Analysis of loadings

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1 Introduction

Minimizing the erosion of sediment into streams is a goal for water quality managers. In order to develop plans to limit the amount of sediment that gets into streams, those managers need to know how sediment gets into the water. A recent study [**?**] has shown that

The next block of code produces a set of bar charts that show the relative contributions of the snow-driven events, post-snow-pre-vegetation events, and the post-vegetation events.

The next block prints a table of the proportion of total phosphorus loading due to each class of event at each site

	snowmelt-driven	early post-snow	late post-snow
eagle	27.0%	29.1%	43.9%
joosvalley	26.9%	20.5%	52.6%
otter	34.8%	21.0%	44.2%

Table 1: Proportion of total suspended solids loading contributed by each type of event

Produce plots of the proportion of the suspended solids and phosphorus (both total loading and stormflow loading) that is contributed by each class of event at each stream site:

Figure out what proportion of total sediment loading is contributed by the top 10% of storms:

	snowmelt-driven	early post-snow	late post-snow
eagle	32.8%	22.9%	44.2%
joosvalley	36.4%	16.9%	46.7%
otter	45.9%	17.1%	37.0%

Table 2: Proportion of total phosphorus loading contributed by each type of event

The top 10% of events contributed 89.1% of the sediment loading at Eagle Creek, 73.1% of the sediment loading at Otter Creek, and 93.4% of the sediment loading at Joos Valley Creek.

Now we want to know how these major events are distributed within the event classes; that is, whether snowmelt tends to produce major loading events, or whether it is the post-snow events. Note that the _tot column measures the total loading during an event. The snowmelt-driven events are different in kind than the rainfall-driven ones because they don't require continuous rain during the event. If the snowmelt-driven events are caused by warm weather, it seems reasonable that a single event might last for many days and cause more loading than a more-intense rainfall event that only lasts a day or two. To account for this, we will look both at total loading (_tot) and average daily loading during an event (_avg).

| | Snowmelt | | Early post-snow | | Late post-snow | |
Creek	All	Major	All	Major	All	Major
Eagle	42%	30%	13%	19%	45%	51%
Otter	39%	42%	12%	19%	49%	40%
Joos	46%	31%	11%	17%	43%	52%

The table shows that the major loading events that produce the majority of the loading can be occur during each of the three annual periods. However, the events caused by snowmelt produced a smaller proportion of major events than their proportion of all events, and their relative contribution to the total sediment load was smaller than their proportion of loading events. Taken together, these insights tell us that, while snowmelt can cause a major loading event, a snowmelt-driven event is less likely to be a major contributor to sediment load than is a rainfall-driven event.

Creek	Period	Sediment		Phosphorus		
		All events	Major events	Loading	Major events	Loading
Aggregated	Snowmelt	43%	27%	34%	36%	43%
	Early post-snow	12%	27%	18%	20%	17%
	Late post-snow	46%	46%	48%	44%	40%
Eagle	Snowmelt	42%	27%	30%	33%	37%
	Early post-snow	13%	29%	19%	23%	21%
	Late post-snow	45%	44%	51%	44%	42%
Joos	Snowmelt	46%	27%	31%	36%	35%
	Early post-snow	11%	20%	17%	17%	19%
	Late post-snow	43%	53%	52%	47%	46%
Otter	Snowmelt	39%	35%	42%	46%	58%
	Early post-snow	12%	21%	19%	17%	12%
	Late post-snow	49%	44%	40%	37%	30%

1

48.34

GUIDE piecewise constant least-squares regression tree model. At each intermediate node, a case goes to the left branch if and only if the condition is satisfied. Number in italics beneath leaf node is sample mean of stottot.

1

175.48

GUIDE piecewise constant least-squares regression tree model. At each intermediate node, a case goes to the left branch if and only if the condition is satisfied. Number in italics beneath leaf node is sample mean of stottot.

theisen
≤ 2.20 1

totalwater
≤ 1.98 2

tmean
≤ 68.50 3

4	5	6	7
18.05	*272.43*	*482.94*	*685.43*

3

GUIDE piecewise constant least-squares regression tree model. At each intermediate node, a case goes to the left branch if and only if the condition is satisfied. Number in italics beneath leaf node is sample mean of stottot.
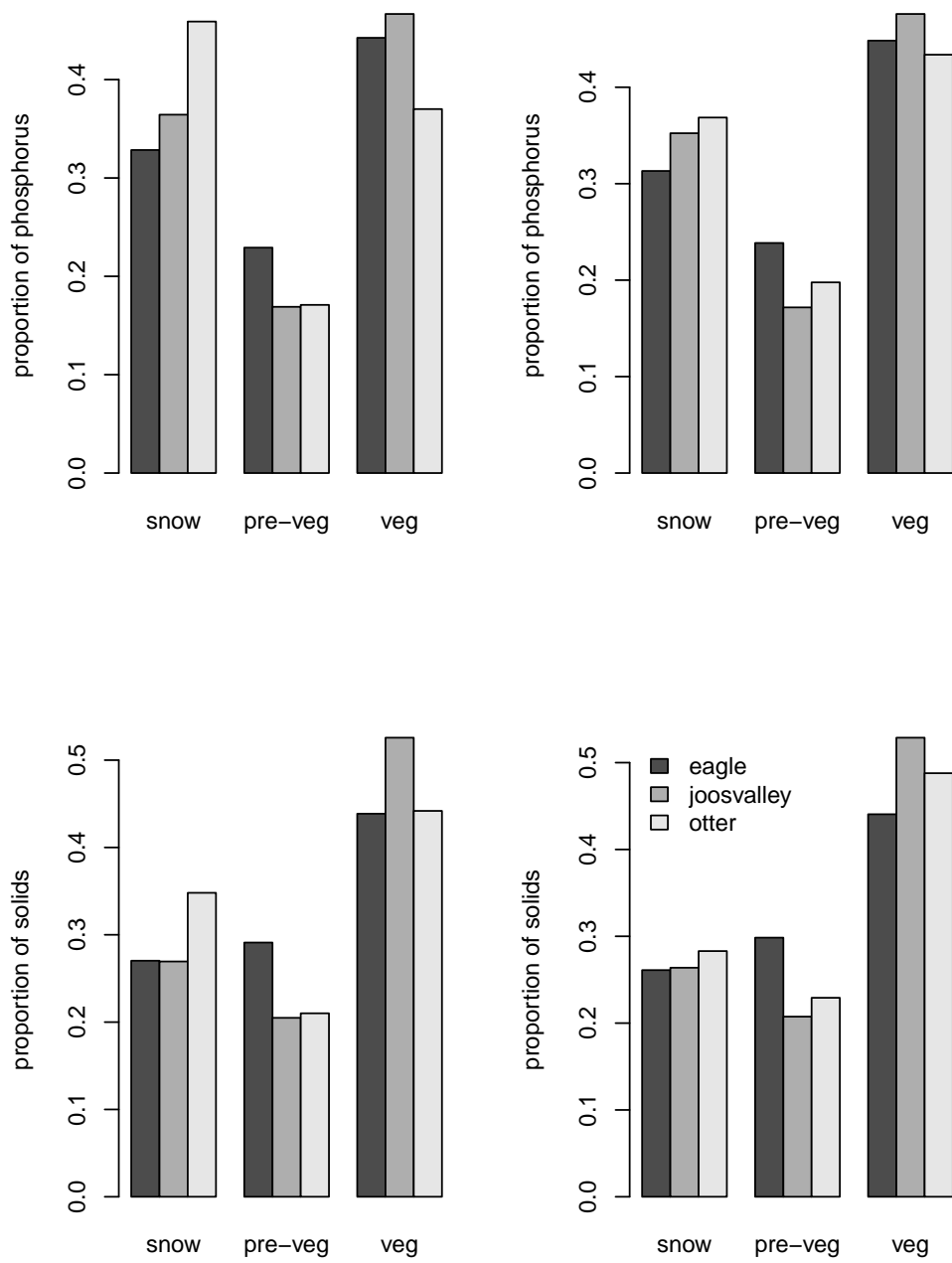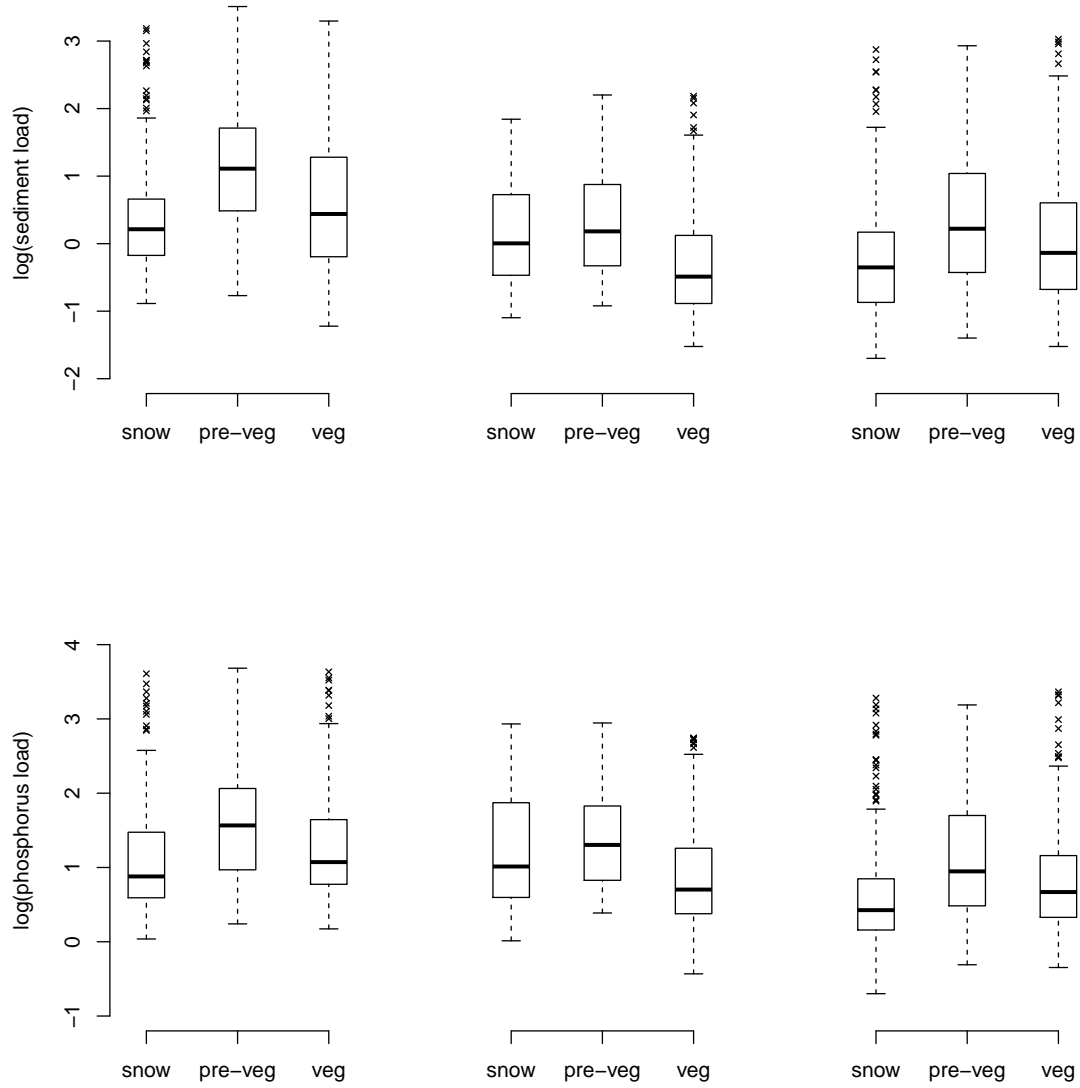
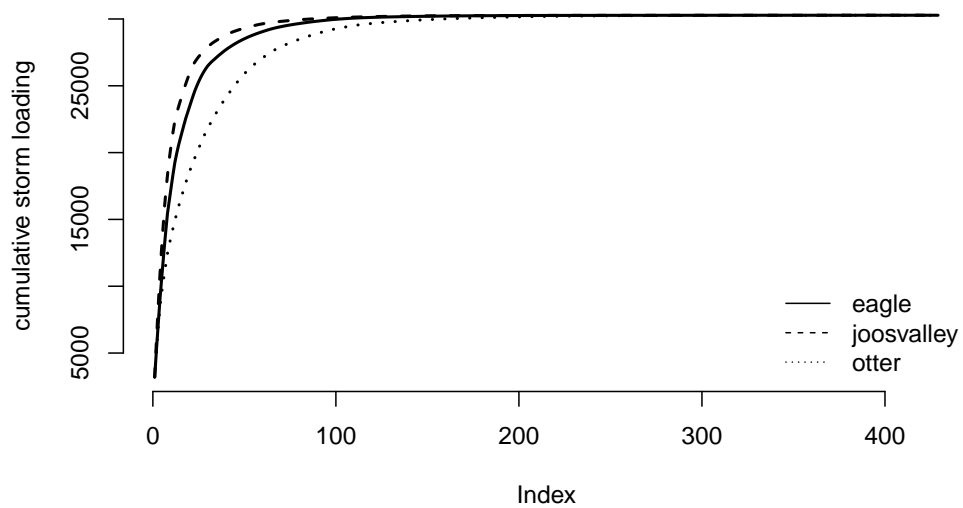Figure 1: Cumulative storm loadings at the three creeks.

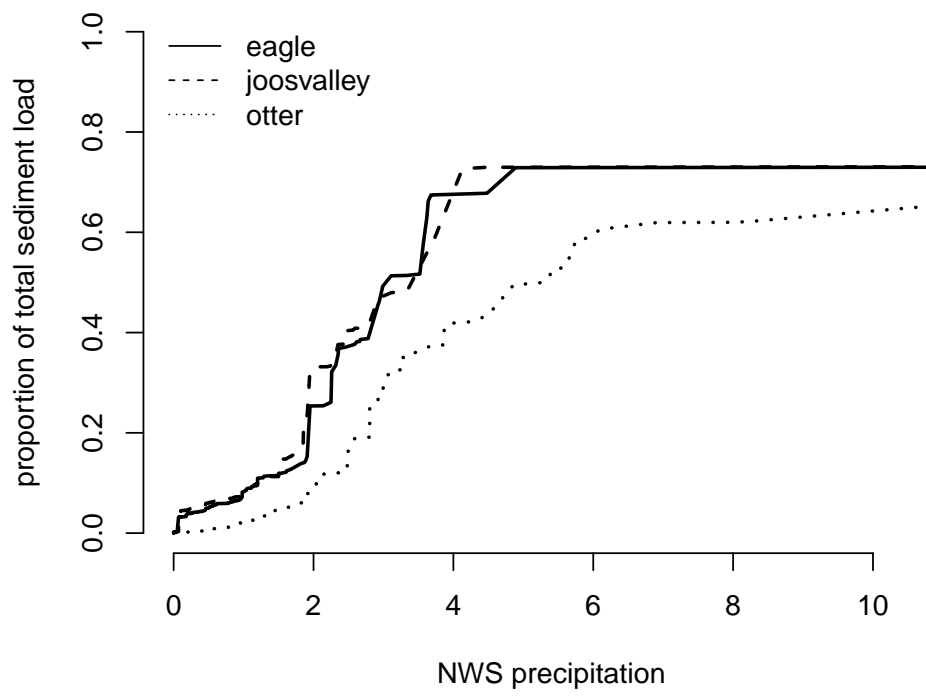Figure 2: Cumulative storm loadings at the three creeks.

Figure 3: Proportion of the total sediment load contributed by rainfall events up to the size shown. Snowmelt-driven events are excluded.
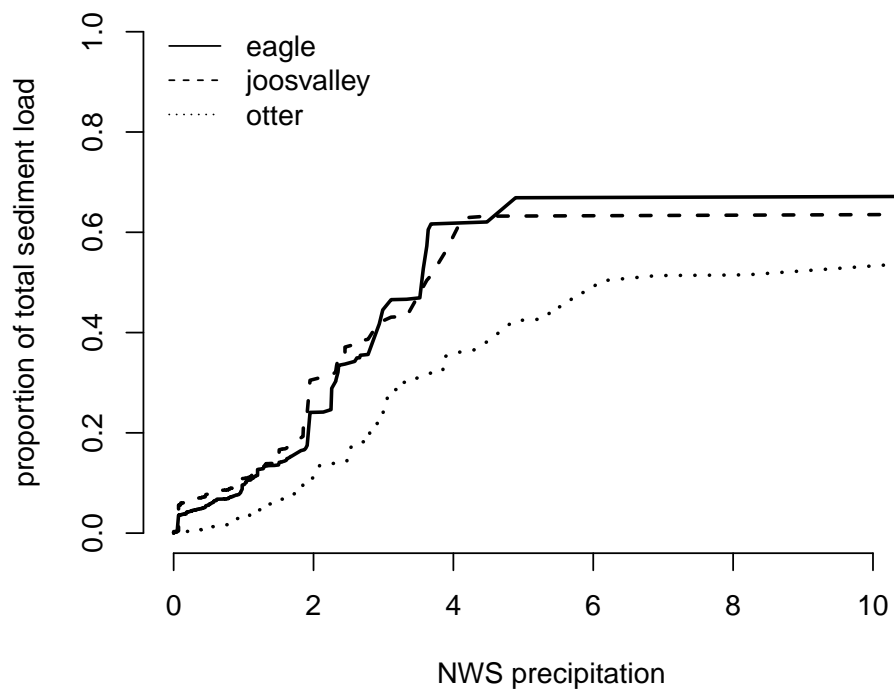
Figure 4: Proportion of the total phosphorus load contributed by rainfall events up to the size shown. Snowmelt-driven events are excluded.