

# Entiatqua Rediscovered Pre-Anthropocene Valleys in North Cascadia, USA

Paul Powers<sup>1</sup>, Brian Staab<sup>1</sup>, Brian Cluer<sup>2</sup>, and Colin Thorne<sup>3</sup>

<sup>1</sup>USDA Forest Service Pacific Northwest Region

<sup>2</sup>NOAA Fisheries West Coast Region

<sup>3</sup>University of Nottingham

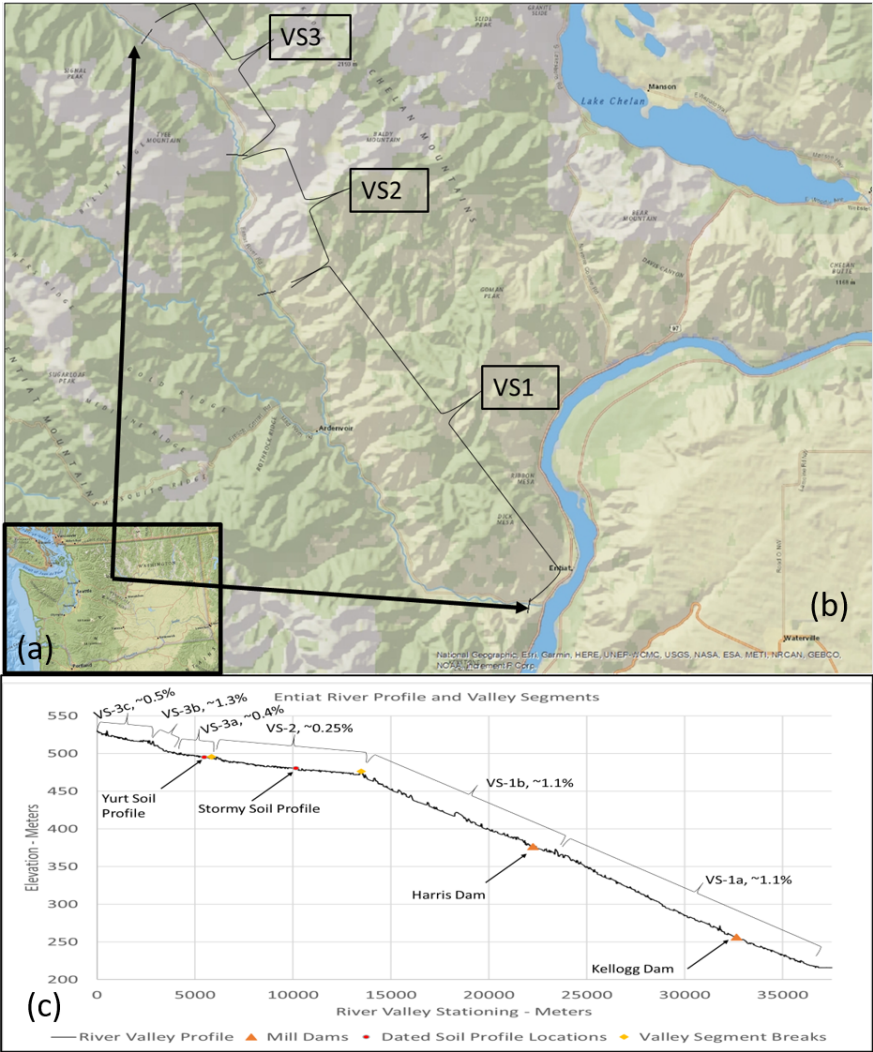
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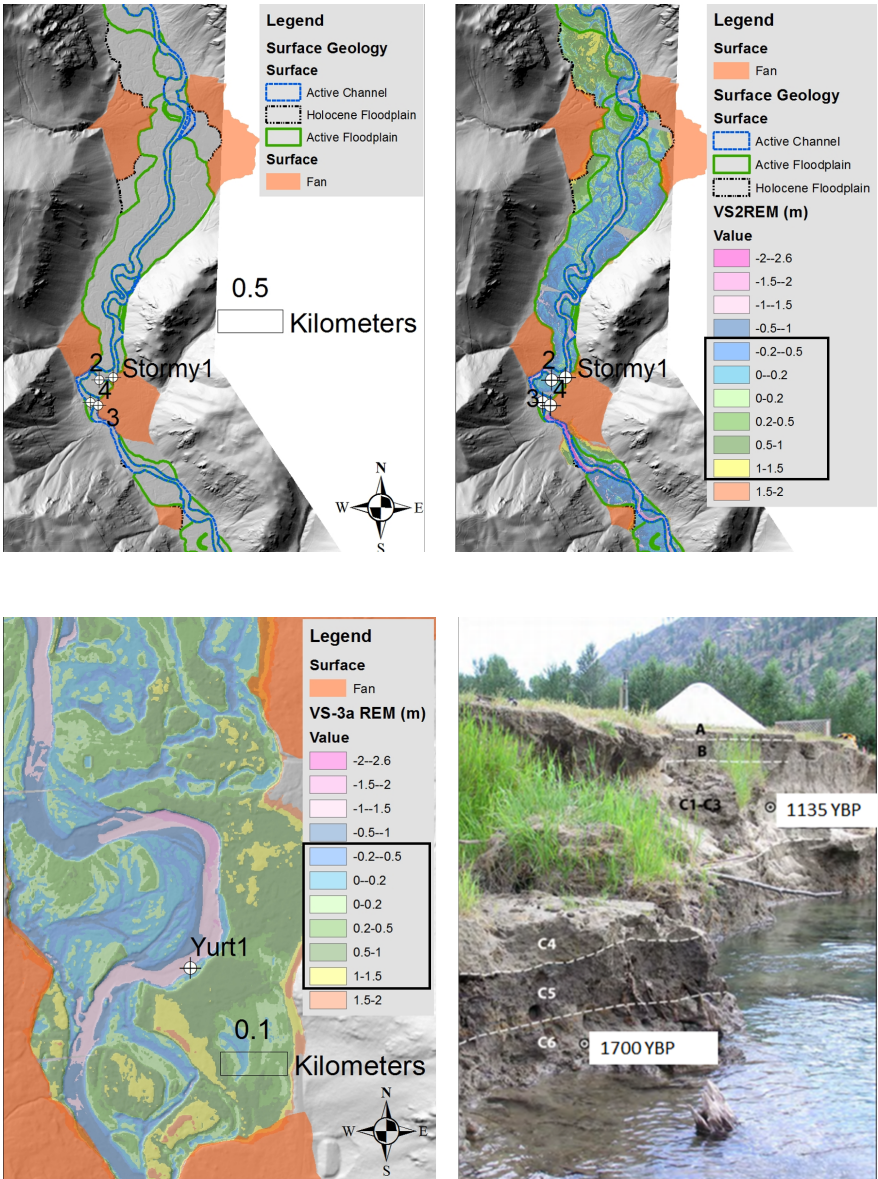
## Abstract

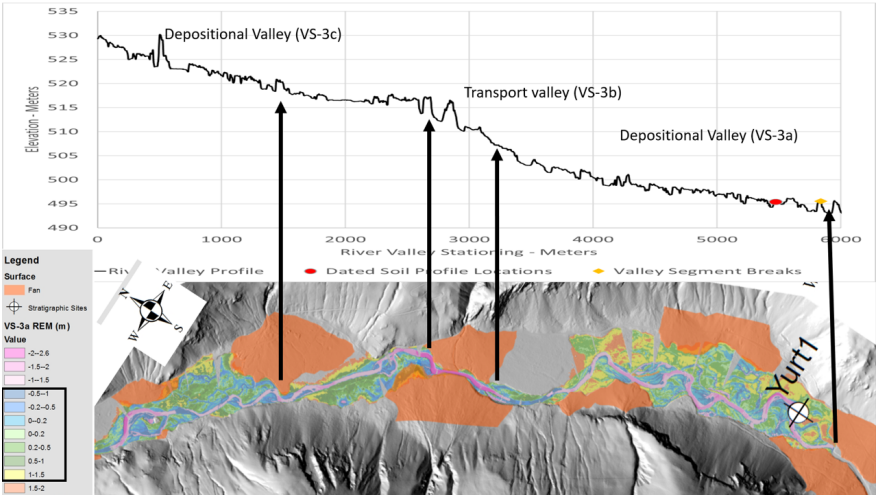
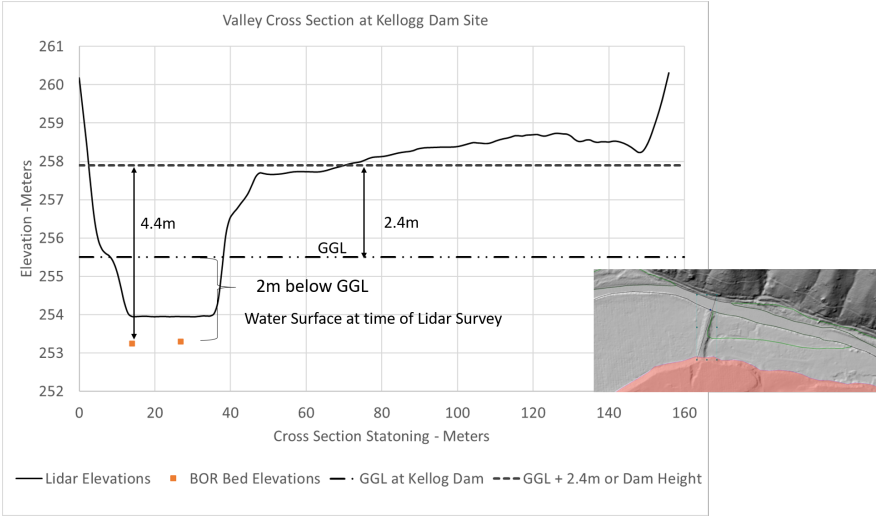
A maturing body of evidence suggests that anthropogenic impacts on river-wetland corridors may be greater and more widespread than previously recognized. We applied the Geomorphic Grade Line (GGL) method to define pre-Anthropocene valley surfaces within segments of the 42-kilometer Entiat River Valley (ERV) of the North Cascade Mountains, USA. We developed GGL-relative elevation models (GGL-REMs) by subtracting, from high-resolution digital elevation data, a detrending surface based on relic fluvial features of the valley floor. We validated the GGL-REMs using surficial geologic maps, C<sub>14</sub>-dated soil profiles, and the identifiable remnants of historic dams. We interpreted these data in the context of settlement land use practices including channelization, large wood removal, and beaver (*Castor canadensis*) trapping. Our analysis indicates that since the early 20<sup>th</sup> century, the river has incised more than two meters in many areas. This triggered a rapid state and process change, wherein unconfined and partially-confined valleys transitioned from net deposition to erosion and transport environments. The distribution of river types shifted from ecologically rich river-wetland corridors towards simpler, single-threaded channels common in confined valleys. The effects of this state change on salmon productivity were profound. Results from the Entiat and other locales indicate that GGL-REMs can be used to help define the fluvial process-form domains, including the vertical dimension needed to guide valley floor restoration. These tools can be used to envisage pre-degradation riverscapes, especially when used in concert with other datasets. Once the pre-Anthropogenic conditions of rivers like *Entiatqua* have been recognized, the case for restoring lost river-wetland corridors to unlock their ecological potential becomes compelling.

## Hosted file

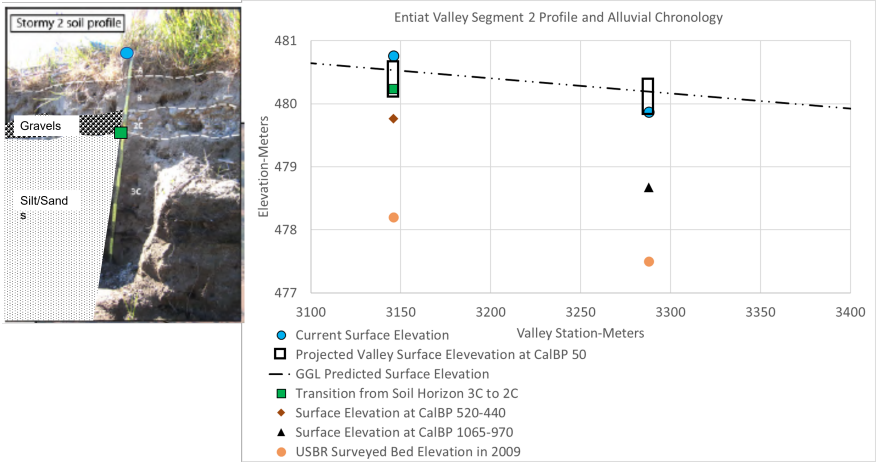
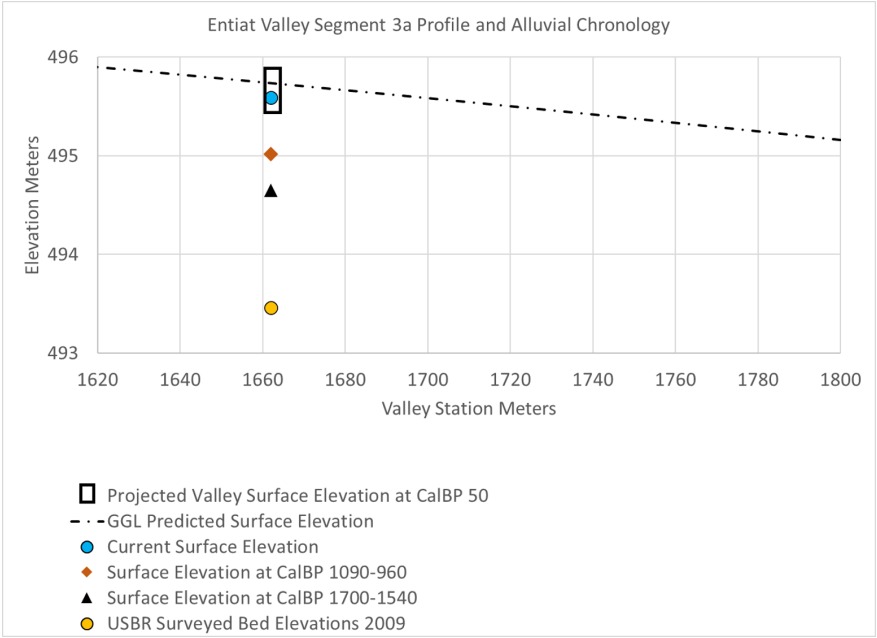
Entiatqua Rediscovered 1\_24\_22 sans figures.docx available at <https://authorea.com/users/457947/articles/554579-entiatqua-rediscovered-pre-anthropocene-valleys-in-north-cascadia-usa>

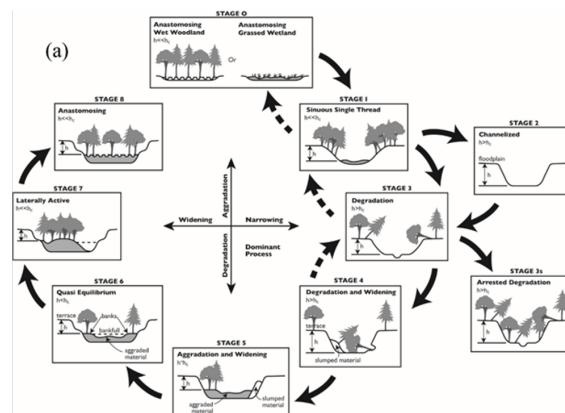




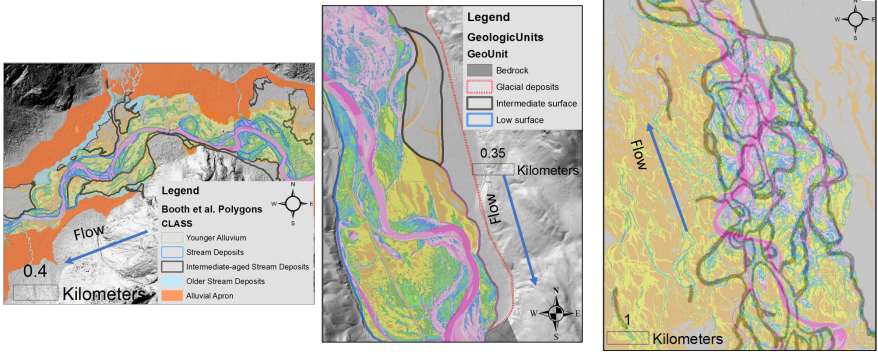
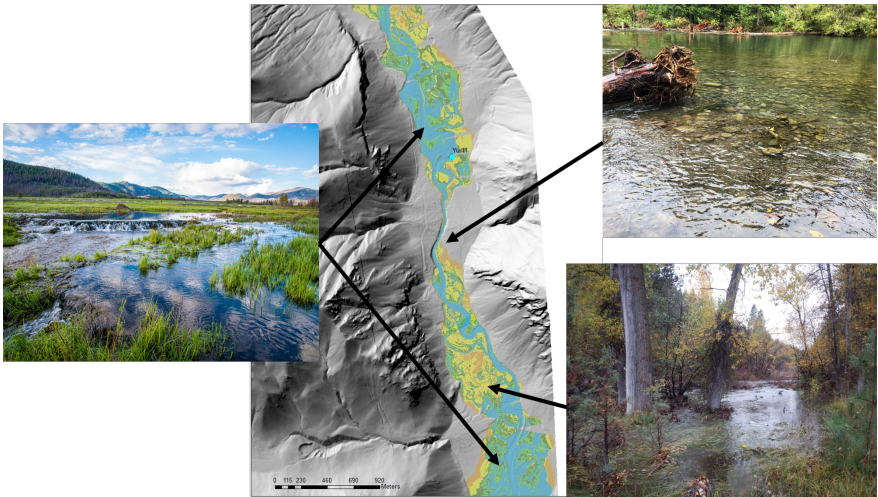








Valley Segment	SEM Stage Designation and Dominant Processes			Approximate Change in Wetted Habitats at Baseflow (%)
	Pre-European Settlement	Current	Predicted Island Braided (Beechie, 2014)	
VS-1a	mostly Stage 0, moderate deposition, RWC in unconfined and partially-confined areas	mostly Stages 3/4, incision, evacuation	56%	-55%
VS-1b	mostly Stage 1, transport in confined areas	mostly Stage 3 incision, evacuation	48%	-23%
VS-2	mostly Stage 0, deposition, RWC	mostly Stage 3, incision, evacuation	100%	-75%
VS-3a			92%	-75%
VS-3b	mostly Stage 1, transport	mostly Stage 3, incision, evacuation	82%	-37%
VS-3c	mostly Stage 0, deposition, RWC	mostly Stage 3, incision, evacuation	81%	-71%
Total				-60%



10 (a)

10 (b)

10 (c)