

## A Large-Scale Field Assessment Using Underwater Epoxy to Install Sensors for Full Year Temperature Monitoring in Mountain Streams

**Dan Isaak, Ph.D.**

322 E. Front St., Suite 401

Boise, ID 83702

Telephone: 208-484-6554

[disaak@fs.fed.us](mailto:disaak@fs.fed.us)

Stream temperature regimes are fundamentally important to understanding pattern and process in aquatic communities. Modern digital sensors can provide accurate and repeated temperature measurements that span multiple years, but are rarely deployed for more than a few summer months in mountain streams due to logistical constraints with seasonal stream access and concerns that large annual floods will destroy sensors. We developed a rapidly applied protocol (sensor installation takes ~20 minutes) that uses underwater epoxy to attach sensors to large rocks that makes full year stream temperature monitoring feasible and cost effective. Initial field trials during the winter of 2009/2010 suggested temperature measurements were not biased by attachment to rocks and 82% of epoxied sensors (9 of 11) were retained through spring floods. A larger scale field assessment was initiated during the summer of 2010 wherein 300 temperature sensors were deployed in streams ranging in channel slope from 0.1% - 16% across the northwestern U.S. Eighty-six of these sites were checked for sensor retention after the large spring flood in 2011 and 74% (64 of 86) of sensors remained in place recording stream temperatures. Retention success was inversely related to channel slope and averaged 85% where slopes were < 3% that are typical of most fish-bearing streams. Our results indicate that the underwater epoxy technique is viable for installing temperature sensors in a wide range of mountain streams where large substrates and suitable attachment sites are common. Moreover, the technique reduces the cost of temperature monitoring by reducing the number of site visits to < 1/year rather than the current norm of 2/year for summer data and 5 years of temperature measurements may be obtained for \$130 in equipment costs (primarily the cost of the sensor) given current memory and battery capacities of temperature sensors. More than 400 additional stream sites were instrumented with temperature sensors using underwater epoxy during the summer and fall of 2011 to continue expanding the regional temperature monitoring network. Data from this network will contribute in future years to improved understanding of stream thermal regimes, alterations associated with climate change, and the thermal ecology of aquatic organisms.