

Brazos River BBEST Overview

Timothy H. Bonner

Texas State University
Department of Biology/Aquatic Station
San Marcos, Texas

Surface Water

1. Salt vs. Fresh (chemical)
2. Fresh: Lakes vs. Rivers (velocity)
3. Rivers: Big vs. skinny (quantity)



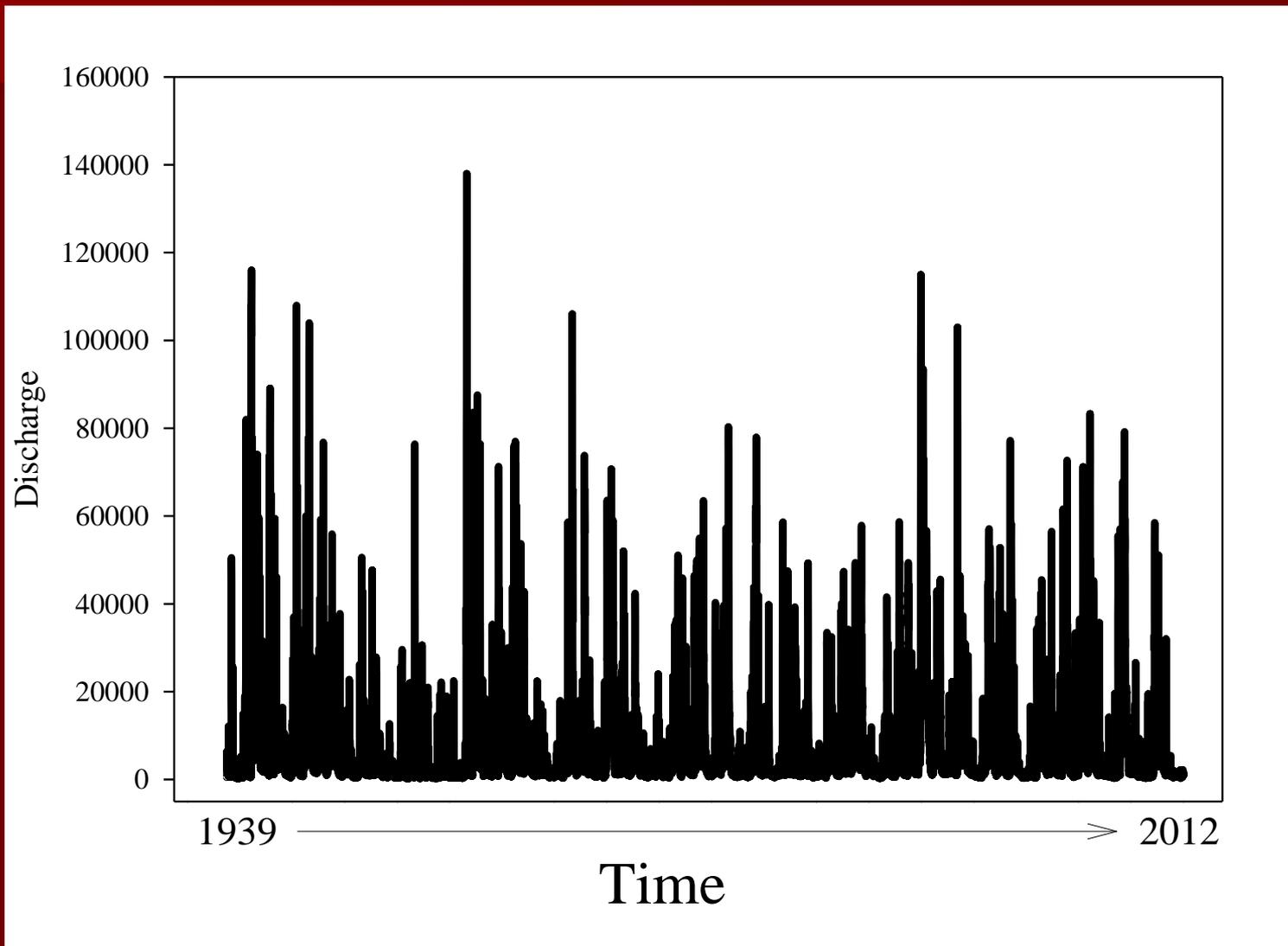


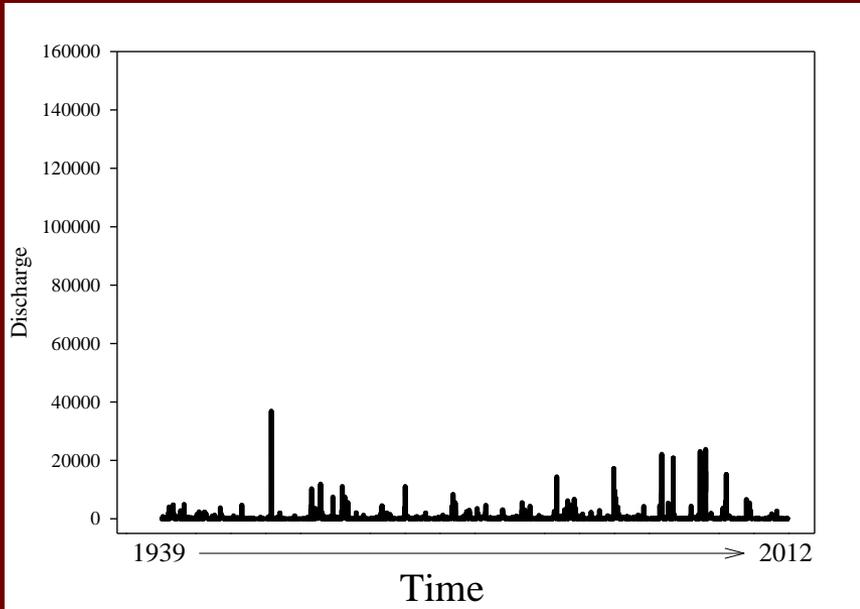
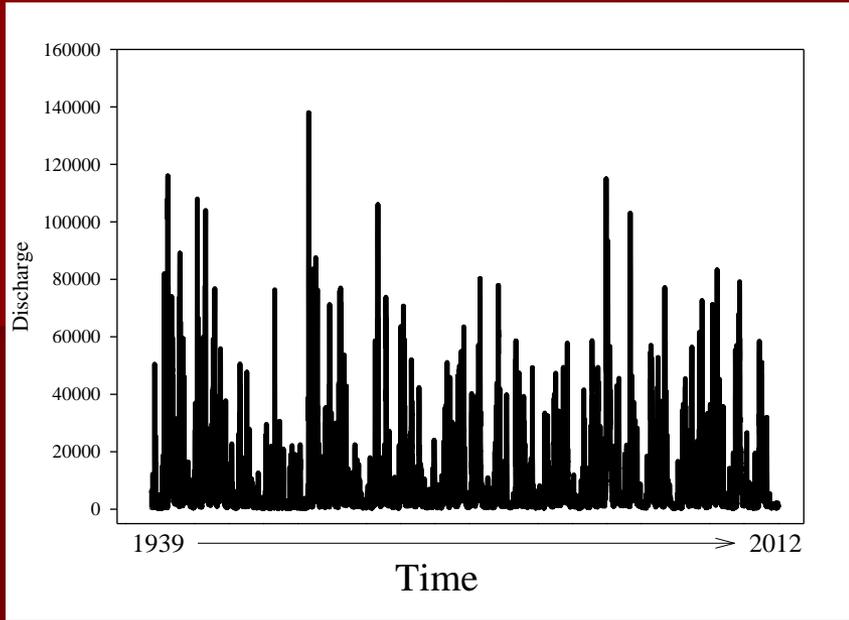
Water quantity defines a river

- Water quantity measurements:
 - Depth x width x velocity = discharge or flow
 - Units: cubic feet per sec (cfs or ft^3) or cms



Hydrographs- Illustrating Water Quantity from USGS Stations



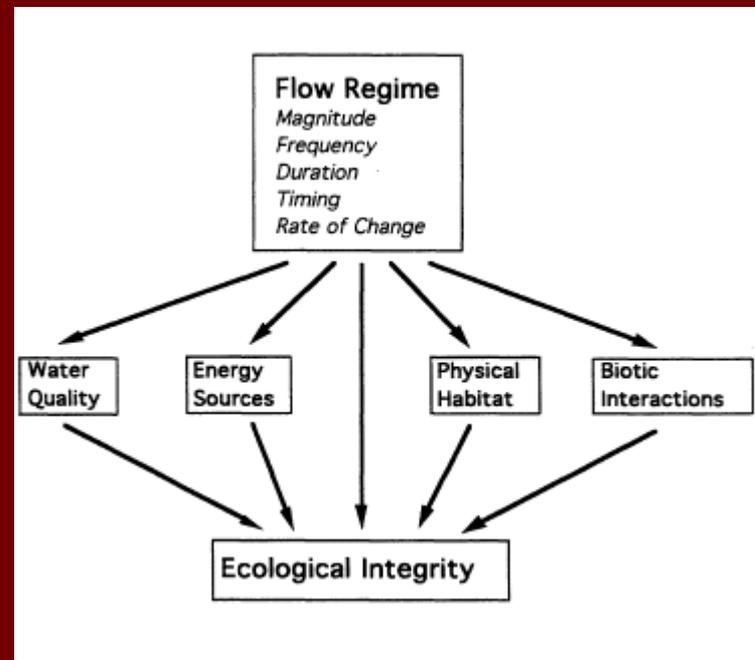


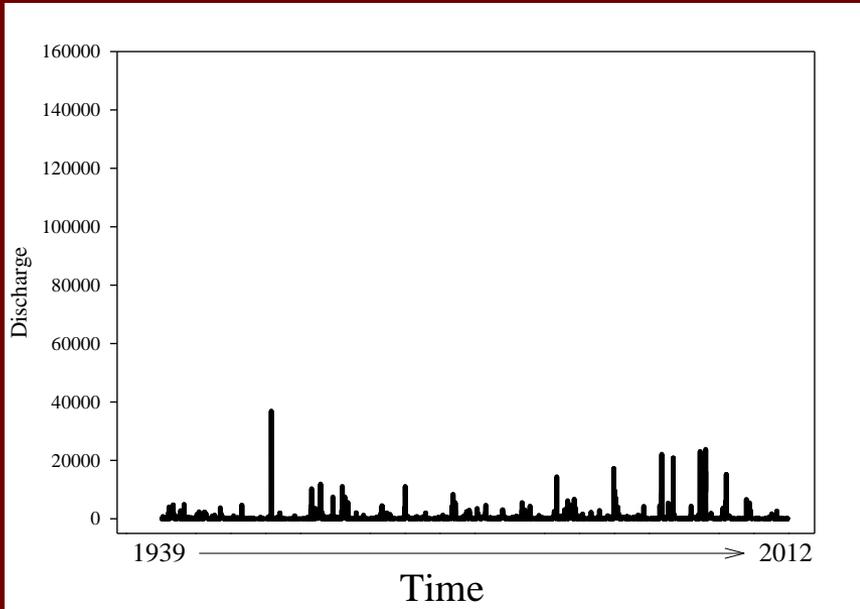
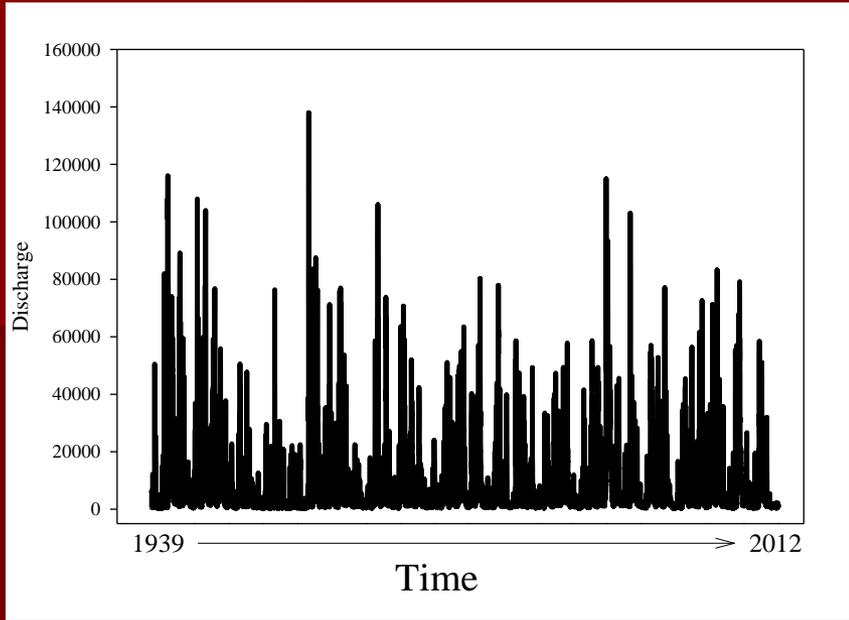
The Natural Flow Regime

A paradigm for river conservation and restoration

N. LeRoy Poff, J. David Allan, Mark B. Bain, James R. Karr, Karen L. Prestegard,
Brian D. Richter, Richard E. Sparks, and Julie C. Stromberg

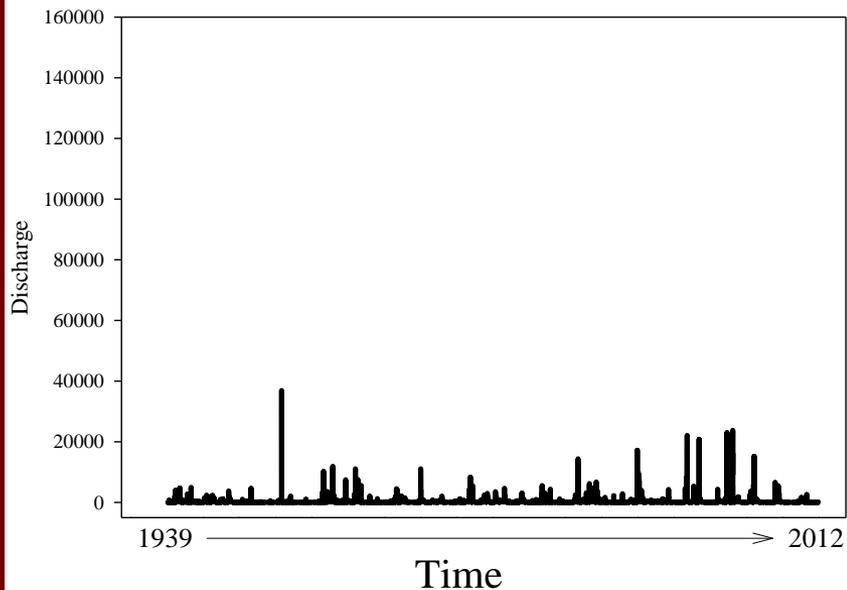
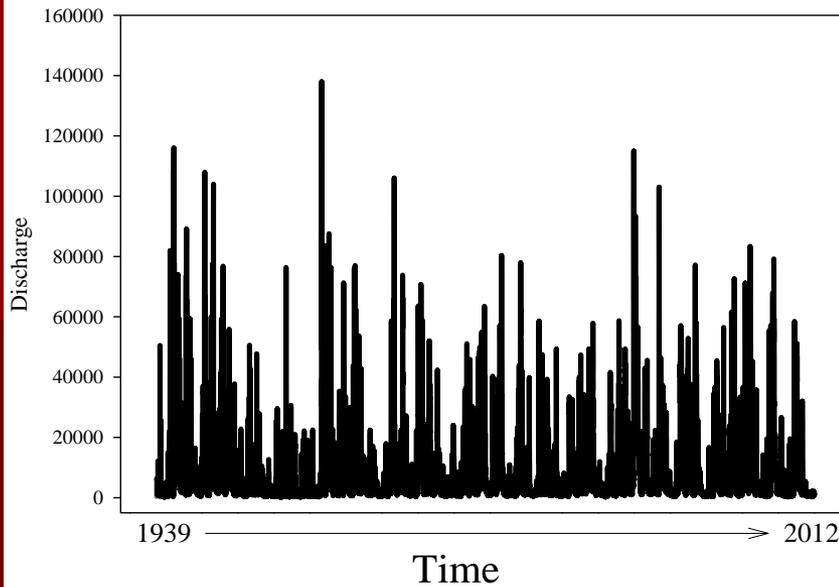
The ecological integrity
of river ecosystems
depends on their natural
dynamic character





Quantify dynamic character by decomposing the hydrograph

- Periods of low flows (subsistence)
- Base flows
- High flow pulses

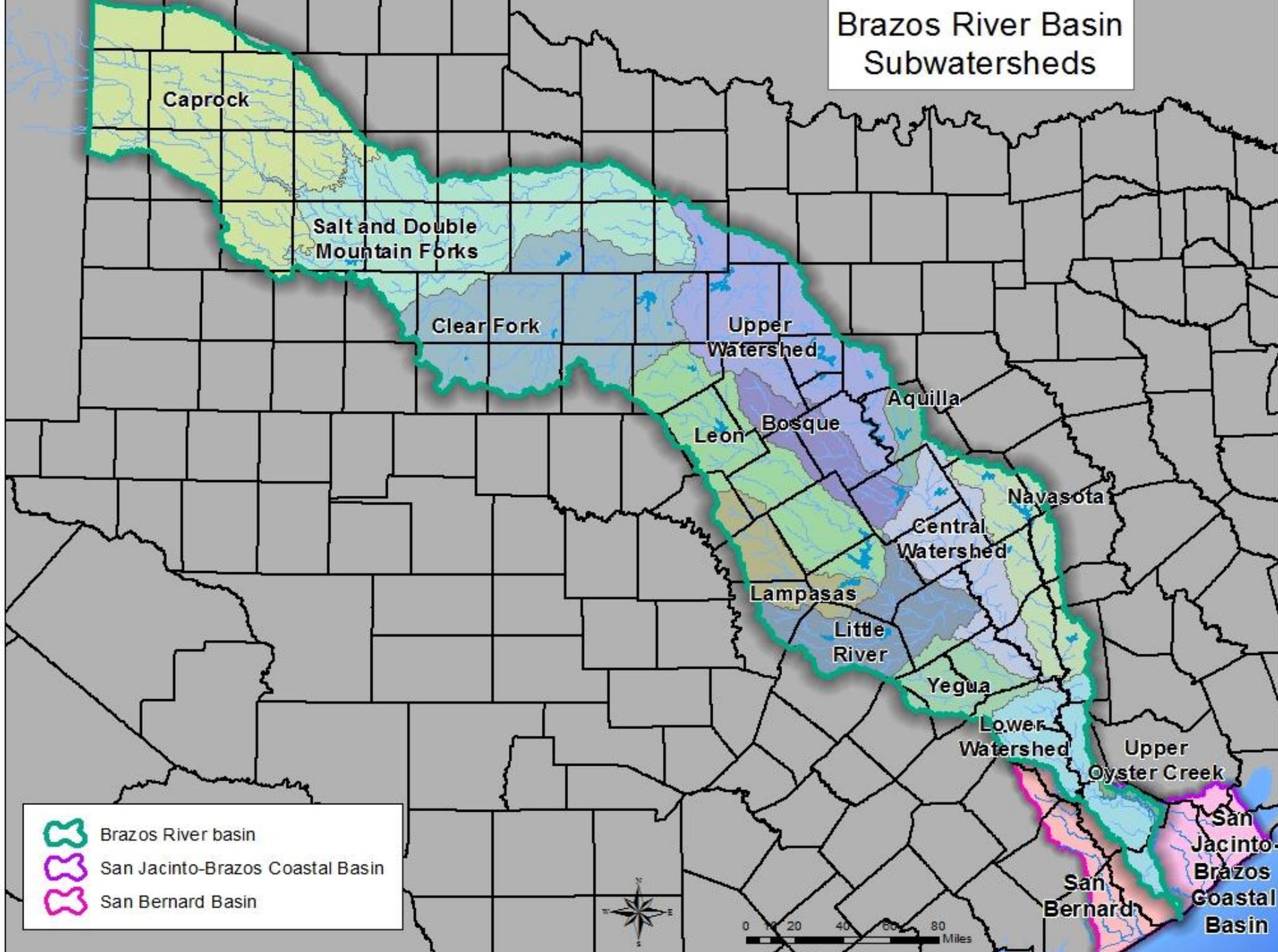


BBEST Charge:

Recommend Flow regimes that maintain a sound ecological environment

- Step 1: Do we have sound ecological environments?

Brazos River Basin Subwatersheds



-  Brazos River basin
-  San Jacinto-Brazos Coastal Basin
-  San Bernard Basin



BBEST Charge:

Recommend Flow regimes that maintain a sound ecological environment

- Step 1: Do we have sound ecological environments?
- Step 2: Availability of USGS stations to provide hydrographs?

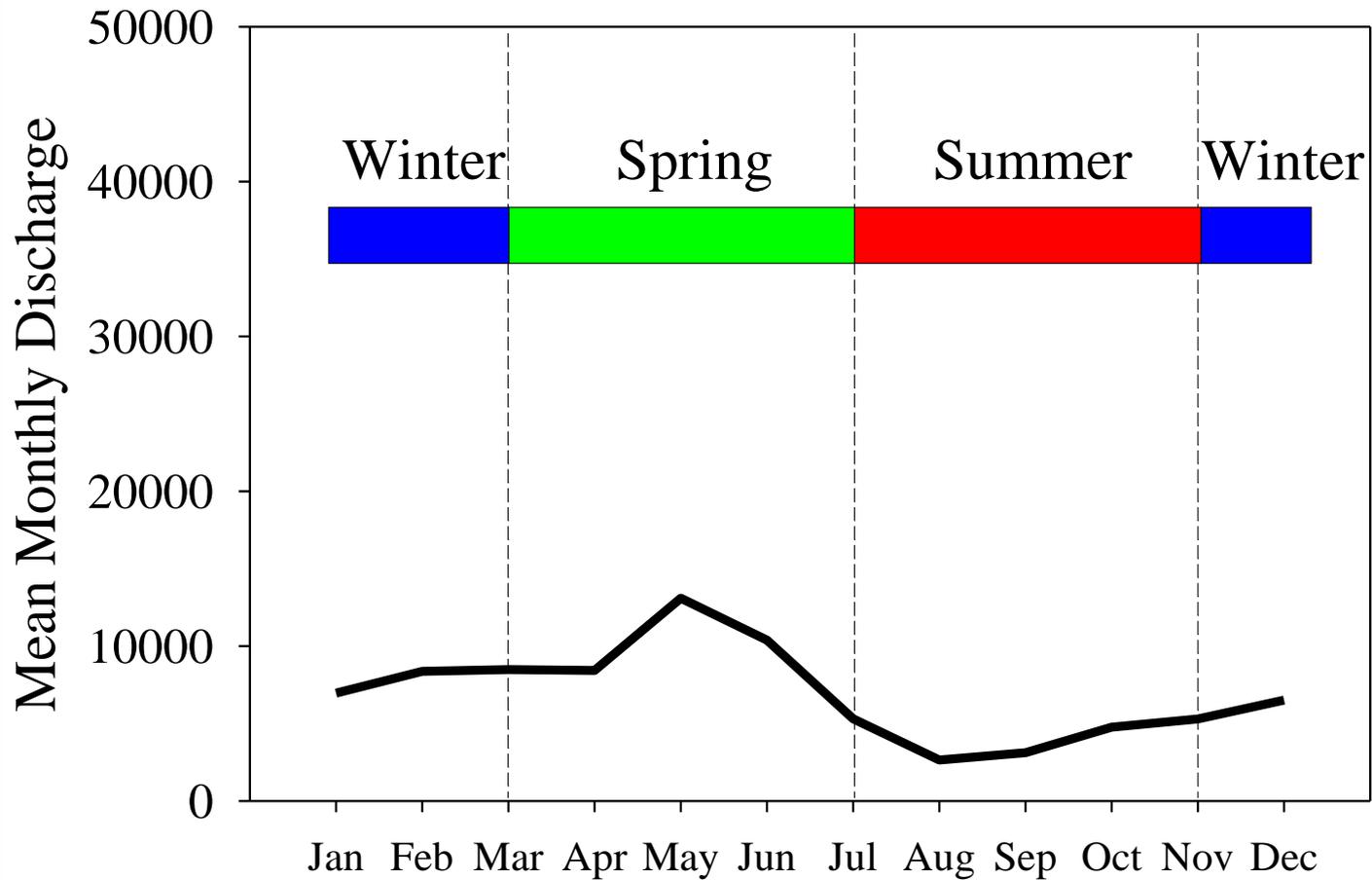
70+ USGS stations in Brazos River basin

- Select ones with adequate length of record to capture natural dynamics
- Spatially distributed to provide reasonable coverage

70+ USGS stations

- Double Mountain Fork Brazos River near Aspermont: 1940-2010
- Salt Fork Brazos River near Aspermont: 1940-2010
- Brazos River at Seymour: 1924-2010
- Clear Fork Brazos River near Nugent: 1925-2010
- Clear Fork Brazos River near Fort Griffin: 1924-2010
- Brazos River near South Bend: 1939-2010
- Brazos River near Palo Pinto: 1925-2010
- Brazos River near Glen Rose: 1924-2010
- North Fork Bosque River at Clifton: 1924-2010
- Brazos River at Waco: 1900-2010
- Leon River near Gatesville: 1951-2010
- Lampasas River near Kempner: 1963-2010
- Little River at Little River: 1963-2010
- Little River near Cameron: 1917-2010
- Brazos River near Bryan: 1928-2010
- Navasota River near Easterly: 1925-2010
- Brazos River near Hempstead: 1939-2010
- Brazos River at Richmond: 1923-2010
- Brazos River at Rosharon: 1972-2010
- San Bernard River near Boling: 1955-2010

Discharge is not equal throughout the year

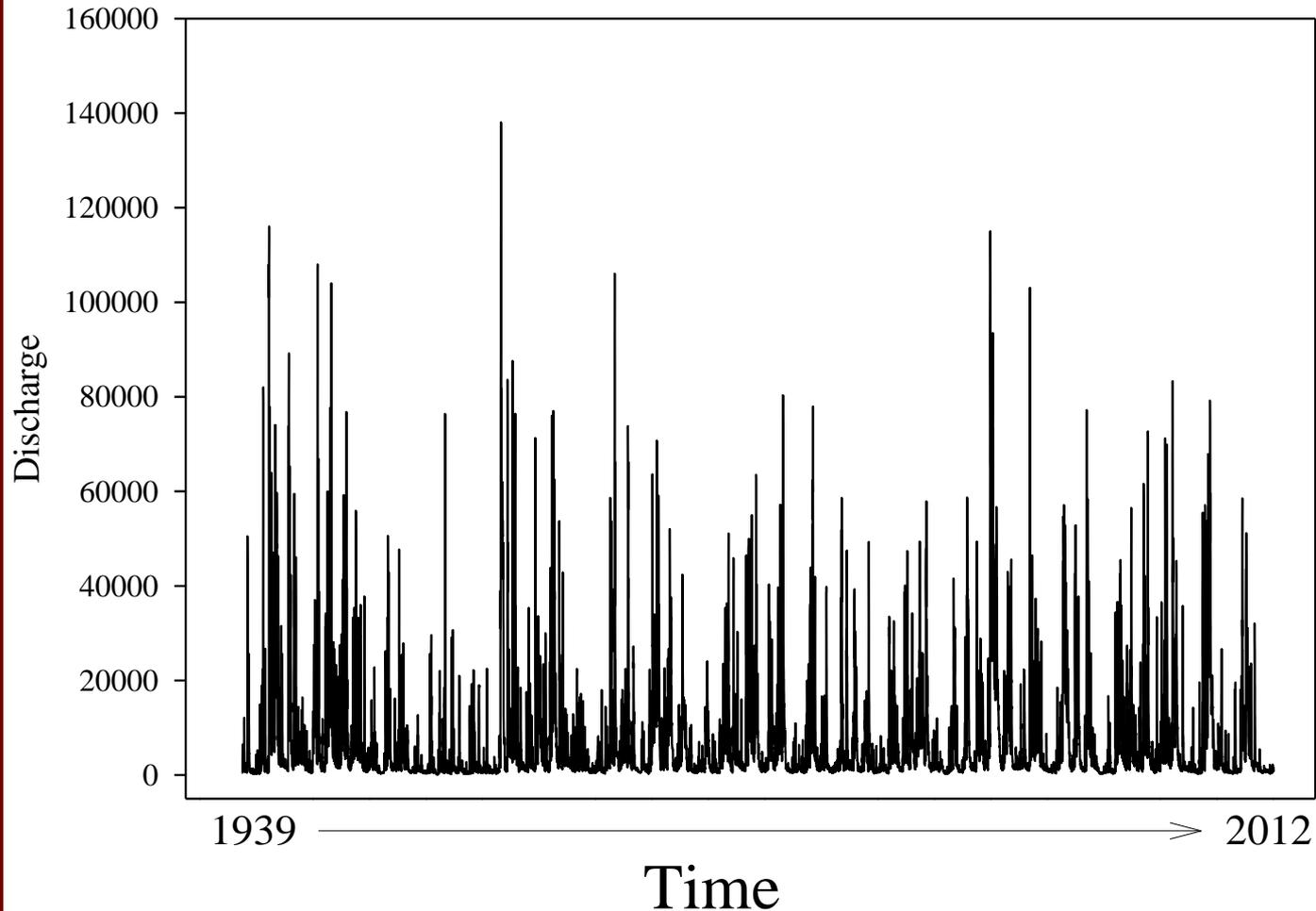


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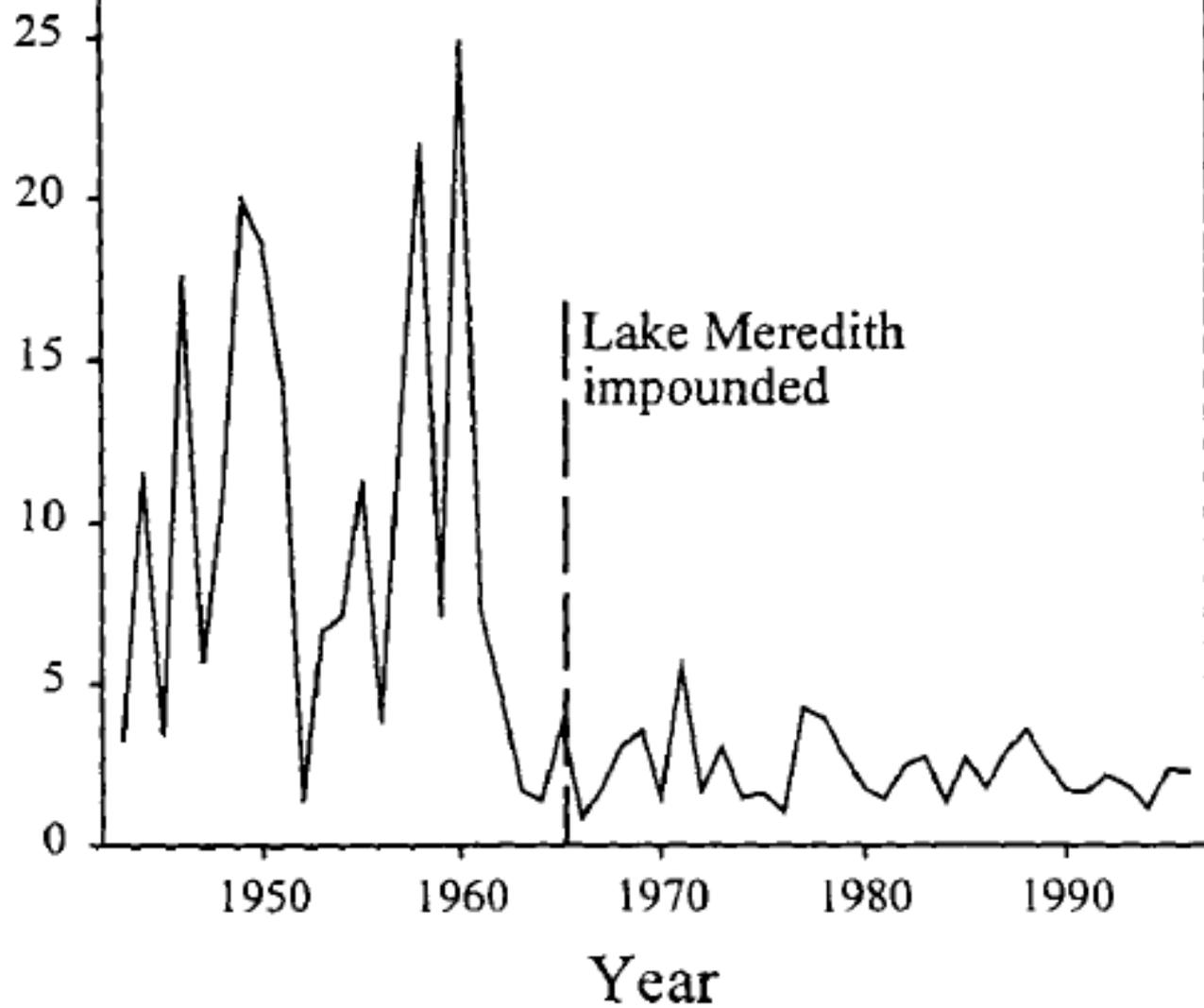
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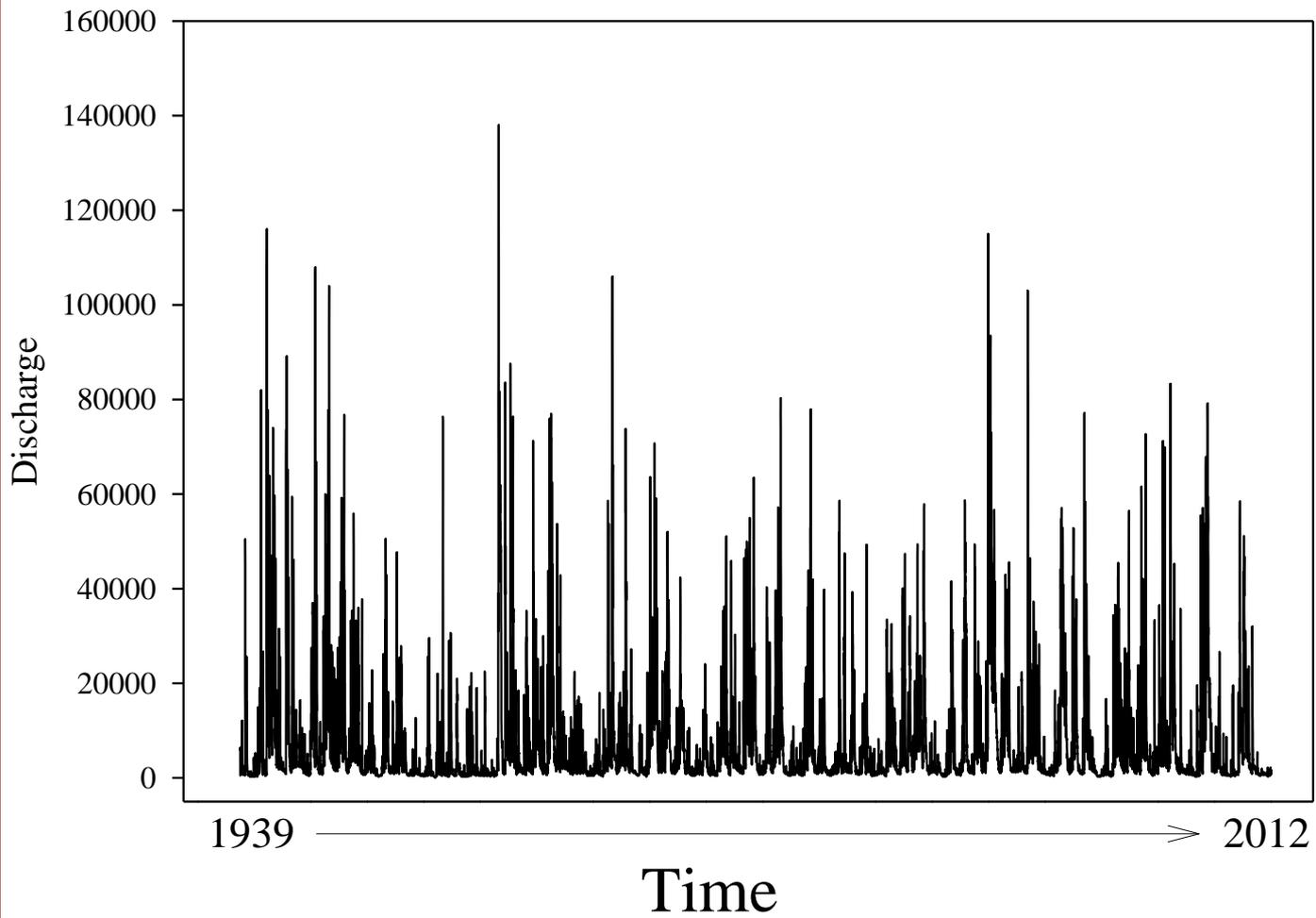
- Step 1: Do we have sound ecological environments?
- Step 2: Availability of USGS stations to provide hydrographs?
- Step 3: Decompose hydrographs

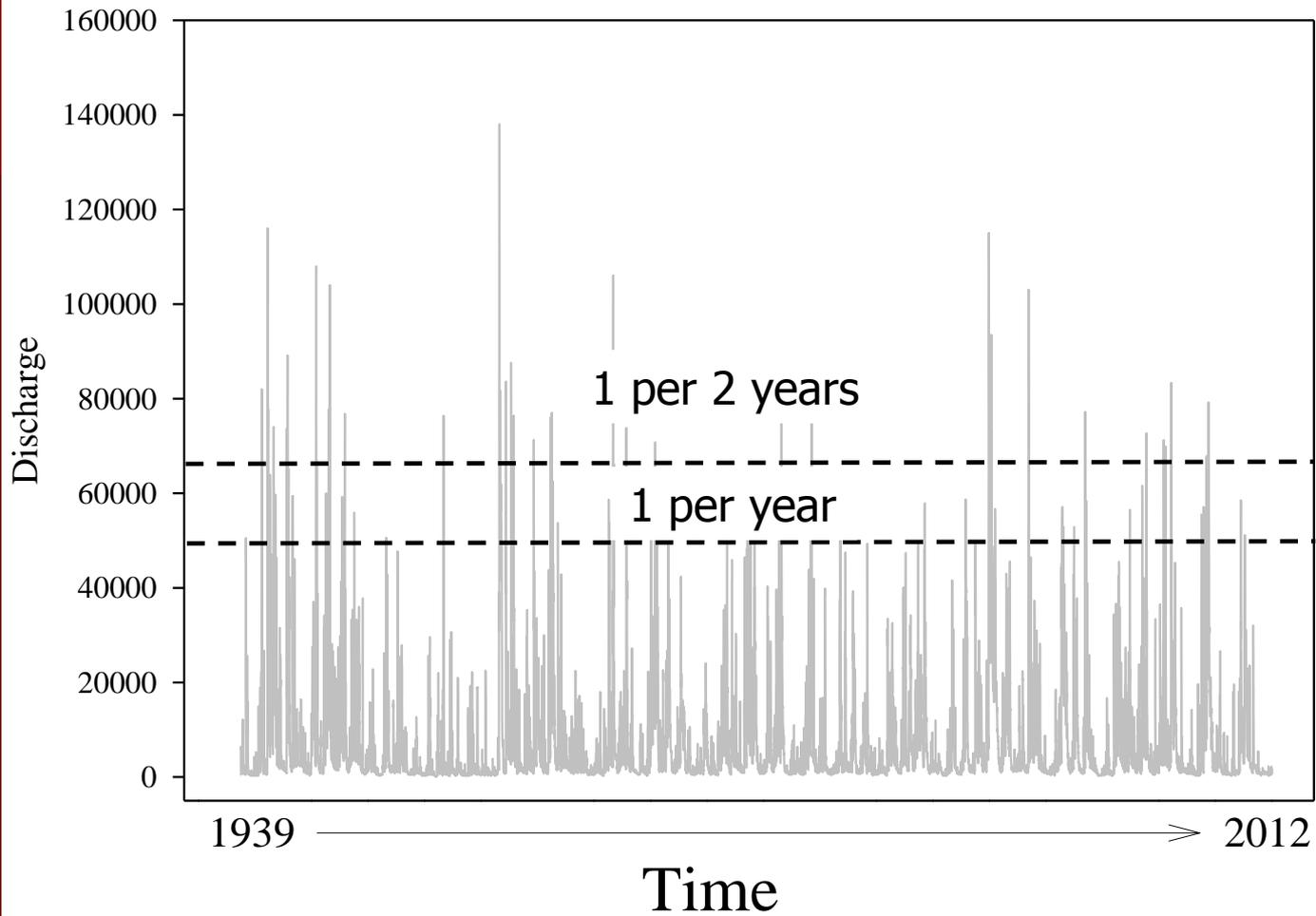
Hydrographs QC— Contemporary Effects?

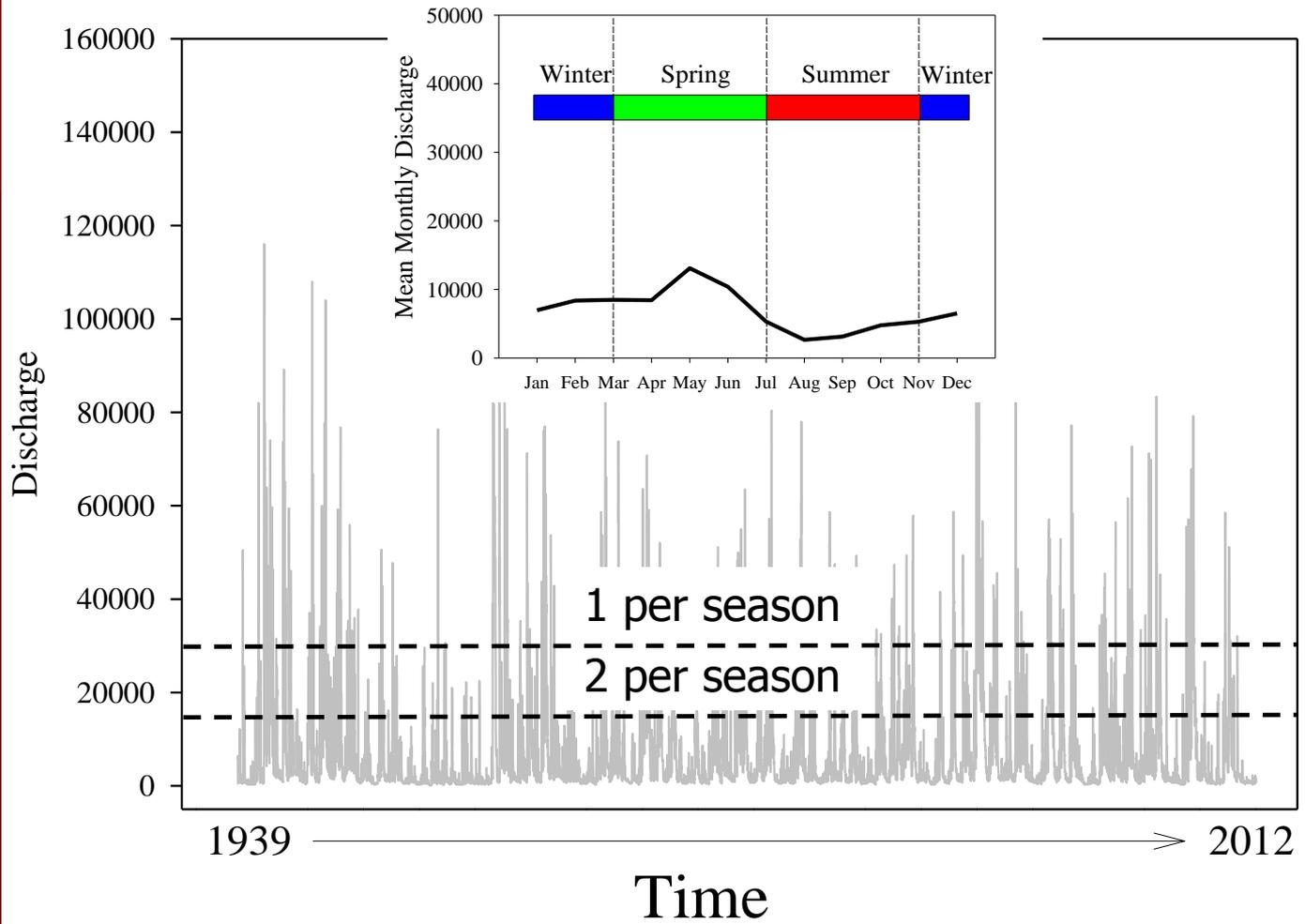


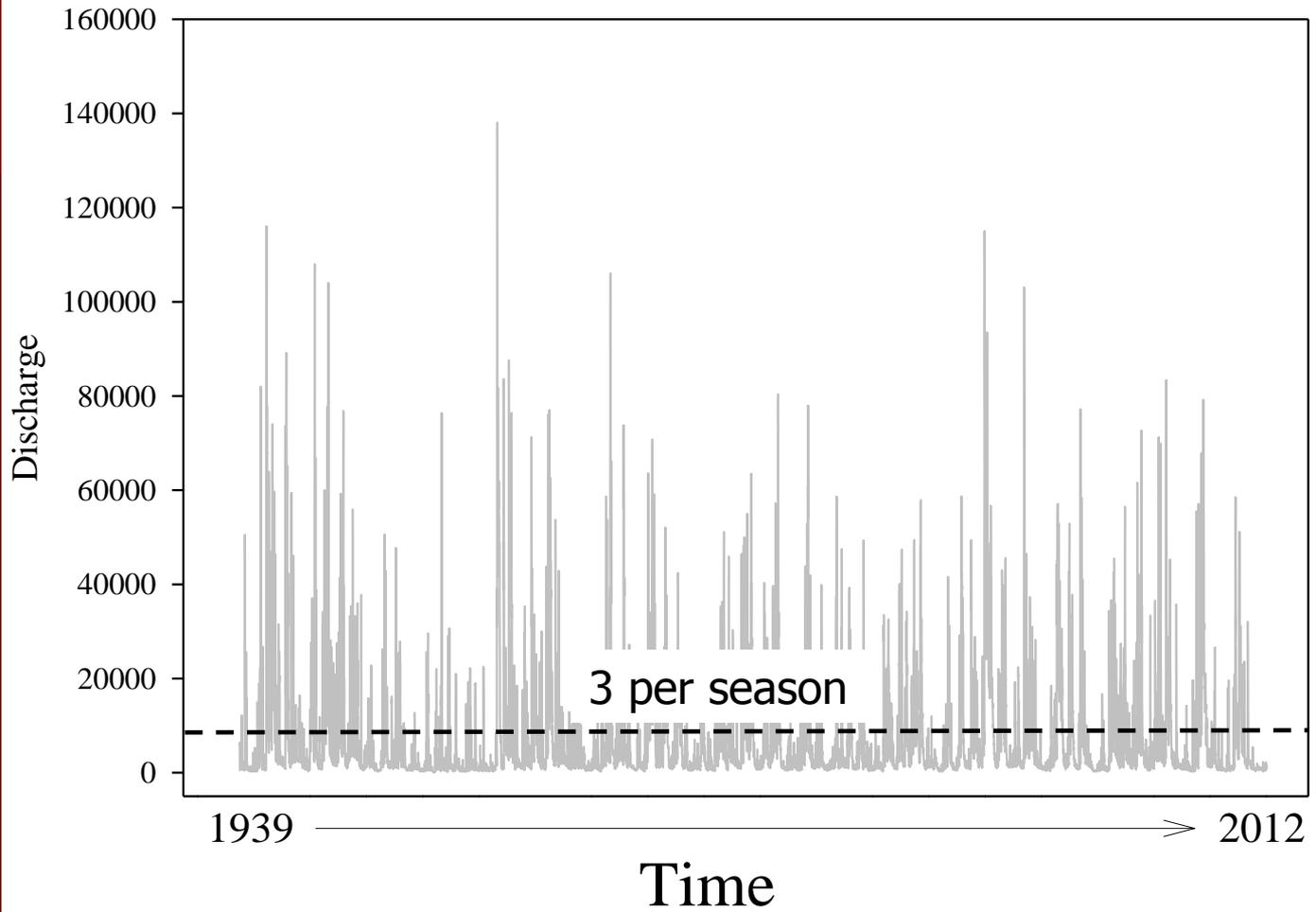
Canadian River,
downstream from Lake Meredith

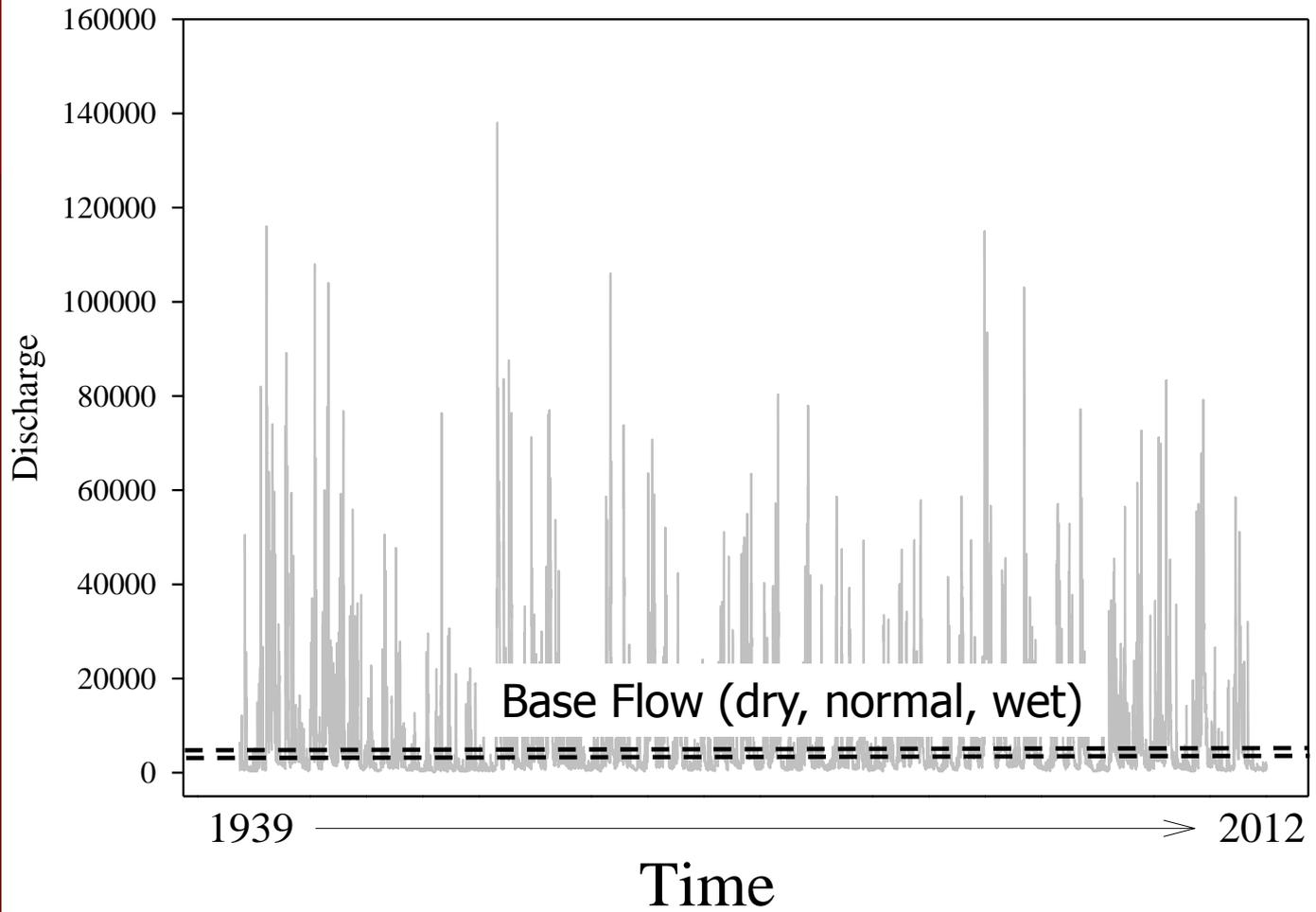


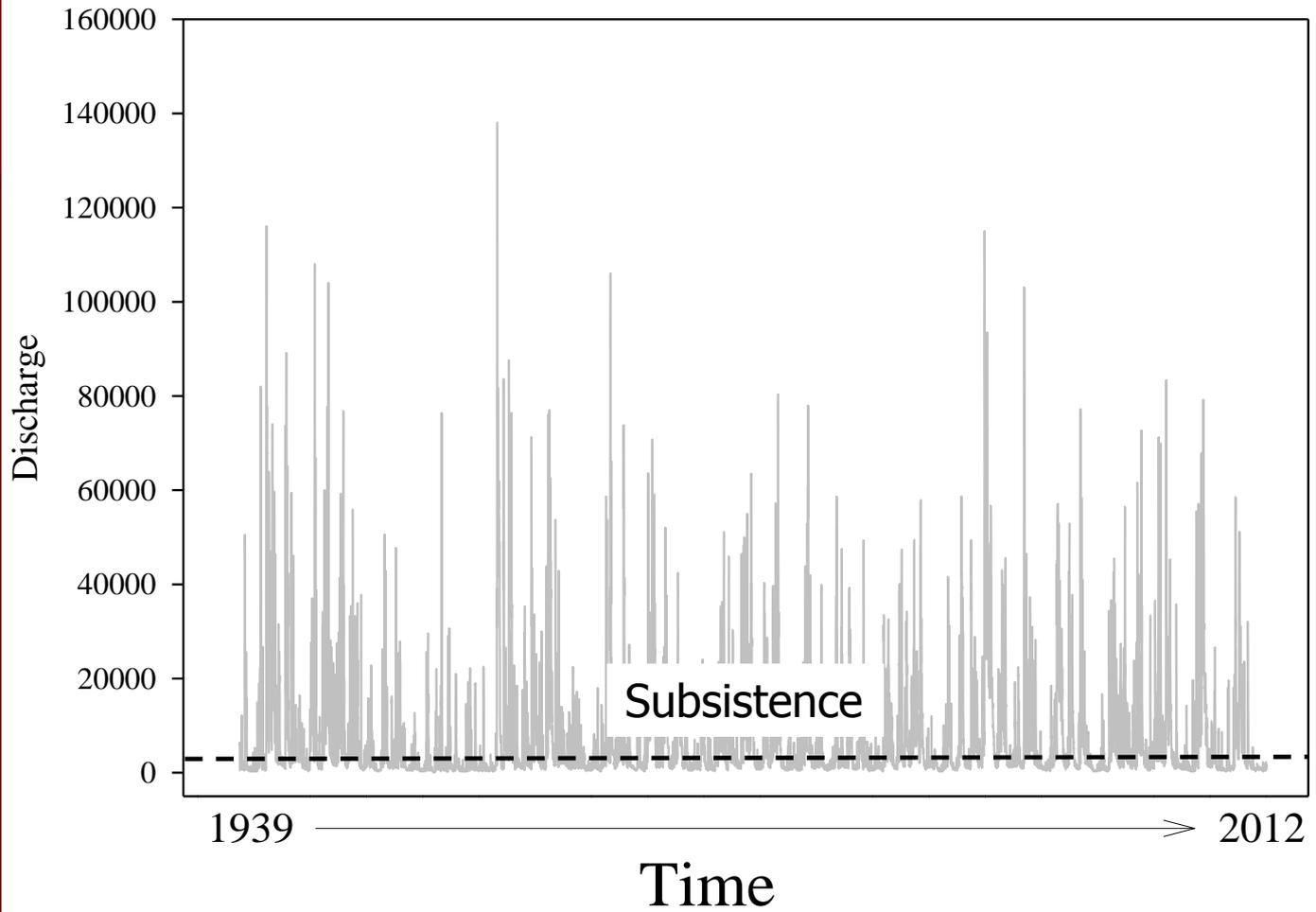












Overbank Events	Qp: 63,900 cfs with Average Frequency 1 per 2 years Regressed Volume is 1,331,000 Duration Bound is 40											
High Flow Pulses	Qp: 50,000 cfs with Average Frequency 1 per year Regressed Volume is 952,000 Duration Bound is 35											
	Qp: 24,800 cfs with Average Frequency 1 per season Regressed Volume is 368,000 Duration Bound is 23				Qp: 34,200 cfs with Average Frequency 1 per season Regressed Volume is 589,000 Duration Bound is 29				Qp: 10,300 cfs with Average Frequency 1 per season Regressed Volume is 104,000 Duration Bound is 14			
	Qp: 11,200 cfs with Average Frequency 2 per season Regressed Volume is 125,000 Duration Bound is 15				Qp: 16,800 cfs with Average Frequency 2 per season Regressed Volume is 219,000 Duration Bound is 19				Qp: 5,090 cfs with Average Frequency 2 per season Regressed Volume is 40,900 Duration Bound is 9			
	Qp: 5,720 cfs with Average Frequency 3 per season Regressed Volume is 49,800 Duration Bound is 10				Qp: 8,530 cfs with Average Frequency 3 per season Regressed Volume is 85,000 Duration Bound is 13				Qp: 2,620 cfs with Average Frequency 3 per season Regressed Volume is 17,000 Duration Bound is 7			
Base Flows (cfs)	2,890				3,440				2,050			
	1,440				1,900				1,330			
	920				1,130				950			
Subsistence Flows (cfs)	510				510				510			
	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct
	Winter				Spring				Summer			

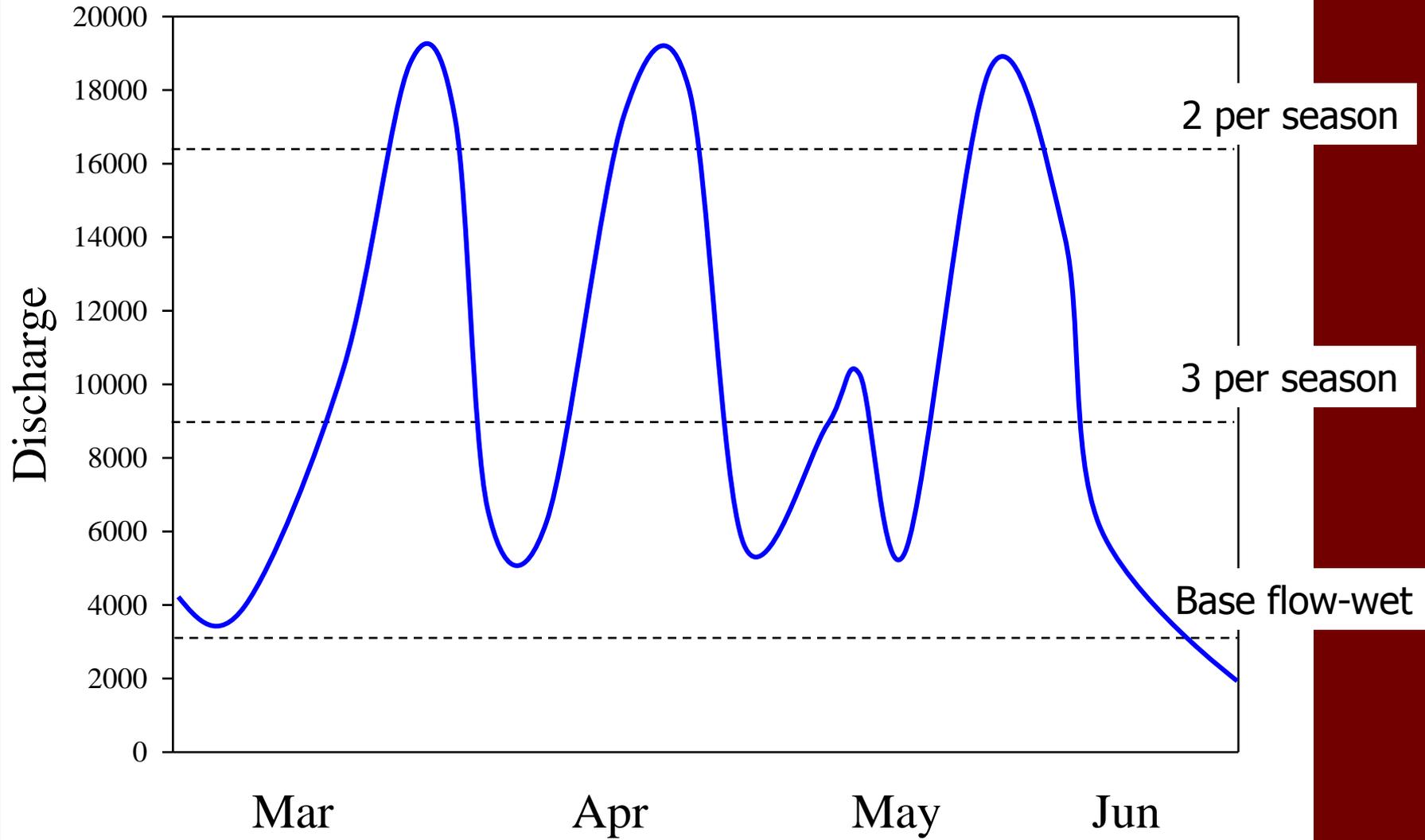
Base Flow Levels	High (75th %ile)
	Medium (50th %ile)
	Low (25th %ile)

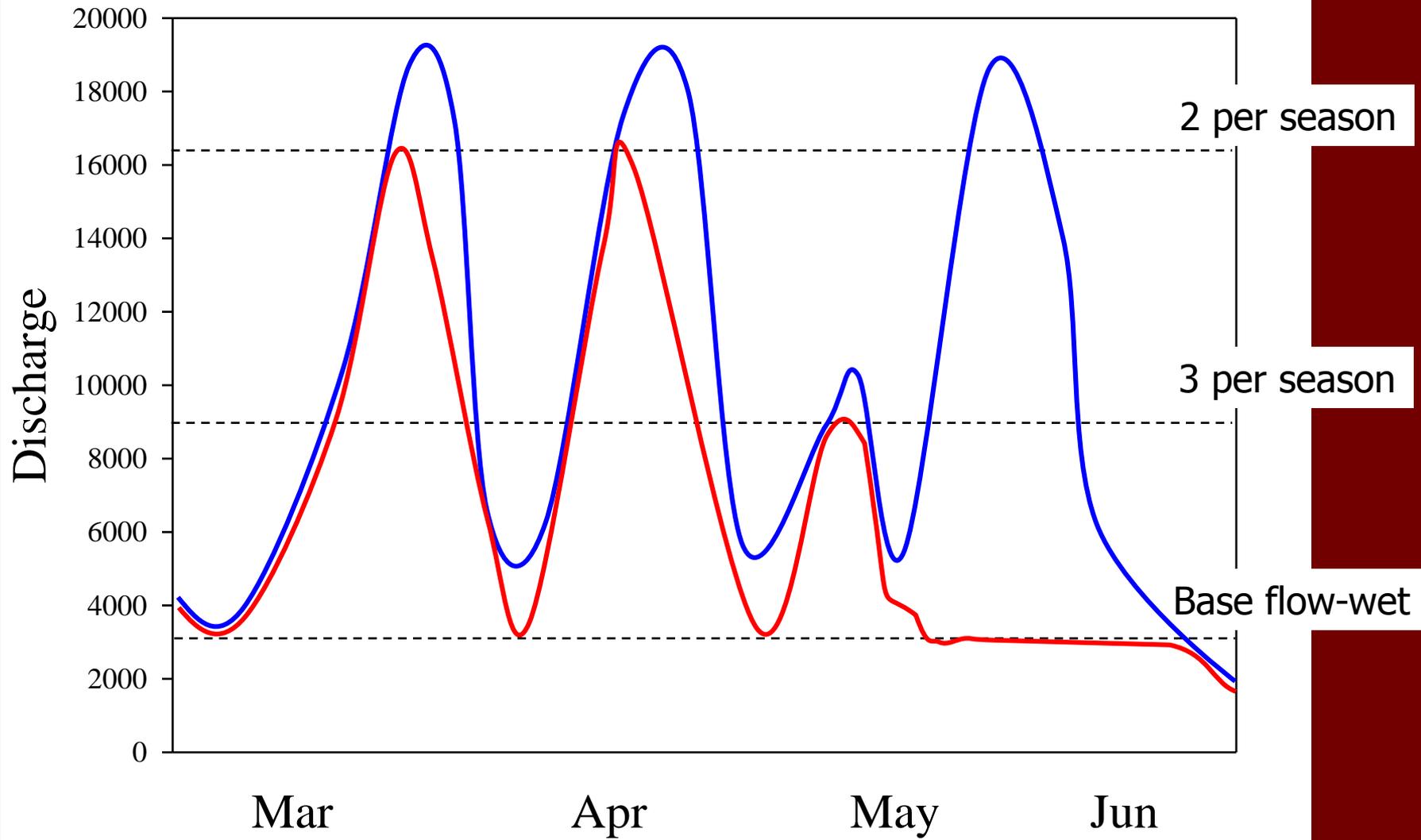
Pulse volumes are in units of acre-feet and durations are in days.

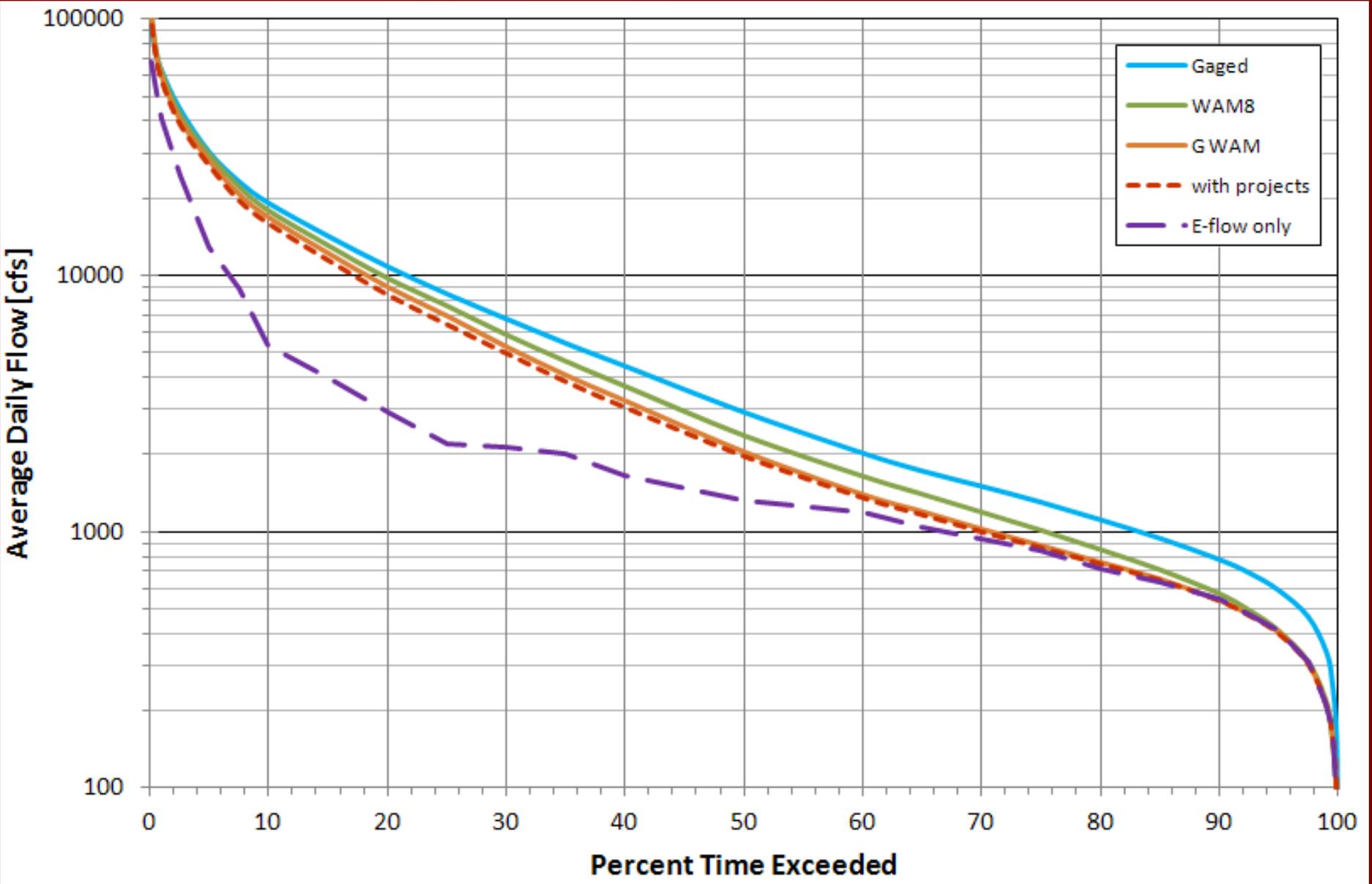
Period of record used : 1/1/1939 to 12/31/2010.

Episodic events are terminated when the volume or duration criteria are met, or when the flow drops below 1200 cfs, or when the flow is below 7680 cfs and the flow drops from one day to the next by less than 5%.

BRHempstead19392010



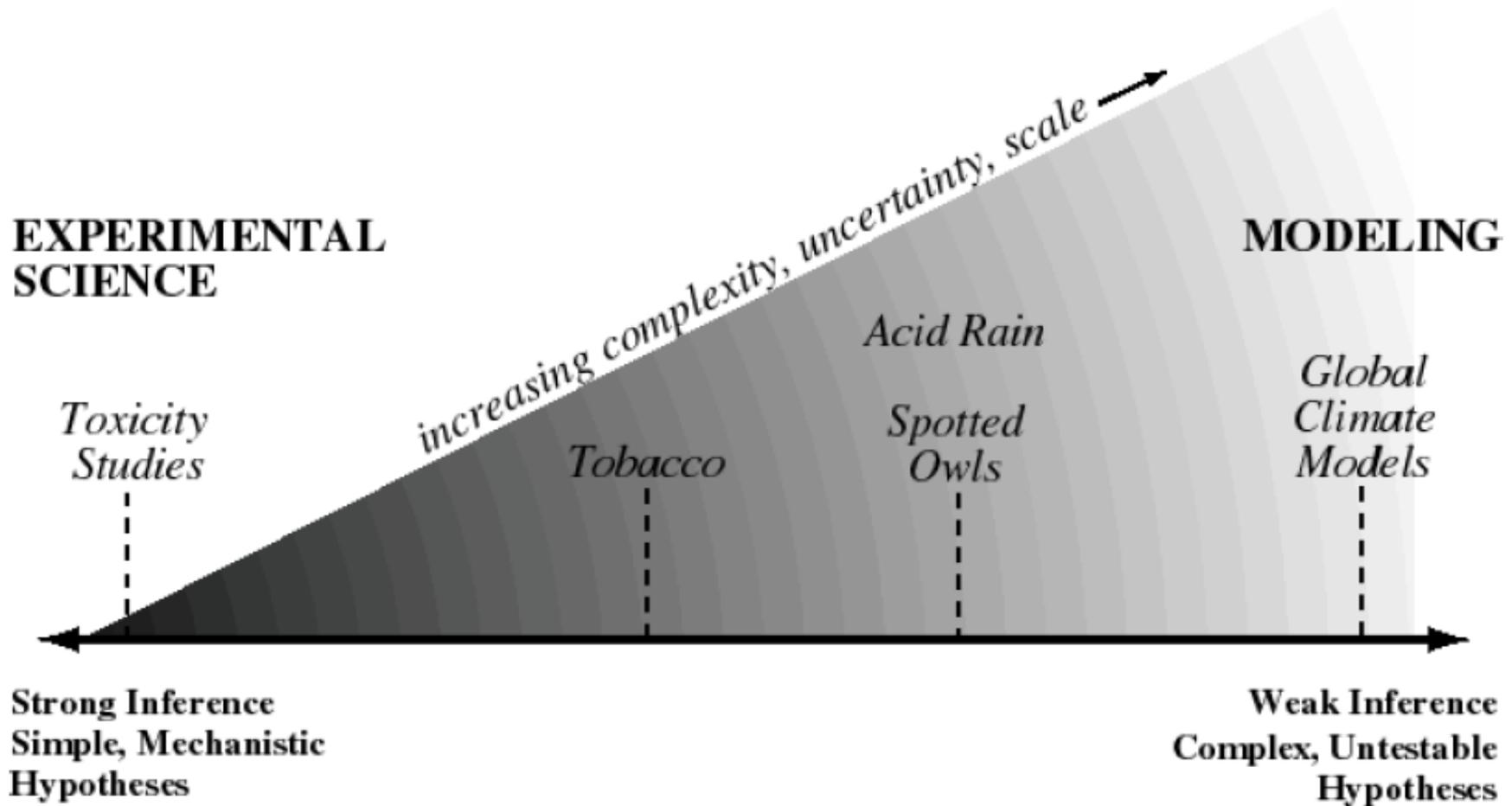




Flow Recommendations Completed our task?

- Simply hypotheses (predictions):
 - Recommended HFP, base flows, subsistence, seasonality will maintain a sound ecological environment .

Hypotheses are not equal



Adaptive Management Plan

- Testing with replication to validate recommendations.

Flow Recommendations

- Sound Ecological Environments:
 - Persistent communities (fish, inverts/mussels, diatoms, riparian vegetation)
 - Death, Reproduction, Movement
 - Growth, Health, Habitat , Food/Nutrients
 - Physical and chemical (sediment transport, water quality)

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