



GROWING FORESTS FOR WATER

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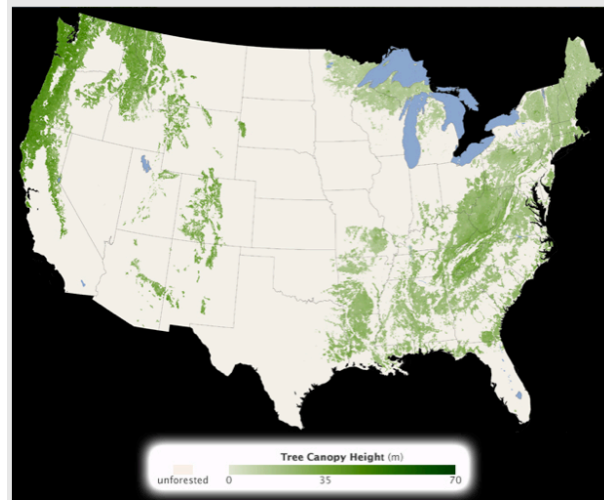
Supporting responsible forest management to enhance and protect water resources

Introduction

In many ways, water is the most precious forest resource. Forests provide wood and paper products, food and other non-timber forest products, recreation and wildlife benefits – and forests also protect and enhance our water resources. By filtering runoff and increasing infiltration to recharge ground water supplies, forests provide and protect drinking water resources for millions of people in the U.S. and billions more around the world.

Surface water - freshwater collected on the ground, in ponds, lakes, streams, rivers, wetlands - is directly impacted by land use decisions, including forest cover and forest management activities. Recent research has found that more than 52 million people in the Northeast and Midwest regions of the United States rely on surface water for municipal drinking water.¹

Figure 1: Forest Canopy Height Map



A forest canopy height map of the contiguous United States. Credit: NASA Earth Observatory/Image by Jesse Allen and Robert Simmon/Based on data from Michael Lefsky.

Source:

<http://www.nasa.gov/topics/earth/features/forest-height-map.html>

Note: Map does not include urban forests or areas with modest tree cover.

Communities throughout the United States have identified mechanisms to retain and improve forest cover and support responsible forest management practices within their municipal watersheds as part of comprehensive programs to protect water supplies. Tools for citizen engagement, regulations and incentives, and innovative approaches to ‘growing forests for water’ are illustrated in this report. This report shares case studies of municipal water supplies from around the United States and their approaches to protecting surface waters through the use and enhancement of responsible forest management.

Background

There is a common connection between forests, surface water and municipal water supplies in many parts of the United States. Some of the most well known examples are the waters of the Catskill Mountains that supply New York City residents, the Quabbin and Wachusett Watersheds serving Boston and eastern Massachusetts, and the Cedar River Watershed supplying the area of Seattle. In the Midwest, many communities also depend on surface water, including the Twin Cities region of Minnesota, as well as Duluth and other communities in the northern part of the state. Cities in Michigan, Missouri and parts of the southeastern region of the U.S. also depend upon surface water.

¹ http://www.na.fs.fed.us/watershed/fwp_preview.shtml

One way to visualize the connection between forests, water, and communities is to look at maps. Figures 1 (previous page) and 2 show data from NASA regarding tree canopy heights in major forested regions throughout the United States. Canopy height can be used as a measure of forest density and abundance.² Figures 3 and 4 highlight the results of watershed studies done by the U.S. Forest Service.

Figure 3 illustrates the ability of respective watersheds to produce clean water (*darker blue regions indicate **higher** watershed integrity and **better** water quality*). Figure 4 illustrates the importance of watersheds in providing municipal drinking water supplies (*darker brown regions indicate watersheds providing supplies to the **greatest** number of people*).

In reviewing Figures 2-4, it is apparent that regions with abundant forest canopy (Figure 2) correlate to regions with high watershed integrity and water quality (Figure 3). Furthermore, regions with high water quality and watershed integrity correlate to regions that rely on surface water and forested watersheds for municipal water supplies (Figure 4). These maps (and the research behind them) provide a geographic illustration of some of the connections that exist between forests and water resources.

A 2002 Survey found that a 10% increase in watershed forest cover results in a 20% decrease in treatment and chemical costs downstream (Figure 5).³ Subsequent studies conducted by educational, governmental, and international institutions⁴ have reinforced the significant relationship between watershed forest cover, water quality, and downstream treatment costs.

Figure 2: Forest Canopy Heights



Source: <http://www.nasa.gov/topics/earth/features/forest-height-map.html>

Note: Map does not include urban forests or areas with modest tree cover.

Figure 3: Watershed Integrity and Health

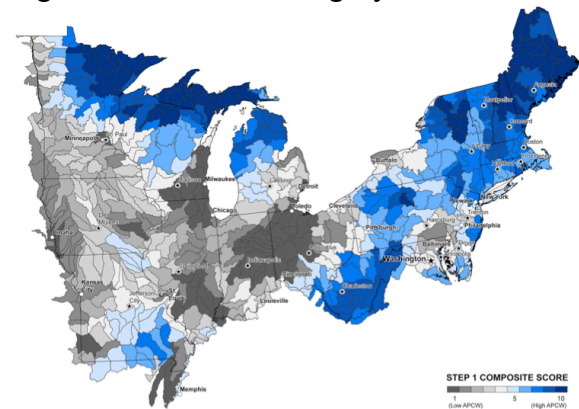
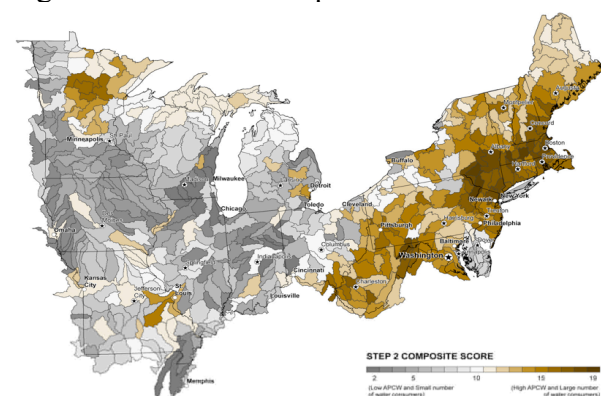


Figure 4: Watershed Importance to Consumers



Figures 3, 4, Source:

http://www.na.fs.fed.us/watershed/fwp_preview.shtm

² These figures depict average height across 5 km² (1.9 square mile) units; therefore, areas with modest tree cover and urban forests are not illustrated.

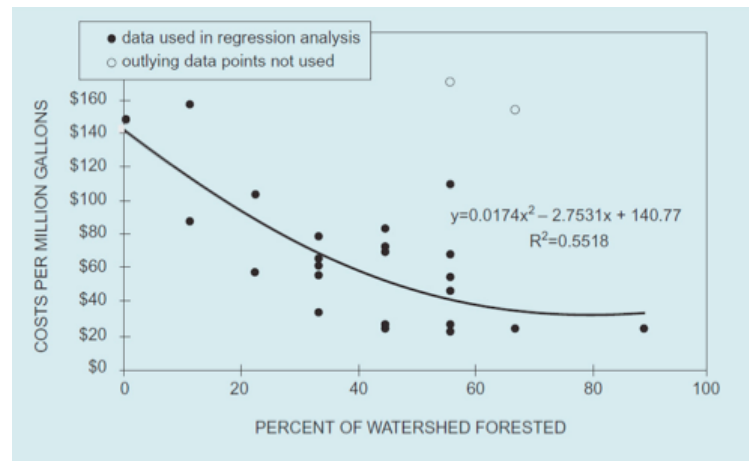
³ *Forestry and Drinking Water*” Watershed Forestry Resource Guide. <http://www.forestsforwatersheds.org/forests-and-drinking-water> (Accessed 10 April 2012)

⁴ Studies of Note: Freeman et al. 2008. “Statistical Analysis of Drinking Water Treatment Plant Costs, Source Water Quality, and Land Cover Characteristics”; The World Bank & WWF Alliance for Forest Conservation, 2003 “Running Pure”.

Growing Forests for Water: Engaging Private Landowners

The first two case studies, from New York and the Chesapeake Bay, illustrate strategies for influencing private landowners. These watersheds have made private landowners into partners – either directly or indirectly – by implementing programs that promote woodland management plans, educate teachers and forestry professionals, support research, and facilitate land acquisition and conservation easements.

Figure 5: Relationship between Water Treatment Costs and Forested Watersheds



Source: "Forestry and Drinking Water" Watershed Forestry Resource Guide. <http://www.forestsforwatersheds.org/forests-and-drinking-water>

New York City

The New York City Department of Environmental Protection's Bureau of Water Supply is responsible for maintaining and protecting the drinking water resources that serve its nine million customers. The water supply system provides eight million people in New York City and one million additional people living north of the city with 1.2 billion gallons of water each day.

The New York City water supply system (Figure 6) includes 19 reservoirs and 3 controlled lakes located up to 125 miles from the city and connected through a system of tunnels and aqueducts. More than 75% of the nearly 2,000 square mile watershed is forested, with the majority of these lands being privately owned.⁵ The water supply system is noteworthy for several reasons, including its large scale, its dependence on surface water, its high water quality (it requires less chemical treatment than comparable systems), and its economic efficiencies (the system is primarily gravity fed, meaning less money is spent on infrastructure). Some of these attributes are a result of geography, topography and other natural features, while some are the outcome of innovative public policy and actions to directly manage and support desired land uses within the watershed, including promotion of forestry.

Forests in the state of New York provide diverse and abundant benefits. New York is over 60% forested, and it is estimated that the state's forest-related tourism has an annual value of \$1.9 billion.⁶ The forest industry is an important employer for many of the state's cities and towns and provides over 72,000 jobs, over \$2.2 billion in income and a total industry output of \$8.8 billion to the state's economy each year.⁷

⁵ <http://www.joe.org/joe/2001april/iw2.php>

⁶ <http://www.dec.ny.gov/lands/73021.html>

⁷ Sources: New York State Department of Environmental Conservation. 2010. *Forest Resource Assessment & Strategy 2012-2015: Keeping New York's Forests as Forests*. and North East State Foresters Association. 2007. *The Economic Importance and Wood Flows from New York's Forests*, 2007.

The New York City Watershed Program

In 1989, the Environmental Protection Agency (EPA) enacted requirements for unfiltered municipal water supplies under the Surface Water Treatment Rule. These requirements define the water quality and watershed management conditions that must be met in order for a municipal water system that relies on surface water to be permitted to operate without filtration. Given the high costs of filtration systems (i.e., an estimated \$3 billion to build a filtration plant for New York's Croton Watershed), there is a strong economic incentive for water utilities to meet the requirements rather than install complete filtration systems.

In 1993, in response to EPA surface water guidelines, New York City developed a comprehensive approach to watershed management, focusing on high water quality and maintenance of a healthy watershed. The City of New York gained approval for the watershed program in 1997 and received a five-year Filtration Avoidance Determination (FAD), allowing an exemption from building a filtration plant for the area's water supply. In 2002, the EPA extended the exemption for an additional five years, and then again for another ten years in 2007. These extensions confirmed the effectiveness of the city's watershed protection program in addressing the Surface Water Treatment Rule's requirements.

Within the system's approved watershed plan, there are several innovative programs that address watershed land uses and protect or enhance water quality.

Watershed Model Forest Program

This program provides "working demonstrations of practical and effective forest management and stewardship practices that are compatible with water quality protection."⁸ There are four actively managed demonstration sites on which research is conducted to determine water quality impacts and which serve as model forests for public education. Each model forest is linked to an environmental education center that provides access to information and education regarding the importance of working landscapes and sustainable forestry management practices.

Watershed Forestry Institute for Teachers

The Watershed Forestry Institute for Teachers (WFIT) began in 1999 as a partnership between the Watershed Forestry Program of the Watershed Agricultural Council, the Catskill Forest Association, the U.S. Forest Service, and the New York City Department of Environmental Protection. Its mission

Figure 6: New York City's Water Supply System



Source:

http://www.nyc.gov/html/dep/html/drinking_water/wsmaps_wide.shtml

⁸ <http://www.esf.edu/nycmf/history.html>

is to provide educators with knowledge, skills, and tools to explore the connection between upstate watershed forests and downstate water quality. Twenty teachers from New York City and the upstate watersheds are brought together for one-week sessions to gain background knowledge, materials, and resources necessary to educate students about the importance of New York City's unique water management approach. Participants are provided curriculum materials that meet classroom, district, and state learning standards. Graduates become part of a network of teachers who receive on-going support from resource professionals, access to grant funding opportunities and programs for students.

Forest Education for Loggers, Foresters, Landowners, and Farmers

Programs such as the Trained Logger Certified (TLC) program support logger education and responsible forestry management practices. For loggers working within the watershed, training programs promote watershed protection and sustainable forestry through proper silvicultural practices, the use of best management practices (BMPs), first aid and CPR, and chainsaw safety. Loggers who attend education sessions are recommended to landowners who plan harvest operations on their watershed woodlots. Loggers also receive incentives for staying current on BMPs.

Education in forest management planning is also provided for professional foresters and forestry consultants. The programs focus on specific water quality issues, including prevention of erosion, stream bank management and riparian area stabilization and include training on watershed delineation, proper culvert sizing and skid road location. After attending training courses, professional foresters are encouraged to develop forest management plans for private landowners located in watersheds within the system. They are also eligible to update forest management plans already filed under the state's forest tax law to meet the Watershed Forestry Program's standards for water quality protection.

The Watershed Forestry Program offers education sessions on forest taxation, forest health, forest road remediation, wildlife management and the production of non-timber products in woodlots. The Watershed Forestry Program and its partners were instrumental in the development of New York State's *Best Management Practices for Water Quality Field Guide*.⁹ In addition to addressing forestlands and forest management, there are also significant efforts to address farmer education and decision making related to cropping and livestock systems within the watershed.

Land Acquisition and Conservation Easements

A cornerstone of New York City's watershed protection system is a land acquisition program that includes direct purchase of land (e.g., acquisition of fee title) as well as the use of conservation easements that prevent land use changes associated with development. Since 1997, the program has enrolled 120,000 acres of land, 90,000 of which are forested. One of the commitments in the city's 2006 Long-Term Water Protection Program was to develop a forest management plan for the acquired lands and the 2007 FAD includes a new land management section. Goals for the city's land management program include providing recreation opportunities, monitoring conservation easement compliance, protecting the watershed from natural gas drilling, and managing natural resources.

As one of the oldest and largest municipal water supply systems in the country, the New York City Watershed Program provides many examples of innovative approaches to supporting the responsible management of private lands to protect water quality.

⁹ Available to download at: <http://www.dec.ny.gov/lands/37845.html>

Chesapeake Bay

The Chesapeake Bay watershed (Figure 7) includes over 64,000 square miles distributed across six states, including New York, Pennsylvania, Delaware, Maryland, Virginia and West Virginia, and the entire District of Columbia. More than 100,000 miles of tributaries lead into the Chesapeake Bay and are included in the watershed. It is estimated that in the 1700s, as much as 95% of the Chesapeake Bay watershed was forested. Today, about 58% of the watershed has forest cover - many former forestlands have been cleared of forest cover to accommodate various forms of development. Nearly 80% of current forested land in the watershed is privately owned. It is estimated that 900,000 family forest owners own parcels of generally less than 25 acres in size. About 75% of the Bay watershed's residents, more than 11 million people, rely on surface water supplies.¹⁰

Given the large geographic scope of the Bay, a key strategy for water quality protection has been inter-governmental cooperation. Nearly 30 years ago, a partnership was formed through a framework called the Chesapeake Bay Agreement. An Executive Council was formed to include governors from the states of Maryland, Pennsylvania, and Virginia; the District of Columbia mayor, the administrator of the U.S. EPA, and the chairman of the Chesapeake Bay Commission (a legislative body serving Maryland, Pennsylvania, and Virginia).

Chesapeake Bay Watershed Programs

In the late 1970s, a congressionally funded study analyzed the Chesapeake Bay's condition and the causes of its degradation. The results identified excess nutrient pollution as the main environmental problem affecting water quality in the Bay. The study's findings led to the creation of the Chesapeake Bay Program aimed at cleaning up pollution within the watershed. The program set goals to guide the Bay toward protection and restoration. These goals are reevaluated each year within the context of two-year milestones. The seven jurisdictions within the watershed follow Bay Water Implementation Plans, which outline specific milestones that aim to reduce negative impacts to water quality that are particular to each jurisdiction. The primary measures used to reduce negative impacts to the Chesapeake Bay include addressing water quality issues associated with land use, habitat restoration, fisheries management, watershed protection and public education.

The watershed programs include limits on allowable sediment loads and activities to inform farm management, land development and forest stewardship in order to address water quality restoration and meet the goals of the program. A primary goal is retention and expansion of the amount of forested land in the Bay watershed. To meet this goal, the program has focused efforts on engaging private woodland owners and promoting forest stewardship.

Figure 7. Chesapeake Bay Watershed



Source: <http://www.epa.gov/chesapeakebaytmdl/>

¹⁰ <http://www.chesapeakebay.net>

Forests in the Chesapeake Bay watershed annually provide approximately \$24 billion worth of economic benefits in the form of ecosystem services including, carbon sequestration, flood control and protection of wildlife habitat. The forest industry is an important employer for many of the region's cities and towns and provides 140,000 jobs, \$6 billion in income and a total industry output of \$22 billion to the Bay area economy each year.¹¹

Management Goals

One goal of the Chesapeake Bay Program is to provide watershed management plans for two thirds of the total 34 million acres that make up the watershed. By 2010, 14 million acres had plans, 62% of the total goal. Another aspect of the Chesapeake Bay Program is protecting land from development; with a goal of preserving 20% (6.8 million acres) of the total watershed acreage in Maryland, Pennsylvania, Virginia, and the District of Columbia. Through purchasing property, creating forest easements, and purchasing development rights, this goal has been achieved. As of 2010, over 7.3 million acres have been protected from development.

The program also promotes the planting of forest buffers along waterways for the purpose of habitat protection and restoration, water temperature regulation, and erosion prevention. In 1995 a goal of planting 2,010 miles of waterway buffers by the year 2010 was adopted. By 2002, the program goal had already been achieved. The goal was subsequently raised to 10,000 miles of riparian areas by 2010. As of 2010, the states of Maryland, Pennsylvania, Virginia, and the District of Columbia have restored 7,229 miles of forest buffers, 72% of the revised goal.¹²

Forestry for the Bay

Forestry for the Bay¹³ is a membership program for owners of small and medium sized forest parcels that are interested in actively conserving their woodland or restoring woodlands on their property. Forestry for the Bay was developed through collaboration between the Alliance for the Chesapeake Bay, the U.S. Forest Service and the Chesapeake Bay Program, with support from the Maryland Forest Service, the Pennsylvania Bureau of Forestry and the Virginia Department of Forestry. The program is managed by the Alliance for the Chesapeake Bay and supported by a diverse advisory committee in addition to partnerships with government agencies, industry, landowner groups, environmental organizations, and land trusts.

The main purpose of Forestry for the Bay is to promote sound forest management practices as a way to increase the vitality of the region's woodlands and improve the health of local streams, rivers and the Chesapeake Bay. To achieve this goal, the program focuses on landowner education. Landowners are taught about "...the connection between healthy woodlands and clean water and that the healthiest woodlands are managed." Forestry for the Bay is also designed to complement existing state and independent forest stewardship programs.

"The goal of the program is to educate landowners about the connection between healthy woodlands and clean water and that the healthiest woods are managed."

-Forestry for the Bay

¹¹ <http://www.chesapeakebay.net/forest.htm>

¹² http://www.chesapeakebay.net/indicators/indicator/planting_forest_buffers

¹³ <http://www.forestryforthebay.org/>

Woodland Plans

The efforts in the Chesapeake Bay Watershed emphasize woodland management and planning. Several resources and alternative types of plans are offered as options to woodland owners. A *Woodland Objectives Plan* is designed for owners who are just getting started with woodland management. The *Woodland Conservation Plan* is a more comprehensive peer reviewed plan divided into six sections. This plan allows woodland owners to do a more thorough evaluation of their property and analyze potential management opportunities. Several publications, including *The Woods in Your Backyard*¹⁴ manual have been created as resources to support woodland planning for owners of parcels that are 1-10 acres in size. The publication provides a step-by-step process for detailing objectives, a how-to for drawing property maps, and a list of suggested steps for property improvement. One area of focus is improvement of water quality by reducing the amount of maintained lawn and increasing forest area on the property.

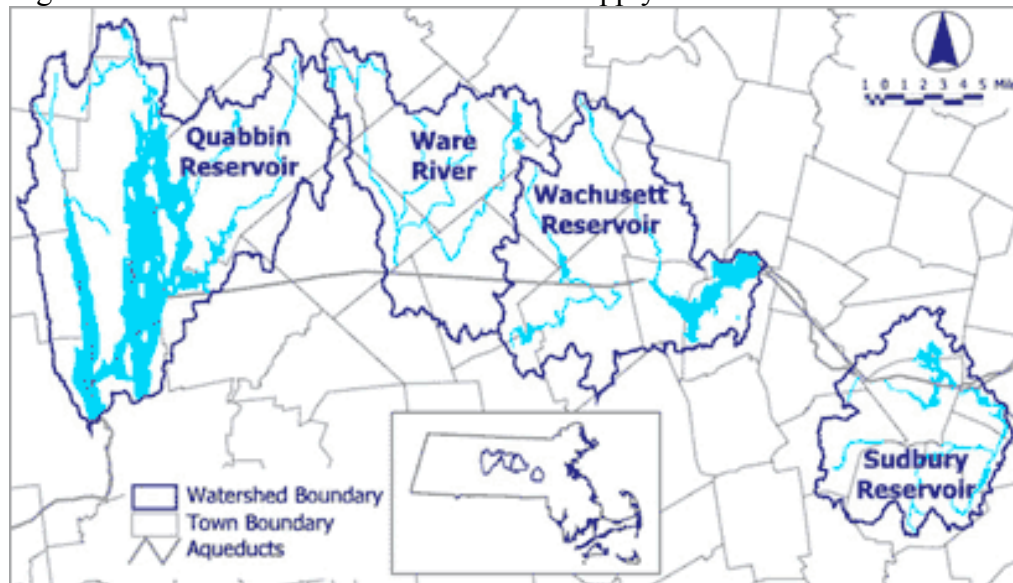
Growing Forests for Water: *The Importance of Public Land Stewardship*

Whereas the New York City and Chesapeake Bay watershed programs focus primarily on influencing land use decisions on private lands, other efforts illustrate the importance of public land stewardship. Boston and Seattle exemplify such efforts.

Boston

The Massachusetts Division of Water Supply Protection (DWSP) is responsible for protecting and managing over 100,000 acres of public forest, with the goal of protecting drinking water supplies from the Quabbin Reservoir, Wachusett Reservoir, and the Ware River (Figure 8). The DWSP manages and protects the drinking water supply watersheds and public lands that serve 2.2 million customers in 47 communities within the Greater Boston area.

Figure 8: Massachusetts Division of Water Supply Protection



Source: <http://www.mass.gov/dcr/watersupply/watershed/shed.htm>

¹⁴ To learn more or to order the publication visit: <http://www.naturalresources.umd.edu/EducationalWBY.html>

Watershed Programs

In the late 19th century, reservoirs that served the Boston area were deemed unsatisfactory in both quality and yield. This led to the 1908 construction of the Wachusett Dam and Reservoir to serve the growing needs of eastern Massachusetts. The Quabbin Reservoir was constructed in the 1930s to add to the supply.¹⁵ Since establishing the reservoirs, the Massachusetts Legislature has passed numerous laws to ensure quality water supplies and to regulate land use activities in the watershed.

Currently, the more than 100,000 acres of public forestlands within the DWSP managed watersheds are primarily even-aged forests that resulted from logging in the late-19th and early-20th centuries and a devastating 1938 hurricane. Comprehensive management of the public lands was not initiated immediately after the reservoirs were established, and only a small percentage of forests in the watershed are made up of young trees (e.g., less than 15 years old).¹⁶ Since forest conditions and tree age within these watersheds are relatively homogenous, there is a significant risk that the degree and scale of disturbance resulting from storm events will be greater than what would be expected to occur in a more diverse forested landscape. When a forest is more diverse (i.e., including a healthy mix of forest cover types and ages), a disturbance event (e.g., storm or hurricane) is less likely to impact the entire ecosystem and its related watershed.

When a high degree of disturbance does occur, it can result in dramatic changes in water quality because of increased sedimentation and nutrient loading from runoff. Because the watersheds are located in a region that is vulnerable to infrequent but high-intensity disturbances like hurricanes, forest management plans are focused on creating a forest that is resistant to serious weather events. Forest management strategies are informed by the lessons learned from storm events like the 1938 hurricane. A primary strategy used to accomplish the goal of greater forest resiliency is development of species and forest age diversity through planned management and harvesting on the public lands.

Within the Massachusetts DWSP, each of the source water supply areas has designed timber harvest plans to guide foresters. The plans are expected to regenerate 1% of the managed public forest annually through responsible harvesting so that over the course of many years, the forest will contain a much broader range of ages. These plans also call for large areas of public forestland, totaling 20,000 acres (approximately 20% of the total forested area) to be put aside as reserves. These reserve areas ensure that very old forests will also be included within the landscape. The plans aim to restore balance to the forestland by 2055 so that both the forestland and its respective watersheds will be more resilient and able to recover much more quickly from natural disturbances.¹⁷

In addition to management goals, the DWSP implements practices to minimize the risks of erosion and the potential for sediments and other pollutants to reach the water supply. Measures include establishment of protective buffers adjacent to streams and wetlands, seasonal restrictions on logging activity, use of portable temporary bridges for stream crossings, equipment restrictions, locating log landings away from water resources, and other conservation management practices.¹⁸ Water quality within the managed watershed is constantly monitored to measure impacts from land uses and changes.

¹⁵ Nesson, Fern L, 1983 "Great Waters: A History of Boston's Water Supply" cited on <http://www.mass.gov/dcr/watersupply/watershed/shed.htm> Accessed on 10 April 2012

¹⁶ <http://www.mass.gov/dcr/watersupply/watershed/diverse.htm>

¹⁷ Additional information and the watershed plans are available at: <http://www.mass.gov/dcr/watersupply/watershed/forestry.htm>

¹⁸ "Watershed Forestry" MassDCR. <http://www.mass.gov/dcr/watersupply/watershed/protection.htm> Accessed 10 April 2012

Seattle

Seattle Public Utilities provides drinking water to over 1.4 million customers in the Seattle metropolitan area. This water supply originates from two watersheds in the Cascade Mountains: the Cedar River watershed and the smaller South Fork Tolt River watershed (Figure 9). The city owns all of the land in the Cedar River Municipal Watershed (making it the only municipal watershed in the country owned completely by the people it serves). The city also owns 70% of the land in the South Fork Tolt Municipal Watershed upstream of the South Fork Tolt Dam. The U.S. Forest Service owns and manages the remaining 30% of the basin.¹⁹

Cedar River Watershed

The primary drinking water supplier to Seattle, the Cedar River Watershed is managed to support and supply clean drinking water to about 70 percent of the 1.4 million people in the greater Seattle area. The watershed covers 90,638 acres and has two reservoirs, Chester Morse Lake and the Masonry Pool created by the Masonry Dam in 1914.²⁰

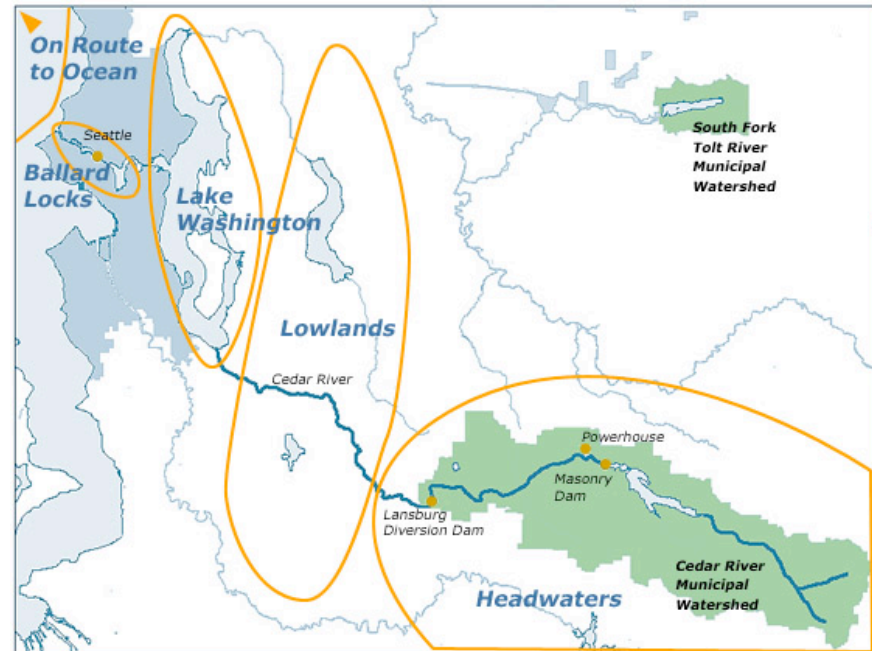
Logging in the watershed began in the 1880s. Over the course of the past century, the city was responsible for harvesting approximately 10% of the total timber volume removed from the

watershed. In 1985, the Seattle City Council declared a moratorium on timber harvesting on city-owned land located within the city's watershed. Accompanying the moratorium was a statement that the primary purpose of the watershed was production of high quality drinking water and that all secondary uses should align with the primary purpose. In 1989, the City Council passed a series of ordinances that reaffirmed the goal of protecting the region's drinking water by creating an ecological reserve managed to promote late successional and old growth forest communities, enacting a long-term timber harvesting plan in secondary growth areas to protect water quality, and protecting habitat for wildlife species dependent on old-growth forests. The management emphasis is on restoration and timber harvesting for commercial purposes is not included within the ecological reserve.

Cedar River Watershed Education Center

The Cedar River Watershed Education Center is an education facility created as a gathering place to connect people with the source of their water. The center provides opportunities for thousands of visitors to learn about the complex issues surrounding the region's drinking water, forests and wildlife.

Figure 9. Seattle Water Supply Watersheds



Source:
http://www.cityofseattle.net/util/About_SPU/Water_System/Habitat_Conservation_Plan/AbouttheHCP/GeographicScope/index.htm

¹⁹ http://www.seattle.gov/util/About_SPU/Water_System/Water_Sources_& Treatment/index.asp

²⁰ "Cedar River Watershed Habitat Conservation Plan" City of Seattle, April 2000

Opened in October 2001, the center was funded through a partnership between the City of Seattle and the Friends of the Cedar River Watershed. Programs offered at the center include a Watershed School Program designed to guide 4th and 5th grade students to discover the sources of their mountain-fed drinking water system and to learn how people interact with and affect the water system and land. The center provides classroom resources supporting integrated systems thinking and sustainability education standards for local teachers in thirteen school districts within the watershed. The center also holds workshops and field trips to salmon spawning grounds and arranges invasive species removal expeditions.

South Fork Tolt Watershed

The South Fork Tolt River is the second watershed in Seattle Public Utilities' freshwater supply system. About 12,500 acres in size, it can provide up to 100 million gallons of drinking water per day. Located in the foothills of the Cascades in east King County, it supplies about 30% of the drinking water for people in and around Seattle. In 1964, the City of Seattle successfully exchanged lands within the watershed with Weyerhaeuser Company, giving Seattle 68.9% ownership (8,400 acres) of the watershed land. The eastern 30.6% of the watershed lies within the Mt. Baker-Snoqualmie National Forest, while the remaining 0.5% is privately owned.²¹ Seattle Public Utilities began developing a management plan for the Tolt Watershed upstream of the Tolt Dam in 2006, and the final plan was approved in 2011. The plan implementation focuses on watershed protection, aquatic restoration, and long-term forest habitat management. Today, 93% of the forest owned by the city is managed, while the remaining 7% contains old-growth area reserves. The forest management plans include the development of late-successional forest habitats and employ various forms of thinning and planting to create forest diversity. The plans also contain goals for selling surplus timber in order to produce revenue to fund additional management activities.

Growing Forests for Water: *Completing the Value Equation*

Healthy forested watersheds reduce water treatment costs while providing a full suite of additional benefits, including carbon sequestration, timber and non-timber forest products, recreation opportunities and jobs. The final case study illustrates the importance of connecting the dots between these cost savings and providing the necessary revenues to support watershed management.

Raleigh

The City of Raleigh, North Carolina supplies drinking water sourced from the Upper Neuse River Basin and Fall Lake Watershed to meet the needs of its 190,000 residents (Figure 10). A report compiled by the Trust for Public Land found a return of \$4 for every \$1 invested in land protection, with the payback coming in the form of ecosystem goods and services such as safer drinking water, flood mitigation, and erosion control.²²

Figure 10. Neuse River Basin, North Carolina



Source: <http://www.epa.gov/esd/land-sci/lcb/nrb/VFRDB/>

²¹ "South Fork Tolt Watershed Management Plan" *Seattle Public Utilities*. June 2011

²² *North Carolina's Return on the Investment in Land Conservation*. The Trust for Public Land. 2011

To continue these benefits, the City of Raleigh works within the watershed to support forest conservation and management techniques that help project water quality. The city's watershed is 61% forestland, 16% agricultural land, and 17% urban and suburban land uses.²³ Raleigh is one of the top five fastest growing cities in the United States, and the population is expected to grow by 58% by the year 2025. Water demand is expected to double. With these trends in mind, the City of Raleigh has created initiatives, models, and plans to protect the watershed for the use of future generations. Former Raleigh mayor Charles Meeker rejected the construction of an expensive water treatment facility to enhance the city's drinking water supply; instead, he made a commitment to protecting the forested land uses that provide natural filtration and water quality benefits.²⁴

The Upper Neuse Clean Water Initiative

The Upper Neuse Clean Water Initiative (UNCWI) was formed as a collaboration to ensure long-term quality drinking water sources through forest conservation and proper land management practices. The initiative also provides a method for linking downstream water consumers with upstream landowners. The initiative is based on a model that reflects stakeholder priorities for conservation, protection of working lands, and habitat connectivity. Initiative partners work with landowners to identify strategies for meeting both the landowners' goals and the goals of the initiative. All forest practices must abide by the *North Carolina Forest Practices Guidelines Related to Water Quality*, a set of guidelines administered statewide.²⁵ These guidelines outline BMPs for forestry activities and support the sustainability of the forest industry, which is a major contributor to the economy and environment of North Carolina. With support from the City of Raleigh and surrounding counties, the initiative has enhanced more than 57 miles of stream banks and 5,460 acres of land in the Upper Neuse Basin and public dollars have been leveraged 13:1 with other contributions.²⁶

The efforts are funded from local municipal water resource programs such as impact fees from the City of Raleigh Public Utilities. Funding models for the entire basin area are being built in order to develop county-specific plans for conservation funding based on the existing resources.²⁷ The Conservation Trust for North Carolina received a grant from the U.S. Endowment for Forestry and Communities²⁸ to protect priority forests and create "revenue sheds" that help local communities finance long-term forest conservation efforts. This was part of the Endowment's *Healthy Watersheds through Healthy Forests Initiative*, which granted funds to three mid-Atlantic cities to foster the connection between forest management and water quality.²⁹ With support from the Endowment, the *One Cent* program places a tax on water withdrawn in Raleigh and Durham, North Carolina and the funds are used to support water quality protection, conservation, and research programs. Adding approximately 40 cents to the

²³ "About the Upper Neuse River Basin." <http://www.unrba.org/aunrb.htm> Accessed 20 March 2012

²⁴ www.usendowment.org/images/Healthy_Watersheds_Overview_11-11.pdf

²⁵ *North Carolina Forest Practices Guidelines Related to Water Quality*. North Carolina Division of Forest Resources Leaflet. December 2007

²⁶ "The Upper Neuse Clean Water Initiative." Conservation Trust for North Carolina.

http://www.ctnc.org/site/PageServer?pagename=prot_upperneuse Accessed 10 April 2012

²⁷ "Healthy Watersheds through Healthy Forests Initiative," UNC Environmental Finance Center.

<http://www.efc.unc.edu/projects/healthywatersheds.htm> . Accessed 27 March 2012

²⁸ The U.S. Endowment for Forestry and Communities is the largest non-profit organization working towards sustainable forestry and rural community development in the country. Through resource development and collaboration, the Endowment aims to grow local markets and maintain forest-reliant communities, while upholding clean watersheds and wildlife habitats. More information available at: <http://www.usendowment.org/home.html>

²⁹ "Forestry and Drinking Water" Watershed Forestry Resource Guide. <http://www.forestsforwatersheds.org/forests-and-drinking-water/> Accessed 10 April 2012

average monthly water bill, the fund is estimated to result in \$2.5 million annually to fund water programs. Rhode Island has a similar program, often referred to as the “penny per hundred” program. For every one hundred gallons of water, one cent is collected and set aside for land acquisition or for projects to protect the quality of drinking water supplies.³⁰ Funding structures such as these are important for ensuring that the necessary resources are available to support watershed protection programs that result in significant cost savings, safe and high-quality water supplies and other diverse benefits.

The Bottom Line

There is a clear and vital link between forested watersheds and water quality protection. Water and forest resources can be protected through forest stewardship on private land, responsible management of public lands, and innovative economic incentives. By promoting forest stewardship and responsible management, municipalities around the country have found cost efficient, socially beneficial, and environmentally responsible methods for protecting and enhancing water resources.

Resources

Healthy Watersheds through Healthy Forests Initiative
University of North Carolina Environmental Finance Center
<http://www.efc.unc.edu/projects/healthywatersheds.htm>

Watershed Forestry Resource Guide
Center for Watershed Protection and US Forest Service - Northeastern Area State & Private Forestry
<http://www.forestsforwatersheds.org/forests-and-drinking-water/>

The Woods in Your Backyard
University of Maryland Extension
<http://www.naturalresources.umd.edu/EducationalWBY.html>

Forests, Water and People Analysis
US Forest Service - Northeastern Area State & Private Forestry
http://www.na.fs.fed.us/watershed/fwp_preview.shtm

³⁰ http://www.wrb.ri.gov/work_programs_pdwp.html

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