Advancing and Optimizing Forested Watershed Protection

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The Water Research Foundation (WRF) and U.S. Endowment for Forestry & Communities (U.S. Endowment), collaborated with Brown and Caldwell, to host a two-day workshop with more than 30 professionals to identify future Forested Watershed Protection research opportunities and priorities.

The literature review disseminates more than 45 research documents (referenced at the end of this document) and a questionnaire, recently completed by 32 participants.

The survey was sent to a targeted list of individuals, and a response rate of greater than 50% was achieved. About 55% of the survey respondents are with utilities, and the other respondents represent private land owners, consulting, academia, professional associations/research organizations, non-profits, and regulatory agencies. Within this document, we capture overriding trends and challenges, and frame up the research needs and opportunities.

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Project Objectives

Building on WRF project #4176 Source Water Protection and Roadmap, WRF and U.S. Endowment aims to:

- **Synthesize and evaluate the state of the science** and effectiveness of forested watershed protection in protecting source water quality and reducing drinking water utility costs, considering the broader context of the framework in the Source Water Protection Vision and Roadmap.

- **Assess understanding and experience with implementing and financing** forested watershed protection, capturing what has worked and what hasn’t (i.e. strategies, rationale, and/or organizational framework).

- **Understand how entities are integrating land use decisions with water management** and planning and what encourages and prevents widespread adoption.

- **Develop a prioritized research agenda** to overcome barriers and accelerate watershed protection by providing a foundation for utilities, communities, and forest managers to invest confidently.
Motivations and Challenges

Benefits
Challenges to Implementation
Forested watershed protection is a component of a multi-barrier approach to protecting water quality. Drivers for forested watershed protection include:

- Water quality deterioration
- Reducing water filtration and treatment costs
- Increasing value for irrigation or industrial use
- Water scarcity
- Regulatory compliance
- Risk reduction
- Personal/organizational conservation ethic

Sources: Ernst et al., 2004; Endowment, 2011; Bennett and Carroll, 2014
Motivations for Participation

Risk reduction and compliance motivate buyers.

Buyers and investors in various watershed services payment schemes are largely focused on water quality risk reduction, regulatory compliance or pre-compliance, avoided cost, and conservation ethic [Endowment, 2011; Bennett and Carroll, 2014].

Top Investment Motivations by Buyer Sector, 2013

<table>
<thead>
<tr>
<th>Rank</th>
<th>Business</th>
<th>Local government</th>
<th>State/Provincial government</th>
<th>National government</th>
<th>NGOs / Donors</th>
<th>Drinking water utilities</th>
<th>Waste water utilities</th>
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</table>

- 🚰 Regulatory compliance
- 🏢 Water availability risks
- 🚰 Water quality risks
- 🏢 Local livelihoods
- 🏢 Protection of existing or planned infrastructure
- 🏢 Cost abatement
- 🇧首位 Country
- 🇧首位 Country
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Motivations for Participation

Cash and stewardship motivates sellers.

While cash payments were reported as the primary seller motive. As a strong secondary benefit, environmental stewardship could motivate landowners to have a responsibility to their community and society.

Identifying and matching buyers and sellers in a water source area is key to developing a successful payment for watershed service program.

### Primary and Secondary Seller Motivations for Participating in PWS

<table>
<thead>
<tr>
<th>Seller Motivation</th>
<th>Primary motivation: # of schemes</th>
<th>Primary motivation: % of schemes</th>
<th>Secondary motivation: # of schemes*</th>
<th>Secondary motivations: % of schemes</th>
</tr>
</thead>
<tbody>
<tr>
<td>Cash payment</td>
<td>13</td>
<td>41%</td>
<td>6</td>
<td>19%</td>
</tr>
<tr>
<td>Access to technical assistance</td>
<td>2</td>
<td>6%</td>
<td>10</td>
<td>31%</td>
</tr>
<tr>
<td>Other non-cash financial benefits</td>
<td>6</td>
<td>19%</td>
<td>6</td>
<td>19%</td>
</tr>
<tr>
<td>Land stewardship/environmental ethic</td>
<td>9</td>
<td>28%</td>
<td>16</td>
<td>50%</td>
</tr>
<tr>
<td>Social/community interests</td>
<td>2</td>
<td>6%</td>
<td>0</td>
<td>0%</td>
</tr>
</tbody>
</table>

*Total exceeds 32 (number of schemes in the Tier 2 inventory) because some sellers had multiple secondary motivations.*

Source: Modified Endowment, 2011
Secondary Benefits

Forest ed watershed protection programs can combine support for water quality protection with support for multiple other resource management areas:

- energy production
- water quantity benefits
- timber harvests
- recovery of salmon populations or other endangered species or habitats

Sources: Herbert, 2007; Endowment, 2013; Puget Sound Partnership, 2014
Disincentives

Challenges keep water utilities from protecting source water quality.

The Source Water Protection Vision and Roadmap surveyed utilities to understand motivations and challenges for implementing source water protection (SWP) programs, including in forested watersheds. These findings were echoed in other surveys for watershed protection [Endowment, 2011; Bennett and Carroll, 2014; Puget Sound Partnership, 2014]. The following disincentives were identified:

- lack of time and funding
- lack of authority to protect source water
- lack of responsibility for source water (e.g., utility buys from other supplier)
- government agencies have control rather than utilities
- SWP is not required so no regulatory incentive
- source is too large to implement SWP
- threats to source water are low
- water quality is good now

“At present, many watershed service beneficiaries either are not aware that they rely heavily on such services, are not aware that such services may be in jeopardy because of inadequate watershed stewardship, or do not feel compelled to compensate ecosystem service providers because they can continue to receive the services for free.” [Puget Sound Partnership, 2014]
Limited Ownership

Many utilities own a small amount of the land surrounding their watershed.

For utilities that participated in the survey, 86% owned less than 20% of their watershed, and greater than 55% owned less than 2%. The quantity of land area/stakeholders involved who are competing for resources adds complexity.

Survey respondents identified the following challenges:

• Public acceptance/consensus and understanding the need for forest management
• Maintaining watershed protection as a high priority Documenting the benefits of forested watershed protection
• Difficulty implementing regulatory measures to limit development within buffer distance of source water, and clearing of forests for development
• Funding for land acquisition
• Reluctance by utilities to publicly discuss water quality concerns

Utility Land Ownership

- Less than 2%
- Between 2 and 20%
- Greater than 20%

Source: 4595 project survey
Existing Knowledge

Water Quality Improvements
Forest/Land Management Practices
Wildfire Impacts
The National Research Council reports that through many paired watershed studies that watershed-scale, integrated water management approaches to forest management can lead to improved water quality, but more research is needed to clarify specific benefits. [NRC 2008]

Other studies have found the following improvements in water quality targets and utility cost savings:

- Forested land has a positive effect on raw water quality compared to other land uses, with an indirect impact on operating costs of water utilities, making drinking water costs lower for consumers [Albidtrup et al., 2011; Fiquepron et al., 2013].
- Agriculture and urban development can explain 25-75% of variation in surface water quality; decreasing those and increasing forest land can improve or protect water quality [Mehaffey et al., 2006].
- Riparian forest buffers on agricultural or urban/suburban land can retain 50-90% of sediment in surface runoff, nitrate in groundwater, and total nitrogen in surface and groundwater [Lowrance et al., 1997].
Forest/Land Management Policies & Practices

Forest and land management policies directly impact water quality

Entire watershed management is required to safeguard drinking water sources with more focused efforts at targeted spatial scales to reduce specific risk parameters. [Hurley and Mazumder, 2013]

Forest management policies that can impact water quality include:

- Stream/riparian protection zones
- Rotation rate and silviculture method
- Forest road construction
- Protection of old growth forest reserves
- Stream water quality monitoring
- Wildfire management practices

Certification for sustainable forest management aims for healthy forests and clean water

Overarching certification processes can help ensure that a forest management plan is meeting all sustainability requirements, including protecting water quality.

Sustainable forestry practices are certified by the following entities:

- Sustainable Forestry Institute
- Forestry Stewardship Council
- Rainforest Alliance – Forest Products Certification
- Programme for the Endorsement of Forest Certification (international)

SFI Certification for Forest Land Management requires documentation of:

- Forest Management Planning
- Forest Productivity
- Protection and Maintenance of Water Resources
- Conservation of Biological Diversity including forests with exceptional conservation value
- Management of Visual Quality and Recreational Benefits
- Protection of Special Sites
- Efficient Use of Forest Resources

Source:
Many forest and land management practices can protect and improve water quality.

**NYC:** Forested land acquisition, easements on agricultural land and other conservation easements

**West coast:** Timber harvest using stream protection zones, sustainable rotation rate and silviculture method, careful road construction, protection of old-growth forest reserves, stream water quality monitoring

**Chesapeake:** Riparian forest buffer zones on streams in agricultural or urban/suburban landscape

**Austin:** Protect standing forests and natural land from development or intensive agriculture

Threats to Water Quality from Forested Lands

A better understanding of the influence of forested watersheds would improve our ability to predict downstream consequences.

Research has shown that forest management activities can produce impacts on physical, chemical, and biological water quality (Stednick 1996; Moore and Wondzell 2005).

Forest practices or natural events that can impact water quality include:

- Timber harvesting
- Road construction
- Wildfire
- Invasive species

At present, forestry Best Management Practice (BMP) programs and guidelines are available in all 50 states - these guidelines are intended to maintain high water quality from forested lands during and following forest management activities (Schilling 2009).
Wildfire Impacts

Severe wildfires can impact aquatic ecosystems and drinking water source quality

Contaminants of concern from wildfires:
- Sediment
- Nutrients
- Organics
- Heavy metals
- Flame retardants

Wildfires can release substantial amounts of contaminants into surface waters, which can be long lasting and extend far downstream beyond forested headwaters (Moody and Martin 2009; Silins et al. 2014). Impacts on drinking water source quality have the potential to necessitate additional and costly drinking water treatment capacity beyond that required prior to wildfire (Emelko and Sham 2014). To reduce impacts on terrestrial and aquatic ecosystems, land managers are increasingly using tools, such as prescribed fire and fuel treatments (Graham et al. 2004; Stephens et al. 2012). However, “both the scale and implementation rate of fuel treatment projects is well behind what is required to make a meaningful difference across landscapes” in the United States (North et al. 2012).
Research on Wildfires

WRF has completed a few projects looking at wildfire impacts on water quality.

Design of Early Warning and Predictive Source-Water Monitoring Systems [WRF 2527, 2001]
Lays groundwork for development of early warning and source water monitoring systems.

Effects of Wildfire on Drinking Water Utilities and Best Practices for Wildfire Risk Reduction and Mitigation [WRF 4482, 2013]
A Wildfire Readiness and Response Workshop was held in 2013. The following issues were highlighted:
• understanding the impacts of wildfire on water quality
• identifying and characterizing strategies that are effective for preventing, mitigating, or minimizing wildfire impacts
• assessing implications of land disturbance on water quality and drinking water treatability
• determining the mechanisms and timeframes for watersheds to recover from wildfires
• understanding challenges faced by drinking water utilities after wildfires and solutions that have been effective
• improving awareness of the impacts of fire-fighting techniques on drinking source water quality
• assessing strategies for managing and protecting water quality with proven restoration and management practices
• providing case studies of inter-municipal cooperation and management strategies.

Wildfire Impacts on Water Supplies and the Potential for Mitigation: Workshop Report [WRF 4529, 2014]
Although studies to date have explored aspects of the relationship of wildfires to water quality, a comprehensive assessment of the potential impacts of wildfires on drinking water utilities has not been conducted. The relative impacts and efficacy of forest and water management options in mitigating wildfire risks to water supply and treatment are still in its infancy.
Current Frameworks

Planning
Implementing
Monitoring
Valuing
Communicating

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Vision from WRF project 4176a, Developing a Vision and Roadmap for Source Water Protection for Drinking Water Utilities:

“Source water protection is essential for providing a reliable supply of high quality drinking water. By 2025, every public community water supply will be protected by an active source water protection program.”

In a review of 32 market-based watershed conservation programs in the US, programs have targeted improvements in the following water quality parameters through implementation of land management practices:

- Nutrient pollution mitigation (53% had nutrients as a primary target, 16% incidental)
- Erosion/sediment reduction (41% primary, 22% incidental)
- Water temperature control (6% primary, 0 incidental)

The WRF 4595 survey found that source water protection goals include maintaining forest cover, decommissioning or improving and maintaining watershed forest road systems, and minimizing erosion and associated turbidity events.

Sources: Endowment, 2011; 4595 project survey
Entities that may have a business case for watershed services include beverage companies, hydropower companies, manufacturers that rely on freshwater for processing, housing developers, wastewater treatment plants, city and county governments, drinking water utilities, and public departments of transportation, among others. Integrating efforts is an important first step. Stakeholders, experts, and champions can expand available resources, increase capacity, and provide political capital. Landowner participation is essential in privately owned watersheds. Investment must be large-scale and sustained.

Reports recommend strong partnerships as the first priority for watershed protection success.

Sources: Ernst et al., 2004; NYCDEP, 2010; Hanson et al., 2011; Gentry et al., 2012; Gartner et al., 2013; Gartner et al., 2014; Puget Sound Partnership, 2014
Planning – Program Types

Protecting water quality through forest management can take a variety of forms.

Payments for Watershed Services [Hanson et al., 2011]
- Voluntary payment by downstream user to upstream landowner to reduce cost of doing business
- Payment made to minimize an entity’s cost of meeting a regulation and made to generate public benefits

Conservation Easements through Land Trusts [Lind, 2000; Land Trust Alliance, 2009; Bates, 2014]
- Charitable donation incentives for voluntary land protection by public or private landowners.
- Payment incentive where easement purchase may provide seed capital to implement management activities.
- Land trusts accept donations of and/or purchase lands for public benefits that are protected in perpetuity.

Water Quality Trading Programs [EPA 2015]
- Trading allows facilities facing higher pollution control costs to meet regulatory obligations by purchasing environmentally equivalent (or superior) pollutant reductions from another source at a lower cost, thus achieving the same water quality improvement in the watershed.
- Watershed stakeholders and state regulatory agencies are willing to try an innovative approach
Understanding program costs is the first step in obtaining appropriate financing.

Payment for Watershed Services (PWS) systems have three financing needs: 1) up-front costs of establishing the system, including establishing the technical “proof”, appropriate organization, and supportive legal framework; 2) actual payments for services; 3) ongoing operations costs.

Financing must be secure and long-term.

Payments must be continuous and open-ended, targeted to different service types or levels, and designed to avoid perverse incentives (such as deforestation of existing forest in a program that only pays for reforestation of deforested lands, not management of existing lands).

Conditions that encourage use of PWS systems: clear hydrologic information on impacts of land management on water and particular user needs; identifiable buyers and sellers; economic benefits showing enough value to be worth implementation (low upstream costs, high downstream benefits); organization for collecting payments; supportive legislation.

Utility survey participants feel more funding is needed for forested watershed protection

When asked if existing funds are sufficient, 83% of utility survey responders said “No”.

Many utilities are still identifying projects that are needed as a part of watershed master planning efforts. Several utilities were looking for funding to support:

- Additional dedicated staff
- Land acquisition
- Large projects
- Expanded water quality monitoring

Non-utilities felt they were able to secure funding on joint efforts for forested watershed protection.

Source: 4595 project survey
Partnerships can help utilities access a range of options.

Funding options include:

- Voter initiated bond/tax
- Conservation easements/restoration funds
- Payments for watershed services
- Federal/state programs/grants
- Utility rates
- Property sales

Several responders said that they were able to leverage multi-purpose funding.

Sources: Ernst et al., 2004; NYCDEP, 2010; Stanton et al., 2010; Endowment, 2011; Endowment, 2013

New York City funds most of our programs with matching grants from the USDA Forest Service.

Our (Central Arkansas) primary source is a volumetric fee of $0.015 per 100 gallons.
Development code and model ordinances identify best practices for managing source water quality.

The Eugene Water and Electric Board reviewed 51 programs and model ordinances for source water protection, identifying watershed protection strategies around the U.S. [EWEB, 2009]. These ordinances link water quality protection strategies to specific development activities, and guide those activities to protect water quality. Utilities have noted that when these strategies are not part of the legal and regulatory framework, implementing watershed protection actions is more difficult [Water Research Foundation, 2012].

Local authorities are developing ordinances to ensure watershed protection.
Planning - SWP Vision and Roadmap as a Resource

Utilities are using a variety of tools to aid decision making

The SWP Vision and Roadmap had the following themes:

- Raising Awareness
- Enhanced Coordination
- Enhanced Support
- Increased Recognition

When surveyed about use of the 2010 Vision and Roadmap, approximately 65% of utilities had not used it as a resource. Other resources used for decision making include:

- Master planning process
- Water supply experts - consultants and academics
- Source water protection plans
- Regulatory requirements from USEPA and state health departments
- Other guidance documents, such as AWWA’s G300 Standard on source water protection and World Resources Institute report on natural infrastructure
- Public opinion polls

Utilities Using Vision and Roadmap as a Resource

Source: 4595 project survey

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Planning Tools

A number of organizations have developed strategic planning tools to help

Planning Tools and Organizations

- Watershed Forest Management Information System – US Forest Service (USFS) and University of Massachusetts Amherst developed the mapping tool to help utilities and watershed councils protect and improve water quality [Gentry et al., 2011]
- Advances in remote sensing are helping to increase the understanding of watershed health [Foged 2014; APEM 2015]
- Conservation Fund – source of tools to help assess needs and resources of a community and provide public and private leaders with integrated solutions [Gentry et al., 2011]

Valuation Tools and Organizations

- Forest to Faucet Partnership – USFS/U Mass Amherst collaboration to place a value on ecosystem/watershed services [Gentry et al., 2011]
- World Resources Institute and the American Forest Foundation - Developing payments for watershed services schemes to provide economic incentives to landowners who protect watersheds through forest/land management [Gentry et al., 2011]
- Source Water Cost Benefit Tool - This WRF tool was designed to help evaluate triple bottom-line costs and benefits of different source water protection options. Cost benefit calculations help evaluate, prioritize, justify, and implement source water protection initiatives. [Oxenford et al., 2010]
Implementation/Measuring Results

Implementation of successful forested watershed protection programs includes water monitoring.

Monitoring programs showed improvement when comparing 2010-2011 to 2012-2013. 54% of programs are performing some time of monitoring. Additionally, some utilities are correlating forest protection with water quality by using land use modeling tools and water quality models and real time data. Macroinvertebrates and other indicators are also being used. Based on the survey, one utility noted they were performing monitoring several times a year to establish a baseline and then following U.S. Forest Service management and actions or pre- and post-wildfire planning activities.

Source: Modified from Bennett and Carroll, 2014

Program Monitoring Rates

- Socio-economic impact monitoring
- Economic performance monitoring
- Biophysical monitoring
- Hydrological monitoring

Source: Modified from © Ecosystem Marketplace, Forest Trends Association
U.S. cities have avoided expensive filtration facilities by focusing on watershed protection.

<table>
<thead>
<tr>
<th>Location</th>
<th>City Population</th>
<th>Estimated Avoided Costs through Watershed Protection</th>
</tr>
</thead>
<tbody>
<tr>
<td>Auburn, Maine</td>
<td>23,000</td>
<td>$30 million in capital costs and $750,000 in operating costs (spent $570,000 to acquire watershed land)</td>
</tr>
<tr>
<td>Boston, Massachusetts</td>
<td>2.3 million</td>
<td>$180 million (gross)</td>
</tr>
<tr>
<td>New York City, New York</td>
<td>9 million</td>
<td>$6 billion in capital costs and $300 million in annual operating costs ($1.5 billion spent on watershed protection over 10 years)</td>
</tr>
<tr>
<td>Portland, Maine</td>
<td>160,000</td>
<td>$25 million in capital cost and $725,000 in operating costs (spend $729,000 annually to protect watershed)</td>
</tr>
<tr>
<td>Portland, Oregon</td>
<td>825,000</td>
<td>$200 million in capital cost</td>
</tr>
<tr>
<td>Seattle, Washington</td>
<td>1.3 million</td>
<td>$120-200 million</td>
</tr>
<tr>
<td>Syracuse, New York</td>
<td>150,000</td>
<td>$45-60 million in capital costs ($10 million watershed plan)</td>
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Source: Modified from Worldwatch Institute, 2005 (Postel and Thompson)

Seattle, WA avoided a $200 million filtration plant, and Boston, MA avoided constructing a $180 million filtration plant through watershed protection. New York City, a well-known example, spent approximately $1.5 billion to protect the Catskills Watershed, and as a result avoided the need to build an $8-10 billion filtration plant (Kenny, 2006).

In 2012, New York’s investment paid off further: During Hurricane Sandy, their protected watershed provided clean, gravity-fed water with no interruption in service. Very few people lost potable water. In contrast, New Jersey’s pumps and filtration plants stopped working due to power cuts. Along with contaminated groundwater, this left much of New Jersey without potable water for weeks after the storm, and an expensive tab for water infrastructure repair (Salzman, 2012; Appleton and Moss, 2012; Johnson, 2012).
Valuation

More studies are demonstrating the value of watershed protection to water utilities, but broad rules of thumbs do not always apply.

A 2008 update of the AWWA study also found a link between high forest cover, high drinking water quality, and lower treatment costs [Freeman et al. 2008]. However, difficulties arise in comparing data from different utilities, which use a range of different treatment methods, chemicals, and water sampling methods in their operations, and account for and report these costs in different ways.

Another study found that forest fuel treatments can significantly reduce size and intensity of wildfires, and the economic benefits of treatments may be 3 to 4 times their costs [Buckley et al. 2014]. Water utilities relying on downstream intakes also experienced significant benefits through reduced sedimentation after a fire.

A few studies have tried to quantify the benefits of forested watersheds through business case evaluations to show that natural infrastructure can be more cost-effective for water utilities than other alternatives [Gartner et al. 2013]. Natural infrastructure provides valuable services to water utilities, like sediment removal and water storage—as well as ancillary benefits like fish and wildlife habitat, increased property values, and recreational opportunities.

AWWA and the Trust for Public Land estimated that for every 10 percent increase in forest cover in the source area, treatment and chemical costs decreased approximately 20 percent, up to about 60 percent forest cover [Ernst et al., 2004] (using the data from the chart above).
Valuation

Source Catchments as Water Quality Assets

Water Services Association of Australia (WSAA) and WRF have developed “The Source Value Transfer Database” for source catchments/ watersheds.

This searchable database includes more than 200 estimates of the economic and financial benefits of source catchments.

The database identifies studies that have estimated the financial, economic, environmental and social impacts that can be associated with source water investments in dollar terms. These estimates are presented in a common format in the database. The goal of the database is to help utilities and regulators make a business case to decision makers for catchment management as a viable alternative to more traditional capital investments.

The work includes a review of regulatory and investment frameworks, market mechanisms, and management practices that impact or may impact source water quality and quantity, and includes the development of a Source Catchment Lifecycle Cost Assessment Tool (Alluvium 2015).
Utilities responded in the survey that they’re trying to monetize the value of watershed protection.

Currently forested areas are under appreciated and undervalued. Their value has not been evaluated.

Haven't formally factored into cost of service analysis.

We can't make a direct comparison but it is clear that investing in protecting forested land is less expensive than losing our filtration-avoidance waiver.

We use existing federal incentive programs to determine cost-sharing rates for private landowners, with the goal of minimizing adverse economic impacts on program participants. When purchasing new lands for City ownership, we use fair market value, but that doesn't necessarily include the value of timber. It is based more on the development potential...

Source: 4595 survey results
Communicating

A variety of approaches/messaging used to communicate the value of source water protection

Approaches to effective public communication include:

• Working with regional land trusts and conservancies to ensure that forested lands, which help purify our source water, are permanently protected for drinking water supply protection
• Lobbying for policies that preserve forests and emphasize water resource protection
• Collaborating with the State to ensure regulations are enforced for wastewater treatment plants that discharge upstream

The following messaging was found most effective:

• Discussing in terms of reliability and resiliency
• Protecting water quality through land conservation is more cost effective than building filtration plant
• Watershed forest protection (acquisition) prevents development projects that threaten water quality
• Sole source of drinking water, thus it is critical to protect it
• Emphasizing connection between forest cover and clean, safe drinking water
Communicating

Most survey respondents view that they have some public support and awareness.

Non-utilities felt they had a higher level of public support and awareness.

Of the utilities surveyed, none gave the highest ranking for public support and awareness.

To educate the public, respondents said that TV news coverage gets the most attention for good or for bad. It’s important to take advantage of the public’s attention when you have it. Annual Water Quality Reports and education of school children will also noted as ways to inform the public.

Source: 4595 project survey
Quotes from Workshop Attendees

Perspectives on Opportunities and Challenges for Forested Watershed Protection

Opportunities exist for greater communication and collaboration between land trusts and water utilities.

Opportunity is to broaden the conversation beyond water utilities and landowners to include traditional corporations and private investment sector to invest into non-traditional green infrastructure.

The challenge is making difficult policy and land management decisions around incomplete knowledge. What is the differential effects of different disturbances and how do our land management responses to those affect water quality and quantity? We need to generate new knowledge to drive models and policy makers to make difficult decisions.

Climate change, drought, and fire are getting the public’s attention and there’s an opportunity to get buy-in in watershed protection. It is a heavy lift with the education component, but once you do it, people are incredibly receptive. It is important to make the business case to rate payers and tax payers so they understand their return on the investment.
Workshop Attendee Perspectives on Opportunities and Challenges for Forested Watershed Protection

Introductory Tweets

- It’s easy to collect data - we are drowning in it, so finding a way to make something useful out of it to prioritize investments. Essentially, closing that loop is a major priority.

- The opportunity/challenge is improving our ability to put value on natural assets. A number of precedents have been set to scale up existing funding mechanisms for investments in forested watershed protection. Great opportunities to replicate across the country and improving exposure in general – being able to compare our gray and green infrastructure.

- Challenge is having the information to go to board and decision makers with business case for investment in forest watersheds in a situation of limited resources.

- It is also a coordination challenge – great to see clean water and safe water policies and regulations together in some location, such as California.
Motivations and Challenges
Best Practices and Remaining Roadblocks
Climate change and other threats to water supply are causing water planners to search for more resilient and cost-effective practices for protecting water quality. Forested watershed protection is the first step in a multi-barrier approach to protecting drinking water quality, making downstream treatment more effective and reducing risk.

The drivers for forested watershed protection include a reduction in nutrients, turbidity, organic carbon, bacteria, and metals. Forested watershed protection programs can also provide secondary benefits including energy production, water quantity benefits, timber harvests, recovery of fish populations or other endangered species or habitats.

Challenges to expanding or adopting forested watershed protection include limited funding and staff and difficulty maintaining it as a high priority within the organization and with local leaders, limiting development, and with valuation of the benefits.
Summary – Best Practices and Remaining Roadblocks

What’s needed to scale up Forested Watershed Protection? Some Aha’s…

Based on survey results, best practices have included:

- Collaborating and partnering with other stakeholders who can help leverage funding or assist with operation and maintenance of forested land
- Developing watershed protection and habitat protection plans
- Having a well-staffed program
- Supporting comprehensive education and training programs for landowners and foresters.

Many research needs were identified in the survey and the 2-day workshop:

- Few utilities have the capacity (financially and organizationally) to expand their forested watershed and maintain it by themselves. Given the diversity of stakeholders, a common understanding of the language, principles, and motivators for potential participants in joint programs is necessary.
- A risk management analysis related to forest disturbances and ecosystem changes (such as dealing with invasive species and forest fires) with potential water quality impacts would be impactful. Risk avoidance was seen as more of an impactful driver for forested watersheds than incremental treatment improvements for filtered water supplies.
- Utilities and other entities are searching for a way to value and manage watershed assets and perform cost/benefit analyses. They are looking for strategies to quantify the impact of land protection projects and efforts, such as benefits of riparian forest on reducing soil and nutrient loss. Ultimately, a framework for business case evaluations of alternatives, which could be used in conjunction with traditional business case analysis for “grey” infrastructure is needed for investment grade decisions.
WRF and the U.S. Endowment plan to invest in forested watershed protection research

Future Research Agenda

Summary Statement

By 2022, advance water utility implementation of forested watershed protection by providing a foundation for utilities, communities, and forest managers to invest confidently. Improve understanding of watershed vulnerabilities, prioritization of forest management practices, and resulting benefits including improved water quantity and quality, reliability, resiliency, and risk reduction. Accelerate implementation by enhancing potential collaborative opportunities and establishing techniques for valuation and funding.
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