	fully integrated	multidisciplinary	narrowly focused
	selected variable(s)	selected variable(s)	multivariate	selected variable(s)	selected variable(s)
	single medium	selected media	multimedia	selected media	single medium
Partnerships	none or few	limited	all relevant interests	limited	none or few
Methodology	inventories, surveys concerned with 'how much,' monetary potential	compliance and regulatory monitoring	comprehensive, integrated monitoring	effects monitoring	natural histories, inventories, rankings, classifications
		case studies on resource use or development	comprehensive ecosystem assessments	case studies on specific environmental concerns	
Time Frame	short-term	short-term	long-term	short-term	short-term

into summarizable information for larger expanses. The method suggested by the NRC (1994) involves assigning, plot by plot, the categories of "healthy," "at risk," or "unhealthy" as means of data reduction. We don't, however, foresee ever having enough budget or personnel to do the very large, frequent, random-point sampling that would lead to statistically adequate answers that way, except for the nationwide to state scales, as proposed by the National Resource Inventory. This leaves us with the task of developing an affordable yet statistically reliable means to measure rangeland "health" at pasture to allotment scales. We also need to avoid gridlock with conservation biologists and other special interest groups, if possible. Fortunately, new scientific ideas and technologies are now giving us some alternatives.

Potential Contributions of Landscape Ecology

Landscape ecology is a revitalized branch of ecology that deals with patterns of form and function that occur across large areas (Formann 1995). Formerly, we could only deal with such notions intuitively. Now through frequent imagery from earth orbiting satellites, organized via geographic information systems and spatial statistical analyses through greatly enhanced computer power, we can finally quantitatively compare patterns over huge areas in their entirety (Turner and Gardner 1990). These synoptic metrics (simultaneous and instantaneous measurements of entire areas) finally allow us to go beyond having only small plots (usually measured at different times) on the ground. Australian rangeland professionals (e.g., Pickup 1996) are far ahead of Americans in making these new technologies practical.

Of course, we will need to validate our interpretations of remotely-sensed imagery at well-known places on the ground. This is called ground-truthing. Global positioning systems allow us to find, mark, and relocate those crucial spots much more easily now. The discipline of spatial statistics is continually developing new approaches for us to quantitatively express the major patterns that can be discovered. These usually involve the determination of true means of population statistics, not the estimated means with their wide margins of error in the more familiar sub-sampling statistics. There can, however, be inherent biases and misclassifications that must be checked by ground-truthing. Some rangeland ecologists are already providing examples of how these metrics can be obtained (Munguia et al. 1997, Wu et al. 1997). Much more testing of them in a variety of contexts will hopefully be coming shortly.

We should be honest and open in specifying where science and values merge in our decision making.

One major misunderstanding, perpetuated by the National Research Council's 1994 report is that there are objective ways to characterize rangeland "health." Unfortunately, it is impossible to develop and use monitoring techniques that don't involve some degree of human value judgement (Burnside and Rasmussen 1997). The choices of which variables to assess, where and when to assess them, and what benchmarks to employ, are all value laden. Determination of "health," condition, functioning or integrity is an interpretation affected by the data collected, judged against management objectives and the benchmarks chosen (West et al. 1994). Choice of benchmarks depends on our expectations of the land to meet human objectives, as well as many technical considerations (West 1991, Tausch 1996). We should be honest and open in specifying where science and values merge in our decision making.

Participate or Become Marginalized

We are all involved in an ideological battle. Most, particularly younger Americans, are aligning themselves with the notion of sustainable development. When this group comes to dominate politically, any user of the land is likely to be asked to prove that his or her actions do not endanger ecological security (Table 1, Column 3). If that can't be shown, the views of selective environmentalism (Table 1, Column 4) or even deep environmentalism (Table 1, Column 5) have greater chances of prevailing. Most conservation biologists are selective environmentalists. One of their major beliefs is that native species should have precedence over the introduced ones (including in some cases, humans). However, designation of what is "native" involves arbitrary choices of when immigration took place.

Conservation biologists are very active in national efforts to devise new means of monitoring the nation's environmental "health" (e.g., Bravo 1996). They are pushing for adoption of monitoring methods that favor their selective world view. Unless the range profession becomes more involved in developing new means to monitor rangelands, at all scales of interest, it will become increasingly left out in setting land use policy for rangelands.

We agree with Gillespie (1996) that new means of ecosystem monitoring will involve multiple perspectives and scales simultaneously (Fig. 1). Multidisciplinarity, ecosystem management, and Coordinated Resource Management Planning (CRMP) are becoming the prevailing modes of operation in resource management. One implication of ecosystem management is that ownership boundaries become less important and thus monitoring has to be similar on lands of equivalent potential under all ownerships if data are to be shared and compared. This doesn't mean throwing away the point-based data we already have, or even adopting yet more complete point-based approaches (e.g., Herrick et al. 1996) for some circumstances. We don't, however, expect to have either the personnel or budgets to be able to apply such intensive approaches at more than a few areas involving particularly intense debate about alternative land uses.

We don't expect discovery by an individual or even a small group, of a "silver bullet" (an easily measured variable that all will readily accept) which will quantify condition and trend for all kinds of rangeland at all scales in space and time. Instead, we foresee rangeland managers and scientists having to participate in many meetings, workshops and field trials with other professionals and interest group representatives until a hierarchically designed and mutually agreeable way is provided to answer the questions agreed upon. We visualize these questions bearing on the management of a particular area to involve populations of some selected species, community attributes at selected "sentinel sites" (Pickup and Stafford Smith 1995), landscape characteristics such as fragmentation, and even social and economic characteristics of embedded humans (Blahna 1995, Harwell et al. 1996), if the area of interest is large.

The chosen indicator(s) at each scale must be quantitative, repeatable, have minimal measurement error, be easily communicated and understood, susceptible to sensitivity analysis, yet affordable. Since there are very few metrics which can be applied at scales ranging from quadrats to continents (e.g., albedo, water use efficiency, Normalized Difference Vegetation Index), we will have to devise "filters" (means of data reduction) that can take the more abundant data collected at the more detailed spatial and temporal scales and quantitatively bridge them to needs across large spans of area and time. Unless most of the viewers at all scales (Fig. 1) can find a transparent (easy to understand and repeatable) process at work, they will mistrust and thus contest the conclusions. "Deep ecologists" (Table 1, Column 5) will not likely be satisfied with any consensual solution since they are driven by moralistic assertions rather than science-based arguments. We have a lot of hard work ahead of us if we are to successfully develop such procedures for assessing rangeland "health" by the beginning of the 21st century.

The range profession took leadership in developing CRMP. Unfortunately, monitoring was not always given the attention it should have received when such planning was first put in place. Where it wasn't, we will need to reconvene and update the plan to include monitoring and encourage the process toward adaptive resource management (Kessler et al. 1992). The mix of issues, and thus the needed approaches for monitoring are probably going to vary greatly in each case. If science and management are to begin to use each case as a mutual learning experience, as the adaptive resource management model calls for (Kessler et al. 1992), then administrators need to begin changing the ways in which their institutions operate. The present financing and reward structure doesn't always encourage timely interactions of the most appropriate personnel (e.g., scientists and mangers). Continued inattention to the pivotal role of monitoring in land management will jeopardize both the health of the land and the rangeland profession.

Literature Cited

Ahl, V. and T.F.H. Allen. 1996. Hierarchy Theory: A Vision, Vocabulary, and Epistemology. Columbia Univ. Press, New York.

Allen, T.F.H. and T.W. Hoekstra. 1992. Toward a Unified Ecology. Columbia Univ. Press, New York, 384 p.

Blahna, D.J. 1995. Integrating social and biophysical factors in ecosystem management. Quest for the philosopher-king. pp. 507–512. *In*: J.L. Thompson et al. (compilers) Proc. Fourth International Outdoor Recreation and Tourism Trends Symposium. Univ. Minnesota, St. Paul, Minn.

Bravo, C.A. 1996. (ed.). North American Workshop on Monitoring for Ecological Assessment of Terrestrial and Aquatic Ecosystems. USDA, Forest Service, Rocky Mountain Forest and Range Expt. Sta., Gen. Tech. Rep. RM-GTR-284, Ft. Collins, Colo.

Burnside, D. and A. Rasmussen. 1997. Ecosystem management: Can it succeed? Rangelands 19(2):20–24.

Denevan, W. 1992. The pristine myth: the landscapes of the Americas in 1492. Annals of the Association of American Geographers 82:369-385.

Formann, R.T.T. 1995. Landscape Mosaics: The Ecology of Landscapes and Regions. Cambridge Univ. Press.

Gillespie, A.J.R. 1996. Research and development needs for forest ecosystem monitoring. pp. 241–246 in C.A. Bravo (ed.). North American Workshop on Monitoring for Ecological Assessment of Terrestrial and Aquatic Ecosystems. USDA, Forest Service, Rocky Mountain Forest and Range Expt. Sta., Gen. Tech. Rep. RM-GTR-284, Ft. Collins, Colo.

Harwell, M.A., J.F. Long, A.M. Bartuska, J.H. Gentile, C.C. Harwell, V. Meyers, and J.C. Ogden. 1996. Ecosystem management to achieve ecological sustainability. The test case of South Florida. Environ. Manage. 20:497–521.

Herrick, J.E., W.W. Whitford, A.G. de Soyza, and J. Van Zee. 1996. Soil and vegetation indicators for assessment of rangeland ecological condition. pp. 157–166 *In:* C. Aguirre Bravo (ed.). North American Workshop on Monitoring for Ecological Assessment of Terrestrial and Aquatic Ecosystems. USDA, Forest Service, Rocky Mountain Forest and Range Expt. Sta., Gen. Tech. Rep. RM-GTR-284, Ft. Collins, Colo.

Kennedy, J.J., B.L. Fox, and T.D. Olsen. 1995. Changing social values and images of public rangeland management. Rangelands 17(4):127–132.

Kessler, W.B., H. Salwasser, C.W. Cartwright, Jr., and J.A. Caplan. 1992. New perspectives for sustainable resources management. Ecol. Applic. 2:221–225.

Kohler, T.A. 1992. Prehistoric human impact on the environment in the upland North American Southwest. Population and Environment 13:255–268.

Laycock, W.A. 1995. New perspectives on ecological condition of rangelands: can state-and-transition or other models better define condition and diversity? pp. 140–164 *In:* L. Montes and G.E. Oliva (eds.). Proc. Internat. Workshop on Plant Genetic Resources, Desertification and Sustainability. INTA-EEA, Rio Gallegos, Santa Cruz, Argentina.

Laycock, W.A. et al. 1995. Grazing on Public Lands. Council for Agricultural Science and Technology, Task Force Report No. 129, Ames, Iowa.

Lockwood, J.A. and D.R. Lockwood. 1993. Catastrophe theory: A unified paradigm for rangeland ecosystem dynamics. J. of Range Management 46:282–288.

Munguia, L.M., N.E. West, and G.A. Rasmussen. 1997. Quantification of landscape structure within the Land Condition-Trend Analysis Monitoring Program at Camp Williams, Ut. Abstracts, 50th Annual Meeting, Society for Range Management, p. 44.

National Research Council. 1994. Rangeland Health: New methods to classify, inventory and monitor rangelands. National Academy Press, Wash. D.C. 180 p.

Noss, R.F. and A.Y. Cooperrider. 1994. Saving Nature's Legacy: Protecting and Restoring Biodiversity. Island Press, Wash. D.C.

Pickup, G. 1996. Estimating the effects of land degradation and rainfall variation on productivity in rangelands: An approach using remote sensing and models of grazing and herbage dynamics. J. Appl. Ecol. 33:819–832.

Pickup, G. and D.M Stafford Smith. 1993. Problems, prospects, and procedures for assessing the sustainability of pastoral land management in arid Australia. J. Biogeography 20:471–487.

Renwick, W.H. 1992. Equilibrium, disequilibrium, and nonequilibrium landforms in the landscape. Geomorphology 5:265-276.

Rietkerk, M., P. Ketner, L. Stroosnyder, and H.H.T. Prins. 1996. Sahelian rangeland development; a catastrophe? J. Range Manage. 49:512–519.

Shear, H. 1996. Ecological assessment in Canada. pp. 20–30 in C.A. Aguirre (ed.). North American Workshop on Monitoring for Ecological Assessment of Terrestrial and Aquatic Ecosystems. USDA, Forest Service, Rocky Mountain Forest and Range Expt. Sta., Gen. Tech. Rep. RM-GTR-284, Ft. Collins, Colo.

Society for Range Management. 1995. New concepts for range condition assessment. Report of the Task Group on Unity in Concepts and Terminology. J. Range Manage. 48:271-282.

Tausch, R.J., P.E. Wigand, and J.W. Burkhardt. 1993. Viewpoint: plant community thresholds, multiple steady states and multiple successional pathways: legacy of the Quaternary. J. of Range Manage. 46:439–447.

Tausch, R.J. 1996. Past changes, present and future impacts, and the assessment of community or ecosystem condition. pp. 97–101 *In:* J.E. Barrow et al. (compilers). Proceedings: Shrubland Ecosystem Dynamics in a Changing Environment. USDA, Forest Service, Intermountain Research Station, Gen. Tech. Rep. INT-GTR-338, Ogden, Ut.

Turner, M.G. and R.H. Gardner (eds.). 1990. Quantitative Methods in Landscape Ecology: The Analysis and Interpretation of Landscape Heterogeneity. Springer-Verlag, New York, 536 p.

West, N.E. 1991. Benchmarks for rangeland management and environmental quality. pp. 30–43. *In*: L.F. James et al. (eds.). Proc. National Conference on Noxious Range Weeds, Westview Press, Boulder, Colo.

West, N.E., K. McDaniel, E.L. Smith, P.T. Tueller, and S. Leonard. 1994. Monitoring and interpreting ecological integrity on arid and semi-arid lands of the western U.S., Report No. 37, Rangeland Improvement Task Force, New Mexico State Univ., Las Cruces, N.M. 15 p.

Wu, J., P.T. Tueller, and W.G. Gao. 1997. Multiple-scale characteristics of the landscape pattern of the Great Basin, USA. Abstracts of the 12th annual symposium, U.S. Regional Assoc. Internat. Assoc. for Landscape Ecology, Durham, NC, p. 123.

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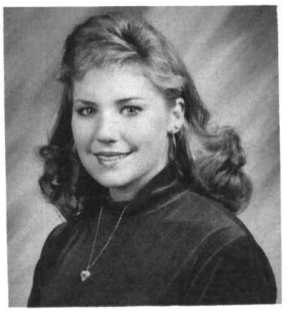

The Significance of Prickly Pear on South Texas Rangelands

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Hot, dry, almost desert conditions—south Texas rangelands. In the middle of summer it can seem almost uninhabitable. In the dead of winter it can appear as barren as a desert. Rainfall in this part of Texas is sporadic at best. Occasionally conditions can be lush and green, a ranchers' dream. But generally speaking, it doesn't last long. What kind of native plant life grows in this kind of environment? Mesquite trees, various brushes, hearty native grasses, and the cactus. The most abundant variety of the cacti is prickly pear. This almost indestructible plant can be a blessing to south Texas ranchers in times of drought and hard winters. Area wildlife depends on it for survival. And lately, it has been used for human consumption.

Prickly pear is a group of cacti consisting of jointed, flattened stems called pads. These fleshy pads enable the prickly pear to store water and withstand long periods of drought. There are about 25 different species of prickly pear all belonging to the genus *Opuntia*. Propagation of the plant can be in the form of cloning. That is, each pad, if broken away, can form a new plant that is genetically identical to the original. Prickly pear may also reproduce from seeds that are produced in the fruit, or tunas, of the plant. As the tunas, or "pear apples", are eaten by livestock and wildlife, the seeds are passed through the digestive system. The new plant from seeds will not be identical to its parent, but may have the genetic make up of two plants, and therefore small variations in the new plant may be seen.

Prickly pear may be found in varying densities in almost every part of Texas except the north east, and it covers an area of approximately 54 million acres. This is an area approximately the size of Utah. Prickly pear is often viewed as a "mixed blessing" in Texas. In the sheep and goat producing areas of Texas, mainly the Edwards Plateau region, this cactus is viewed as a problem. It is not an advisable feed source due to the many health problems associated with its consumption. Ulceration and infection of the lips, tongue, gums, palate, and gastrointestinal tract are symptoms from ingesting the spines. The seeds of the tunas may also cause rumen impaction which results in death. When a more desirable forage is not available, the sheep and goats begin eating the prickly pear. The economic loss is felt greatly by ranchers in this region.

However, south Texas cattle ranchers tell a different story. In times of drought or hard winters, ranchers must rely on the prickly pear to feed their cattle. Prickly pear is considered an effective emergency feed and has been used for more than 150 years by ranchers in Texas and northern Mexico. While there are several different methods of feeding prickly pear, it is absolutely necessary that the spines are singed from both sides of the pads. It is important to only singe the spines and not cook the pear. Cooked pear is just as detrimental to cattle as not burning the spines completely, as it may cause scouring.

The most common tool for singeing the spines is the pear burner. A pear burner is a flame thrower that consists of a fuel tank (usually 5-gallon), a hose, a wand, and a burner. An individual carries the tank over his shoulder and moves from plant to plant. The hand-held burners are the most common and have been used for many years by ranchers. A larger tank may be mounted in the back of a pickup or on a trailer and equipped with a long hose. One person drives the vehicle while another operates the burner, thus saving time and energy on the rancher's part. Yet another form of modification is to mount torches on a tractor operated boom. While this method can burn very large amounts of pear at a time, it also tends to waste fuel. The burners used today are fueled with propane instead of kerosene, diesel, or gasoline. Propane is less dangerous and is a cheaper source of fuel. The cost of propane today is about $1.09 per gallon. When burning by hand, it is recommended to have a second burner on hand in case of breakdown because the rancher will not have to keep hungry cattle waiting while the "only burner on the place" is being repaired.

While moving from plant to plant is the most common way to burn pear, there are other methods. Prickly pear may be chopped, windrowed, and singed, and then fed in troughs. Non-singed prickly pear may be cut and stockpiled for several weeks before chopping and burning. Twice as many cattle can be fed on a given acreage by feeding in troughs as there is less pad waste, and the plant is better utilized. Fuel is also used more efficiently. However, this method is very labor intensive.

When considering the nutritional aspects of feeding prickly pear, ranchers and researchers will often times disagree. Scientifically, prickly pear is not a good feed source. In fact, it is considered to be poor. It is very high in fiber and ash which can cause digestive upsets. It is low in crude and digestible protein. Therefore, when feeding prickly pear, cattle should be supplemented with dry matter such as hay or cottonseed hulls, as well as salt and mineral supplements.

Ranchers consider prickly pear to be an excellent emergency feed source. It is high in energy levels, and since energy is needed in the greatest amount in times of stress (drought, hard winter), prickly pear can be considered a "good feed" even though it is somewhat unbalanced. South Texas ranchers use prickly pear as a "hollow belly" cure. A 1988 survey indicated that 40% of ranchers in this area feed prickly pear, not only as emergency feed, but as part of a nutritionally managed plan. When looking for cattle lease rangeland, many ranchers consider only "pear pasture".

When using prickly pear as a feed source, there are a few suggestions to keep in mind.

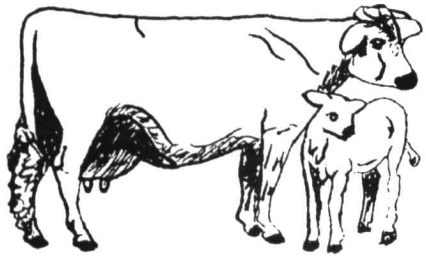
(1) Keep cattle in a small fenced-in area of prickly pear. This reduces the amount of energy used by the cattle.

(2) Burn pear daily as opposed to every other day. Burning every other day forces the cattle to gorge themselves, which leads to scouring and then wandering in search of other food. Proper burning by the rancher will control movement of cattle.

(3) Feed a roughage, such as hay, and protein and mineral supplements.

It has been often said by south Texas ranchers that the prickly pear is a valuable forage plant, and, without it, the stockman could not bring his herd through a drought or bad winter alive.

Not only is livestock in south Texas dependent on prickly pear, but also is wildlife. Many wildlife species in this region rely on the prickly pear for food, water, and cover. Leasing range and pasture lands for hunting has become a big business in south Texas. White-tailed deer, quail, and javelina are the species most sought after by hunting enthusiasts. The javelina, or peccary, benefits the most from prickly pear. It is only found where prickly pear is abundant because it comprises 85% of the javelina's diet. During the months of October through March, the javelina feed mostly on the pear pads. Then during the months of April through September, the tunas become the important part of the plant for them to eat. The javelina cannot survive without prickly pear.



In addition, the bobwhite quail, a very popular game bird, uses prickly pear not only as a food source, but also as cover. While the pear bush does not offer enough shade for a nesting site, it serves as excellent travel cover and escape from predators.

The white-tailed deer is probably the most important game animal, and in many instances, the land owner may receive more income from hunters seeking a trophy white-tailed buck than he could receive for cattle grazing rights. The average price per acre in south Texas brush country for a cattle lease is $3. For quail, a hunter can expect to pay an average of $4 per acre, while deer leases run an average of $6 per acre.

Prickly pear comprises 21% of the white-tailed deer's annual diet. The plant is heavily selected from June through September and, at that time may make up as much as 33% of their diet. Minimal consumption is found during the late winter and early spring. Along with food value, the deer use the pear bushes as cover for young fawns.

Many other species of wildlife are dependent upon the prickly pear for food, shelter, and cover. The Texas tortoise, a protected species, relies upon this cactus for its survival. The roadrunner, one of Texas' favorite inhabitants, uses the prickly pear for its nesting site as well as for food and cover. Rattlesnakes, jack rabbits, butterflies, and honey bees, (the list goes on and on), all use the prickly pear in some form or another. It has been predicted that a 50% to 70% reduction of prickly pear would have a negative influence on most wildlife habitat in Texas.

Recently it has been discovered that prickly pear is an excellent food source for human consumption. It serves as a fruit (the tuna or pear apple) and a vegetable (the young tender pads). The large, sweet, pear apples can be eaten raw, prepared as a jelly, or candied. Also a seed-free puree can be frozen for use in margaritas and dessert toppings. The young tender pads are called nopalitos and can be eaten in salads and omelets, or used as a garnish. More than 1.5 million pounds of pear apples are imported to the U.S. from Mexico each year. In addition, large amounts of nopalitos are also imported annually. The idea of cultivating prickly pear in south Texas for human consumption is just beginning to take hold.

Chefs are now becoming interested in using the nopalitos to make a low fat sausage and meringues from whipped mucilage. In many cultures cactus has been a part of traditional food and medicine for several years, but it is relatively new to the U.S. and much of Europe. It is estimated that Mexicans eat as much prickly pear as Americans eat cauliflower. Chefs are continuing to try new ways of using the prickly pear for human consumption, and the market for the prickly pear is continually growing.

In south Texas most ranchers do not control the prickly pear because they consider it valuable; instead, they try to encourage the growth of the plant. This may be accomplished by planting it in rows as a cultivated crop, which enables an easier method of burning or harvesting. Also discing, chaining, or railing pear patches will scatter pads and encourage the rooting, therefore, spreading the cactus. For those ranchers who do want to control the pear, there are several different methods of doing so. Prickly pear on rangeland may be controlled with prescribed burning, aerial or ground broadcast spraying with picloram, hand grubbing, and individual plant treatments with picloram using backpack or wheeled sprayers. The most effective method, however, is the combination of prescribed burning followed by aerial spraying of a reduced rate of picloram. After prescribed burning the prickly pear is severely weakened and is easily killed with less chemicals.

Friend or foe, prickly pear has its place in Texas. In south Texas its benefits far outweigh its disadvantages to livestock, wildlife, human consumers, and rangeland managers. It is up to each individual manager to evaluate his rangeland and determine the proper use for this prolific plant.

The author would like to express her appreciation to Dr. C. Wayne Hanselka, extension range specialist; Mr. Joe G. Herrera; the Atascosa County Soil and Water Conservation District; and the Atascosa County Extension Service; Atascosa County ranchers Kenneth Culpepper, Leroy Krueger, Larry Persyn, Lonnie Rakowitz, and Karl Rakowitz. All of these people provided her with materials and information to prepare this paper.

Editor's Note

This is the 1st Place winner of the High School Youth Forum presentations at the SRM Annual Meeting in Rapid City, South Dakota.

Riparian Management: The Future is in Our Hands

Hannah Kaufman
Brooks, Alberta, Canada

Riparian areas are important because, when well managed, healthy, and productive on a ranch they can be used as a powerful tool for a rancher to get the most out of what he has and increase the worth of his land and livestock. It is now clear from three decades of research by range managers, biologists, and hydrologists, that the two percent of our rangelands which are riparian areas are disproportionately more important than their size would indicate.

Is riparian management a problem? Riparian areas need to be managed differently than uplands, and research has shown us that it is difficult to restore the functions and values of these areas' years of damage. If riparian areas are not well managed the destructive impacts of floods and droughts are alarming. Potential income is reduced since abundant water, shelter and forage translate into marketable value.

Animals prefer to graze and loiter in riparian areas. Damage then occurs because they will stay there unless they are moved or induced to seek desired nutrition. Before they will leave a riparian area the vegetation will become short stubble and the area becomes denuded. What can be done to improve this? Don't let cattle "settle" there in the first place. Move salt blocks and mineral away from riparian areas so cattle will traverse to uplands. One consideration would be to temporarily fence off any areas that the cattle won't leave alone. Give it a chance to repair and recover from grazing. Another option is to allow a type of grazing strategy that won't be as hard on that area.

An understanding of how stream valleys store and release water helps us to save more water and benefit from it, especially during those years of below average precipitation. Healthy flood plains, which are well vegetated slow the flow of water and allow it to spread and soak in effectively.

With poor vegetative health, water speeds over the flood plains and doesn't linger long enough to fill the underground "sponge". After water is "soaked up" in healthy riparian areas the stored water is released back into the stream. If the water hasn't had a chance to soak in then you may be short of water, and won't have an efficient supply for livestock, fish or wildlife.

Some areas that undergo harsh treatment are places where livestock water. The livestock may use a large area and trample fragile vegetation. Gravelling or hardening points that cattle naturally want to use, provides easy access for animals to get to water, therefore encouraging cattle to use a smaller area. This reduces trampling impact and risk of erosion.

Some other actions that contribute to riparian problems are straightening and widening stream channels. This increases horsepower of the stream often transferring flood erosion problems and/or risk to downstream neighbors. Beaver dams come and go naturally, but removal of too many all at once increases the stream gradient and increases its horsepower, thus increasing erosion. One significant contributor to riparian degradation is the excessive removal or alteration of vegetation by livestock. The "too soon, too long, too much and too often" type of grazing fails to protect riparian areas.

Allowing livestock to graze areas that are vulnerable to damage such as tree seedlings and shrubs in autumn or winter can have harmful effects on the land. Soft stream banks can also be ruined if grazed.

By including additional rest to the grazing cycle, we can enhance plant vigor and allow bank building to take place as well as allowing tree seedlings to grow and reach a more grazing resistant stage.

Grazing intensity is very important because this determines how long a particular number of cattle should graze a certain area. Lower intensity results in better plant diversity and species composition.

Fencing riparian areas into a separate pasture with specific management objectives allows for management of the area with increased control over the grazing process. Healthy riparian areas have a wide diversity of plants with strong root systems slowing the water down through friction. For example, a 5 cm deep rootmass resists erosion up to 20,000 times better than bare soil stream banks. A woody rootmat is the "re-bar" of stream banks.

On smaller, low gradient streams sod forming, deep-rooted grasses protect stream banks. For larger, higher gradient streams and rivers, brush and tree species are needed to stabilize stream banks. This is where willow trees can be beneficial. Allowing livestock to destroy or degrade these plants removes protection from erosion, and also deterio-

rates suitable habitat and shelter for animals. Degradation of riparian areas is significant because approximately 80% of Alberta's wildlife use riparian areas for all or part of their life cycle requirements.

A grazing system can utilize range management principles and practices and contribute to the productiveness of the landscape and watershed. Grazing strategies enhance livestock production and maintain or improve plant communities. With proper rest and deferment, a good grazing system can offset the impact of cropping and trampling. Deferred rotation, rest rotation and time controlled systems all are good "tools" to put into practice.

When dealing with high risk or chronic problem areas the best thing to do may be to exclude livestock from grazing the area until it can once again sustain animals and not suffer unwanted damage. Giving that piece of land a chance to "heal" itself will prove to be beneficial to everyone in the long run.

Riparian areas sustain us, our life styles, and our businesses. The importance and significance of riparian areas is far greater than their area size suggests. Ignoring or avoiding riparian problems will not serve us well in the long run and these problems will only get worse. We can work with our neighbors and begin now to build back and protect an important part of our ranch. All of us will reap the rewards. Start now and look for the results. The future is in our hands!

Editor's Note
This is the 3rd Place winner of the High School Youth Forum presentations at the SRM Annual Meeting in Rapid City, South Dakota.

Noxious Weed Survey and Mapping System

Diana Cooksey and Roger Sheley

The primary objective of weed surveying and mapping is to identify and delineate land with populations of unwanted plants. These surveys are conducted to predict areas potentially subject to weed invasion; understand the invasion process and determine how weeds spread; develop, implement, and evaluate weed management plans; assess the economic impact of weed invasion; and increase public awareness, education, and weed management efforts.

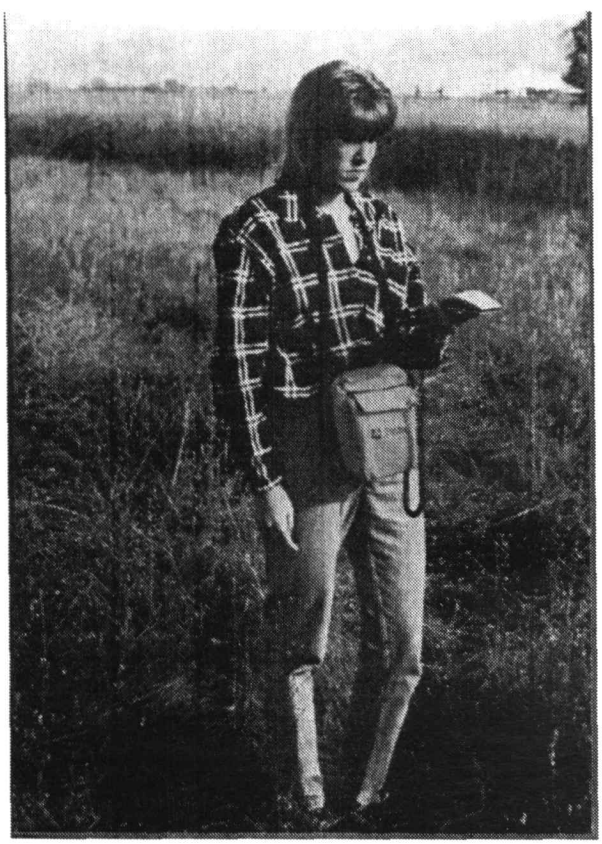
Survey information is collected and compiled into maps showing the distribution and severity of infestations. Monitoring involves repetitive surveys to track weed populations over time. A standardized system is necessary to provide reliable information that can be compared from year to year.

In Montana, representatives from federal, state, and county agencies—as well as industry and private individuals—developed guidelines and standards for a statewide noxious weed survey and mapping system. This document introduces *Montana Noxious Weed Survey and Mapping System.*

The specific objectives of the *Montana Noxious Weed Survey and Mapping System* are:

- to determine and record locations of noxious weeds in Montana,
- to accurately calculate the total number of acres infested for each weed on the state noxious weed list,
- to determine how fast noxious weeds are spreading by comparing weed inventories from year to year.

This effort represents the beginning of a noxious weed inventory for the state of Montana. As more weed managers participate in the program, a greater portion of the state will be accurately mapped, a process that will take several years.



Collecting data using GPS.

Type and scale of base maps

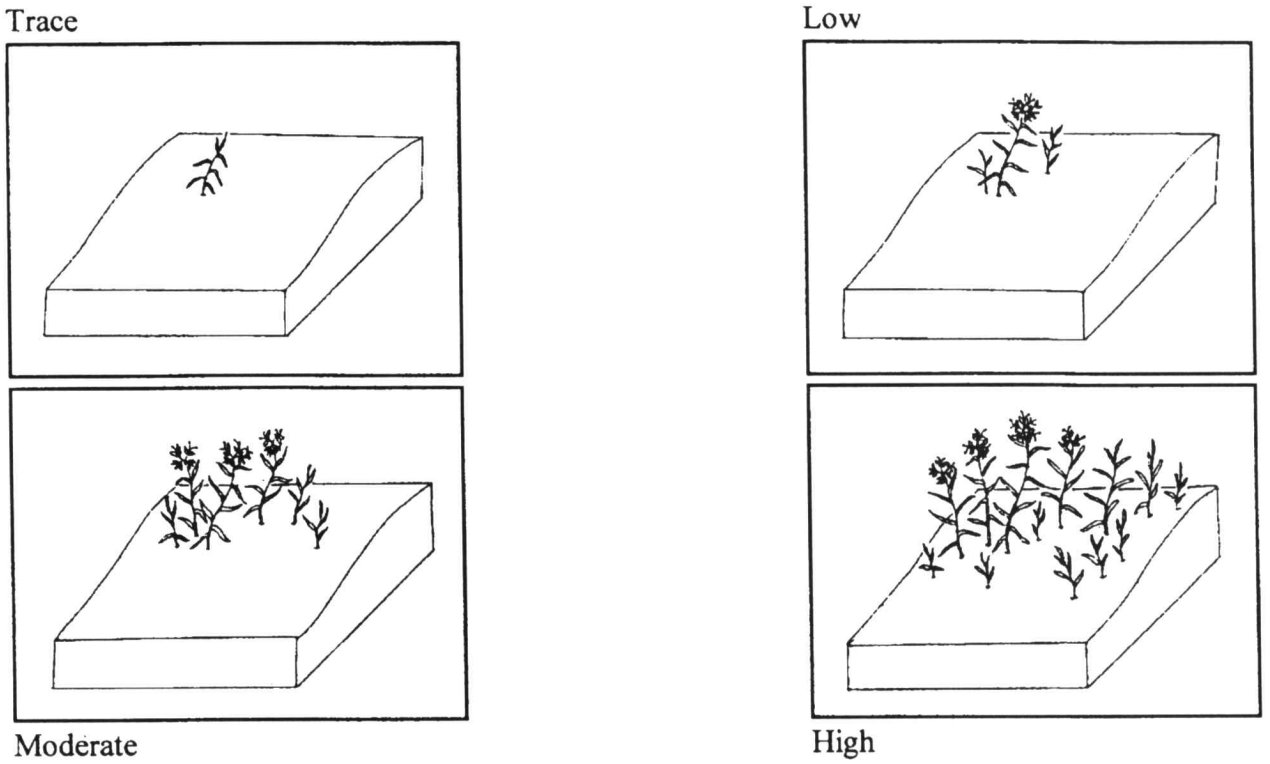
Weed survey maps may be created by hand-drawing infestation boundaries on base maps, using a computerized mapping system such as ArcView or CountyCAD, or by collecting location coordinates of weed infestations using Global Positioning System (GPS) technology. For those who are hand-drawing weed infestations on base maps, USGS 1:24,000 scale (7.5 minute series) maps should be used. This scale is appropriate for weed management planning and can easily be consolidated into 1:100,000 scale county and statewide maps.

In counties where detailed soil surveys have been completed, aerial photographs may be available (contact the Natural Resources Conservation Service for information). Aerial photographs show good detail and can be used to locate your position and draw in surveyed weed infestations. It is important that they are geodetically corrected[1], otherwise they cannot be digitized. If the aerial photographs are not geodetically corrected, the weed delineation could be drawn on them and then later transferred to a topographic map which can be digitized.

Color pencils

A problem with hand-drawn maps is that the accuracy of mapping can be affected by the size of the drawing instrument. A line 1/32 of an inch wide (1 mm) on a 1:24,000

[1]There are changes in scale across an aerial photograph due to the particular configuration of platform altitude, camera system alignment and topography. The image must be rectified so it matches with a "correct" map of the earth. This process is called rubber-sheeting and results in a geodetically correct image that can be reliably used in a Geographic Information System (GIS).



Examples of cover classes.

scale USGS map is equal to 62.5 feet on the ground. If a felt pen is used to mark the perimeter of a weed infestation, it may appear larger than if a No. 2 pencil is used. Therefore, a standardized size of drawing instrument should be used to delineate weed infestations. For the *Montana Noxious Weed Survey and Mapping System*, Berol® VERITHIN® color pencils were chosen. If the pencils are kept sharp, the line width is about 1/64 of an inch (0.5 mm). This line width represents about 30 feet on a 1:24,000 scale map. The pencils come in sets of 24 colors (15 are used to designate Montana's category 1, 2, and 3 noxious weeds), have strong, long-lasting lead and are light-fast and waterproof. They work well with both paper maps and mat acetate or Mylar overlays. The overlay should be smaller than the topographic map so it can be taped to the map. A convenient size to use with 7.5 minute topographic maps is 18" x 24". Mylar overlays should be sprayed with a map fixative so pencil markings don't smear. Topographic maps usually have four "+" marks that can be used for lining up the overlay on the map. These should be marked carefully on the overlay.

Symbols

Before mapping weed infestations, *outline* the survey area on the map and write the *date* of the survey in the upper right corner of the outlined area. Areas inside the survey boundary without size and location designations will be considered weed free. Map the infested areas using the following symbols to designate the size and locations of the infestations (symbols should be centered over the infestation sites).

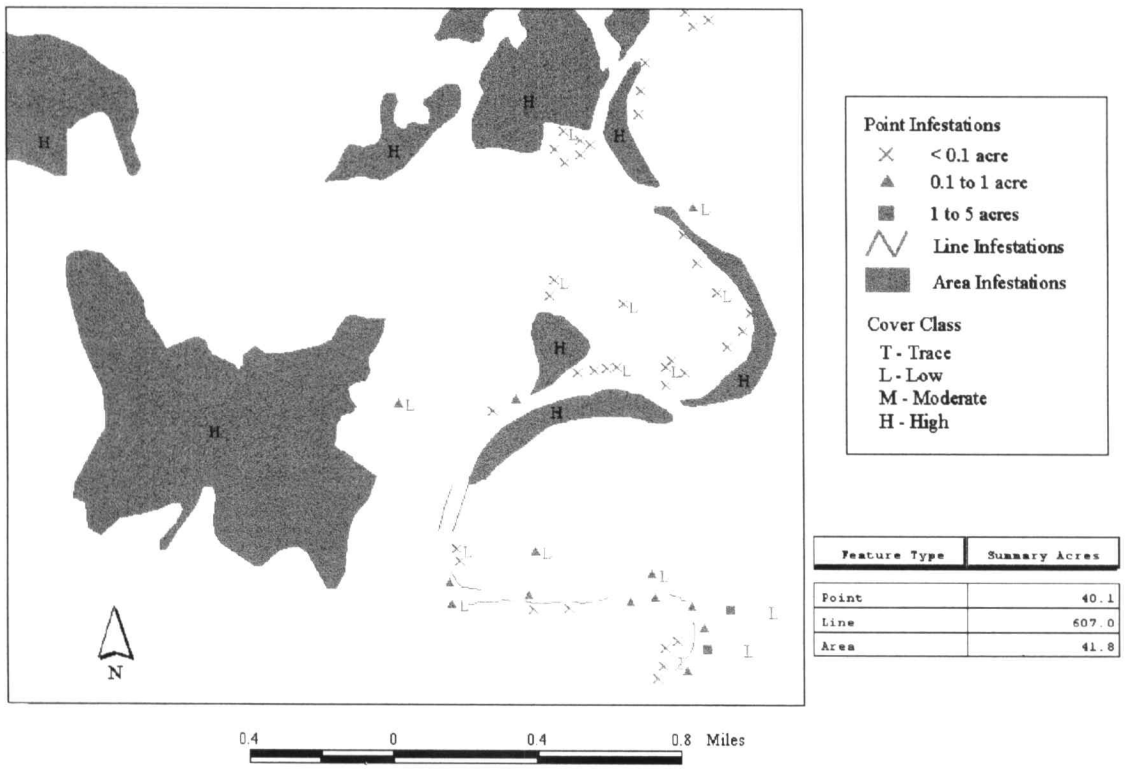
Infestation size

- x = less than 0.1 of an acre
- Δ = 0.1 to 1 acre
- ❐ = 1 to 5 acres
- ☁ = areas larger than 5 acres should be outlined directly on the map
- ~ = infestations that follow linear features such as roads and streams should be designated by drawing lines on the map

In addition to drawing the line on the map, record the following information:

1. Width of line. Record the width of the weed infestation in meters or yards next to the line drawn on the base map.
2. Direction of weeds from line. Next to the line, write an L, R, or C depending on where the weeds are located (i.e. are the weed infestations to the left, right, or on the line you have drawn on the base map?)

Noxious weeds should be designated by their Weed Science Society of America-approved computer codes from the *Composite List of Weeds*, Revised 1989, available from WSSA, 1508 West University Ave., Champaign, Ill. 61821–3133 (and shown for some common Montana weeds in Table 1). Each plant on Montana's state noxious



Computer-generated map of weed infestations along the Smith River near Great Falls, Mont. in the summer of 1996.

weed list should also be color coded according to Table 1. Standardized color coded designations by weed species facilitate map interpretation.

Percent cover by species

Mapping systems for weed management planning must be simple and the data must be easy to collect. Weed cover has been determined to be the most important stan-

Table 1. Five-letter codes and color designations for the 16 Montana noxious weeds.

Noxious weed species Common Name	Noxious weed species Scientific name	WSSA 5-letter code	Designated color (Berol® VERITHIN®/ white box)[1]	Designated color (Prismacolor Berol® VERITHIN®/black box)[1]
Category 1				
leafy spurge	*Euphorbia esula*	EPHES	Green (739)	Peacock Green (739)
Canada thistle	*Cirsium arvense*	CIRAR	Tuscan Red (746 1/2)	Tuscan Red (746 1/2)
Russian knapweed	*Centaurea repens*	CENRE	Carmine Red (745)	Terra Cotta (745 1/2)
spotted knapweed	*Centaurea maculosa*	CENMA	Lavender (742 1/2)	Parma Violet (742 1/2)
diffuse knapweed	*Centaurea diffusa*	CENDI	Light Grey (734 1/2)	Warm Grey (734 1/2)
field bindweed	*Convolvulus arvensis*	CONAR	Pink (743)	Deco Pink (743)
whitetop (hoary cress)	*Cardaria draba*	CADDR	Sky Blue (740 1/2)	Peacock Blue (740 1/2)
Dalmatian toadflax	*Linaria dalmatica*	LINDA	Canary Yellow (735)	Canary Yellow (735)
St. Johnswort (goatweed)	*Hypericum perforatum*	HYPPE	Olive Green (739 1/2)	Olive Green (739 1/2)
sulfur cinquefoil	*Potentilla recta*	PTLRC	Orange (737)	Orange (737)
Category 2				
dyer's woad	*Isatis tinctoria*	ISATI	Grass Green (738)	Grass Green (738)
purple loosestrife	*Lythrum salicaria*	LYTSA	Purple (752)	Dahlia Purple (752)
purple loosestrife	*Lythrum virgatum*	LYTVI	Black (747)	Black (747)
Category 3				
yellow starthistle	*Centaurea solstitialis*	CENSO	Ultramarine (740)	Ultramarine (740)
common crupina	*Crupina vulgaris*	CJNVU	Violet (742)	Violet (742)
rush skeletonweed	*Chondrilla juncea*	CHOJU	Scarlet Red (744)	Scarlet Red (744)

[1]Because of a change in ownership there are 2 versions of the Berol® VERITHIN® pencil packs. The original set comes in a white box. The new set comes in a black box. There are slight differences in the color names and numbers. Please use the colors listed in the column that refers to your box. Please choose different colors for mapping other county-designated noxious weeds not listed here.

dard data to be collected for the statewide system. Cover may be estimated as a percent of the ground covered by a particular weed species. Estimates are categorized by cover class. Cover class should be indicated directly on the map next to the infested acres symbol. Use the following symbols to indicate infestation cover class.

Cover class

T = (Trace; rare): less than 1% cover.
L = (Low; occasional plants): between 1 and 5% cover.
M = (Moderate; scattered plants): between 5 and 25% cover.
H = (High; fairly dense): between 25 and 100% cover.

Additional information (such as weed density or growth stage) is optional and can be noted on either base maps or clear overlays.

Density (optional)

Note number of plants per square yard or square meter.

Growth stage (optional)

S = Seedling
B = Bolt
Bd = Bud
Fl = Flower
SS = Seed Set
M = Mature

Using weed survey data

Weed data and maps can be used to develop a county weed management plan based on land-use objectives. Critical management and environmental information such as weed species present, extent and severity of weed infestations, and environmental conditions (e.g. sensitive areas) can be determined from maps. Maps can also be used to direct the implementation of the weed management plan. They show the location of areas needing attention and can be used to set priorities, estimate needs for equipment, supplies and labor, and to guide action crews. Once the plan is implemented, maps can be used to evaluate weed management strategies by comparing initial maps with subsequent maps to find out how weed infestations have changed over time. This information should be used to identify portions of the plan which do not meet management objectives and to adjust management strategies.

Maps can also be used to predict those areas potentially subject to weed invasion and guide surveys of land adjacent to infested areas. They can be used as communication tools for public awareness and education, and for calculating the economic and ecological impacts of noxious weed invasion.

Authors are land resources project coordinator and extension noxious weed specialist, respectively, Department of Plant, Soil and Environmental Sciences, Montana State University-Bozeman. Published with approval of the directors, Montana Agricultural Experiment Station as Journal No. J-5106.

The authors appreciate the efforts of the *Montana Noxious Weed Survey and Mapping System* working group which includes representatives of county, state, and federal agencies as well as private individuals. The Guidelines for Coordinated Management of Noxious Weeds in the greater Yellowstone Area provided the basis for this mapping system. We gratefully acknowledge the Montana Department of Agriculture-Noxious Weed Trust Fund for providing funding for this project.

Nebraska Range Shortcourse: A Successful Approach to Continuing Education

Daniel R. Vaughn, Anthony D. Watson, Lowell E. Moser, and Walter H. Schacht

Casual visitors to Nebraska rarely see the diversity of the 23 million acres of its rangeland. The state boasts of its nonparalleled range beef cattle industry which relies heavily on the Sandhills, a seemingly endless expanse of grass-covered dunes. In sharp contrast to the Sandhills, however, is a wide array of landscapes including the pine ridge of northern Nebraska, the sagebrush grassland of the southwestern region, the shortgrass prairie of the panhandle, the highly-dissected loess hills, and wooded river valleys. These landscapes offer a complex mixture of habitats, recreational opportunities, rangeland products, and management challenges. People with varied education and experience have interest in stewardship and management of Nebraska rangelands. They include ranchers, personnel of the Cooperative Extension Service and Natural Resource Districts, high school agricultural teachers, university professors and students, and federal agency personnel [e.g., Natural Resources Conservation Service (NRCS) and United States Forest Service (USFS)]. Because of the diversity and number of people interested in range management in Nebraska, a continuing education program was identified as a means of providing comprehensive instruction in range science and management.

Nebraska

In 1978, the Nebraska Section of the Society for Range Management (SRM) developed the Nebraska Range shortcourse through a grant from the Old West Regional Range Program of the USDA Soil Conservation Service. This was the beginning of a 20-year success story in adult range education. The Nebraska Section, in collaboration with the University of Nebraska-Lincoln, planned and conducted the first shortcourse. The University of Nebraska-Lincoln (UNL) has assumed the leadership in organizing and teaching since 1978. Chadron State College (CSC) faculty, USFS and NRCS personnel, and ranchers currently contribute to classroom and field instruction. The Nebraska Section is a sponsor and the section's Range Shortcourse Committee is comprised of a group of the course's instructors.

The shortcourse is designed to meet the needs of a diverse audience. It provides (1) continuing education for people working in range-related occupations such as ranchers, range conservationists, or other professional range managers; (2) fundamental education in range science and management for individuals with little or no range background; and (3) field application experience and integration for range undergraduate and graduate students. It also exposes participants to the philosophy and personnel of the range-related educational institutions and agencies in Nebraska. Although the course is open to anyone interested in management of rangeland resources, the goal of the course is to provide an integrated view of rangeland management to individuals with training or experience in managing various components of rangeland or agricultural ecosystems. The article outlines a successful approach to conducting a continuing education experience in range management.

Structure and Approach

The shortcourse is offered in June of even-numbered years at CSC in northwestern Nebraska. It is an intensive, week-long commitment and participants thoroughly immerse themselves in the study of range science and management. The Chadron area offers access to public lands, ranches, and other areas having a diversity of range sites and plants. When registering, participants are given the opportunity of taking the shortcourse for academic credit, either from UNL or CSC. It can be taken for undergraduate or graduate credit, but individuals taking the graduate credit option must complete a project in addition to the week-long course. Examples of projects have included conducting range surveys, preparing written reviews of range-related subjects, or developing ranch plans.

Participants are provided a 3-ring binder containing materials relating to each section of the course. Each morning, 3 to 4 classroom sessions about 1 hour long are presented by experts in each topic area. Afternoon field trips are used as a means for participants to gain practical experience related to material learned in the classroom sessions. This schedule provides variety and stimulates informal interaction among instructors and participants. Evenings are left open for studying plants and course material or for further interaction among participants and instructors. A quiz is given each morning covering the previous day's activities to encourage participants to review material presented. In the middle of the week, participants take a plant identification test in the field. A comprehensive exam is given on the final day so that participants and instructors can assess the effec-

tiveness of the shortcourse as a learning experience. Scores on the tests also serve as the basis for assigning course grades for those signed up for credit.

Topics

The course is structured around 5 main areas of range management: (1) rangeland resources; (2) ecology; (3) management of private and public land; (4) grazing and livestock management; and (5) fitting livestock to the production environment. Fundamental concepts are learned first to establish a foundation. Later, these concepts are integrated into practical application scenarios.

A slide presentation, "Vegetation Evolution on the Great Plains," on Sunday evening allows the participants to visualize the evolution of Nebraska rangeland and sets the stage for the course. Registration is completed and course materials are distributed during the first evening so that instruction can begin promptly the following morning.

Range Resources

Rangeland resources, i.e., geology, hydrology, soils, and plant physiology and identification, are emphasized on Monday. Factors involved in forming range soils illustrate why there is diversity among range sites. Plant physiology and morphology, including the impact of defoliation, provides a basis for understanding plant growth and response to environmental factors and management. Plants are identified on an instructor-led afternoon field trip. Participants learn the characteristics of about 75 common grasses, forbs, shrubs, and sedges. Their diligence in studying plants during the first part of the week pays off when a plant identification exam is given mid-week (Fig. 1).

Ecology

The interrelationship of climate, soils, plants, and animals in Great Plains ecosystems is the focus of the second day. An emphasis is placed on plant community dynamics and community response to environmental and management-related factors. Ecological models (e.g., plant succession, multiple stable states, and state-and-transition) are presented as they relate to assessment of range condition and health. The morning classroom instruction concludes with a session on range sites and condition. Students determine species composition, practice plant identification, and calculate range condition scores on an afternoon field trip (Fig. 2). Soil cores are removed from various locations to demonstrate the differences in range sites.

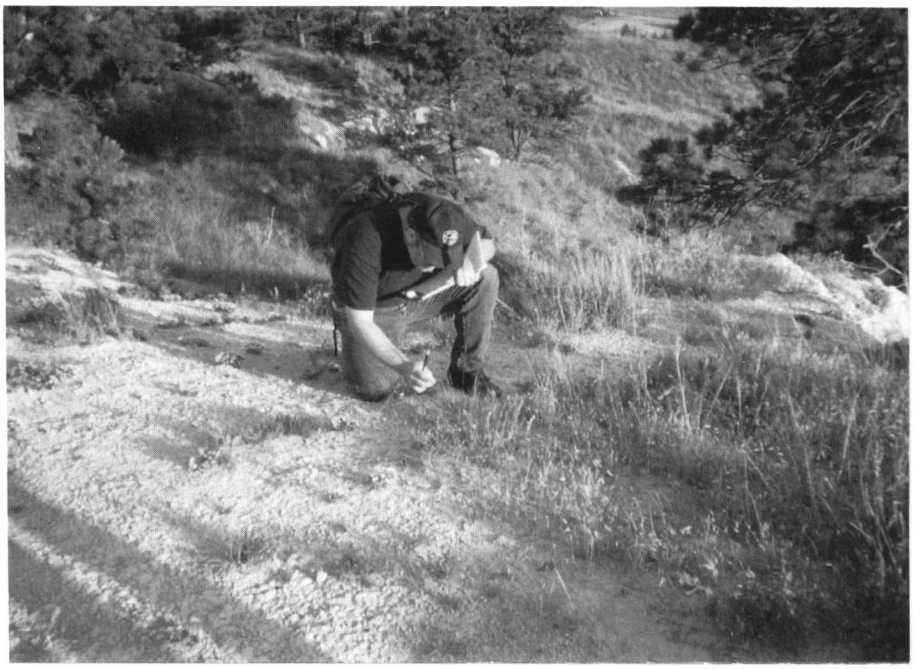


Fig. 1. *John Overstreet, Nebraska Forest Service, studies one of about 75 grasses, forbs, and shrubs in preparation for the Wednesday evening plant identification exam.*

Management of Private and Public Land

Prescribed burning and revegetation are evaluated as examples of strategies for managing private and public rangeland. Staff of the USFS describe public land management for multiple uses, including recreation, wildlife, livestock, and conservation. A classroom session on inventorying vegetation and assessing wildlife habitat precedes an afternoon trip to USFS land. Participants are given an opportunity to interact in small group discussions and to conduct inventory exercises using such methods as the Robel-pole to document visual obstruction and the step-point method to determine botanical composition.

Grazing and Livestock Management

Matching livestock demand to the range resource is a key topic. Participants balance forage supply and demand to determine the appropriate stocking rates and related management strategies. Grazing systems and their potential to influence stocking rate, range condition, and management flexibility are illustrated. Range livestock management practices are discussed emphasizing nutrient requirements at various phases in the animal's life cycle. A computer decision support system, Grazing Land Applications, is presented as a tool used by the NRCS for analyzing management plans and aiding in decision-making processes. Visualizing range management concepts in a production setting is accomplished by a ranch tour. An important part of the tour is the question and answer session with the rancher that allows participants to explore areas of personal interest in more depth.

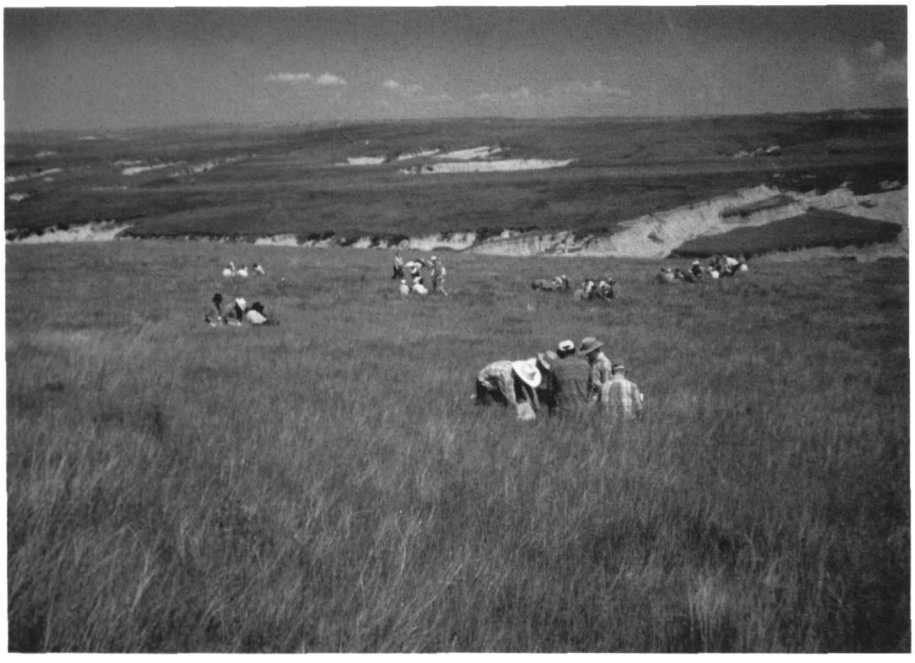


Fig. 2. *Shortcourse participants assess range condition during an afternoon field session.*

Fitting the Livestock to the Range Resource

The final session is jointly presented by an animal scientist, a range scientist, and a range economist. They stress integrating rangeland, livestock, and economics in making decisions in a range livestock enterprise. Various management practices used in cow-calf operations are assessed, and alternatives are evaluated. Particular emphasis is placed on reducing production costs by adopting management strategies which minimize high-cost inputs (e.g., harvested forages and commercial feeds) and extend the grazing season.

Keys to Success

The Nebraska Range Shortcourse has 421 alumni. Interest in the course has remained high and enrollment has been excellent with an average of 45 to 50 participants. The following factors have been identified as keys to the continued success.

- Hands-on approach and small group interaction during field trips.
- An intensive, interactive, week-long format provides the depth of experiences the participants are seeking.
- Optimum enrollment number (45–50) keeps individual registration fees low while maintaining a group size that is logistically manageable
- Popular activities such as plant identification allow participants to make measurable progress during the week.
- Quizzes and exams encourage participants to review subject matter during the week.
- Core instructors (5) remain at CSC the entire week and are available during the day and evenings for discussion.
- Social activities (e.g., evening tours and group dinners) improve group identity and interaction.
- Food and lodging at CSC are available at reasonable prices.
- Formal evaluation allows participants to critique the course and provide input for course improvement.

The comments from participants have been very positive. One participant stated "the plant identification exercise really challenged me and seems so essential in understanding what makes up some of our rangeland. I kind of surprised myself on how much and how fast I was able to learn these plants." Another participant said the course "rounded out [my] knowledge of the different aspects of range management." In 1996, all participants stated that they would recommend the course to others. The overall rating of the course in 1996 was 1.96 on a scale of 1 to 5 with 1 being the highest and 5 being the lowest.

Over the years, the shortcourse has "evolved to include more synthesis material and less specific information," emphasizes Dr. Lowell Moser, the shortcourse coordinator. Instructors and organizers continually seek ways for improvement by reviewing comments from participants, updating or refining subject material, evaluating presentation methods, and developing new field activities. The Nebraska Range Shortcourse is a successful vehicle to increase the knowledge base of people interested in and/or are actively involved in managing rangelands. It has successfully met the educational needs of each year's class even though the participants have varied backgrounds. Participant diversity has been a positive aspect of the shortcourse and has added breadth to discussions and field activities. Instructors have been encouraged to recognize the diversity when developing their presentations and to provide individualized instruction to participants whose range management knowledge is at either an especially low or high level. The shortcourse will continue to evolve and meet the changing needs of those interested in rangeland stewardship and management. Contact Lowell Moser, Coordinator, for further information about the Nebraska Range Shortcourse.

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California Certified Rangeland Manager Program

William E. Frost, James W. Bartolome and J. Michael Connor

The intent of California's Certified Rangeland Manager Program is to ensure and provide evidence of professional competency, to protect the public interest, and to promote proper management of the state's rangeland resources as embodied in the Code of Professional Ethics of the Society for Range Management. The need to create this program arose from a series of California state laws and legal interpretations of those laws.

The Professional Foresters Licensing Act became law in 1972. Leaders in the range and wildlife professions declined to participate in development of the law because they felt it had no chance of enactment and would have little impact on non-foresters. They were wrong.

The Professional Foresters Licensing Act requires a license to practice forestry in the State of California. The Board of Forestry is responsible for standards, administration, and enforcement of the activities of registered professional foresters. In 1987, partly due to public pressure for stricter enforcement of forest practice rules, the Board of Forestry appointed a task force to examine the role of the Registered Professional Forester in management of hardwood-dominated rangelands, which includes most of the California hardwood-annual grass type range. Surprisingly, the task force determined that the Professional Foresters Licensing Act required a Registered Professional Forester to supervise all wildland management. The implication was that nearly all range managers would have to either be licensed as foresters or work under the supervision of a Registered Professional Forester. The following year the Board of Forestry appointed an ad hoc Hardwood Range Committee charged with developing and recommending administrative and possible legislative solutions (i.e. changes in regulations and laws) to enable resource professionals other than Registered Professional Foresters to legally supervise work on wildlands. This committee included the California SRM Section President. The ad hoc committee concurred with the earlier task force findings, but also suggested clarification of legal terms and definitions, revisions of regulations, and changes in the Professional Foresters Licensing Act to provide for non-forestry professional practice.

In 1990 the SRM Section's Professional Affairs Committee was alerted by a member that the California Professional Foresters Examining Committee was looking into the issues of non-Registered Professional Foresters practicing wildland management. Around the same time the SRM Section was informed by the Executive Secretary of the Professional Foresters Licensing Committee that any person other than a Registered Professional Forester making management recommendations on private rangelands would be subject to prosecution. In response, the Board of Directors of the California Section of SRM asked its Professional Affairs Committee to propose certification criteria and procedures, and by 1992 the Section had developed and approved procedures, created a Panel on Certification, and was ready to certify rangeland managers. Also in 1992, the California Assembly modified the Professional Forestry Licensing Act to authorize individuals to seek Board of Forestry licensing under the auspices of an approved professional society's program. The California Section, SRM Panel on Certification finalized its program for certification, and it was presented to and accepted by the Board of Forestry. The next year the California Code of Regulations was amended to allow state licensing of Certified Rangeland Managers under the Professional Foresters Licensing Act and another law slightly narrowed the scope of the Professional Foresters Licensing Act as applying to "forested landscapes." Forested landscapes were defined as "tree dominated landscapes and *their associated vegetation types* which are naturally capable of growing a significant amount of native trees." The interpretation of this description has been that a 10 percent native tree cover (or the potential) constitutes a forested landscape. Thus, hardwood rangelands (oak woodland) within the State were clearly included in the scope of the regulations.

The SRM Section began certifying rangeland managers in 1993, and since 1995 Section certified individuals can apply for state licensing.

The SRM Section began certifying rangeland managers in 1993, and since 1995 Section certified individuals can apply for state licensing. Certification by the Section requires meeting certain educational and experience requirements, providing letters of reference, and passing a written rangeland management examination. Applicants must have completed a course of study leading to a bachelor's or higher degree. If the applicant's degree is not in range management, he or she must have completed course work in rangeland ecology, rangeland plant physiology, rangeland animal management, rangeland policy and planning, range economics, and rangeland measurements. Also required are five years of professional experience directly related to range and/or rangeland management, including demonstration of the application of rangeland management principles. Part of this experience (preferably two years) must be in a range type found in California (not necessarily experience in California). The Certification Panel has the

discretion to substitute additional experience for partial fulfillment of educational requirements. Individuals not meeting the experience requirement must work under the supervision of a Certified Rangeland Manager or Registered Professional Forester until the experience requirements are met. Applicants must also provide three letters of reference attesting to their ethical and professional qualifications, one of which must be from a Certified Rangeland Manager. The Section's Panel on Certification reviews proof of education and experience. The applicant must meet requirements before being permitted to take the written examination.

The written examination is prepared by the Panel on Certification and administered by the State's Professional Foresters Licensing Committee. The day-long examination consists of short answer and essay questions related to ecology, plant physiology, animal management, policy and planning, economics, and measurements. Questions are targeted toward rangeland management conditions in California. The exam is offered one or more times a year at several locations throughout the state.

Those passing the exam become certified by the California Section SRM. This does not entitle the person to be known as a Certified Rangeland Manager, nor to be legally recognized as such. This requires licensing by the State of California. Fortunately, the State has accepted the Section's process as meeting their licensing requirements, thus, licensing is *only* a formality. The Section-certified individual must apply to the State for a license and pay an annual fee of $35. That person may then be referred to as a Certified Rangeland Manager. Applicants also pay a one-time fee to the California Section to cover administrative costs. The fee is currently $50 for Section members and $100 for non-members.

The certification program includes a process for disciplinary action for violations of professional standards. The procedure allows for censure, suspension, or revocation of certification for cause. Complaints are directed to the State Professional Foresters Licensing Committee, which refers them to the SRM Section's Panel on Certification for recommendations. The legal authority for action lies completely with the State, not with the Section.

A state license is required for range management activities on forested landscapes as described earlier. Forested landscapes include areas such as hardwood rangeland, and mountain meadows (as they are associated with conifer forests), but do not include shrublands incapable of having trees, native or cultivated grasslands, or croplands. The Board of Forestry and the Panel on Certification currently agree on the following interpretations of existing law. Activities covered include making management recommendations, developing conservation plans and management plans, and other rangeland management activities. Professionals working in the private sector, or for universities, state agencies, and federal agencies (when working on non-federal lands), should be licensed. Licensing is not required for landowners working on their own lands, nor is it necessary for individuals working on federal land. For example, employees of the Natural Resource Conservation Service or the California Department of Fish and Game should be licensed as certified rangeland managers if they are making management recommendations or developing conservation plans on areas such as privately owned hardwood rangelands. But Forest Service employees working on National Forest lands do not need licensing.

The California SRM Section has now certified approximately 90 persons.

What in 1972 was regarded as an unimportant state law applying only to foresters (Professional Foresters Licensing Act), has had significant beneficial effects on the range profession *in* California. This came about only through the determined efforts of many dedicated range professionals working closely with legislators and the Board of Forestry. Certification in general provides professional credibility for any profession, but is much stronger when it carries the weight of law. The development of certification standards required close examination of the levels of knowledge needed for professional practice and has provided the impetus for a much stronger continuing education program.

The California SRM Section has now certified approximately 90 persons. To date about 65 have chosen to become state-licensed. The California Section is working closely with the Board of Forestry and its Professional Foresters Examining Committee to continue clarification of laws and regulations and the proper role of Certified Rangeland Managers in resource management. This outcome, building on a solid legal basis, provides an excellent foundation for the future of professional rangeland management.

The authors are Natural Resource Advisor, University of California Cooperative Extension, Placerville, California; Professor of Range Ecology, University of California, Berkeley, California; and Superintendent, University of California Sierra Foothill Research and Extension Center, Browns Valley, California, respectively.

National Range Judging Contest

Angela S. Williams

Earlier this year I received a special request from Mark Moseley to attend the 1997 National Range Judging Contest Awards Ceremony in Oklahoma City, OK and present an award on behalf of the Society. The winners of the High Point Individual, Team and Coach in both the 4-H and FFA categories are presented an SRM jacket acknowledging their award. I graciously accepted as any good Director would do. Besides for years I have spent days out in the blistering heat, torrential downpours and chigger infested fields assisting with the actual contest. This was my first opportunity to not only hear the results but to see and/or participate in the awards banquet.

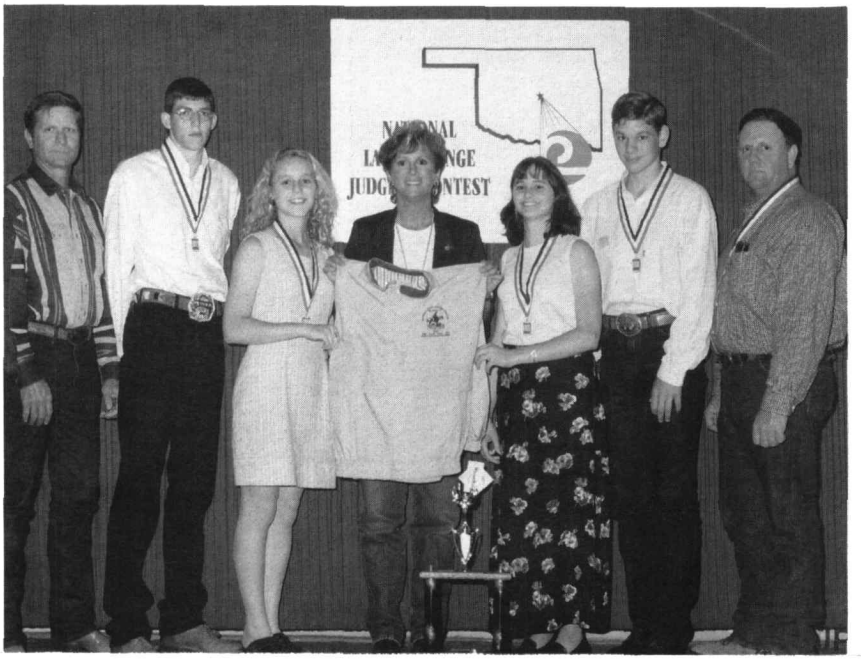
The evening of the banquet I arrived at the Fairgrounds to enter an open building which seemed as large as a football field to find it packed with a sea of "Blue Jackets", frayed Coaches, smiling parents and sponsors. As I stood at the podium and looked over the masses to introduce the Society, its mission, the award, etc., I found that it was a very humbling experience.

This last year there were over 900 students that participated in the contests from all reaches of the continental USA. I commended them for all their efforts and their tremendous commitment. Every individual who received a jacket was as proud of that award as they were of their trophy. Students and parents alike expressed their appreciation to the Society as well as commenting on wanting to become members. Some of the students had attended Range Youth Camps in their area and some have even attended local and national SRM meetings.

I saw before me the future . . . and it was a beautiful sight of intelligence and enthusiasm. I cannot express the pride I felt as an SRM member and a Range professional.

I truly believe that this activity within the Society is one of our best kept secrets. The presentation of this award is an effective tool for increasing our visibility, for promoting and recruiting members, for enhancement of our High School and student programs and most of all for sustaining a highly qualified resource base of potential range professionals.

Mark Moseley has informed me that the special account to pay for the purchase of these jackets is running dry. The funds that were used came from donations from Sections within the Society, which means that your Section will probably be receiving another request for contributions. This solicitation benefits all members of the Society. I encourage each Section to give this full consideration and priority. I can only say that I want to thank the Society for without serving them I would have missed out on one of the most memorable experiences of my career.



Kendall 4-H, Kendall Co, Texas—High Point Team. Team Members, Jessica Rose, J.T. Stehling, Lori Beth Moldenhauer, Brandon Rusch, Coach, Robin Glles and Bob Bailey.

High Point Individual, 4-H: Travis Waiser, Milam Co., Texas with Angela Williams

Menard FFA, Menard Co, Texas—High Point Team. Team Members, Kelly Jennings, David Anderson, Marshal Bridges, Coach, Ernie Eckert.

High Point Individual, FFA, Jason Barnes, Gans. OK and Angela Williams

Changing of the Guard: Undergraduate to Graduate Studies

As an undergraduate student there is a feeling of intimidation associated with the University environment. Professors are seen as adults who have the role of disseminating and delivering information to students who take or accept the material as "given". Perhaps it is due to socialized response to not question authority or parent/teacher figures, that there is little debate from undergraduate students as to the correctness or accuracy of the information being taught. In the move from undergraduate to graduate studies there is a transformation which occurs by virtue of the student's association to the taught subjects and their relationship with professors. The formation of such relationships and independent thinking parallels that in the professional world outside the University environment.

At a graduate level a slight transition is made from strictly being a pupil to being an investigator. In addition to classes, graduate students are often expected to conduct original research in a field related to their corresponding coursework. Therefore, the applicability of what is being taught can be referenced to specific data and situations experienced or soon to be experienced by the graduate student. Even if the student has not yet begun their specific research, the principles of what they will be doing is at the forefront of their mind. As a result of this increased listening and knowledge of the specific concepts being taught in classes, graduate students can bring additional insight, have basis for debate and provide possible new conclusions to the subject being taught. The level of learning is thus increased from an undergraduate level of accepting and learning to a graduate level of investigating and analyzing.

A second factor to explain the transition is that many graduate students are in their mid-twenties or older, thus putting them at a different social dynamic with their professors. Professors may be seen more as peers and colleagues than as authority figures. Concurrently, it is also often in a person's early to mid-twenties that they begin to form friendships with their parents rather than a child-parent relationship. By relating to teachers as colleagues, a greater potential for scientific discussion and genesis of ideas is more likely to occur. Learning to work well with people is one of the most valuable skills education can provide. In the professional world, to have colleagues as resources is crucial in the realm of a person's career; to have colleagues as friends is important in the realm of personal satisfaction. Considering that a minimum of 35% of each week is spent at work for many people, the relationships formed with co-workers can affect the overall enjoyment, or disenchantment of a career. Integral to any relationship is communication, and how effectively a person can express or communicate their needs/ideas, thoughts can shape their life. Similarly the importance of communication carries over to how supervisors manage employees. Effective leadership can stimulate individual ownership in projects and increase the potential for the formation of a relationship of colleagues, and not merely boss-worker. This ownership in projects and relationships as colleagues is the essence of the graduate student-professor relationship. When the ability to form these types of relationships is coupled with the ability of independent thought, graduate students are well-prepared for professional careers outside the University environment.—**Meegan Flenniken**

Author is Graduate Research Assistant, CSU, Ft. Collins, Colorado.

Where the Caribou and Moose roam
Where the drone of the Beavers, Otters, Super Cubs, Rangers and 182's are occasionally heard.

With a little persuasion at Rapid City from Ed Nelson my brother Jeff and I are on a range tour we won't soon forget. Ed's daughter Brenda and her husband Ron Fleming contributed this trip to the SRM Endowment fund silent auction.

The week long trip started at Smithers, British Columbia where we boarded a float equipped Cessna 182 and flew north to the head waters of the Finlay River. This was the first range tour I've been on where we landed on a river and got stuck on a gravel bar. Brenda the assistant guide, cook, taxonomist, photographer and mother now had the added duty of helping us get off the gravel bar.

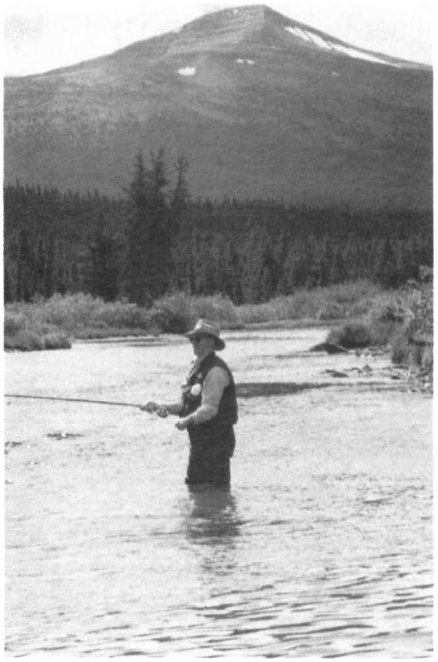
The first day in camp Ron and Brenda's daughter Rena assumed initial guiding responsibilities and showed me again the technique of tieing knots in leader material that could be used for spider webs.

With a few hours coaching, Ron has helped me develop my stream surveying technique to satisfactory. After several more days of surveying we have a base line established; if there wasn't a fish on at least every third cast things were slow. It wasn't slow very often!

We found Caribou while hiking on plateaus and basin and Moose were regulars around the camp and on the river. On one day we watched 14 moose including two mature bulls and five calves.

It was a great time thanks to Ron, Brenda and Rena! I highly recommend it for anyone wanting a great time fishing, hiking and just taking it easy. Ron and Brenda also take Caribou, Moose, Goat and bear hunters starting in mid August (a trip I hope to take in coming years).

Our thanks go out to Ron and Brenda for the great time and their contribution of this trip to the Endowment Fund silent auction. Also a personal thanks to Ed for goading me into "putting my money where my mouth is".—**Lou Hagener**



(EVP Report Continued from Page 3).
manager. I won't speculate on the reason for this decline, but I will say that SRM needs their ideas, their energy, and their diversity. They on the other hand, need the knowledge, networks, and opportunities for growth that SRM can make available. In conclusion, I am reprinting, with permission, an article by Idaho Section President John Fend, on his reasons for federal employees to belong to SRM. This article appeared in the summer edition of the Idaho Section Newsletter.

> Why belong to the Idaho Section of the Society for Range Management? As a career federal employee practicing 'rangeland management' for my first ten years, then 'ecosystem management', and now as a 'line manager' directing traffic across the entire range of public resources, I have found my affiliation with SRM priceless.
>
> The doors that have opened from the professional networks I maintain through SRM are nearly endless. Colleagues offer advice, mentor and challenge, professional meetings offer discussions of current events, and working within the SRM leadership committees provides a place to develop people skills and influence policies/positions developed by the parent Society. The professional journals offer research developments, discussions of management techniques and practices, and editorial opinions that challenge all of us to maintain an open mind.
>
> While at times this journey has been a rocky road (the SRM positions have not always agreed with my own), it's the dedication to the profession of rangeland management and the rangelands themselves by this Society and its diverse members that I believe in. I assert that you have to be actively involved, dedicated to improvement, and personally effective to influence changes–"If not you, then who?".
>
> If you are already a member great! Go out and talk to yours peers. Convince them of what the Society for Range Management has to offer and ask them to join. If you are not a member, or have not renewed your membership yet, please join us! We are a fun bunch with many years of collective experiences just waiting to be tapped. Look for the membership application within this newsletter and join us now! And welcome aboard!—*John Fend, Area Manager Bureau of Land Management.*

John comments are very appropriate for consideration by federal employees or anyone else who would benefit by participating in SRM.—**J.C. Whittekiend, EVP.**

Happy Holidays!

Requiesat in Pace

Mr. Irvin L. Sealander, a charter member of the Society for Range Management, passed away on July 2, 1997 of heart disease. He was 86 at the time of his passing.

Irvin was born in Lyons, Colorado and lived in Riverside, California for 30 years before moving to Yuba City, California 2 years ago. He was a range conservationist for the U.S. Department of Agriculture Soil Conservation Service in Riverside and Escondido for 35 years, retiring in 1975. He received his bachelor's degree in soil science from Colorado State University in 1937. He served in the U.S. Army during World War II and was discharged in 1946 with the rank of captain.

As well as being a devoted member of SRM for 50 years, Irvin belonged to the Soil Conservation Society of America, the Native Plant Society, the Jurupa Mountains Cultural Center, the Lyons Historical Society, Grace Luthern Church, and VASA Lodge in Riverside.

He is survived by 2 sons, John of Los Angeles and Norman of San Pedro; a daughter, Sara of Yuba City; 2 grandchildren; and 2 great-grandchildren.

The family suggests that any memorial contributions be made to the Nature Conservancy, 201 Mission St., Fourth floor, San Francisco, Calif. 94105.

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I certify that the statements made by me above are correct and complete –*J.C. "Craig" Whittekiend,* Managing Editor.

A National Insect

Steve Lucas

Most countries have national birds, each state in the USA has a state bird, state flower, state tree; there is even a movement to establish a state soil. With the following poem, I suggest a national insect:

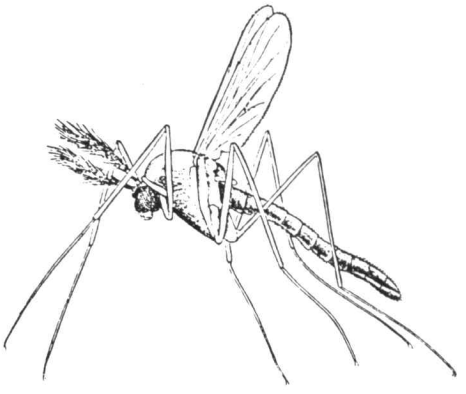
A National Insect

The selection of an insect to represent the United States,
Has become the topic of many arguments and debates.
The dairymen want the butterfly, the bee keeper wants the bee
Preachers want the mantis, and Athletes want the flea.
(for unsurpassed leaping abilities)
Women support the lady bug, and horse riders, the horse fly.
Importers want to give the Japanese beetle a try.

I, for one, shall cast my vote for the mosquito, I think.
She wakes me up many times at night when she stops to take a drink.
My head may nod, and I may doze at calving times of years.
I am quickly awakened, though, by mosquitoes buzzing in my ears.

Scratching bites helps keep me awake on hot summer nights too.
Without this insect to keep me awake, I don't know what I'd do.
Some may laugh at what I say, but to this I retort:
That mosquito is better than any flea,
And worthy of your support.

Steve Lucas
Mountain View Farm
Louisa, Virginia



Browsing the Literature

Jeff Mosley

This section reviews new publications available about the art and science of rangeland management. Personal copies of these publications can be obtained by contacting the respective publisher or senior author (addresses shown in parentheses). Suggestions are welcomed and encouraged for items to include in future issues of *Rangelands.*

Animal Ecology

A comparison of weaning techniques in farmed wapiti *(Cervus elaphus).* J.C. Haigh, J.M. Stookey, P. Bowman, and C. Waltz. 1997. Animal Welfare 6:255–264. (Western College of Vet. Med., Univ. of Saskatchewan, 52 Campus Dr., Saskatoon, SK S7N 5B4, Canada). Calves allowed fence-line contact with their dams displayed less stress than calves visually separated from their dams, but weight gain of the two groups did not differ at 31 and 63 days after weaning.

Effects of drought and prolonged winter on Townsend's ground squirrel demography in shrub steppe habitats. B. VanHorne, G.S. Olson, R.L. Schooley, J.G. Corn, and K.P. Burnham. 1977. Ecological Monographs 67:295–315. (Dept. of Biol., Colo. State Univ., Fort Collins, CO 80523). Townsend's ground squirrels in sagebrush habitat survived drought and severe winter weather better than ground squirrels in grassland habitat.

Genetic changes in reintroduced Rocky Mountain bighorn sheep populations. N.N. Fitzsimmons. S.W. Buskirk, and M.H. Smith. 1997. Journal of Wildlife Management 61:863–872. (Dept. of Zoology, Univ. of Queensland, Brisbane, QLD 4072, Australia). Suggests management practices to minimize the loss of genetic variation from reintroduced populations of bighorns.

Predicting late winter distribution of muskoxen using an index of terrain ruggedness. C. Nelleman and P.E. Reynolds. 1997. Arctic and Alphine Research 29:334–338. (Norwegian Inst. of Land Inventory, Drobakveien 11, N-1430 As, Norway). Muskoxen in winter favored habitats with rugged terrain that likely influenced local vegetation and snow conditions.

Social learning an important influence on foraging behavior in white-tailed deer? D.E. Spalinger, S.M. Cooper, D.J. Martin, and L.A. Shipley. 1997. Journal of Wlldlife Management 61:611–621. (Dept. of Biol. Sci., Univ. of Alaska, 3211 Providence Dr., Anchorage, AK 99508). "We suggest that food selection by white-tailed deer is largely an innate behavior and that hand-reared deer are essentially the foraging equivalents of maternal-reared or wild animals."

Theory and practice of immunocontraception in wild mammals. L.I. Muller, R.J. Warren, and D.L. Evans. 1997. Wildlife Society Bulletin 25:504–514. (Dept. of Agr. & Natural Resources, Delaware State Univ., Dover, DE 19901). Reviews the use of immunocontraception to control wildlife populations.

Grazing Management

Grazing sheep and cattle together or separately: Effect on soils and plants. A.O. Abaye, V.G. Allen, and J.P. Fontenot. 1997. Agronomy Journal 89:380–386. (Dept. of Crop & Soil Environ. Sci., Virginia Tech Univ., Blacksburg, VA 24061). Grazing cattle and sheep together benefited several plant and soil variables compared with grazing cattle and sheep in separate pastures.

Landscape Teacher's Guide. L. Flowers et al. 1997. (Jeff Mosley, Montana State Univ., P.O. Box 172820, Bozeman, MT 59717). This teacher's guide (grades K–12) on livestock/wildlife relations was developed to accompany the video "Landscape: A New Story of Possibility in Changing the American West".

Off-stream water sources for grazing cattle as a stream bank stabilization and water quality BMP. R.E. Sheffield, S. Mostaghimi, D.H. Vaughn, E.R. Collins, and V.G. Allen. 1997. Transactions of the ASAE 40:595-604. (S. Mostaghimi, Dept. of Biol. Syst. Engin., 308 Seitz Hall, Virginia Tech Univ., Blacksburg, VA 24061). Installation of an off-stream water trough for cattle dramatically reduced streambank erosion, nutrient loading, and fecal bacteria loading caused by cattle grazing. Also, cattle preferred to drink from the trough rather than the stream.

Wild ungulate damage: Perceptions of farmers and ranchers in Montana. L.R. Irby, J. Saltiel, W.E. Zidack, and J.B. Johnson, 1997. Wildlife Society Bulletin 25:320–329. (Dept. of Biol., Montana State Univ., Bozeman, MT 59717). Rangeland and pasture forage consumption was the most common type of damage by wild ungulates, while damage to haystacks was the least frequently cited problem.

Hydrology

Stream channel adjustments following elimination of cattle grazing. F.J. Magilligan and P.F. McDowell. 1997. Journal of the American Water Resources Association 33:867–878. (Dept. of Geog., 6017 Fairchild, Dartmouth Coll., Hanover, NH 03755). Exclusion of cattle grazing from eastern Oregon streams enabled stream channels to narrow and pool frequencies to increase.

Improvements

Effects of simulated defoliation on leafy spurge *(Euphorbia esula)*-infested rangeland. D.R. Kirby, T.P. Hanson, K.D. Krabbenhoft, and M.M. Kirby. 1997. Weed Technology 11:586–590. (Dept. of Anim. & Range Sci., North Dakota State Univ., Fargo, ND 58105). Defoliating leafy spurge twice per growing season for 4 consecutive years reduced its stem density by 55%.

Measurement/Sampling

Measuring dominance and diversity in ecological communities: Choosing the right variables. Q.F. Guo and P.W. Rundel. 1997. Journal of Vegetation Science 8:405–408. (Lab. of Struct. Biol. & Mol. Med., Univ. of California-Los Angeles, Los Angeles, CA 90095). Recommends biomass or productivity data as the best variable to use when calculating community diversity.

Plant/Animal Interactions

A comparison of sheep- and wildlife-grazed willow communities in the Greater Yellowstone Ecosystem. C.E. Kay and J.W. Walker. 1997. Sheep & Goat Research Journal

13:6–14. (Texas A&M Res. & Ext. Ctr., 7887 North Hwy 87, San Angelo, TX 76901). Concludes that excessive browsing by wild ungulates has caused willow communities to decline in Yellowstone National Park.

An increase in herbivory of cottonwood in Yellowstone National Park. R.B. Keigley. 1997. Northwest Science 71:127–136. (Greater Yellowstone Research Group, Biol. Resources Div., U.S. Geol. Survey, Bozeman, MT 59718). Narrowleaf cottonwood will likely be eliminated from Yellowstone National Park's northern range unless elk browsing is reduced.

Are overabundant deer herds in the eastern United States creating alternate stable states in forest plant communities? K.A.K. Stromayer and R.J. Warren. 1997. Wildlife Society Bulletin 25:227–234. (Biosphere Program, U.S. State Dept., Room 107, SA-44C, Washington, DC 20522). Presents evidence that browsing by white-tailed deer is creating alternate stable states in woody plant communities of the eastern United States.

Moose herbivory and carbon turnover of early successional stands in interior Alaska. K. Kielland, J.P. Bryant, and R.W. Ruess. 1997. Oikos 80:25–30. (Inst. of Arctic. Biol., Univ. of Alaska, Fairbanks, AK 99775). "Thus, the net effect of moose browsing on aboveground and belowground processes in these early successional stands is to accelerate carbon turnover."

Wild ungulate influences on the recovery of willows, black cottonwood and thin-leaf alder following cessation of cattle grazing in northeastern Oregon. R.L. Case and J.B. Kauffman. 1997. Northwest Science 71:115–126, (Big Lake Ranch, Big Lake, BC V0L 1G0, Canada). Wild ungulate browsing limited the height, crown area, crown volume, and standing biomass of willows.

Plant Ecology

Absence of interactions between perennial bunchgrasses in a semi-arid temperate savanna: A 5-year field experiment. G.R. McPherson. 1997. Journal of Arid Environments 36:565–570. (School of Renewable Natural Resources, Univ. of Arizona, Tucson, AZ 85721). This study did not detect any response by perennial grasses to changes in the basal area of neighboring perennial grasses.

Determining reference conditions for ecosystem management of southwestern ponderosa pine forests. P.Z. Zule, W.W. Covington, and M.M. Moore. 1997. Ecological Applications 7:895–908. (School of Forestry, Northern Arizona Univ., Flagstaff, AZ 86011). "The mean presettlement fire interval between 1637 and 1883 was 3.7 yr for all fires and 6.5 yr for widespread fires.

Effects of elevated CO^2 and defoliation on grasses: A comparative ecosystem approach. B.J. Wilsey, J.S. Coleman, and S.J. McNaughton. 1997. Ecological Applications 7:844–853. (Dept. of Biol., McGill Univ., Montreal, PQ H3A 1B1, Canada). Elevated levels of atmospheric carbon dioxide did not alter forage quantity for ungulates, but forage nutritive quality declined in C-3 grasses.

Growth and survivorship of Fremont cottonwood, Goodding willow, and salt cedar seedlings after large floods in central Arizona. J.C. Stromberg. 1997. Great Basin Naturalist 57:198–208. (Ctr. for Environ. Studies, Arizona State Univ., Tempe, AZ 85287). Saturated soils favored Goodding willow, dry surface soils favored Fremont cottonwood, and salt cedar was equally abundant in saturated and dry surface soils.

Stand structure and vegetation dynamics of a subalpine treed fen in Rocky Mountain National Park, Colorado. J.B. Johnson. 1997. Journal of Vegetation Science 8:337–342. (Dept. of Biol., Colorado State Univ., Fort Collins, CO 80523). Describes the progressive colonization of a sedge fen by spruce and subalpine fir trees.

Socioeconomics

Compensation programs for wildlife damage in North America. K.K. Wagner, R.H. Schmidt, and M.R. Conover. 1997. Wildlife Society Bulletin 25:312–319. (USDA-APHIS, 9701 Blomberg St. SW, Olympia, WA 98512). Reviews the nature and extent of financial compensation programs for damages caused by wildlife in the U.S. and Canada.

Conservation under the Endangered Species Act: A promise broken. National Wilderness Institute. 1997. ($25; NWI, P.O. Box 25766, Washington, DC 20007, Phone: 703-836-7404). This 75-page report concludes that, "The problems with the ESA are profound and require drastic revisions or wholesale replacement to create an endangered species program that will result in real conservation achievements."

Grazing the Hill

Vivan M. Jennings
Washington Representative

Paul Johnson Returns to Iowa

On November 8, 1997, Paul Johnson, the immensely popular Chief of the Natural Resources and Conservation Service (NRCS) returned to his home state of Iowa. Earlier, Johnson announced that he had decided to return to life on his farm. Johnson said: "it has been an honor to serve NRCS, conservation partners, and private landowners for the past four years, but now it is time to go home."

Johnson leaves NRCS at a time when conservation partnerships are strong. Private landowners, linked through NRCS efforts have made substantial progress over the past decade. It was through Johnson's leadership, that conservation issues were addressed and measured progress was made. Paul was never on the defensive about problems confronting NRCS. He can take credit for providing outstanding leadership to reach a shared vision of conservationists to not only protect soil and water resources, but to enrich the land we live in.

Johnson leaves NRCS with a statement from the new publication, "Geography of Hope" where it states: "As we move into the next millennium, our Nation must strive for a state of harmony. We can no longer be satisfied with slowing erosion, water pollution, and other forms of land degradation. Harmony will demand that we set our sights higher to improve the land upon which our destiny rests by restoring those places that are damaged, by enhancing those places whose condition is merely adequate, and by protecting those areas that remain pristine. Achieving the ideal may well prove impossible, but helping farmers, ranchers, and others try is the fundamental mission of NRCS."

Paul Johnson's wisdom, judgment, and wit will be missed as he leaves the helm of NRCS for other opportunities. We wish him well in his new endeavors.

Pathways–Why are We Here and Where are We Going?

When pioneers made their way west in the 1850's, they encountered a sign at the eastern edge of the prairie stating they should choose their rut carefully, since they were going to be in it for the next 500 miles.

The pathway we follow individually and organizationally often evolves in strange ways. We sometimes continue to do what we continue to do. Often we plan our future by looking in the rear view mirror, or follow a comfortable pathway to get from one point to the other. That's not bad planning initially, but may need to be altered as our purpose, or why we are here, or our vision of where we want to go changes.

When George Washington commissioned General Braddock to build a military road to western Pennsylvania in the mid 1700's, Braddock followed Nemacolin's trail. Nemacolin, a native American scout, had followed an animal trail across the mountains for years, as did his ancestors. Braddock closely followed the trail to reach his destination. This road, originally known as Braddock Road evolved into the National Pike, or U.S. Route 40, which most pioneers followed west to reach their destination. It served its' purpose well, but today, most travelers, unless they're looking for a scenic route, take Interstates 68 and 70, or fly, to reach their destination more quickly and efficiently.

Messages from across the country, and certainly, you hear it in our Nation's Capital, indicate that professional society members individually and organizationally need to look at new pathways to become engaged and to be relevant. At a minimum, a new pathway needs to openly reflect a societies' purpose, mission, and vision. Possibly more attention needs to be focused on ways to communicate and link with the public. Politically, times are changing, and its not a good time to be singing to the choir.

For most part, external from SRM, the public knows little about rangeland ecosystems but are intensely interested in the health of rangeland and natural resources. They often don't know how to engage in the process in a meaningful way. What we need to do is determine new and interesting ways that make it easy for other people, young and old, and external to SRM to know what we do professionally that makes a difference in their lives and interests. We need to make it easy, not hard, to find out who we are, why we are here, and where we are going. Increasingly, we will find that the public will be accessing us through new forms of information technology. We must revise our system to take full advantage of the new technologies available. I'm not aware of a single household in the development where I live, that doesn't have a computer. Most of them easily access and get information off of the World Wide Web to help make decisions. To be relevant in the future will require developing creative communication links to the world.

SRM President John Buckhouse is spearheading action by the Board of Directors to revise and update the SRM Strategic Plan. Input and creative thinking is needed to reflect on who we are and where we are going as an organization. Your input in the process is needed now to bring about the needed changes to make SRM an effective organization that meets the needs of not only its members, but other stakeholders as well.

SRM Joins CAST

At its November 1–2, 1997 meeting in Chicago, the Council for Agricultural Science and Technology (CAST) voted unanimously to accept the Society for Range Management as a member of the organization.

CAST is this Nation's largest member supported consortium of agricultural scientists. Its collective professional membership represents 35 organizations and now exceeds 80,000 members.

For the past 25 years, CAST has identified food, fiber, environmental and other agricultural issues and interpreted related scientific research information for public policy decision makers. CAST works closely with legislators, regulators, and the media and provides balanced scientific information. CAST also creates scientific publications and disseminates them to influential readers so they are better informed on the issues. Legislators find CAST reports crucial in separating fact from fiction as they are called on to draft new legislation and make important decisions.

If you would like to know more about CAST, you can visit their web site at http://www.netins.net/showcase/cast/.

SRM will have one member on the CAST Board of Directors. The member representing SRM is yet to be determined.

Status of Livestock Grazing Legislation

The Livestock Grazing Bill has now been voted on by the full floor of the house and passed 242 to 182. It will next go to the Senate. If it passes there, it will go on to the Joint Committee. That will take some time and probably not happen until after the first of the year. It will then need the President's signature to be enacted.

The *Washington Post* has taken the position that the President should veto the Bill. But, there are a lot of reasons that he may not. Foremost, is political support in the Senate for the Bill and related issues. Also, House Ag. Committee Chair Bob Smith has sent a letter to the editor of the *Washington Post* challenging the paper's position on the issues.

Federal Agencies Fail GPRA Accountability Plans–or do They!

As first reported in the *Washington Post*, August 27, 1997, House Majority Leader Richard K. Armey (R-Tex.) has handed out failing grades to the top federal agencies for inadequately meeting the requirements of a new law aimed at measuring the performance of government programs. According to Armey, draft "strategic plans" prepared by federal agencies for the Government Performance and Results Act (GPRA) left out required elements and did not address major management problems.

The GPRA signed into law by President Clinton in 1993, was to be a key element in his "reinventing government" initiative. The GPRA gave agencies time to prepare five-year strategic plans and were supposed to be published in September, 1997. The law was designed to force agencies to explain their goals for major programs, establish measures for their progress ,and demonstrate what the public gets for its tax dollars.

On August 7, Armey sent a letter to Office of Management and Budget Director Franklin D. Raines stating "rather starkly how far agencies are from the ideal." On Armeys' score card, there is a possible 105 points. The highest score was the Social Security Administration with 62 points. The lowest was Labor at 6.5. The average score was 29.9. Third from the bottom was Agriculture with a score of 11. By November 5, Agriculture's score has increased to just under 30. Somewhat higher than Agriculture, but below the average, was Interior with 26.5 points. By November 5, Interior showed only a slight increase in their score.

So what does all this mean? It means that once again, trying to mandate action doesn't work very well with people and the same goes for agencies. The law was supposed to link program performance with the budget process, but Hill appropriators, who carry a lot of clout with agencies have not paid much attention to the GPRA. The end result shows a great need to improve communications between the Hill and departmental and agency leadership. Those in agencies tell me that quantification of goals is difficult, but the understanding within agencies of long range goals, actions and teamwork expected is valued highly by staff and administrators who provide the leadership. The bottom line, is GPRA is having many other benefits of great importance to the functioning of federal agencies not easily observed.

Now, a new twist has been added, politics. It's a case of dueling banjos between Vice President Gore and top House Republicans! On the morning of November 5th, Armey and three GOP colleagues, gave another scathing report of the new strategic plans failing to improve government agency program performance. By afternoon, Gore issued his National Performance Review report portraying that his reinvention program was right on track. Gore stated that the NPR "has become the longest and by far the most successful government reform effort in U.S. history." When told about the Armey report indicating failing grades for government agencies, Gore replied that the feeling was mutual, with an obvious reference to House Republicans performance.

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