THE WATER QUALITY CONNECTION: HOW SCIENCE CAN INFORM LAND PROTECTION FOR HEALTHY WATERSHEDS

How much of a watershed must remain forested to produce clean water? And what kind of information do water utilities, government agencies, and other funders need to support further investment in land protection as a strategy to maintain water quality? Answering these questions is essential to keeping clean water clean.

Despite broad scientific consensus on the importance of forest cover to maintain water quality, there is a tendency among public agencies and funders to privilege "fixing things" over efforts to avoid impacts in the first place. This emphasis leads to high spending to restore degraded farmland and misses an opportunity to protect intact forests now so that they don't become degraded and cost a great deal more to restore later. For example, in 2018 the federal government allocated $73 million for restoration in the Chesapeake Bay and only $6 million for land conservation, a 12 to one ratio. Nationwide, the amount that water utilities in the United States spend annually to chemically treat drinking water is 19 times what the federal government invests in land protection that keeps pollutants out of lakes and rivers.[1]

This brief summarizes key findings and offers recommendations for addressing gaps in knowledge that clarify the case for land protection as a high impact investment to safeguard water quality. The brief is based on information gathered in two reports conducted by Open Space Institute (OSI): *Literature Review: Forest Cover and Water-Quality Implications for Land Conservation* (Morse et al. 2018) and *Water Quality Protection Programs: Insights from Six Eastern United States Cases* (Morse and Weinberg, 2019).[2]

For Clean Water, How Much Forest Cover?

Watersheds with 60-90 percent forest cover reliably yield high water quality, but forest location and the type and intensity of other land uses also matter.

Land use studies from around the globe affirm that abundant forest cover is crucial to water quality. OSI's research confirmed through review of the scientific literature that forest cover between 60 and 90 percent has been proven to meet a variety of ecological and chemical definitions of water quality. Notably, major metropolitan centers that meet the Environmental Protection Agency's filtration avoidance criteria, which allow cities to use the filtration provided by forests in lieu of building multibillion-dollar water treatment plants for their public water supply, maintain forest cover within this range (see Table 1).

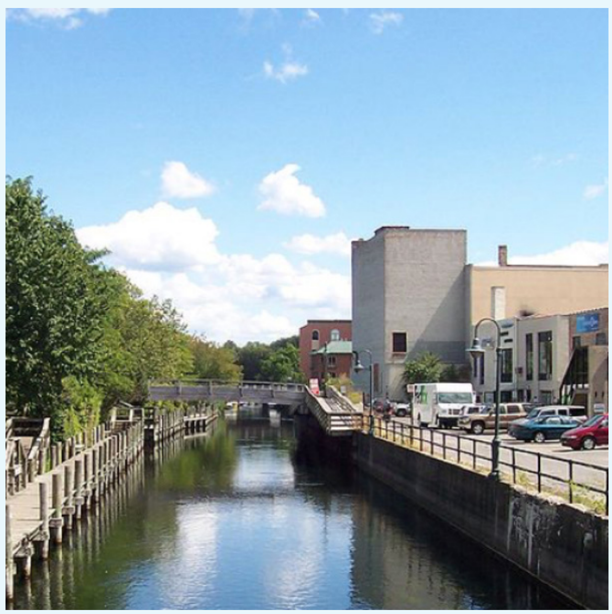
1. Center for Watershed Protection (2018) Forests and Drinking Water. Available at: https://www.cwp.org/forests-and-drinking-water/
2. Full text and detailed methods can be found at www.openspaceinstitute.org.

TABLE 1. Forest Cover in Select Watersheds Serving Metropolitan Centers

WATERSHED	WATER SUPPLY	PERCENTAGE FOREST COVER
Catskill/Delaware	New York, NY	75%
Quabbin	Boston, MA	88%
Sebago Lake	Portland, ME	84%

The exact amount of forest cover needed depends on a range of factors that are broad but knowable. The non-forest land uses within a watershed are a significant factor – for example, is the remainder of the land cover in low-intensity agriculture or high-density development? If the latter, more forest cover will be needed to slow down fast-moving water running off impervious surfaces. Our review confirmed that water quality can begin to degrade when a forested watershed exceeds 18-50 percent agricultural area or as little as 3 percent impervious area.

Other variables, like the location of forest cover relative to water bodies or highly erodible soils, can also be influential. Literature confirmed the importance of protecting forests buffering streams in the headwaters of watershed. In sum, the scientific literature suggests that the more forest cover in a watershed—especially in sensitive areas like steep slopes—the better for water quality.



Non-Forest Land Uses: The type and intensity of non-forest land uses in a watershed have different impacts on water quality. Water quality can begin to degrade when a forested watershed exceeds 18-50 percent agricultural area (left), or as little as 3 percent impervious area (right).

Photo credits: JackTheVicar and Iulus Ascanius via Wikipedia

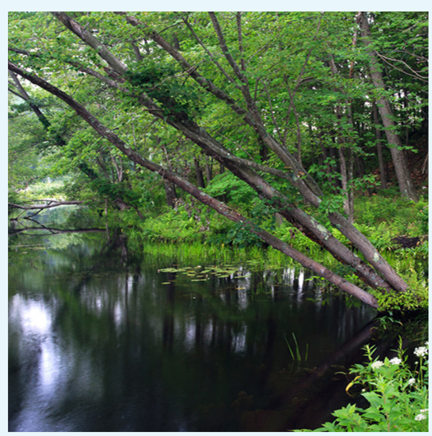
How Can Land Use Science Help?

Land protection programs focused on water quality frequently apply land use science to identify projects for funding, but methodologies vary widely, and there is no clear consensus on best practices. Science-based evaluation remains uncommon.

State agencies, land trusts, watershed councils, and public-private partnerships are all active at the intersection of land protection and water quality. OSI reached out to six programs that fund land protection to achieve water quality goals to understand how they employ science to inform project selection and program evaluation. The strategies used include map-based analyses that predict water quality impacts from land use change, and geospatial analyses that identify priority forested landscapes within important watershed areas, often based on forested land cover. Other programs use analysis to identify sites where co-benefits, such as biodiversity, are present along with high forest cover.

We found that programs have limited knowledge of how their peers function, and there is no consensus on the best approach for project selection. Furthermore, lack of funding, research capacity, and fluency with science can all limit the types of strategies adopted by practitioners.

Although science-based project prioritization is gaining ground, science-based methods for evaluating program impacts on water quality are uncommon. Techniques like predictive modeling of conservation benefits to water quality are occasionally discussed but rarely implemented. Across diverse programs, project evaluation still largely relies on traditional metrics of success like "dollars, acres, and stream frontage." These approaches over-emphasize land protection milestones and underemphasize water quality impacts from those activities. Without metrics to track water quality impacts from land protection, programs may struggle to measure their progress towards water quality goals and show their work's value and enact smart, cost-effective conservation strategies in the future.



Recommendations

Lack of best practices to select land protection targets for water quality and the absence of assessments to evaluate the water quality outcomes are hampering the ability to rigorously evaluate the contribution of land protection to clean water. The following recommendations offer steps to strengthen the practice of water protection and validate land conservation as a sound investment to maintain high water quality.

STRATEGIZE:

Develop quantitative land protection goals for water quality protection programs that also guide project selection criteria. Based on existing land cover and current water quality, set a goal for maintenance of forest cover within the 60-90 percent range depending on other land uses in the watershed. The goal can be achieved through land protection and potentially other mechanisms (zoning, incentives, etc.) and can guide watershed-scale decisions about the appropriate balance of protection, restoration, and development to maintain high water quality. Consider the preferred location of forest cover along waterways and in headwaters when informing land protection targets.[3]

EVALUATE:

Invest in applied and evaluative experiments to link land protection back to water quality outcomes. More research is needed to develop credible methods for assessing the impact of maintaining forest cover on discrete water quality parameters. Setting a forest cover goal (discussed above) creates a reference point to identify when a program has gone off track or when an investment in assessing impact is called for.

CONVENE:

Foster a dedicated community of practice for land and water quality protection professionals to share knowledge and work towards developing best practices for prioritizing and evaluating water quality protection projects. Building best practices with broad buy in from key stakeholders will clarify expectations among water program administrators and support field growth.

3. OSI developed a model prioritization scheme that can be viewed in full in the Delaware River Watershed Initiative Project Evaluation Summary at www.openspaceinstitute.org.

For more information, contact:
Abigail Weinberg, OSI Research Director
aweinberg@osiny.org
212-290-8200 x 1235

Open Space Institute
1350 Broadway, Suite 201
New York, NY 10018
openspaceinstitute.org

OPEN SPACE INSTITUTE