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Advancing Water Quality Through Land Protection: Lessons from the Delaware River Watershed Initiative

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Direct land protection for clean water, climate resilience, and healthy communities.

$50 million in grants for 260 land protection projects conserving 2 m acres

Nearly $1 million to integrate science into 80 conservation plans covering all or part of 19 states.
EPA 2022 Vision Watershed Protection: Minimizing or avoiding water quality degradation to currently healthy waters

OSI Land Protection: Permanent, legal protections that prevent development & minimize loss of forest cover (i.e. easement or fee purchase by a qualified owner)
What I’ll Cover

- Delaware River Watershed Initiative
- Targeting Land Protection
- Assessing Impact
- Reflections & Discussion
Delaware River Watershed Initiative
Top-down Planning for Priority Regions
**Science screen** — Led by Academy of Natural Science

**Feasibility Screen** — Led by Open Space Institute in consultation with ANS and key experts

**Science-based focus areas**

- Key data:
  - Physical
  - Biological
  - Development trends
  - Protected lands
  - Ground water

**Ranking of watersheds by conservation / restoration need**

- Capacity
  - Organizations
  - Track Records

- Impact/investment
  - Urgency
  - Leverage
  - Feasibility

- Measurability
  - Indicators
  - Monitoring
  - Measures
Data Inputs

- Impaired streams
- Stream designations
- Riparian zones
- Forest & wetlands
- Impervious surface
- Development and
- Agriculture
Each cluster of sub-watersheds comprises 3-11 on-the-ground conservation organizations (45 total) that are actively implementing a shared restoration and/or protection plan.
Delaware River Watershed Initiative
Bottom-up Planning for Implementation Sites
Ability to Prohibit Clean Abundant Water

% Forest/Wetland (+) + % Riparian Natural Cover (+) + Erosion Potential (-) + Groundwater Recharge (+)

% Headwaters Streams (+) + % Cool Water Streams (+) + % Base Flow (+)

= Ability to Produce Clean Water

Final results of combining 7 factors

Geographic Targets for Protection & Restoration Strategies

Watershed “Clusters” & Focus areas
OSI Delaware River Watershed Protection Fund

1. Watershed context
2. Water resources & stewardship
3. Risk of conversion

To date:
65 approved grants protecting 27,000 acres of natural land
15,000 acres of headwaters
135 miles of stream bank
Assessing Impact
Lit Review: Forest Cover vs. Water quality

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

How much of a watershed must be forested to produce clean water? And what kind of information do water utilities, government agencies, and other funders need to justify further investment in land protection as a strategy to improve 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 long history of public resistance to imposing “hiking zones” over threats to social impacts. In some regions, this resistance has led to declines in forested land, with significant implications for water quality. This review examines the latest science on the relationship between forest cover and water quality, and how this knowledge can inform policies and practices.

The Water Quality Connection

This review summarizes key findings and offers recommendations for advancing public and private investments in protective forest cover. The report is based on a comprehensive review of the latest scientific literature on the relationship between forest cover and water quality, and includes case studies from around the world.

No Clean Water, How Much Forest Cover?

Waterbodies with less than 40 percent forest cover rarely yield high-quality water, but forest location and the type and intensity of other land uses also matter.

Land use studies from around the globe allow that additional forest cover is crucial to water quality. This research continues through review of the scientific literature that examines the relationship between forest cover and water quality. Studies major regional centers across the United States that review the environmental protection agencies’ latest available evidence. The report cites how these data provide the necessary framework for understanding the effects of land use on water quality and how these effects can be mitigated through targeted investments in land protection.

For example, in the United States, forests with a high density of trees and other vegetation are more likely to retain nutrients and prevent erosion, resulting in cleaner water. This is particularly true in areas where forests are adjacent to water bodies, such as streams and rivers.

Other variables, like the location of forest cover relative to water bodies or highly vulnerable sites, can also be influenced. For instance, high-quality water is often found in areas where forests are adjacent to water bodies, such as streams and rivers.

The report concludes with recommendations for action, including targeted investments in land protection, and highlights the importance of continuing research and monitoring to improve our understanding of the relationship between forest cover and water quality.
Research: Assess Water Quality Impacts

Land Protection Leadership
Peter Howell
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Sampling
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Timothy McGuire

Modeling
Anthony Aufdenkampe
Caitlin Lulay, Sarah Jordan

Dave Arscott
Sara Damiano
Lin Perez
Barry Evans
Mike Campagna

Claire Jantz
Tim Hawkins
Our Overarching Question

What percentage of forest cover is needed in a watershed in order to maintain high water quality and ecosystem integrity?

- What is **high** water quality and **high** ecosystem integrity? (not a regulatory standard)
Sampling Sites

Controls

- One Ecoregion (Northern Glaciated Allegheny Plateau)
- Well forested (Forest Cover > 50%)
- Small watersheds (700-4000 acres)
- Limit wetland influence (<10% wetlands watershed, <2% wetlands local)
- No point sources
Watershed land cover is more predictive than riparian or local site land cover.

Above 85% forest, no detectable impacts; between 70% and 85% limited detectable impacts for macroinvertebrates.

Between 50-70% forest, nutrients and major ions are elevated and statistically relatable to human influences.

For chemistry and macroinvertebrates:

- Forest cover (%) was generally the best predictor of water quality (nutrients) and stream condition (macroinvertebrates).
- Watershed land cover is more predictive than riparian or local site land cover.
- Above 85% forest, no detectable impacts; between 70% and 85% limited detectable impacts for macroinvertebrates.
- Between 50-70% forest, nutrients and major ions are elevated and statistically relatable to human influences.
Future Opportunity: HUC12s With Sufficient Natural Land
Modeling: Approaches

65 projects evaluated for:

1. Avoided Land Use Change
2. Downstream Benefit
3. Riparian Buffer Benefit
Avoided Land Use Change Scenarios

Professional Judgement of Development Threat

Low density development

Modeled Development, Centers 2100

Modeled Development, Sprawl 2100
Future Loads Avoided

Parcel averages of estimated avoided phosphorus loads (average lbs/year)

Each scenario shown at right
Stormwater Runoff

24 hr storm; 3.3 inches

Sum of estimated costs for stormwater infrastructure for 51 projects

Each scenario shown at right
Modeling Comparison: Protection vs. Restoration

Phosphorus Reduced by Restoration (57,000 acres) and Avoided by Protection (35,000 acres)

- ~30-40 percent of projects are annual practices with annual costs and are susceptible to long term management changes
- Many suburban BMPs have maintenance and replacement lifespans
- There are potential annual maintenance expenses for all categories.
Reflections & Discussion
Reflections

- Without timescale of impact, pollutant loads avoided/filtered were modest compared to non-point source BMPs
- Best practices for implementing “avoided development” could help advance the field
- Avoided pollutants were greater in undeveloped headwaters than areas with higher projected development due to large parcels in headwaters
- A consistent standard for “clean waters” could help clarify where protection is an appropriate strategy
- Planning and assessment at the HUC 12 scale works well for implementation and assessing impact
- Clear goals for achieving “effectiveness” need to consider scale, available funds and timeline
Thank you!

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