Acidification of the Mulberry River?

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Introduction

The Arkansas Department of Environmental Quality listed the Mulberry River as impaired for pH in 2008. Typically rivers and lakes have a pH between 6 and 8, however, some of the pH values in the Mulberry River have been lower than that, indicating that the river may be acidifying.

Acidification of lakes and rivers in certain areas of the U.S. is fairly common. These areas include the Adirondacks, the Appalachians, the Catskills and the upper midwest. The geology of the Mulberry River basin is similar to these other areas in that it is dominated by sandstone and shale, with little or no surface limestone. In other Arkansas watersheds, such as the Buffalo River, Illinois River and White River there are plenty of surface limestone deposits, which buffer acidity.

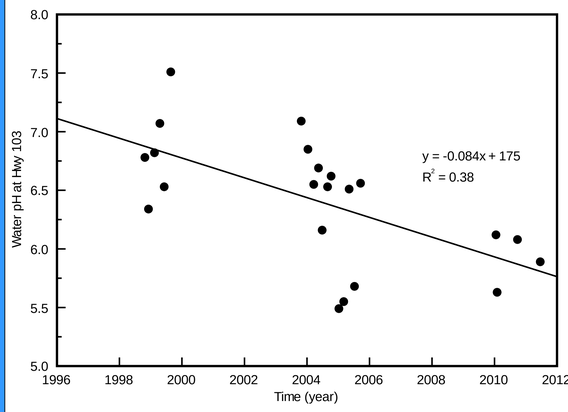

Figure 1 - The pH of the Mulberry River has been decreasing during the past few years. If it keeps dropping at the current rate, then in just 7-8 years the pH will decrease to pH 5, at which point fish eggs don't hatch. These measurements were made by the Arkansas Department of Environmental Quality (ADEQ) where Hwy 103 crosses the Mulberry.

Figure 2 - This graph shows the water pH that is survivable for different aquatic organisms. Note that at pH 5, perch and frogs will survive, but bass, crawfish, snails and mayflies will not. It should be noted that even though perch will survive at pH 5, their eggs will not hatch. Also, under acidic conditions the food sources of fish (bugs, crawfish, etc.) will be greatly affected.

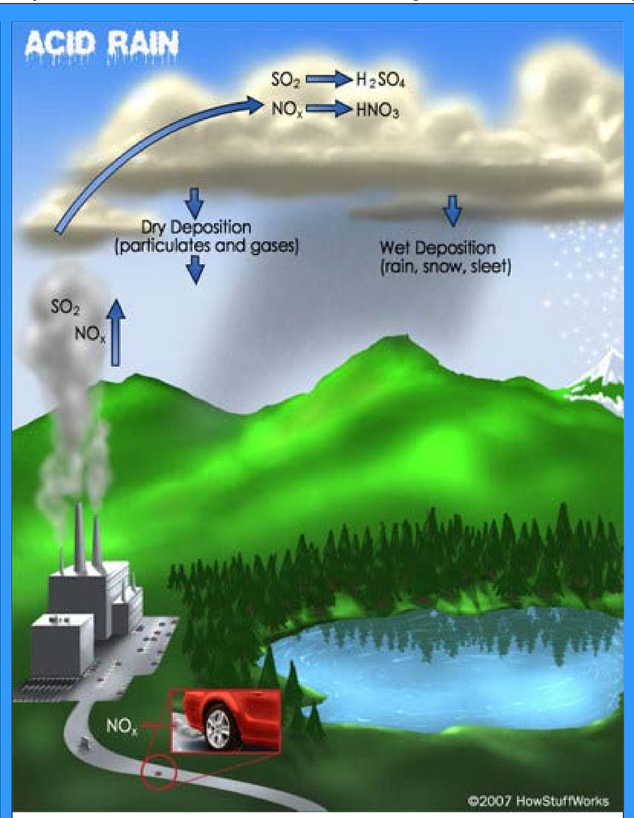

Figure 3 - Acid rain is formed when fossil fuels are burned, which release SO_x and NO_x compounds into the atmosphere. These compounds are converted to sulfuric and nitric acid, which acidifies soils, rivers and lakes. Acid precipitation in this area of Arkansas is as high as that in the Appalachians where lake and river acidification is well documented. Other potential sources of acidification include atmospheric ammonia, which is nitrified in soils causing acidification, and converting forests from hardwood species to pine, which can acidify soils.

As a result of the findings of the ADEQ on the Mulberry, the study "**Spatial and temporal variability in pH and water chemistry of the Mulberry River**" was initiated in February, 2014.

Objectives: The objectives of this research are: (1) to survey the spatial and temporal variability in pH and water chemistry in the Mulberry River and its tributaries, and (2) try to determine if there is a point source of acidity.

Materials and Methods: Water samples were taken from 48 locations on the river and from the major tributaries. The samples will be analyzed for EC, pH, acid neutralizing capacity (ANC), titratable acidity, total C, inorganic C, total N, alkalinity, metals (Al, As, B, Ca, Cd, Co, Cr, Cu, Fe, K, Mg, Mn, Mo, Na, Ni, Pb, Se, Si, Ti, and Zn), dissolved TC, dissolved IC, dissolved TN, sulfate, chloride, nitrate, ammonium, and SRP. Based on the results of this first survey, ten sample locations will be identified for long-term monitoring.

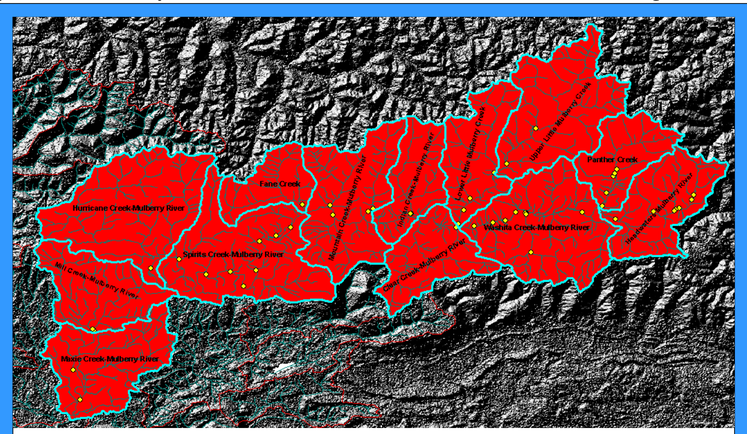

Figure 5 – Map of the Mulberry River sub-watersheds. Yellow points indicate the 48 sampling locations used for synoptic survey.

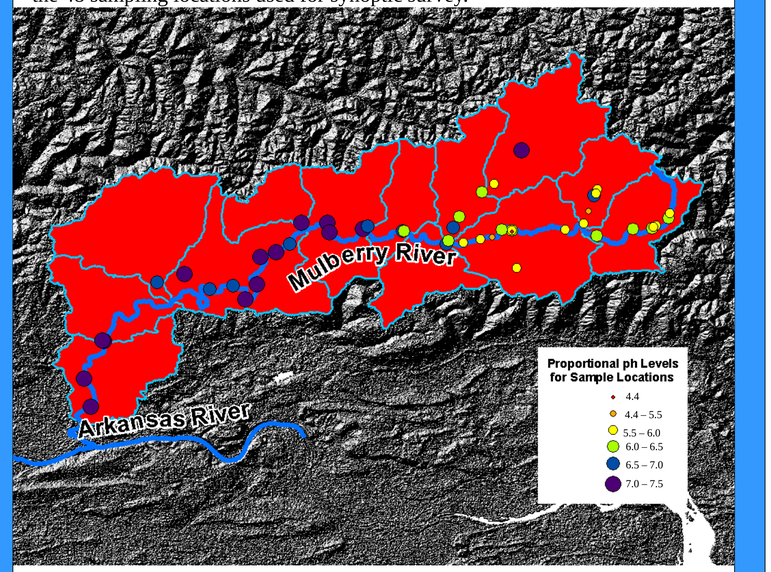

Figure 6 – Map of pH values measured in the river and various tributaries. Smaller points indicate higher levels of acidity.

Figure 7 – Water samples were taken at each location and measurements of pH, electrical conductivity, and temperature were made. GPS readings were also made.

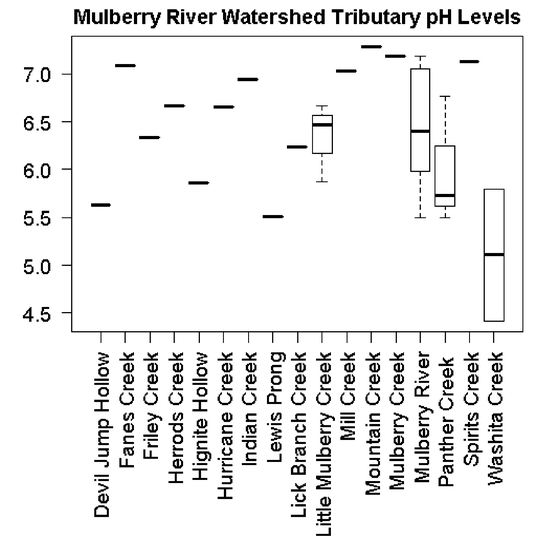

Figure 8 – pH of the Mulberry River and selected tributaries. Lower numbers indicate higher acid levels. Washita Creek was the most acid tributary.

Conclusions

• At this point we are uncertain whether the river is really becoming acidic or not.

•The Arkansas Department of Environmental Quality (ADEQ) has listed the Mulberry River as "impaired" for pH. If the trend of acidification is real and continues, then in 7-8 years the pH could be 5. At pH 5, most fish eggs will not hatch.

• Data from our synoptic survey indicated that Washita Creek had the lowest pH. This tributary enters the Mulberry just upstream from Highway 103, which is the location that ADEQ has been sampling.

• We plan to start a long-term study on the Mulberry River where multiple locations will be sampled on a monthly basis.

• We also plan to write grants for future research to determine the source of this acidity.

What are the solutions?

If the river is becoming acidified, then a fix needs to be put in place before that happens or the ecology will never be the same.

The best fix may involve adding lime to the river. There are numerous ways to do that, but the most cost-effective, reliable method is to set up a liming station that slowly trickles in a limestone slurry at a rate needed to buffer the water pH around 6 or higher.

These stations are both expensive to build and to operate. However, they are being built in the northeastern U.S. and in many countries in Europe, so there is no reason that it could not be done on one of our Nation's Wild and Scenic Rivers.

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