exceeded orthophosphate, phosphorus, and aluminum. BUFF 14.6 was located downstream of a wastewater treatment plant, which could be a possible source for the higher phosphorus and orthophosphate values. It also has land application of biosolids in the headwaters (PADEP, 2005), which may be a possible source for the aluminum. Little Buffalo Creek also had nitrogen and nitrate-n levels slightly above background concentrations. The site located in Little Buffalo State Park, LBUF 2.1, had moderately impaired macroinvertebrate conditions, possibly a result of disturbance in the well-used park and because the site was located downstream of the dam. Even though the site at the mouth was located downstream of a concrete plant and quarry, the macroinvertebrate community was nonimpaired. The habitat at LBUF 0.1 was rated supporting due to a more urbanized environment that affected channel alteration, condition of banks, and riparian vegetative zone width.

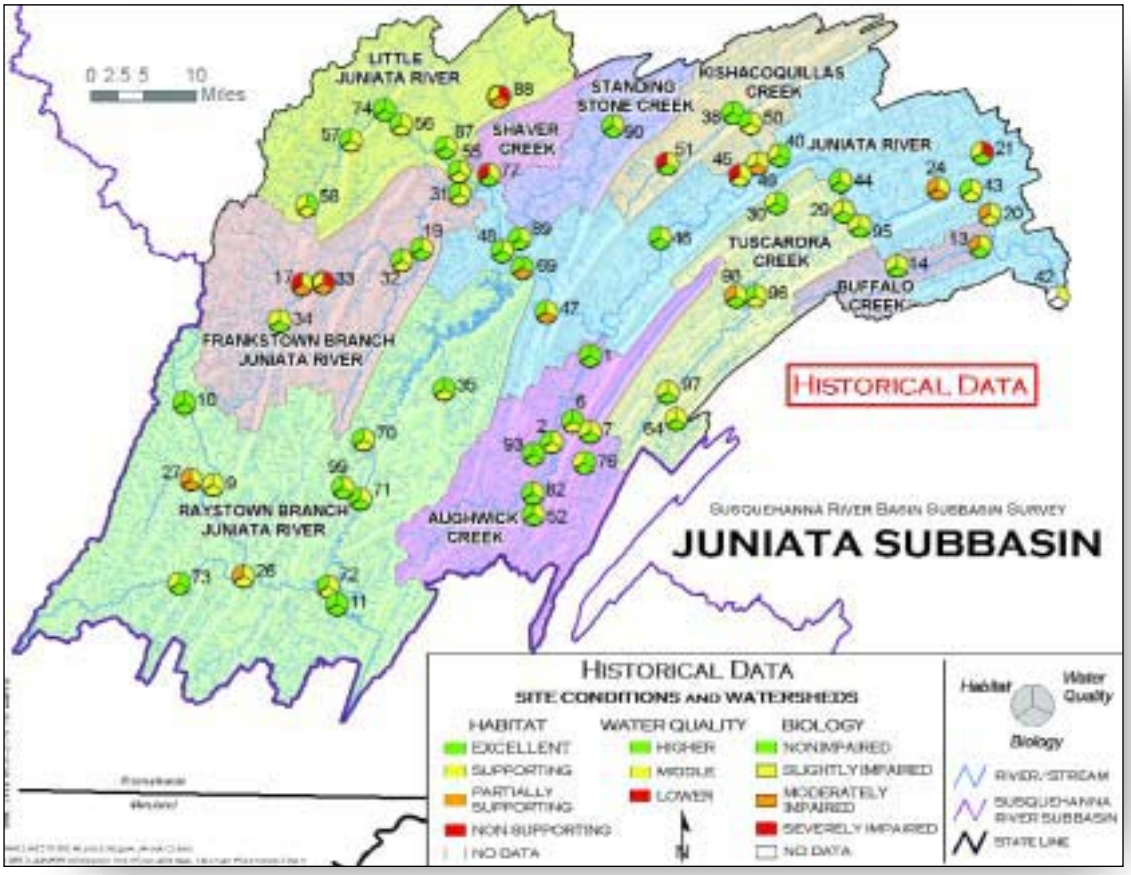

Figure 7. *Water Quality, Biological, and Habitat Conditions in 1995 Sample Sites in the Juniata Subbasin*

JUNIATA RIVER MAINSTEM

Water quality conditions for the Juniata River are depicted in Figures 5 and 6. The mainstem was not sampled for macroinvertebrates on account of high flows. The seven sites dispersed throughout the Juniata River were all rated "middle" quality, and all had nitrogen and nitrate-n values slightly greater than natural background concentrations.

Comparison of 1995 and 2004 Data

A comparison of historical Juniata Subbasin data from 1995 and the current survey data from 2004 indicated that the biological conditions have remained relatively the same. The results for water quality, biology, and habitat conditions in the 1995 Juniata Subbasin Survey are depicted in Figure 7, and the sites that were sampled in 1995 and 2004 are in blue print with an asterisk in Appendix A. The methods have changed slightly throughout the years, and the methods for the 1995 survey can be found in McGarrell, 1997. Specifically, the number of macroinvertebrates subsampled changed from 100 to 200 count, the habitat assessment form changed to assigning each parameter 20 points instead of weighting the parameters with different point ranges, and the water quality assessment analysis has changed. In the 1997 report, McGarrell assessed water quality using Principal Components Analysis and cluster analysis and did not assign rating categories for site conditions. For comparison purposes, the 1995 data was analyzed using current methodology to acquire water quality site condition ratings. In addition, the reference categories have changed for a couple of sites due to advances in GIS (Geographic Information Systems) technology, and in 1995, sites in subecoregions 67c and 67d were grouped together. Another difference was flow, which was much higher for most of the sites in 2004 than in 1995.

In 1995, 55 percent of the biological conditions were nonimpaired, 31 percent were slightly impaired, and 14 percent were moderately impaired (Figure 8). A summary of the biological conditions in 2004 yielded similar results with 54 percent being nonimpaired, 32 percent slightly impaired, 10 percent moderately impaired, and four percent severely impaired (Figure 9). A different number of samples was collected in each survey; however, overall it appears that conditions remained similar. Of the sites that were sampled in 1995 and 2004, 57 percent maintained the same site condition rating, 24 percent improved, and 19 percent degraded. The improvements and degradations were only by one step in category, except for SHAD 1.8, which degraded from nonimpaired conditions in 1995 to moderately impaired conditions in 2004.

The 1995 data were analyzed using current methods and levels of concern, and 23 percent of the sites were considered "higher," 72 percent were "middle" quality, and five percent were considered "lower" quality. In 2004, 23 percent were

"higher" water quality, 63 percent were "middle" quality, and 14 percent were considered "lower" quality. The sites that were added in 2004 tended to be of poorer quality, and in particular more AMD streams were added. A site-to-site comparison indicated that 67 percent of the sites had the same water quality site condition category in 2004 as in 1995, 18 percent improved, and 15 percent degraded.

Table 6 shows a comparison of the total number of sites to exceed levels of concern for the sites that were sampled in both 1995 and 2004. Total nitrogen had a similar number of exceeding values, while nitrate-n exceedences increased in 2004. The range of nitrogen values differed from 1995 to 2004, with a high of 6.31 mg/l in 1995 and 11.64 mg/l in 2004. More sites exceeded orthophosphate and phosphorus levels of concern in 1995 than in 2004, which could be a consequence of upgrades in wastewater treatment plants and best management practices (BMPs) to prevent soil erosion. Streams that did not exceed the aluminum level of concern in 1995 exceeded this level in 2004. The largest difference in parameters from 1995 to 2004 was in temperature. Flow was lower at most of the sites sampled in 1995, and a majority of the sampling was conducted in July and August.

Although the habitat assessment form has changed from 1995 to 2004 and the assessments are subjective measures completed by different people, the process of assigning a comparative condition category using a reference site remained the same. A much higher percentage of stream sites was rated excellent in 2004. Forty-one percent of the habitat condition ratings remained the same, 52 percent improved from 1995 to 2004, and seven percent degraded from 1995 to 2004.

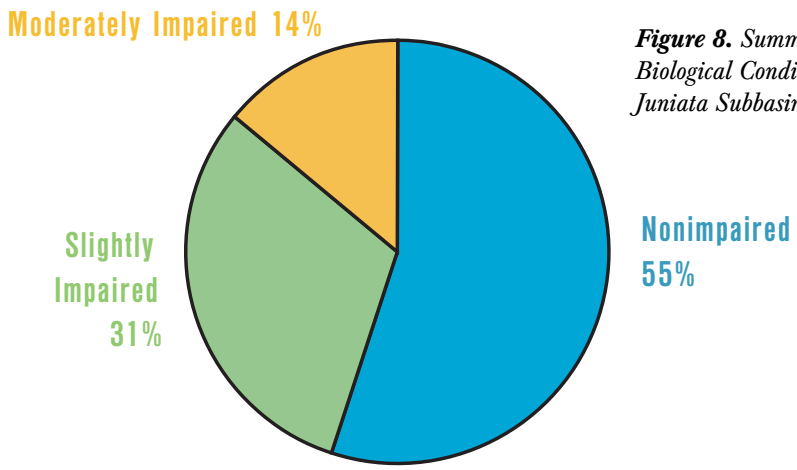

Figure 8. *Summary of the Biological Conditions in the Juniata Subbasin in 1995*

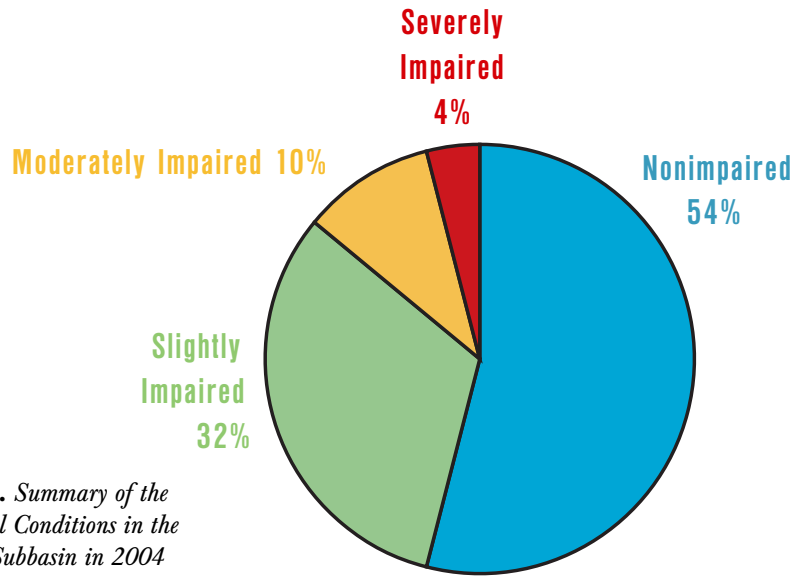

Figure 9. *Summary of the Biological Conditions in the Juniata Subbasin in 2004*

Conclusions

Overall, streams in this subbasin had very good water quality, macroinvertebrates, and habitat in 2004. Approximately half of the sites sampled in this subbasin had nonimpaired macroinvertebrate conditions. The largest source of impairment appeared to be from agricultural activities, although many streams exhibited only slight increases over background levels. Areas of AMD pollution were concentrated mostly in the area west of Altoona and in the area from Hopewell to Saxton, Pa. Urban pollution was not detected often in this survey, with the most urban influence found in the Altoona area.

Some of the highest quality watersheds within this subbasin were Aughwick Creek, Tuscarora Creek, Jacks Creek,

Table 6. *Number of Water Quality Values Exceeding Levels of Concern for the same sites in 2004 and 1995*

Year	Nitrite-N T	Nitrate-N T	Nitrogen T	Orthophosphate T	Phosphorus T	Sodium T	T Susp Solid	Acidity	Alkalinity	Aluminum T	Iron T	Temperature
1995	1	31	39	12	11	4	1	1	2	2	1	13
2004	0	38	40	8	3	1	0	0	2	5	0	0