

# Watershed History Revealed Through Government Land Office Surveys: Detecting Change Over A Century Of Land Use In The Columbia River Basin



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## Introduction

Historical land use has been shown to be a major contributor to current environmental conditions from local to landscape scales (Allan 2004), with information on riparian vegetation characteristics improving our understanding of watershed environmental history. This can become an important factor in designing watershed and stream restoration projects for ESA-listed Pacific salmon and steelhead. We describe the synthesis of environmental history of three watersheds in the Grande Ronde sub-basin of the Columbia River using General Land Office (GLO) township survey notes and maps from the 19<sup>th</sup> century.

This summary provides insights into ways the GLO survey data can be utilized to determine changes from the late 1800's to the present in the mainstems of the Upper Grande Ronde River, Catherine Creek, and the Minam River where Chinook salmon currently and historically spawn and rear.



Grande Ronde River 1926, US Forest Service



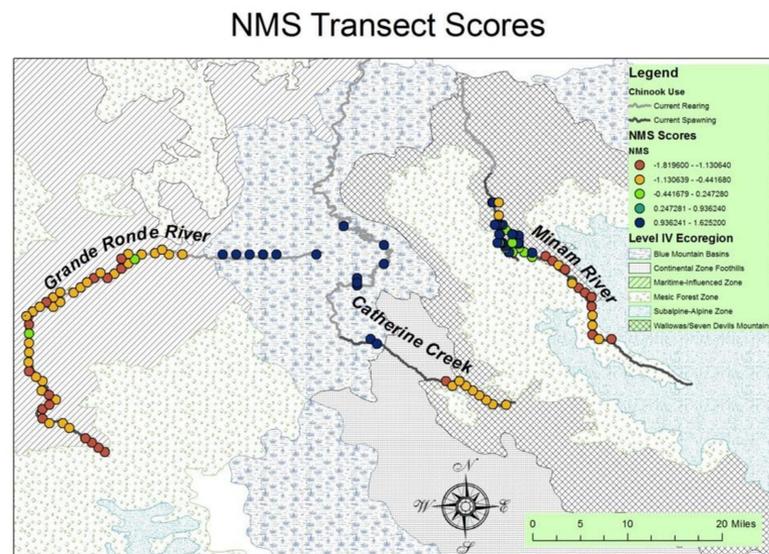
Upper Grande Ronde River 2012, Columbia River Inter-Tribal Fish Commission

## Questions:

- How were historical riparian and upland plant communities distributed in the watershed area?
- How can the GLO data be utilized beyond mapping of plant communities?

## Analysis of Historic Vegetation Patterns

Historical information such as human structures, stream crossings, and vegetation was gathered from the Government Land Office (GLO) township surveys (1863 – 1901). Data were mapped using GIS along each 1 mile section line where townships were broken up into 36 sections of 1 square mile. At the time of GLO surveys, distance was measured in chains and chain links, where 80 chains equals one mile. The 40 chain mark of each 1 mile transect was marked as a summary point of the data along each transect. Vegetation data was compiled in a database and analyzed using a nonmetric multidimensional scaling (NMS) technique which describes multivariate patterns of upland versus riparian plants across the project area. The NMS values span a range of plant composition from riparian taxa (dominant in the Grande Ronde valley) to upland taxa (predominant in the mountainous regions). Level IV ecoregions explained a large amount of variation in the historical vegetation community composition.



Upland versus riparian vegetation in the Grande Ronde River basin with higher positive NMS scores representing riparian plant assemblages (e.g., willow, alder, cottonwood) and lower negative NMS scores representing upland plant assemblages (e.g., larch, fir, pine).

## Comparison of Past vs. Present Channel Complexity

Another way in which the GLO data can be used is to compare past and present stream complexity—documenting the loss of channel meanders and off-channel habitats. This can be done by locating a transect line that runs parallel to a river valley and intersects a stream to compare the number of occurrences of past stream crossing from the GLO surveys with the present crossings from aerial photographs, using the following equation:

$$\text{Change in channel complexity} = \frac{\text{No. present crossings}}{\text{River km}} - \frac{\text{No. historic crossings}}{\text{River km}}$$

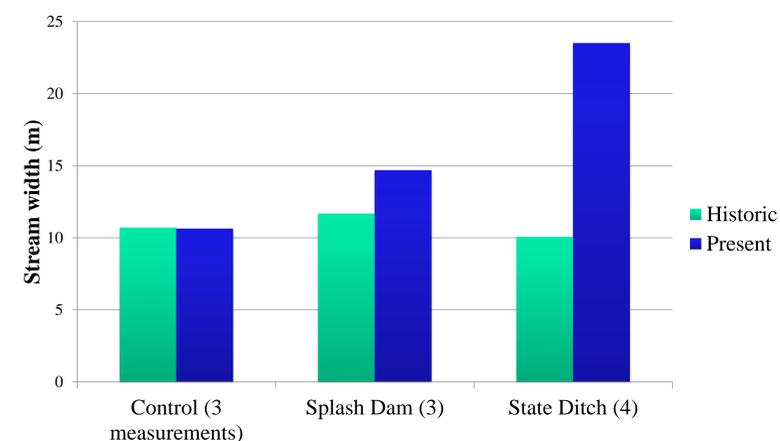


## Acknowledgments

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## Altered Channel Widths From Splash Damming

Splash damming, a formerly common land use practice, consisted of constructing a temporary wooden dam across a river, generating a pond for storage of timber, and later destroying the dam to release the timber downstream in a water torrent to a sawmill. This practice often resulted in carving out the stream bed and riparian zone and widening the channel. The GLO survey data can provide information about how splash dams and channelization may have altered stream width by comparing the GLO stream crossing data on channel width, which were collected prior to logging, with current stream width data provided by ODFW Aquatic Inventories.



Preliminary analysis of increased stream width in upper Grande Ronde impacted reaches, 1880s to Present (Roosevelt High School intern Jazzmine Allen).

## Caveats to Using GLO Data

The use of GLO data for the purposes described is made with the following caveats: (1) these data were collected by surveyors with a bias toward resource extraction potential rather than strictly plant communities, and (2) the data gathered at the time of GLO surveys reflects a landscape that had already been altered by anthropomorphic change, for instance the local extinction of beaver and resulting loss of stream complexity.

## Conclusion

The GLO surveys provide the resources to reconstruct historical stream and riparian conditions for future restoration projects to be used as a generalized baseline to monitor changes in vegetation, stream complexity, and stream width. Although GLO data do not represent pre-development conditions, we assume that the short period of use and the sparse human population in the region make observed conditions relatively representative of moderately high quality.

## References

- Allan, J.D. 2004. "Landscapes and Riverscapes: The Influence of Land Use on Stream Ecosystems." *Annual Review of Ecology, Evolution, and Systematics* 35: 257–284.
- U.S. Department of the Interior Bureau of Land Management. 2014. "Land Status & Cadastral Survey Records." <http://www.blm.gov/or/landrecords/survey/>.