



Water Resources Research

Supporting Information for

The Transience of Channel-Spanning Logjams in Mountain Streams

Ellen Wohl and Emily P. Iskin

Department of Geosciences, Colorado State University, Fort Collins, CO 80523-1482, USA

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Additional Supporting Information (Files uploaded separately)

Basic Supporting Data

Introduction

Text S1 lists the details of each statistical model used to analyze the data.

Supplemental Figures 1 to 7 illustrate issues discussed in the main text.

Basic Supporting Data is an Excel file that contains worksheets with the coordinates of the logjams; reach-scale averaged variables over the period of the study; reach-scale annual values of variables over the period of the study; the data organized for statistical analysis of individual logjam persistence; and the data organized for statistical analysis of site persistence.

Text S1. Statistical models

Detailed Data

Model 1 – Linear Regression

Response Variable: number of years of avg jam life (all sticky & non-sticky)

Note: two observations removed due to large Cook's distances

Predictor Variables (Full Model): drA, ln(S), Age, ln(FP/CH), LWL/CH, ln(AvgDen), Planform

Best Subsets Model: significant $p < 0.05$, adjusted $R^2 = 0.5681$

- Intercept: estimate = 1.21473, significant
- ln(S): coefficient = -0.25760, not significant, importance in the full model = 0.69
- Age: positive association, importance in the full model = 0.96
- ln(AvgDen): coefficient = 0.26732, significant, importance in the full model = 0.80

Model 2 – Linear Regression

Response Variable: sqrt(number of sticky sites/100 m channel)

Predictor Variables (Full Model): drA, ln(S), Age, ln(FP/CH), LWL/CH, ln(AvgDen), Planform, Number of Non-Sticky Sites per 100 m

Best Subsets Model: significant $p < 0.05$, adjusted $R^2 = 0.8759$

- Intercept: estimate = 0.91578, significant
- ln(AvgDen): coefficient = 0.59043, significant, importance in the full model = 1.00

All Data

Model 3 – Linear Regression

Response Variable: proportion of moderate and high backwater ponding and storage

Note: this model may not fulfill the assumption of homoscedacity

Predictor Variables (Full Model): ln(drA), ln(S), Age, ln(FP/CH), LWL/CH, sqrt(AvgDen), Planform

Best Subsets Model: significant $p < 0.05$, adjusted $R^2 = 0.2766$

- Intercept: estimate = 0.35194, significant
- sqrt(AvgDen): coefficient = 0.17213, significant, importance in the full model = 0.91

Model 4 – Linear Regression

Response Variable: proportion of ramp and bridge key pieces

Predictor Variables (Full Model): ln(drA), ln(S), Age, ln(FP/CH), LWL/CH, sqrt(AvgDen), Planform

Best Subsets Model: significant $p < 0.05$, adjusted $R^2 = 0.1754$

- Intercept: estimate = 0.70652, significant
- Age: negative association, importance in the full model = 0.79

- Planform: negative association, importance in the full model = 0.40

Individual Jams on the North St. Vrain

Model 5 - Binary Logistic Regression

Response Variable: Backwater ponding and storage category (High/Moderate and Low)

Note: the order of the categories was not taken into account (not an ordinal method)

Predictor Variables (Full Model): Annual jam density, Decay, drA, Age LWL/CH, Planform, S

Best Subsets Model: Efron's pseudo $R^2 = 0.1087381$

- Intercept: estimate = -0.3045
- Annual jam density: coefficient = 0.2738, significant, importance in the full model = 1.00
- Decay: positive association, importance in the full model = 1.00
- S: estimate = -12.7066, significant, importance in full model = 1.00

Summary Table:

	Decay Category			
BW Category	<i>1</i>	<i>2</i>	<i>3</i>	<i>4</i>
<i>High/Moderate (1)</i>	25	174	320	161
<i>Low (0)</i>	34	68	202	108

Model 6 - Binary Logistic Regression

Response Variable: Key piece category (Ramp/Bridge and Pinned/Buried)

Predictor Variables (Full Model): Annual jam density, Decay, drA, Age LWL/CH, Planform, S

Best Subsets Model: Efron's pseudo $R^2 = 0.1928078$

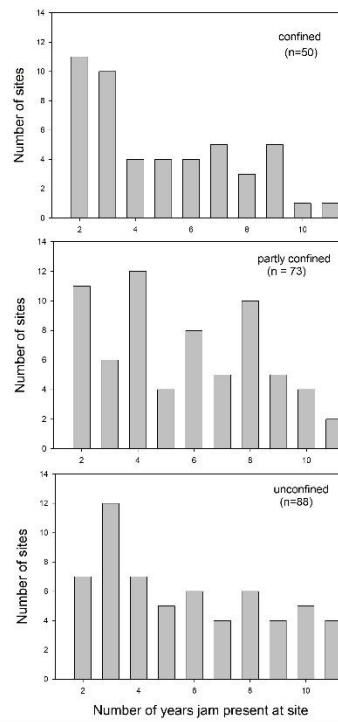
- Intercept: estimate = 2.3892, significant
- Decay: negative association, importance in the full model = 1.00
- LWL/CH: estimate = 5.0872, significant, importance in full model = 0.72
- Planform: negative association, importance in full model = 0.50
- S: estimate = 6.2717, importance in full model = 0.45

Summary Tables:

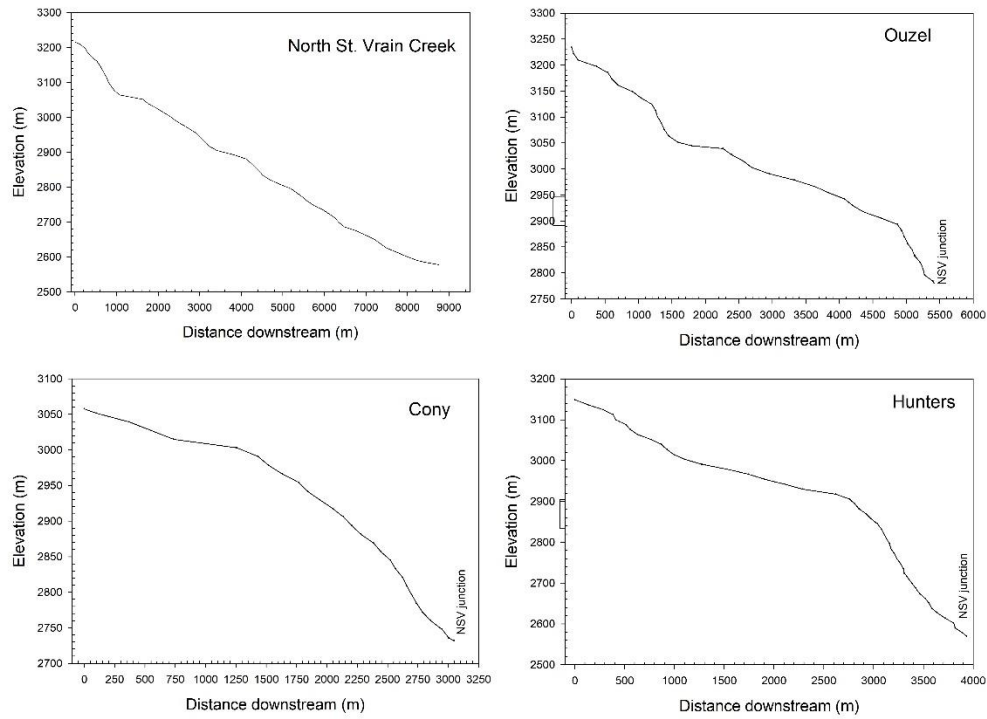
	Decay Category			
KP Category	<i>1</i>	<i>2</i>	<i>3</i>	<i>4</i>
<i>Ramp/Bridge (1)</i>	58	228	301	126
<i>Pinned/Buried (0)</i>	1	14	221	143

	Planform	
KP Category	<i>Multi</i>	<i>Single</i>
<i>Ramp/Bridge (1)</i>	446	267
<i>Pinned/Buried (0)</i>	191	188

Supplemental Figures



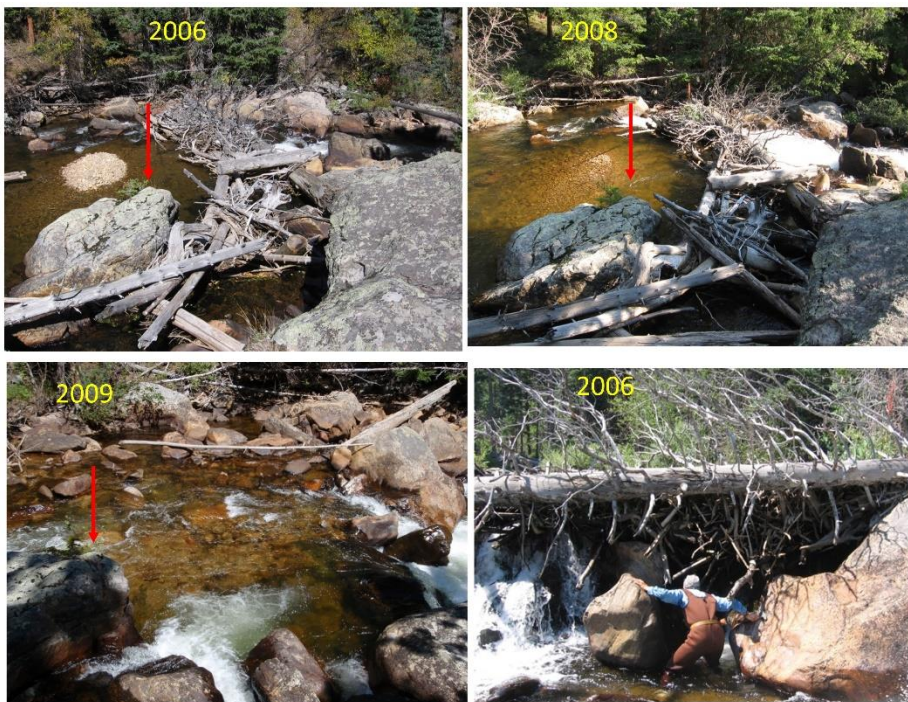
Supplemental Figure 1. The number of years a jam was present at a site versus the number of sites, differentiated based on lateral confinement. This includes all sites in the detailed dataset where a jam was present for at least 2 years. In the confined reaches, for example, 11 sites had a jam present for 2 years, 10 sites had a jam present for 3 years, etc. 'n' indicates sample size.



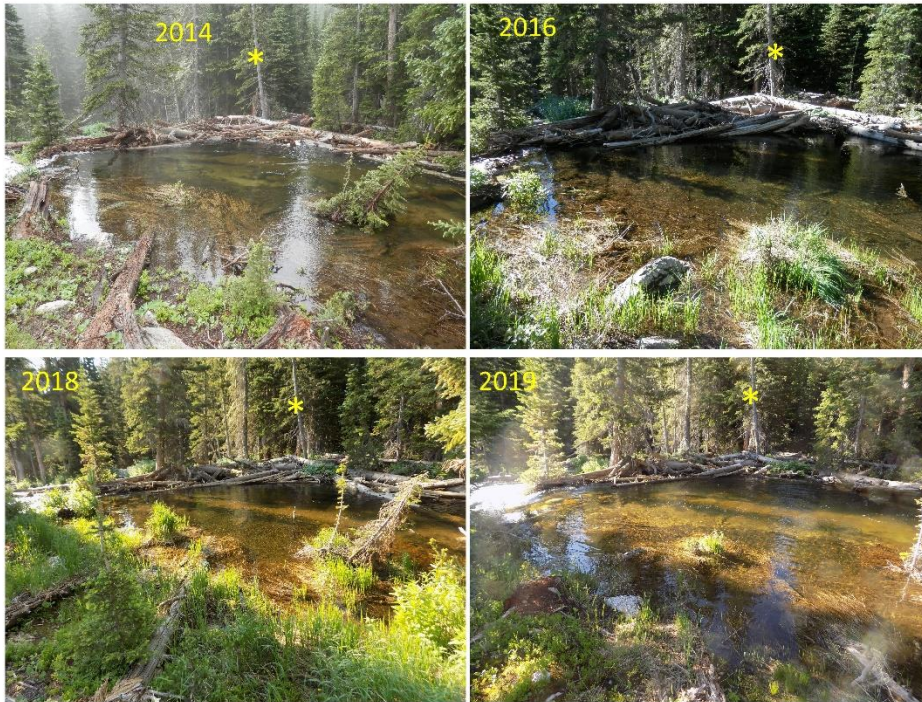
Supplemental Figure 2. Longitudinal profile of each creek in the study area. Ouzel, Cony, and Hunters Creek profiles end at the junction with North St. Vrain Creek. North St. Vrain Creek longitudinal profile ends at the downstream point of the study area.



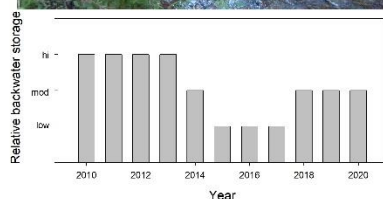
Supplemental Figure 3. Large logjams examined in the precursor to this study. (A) A logjam along Glacier Creek in Rocky Mountain National Park, Colorado. More than 100 individual wood pieces were tagged within this jam in 2006, which then completely disappeared 2 years later. The red arrows indicate the same foreground boulder in the two views.



Supplemental Figure 3. (B) A logjam along North St. Vrain Creek, downstream from Rocky Mountain National Park. More than 80 individual wood pieces were tagged within this jam in 2006, but the jam disappeared between 2008 and 2009. The lower right view is from downstream prior to disappearance of the jam. The red arrows indicate the same boulder in the foreground.



Supplemental Figure 4. Additional examples of changes through time in logjams that were present throughout the 11 years of this study. (A) A logjam on Ouzel Creek that was one of the more persistently retentive jams in the study. Backwater storage at this logjam was high from 2010 through 2018, then declined to moderate during the 2019 and 2020 surveys as a breach on the left side of the jam gradually increased. Yellow asterisk at the rear of each photo indicate the same tree.



Supplemental Figure 4. (B) A logjam on Hunters Creek that changed from high backwater storage at the start of the study, to low, and then back to moderate, as indicated by the bar graph at lower right. The red arrows at the left in the first three photographs indicate the same stump and the white arrows at the right in the last two photographs indicate the same leaning tree.



Supplemental Figure 5. Examples of secondary channels associated with logjams. (A) At this site on North St. Vrain Creek, formation of a channel-spanning logjam during the 2013 flood facilitated overbank flow. Although the logjam was partly breached by 2014 and gone by 2015, the secondary channels persisted at least through 2020. The upper photograph shows overbank flow that is not organized into a channel in 2015 (the main channel is out of sight at the rear of this view and flow is from the foreground toward the background). The lower three photographs from 2020 show disorganized overbank flow at the upstream end of the site (left) and overbank flow organized into progressively more distinct and persistent secondary channels (center and right) moving downstream parallel to the main channel.



Supplemental Figure 5. (B) At this site on Ouzel Creek, the logjam on the main channel was greatly enlarged during the 2013 flood. A short secondary channel formed adjacent to the main channel, as indicated by the red arrows. The lower photograph is a view from downstream. The logjam and short secondary channel remained in place as of 2020. (This secondary channel is only about 30-m-long and the reach is classified as single-thread planform.)



Supplemental Figure 6. An example of a logjam categorized as having low backwater storage because the bed has aggraded to the upstream level of the logjam. This logjam is on a steep reach of Cony Creek.



Supplemental Figure 7. Examples of jams along Ouzel Creek that changed noticeably after the 2013 flood. (A) Marginal remnants of a large logjam that spanned channel prior to the flood. (B, C) Logjams that more than doubled in size from pre- to post-flood, in Ouzel reach 5. (D) A logjam at the lip of Ouzel Falls at the downstream end of reach 6. There was no channel-spanning logjam here prior to the 2013 flood. Flow is left to right in each photo. Bankfull channel is ~12 m wide in A, B, & C; ~6 m wide in D.