Fact Sheet #9: The Importance of Protecting Riparian Areas along Smaller Brooks and Streams.

[This fact sheet was prepared by *Russell Cohen, Rivers Advocate*, Division of Ecological Restoration, **Massachusetts Department of Fish abnd Game**. This document is intended for educational purposes only and does not necessarily represent the viewpoint of agencies and commissions having regulatory authority over riparian lands. Last updated: June 12, 2014.]

Why do riparian areas along smaller streams need and deserve at least as much protection as those along larger rivers?

Riparian areas are the lands adjacent to, and/or interacting with, rivers and streams. It is equally, if not more, important from a scientific perspective to preserve corridors of natural vegetation along the smaller brooks and streams as it is to maintain them along the larger rivers. The water quality and quantity in mainstem rivers is largely determined by what they receive from their many smaller tributaries. Many of the degrading impacts of developments encroaching on riparian areas along these tributaries are carried downstream and are often amplified once they drain into the larger mainstem rivers. On the other hand, tributaries with relatively undisturbed riparian vegetation contribute steady amounts of clean, cool water to the mainstems and provide organic matter needed by aquatic organisms downstream. In addition, the fragility of riparian areas is often accentuated in small headwater stream reaches. These small streams are the most vulnerable to human disturbance because they respond dramatically and rapidly to alterations on adjacent lands and are the most sensitive to changes in riparian vegetation in the surrounding watershed.

Even though they may not be tributaries to larger rivers, it is critical to maintain and/or restore vegetated riparian areas along small coastal rivers and streams as well, as they play an equally important function for supporting anadromous fish runs and breeding or nursery habitat for marine animals, help provide clean fresh water and organic detritus needed to maintain healthy shellfish populations, help moderate coastal flooding and storm damage and help prevent pollution of sensitive coastal embayments.

Here are some additional reasons why preserving and/or restoring naturally vegetated riparian areas along the smaller brooks and streams is especially important:

Flood Control and Storm Damage Prevention:

A large proportion of the water in the state's rivers is contributed by the smaller tributaries. If riparian areas along these brooks and streams is altered in a manner (e.g., the removal of forest cover and/or the placement of buildings) that impairs their ability to detain and absorb floodwater and stormwater, the cumulative impact of streams discharging flood and storm flows into rivers at a greater volume and velocity will result in worsening flooding and storm damage to existing structures and mainstem river communities downstream, even if mainstem floodplains are safeguarded against further development. In addition, the smaller headwater tributaries tend to be located on some of the steepest-sloping and erosion-prone lands within a watershed. Furthermore, all other things being equal, the same development is likely to have a relatively greater negative impact on flooding conditions in an adjacent small stream than the same project along a larger river (e.g., the runoff from one large parking lot can itself be enough to overwhelm a small stream channel).

Wildlife Habitat:

Wildlife use of riparian areas along smaller brooks and streams, although somewhat different in character from the major rivers, is still quite extensive. Many species utilize vegetated riparian areas during all or part of their life cycle regardless of the size of the adjacent watercourse. In fact, several sensitive species in Massachusetts (e.g., the spring salamander) thrive only in cold, unpolluted springs and small streams. Last but not least, as most of the major river corridors in Massachusetts have already been extensively developed, the areas which remain in a relatively pristine condition (and as such are likely to have the best quality wildlife habitat) tend to be located on the smaller tributaries.

Fisheries:

It is particularly important from a fisheries protection perspective to preserve corridors of natural vegetation along the smaller brooks and streams. Most of the annual flow in the smaller headwater streams is provided by groundwater that, in turn, is replenished by rainwater falling onto and infiltrating the soil under vegetated areas. Since water seeps slowly through the soil, the surface water flowing in streams can represent rainwater that fell days, weeks or even months ago. This regular,

continuous seepage of groundwater that keeps streams flowing is called "baseflow".

Baseflow is critical to stream life and water quality. Low flow periods are typically the most stressful periods for aquatic organisms, resulting in crowding due to less available habitat, elevated water temperatures in the summer and greater freezing in the winter. Sportfish, fish food animals, and water plants require a stable, continuous flow of water, particularly during dry periods. Groundwater discharge is a major source of streamflow for smaller streams, especially during hot and dry summers, where the discharge both augments the streamflow and mitigates harmful temperature increases. This groundwater discharge is key to maintaining adequate water levels and temperatures in streams to support healthy aquatic ecosystems.

Because of their small ratio of stream bottom width to shoreline, small headwater streams are especially vulnerable to harmful increases in temperature due to removal of shading from streamside forests. This removal of shading will also increase evaporation rates, making the streams lose water at the very time that groundwater replenishment is diminished due to the removal of these same forests. As a result, the failure to maintain vegetative cover on or keep impervious surfaces out of riparian areas adjacent to smaller brooks and streams is likely to increase the frequency, duration and severity of low flow conditions. In smaller streams, where flows are already modest in size, a reduction in baseflow is especially harmful. Small streams deprived of groundwater flow may even dry up completely, a condition that is obviously extremely stressful if not fatal to fish and other aquatic organisms.

Optimum spawning sites for important game fish frequently exist in headwater streams, even though these same fish may spend the remaining time in the larger rivers. Fish often retreat to these cooler tributaries when the mainstems get too warm for them. An increase in water temperature in headwater streams may result in a decrease in fish reproduction and useable habitat. Fortunately, the effectiveness of streamside forest buffers at controlling water temperature increases as stream size decreases. And if water temperatures are kept cool by streamside forests in the upper portion of the watershed, the tributaries will provide a significant beneficial cooling effect on the main watercourses during the summer, when flows are lowest and temperatures are highest.

Even where inaccessible to fish, the small headwater brooks and streams and adjacent riparian areas remaining in a relatively pristine condition provide high levels of water quality and quantity, sediment control, nutrients and woody debris for downstream reaches of the watershed. Thus, especially in the highly degraded systems, headwater streams serve as critical ecological anchors for riverine systems and important refuges for biodiversity. As many of the fisheries in Massachusetts' mainstem rivers have already suffered serious degradation, it is the smaller tributary streams, especially the "coldwater" streams capable of supporting naturally reproducing wild trout, where preventing further encroachments into riparian areas is arguably of greatest value from a fisheries perspective.

Groundwater and Public Water Supply Protection:

As mentioned previously, groundwater can and often does reemerge as surface water, and groundwater discharge into rivers and streams has a beneficial effect on both the quantity and quality of water in the recipient watercourse. This is particularly true for the smaller headwater streams, where most of their annual flow is attributable to groundwater reentering the surface as natural spring seeps that, in turn, are replenished by snowmelt and rainwater falling onto and infiltrating the soil under vegetated areas. Groundwater discharge is a major source of streamflow for smaller streams, and is key to maintaining adequate water levels and cooler temperatures in streams to prevent sediment-bound pollutants from breaking free and to dilute pollutant concentrations below harmful levels.

The failure to maintain vegetative cover on or keep impervious surfaces out of riparian areas adjacent to smaller brooks and streams is likely to result in a significant loss of groundwater recharge and increase the frequency, duration and severity of low flow conditions. Small streams deprived of groundwater flow may even dry up completely, a condition that obviously limits their value for public and private water supplies. Last but not least, as most of the major rivers in Massachusetts continue to have degraded water quality, due in part to their role in assimilating municipal wastewater and other point source discharges, it is the smaller headwater streams and watersheds that remain in a relatively pristine and uncontaminated condition that are likely to have the greatest value for public water supplies.

Pollution Prevention:

Due to their modest size, small streams and brooks are especially vulnerable to degradation by excessive sediment, nutrients and other pollutants, simply because there is a smaller volume of water available to flush out and/or assimilate these pollutants. All other things being equal, the same development is likely to have a relatively greater negative impact on a small stream's water quality than the same project along a larger river (the lower water volume in the smaller watercourse will result in higher nonpoint source pollution concentrations). In addition, smaller, shallower rivers and streams are also especially susceptible to stream heating, and excessive algae growth, dissolved oxygen depletion, and pathogenic organism activity are all triggered by higher stream temperatures.

Maintaining a living filter of natural vegetation along smaller brooks and streams is key to intercepting pollutants before they reach and degrade the sensitive smaller streams as well as enabling groundwater recharge and low flow augmentation to help maintain cooler temperatures and dilute pollutant concentrations. In addition, studies have found that streamside wetlands along smaller streams are more efficient at absorbing nutrients and sediments from adjacent waterways than along the larger rivers because a greater proportion of the water in smaller watercourses comes into direct contact with the cleansing action of streamside wetland plants and microorganisms.

A large proportion of the water in the state's rivers is contributed by the smaller tributaries. If water quality is allowed to degrade in these smaller tributaries by the placement of polluting activities in the riparian areas along smaller brooks and streams, mainstem riverine water quality will deteriorate regardless of protected riparian vegetation along the larger rivers. In addition, the typically cleaner flow of tributaries performs a key role in diluting concentrations of pollutants in the mainstems coming from industrial and other wastewater treatment discharges. If the water quality in the tributaries is allowed to degrade, then they cease to perform this important dilution function for the major rivers.

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