# Upland Water and Deferred Rotation Effects on Cattle Use in Riparian and Upland Areas

John Carter[1], Jim C. Catlin[2], Neil Hurwitz[3], Allison Jones[2], and Jonathan Ratner[4]

WILD UTAH PROJECT

## Introduction

In 2007 on the Duck Creek allotment in Rich Co. (Fig 2), the Bureau of Land Management (BLM) installed fences to divide the allotment into four pastures so grazing could be managed under a deferred rotation system. The aim was to reduce livestock access to riparian areas from 4 months to 1 month, provide alternating periods of growing season rest, and correct a distribution problem. The results expected by the BLM were reduced use of the riparian areas, no measurable increase in use of the uplands, and improved conditions for both. For 4 years prior and 4 years after implementation of the new deferred rotation grazing system, we collected data for parameters used by BLM to assess compliance with objectives for upland and riparian utilization and greenline stubble height to determine whether these objectives were met. We expected that if the changes in the grazing system and upland water resulted in less use of the riparian area, then riparian utilization, greenline stubble height, and bank alteration would decline. Similarly, for the uplands, we were interested in whether measurable changes in utilization would occur.

**Figure 1.** Riparian Vegetation Residual Sampling, and grazing utilization estimation method using the DOI Paired Plot method, in one of the Riparian sites.

## Methods

**Study Area** - The Duck Creek allotment is located in Rich County in northeastern Utah (Fig. 2) on the Bear River Plateau. It is a semi-arid cold desert sagebrush-grassland, in which precipitation averages 34.5 cm annually. Elevations on the Duck Creek allotment range from 1,920 to 2,220 m. The allotment contains 9,053 ha, including BLM-managed land, private land, and state-managed lands. Three perennial streams occur within the allotment. Currently, six individual permits allow 641 cow/calf pairs, 14 horses, and 1,070 ewe/lamb pairs to graze on BLM-managed lands. The grazing season for cattle is May 10 through September 7. Sheep graze under two permits (spring and fall). Total animal unit months (AUMs) under Active Use are 3,310 AUMs.

**Study Design and Field Methods** - Stubble Height of Nebraska sedge was measured along the greenline of three perennial stream reaches to assess compliance with a 12.7-cm BLM resource management objective. Heights were measured on both sides of the stream at approximately 1-m intervals extending for 30 m up- and downstream from riparian utilization cages. The Multiple Indicators Method (MIM) was used for collecting Bank Alteration data along both sides of three stream reaches, in which measurements were made at 2-m intervals along each side of the stream. Both upland and riparian Herbaceous Vegetation Residual Biomass (air dry) was measured at 12 (upland) and 3 (riparian) locations, after the end of the cattle grazing period, using a slight modification of the Paired Plot method (BLM 1996).

**Data Analysis** - Data for each parameter were pooled by year and analyzed with Microsoft Excel (2013). To compare the means of habitat measurements in the pre- and post-grazing system implementation periods, we aggregated the observations across all years and performed a version of Student's t tests that pools variance estimates to account for unequal sample sizes and variances between two populations.

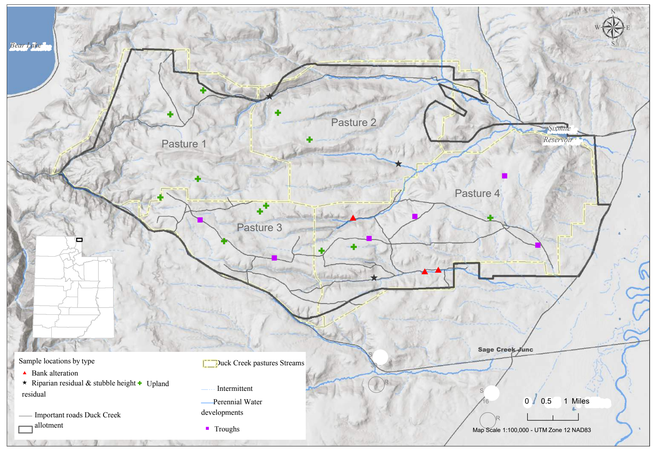


**Figure 2**. Map of the Duck Creek allotment, southeast of Bear Lake in Rich County, UT., showing the new fences and pasture arrangement as of 2009. Symbols show sites where various field measurements helped determine whether the new livestock roatation system implemented in 2009 is meeting goals for grazing utilization, and riparian and upland vegetation biomass residuals and stubble height.

**Table 1. results of *t*-tests: 2-tailed, unpaired, unequal variance**

| | 2006 - 2009 (Pre-Implementation) | | | 2010-2013 (Post-Impl) | | | *t* test | |
|---|---|---|---|---|---|---|---|---|
| | N | Mean | Std. Dev. | N | Mean | Std. Dev. | d.f | *P* value |
| Upland Residuals | 470 | 74 kg/ha | 58.6 | 450 | 45.4 kg/ha | 33.1 | 747 | <0.0001 |
| Riparian Residuals | 58 | 125.3 kg/ha | 98.3 | 49 | 144.5 kg/ha | 199.3 | 67 | 0.54 |
| Stubble Height | 366 | 7.5cm | 3.1 | 606 | 5.6cm | 3.9 | 893 | <0.0001 |
| Bank Alteration | 239 | 4.1 hits | 0.9 | 950 | 4.0 hits | 1.2 | 468 | 0.8 |

**Table 1.** Results of t-tests: 2-tailed, unpaired, unequal variance.

## Riparian Greenline Stubble Height

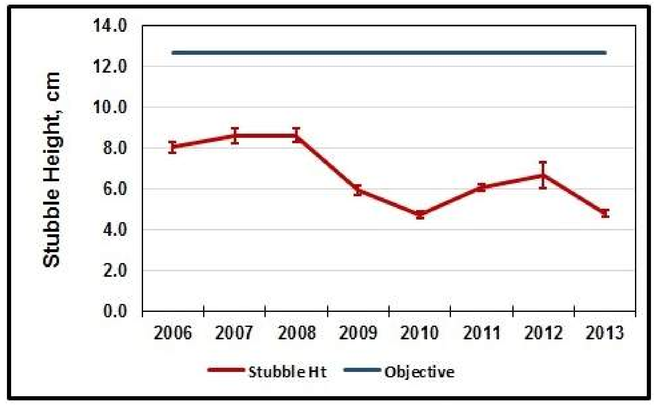


**Figure 3**. Riparian greenline stubble height for Nebraska sedge. Stubble heights were significantly greater in the pre-implementation period (2006-2009) as compared with the post-implementation period (2010-2013), and never hit the BLM's objective for stubble height.

## Results

- Riparian Greenline Stubble Height: Lumping the data from the pre- and post-implementation of the deferred grazing, mean stubble heights on Nebraska sedge ranged from 4.7 to 8.6 cm, compared with BLM's objective of 12.7 cm. Stubble heights were significantly greater in the pre-implementation period as compared with the post-implementation period (Table 1, Fig 3).
- Bank Alteration: When comparing pre- and post-implementation, bank alteration remained nearly constant across all years at 4.0 to 4.1 hits (80%-82%) of hoof print counts on the banks. BLM has no standard for annual bank alteration but uses it as part of MIM. All measures greatly exceeded levels (15%-20%) known to restore streambanks and channel width (Table 1).
- Upland Residual Grasses: Over the 8 years of data collected, grass residual amounts varied between 32.0 and 90.7 kg/ha for grazed plots and 141.2 to 264.1 kg/ha for ungrazed plots. Post-implementation grazed residuals were significantly less than pre-implementation residuals (Table 1, Fig. 4), and this could not be explained by precipitation.
- Riparian Residual Herbaceous Vegetation: Grazed riparian herbaceous vegetation ranged between 22.9 and 241.3 kg/ha, while ungrazed riparian herbaceous vegetation ranged between 882.6 and 3478.5 kg/ha over the 8 years. When the pre-implementation data were pooled for comparison with the post-implementation data, no significant difference was found (Table 1).
- Utilization: Grazed and ungrazed upland and riparian residuals were used to determine utilization. Upland utilization ranged from 58.3% to 81.4%, while riparian utilization ranged from 86.4% to 99.2% (Table 1, Fig. 5). BLM objectives were not to exceed 50% utilization in upland and riparian areas. This level was exceeded throughout the study period for both upland and riparian areas, for both the pre- and post-implementation periods.

## Upland Residual Grasses

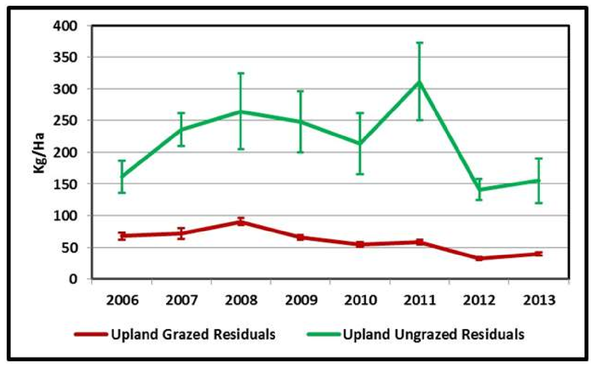


**Figure** 4. Upland grazed and ungrazed residual grasses. Post grazing system implementation residuals were significantly less than pre-implementation residuals (Table 1), and this could not be explained by precipitation.

## Grazing Utilization

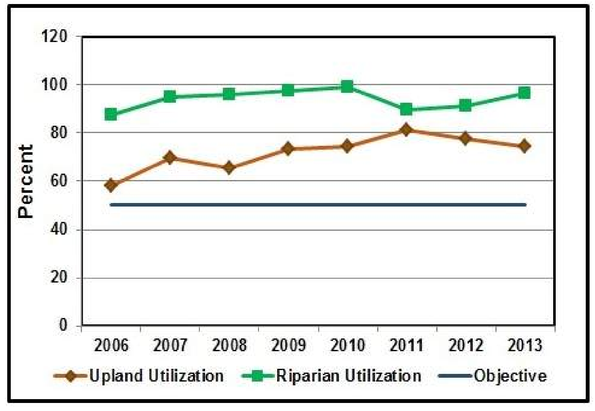


**Figure** 5. Upland and riparian livestock utilization. The BLM's 50% utilization objective was exceeded throughout the study period for both upland and riparian areas, for both the pre- and post-implementation periods

## Discussion & Conclusions

The measures of riparian stubble height, bank alteration, upland residual grasses, riparian residual herbaceous vegetation, and utilization bear out the research over the past few decades showing that rotational grazing systems cannot overcome the effects of overstocking in arid or semi-arid systems such as the Duck Creek allotment (see Carter et al. 2017 for references). Upland water developments and supplements do not overcome the propensity of cattle to linger in riparian areas, resulting in overgrazing and stream damage, and therefore do not lead to recovery of these damaged systems. As such, riparian greenline stubble height never met the objective of 12.7 cm in the Duck Creek allotment. Post-implementation stubble height was significantly less than pre-implementation levels, likely a result of concentrating all the animals in one pasture of the allotment without herding them away from riparian areas. Agency research shows that at least 15 cm of residual herbaceous plant growth at the end of the grazing season typifies riparian areas in excellent, good, or rapidly improving condition. This typically corresponds to utilization of 25% to 35% in the riparian area (Clary & Webster 1989). Upland residual grass biomass measurements showed that significantly less remained in uplands after implementation of the upland water and grazing system. This was reflected in an increase in utilization in uplands, up to 81.4% post-implementation, well-exceeding the BLM's 50% utilization objective. In degraded arid or semi-arid systems such as this, utilization of 25% to 30% by livestock is recommended (e.g Holechek et al. 2004). Similarly, riparian herbaceous residuals were not significantly different pre- and post-implementation, and riparian utilization remained between 80% and 90% during the entire 8 years, far exceeding BLM's 50% objective.

**Overstocking and lack of adequate science-based standards have result in overuse and degraded conditions in the Duck Creek allotment. Implementation of the upland water and deferred rotation grazing system demonstrably failed to reduce riparian use by livestock while further increasing upland utilization rates. Restoring the degraded conditions and sustaining native plant species will require a change in management, including:**

- **setting stocking rates based on current levels of preferred forage species and forage consumption rates of livestock**
- **enforcing sustainable utilization rates of less than 30% in both upland and riparian areas**
- **enforcing riparian stubble heights of greater than 15 cm, applicable to the entire aquatic influence zone and floodplain**
- **enforcing bank alteration levels of less than 20%**
- **providing adequate rest based on the needs of the preferred native grasses and forbs such as bluebunch wheatgrass and Idaho fescue, typically multiple years following each grazing period in a pasture.**

## Acknowledgements

This work was recently published in Rangelands (Carter, J., Catlin, J., Hurwitz, N. Jones, A. and J. Ratner. 2017. Upland Water and Deferred Rotation Effects on Cattle Use in Riparian and Upland Areas. Rangelands 39:112-118)

**AUTHORS:**

[1] Keisha's Preserve, Paris Idaho

[2] Wild Utah Project, Salt Lake City Utah

[3] Ecostatistics Consulting, Washington D.C.

[4] Western Watersheds Project, Pinedale Wyoming