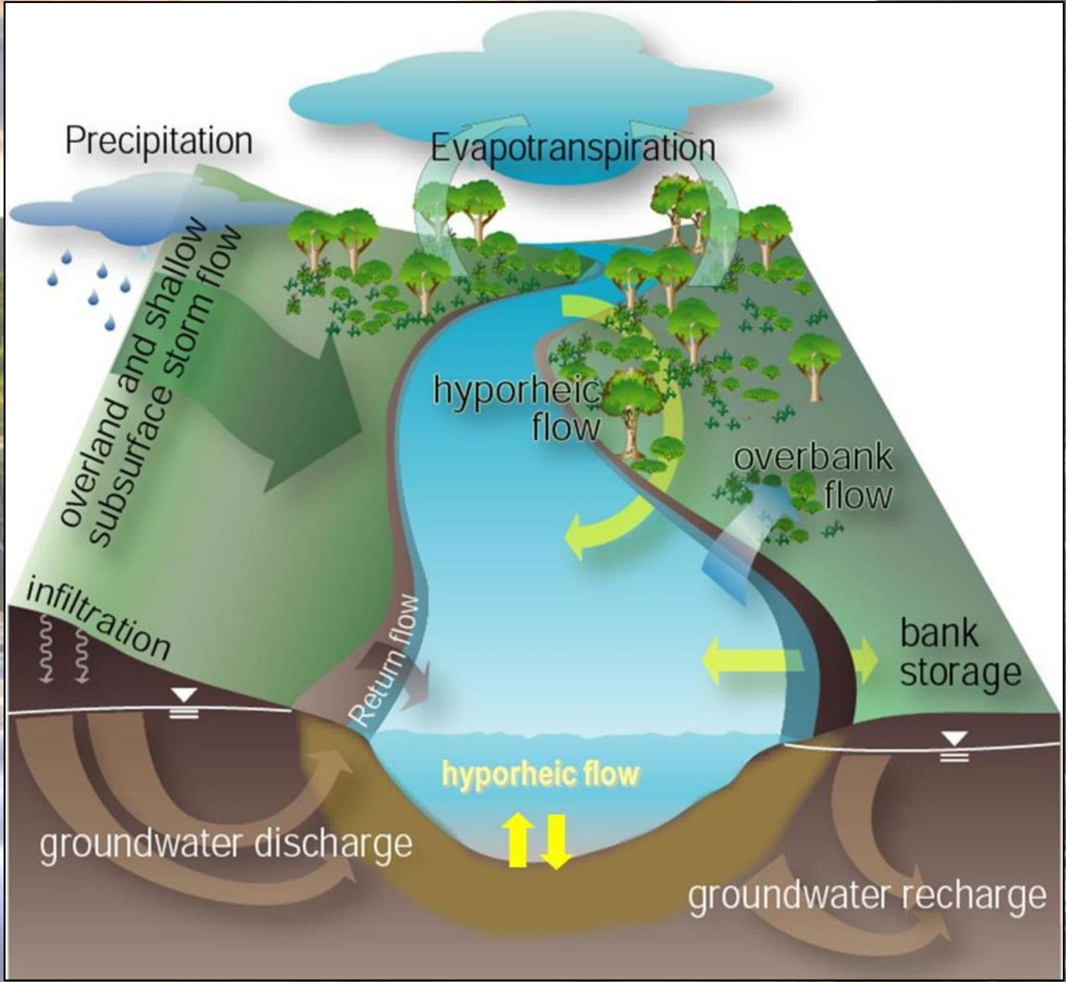
Stream Concavity as a Predictor of River Corridor Exchange

Hunter Stanke

Ecosystem Informatics Summer Institute

River Corridor Concept

- **Rivers flow**



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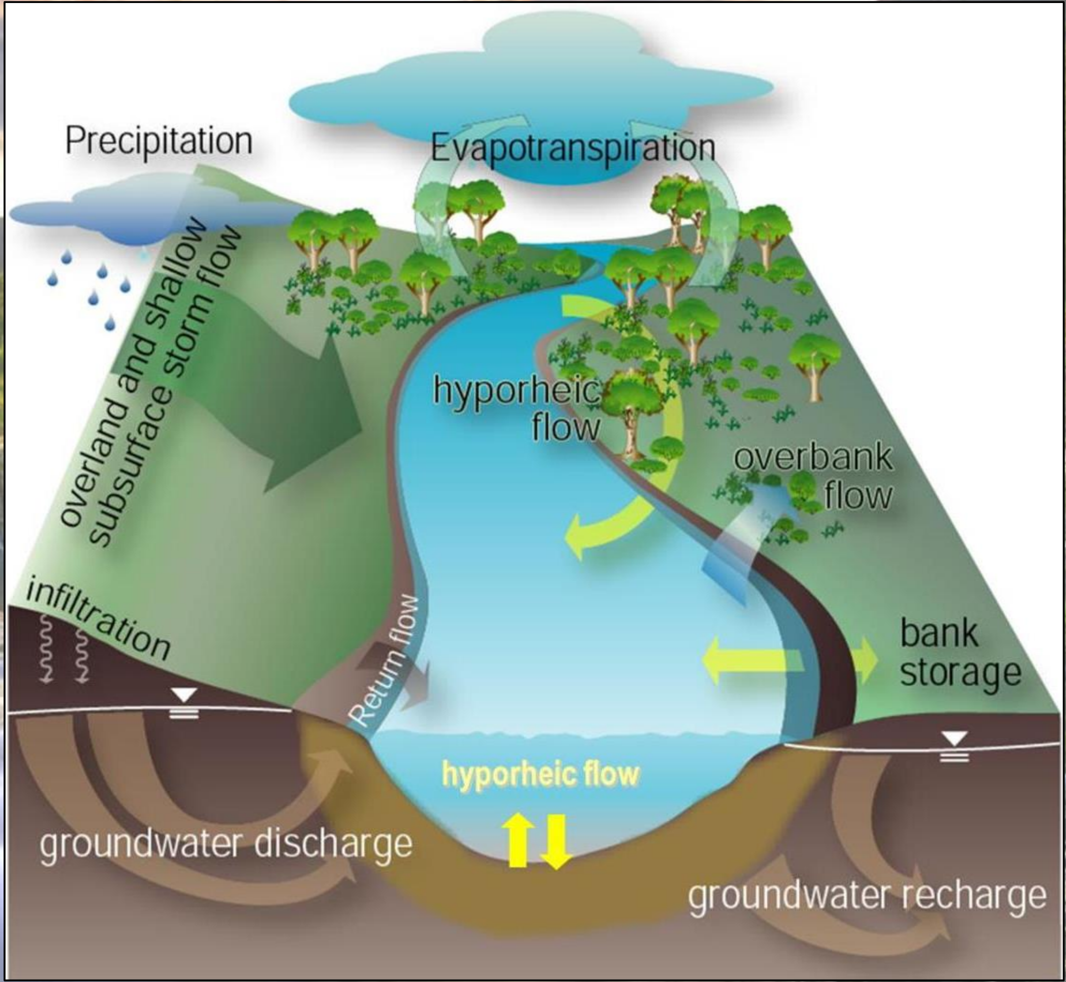

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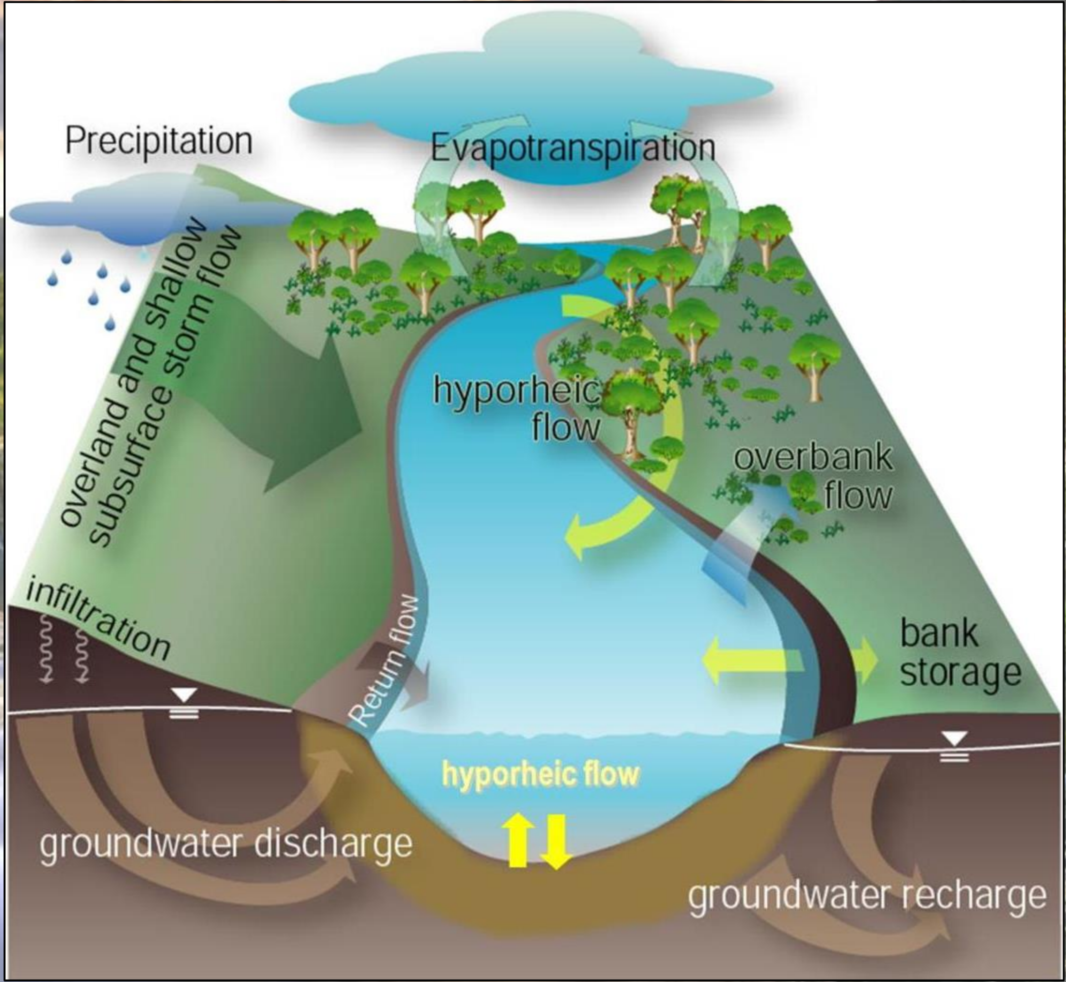

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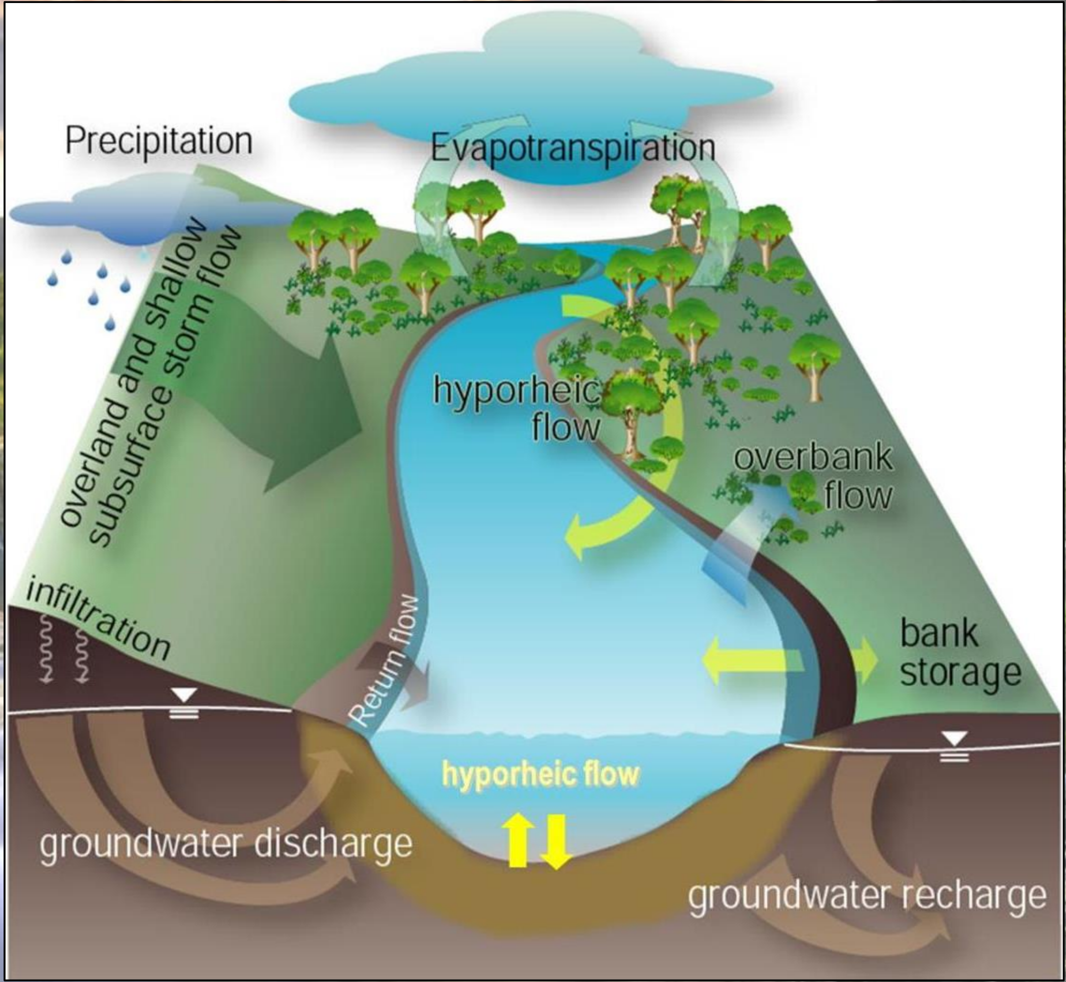
- ❖ **Exchange water and solutes with the landscape**
- ❖ **Exchange results in *TRANSIENT STORAGE***
- ❖ **Provides ecosystem services**



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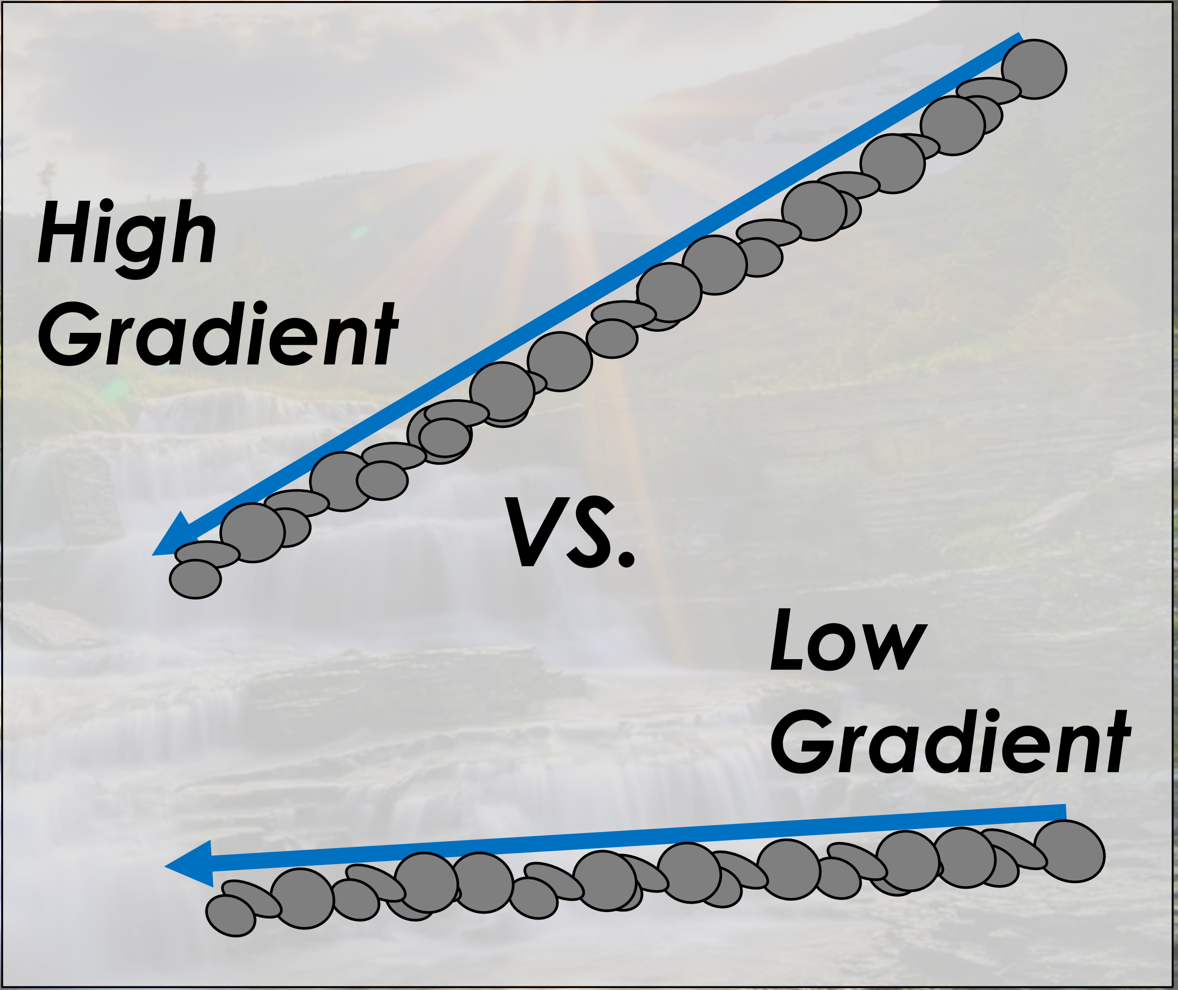

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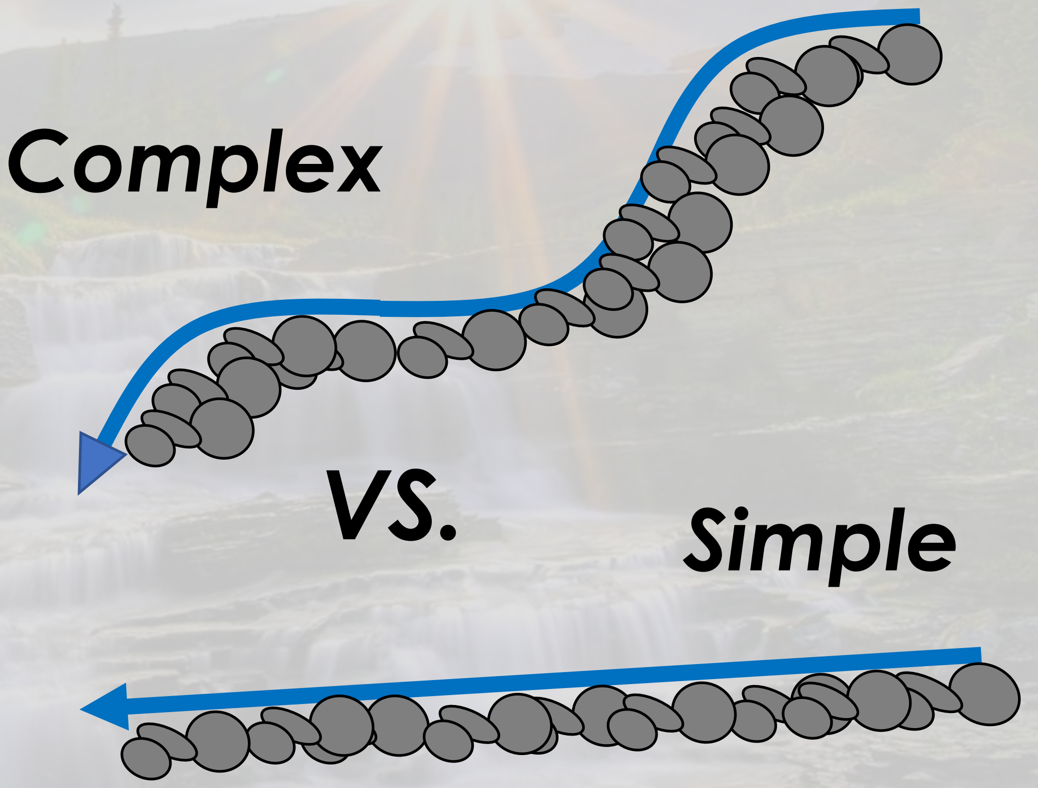

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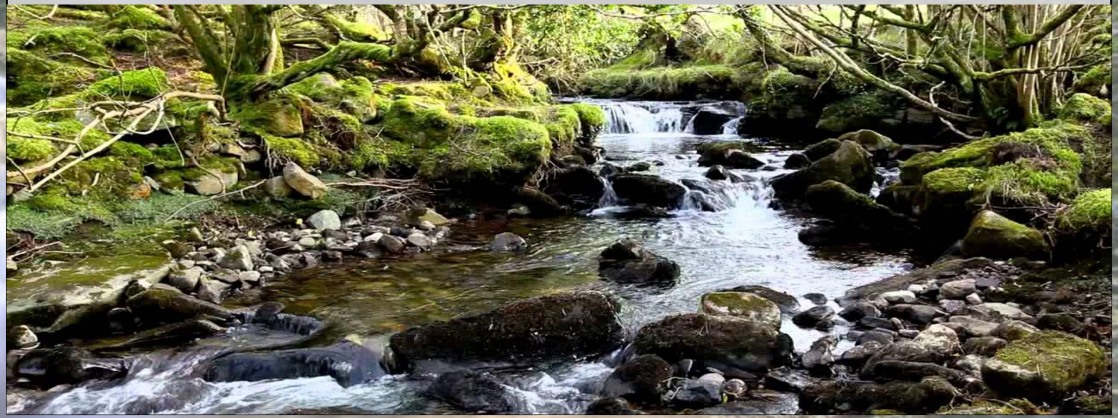

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- Decades of research, no predictive capacity
- Studies report contrasting results
- Likely related to physical environment and hydrologic forcing
- Need for predictive framework

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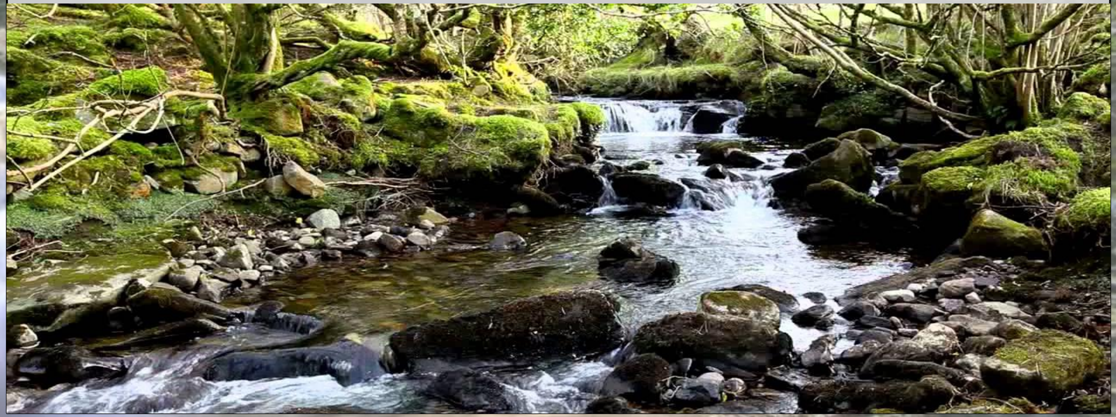
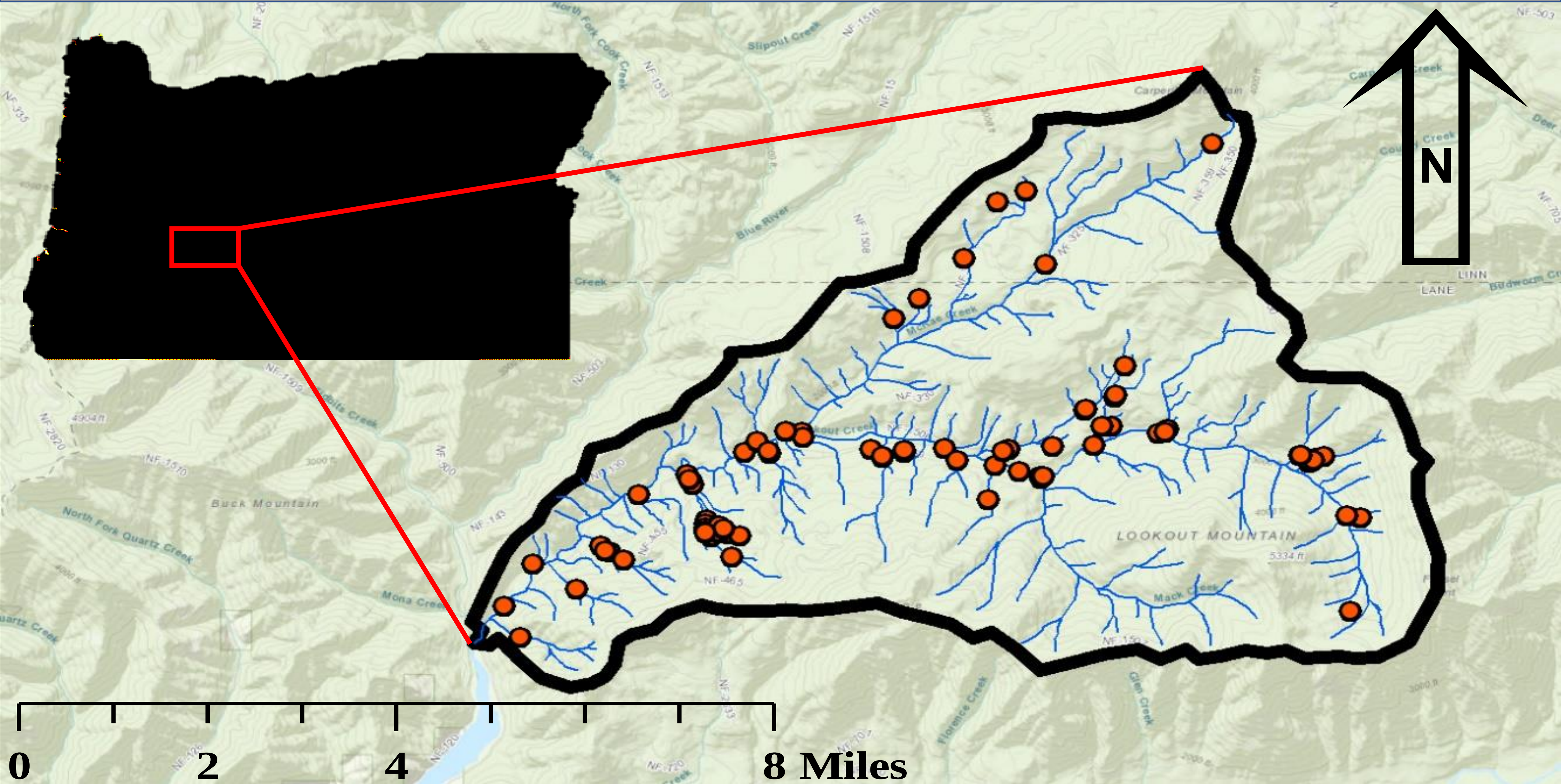


Objectives

1) Assemble comprehensive dataset assessing exchange across gradient of geomorphic and hydrologic conditions

Lookout Creek Drainage Network -- HJA Experimental Forest



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2) ***Predict response of river corridor exchange with respect to TOPOGRAPHIC, HYDROLOGIC, and CONCAVITY indices.***

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2) *Predict response of river corridor exchange with respect to TOPOGRAPHIC, HYDROLOGIC, and CONCAVITY indices*

3) ***Compare performance of linear models and machine learning techniques in predicting exchange response***

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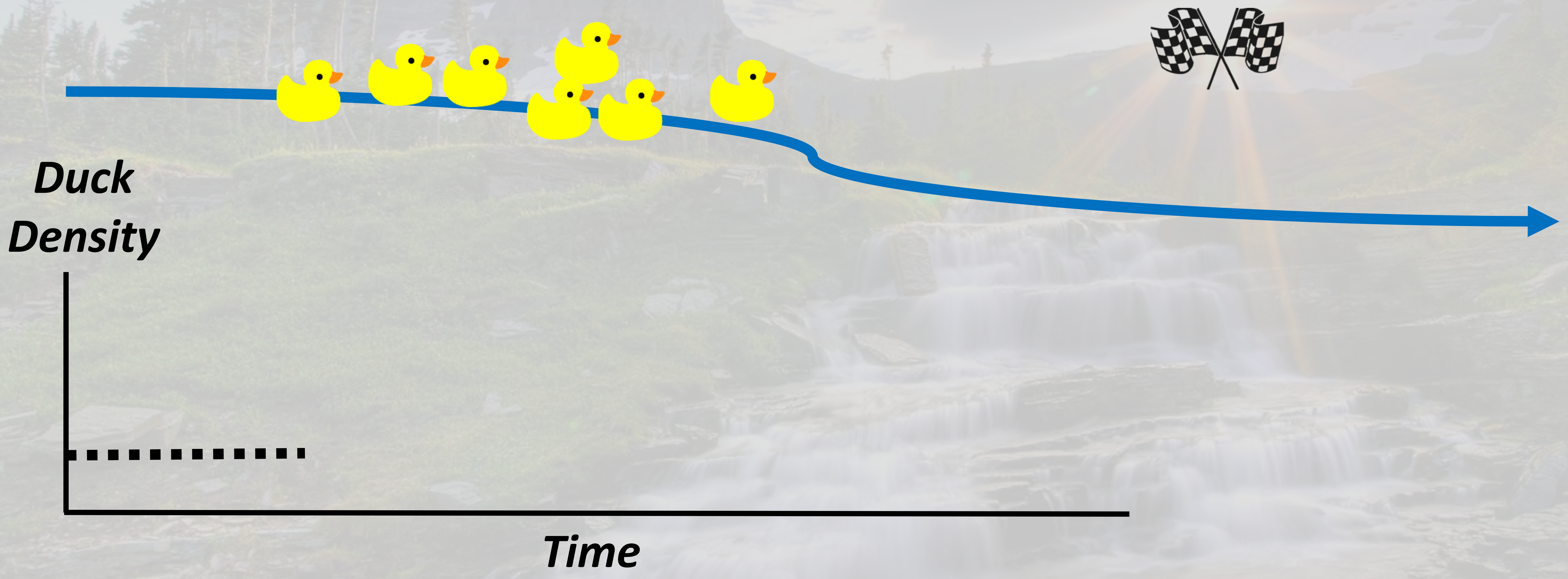

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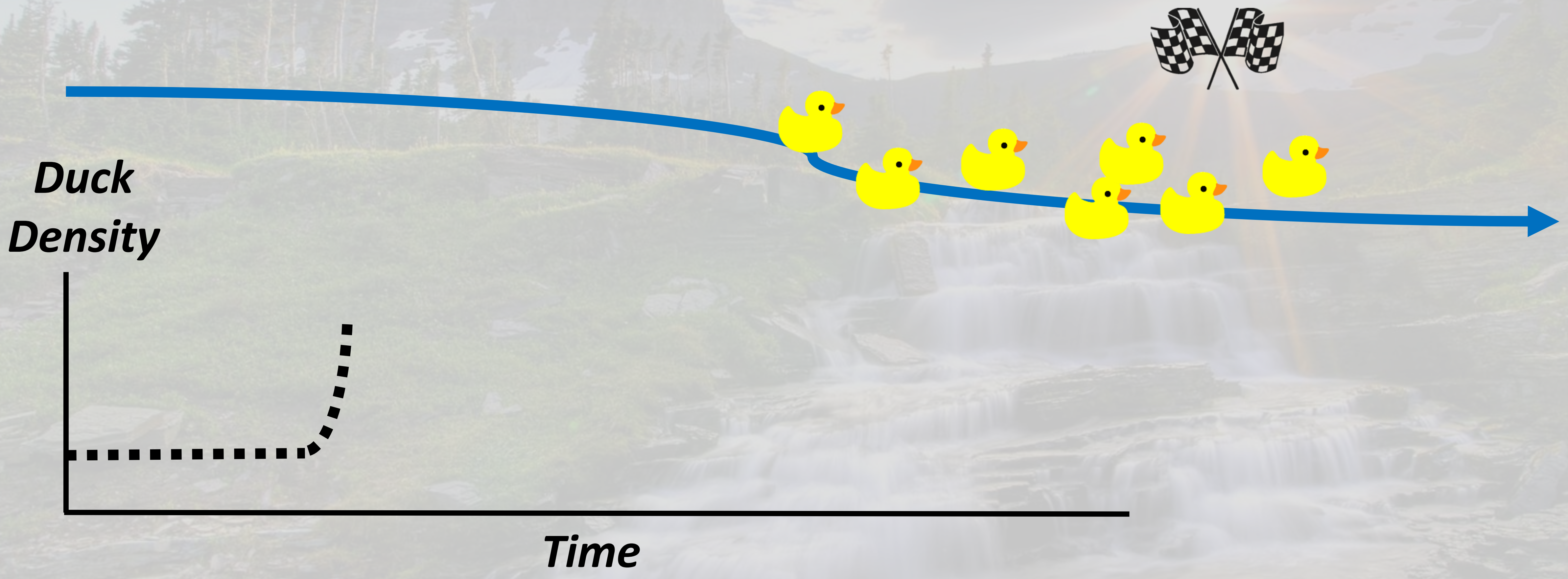

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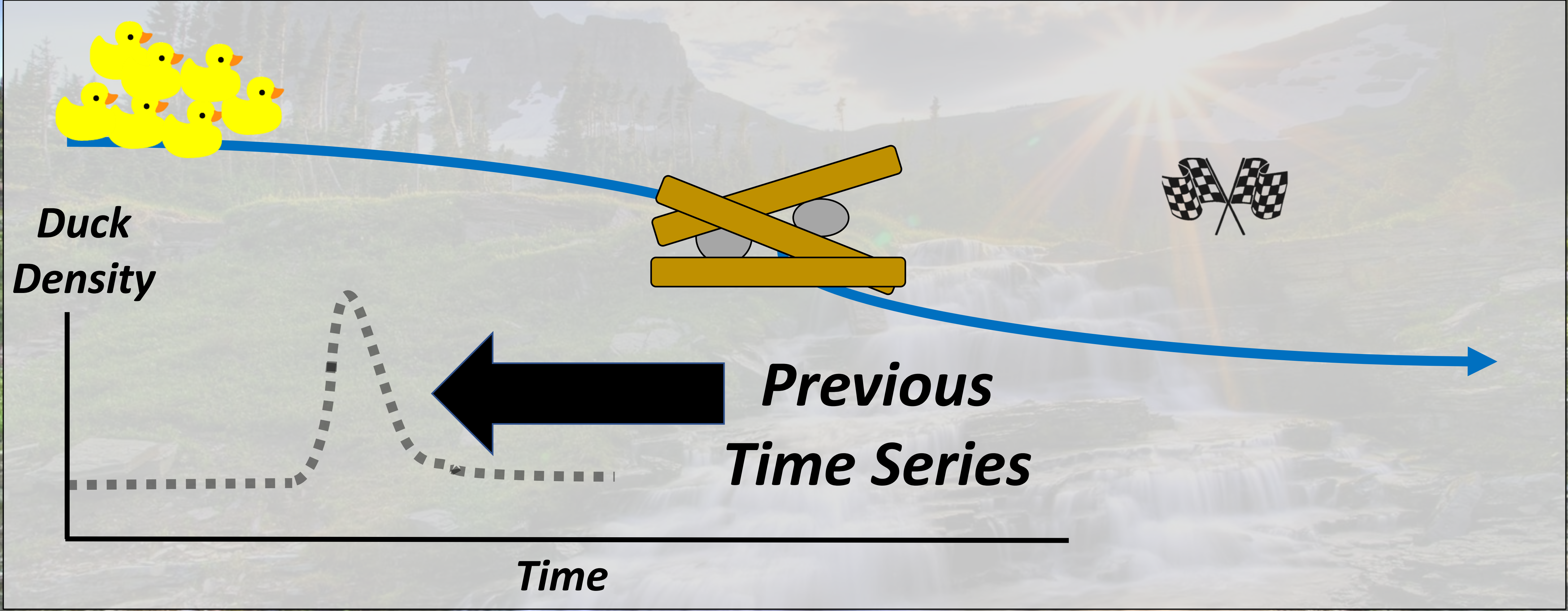

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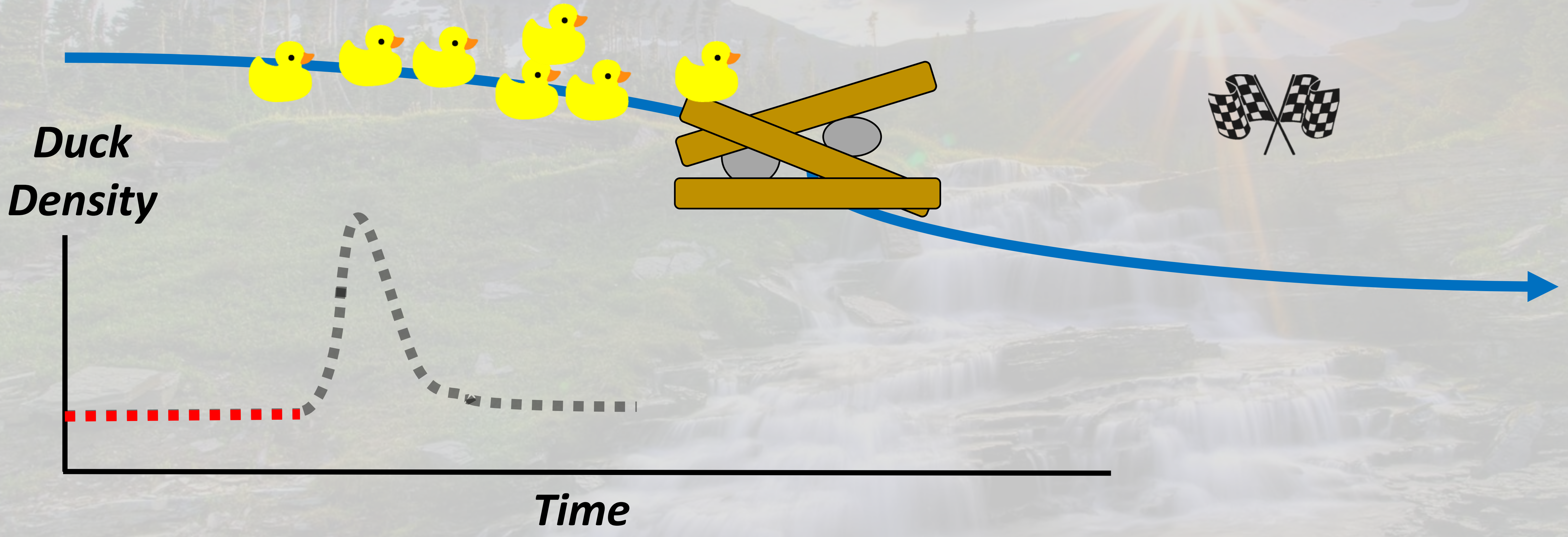

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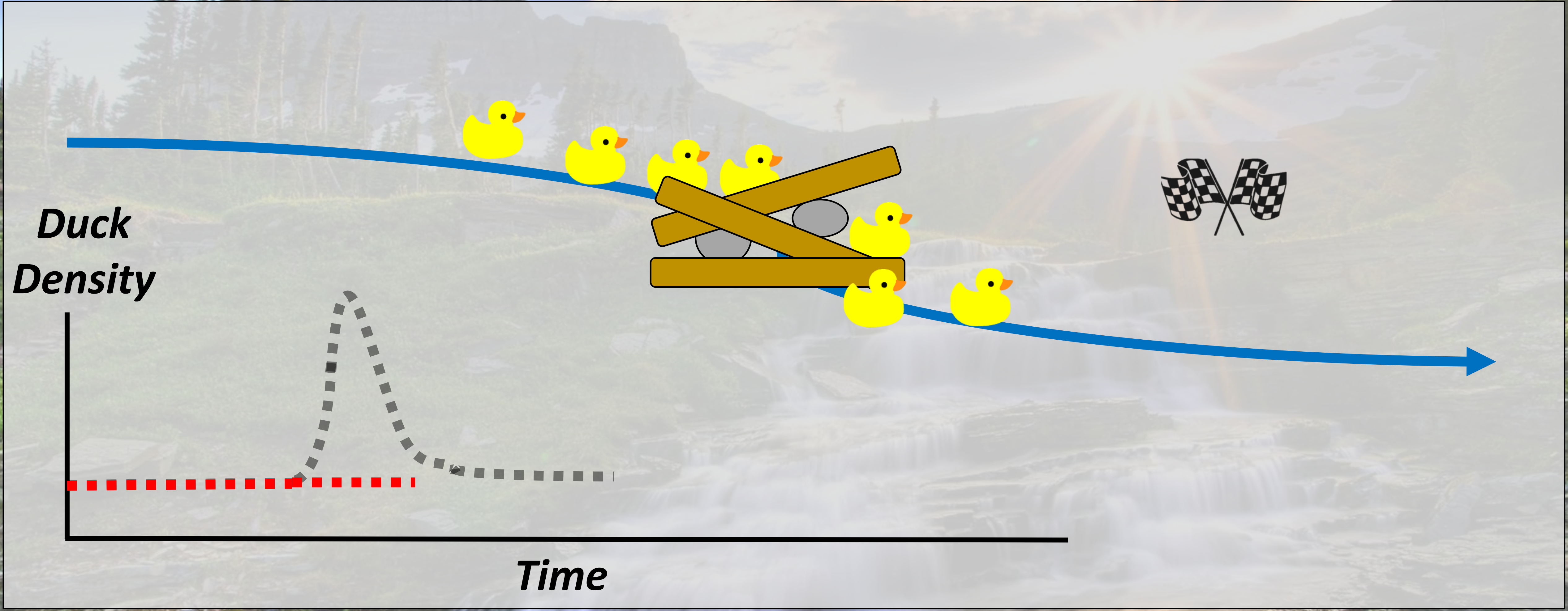

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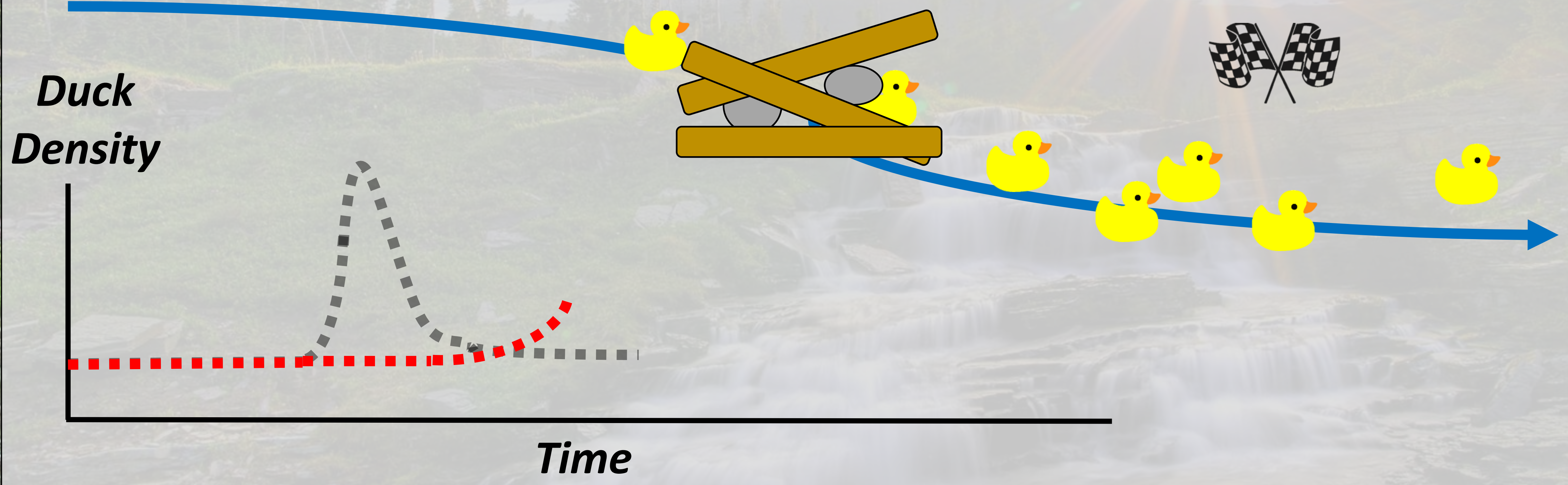

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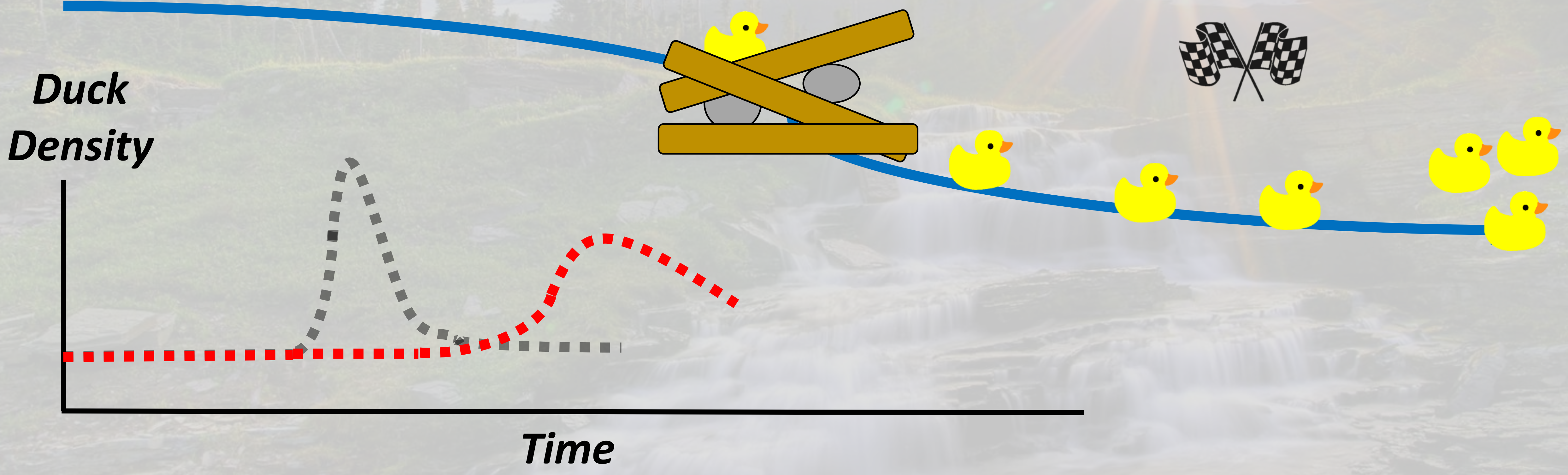

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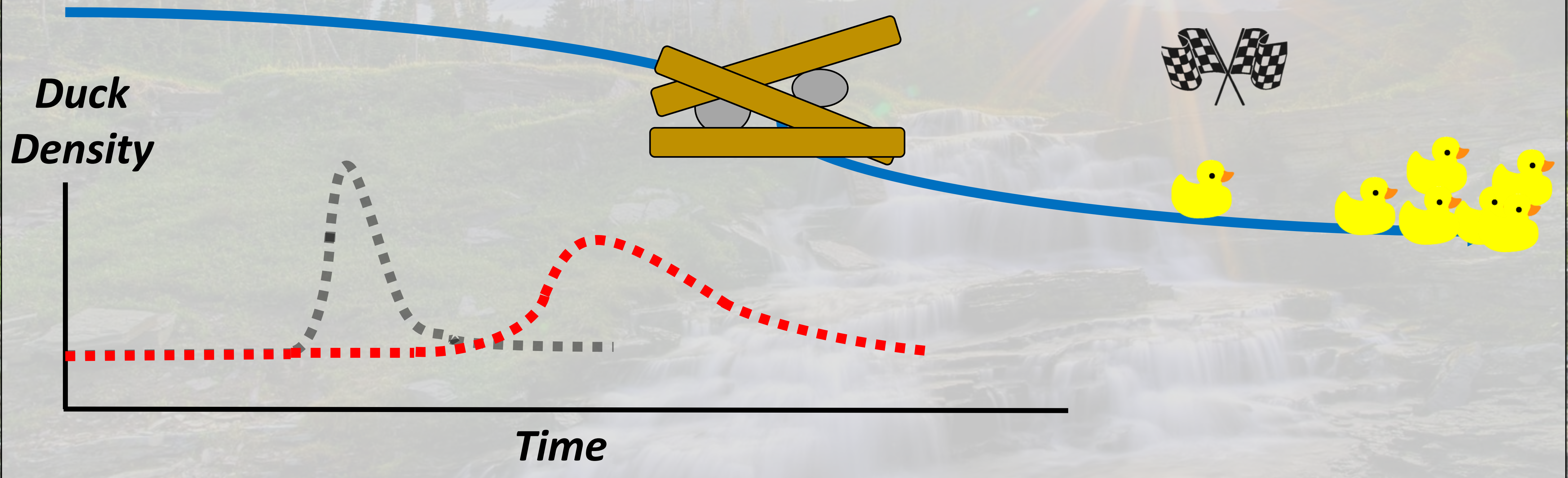

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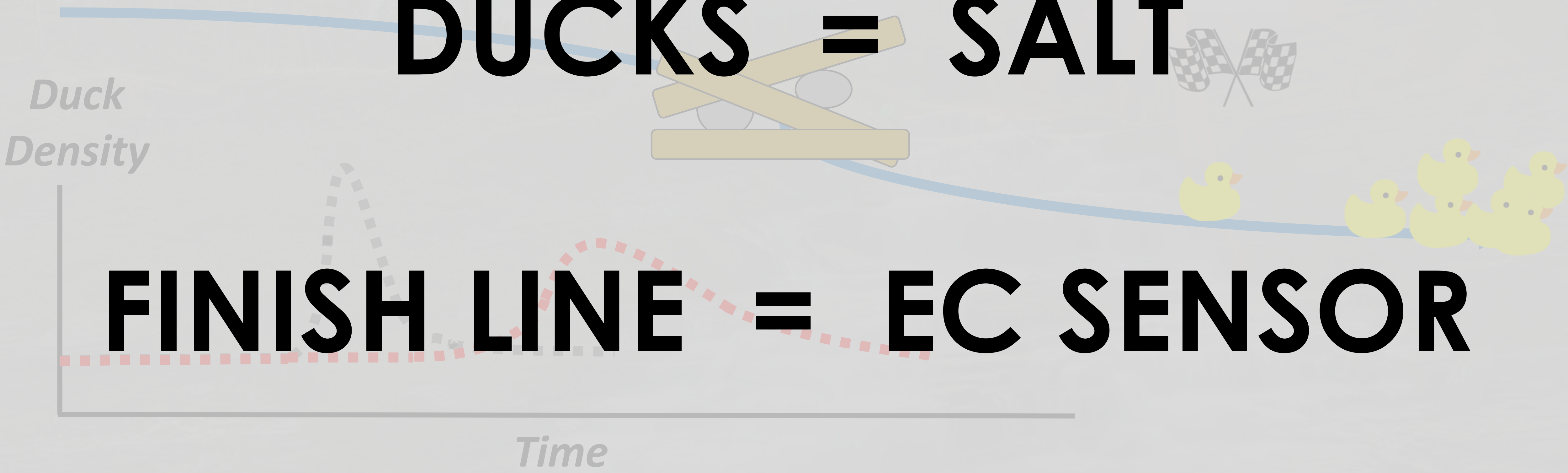
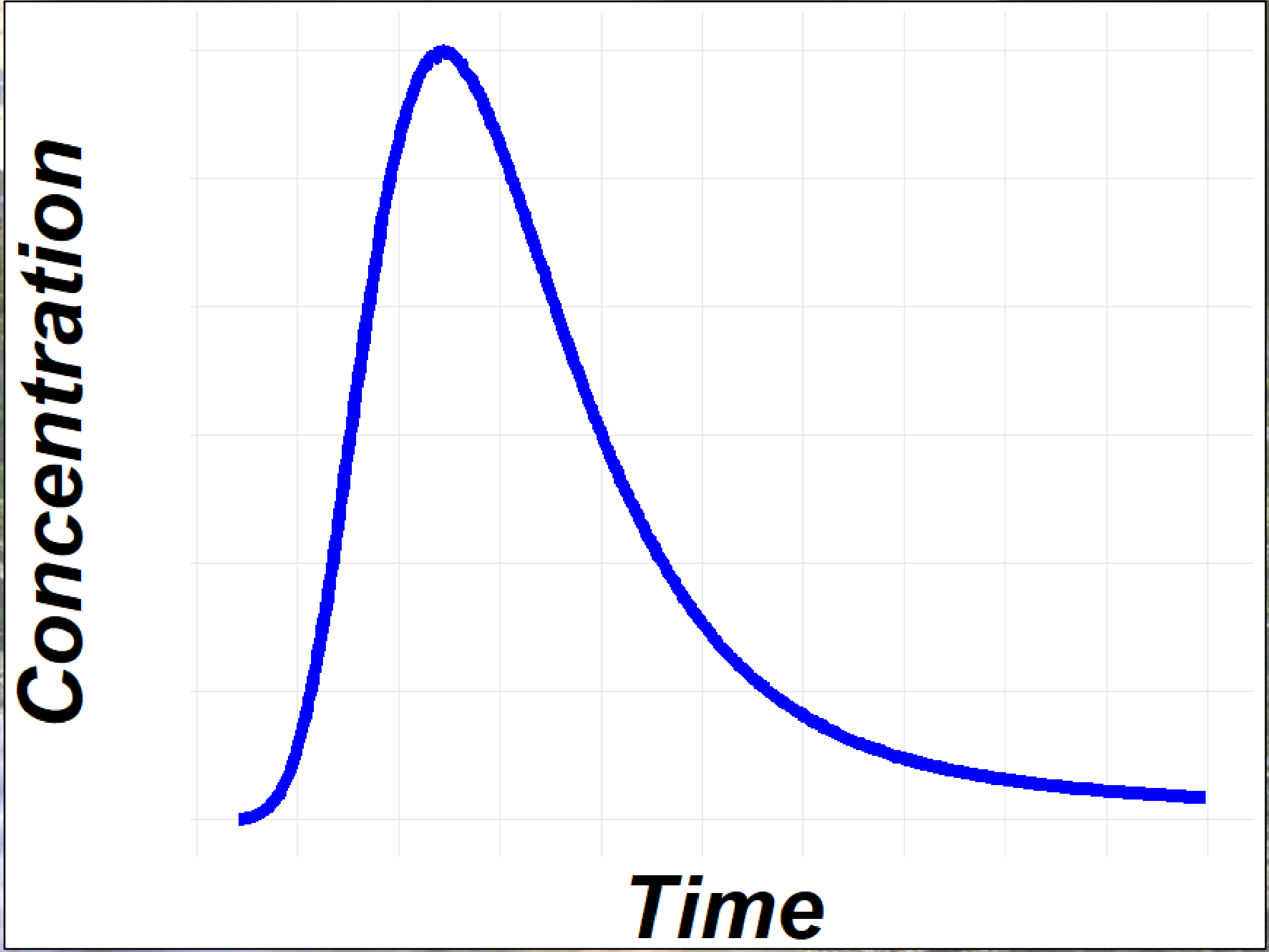


DUCKS = SALT

FINISH LINE = EC SENSOR

Exchange Response

- ❖ T99
- ❖ Skewness
- ❖ CV
- ❖ Holdback



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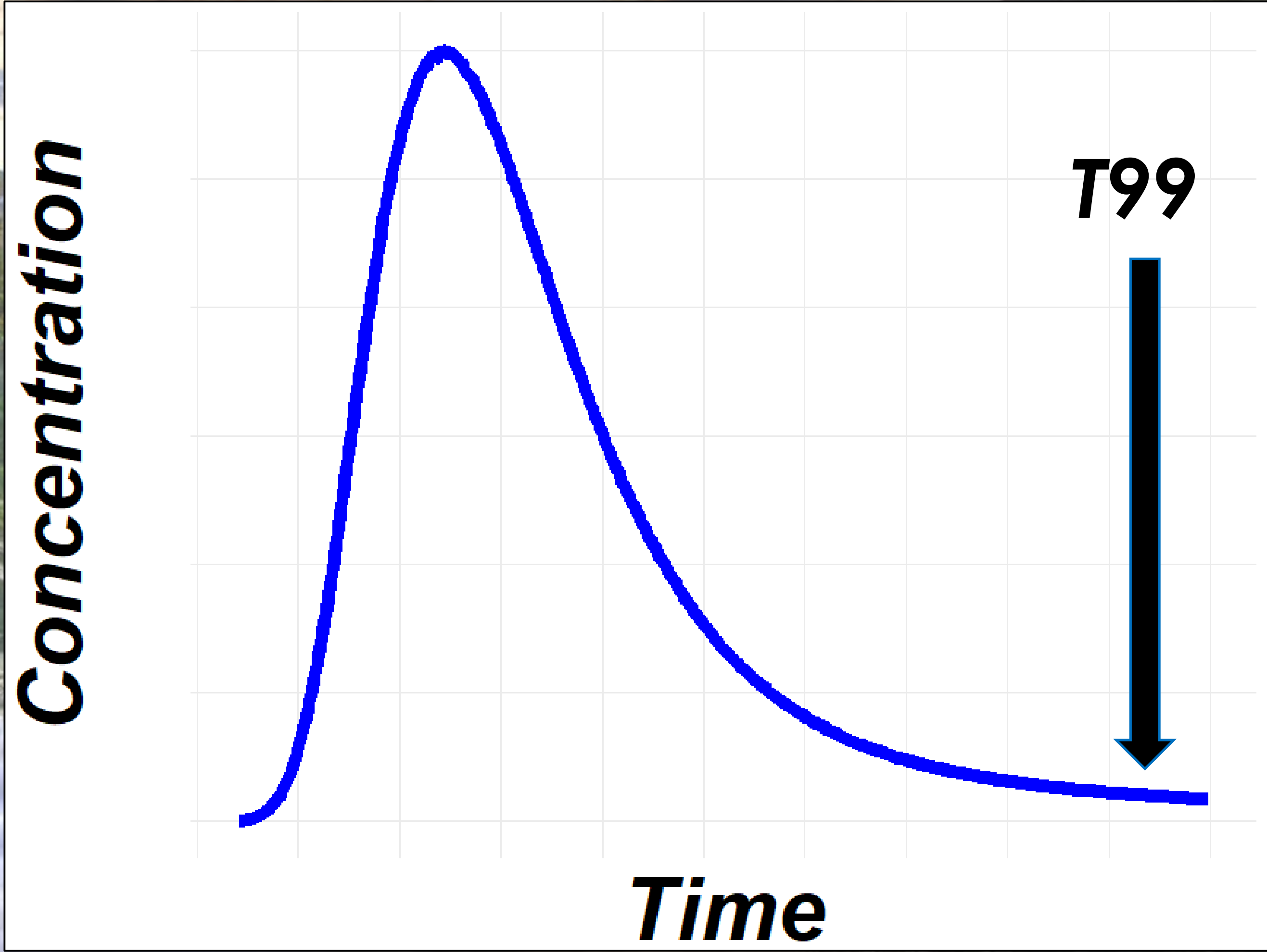

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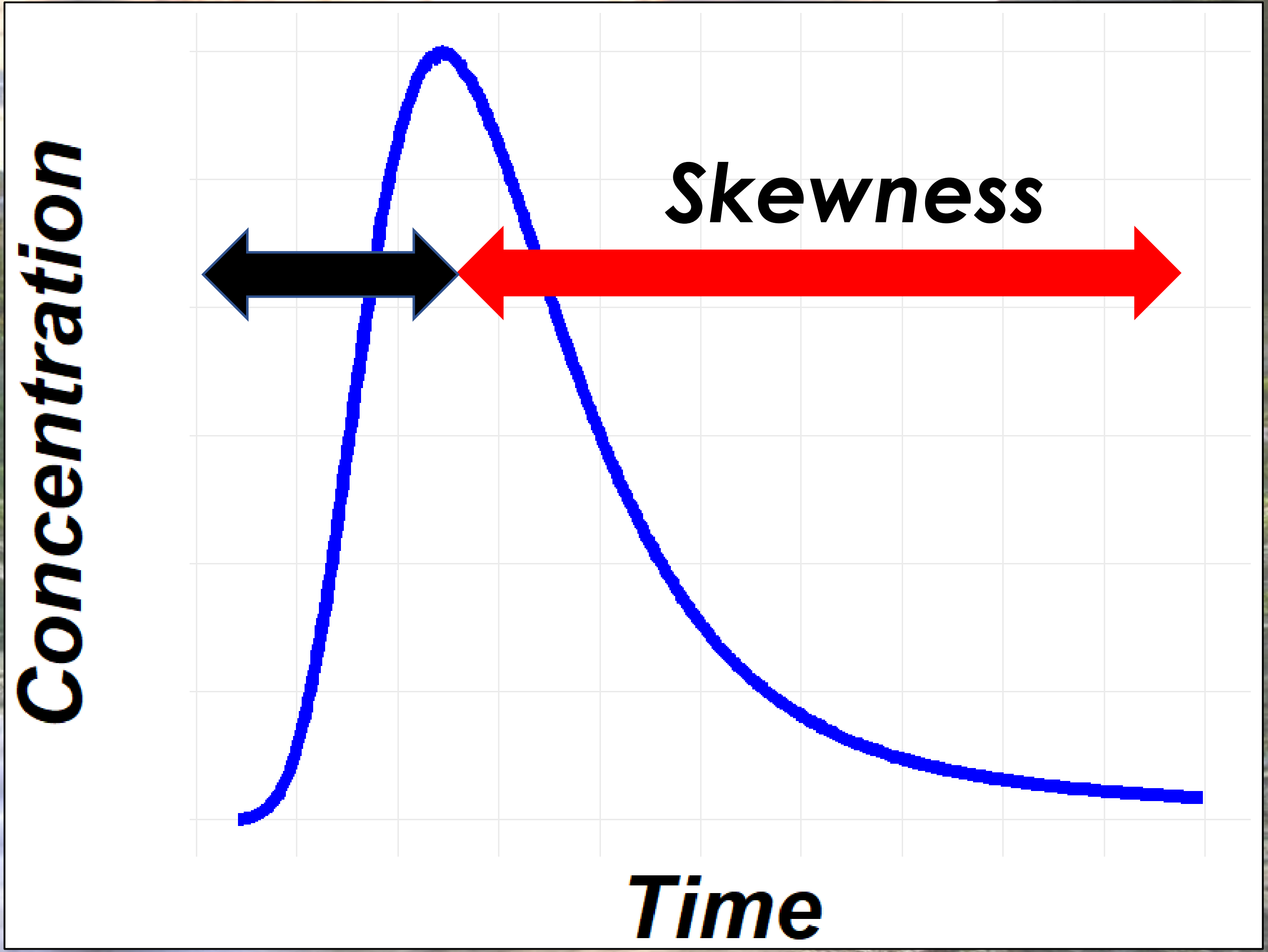

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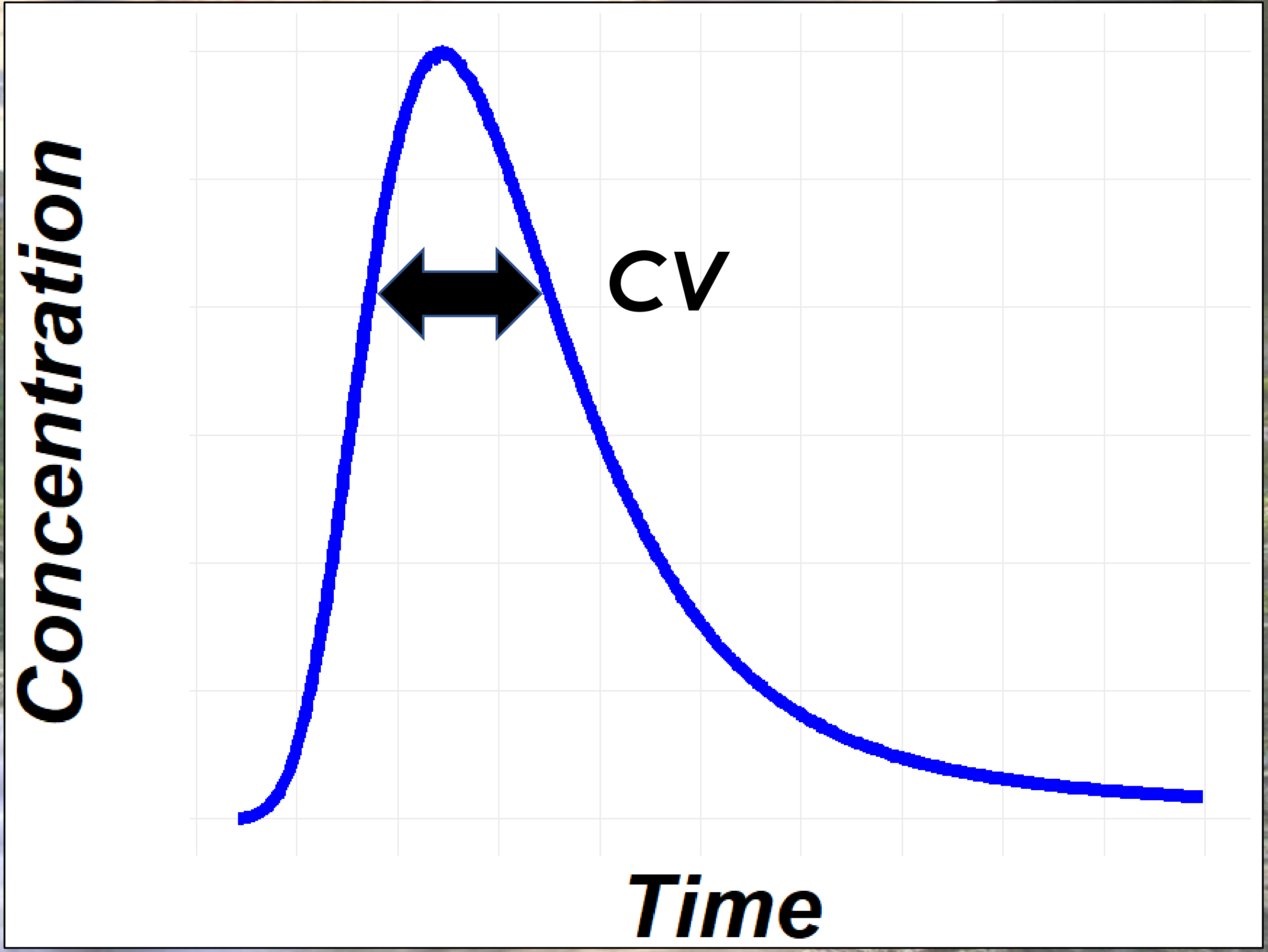

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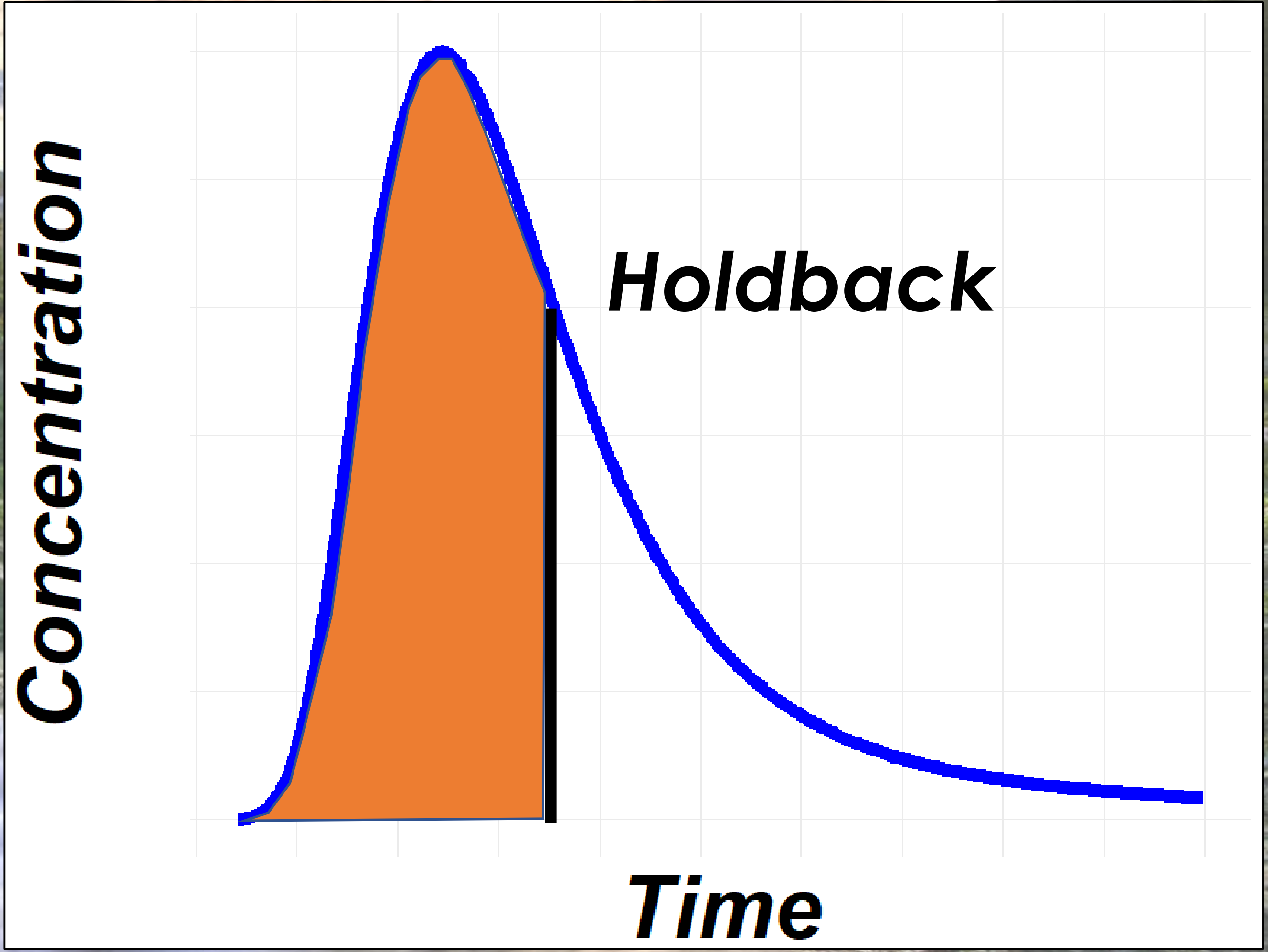

Topographic & Hydrologic Predictors

- Valley Slope
- Valley Width
- Sinuosity
- Discharge
- Velocity

Concavity Predictors

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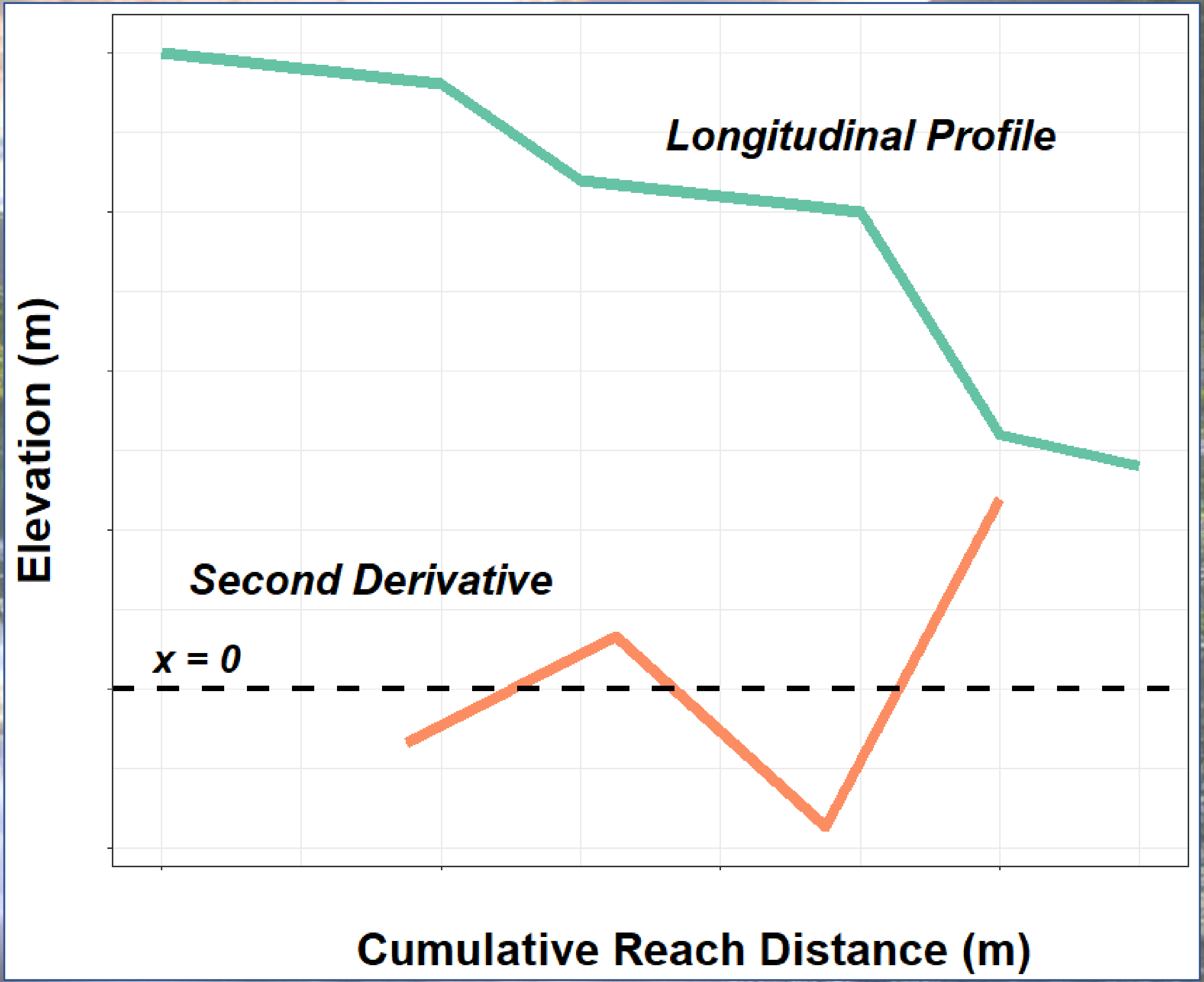
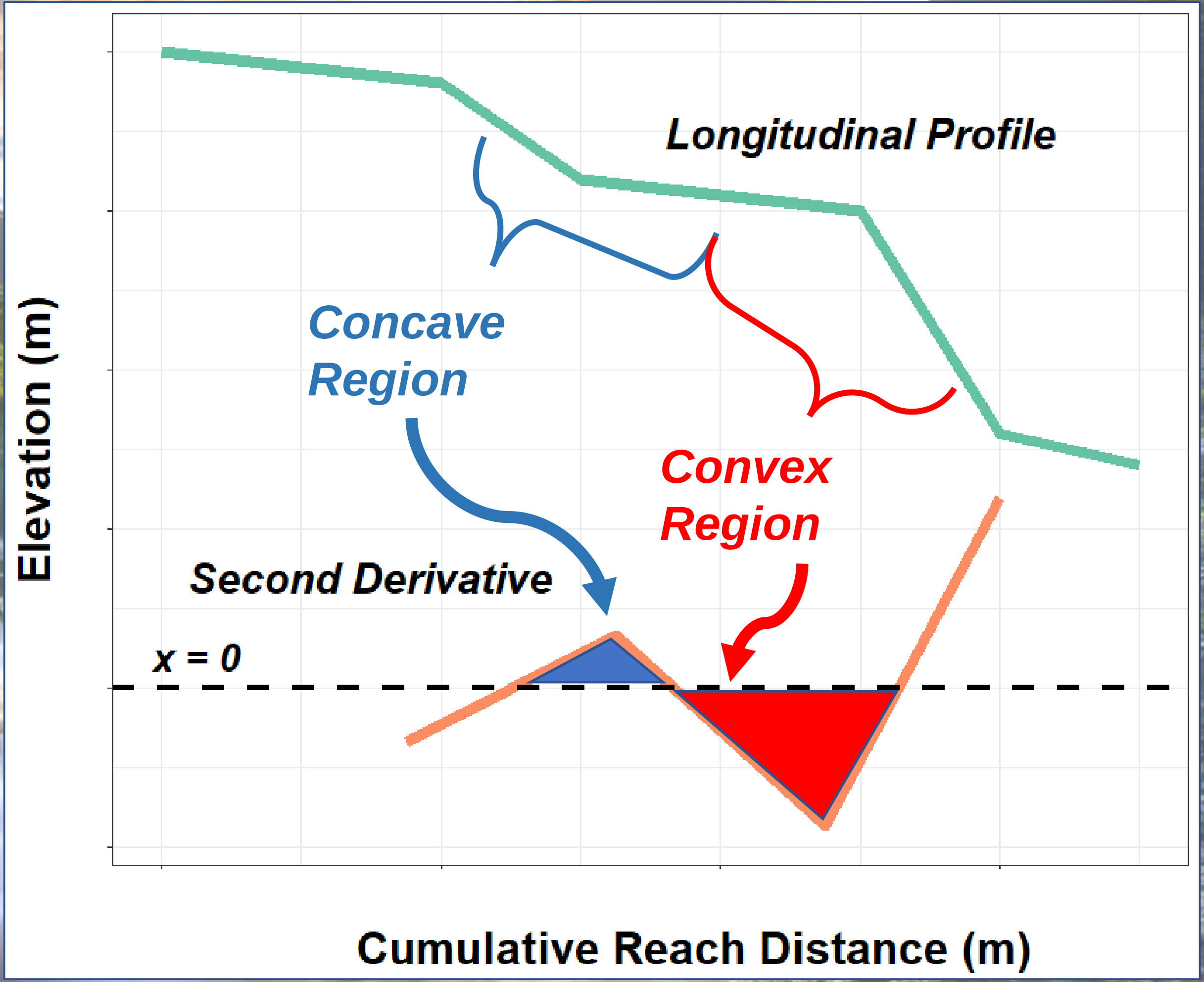


Concavity Predictors

- Essentially measures vertical 'curviness'
- Stream concavity induces hyporheic exchange
- Second derivative describes shape
- Sum +/- areas



Linear Modelling Results

- Simple analysis, assume no interaction among predictors
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- **Automated Model Selection**
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Model Formula	Adj. R^2
***T99* ~** *Discharge + Velocity + Concavity*	**0.32**
***Skewness* ~** *Valley Slope + Valley Width*	**0.08**
CV ~ *Discharge*	**0.05**
***Holdback* ~** *Valley Slope + Valley Width*	**0.06**

Linear Modelling Results

- Simple analysis, assume no interaction among predictors
- Automated Model Selection
- Poor results
- Best performance with T99

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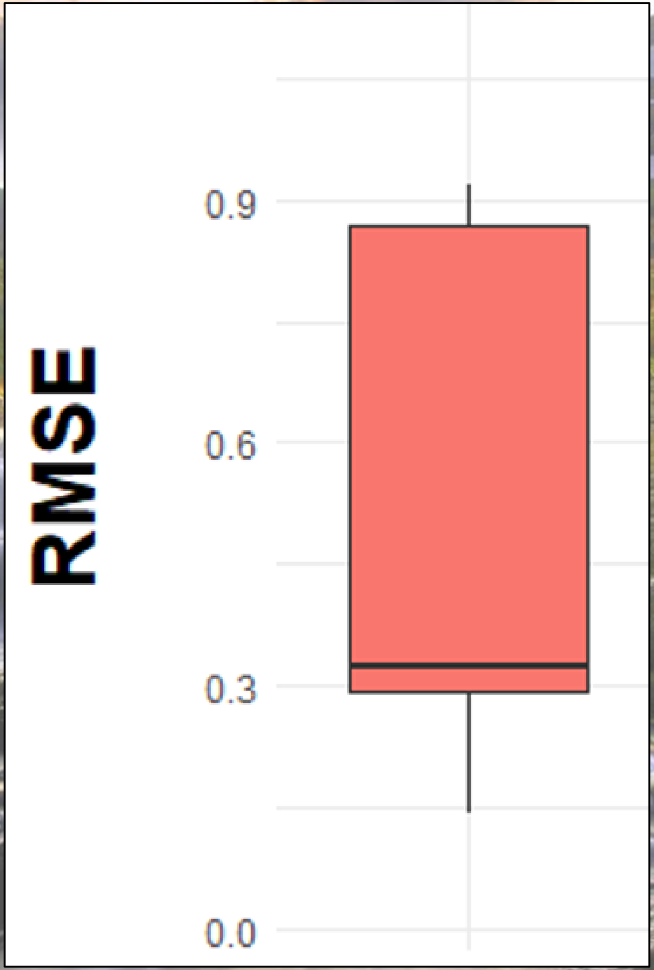

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- ❖ 5-fold cross validation
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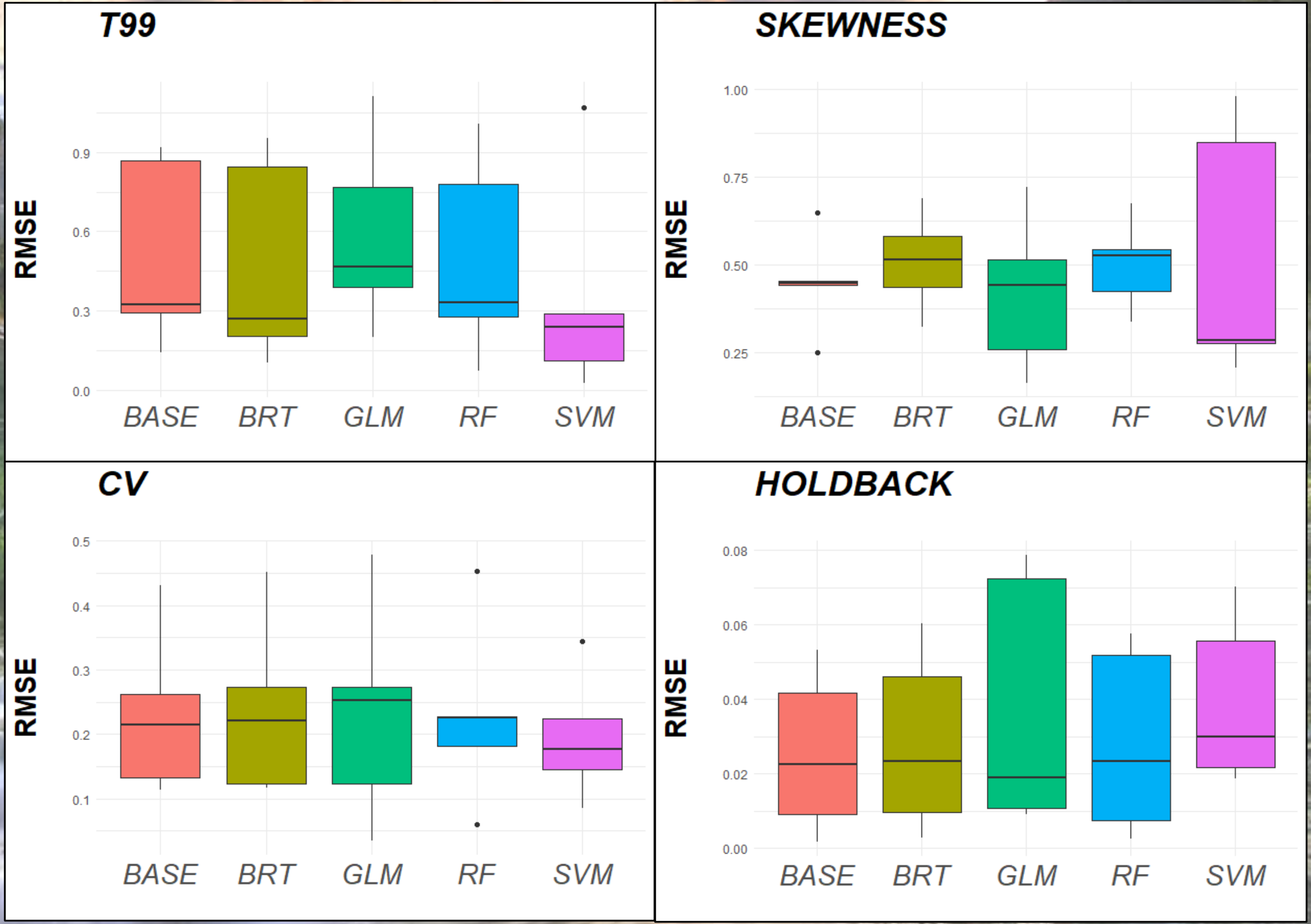
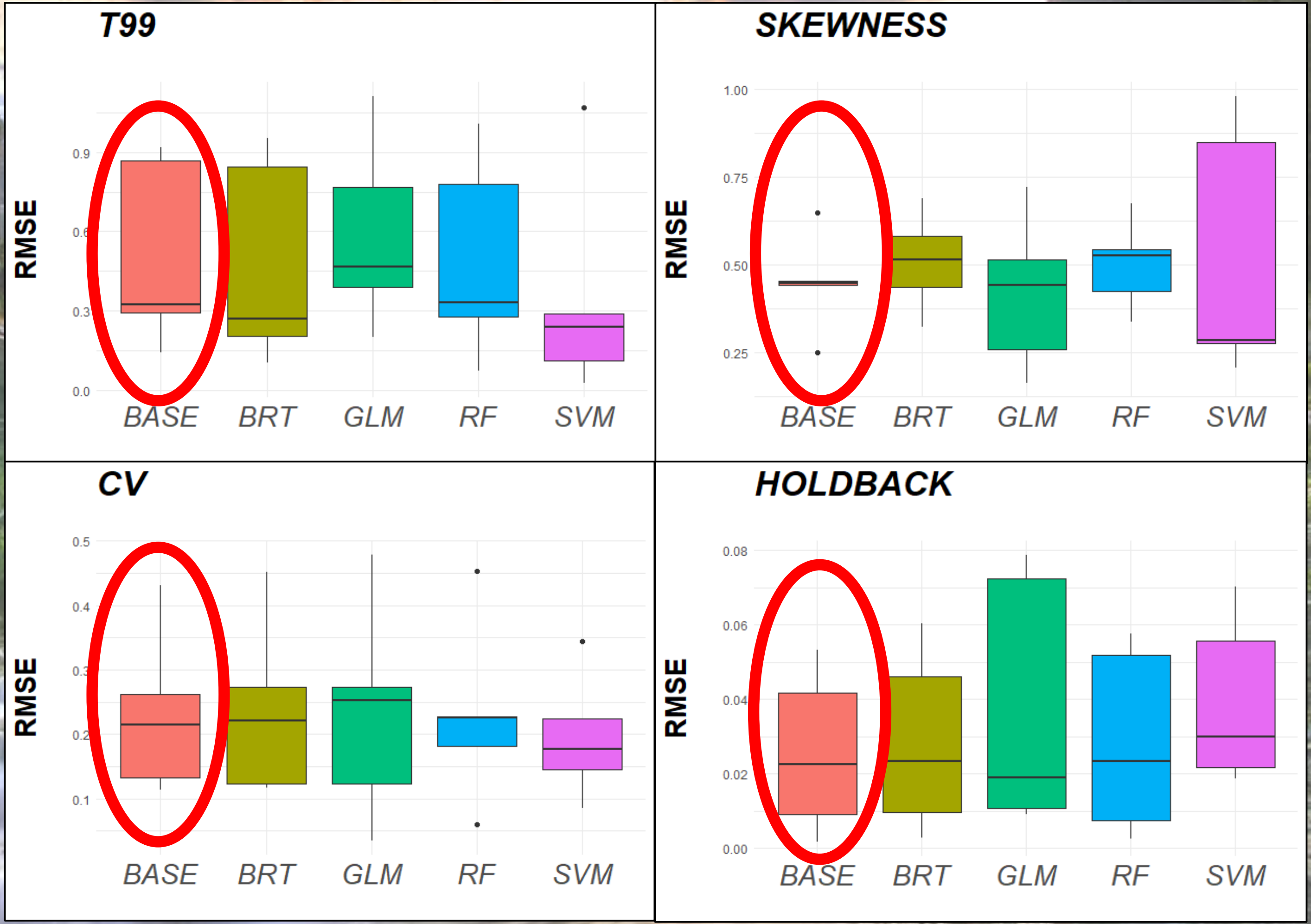


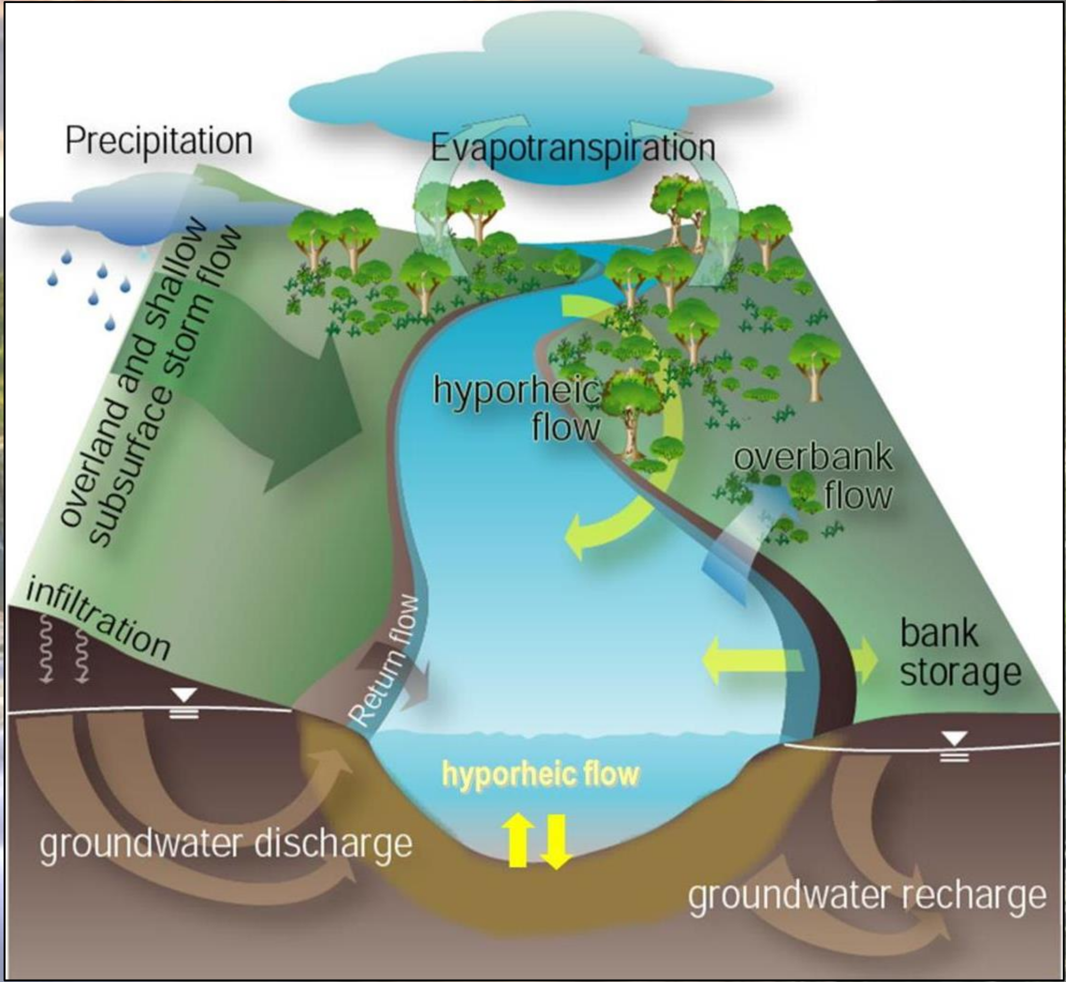
Model Comparison Results

- Compare multiple modelling approaches
- 5-fold cross validation
- Similar performance across all models
- No models beat baseline predictions



What does it all mean?

- **Maintain limited predictive power of river corridor exchange**



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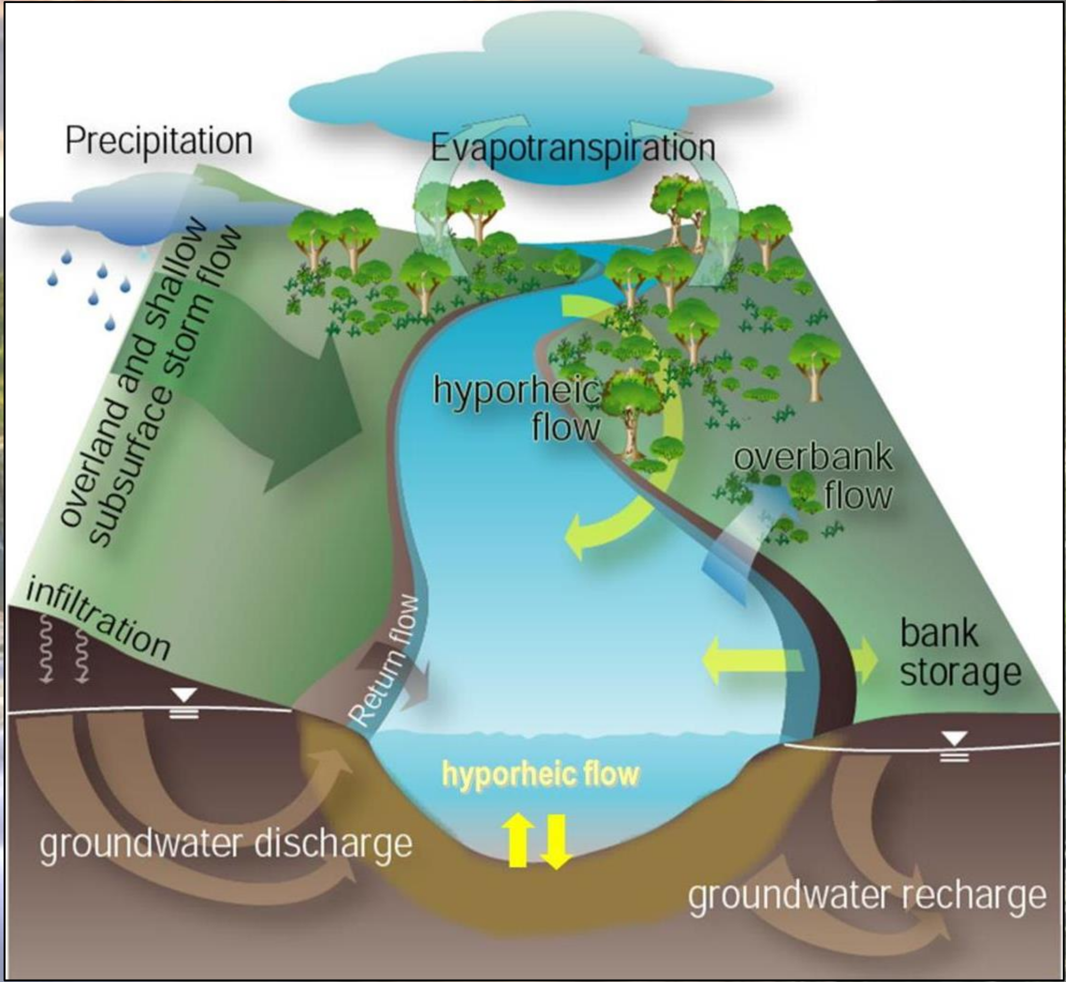

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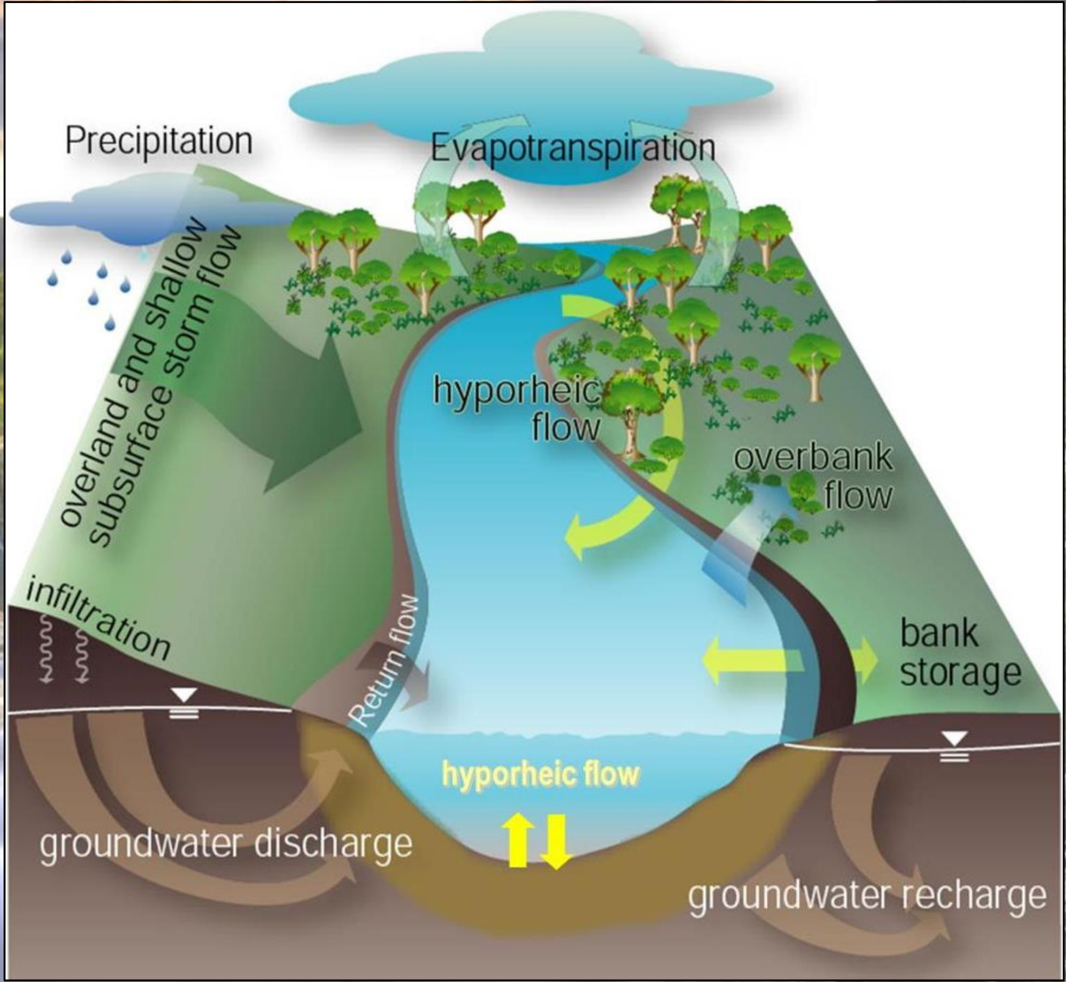
- Maintain limited predictive power of river corridor exchange
- Hydrologic indices are likely substantial drivers
- Stream concavity appears to be of lesser influence



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