A Century of Trees and Water - the Chesapeake Connection

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Water quality in the Chesapeake Bay is closely linked to the forests in its watershed. Forests are the natural cover in most of the Chesapeake Bay basin; streams and many of the native species within them tend to be healthiest with forests protecting the soils and keeping the water cool. Forests are a first step in generating clean water without expensive treatment, part of our "green infrastructure". Forest canopies moderate hard rainfall, forest litter protects the soil surface, and forest soils develop good porosity so rainfall soaks in quickly. Forest buffers kept next to other land uses filter pollutants from storm runoff before they get to the water, essentially a last line of defense for the stream. Forest types in the Chesapeake basin have changed over the centuries with climate, fires, and storms, but all have done what forests usually do for watersheds: generate excellent quality water.

By 1906, Maryland had been settled for several centuries and over 60% of its forests were converted to farms, towns, and small cities. Cleared soils eroded rapidly, contributing tons of sediment to the stream systems. Some of the harbors in Maryland's historic shipping towns like Port Tobacco and Joppatown silted in. Some of the sediment is still in the streams and still moving slowly down to the Chesapeake Bay. In towns, sanitation projects had begun to address epidemics like typhoid. The solution was usually piping waste out into large water bodies, which greatly improved public health in the city but it added more nutrients to the large load of sediment.

Even where forests had not been cleared, trees were cut without considering a future forest. Cutting practices left lots of limbs and tree tops behind, which fueled very large and hot forest fires. Fire is a natural part of the landscape, and trees have ways to quickly regrow from seeds stored in the forest floor and roots that sprout new trees. However, the very large, intense fires burned the seedbank, scorched the roots, and even consumed the soil in places, slowing or sometimes preventing forest regrowth.

In 2006, it is easy to see the great improvement in land use practices. Forests rebounded from historic lows, particularly as farms were left during major events like the Depression or wars. Increasing numbers of people moved to cities. Technological changes of machines and fossil fuels literally replaced horse power and reduced the need for pastures. Fertilizers have meant increased crop yields with fewer acres under cultivation. Today, forest harvesting follows Best Management Practices (BMPs) for sediment and erosion control. Most farms employ basic conservation practices that limit soil erosion. Maryland has added requirements for nutrient management that are starting to be applied on farms. Forest buffers are being used increasingly to moderate effects of upland land uses and sustain stream habitat and function. Sewage treatment plants have reduced solids and sediment-bound pollutants from wastewater,

and more recent upgrades using biological methods finally reduce dissolved nutrients before waste flows are released to rivers and the Bay.

Despite these many advances, water quality in the Chesapeake falls far short of its historic condition, and the bounty of the largest estuary in the United States has diminished as a result. Part of the reason lies in the continued population increase, over 10 million Bay-wide with over 4 million just in Maryland, and the many ways in which we add nutrients and impervious surfaces to the watershed. Another reason lies in the forests. Maryland is now only 41% forested. The natural functions that cleanse water and sustain year-round stream flow rely on most water infiltrating into the soil and moving slowly (often over decades) to streams, or returning to the atmosphere through evaporation or transpiration by plants. Even farms, which maintain vegetation on the land, send measurably more stormwater into streams, resulting in larger stream channels.

However, the greatest changes are seen where we've built impervious surfaces, the buildings, roads, and driveways that shelter and help transport us. Instead of filtering into groundwater, two to five times more water goes into the stream channels during storms in developed areas compared to forested ones. This means higher flood levels and more frequent floods with the same rainfall. It also means larger channels, expanding by eroding deeper or wider. Even where good practices have limited erosion from uplands, just the increased water delivered to channels means more sediment eroded from the channel itself and delivered eventually to the Chesapeake Bay. The pollutants that land on impervious surfaces tend to be delivered rapidly to streams, while forests and vegetated areas grant an opportunity to trap contaminants and protect water quality.

People are part of the watershed now, and there is plenty of room for improvement beyond the practices already being used. Trees and forests can be an important and cost-effective part of the solution to improved water quality and Chesapeake Bay health.

Restoring and keeping forest buffers by streamsides are critical first steps. Forest buffers maintain high infiltration in the near-stream areas and reduce nutrients coming from uplands. Shade keeps the streams cooler, which aids cool-water fisheries and avoids excess algal growth and unwanted biochemical reactions. Large woody debris contributed to the streams supports pool formation and cover for fish habitat, and leaf litter supplies the main food source for organisms in headwater streams. Deep rooting can enhance bank stability and maintain stream width. Forested streams tend to support more surface area for aquatic organisms that can capture nutrients, aiding nutrient reduction in-stream even beyond the buffer boundaries.

Beyond buffers, trees and forests are one of the easiest ways we have to move towards a healthier hydrology for the Bay and its watershed. Forests have the highest infiltration rates of all of land uses, and should be a deliberate part of developed landscapes in this region. Low-impact development design is important for minimizing impervious surfaces and their connectedness to streams. Stormwater treatment strategies that focus on infiltration and take advantage of trees and intact forest buffers can counter the unhealthy stream habits of development.

Landscape practices that minimize nutrient addition and erosion are needed to avoid overwhelming buffers in a fragmented landscape. Encouraging native landscaping helps avoid problems of invasive weeds in our existing and newly restored forests.

Urban canopy can help shift rainfall from excessive storm runoff to more hydrologically friendly evaporation and transpiration. The cooling and moderating effect of urban canopy results in improved air quality and lower energy use. Each of these translates to benefits in water quality and stream health that can ripple downstream to the Bay.

Harrison Weigand, DNR

Trees have served us for many years in ways beyond the visible benefits of wood products and beauty. The water quality and stormwater benefits grow over time along with the trees, and inherent regenerative capacity helps sustain functions for future generations. Restoring trees to critical places in the watershed helps move towards healthier streams and the Chesapeake Bay.