

Monitoring Restoration of the South Fork of the Crooked River Using Stream Profiles

Henry DeGrazia, Bio 410 Summer 2009

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Introduction

The Pacific Northwest is not well adapted to heavy grazers such as cattle. Unlike the areas of the Great Basin that evolved under the selective pressures of large grazers and where grasses have evolved adaptive strategies to survive and even thrive under such conditions, the grasslands of the northwest are composed of sedges and rushes which have only in the past century been exposed to heavy grazers and thus are poorly adapted to survive such conditions (Kinney 1996). Cattle have damaged ~ 80% of the western streams and rivers in the U.S (Belsky et al 2002). Where the land is arid during the hot dry summer months, cattle are drawn to the lush vegetation and cool waters of the riparian zones (Darambazar et al 2003) further concentrating the impact to these areas. By eating and trampling the vegetation along the banks the cattle reduce the bank integrity leading to soil erosion and a widening and shallowing of the river profile. This significantly reduces the habitat for riparian vegetation and wildlife (Dobkin et al. 1998; Tewksbury et al. 2002), and allows the water to warm due to the greater surface exposed to sunlight, impacting fish habitat (Carter 2002).

Because cattle ranching has not been economically tied to the financial impact on the fish harvest, there has been little money available to study the restoration of these areas and thus little is known. With current river levels eroded below the original floodplain, it is unlikely that many river systems will recover back to become connected to their original floodplain. It is likely however that many of these systems can be restored to the point where they can once again support larger populations of native fish, plants, and wildlife (Dobkin et al. 1998; Deschutes Coordinating Group

2004). As most ecosystems are amazingly resilient given the opportunity, the first step has been to remove the impact of cattle from the fragile riparian zones.

Once cattle are removed, the question becomes how long it will take for these systems to become functional again. More research is needed into studying the fundamental question of how to restore the habitat in cattle damaged areas as evidenced by a federal judge recently ordering a halt to cattle grazing within important native trout streams in eastern Oregon's Malheur National Forest until more data can be collected (Erntz 2009). As cattle ranching is a multimillion dollar industry in Oregon, it is clear that to some extent cattle will also have to share the land, thus once the ecosystems are functional, it will also be necessary to determine what level of grazing can be supported without significant deterioration.

In order to address these questions we have studied several sections of the South Fork of the Crooked River in which cattle have been excluded from small (approximately 1-.15 miles stream length) exclosures since 2001. The exclosures were activated in 2001 at the request of the Oregon Department of Fish and Wildlife, which wanted the BLM to address whether cattle along the South Fork were impeding the breeding success of redband trout. This report includes the first preliminary look at how these sections of river are recovering by examining the changes to the river channel profile. If recovering, it is expected that the river profile will be shifting back towards a narrow deep channel with undercut banks.

Methods

Study Site. The study site is on the South Fork of the Crooked River, located in Eastern Oregon at an elevation of approximately 3800 ft. The specific sites studied were set up as cattle exclosures in August 2001 by the BLM. The sites studied involve three areas (A, B, and C), each 1 to 1.5 mi in length along the S. Fork. The areas were divided in half at random, with one treatment assigned to each half. Controls were designed to remain cattle-free throughout the year, while treatments receive

the same grazing regime (mid April to mid May, two out of three years) as the rest of the BLM property in the drainage. Baseline stream profiles, pebble counts, and bank angles for these sections were collected by the BLM in 2001 and 2002 (BLM Studies). This report adds to the work originally started by the BLM by resurveying some of the cross sections in the study area seven to eight years after the original surveys were performed.

Stream profiles. Stream profiles were collected using benchmarks established by the BLM study in 2001. Each of the sites in this study is centered in a riffle and extends from the first floodplain terrace to first terrace on the other side of the river. Procedures for collecting data are described in Harrelson et al. 1994. Elevation measurements were collected at 2ft intervals and any elevation transition points. Measurements were taken at 1 ft intervals across the river channel itself. Data taken by UO courses were collected from right bank to left bank then inverted to match conventions, which call for taking it from left bank to right.

Pebble Count. We utilized the Wolman Pebble Count according to the procedure found in Harrelson et al. 1994. Pebbles were collected from 10 feet upstream and downstream of our transect, 50 particles were counted on each side for a total of 100. Pebbles were selected by traveling back and forth within these regions perpendicular to the current flow one step at a time collecting the first object to come into contact with the tip of the index finger directly in front of the foot while averting our gaze. The intermediate axis was utilized in determination of size.

Velocity. The float method was utilized to determine the velocity of the current. With the transect as the starting point, we measured the time it took an orange peel to travel three channel widths downstream of this point. The procedure was repeated 7 times starting each time at a different distance from the shoreline. The values were averaged and then multiplied by 0.85 to calculate the mean velocity of the entire cross section (Harrelson et al. 1994).

Bank Angle. Bank angle was taken using a compass with a built-in clinometers and a folding

yardstick using the methods stipulated in Platts et al 1987. Bank angle was measured in six locations: right and left bank along the transect and upstream and downstream of the transect. The distance upstream and downstream has been inconsistent in this and previous UO studies. The distance is noted for each location (see Results).

Results

Data were analyzed using Open Office then converted to an Excel format. Both versions of the spreadsheet containing raw data are available by contacting Matt Orr. Stream profiles and pebble counts have remained remarkably consistent from 2001 until 2009 (Figures 1 & 2; see in text after References section). Stream velocities were 2.04 ft/sec at A1, 1.53 ft/sec at A2, and 1.68 ft/sec at B1. Bank angle measurements from all sites recorded to date are below (Table 1; in text after References). We do not have BLM data on stream velocities and bank angles for comparison to 2009 measurements.

Discussion

While the data provide some hints of changes (a slight narrowing of the left bank in experimental unit B1 and a slight deepening of the channel along the left bank in experimental unit A1), the differences are too small and the data sample too limited to draw any clear conclusions at this point. Further data will be necessary to determine whether the channel is actually narrowing and deepening as expected. There may be a slight shift towards larger pebble sizes at the sites, which would also be indicative of the river returning towards a healthier state with lower sediment levels in the water. At this point, however, a lack of change seems to be the strongest pattern at these three sites in the eight years since treatments were implemented. There are three possible explanations for the lack of changes seen here. First, at some locations it may take as long as 20 to 30 years to see significant riparian improvement once cattle are removed (Wyman 2006). Part of what may cause a delay, at least in the case of the present study, is that forage grasses now form a large (and in the case of transect B1, dominant) component of the streamside community. Such forage grasses are not well-suited to

physically repairing stream structure via a riparian-adapted root system. Second, early-season “low impact” rotational grazing practiced at these sites prior to establishment of the exclosures may have been sufficiently successful that removing cattle has little subsequent effect. Third, the exclosures may not be fully cattle-proof, thus reducing differences between the treatments. Additional comparisons using BLM baseline profiles that have not yet been resurveyed, plus transects added from Otto Keller’s property, where cattle are now rigorously excluded, may help to resolve these three possible interpretations in the future.

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Table 1. Bank angle measurements taken by University of Oregon, 2008-2009. A ninety degree profile is a vertical bank; anything less than ninety degrees is undercut. In most cases a ninety degree bank was produced by dense stands of straight-standing vegetation, and not by vertical root wads or soil structure. Distances upstream and downstream from the center line (where the stream profile was taken) varied from one location to the next: In 2008 these were taken at the ¼, ½, and ¾ distances from the top of the riffle D1, which measured 18 feet from the midline, and the same distances were used thereafter. In 2009 we instead took them at the 10 m mark (Matt Orr) and 10 foot mark (students). In comparing our measurements with BLM bank angle measurements, the only place where banks will be resurveyed at an identical location will be at the center stream profile line. Bank angles from site G1 were not included in Erin Barnholdt’s 2007 report and appear to be lost. These should be remeasured by the course in 2010.

Transect	Year Measured	Dist, Up / Down to Ctr line	Location Measured					
			Up, rt.	Up, left	Mid, rt.	Mid, left	Down, rt	Dn, left
A1	2009	10 feet	90	90	90	75	90	85
A2	2009	10 feet	90	90	90	90	79	90
B1	2009	10 m	90	52	110	80	90	80
D1	2008	18 feet	102	90	110	95	110	82
E1	2008	18 feet	100	112	99	106	101	95
F1	2008	18 feet	110	110	95	125	115	75

Figure 1. Stream profiles compared at one limited rotation grazing treatment (T, top) and two treatments where cattle have been fully excluded for eight years (C, panels 2 & 3). There has been remarkably little change in stream profile at all three locations since cattle were excluded. This may indicate that limited grazing rotations prior to full cattle exclusion were successful at limiting riparian damage, or it may indicate that barrier fencing has not been effective at excluding cattle since 2001.

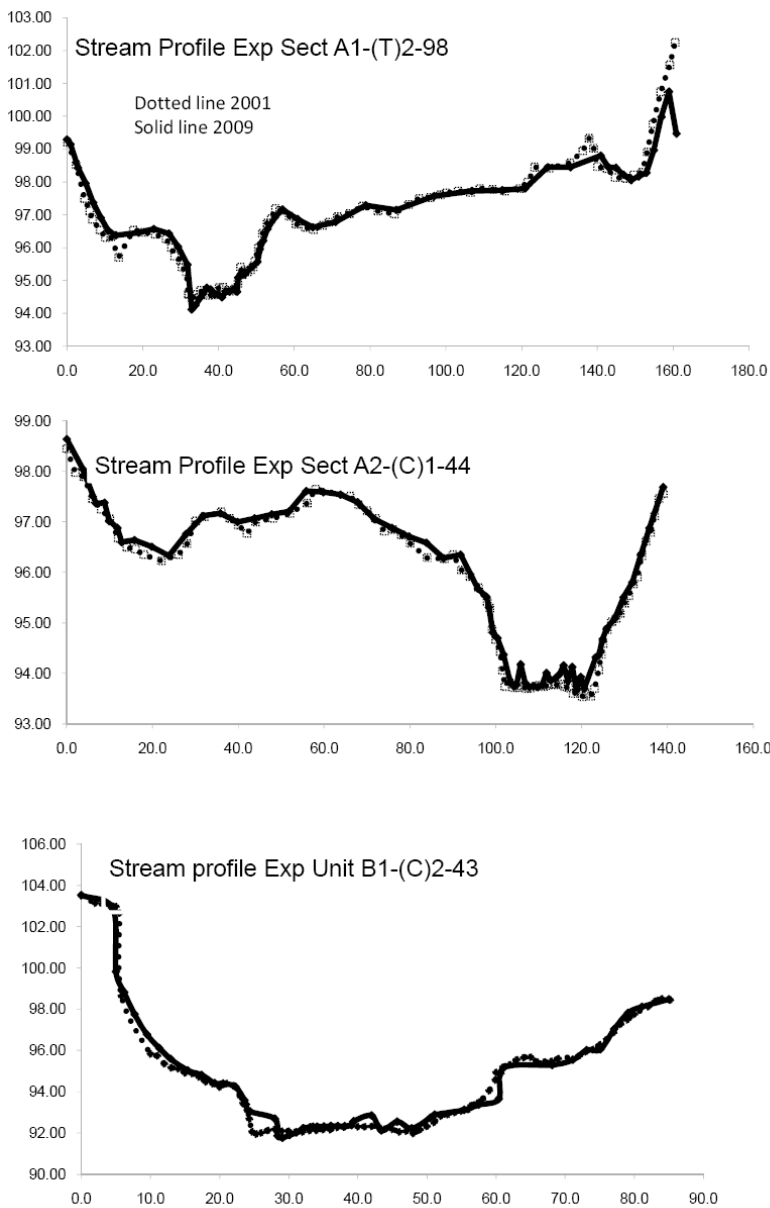


Figure 2. Pebble counts. Data from 2009 are green and yellow lines; data from 2001 are red and blue lines. Comparison for site A-1 awaits 2001 data from the BLM.

