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

GIS shade analysis

Elk Creek Upstream of Drain, Oregon – 10 meter DEM
**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.

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*Steamboat Creek at Confluence with Big Bend Creek*

After Mixing, Temp = 65°F

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**TIR Longitudinal Profile**
Effective Shade - Defined

Solar₁ = Potential daily direct beam solar radiation load adjusted for julian day, solar altitude, solar azimuth and site elevation.

Solar₂ = Daily Direct Beam Solar Radiation Load Received at the Stream Surface

Effective Shade = \( \frac{\text{Solar}_1 - \text{Solar}_2}{\text{Solar}_1} \)

Where:

\( \text{Solar}_1 \): Potential Daily Direct Beam Solar Radiation Load

\( \text{Solar}_2 \): Daily Direct Beam Solar Radiation Load Received at the Stream Surface

Level IV Ecoregions

Elk Creek – River Mile 18.3
Umpqua Interior Foothills and Mid-Coastal Submontane Transition zone
Load Allocations: Shade Curves

Ecoregion 4a – Western Cascades Lowlands and Valleys  
Conifer  
(Southern Firs)  

- N-S stream aspect
- NE-SW, NW-SE stream aspect
- E-W stream aspect

Effective Shade Allocation

Stream Channel Width (Feet)

Heat Source

- 1-D, hydrodynamic
- Heat and mass transfer

Modeled Streams

563 stream miles have been simulated with Heat Source.
Natural Thermal Potential (NTP) has been simulated for all 563 stream miles.

Natural Thermal Potential:

- >25°C
- 22-25°C
- 19-22°C
- 16-19°C
- <16°C

**Next Steps: Model Scenarios & WLAs**

Following are DRAFT EXAMPLES of Cow Creek scenarios:

- **Current Condition**
- **No PODs**
Sensitivity Analysis Shows Minimal Effects of Point Sources

Improved Channel Widths
Improved Width:Depth Ratios

Current Condition
Natural Thermal Potential
401 Certification

Lemolo Res.
Steamboat Cr.
NF and SF Confluence
Tidewater Begins
Solar Heat Load Distribution

Nonpoint Source, 24%
Background, 76%

Distribution of simulated stream temperatures

Natural Disturbance
What was the range of the 10 different NTP simulations?

Cavitt Creek

River Mile

What was the range of the 10 different NTP simulations?

Jackson Creek

River Mile

TMDL Roles and Responsibilities

DEQ calculates TMDLs, sets allocations to reach water quality compliance
Questions?