Status of the Watershed

OZARKS WATER WATCH

A REPORT FROM THE OZARKS WATER WATCH FOUNDATION
ON WATER QUALITY IN THE UPPER WHITE RIVER BASIN

DECEMBER 2011

How's the Water?

Ozarks Water Watch is happy to present our fourth annual Status of the Watershed report designed to answer the question, "How is the water?" in the Upper White River basin. The rivers, lakes and streams in southwest Missouri and northwest Arkansas establish a foundation for the region's economic prosperity and attractive lifestyle. If these waters become polluted or spoiled by unconstrained growth and development, they will diminish the vibrant economy, discourage visitors and tourism, and compromise the enjoyment so many in the region now find in these natural assets.

Historically this report has been based only on scientific studies of water conducted by the U.S. Geological Survey (USGS) and science faculty from the University of Arkansas and Missouri State University. This water quality data is definitely the gold standard. But as we all realize, conducting monitoring at that level is expensive and limits the number of sites that can be monitored. Ozarks Water Watch is embarking on a new project that will combine other sources of water quality monitoring along with USGS data. This will include a program to build on and expand the highly successful volunteer-based Stream Team effort in both Missouri and Arkansas. Properly trained volunteers can provide reliable and valuable water quality data over a large number of sample sites providing for a higher resolution picture of how our lakes, streams and rivers are doing at any given place and time. While this year's report already includes additional data sources, Ozarks Water Watch will expand and refine our monitoring efforts to continue to bring you the best possible information on our basin's water quality.

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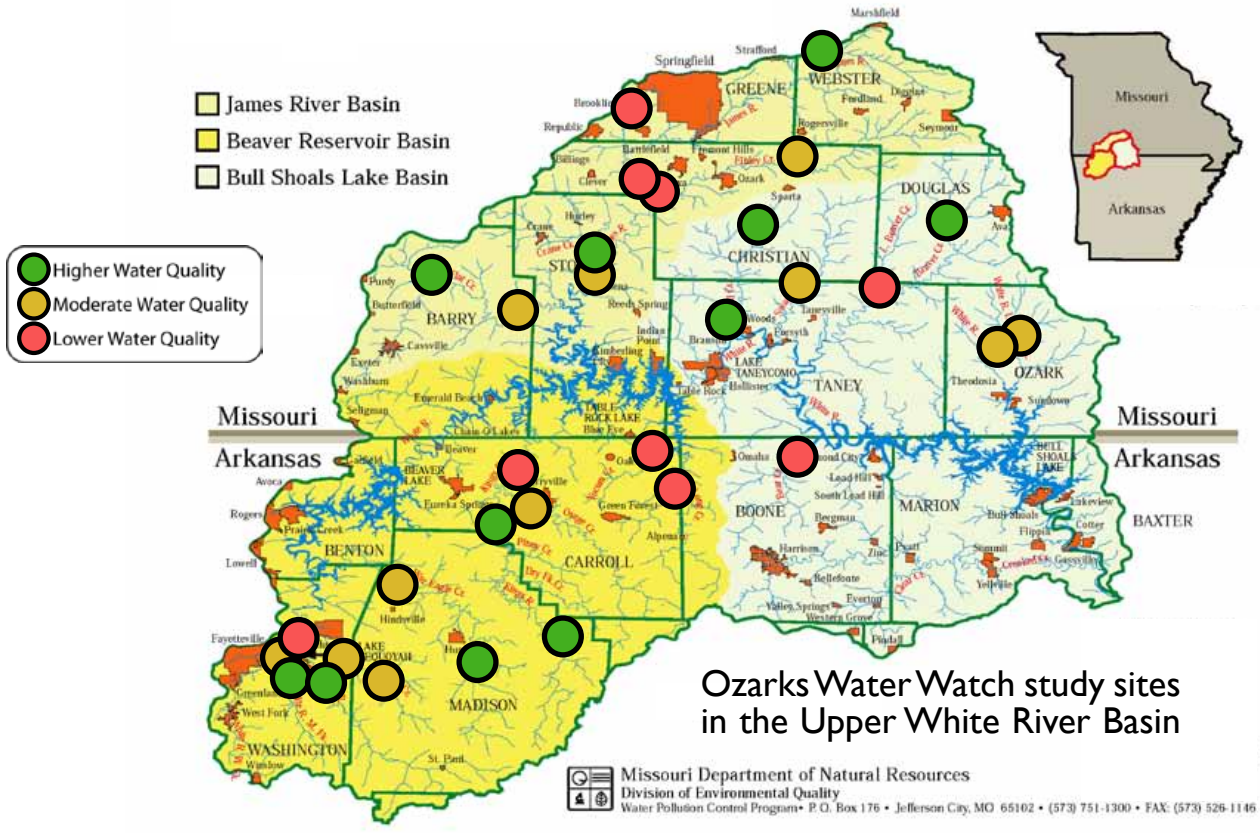
This report summarizes three years of biological monitoring by the University of Arkansas and laboratory testing by the United States Geological Survey (USGS) within the Upper White River Basin. The 14,000 square mile basin reaches across 19 counties in Arkansas and Missouri and is home to a million people.

According to the USGS data, nutrient pollution is the biggest water quality problem facing the region. Nutrient pollution comes from many sources and drives the growth of the algae that can choke our streams and lakes. Urban and suburban areas contribute polluted runoff from streets, sidewalks, buildings, overfertilized lawns and bad development practices. Runoff from agriculture in rural areas carries nutrients and sediment to streams and lakes. While wastewater treatment methods have improved, many systems have yet to be upgraded and continue to discharge high-nutrient effluent into our waters

Water quality at the James River south of Nixa, MO (near Boaz) and Yocum Creek near Oak Grove, AR ranked in the poorest category for both biological and laboratory testing. Urban impacts are likely to blame for the poor water quality at the James River site, while agricultural practices are probably responsible for the poor water quality in Yocum Creek.

Concentrations of the nutrient phosphorus have declined in the James River at Boaz thanks to improved wastewater treatment techniques and other nutrient control measures taken by the communities in the watershed. That's a great start but we still have a long way to go. For example, in the James River at Galena (south of Boaz) concentrations of the nutrient nitrogen have increased. Reducing nutrients in our streams should be our highest water quality priority.



All of the sites we monitored reflect the negative influence of humans. Water quality in the upper White River basin needs to improve.

Invertebrate Monitoring

Between December 2008 and February 2011, University of Arkansas researchers visited 30 sites in the watershed to count and identify the small creatures that live on the stream bottom. These creatures, called invertebrates, reflect the health of the stream they live in. By combining four different approaches that highlight certain qualities of the invertebrate community, we can gauge water quality.

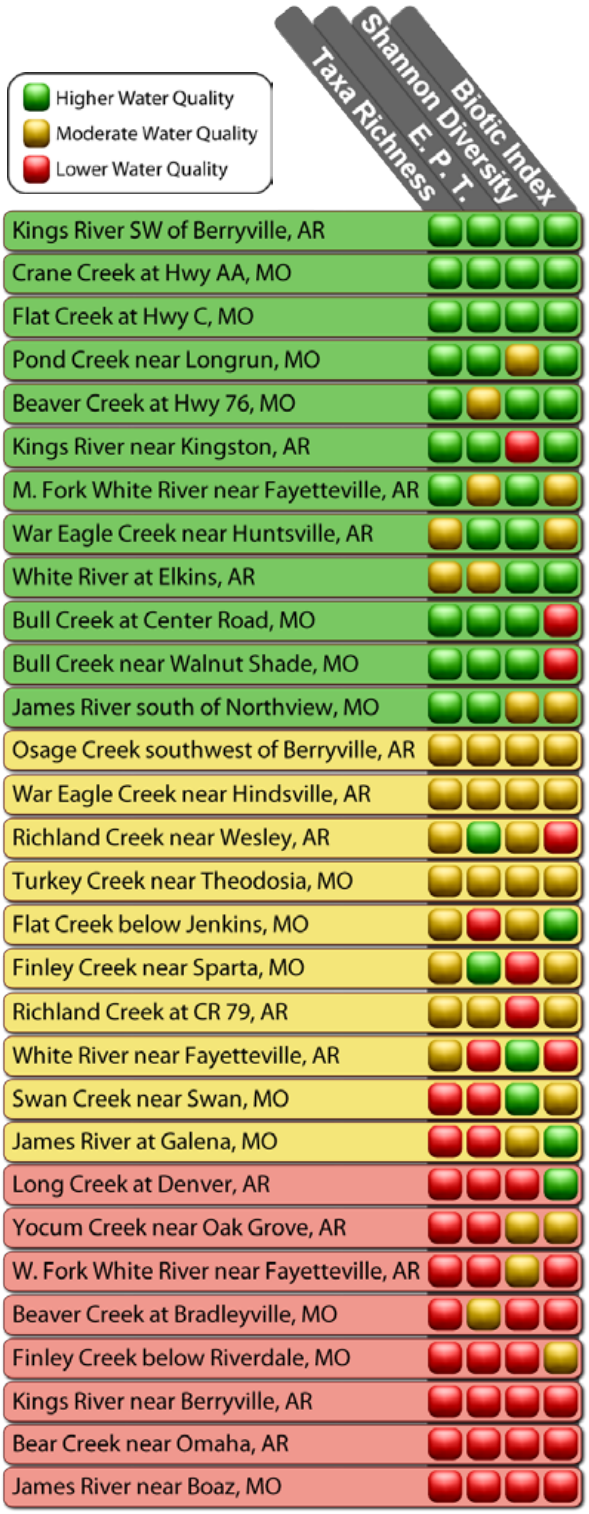
To determine which stream locations need the most help, we ranked them based on their invertebrate index scores. Sites are identified as having higher, moderate or lower water quality.

In order to compare water quality across the watershed, we ranked the 30 sites based on their score for each of the invertebrate indices. For the table on the facing page, we separated the sites into thirds to identify the best and worst sites based on each index. If a site's score is in the top third for a given index it is identified with a green box, yellow for the middle third and red for those sites that ranked the worst. The background color indicates the general overall ranking based on the combination of all four indexes.

Three sites (James River at Boaz, Bear Creek near Omaha, and Kings River near Berryville) scored in the bottom third for all four indices, meaning water quality was the worst at these sites. There is little diversity at these sites and the invertebrate community is dominated by pollution-tolerant species.

Flat Creek at Highway C, Crane Creek at Highway AA and the Kings River southwest of Berryville ranked in the top third in all four indexes. There is more diversity at these three sites than the previous three sites, and the water quality allows for the presence of a greater number of pollution-sensitive species.

U.S. Geological Survey/photo by Jennifer Graham



Taxa Richness:

This analysis estimates stream health by looking at the diversity within the invertebrate community. Streams with high water quality tend to have many types of aquatic invertebrates, while streams with poor water quality may be limited to a small number of pollution-tolerant invertebrate groups.

EPT:

The EPT analysis is similar to the Taxa Richness method except if focuses on only three major groups of invertebrates: mayflies (Ephemeroptera), stoneflies (Plecoptera) and caddis flies (Trichoptera). These three groups are generally sensitive to pollution.

Shannon's Diversity:

This index takes into account the "evenness" of the invertebrate community. Streams where one or two groups of invertebrates dominate the total number of individuals in the community generally have lower water quality than streams where there is balance among groups.

Biotic Index:

The Biotic Index estimates water quality by assigning each invertebrate group a score based on its sensitivity to pollution. Sites dominated by pollution-tolerant invertebrates have poor water quality, while sites with pollution-sensitive invertebrates have good water quality

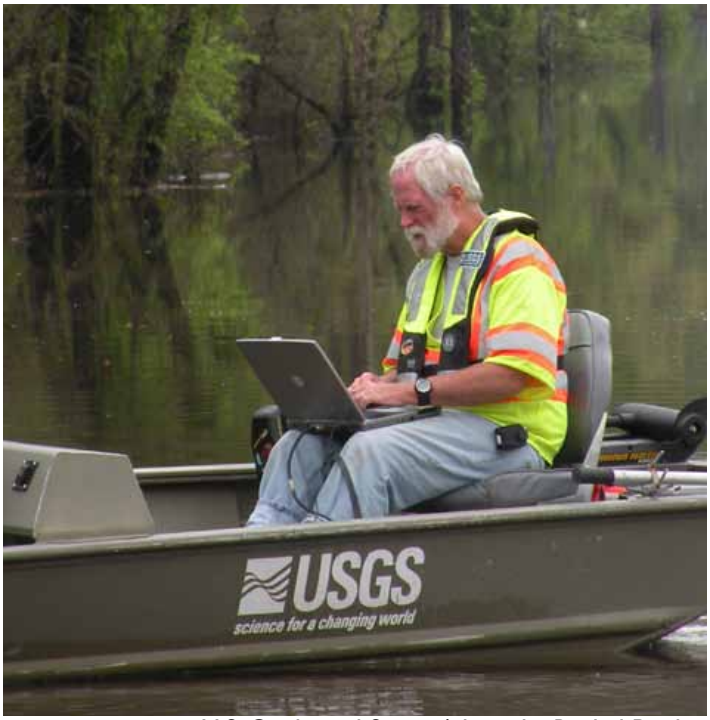
Depending on where the samples were collected, invertebrate communities in the Kings River were among either the best or worst in the region.

Water Monitoring

Water quality in the basin is directly assessed using stream and river data collected from 12 USGS gauging stations. For this report, we looked at dissolved oxygen, E. coli bacteria, total phosphorus and total nitrogen. These measures of water quality warn us about the problems that can impair aquatic life and the pollution that can endanger recreational users.

Water quality at the 12 sites was evaluated based on the percentage of observations that did not meet criteria. The criteria were as follows:

- Dissolved oxgen values greater than 5 mg/L and below 110% of saturation (State of Missouri criteria)
- E. coli counts of 126 “colony forming units” and lower (State of Missouri criteria)
- Total nitrogen values 0.46 mg/L and lower (EPA-recommended criteria)
- Total phosphorus values 0.01 mg/L and lower (EPA-recommended criteria)



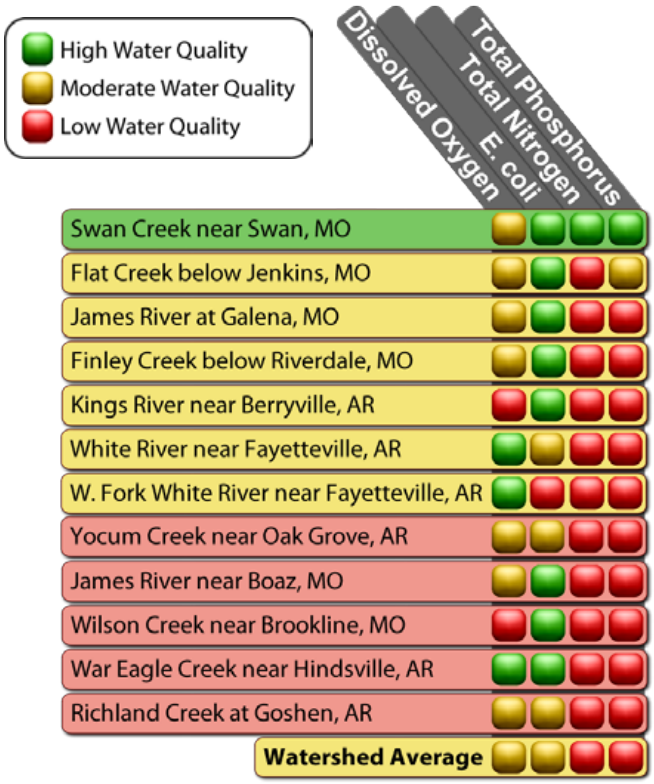
U.S. Geological Survey/photo by Rachel Pawlitz

The table on the facing page shows the 12 USGS sites and their score rankings for each water quality measurement. If a site met criteria in 100% to 75% of observations, it was given a “high” water quality rank (green box). If a site met criteria between 75% and 50% of observations it was given a “moderate” water quality rank (yellow box). If a site met criteria in fewer than 50% of observations, it was given a “low” water quality rank (red box). The average for each site determined the background color.

Dissolved oxygen values indicate low water quality at Wilson Creek and the Kings River near Berryville. Water quality was moderate at seven sites and high at the three remaining sites. Dissolved oxygen was too high in most of the samples not meeting criteria, suggesting excessive algal growth on the stream bottom.

E. coli counts indicate low water quality at Wilson Creek, moderate water quality at three sites and high water quality at the remaining eight sites.

With the exception of Swan Creek, all sites showed evidence of nutrient pollution. Nitrogen concentrations at 11 sites and phosphorus concentrations at 10 sites indicate low water quality. Flat Creek phosphorus values were within the moderate range. According to the data, excessive nutrients are the biggest problem in our Ozark streams.



Additional data received from the Beaver Water District show similar water quality at eight stream sites.

Dissolved Oxygen:

Aquatic life requires the correct amount of dissolved oxygen to breathe. Low levels can result from high inputs of organic material entering the stream or certain chemicals that reduce dissolved oxygen through chemical reactions. Extreme levels of dissolved oxygen can result from excessive algae growth.

E. coli:

E. coli are a group of bacteria associated with the fecal material of warm blooded animals, including livestock, wildlife and humans. While most E. coli are harmless, elevated levels of the bacteria indicate fecal contamination of the waterway and the possible presence of dangerous microbes.

Total Phosphorus and Total Nitrogen:

These two nutrients act as fertilizers in our waterways, promoting the growth of algae in streams and lakes. While phosphorus and nitrogen occur naturally, human activities in the basin can degrade water quality by contributing excess nutrients. Phosphorus and nitrogen are abundant in sewage effluent and runoff from city streets, residential yards and agricultural areas.

High nutrient concentrations are the primary cause of impairment in the watershed. Only Swan Creek met EPA recommended nutrient criteria at least 75% of the time.

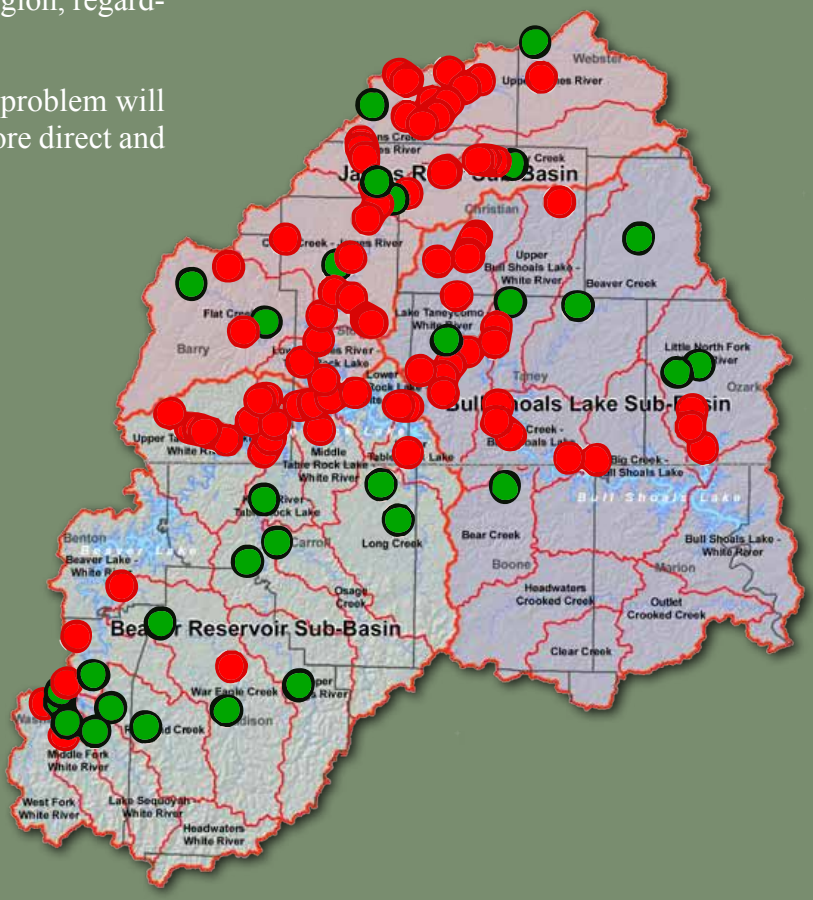
The Future

The water quality problems of the region start and end with us. We created the issues by working and living in the watershed. The roads we drive on, the farms where our food is grown and even the homes we live in contribute to water pollution. By taking ownership of the problem we can begin to fix it.

In the coming years, Ozarks Water Watch will be using volunteers to monitor water in the region. By doing this, we will be able to monitor MANY more sites without increasing costs. Moving in this direction will also give us the opportunity to partner with exisiting citizen science groups as Missouri Stream Team, Arkansas Stream Team, Lakes of Missouri Volunteer Program and Beaver Water District, to name just a few.

Volunteer water quality monitoring methods differ for each program. Differing methods makes comparing data difficult, so in addition to their regular duties, OWW volunteers will also collect water samples to be laboratory-analyzed by professional scientists. This will allow us to accurately compare data across the entire region, regardless of the volunteer protocol used.

As we collect more data, our picture of the problem will become clearer and our solutions will be more direct and cost-effective.



Ozarks Water Watch study sites (green)

Volunteer sites monitored in 2010 (red).