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Patterns and sources of anthropogenic contaminants in the Otter Creek watershed, Madison County, Kentucky

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Stream systems are often affected by anthropogenic contaminants that affect water quality and stream ecosystems. Land use determines the type and quantity of contaminants present in natural waters. The Otter Creek watershed (170 km²; Madison County, Kentucky) consists predominantly of pasture and rural housing, with some cropland. The basin also receives runoff from the town of Richmond and a sewage treatment plant operates within the watershed. We measured concentrations of nutrients (phosphate, ammonium, nitrate) and fecal microbes to discover levels of anthropogenic contaminants affecting water quality and to identify contaminant sources.

We sampled 4 times in the summer field season of 2015 over a variety of conditions. Water samples for nutrient analysis were pressed through a 0.45 µm filter, placed in pre-acidified vials, and measured one or two days after collection. Nutrients were measured colorimetrically using established methods. Microbial samples were collected in sterile containers, placed on ice in the field, and then transported to the lab where they were spiked with Colilert-18 media. Samples incubated overnight at 35°C, and *Escherichia coli* were quantified using IDEXX rapid-assay techniques.

Phosphate (0 – 0.5 mg/L) and ammonium (<0.1 mg/L) concentrations were low for all sampling days, whereas nitrate was the dominant anthropogenic nutrient contaminant showing concentrations of 1 – 3 mg/L. Consistently higher levels of phosphate and nitrate were found in the waters of Dreaming Creek, which drains urban Richmond. High ammonium levels were sporadic and associated with pasture. High *E. coli* counts occurred in Dreaming Creek, the upper reaches of Otter Creek, and proximal to pastures.

Both point- and non-point sources exist for contaminants. The sewage treatment plant is a definite point source for nitrate and less so for phosphate and ammonium. High concentrations of nitrate, phosphate, and fecal microbes occur along Dreaming Creek, likely due to leaky sewage distribution pipes. Spikes in ammonium concentration are sourced from cattle pasture.

We also tested contaminant levels immediately before and after a rainfall event associated with tropical storm Bill. Phosphate and ammonium levels decreased, whereas nitrate increased significantly. *E. coli* counts also increased dramatically.