Resilience

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BEYOND RESILIENCE

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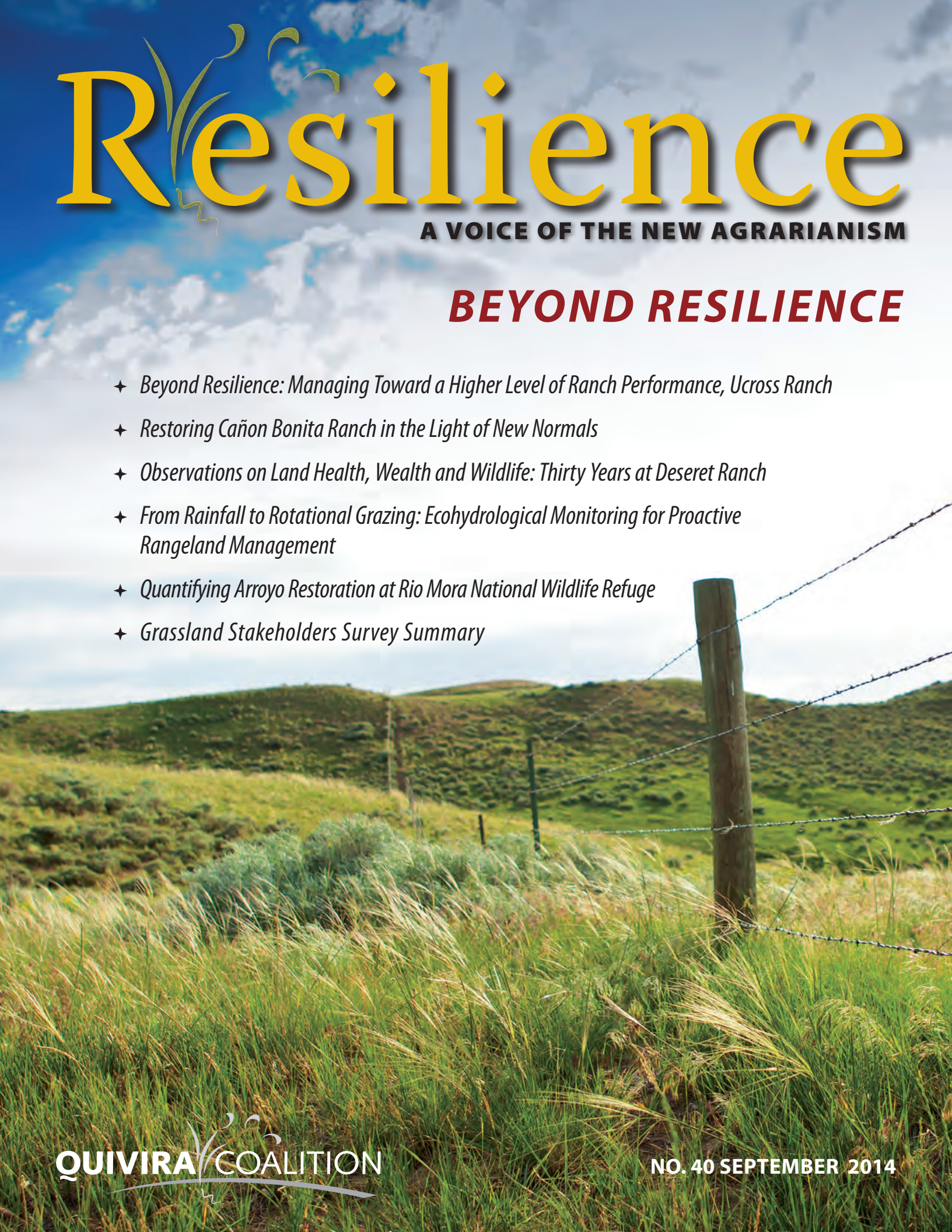

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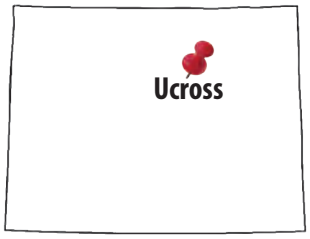
Beyond Resilience: Managing Toward a Higher Level of Ranch Performance

Ucross Ranch, Wyoming

By Todd Graham



Wyoming

Many conservationists and ranchers speak of resilience, the notion that resources, when they are well taken care of, should bounce back from a disturbance. It is said that managers should position their resources to quickly recover from events such as drought, fire and insect outbreaks. Pastures facing drought, for example, may rapidly respond once rains return. Or, a lightning-caused fire may only disrupt grazing operations for a couple of years. The point of resilience thinking seems to be that it is best for resource managers to endure disturbances while waiting for the return of better conditions.

This is a pleasing idea, but achieving resilience is largely impractical. How does a manager quantify a resource's preparedness for a disturbance when the incidence rate and duration are largely unknown? For example, a ranch may build cash reserves in preparation for a dry year, but managers will not know how long the drought will last and how much cash may be needed until grasslands "bounce back." Further, how should a resilient pasture be defined? After analyzing its ecological and financial assets, what would a ranch need to quantify to know if it was truly resilient? Answers to these questions don't arrive easily, which suggests that a better approach is needed.

One such approach is to focus on constant improvement while realizing that disturbances, such as drought, slow the rate of improvement. By contrast, good years allow for greater gains. This is analogous to a tree whose rings grow smaller in poor years and larger in good years. The tree adds less trunk mass in poor years, while piling it on in good years. Thus, the fundamental management strategy for a ranch should be constant improvement of is ecological and financial assets. In good years, great gains may accrue, but in poor years, those gains are slowed. This strategy, when followed through time, will produce an overall higher level of ranch performance.

A CASE STUDY OF IMPROVEMENT

A case study in this approach to management is found at Ucross Ranch, near the community of Clearmont in northeast Wyoming. Despite enduring disturbances such as fire, grasshopper outbreaks and several dry years, Ucross has increased pasture productivity, tripled its stocking rate and reduced bare ground. Streams that were once ephemeral now carry water year round. The ranch's ecological assets have increased greatly, along with its ability to generate revenue. The story of this improvement is one of mixed-pace gains that are highly dependent upon growing conditions. These gains are so noteworthy that in 2014 the Society for Range Management awarded the ranch its prestigious National Excellence in Rangeland Stewardship Award.

UCROSS RANCH'S LAND BASE

Ucross lies in a mix of resource areas: to the east of the Bighorn Mountains, to the west of the Great Plains and to the north of the Cold Desert (Figure 1). The ranch hosts physical features from all three resource areas and plant species from the mountains, plains and deserts, oftentimes in the same pasture. Large hills and towering spires rise above deep-soiled rangelands in a mix of vegetation types that provide ample cover and forage for big game and sage grouse. All of the ranch's 21,000 acres are located in a 10-14 inch precipitation zone and—as with so many western ranches—consist of a mix of rangelands, state and federal grazing leases, irrigated meadows and sub-irrigated bottoms. Clear Creek, the area's major drainage, flows through the ranch and provides a perennial source of water for livestock, waterfowl and big game. Running parallel to Clear Creek on the ranch's opposite flank is a major railroad track, over which coal is hauled from Wyoming's famous Powder River Basin to far-off population centers. Coal mines, trains and gas wells are as visible here as cows and sheep.

In 2002, when Ucross considered changing management approaches, managers were faced with abundant bare soil, signs of erosion, low plant productivity, too many noxious weeds (such as cheatgrass and leafy spurge) and poorly watered pastures. This ranch was underperforming and managers realized that change was needed. The first step was to alter the grazing strategy.

MIDDLE ALKIRE PASTURE AND ECOLOGICAL PROCESSES

A good example of the ways in which grazing management was altered is found in the Middle Alkire Pasture, which is rectangular in shape and divided down the middle by a small stream. Historically, cattle were placed in this pasture from early May until late June (roughly 60 days every year), and they spent much of their time in the willows and cottonwoods along the creek, rarely venturing into surrounding rangelands. As a result, streambanks were degraded, water quality suffered and erosion was evident. The grazing management strategy that produced these negative impacts on the land was 350 cow/calf pairs, grazing 1700 acres for 60 days (350 pairs x 60 days / 1700 acres), which equaled a stocking rate of 12.3 Animal Days per Acre (ADA).

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ADA is a handy measure of stocking rate and allows pasture performance to be tracked through time and to be compared across ranches. The ADA is a grazing manager's greatest measure of ecological and financial performance.

When altering the grazing strategy, managers elected to keep the same stocking rate (12.3 ADAs), but increased the number of livestock to 569 animal units (equivalents of sheep and cow/calf pairs), shortened the grazing period to 35 days and kept the number of acres the same. On the first try, cattle roamed well beyond the riparian areas to the rangelands, and their hoof action knocked standing dead plant material to the soil surface. Grazed plants were then allowed to recover until the next growing season, which greatly improved plant vigor (Figure 2, page 4).

Within a few short years, signs of erosion declined; desired grasses were more commonly observed in the pasture; and the once heavily grazed riparian area displayed

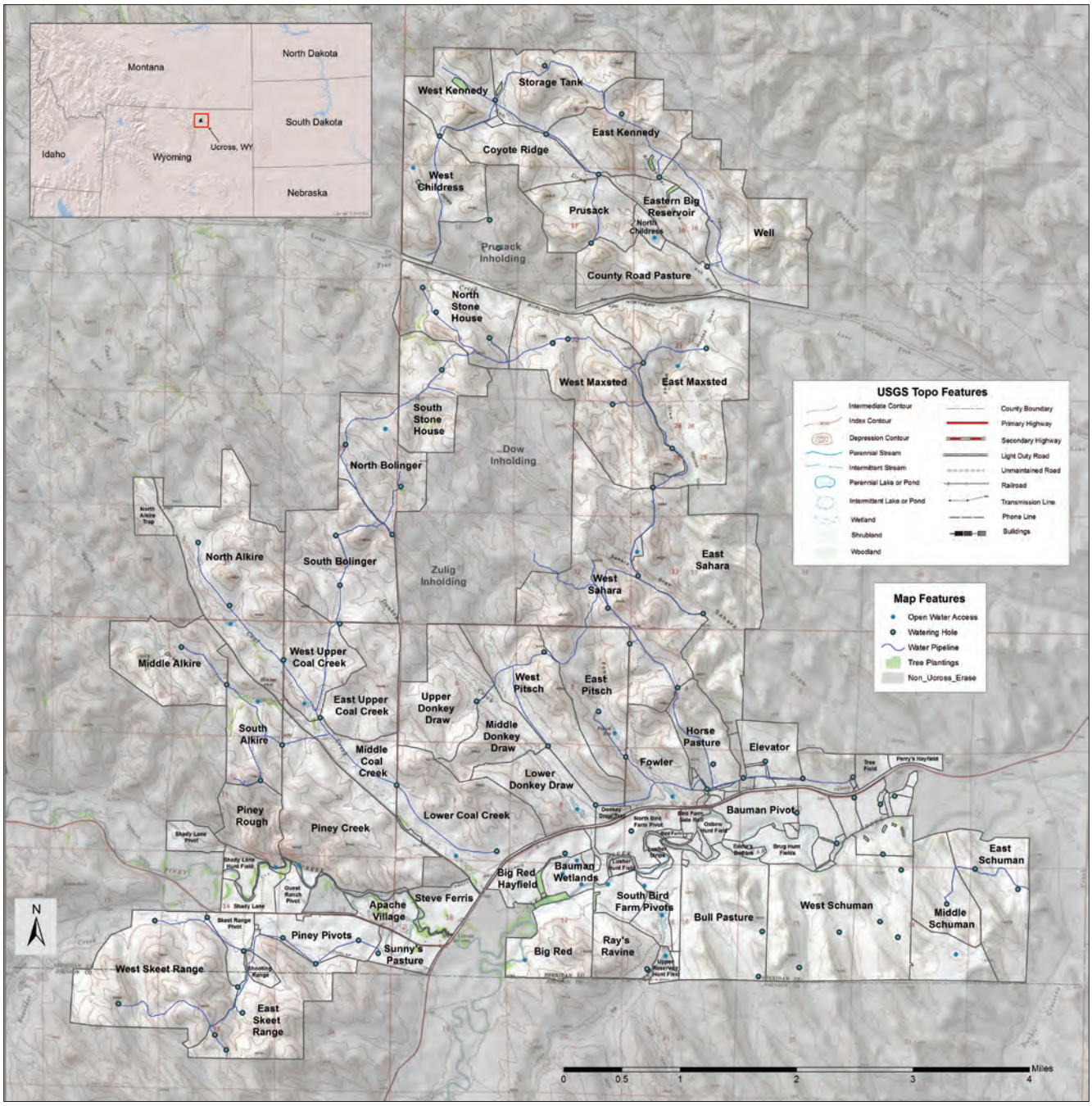

Figure 1. Ucross Ranch map, courtesy of Ucross Ranch.

abundant new growth, providing forage and cover for both wildlife and livestock. In later years, Ucross divided Middle Alkire into four separate pastures, using high-tensile electric fence to further increase stock density, and shortened the grazing duration to less than 10 days per pasture.

Armed with what they learned from pastures like Middle Alkire, grazing managers knew they had a recipe that could be repeated elsewhere on the ranch. Improvements in rangeland health could lead to improved stocking rates and increased future revenue. But, they first needed to spread and improve stock water points across many dry acres.

CORRECTING DISTRIBUTION PROBLEMS WITH WATER DEVELOPMENTS

Sixteen total pastures existed when the ranch changed management in 2002, but roughly 25 percent of the

ranch lacked reliable stock water. This meant that much of the ranch simply could not support livestock and that cattle tended to congregate near existing water sources, potential revenue was reduced and the ranch performed below its 21,000-acre potential. Only water developments would improve this grazing distribution problem. Using grant funding and its own cash reserves, the ranch embarked on a series of stock water development projects that greatly increased its grazeable acres. Placement of new stock tanks was dependent upon providing the greatest number of new grazeable acres on the best soils, which maximized financial returns relative to costs.

Further, the ranch designed a series of stock water tanks called "water circles" that service multiple pastures at once. These circles (Figure 3) are designed with a tire tank in the center (nearby coal mines provide an ample supply of used tires) and a small corral around the outside. Cattle are prevented from lingering near water with this design, and the gate to the next pasture can simply be thrown open to reduce cowboying time and costs.

On the Ucross, once new stock water was developed, pastures could then be broken into smaller units to facilitate improved grazing distribution. Using high-tensile electric fence (which is less expensive than barbed wire) and temporary poly-wire fencing, the ranch was divided into 57 total rangeland pastures. This number of pastures added flexibility for livestock operations and altered the grazing strategy even further. Ultimately, infrastructure improvements cost the ranch $10.45 per acre to develop. Over a five-year window, each dollar spent on infrastructure returned 3.66 additional animal days of grazing, and the ranch was able to pay for all water and fencing within 3.5 years.

MAJOR VARIABLES OF GRAZING MANAGEMENT

Reliable water and altered pastures changed the way in which the whole ranch was grazed. The major variables of grazing management may be described as follows:

- Grazing duration is the number of days cattle or sheep are in a pasture—in most cases, fewer than 14 days per grazing.

Figure 2. Basal cover chart in the Middle Alkire Pasture. In 2005, bare ground was 44% and in 2011, 5%. Over the same period of time, desirable live plant cover increased from 4% to 10%, and the number of plant species found at the site nearly doubled.

BASAL COVER

	2005	*2007*	*2011*
Bare	44%	25%	5%
Litter	52%	69%	85%
Live	4%	6%	10%

PLANT SPECIES COUNT

2005	*2007*	*2011*
21	29	38

During this change in management strategy, Ucross also established a rangeland monitoring program designed to track changes in land health through time and to provide guidance for future management decisions. Data from Middle Alkire showed that undesired bare ground decreased, desired live plant cover increased and the number of plant species nearly doubled.

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Figure 3. "Water circles" provide stock water to more than one pasture (three in this case). When the time comes to move cattle onto fresh pasture, a gate is thrown open and many cattle move themselves.

- Frequency of grazings is the number of times a pasture is grazed per year. For example, twice, once or not at all, depending on the condition and production of the pasture.
- A recovery period between grazings allows grass to regrow. When growing conditions are favorable, 90 days is the standard recovery period; when they are unfavorable, pastures are allowed at least a year to recover.
- Timing of grazing may be altered seasonally, based on historic use and growing conditions. Ucross has displayed historic sensitivity to spring grazing, so spring grazing events are altered each year.

With such short grazing durations, strong flexibility exists to adjust pasture movements in response to plant growth and disturbances such as fire, and also to provide a forage reserve. At Ucross:

- Stock density (the number of livestock per unit area) has more than doubled, reaching roughly one head per acre by 2013.
- Stocking rate (the number of livestock grazing a given pasture for a unit of time) has tripled since 2002.

HOW THE LAND RESPONDED TO MANAGEMENT

The land responded quickly to the new grazing strategy. The first changes observed were strong reductions in bare ground. Following the establishment of various rangeland health transects, bare ground was found to have dropped dramatically. The North Childress Pasture's bare ground decreased from 29 percent in 2004 to 6 percent in 2011, while live plant cover more than doubled (Figure 4).

Figure 5 data suggest that the water cycle was improving. Signs of erosion began to disappear. As water flowed into the soil rather than running off, an unexpected, massive increase occurred in undesired species, such as cheatgrass and Japanese brome. These two species seemed to flourish for several years and often composed nearly half of total plant production in the community. But Ucross didn't panic. These were pioneer species in the beginning phase of the successional process. In later years, as the successional process advanced, most cheatgrass was replaced by more desired plant species.

Next, plant productivity increased. In the Stonehouse Pasture, plant productivity has more than tripled since 2003 (Figure 5). Photos show the changes in plant productivity well. For example, the Upper Coal Creek Pasture's production climbed substantially (Figure 6, page 6).

Lastly, shifts in plant species composition brought more highly desired bunchgrasses, including green needlegrass and Idaho fescue. These are high-producing species, and in this area, they are favored by cattle. Increases in desired species in three pastures are displayed in Figure 7, page 6.

BASAL COVER - North Childress Pasture

	2004	*2008*	*2011*
Bare	29%	5%	6%
Litter	63%	88%	77%
Live	8%	7%	17%

Figure 4. Basal cover from the North Childress Pasture. The amount of bare ground decreased by 23 percentage points and live plant cover more than doubled.

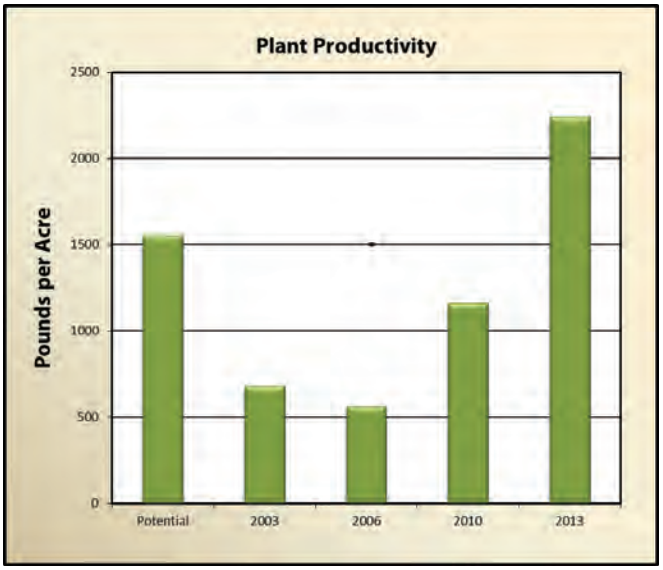

Figure 5. Total above-ground plant productivity in the Stonehouse Pasture. The years 2003 and 2006 were both dry, and 2010 and 2013 approached average precipitation. Each year shown in this figure corresponds to the year in which the pasture transect was read.

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Figure 6. The photo on the left shows the Upper Coal Creek Pasture in 2002, the first year of the new management approach. On the right, plant productivity had more than tripled by 2011. Both photos show the pasture before grazing.

When examined together, these data paint a picture of mixed-pace gains. In the drier years of 2002 through 2004, management changes produced slow improvement in ecological processes, including small reductions in bare ground. Wetter years like 2005 brought more rapid change and large reductions in bare ground. This allowed the ranch to achieve an overall higher state of performance than it had ever known. By the late 2000s, data showed increased basal cover of the more desired plant species (Idaho fescue, green needlegrass, winterfat). Warm-season grasses like sand dropseed and little bluestem also appeared more prominently. These changes elevated the ranch's overall ecological performance.

Green needlegrass in Ray's Ravine Pasture	**2002**	**2005**	**2011**
	0%	18%	35%

Idaho fescue in Stonehouse Pasture	**2006**	**2010**	**2013**
	3%	6%	21%

Idaho fescue in North Childress Pasture	**2004**	**2008**	**2011**
	19%	46%	58%

Figure 7. Changes in relative basal composition of desired grass species in three different pastures.

PROGRESS DURING DISTURBANCE

The improvements described above also occurred in the face of disturbance. In 2008 and 2009, for example, severe grasshopper outbreaks resulted in the loss of much standing forage across the region. Some Ucross pastures were severely affected by these outbreaks, to the point where grazing durations were greatly shortened. Grasshoppers consumed so much forage in the Bollinger Pasture that it could barely be grazed. Fortunately, forage reserves had been planned, and cattle were moved away from the grasshopper-afflicted pastures to better forage elsewhere. Improvements in rangeland health were slowed for these two years, but the amount of bare ground measured in the Bollinger still declined.

In 2008, a fire started by a hunter's idling vehicle disturbed thousands of acres reserved for autumn grazing. Managers then scrambled to reallocate forage in an effort to minimize hay feeding. Again, because forage reserves had been planned, the financial impact was minimized. This disturbance also produced interesting shifts in plant species composition. Prior to the fire, the desired grass, needle-and-thread, was abundant, and after the fire another desired species, green needlegrass, grew aggressively. In this instance, one desired grass replaced another (Figure 8). Due to the pasture's high state of rangeland health and the quick response by green needlegrass, no rest period was considered and the pasture was grazed in the year following the

fire (many ranchers and most federal and state agencies pursue a two-year post-fire recovery period).

Lastly, the year 2012 brought one of the hottest, driest years on record. As the summer progressed and news spread of the crippling drought, Ucross pastures did not display poor growing conditions. Rather, pastures continued to produce vigorously and even showed green growth late into the hot month of August (Figure 9). While the stocking rate was reduced to help maintain rangeland health, calves were shipped only six days early that year. This was in contrast to many other ranches in the region, which shipped their calves several weeks early due to lack of forage.

THE TAKE-HOME LESSON

It was during that hot, dry year of 2012 that the notion of achieving a higher state of ranch performance became clear. Plant production did not plummet—it was only reduced. Stocking rates did not oscillate wildly from prior years—they changed gradually. Managers did not scramble to buy high-priced hay to survive the year—they allocated grazeable forage as in prior years. The lesson learned was that high-performing ecosystem processes reduced the negative impact of this dry year. The same can be said for the grasshopper outbreak and fire. Each presented its own kind of disturbance, and a high level of rangeland health, plus a good management approach, minimized the negative effects.

Looking back on Ucross since 2002, abundant disturbances are revealed: the years 2002-2004 were dry, 2006 was hot and dry, 2008 and 2009 brought hellish grasshoppers, 2010 was dry, and 2012 was one of the hottest, driest years on record. The land did not display resilience from this series of disturbances, it displayed constant improvement. What changed was the *rate of improvement*, which slowed during the poor years. In good years like 2005, 2007, 2011 and 2013, rangeland health data revealed more rapid reductions in bare ground, strong plant productivity, and more rapid and desired shifts in plant species composition. These are the changes that produce a higher state of rangeland health and ranch performance.

Figure 8. A fire occurred in this pasture in 2008. The yellow stripe in the photo's center is cheatgrass caused by a dozer creating a fire line. The fire burned on the left of the fire line, and the desired species, green needlegrass, responded well to the fire. On the unburned side on the right is the desired grass needle-and-thread. In this instance, one desired grass replaced another. No rest period was scheduled for this pasture following the fire because plants and rangeland health displayed rapid recovery.

Figure 9. A gravelly, east-facing slope in the Skeet Range Pasture shows strong plant vigor and green growth in late August 2012—one of the hottest, driest years on record in northeast Wyoming.

When planning for the future and its inevitable droughts and fires, Ucross can quantify its preparedness for those disturbances. Managers can allocate forage based on a least-cost strategy while still improving the resource, even when they don't know how long the disturbance will last. This allows for a livable income stream from livestock operations in good or bad years, while still providing forage and cover for the wildlife that the ranch so highly values.

FINANCIAL AND ECOLOGICAL DIVIDENDS

A dividend is a reward for efforts that are paying off, and in the case of Ucross Ranch, the dividends have been accruing both financially and ecologically. Financially, the ranch has tripled its stocking rate (Figure 10). Since 2002, with the number of acres remaining the same, the ranch has tripled the number of animal days harvested. Herd size was reduced in 2012 due to the dry year and again in 2013 to allow the land to recover, but the ranch's grazing output was still triple that of 2002. Since adopting a new management approach and with no change in cost structure, the ranch's financial margins have increased substantially. Even if the ranch faces a series of dry years and herd size must be greatly reduced, it will still be better off financially.

The ranch's ecological dividends are accruing in newly formed perennial streams. Once flowing only during spring runoff, several channels now carry water year-round, an occurrence that no living person had observed before. Such drainages provide many new watering points for livestock and wildlife, as well as associated high-production forage. Even in the dry year of

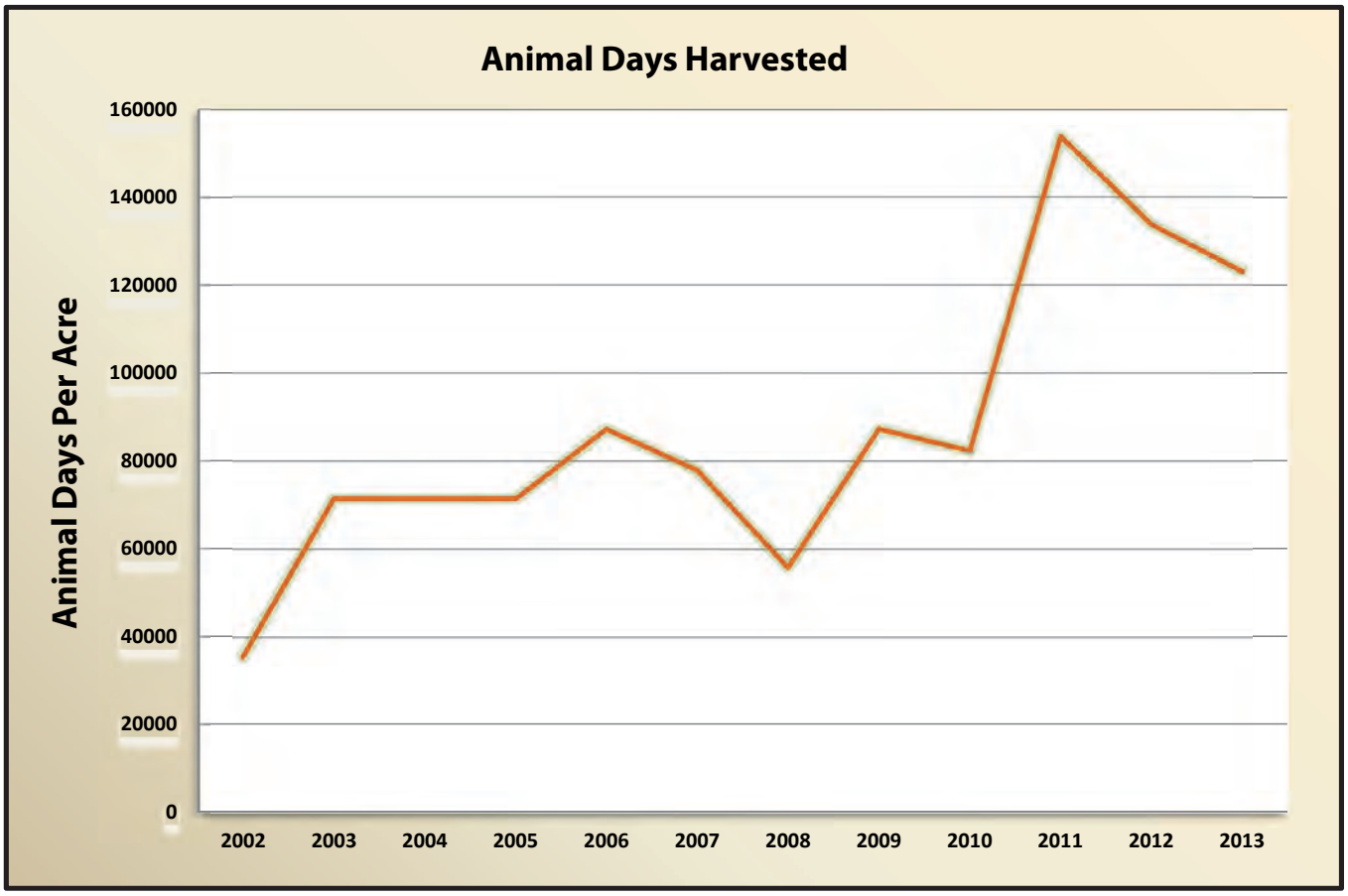

Figure 10. Animal days harvested at Ucross Ranch. These figures show animal unit equivalents of grazing by cow/calf pairs, yearling cattle and sheep. Grazing days represent one animal unit's worth of forage consumed. The stocking rate was nearly quadrupled between 2002 and 2011. It was reduced in the dry year of 2012 and lowered again in 2013 to allow for recovery from the dry year. Acres involved have remained the same.

2012, the bottom of the Donkey Draw Pasture ran water through the entire summer (Figure 11). This is yet another example of the higher state of performance attained at Ucross Ranch.

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Figure 11. A view of the Donkey Draw Pasture and its newly formed perennial stream. This photo was taken in late-August 2012, one of the hottest, driest years on record in northeast Wyoming. This channel began running water perennially in 2011, after having historically carried water only during spring runoff.

A LOOK AHEAD

How can Ucross improve upon its current position? Pastures still appear to be responding to current management practices, and desired plant species appear to be increasing in the community. These are positive signs that speak to improved plant production, higher stocking rates and increased revenue. But grazing management can always be improved, and Ucross will continue to tweak its practices to enable better performance of natural resources.

As the 2014 growing season gets underway, Ucross cannot quantify an upper limit of resource performance, for the gains appear to be continuing. Ideally, in another 10 years, the ranch will have achieved an even higher level of performance. And, such gains need not be restricted to Ucross alone, for these management practices are readily repeatable. Ucross just happens to have captured its improvements in photos and data, which tell a terrific story.

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Todd Graham is a partner at Ranch Advisory Partners and has been privileged to help Ucross Ranch change their grazing management approach, redesign grazing operations and perform land health monitoring since 2002. *www.ranchadvisory.com*