

Water Temperature Analysis (Main Stem)

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Introduction/Summary of Concerns

Much of the Illinois River has summer temperatures that exceed conditions desirable for salmonid rearing. There are three primary areas where human activities have influenced water temperatures: channels that are likely wider and more shallow than historically, decreases in instream flows, and decreases in riparian forests. Maintaining and restoring riparian conditions in Sucker, Elk and Althouse Creeks are recommended as a first priority; the East Fork and main stem below Cave Junction are the second recommended priority.

Scope & Objectives

This report fulfills the outputs required under Product #9, Water Temperature Analysis, Main Stem Illinois River.

The scope extends up the main stem from Briggs Creek. It goes into the West Fork up to Rough and Ready and into the East Fork up to Elder Creek. These breaks were made on the basis of available data, because the author believes that the greater influence of people on the river environment is felt in these segments, and on channel form. The valley floors begin to narrow considerably and riparian conditions change to a less managed condition above the two end points on the East and West Forks.

This report does not include modeled nor expected water temperatures that may occur should changes in riparian vegetation or water use management be undertaken on the Illinois system. It is clearly documented in the literature that increasing flow volume and increasing stream shade will result in decreases in water temperatures (Brown, 1972).

The objective of this report is to discuss the current condition of the Illinois with regard to stream temperatures and to discuss potential trends and opportunities.

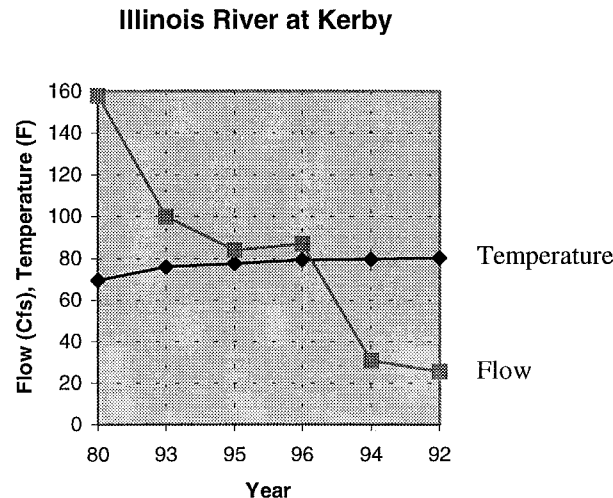
Results/Discussion

The existing condition of the main stem Illinois and many tributaries of the river is that they exceed State water quality standards for temperature (64 degrees Fahrenheit) for much of the summer (see Appendix A, Map 16). In general, the water is warmer as one moves downstream. The table below lists some summary data for the Illinois system. The data are arranged in the downstream direction.

Table. Temperature Summary for the Illinois River above Briggs Creek
Maximum 7 day average high temp (F)

Location	Year -->							
	1980	1992*	1993	1994	1995	1996	1997	1998
East Fork at Gauge near Takilma		73.6	70		69		70.3	69.9
East Fork at MZ's				73	71.2	71		74.1
East Fork at Mouth (Forks Park)		81.2				73.4	77.4	78.3
West Fork below Elk						74	75.8	76.7
West Fork above Rough and Ready						76.9	77.2	79.8
West Fork below Rough and Ready						77.9	79.2	81.4
West Fork at Mouth (Forks Park)		77.9				80.3	73.6	80.2
Illinois River below Pomeroy Dam		78.8						
Illinois River at Kerby Gauge		80.1	76	79.6	77	79.3	77.9	77.6
Illinois River at Store Gulch	69.4							
Illinois River above Briggs			73.1					
		* 5-Day average high						

The graph below is a plot of the 7-day maximum temperature against the average daily flow for that same 7-day period. The 1980 temperature is from the river at Store Gulch - several miles downstream of the Kerby gauge. A comparison of the average warmest daily temperature on the 7 warmest days of the summer versus flow shows that higher flow volumes are generally cooler. Note, however, that the temperatures vary little despite fairly large changes in flow. The 1980 data does not capture the hottest days of that summer; the recorder was vandalized after July 10th.



As mentioned, water temperature is strongly linked to flow and shading (Brown, 1972). The river is warming in the downstream direction and yet the amount of land area contributing water to the river is increasing. This reflects at least two other influences: loss of flow volume and heating that results from water being exposed to solar radiation. Declines in flow volume may be due to water withdrawals and/or surface water recharging groundwater. Water withdrawals and their influence on summer flow volumes are discussed elsewhere in this watershed analysis (see Water Resources Budget).

Exposure to solar radiation varies along the river corridor. The Potential Natural Vegetation Map (see Appendix A, Map 3) identifies the vegetation communities that could exist given soil and climate along the corridor. A review of soils mapping in the alluvial flats that underlie the river between its confluence with Reeves Creek upstream to the end points described earlier suggests that many of the alluvial soils found in this area are able to support mixed stands of Ash, Cottonwood, Ponderosa Pine, and in some places, Douglas Fir. Encouraging stand development within and adjacent to existing stands will trend temperature values towards cooling.

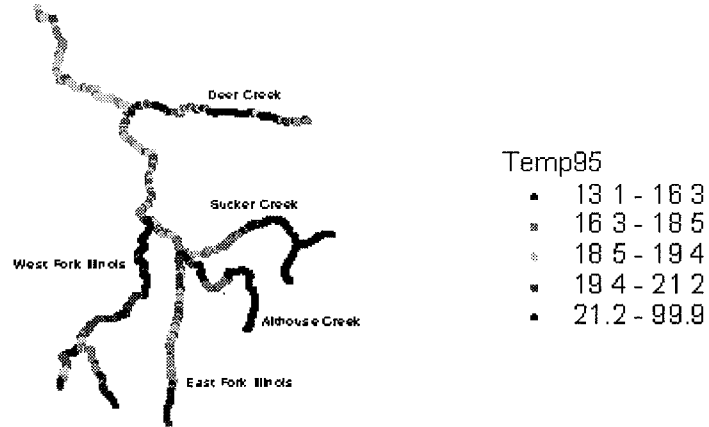
On August 30, 1995, the Illinois Valley Soil and Water Conservation District contracted with the University of Oregon to gather water temperature data using an infrared camera and a standard video. Reviews of the video reveals two primary conclusions:

1. Summer low flows are spatially isolated from riparian vegetation, e.g., the river 'snakes' between gravel bars or within a narrow portion of the larger canyon, and
2. There are numerous places where land management, especially agricultural uses, has resulted in a very narrow and/or non-existent band of riparian vegetation.

The wide variation between summer and winter flows results in the 'spatial isolation' discussed above. The average February flow is 1,625 cubic feet per second (cfs), the average August flow is 39 cfs. Given the shape of the river channel, this results in flows being very distant from much of the riparian vegetation. There are two places that have the least amount of riparian cover for relatively long distances: the Kerby Flats and the East Fork main stem.

Sediment transport, especially the frequency of gravel bars, results in situations where the river banks are less stable and less able to support a healthy, diverse riparian stand. Wide, shallow channels expose more flow volume to solar radiation than do narrow, deep channels carrying the same volume. Channel form will be discussed under the sedimentation section in the final version of this study. Additionally, human disruption of gravel bars, especially those surfaces that might otherwise revegetate, may also contribute to a decline in the amount and quality of riparian vegetation available for bank stabilization and shading.

The graphic below is one of the results of the infrared temperature monitoring. It shows the average temperature within each single frame of the video. Gathering the information occurred over several hours, so the graphic does not represent a single moment. The black tips at the upper ends of Sucker, Althouse, and Elk Creek represent places where the vegetation closed over the creek and the video was no longer able to record water temperatures. The temperatures are reported in Celsius; the table below gives a few figures in both metrics. It is important to note that by late August, stream temperatures are generally past their highest values.

Median Temperature - August 30, 1995

Fahrenheit	Celsius
55.6	13.1
61.3	16.3
65.3	18.5
66.9	19.4
70.2	21.2

There are several valuable pieces of information shown on this graph. The most basic observation is one that has been documented for some time: our coolest waters lie in the headwater drainages and the system gets progressively warmer downstream. Sucker, Elk and, to a lesser extent, Althouse Creek provide some of the coolest water to the system. The black dots in the lower end of Althouse are located in a reach of channel that is believed to have been created by mining activity in the 1800's. The Illinois is slightly cooler in the canyon portion past Deer Creek than it is through much of the Kerby Flats area.

The most cost effective and lowest risk solution will be to concentrate efforts on maintaining and improving Sucker, Elk and Althouse watersheds. I recommend that the second priority be efforts on the East Fork and the main stem below Cave Junction. At this point in time, based on this data alone, it would be difficult to prioritize work on the West Fork or in much of Deer Creek. It is recognized that any effort has a cumulative effect, however.

Reference

Brown, 1972. Water Temperature, Chapter III in Forestry and Water Quality, no pub.

