Filtration of Surface Water

Surface waters, in the form of rivers, streams, lakes and wetlands, are inextricably linked with human activities. Throughout human history, such waters have been used to carry away our pollutants (Carpenter et al 1998)[1]. Surface waters not only export pollutants easily and swiftly away from local communities, but they also act to absorb and filter these substances. This absorption and filtration process is a regulating ecosystem service, which is commonly referred to as the filtration of surface water.

Filtration is aided by both biotic and abiotic factors. The main processors of pollutants are biotic, including bacteria, plankton, plant life, detritivores, and more, that capture, process, and mineralize pollutants, organic matter, or excess nutrients (Maes et al 2011)[2]. Abiotic factors, such as geologic features can aid in filtration by providing prolonged residence time of the water, allowing greater time for biotic processing (Maes et al 2011)[3].

One of the best studied examples of filtration of surface water is the removal of excess nitrogen. Excess nitrogen usually derives from agricultural inputs (fertilizers, etc.) and industrial areas, and can cause numerous problems in aquatic ecosystems, such as “toxic algal blooms, loss of oxygen, fish kills, loss of biodiversity (including species important for commerce and recreation), loss of aquatic plant beds and coral reefs, and other problems” (Carpenter et al 1998)[4]. Nitrogen uptake by plants, microbial immobilization, soil storage, groundwater mixing (Lowrance et al 1997)[5], and denitrification (Mayer et al 2007)[6] are thus important aids in protecting against these impacts.

By filtering pollutants, excess nutrients, and organic matter, surface water filtration ensures safe human use, the downstream health of ecosystems, and more. Natural filtration therefore helps to avoid costs associated with anthropogenic filtration and treatment, improve aesthetics, and support important native species (Loomis et al 2000)[7].

AlpES WebGIS Link

The AlpES project quantifies and maps the ES of surface water filtration by ecosystem type for the Alpine Space. These maps, demonstrating the distribution and rates of filtration, will be located here.

Additional Resources

- The Nature and Value of Ecosystem Services: An Overview Highlighting Hydrologic Services[8]
- Riparian forests as nutrient filters in agricultural watersheds [9]
- A spatial assessment of ecosystem services in Europe: methods, case studies and policy analysis - phase 1 [10]

1) , 4)
Carpenter, Stephen R., et al. “Nonpoint pollution of surface waters with phosphorus and nitrogen.” *Ecological applications* 8.3 (1998): 559-568.
2) , 3) , 10)
Maes, Joachim et al 2011. A spatial assessment of ecosystem services in Europe: methods, case studies and policy analysis - phase 1. PEER Report No 3. Ispra: Partnership for European Environmental Research
5)

Lowrance, Richard et al. 1997. Water quality functions of riparian forest buffer systems in Chesapeake Bay Watersheds. *Environmental Management* 21(1997): 687–712.
6)

Mayer, Paul M., et al. “Meta-analysis of nitrogen removal in riparian buffers.” *Journal of environmental quality* 36.4 (2007): 1172-1180.
7)

Loomis J, Kent P, Strange L, Fausch F, Covich A (2000) Measuring the total economic value of restoring ecosystem services in an impaired river basin: results from a contingent valuation survey. *Ecological Economics* 33: 103-117
8)

Brauman, Kate A., et al. “The nature and value of ecosystem services: an overview highlighting hydrologic services.” *Annual Review of Environment and Resources* 32 (2007): 67-98.
9)

Lowrance, Richard, et al. “Riparian forests as nutrient filters in agricultural watersheds.” *BioScience* 34.6 (1984): 374-377.