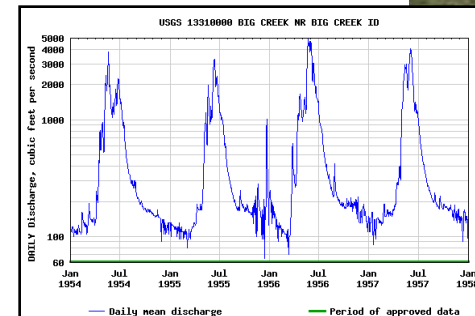
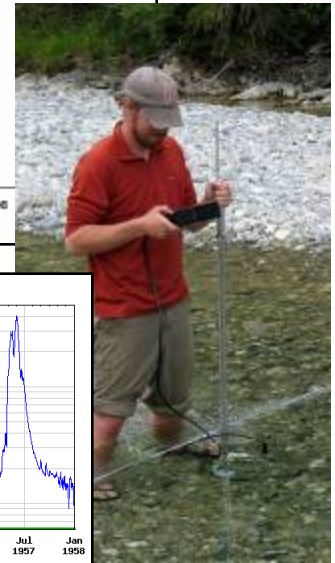
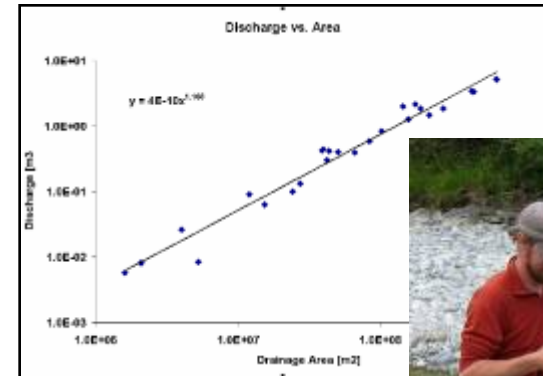
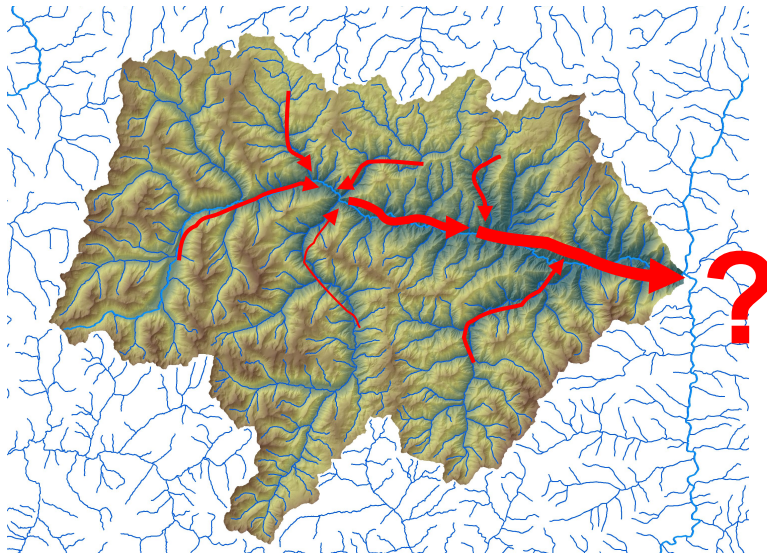


# Water, Water, Everywhere, But Not a Drop Measured

A Project to Establish Reliable Basin Hydrology for the Big Creek Watershed.

A Proposed Graduate Research Assistantship

**Dr. Benjamin Crosby, ISU Geosciences**



Transitioning from hydrologic ignorance



To hydrologic awareness

# River Flow Exerts a Fundamental Control on Physical and Ecological Processes in River Systems

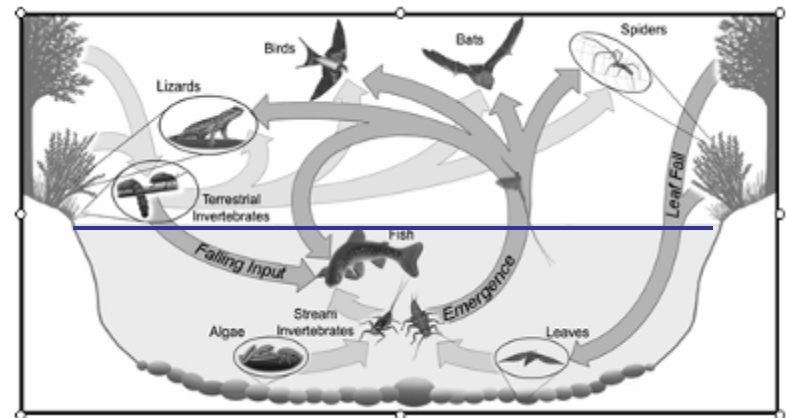
## Controls on Physical Processes

- Determines river erosion rates
- Controls rates of sediment transport and/or sediment deposition
- Determines channel bed and bar morphology (height, width, bends)
- Influences grainsize distribution



## Controls on Ecological Processes

- Influences aquatic predator/prey interaction
- Determines the availability of safe or suitable habitat and resources
- Influences nutrient export to the riparian zone and beyond



(from Baxter et al. 2005)

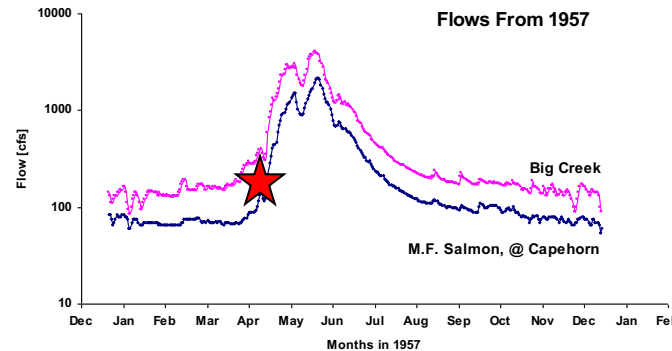
# An Example of How Flow Affects Food Chains



Grazer



Predator



Algae

→ The length of a river food chain changes from year to year, shifting with the hydrologic regime. (from: Marks, Power and Parker, 2000 )

★ Following flood disturbance, predators suppress grazers, releasing algae

• During drought years, grazers suppress algae, while predators are unimportant.

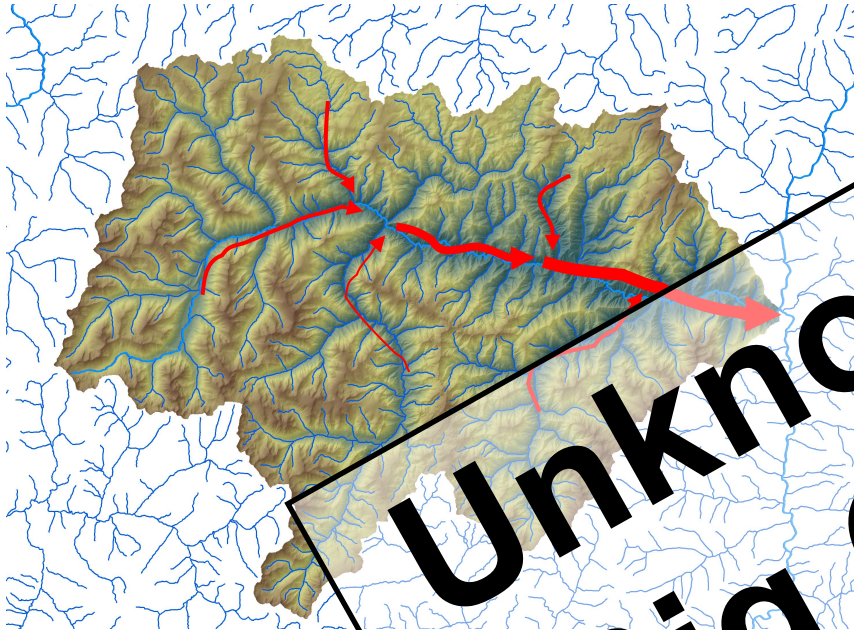
• These results suggest that hydrologic regime, *rather than productivity*, determines the functional length of this river food chain.



# River Flow Varies in Both Space and in Time

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## Variation in Space



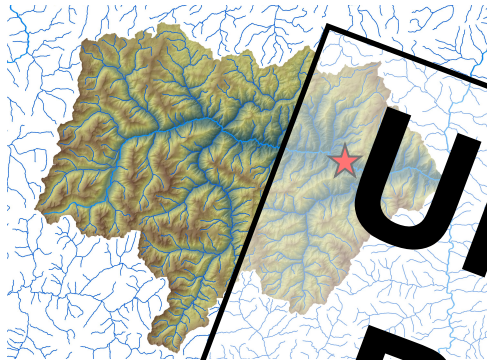
**Unknown in  
Big Creek!**

Flow accumulates in the downstream direction, increasing step-wise at each tributary junction. The farther downstream, the more flow.

Snow accumulation and precipitation are not uniformly distributed across the landscape. Thus, some tributaries have more flow than others.

# River Flow Varies in Both Space and in Time

## Variation in Time

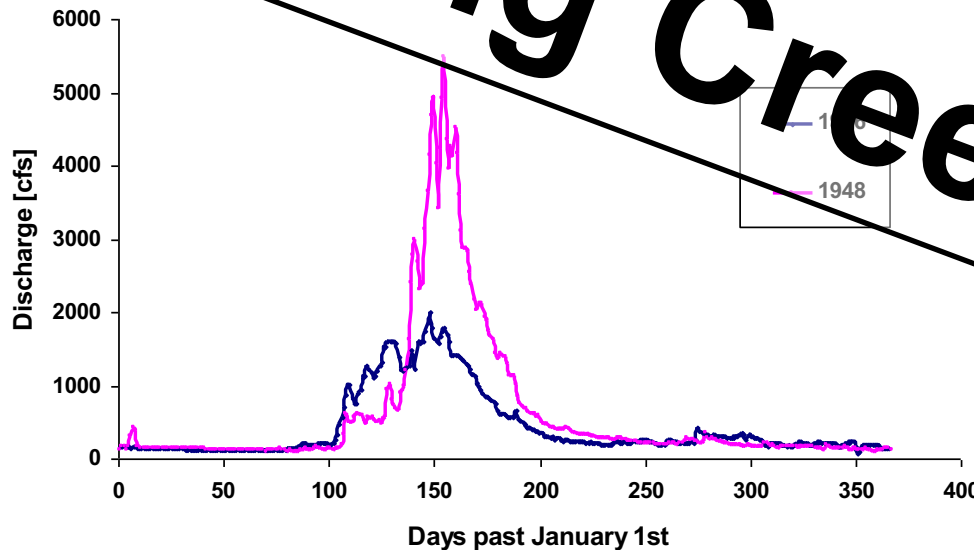


A gaging station is where flow is continuously measured at a single location.

Flow can vary in time as:

1. a consequence of seasonal effects (melting snowpack)
2. a consequence of individual storm events (consecutive thunderstorms)
3. a consequence of long term climate trends (drought, warming)

Big Creek Discharge Comparison: 1946 and 1948



**Unknown in Big Creek!**

# Continued Progress in Water-Based Research in Big Creek Demands Measured Flow

- Could explain observed *seasonal* or *along-stream* variations in ecological or physical processes
- Allows accurate comparison to other rivers
- Facilitates interpolation of no a observations over the entire basin
- Allows comparison of modern observations to past records of flow or ecological metrics
- Monitor impacts of modern climate change

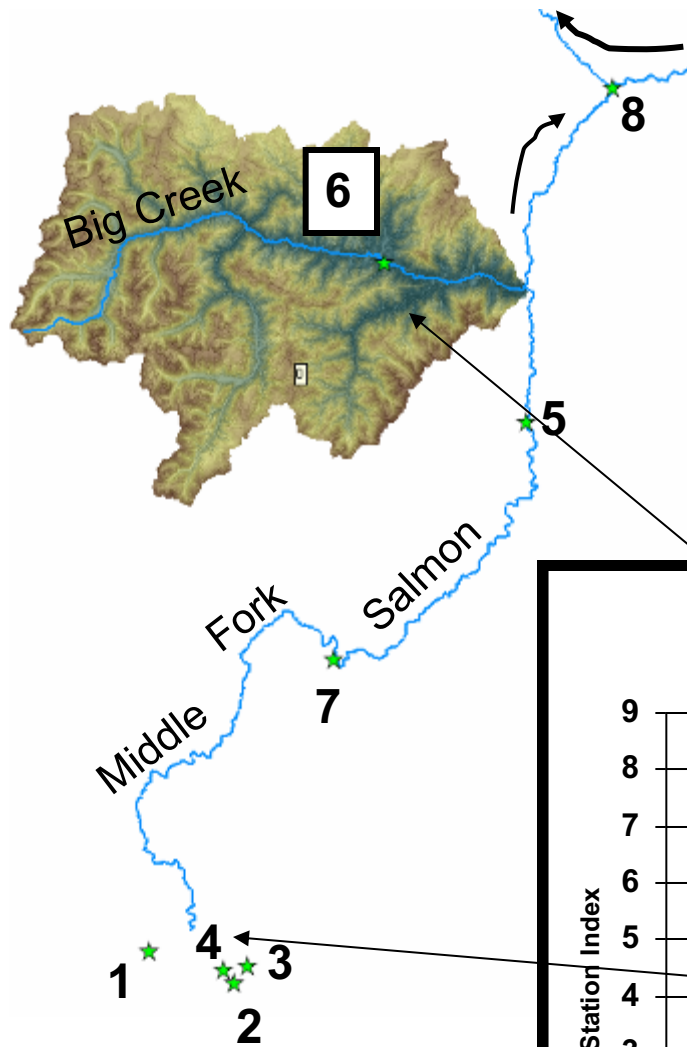
**Unknown in  
Big Creek!**



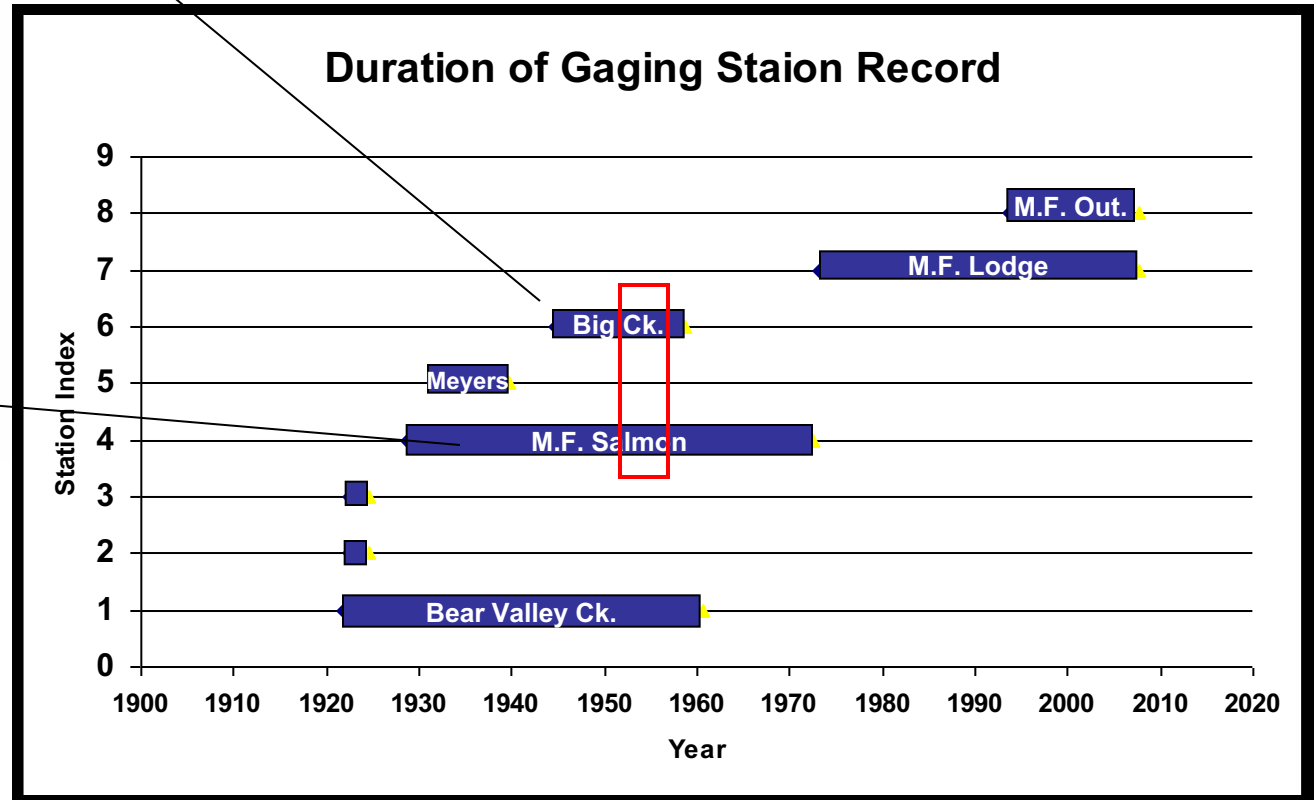
photos: Taylor Ranch  
website and Janet Pope



# Past and Present Measurement of flow on the Middle Fork Salmon



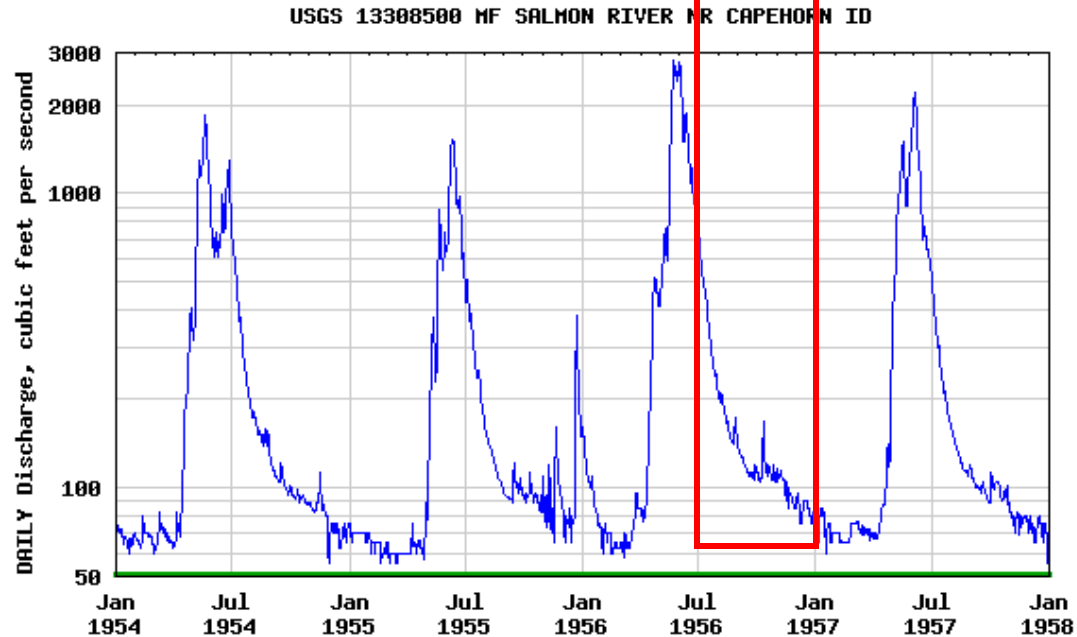
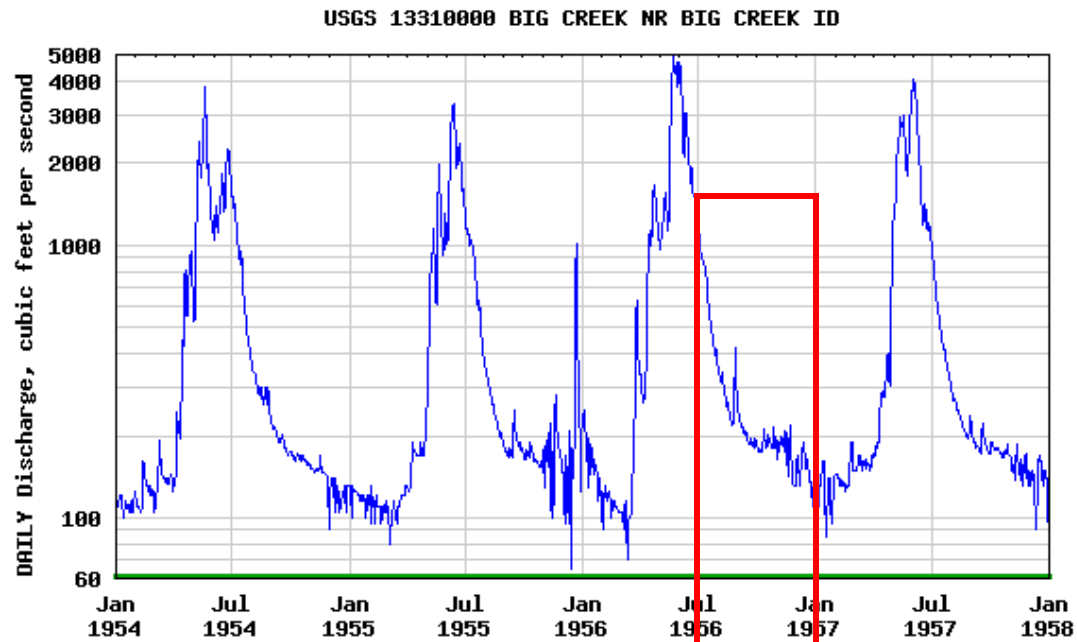
- Only 8 stations with multi-year records
- Only 2 active stations on M.F. Salmon (7,8)
- Big Creek station record overlaps with 2 stations



# January, 1954 – January, 1958

Comparing flow records from two gaging stations for the same period of record reveals similar hydrologic responses to the seasons.

Note the flows are different magnitudes, but still follow roughly the same pattern.



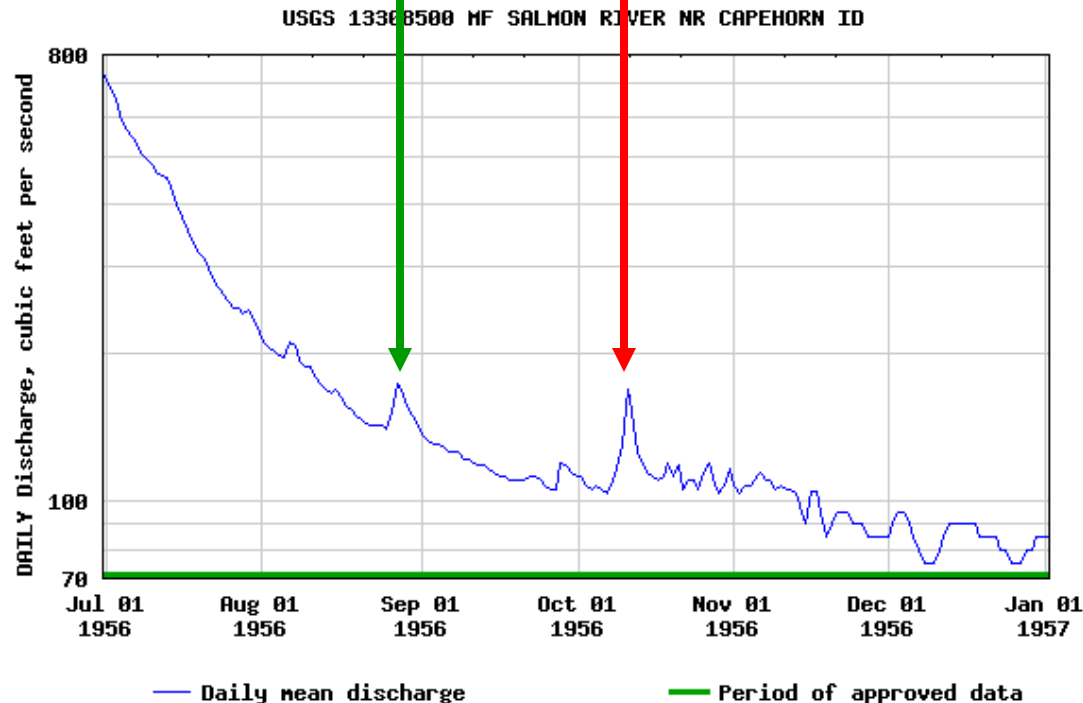
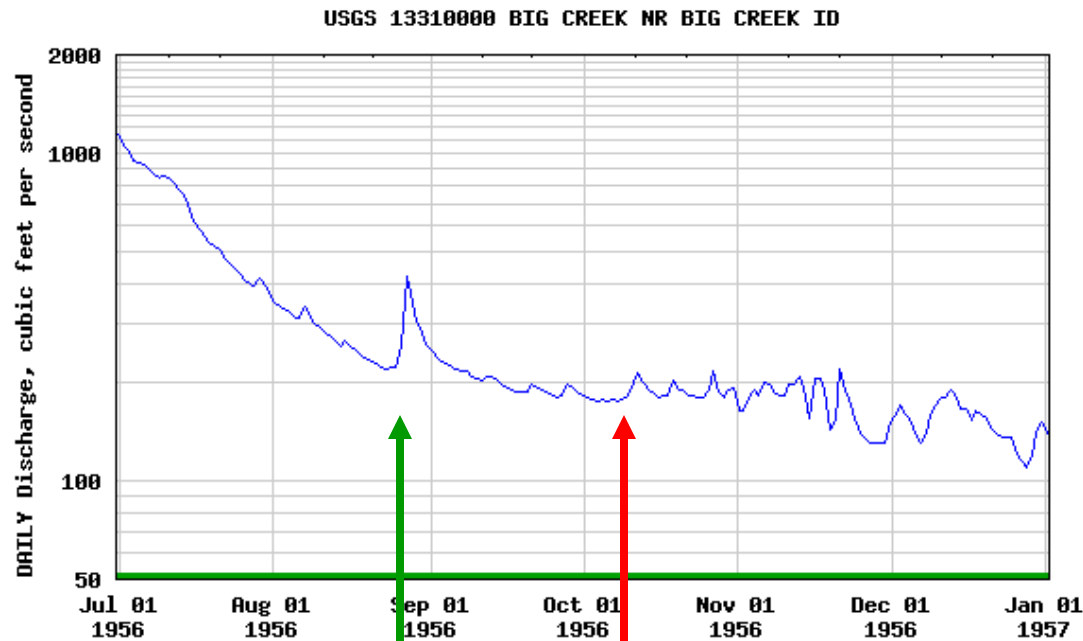


# July, 1956 – January, 1957

When we look closer, we find significant differences.

Sometimes the records match well (green line),

And sometimes the records don't. These are due to regional events like local convective storms (red line).



# How to Quantify the Basin Hydrology of Big Creek

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- Establish a permanent stream gaging station at Taylor Ranch Bridge. Records of flow will be made available to the public over the internet in real-time.
- Develop of a hydrologic model for the spatial and temporal distribution of flow in Big Creek and its tributaries, allowing flow prediction in ungaged locations.
- Reconstruct of a record of water flow in Big Creek over the last 50 years, rigorously calibrated to the continuous records available along the Middle Fork Salmon River.



Through the research program outlined above, a graduate student will be able to address hypotheses regarding the spatial and temporal availability of water in Big Creek while, at the same time make a significant contribution to the research infrastructure of Taylor Ranch Field Station.