Blue Thumb Volunteer Monitoring Data Review
Compiled by: Kay Frank
December 13, 2010

Spring Creek: Fram

Spring Creek, in Cherokee County, OK, at Willow Branch Farm

NW NE NW SE Section 15-19N-22E
Lat N 36° 07' 31.7"
Long W 94° 56' 47.9"
Cherokee County, Oklahoma
WBID#: OK 121600-01-0290R

Setting and History

Spring Creek is a typical Ozark stream, clear with a gravel bottom. Headwaters are near the town of Kansas, OK. It flows through Delaware, Cherokee, and Mayes Counties into the Neosho River, which eventually empties into Lake Fort Gibson. It is thus part of the Grand River drainage and under the legal jurisdiction of the Grand River Dam Authority, unlike most other Oklahoma streams. Although close to the Illinois River, it is not part of the Illinois River watershed.

It is located in the Ozark Highlands ecoregion. Climate is typical of northeast Oklahoma, although temperatures are frequently a few degrees lower than Tahlequah's and first frost and last frost usually about two weeks earlier and later, respectively.

This sampling site, about 15 miles from the headwaters, is the most upstream of three current Blue Thumb sampling sites on Spring Creek. There are also historical data from at least two other Blue Thumb Spring Creek sites, and fish collection data from several earlier sources. At this site, the creek has drained about 50 square miles, or one third of the total Spring Creek watershed (about 150 square miles).

Willow Branch Farm is located at the northern edge of Cherokee County. The site and the watershed above it are mainly second-growth oak-hickory woods and agricultural: haying, a few cattle, an organic farm, individual farm houses with old septic systems, and the small communities of Oaks, Kansas, Lowrey, and Twin Oaks (total population about 1200). Three of these communities have rural schools.

The monitoring site is roughly in the middle of the 400-meter section of the creek used for habitat assessment. This point is just below the entry, from the south, of a year-round tributary ("Willow Branch") through a small wooded wetland draining four small (< one acre) ponds of a former fish farm. Above the ponds, the tributary (about 3/4 mile?) drains steep wooded hillsides, currently undisturbed (last 30 years), although probably frequently cut for firewood within the last 100 years. There is one house, with a septic system, on the tributary.

Spring Creek flows all year round, although in dry summers pools form and the flow goes under the rocks in places. Normal depth is 6" to 24", with some pools up to 7' deep.

The south edge of the creek has a good deal of bedrock and comes down steeply. The north side is an extensive flood plain above a 3-foot bank. Thus floods spread out to the north, reducing the damage to the south banks.

During floods (more the last three years) water level has risen as much as 10 feet above normal. Flooding causes extreme changes in shape and relative depths, as large trees wash downstream with heavy loads of gravel. However, overall the general shape of the banks has been pretty constant over the past 30 years (my own memory). The stream does seem slightly wider and shallower.

There is an old trash dump (1950's and earlier) embedded in the south bank. Floods unearth more old glass, metal and plastic every spring.

According to a local resident who lived his whole life here (R.C. Forrest), the water level fluctuations (both flooding and drying) are much greater than earlier in the 20th century, including Dust Bowl days. Past agricultural use along the stream banks included cotton and corn in the 20's and 30's.

Habitat Assessment

The 400-meter habitat assessment done at the monitoring site on September 2, 2008, indicated the following:

1. good instream cover, with a diverse assortment of hiding places for small living organisms (bugs and fish): logs, bunches of sticks, and irregular rocks and gravel pockets;

2. a variety of pool shapes and depths;

3. good riparian cover along both banks, (a) for shading the water in summer, (b) for energy input to the stream ecosystem, and (c) for maintaining a diversity of adult forms of insects whose larval forms are part of the stream ecosystem;

4. many riffles, where the water is exposed to surface oxygen, necessary for healthy instream life; and

5. stable banks, once floods subside (although these are becoming slightly less stable as flooding events increase).

The stream is fairly straight at the sample site and seems to have maintained its shape over the past 100 years. There are two "permanent" big bends, one above and one below the site, probably created by surface bedrock. Fish and other vertebrates hang out in deep pools at these bends.

Flooding alters the channel substrate and pool bottom substrate about 4 to 6 times per year, nowadays, bringing in new rocks and gravel (and new fossil crinoids and brachiopods to discover!). Vegetation on the point bars (willow, mullein, jewel weed, Polygonum, etc.) either

survives or reappears quickly so riparian cover remains. Apparently macroinvertebrate populations tend to survive under the rocks.

These data agree with my overall subjective perception of average stream habitat conditions. The overall habitat score was 119, which is considered high quality, compared to a typical high quality Ozark Highland Reference stream score of 122.

Fish

Fish were seined on September 2, 2008 from the same 400-meter section. The condition of the fish community is based on the total number of species found, the Shannon-Weaver Index of diversity, the proportions of sensitive bottom species, the proportion of species intolerant of environmental stress, and the proportion of cyprinid insectivores in the sample. An overall score of 0.93 compared to a typical high quality Ozark Highland Reference stream score of 1.00 estimates fish quality of Spring Creek at this site and time as "A" (pristine).

Specifically, the sample contained 14 species, but 83% of the individuals at this time were cardinal shiners. There were 4 benthic species sensitive to poor conditions (fantail and orangethroat darters, madtoms, and sculpin). There were 2 sunfish (bass) species, in spite of the unstable gravel bottom. They might be repopulating the creek from the abandoned fish ponds where nests are visible every year. Seventy percent of the species were intolerant of environmental stresses; only 1 species (largemouth bass) is considered tolerant. Stonerollers, chub, and orangethroat darters are considered to be somewhat tolerant.

The proportion of insectivorous cyprinid individuals (shiners and minnows) in the sample was very high, 85%, indicating plenty of insects must be present as food, and suggesting that these insects are keeping the algae under control, as is visibly apparent.

The Shannon-Weaver index of diversity was only 0.80 as compared to 1.91 for the reference high quality stream. Since the total number of species present was good (14 as compared to 17 for the reference), the low S-W index is probably a reflection of the very high abundance (83% of individuals) of one species (cardinal shiners), which skewed this particular sample.

Macroinvertebrates

Macroinvertebrates have been collected from riffles at this site from Winter, 2000, up to the present. This summary is based on data through Summer, 2008, for a total of 15 samples, lacking 3, possibly due to either floods or droughts. Variability of the summary indices is much greater among all samples than between winter and summer. This is probably due to variability of physical habitat at the times of sampling more than to overall stream quality. Flooding can occur any month from September through June. Drought tends to be most severe in August of dry years. Some insects survive these stresses deep under the gravel; others have their populations severely reduced.

Taxa richness, a measure of the number of individually separated taxa (usually genera), varies from 9 to 20, with two thirds of the samples being 19 or 20, compared to the average values in the high quality reference stream of 20 to 22.

The HBI Score (Modified Hilsenhoff Biotic Index) measures the invertebrate community's tolerance to organic pollution. Lower index numbers thus represent less tolerance, or more sensitive organisms in the samples. In general, Spring Creek's HBI Scores are higher than the high quality reference stream's scores, indicating a significant presence of organisms somewhat tolerant of organic pollution. (However, chemical measures of phosphorus and nitrogen are consistently low, (see below).

The Shannon-Weaver Diversity Indices vary from 1.92 to 3.55 among all the samples, compared to something between 2.31 and 2.51 for the reference stream. In total, Shannon-Weaver diversity was lower than the reference average value in only 2 of the 15 samples, in winter, 2004, and winter, 2008. This indicates good diversity within the macroinvertebrate community most of the time.

Overall grades for the stream quality as measured by the macroinvertebrate community varied from "A" which is best down to "C" which suggests loss of the most intolerant forms. Nevertheless, caddis fly larvae and stonefly nymphs, groups very sensitive to water quality, continue to be present in most samples.

Chemical Testing

Water quality has been tested for seven chemical parameters since July, 2001, up to the present. The parameters are early morning dissolved oxygen, pH, chloride, orthophosphate phosphorus, and nitrogen in the forms of nitrate, nitrite, and ammonia. This summary refers to data collected through April, 2009, but nothing obvious has changed since then.

1. Oxygen

Since the creek is generally shallow, contains many riffles, and has no significant chemical or biological oxygen demand, oxygen concentrations, measured between 8 and 9 a.m., about 6 inches below the surface, is usually near saturation or above. Occasionally it drops to 80% or 90% in still pools in late summer. In any case, dissolved oxygen concentration is never a limiting factor in this part of Spring Creek.

2. pH

Measurements of pH range from 7.0 to 7.5 and must be buffered in some way as it does not vary much at all.

3. Nitrogen

Soluble nitrogen is generally low at this site. Ammonia Nitrogen and Nitrite are always Below Detectable Levels. Nitrate levels are usually at 0.5 to 1.0 mg/L nitrogen as indicated by the color match. Earlier measurements, before August, 2005, using a different testing method, were similarly low, usually below 0.5.

4. Phosphorus

The level of orthophosphate phosphorus is normally low, generally at or below 0.05 mg/L.

It is reasonable that nitrogen and phosphorus levels might rise after a flood, but these events might be too temporary to be reflected in these data. Potential sources of excess nitrogen or phosphorus would likely be from cattle or rural septic systems upstream. There is probably little application of fertilizer in the watershed.

5. Chloride

Chloride concentrations are consistently low, at 10 to 15 mg/L, although there have been occasional spikes to 20 (7 readings).

Bacteria

Spring Creek has not been tested for the presence of coliform bacteria at this site.

Conclusion

Spring Creek is a very healthy stream.