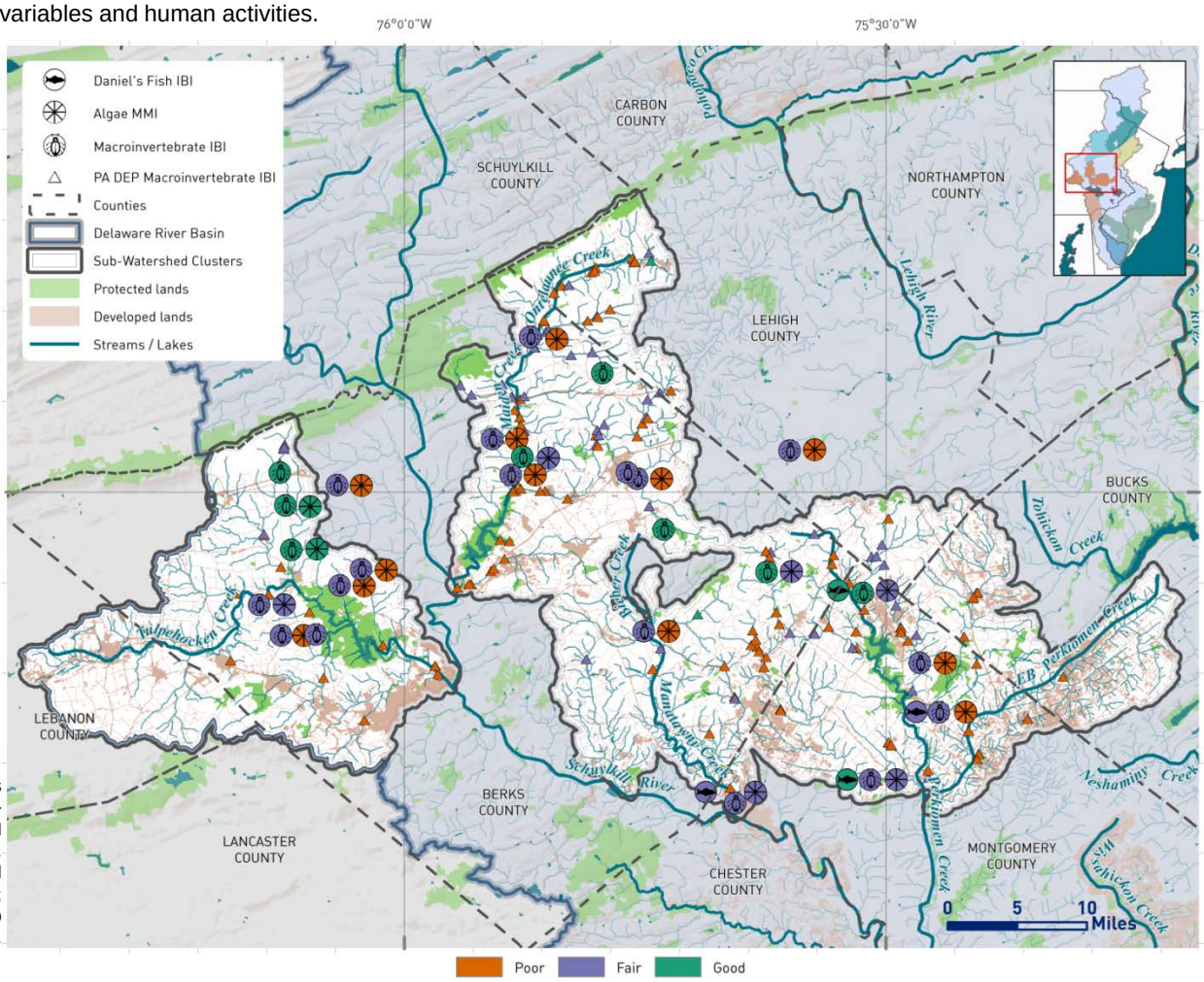
Baseline conditions of the

MIDDLE SCHUYLKILL

Delaware River Watershed Initiative

Multiple Indicators: Data collection includes chemical parameters as well as biota. Water chemistry alone can either over exaggerate or fail to detect changes from brief pollution events, but biota provide information on year-round water and habitat quality. Different biota respond differently to stressors. Analyzing data on multiple groups of biota tells a more complete story of ecosystem structure and function in relation to landscape variables and human activities.



Circle icons represent 2013-2014 DRWI sites. ANS/Stroud WRC sites = **24**; Cluster Group sites = **17**.

Indices of Biological Integrity: An index of biological integrity (IBI) is a collection of metrics which describe the structure and function of an ecosystem based on its biota. Metric values are converted to scores and yield a total IBI score. These scores can be translated into easily-interpreted regional quality classifications.

Rating	Daniels Fish IBI	PADEP Macro-invertebrate IBI	Algae MMI
Poor	0 – 35	0 – 45	0 – 3.33
Fair	35.1 – 46	45.1 – 74	3.34 – 6.66
Good	46.1 – 60	74.1 – 100	6.67 – 10

Notable Fish & Significance to IBI

Cutlip Minnow *(Exoglossum maxillingua)*
Insectivore, intolerant, sensitive to non-specific stressors

Blacknose Dace *(Rhinichthys atratulus)*
Generalist feeder, tolerant to non-specific stressors

Tessellated Darter *Etheostoma olmstedi*
Insectivore, intermediate tolerance to non-specific stressors

Average Daniels Fish IBI Score: 48.00 (Good)

Notable Macroinvertebrates & Significance to IBI

Midges*: Chironomidae*
Present here are pollution tolerant collector-gatherers & shredders

Tube-making caddisflies*: Polycentropus*
Require fast-flowing waters, moderately pollution tolerant, predator

Amphipods*: Amphipoda*
Moderately pollution tolerant, collector-gatherers

Average Macroinvertebrate IBI Score: 66.77 (Fair)

Notable Algae & Significance to IBI

Amphora pediculus
Nutrient tolerant, organic pollution sensitive, grazer & scour resistant

Achnanthidium rivulare
Nutrient tolerant, neutral pH optimum, grazer and scour resistant

Nitzschia inconspicua
Nutrient tolerant, organic pollution tolerant, grazer and scour resistant

Average Algae MMI Score: 2.94 (Poor)

THE ACADEMY OF NATURAL SCIENCES
of DREXEL UNIVERSITY

July 2016

MIDDLE SCHUYLKILL

Cluster Organization

Partners: Berks Nature*, Natural Lands Trust, Partnership for the Delaware Estuary*, Stroud Water Research Center*. (*monitoring partners)

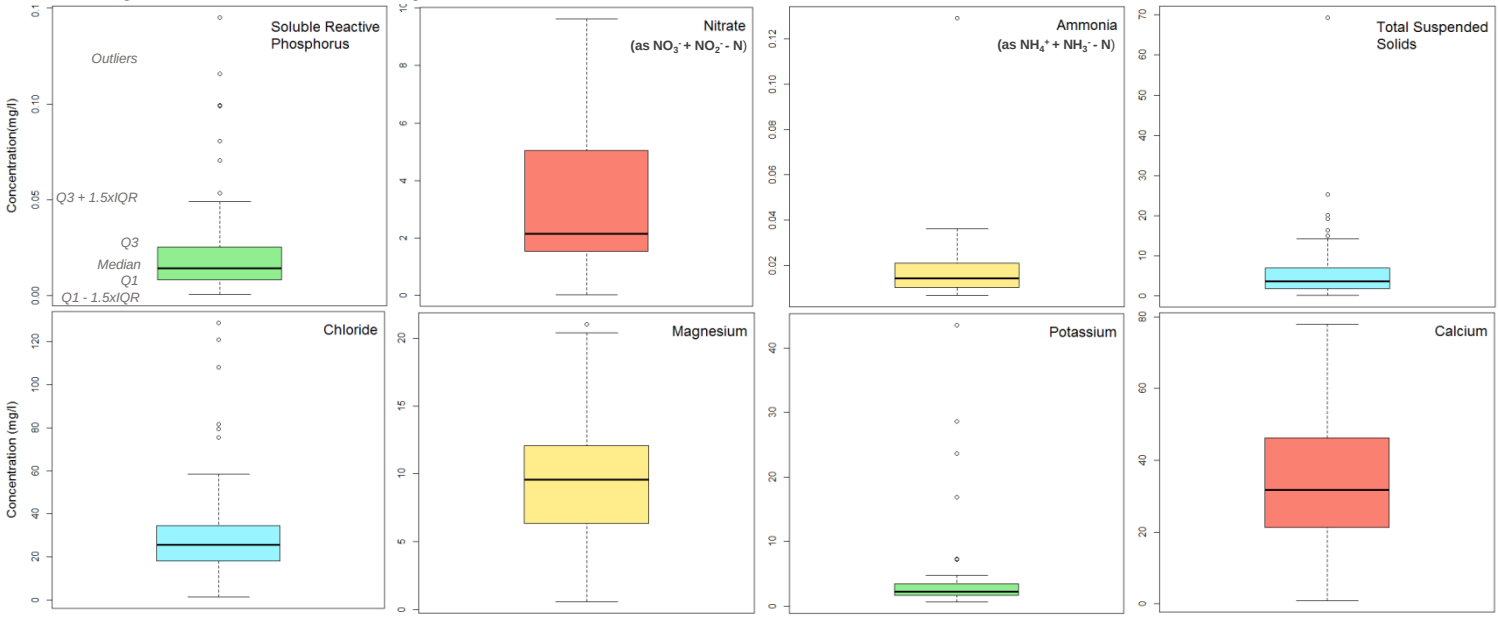
Strategy: Address negative impacts of agricultural land use by working with farms on conservation and nutrient management, and implementation of best management practices. Engage and educate agricultural community on the relationship between agriculture and water quality. Utilize established conservation practices to prevent further degradation of waterways.

Monitoring Objectives: Establishing baseline conditions in areas not previously sampled, and providing data on agricultural restoration projects. Monitoring is conducted by professionals and a volunteer/citizen science cohort.

Habitat Assessment

In-stream habitat assessments are a composite of variables including flow type descriptions, particle size classifications, and embeddedness estimations. These features interact to influence biotic communities. Reaches sampled in the Middle Schuylkill cluster were highly dominated by glide (45%; fast-flowing but not as choppy as a riffle) and pool (40%; still or backflow) flow types, with much fewer riffle areas. The flow type is often reflected in both substrate particle size and how embedded particles are. Particle size and embeddedness then, in turn, partially determine the area of habitat available for fish, macroinvertebrates, and algae within a reach. In the Middle Schuylkill cluster the dominant particle sizes were cobble (27%), gravel (18%) and fine sediment (14%; e.g. clay). The coarse gravel, cobbles, and boulders present were about 60% embedded (covered in fine sediment; high percentages can indicate erosion of upstream land). Overall this cluster was given a habitat grade of suboptimal.

Summary Of Water Chemistry Parameters



Box-and-whisker plots of chemical parameters in the Middle Schuylkill cluster.

There were 57 sampling events performed by the Academy of Natural Sciences and Stroud Water Research Center at 23 sites from 2013 to 2014. The cluster is dominated by agriculture (44% of land use), which can correlate with high levels of nitrate, soluble reactive phosphorus (SRP) and total suspended solids (TSS). The "integrative" site on the upper west branch of Perkiomen Creek met cold water standards for all parameters at all six sampling events. Situated close to its headwaters, it has a drainage area of 91 km^2, and it includes 41% forested land.

Two thirds of sampling events met recommended criteria for nitrate for cold-water fish communities (<3.1 mg/L nitrate, Minnesota PCA). Fourteen samples exceeded 4.9 mg/L nitrate, failing to meet nitrate criteria for warm water fish communities. One site on Tulpehocken Creek failed to meet nitrate criteria at all six events (across all seasons). This "integrative" site captures a 221 km^2 drainage area which is dominated by agriculture (70%) and includes several small towns (17% urban). Seven sampling events (from Saucony and Swamp creeks) were greater than 0.05 mg/L SRP – a widely-referenced maximum concentration for suitability for aquatic life. Only two samples (from Maiden and Saucony creeks) exceeded the limit for TSS in cold water streams (25 mg/L, NJ DEP). One site on Saucony Creek failed to meet cold water community criteria for SRP, nitrate and TSS during summer sampling events. However, it attained warm water criteria for nitrate and TSS. Chloride can be related to urban land use via road salts and wastewater treatment. All samples in the cluster attained standards for aquatic life under chronic exposure to chloride (<230 mg/L, EPA).

Ammonia concentration and its effects on freshwater communities is highly variable; upper limits of concentrations suitable for aquatic life can range from 0.07 to 2.0 mg/L total ammonia (EPA) depending on temperature, pH and species. One sample from Tulpehocken Creek was 0.13 mg/L total ammonia, which, while not below 0.07 mg/L like the rest of the samples in this cluster, does fall within the accepted range of maximum values. Potential sources of ammonia are wastewater treatment plants, agricultural run-off or direct contamination from animals. Weathering is the main source of calcium (from limestone), magnesium (from igneous rocks that include biotite and pyroxene), and potassium (from igneous and silicate rocks including feldspar) in freshwater streams. Their concentrations vary depending on rainwater and pollution as well as local geology, with ion concentrations in igneous geographies roughly half those of sedimentary landscapes. Downstream this variation becomes less notable than in headwaters, and ion concentrations increase overall (Allan and Castillo, 2007).