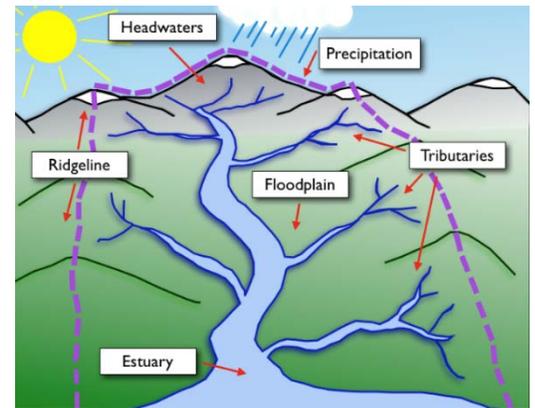


## The Role of Headwater Streams in Downstream Water Quality

### What is a headwater stream?

In layman's terms, a headwater stream is the furthest point from a river or stream's endpoint. It is often the point of integration with other rivers, streams, or wetlands. Headwater streams generate approximately 60-80% of the total stream length within a given watershed. They also generate most of the stream flow and therefore have the largest impact on downstream tributaries.



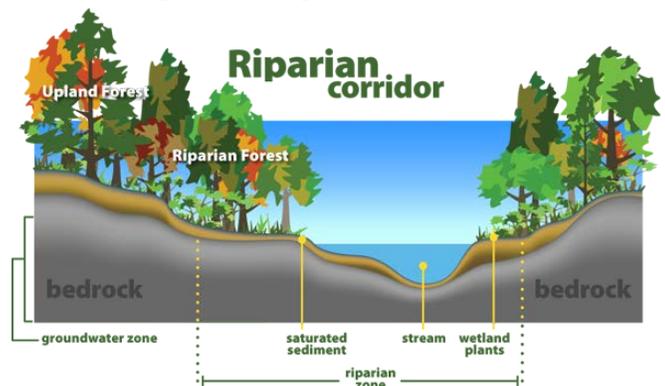
### Effects on Downstream Water Quality

Headwater streams in their natural state, help to improve water quality by filtering runoff, sediments and contaminants before they move downstream. This makes them an important component in any watershed, including that of the Chesapeake Bay. As the landscape is altered by urbanization, deforestation, and land use changes, headwaters can become compromised, producing many common pollutants; such as, sediments, organic matter, and nutrients, and delivering them to downstream waterways.

Biological (or Riparian) buffers such as forests and wetlands trap most of these pollutants and protect the landscape from flooding. However, without these beneficial features, pollutants are readily carried downstream where they potentially degrade water quality.

Degradation of downstream water quality imposes detrimental effects on aquatic organisms and neighboring terrestrial organisms. Studies examining the effects of land management activities on stream communities found various aquatic changes including decreased fish populations and reduction in the diversity of aquatic organisms in headwater streams.

Throughout the year, flow from the headwater stream may either be continuous or intermittent. This creates difficulties in assessing the effects of headwater streams on biological diversity in both aquatic and riparian (adjacent terrestrial) zones.





Ultimately, headwater streams are efficient conveyers of water, particularly at higher flows and exhibit connections to landscape processes and downstream waters through their influence on the supply, transport, and quality of water within watersheds. Headwater streams are a vital part of natural stream systems but are often overlooked or abused. Many of the changes we see downstream in the watershed can be traced back to these vital areas; therefore,

the protection and restoration of headwater streams is essential for water quality maintenance, continued aquatic diversity and stream habitat stabilization. In short, healthy headwaters lead to healthy stream systems.

### **How does this affect GSFC and other federal facilities?**

The National Environmental Protection Act (NEPA) mandates that federal agencies must evaluate and consider the environmental impacts of a proposed action during the decision making process. A strong understanding of the interactions between headwater streams and downstream waters is a necessary element of this evaluation. GSFC makes every possible effort to minimize impacts to surface waters and their subsequent effects on the Chesapeake Bay. Under NEPA, federal facilities are required to document a record of environmental consideration for all projects.

*Visit the following websites for more information on Headwater Streams and Water Quality:*

<https://www.epa.gov/water-research/headwater-streams-studies>

[http://www.nrel.colostate.edu/assets/nrel\\_files/labs/macdonald-lab/pubs/MacDonald\\_Coe\\_Forest\\_Science.pdf](http://www.nrel.colostate.edu/assets/nrel_files/labs/macdonald-lab/pubs/MacDonald_Coe_Forest_Science.pdf)

[https://www.fs.fed.us/pnw/pubs/pnw\\_gtr880/pnw\\_gtr880\\_030.pdf](https://www.fs.fed.us/pnw/pubs/pnw_gtr880/pnw_gtr880_030.pdf)

[https://www.nwf.org/~media/PDFs/Water/State-Fact-Sheets/ChesapeakeBay\\_WeakeningTheCleanWaterAct.ashx](https://www.nwf.org/~media/PDFs/Water/State-Fact-Sheets/ChesapeakeBay_WeakeningTheCleanWaterAct.ashx)

<http://www.mostreamteam.org/Documents/Fact%20sheets/Factsheet6WWW.pdf>

*Also, check out the some of our past environmental bulletins on this and similar topics:*

<https://code200-external.gsfc.nasa.gov/250/environmental/environmental-bulletins.html>

