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.