Oregon Cattlemen's Association

Project Report 2020

Assessment of Measurements of Livestock Impacts on Riparian Sites

Background

A number of conflicts have developed between different natural resource disciplines regarding livestock grazing in riparian and stream ecosystems due in part to the use of varying objectives and monitoring techniques. These conflicts have focused on the impact of livestock grazing on streambank alteration, residual stubble height and riparian shrub populations.

Federal monitoring of grazing impacts on riparian vegetation is focused on the greenline of perennial streams (Burton et al. 2008). The greenline, defined by Winward (2000), is the first perennial vegetation that forms a lineal grouping of community types at or slightly below the bankfull stage of a perennial stream channel.

The channel of a perennial stream is formed when flowing water conducts sufficient work to erode and deposit materials to form a channel (Rosgen 1996). The bankfull location within the channel occurs at the elevation on the streambank where channel water enters the floodplain.

Floodplains in Eastern Oregon typically contain a Horseshoe, Ingram and Winkle geomorphic surface, each represents different episodes of landscape development. These landscapes are subject to rapid changes which result in the formation of new channel, abandonment of older channel, lateral migration of meanders and downstream alluvial deposition. The Horseshoe surface contains the channel. The bankfull location within the floodplain typically occurs on the Ingram surface at the edge of the channel/Horseshoe surface where flood water enters the floodplain. The Ingram surface is directly above the Horseshoe surface and typically consists of sands, gravel and cobbles near the horseshoe surface and finer textures toward the Winkle surface. The Winkle surface is the oldest surface related to drainage system. The surface is dominated by silt and clay over stratified layers of sand and gravel at a depth of 2-6 feet.

Hoof imprints will occur on the streambank when the weight distributed by the hoof exceeds partially or fully the internal structural of the substrate supporting the hoof. In riparian environments substrate composition often range from boulder to silt sized material. Coarse substrate material provides resistance to structural change due to the mass and size of individual pieces and the amount of friction that they contribute to the internal structure of the substrate. As substrate size approaches silt and fine sand sizes both the mass and size of individual pieces are reduced to the point that little energy is needed to move an individual piece. This resistance is further reduced by the lubrication provided by water in the wetted substrate. When water content approaches saturated and supersaturated conditions silt and fine sand particle contact is minimized and adhesion within the internal structure is lost (Hillel 1980). Thus, the area under the hoof is subject to hydraulic pressures which are released to the side as well as downward, leaving a hoof imprint that is raised on the sides and compressed in the center. The duration of the imprint is limited if saturated and super saturated conditions remain allowing materials pushed to the side to return to a level state through the impact of gravity. This process is further influenced when organic matter is present contributing additional shrink and swell characteristics to freeze-thaw and wet-dry cycles.

Federal monitoring, in application, has been extended to lentic and intermittent systems. Lentic valley bottoms are associated with slow to motionless water and lacks sufficient flow to develop floodplain or channel surfaces. Lentic bottoms are subject to saturated/flooded conditions that can range from continuous to limited periods of saturation during the growing season depending on seepage from the water source. Most lentic systems support varying types of hydric plant species. The placement of comparable moisture regimes and plant communities associated with the bankfull position on perennial streams occurs at the outer edges of the lentic bottom.

Intermittent streams will typically lack sufficient seasonal moisture and flows to conduct the work required to form the channel, floodplain and hydric vegetation associated with perennial streams. Thus, upland geomorphic surfaces typically extend to a channel edge with an absence of floodplain attributes. The deviations from perennial stream attributes in lentic and intermittent systems make the placement of greenline monitoring problematic when the federal monitoring protocol is applied to lentic and intermittent systems.

Method of Bank alteration analysis - Using a bank alteration standard of 20% (BLM and USFS standard in Eastern Oregon, derived from Bengyfield (2006)), twelve bank alteration data sets were tested for appropriate sample size (sequential analysis) and estimate accuracy (Chi square test). The 12 stream sites occur within 6 allotments and estimates of bank alteration, vegetation height, and shrub density are being collected before livestock enter the area and after the livestock exit the stream area. The data sets are being assessed for compliance with the standard for bank alteration of 20%, vegetation stubble height standards of 4 inches or 40% use, and shrub browsing not to exceed 20%.

Data sets of 60 random plots $0.1m^2$ are being collected to ensure a 95% confidence that estimates of bank alteration were within 10% of the true mean value. Forage leaf heights are being measured before livestock grazing and after livestock grazing in each randomly located plot.

Protocol described in Larson and Larson (2020) are being used to assess the amount of livestock and wildlife browse that occurred during the grazing season. The protocol uses binomial (presence/absence) data set comparisons to determine the amount and changes in mature (>150cm tall), immature shrub (<150 cm) as well as browsing impact on the shrub growth form.

In this study the questions that we want to answer after another year of monitoring on the same sites will include: Did the amount of tracking exceed the bank alteration standard? Did the amount of tracking observed before livestock grazing occurred change between years? Did the tracking change during the period of livestock grazing? Similar questions will be answered for stubble heights and shrub browse.

Preliminary Results

Currently the Forest Service and BLM rely on a monitoring method called Multiple Indicator Monitoring. It has many flaws including their use of systematic plots along a single transect. When the method was developed the authors of the protocol “modified” the scientific method which requires random selection of sampling plots. They also modified where the greenline sampling area is located and the data analysis is seriously flawed.

To address the greenline issue a second set of data was collected this year on half of the study sites. The data compared measuring bank alteration at the greenline defined by Winward (2000) versus measuring bank alteration at a modified greenline that moves throughout the season (Burton et al. 2008) and is favored by the BLM and Forest Service.

The difference between bank alteration measured on the true greenline versus the modified greenline has resulted in differences of 10%, 20%, and 33% (Table 1). These differences are not favorable to the ranchers and permittees by the BLM or Forest Service. We are looking forward to the second year of data collection to determine if the trend continues.

Table 1. Track accumulation at 3 study sites (Rosgen 1976, B3) observed along the greenline versus the Multiple Indicator Monitoring modified greenline described by Burton et al. (2011).

Site	Stream type	Greenline %	MIM line %	Difference %	
3-1	B3	12	22	10	
3-2	B3	8	28	20	
2-2	B3	15	48	33	

The methods we are employing in this study were published in 3 different peer-reviewed articles in 2019 and 2020. The article on systematic sampling illustrated the impact on data accuracy and analysis. The article on shrub-browse protocol demonstrated how to describe the shrub population and separate livestock and wildlife consumption. The article on bank alteration indicated the amount of tracks are often related to variables outside of the control of livestock grazing management.

Table 2 illustrates 1st year data on track accumulation of 4 sites. The data illustrates that none of the sites exceeded the tracking standard and that the tracking (wildlife) that occurs prior to livestock grazing can be significant.

Table 2. Before and after track accumulation on 4 sites.

Site	Stream type	Before Grazing %	After Grazing %	Change%
2-1	B3	3	16	13
6-2	B3	3	13	10
6-1	B3	3	15	12
5-1	B3	10	15	5

References

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Examples of the study sites.

Photo 1. This site is located in the sagebrush country of Eastern Oregon.

Photo 2. This site is located in a mixed conifer forest of Eastern Oregon.