Topographic Controls on the Distribution and Timing of Spring Runoff in a Snow-Dominated Basin in Central Idaho

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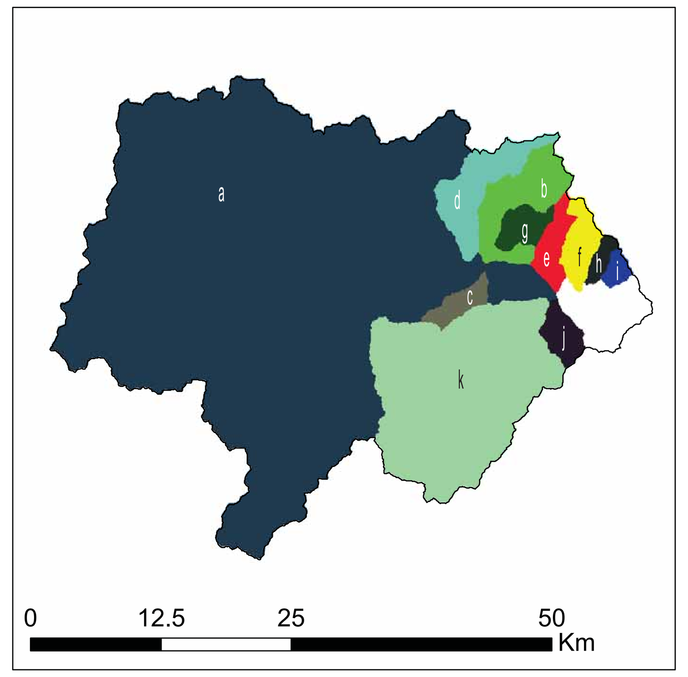
Introduction

Anticipated warming of the Intermountain West is expected to produce shifts in the hydrologic patterns of snow dominated basins as more storms shift from snow to rain and spring melt occurs earlier. The Big Creek catchment in central Idaho (figure 1.) has potential to undergo change due to the pronounced topography . Low elevation, south-facing catchments are particularly susceptible to these shifts. Riparian and aquatic ecosystems are currently adjusted to a hydrograph dominated by a large spring peak. A shift to a rain dominated hydrograph would have detrimental effects to these communities.

Figure 1. Area map of Big Creek in central Idaho and relative positions of all tributaries within Big Creek



Bridge mount for Big Creek gaging station

2008 Climatic Conditions

- Average to above average snow water equivalent
- Rapid warming in early May followed by a quick drop in temp and numerous rain/snow events
- Higher than average flows in nearby rivers

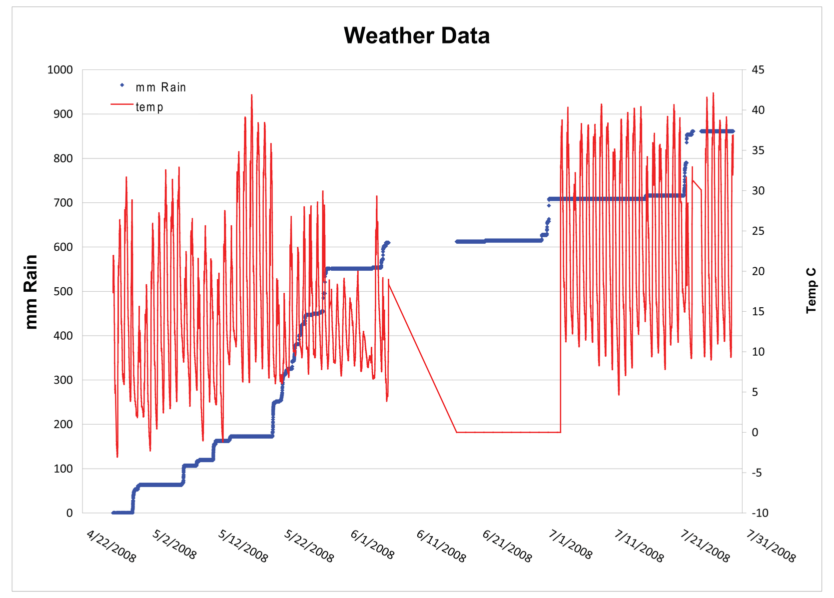
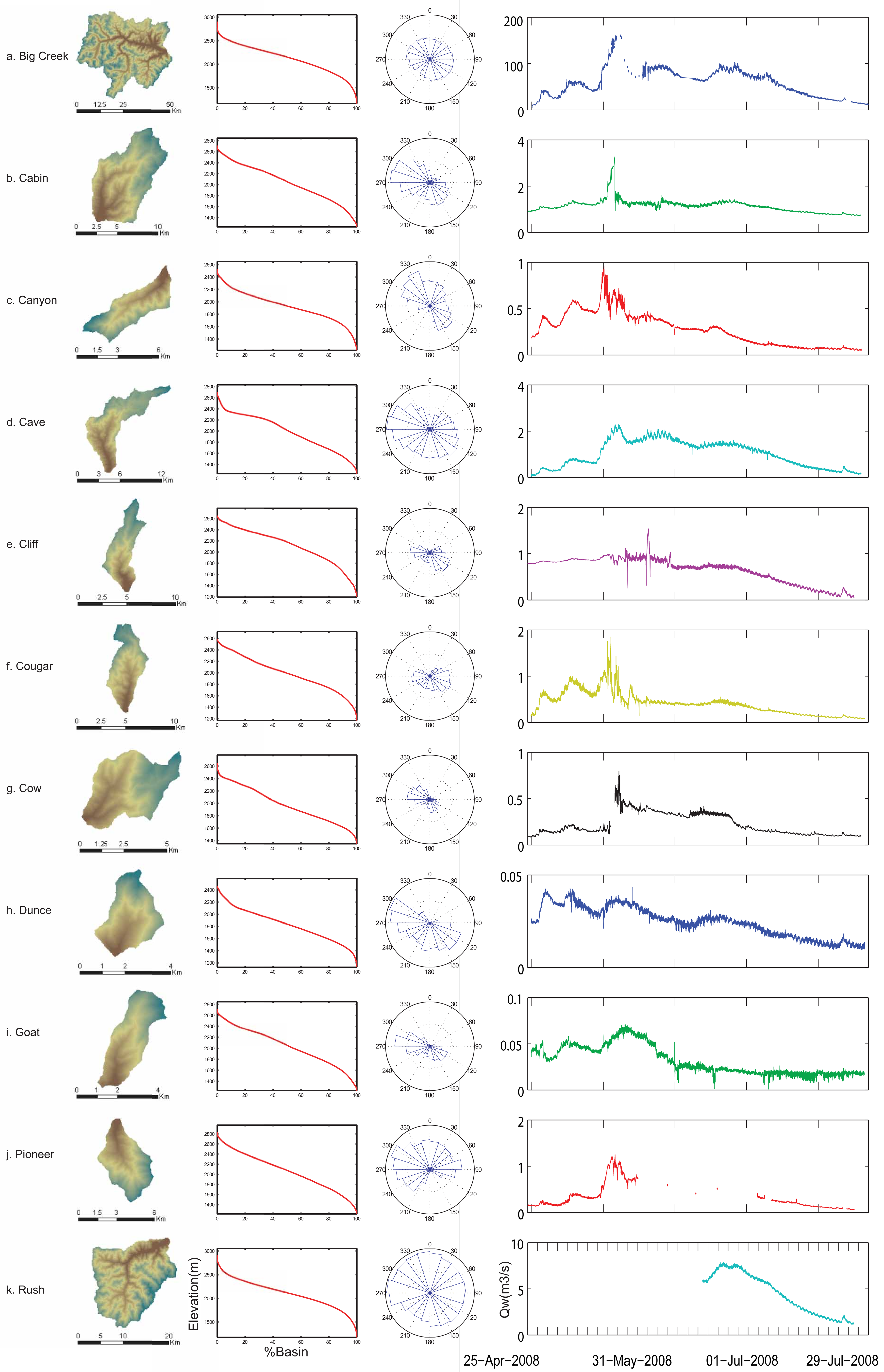


Figure 3. Weather data for summer. Weather station located at same location as Big Creek gaging station. Missing data due to equipment problems.

Figure 3. Clipped DEMs of watersheds, hypsometry curves, rose diagrams and discharge time series



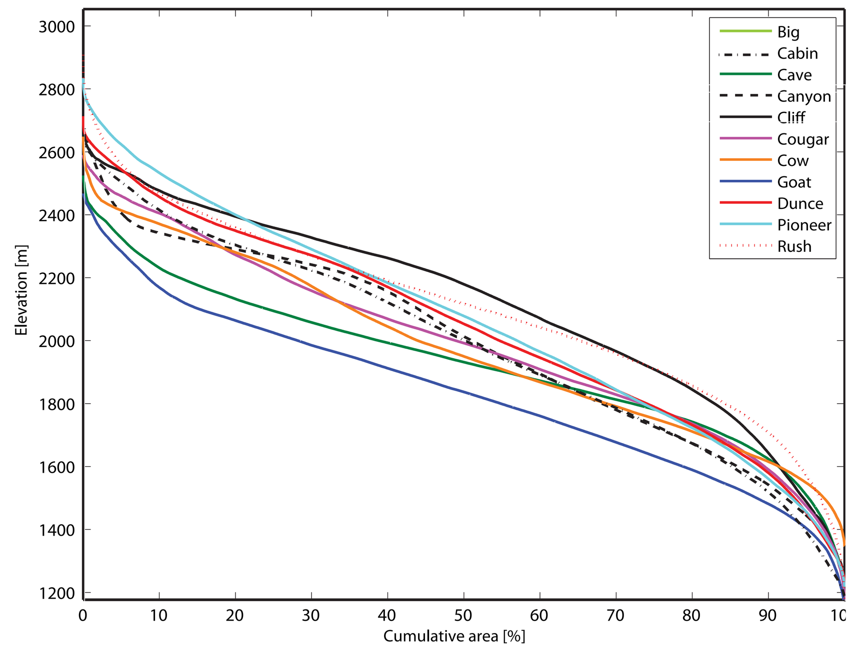


Figure 4. Hypsometry curves for all 11 basins

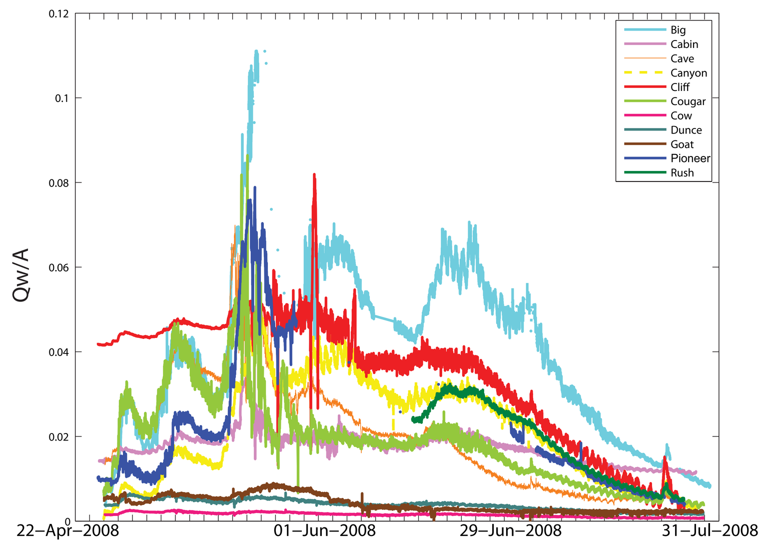
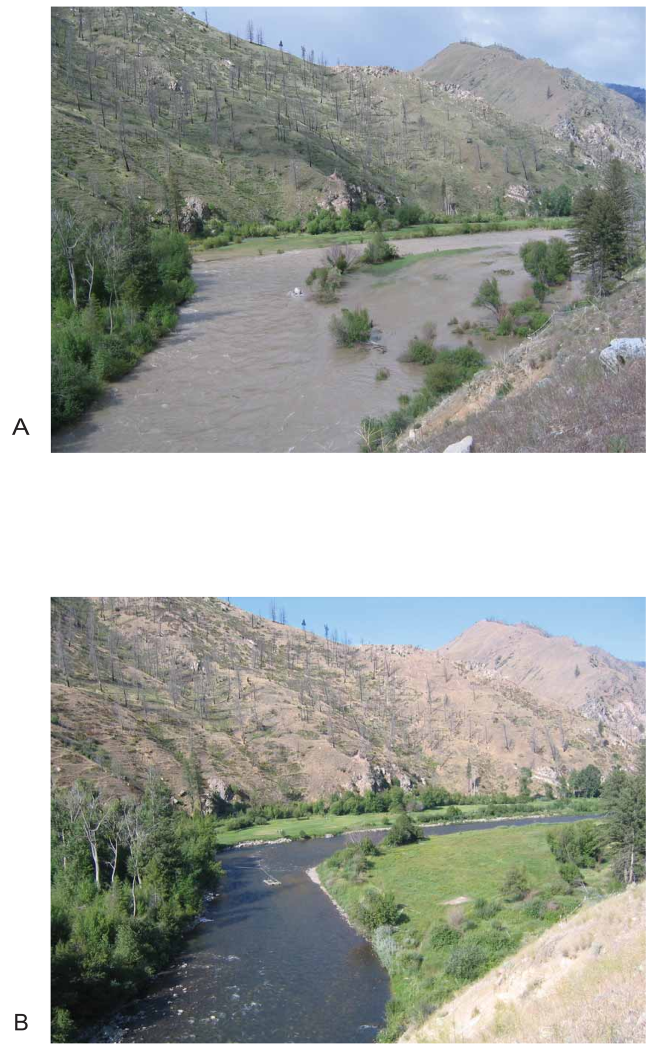


Figure 5. Discharge records for all 11 basins normalized by area

Collection of field discharge measurement on Cliff Creek



View of Big Creek at flood stage (A) and in late June (B)

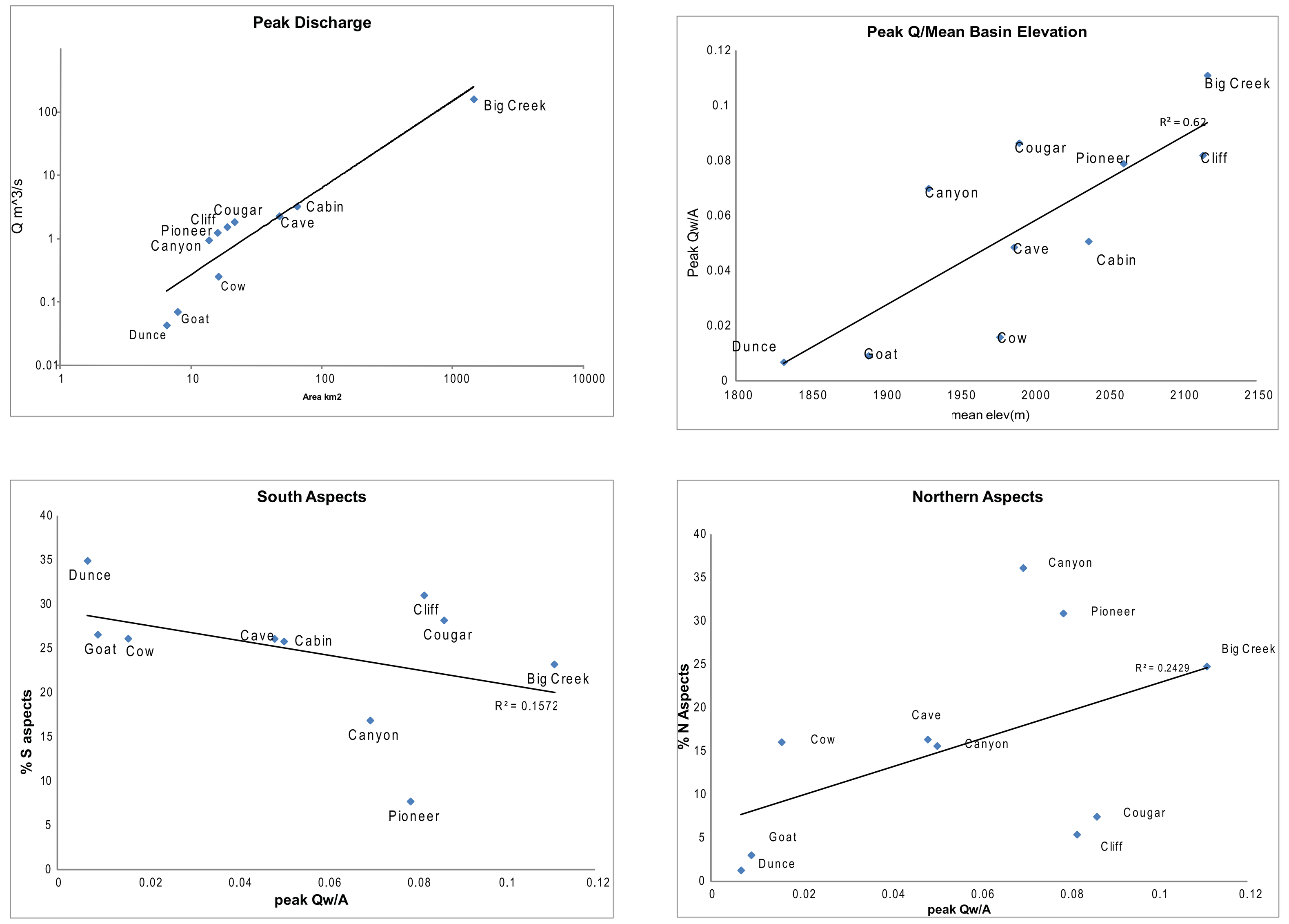


Figure 6. Plots of peak discharge measurements against basin characteristics.

Conclusions

Mean basin elevation has a positive correlation with peak discharge as a result of better snow retention at higher elevations. As temperatures warm and snowlines increase, basins with a large portion of drainage area at low elevations will show decreased peak flows as more water comes off the basin in the winter rather than being stored as snowpack.

Basin orientation affects the size of the peak runoff. Percent of north facing aspects shows a positive correlation with high peak discharge and percent of south facing aspects shows a negative correlation with peak discharge.

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