Case Study: Long-Term Livestock Grazing Influence on Vegetation Class in Coyote Flat, California, USA

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On the Ground

- Parker Three-Step data that exist on many US Forest Service allotments may be the only remaining, truly long-term vegetation and soil data available. Although Parker Three-Step procedures have been abandoned on many Forest Service districts, the historical insight they provide may be worth revisiting for management purposes.
- The Parker photos that accompany the transect data may be of more value than the data.
- Long-term vegetation records in Coyote Flat reveal the range to remain generally in fair condition since at least 1931, despite large reductions in livestock numbers, drastically shortened season of use, and 7 years of rest out of the last 13 grazing seasons.
- The correlation and interaction between reduced grazing pressure and ecological condition on high-elevation mountain meadow ecosystems, particularly as revealed by Parker Three-Step data, is not always intuitive or linear.

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What are the long-term effects of changes on a plant community when the livestock grazing pattern is changed? This is the core of many debates. It is not something that can easily be determined in a short time frame.

Despite large reductions in livestock numbers, shortened seasons of use, and implementation of rotational and deferred grazing, many rangelands have not seen species or vegetation community changes that traditional range theory predicts should occur with those management changes. In some instances, when changes do occur, they are not only contrary to predictions, but also trend in the direction that management would not prefer.

In this case study we summarize 49 years of data from an area in eastern California. We used Parker Three-Step photo records, 44 years of Parker Three-Step vegetation data (grouped by vegetation class, i.e., grass, sedge, rush, willow, sage, pine, and other), and 150 years of grazing history to evaluate vegetation response to changes in livestock grazing on a US Forest Service allotment in the eastern Sierra Nevada region of California.

We use information about Coyote Flat in eastern California to illustrate this situation. Our example, through a combination of Parker Three-Step transect data, photographs, and professional visual experience, highlights a "state-and-transition"[1] scenario that may not be acting as predicted or expected by traditional range scientists. The vegetation communities in Coyote have changed over the years, but even with "current best management practices," plant communities are not moving in a predicted direction (more native species) or in the direction management would prefer. Our assumption is that there has been a transition to a new vegetation state. There is a high probability that the changes to this "new" state are irreversible under the current climatic conditions.

After 150 years, the rangelands in Coyote appear to have either static vegetation composition or an increase in shrubs or trees. Significant "desired improvement" such as increases in native grass species or improved ecological condition that was expected has not been realized. Whether we evaluate the vegetation community in Coyote using Clementsian theory and the climax community concept, or if we use the potential plant community concept within ecological site description theory, we are not seeing the plant community move in the direction predicted. Coyote is unique in that there is a well-documented historical grazing record that

can be combined with long-term condition and trend data and photos.

Historical Background

Coyote is located southwest of Bishop, California, at lat 37°11.7′N, long 118°27.3′W. Its grazing history is typical of many areas in the West. Ranchers first drove livestock, consisting mainly of horses and cattle, into Coyote from Owens Valley, California, in the 1860s.[2,3] By 1914, staff from the Sierra Forest Reserve established grazing allotments in Coyote and sheep and cattle became the predominate grazers.[2]

Land ownership and grazing allotments changed over time. Originally there was just one allotment in the Coyote area, named the Coyote allotment, with multiple stockmen running in common. Over time the area was subdivided into various-sized allotments that were frequently managed under different scenarios. At various times some of the allotments were rested for periods of up to 6 years. Permitted animal numbers were dramatically reduced in most areas. Through various land and permit purchases and exchanges the entire area is now combined into a single operation. The Yribarren Ranch currently holds all three allotments and runs their summer operation on the Inyo National Forest as a combination rest rotation and deferred rotation system, depending upon range readiness conditions.

Nonuse first occurred on all of the Coyote grazing area in 1944, then again in 1948, 1983, 1986, 2000, 2001, 2006, 2007, 2008, 2010, and 2011. Resource concerns, drought, voluntary rest by the permittee, and impacts of desired habitat management for species recently designated endangered (e.g., Sierra Nevada yellow-legged frog [*Rana sierrae*]) have all, at one time or another, been deciding factors for nonuse.

In 1924 over 7,000 animal unit months (3,058 combined head of sheep and cattle) grazed the Coyote area, the highest recorded use for the area. In 1949 it was converted to only cattle grazing. Eight hundred seventy-eight cattle were in Coyote in 1949. Since then the numbers have been steadily reduced to the current maximum of 400, depending upon range readiness conditions. Historically, livestock entered the allotment in early or mid-June (some years as early as May 1) and left by mid-October. Now grazing lasts for only 51 days.

Recreational use is ever increasing in Coyote, especially all-terrain vehicle use, which in several areas has impacted grazing. It has become difficult for the permittee to keep livestock in some meadows simply because there is so much human recreational activity.

Calf death losses began to be a real problem in Coyote around 1968, with 20 or more calves dying in some summers. Death losses usually start occurring after the first frost. Many people, including University of California Davis veterinarians, have speculated multiple reasons for the increase in calf mortality.[3] The generally accepted cause is ingestion of locoweed (*Astragalus whitneyi*). Locoweed poisoning greatly influences season of use for cattle by making early season grazing the only feasible option. As a result, the permittee usually cannot stay past the first of September without calf death losses. In 2012, the first calves died mid-August.

The Yribarrens, with the approval of the US Forest Service (USFS), have modified their on–off dates to deal with the calf mortality issue. The cattle are driven to Coyote by cowboys on horseback as has historically been done, but now the grazing season on date is about June 25 and the off date is about August 15.

Environmental Setting

The combined Coyote area comprises over 50,000 acres. Elevations range from 8,500 feet to over 12,000 feet, with most grazing between 9,500 feet and 10,000 feet. Three predominant vegetation communities exist in Coyote: sagebrush uplands, wet meadows, and dry meadows. Lodgepole pine (*Pinus contorta*) and aspen (*Populus tremuloides*) adorn parts of the allotments. Sedges (*Carex* spp.), rushes (*Juncus* spp.), hairgrass (*Deschampsia cespitosa*), and willows (*Salix* spp.) dominate wet meadows, while bluegrasses (*Poa* spp.), spike trisetum (*Trisetum spicatum*), mat muhly (*Muhlenbergia richardsonis*), and dry sedges prevail on dry meadows. Big sagebrush (*Artemisia tridentata*) and low sagebrush (*Artemisia arbuscula*) species occur on both dry meadow and upland sites. Upland herbaceous species consist predominantly of needlegrass (*Achnatherum* spp.), Indian ricegrass (*Achnatherum hymenoides*), junegrass (*Koeleria macrantha*), and squirreltail (*Elymus elymoides*).

The US Fish and Wildlife Service listed the Sierra Nevada yellow-legged frog as an endangered species in 2014. Much of the Coyote allotment is being considered for inclusion in a critical habitat designation for this species; that decision is forthcoming this year or next. One area had a population of yellow-legged frogs that was extirpated in 2011 as a result of chytrid fungus (*Batrachochytrium dendrobatidis*).

Long-Term Monitoring Using Parker Transects

Ruyle and Dyess[4] note the value of using Parker transects under the "preponderance of evidence" interpretation guidelines, combining photo records, transect data, weather data, and professional experience to evaluate the vegetation changes. This is the process used to evaluate the changes in Coyote. The protocol for the Parker methods can be found in the 1969 Region 5 USFS *Range Environmental Analysis Handbook*.[5,6]

Each unit (Peterson Mill, Baker Creek, and Sanger) in the Coyote allotment has at least one Parker Three-Step cluster (a location with one or more Parker Three-Step transects). There are four total clusters in Coyote: one cluster for Peterson Mill (one transect, known as C2T1), one cluster for Baker Creek (one transect, known as C1T1), and two clusters for Sanger (four transects, known as C1T1, C1T2, C2T1, and C2T2), for a total of six transects in Coyote (Table 1). Transect readings were done on an approximate 5-year cycle, but on some transects there were up to 10 years between readings.

Table 1. Summary of Parker Three-Step clusters and transects by allotment

Allotment	Cluster	No. of transects	Initially established	No. of field readings
Baker Creek	C1	1	1969	8
Sanger	C1	2	1964	9*
	C2	2	1973	7
Peterson Mill	C1	1	1964	9[1]

*Vegetation data for 1964 has been lost, although the photos exist; thus, raw data available for Peterson Mill and Sanger cluster C1 begins in 1969.

Range Condition Observations

District Ranger Guy Way stated in 1931,

> *Utilization is, in my opinion, just a little too close to reflect good range management, but considering the fact that for sixty or seventy years there has been regular annual use by capacity numbers, the range may be said to be in fair condition.*[2]

Stechman[3] noted in his 1986 report that the Coyote Range generally remains in fair condition, much as it was found in 1931.

The 2013 Parker Three-Step data for vegetation condition and trend indicate that Peterson Mill is in poor condition with a static trend, which is likely a result of cows trailing on the transect for about 15–20 feet to cross the meadow. The trail definitely impacts the vegetation data. Baker Creek is in fair condition with an upward trend; Sanger C1 is in fair condition and upward trend; and Sanger C2 is in fair condition with a static trend. All four locations have remained predominantly in fair condition using the Parker method, whereas some of the transects were rated in good condition during the period of record (R. Pearce, unpublished data, 2013).

Precipitation Data

Any analysis of Parker data should include an evaluation of the corresponding precipitation data, if available.[4] Annual precipitation greatly impacts the site, as evident in the photo comparisons.

There are no weather stations located directly in Coyote, but to the north there are three stations: South Lake, Lake Sabrina, and Bishop Creek (ranging from 5 miles to 10 miles away).[7] Each station has intermittent records for the record period, so not all years of Parker sampling had precipitation data available (Table 2). All three stations exhibited lower than mean annual precipitation for 1976, 1994, and 2003. No data were available for 1964, 1969, 2008, and 2013.

Wildlife Impacts

Browsing mule deer (*Odocoileus hemionus*) may impact results, but there have been no investigations to distinguish wildlife impacts from domestic livestock impacts in the area. In October 2013, while reading grazing utilization, we saw over 20 deer within 50 yards of the Peterson Mill transect, and about the same number in Sanger meadow. The Coyote region is a favorite of deer hunters in the eastern Sierra. Deer herd size (or sizes) in Coyote are generally considered small. Being primarily browsers rather than grazers, their impact on vegetation community change is considered minimal compared to livestock impact over time. Elk grazing is not a factor because they are not present in Coyote.

Photos Spanning 49 Years in Coyote

We start with the comparison photos and anecdotal observations as we delve into understanding the vegetation response in Coyote. Summaries and observations for four clusters (Baker Creek, Peterson Mill, Sanger C1, and Sanger C2; Fig. 1) are discussed below. For Baker Creek, Peterson Mill, and Sanger C1, we have included photo comparisons with the earliest photo and most recent photo for those three transects (Figs. 2–4).

The first example is the Baker Creek site (Fig. 2), where in 1964 no lodgepole pine was observed in the meadow. By 2013, the site has significant lodgepole pine and willow species throughout the meadow.

The 1964 photo of Peterson Mill (Fig. 3) shows a meadow completely void of willows, whereas the 2013 photo shows a site filling in with willows.

As evident in the 1964 photo (Fig. 4), the Sanger cluster C1, transect 2, appears to have had very little sagebrush, and what was present in 1964 had very low stature. By 2013, the site is dominated by sagebrush. Near this site, prior to the early 1980s, there was a flowing spring that today is completely dry. The site was originally considered a wet meadow for Parker analysis, but the type was changed to dry meadow

Table 2. Summary of corresponding annual precipitation, where available, for the three closest weather stations in relation to the Parker transect sites

	Years transect read											
	1964	**1969**	**1973**	**1976**	**1983**	**1991**	**1994**	**1996**	**1997**	**2003**	**2008**	**2013**
Cluster												
Peterson Mill	x	x		x	x	x	x		x	x	x	x
Baker Creek		x		x	x	x		x		x	x	x
Sanger C1	x	x		x	x	x		x		x	x	x
Sanger C2			x		x	x		x		x	x	x
	Precipitation data in inches (by year) and weather station (bold text indicates are years when precipitation was below the mean annual)											
Weather station												
Sabrina*				**11.74**	25.72	16.79	**13.90**	23.04	15.29	**10.98**		
South Lake*				**13.13**	28.94	**17.33**	**15.55**	33.17	20.01	**13.66**		
Bishop Creek*	**8.25**	**3.36**	15.36	**9.28**	23.50	13.26	**11.77**	20.17	13.03	**8.97**		

*Mean annual precipitation for Sabrina=16.25 inches, Bishop Creek=12.37 inches, and South Lake=18.40 inches. Weather station numbers, elevation, and data record: Sabrina 044705, 9,080 feet (data record 1925–2009); Bishop Creek 040819, 8,150 feet (data record 1959–2009), and South Lake 048406, 9,680 feet (data record 1924–2009).[9] Distances from the Sabrina, Bishop Creek, and South Lake weather stations to the Baker Creek cluster are 9.9, 9.3, and 6.6 miles, respectively. The distances from the Sabrina, Bishop Creek, and South Lake stations to Sanger cluster 1 are 9.3, 8.4, and 6.4 miles, respectively, and 9.0, 8.0, and 6.1 miles from Sanger cluster 2. Sabrina, Bishop Creek, and South Lake stations are 7.0, 5.1, and 5.6 miles from the Peterson Mill cluster.

in 1991. That type change results in a different table being used for determining condition and trend under the Parker method.

The other transects in Coyote are on the Sanger allotment and the photo comparisons show similar conditions as the example Sanger photos, namely, that meadows are converting to a sagebrush-dominated vegetation system.

Forty-Four Years of Coyote Vegetation Data Collection

Within the six transects in Coyote, 58 different vegetation species were recorded during the record period. Many of the original data sheets only had vegetation identified to the genus level, as well as numerous unknown vegetation hits recorded. It was therefore difficult to analyze species composition differences among years. As mentioned previously, there has been considerable literature devoted to interpreting Parker data, and there are quantification and interpretation issues that must be acknowledged about the value of the Parker data. For this paper, we chose to organize the data as suggested by Ruyle and Dyess.[4]

Vegetation data were grouped by class (grass, sedge, rush, willow, sage, pine, other, and unknown) and by soil surface hits (bare soil, erosion pavement, rock, litter, and moss/lichen). Table 3 shows the data for the Peterson Mill, Baker Creek, Sanger C1T1, and Sanger C1T2. Those four transects are discussed below, since they have the longest record for the Coyote Parker transects.

Grouped by class, several changes are evident, especially when combined with the photo comparisons:

1) Peterson Mill: Willows are beginning to spread and dominate the site. The first willow hits were in 2008, and they increased on the 2013 readings.

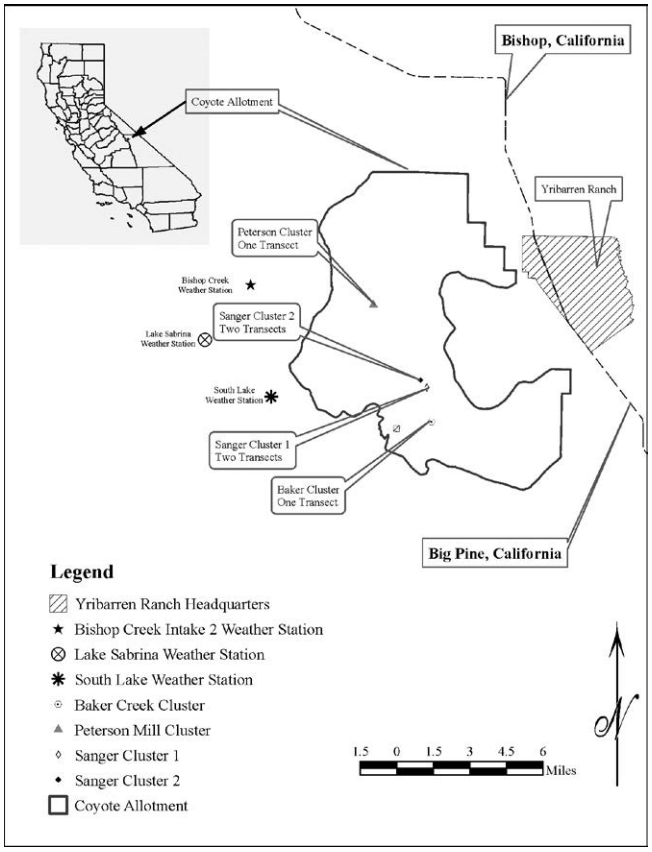

Figure 1. Map of Coyote allotment and Parker Three-Step cluster locations.

2) Baker Creek: Willows have been steadily increasing, and pines have been increasing since 2003.
3) Sanger: C1T1 sagebrush has been increasing since 2003. At the C1T2 site, sagebrush has rapidly increased since 1991. (Additionally, C2T1 and C2T2 sagebrush counts have increased since 2003 and 1996, respectively).

Table 4 presents the vegetation class data ranked as the most prevalent class to the fourth-highest observed class by transects. These rankings are summarized below:

1) Peterson Mill: Sedge has been ranked number one for all but 2003, 2008, 2013, with willows being first ranked in the top four most prevalent classes in 2013.
2) Baker Creek: Sedges or rushes have ranked in the top two spots of the entire period of record, and in 2003, pine first ranked in the top four, with pine ranked second in 2013.
3) Sanger: In C1T1, sedge or grass are ranked in the top two spots for most years, with sage ranked as number three in 2008 and 2013. In C1T2, sedge or grass were ranked as number one until 2008 and 2013 when sage was ranked as number one.

What Do the Data and Photos Tell Us?

We employed the "preponderance of evidence" qualitative analysis method and "professional judgment" for evaluation of the data and photos.[4]

Evaluation of the vegetation data in correlation with the precipitation data reveals no readily observable changes in vegetation species composition, cover, or vegetation classes in relation to wet or dry years. However, photo comparison between wet and dry years on each site does reveal productivity changes Sanger C1T1 has the most striking photo comparison between a very productive, wet year (1996), and a low-production, dry year (2013) (Fig. 5).

Combining the photo record with the data record, it is obvious that vegetation changes are occurring on the range. We see sagebrush increasing on both sites in Sanger (C1 and C2 clusters). Additionally, both Baker Creek and Peterson Mill have increasing willow stands, and pine trees are increasing in Baker Creek.

Stechman[3] stated in his 1986 report that in his opinion:

Figure 2. Photo comparison for Baker Creek Parker transect between August 1969 and July 2013. Notice the increase in lodgepole pine in the 2013 photo.

Figure 3. Photo comparison for Peterson Mill Parker transect between July 1964 and July 2013. Notice the increase in willow in the 2013 photo.

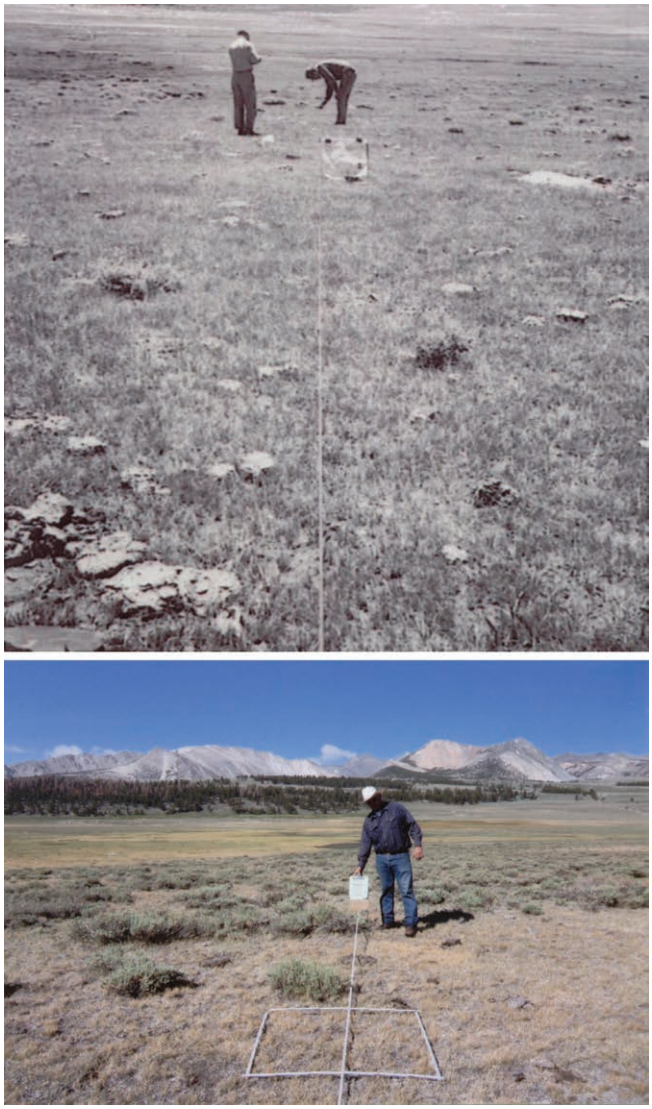

Figure 4. Photo comparison for Sanger, cluster 1 transect 1, between July 1964 and July 2013. Notice the increase in sage in the 2013 photo.

> *it appears that this range area is neither near its productive potential nor has it yet shown the remarkable improvement in forage yield. Most certainly Coyote could not now sustain the likes of what it did in many of the seasons before 1931—1,500 head of sheep and 400 head of cattle from May 1 through October 15.*

Additionally, he hypothesized:

> *From an overview, one could conclude that exploitive overgrazing by sheep and cattle from the 1870s through the mid-1940s of the once-excellent Coyote range simply resulted in depletion for which, in spite of corrected management, nature has not compensated within the time span involved.*

These two quotations make a good starting point for discussion of vegetation composition in Coyote, and how management has impacted the area. As the historical record captures, livestock grazing in Coyote has changed significantly since the 1870s. Numbers have been greatly reduced under federal grazing guidelines; the class of livestock has changed from horses and cattle to sheep and cattle, and most recently to cattle only. The season of use has also been altered, being shortened from almost 6 months to little more than 6 weeks. Rotational and rest systems are used so that all three allotments are not collectively grazed every year, and when grazed, the timing is typically different among years. Additionally, all three allotments in Coyote have been rested seven out of the last 13 years. Many management changes that range science theory predicts should improve vegetation communities (i.e., move the vegetation composition to, or toward, a desired community), have been implemented in Coyote, yet the desired improvements in vegetation composition have not been realized. The only

Table 3. Transect summary table for Peterson Mill, Baker, and Sanger C1 transects. Vegetation classified by class. Bolded years are below-normal precipitation years

	Grass	Sedge	Rush	Other	Willow	Sage	Pine	Unknown	Bare soil	Erosion pavement	Rock	Litter	Moss/ lichen	Total
Peterson														
1969	23	36	31	4	0	0	0	0	0	0	3	1	2	100
1976	8	39	9	17	0	0	0	0	3	0	2	16	6	100
1983	9	41	11	26	0	0	0	1	5	0	3	2	2	100
1991	6	35	18	8	0	0	0	0	1	0	4	28	0	100
1994	19	28	15	12	0	0	0	0	3	0	2	21	0	100
1997	12	28	28	12	0	0	0	3	8	0	3	5	1	100
2003	25	16	6	4	0	0	0	1	2	0	2	44	0	100
2008	10	7	29	4	2	0	0	1	3	0	5	32	7	100
2013	4	13	7	18	8	0	0	4	9	0	4	33	0	100
Baker														
1969	14	38	35	5	0	0	0	3	2	0	2	0	1	100
1976	13	29	27	7	0	0	0	4	4	0	7	1	8	100
1983	11	28	9	24	0	0	0	0	9	0	5	9	5	100
1991	10	30	35	11	1	0	0	3	2	0	2	6	0	100
1996	3	24	30	9	2	0	0	4	2	0	2	16	8	100
2003	5	11	3	20	4	0	6	5	0	0	2	43	1	100
2008	2	15	24	12	2	0	8	1	2	0	3	28	3	100
2013	8	12	5	36	4	0	13	5	2	0	2	12	1	100

Table 3. Continued

	Grass	Sedge	Rush	Other	Willow	Sage	Pine	Unknown	Bare soil	Erosion pavement	Rock	Litter	Moss/ lichen	Total
Sanger C1T1														
1969	9	27	13	0	0	10	0	17	17	0	1	3	3	100
1973	37	22	1	2	0	0	0	0	7	0	0	30	1	100
1976	16	32	0	2	0	0	0	0	7	1	1	41	0	100
1983	46	20	0	5	0	0	0	9	11	0	1	1	7	100
1991	19	26	0	0	0	0	0	6	3	0	2	44	0	100
1996	12	53	0	1	0	0	0	5	4	0	2	23	0	100
2003	28	22	0	6	0	2	0	4	3	0	0	35	0	100
2008	29	22	0	0	0	4	0	0	4	0	2	39	0	100
2013	32	26	0	2	0	4	0	0	4	0	1	31	0	100
Sanger C1T2														
1969	41	30	4	0	0	2	0	4	5	0	0	13	1	100
1973	30	24	6	0	0	2	0	0	10	6	0	22	0	100
1976	12	53	0	1	0	0	0	0	1	0	0	33	0	100
1991	17	30	0	0	0	4	0	1	0	0	0	48	0	100
1996	10	47	0	0	0	11	0	0	3	0	1	28	0	100
2003	24	9	0	0	0	14	0	1	5	0	0	47	0	100
2008	15	15	0	0	0	27	0	0	8	0	1	34	0	100
2013	18	11	0	0	0	22	0	0	9	0	0	40	0	100

Table 4. Transect summary table for Peterson Mill, Baker Creek, and Sanger C1 transects. Vegetation by class

Rank	Year										
	1969	1973	1976	1983	1991	1994	1996	1997	2003	2008	2013
	Peterson Mill vegetation class rank										
1	Sedge		Sedge	Sedge	Sedge	Sedge		Sedge Rush	Grass	Rush	Other
2	Rush		Other	Other	Rush	Grass			Sedge	Grass	Sedge
3	Grass		Rush	Rush	Other	Rush		Grass Other	Rush	Sedge	Willow
4	Other		Grass	Grass	Grass	NH			Other	Other	Rush
	Baker Creek vegetation class rank										
1	Sedge		Sedge	Sedge	Rush		Rush		Other	Rush	Other
2	Rush		Rush	Other	Sedge		Sedge		Sedge	Sedge	Pine
3	Grass		Grass	Grass	Other		Other		Pine	Other	Sedge
4	Other		Other	Rush	Grass		UNK		Grass UNK	Pine	Grass
	Sanger C1T1 vegetation class rank										
1	Sedge	Grass	Sedge	Grass	Sedge		Sedge		Grass	Grass	Grass
2	UNK	Sedge	Grass	Sedge	Grass		Grass		Sedge	Sedge	Sedge
3	Rush	Other	Other	UNK	UNK		UNK		Other	Sage	Sage
4	Sage	Rush	NH	Other	NH		Other		UNK	NH	Other
	Sanger C1T2 vegetation class rank										
1	Grass	Grass	Sedge		Sedge		Sedge		Grass	Sage	Sage
2	Sedge	Sedge	Grass		Grass		Sage		Sage	Grass Sedge	Grass
3	Rush UNK	Rush	Other		Sage		Grass		Sedge		Sedge
4		Shrub	NH		UNK		NH		UNK	NH	NH

UNK indicates unknown; NH, no hits.

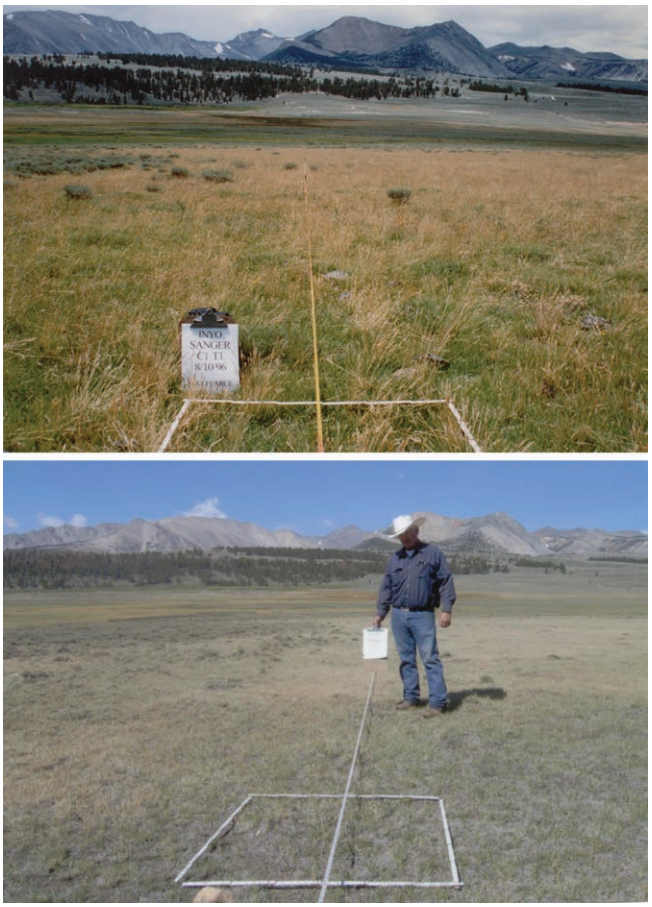

Figure 5. Photo comparison for Sanger, cluster 1 transect 1, showing the impact of a wet year, 1996, and a dry year, 2013. Notice the taller and denser vegetation in the 1996 photos.

really observable vegetation change is the increase in willows, sage, and lodgepole pine on several of the transects. Increasing pine and willows in mountain meadows has been observed on many other locations and may be a result of reduced grazing impacts.[8]

The review of the Coyote data and photos tends to suggest there is a flawed assumption for potential vegetation composition in Coyote. Perhaps Coyote is at its potential? Or possibly heavy grazing use in the 19th and early 20th centuries shifted the site to a new ecological state beyond which it has not recovered, despite reduced livestock use; perhaps that may be the new state for which we should be managing.[1]

From a strictly management perspective, much of the Coyote range is not grazed when compared to historical times when the grazing season was longer and more cattle were on the range. Today cattle are mainly distributed in (or confined to) the large meadows. In previous years with higher stocking rates, cattle were also found in higher elevations, using many of the smaller, outlying stringer meadows. There may have been more numbers in earlier years, but the livestock were more widely distributed.

When the Peterson Mill site was rested from 1985 to 1990, several interesting changes occurred. There were both negative and positive vegetation responses following the removal of livestock. The meadows produced a thick thatch, comprised primarily of *Juncus* species, that was decadent and extremely dense. By the sixth year of rest, little herbaceous vegetation would have enough time during the growing season to elongate above the thatch layer. A positive vegetation response was willows and aspens returning to many sites where they had been absent prior to the rest of Peterson Mill.

Beyond the vegetation response, there have been other positive improvements in Coyote. Under the current management system, active Type E stream channels[9] have narrowed and banks are stable along many reaches. Though vegetation community responses may not be what management would like to see, and the ecological condition is static, other resource improvements have been realized with the current management.

Conclusions

Since 1931 range managers working in Coyote have stated that the range has remained in generally fair condition. We have seen vegetation composition remain fairly constant for the last 49 years with the exception of increasing shrubs and trees. Both these conditions have occurred with mild to moderate grazing pressure.

Forty-nine years of photo coverage and 44 years of data collection have revealed a story, but perhaps not one we would expect. Our plan is to continue to monitor the Coyote Parker transects and see if the apparent changes in vegetation composition continue, particularly for woody species. The next transect readings are scheduled for 2018. The Coyote range continues to provide valuable summer forage for the permittee, although for a much shorter duration and for reduced stocking than occurred historically.

It will be interesting to see what the future in Coyote holds for vegetation composition, hydrology, livestock grazing, and recreation. Concerns for yellow-legged frog habitat maintenance have the potential to completely curtail grazing use. Environmental and recreational issues in Coyote will continue to impact grazing.

Our case study raised more questions than answers about the influence of management changes, such as reduction in livestock numbers, shorter season of use, and changes in grazing systems on vegetation change in Coyote. However, that uncertainty has value. First, the livestock number reductions and shortening of the grazing season have not prevented woody species from increasing. That is a concept worth contemplating when making management decisions on similar allotments. Secondly, as land managers it reminds us to ask ourselves if our assumptions are correct for any given management decision. Additionally, we used the case study to show the value of the raw Parker data and the photo record to assist in monitoring and determining vegetation change on rangelands.

Acknowledgment

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