

“We believe that access to valid information on environmental trends and priorities enables all of us—whether at EPA, our partnering state and local agencies, environmental organizations, industry, or the general public—to develop the right policies and make the right investments to best protect our environment.”

– Donald Welsh, Regional Administrator US EPA Region 3

THE PULSE OF THE HIGHLANDS

While the Mid-Atlantic Highlands region enjoys rich natural and cultural resources, all is not well. The region suffers from past and current environmental and socioeconomic impacts at scales ranging from the local community to the entire region. Programs established to measure the region's condition have been enhanced over the past decade. Traditional federal and state monitoring programs

Biological organisms—fish, birds, insects—all indicate that, in general, anywhere from 50% to 75% of the Highlands landscapes and streams are in fair to poor condition.

have been augmented by initiatives such as the EPA MAIA, a partnership between EPA Region 3 and the EPA Office of Research and Development. MAIA is a scientific effort to measure the condition of the living resources of the Region. Together with ongoing programs, these monitoring results point to past, present, and future threats to the Mid-Atlantic Highlands. More information on MAIA, including reports and assessments results, can be found on the Internet at www.epa.gov/maia.

ENVIRONMENTAL CONDITION OF THE MID-ATLANTIC HIGHLANDS

When there is no life in a stream, or the land has nothing growing on it, it is easy to assess environmental condition. The condition is bad! Because of the progress that has been made over the past 30 years, however, these extreme environmental situations are rare today. So, how can the condition of the environment

in the Mid-Atlantic Highlands be assessed?

One of the best ways to assess the overall health of the environment is to assess the condition of the biological organisms such as fish, insects, birds, and trees living in these areas. These organisms integrate the physical and chemical factors in the environment, so that not every aspect of the physical habitat or every chemical in the air, water, and soil has to be measured to adequately assess environmental condition. Biological organisms provide a more complete picture of the condition of the place in which they live.

The organisms that are measured, called biological indicators, also represent desired ecological endpoints, the things individuals and communities care about and want—reproducing trout fisheries, diverse and productive forest communities, and songbirds. In addition, good environmental stewardship protects the health of humans, other animals, and plants. Measuring the health of organisms pro-

vides a direct measure of how well environmental stewardship programs are working.

LANDSCAPE

The patterns of land types that compose the regional landscape influence ecosystem condition. At the regional scale, measures that characterize changes in land use, forest fragmentation, the intensity of human impacts, changes in water quality, and air pollution serve to differentiate relatively undisturbed ecosystems from those impacted by human activities. The EPA has used such measures to characterize the health of landscapes in the Mid-Atlantic States. Their maps show that relative to other areas in the Mid-Atlantic, the Mid-Atlantic Highlands region generally contains large tracts of interior hardwood forest, low human population, high levels of acid rain, high numbers of roads crisscrossing streams, and low levels of nutrient or fertilizer runoff into streams. These measures provide a means to identify relatively undisturbed ecosystems as well as areas affected by stressors and human activities. To further explore the quality and integrity of the Mid-Atlantic Highlands landscape, biological indicators are

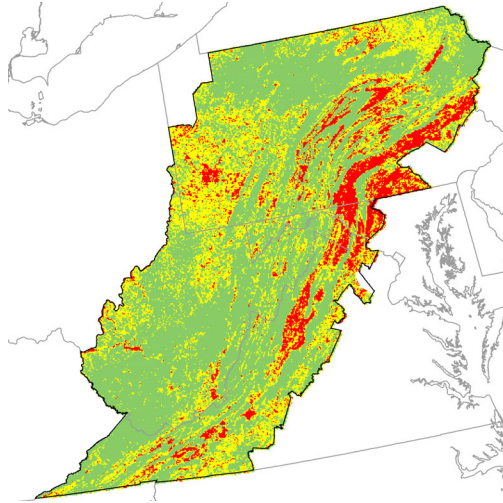


Figure 4. Bird communities give us an indication of the health of the landscape. They are telling us that 57% of the Highlands landscape is in fair or poor condition, indicated on the map by yellow or red areas.

needed. Birds, trees, fish, and insects provide a clearer indication of ecosystem health in the Mid-Atlantic Highlands.

BIRDS

Researchers at The Pennsylvania State University have found that bird communities in the Mid-Atlantic Highlands reflect the overall ecological condition of the landscape. As birds fly, they evaluate the landscape below them, choosing to nest, breed, or feed in areas they judge suitable. Birds not only evaluate the composition, but also the patterns of the landscape. Where the landscape is highly fragmented or dominated by agricultural or urban development, bird communities are impoverished. Where the landscape is composed of large tracts of in-

terior forest, bird communities are diverse, including an array of species that use different parts of the habitat.

Based on these observations, scientists developed a Bird Community Index (BCI) to describe the overall

ecological condition of the landscape. The BCI tells us that 43% of the Mid-Atlantic Highlands landscape is in good to excellent condition, 36% is fair, and 21% is in poor condition (Figure 4).

The BCI can also be used to evaluate the condition of the landscape within individual watersheds. Relative to other areas in the Mid-Atlantic Highlands, the landscape in southwestern West Virginia and north-central Pennsylvania is in better overall condition.

TREES

One indicator of forest health is the condition of the tree crown or canopy. The US Forest Service, in conjunction with Mid-Atlantic Highlands states, has been monitoring a suite of indicators of forest health, including indicators of tree crown dieback. Healthy tree crowns indicate good productivity and growth of the trees; poor tree crown condition means poor growth and

productivity and that the trees are being affected by one or more stressors. Poor growth and productivity, as indicated by poor tree crown condition, has both economic and environmental consequences. In general, tree crown measurements indicate the forests across the Mid-Atlantic region are in good condition. While there are no apparent regional problems that are affecting all the tree species, localized problems do occur in different forest stands. Invasive species, forest fragmentation, acid rain, and high ozone concentrations are all affecting the health of trees in Mid-Atlantic Highlands forests. Even though the tree crown might indicate the forest is in good condition, other indicators show that all might not be well.

FISH

Assessing the condition of a Mid-Atlantic Highlands stream provides information not only about the health of the stream, but also the upstream watershed. Streams, wetlands, lakes, and other aquatic ecosystems integrate what is happening in the watershed with what is happening in the water. Aquatic organisms integrate the physical, chemical, and other biological stressors arising in the watershed with processes that are occurring within the



Fish communities indicate that 31% of Highlands streams are in poor condition, 36% are in fair condition, and 17% are in good condition. In 16% of Highlands streams no fish were found.

stream itself. Scientists have developed an Index of Biotic Integrity (IBI) to indicate the condition of fish communities. This index considers multiple factors contributing to the health of fish communities in streams, just like the BCI did for the watershed. Estimates of the health of fish communities in over 72,000 miles of Mid-Atlantic Highlands streams indicated that there were almost twice as many miles of streams in poor condition (31%) as in good condition. The IBI indicated that over 67% of the stream miles in the Mid-Atlantic Highlands were in fair to poor condition. The total number of stream miles were estimated based on

USGS 1:100,000 scale maps and include 1st, 2nd, and 3rd order streams identified at that scale.

INSECTS

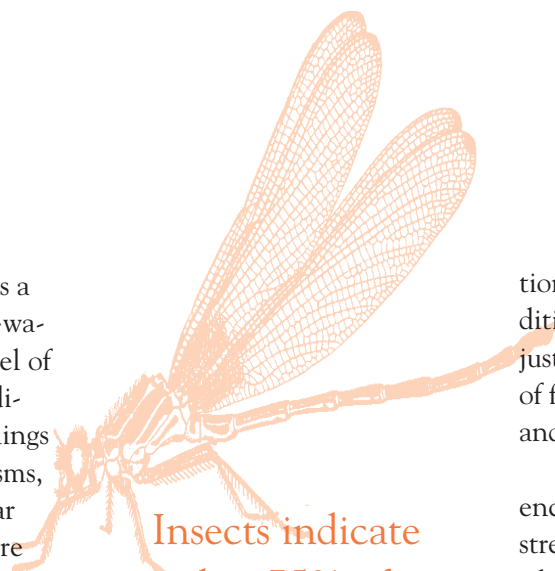
Stream insects are another group of organisms that have traditionally been used to assess the condition of streams. Stream insect assemblages are easier to sample than fish, serve as food for fish and other wildlife, and are also sensitive to pollutants and habitat damage. An insect index, called the EPT, was used by EPA scientists, along with scientists from the Mid-Atlantic Highlands states, to assess the health or condition of Mid-Atlantic Highlands streams. This stream insect index indicated that about one quarter of Mid-Atlantic Highlands streams are in good condition (25%) while about 27% are in poor condition. Seventy-five percent of Mid-Atlantic Highlands streams were estimated to be in fair to poor condition, which is similar to the condition estimated by the fish index.

BIOLOGICAL CONDITION

Biological organisms are stressed throughout the region (Table 4). Stream bottom animals, stream fishes, and birds all show signs of stress. It does not matter if the Mid-Atlantic

Highlands are examined as a whole, on a watershed-by-watershed basis, or at the level of individual states, the condition is the same. Living things are stressed. These organisms, like trout, honeybees, sugar maple, and black cherry, are important to us both environmentally and economically. When they are in poor condition, the things Mid-Atlantic Highlands residents and visitors value and desire—jobs, fishing, hunting, recreational and tourism revenue, and even flowers that need bees to pollinate them—are affected.

The current reality, then, is that many of the values and desires of local communities are not being attained. Previous regulatory and environmental management programs



Insects indicate that 75% of Highlands stream miles are in fair or poor condition. Only 25% of stream miles are in good condition.

have made progress, but it is not enough. Why is the environment in fair to poor condi-

tion? What is causing this condition? Unfortunately, it is not just one thing. A combination of factors is stressing humans and other biological organisms.

The conditions are influenced by factors, also called stressors, in the environment, which are often a result of human activities. For example, a stream may be devoid of fish because of highly acidic conditions. The acidic conditions might have been caused by improperly managed mining practices or by atmospheric deposition of man-induced pollutants like acid rain. What are some of these stressors affecting the condition of the environment?

Table 4. Biological indicators show that the majority of the Highlands region is in fair or poor condition.

Biological Indicator	Condition		
	Good	Fair	Poor
Landscape (fragmentation)*	53	39	8
Birds (BCI)*	43	36	21
Fish (IBI)+^	17	36	31
Aquatic Insects (EPT)+	25	48	27

* Percent of area

+ Percent of stream miles

^ In 16% of stream miles no fish were found