The West Branch Susquehanna Subbasin

The West Branch Susquehanna Subbasin drains an area of approximately 6,982 square miles from Carrolltown to Northumberland, Pennsylvania. Counties located primarily in the subbasin include Cambria, Clearfield, Elk, Cameron, Potter, Clinton, Centre, Tioga, Sullivan, Lycoming, Union, Northumberland, and Montour, all located in Pennsylvania. The subbasin boundaries include three different ecoregions:

- Northern Appalachian Plateau and Uplands,
- North Central Appalachians, and
- Central Appalachian Ridges and Valleys (Omernick, 1987; USEPA, 2007).

All the sites sampled in the subbasin, however, were located in the North Central Appalachians and the Central Appalachian Ridges and Valleys. The West Branch Subbasin contains some of the most scenic forestland in Pennsylvania and a large portion of the subbasin is located in the Pennsylvania Wilds (http://www.pawilds.com/index.aspx), an area of Northcentral Pennsylvania comprised of more than one million acres of public land with numerous recreational and tourism opportunities. Figure 2 shows the land use in the West Branch Susquehanna Subbasin, which is mostly forested with numerous state forests and gamelands.

Figure 1. Six Major Subbasins of the Susquehanna River

Agricultural lands are located mostly in the southeastern portion of the subbasin and urban areas are mostly small and scarce, especially in the central and northwestern areas. The largest urban centers in the subbasin are Williamsport, State College, Lock Haven, and Clearfield. A prominent industry in the subbasin is resource extraction. Coal extraction activity prior to current regulations left numerous abandoned mine lands and problems with AMD severely impacting streams (Figure 2). Natural gas extraction activities also are growing in this region, with recent interest in areas underlain by the Marcellus Shale formation. Concern over the natural gas extraction activities, which include technologies and methods new to Pennsylvania and New York, has prompted SRBC to initiate a Remote Water Quality Monitoring Network program. This program concentrates on smaller rivers and streams where the gas extraction activities occur and where only minimal data and monitoring exist due to the remote location. More information on this program is available at http://www.srbc.net/programs/remotenetwork.htm.

The West Branch Susquehanna Subbasin had the most extensive impact from AMD than any other subbasin in the Susquehanna River Basin. AMD impacts water quality by increasing acidity (decreasing pH and alkalinity), and increasing metals, especially iron, aluminum, and manganese. Sulfate is often elevated in AMD-impacted streams also. These water quality conditions are detrimental to the aquatic biota living in these streams. Low pH conditions (approximately less than 5.5) can cause respiratory or osmoregulatory failure depending on individual species tolerance levels (Kimmel, 1983; Potts and McWilliams, 1989). Mayflies, in general, are detrimentally impacted by low pH conditions, whereas some stoneflies and caddisflies can tolerate low pH conditions (Sutcliffe and Hildrew, 1989; Earle and Callaghan, 1998; Kimmel, 1999). Heavy metals, such as aluminum, can be toxic to aquatic life, especially in low pH conditions (Baker and Schofield, 1982; Earle and Callaghan, 1998). Also, elevated metals can cause habitat problems due to precipitation onto surfaces, which disrupts habitat niches, coats gills, smothers eggs, and can increase turbidity (Hoehn and Sizemore, 1977).

Another pollution problem in this region is acidic atmospheric deposition. This includes wet and dry deposition of sulfur, nitrogen, and other compounds in air pollution, often due to the burning of fossil fuels. The impacts of acidic deposition are usually noticed in the higher elevations or ridgetops that receive more deposition due to the orographic effect, and also have geologic formations that are unable to buffer acidic conditions (Sharpe et al., 1984; Kimmel, 1999). Also, the impacts of acidic deposition are usually more severe at higher flow conditions (Sharpe et al., 1984; Kimmel, 1999). Streams impaired from atmospheric deposition have low alkalinity and elevated aluminum during high flows (Sharpe et al, 1984; Kimmel, 1999).

The aluminum is leached from the soil when other minerals such as calcium and magnesium are not available or already depleted (Swistock et al., 1989). Macroinvertebrate community impairment can be difficult to determine since many stoneflies sensitive to other kinds of pollution are tolerant of acidic conditions. A large increase in Diptera (true flies) and a decrease in Ephemeroptera (mayflies) is often an indication of atmospheric deposition impairment (Earle and Callaghan, 1998; Kimmel, 1999). Detrimental impacts to fish populations can occur with atmospheric deposition as aluminum is toxic at levels higher than 200 µg/l when pH values are lower than 5.0 for sustained periods (Baker and Schofield, 1982; Gagen et al., 1993). More information on atmospheric deposition and data from deposition across the United States is available at the National Atmospheric Deposition Program's web site at http://nadp.sws.uiuc.edu/.

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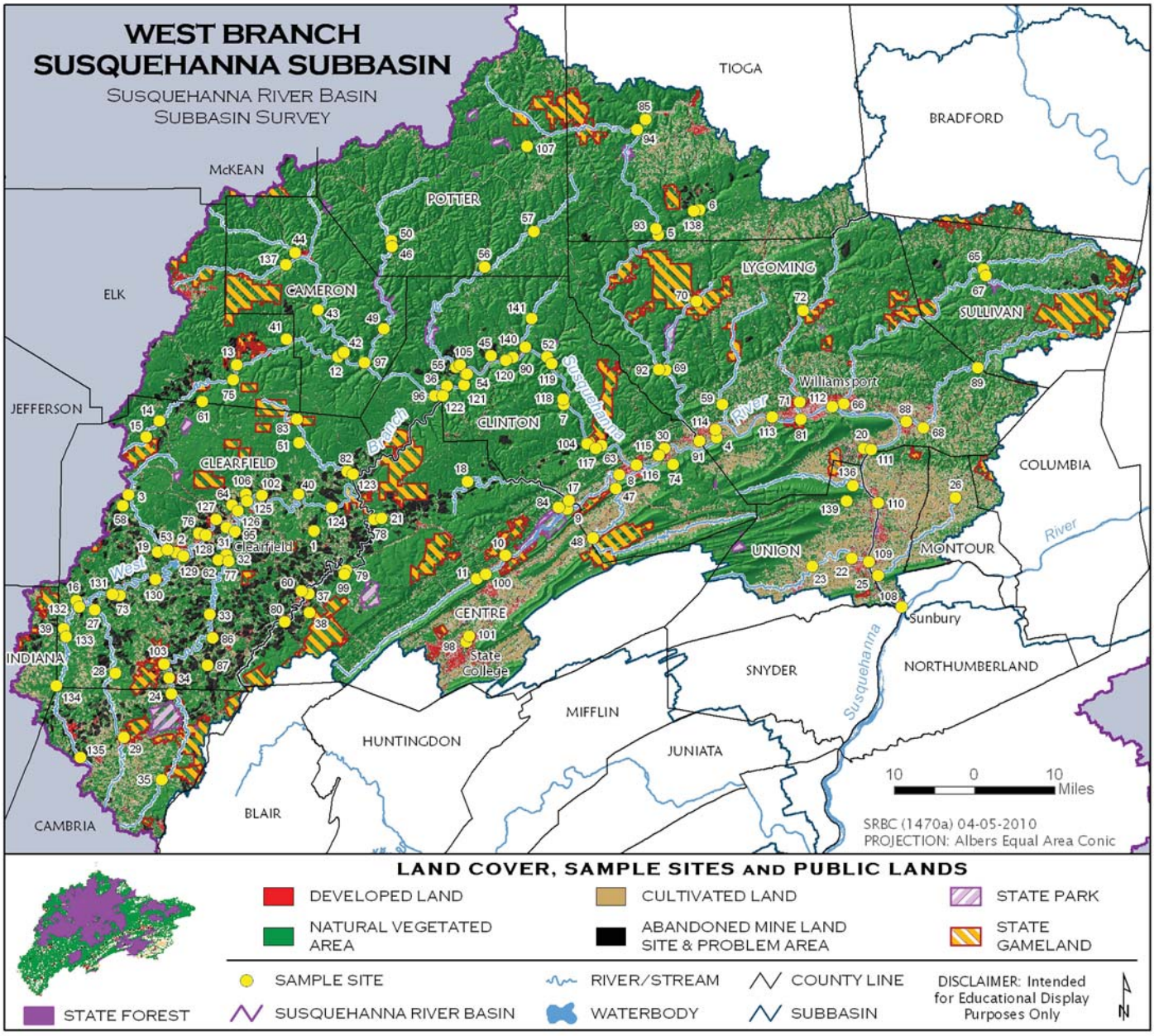

Figure 2. Land Cover, Sample Sites, and Public Lands in the West Branch Susquehanna Subbasin