Lower Cedar River Watershed Characterization

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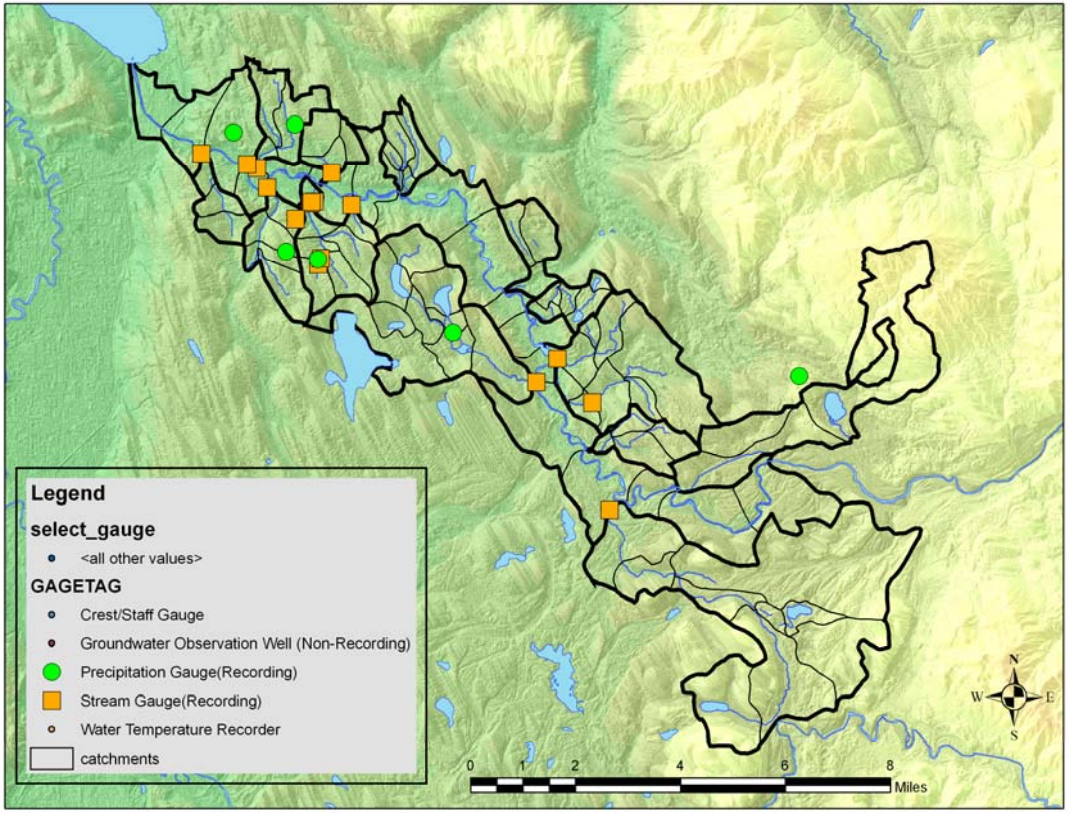
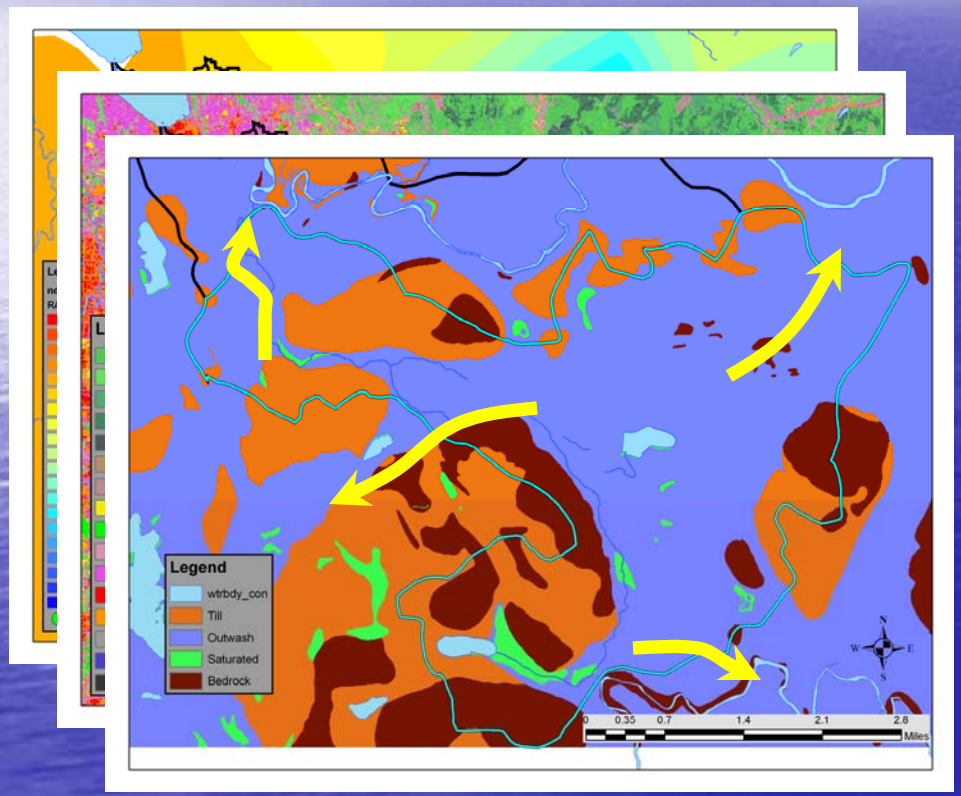
Model Development



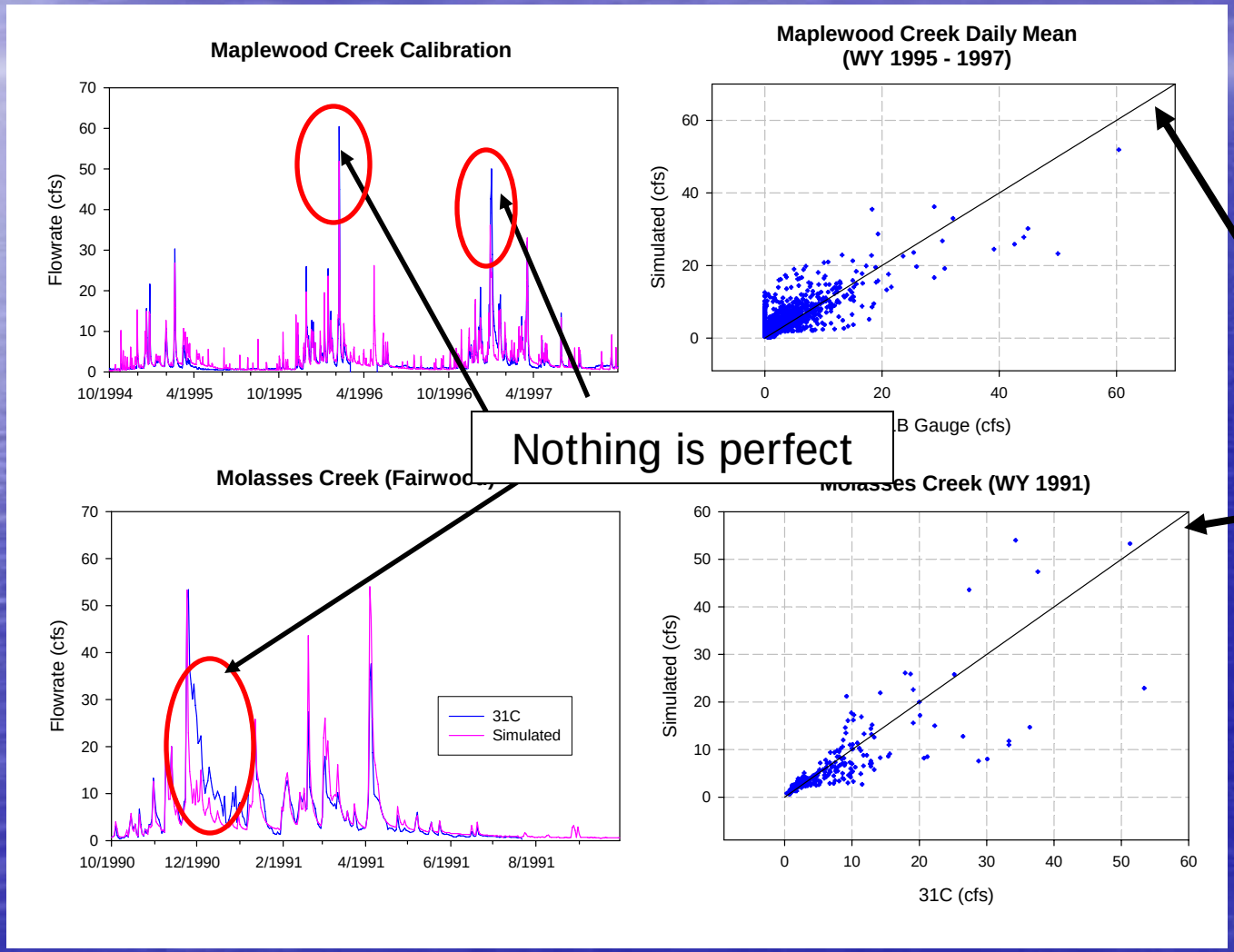
- 14 HSPF Models
  (1 mainstem, 13 subbasins)
- 83 Catchments
- Available Local Precipitation and Stream Flow Monitoring Stations

Calibration Challenges



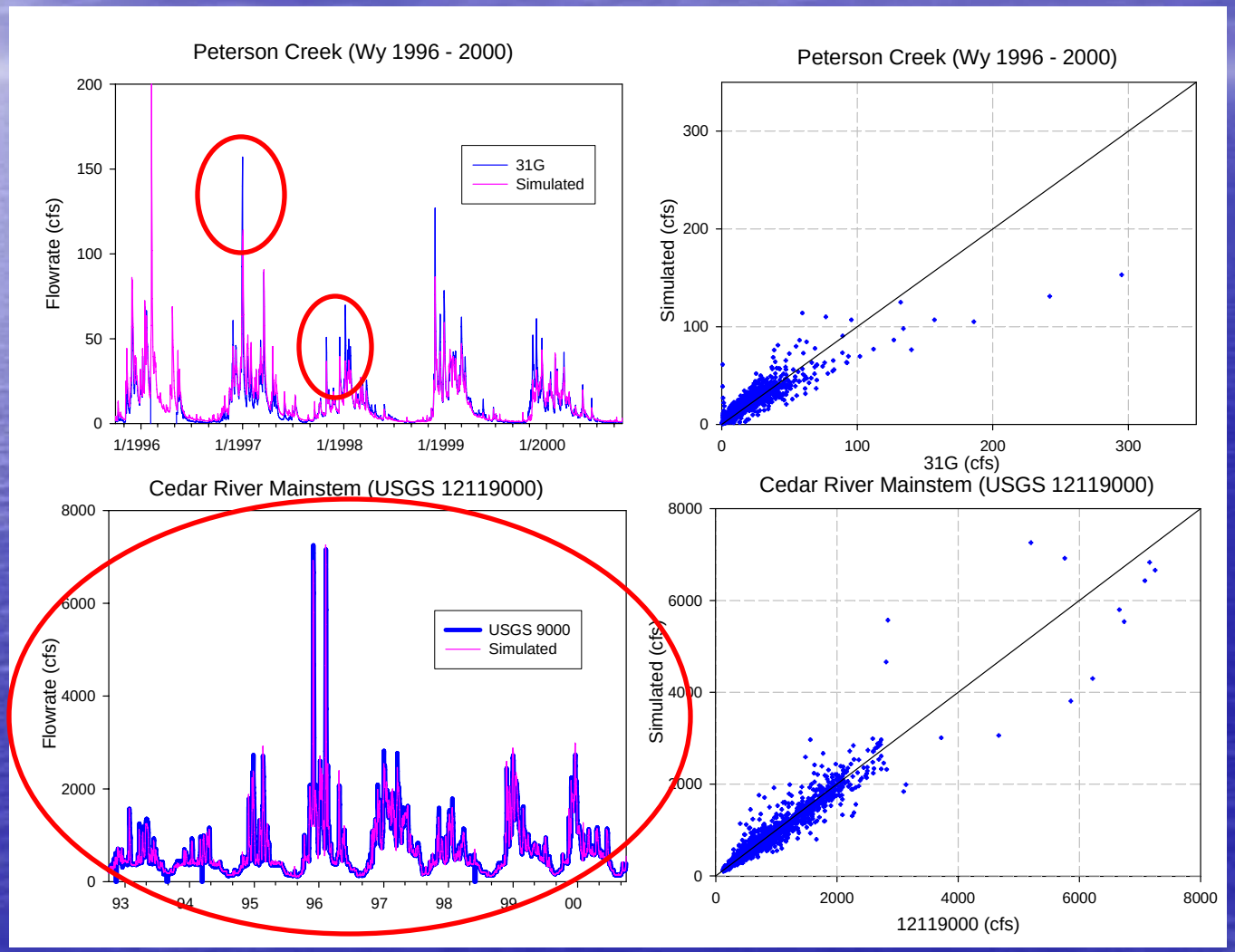
- Representative Precipitation
- Assumed Land Cover Characteristics of Land Use (e.g. EIA)
- Accuracy of Remotely Sensed Interpretations (e.g. LandSat-TM)
- Sub-surface Inter-basin transfers (i.e. Groundwater flow directions)
- Heterogeneity of Hydrologic Response Units (HRUs) and in-line storages

Local Inflow Model Calibrations



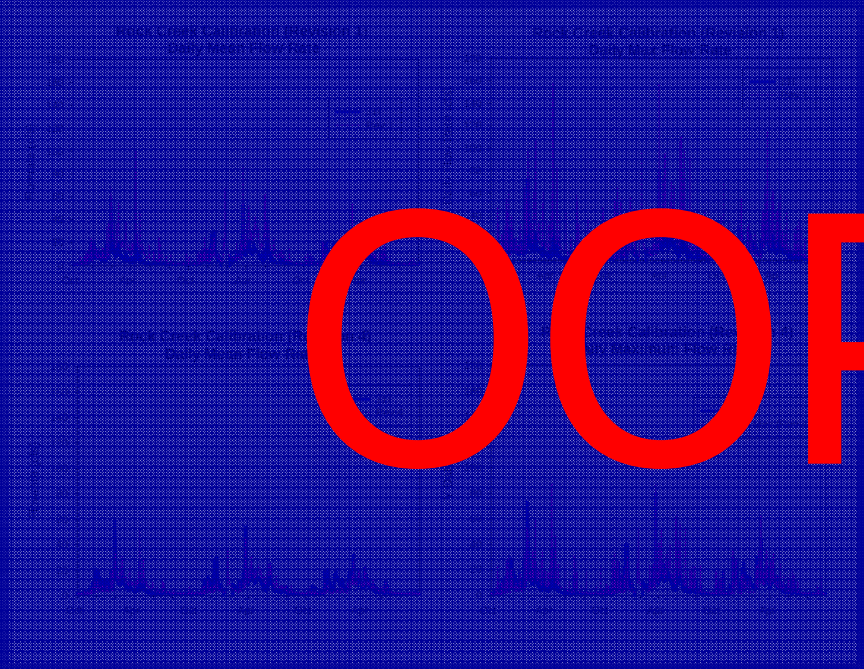
1 : 1
Reference
Line

More Model Calibrations



Almost Perfect!!!

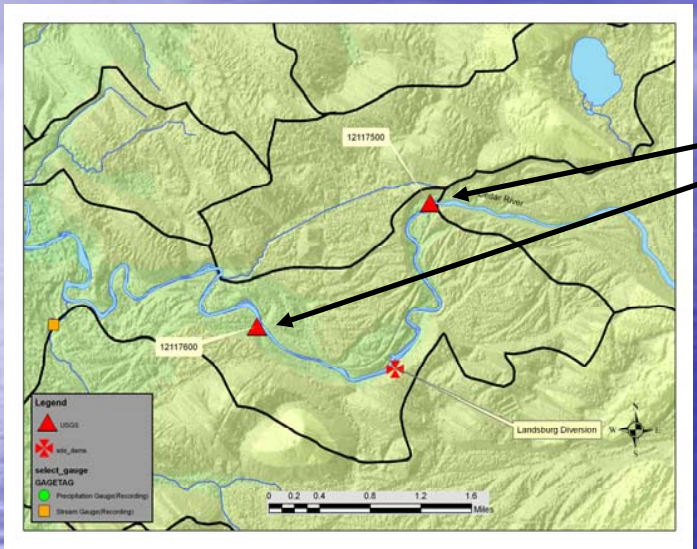
An Anomalous Calibration

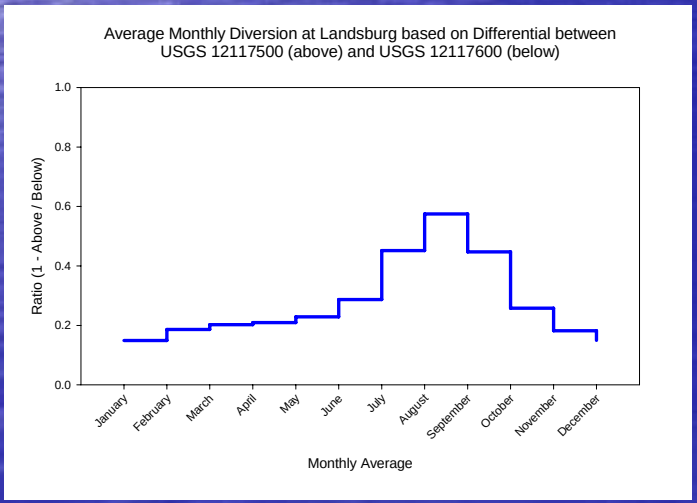


- 4 sq. miles of Outwash Active GW
- Inter-basin transfer
- Majority of land cover underlain by till routed into outwash
- Lower EIA

OOPS!

Upstream Boundary Conditions



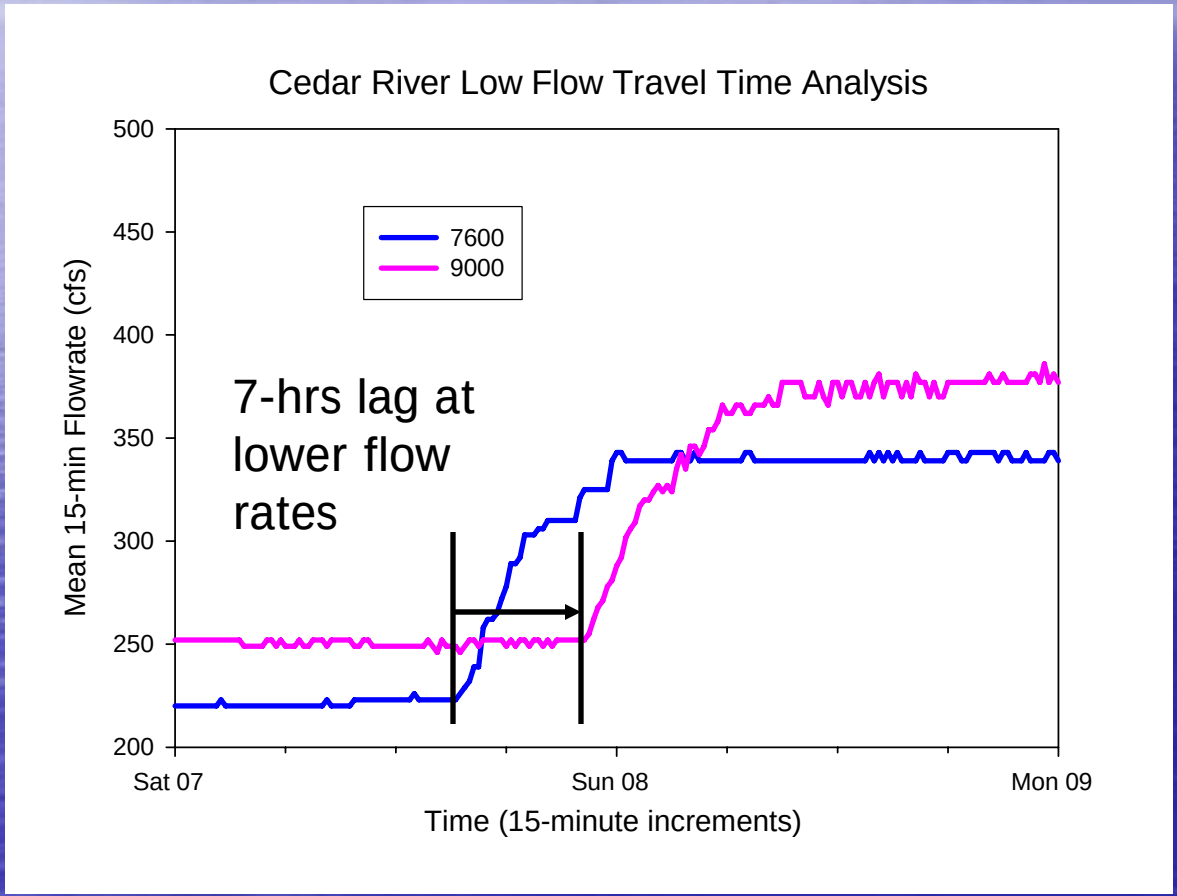


- 2.8 river miles between 12117500 and 12117600
- USGS 12117600 (Started 1991)
- USGS 12117500 (since before 1901)
- Assumed Diversion for Period of Record based on in-stream Flow records from 1991 – Current

Model Resolution Does Not Account for:

- Less Population (less demand)
- Evolution of conservation measures
- Others (gauge accuracies, Pre/Post Implementation of HCP, etc.)

Cedar River Mainstem Travel-Time



What if…

Changes in Landscape Occurred

Land Use / Land Cover

A long time ago

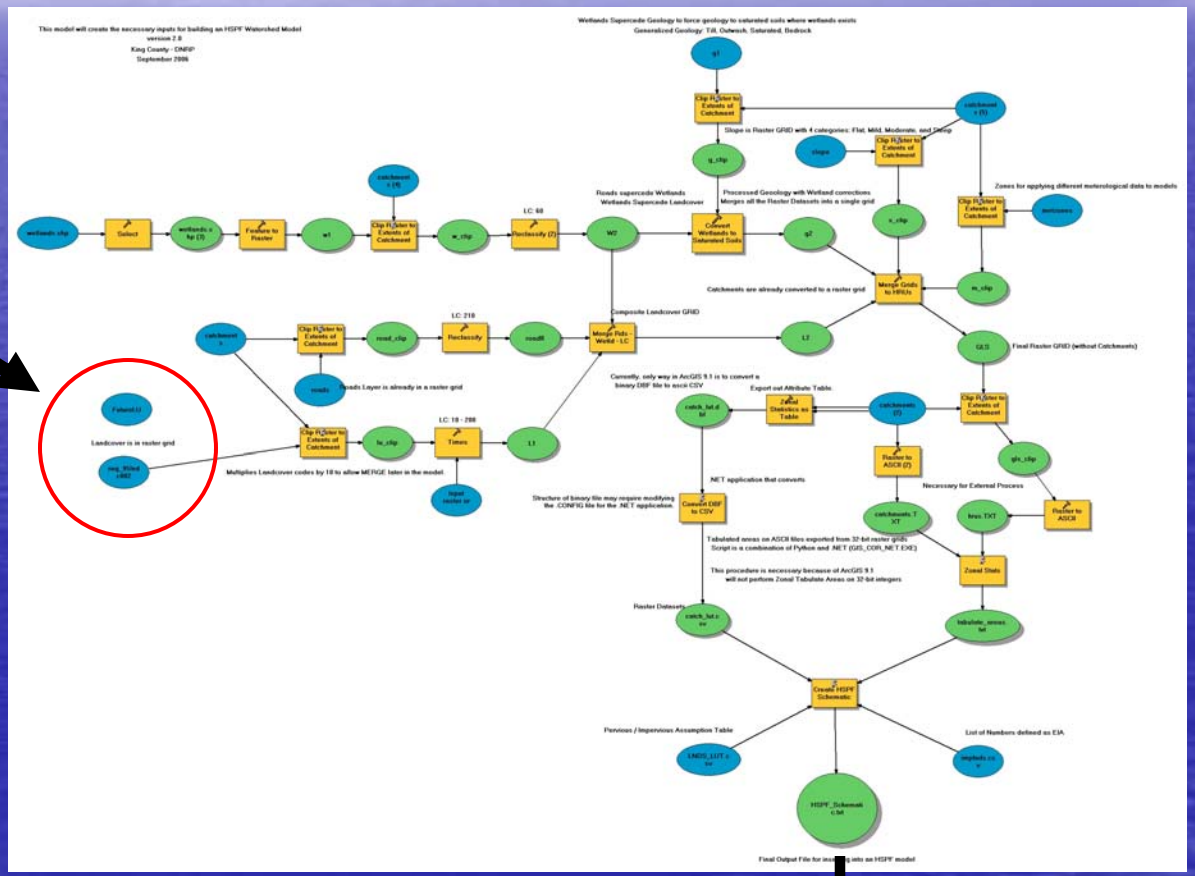
Year 1995

Future

GIS Model Integration to HSPF

LCCM &

UrbanSim



Modeling Languages

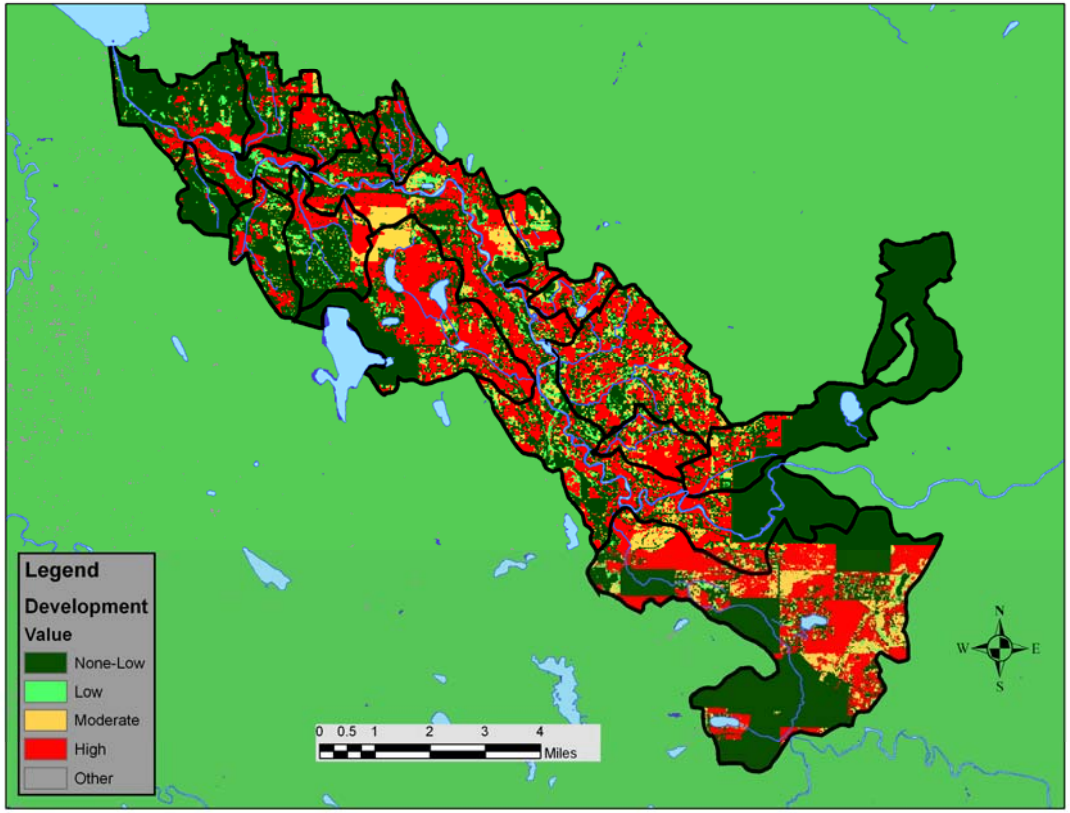
UrbanSim (Java → Python)

LCCM (Python)

KC GIS Model Integration (Python, .NET, ArcGIS)

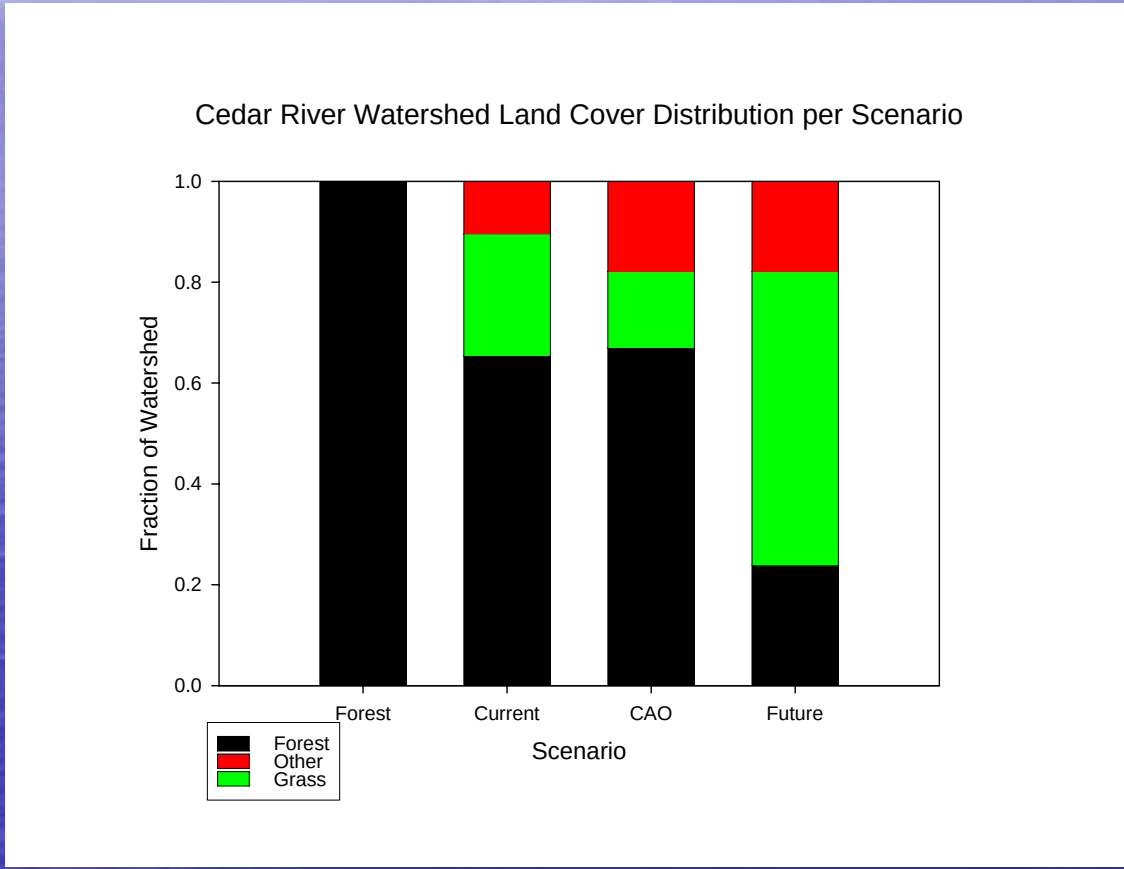
HRUs in HSPF Syntax

Draft Land Cover Change Scenarios



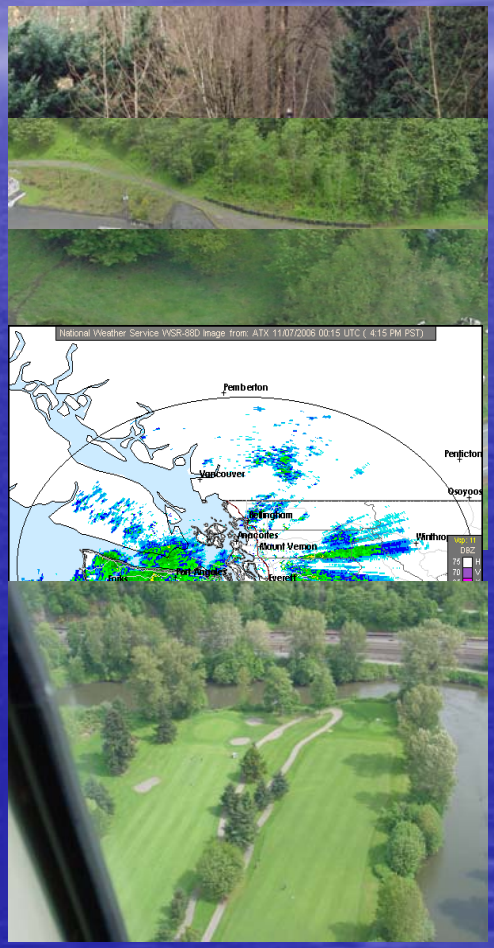
- Forested “Historical”
- 1995 Conditions “Current”
- Full Build-out “Future”
- Full Build-out 65% Forest Retention “CAO”
- Summarized Difference between 1995 and Future

Generalized Distribution of Land Cover Between Scenarios

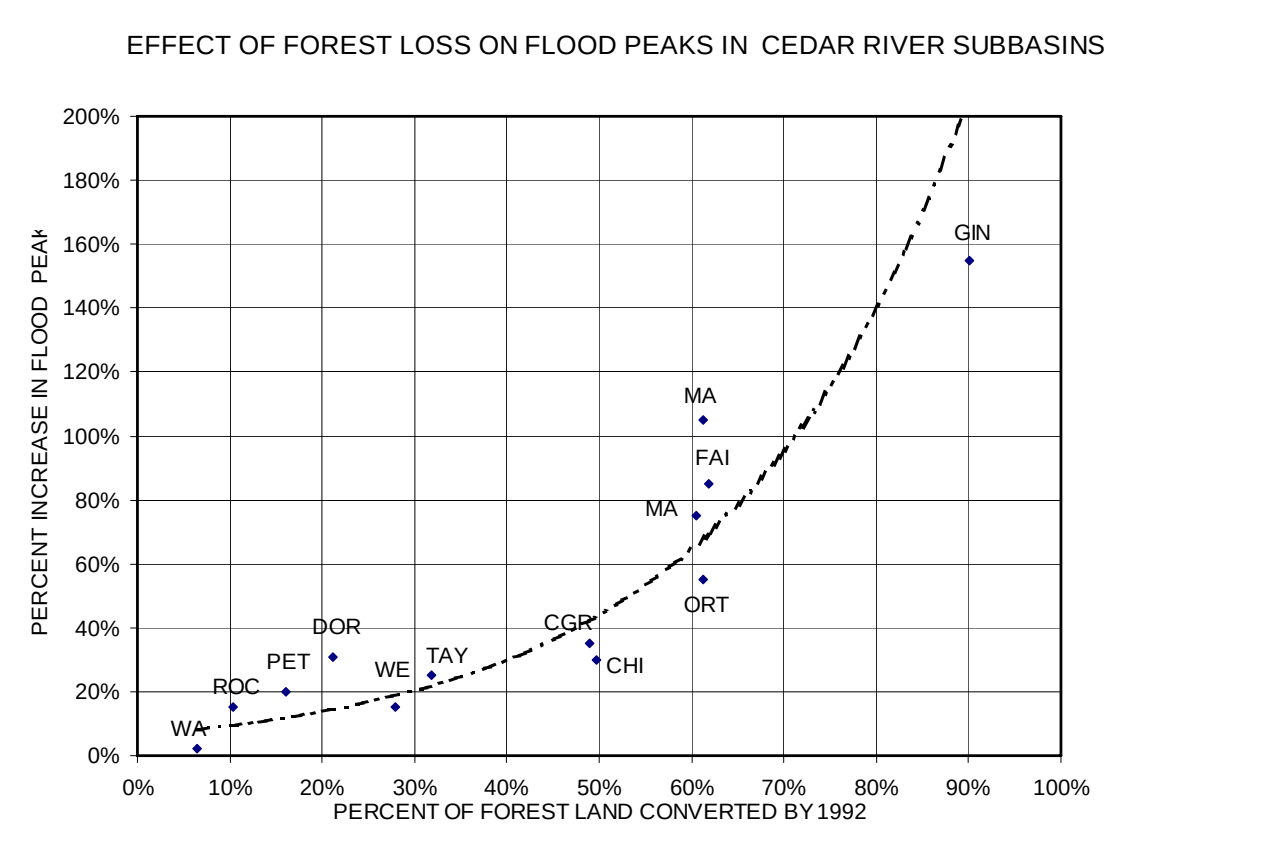


Types Model Simulations & Results

- Flood Frequency Analyses
- Index of Hydrologic Alterations (aka KC – Normative Flow)
- Pollutant Loadings (point & non-Point sources)
- Climate Change Possibilities
- Consumptive Uses
- Etc.

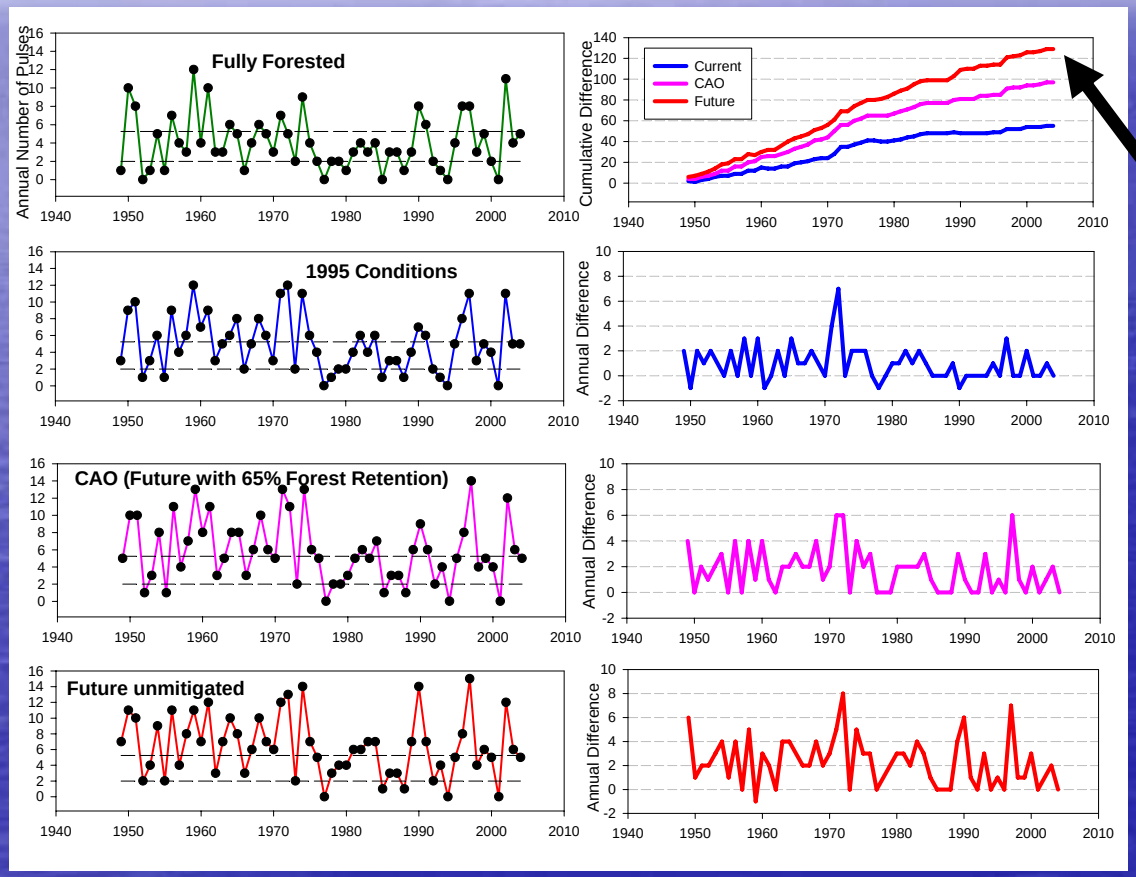


Effects on Flood Peaks



From: Cedar River CFC Report

NFP (Metric #40)
Cedar River Mainstem
High Pulse Counts



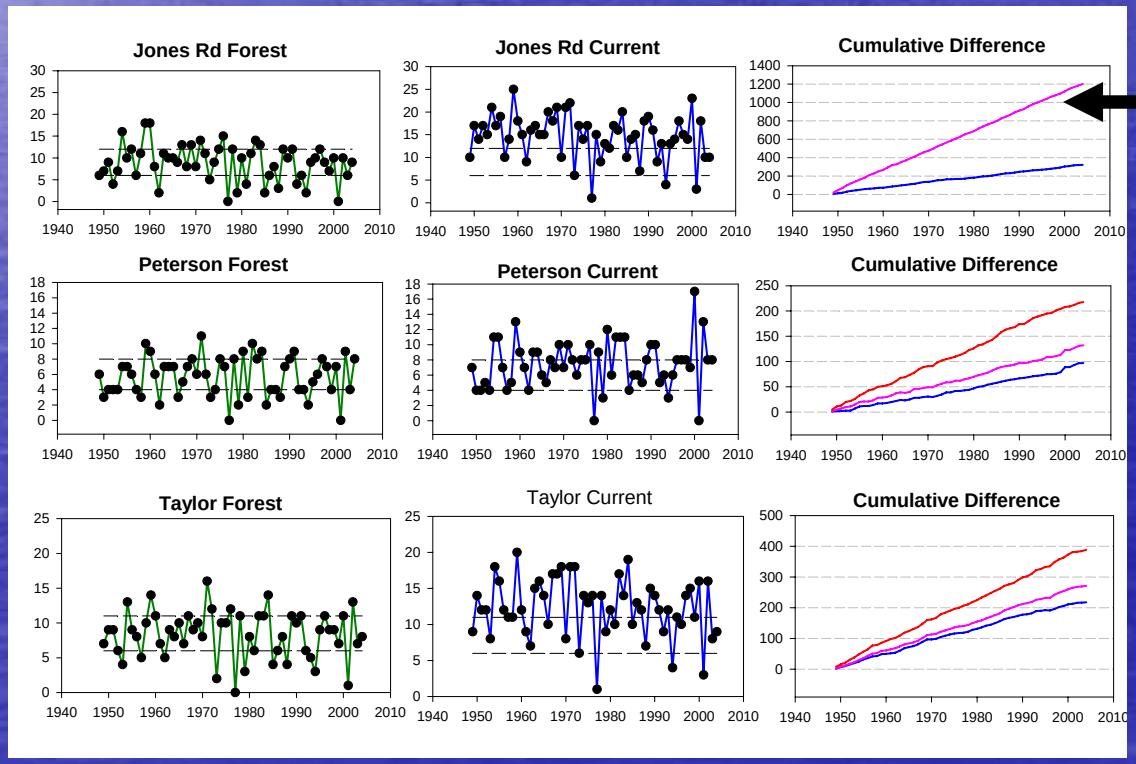
Under Future unmitigated Conditions, on average 2.3 more High Pulse Counts per year

NFP (Metric #40)
Subbasins: Jones, Peterson, Taylor
High Pulse Counts

Forested

Current

Current, CAO, Future

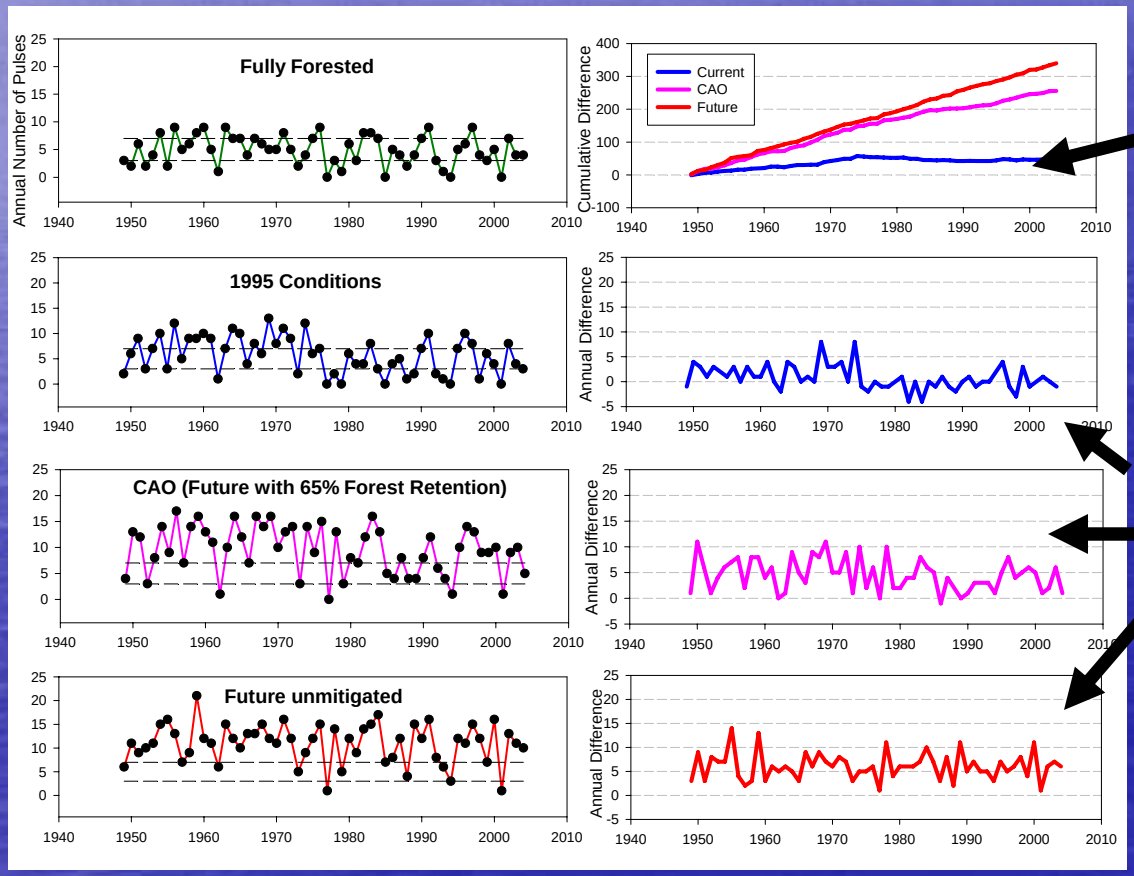


CAO & Future nearly the same

Natural Storage > 5.0 inches in subbasin

NFP (Metric = 40) Subbasin: Rock Creek High Pulse Counts

Forested Condition is w/o Kent Diversion (~ 6.2 cfs)

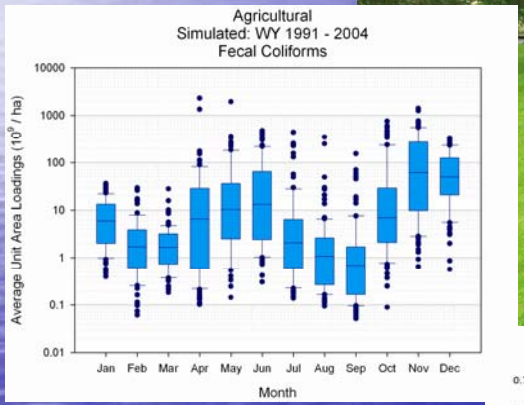


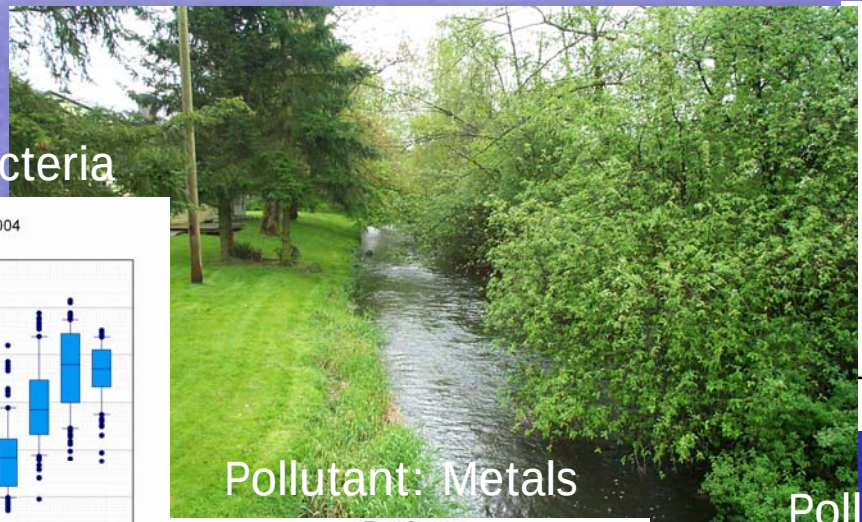
Current Conditions hydrology very similar to Forested Conditions

Absolute Change in High Pulse Counts per water year, by scenario

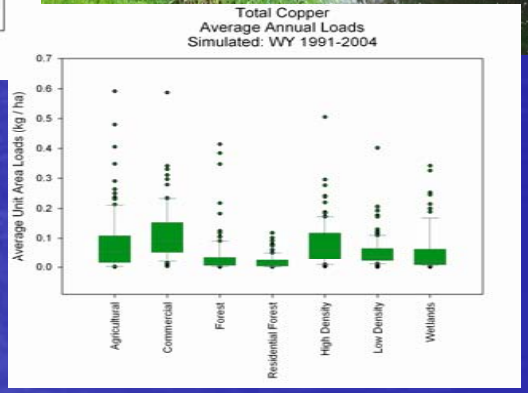
Additional Modeling Parameters measuring environmental change

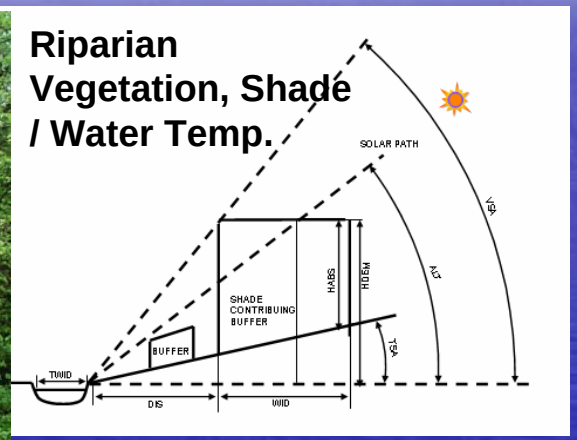
Pollutant: Bacteria



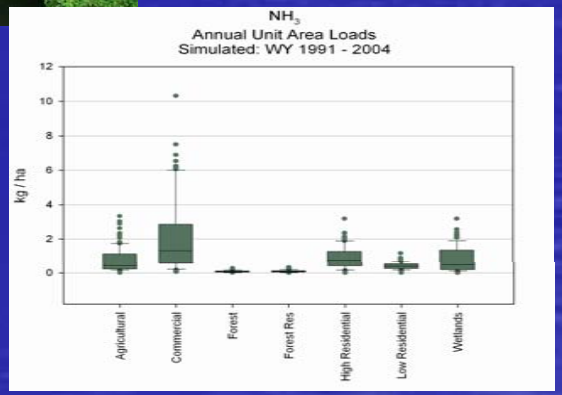


Pollutant: Metals

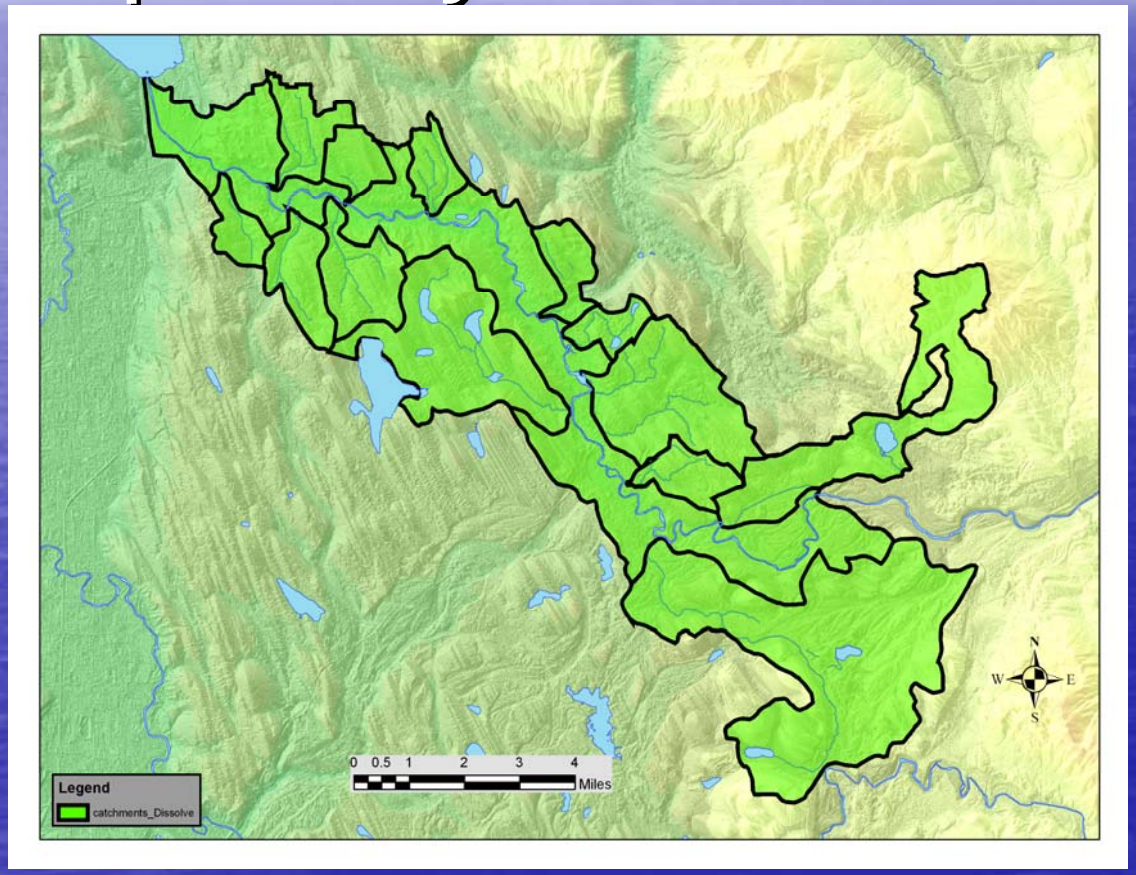




Pollutant: Nutrients



So how much environmental alterations have occurred and possibly will occur?



To be continued…