Chapter 5.

Family-Level Macroinvertebrate Community Descriptions

Family MI High Quality Headwater Stream Community

Community Indicators: rolledwinged stonefly (Leuctridae), small minnow mayfly (Baetidae), crayfish (Cambaridae), trumpetnet caddisfly (Polycentropodidae), darner dragonflies (Aeshnidae)

Habitat: Typically found in small ($\overline{x}$ = 33.2 mi^2 watershed area), high gradient ($\overline{x}$ = 2.3%), high elevation ($\overline{x}$ = 397 m) streams, this community is indicative of high quality headwater stream habitats. Water chemistry is characterized by moderate values of alkalinity ($\overline{x}$ = 51 mg/l) and conductivity ($\overline{x}$ = 223 uS/cm).

This community is typified by a diverse group of macroinvertebrates that are generally sensitive to organic pollution. These organisms may tolerate other types of pollution, namely those types that can be found in suburban streams. The amount of urban area in the watershed is fairly low ($\overline{x}$ = 1.3%), but agricultural land makes up a relatively large proportion of the watershed ($\overline{x}$ = 29.6%) and may negatively influence some habitats that support this community.

Despite some potential pollution sources, the imprint from human development seems to be small where this community is found. This community has the second highest taxa richness ($\overline{x}$ = 16.3) and EPT richness ($\overline{x}$ = 8.3) values of all the family-level macroinvertebrate spring communities. It also has a low proportion of organisms that are tolerant of organic pollution ($\overline{x}$ = 3.9%).

Stream Quality Rating: High

Community Rarity: No

Threats: This community usually occurs in watersheds with moderate urban and agricultural development. In some locations, siltation and excess nutrients from agriculture may be impairing stream systems. Urban streams generally receive more storm water runoff from roads and municipal point source discharges, such as sewage treatment plant effluent.

Conservation Recommendations: This community is representative of high-quality stream habitat. Reducing runoff from poorly buffered agricultural land would be most beneficial for improving stream quality for the High Quality Headwater Stream Community. In areas such as these, runoff and stream bank erosion can be controlled by installing riparian buffers of an adequate width along pastures and crop fields and excluding livestock from streams and riparian zones. Stream habitats will improve over time with the addition of riparian buffers.

Retention and treatment of storm water from roads and urban developments would ameliorate water quality problems in streams receiving these urban effluents. In addition, adequate remediation of sewage treatment discharges would improve stream water quality and habitat condition for all aquatic communities. Mitigation of all direct stream discharges is recommended.

Strongest Indicators of Community Type

Rolledwinged stonefly (Leuctridae)

Photo source: www.dfg.ca.gov

Small minnow mayfly (Baetidae)

Photo source: www.dec.state.ny.us

Family MI High Quality Headwater Stream Community

Known Locations:

Example Habitat:

Small, high-gradient streams with rocky habitats are typical habitats of the Family MI High Quality Headwater Stream Community.

Photo source: PHNP

Family MI Common Headwater Stream Community

Community Indicators: little plain brown sedge (Lepidostomatidae), slender winter stonefly (Capniidae), spiketail dragonflies (Cordulegastridae)

Habitat: The Common Headwater Stream Community is generally found in high gradient ($\overline{X}$ = 3.0%) streams at high elevations ($\overline{X}$ = 397 m). Streams where this community exists appear to have a diversity of in-stream habitat types with little channelization or riparian disturbance.

Streams that support this community type generally have low amounts of dissolved ions, low alkalinity ($\overline{X}$ = 22 mg/l) and moderate conductivity ($\overline{X}$ = 269 µS/cm) values are typical. However, this community type may occur in streams that are degraded by abandoned mine drainage (AMD) (Figure 5-1), which can dramatically alter the water chemistry profiles for affected streams.

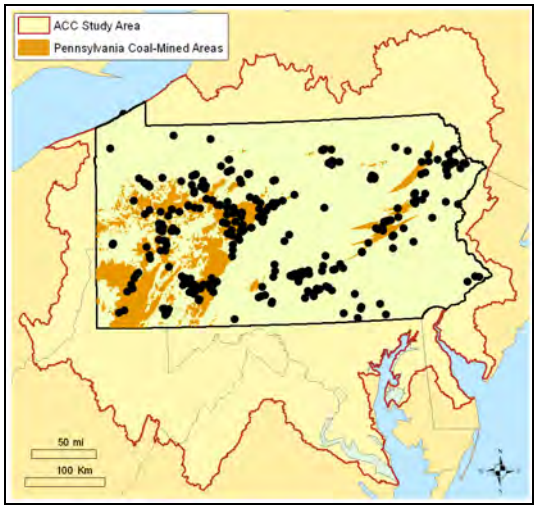


Figure 5-1. The locations of the Common Headwater Stream Community (black dots) show considerable overlap with the coal-mined areas of Pennsylvania.

The watersheds are primarily forested where this community occurs. Typically, only small amounts of agriculture ($\overline{X}$ = 12.2% of the watershed) and urbanization ($\overline{X}$ = 2.0%) are associated with these watersheds.

The taxa richness of this community is relatively moderate ($\overline{X}$ = 10.4), but the EPT richness is comparatively high ($\overline{X}$ = 7.9) and the proportion of pollution tolerant organisms is second lowest of all spring family-level macroinvertebrate communities ($\overline{X}$ = 2.5%).

Stream Quality Rating: Low

Community Rarity: No

Strongest Indicators of Community Type

Little plain brown sedge (Lepidostomatidae)

Photo source: www.dec.state.ny.us

Slender winter stonefly (Capniidae)

Photo source: www.dec.state.ny.us

Threats: AMD and acid deposition from air pollution occur often with this stream community, and appear to be the driving force behind its biological composition. Acidic streams can be inhabited by some stoneflies that are tolerant of low pH, but few other organisms can survive in streams with toxic AMD.

Conservation Recommendations: Addressing water pollution from AMD is critical for the Common Headwater Stream Community. Adequate remediation of the water that discharges from abandoned mines can reduce its acidity and levels of dissolved metals, greatly improving water quality and habitat condition. Liming, or the application of alkaline materials, watersheds and/or streams raises the pH of the water to normal levels and decreases the solubility of the dissolved metals associated with AMD. This method can be expensive due to the costs of the materials and maintenance that is required post-liming; the alkaline materials produce a metal-laden sludge that must be removed from the streams.

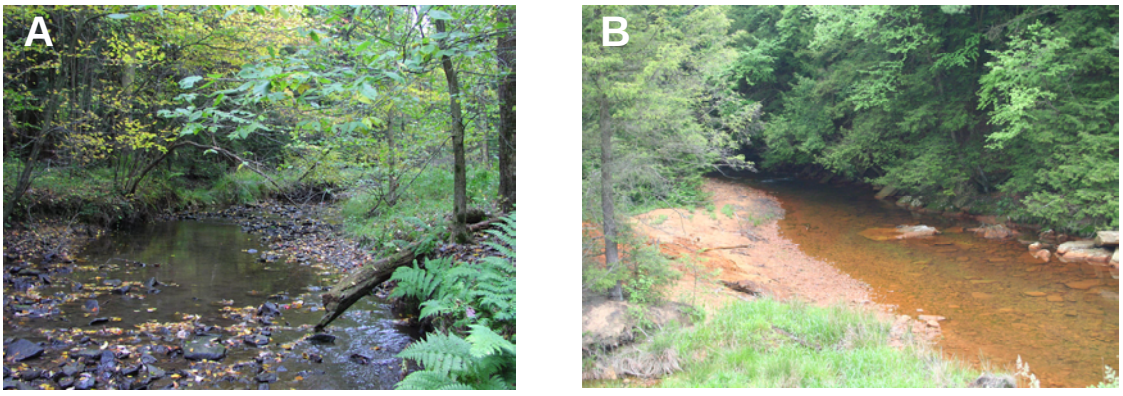
Passive treatment of AMD can offer a lower cost alternative to active chemical application. For example, constructed wetlands allow naturally occurring chemical and biological processes that facilitate AMD treatment to take place in a controlled treatment system, rather than in the receiving water body. For more information on AMD and its remediation, see the Pennsylvania DEP's Bureau of Abandoned Mine Reclamation webpage:

http://www.dep.state.pa.us/dep/deputate/minres/bamr/bamr.htm

Family MI Common Headwater Stream Community

Known Locations:

Example Habitat:



High quality habitats in small streams are the typical habitat of the Common Headwater Stream Community (A). However, sources of abandoned mine drainage (B) may impair streams such as these.

Photo source: PNHP

Family MI AMD Stream Community

Community Indicators: alderfly (Sialidae), dance fly (Empididae). This community is also associated with the watersnipe fly (Athericidae), saddlecase maker (Glossosomatidae), and common burrower mayfly (Ephemeridae).

Habitat: The AMD (abandoned mine drainage) Stream Community is found in small to medium sized streams ($\overline{X}$ = 33.5 mi^2 watershed area) with intermediate gradient ($\overline{X}$ = 1.6%). The high conductivity ($\overline{X}$ = 417 µS/cm) and low pH that often accompany AMD are found in watersheds containing the AMD Stream Community. Alkalinity is typically moderate in the streams with this community type ($\overline{X}$ = 47 mg/l).

Watershed land use suggests that agricultural land ($\overline{X}$ = 19.0% of the watershed) and urbanization ($\overline{X}$ = 15.6%) likely lead to water quality impairment where this community is found. However, coal mining is probably the main source of degradation in these streams (Figure 5-2). Poor habitat quality scores also accompany this community type.

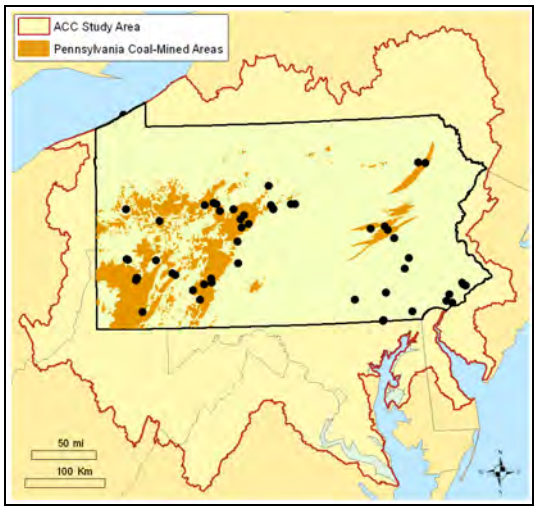


Figure 5-2. Locations of the AMD community (black dots) show considerable overlap with the coal-mined areas of PA.

This community shows the poorest taxa metrics of all family-level macroinvertebrate groups, with a mean taxa richness of 5.2 and mean EPT richness of 6.3. The proportion of pollution-tolerant organisms is also relatively high ($\overline{X}$ = 12.4%).

Stream Quality Rating: Low

Community Rarity: No

Threats: AMD is the most common pollution source in watersheds that contain the AMD Stream Community. In some areas, siltation and lack of riparian vegetation may also degrade these habitats.

Strongest Indicators of Community Type

Alderfly (Sialidae)

Photo source: www.benthos.org

Dance Fly (Empididae)

Photo source: http://ceratium.ietc.wwu.edu/IWS

Conservation Recommendations: Addressing water pollution from AMD and acid deposition are critical for the AMD Stream Community. Treating AMD can reduce acidity and levels of dissolved metals in the water and greatly improve stream habitat quality. Liming, or the application of alkaline materials, watersheds and/or streams raises the pH of the water to normal levels and decreases the solubility of dissolved metals associated with AMD. This method can be expensive due to material cost and the required maintenance post-liming; alkaline materials produce a metal-laden sludge that must be removed from the stream.

Passive treatment of AMD, such as the use of mitigated AMD wetlands, can offer a lower cost alternative to active chemical application. For more information on AMD and its remediation, see the PA DEP's Bureau of Abandoned Mine Reclamation webpage:

http://www.dep.state.pa.us/dep/deputate/minres/bamr/bamr.htm

Family MI AMD Stream Community

Known Locations:

Example Habitat:

The presence of the AMD Stream Community generally indicates the presence of urbanization and/or abandoned mine drainage (AMD) in the watershed.

Photo source: PNHP

Family MI High Quality Small Stream Community

Community Indicators: brushlegged mayfly (Isonychiidae), fingernet caddisfly (Philopotamidae), dobsonfly (Corydalidae), saddlecase maker (Glossosomatidae), watersnipe fly (Athericidae), common burrower (Ephemeridae), snail-case maker caddisfly (Helicopsychidae)

Habitat: This community is found in small to medium-size streams ($\overline{x}$ = 67 mi^2 watershed area) of moderate elevation ($\overline{x}$ = 251 m) and intermediate gradient ($\overline{x}$ = 1.4%). Urban land cover in the watershed is relatively low ($\overline{x}$ = 1.9%), but moderate amounts of agricultural land ($\overline{x}$ = 33.0%) may have an adverse influence on water quality and stream habitat where this community occurs.

The High Quality Small Stream Community is typically found in streams with mixed substrates. This community type is indicative of high quality streams, and the associated organisms are generally intolerant of pollution.

Water chemistry values of the streams that support this community type are usually typified by moderate alkalinity ($\overline{x}$ = 53 mg/l), moderate conductivity ($\overline{x}$ = 203 µS/cm) and a neutral pH.

This community has high values for taxa richness ($\overline{x}$ = 16.0) and EPT richness ($\overline{x}$ = 8.2). These values are among the highest of all family-level macroinvertebrate communities. Only a small portion of the organisms that make up this community are tolerant to pollution ($\overline{x}$ = 5.8%), which also indicates streams of high quality.

Stream Quality Rating: High

Community Rarity: No

Threats: Organisms in the High Quality Small Stream Community are sensitive to organic pollution and habitat degradation. The group occurs in watersheds with moderate amounts of agricultural land, which can alter in-stream habitat if improperly managed. Poorly buffered agricultural land can lead to the input of excess nutrients and sediments into streams.

In urban locations, municipal point sources (e.g., sewage treatment plants and impervious surface runoff) may affect water quality. Urban streams receive elevated levels of inorganic pollutants and are prone to dramatic rises in water levels during storm events.

Strongest Indicators of Community Type

Brushlegged mayfly (Isonychiidae)

Photo source: www.dec.state.ny.us

Fingernet caddisfly (Philopotamidae)

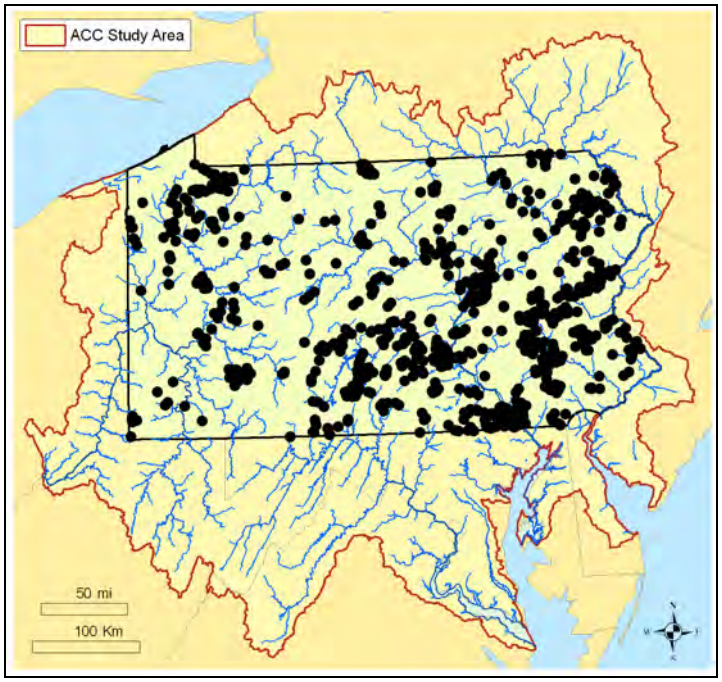
Photo source: www.dec.state.ny.us

Conservation Recommendations: This community is representative of high-quality stream habitat. While some non-point source pollution occurs in watersheds supporting the High Quality Small Stream Community, the pollution problems here are less severe than in other stream types. In areas where non-point source agricultural pollution is occurring, runoff and stream bank erosion can be controlled by installing riparian buffers of an adequate width along pastures and crop fields and excluding livestock from streams and riparian zones. Stream habitats will improve over time with the addition of riparian buffers.

Mitigation of any direct stream discharges, including urban stormwater runoff and point-source sewage effluent, is recommended. Retention and treatment of storm water would ideally ameliorate water quality issues in streams receiving urban effluents. Upgrades in sewage treatment systems would also improve stream water quality and habitat condition.

Family MI High Quality Small Stream Community

Known Locations:



Example Habitat:

Typical habitats of the High Quality Small Stream Community are small to medium-sized streams with diverse stream-bottom habitats and high water quality.

Photo source: PNHP

Family MI Low Gradient Valley Stream Community

Community Indicators: riffle beetle (Elmidae), waterpenny beetle (Psephenidae) netspinning caddisfly (Hydropsychidae), Asian clam (*Corbicula fluminea*), narrow-winged damselfly (Coenagrionidae), rusty dun mayfly (Caenidae), fingernail clam (Sphaeriidae), freshwater limpet (Ancylidae), broad-winged damselfly (Calopterygidae)

Habitat: This community generally occurs in medium-sized streams ($\overline{X}$ = 75.3 mi^2 watershed area). The intermediate gradients ($\overline{X}$ = 1.0%) of valley streams at moderately low elevations ($\overline{X}$ = 201 m) characterize the habitat for this community.

Water chemistry values associated with the Low Gradient Valley Stream Community are high for alkalinity ($\overline{X}$ =76 mg/l) and conductivity ($\overline{X}$ = 318 µS/cm), but pH generally remains neutral. Moderately high amounts of urban and agricultural land cover in the watershed ($\overline{X}$ = 7.2 % and 44.5%, respectively) contribute to water quality issues in watersheds where this community occurs. Additionally, forest cover is relatively low in these watersheds ($\overline{X}$ = 46.1% of the watershed).

This community has moderate values for taxa richness ($\overline{X}$ = 13.5) and EPT richness ($\overline{X}$ = 7.0). However, over 14% of the organisms in these communities are tolerant to organic pollution, which is the second highest proportion for all family-level macroinvertebrate communities. This means that this community represents a biologically diverse assemblage of macroinvertebrates that are not necessarily sensitive to disturbances in the watershed.

Stream Quality Rating: Medium

Community Rarity: No

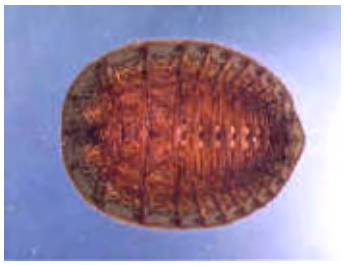
Threats: The exotic Asian clam, *Corbicula fluminea*, commonly occurs with this community type. The Asian clam may be a threat to other bivalves due to competition for food resources and habitat.

The habitats for this community type may receive pollution from a variety of sources. In these streams, water quality may be moderately degraded from excess nutrients, habitat modification or siltation due to poorly maintained agricultural practices. In heavily populated areas, municipal point sources such as sewage treatment plants and urban stormwater effluents may contaminate these streams. Abandoned mine drainage (AMD) may negatively influence water quality and community habitats in some locations.

Strongest Indicators of Community Type

Riffle beetle (Elmidae)

Photo source: www.epa.gov



Waterpenny beetle (Psephenidae)

Photo source: www.dec.state.ny.us

Conservation Recommendations: Where this community is found, non-point source pollution from the surrounding watershed may be contributing to degraded water quality and habitat conditions. Although this community type does not suggest extremely poor stream quality, some stresses to stream condition are indicated.

Watersheds with large amounts of agriculture have the potential to contribute non-point source pollution to streams in the form of excess nutrients and sediments. In these environments, runoff and stream bank erosion can be controlled by installing riparian buffers of an adequate width along pastures and crop fields and excluding live-stock from streams and riparian zones. Stream habitats will improve with the addition of riparian buffers.

Mitigation of any direct stream discharges, including urban stormwater runoff and point-source sewage effluent, is recommended. Retention and treatment of storm water would ideally ameliorate water quality problems in streams receiving urban effluents. Upgrades in sewage treatment systems would also improve stream water quality and habitat condition.

Family MI Low Gradient Valley Stream Community

Known Locations:

Example Habitat:

The Low Gradient Valley Stream Community is typically found in slow-flowing valley streams with some influence from agricultural practices in the watershed.

Photo source: PNHP

Family MI High Quality Mid-Sized Stream Community

Community Indicators: green stonefly (Chloroperlidae), giant black stonefly (Pteronarcyidae), spiny crawler (Ephemerellidae), flat-headed mayfly (Heptageniidae), free-living caddisfly (Rhyacophilidae), light brown stonefly (Perlodidae), prong-gill mayfly (Leptophlebiidae), common stoneflies (Perlidae), crane fly (Tipulidae), roachlike stoneflies (Peltoperlidae), clubtail dragonfly (Gomphidae), northern case maker (Limnephilidae), uenoid caddisfly (Uenoidae), odontocerid caddisflies (Odontoceridae)

Habitat: The High Quality Mid-Sized Stream Community is found in medium-sized streams ($\bar{x}$ = 94.6 mi^2 watershed area) in high elevations ($\bar{x}$ = 371 m). Streams are generally high gradient systems ($\bar{x}$ = 2.8%) with good habitat quality.

Streams where this community is found generally have low values of alkalinity ($\bar{x}$ = 27 mg/l) and conductivity ($\bar{x}$ = 178 µS/cm). Watersheds are typically undisturbed by humans and are often in heavily forested basins ($\bar{x}$ = 80.5%). Landscape disturbance is relatively uncommon in these watersheds, as there is very little urban or agricultural area ($\bar{x}$ = 0.9% and 15.9%, respectively). The most common community members are a combination of stoneflies, mayflies, caddisflies and other organisms that are generally pollution sensitive.

The biota of this community shows the highest values for taxa richness ($\bar{x}$ = 18.4) and EPT richness ($\bar{x}$ = 8.9) of all family-level macroinvertebrate spring community groups. This community also has the lowest proportion of pollution-tolerant organisms of all communities ($\bar{x}$ = 2.1%).

Stream Quality Rating: High

Community Rarity: No

Threats: Streams with the High Quality Mid-Sized Stream Community generally have few threats compared to other communities. Since high elevation streams tend to be on steep slopes, which are not generally conducive to human development, the typical urban and agricultural pollution problems are not as common in this community type as they are in streams indicated by other communities. Acidification from abandoned mine drainage (AMD) and air pollution is likely the most prominent pollution threat. In some locations, siltation from agriculture or industrial point source pollution may degrade the habitat of the High Quality Mid-Sized Stream Community.

Strongest Indicators of Community Type

Green stonefly (Chloroperlidae)

Photo source: www.dec.state.ny.us

Giant black stonefly (Pteronarcyidae)

Photo source: www.dec.state.ny.us

Conservation Recommendations: As streams get larger, they generally experience more habitat disturbance and water quality alteration. This community represents relatively undisturbed mid-sized stream habitat, indicating a unique resource that should be preserved.

Addressing water pollution from AMD and acid deposition are critical for the High Quality Mid-Sized Stream Community. Treating AMD can reduce acidity and metals and greatly improve water quality. Liming watersheds and/or streams is one option for minimizing the effects of AMD and acid deposition. The creation of AMD-mitigation wetlands offers a lower-cost alternative for AMD remediation. For more information on AMD and its treatment, see the Pennsylvania DEP's Bureau of Abandoned Mine Reclamation webpage:

http://www.dep.state.pa.us/dep/deputate/minres/bamr/bamr.htm

Family MI High Quality Mid-Sized Stream Community

Known Locations:

Habitat:

Mid-sized, high gradient streams with high quality habitats and water quality are the typical habitat of the High Quality Mid-Sized Stream community.

Photo source: PNHP

Family MI Common Large Stream Community

Community Indicators: nemourid broadback stonefly (Nemouridae), ameletid mayfly (Ameletidae), taeniopterygid broadback stonefly (Taeniopterygidae)

Habitat: The streams that support the Common Large Stream Community occur at relatively high elevations ($\overline{x}$ = 333 m) and high gradients ($\overline{x}$ = 2.3%), with a diverse assemblage of organisms. These moderately large ($\overline{x}$ = 155.8 mi^2 watershed area) streams also have high quality in-stream habitats.

Water chemistry profiles usually show moderate to high values of alkalinity ($\overline{x}$ = 58 mg/l) and conductivity ($\overline{x}$ = 320 µS/cm). Macroinvertebrates in this community are slightly more tolerant of organic pollution than the High Quality Mid-Sized Stream community (pg. 5-11). Agriculture is the predominant land alteration in these watersheds ($\overline{x}$ = 28.9% of the watershed), and may be negatively influencing water quality in some locations. Urban influences are less prominent where this community is found ($\overline{x}$ = 2.0 %).

The biota found with this community type show relatively high values for taxa richness ($\overline{x}$ = 13.4) and EPT richness ($\overline{x}$ = 8.0). The proportion of pollution-tolerant organisms in this community ($\overline{x}$ = 6.25%) is moderate relative to the other community types, but represents quality large-stream or river conditions.

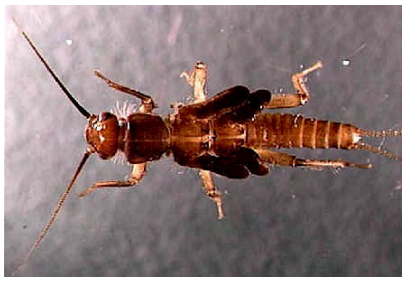
This community type is indicative of larger streams of good quality, despite being affected by watershed disturbances that alter the habitats of most streams of this size.

Stream Quality Rating: Medium (higher in larger streams and rivers)

Community Rarity: No

Threats: Excess siltation from agricultural runoff and animal feed lots is likely impairing the habitats where this community is found. In addition, acid mine drainage may also occur in some watersheds where this community occurs, but it is not usually associated with this community type. As with other streams of larger size, development pressure in the watershed is an issue for this community.

Strongest Indicators of Community Type



Nemourid broadback stonefly (Nemouridae)

Photo source: www.dec.state.ny.us

Ameletid mayfly (Ameletidae)

Photo source: www.dec.state.ny.us

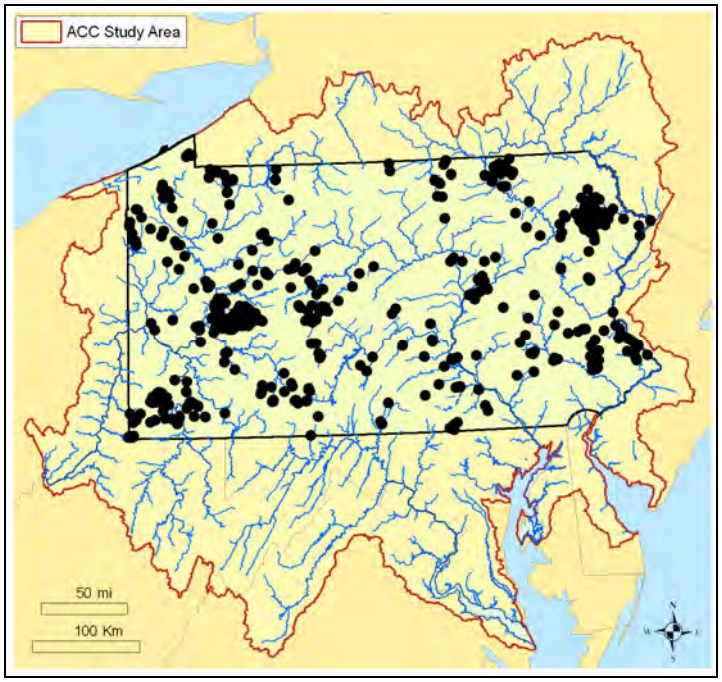
In heavily populated areas, municipal point sources such as sewage treatment plants and urban stormwater effluents may contaminate these streams.

Conservation Recommendations: While some non-point source pollution problems occur in watersheds with the Common Large Stream Community, pollution is less severe than in other streams of similar size. In areas where non-point source agricultural pollution occurs, runoff and stream bank erosion can be controlled by installing vegetative buffers of an adequate width along streams in pastures and crop fields. Excluding livestock from streams and riparian zones will also help improve stream habitats.

Large streams and rivers typically flow through populated areas, and therefore experience the water quality issues that are associated with urban settings. To combat these effects, mitigation of stream discharges, including stormwater runoff and point-source sewage effluent, is recommended. Retention and treatment of stormwater and keeping sewer treatment systems upgraded ameliorates water quality problems and habitat condition in streams receiving urban effluents.

Family MI Common Large Stream Community

Known Locations:



Example Habitat:

Large to medium-sized high gradient streams are typical habitats of the Common Large Stream Community. Non-point source pollution can cause excess stream sediment or other poor water quality conditions.

Photo source: PNHP

Family MI Limestone / Agricultural Stream Community

Community Indicators: scud (Amphipoda), black fly (Simuliidae), aquatic sowbug (Isopoda), Planaria (Turbellaria), segmented worms (Annelida), midge (Chironomidae), common pond snail (Physidae), predacious diving beetle (Dytiscidae), ram's horn snail (Planorbidae)

Habitat: This community is found in large streams ($\bar{x}$ = 368 mi^2 watershed area) with low gradients ($\bar{x}$ = 1.1%). It occurs at moderate to low elevation ($\bar{x}$ = 200 m), mainly in valleys with calcareous geology (Figure 5-3). Relatively large amounts of agriculture ($\bar{x}$ = 46.3%) and urban areas ($\bar{x}$ = 11.6%) in the watershed likely contribute to degradation of stream habitat.

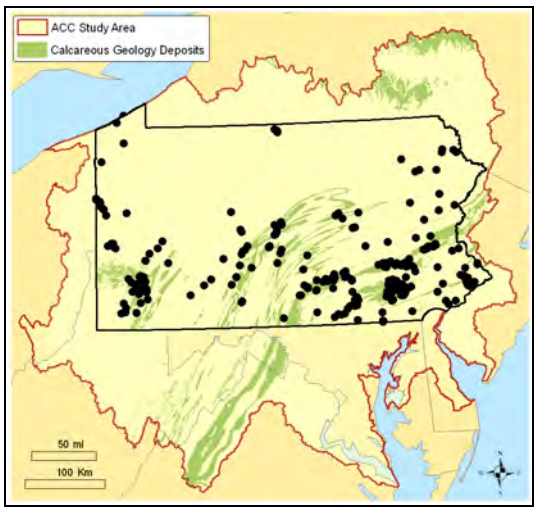


Figure 5-3. The locations of the Limestone / Agricultural Stream Community Locations are concentrated in areas of calcareous geology.

With calcareous geology influences, high alkalinity ($\bar{x}$ = 95 mg/l) and conductivity ($\bar{x}$ = 364 mg/l) values are typical water chemistry profiles of streams that support this community. The values for taxa richness ($\bar{x}$ = 8.8) and EPT richness ($\bar{x}$ = 6.8) are among the lowest of all family-level macroinvertebrate groups, and the percentage of pollution-tolerant organisms is the highest of all family groups ($\bar{x}$ = 23.3%).

Stream Quality Rating: Low

Community Rarity: No

Threats: This community is generally found in streams influenced by calcareous geology, in the valleys of central and eastern Pennsylvania. Minimally degraded limestone streams are very rare in the commonwealth, as these areas are usually heavily populated and/or in agricultural production. Both of these landscape alterations can have negative effects on stream habitat. Poorly buffered agricultural areas can lead to excess nutrient loading and siltation of streams, altering habitat and adversely affecting resident communities.

Strongest Indicators of Community Type

Scud (Amphipoda)

Photo source: www.dec.state.ny.us

Black fly (Simuliidae)

Photo source: www.epa.gov

Conservation Recommendations: The agricultural non-point source pollution issues associated with this community may be more severe than in streams indicated by other community types, based on watershed characteristics and the characteristic taxa. In areas where agricultural pollution is occurring, installing riparian buffers along pastures and crop fields and excluding livestock from streams and riparian zones can control bank erosion and improve stream habitats over time.

In urban settings, mitigation of direct stream discharges is recommended. Adequate retention and treatment of storm water ameliorate water quality and habitat condition issues in streams receiving urban effluents.

Family MI Limestone / Agricultural Stream Community

Known Locations:

Example Habitat:

Calcareous geology provides habitat for the Limestone / Agricultural Stream Community. Agricultural or developed valleys may contribute non-point source pollution to the watershed.

Photo source: PNHP

Family MI Photo Credits – *all photos used with permission*

http://ceratium.ietc.wwu.edu/IWS: Western Washington University, Institute for Watershed Studies

Pennsylvania Natural Heritage Program (PNHP), all rights reserved.

www.benthos.org: North American Benthological Society.

www.dec.ny.gov: New York State Department of Environmental Conservation.

www.dfg.ca.gov: State of California Department of Fish and Game.

www.epa.gov: United States Environmental Protection Agency.