E. COLI IN THE URBAN SOUTH PLATTE RIVER WATERSHED

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ABSTRACT

The South Platte River, which originates in the Rocky Mountains, eventually runs through the center of metropolitan Denver, Colorado and north through agricultural plains. Since 1998, the watershed has been extensively monitored by the South Platte Coalition for Urban River Evaluation (SPCURE). In 2008, it was reported that there was little if any change of E. coli levels in the South Platte as it moved through the Denver metropolitan area. New research, using more sensitive data trend modeling and corrections for differences between analytical methods, can now distinguish an impact in the metropolitan area despite very noisy data.

The data collected from this ongoing study still demonstrates that the now implemented stream standard of 126 cfu/100ml will be difficult, if not impossible, to attain in the urban South Platte River watershed because of natural biological conditions. It also demonstrates the degree to which large sets of temporal and spatial data, are necessary to understand complex relationships in a watershed.

The USEPA uses E. coli measurements to determine the presence of human waste contamination in environmental waters. This is in spite of the fact that (1) E. coli represents only a miniscule fraction of bacteria in the human gut, (2) that many other warm blooded animals (and possibly fish) contain E. coli in their gut, and (3) E. coli are found in stream sediments (Russell & Mittal 2008).

Since 1998 SPCURE has been studying the urban South Platte River. The study includes a reach of about 60 miles; from a reservoir south of Denver, Colorado, and extending north through open agricultural areas. The SPCURE study has produced ~2,000 E. coli measurements in the river and its tributaries. The area of this study is shown in Figures 1a and 1b. An earlier study using SPCURE and USGS study data (Sprague, et. al. 2006) seemed to indicate that E. coli levels remained fairly consistent, on average through the metropolitan and agricultural region (figure 2a and 2b). However, a more recent study of the extensive SPCURE E. coli data set, using a more sensitive model and corrections for one sampling group's methodology, shows that there is an average increase in E. coli just north of metropolitan Denver before the South Platte River intercepts the effluent from the largest wastewater treatment plant in Colorado (Figures 3a and 3b, and Figures 4a and 4b). It is also observed that the average pattern of E. coli persists from year to year and may be spatially different depending on seasonal flow rates in the South Platte through Denver (Figure 5).

With enough measurements, even typically very noisy data, like river microbiology, distinct patterns can be observed.

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Figure 1a. The area of this study's focus in central Colorado.

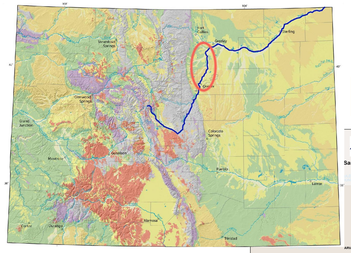
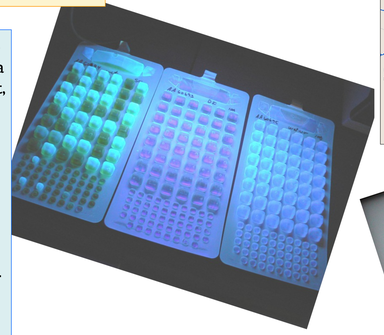


Figure 1b. SPCURE sample sites in the Denver urban South Platte River Watershed.



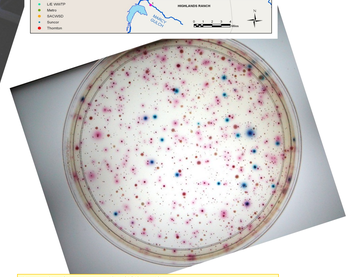


Figure 2a. Summary of SPCURE E.coli presented using a Least Squares model fit. The red arrows indicate the location of two major wastewater treatment facilities.

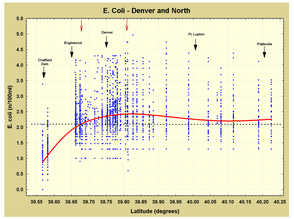


Figure 2b. Summary of USGS EUSE one year study comparing E.coli with the degree of urbanization from urban Denver, CO, (UII=100) to open Wyoming range land (UII=0).

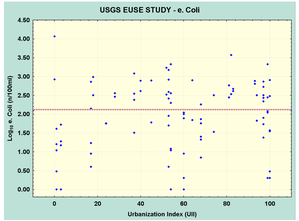


Figure 3a. Summary of SPCURE E. coli presented using a Lowess weighted running average model fit and correction for analytical method differences. From Englewood to Platteville (~55 miles), Denver centered at Cherry Creek.

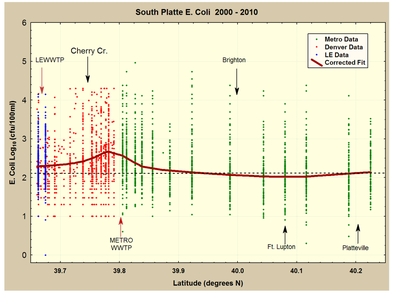


Figure 3b. Summary of SPCURE E. coli presented using a Lowess weighted running average model fit and correction for analytical method differences. Denver centered at Cherry Creek. Expanded vertical scale.

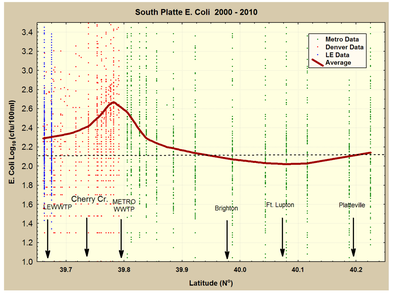


Figure 4a. Summary of SPCURE E. coli presented using a Lowess weighted running average model fit and correction for analytical method differences. Horizontal scale expanded from Englewood to Thornton (~20 miles), Denver centered at Cherry Creek.

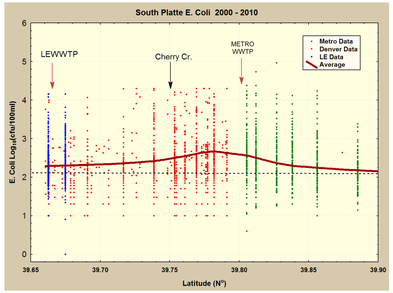


Figure 4b. Summary of SPCURE E. coli presented using a Lowess weighted running average model fit and correction for analytical method differences. Horizontal scale expanded. Denver centered at Cherry Creek. Expanded vertical scale.

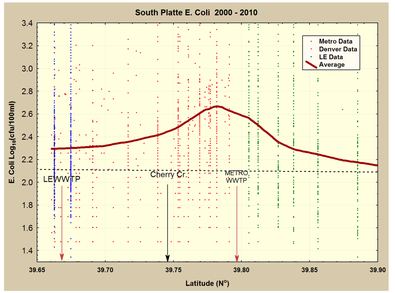
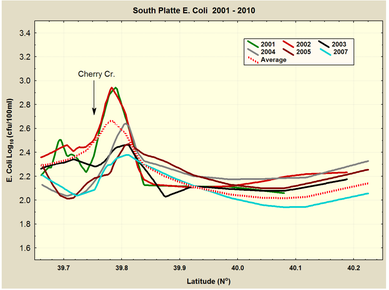


Figure 5. Yearly summaries of SPCURE E. coli presented using a Lowess weighted running average model fit and correction for analytical method differences. Denver centered at Cherry Creek. Expanded vertical scale. 2001 and 2002 were notably dry years producing unusually low flows in the urban South Platte.



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Sprague, Lori A, et. al. 2006. *Effects of Urbanization on Stream Ecosystems in the South Platte River B Basin, Colorado and Wyoming.* U.S. Geological Survey, Scientific Investigations Report 2006-5101-A. U.S. Geological Survey, Reston, Virginia.