

Preliminary Report

Temperature Monitoring of the Middle Fork of the John Day River

Overview

The Confederated Tribes of Warm Springs Reservation of Oregon (Tribes) have completed Phase 1 of river restoration during the summer of 2008 on the Forrest property of the Middle Fork of the John Day River. This first phase included placement of 18 log structures with excavated pools at 12 structures along with removal of 33 existing rock barbs. Distributed Temperature Sensing (DTS) and Fiber Optic technology was deployed pre and post restoration in summer of 2008 to determine if significant change in stream temperature occurred due to restoration efforts. In addition to the Forrest property, stream temperature using fiber optics and DTS were taken at the Oxbow property for pre-restoration data and at a confined reach of the Malheur National Forest. To get a better understanding of the local hydrology 34 groundwater monitoring wells were installed throughout the two properties.

Research Methods

A typical deployment consisted of 4 km of fiber optic cable in 2 km of stream. We used two cables of 2 km lengths and ran them parallel down the river 1 m from the bank, in theory this will show changes in the river's microclimates and through the entire reach. The DTS was set at 10 minute intervals with a spatial resolution of 1m, with this high resolution we can link how the river temperature changes with respect to climatic changes. Each site had at least 1 weather station that recorded air temperature and humidity, wind speed and direction, and solar radiation. Coupling the stream temperature and climate data with the Bureau of Reclamation's geographic data the mass and energy balance model, HeatSource, will be used to assess the effectiveness of restoration with respect to stream temperatures.

In order to understand how the surrounding hillslopes and floodplains interact with the river 34 groundwater monitoring wells were installed. Of the wells 24 were constructed of slotted PVC and installed with a hand auger. The remaining 10 were steel screened wells, installed with a 60 pound slide hammer. The typical depth of the PVC wells was roughly 1 meter while the steel wells were almost 2 meters. By the end of the summer all of the PVC wells had dried up while 8 of the steel wells still had a measureable water level.

Preliminary Results

DTS technology is a high resolution technology and with that comes very large data sets which take a considerable amount of effort to calibrate. Of the data collected this

summer the Forrest post-restoration is the only set completely calibrated and with preliminary analysis started hence this will be the focus of the report. An atypical trend found in the Forrest property reach is a decrease in temperature traveling downstream. This could be due to the fact that within the 2 km site there are 3 tributaries that deliver cold water to the main stem with the largest being Vinegar Creek. At the warmest time of day Vinegar Creek causes the main stem to drop over 2°C. There are spikes seen are due to the cable exiting the water to get over log structures that span the entire river. Although preliminary results don't show any change due to log structure placement throughout the reach this will be verified during the winter months with use of the HeatSource model.

Discussion

From preliminary analysis there does not show to be a decrease in temperature due to addition of log structures. Although, the river has not seen high winter flows since restoration and that will undoubtedly change scouring patterns. The spring will bring either deepened scour pools or shallower sedimentation pools causing again a change in the local river temperature regime.

Like all field work there were a few glitches throughout the summer. The fiber optic cable manufactured specifically for the MFJDR installations turned out to be more fragile than expected. This fragileness caused breaks throughout the reach requiring repair by fusing the glass cable back together. Not only was the cable delicate but the manufacturer had many setbacks in the production and multiple times the cable delivery was a week or more behind schedule. The summer was set up to allow at least 2 weeks of continual readings for each site but unfortunately due to these problems that was not accomplished. Although, enough data was collected at each site to use with the model so there has been no waste of effort. On top of these difficulties, during the first installation at Forrest water levels were much higher than expected due to the large snowpack year. The current was so fast it was difficult to secure the cable completely and was sometimes displaced from its original location. This only caused a problem when the water dropped throughout the two week period and there was cable exposed. Fortunately, the majority of the cable was still in the river and parsing out the cable segments is a menial task. The only difficulty faced with for the wells are the grazing cows, they rub against the 12 inch PVC segments sticking out of the ground and they separate at the coupling right below surface. This will be fixed December 6th and 7th by installing metal supports to protect the wells.