Temporal and Spatial Variation in Tributary and Mainstem Suspended Sediment Fluxes in Big Creek, a Recently Burned Sub-Alpine Idaho Catchment

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Project Summary

Motivation

-To investigate suspened sediment transport in a recently burned wilderness catchment
-Suspended sediment transport due to spatial and temporal patterns
-Suspended sediment transport, and it processes, affects aquatic wildlife as it pertains to stream ecology

Field Site

-Located in the Frank Church Wilderness of No Return, Central Idaho
-Operated out of Taylor Ranch Field Station, owned by U of I
-Sampled a total of thirteen streams,including a large tributary which feeds the Middle fork of the Salmon River.

Methods

-Used two Isokenitic sampling devices; one hand sampler, and the other a bridge based sampler
-Isokinetic samplers collect a representative sample across the entire stream channel
- Used an ISCO, automated sampler, which obtains samples from a stream at pre-set time intervals

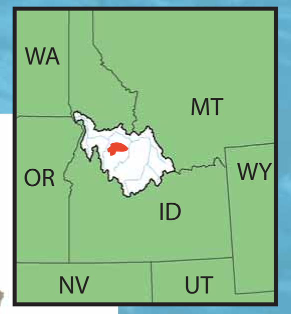
Results

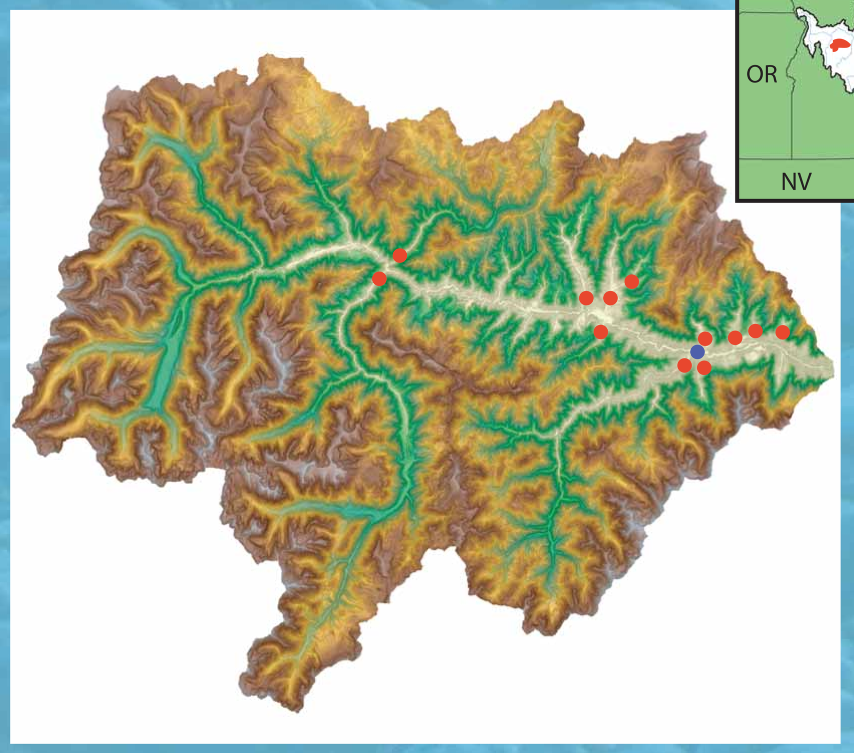
-Suspended sediment flux is directly correlated to stream discharge
-Suspended sediment flux within a stream is not dependent on a single storm or flooding event
-Normalization of suspended sediment yield, based on catchment size, illustrates sediment flux is spatially dependent

Interpretition

-Due to having a high amount of snow fall, which influences spring runoff, suspended sediment flux is correlated to discharge
-Suspended sediment supply within the streams, due to readily available sediment within stream channels and hillslopes, dictates high sediment yield in larger catchments.
-The main tributary experiences higher sediment flux due to its size, available sediment supply, and the fact that it is being feed by all twelve streams.

Field Setting





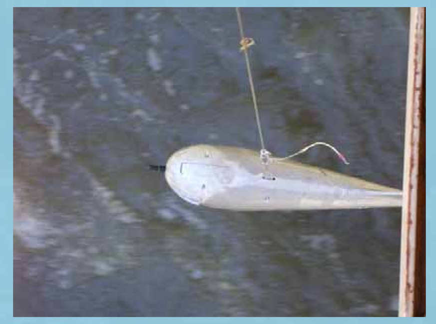
-Elevation change, from valley bottom to mountains peak, is from 1100 meters to 2500 meters
-The watershed area has a variety of both North facing and South facing slopes
-The main stream, and its tributaries, have burned in 2007, 2006, 1998, and as well as having no record of any historical burns
-The total sampled drainage area is approximatley 1899 square kilometers

Methods

Isokinetic Samplers

-Bridge based Isokinetic sampler was lowered from a bridge, used solely on Big Creek, to obtain integrated samples which represent suspended sediment moving within channel.

- Isokinetic hand sampler was used to sample smaller size streams to obtain integrated samples of suspended sediment moving within the channel.



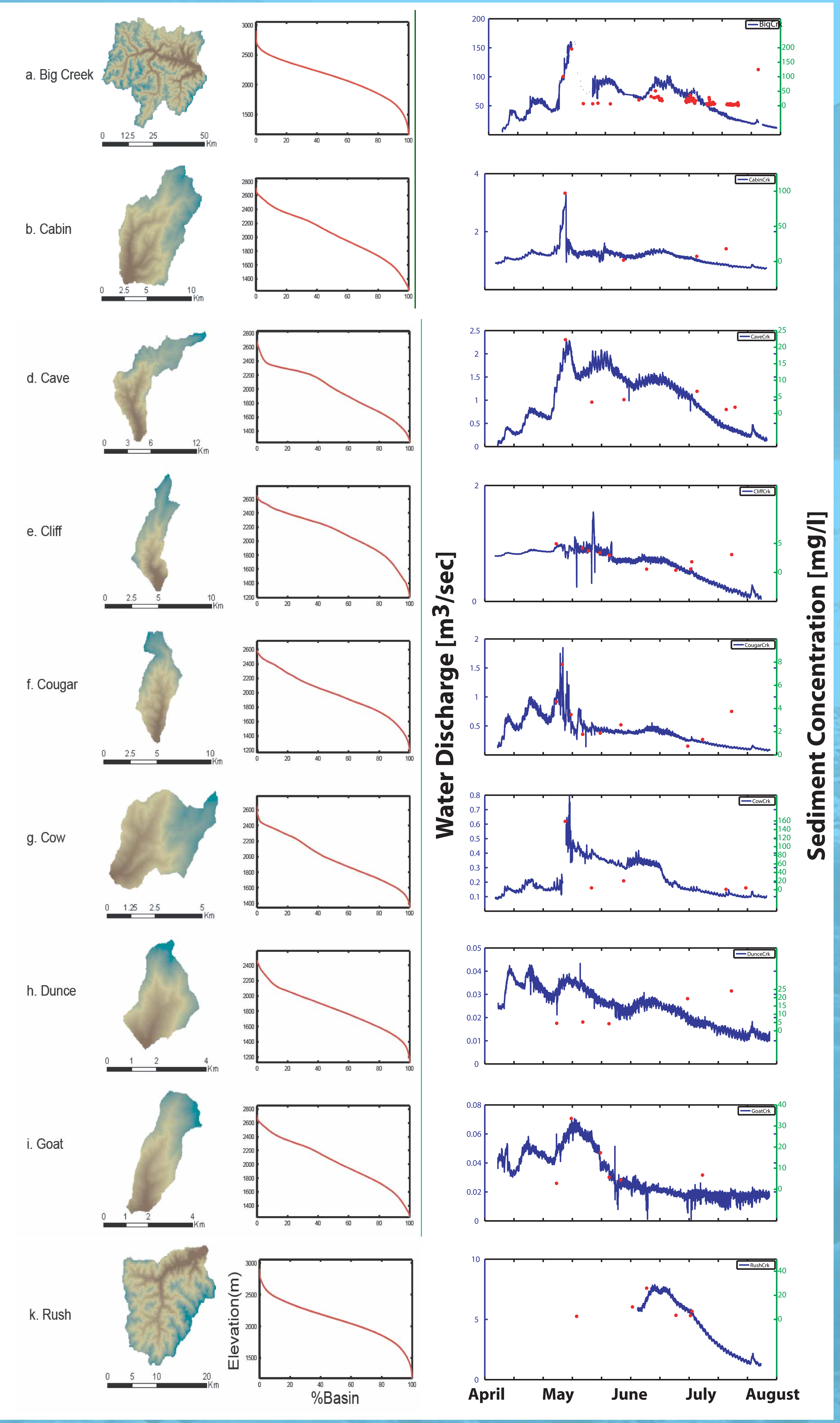
ISCO

- This is an automated device that extracts samples from the stream at fixed time intervals. The inlet of the intake hose was place one quarter of the distance across the channel, and within the center of that water column.

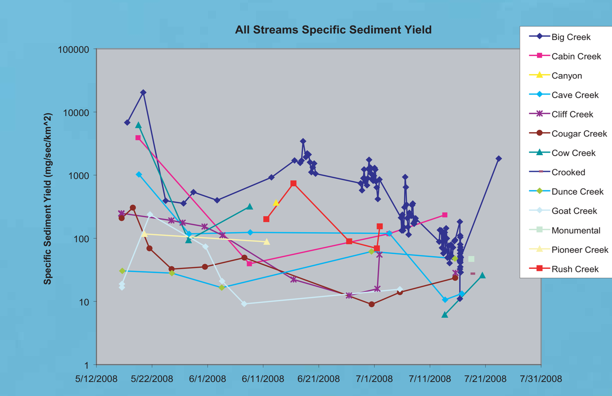
Lab Work

-Each sample, on the order of 200 mL to 1 L, were filtered using filter paper and a vacuum pump. Once sediment was extracted, the samples were dried, then weighed. This dry weight incorporates the amount of inorganic and organic sediment. Then the filters, containing this sediment, were placed in a muffle furnace at 500 degrees Celsius to burn off all inorganic material. Then the final weight gives only the amount of inorganic sediment.

Data



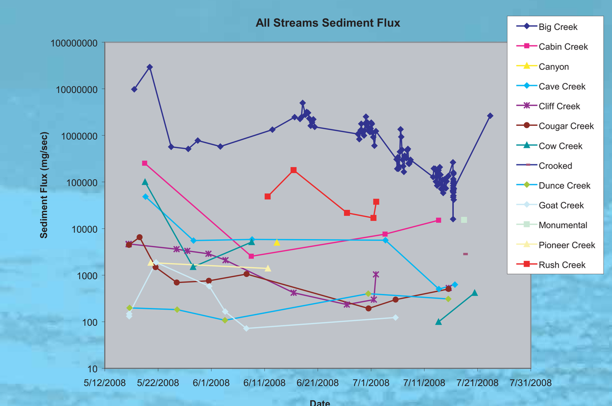
Discussion



-Sediment yield demonstrates the movement of suspended sediment downstream, normalized to the drainage area. Furthermore, this graph demonstrates that the drainage area plays a direct role in the amount of suspended sediment being transported in the stream.

-Big Creek retains the highest amount of sediment yield.

-Sediment yield consistently declines as discharge declines.



-Sediment flux shows the drastic difference in sediment transport among the 13 different streams.

-As channel size and drainage area decrease, sediment flux becomes smaller.

-Sediment flux is not dependent on a single storm or flooding event.

Interpretation

- One of the main conclusions is that there exist a strong correlation between discharge and sediment flux. The data provided illustrates this correlation, as discharge changes, sediment flux follows the same trend. This may be due to the unusually high snow fall experienced this year, which created high spring runoff. Also, Big Creek experienced large discharges throughout the summer (as compared to its tributaries), thus allowing for its sediment carrying capacity to be greater. In addition, the amount of available sediment within the stream channel itself was much more abundant in Big Creek than any other sample sites. This trend is evident in the sediment yield graph as well. When the drainage area of each stream is taken into consideration, we still see that Big Creek has large sediment transport. This is also recognized in the tributaries, the larger streams experience more sediment yield than the smaller streams. Thus providing evidence that drainage area is playing a direct role in the transport of sediment.

Conclusion

Sediment flux in Big Creek, as well as its tributaries, is strongly related to the discharge of the streams. As discharge increases or decreases within a given stream system, sediment transport responds accordingly. The size of the catchment itself also dictates the amount of sediment yield. Larger watershed areas have the ability to release more sediment. In addition, the streams within the larger catchments have a higher sediment carrying capacity, as well as more availiable sediment within the channels.

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