13. Data Product Descriptions

We created Aquatic Community Classification (ACC) data products that are now made publicly available in this report. Data products are described and documented in this section. Please see the product metadata for specific details.

Aquatic community, physical stream type, water quality, and watershed conservation and prioritization data are available and desribed here.

Community types and descriptions

User's Manual, Chapters 4-7

Community types were developed for three taxa groups: mussels, fish and macroinvertebrates. Because zoogeographic ranges for mussel and fish species were limited by watershed boundaries, community types were developed within three basins for mussels and two basins for fish. The mussel classifications were developed separately for: 1) the Delaware River Basin, 2) the Susquehanna and Potomac River Basins, 3) the Ohio River and Great Lakes Basins. Fish assemblage classes were developed for 1) the Ohio River and Great Lakes Basins, 2) the Atlantic Slope Basins, or Atlantic Basins, that include the Delaware, Susquehanna, and Potomac River Basins.

Each type of aquatic community taxa provides a different perspective on aquatic habitats. Macroinvertebrate assemblages are particularly sensitive to changes in water quality and character and in-stream habitats. Assemblages represent habitats in watersheds up to 200 mi^2 for most communities with the exception of one community associated with larger streams and rivers. Macroinvertebrate communities are based on organisms that are found in spring months (April through June).

The mussel communities tend to occur in larger streams and rivers, where the watershed area was over 100 mi^2; they do not tend to occur in waters with non-organic pollution and severe habitat alteration. Assemblages of fish classes are found from small headwater streams to large river habitats. Thermal tolerance, water quality, and habitats most influence fish communities.

We recommend that use of aquatic community classes be tailored to the particular application. Large watersheds and regions may encompass all taxa assemblages; mid-size to large streams also are likely to contain communities of fish, mussels, and macroinvertebrates. Data users interested in small stream systems may wish to consider only fish and macroinvertebrate communities. We urge new ACC data users to explore all information about the communities in their area of interest.

The use of different taxonomic levels of macroinvertebrates in both community classification and biological monitoring are subject of debate in the aquatic science community (Reynoldson et al. 2001, Waite et al. 2004). An exploratory part of this project was to investigate differences between macroinvertebrate community classifications at two taxonomic levels: family and genus. These taxonomic levels are both commonly used in stream analyses for developing macroinvertebrate community groups and general aquatic research. Upon final analysis of the results from the communities at each taxonomic level, we determined that the genus macroinvertebrate classes were the most meaningful statistically and biologically. Therefore, we are endorsing our genus-level macroinvertebrate classification for use in applications related to ACC products and tools. In order to show the results of our community analyses and present users with the differences between classifications, both family and genus macroinvertebrate community classifications are described in the community descriptions (Chapters 5 and 6).

Community descriptions contain information about the species and taxa, called community indicators, which are typically found with each community type. The habitat occupied by the community is described by stream channel, watershed characteristics, and water chemistry characteristics. The stream quality and community rarity ratings indicated by the community are also noted.

Community locations

File names and locations:

Reach-Community Shapefiles:
FishCommunitiesAtlanticBasin_RF3_NAD83
FishCommunitiesOhGrLakesBasin_RF3_NAD83
MacroinvertFamilyCommunities_RF3_NAD83
MacroinvertGenusCommunities_RF3_NAD83

MusselCommunitiesDelawareBasin_RF3_NAD83
MusselCommunitiesOhGrLakesBasin_RF3_NAD83
MusselCommunitiesSusqPotomacBasin_RF3_NAD83

Metadata:
FishCommunitiesAtlanticBasin_RF3_NAD83.xml
FishCommunitiesOhGrLakesBasin_RF3_NAD83.xml
MacroinvertFamilyCommunities_RF3_NAD83.xml
MacroinvertGenusCommunities_RF3_NAD83.xml
MusselCommunitiesDelawareBasin_RF3_NAD83.xml
MusselCommunitiesOhGrLakesBasin_RF3_NAD83.xml
MusselCommunitiesSusqPotomacBasin_RF3_NAD83.xml

Community locations can be mapped as occurrences and predicted occurrences within stream reaches. Community types for mussels, fish, and macroinvertebrate assemblages are represented at the stream reach scale. The top one or two species most strongly associated with the community are included in the community scientific names. Descriptive names are also given to describe general habitat conditions associated with the community. Scientific and descriptive community names in this file refer to those listed in the *Community Descriptions* (*Chapters 4-7*). In addition to the community locations, predicted locations in stream reaches for community habitats are also available in the file. Model prediction probabilities vary for each stream reach and are noted for each community prediction. Community prediction probabilities and model error rates should be evaluated when considering model predictions. Please see Chapter 5 of the *Classifying Lotic Systems for Conservation: Methods and Results of the Pennsylvania Aquatic Community Classification Project* document for descriptions of the community prediction habitat models.

HUC-12 – Communities Shapefile:
huc12_community_NAD83.dbf

Metadata:
huc12_community_NAD83.shp.xml

Additionally, community habitats can be viewed at a watershed scale. The most frequently occurring community type for each of the mussel, fish, and macroinvertebrate classification are attributed to the HUC 12 watershed. The number of actual community sample locations was counted in this analysis, but predicted community locations were not used. Data users interested in looking at large scale patterns of biodiversity may be interested in communities summarized by watershed.

Stream reaches

Shapefiles:
RF3_Line_NAD83

Metadata:
RF3_Line_NAD83.shp.xml

Stream reach data files are provided to accompany reach-community shapefiles and Least-Disturbed Stream shapefiles.

Abiotic data

Shapefile:
RF3_Polygon_Abiotic_NAD83

Metadata:
RF3_Polygon_Abiotic_NAD83.shp.xml

Also, see the metadata for original data sources.

Geology:
DE_Geol_Metadata.html
NJ_Geol_Metadata.html
PA_Geol_Metadata.html
VA_Geol_Metadata.html
WV_Geol_Metadata.html

Dams:
Dams.html
Dam_heightclass.html
Dam_heighttypes.html

Landcover
LandCoverClasses.html

Roads:
Roads_tigerlines.pdf
Roads_tigerlines_metadata.html

Point sources and mines:
Cerclis.html (point source data)
IFD.html (point source data)
TRI.html (point source data)
Mines.html

Landscape, watershed and stream channel information are attributed to stream reach polygons in this dataset. Polygons correspond to stream reaches in the reach-community shapefiles and the stream reach shapefiles. Polygons were defined by GIS analysts at The Nature Conservancy for the 2003 Lower New England Ecoregional Plan (Anderson and Olivero 2003). Each polygon has reach, riparian buffer, reach watershed, and catchment attributes data summarized (Table 13-1, Figure 13-1).

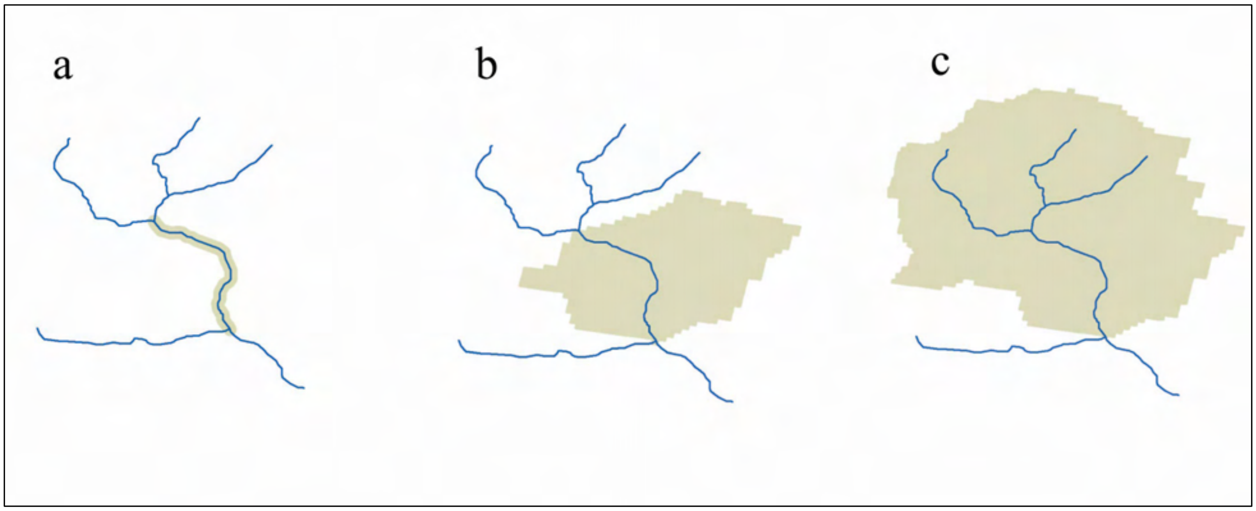
Data include riparian and watershed landcover, geology, watershed area, reach gradient, elevation, stream order, stream link, arbolate sum, road stream crossings, dams, and industrial and mining point sources. Calculated attributes were developed by the report authors and by GIS analysts at The Nature Conservancy for the 2003 Lower New England Ecoregional Plan (Anderson and Olivero 2003). Methods for attributing stream reaches with for many types of calculated data are documented in Fitzhugh (2000). Information about datasets analyzed in the calculated attributes is available in the file metadata.

Physical stream types developed for the study area based on methods and approaches outlined in Higgins (2005). Physical stream types were identified by classes of reach gradient, watershed size, and dominant geology. Habitat types, gradient classes, watershed size classes, and dominant geology classes are attributes of this dataset. See Chapter 8 for descriptions of the approach, methods, and results of the stream types.

Table 13-1. Attributes summarized for reaches, riparian buffers, reach watersheds, and catchments.

Reach	Riparian buffer	Reach watershed	Catchment
Arbolate sum	Land cover	Dams	Dams
Elevation		Geology	Geology
Gradient		Landcover	Landcover
Link		Point sources	Point sources
Strahler order		Mines	Mines
		Road – stream crossings	Road – stream crossings
		Physical stream type	Catchment area
		Geology class	
		Gradient class	
		Watershed size class	

Figure 13-1 (a-c). Spatial boundaries of a riparian buffer surrounding a stream reach, a reach watershed, and a catchment. Areas are shaded for a) a riparian buffer, b) a reach watershed, and c) a catchment (Adapted from Brenden et al. 2006).



Least Disturbed Stream (LDS) condition analysis

Shapefiles:*
RegionWide_LDS.shp
CalcareousGeol_LDS.shp
CrystallineMaficGeol_LDS.shp,
CrystallineSilicicGeol_LDS.shp
Piedmont_LDS.shp
GreatValley_LDS.shp
SusquehannaLowland_LDS.shp
WaynesburgHills_LDS.shp
NWGlaciatedPlateau_LDS.shp

Metadata:
RegionWide_LDS_Metadata.html
CalcareousGeol_LDS_Metadata.htm,
CrystallineMaficGeol_LDS_Metadata.htm,
CrystallineSilicicGeol_LDS_Metadata.htm,
Piedmont_LDS_Metadata.html
GreatValley_LDS_Metadata.htm
SusquehannaLowland_LDS_Metadata.html
WaynesburgHills_LDS_Metadata.html
NWGlaciatedPlateau_LDS_Metadata.html

**In order to minimize duplicity and file size, only the watershed size class field was retained in the specialized LDS shapefiles. To see more information about stream reaches in these shapefiles, overlay them with the complete stream layer, found in the shapefile. RF3_Line_NAD83.*

Stream reaches with the least amounts of human disturbances were selected as potentially high quality habitats. Human disturbance indicators included watershed and riparian landcover types indicating non-point source pollution for agriculture and urban sources, point sources from municipal, industrial, and mining sources, road-stream crossings, and number of watershed dams. Primary stream reaches selected indicate those meeting criteria for human disturbance indicator varia-les. A secondary analysis, using relaxed criteria, selected reaches in ecological regions and habitats that may face more human disturbance than other areas. We captured the best remaining examples of streams in watersheds with calcareous, crystalline silic, and crystalline mafic geologies and streams from watersheds in the Great Valley, Northwest Glaciated Plateau, Piedmont, Waynesburg Hills and Susquehanna Lowlands physiographic regions. See LDS chapter (9) for more information.

Conservation priority results

Shapefiles:
Conservation_HUC12s.shp
French_Creek_Conservation_HUC12s.shp
Piedmont_Conservation_HUC12s.shp
WaynesburgHills_Conservation_HUC12s.shp
CalcareousGeol_Conservation_HUC12s.shp

Metadata:
Conservation_HUC12s_Metadata.html
French_Creek_Conservation_HUC12s_Metadata.html
Piedmont_Conservation_HUC12s_Metadata.html
WaynesburgHills_Conservation_HUC12s_Metadata.html
CalcareousGeol_Conservation_HUC12s_Metadata.html

Conservation priority watersheds for Pennsylvania were determined as those having habitat for high quality biological communities, scoring high community biological metrics, and having a high proportion of least-disturbed streams in the watershed. The Tier 1 and 2 watersheds represent those meeting the most stringent criteria. Watersheds receiving Tier 1 status have highest amounts of community habitat, have biological indicators that suggest good habitat, and have few human disturbance indicators. Tier 2 watersheds score secondarily in one or all of the criteria variables. Additional, watershed prioritization occurred for areas in the Piedmont Physiographic Province, Waynesburg Hills Physiographic Section, watersheds dominated by calcareous geology, great rivers (watershed area >2000 sq. mi.), and the French Creek watershed in the Allegheny River basin.

Restoration priority results

Shapefiles:
Restoration_HUC12s.shp

Metadata:
Restoration_HUC12s_Metadata.html

A tiering system similar to that used in the watershed Conservation Prioritization analysis was used to indicate the state of impairment that each altered watershed is in. The ‘Tier 1’ category here represents the most disturbed watersheds that exist in Pennsylvania. The ‘Tier 2’ category also represents a condition of impairment, but the need for restoration action in these areas may not be as immediate as those with ‘Tier 1’ status.

These watersheds are an immediate priority for restoration action. Watersheds fell into the a restoration priority category if it had no LDS reaches, had low-scoring macroinvertebrate metrics, and had multiple occurrences of fish or macroinvertebrate communities that indicate poor-quality stream habitat.

Watershed Enhancement Areas

Shapefiles:
Watershed_Enhancement_Areas.shp

Metadata:
Watershed_Enhancement_Areas.html

Watersheds that did not fall into either the Conservation or Restoration priorities were identified as "Enhancement" watersheds. These watersheds reflect conditions that are likely not pristine, and are prime candidates for restoration action because they are not as severely degraded as the Restoration watersheds. The restoration of these Watershed Enhancement Areas will likely yield the most significant ecological gains for the amount of conservation dollars spent.

Pennsylvania Aquatic Database

Database:
PAD.mdb

Metadata:
PADfieldlist.xls

The database contains aquatic habitat, water chemistry, and biological data for the study area. Biological datasets include mussel, fish and macroinvertebrate surveys. Most datasets gathered for the project from a number of sources, including state and federal agencies, watershed groups, river basin commissions, and universities, are made publicly available in this database. The database is organized by data station, samples, replicates, and survey data with many supporting tables.

References

Anderson, M.A. and A.P. Olivero. 2003. TNC Stream Macrohabitats. Lower New England Ecoregional Plan. The Nature Conservancy. Boston, MA.

Brenden, T.O., R.D. Clark, Jr., A.R. Cooper, P.W. Seelbach, L. Wang, S.S. Aichele, E.G. Bissell, and J.S. Stewart. 2006. A GIS framework for collecting, managing, and analyzing multiscale landscape variables across large regions for river conservation and management. Pages 49-74 *In* Hughes, R. M., L. Wang, and P. W. Seelbach, *Eds.* Landscape influences on stream habitats and biological assemblages. American Fisheries Society Symposium 48. American Fisheries Society, Bethesda, MD. 698 pp.

Fitzhugh, T. 2000. GIS tools for stream and lake classification and watershed analysis: A tool primer. The Nature Conservancy. Arlington, VA. http://conserveonline.org/coldocs/2000/11/tnctools_10_20.zip/view?searchterm=tnctools_10_20
US Environmental Protection Agency. 2002.

Higgins, J.V., Bryer, M.T., Khoury, M.L., and T.W. Fitzhugh. 2005. A freshwater classification approach for biodiversity conservation planning. Conservation Biology. 19 (2): 432-445.

Master, L.L., Stein, B.A., L.S. Kutner, and G.A. Hammerson. 2000. Vanishing Assets: Conservation status of U.S. species. In. Stein, B.A., Kutner, L.S., and J.S. Adams, Eds. Precious Heritage: The status of biodiversity in the United States. The Nature Conservancy and the Association for Biodiversity Information. Oxford University Press, Inc. New York, NY. 10016. 399 pp.

Reynoldson T.B., D.M. Rosenberg and V.H. Resh. 2001. Comparison of models predicting invertebrate assemblages for biomonitoring in the Fraser River catchment, British Columbia. *Canadian Journal of Fisheries and Aquatic Sciences.* 58 (7): 1395-1410.

Trout Unlimited, 2006. Eastern brook trout: Status and Threats. Trout Unlimited, Arlington, VA.

US EPA, Office of Water. Water quality conditions in the United States: A profile from the 2000 National Water Quality Inventory. (4503F), Report EPA-841-F-02-003.

Waite I.R., A.T. Herlihy, D.P. Larsen, N.S. Urquhart and D.J. Klemm. 2004. The effects of macroinvertebrate taxonomic resolution in large landscape bioassessments: an example from the Mid-Atlantic Highlands, USA. *Freshwater Biology*. 49 (4): 474-489.