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Melding Rangeland Ecology and Livestock Grazing Management

by **Kris Havstad**, *Supervisory Scientist, USDA, Agricultural Research Service, Arid Rangeland Research Unit at the Jornada Experimental Range, Las Cruces, New Mexico*

Introduction

Sixty-one years ago, F. E. Mollin wrote an article entitled *If and when it rains: the stockman's view of the range question* published by the American National Live Stock Association (1938). That article conveyed the idea that our western rangelands were in good shape and any deteriorated lands would be restored with adequate rain. We've come a long way from the extremism of that 1930s dust bowl perspective. We now know that many of our western rangelands have been overgrazed, that some areas remain in degraded states despite adequate rainfall, and that some rangelands shouldn't be grazed by livestock. Yet, we also know fairly clearly that livestock grazing of rangelands can be a sustainable practice for many sites, for many seasons, and for many years. Extensive experimentation has illustrated that grazing can be managed and the integrity of rangeland ecosystems, in terms of

their ability to produce, capture and store nutrients and to conserve soil resources, can be maintained.

The purpose of this essay is to outline a scientific perspective that links rangeland ecology with management of rangeland grazing by live-

stock. We know that well-managed grazing on appropriate sites is characterized by managerial control over the intensity, timing, and frequency of livestock grazing. We also know that some sites (such as riparian areas as described by A.J. Belsky, A Matzke and S. Uselman in a 1999 article in the first quarter issue of the *Journal of Soil and Water Conservation*, pp. 419-431) may require periods of rest and/or very controlled grazing management practices. Irrespective, the livestock management principles underlying these practices have been well described and don't need elaboration in this essay. What needs elaboration are the ecological intricacies of these rangelands, and the ecological processes that should be the basis for their management.



Editor's Note

This is the first of four newsletters on issues surrounding the **New Ranch**. This edition discusses the **Ecology of the New Ranch**. Future newsletters will address the **Economics of the New Ranch**, the **Market and the New Ranch**, and the **Community and the New Ranch**.

Understanding and Modification

During the 20th century

(con't on page 19)

From the Founders

Jim Winder
Courtney White
Barbara Johnson

It is hard to believe that it has been a little over two years since we founded the Quivira Coalition. It seems like only yesterday—and a million years ago.

We set forth on our journey wondering if anyone would pay attention to our message of cooperation and collaboration, especially the media. The New Ranch, we thought, lacked the rhetorical extremism that seemed to be a prerequisite to getting noticed in a very noisy world.

Fortunately, we were wrong.

There are many barometers to measure our success. We started with less than 100 names on our mailing list; now we have 1200. We began with only three members—us; now we have almost 500.

New grass is growing along Macho Creek, on a mine site near Cuba, among the rolling hills south of Quemado, and in the mountains above Peñasco.

We have been profiled in newspaper stories from Deming to Taos; in Range magazine and American Cowboy (upcoming); our op-eds have been published in daily papers in Tucson, Omaha, and Los Angeles.

The most important barometer, however, is our volunteers. Without the help of so many talented and dedicated folks, the progress of the Quivira Coalition would have been negligible.

Thus, at the conclusion of our second full season of work, we want to thank our volunteers publicly. We sincerely hope they will continue to work with us in the future.

Many thanks to:
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THE QUIVIRA COALITION

551 Cordova Road, #423
Santa Fe, NM 87501

(505) 820-2544

(505) 466-4935 (fax)

www.quiviracoalition.org

Founders:

Jim Winder

(505) 267-4227

jrwinder@aol.com

Courtney White

(505) 982-5502

wldwst@rt66.com

Barbara Johnson

(505) 466-4935

lunah3@aol.com

Editor:

Barbara Johnson

(505) 466-4935

lunah3@aol.com

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 Rio de la Vista,
 Pagosa Springs, CO
 Anne Watkins, Albuquerque
 Terry & Diana Wheeler,
 Globe, AZ
 Jim & Joy Williams, Quemado
 (and all the others we forgot!)

We are looking forward to
 another exciting year. We hope
 you are too!

From the Founders (con't)



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What About Nature? Or What Does Nature Have to Say About Grazing?

by Dan Dagget

A friend of mine who teaches ecosystem studies at Northern Arizona University regularly takes his students out onto nearby rangelands for field trips. When he does, he usually asks them whether the lands they're visiting are healthy or not. Often, he says, the students have trouble answering. They fidget and get nervous and eventually ask him a question: "Is this land grazed or not?"

Many of us would experience the same unease if we were put in the middle of black gramma grass, rabbitbrush, and juniper in which we couldn't see any obvious clues as to how it was being managed. And so we would likely ask the same question my friend's students ask: "Is this land grazed or not?"

And if the answer we get is "Yes," most likely we would respond as those students do. We would say the land was unhealthy. If, on the other hand, we were told, "No, this land isn't being grazed," most of us would say the land was healthy no matter what it looked like.

We would answer in that way because most of us assume that if land is being left alone it is healthy. In fact, that's what most of us mean by healthy when it comes to the land—that it is being left alone. We're like an environmentalist I know who was talking to a rancher one day when the rancher offered: "Tell me what you want this land to be, and I'll make that my goal and manage toward it, and then we can be allies instead of adversaries."

The environmentalist thought a while and then answered,

"There's only one thing you can do to make this place better. . . you can leave. Because if you leave, whatever happens will be natural and, therefore, good, and if you stay, whatever happens will be artificial and, therefore, bad."

There's a problem with this approach to judging the health of rangeland ecosystems. For one thing, using this technique, we can judge whether a piece of land is healthy or not without even seeing it.

If you don't think this sort of judging can get you into trouble, I've got some examples that might change your mind. Some of them you've already read about in earlier issues of this newsletter. Some of them you haven't.

U Bar Ranch

First, consider David Ogilvie's U Bar Ranch along the Gila River in southwestern New Mexico. This ranch, at present, serves as the home to more endangered Southwestern Willow Flycatchers than any other place in the world. The reason those birds are there, scientists tell us, is because of the way David manages his ranch. Specifically, because he has returned water flow to a series of dirt irrigation ditches whose natural leakage nurtures a riparian forest of cottonwoods and box elders that serves as habitat for the flycatchers. David's management includes grazing cattle in some areas where the flycatchers are nesting and feeding. If you would say the land is unhealthy because cattle graze there, you may want to clear



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that with the flycatchers. They, obviously, have endorsed David Ogilvie's management with their presence, with their nests, and with the highest rate of breeding success of any known population. Southwestern Willow Flycatchers, in other words, would say that, as far as they're concerned, this is some of the healthiest land on the planet.

Cyprus Miami Copper Mine

Next, consider an area where Terry Wheeler, a rancher and ecologist from Globe, Arizona, has used cattle to initiate natural healing processes to transform an ecological disaster into a green and growing grassland.

The restoration site is located on a pile of copper mine tailings roughly 1,100 acres in area and up to 300 feet thick at the Cyprus Miami Copper Mine in Miami, Arizona, southeast of Phoenix. These tailings are what's left of copper-bearing rock that has been dug up, crushed to the consistency of talcum powder, and then treated with a combination of chemical agents which includes, among other things, cyanide. After the chemicals have been used to leach the copper and other marketable minerals from the ore, the leftover slurry is drained and piped onto the huge intentional spill I have just described. There the tailings sit in suspended animation, a dilemma Nature has been unable to solve, incorporate, or reclaim for more than half a century.

Terry, who grew up in Globe, looked at that pile of mine tailings for most of his life and saw nothing but sterile rock dust and

the problems it caused. After taking a course in Holistic Management, however, he saw the same area as an opportunity and a challenge. "That course got me to thinking," Wheeler declared. "Soil's a living thing. It's made up of rock dust and micro-organisms. We've got plenty of rock dust. All we need is to add the micro-organisms."

Wheeler surmised that, by enriching the tailings with organic material in the form of hay and by having cattle trample that hay into the tailings and add the microbes from their gut to jumpstart the process of decay, which is the essence of a living soil, he could turn that sterile pile of mine tailings into a living ecosystem.

And so he did. After a lot of hard work and sweat and wondering whether this method was going to work or not, Terry Wheeler and the cows he call Four-Legged Organic Soil Builders (or "FLOSBes") covered a considerable chunk of that tailings pile with green growing grass, and they were making steady headway on the rest.

So, here you are on a field trip, like those students, getting ready to answer the question, Is this land healthy or not? First, you walk out onto the untreated tailings. As you do, you sink in almost to your shoe tops. When cattle step onto this stuff, they sink in sometimes to their chests. As you look around, you notice that the only things growing here are a few small, spindly weeds, and they're crusted with tailings. A puff of

(con't on page 16)

What About Nature? (con't from page 4)

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To Rest, Or Not To Rest: Lessons from a Chaco Fence

by Courtney White

(with Kirk Gadzia)

Few issues inflame the passions in the grazing debate more than the question of rest.

For many environmentalists, “Rest the West!” is the only acceptable resolution to the problem of persistent overgrazing by livestock; to many ranchers, rest is an unacceptable economic hardship; to public land managers, rest is often a convenient “out” for resolving contentious problems on the range (often unsatisfactorily); for holistic educators, rest is just one tool that can be used to effectively manage land; to scientists, rest is a complex puzzle; and to the

National Academy of Sciences book *Rangeland Health* (1994), along to help me understand what I was seeing.

Fence Line Contrast

We stopped at the park’s East Boundary fence, where it meets the pavement. On the western side of the fence was the National Park Service, which had excluded livestock from grazing on its land for over 50 years. On the eastern side was the Navajo Nation, whose cattle could be seen loafing nearby.

The contrast between the two sides was as dramatic in September as it had been a dozen years ago when Allan Savory declared the conditions on the Chaco side to be an archetypal example of the dangers of overrest. Savory even took classes to Chaco to see for themselves.

My goal this day was not to declare anything. I wasn’t looking for a silver bullet of any sort, yea or nay. I simply wanted to learn a few facts; and with Kirk’s guidance, what we saw is summarized in the box on page 7.

We agreed that both sides of the fence looked unhealthy, from a watershed perspective. The impact of livestock grazing on the Navajo side was heavy, and apparent. Plants were

not being given enough time to recover before being bitten again. As a result, despite the recent rains, the plants on the Navajo side lacked the vigor they would have exhibited in the presence of well-managed grazing.

According to Kirk, however,

(con’t on page 7)



East Boundary of Chaco Culture National Historical Park. Chaco is on the left.

public at large, rest is often a simplistic solution.

But what, exactly, is “rest?”

In early September, I drove to Chaco Culture National Historical Park to take a peek at a famous fence line contrast, and maybe learn a few things about the complexities of this issue. I invited Kirk Gadzia, a range expert and co-author of the



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the Chaco side exhibited increased signs of instability (i.e., more unhealthy). “The major contributing factor to this condition is the lack of tightly spaced perennial plants,” he said “which exposes the soil to the erosive effects of wind and rain. When soil loss is increased, options for the future are reduced.”

He immediately put some caveats in place: it was impossible to say how much of what we saw was site specific. “The fence location itself may be a factor since it is located near the head of the watershed,” he noted, “although the downcutting of the arroyo begins immediately on the Chaco side of the fence.”

Other site-specific factors include how soil type might be affecting the plant community, how the cattle were managed, and what role the recent heavy rains might have played.

Effects of Rest

Nevertheless, Kirk made one generalization: based on his experience in arid environments around the world, total rest from grazing has predictable results. In the first few years, there is an intense response in the system as the pressure of overgrazing is lifted. Plant vigor, diversity, and abundance often return at once and all appears to be functioning normally.

Over the years, however, if the system does not receive periodic disturbance (i.e., fire or grazing by ungulates), then the symptoms listed in the box often materialize. “The net result,” says Kirk, “may not be what managers have in mind as their goal for the health of the land.”

All of which was plainly in evidence on the Chaco side of the

fence (we visited the South Boundary fence too, and found similar conditions, though on a much less dramatic scale).

“Does this mean Chaco is unhealthy?” I asked Kirk.

“From a watershed perspective, from what I’ve seen, I have to say yes,” he replied.

“But there’s a bigger question here,” he continued. “Is rest producing what the park wants? Ecologically, the answer is probably ‘no.’ But from a cultural resource perspective,

To Rest, or Not to Rest (con’t from page 6)

On The Chaco Side

Lots of bare ground
Lots of annuals and shrubs
Wide spaces between plants
Lots of woody material, some of it dead
Few juvenile plants
Lots of oxidized, gray plant material
Few bunch grasses
Greater diversity of plant species
Poor plant vigor
Undisturbed, capped soil
Evidence of soil movement
Puffy soil
Gullies and other signs of erosion
No manure
More birds
More seed production
No sign of overgrazing

On The Navajo Nation Side

Lots of plant cover and litter
Lots of perennial grasses
Tight spaces between plants
Few woody plants
Wide age-class distribution
Very little oxidization
Lots of bunch grasses
Less diversity of plant species
Poor plant vigor
Lots of trampled soil
Little evidence of soil movement
Tighter, compacted soil
No gullies, less signs of erosion
Lots of manure
Fewer birds
Less seed production
Lots of overgrazed plants

the answer might be ‘yes.’ From the public perspective, too. People may not want to see fire or grazing in their park.”

I thought about this all the way home. From the environmental perspective, prolonged rest in arid environments clearly can result in ecological harm. On the other hand, not

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The Señorito Creek Project

Holistic “reclaimers” at
work on mine slope.



This project began in July 1999 with the construction of initial training and holding paddocks and electric fencing.

On August 3, 31 cattle arrived on site and were kept for 3 days in the training pen. On August 18, 1999, 49 additional cattle arrived on site (for a total of 80) and were kept for 2 days in the training pen.

Nine flat paddocks have been constructed, averaging .21 acres each, for a total of 1.93 acres. Five slope paddocks have been constructed, averaging .24 acres each, for a total of 1.19 acres. A total of 3.125 acres have thus far been treated.

The average animal days per paddock have been 154 for the flat areas and 240 on the slopes. We have used 43 lbs of hay per head per day on the flat areas, and 62 lbs of hay per head per day on the slopes.

We are feeding the cattle on (about 20 lbs per acre) a seed mix of: Western Wheatgrass; Sideoats Grass; Mountain Muhly; June Grass; Southern Brome Grass; Orchard Grass; and Yellowblossom Sweet Clover. We are overseeding with whole oats.

Five permanent quantitative monitoring points were established in August using the Jornada Monitoring Protocol described on page 15: 3 on slopes and 2 on benches. The following baseline measurements were made: Plant community cover and composition (canopy and basal) were recorded using a line point intercept method. Additionally, canopy gaps were measured using a continuous line intercept in order to quantify the area which is potentially exposed to wind erosion and to characterize the site with respect to runoff. Soil samples were collected and

tested in the field for stability in water. This test is also an indicator of the level of soil biotic activity as most of the bonds which maintain aggregates larger than 1.5mm (the screen size) are organic. Photos have also been taken.

We held an Open House at the site on September 17 for permittees, members of the public, members of the Rio Puerco Management Committee, and the media. We have contacted the area BLM permittees, and some of the Forest Service permittees. We have also contacted many members of the Cuba community, and we have found consistent support for our efforts. We will soon schedule a meeting with permittees and other interested ranchers to begin work on a draft management plan for the Señorito Creek watershed.



Terry Wheeler, project director.

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Señorito Creek (con't)

Top: Contrast between re-claimed and unreclaimed land.

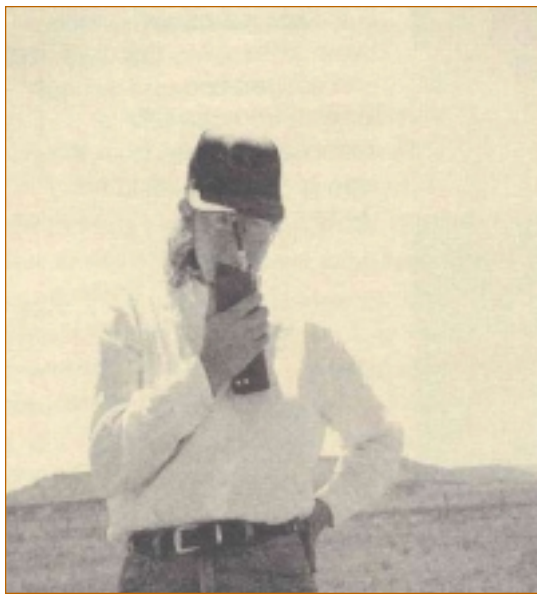
Middle: Project site.

Bottom: Open House at the overburden pile from the Nacimiento Mine, which is located on private land owned by Aparcio Gurule. This project could not have been undertaken without Mr. Gurule's help and cooperation and without funding from the EPA and consistent support from the New Mexico Environment Department.



*Profile of Good
Stewardship:*

The Davis Family and the CS Ranch



Julia Davis-Stafford on the radio.

Curiosity can be a productive tool, especially if placed in the hands of caring people.

It certainly seems to have worked to the benefit of the Davis family and the CS Ranch. In little over a dozen years, the 100,000 acre CS has transformed itself from a traditional cattle operation to one guided by the principles of holistic management.

The ranch's 3,000 head of cattle, which can graze on three separate parcels of private land near Springer, in northeastern New Mexico, are managed effectively as one herd. This allows the Davis family flexibility to control the impact of the herd on the land.

The family hasn't stopped there, however. Over the years they have fine tuned their management; expanded a profitable hunting and guiding service; investigated the benefits of conservation easements; and even co-hosted a workshop on rangeland health with the Quivira Coalition. Recently, the family has turned its attention to long-term monitoring of their land.

Curiosity, in the case of the Davis family, has expanded numerous horizons.

Family Affair

The CS is co-managed by all six children of Les and Linda Davis. Les' grandparents emigrated to northeastern New Mexico from Iowa in 1873. Perhaps following this ancestral spirit, the four brothers and two sisters migrated away from the ranch as young adults,

pursuing careers as different as pilot and public defender.

Eventually all six siblings returned to the CS. Although their motivations for coming home were different, they were united by an abiding love of the ranch and a deep family bond. "We were very tight as a family growing up," says Julia Davis-Stafford, "and we remain best friends today."

Things had changed, though, during their time away from home. The business of ranching, for example, had changed dramatically. The globalization of the economy, the centralization of the beef industry, advances in animal genetics, new technology, subdivision development pressure, and other "real world" factors confronted the whole Davis family.

Sitting still was not an option.

Fortunately, change had brought along new ideas too—ideas that the Davis family was willing to try. In the mid-1980s they enrolled in classes offered by Allan Savory's Center for Holistic Resource Management in Albuquerque. They liked what they heard and put this new thinking to work on the ranch.

And they never looked back.

As a private-lands ranch, the CS is shielded from most of the lawsuits, shouting matches, and finger-pointing that has engulfed grazing on public lands. A great deal of the shouting involves monitoring or the lack of it, and the ability of land managers to accurately determine the condition of the land and predict trends.

It is to the credit of the Davis family that they are willing to make such a determination anyway.

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Land EKG

One method they are trying is called “Land EKG”—the copyrighted name of a monitoring protocol developed by Charlie Orchard of Bozeman, Montana. Charlie is a fourth generation rancher who became frustrated one summer with the conflicting and time-consuming methods of monitoring he was required to use by various agencies. Worse, he wasn’t getting a sense for the “big picture” of range health. He decided there had to be a better way.

According to Charlie, Land EKG “visually depicts the relative health of the soil system and plant

pinpoints problems.

Indicators include the presence of living organisms, litter accumulation, gullies, pedestaling, the percentage of bare soil, the number of germination sites, species diversity, plant vigor, plant recruitment and distribution.

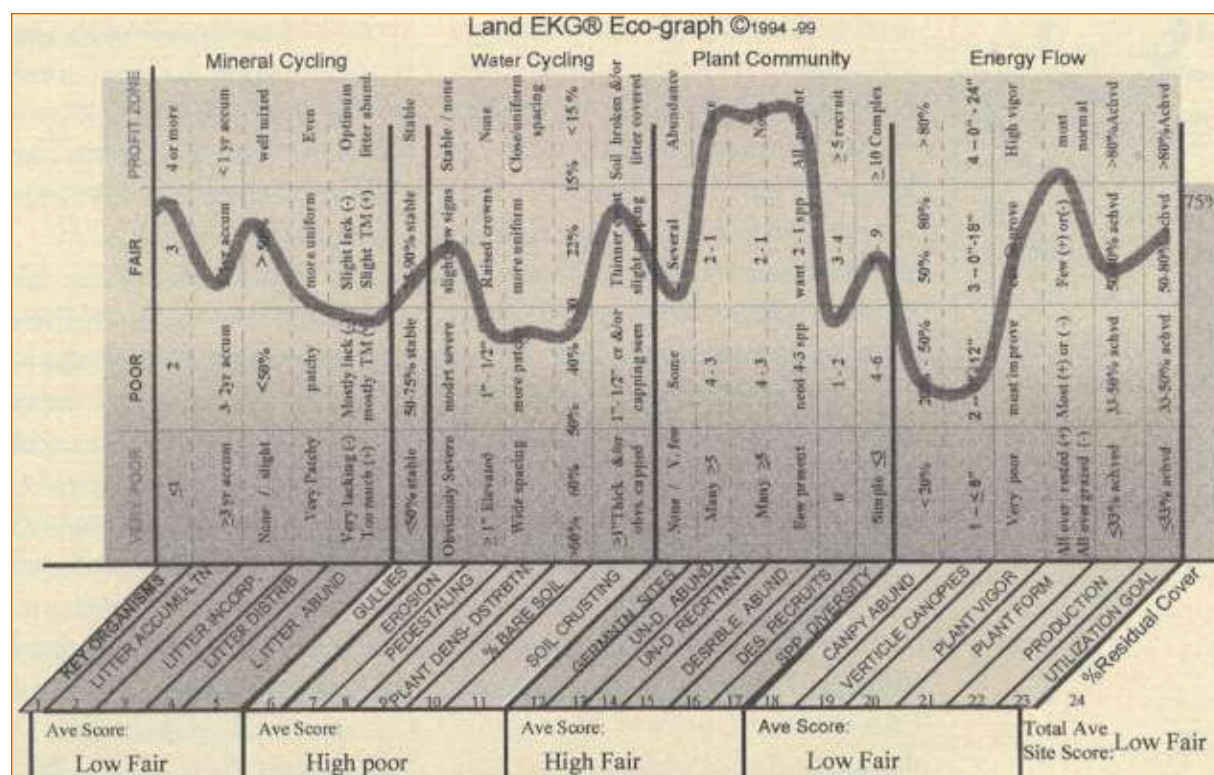
Questions that Land EKG asks include: Is litter cover adequate and cycling quickly back into the soil? Is top soil staying on site? Is moisture absorbed where it contacts soil? Is the plant community diverse? Does it express a healthy age structure? Is the capture of sunlight being optimized and effectively transferred to other life forms?

Good Stewardship:

CS Ranch

(con’t from page 10)

Land EKG courtesy of Charlie Orchard.



community, incorporating the four basic ecosystem processes: water cycle, nutrient cycle, energy flow, and plant succession.” Charlie studies 20 soil and vegetation indicators along permanent transects. The result is an “ecograph” that describes how well the site is functioning and

The answers to these questions are not idle curiosity—they could make or break a ranch financially. “Ranchers should monitor,” says Charlie, “to verify what we’re doing right, and change things if

(con’t on page 23)



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The Far Horizon

by Courtney White

*“Off with their heads!” —
The Red Queen,
Alice in Wonderland*

I really hate bumper-sticker environmentalism.

On October 4th, while traveling to speak at a conference honoring the legacy of Aldo Leopold, I innocently bought a copy of the *New York Times*. I opened it only to be confronted by a full-page advertisement entitled “*End Welfare Ranching*.”

The ad was the fourth in a series on the “*Extinction Crisis*,” paid for by an organization called the Turning Point Project. It contained the customary shock rhetoric about beer and oil barons feeding at the federal trough while their cattle denuded the land. The standard catalogue of ills associated with overgrazing were reiterated, along with the requisite “before” and “after” photos of a healthy stream vs. one nuked by cattle.

The ad’s authors even had the audacity to cite an article in *Bioscience* in support of their position—without stating one of the article’s conclusions, that recreation posed a greater threat to endangered species than grazing. I wondered if the next ad in the series would be “*End Welfare Recreation*.” I bet it won’t.

In addition to the usual suspects, the list of sponsors for the ad included, to my surprise, Earth Island Institute, Friends of the Earth, U.S. Public Interest Research Group, Wild Earth, and Defenders of Wildlife (a co-sponsor of the Leopold conference!).

I was appalled, to be frank. We all understand that overgrazing is a huge problem that needs immediate attention. Livestock grazing in the American West, however, incorporates a complex

web of ecological, cultural, historical, political, and commercial concerns; to wave the “magic wand” of abolition over the problem is not a viable solution.

In fact, of all the issues on the “To Do” list of environmental activists, grazing reform should be one of the most resistant to bumper-sticker sloganeering. So why is this train gathering speed?

Why Now?

Lately I have wondered aloud to friends and neighbors why so much momentum is building to extinguish public lands ranching. Why now, when so much scientific evidence points at decades-old overgrazing as the primary culprit in the poor condition of some rangeland? Why now, when the numbers of livestock on public lands are at historic lows (and going down)?

Why now, when the economics of the cattle business already have ranchers on the ropes; when the status quo, traditional ranching paradigm is crumbling before our eyes; and when a progressive ranching movement is beginning to make a difference?

Why now, when public land management agencies are giving greater weight than ever to ecological values as part of their “multiple use” mandate; when new ideas in land stewardship, particularly livestock and wildlife management, are beginning to take root among agency decision-makers; and when scientists are stepping up to the plate in increasing numbers to help solve environmental conflicts?

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Why now, when urban sprawl, often implemented at the expense of private farm and ranch land, has become a major concern of environmental organizations (fighting sprawl is one of four long-term national campaigns being conducted by the Sierra Club); when industrial-strength factory farms threaten our land and water; and when wildlife habitat is being fragmented by subdivisions across the West, sometimes at the rate of an acre an hour?

Why now, when our food supply is increasingly centralized in the hands of a very few corporate conglomerations; when the demand for organic food is on the rise; and when biochemical companies and feedlot operators insist on injecting meat with a widening array of genetically altered, technology inspired supplements?

Why now, when the corporate globalization of our economy threatens to wipe out the last vestige of our family-scale agricultural heritage; when indigenous peoples around the world are fighting to maintain their integrity and identity; and when collaborative efforts between rural and urban activists (who often share similar goals) are beginning to blossom?

Why now call for the end of public lands ranching? Why now, when solutions to problems so plainly exist? Why?

Trouble With Priorities

Much like the grazing debate itself, there is no simple answer to this question.

Mounting frustration by environmental activists at a con-

spicuous lack of progress on key issues, such as wilderness designation, is one partial answer. An embedded, and souring, "us vs. them" paradigm is another, especially since so much of the debate over the environment has shifted into the political arena. Ignorance, I'm sorry to say, is another explanation, as is anger.

A current event illuminates my concern. This summer, Secretary of the Interior Bruce Babbitt proposed the creation of a 450,000-acre National Monument in the "Arizona Strip" country, north of the Grand Canyon. He called the land one of Arizona's "last best places" and urged that it be preserved by an act of Congress. Conservation organizations immediately demanded that the ante be upped to one million acres.

A few years ago, I would have energetically applauded both proposals. Today, however, I have decidedly mixed feelings.

Babbitt made his proposal in order to "protect" the land. But protect it from what? Not from livestock grazing, since that use will be grandfathered into the legislation. Not from residential subdivisions, since most of the land is public, and very remote. Not from the destructive attention of a foreign-owned mining company, since the area is not minerally attractive (the threat of a coal mine was the catalyst for the creation of the Grand Staircase-Escalante National Monument across the border in Utah).

The Secretary cited concerns about potential oil-and-gas development and off-road vehicle

(con't on page 14)

The Far Horizon **(con't from page 12)**

Ball Caps Available!

Support the message of the Quivira Coalition by wearing one of our attractive ball caps. They are beige with a green brim and embroidery have this logo on them:



They are \$12 plus \$3 postage and handling. Send a check to 551 Cordova Rd., #423, Santa Fe, NM 87501 to order.

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The Far Horizon (con't from page 13)

“Drawing a line around one million acres of land may no more guarantee its ‘preservation’ than kicking all the cows off public land will guarantee long-term environmental rejuvenation.”

use. Doubtless these are legitimate threats to the area’s integrity, but I wonder if the benefits of their exclusion will be offset by the rise in tourism and other recreational pressures that will inevitably follow in the wake of the Monument’s designation? I, for one, am tired of seeing our “last best places” turned into playgrounds.

The point is this: our priorities are upside down. Damage is damage, no matter what, or who, causes it. We should work from the ground up. We should embrace complexity, not fight it. Preservation, as we have defined it for nearly a century, may not actually preserve much of anything anymore. Drawing a line around one million acres of land may no more guarantee its “preservation” than kicking all the cows off public land will guarantee long-term environmental rejuvenation.

As John Muir correctly observed, the universe is a complex system of interlocking parts, each one affecting the other. To pull on one is to pull on the whole; nothing can be, or should be, separated and isolated. Reductionism is as dangerous as absolutism.

Of course, John Muir never saw a bumper sticker.

Restoration

I believe the environment, especially public land, is in dire need of restoration, not just preservation.

I’m not a scientist, but it doesn’t take a Ph.D. to know that things are seriously out of kilter across the West. Overgrazing, overlogging, overmining, overrecreating, and many other

forms of overuse (as well as neglect) have imperiled many of our natural systems. Throw global warming, the carbon dioxide build-up in our atmosphere, and population pressure into the pot, and you have a recipe for a crisis.

The goal, it seems to me, is to solve these problems. The debate should move back to issues surrounding the basics of environmental health—what some call “proper functioning condition.” Values, such as grazing, mining, recreation, and preservation, should be secondary to function. Get the system to working properly first, then let’s have a debate about which value we wish to see occur there.

This isn’t rocket science; we already know how to restore many natural systems to functionality, and how to do it in an ecologically sensitive, self-sustaining manner. What we lack is the willingness to pull the debate out of the political arena and back into an environmental one.

This doesn’t mean turning over the keys to scientists. What it means is an energetic debate about environmental and economic health that engages the expertise of all the players. It means education, dialogue, cooperation, patience, respect, and trust—all of which are sorely lacking in the current debate over the future of our public lands.

It means the creation of more organizations like the Quivira Coalition. It means rolling up our sleeves, shaking hands, and getting to work on the real grassroots.

By that I mean the grass and the roots.

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A committee organized by the federal government recently defined rangeland health as “the degree to which the integrity of the soil, vegetation, and air as well as the ecological processes of the rangeland ecosystem are balanced and maintained.” Integrity was defined as “Maintenance of the functional attributes characteristic of a locale, including normal variability.”

The challenge for rangeland managers is to translate these definitions into on-the-ground meaning. One way to do this is with a monitoring program. The purpose of a monitoring program is to provide repeated and relevant interpretations of rangeland health that can be related to management impacts. These interpretations can then provide a basis for evaluating and adjusting those management actions.

Unfortunately, ecological processes are difficult to observe or measure. Monitoring methods usually rely on indicators, defined as components of a system whose characteristics are used as an index of attributes that are too difficult to measure. For example, amount of the ground at the soil surface covered by live plants (referred to as basal cover) is used as an indicator of vegetation health. Indicators have a long history of use in rangeland monitoring, and have usually been related to vegetation attributes. Today, our interests are in a broader evaluation of rangeland ecosystems, and we strive to monitor not only for biotic integrity, but also for soil stability and hydrologic function.

In 1994 the National Academy Press of Washington D.C. published a booklet entitled: *Rangeland Health: New Methods to Classify, Inventory, and Monitor Rangelands*. This booklet called for the

collection of consistent sets of data on a small, selected set of indicators as part of all current and ongoing rangeland management and assessment activities.

There are many systems available for monitoring rangelands. A difficulty is in identifying monitoring objectives and selecting a set of methods to achieve those objectives from all of the available techniques. The Quivira Coalition is using a newly developed manual on rangeland monitoring from the USDA in structuring the data we are collecting from our various on-the-ground projects. Scientists at the USDA Jornada Experimental Range are developing this manual with the Environmental Protection Agency.

The manual is divided into four sections. Sections 1 and 2 describe how to design and implement a monitoring program for a watershed or allotment. Section 3 provides details on each of the 10 types of measurements that may be included. The measurements described in these sections are designed for completion every 1 to 5 years. Few monitoring programs will include all 10 measurements. Section 4 describes how to enter and interpret the data. Appendices include information on qualitative evaluation systems for upland and riparian areas, estimating vegetation production, and calculating stocking rates for livestock.

The approach described in the manual:

—Combines rapid, qualitative approaches (developed by NRCS and BLM) with easily applied quantitative techniques, allowing field-based monitoring at the

Monitoring and the USDA's Rangeland Monitoring Manual

by Dr. Kris Havstad

“The purpose of a monitoring program is to provide repeated and relevant interpretations of rangeland health that can be related to management impacts. These interpretations can then provide a basis for evaluating and adjusting those management actions.”

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(con't on page 18)

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What About Nature? (con't from page 5)

wind gusts past you and propels a mare's tail of dust into the air and down into the town of Miami. In the restaurants there they joke about eating "tailings tacos."

Next, you walk out onto the part of the waste pile on which Terry Wheeler and his cows have restarted the natural ecosystem processes associated with functioning

were no such signs of life over on the untreated tailings.

If I were to ask you which of these two places is healthiest, the grazed or the ungrazed one, what would you say? If you have any trouble answering at all, consider what the plants have said. What have the deer said? What does the wind say? Have they said land is automatically unhealthy if it's grazed?

60 Years of Rest

Not too far from Terry Wheeler's mine tailings restoration, a barbed-wire fence separates a ten-acre watershed study plot from the surrounding desert rangeland. A sign inside the enclosure indicates that the land within the fence has been protected from livestock grazing since 1934—more than 60 years. The land outside the enclosure has continued to be grazed by cattle for those same 60+ years.

The startling thing about this living comparison is that both sides of the fence are virtually the same. More than 60 years of protection has produced no more diversity, no more grass, no more wildlife on the protected side than on the unprotected side. And on the unprotected or grazed side, more than 60 years of continued use, or as some would call it, abuse, has produced no less vegetation and wildlife and no more bare

(con't on page 17)



Dr. Scott Stoleson and David Ogilvie (right) looking for Flycatchers on the U Bar.

grasslands. Here, grass reaches to your knees, in some places higher. You notice that it's cooler here, too, and that the wind's not as strong because the plants diffuse the heat rays and break up the wind currents. When you look down, you notice that there is still plenty of bare dirt between the plants, but in these areas you see a thick thatch of hay trampled into the soil, armoring it against erosion. As you look closer, you see deer droppings and then the droppings of other animals. There



ground than on the “protected” side. This plot is not some oddball anomaly. Hundreds, maybe thousands, of similar comparisons exist all over the West. Of the scores I have seen, all have been just as unsupportive of the absolutist assumptions most of us make when we learn that a piece of land has been grazed or not.

What Is Nature Telling Us?

Consider what Nature is telling us in the places I’ve just described. When we do something that affects the environment (which is almost everything we do), the language which Nature uses to tell us whether it works or not is results.

Actions directed toward Nature are questions—“Does this work?” “If we do this, do we get what we want?”

Results are the answers. Bare dirt is an answer. So are two places that are identical in spite of the fact that they are being managed in ways most of us see as the antithesis of one another. In this case, the answer is: “No difference.”

When we pay attention to those answers, we engage in a functional conversation with Nature—a dialogue. When we don’t pay attention, we make what Nature has to say irrelevant in the same way we make what anyone says irrelevant when we ask a question and don’t listen to their reply.

By giving us a riparian forest full of proliferating flycatchers and by growing grass in an area where all other efforts to grow it have failed, it seems to me that Nature has said, “Yes, this works,”

with regard to what Terry Wheeler and David Ogilvie have done. By giving pioneers like these the remarkable results they have achieved, it seems clear that Nature has said in no uncertain terms that it is illegitimate to assume that if land is grazed, then it must be unhealthy.

Getting back to that fence that’s grazed on one side and not on the other—by giving us the same results on both sides of that fence, Nature seems to be saying that it is also illegitimate to assume that land that’s not grazed is always healthier than similar land that is. And, since that fence line comparison is only a few miles from the place where Terry Wheeler has used grazing to jumpstart the natural processes which create and sustain a functioning grassland, it would seem that Nature is telling us that protection is not even more “natural” than grazing. In fact, in some cases it is less so.

The Quivira Coalition is currently engaged in a number of results-based dialogues with Nature around New Mexico. One involves Terry Wheeler on a mine-site restoration within the Rio Puerco watershed near Cuba (see page 8). Another is a riparian recovery along Macho Creek near Deming. At present, we’re just asking questions, which means we’re taking action. And while we’re at it, we’re monitoring closely to make sure we don’t miss any of Nature’s replies. As we get those answers, we’ll be sure to pass them on to you via this newsletter. So stay tuned.

What About Nature? (con’t from page 16)

Help!

We are in desperate need of some volunteer help. We have grown much faster than our funds and we need help (which may turn into paying jobs) with **BOOKEEPING** and **GENERAL CLERICAL** work. If you are interested in helping the Quivira Coalition out, please contact our **Executive Director, Courtney White, at 505-820-2544.**
And thank you!



To Rest, or Not to Rest (con't from page 7)

“...we need to understand clearly the conditions on the ground in front of us. Objective data-gathering is an essential foundation for decision-making, and a prerequisite for combating the inflexibility that permeates so much of the grazing debate.”

enough rest—the source of overgrazing—or the wrong type of rest, also carries ecological costs. A compromise of the two, which might anger both ranchers and environmentalists simultaneously, may not be acceptable to federal land managers or to a judge.

At the same time, what's good for the environment may be bad for recreation, or the preservation of cultural resources, or public relations. Grazing cattle in Chaco is almost certainly out of the question, no matter what benefit it might have for the environment. Prescribed fire might be a problem as well.

Yet, as a trained archaeologist, I worry that Chaco's world-class archaeological treasures are being threatened by the effect of accelerating erosion from deteriorating environmental conditions in, and around, the park.

Nevertheless, my trip to Chaco reinforced my belief that before we can talk about archaeology, or fire, or grazing, we need to understand clearly the conditions on the ground in front of us. Objective data-gathering is an essential foundation for decision-making, and a prerequisite for combating the inflexibility that permeates so much of the grazing debate.

But we can't stop there. The next chore will be to bring together a confluence of like-minded values to solve problems—such as how to restore Chaco's watersheds to health without compromising its cultural resources, or its attractiveness to the tax-paying public.

Facts can be our steppingstones, but only if we are willing to walk toward a common goal.

(All photos in this issue are courtesy of Courtney White.)

Monitoring (con't from page 15)

landscape level.

—Integrates soil and vegetative indicators.

—Is designed to quantify the potential of the system to support a range of societal values rather than to support any particular value: to resist degradation and to recover following degradation.

—Is flexible and can be easily adapted to local conditions and objectives:

Both upland and riparian areas. Many measurements are common to both, reducing training time and increasing efficiency. Others are designed to capture the unique characteristics of riparian areas.

Different monitoring objectives, expertise, and time available. Decision trees and tables allow the user to base site selection, indicator selection, and the number of measurements on monitoring objectives and the time available. Measurements can also be modified depending on knowledge of, for example, local flora.

Different management objectives. Both the quantitative and qualitative systems are designed to provide information which supports a broad range of management objectives. Additional methods are included which provide more specific information.

—Is supported by an ongoing research program in which indicators are being directly calibrated to specific ecosystem functions.

Rangeland managers are currently editing a draft version of this manual prior to its publication in 2000. The Quivira Coalition will be sponsoring workshops on monitoring during 2000.



we've witnessed tremendous advancements in our knowledge of ourselves as organisms. Our understandings of our anatomy, our physiology, our nutritional requirements, the clinical basis for evaluating our psyche, our reproductive functions and behaviors, and our intellectual capacity are truly startling. This knowledge is from whole organism to sub-cellular, and from conception to death. Yet, we still are faced with significant gaps in our knowledge of critical elements influencing our individual survival, such as cures for certain diseases, variable consequences of aging, intricacies of our genetic code, and environmental influences on emotional development.

For example, there is no clear scientific basis supporting a specific "blue-print" for a parent to follow in rearing a child. Certainly, there are basic ethical beliefs for a particular culture within our society that might guide child rearing. However, a single methodology derived from hypothesis-based scientific experimentation and that services all possible combinations of parents, children, and environments does not exist. The science-based knowledge we have today provides the opportunity to raise healthy, well-educated children with longer life spans. Yet, how we accomplish that is still subject to debate, trial and error, opinion, prior experiences, outside influences, sudden disruptions, changing environments, cultural traditions, community mores, and individual characteristics.

Like the human sciences, we have an impressive knowledge base about specific processes that occur within ecosystems where we live. We understand many basic elements of nutrient cycling, primary production, and soil genesis, for example. This understanding has been rapid given that studies about nature and our environment are relatively recent.

(The term "ecosystem" was not defined until this century.) Yet, like human nature, there does not exist a single science-based blueprint for how we interact with our environment. The actual definition of ecology is the study of how organisms interact with their environment. Most of us are probably at least amateur ecologists in that we, at a minimum, try to understand and learn about our interactions with our environment. There are certainly some elements of ethical belief that permeate our understandings and shape our basic principles guiding our interactions with our environment. However, environmental management is constrained by our ability to manipulate only a few components of a landscape.

Thousands of Variables

It is difficult for us to manage growth and development of ourselves, our families, and our communities, and management of arid and semiarid lands is equally challenging. Rangeland ecosystems are a collective manifestation of thousands of variables and millions of interactions among those variables. Rangelands don't always "behave" in predictable fashions. Rangelands defy any easy, quick, simplistic encapsulation of their responses to livestock grazing, and they challenge application of any specific, single system, or blueprint, for their management.

There are no simple solutions, and we do a tremendous disservice to our understanding of our environment if we insist on simple explanations. This need for depth in understanding is not new. Fifty years ago, Lincoln Ellison wrote insightfully about rangelands in an article published in the *Journal of Forestry* (1949, vol. 47: 787-795):

"The man assigned the

(con't on page 20)

Rangeland Ecology and Livestock Management (con't from page 1)

***"Rangelands don't
always 'behave' in
predictable fashions.
Rangelands defy any
easy, quick, simplistic
encapsulation of their
responses to livestock
grazing, and they
challenge application of
any specific, single
system, or blueprint, for
their management."***

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November 1999

Rangeland Ecology and Livestock Management (con't from page 19)

JOIN US!

Would you like to join the Quivira Coalition? While we have are beginning to receive grant money, we still rely heavily on donations. If you would like to help us continue our educational mission, please send your contribution with this form to our Santa Fe address.

Yes! I would like to join the Quivira Coalition. I can contribute:

___\$15

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___\$50

___\$100

___Other

Contributions entitle you to receive this newsletter, notices of upcoming events and publications, and preference in enrollment for our Outdoor Classrooms.

Thank You!

management of . . . range land faces problems whose final solutions require years of scientific study, but he is expected to deliver immediate answers that are both correct and practical. With the help of a few ecological principles he must be his own scientist, and by observation ascertain what standards he can use for range in ideal condition, on a variety of sites. He must appraise the condition of each site—the character of soil erosion, vegetal cover, and plant composition in relation to the site's potentialities. Finally, he must weigh the evidences of change, to ascertain whether range trend is toward or away from the kind of plant cover and soil stability that is desired."

Today, both genders are involved in land management, but the essence of Ellison's remarks remains relevant. Ellison, and others who worked on and wrote about rangelands during the first half of this century, recognized that these were not simple, easily understood systems. For example, Ellison observed that sites had several potentials, and understanding took years of study. Ellison's remarks also acknowledged that factors other than forage conditions, such as soil stability and species diversity, were important in evaluating the condition of land. Interestingly, later in his article Ellison used the term "rangeland health" to reflect standards of soil stability and species composition for rangelands. Rangeland health is a term we are returning to today.

Four Management Objectives

We have made advances since 1949 in our understanding of ecological principles, the mechanisms driving ecological change, and characteristics of ecological sites. In thinking about management of rangelands today, we can build on Ellison's comments of 50 years ago. We should

strive for four objectives in managing livestock grazing on New Mexico's rangelands. 1) We should have some understanding of the ecological processes that characterize specific grazed environments. 2) We should know local conditions that modify those ecological processes within these environments. 3) We should monitor grazed environments in order to evaluate ecological responses to management. 4) We should be able to adjust management actions appropriately in response to monitored observations. Working towards these objectives can create a knowledge base for grazing management.

Ecosystems are defined as communities of organisms and their environment. In reality, communities and their respective environments can span from microscopic to global scales. Most often though, we probably think of ecosystems in scales we interact with, characterized by distinctive plant assemblages across the landscape. We know a tremendous amount about individual processes characteristic of our ecosystems, but much less about their collective interactions. We know a lot about the effects of drivers (drought and fire, for example), but less about how to drive the system ourselves. We know a tremendous amount about past manifestations of these ecosystems, and much less about future trajectories.

This confession of insufficient knowledge should not be discounted as a typical lament of a scientist. It's understood that we will never have complete knowledge, and that management decisions and public policy regarding rangelands will continue to be made from a limited knowledge base. However, it is important to recognize that we understand some pieces of the ecosystem puzzle, but

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many pieces need more clarification, and that there is no one set way to manage the pieces of all our different environments. What we strive for is sustainability.

Sustainability

In general, sustainability refers to the maintenance of ecological integrity over time. However, an exact definition of “sustainability” has been elusive. It has been argued that the application of sustainability to rangelands is nonsensical for two reasons. First, rangelands are dynamic and subject to change, defying the notion of long-term stability. Second, ecosystems by definition sustain use or they would cease to exist. Yet, if human use of rangelands is considered, and some economically based use is involved, the concept of sustainable use as a goal has value.

Sustainable use can be defined as an appropriation of production (such as biomass used by grazing livestock) that allows for natural processes to replace appropriated materials. This means that standards of use or consumption are, in some fashion, gauged to the natural limits of an ecosystem. This is what the melding of ecological principles and grazing management is all about today, and is what Ellison was trying to convey in his article in 1949. Thus, at the center of grazing management is the need to be able to evaluate rangeland environments.

Management Problems

Our primary problems related to management of livestock grazing are those we have continually dealt with throughout the 20th century: 1) coping with variations (spatial and temporal) in forage production, 2) manipulating an animal behavior process (grazing) that is plant species specific, and 3) managing grazing across landscapes with limited (if

any) measurements to monitor or assess impacts. Fortunately, there are management tools, such as conservative stocking and seasonal use, prescribed burning, and herding, that are effective in managing these problems.

Basically, though, what we want to manage for is plant production. This is not to be viewed as myopically managing for forage production, but as a much broader objective related to the composition and functioning of ecosystems. There are many processes that we can not effectively manage, but key processes related to plant production, such as germination, seedling establishment, and plant growth are processes we can impact.

Additionally, there is a tremendous knowledge base related to factors that influence plant production processes that we can employ in our management. Plant production processes serve as a means for organizing our knowledge about rangelands, and structuring our management. For example, plant productivity is strongly controlled by the availability and distribution of water and nutrients. So, it is not just if and when it rains, but how that moisture moves and is stored across the landscape. Other important processes, such as decomposition and mineralization are affected by moisture distribution. We can base our management actions on how we impact properties of these landscapes that are related to these key processes. It is then important that we base our evaluation of our management, our monitoring actions, on indicators of these important properties.

Monitoring

Currently, we identify three general elements of these systems for monitoring that directly relate to plant

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Rangeland Ecology and Livestock Management

(con’t from page 20)

“...there is a tremendous knowledge base related to factors that influence plant production processes that we can employ in our management.”

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Rangeland Ecology and Livestock Management (con't from page 21)



Quivira Coalition Website

We are pleased to
announce that our
website is up and run-
ning! You can visit us
online at

www.quiviracoalition.org

production. These are: 1) the types, proportions, and distributions of plants (biotic integrity), 2) soil erosion rates and soil compaction (site stability), and 3) water flows and infiltration capacity (hydrologic function). These elements are linked to observable features of the system which reflect key processes related to the functioning of the system. **No one element, or indicator of an element, can be used to judge rangeland health.**

Indicators of biotic integrity include plant community composition and distribution, amount of bare ground, diversity of plant functional groups, plant demographics (such as evidence of mortality or decadence), amount of litter, annual production, and perennial plant reproductive capability.

Indicators of soil and site stability include presence of pedestal plants, soil surface resistance to erosion, extent of soil loss, and extent of wind scoured areas.

Indicators of hydrologic function include presence of rills and gullies, water flow patterns, and distribution of litter.

These and other indicators can be evaluated qualitatively or, in many cases, quantitatively in objective and repeatable fashions. Basing our evaluations on a suite of indicators related to these processes provides an ecological framework for structuring grazing management as a sustainable activity. This also provides us a means for logically and scientifically interacting with these intricate ecosystems. In this manner we have advanced our management beyond the setting Ellison described in 1949.

Melding Ecology and Management

There are three central postulates that describe the ecological

character of rangelands: 1) plant communities and production are strongly influenced by just a few species, 2) plant dominance within these communities is often long-lived, and 3) there are transitional thresholds as one community changes to another. The driving forces of these changes are typically environmental stresses, especially drought or prolonged absence of fire, and these stresses can be amplified by mismanagement, especially overgrazing.

We have two primary management options: 1) we can manipulate vegetation structure in direct and indirect ways, and 2) we can affect plant and animal production by adjusting our controls over livestock. These options are employed based primarily on the condition of the land. For lands in satisfactory health we manipulate secondary consumers (primarily livestock, but on many ranges this can also include manipulations of wild or feral herbivores). For rangelands at risk, we would direct our attention towards the primary producers (the plants), and affect processes related to plant production. For seriously degraded lands we would gear our attention towards the physical environment (such as methods to rebuild soil). In all cases, our actions require evaluations based on ecological conditions.

One additional challenge we face in rangeland management is identifying the spatial scale for management. Rangelands are actually a nested set of spatial scales, from individual plants, to plant communities, to landscapes, and to regional scales. Management actions need to be structured to spatial scales that can be observed and manipulated in an economical manner. Often, this will be accomplished at relatively small scales. It is unlikely that site-specific infor-

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mation will be available for each managed situation. Management will require application of ecological principles, modifying this application to local conditions, monitoring responses, and adjusting actions based on these observations. This management model represents a melding of our knowledge of range ecology with our knowledge of grazing management practices. It is similar to the process Ellison described, but based on a much-improved knowledge base regarding ecological processes and evaluating the health of these rangelands. Today, we label this model “adaptive management.” At the cen-

ter of adaptive management is the same need that Ellison described; we must be educated and practiced observers of our environment.

I’m not sure what someone might write 50 years from now about our 1999 perceptions on rangeland management. I would hope that it would be as complimentary as my assessment of the relevance of Ellison’s 1949 remarks. If we base our understanding, our evaluations, and our management on ecological principles, then what we are working towards today should remain relevant. More importantly, working from an ecological basis will ensure that 50 years from now we are managing these resources in a sustainable fashion.

The CS Ranch (con’t from page 11)

they’re going wrong.”

Of course, a prerequisite to discovering answers is a willingness to ask questions in the first place.

The Ultimate Goal

Charlie’s objective was to create a monitoring system that was simple to use, scientifically credible, and rancher friendly. It is based on the belief that economic health flows from environmental health—that you can’t have one without the other. The ultimate goal of Land EKG is to achieve both.

And that’s the aspiration of the Davis family as well.

As the next generation of Davis kids grow up (there are eight so far) thoughts turn inevitably to the future of the CS. As development pressure increases on all sides of the ranch, the prospects for business-as-usual, even by the progressive standards of the Davis family, grow more complicated. Monitoring will help them face an uncertain

future with necessary facts and figures, but it cannot solve every problem—a situation confronting ranchers all over the West.

One answer might be more affection, as author Wendell Berry put it—affection of people for the land, and for each other. The enormous amount of affection the Davis family has for its ranch, and for each other, is obvious and will undoubtedly carry them through adversity and uncertainty.

Another word for affection is respect; and if life teaches us anything, it teaches that respect is the key to success—respect for the natural world that sustains us, and respect for fellow human beings who live in, and care about, that world. Respect is the glue that binds us together and helps us endure change.

Of course, curiosity can help too.

Rangeland Ecology and Livestock Management (con’t from page 22)

The CS Ranch
Julia Davis-Stafford
P.O. Box 518
Raton, NM 87740

Land EKG
Charlie Orchard
6085 Browning Lane
Bozeman, MT 59718
(406) 582-7480
or (888) 450-5354
corchard@montana.net

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UPCOMING EVENTS

ANNOUNCING A THREE-DAY WORKSHOP ON LIVESTOCK MANAGEMENT

November 17-19, 1999

Quemado, New Mexico

The Quivira Coalition and the Catron County Farm Bureau are pleased to announce a three-day class on ecologically sensitive livestock management to be held in Quemado, NM. The class will be taught by Kirk Gadzia.

WHEN: November 17-19 (Wednesday through Friday), 8am to 4pm.

WHERE: Quemado Community Center.

WHO: Total attendance will be 25 people maximum. Reserved for Catron County residents first, non-residents will be included if there is room.

COST: \$100 for Catron County residents (\$150 for non-residents) That's \$400 off Kirk's regular price!!

The class will cover the basic principles of conservation ranching. Don't miss this outstanding opportunity to learn from one of the best teachers in the country!! For reservations, call Courtney White at 505-820-2544. A deposit of \$65 will be required to hold a place.

Tour Jim Winder's Ranch Saturday, January 22, 2000

Jim will lead a free four-hour tour of his ranch. Learn about cattle rotation, range ecology, biodiversity, economics, and other cool stuff. Enjoy the open spaces and blue skies of southern New Mexico. We will assemble at 10 a.m. at Jim's house, located two miles north of Nutt, New Mexico. Take I-25 to Hatch, then drive 19 miles west on Highway 26 to Nutt (or 29 miles east from Deming). Bring a lunch, water, a hat, and sunscreen. For more information, call Courtney White at 505-820-2544.

An Evening with Sid Goodloe: Conservation Easements and Land Trusts TBA in Santa Fe in February 2000

Sid will come and speak on the workings of conservation easements and their utility in protecting rangeland from development and his efforts to establish a Land Trust. Further information will be forthcoming in the next newsletter.



The
Quivira
Coalition

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