

Science

BRIEFING

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STREAM TEMPERATURE MODELING AND MONITORING

BACKGROUND

Thermal regimes are important to aquatic ecosystems because they strongly dictate species distributions, productivity, and abundance. Inexpensive digital temperature loggers (thermographs, such as the TidbiT data logger pictured at right), geographic information systems (GIS), remote sensing technologies, and new spatial analyses are facilitating the development of temperature models and monitoring networks applicable at broad spatial scales.

RESEARCH

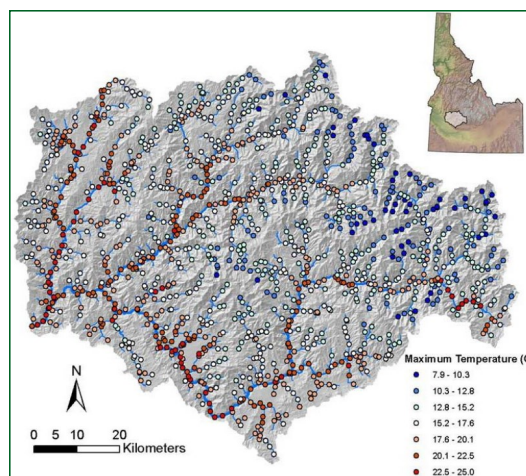
Research Activity: The [Stream Temperature Modeling and Monitoring](#) website provides a mapping tool to help organize temperature monitoring efforts, describes techniques for measuring stream temperatures, and describes several statistical models for predicting stream temperatures and thermally suitable fish habitats from temperature data.

Benefits to Resource Managers:

Understanding spatial variation in stream temperatures and predicting future trends is necessary for proactive management of aquatic resources. Temperature data are being used with [Spatial Stream Network \(SSN\)](#) models to develop an accurate and consistent set of geospatial temperature scenario maps for streams in the region. This will facilitate more efficient temperature monitoring designs, better understanding of thermal constraints on aquatic species, and strategic prioritization of conservation efforts across the region.



A dynamic mapping tool provides a spatial index to nearly 3,200 sites on streams and rivers in the U.S. and Canada where full year stream temperatures are currently being monitored by several agencies.



Predicted maximum summer stream temperatures across the Boise River Basin. This modeling approach uses thermograph data and predictor variables (air temperature, solar radiation, elevation, and stream flow).

KEY FINDINGS

- Thermal regimes are a fundamental attribute of stream ecosystems and the ability to monitor and model these regimes are rapidly advancing.
- Extensive monitoring infrastructures are being built to increase our knowledge of stream temperatures across National Forest lands.
- Advances in GIS and remote sensing technologies make it possible to model stream temperatures from landscape features. Using these new spatial statistical models provides strong predictive ability.
- Temperature models can be used to predict suitable habitats for aquatic species, determine compliance with water quality standards, or optimize stream temperature sampling.

MORE INFORMATION

The Stream Temperature Modeling and Monitoring website (www.fs.fed.us/rm/boise/AWAE/projects/stream_temperature.shtml) provides links to stream temperature resources such as publications, videos, and presentations on topics relating to thermal regimes in streams. For more information, please contact **Dan Isaak**, USFS Research Fishery Biologist, disaak@fs.fed.us, (208)373-4385.