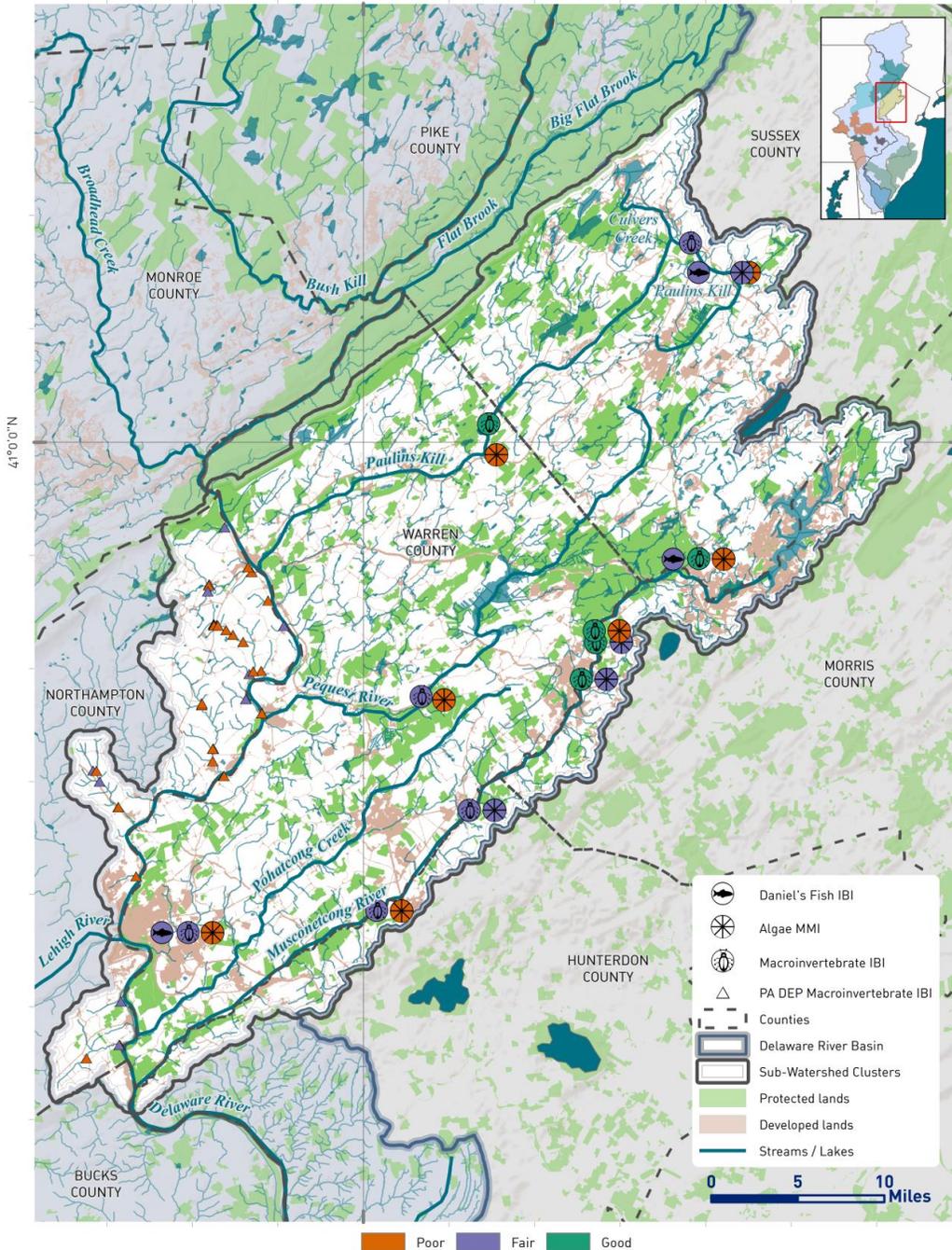


# NEW JERSEY HIGHLANDS

**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.

75°0'0"W



Circle icons represent 2013-2014 DRWI sites. ANS/Stroud WRC sites = 12; Cluster Group sites = 38.

**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.

**Notable Fish & Significance to IBI**

**Margined Madtom (*Noturus insignis*)**  
Insectivore, intermediate tolerance to non-specific stressors

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

**Longnose Dace (*Rhinichthys cataractae*)**  
Insectivore, intermediate tolerance to non-specific stressors

**Average Daniels Fish IBI Score:**  
41.33 (Fair)

**Notable Macroinvertebrates & Significance to IBI**

**Midges: Chironomidae**  
Those present here range from pollution sensitive to pollution tolerant, collector-gatherers and shredders

**Small minnow mayflies: Baetidae**  
Pollution tolerant, collector gatherers, very common

**Average Macroinvertebrate IBI Score:**  
74.05 (Good)

**Notable Algae & Significance to IBI**

**Cocconeis placentula**  
Moderate nutrient tolerance, grazer and scour resistant

**Amphora pediculus**  
Nutrient tolerant, organic pollution sensitive, grazer and scour resistant

**Rhoicosphenia abbreviata**  
Nutrient tolerant, grazer and scour resistant

**Average Algae MMI Score:**  
2.68 (Poor)

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

# NEW JERSEY HIGHLANDS

## Cluster Organization

**Partners:** Association of New Jersey Environmental Commissions, Hunterdon Land Trust, The Land Conservancy of New Jersey, Musconetcong Watershed Association\*, The Nature Conservancy\*, New Jersey Audubon, New Jersey Conservation Foundation, New Jersey Highlands Coalition, North Jersey Resource Conservation & Development, Walkkill River Watershed Management Group, Trout Unlimited. (\*monitoring partners).

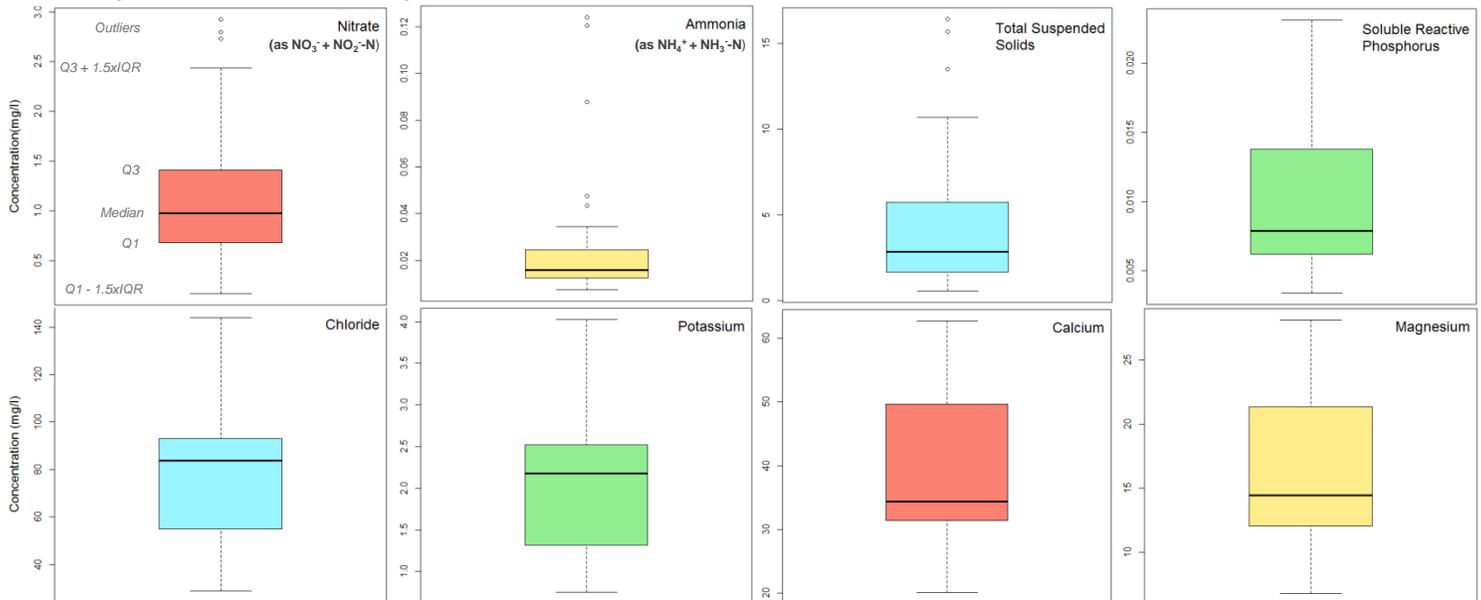
**Strategy:** Protection and restoration of in-stream conditions, headwaters and floodplains. Expanding knowledge about floodplain conditions and microbial sources; land acquisition and stewardship in forested headwaters and floodplains; agricultural best management practices; stormwater and septic system management; development of community engagement and volunteerism.

**Monitoring Objectives:** Assessing change resulting from multiple projects by monitoring at cluster-wide and focus-area scale; and project-specific monitoring to understand local impacts. Monitoring is conducted by a mix of professional and volunteer personnel.

## 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 New Jersey Highlands cluster were dominated by glide (40%; fast-flowing but not as choppy as a riffle) and pool (31%; still or backflow) flow types, but had a significant amount of riffles and rapids (larger boulders with cascade-like features). 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 New Jersey Highlands cluster, dominant particle sizes were cobble (31%) and then an even mixture of gravel (16%), sand (13%), small boulders (9%) and fine particles (16%; 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 New Jersey Highlands cluster.

There were 35 seasonal sampling events performed by the Academy of Natural Sciences and Stroud Water Research Center at 11 sites from 2013 to 2014. The cluster is predominantly forested (46%) and contains significant percentages of agricultural (26%) and urban land (15%).

Regarding soluble reactive phosphorus (SRP), nitrate and total suspended solids (TSS), all sampling events at all sites met the criteria for suitability for aquatic life in cold water (trout-producing) streams. Phosphorus is related to agricultural run-off, but wastewater treatment and sewage overflow might also be factors. The highest values for nitrate were from samples on the lower Musconetcong River. This site is downstream of Hackettstown, N.J., and also captures some agricultural land (22% urban, 7.8% agriculture in its drainage). Nitrate concentrations on Musconetcong River just upstream of Hackettstown ranged from 0.24 to 1.21 mg/L nitrate (avg. 0.81), while the lower Musconetcong site ranged from 0.67 to 2.93 mg/L (average 2.06 mg/L). The lower Musconetcong site also produced the highest concentration of chloride (144.1 mg/L), though it and all other sampling events in the cluster satisfied criteria for chloride concentrations suitable for aquatic life under chronic exposure (<230 mg/L). High chloride concentrations can be related to urban land use via road salts and wastewater treatment plants. The three highest TSS concentrations were from sampling events on the upper Paulinskill (13.5 mg/L), Pequest (15.7 mg/L) and upper Musconetcong rivers (16.5 mg/L). The maximum TSS concentration recommended for cold water streams is 25 mg/L (NJ DEP).

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. All but three samples had total ammonia concentrations below the low end of the range of maximum concentrations; these three samples – one each from the upper Paulinskill, lower Musconetcong and Pequest rivers, do still fall within the range of upper limits. 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).