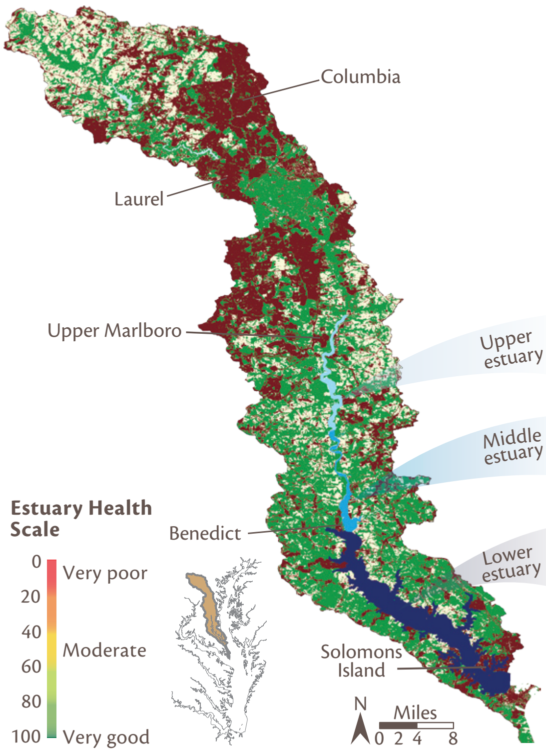
2007 PATUXENT RIVER REPORT CARD

Patuxent RIVERKEEPER®

This newsletter introduces the first Patuxent River ecosystem health report card. This report card provides grades for three regions within the Patuxent River estuary (i.e., the tidal portion of the river). The report card grades are based on the progress of six indicators towards ecological targets. The report card shows that the Patuxent River estuary is mostly in poor condition and that substantially more effort is needed to see measurable improvements. This report card was produced in collaboration with the Patuxent Riverkeeper who recently started a citizen water quality monitoring program with the aim of using this information to assess the health of the region's creeks and estuary. Next year this data will be used to provide a more comprehensive report card.



Frequency (%) that indicators meet target levels

Region	Grade	Overall: Health index	Water Quality: Dissolved oxygen	Water Quality: Water clarity	Water Quality: Chlorophyll *a*	Biotic: Aquatic grasses	Biotic: Benthic community	Biotic: Phytoplankton community
Upper estuary	C-	**43**	94	6	53	57	–	13
Middle estuary	D	**30**	43	0	43	24	50	20
Lower estuary	F	**17**	67	6	3	2	24	0
Overall	D-	**20**	66	5	9	9	28	3

Upper estuary | Middle estuary | Lower estuary

Figure 1: 2007 report card grades and indicator scores for the three estuarine regions of the Patuxent River. Note: Overall scores are area weighted. See www.eco-check.org for methods and additional data.

Overall health of the Patuxent River estuary in 2007 was poor, scoring 20 out of a possible 100 points (Figure 1). A comparison of the 3 smaller regions shows that there are substantial differences in habitat health among different areas of the estuary. The upper estuary region had the best report card score (43%), largely due to the relatively high aquatic grasses cover (although much decreased from last year), and chlorophyll *a* and dissolved oxygen conditions that more frequently met the target levels. The lower estuary region scored the worst (17%), with all indicators performing poorly relative to the target levels. Most indicator scores differed greatly among regions; however, water clarity was consistently poor throughout the estuary (0 to 6%), a trend that is consistent with the entire Chesapeake Bay. While the report card does not account for the health of fish and shellfish, it does provide an assessment of aquatic grasses and benthic community conditions that are critical to healthy fish and shellfish populations. Future report cards will incorporate citizen monitoring data collected by the Patuxent Riverkeeper. To see how Patuxent River health compares to other regions of Chesapeake Bay, view the Chesapeake Bay report card at www.eco-check.org.





From left to right: Solomons Island Bridge, autumn in the Patuxent watershed, Bernie Fowler Wade-in, sunset over the Patuxent River, freshwater swamp. Photo credits: Patuxent Riverkeeper and University of Maryland Center for Environmental Science.

GETTING TO THE SOURCE OF THE PROBLEM

Rapidly changing land use

Excess nutrients and sediment entering the Patuxent River from the surrounding watershed are the main reasons for poor river health. Over 53 percent of the Patuxent watershed is now being used for agriculture or urban development (Figure 2), which are large contributors of nutrients and sediment to the river. Sandwiched between Washington, D.C. and Baltimore, the central regions of the watershed are gradually succumbing to urban expansion with agricultural and forested lands being converted to houses, roads, and associated infrastructure (Figure 3).

Developed land (including urban run-off and partial treatment of human waste) within the Chesapeake Bay watershed generates on average a total of 14.8 pounds of nitrogen per acre compared with the average agricultural rate of 11.7[1]. With urban best management practices lagging behind urban expansion[2], nutrient loads from developed areas are increasing significantly. Applying these bay-wide figures to the Patuxent River indicates that nutrient and sediment loads will increase if they are not offset by increased urban best management practices. The upper watershed mostly features large-lot rural residential development, forested lands, agricultural cropland, and pasture (Figure 3). The lower watershed has a relatively high forest cover, with agricultural lands tending to fringe the river. Wetlands are also an important feature of the Patuxent watershed, especially in the tidal regions where they have been shown to play a pivotal role in nitrogen removal (see opposite page).

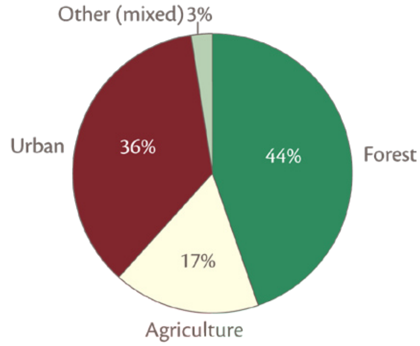


Figure 2: Percent land use within the Patuxent River watershed in 2000. Data: Chesapeake Bay Program Watershed Model, Phase 5 classification.

Sources of pollution

Figure 3: Conceptual diagram of major land use types and key features of the Patuxent River watershed.

The amount of nutrients and sediment entering the Patuxent River from the watershed is estimated using the Chesapeake Bay Watershed Model (Note: the model does not account for pollutants entering the estuary from the Chesapeake Bay mainstem). The model estimate loads are based on factors such as best management plan assumptions, hydrology, vegetation cover, and point source nutrient loads. The modeled load estimates for 2007 highlight a number of interesting features (Figure 4). First, diffuse urban loads are the greatest contributor of nitrogen and phosphorus, and the second largest contributor of sediment to the estuary. If urban and point source nitrogen loads are considered together, they represent over half of the total nitrogen loads. Second, agriculture is estimated to be the largest single source of sediment, contributing approximately 50% of all sediment from the watershed (not accounting for coastal erosion). It is important to note that these estimates do not account for the ultimate source of pollution, for example, ~22% of nitrogen entering Chesapeake Bay can ultimately be attributed to atmospheric deposition.

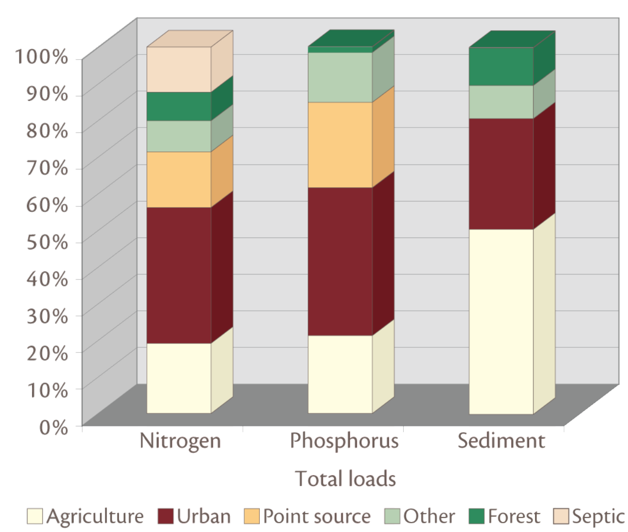


Figure 4: 2007 estimated total nitrogen, total phosphorus, and sediment loads to the Patuxent River estuary in 2007. Load estimates are based on the Chesapeake Bay Program Watershed Model, Phase 4.3, 2007 Progress Run.

MARSHES REMOVE NITROGEN FROM ESTUARY

Researchers at the University of Maryland Center for Environmental Science (UMCES) recently identified the important role tidal marshes play in removing nitrogen from the Patuxent estuary (the tidal regions of the river)[3]. Researchers used a multi-year budget that measured the inputs and removal of nitrogen in the sub-tidal sediments, tidal marshes, and the nutrient transport between estuarine zones in the system (Figure 5). Two major ecological processes (denitrification and long-term sediment burial) are responsible for the removal from the ecosystem, while pollution (point and non-point), septic, and atmospheric contributions are responsible for the inputs to the ecosystem. One of the most important findings was that a small part of the ecosystem, the mid-estuary with extensive tidal marshes, removed approximately 55% of total upland nitrogen inputs (45% in highest nitrogen load years). There was also clear evidence that major estuarine processes, including the growth of aquatic grasses, responded rapidly to inter-annual variations of nitrogen inputs (see below). Research conducted by Walter Boynton (UMCES) indicates that non-point source nitrogen controls are the key to successful water quality and habitat restoration in this estuary.

Marshes in Jug Bay, part of the National Estuarine Research Reserve System.

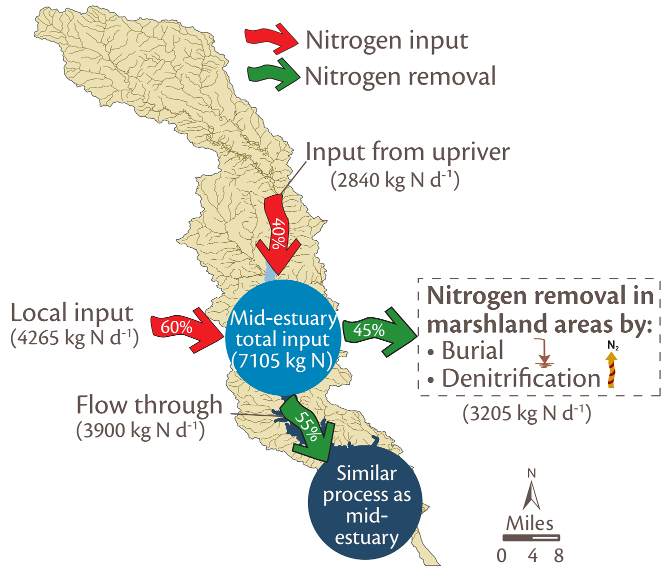


Figure 5: Nitrogen input and removal within the Patuxent estuary. Based on year with highest nitrogen inputs (2006).

Nitrogen removal processes in marshes

N_2 **Denitrification:**
Denitrification is the conversion of biologically available forms of nitrogen (nitrate and nitrite) to biologically unavailable nitrogen gas. Denitrification is carried out by bacteria and only occurs in low oxygen environments such as marsh sediments.

Burial:
Nutrient burial in marshes occurs through two processes. First, through the burial of marsh plants that have absorbed nutrients from the surrounding environment (marsh plants only partially decompose because oxygen levels are low in the surrounding sediment). Second, marshes trap sediment transported into the marshes during high tides. These sediment-bound nutrients are then buried with the partially decomposed plants.

NITROGEN LOADS DOWN, AQUATIC GRASSES UP

Abundance of aquatic grasses (also called submerged aquatic vegetation or SAV) in the mid to upper Patuxent estuary increased rapidly in the mid-1990s according to data collected by scientists at the Virginia Institute of Marine Science (VIMS). In the first eight years of monitoring, aquatic grasses throughout this region were virtually non-existent (Figure 6). However, around 1993, abundance increased rapidly in the mid to upper estuary, in contrast to the lower estuary that had shown alternating periods of gains and losses, but still far below its restoration goal of 128 hectares. The increase in aquatic grass abundance was most likely due to a reduction of below fall line point source nitrogen in the early 1990s with the upgrading of wastewater treatment plants. Unfortunately, over the past two years there has been a significant reduction in aquatic grass area, decreasing over 70% from 182 hectares in 2005 to 58 hectares in 2007. Whether this decline is a temporary fluctuation similar to that seen in 2002, or a more permanent reduction, can only be determined in the following years as trends in non-point and point source nutrient loads become more apparent.

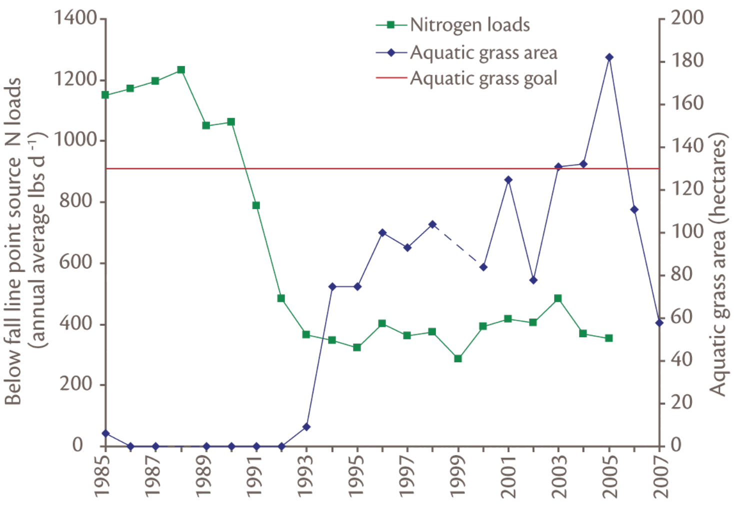


Figure 6: Aquatic grass area and annual average below fall line point source total nitrogen loads to the mid to upper estuary.

Common waterweed (Elodea canadensis), a species of aquatic grasses found in the Patuxent River.

THE PATUXENT NEEDS YOU!

Heron flying in the watershed.

Patuxent Riverkeeper

Patuxent Riverkeeper recently established a citizen water quality monitoring program and is looking for volunteers to adopt a local monitoring station. Benchmarking and identifying problems in the Patuxent watershed is a starting point for cleaning it up. Citizen water testing raises awareness but also helps direct public attention and public willpower toward the root causes and known problems in the tributary. The Patuxent Riverkeeper provides training and water testing kits to citizen monitors. A public web portal, where water testing volunteers can post their results, compare their sampling data with others, and empower themselves and others with knowledge about water quality impairments is presently being finalized. Water testing sites are still available throughout the Patuxent River watershed (see Figure 8 for location of stations). Please contact Patuxent Riverkeeper if you are interested in becoming a water quality testing volunteer (details below).

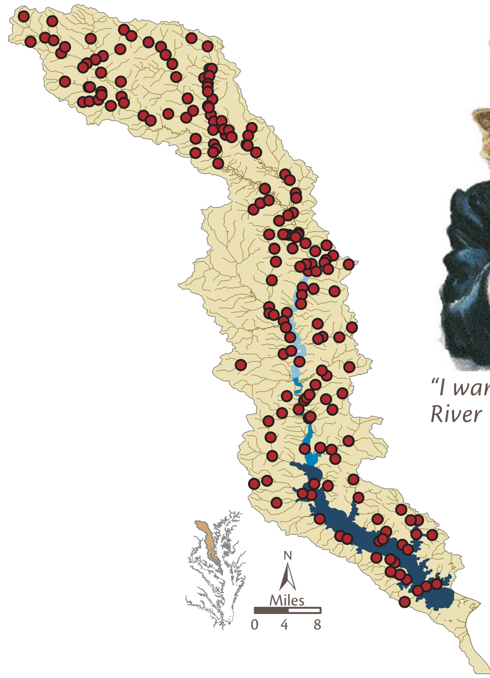


Figure 8: Locations of water quality monitoring sites to be tested by citizen monitors. The Patuxent Riverkeeper oversees this monitoring.

"I want you for Patuxent River water testing."

WHAT YOU CAN DO

A few ways you can reduce your nutrient footprint:

1. Look for ways to filter run-off and protect water in your community.
2. Join a tributary team or local watershed group.
3. Be alert to out-of-date, obsolete, or poorly functioning stormwater ponds and infrastructure.
4. Hold new construction in your neighborhood to higher quality standards.
5. Report problems and violators; become best stewards of your local water resource.
6. Plant native trees and plants along your neighborhood stream to increase the riparian buffer, thereby decreasing the amount of unfiltered stormwater running into the stream.
7. Hold a neighborhood cleanup to remove trash from the streets and streambanks before it enters the storm drains.

Patuxent Riverkeeper, UMCES

Ways you can contribute to a positive change: organize a community cleanup, plant a raingarden to help filter run-off, join a watershed team, and plant native trees and plants.

To contact the Patuxent Riverkeeper:
E-mail: info@paxriverkeeper.org
Phone: (301)-249-8200
Website: www.paxriverkeeper.org

Many more ways to reduce your impacts can be found at:
http://www.chesapeakebay.net (Get Involved)

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www.paxriverkeeper.org
www.eco-check.org
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References:

1. Hanmer R (2006) Food for thought: Save a farm to save the Bay. Action notes from the Director's Chair. *Chesapeake Bay Journal*, 10/2006.
2. Chesapeake Bay Program (2006) Chesapeake Bay 2006 Health and Restoration Assessment. Part two: Restoration Efforts. EPA 903R-07002.
3. Boynton et al. (2008) Nutrient Budgets and Management Actions in the Patuxent River Estuary, Maryland. *Estuaries and Coasts* (in press).