EFFECTS OF LARGE WOOD AT TRINITY RIVER BANK REHABILITATION SITES

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Figure 8. Taj Mahal, Hilton, or Holiday-Inn Express? The largest wood installion of 2009 – a 31 piece structure located on the right bank at Sawmill

INTRODUCTION

The goal of the Trinity River Restoration Program (TRRP) is to restore the fish and wildlife populations in the Trinity River basin to levels that existed before the construction of Trinity and Lewiston Dams. To achieve this goal, the TRRP has implemented a suite of management actions including flow management, coarse sediment augmentation, channel rehabilitation and large wood management. To address habitat deficiency and a lack of wood loading resulting from low historic flows and the discontinuity created by Trinity Dam, large wood has been installed at Bank Rehabilitation sites on the Trinity River. Large wood is a dominant factor in the creation and maintenance of essential fish habitat and fluvial processes.

We have established a monitoring scheme to evaluate the effectiveness of TRRP large wood structures over time, and analyze the effects of structures as they relate to management objectives. Our survey was done in conjunction with the Integrated Habitat Assessment Project (IHAP) that quantifies changes in habitat area resulting from the structures.

This survey specifically addresses the large wood management aspect of TRRP restoration actions. The survey objective is to monitor key attributes and processes relating to LWD installations as a geomorphic and habitat providing tool, track the effects over time and inform interested parties. Another objective is to promote understanding and guide subsequent actions, improving the effectiveness of future installations.

Logjams

Original Installation, Valdor 2006 | **Natural-Recruiting Logjam, Valdor Gulch 2008**

Figure 1. The placement of this installation within proximity of the thalwag led to the natural recruitment of wood. The resulting scour and cover provides excellent rearing habitat for juvenile salmonids.

Transported Pieces-Abandoned Site

Lower Indian 2007 | **Lower Indian 2008**

Figure 2. The transport of this wood assisted in scouring out the head of the Indian Creek side-channel and sorting of the substrate, leaving gravel and removing fine material

MATERIALS AND METHODS

- This survey is repeated annually to document changes at rehabilitation sites with flow and through time. Equipped with a Trimble ProXH GPS, tablet PC and Nikon Coolpix SLR camera, we walk through the sites and collect the following data for each structure:
- LWD size- Due to the focus on installed pieces, the minimum size requirement is 20 cm diameter X 2 m length; diameter is measured at breast-height and length from root wad to end of stem. We use a three size class system to speed up the survey
- Tracking the number of pieces, enumeration of large wood: Our survey tracks the total number of new pieces, recruits, transported pieces, and natural pieces (as opposed to restoration-installed) to quantify changes from year to year.
- Wood Location- All pieces of wood are assigned a channel location to which they belong, ie. bank, side-channel, etc
- Flow-Location: Discrete classes describing where the wood is located on bank: peak-flow- wood becomes wetted at flows above 2,000 cfs. banks, spring-flow- wood is wetted between 450-2,000 cfs., and base flow- always wetted (between 300-450 cfs).
- Descriptors-installation specific information.
  - Root wads with stems or root wad only- wood features with no attached stem.
  - Height- categorized to assess inundation levels, either >2 m or < 2 m.
  - Wetted- estimated length of wood lying within the stream. Quantifying the amount of cover provided by structures.
  - Orientation- Position of wood relative to stream flow is an important variable relating to stability of structures.
- Properties: any possible characteristic relating to or resulting from the placement of wood. Does the installation cause scour, deposition, velocity breaks, or bank instability. Is it anchored (if the log is partially buried, fixed with boulders, or an engineered structure)? Is the installation recruiting wood and forming a logjam . Does the installation have branches or riparian vegetation, is it overgrown, or are there no effects.
- Post processing of the data is conducted using ArcMap, GPS Pathfinder Office and Microsoft Excel.

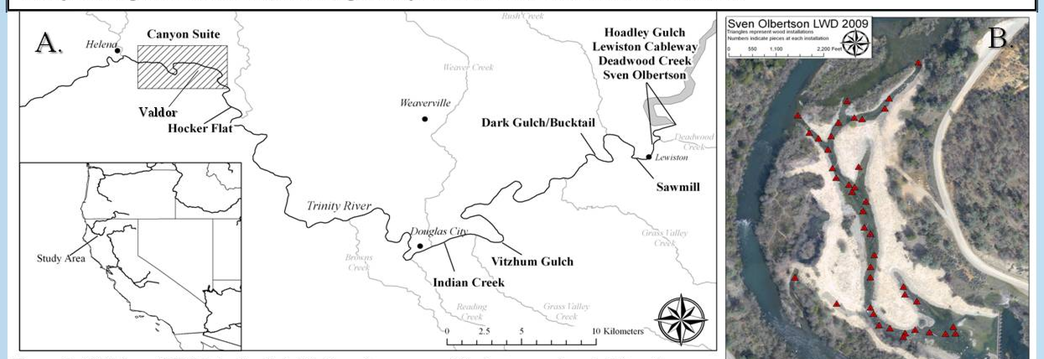

Figure 3: (A) Map of TRRP bank rehabilitation sites surveyed for large wood and (B) a site map showing wood locations at the Sven Olbertson site in 2009.

Scour: Valdor Gulch 12

Valdor Gulch 2006 | **Valdor 2007**

Figure 4. This installation left an enormous scour pocket as high flows & vacating logs cut into the bank during Spring 2006.

Recruited Pieces-Natural Transport:

Lower Indian 2007 | **Lower Indian 2008**

Figure 5. Transported wood recruited onto a key piece. The resulting scour and cover provides excellent fish habitat.

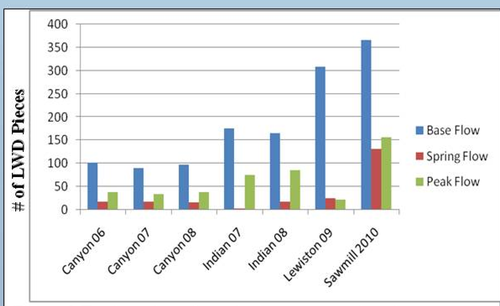

Figure 6. Total number of wood pieces surveyed, and location within one of three discrete flow thresholds

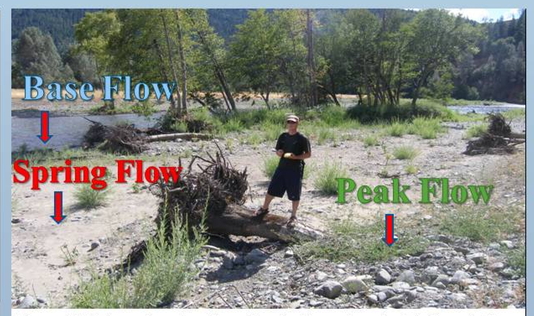

Figure 7. Picture showing flow thresholds, colors depict discrete flow thresholds from figure 6.

RESULTS

- The TRRP installed 1,265 pieces of wood at 564 installations since 2006. Site designs have seen annual increases in the quantity and complexity of wood placed, as designers are becoming more creative.
- Canyon Suite and Indian Creek data shows us the dynamics of restoration sites after construction, processes such as riparian establishment take 1-2 years before major colonization occurs (Table 1).
- The likelihood of transport also decreases dramatically with time, as structures become incorporated into the stream channel through deposition and scour. (Table 1, shaded blue)
- More recent installations at Sawmill and Lewiston reflect a shift in design methods as branches, riparian planting and logjam structures have become more common (Table 1, shaded Green)
- An estimated length of 2,808 meters of wood (almost 2 miles!) is located within the base flow threshold where it is available to juvenile and adult salmon, amphibians, waterfowl, and other wildlife throughout the year.

Figure 9. Large wood within the base flow threshold: available for fish use & affecting morphology. Indian Creek side channel 2008

Figure 10. Large wood on the peak flow threshold where it is not producing measureable effects to channel morphology or fish habitat.

CONCLUSIONS

- Our data suggests that wood installations at bank rehabilitation sites are very dynamic during the initial two year timeframe. Factors influencing wood structures relate to size, complexity, the initial placement, orientation, anchoring and hydraulic pressure acting upon the wood during peak and high flow events.
- The Sawmill construction poses several unique questions relating to site-specific variables. For example, what roles will geomorphic properties of the site play in its development over time? The Sawmill and Lewiston sites are in close proximity to the dam and receive fewer and lower magnitude high flow events than Indian Creek or the Canyon Suite (located downstream of tributaries). The numerous side-channels at Sawmill are effective at collecting natural wood (Table 1, shaded red), as the hydraulic energy of the river is diffused through unconfined area. A site of this complexity will process wood differently than a bowling alley reach such as Valdor Gulch (Canyon Suite).
- The role of site specific variables cannot be overlooked, and should receive consideration during the design phase and site-selection processes. No cookie cutter approach exists, and the burden is placed on the designer to grasp the bigger picture and use creative techniques that suit the site-specific variables.
- Incorporating wood designs into site blueprints should be commonplace. Having a premeditated strategy and goals for wood installations will improve their effectiveness, reducing the incidence of ineffective or misplaced installations that provide minimal gains toward site specific objectives (Figure 10) .
- Of greatest significance to this study is the importance of placing installations within the active base flow channel. Pieces within the low flow channel produce immediate benefits to fish rearing at winter base flow, and initiate geomorphic effects at reduced flows (Figures 9&10)

Table 1: Summary statistics for TRRP wood installations surveyed from 2006 to 2010, showing the effects at each site by year. The first four rows show number of pieces, remaining values are # of installations

	Canyon 06	Canyon 07	Canyon 08	Indian 07	Indian 08	Lewiston 09	Sawmill 10
Number of Pieces	158	141	153	254	268	356	653
Natural	0	10	28	3	58	29	124
Recruits	0	11	26	0	59	0	0
Transported	0	28	12	0	43	0	0
Wetted	378	237	251	486	706	1072	779
Velocity Break	36	21	17	30	38	119	109
Scour	4	28	45	11	67	72	69
Deposition	1	32	51	8	74	78	87
Instability	2	9	6	7	11	20	67
Riparian Veg	0	8	42	0	33	5	31
Logjams	1	11	12	3	26	7	105
Branches	16	15	17	22	26	62	121
No Effects	35	26	9	84	21	79	108