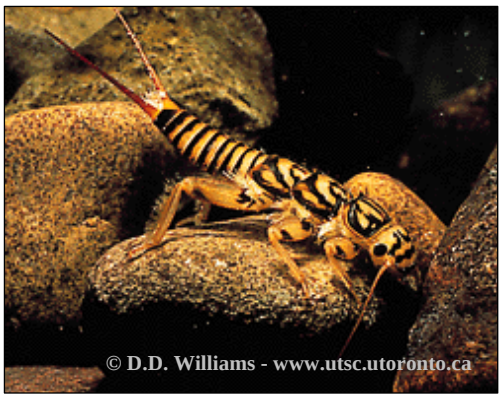
Chapter 6.

Genus-Level Macroinvertebrate Community Descriptions



Genus MI Forested Headwater Stream Community

Community Indicators: little yellow stonefly (*Alloperla*), Tipulan crane fly (*Tipula*), dark brown spinner mayfly (*Ameletus*)

Habitat: This community is found in very small streams ($\bar{x}$ = 2.7 mi^2 watershed area) in sparse distribution across the study area. It occurs at very high elevations ($\bar{x}$ = 410 m) and gradients ($\bar{x}$ = 3.7%). There is slightly over 4% urban land cover and nearly 15% agricultural land cover in the basins where this community occurs, which is high considering the small size of these watersheds. However, the catchments remain almost 80% forested, which may account for the persistence of the environmentally sensitive taxa that represent this community group.

Water chemistry values show a slight impairment in stream condition, likely from the agriculture and urbanization existing in the watersheds. These streams are slightly alkaline ($\bar{x}$ = 54.2 mg/l), but have relatively low specific conductivity ($\bar{x}$ = 173 µS/cm) and cool temperatures ($\bar{x}$ = 15.5°C).

The taxa richness ($\bar{x}$ = 9.3) for this community suggests moderate to good water quality despite the fact that high elevation, heavily forested headwater streams such as these generally do not support highly diverse assemblages of organisms. The taxa that make up the assemblages in this community are the most sensitive to organic pollution of all genus-level macroinvertebrate communities. EPT richness ($\bar{x}$ = 5.9) is high relative to the overall taxa richness, which means that the taxa that comprise the majority of the organisms in this community are generally sensitive to alterations in habitat and stream function.

Stream Quality Rating: High

Community Rarity: Yes

Threats: Found in the smallest streams, the Forested Headwater Stream Community faces fewer threats than communities in larger streams and rivers. In these high elevation watersheds, agriculture and urban developments are not substantial threats. Maintenance of forest cover in the watershed, especially within the riparian corridor, will help preserve this community type.

Strongest Indicators of Community Type

Little yellow stonefly (*Alloperla*)

Photo source: http://bio-ditrl.sunsite.ualberta.ca

Tipulan crane fly (*Tipula*)

Photo source: www.lrca.org

Poor acid buffering capacity in small, ridgetop watersheds makes these headwater streams more susceptible to the effects of acid precipitation. Abandoned mine drainage (AMD) can be a common pollution source in the small watersheds where the Forested Headwater Stream community is found.

Conservation Recommendations: This community should be of utmost conservation importance not only because of its quality and environmental sensitivity, but also because of its rarity. It only occurs in only 19 of over 850 stream locations used to define these macroinvertebrate communities. Watersheds where this community is known to occur should be preserved. Additionally, steps should be taken to preserve these habitats from damage due to AMD and/or acid deposition.

Genus MI Forested Headwater Stream Community

Known Locations:

Example Habitats:

Deadman Run, Fayette County, PA

UNT Cowanshannock Creek,
Armstrong County, PA

Photo source: PNHP

Genus MI Sluggish Headwater Stream Community

Community Indicators: common pond snail (Physidae), leech (Hirudinea), ram's horn snail (Planorbidae), midge (Chironomidae), agabian predaceous diving beetle (*Agabus*), dextral pond snail (Lymnaeidae).

Habitat: The Sluggish Headwater Stream Community is found in headwater streams of moderate gradient ($\overline{x}$ = 1.3%) in areas impaired by human influence. Communities are usually found in small ($\overline{x}$ = 5.7 mi^2 watershed size), moderate to low elevation streams ($\overline{x}$ = 206 m).

High amounts of watershed urbanization ($\overline{x}$ = 22.7%) and agricultural land ($\overline{x}$ = 36.6%) occur with this community type, and natural vegetation land cover is low ($\overline{x}$ = 39.3% forested area in watershed). Warm water temperatures ($\overline{x}$ = 17.4°C) and poor water quality are likely contributing to the poor habitat conditions where this assemblage is found. High alkalinity ($\overline{x}$ = 107 mg/l), pH ($\overline{x}$ = 7.16) and conductivity ($\overline{x}$ = 431.8 µS/cm) suggest ion concentrations may be artificially high because of pollution.

The taxa richness and EPT richness are both very low ($\overline{x}$ = 8.2 and 2.0, respectively), which also suggest degraded habitat. Most taxa occurring in this community group are tolerant to organic pollution.

Since the indicator taxa of this community are also representative of wetland environments – still or slow moving water with abundant aquatic vegetation – the presence of this community may indicate a transitional stream-wetland habitat. However, the mean values for the environmental data suggest that most of these locations are severely impaired, regardless of habitat type.

Stream Quality Rating: Low

Community Rarity: No

Threats: The Sluggish Headwater Stream Community is concentrated near the urban centers of Philadelphia and Pittsburgh and in some agricultural valleys throughout the state. Point and non-point source pollution from both agriculture and urban areas appear to impair streams with this community. The presence of this community type is an indicator for severe pollution problems of various types.

Strongest Indicators of Community Type

Common pond snail (Physidae)

Photo source: www.usask.ca

Leech (Hirudinea)

Photo source: www.troutnut.com

Excess nutrient runoff and siltation usually lead to stream impairment in watersheds with a large amount of agricultural land. In urban areas, runoff from impervious surfaces and storm sewers threatens water quality. In both environments, habitats are modified when they are channelized and stream riparian buffers are removed. Other point sources from municipalities, such as industrial discharges and water treatment plants, can also lead to stream impairment.

Conservation Recommendations: In watersheds with poorly maintained agricultural areas, installing riparian buffers along pastures and crop fields can control excess nutrient runoff and stream bank erosion. Excluding livestock from streams and riparian zones will also restore water quality and stream habitats.

Retention and treatment of stormwater 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.

Genus MI Sluggish Headwater Stream Community

Known Locations:

Example Habitats:

Un-named tributary to
Brush Creek, Butler County, PA

Updike Run, Jefferson County, PA

Photo source: PNHP

Genus MI High Quality Headwater Stream Community

Community Indicators: forestfly (*Amphinemura*), tube-case caddisfly *(Lepidostoma*), rolled winged stonefly (*Leuctra*), blackfly (*Prosimulium*)

Habitat: This community occurs in high quality headwater streams ($\overline{x}$ = 6.3 mi^2 watershed area) that exist in high elevation ($\overline{x}$ = 439 m). These catchments are well forested ($\overline{x}$ = 78% of watershed) and have high stream gradients ($\overline{x}$ = 2.9%). There is very little urbanization ($\overline{x}$ = 1.4% of watershed area) in these watersheds, but there is some agricultural land ($\overline{x}$ = 18.1%) where this community is found. Alkalinity ($\overline{x}$ = 25.3 mg/l) and pH ($\overline{x}$ = 6.62) values are comparatively low and conductivity is moderate ($\overline{x}$ = 172.0 µS/cm). Water temperatures are typically cool ($\overline{x}$ = 15.5°C).

The High Quality Headwater Stream Community has slightly lower values of taxa richness, EPT richness, and number of intolerant taxa than the other high quality communities ($\overline{x}$ = 16.2, 9.0, and 6.5, respectively). However, these metrics still suggest a high level of water quality, since biotic assemblages in headwater streams are generally not as diverse as those found in larger stream reaches that exist lower in the watershed.

Stream Quality Rating: High

Community Rarity: Potentially

Threats: The acidification of water from abandoned mine drainage (AMD) and acidic precipitation is likely the most prominent pollution threat in these headwater streams. Small, high-elevation streams such as these generally have poor acid buffering capacity, which can exacerbate the effects of acidic inputs and lead to stream acidity outside the tolerable range for most organisms. Additionally, the effects of poorly maintained agricultural land in the watershed may affect water quality and stream habitat in some locations.

Conservation Recommendations: This community type represents the highest quality headwater stream macroinvertebrate assemblage in the study area. Headwater streams of similar size that are in need of restoration may use the community type as a restoration target.

Strongest Indicators of Community Type

Forestfly (*Amphinemura*)

Photo source: http://www.lrca.org/

Tube-case caddisfly (*Lepidostoma*)

Photo source: http://www.dfg.ca.gov

Installing riparian buffers along streams in areas of poorly maintained agricultural land can reduce nutrient runoff and stream bank erosion. Excluding livestock from streams and riparian zones will also restore stream quality and habitat.

Addressing water pollution from AMD and acid deposition are critical for the 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 acid deposition. Other AMD remediation options include passive treatments, such as AMD mitigation wetlands. For more information on AMD, see the PA DEP's Bureau of Abandoned Mine Reclamation webpage:

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

Genus MI High Quality Headwater Stream Community

Known Locations:

Example Habitats:

Un-named tributary to
Limestone Run, Fayette County, PA

Cherry Creek, Clarion County, PA

Photo source: PNHP

Genus MI Mixed Land Use Stream Community

Community Indicators: Cinnamon caddisfly (*Hydropsyche*), fishfly (*Nigronia*), prong-gill mayfly (*Leptophlebia*), watersnipe fly (*Atherix*).

Habitat: This group is generally found in headwater streams ($\bar{x}$ = 6.8 mi^2 watershed size) with moderately high gradients ($\bar{x}$ = 2.1%) and elevations ($\bar{x}$ = 345 m). There are some occurrences of this community in headwater streams of the Delaware River, Lake Erie, and the Youghiogheny River basins. Streams are normally alkaline ($\bar{x}$ = 68.6 mg/l), with high conductivity ($\bar{x}$ = 242.3 µS/cm).

The water quality where this community is found may be impaired by runoff from relatively large amounts of agricultural activity ($\bar{x}$ = 25% watershed landcover) and moderate levels of urbanization pressure ($\bar{x}$ = 3.0% watershed landcover). There is some remaining natural vegetation cover in the watershed ($\bar{x}$ = 63% forested area), which likely aids in buffering pollutants from runoff that originates from agricultural and urban land areas. Additionally, low pH values may be reflective of presence of abandoned mine drainage (AMD) in some areas.

Modest scores for taxa richness and EPT richness ($\bar{x}$ = 8.8 and 6.0, respectively), suggest that this community is found in streams of moderate quality.

Stream Quality Rating: Medium

Community Rarity: Yes

Threats: Similar to large streams, small headwater streams may also suffer from the influence of urbanization and agriculture. This community type reflects locations that are influenced by moderate amounts of agriculture and urbanization, but do not have the necessary forest area in the watershed to counteract the effects of the disturbances. For example, the High Quality Headwater Stream Community (pg. 6-5) is found in similarly sized watersheds ($\bar{x}$ = 6.3 mi^2) with nearly 20% agriculture land cover, but the effects from the this appear to be mitigated by nearly 80% forest cover in the watershed.

Conservation Recommendations: A lack of natural vegetation near headwater streams can negatively influence water quality in lower stream reaches. Streamside vegetation helps keep headwater streams cool and contributes leaf litter that supports important components of the stream food chain. Stream restoration in headwater habitats should involve the establishment or maintenance of a riparian area and forest maintenance in the greater watershed. Restoration of streams lower in the watershed will be more effective if water quality issues at the headwaters are resolved first.

In areas with a large amount of agriculture, the installation of riparian buffers along pastures and crop fields can control excess nutrient runoff and stream bank erosion. Excluding livestock from streams and riparian zones will also restore stream quality. In urban settings, the retention and treatment of municipal discharges and stormwater helps improve stream water quality and habitat condition.

Strongest Indicators of Community Type

Cinnamon caddis (*Hydropsyche*)

Photo source: http://www.usask.ca/biology/skabugs

Fishfly (*Nigronia*)

Photo source: www.troutnut.com

Genus MI Mixed Land Use Stream Community

Known locations:

Example Habitats:

Sixteen Mile Creek, Erie County, PA

Photo source: PNHP

Genus MI Small Urban Stream Community

Community Indicators: Netspinning caddisfly (*Cheumatopsyche*), Stenelmian riffle beetle (*Stenelmis*), blackfly (*Simulium*), dancefly (*Hemerodromia*)

Habitat: This community type is typical of small streams ($\bar{x}$ = 13.1 mi^2 watershed area) flowing through highly urbanized watersheds ($\bar{x}$ = 25.4% urban area). It is mainly found in urban Philadelphia and surrounding counties (Chester, Delaware, Philadelphia and Montgomery). There are a small number of occurrences spread across the remainder of the study area.

This community type occurs in streams of low elevation ($\bar{x}$ = 141 m) and low to moderate gradient ($\bar{x}$ = 1.1%), mainly in the Piedmont region (Figure 9-2). These streams are generally alkaline ($\bar{x}$ = 73.6 mg/l), have a neutral pH ($\bar{x}$ = 7.0) and very high conductivity ($\bar{x}$ = 492.4 µS/cm). High conductivity values such as this are usually indicative of pollution resulting from large amounts of urbanization in a watershed. This community is commonly found in areas of crystalline silicic geology.

On average, 25.4% of the watershed is urbanized and 30.0% is agricultural. Only a small portion of the watershed has natural vegetation ($\bar{x}$ = 43% forested area), which amplifies the effects of developed and farmed land because there is little absorption of pollutants before they reach streams. This occurrence is reflected by the poor biological integrity of the community; this group displays low means for EPT richness ($\bar{x}$ = 4.3), number of pollution intolerant taxa ($\bar{x}$ = 1.4) and taxa richness ($\bar{x}$ = 12.2).

Stream Quality Rating: Low

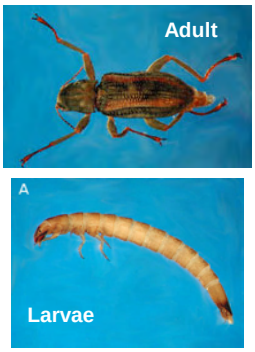
Community Rarity: Yes

Threats: This community has many threats from the surrounding landscape. Urbanization can be severely damaging to streams, generally because of road or stormwater runoff and industrial discharges. Runoff from roads and parking lots may be laden with metals, sediments, hydrocarbons and other pollutants. Channelization and other permanent habitat modifications are also common in urban streams. Industrial discharges are frequently found in developed areas and carry a number of pollutants to stream channels. Runoff containing excess nutrients and toxins from residential areas (lawns, parks, etc.) can lead to a variety of stream impairments.

Strongest Indicators of Community Type:

Netspinning caddisfly (*Cheumatopsyche*)

Photo source: www.epa.gov



Riffle beetle (*Stenelmis*)

Photo source: www.waterbugkey.vcsu.edu

Conservation Recommendations: This community type is common in the Piedmont region of southeastern Pennsylvania, where geology types are unique to the study region. Crystalline silicic geology may represent specialized habitats for this community type.

In urban settings, the retention and treatment of municipal discharges and stormwater helps improve stream water quality and habitat condition. This may be accomplished through mitigated wetlands or stormwater retention ponds. Additionally, both in-stream and riparian habitats can be restored through stream bank riparian zone plantings and restoration of natural stream channels. Restoration of larger streams will be more effective if water quality issues at the contributing headwaters are resolved first.

Genus MI Small Urban Stream Community

Known locations:

Example Habitats:

Salt Lick Creek, Susquehanna County, PA

Martin Creek, Susquehanna County, PA

Photo source: PNHP

Genus MI High Quality Small Stream Community

Community Indicators: iron dun (*Epeorus)*, oulimnian riffle beetle (*Oulimnius*) stripetail stonefly (*Isoperla*), salmonfly (*Pteronarcys*), free-living caddisfly (*Rhyacophila*)

Habitat: This community type is found in smaller streams ($\overline{x}$ = 16 mi^2 watershed area) in heavily forested headwater catchments ($\overline{x}$ = 88.4% forested area in watershed) with very low urbanization ($\overline{x}$ = 0.7%) and agricultural ($\overline{x}$ = 9.1%) development.

This community occurs in streams of high elevation ($\overline{x}$ = 406 m) and gradient ($\overline{x}$ =1.6%). Water quality is typical of undisturbed headwater streams, with low alkalinity ($\overline{x}$ = 22 mg/l), pH ($\overline{x}$ = 6.68) and conductivity ($\overline{x}$ = 99.5 µS/cm). Water temperatures are cool ($\overline{x}$ = 14.1°C). This community is widespread across the region, but is generally absent from the lower Susquehanna River watershed.

The High Quality Small Stream Community has a rich assemblage of organisms, including a large number of EPT taxa ($\overline{x}$ = 15.2) and number of taxa that are intolerant to organic pollution ($\overline{x}$ = 11.7). The most common community members indicate the presence of quality riffle habitat.

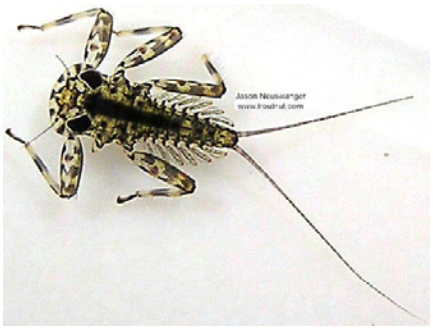
Stream Quality Rating: High

Community Rarity: No

Threats: Found in high-elevation headwater streams, this community faces fewer threats than valley stream communities. However, in a few locations the High Quality Small Stream Community may be in watersheds potentially degraded by poorly maintained agricultural land or abandoned mine drainage (AMD). In small watersheds, such as those that contain this community type, unpaved roads can cause increased sedimentation rates in streams. Poorly buffered agricultural land can contribute unhealthy levels of sediment and nutrients to these streams.

Conservation Recommendations: This community group is a strong indicator of a high quality, naturally functioning small stream system. This community can serve as a target community type for the restoration of similar streams in poor condition.

Strongest Indicators of Community Type



Iron dun (*Epeorus*)

Photo source: www.troutnut.com

Riffle beetle (*Oulimnius*)

Photo source: Brady Richards

Addressing water acidification from AMD and acidic deposition is critical for the High Quality Small Stream Community. Treatment of AMD can reduce acidity and levels of metallic compounds in the discharge effluent, greatly improving water quality.

Adequate maintenance of unpaved road surfaces and management of stormwater from paved roads will reduce the amount of sediments and contaminants introduced to streams.

In agricultural areas, runoff and stream bank erosion can degrade stream quality by enriching nutrient concentrations beyond safe levels and smothering important stream habitat with sediment. Nutrient enrichment and sedimentation can be controlled by installing vegetated riparian buffers of adequate widths along pastures and crop fields.

Genus MI High Quality Small Stream Community

Known Locations:

Example Habitats:

Silver Creek, Butler County, PA

Sides Run, Indiana County, PA

Photo source: PNHP

Genus MI Common Small Stream Community

Community Indicators: Cahill mayfly (*Stenonema)*, waterpenny beetle (*Psephenus*), yellow caddisfly (C*himarra*), saddlecasemaker (*Glossossoma*), brushlegged mayflies (*Isonychia*)

Habitat: The Common Small Stream Community occurs in small watersheds ($\overline{x}$ = 22.5 mi^2 watershed area). Streams typically have low gradients ($\overline{x}$ =1.2%) and occur at low elevations ($\overline{x}$ = 183 m). These streams are generally alkaline ($\overline{x}$ = 61 mg/l), with a basic pH ($\overline{x}$ = 7.6) and moderate specific conductivity ($\overline{x}$ = 172 µS/cm).

This community is commonly found in valley streams with large amounts of agriculture ($\overline{x}$ = 34.4%) and some urbanization ($\overline{x}$ = 5.2%) in their watersheds. It occurs in relatively dense concentrations in southeastern PA in agricultural and suburban watersheds, and has a small number of locations in the Ohio River Basin.

Although agricultural land areas may have some negative influences on water quality or in-stream habitat, the biological metrics suggest that the Common Small Stream Community is relatively unimpaired. The assemblages of taxa in this community remain remarkably diverse ($\overline{x}$ = 20.2 taxa richness), and the mean tolerance values are comparatively low ($\overline{x}$ = 3.6). The EPT richness for this community type ($\overline{x}$ = 11.8) indicates that the organisms in this community do not generally tolerate high levels of pollution.

Stream Quality Rating: Medium

Community Rarity: No

Threats: The small watersheds where this community occurs may be subject to water quality and habitat degradation due to poorly maintained agricultural land. In the absence of vegetated riparian buffers, agricultural streams can experience flow modifications, increased sedimentation, and excessive nutrient inputs. Municipal point source pollution, like sewage treatment plants and stormwater outfalls, likely pollute these streams in some locations.

Conservation Recommendations: The macroinvertebrates that comprise this community type suggest streams of high quality, but the environmental settings where it is found appear to be at least somewhat degraded. This condition may indicate that the habitats where the Common Small Stream Community exists in are especially threatened by watershed development. This community type occurs frequently in the Piedmont region of southeastern Pennsylvania. The area is subject to continued pressure from agricultural and urban development, which will likely have negative effects on the persistence of this community in these areas.

Strongest Indicators of Community Type:

Cahill mayfly (*Stenonema*)

Photo source: www.troutnut.com

Waterpenny beetle (*Psephenus*)

Photo source: www.epa.gov

Restoring channelized streams to natural meanders will help to ameliorate factors that inhibit natural stream function. Establishing or maintaining riparian buffers will help to reduce sediment runoff and nutrient enrichment in agricultural areas.

In urban settings, the retention and treatment of municipal discharges and stormwater helps improve stream water quality and habitat condition. Restoration of larger streams will be more effective if water quality issues at the contributing headwaters are resolved first.

Genus MI Common Small Stream Community

Known Locations:

Example Habitats:

Little Salmon Creek, Forest County, PA

Salmon Creek, Forest County, PA

Photo source: PNHP

Genus MI High Quality Large Stream Community

Community Indicators: blue-winged olive dun (*Drunella)*, acentrellan mayfly (*Acentrella*), dark leadwinged olive (*Serratella*), ephemerellid mayfly (*Ephemerella*), pale evening dun (*Leucrocuta*), fingernet caddisfly (*Dolophilodes*), netspinner caddisfly (*Ceratopsyche*), small minnow mayfly (*Baetis*).

Habitat: This community represents high-quality mid-reach streams ($\bar{x}$ = 39 mi^2 watershed area) found at high to moderate elevations ($\bar{x}$ = 328 m) with moderate gradients ($\bar{x}$ = 1.2%). Alkalinity ($\bar{x}$ = 38.9 mg/l) and conductivity ($\bar{x}$ = 156.9 µS/cm) values are higher than that of headwater streams, but do not indicate elevated levels of pollution in larger streams. Streams are cool ($\bar{x}$ = 15.4 °C), have high quality habitats and are in highly forested catchments ($\bar{x}$ = 81% forested area). The amount of urban land cover in the watersheds associated with this group is very low ($\bar{x}$ = 0.8%). Watershed agricultural land area is also low for streams of this size ($\bar{x}$ = 15.7%).

Biological community indicators confirm the description of high quality habitat. This macroinvertebrate community is very high in taxa richness and EPT richness ($\bar{x}$ = 16.2 and 9.0, respectively), and the community indicators are generally intolerant of organic pollution ($\bar{x}$ = 3.1 tolerance value). The habits of the strongest indicator taxa and the regional gradient statistics suggest that this community is found in stream run habitats more than in riffle habitats.

Stream Quality Rating: High

Community Rarity: No

Threats: Mid-reach streams usually exist below high quality headwaters and receive waters with little impairment. However, threats to water quality become more prevalent once streams reach valleys, where the landscape is subject to greater development pressure. Pollution and habitat alteration associated with poorly managed agricultural land (e.g., sedimentation, nutrient enrichment, changes in temperature regime) might affect this stream type. In addition, because of widespread coal mining in Pennsylvania, abandoned mine drainage (AMD) may also influence watersheds where this community occurs.

Strongest Indicators of Community Type

Blue-winged olive dun (*Drunella*)

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

Acentrellan mayfly (*Acentrella*)

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

Conservation Recommendations: High quality valley streams are valuable natural resources, as they are readily accessible and appealing for recreational use. Streams of this type support some of the state's designated coldwater fisheries. This community represents the highest quality mid-reach stream habitats in Pennsylvania, and should be a priority for conservation and protection.

To protect the recreational and intrinsic value of these streams, active conservation strategies should be implemented. In areas with intense agriculture, remediation of poorly managed agricultural land may be necessary. Stream bank fencing and riparian vegetation plantings will facilitate the mitigation of sedimentation and agricultural runoff that affect water quality.

Although urban areas do not appear to be prevalent in areas where this community occurs, retention and treatment of any municipal discharges helps improve stream water quality and habitat condition. Treating AMD can reduce acidity and metallic compounds in stream water, greatly improving water quality.

Genus MI High Quality Large Stream Community

Known Locations:

Example Habitats:

Kettle Creek, Potter County, PA

Bear Creek, Butler County, PA

Photo source: PNHP

Genus MI Limestone / Agricultural Stream Community

Community Indicators: sowbug (Isopoda) and aquatic worm (Oligochaeta)

Habitat: The Limestone / Agricultural Stream community is found in calcareous (limestone and dolomite) valleys across the study area (Figure 6-1). This community type occurs most commonly in medium to large-sized streams ($\overline{X}$ = 62.3 mi^2 watershed area) at intermediate elevations ($\overline{X}$ = 217 m) and moderate gradients ($\overline{X}$ = 0.9%).

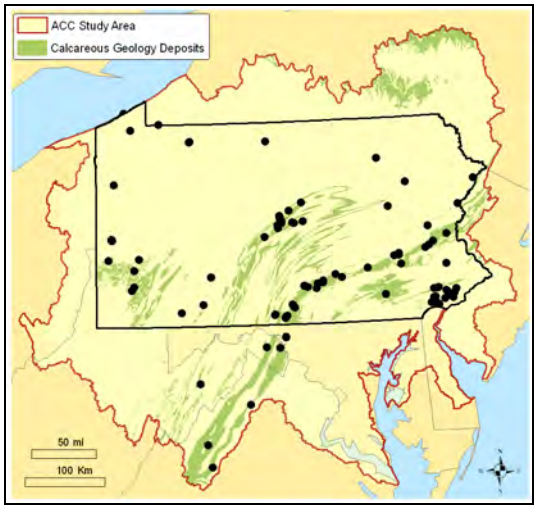


Figure 6-1. The locations of the Limestone / Agricultural Stream Community Locations are concentrated in areas of calcareous geology.

Calcareous geology is usually found in valleys with agriculture and urban or residential development, as this geology type generally results in land well suited for agriculture. Consequently, this community occurs in watersheds with large amounts of agriculture ($\overline{X}$ = 43.7%) and urbanization ($\overline{X}$ = 13.4%). Natural landcover types are relatively low ($\overline{X}$ = 40.9% forest cover). Streams affected by calcareous geology generally show high alkalinity and conductivity values, but the high values associated with this community ($\overline{X}_{alkalinity}$ = 127 mg/l; $\overline{X}_{conductivity}$ = 407 µS/cm) are likely inflated due to non-point source pollution from excessive agricultural and urban development. Water temperatures are generally cool ($\overline{X}$ = 14.4°C).

Taxa richness values ($\overline{X}$ = 11.5) and the number of pollution-intolerant taxa ($\overline{X}$ = 1.4) are relatively low for this community, showing that taxa found in this community type are generally tolerant to organic pollution. Factors shaping the structure of this community are compounded by both watershed disturbance and calcareous geology.

Strongest Indicators of Community Type

Sowbug (Isopoda)

Photo source: www.troutnut.com

Aquatic worm (Oligochaeta)

Photo source: www.troutnut.com

Stream Quality Rating: Low

Community Rarity: No

Threats: Biological assemblages face a variety of significant water quality and habitat degradations where this community is found. Excess nutrients and sediments congest these streams in agricultural valleys, smothering substrate used for habitat. Additionally, modifications in habitat, stream bank structure, and flow regime all pose threats to the streams that support this community. In urban areas, runoff from impervious surfaces can also impair streams.

Conservation Recommendations: This community type occurs in a fairly unique environment in the study area. Calcareous rock can exert a strong effect on streams that flow through this type of geology. Limestone streams that remain in good condition are few; restoration of calcareous streams and conservation of high quality limestone systems should be priorities for aquatic resource managers.

Watersheds with large amounts of agriculture have considerable potential for non-point source pollution. In these areas, runoff and stream bank erosion can be controlled by installing riparian buffers along pastures and crop fields and excluding livestock from streams and riparian zones. In urban areas, management of stormwater and mitigation of any direct stream discharges are recommended. Improvements and upgrades to municipal discharge systems will improve stream condition.

Genus MI Limestone / Agricultural Stream Community

Known locations:

Example Habitats:

Squaw Run, Allegheny County, PA

Pigeon Creek, Washington County, PA

Photo source: PNHP

Genus MI Common Large Stream Community

Community Indicators: dubiraphian riffle beetle (*Dubiraphia*), little white mayfly (*Caenis*), brown dun (*Ephemera*), optioservian riffle beetle (*Optioservus*), biting midge (*Probezzia*), common stonefly (*Perlesta*)

Habitat: The Common Large Stream Community represents larger streams ($\bar{x}$ = 191.3 mi^2 watershed area) with high quality habitats, relative to other streams of similar size. This community is found in moderate elevations ($\bar{x}$ = 308 m) and gradients ($\bar{x}$ = 0.9%) across the region. Streams are generally alkaline ($\bar{x}$ = 76.2 mg/l) with high conductivity ($\bar{x}$ = 340.1 µS/cm).

There are substantial amounts of agricultural land ($\bar{x}$ = 31.4% watershed area) associated with this community type, but little disturbance from urban landcover ($\bar{x}$ = 4.0%) compared to similarly sized streams. Forested area ($\bar{x}$ = 61.4%) accounts for a large portion of these watersheds.

The biological assemblage in this group appears relatively intact. Taxa richness is high ($\bar{x}$ = 19.0), and EPT richness and number of pollution-intolerant taxa ($\bar{x}$ = 9.7 and 4.2, respectively) indicate quality large-stream habitats. Water chemistry conditions suggest some watershed alteration. This community type may represent the best examples of quality large stream and river habitat in the region.

Stream Quality Rating: Medium (higher in larger streams)

Community Rarity: No

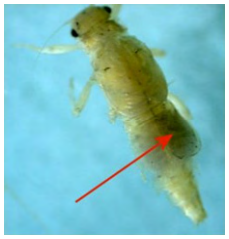
Threats: This community generally indicates quality streams of larger catchment size. These watersheds, however, are still subject to threats similar to other valley streams. Abandoned mine drainage (AMD), urbanization, and agricultural development all pose threats to stream habitat condition in these watersheds. These streams may be subject to a variety of upstream point and non-point pollution sources as well.

Conservation Recommendations: This community is representative of quality streams of large catchment size, which makes the community a unique attribute of any landscape. This community type may be useful as a benchmark community for the restoration of degraded streams with larger catchments, potentially streams that currently support the Genus MI Generalist Community (pg. 6-21).

Strongest Indicators of Community Type

Dubiraphian riffle beetle (*Dubiraphia*)

Photo sources: www.waterbugkey.vcsu.edu (larvae); www.xerces.org (adult)



Little white mayfly (*Caenis*)

Photo source: www.epa.gov

Restoring or installing riparian buffers along streams near pastures and crop fields can control non-point source pollution and stream bank erosion, which are usually prevalent in areas with large amounts of agricultural land. Excluding livestock from streams and riparian zones will also help to protect and restore stream habitat. Treating AMD can reduce levels of acidity and metals in the stream and greatly improve water quality and habitat condition for this community.

The Common Large Stream Community also faces pressure from urban development. Urban effluents can carry a range of pollutants and toxins, including petroleum-based materials, pesticides, herbicides, road salts, and sewer treatment plant discharges. Management of stormwater and mitigation of any direct discharges to streams are recommended. Keeping sewer treatment facilities updated and working properly is also important in alleviating the effects of urbanization on stream systems.

Genus MI Common Large Stream Community

Known Locations:

Example Habitats:

Deer Creek, Allegheny County, PA

Pucketa Creek, Allegheny County, PA

Photo source: PNHP

Genus MI Large Stream Generalist Community

Community members: No macroinvertebrates are significant indicators for this group, but midges (Chironomidae) and aquatic worms (Oligochaeta) are common associates.

Habitat: This community type represents large streams and rivers ($\overline{x}$ = 835 mi^2 watershed area) that are severely degraded by pollution. Moderate gradient ($\overline{x}$ = 1.2%) and moderate elevation ($\overline{x}$ = 322 m) suggest that this community generally occurs in the middle to lower reaches of a watershed. This group is found in portions of the study area where streams are impaired by a variety of pollutants.

Water chemistry data suggest that these streams can be very acidic ($\overline{x}_{pH}$ = 4.3) and have high concentrations of dissolved ions ($\overline{x}_{alkalinity}$ = 56.4 mg/l; $\overline{x}_{conductivity}$ = 286 mg/l). Coal mining occurs frequently in watersheds containing the Large Stream Generalist Community; the resulting abandoned mine drainage (AMD) in the area may be the greatest source of acidification. Agricultural land cover is also common in the watersheds where this community is found ($\overline{x}$ = 33.0%). Urbanization likely affects the biota of these streams as well, as urban land accounts for an average of 4.4% of watershed area. Forest cover remains slightly over half in these watersheds ($\overline{x}$ = 60.4%).

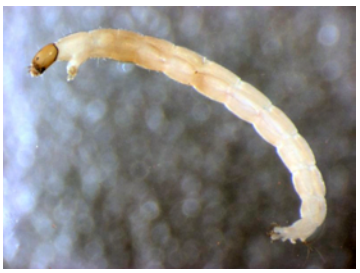
Midges and aquatic worms, the most common community associates, are generally very tolerant of organic and other types of pollution. The community shows low values for both taxa richness and EPT richness ($\overline{x}$ = 3.8 and 1.3, respectively).

Stream Quality Rating: Low

Community Rarity: Uncommon, but not a conservation priority.

Threats: Although the causes of stream impairment appear to vary across community locations, presence of this community type generally indicates very poor water quality. Siltation, erosion, organic enrichment and municipal wastewater discharges are all potentially causing habitat degradation. Abandoned mine drainage (AMD) from coal mines and runoff from surface mining are also associated with streams where the Large Stream Generalist Community occurs.

Common Associates of Community Type



Midge (Chironomidae)

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

Aquatic worm (Oligochaeta)

Photo source: www.troutnut.com

Conservation Recommendations: Locations where this community occurs are in great need of habitat restoration. Large amounts of agriculture, urban development, and roads in these watersheds can contribute non-point source pollutants to these streams. Establishing and maintaining healthy riparian buffers of an adequate width along streams in the tributaries will enhance water quality in the headwaters and the lower reaches where the Large Stream Generalist Community is found. In urban environments, management of stormwater and mitigation of any direct municipal discharges (such as wastewater treatment facilities) to streams are recommended.

Treatment of AMD can reduce the acidity and metallic compounds in the discharges from coal mined areas, greatly improving water quality and habitat condition of streams. 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

Genus MI Large Stream Generalist Community

Known Locations:

Example Habitats:

UNT Mill Creek, Berks County, PA

Toby Creek, Clarion County, PA
(*Note reddish color of stream bottom, an indicator of AMD*)

Photo source: PNHP

Genus MI Ohio River Community

Community Indicators: netspinner caddisfly (*Cyrnellus*), scud (Amphipoda), microcaddisfly (*Hydroptila*), leptohypid mayfly (*Tricorythodes*)

Habitat: Except for two locations in the lower Schuylkill drainage, this group is found exclusively in the Ohio River and the Allegheny River near Pittsburgh. Elevation ($\bar{x}$ = 206 m) and gradient ($\bar{x}$ < 0.01%) are both low in these large river locations ($\bar{x}$ = 18,194 mi^2 watershed area). The water is generally alkaline ($\bar{x}$ = 69 mg/l), with high conductivity ($\bar{x}$ = 457 µS/cm) and pH ($\bar{x}$ = 7.63). Water temperatures are warm ($\bar{x}$ = 22.5°C). The deep-water habitats indicated by this community type are uncommon in the remainder of the study area.

The slow waters maintained by the lock and dam system in these large rivers offer specialized habitats that lie somewhere in between riverine and lacustrine conditions. The indicator taxa of this community are fairly general in their habitat requirements, but all are capable of inhabiting both lotic and lentic environments. Total taxa and EPT richness are low among community types ($\bar{x}$ = 4.3 and 2.1, respectively). Macroinvertebrates associated with this community type are generally tolerant to organic pollution.

Large river environments near urban centers like Pittsburgh are certainly influenced by surrounding development. Watershed land cover averages 5% urban and 23% agriculture where this community occurs. In the local drainage basins (HUC12), urbanized land accounts for more than 33% of the contributing basin.

Stream Quality Rating: Medium

Community Rarity: Yes

Threats: Large river habitats in the Ohio and Allegheny River basins have been fundamentally altered by a long history of industrial pollution, hydrologic alteration, and dredging. The manage-ment of industrial pollution discharges has been largely improved in recent decades. An extensive lock and dam system remains that creates navigational pools but disrupts the hydrologic regime and habitats within the river system. Combined sewer overflows are common in the Ohio and lower Allegheny River basins. Runoff from impervious areas also impairs local streams and rivers. Additionally, many of the tributaries to the Ohio, Monongahela and Allegheny River watersheds are impaired by abandoned mine drainage.

Strongest Indicators of Community Type

Netspinner caddisfly (*Cyrnellus*)

Photo source: www.waterbugkey.vcsu.edu

Scud (Amphipoda)

Photo source: http://www.usask.ca/biology/skabugs

Conservation Recommendations: Ameliorating water quality impairments on tributaries to these large rivers will improve conditions in the main channels. Retaining and treating stormwater before it enters the large rivers will also create better conditions for the Ohio River community.

The Ohio and Allegheny River basins are part of the biologically diverse Mississippi River watershed. These river basins offer specialized habitats to a unique faunal assemblage of macroinvertebrates. Other unique community types in the large river system include several mussel and fish groups. Restoration of large river ecological function and habitats is a lofty conservation goal that may be undertaken in small steps. To facilitate this, the dams could be used to mimic the natural flooding and scouring activity that river systems depend on by staging large, periodic flow discharges. Another option is to establish portions of the rivers to be targeted for patch-scale habitat preservation.

Genus MI Ohio River Community

Known locations:

Example Habitats:

Ohio River at Neville Island, Allegheny County, PA

Ohio River at Merrill Station, Beaver County, PA

Photo source: PNHP

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http://bio-ditrl.sunsite.ualberta.ca. Bio-DiTRL, University of Alberta.

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

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

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

www.lrca.org. Copyright © 2006 Lackawanna River Corridor Association, Scranton, PA

Richards, Brady. Personal Communication, 2006.

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www.usask.ca/biology/skabugs. Department of Biology, University of Saskatchewan. Photos by Dale Parker, AquaTax Consulting.

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www.waterbugkey.vcsu.edu. Valley City State University, Valley City, ND 58072

www.xerces.org. ©2006 The Xerces Society for Invertebrate Conservation.