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Evaluating the effectiveness of floodplain restoration on the North Fork John Day River in Northeast Oregon

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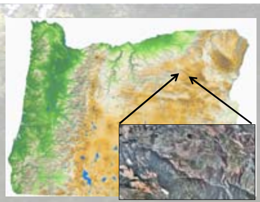


Study area location and section of North Fork John Day River, NAIP imagery

Background

Restoration efforts have been ongoing in the John Day basin for decades yet effectiveness has been poorly documented on most projects. The John Day River is the second longest free-flowing river with wild anadromous salmon and steelhead in the continental United States, and is high priority in regional fish and water quality recovery efforts.

NFJD River Project Reach

Between 1993 and 1997, a 15 km reach of the North Fork of the John Day River was treated by recontouring and revegetating dredge mine tailings that confined the active channel, and occupied former floodplain surfaces. Treatments were expected to improve floodplain, riparian, and aquatic habitat by: reconnecting the channel and floodplain, increasing overbank flows, and improving aquatic habitat. Inferred benefits include: increasing shallow subsurface storage and baseflows, reducing flood peaks, and decreasing summer water temperatures.

Gold dredge, in Sumpter, OR

Restoration effectiveness monitoring has historically been limited to field-based, site-scale studies. Applications of remote sensing and GIS to environmental monitoring show promise for improving evaluation of project effectiveness and identifying longer-term river response especially on larger project areas.

Objectives and Methods

Floodplain restoration work on dredge tailings in progress

- Evaluate "on-hand" imagery for use in monitoring restoration project effectiveness by field verifying attributes measured on 2005 National Agricultural Imagery Program (NAIP) imagery (http://165.221.201.14/NAIP.html)
- Assess effects of restoration treatments, on river and floodplain function comparing selected attributes measured on 1995 Resource photography (pre project) and compared to 2005 NAIP (post-project)

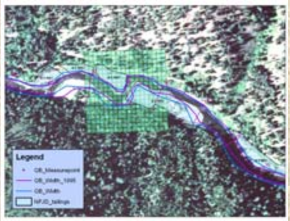
Sinuosity: digitized channel centerline and valley length on 1995 1:24000 resource photography (scanned, orthorectified) and 2005 NAIP imagery, used valley bottom (VB) generated from the RSAC Valley Bottom Mapping Tool model for GIS (Walterman et al, 2006).

Active channel widths: digitized at 100 m interval length of project, total of 160 measure points. Coordinates generated for measure points used for field verification, located using Trimble GPS, and surveyed widths with laser Rangefinder.

Vegetation cover/type: sampled using 180 m^2 grid spaced at 1 km intervals, 7 dominant life form categories, class recorded for 1 m^2 center cell. Field verified 25% of classified cells, all grids with treated DTs, analyzed classification accuracy

Area in bars and islands digitized on 1995 and 2005 imagery using criteria described in McDowell and Hughes (2003). Field verified location and feature type

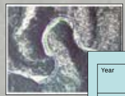
High water (inundation) field surveyed treated DTs, located HW evidence, GPS mapped to determine treated area inundated



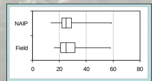
Sample section with treated DTs, Vegetation Grid and Digitized Active Channel Widths (ACW)

Results

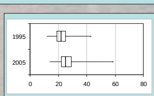
	NAIP vs FIELD	BEFORE-AFTER TREATMENT
Sinuosity →	*-NA-*	*Low sinuosity, slight (localized) increase*
Active Channel width →	*No difference after reconciling map def.*	*Significant increase in channel width of 1.5 m from 1995 to 2005*
Vegetated Area/Type →	*Low classification accuracy (error matrix) coregistration*	*Increase in forb cover type on treated dredge tailings*
Area in Bars/Islands →	*86% of bar features correctly typed, map interp issues*	*Increased number of bars and area (stage-adjusted)*



Year	River distance (meters)	Valley distance (meters)	Sinuosity
1995	15,622	15,253	1.024
2005	15,947	15,253	1.046
Absolute change			0.022
Percent change			2



ACW (meters) 2005 NAIP compared to field



ACW (meters) change 1995 to 2005

High Water Field Mapping –highest evidence of flow mapped on treated DTs, created HW line, calculated area inundated, all treated DTs have been partially inundated (ave=35%), total 8 ha, 32% of treated area

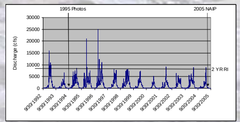
DT 27 1996 before 1999 after treatment

Summary of Results

Response Variable	RS Measure	Post-treatment Channel Response	Direction of Change	Comment
Sinuosity	Yes	Yes, localized, limited	Positive (increase)	RS measure only
Channel Width	Yes	Yes	Negative (increase)	
Vegetated Cover on treated tailings	Yes but…	Yes, limited to forbs	Positive (increase)	Limitations to NAIP imagery and methods
Bars	Yes	Yes	Positive (increase)	
Floodplain inundation	No	Yes	Positive (increase)	Field measure only

Key Findings

- NAIP imagery found useful for measuring key river attributes (sinuosity, channel width, bars), despite known limitations to preexisting imagery (timing, shade)
- Localized response (slight increase) in sinuosity, limited by valley width
- Increased channel widths is generally considered negative response in aquatic habitat objectives. Lateral adjustment to increased floodplain area is likely a channel evolution phase of recovery
- Methods for vegetation sampling involve tradeoffs (polygon vs grid sampling), difficult to field-verify RS data accurately, need broad scale analysis with intensive field monitoring at the site scale
- Increased channel bars indicate sediment deposition in restored reach
- Increased functional floodplain by about 30%
- River responses controlled in part by watershed history and key disturbance events: in the 10-14 year span since treatment several >2 year events, multiple high flows necessary to promote floodplain and channel response



North Fork John Day at Monument gage, >2 year events in 1996 and 1997 accessed newly constructed floodplain

DT 24 complete in 1997, 1998 high flow over restored floodplain

REFERENCES: Walterman, M. Fisk, H. Lachowski, H. Maus, P. Stephens, R. Breeden, C, Rightmyer, D., 2006. Mapping Valley Bottoms for Resource Management. RSAC-0081-TIP1. Salt Lake City, UT: U.S. Department of Agriculture Forest Service, Remote Sensing Applications Center. 4 p.
McDowell, P. and M. Hughes, 2003. Classification of River Channel and Riparian Features from Historical Aerial Photographs. http://geography.uoregon.edu

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