The Effect of Cattle Trails on Weston County Wyoming’s Natural Resources

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**Abstract**

What makes cattle trails so large and what natural resources are missing from them? Cattle trails can get quite large in Weston County, Wyoming, creating a potential loss of resources in pastures where they are present. This study aimed to examine cattle trails and their effect on the surrounding rangeland ecosystems. Specifically, the study focused on gathering information about the potential loss of rangeland natural resources including soil, forage, and precipitation. The evidence collected was analyzed to prove that there is a substantial loss of natural resources due to cattle trails.

Many different approaches were used for this project to collect empirical evidence. Technology such as Google Earth and a GPS unit helped to map and track the presence of trails. Measuring width, depth, and length of each trail was also important for the study. A variety of formulas were utilized to calculate rangeland production, forage loss, water loss, and soil compaction for each pasture where trails were present.

Soil, forage, and water are all very important to any rangeland ecosystem; however in Weston County, healthy, productive rangelands are important for the production of beef and sheep. The loss of these important natural resources is a major problem for landowners. Previous studies have prescribed conservation through selective placement of mineral and additional water sources to help mitigate the effects of cattle trails, creating a potential solution to help minimize the effects of cattle trails.

**Introduction**

Many pastures in Weston County, Wyoming have intricate trails, some carved deep enough that horses are forced to jump them, sparking the question, “Why are these trails so large and prominent?” Cattle trails, while a normal phenomenon when grazing cattle, present a number of challenges for rangeland ecosystems. However, most people don’t realize that cattle trails can cause a loss of natural resources within rangeland ecosystems. Cattle trails, or continually compacted soil resulting from the movement of animals, have become a concern for rangeland managers as these ecosystems become more strained (George ET al). However, many ranchers don’t recognize cattle trails as a problem, thus failing to manage cattle trails to conserve natural resources.

This study sought to examine the effects of cattle trails on rangeland resources in Weston County, Wyoming. Specifically, it hypothesizes that cattle trails cause a loss of natural resources. The study aimed to secure substantial evidence in order to show that there is a loss of natural resources in rangeland ecosystems in Weston County, Wyoming. A total of twenty-four trails spanning eight pastures were analyzed for natural resource losses. Empirical evidence from these cattle trails measured data on soil, water, and forage using the trail width, depth, and length. Additionally, the forage production for each pasture was measured and calculated in pounds per acre. This paper presents the results of this study.

**Literature Review**

There are multiple resources to consider when studying cattle trailing and its effect on the respective ecosystems. Many of these research proponents study how cattle trails affect riparian areas such as streams and ponds. For example, Grazing Management for Streamside Areas by, Brockmann, or Cattle Grazing Has Varying Impacts on Stream-channel Erosion in Oak Woodlands by George, Royce, Mcdougald, Tate, Gerlach and Fulgham. Also Managing Grazing in Stream Corridors by Moechnig focus on riparian ecosystems, studies what happens to streams and ponds if cattle graze those areas.

There are also a number of resources which provide information about how to increase cattle distribution allowing for less cattle trailing. For example, *Management strategies for optimal grazing distribution and use of arid rangelands* outlines many different ways to improve cattle distribution including fencing, developing new water sources and adjusting the location of current water sources. These studies prescribe possible ways to reduce cattle trailing to preserve natural resources. This research project differs from previously published studies because of its narrow focus on rangeland in Weston County, Wyoming.

**Materials and Methods**

Twenty-four trails in Weston County were randomly selected for this study with permission from local landowners. Google Earth provided bird’s eye views of the pastures so trails could be counted and assigned numbers in order to randomly select three to study. Surveys were administered to landowners to gather data about the pastures in which the trails were studied. The questions included:

1. How large is the pasture?
2. How far apart are the water sources?
3. Do you place mineral or salt in the pasture?
4. If so, is it with a water source?
5. If not, how far is it from another mineral source?
6. How far is the mineral from the farthest water source?
7. What types of animals are in the pasture and for how long?

These questions gave insight to the animal distribution in each pasture as well as the information needed to calculate animal unit months (AUM), and animal unit equivalency (AUE) statistics for each pasture. The AUM and AUE statistics allowed the calculation of stocking rate and density in each pasture.

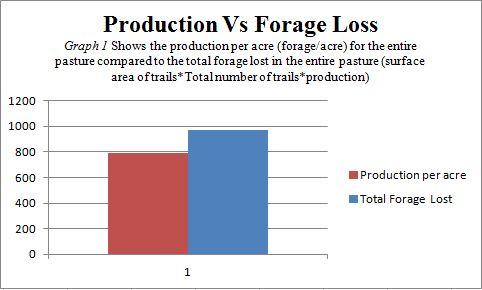
After the survey was conducted a Garmin 450 GPS was used to measure the length of the randomly selected trails. Width was measured at the beginning of each trail using a tape measure from vegetation to vegetation. Additionally, a plum bob was used to measure the depth of the trail in the deepest point. Throughout the trail, the width and depth were measured at every 100 ft. then again at the end of the trail. The length, depth, and width measurements were all recorded in an Excel spreadsheet to calculate each trail’s average.

After collecting data from the selected cattle trails the production of the pasture was measured to complete the data collection process. A square foot hoop was placed at random places in the pasture. All ‘new growth’ was collected, dried, and weighed. This process was repeated seven times throughout each pasture. Averaging the dry weight from all five sites the production was estimated using the formula w\*43560. With “w” being the weight of the sample which was taken.

Soil compaction in the trails was calculated using the formula (πr2 h)/2 with r being the average of the depth and width and h being the length. This formula was utilized because it is one-half the volume of a cylinder and a cattle trail is roughly the shape of half a cylinder. Since compacted soil can reduce permeability a rough estimate of lost precipitation was calculated (Effects of Soil Compaction).

The potential amount of water lost was calculated through a simulated rainfall event. Two experiments were set up, one on a cattle trail the other on pasture in good range condition. This experiment sought to measure the difference in permeation of water into the soil. Both experiments were set up on a 5% slope as to simulate natural occurring slopes in Weston County. 1,000 mL of water were sprinkled across the soil and down 50 cm to a catch pan. Results were then applied to a formula to calculate the total surface area of the trail. Surface area of each cattle trail was calculated with the formula used to find the surface area of a cylinder divided by two, (πrh)+(π(r2 )), with r being the average of the width and depth and h being the length. Applying this to the average inches of precipitation measures potential water displacement because it calculates the amount in square inches of precipitation that fall into the trail. This was then converted to gallons lost per year per pasture. Calculations were completed by applying the gallons of water known to fall with one inch of precipitation, onto an acre of land. According to USGS Water Science School, one inch of rain over one acre of land equals 27,154 gallons of water.

**Results**

Soil compaction is a major contributor to loss of natural resources because forage is unable to grow in overly compacted soil (DeJong-Hughes et al). Additionally, compaction decreases water absorption further limiting the types of forage that can grow in affected areas. The average soil compacted per pasture due to cattle trailing was 74,303.3 cubic feet. Another major natural resource that the data shows at a loss is forage. Forage is important because it is a major part of several animals’ diet; forage makes up 83 percent of all beef cattle rations, 91.1 percent of sheep and goats rations, and 72.2 percent of a horse ration (Adesogan). Graph 1 illustrates forage lost as a result of cattle trailing in these pastures. The average forage lost per pasture was 991.81 pounds, while each acre was producing 793.45 lbs. of forage. 

The final natural resource that is being lost is water. Through the simulated rainfall event experiment it was found that 470 mL of water out of 1,000 mL was caught in the catch pan on a cattle trail compared to 100 mL of water out of 1,000 mL on a range site in good condition. There are 166,151.5 gallons per year per 320 acre pasture of water displaced, due to cattle trailing. This is found by taking the gallons of water for every one inch of precipitation over an acre (27,154) multiplied by 1.25 (the average surface area of trails in an average 320 acre pasture). This gives us 33,942.5 gallons of water for every inch of precipitation on 1.25 acres. This is then multiplied by 13.23 the precipitation in Weston County Wyoming in 2015 (Wyoming Agriculture Statistics). Then this is further multiplied by 37% because that is the difference in the average amount of water, that will runoff a trail versus a site in good range condition.

**Discussion and Conclusion**

The data collected shows a substantial loss of resources as a result of unmanaged cattle trails in the pastures studied. The most important resource, soil, greatly impacts the presence of all other resources in rangeland ecosystems (“The importance of soil”). In a series of cause and effect, the more soil that is lost, potentially more water and forage are lost.

Through my rainfall event simulation I found that a trail permeates 37% less water than a range site with no trailing in good condition. In the average pasture with 320 acres there is 157,170.75 gallons of water that are displaced, due to cattle trailing.

Forage is another natural resource lost due to cattle trails. The average forage lost per pasture per year was 991.81 pounds. Grazing an 800 weight steer, this animal will need 1,280 pounds of forage per month, considering the take half leave half rule (Hancock). This is significant because when you look at the economic impacts in Weston County, you see that there is a potential loss of up to $292,158.49. This is found by using the following steps in chronological order:

* Divide the amount of forage lost (991.81 lbs.) by two, in consideration of the take half leave half rule. Then you divide this by how much forage one 800 pound steer will consume in a day, 21.33 lbs. (Hancock). Resulting in 23.25 days you would be unable to feed an 800 weight steer.
* Multiply the number of days by the average daily gain of a steer, 1.7 pounds, (Ringwall). This results in the number of pounds that won’t be produced in a year, in one 320 acre pasture. This results in 39.52 pounds not gained due to trailing, per 320 acre pasture.
* Then you multiply the number of pounds not produced, by the average price of a pound of beef. In Wyoming in 2015 this was $1.54 per pound (Wyoming 2015 Agriculture Statistics). Resulting in a loss of $60.87 per 320 acre pasture.
* You then multiply this by the number of 320 acre half sections there are in Weston County Wyoming, 4,800 (Conklin).

You get $292,158.49 this is the economic impact on the producers in Weston County alone. In addition if you were producing that same 800 pound steer, with the average 105.76 grams of protein in a pound of beef (USDA). Then assuming 51% cutability, a yield grade 2 steer, which means that the carcass is almost completely covered with external fat, however lean is visible through the fat over the round, chuck, and neck (Hale et al). Weston county producers could feed an additional 491, 18 year old men, their daily protein requirement of 57g, for one full year.

Resource loss may not be a result of cattle trails alone, it also may include factors such as two track roads and other human activities such as horseback riding. Rangelands that lose these important natural resources are not as productive for landowners, which in turn can affect livelihoods, making conservation an important management tool to consider. There is a potential for continuing this project. Measurements could be taken from the trails after the cattle distribution had been improved to evaluate if management conserves natural resources. Another option would be to measure the trails again without any cattle distribution management, to evaluate any further degradation in the resources from year to year. In addition continuing to collect water data across multiple pastures would further validate these results.

This research reflected that no matter how many AUMs and AUEs present on a pasture, as long as the land is not over grazed, the number of animals doesn’t affect cattle trails. The pasture with the farthest distance between water sources (pasture 1) was compared to the pasture with the shortest distance between water sources (pasture 2), and the volume of pasture 1’s trails was 42.7 percent higher volume on average than 2’s trails. However, animal distribution is the main factor forming cattle trails. Animal distribution can be controlled using fence, mineral, and water placement to keep livestock disbursed. Conservation management plans should include adopting these principles to help mitigate the loss of natural resources due to cattle trails.

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