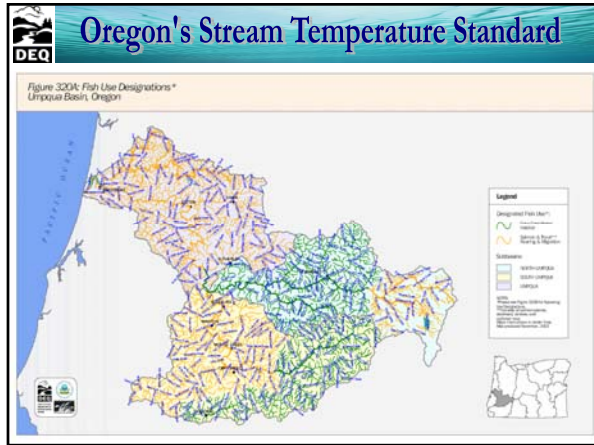
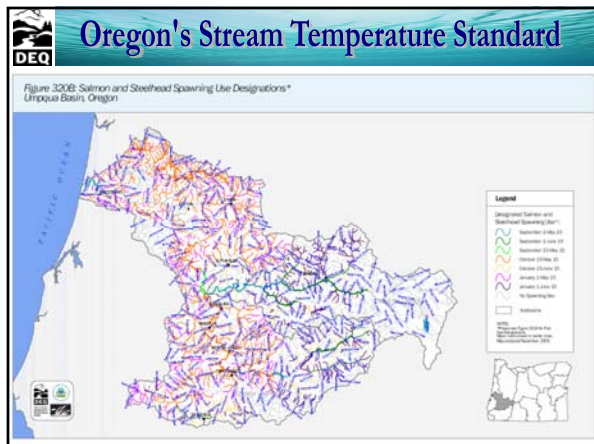


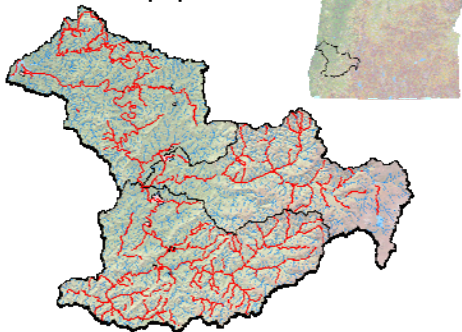
Outline

- Umpqua Basin overview
- Types of data and analysis
- Heat Source Temperature Model and results
- Implementation





Temperature impaired streams Umpqua Basin



Questions

- Is there a natural condition which precludes meeting the numeric criterion?
- What are the sources of heating?
- What is the maximum amount of heat that point sources can discharge?
- Nonpoint sources?

On smaller streams ...

Working hypothesis:
Riparian vegetation
has the largest impact

- Other factors:
- point sources
 - decreased flow
 - wider/shallower streams



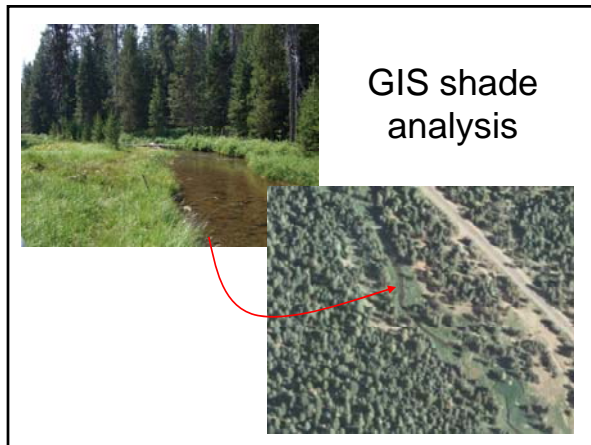
Types of data

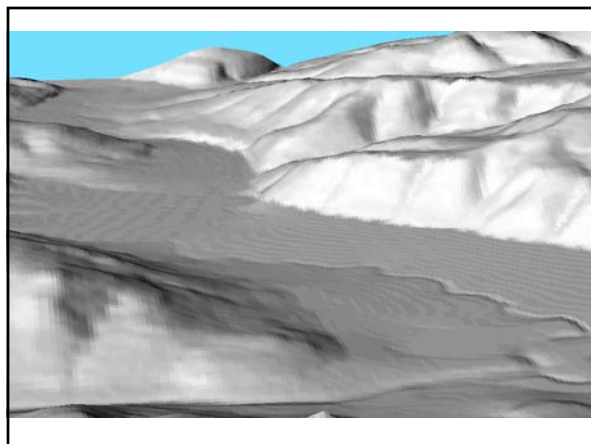
Riparian condition:

- Aerial photos
- LiDAR

Stream temperature:

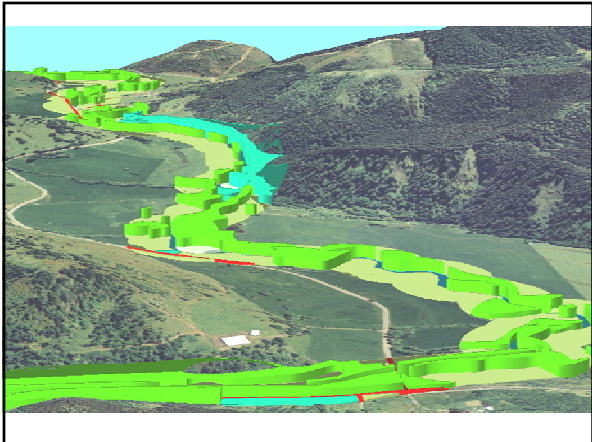
- TIR
- Continuous monitoring

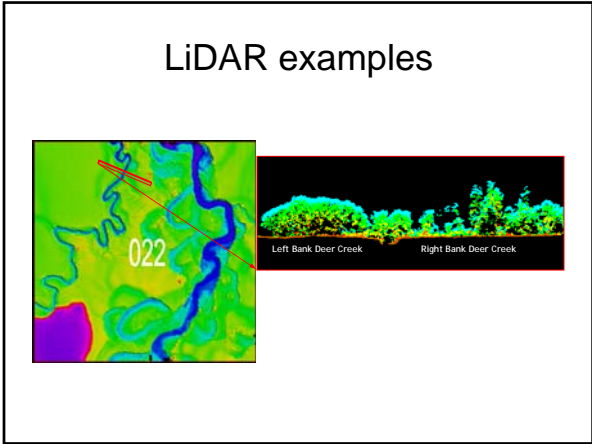


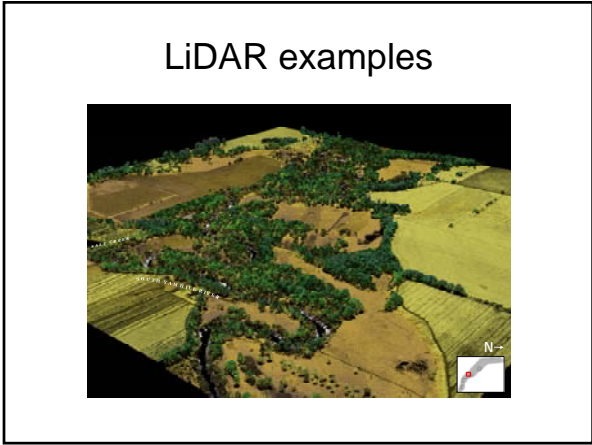


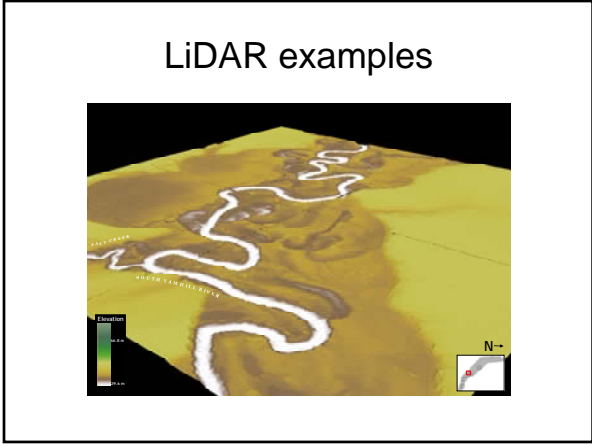








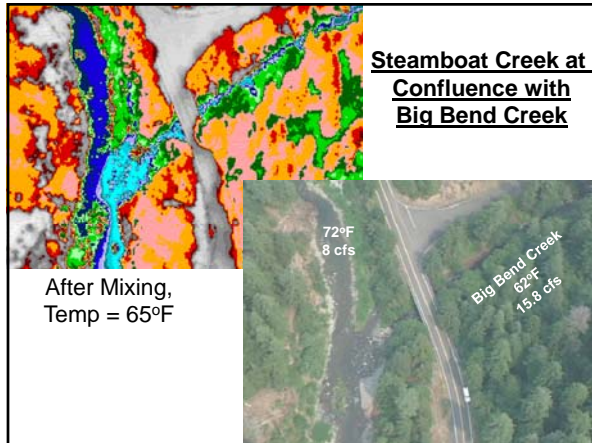


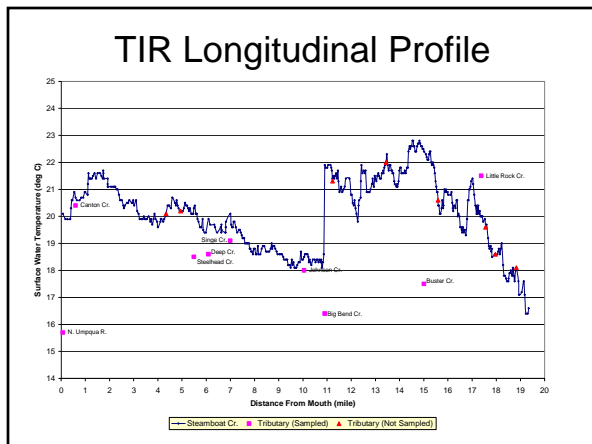


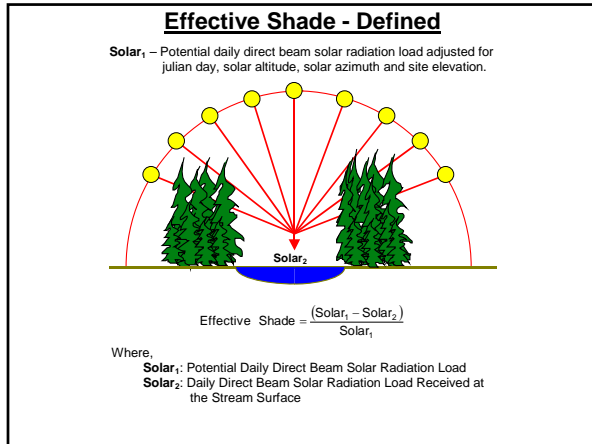
TIR Stream Temperature Data:

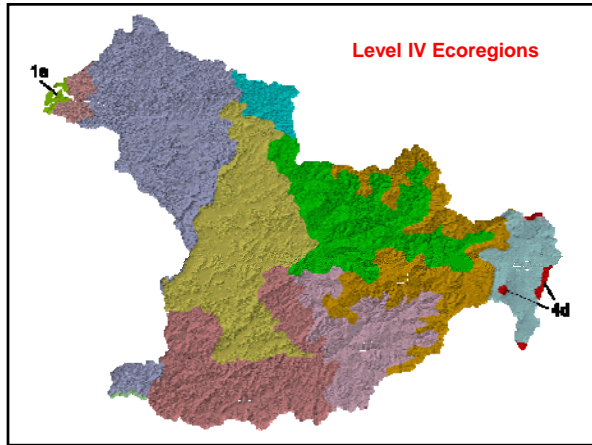
- TIR and Visible Band cameras on gyro-stabilized mount.
- Spatially referenced with global positioning system (GPS).
 - Pixel Size ~20 cm.
 - ±0.5°C Accuracy.
- Frames are ~150 x 100 m, with >50% overlap between images.



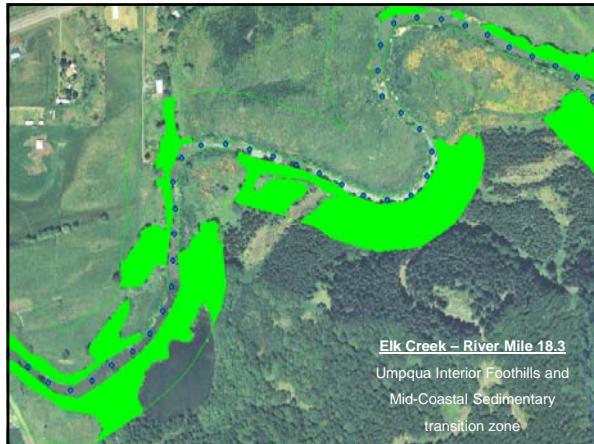


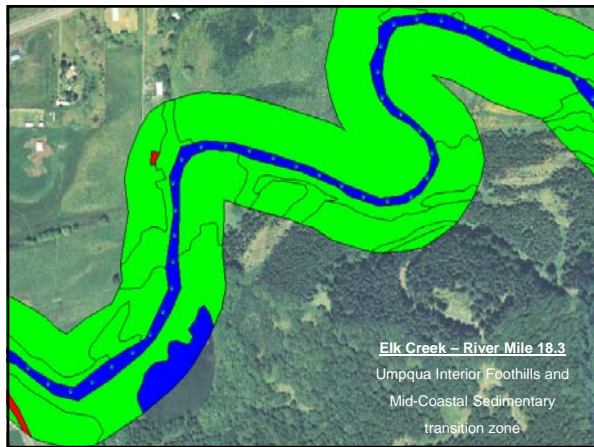


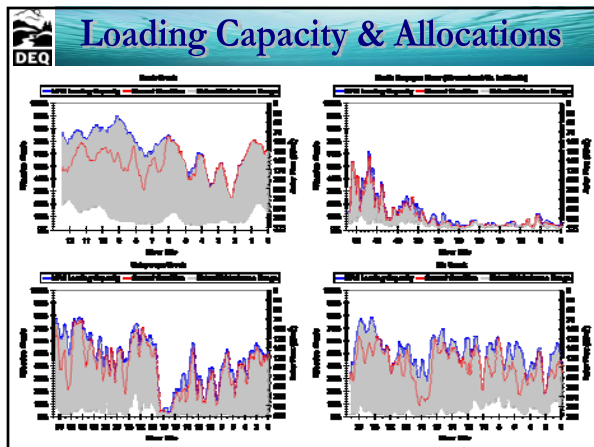


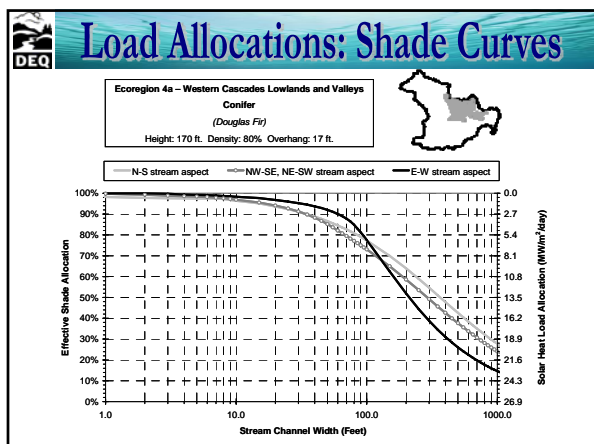


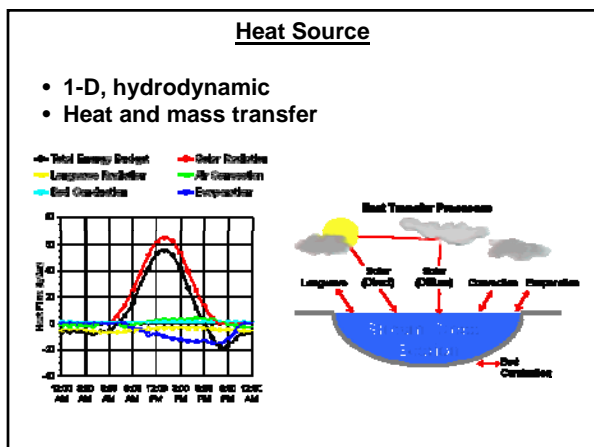


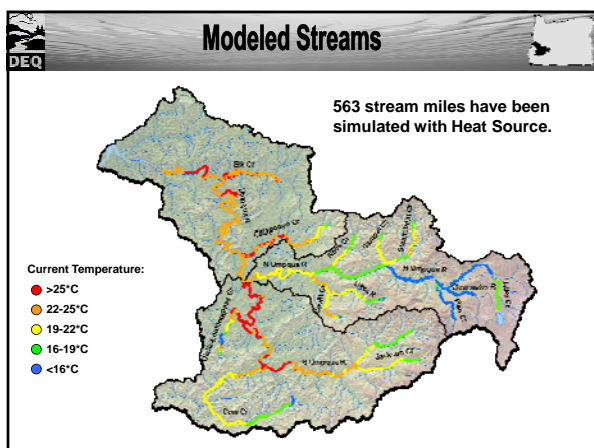


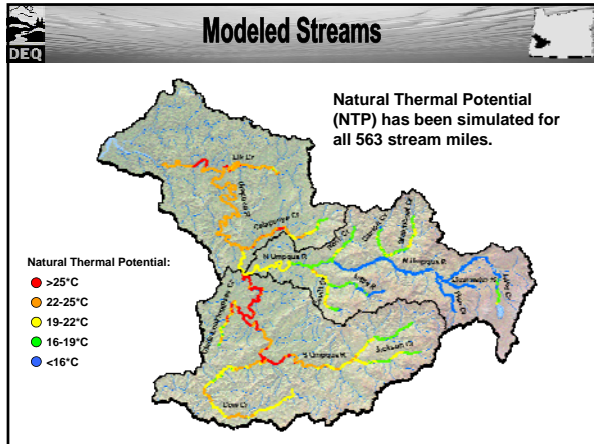


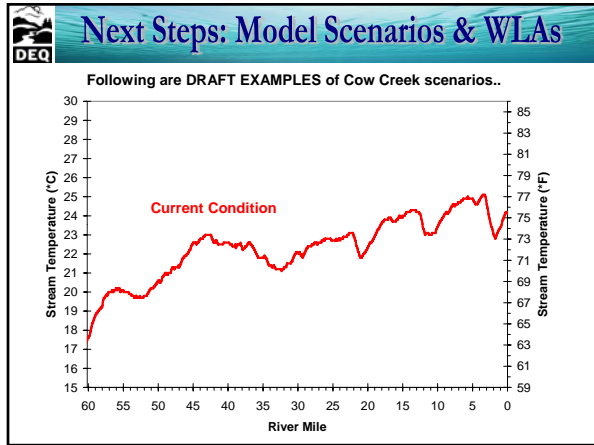


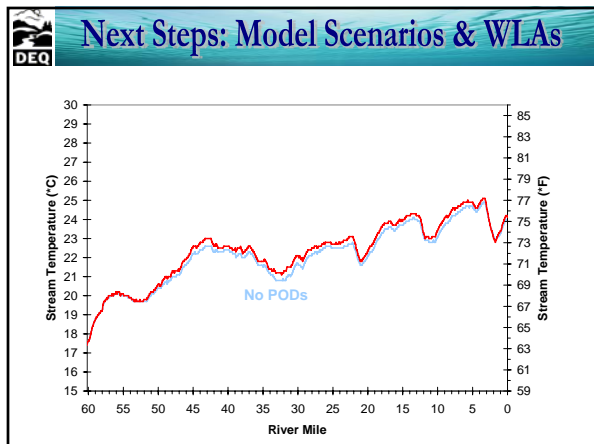


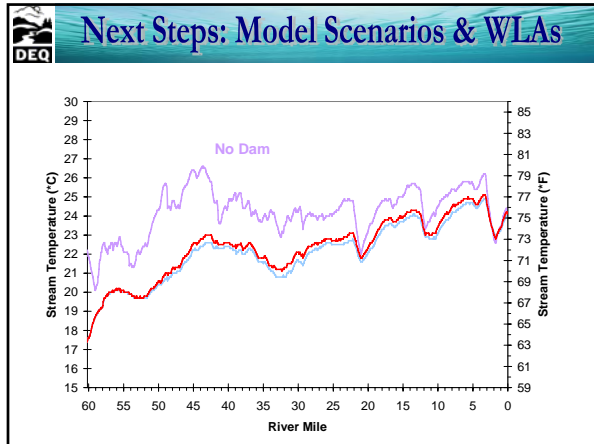


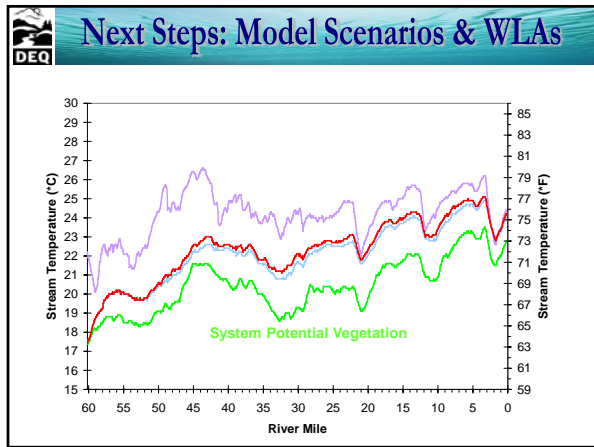


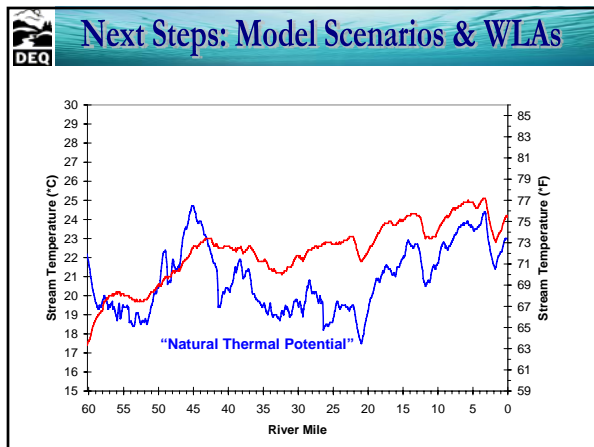


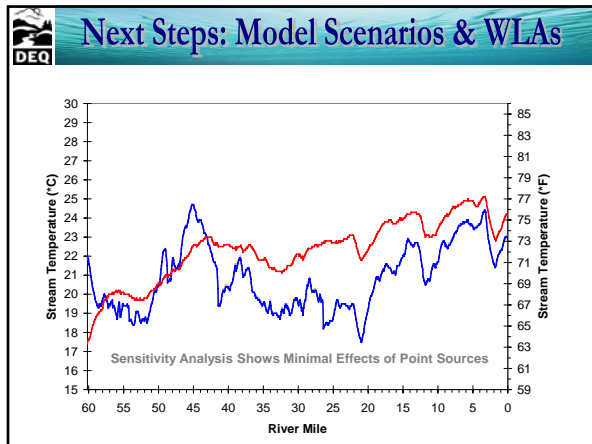


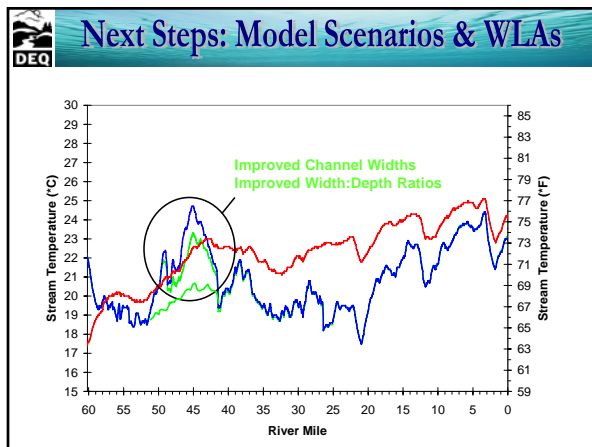


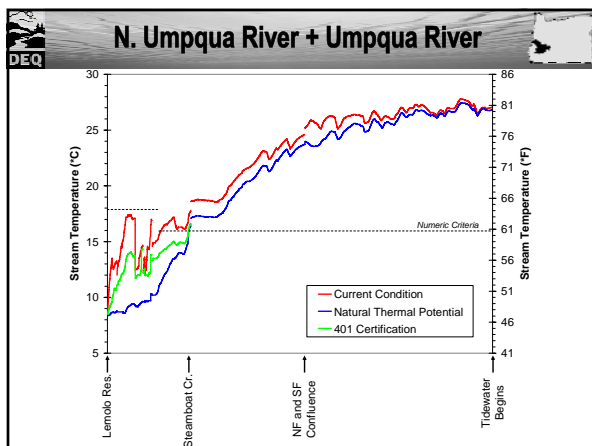




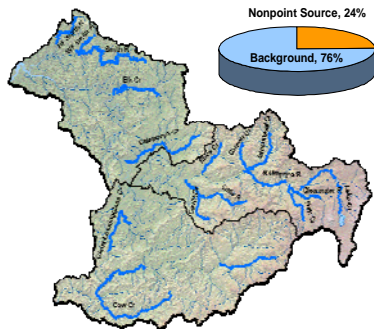




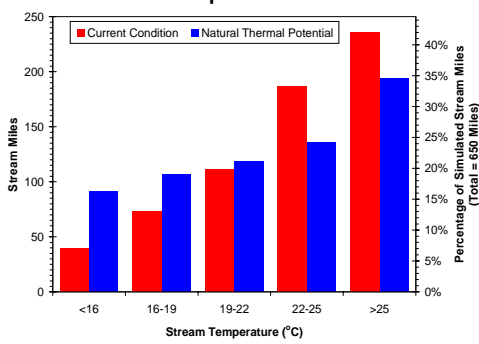




Solar Heat Load Distribution



Distribution of simulated stream temperatures



Natural Disturbance



