MARYLAND DEPARTMENT OF NATURAL RESOURCES

Tidewater Ecosystem Assessment

Patuxent River
Water Quality and Habitat Assessment
Overall Condition 2010-2012

Healthy rivers and bays support a diverse population of aquatic life as well as recreational uses, such as swimming and fishing. To be healthy, rivers and bays need to have good water and habitat quality. High levels of nutrients and sediment lead to poor water quality. Poor water quality reduces habitat quality, including water clarity (how much light can get to the bottom) and the amount of dissolved oxygen in the water. In turn, habitat quality affects where plants and animals can live. The Maryland Department of Natural Resources (DNR) is responsible for monitoring water and habitat quality in the Chesapeake Bay and rivers, as well as the health of aquatic plants and animals. DNR staff use this information to answer common questions like "How healthy is my river?", "How does my river compare to other rivers?", "What needs to be done to make my river healthy?" and "What has already been done to improve water and habitat quality in my river?"

Land use in the Patuxent River watershed as a whole was roughly 40% urban and 40% forest. Approximately 20% of the watershed was used for agriculture. Agricultural land use was highest in the uppermost portions of the watershed, while the central watershed was 45% or more urban. The lower portion of the basin was largely forested. Human population density was mostly low, though moderate densities were common in the areas surrounding cities and towns. There were also a few pockets of lower population density and of very high density.

Point sources were the largest contributor of nitrogen and phosphorus and agriculture was the largest contributor of sediment to the upper river. Urban runoff was also an important source of nitrogen, phosphorus and sediment loadings to the upper river. Agriculture was the largest source of nitrogen, phosphorus, and sediment loadings to the middle river, but septic and forest sources were as important as agriculture for nitrogen loadings, and forest and urban were important sources of phosphorus loadings. Septic was the largest source of nitrogen to the lower river and forest and agriculture were also important. Point sources and agriculture were the major sources of phosphorus to the lower river, and sediment loadings were from agriculture and urban runoff.

How healthy is the Patuxent River?

Upper River

Sediment loadings from the upper river watershed increased but nitrogen loadings decreased. In the non-tidal waters of the Patuxent, phosphorus levels decreased; non-tidal nitrogen levels increased at the upstream station but decreased at the fall line station. There were no trends in sediment levels at the non-tidal stations.

In the tidal portion of the upper river, water quality is fair and nitrogen, phosphorus and sediment levels are improving. However, nutrient levels are still too high throughout and sediment levels are too high in the lower portion (Table 1). Habitat quality is poor due to low water clarity and moderate algal abundances. Summer bottom dissolved oxygen levels are good.

Underwater grasses covered larger areas in the early 2000s, meeting restoration goals, but have not been as widespread in more recent years and were especially limited in 2012. Bottom dwelling animal populations are healthy.

Middle River

In the middle river, water quality is poor. Nitrogen and phosphorus levels improved at the upstream station. However, nutrient and sediment levels are too high to provide healthy habitat for underwater grasses. Habitat quality is poor due to moderate algal densities, low water clarity and unhealthy dissolved oxygen levels at the downstream station. Habitat quality has degraded in the middle river. Underwater grasses covered areas close to restoration goals until the last several years but were especially limited in 2012. Bottom dwelling animal populations are degraded or severely degraded in many areas and have degraded over the longer term period.

Lower River

In the lower river, water quality is good. Nitrogen, phosphorus and sediment levels are low enough to provide healthy habitat for underwater grasses. However, nitrogen and phosphorus levels increased at the upstream station. Habitat quality is poor in the upstream area due to poor water clarity, high algal abundances and unhealthy dissolved oxygen levels. Habitat quality is poor in the downstream area due to unhealthy dissolved oxygen levels. Habitat quality has degraded in the lower river overall.

Very limited areas of underwater grass beds are present in this section of the river. Bottom dwelling animal populations are degraded or severely degraded in many areas and have degraded over the longer term period.

How does the Patuxent River compare to other Maryland rivers?

The Patuxent River is in the 'High Urban, Low Agriculture' land use category. Compared to other similar systems, the Patuxent has lower nitrogen levels, moderate sediment levels and high phosphorus levels (Figure 1). Algal densities are relatively low and slightly higher than the reference level of 15µg/l. Water clarity is moderate for similar systems and summer bottom dissolved oxygen levels are moderate compared to similar systems but are below the 5 mg/l threshold for healthy systems.

Table 1. Summary of tidal habitat quality and water quality indicators.
Algal densities, water clarity, inorganic phosphorus and sediment either ‘Meet’ or ‘Fail’ SAV habitat requirements. Dissolved nitrogen levels below the level for nitrogen limitation ‘Meet’ criteria, otherwise ‘Fail’ criteria. Summer bottom dissolved oxygen levels above 3 mg/l ‘Meet’ criteria, otherwise ‘Fail’ criteria. Annual trends for 1999-2012 ether ‘Increase’ or ‘Decrease’ if significant at $p \leq 0.01$ or ‘Maybe Increase’ or ‘Maybe Decrease’ at $0.01 < p < 0.05$; blanks indicate no significant trend. Improving trends are in green, degrading trends are in red. Nitrogen trends are for total nitrogen, phosphorus trends are for total phosphorus, water clarity trends are for Secchi depth. Data is from the long-term monitoring program (2010-2012). Gray boxes indicate there is no data to evaluate that component.

		Water Quality			Habitat Quality		
	Station	Nitrogen	Phosphorus	Sediment	Algal densities	Water Clarity	Summer Bottom Dissolved Oxygen
Western Branch	Upper Western Branch	FAIL Decreasing	MEET	MEET	MEET Maybe Dec.		
	Mouth Western Branch	FAIL Decreasing	FAIL Decreasing	MEET Decreasing	FAIL	FAIL	
Upper River	Waysons Corner	FAIL Decreasing	FAIL Decreasing	MEET Decreasing	MEET	FAIL	
	Jackson Landing	FAIL Decreasing	MEET Decreasing	FAIL Decreasing	FAIL	FAIL	
	Nottingham	FAIL Decreasing	FAIL Decreasing	FAIL Maybe Dec.	FAIL Maybe Dec.	FAIL	MEET
Middle River	Lower Marlboro	FAIL Decreasing	FAIL Decreasing	FAIL Maybe Dec.	FAIL	FAIL	MEET Decreasing
	Jack's Creek	FAIL	FAIL	FAIL	MEET Increasing	FAIL	MEET
	Long Pt.	MEET	FAIL	MEET	FAIL	FAIL Maybe Dec.	MEET
Lower River	Jack Bay	MEET Increasing	MEET Increasing	MEET	FAIL Increasing	FAIL Decreasing	FAIL
	Petersons Pt.	MEET	MEET Maybe Inc.	MEET	MEET Increasing	MEET	FAIL
	Pt. Patience	MEET	MEET	MEET	MEET Maybe Inc.	MEET	FAIL
	Drum Pt.	FAIL	MEET	MEET	MEET Maybe Inc.	MEET Maybe Dec.	FAIL Decreasing

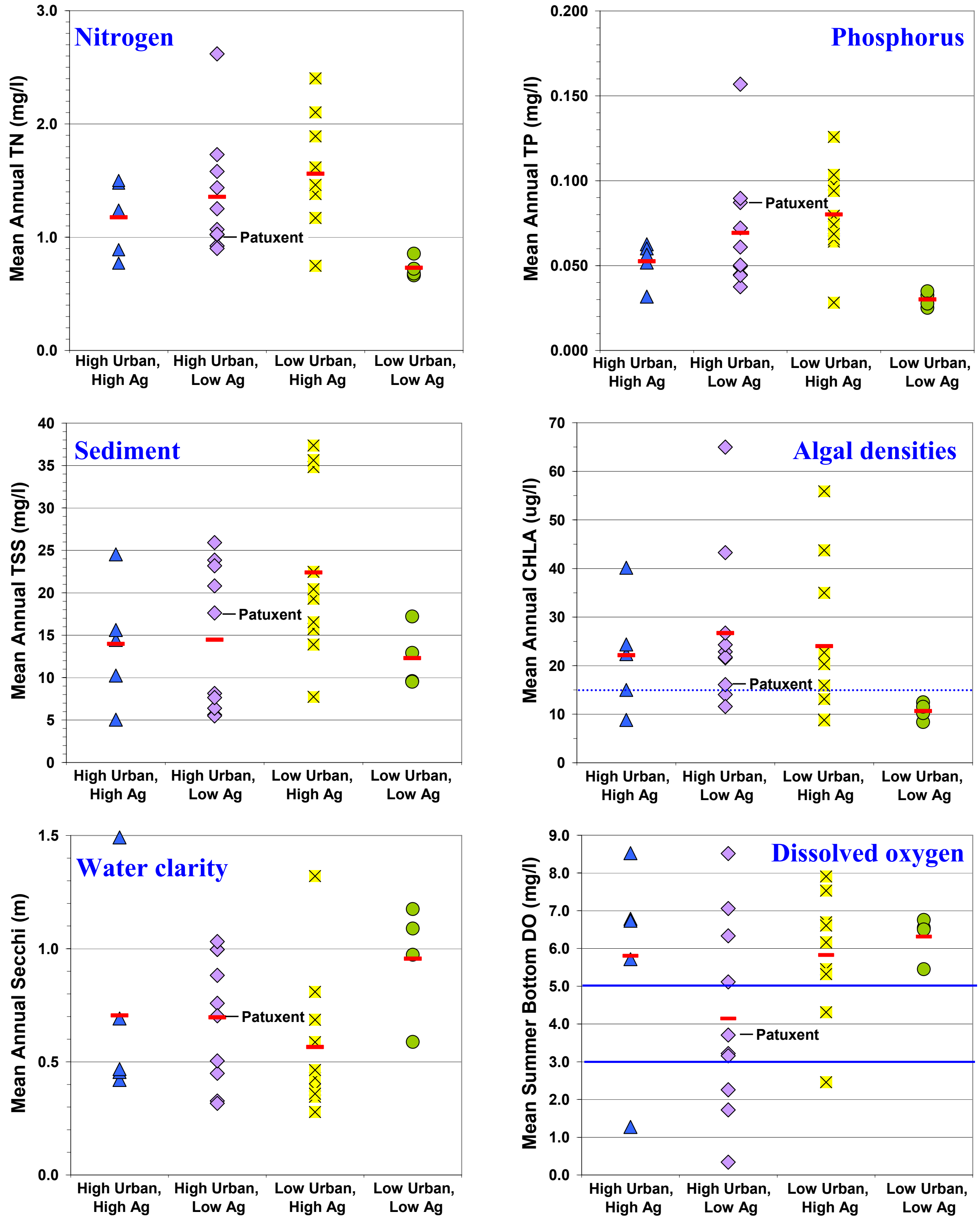

Figure 1. Comparison of the Patuxent River to similar systems.
The mean annual concentration or depth (bottom dissolved oxygen is only summer) for 2010-2012 data. Total nitrogen (TN), total phosphorus (TP), total suspended solids (TSS), chlorophyll *a* (CHLA), Secchi depth and summer bottom dissolved oxygen (DO). Red bars indicate the mean of all systems within a category. Reference lines are included on the CHLA and summer bottom DO graphs.

What needs to be done to make the Patuxent River healthy?

The biggest water quality and habitat issues are moderate to high nutrient and sediment levels and poor water clarity in the upper and middle river and dangerously low dissolved oxygen levels in the lower river. Even though nutrient and sediment levels have improved, habitat quality has degraded. By further lowering nutrients and sediment levels, water clarity should improve which will improve habitat quality for underwater grasses. Lower nutrients will also lead to lower algal densities and further improve habitat quality. Lower algal densities will improve dissolved oxygen conditions and improve habitat for bottom dwelling animals.

In the upper river, point sources were the largest contributor of nitrogen and phosphorus and agriculture was the largest source of sediment. In the middle river, agriculture was the largest source of nitrogen, phosphorus, and sediment loadings. In the lower river, septic was the largest source of nitrogen; point sources and agriculture were the major sources of phosphorus; agriculture and urban runoff were the major sources of sediment loadings. Upgrades to wastewater treatment plants will reduce nitrogen and phosphorus loadings, and these improvements are already complete or under construction. Reducing nutrient and sediment loadings from agriculture should also be a priority. In heavily urbanized sub-watersheds, retrofitting existing structures with alternatives to conventional building materials and methods should be used to reduce the amount of impervious surfaces and prevent additional degradation of water quality.

What has already been done to improve water and habitat quality in the Patuxent River?

A variety of actions have already been taken to lower nitrogen, phosphorus and sediment loadings from urban lands. Upgrades to the largest wastewater treatment plant that discharges to the Patuxent River are under construction and will be completed by 2014. Previous upgrades to the largest facilities have already reduced nitrogen loadings by half. Managing stormwater runoff has reduced nitrogen loadings and prevented 18,200 pounds of nitrogen from entering the river since 2003, and almost 270 septic systems retrofits were completed between 2008-2011.

To reduce nutrient inputs from agricultural lands, over 13,560 acres of cover crops were planted in between growing seasons to absorb excess nutrients and prevent sediment erosion. Fencing on over 8,000 acres of farmland was used to keep livestock out of streams and prevent streambank erosion. Almost 2,600 acres of stream buffers were also in place, allowing areas next to streams to remain in a natural state with grasses, trees and wetlands. More than 240 containment structures have been built to store animal wastes to allow these nutrients to be applied to the land in the most effective manner at the appropriate time.

Maryland also has a number of programs in place to reduce the impacts of continued development and increasing amounts of impervious surfaces in the Patuxent River watershed. Program Open Space projects have conserved more than 230 acres of land for outdoor recreation opportunities. Rural Legacy Program projects have protected more than 6,170 acres, with special focus on areas with important cultural sites and natural resources and to ensure large areas of habitat. Maryland Environmental Trust projects have helped individual land owners protect more than 3,000 acres. Maryland Agricultural Land Preservation Program projects have preserved more than 800 acres of agricultural land from development.

For more information

An integrative assessment of the water and habitat quality of the Patuxent River is available online at **http://mddnr.chesapeakebay.net/eyesonthebay/tribsums.cfm**.

The full report includes:

a. Information on land use and human population densities within the basin, including the health of streams and location of Maryland Trust Fund Priority watersheds
b. Information on land use in 2010, change in land use since 2000 and percent impervious surfaces in watershed
c. Nutrient and sediment loadings information, including breakdown of nitrogen, phosphorus and sediment load by source (agriculture, urban runoff, point source, etc.).
d. Loadings information for major wastewater treatment plants including status of upgrades and progress toward loading caps
e. Water and habitat quality results for non-tidal streams and tidal waters from long-term monitoring programs
f. Shallow-water monitoring results including percent failures of dissolved oxygen, chlorophyll and turbidity thresholds and comparison to long-term monitoring stations
g. Phytoplankton information
h. Submerged aquatic vegetation coverages
i. Benthic program results
j. Appendices with station locations, analysis methods tabular results

Current water and habitat quality information is also available from Maryland DNR's Eyes on the Bay website **www.eyesonthebay.net**