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Impact of Drought on Suspended Load in South Dakota Tributaries

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The installation of Gavins Point Dam on the Missouri River has drastically influenced sediment loads. Dams can restrict the flow of the river, greatly reducing sediment loads downstream while also trapping sediment upstream. While too much sediment can be detrimental, too little sediment can also diminish ecosystem quality (Jacobson et al., 2009). I measured the suspended load of three major tributaries (Vermillion, Big Sioux, and James) below the Gavins Point Dam and looked at their overall contribution to the Missouri River sediment load. The state of South Dakota was enduring a severe drought during sampling from March to August 2017. As drought persists, the suspended load of sediment may continue to decrease until a heavy rain event takes place, which would subsequently mobilize the sediment, and alter the ecosystem.

Our three study tributaries vary in length and basin size, with the Vermillion being the smallest. The Vermillion also had the lowest discharge, while the Big Sioux had the highest. Using a depth integrated sampler, we collected suspended sediment from the water column at two locations in each river every other week. We observed a positive correlation between suspended load and variables such as total dissolved solids, salt, conductivity, and loss on ignition. Loss on ignition measures the amount of organic carbon in the suspended sediment, and can serve as a proxy for nutrient loads, which are essential resources for organisms living in the river environment (Grove and Bilotta, 2014).

The Vermillion was significantly different compared to the other tributaries in terms of nutrient load, containing two times the amount of organic carbon compared to the James and Big Sioux. In the Vermillion, the suspended load decreased as the discharge decreased. This might be due to settling of sediment in the water column while higher flows in the other tributaries would not allow this trend. In the Big Sioux and James rivers, suspended load remained relatively constant as discharge declined over the summer. The Big Sioux and James have a high enough flow to cause turbulence that mixes and dilutes the suspended sediment. Lack of correlation between suspended load and discharge in the other tributaries might be due to the bigger size of their basins and potential dilution taking place because of their larger discharges (Xu, 2014). The Vermillion River had the lowest discharge overall, yet had the

highest suspended load and total dissolved solids values, which might indicate that more sediment erosion is occurring in this basin compared to the others. These tributaries are probably the primary nutrient source for the Missouri River (Wetzel et al., 2014), which saw a >90% reduction in suspended sediment loads after the Gavins Point Dam was constructed (Jacobson et al., 2009) Land use may also play a role in sediment load of these tributaries. Future research efforts will provide additional suspended load data as well as an analysis of land use for each tributary basin.

Bethany taking a sample along a Missouri River tributary

Bethany holding up gear that is needed to survey the tributaries - waders!

Literature Cited

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