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wildland WATERS

IN THIS ISSUE

- Good to the Last Drop: Our Municipal Water Supplies and Our Forests
- Summary of Key Issues
- Land Management Implications
- For Further Reading

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Welcome . . .

to the inaugural issue of Forest Service Wildland Waters. This new quarterly publication will highlight news, views, and current technological and public policy information on local, national, and international water issues. One goal is that within these pages we provide information for collaborative solutions to water issues — issues in need of continued attention from government and nongovernment organizations and private citizens as our world increasingly brings public and private lands under a more unified ecological and political arena. In this first edition, science specialist Sally Duncan provides a broad view of the current ecological, political, and social status of water issues in the United States. Future editions will examine such issues, and the ever-evolving scene, in detail. We welcome comments and suggestions for future editions.

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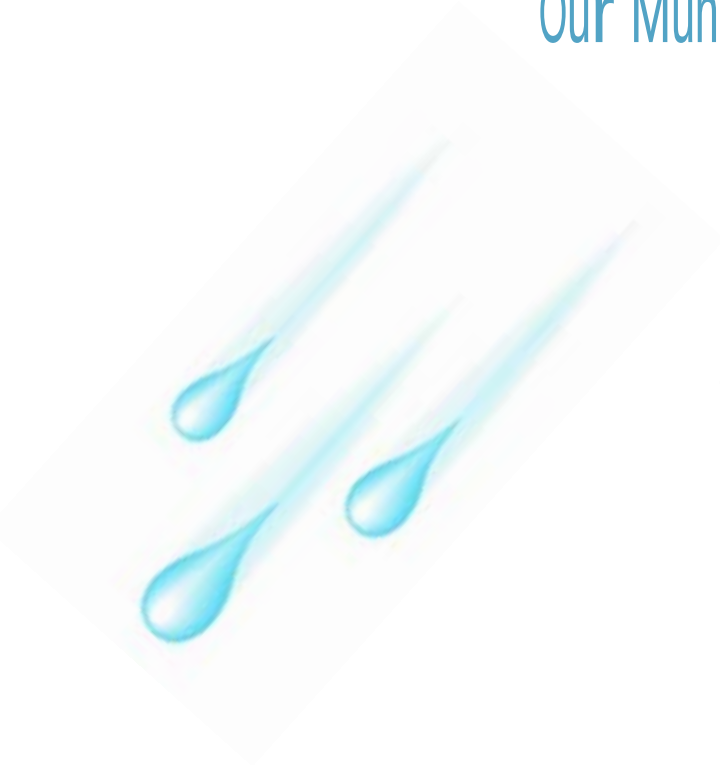
Good to the Last Drop:

Our Municipal Water Supplies and Our Forests



Drinking water comes out of your faucet — whenever you want it, however much you want, and perfectly safe to drink.

Actually, let's back up. In the 1940s, the U.S. Department of Agriculture Forest Service produced an information film starring the character "Junior Raindrop." In the 10-minute film, dated by the style of its animation and narration, we watch Junior Raindrop's danger-fraught journey from the headwaters to the ocean.

What is most instructive in viewing the cartoon over 50 years later is that most of the problems plaguing public water supplies today were clearly identified and explained back then, albeit simplistically.

"There's no question that most of the issues were understood 50 years ago at an anecdotal level," explains Doug Ryan, watershed research specialist, Forest Service Washington Office. "The difference today is that we have a far greater body of research to support our understanding, and we know better how to protect public health."

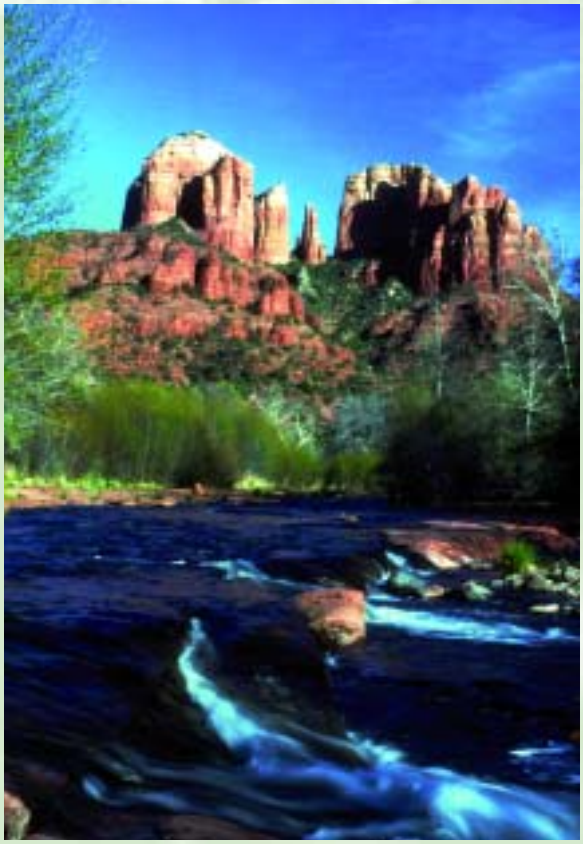
But all of what Junior had to deal with still haunts our water supplies:

- Effects of urbanization — erosion from land cleared for construction, household pesticides and herbicides, leaking sewers and septic tanks, and storm water runoff.
- Industrial problems — oil spills and air pollution.
- Cropland and livestock activities on agricultural lands and grazing on rangelands.
- Timber harvesting and recreation in forests.
- Mining.

Added to this list is the spread of pathogens. Certain pathogens didn't even manifest themselves as threats until as recently as 20 years ago. The pathogenic E. coli didn't cause disease until it became antibiotic-resistant in the 1990s. It can be water-borne and is not uncommon, just like

Cryptosporidium, which killed 100 people and infected 400,000 in an outbreak in Wisconsin in 1993. Its victims belonged to a group with compromised immune systems, a population at risk that has increased with growing numbers of organ transplant and cancer treatment survivors and HIV-positive individuals.

Through this gauntlet of human activities and disease susceptibilities, a lot of the Nation's drinking water travels relatively unfettered, and most of us continue to drink it with supreme trust. According to national surveys, less than 10 percent of the U.S. water-drinking population thinks beyond the kitchen faucet. A few imagine their water coming from a water treatment plant, but not many ever get so far as to think about a forested watershed. Fewer than 40 percent of Americans can identify what a watershed is. As the proportion of our population living in urban centers grows beyond 75 percent, the social disconnect from the origins of drinking water is likely to increase.



Robert Stottlemyer

Water and the Forest Service

So what is the typical source of our drinking water?

In most States, over two-thirds of the population uses surface water as a municipal water source. Surface water provides less than a third of municipal supplies in only seven States — Florida, Hawaii, Idaho, Iowa, Mississippi, Nebraska, and New Mexico. Forests are critically important to protecting the surface water supplies and sustaining them in the future.

It is estimated that national forests and grasslands are the source of drinking water for 3,400 towns serving an aggregate population of 60 million people, and for 3,000 noncommunity water supplies such as campgrounds. The population served by *all* forests and grasslands nationwide is far larger than this figure, making the bond between drinking water and the Forest Service obviously tight.

When they decided to set aside some of these forested lands from settlement by proclaiming Forest Reserves, President Harrison and later the Congress were responding to public outcries

Land uses common to forests and grasslands usually produce water that is cleaner than more developed urban and agricultural land uses.

to stop wanton logging and burning of public lands, practices that were harming local water supplies. The 1891 Creative Act set aside the first Forest Reserve but contained no direction for Forest Reserves or funds for their management. The 1897 Organic Administration Act provided direction for the Forest Reserves, including "securing favorable conditions of water flows." It has remained a key objective of the Forest Service to the present.

But the real threats to municipal water supplies at the end of the 19th century — heavy-handed logging, land clearing and extensive agriculture, and intense grazing on forest lands — have paled beside the kaleidoscope of challenges some 100 years later. These challenges include an American population that has almost quadrupled from 75 million to 280 million, increased pollution of water supplies, and the risk of environmental damage from internal or external terrorist activity.

So in this new century, the Forest Service is returning to its water roots. A renewed emphasis on the role of forests in supplying clean water to large segments of the population has taken hold both in policymaking and in the research that supports it.

The complex interactions among natural processes, land use, water management, and drinking water underscore the need for integrated management of watersheds and a renewed focus on the role of forests in their protection. The sharp increase in local watershed councils and the States' Source Water Assessments (SWAs) process across the country has given the Forest Service an important public venue for meeting the challenge of collaborating across mixed ownerships.

The Rising Crisis

Shortages of fresh water and the continuing threat of pollution limit endeavors ranging from urban and recreational development to agriculture and the computer industry. With current droughts and power shortages in the West, water issues inexorably take center stage. Even in the humid East, water

rationing has become commonplace. When the Washington, DC, region faced a dry summer in 1998, authorities drew nearly 70 percent of the Potomac River's flow to supply water to area residents.

"A crisis always helps focus attention on these matters," notes Steve Glasser, water rights and uses program manager for the Forest Service Washington Office. "Although most U.S. residents take safe public drinking water for granted, assuring its safety remains a high national priority and absorbs increasing amounts of time and effort." He adds that the substantial investment by all levels of government in maintaining and upgrading public water systems may be invisible to most of the public, but it is real to people working in the water sector: researchers, land managers, utility managers, and lawyers.

For more than 50 years, a basic axiom of public health protection has been that safe drinking water reduces infectious disease and extends life expectancy. In principle, providing safe drinking water to protect human health is a high priority in our society. In practice, this priority is not often well represented in land-use decisions.

Robert Stottlemyer

The many activities within a watershed that can contaminate water continue relatively unabated today, and protection is an increasingly complex matter. In New Hampshire, for example, lands containing the critical drinking water supply make up over 10 percent of the State, while 75 percent of the population and most places of employment rely on these public drinking water supplies. But even that 10+ percent water supply land, according to a recent State-commissioned study, is four times more developed than the State as a whole, and is widely threatened by contamination from numerous sources. But only 12 percent of these critical areas — less than 1 percent of the entire State — have been permanently protected as a water source, even as the forests surrounding many drinking water supplies are being rapidly encroached upon by development and other potentially hazardous land uses.

The New Hampshire story is far from unusual.

Checking the Source

Silently, our trees and forests are working hard to keep our drinking water clean. Less silent will be the campaign to research, inform, and collaborate.

Most water supplies are not suitable for human consumption without some form of treatment. Furthermore, standards for drinking water apply to water that is delivered to consumers—*after* it has been treated to remove contaminants, but not to raw water as it is withdrawn from surface or groundwater sources.

For the 250 million Americans who rely on public water supplies and source waters, the 1996 Safe Drinking Water Act Amendments are already under vigorous investigation.

Congress chose source water protection as a strategy for ensuring safe drinking water because of its high potential to be cost effective. All States and participating tribes must delineate the boundaries of areas that serve as sources for individual public drinking water systems, then identify potential sources of contamination and determine how susceptible each system is to contamination. In other words, to protect the water, we must look to the land and the forests that serve as its source.

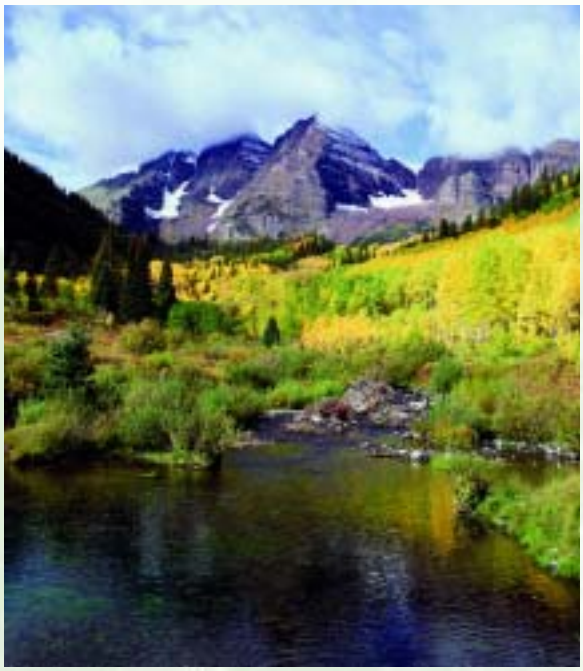
"These measures help communities know the threats to their drinking water, and citizens can then more effectively and efficiently address these threats," Ryan explains. "Appropriate land-use practices that protect source water may be more cost effective for society than removing pollutants after the fact. However, decisions about land uses and their effects on water are often made piecemeal, and potential savings are often not realized."

Until about 1990, water treatment was regarded as an engineering problem, a "we can fix it" mentality that focused more on mechanical and chemical methods of removing impurities than on preventing pollution at the source.

"What we're discovering now is that more rigorous treatment can leave more residues in the water that are harmful to people, such as chlorinated hydrocarbons," Ryan notes. "New methods of treatment are also becoming more expensive, and passing those costs on to consumers is not a popular move."

Protecting the water source looks like the smarter solution.

Protection: Integrating from Ridge Top to Ridge Top



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Providing safe drinking water is a high priority. In practice, this priority is not often well represented in land-use decisions.

Stories abound on the challenge of protecting water sources, and one from Oregon highlights some of the details.

During a major flood in 1996, Salem, OR, temporarily suspended use of its water treatment facilities because of high levels of turbidity. Forest Service logging in upper parts of the multiowner watershed was initially blamed for the sediment levels. X-ray diffraction "fingerprinted" the sediment, showing that certain types of clay in the area produced persistent turbidity. The sediment itself originated from multiple sources, including erosion by floodwaters of the toes of ancient, natural landslides, as well as management effects on both Federal and private lands.

Further complicating the story, a large flood-control reservoir in the Salem water supply catchment area was able to reduce flood levels downstream, but in doing so stored and then slowly released turbid water over many days. As the city moved to increase chemical treatment of the turbid water, computer chip manufacturers expressed concern that the introduced chemicals would degrade water quality for their particular industrial needs.

"What started out being portrayed as muddy water from Forest Service lands became better understood as an interaction of natural sources, rock and soil types, inadequate treatment capacity, some land management effects, and flood control maintaining a steady flow of muddy water into the system," explains Fred Swanson, research geologist for the Forest Service Pacific Northwest Research Station in Corvallis, OR. Swanson contributed to the study conducted by a technical team from the Forest Service, Salem Water Department, and Oregon State University. The findings of this study suggest that the general approach to fingerprinting causes of water-quality degradation can be applied more broadly.

Watersheds respond to floods and land use in independent and unique ways, with significant implications for drinking water supplies. For example, watersheds with extensive areas

Social disconnect from the origins of drinking water is likely to increase.

of unstable rock and soil types are likely to have lower water quality, even if human land-use activities were absent.

In the Western United States, public lands can play a dominant role in the supply of public drinking water. In the East, managing the forests that protect vital water supplies is more dependent upon decisions made by thousands of private landowners, further complicating the challenges faced by communities and water suppliers.

Will Public-Private Land Management Always Be a Problem?

Let's take a closer look at what goes on in the Eastern United States.

By working with landowners to reduce a number of water quality threats, New York City has maintained a high-quality water supply system that is still the largest unfiltered supply in the world, due primarily to careful management of the Catskill Mountain watersheds where it originates. Intense efforts are under way to try to keep water quality threats low, while balancing watershed management with other local needs.

In 1997, the city entered into an agreement with the Watershed Agricultural Council to administer a forestry program that protects the city's water supply and promotes economic viability. The Watershed Forestry Program is a pollution prevention program built on the premise that well-managed forests provide the most beneficial land cover for water quality protection.

As Al Todd describes, "considering that a large percentage of the watershed forest land is privately owned, collaboration on goals was crucial. That included 'Green Book' recommendations collaboratively developed by landowners, loggers, sawmill owners, government agencies, and environmentalists." Al is the watershed program leader for the Northeastern Area, State and Private Forestry branch of the Forest Service.

In Massachusetts, the 58,000 acres of undeveloped, Metropolitan District Commission (MDC)-controlled land surrounding

Protecting the water source begins

to look like the smarter solution.

Quabbin Reservoir is seen as its most valuable asset. A 10-year Quabbin Watershed Land Management Plan was designed expressly to protect the public water supply for the city of Boston.

"The plan has the primary objective of maintaining a diverse mosaic of forest types and ages as the most resilient forest cover for the watershed," Todd explains. "The forests around the Quabbin Reservoir will be deliberately restructured through commercial harvesting, using primarily group selection and irregular shelterwood techniques." Small-scale, frequent disturbances, according to this plan, will offset the potential effects of infrequent but catastrophic disturbances, such as hurricanes.

With a mix of public and private ownership, collaboration between owners is also paramount on the Quabbin and other, smaller water supply watersheds in the State.

Encouraging private landowners to be good stewards of forests that provide water supply requires increasing technical assistance, using conservation easements, ensuring fire protection, and better managing access roads. By supporting locally led projects such as the Massachusetts "Pure Water Stewardship," the Forest Service actively encourages landowners with many different objectives to be stewards of their water supply and to keep their land in forest cover.

Lesser of Many Risks?

Our society has a passive but deep faith in forests and grasslands, but how do these lands actually rank as clean water providers?

A team of scientists and land managers recently examined the concern that we haven't synthesized the risks and opportunities of forest and range management to protect drinking water. With assistance from the U.S. Environmental Protection Agency and the National Council for Air and Stream Improvement, Forest Service and other scientists wrote and in 2000 published *Drinking Water from Forests and Grasslands: A Synthesis of the Scientific Literature*. As Ryan explains, this team

concluded that the land uses common to forests and grasslands usually produce water that is cleaner than more developed urban and agricultural land uses.

According to U.S. Geological Survey studies, the lower levels of intensity of use in forests and grassland generally result in lower overall contaminant levels in water coming off those lands compared with water from urban and agricultural lands. *The Oregon State of the Environment Report 2000* concurs, showing over 50 percent of water quality in forested lands in the good to excellent range, compared with less than 20 percent in agriculture and none in urban areas. However, some widespread forest management practices still pose risks of contamination to drinking water sources.

While New York City and some other areas have voluntarily taken on self-assessment, the SWAs mandated by the 1996 Safe Drinking Water Act Amendments are clearly justified. They will provide extensive and productive data upon which to base restoration and management decisions. Forest Service hydrologists will also be conducting "fingerprinting" analysis of National Forest System lands, some of which will tie to the SWAs efforts. Public and private landowners everywhere will be called upon to assist.

Managing by Numbers?

"We know that each water supply comes with a different set of risks. What is important to manage as a potential pollutant in one watershed may not be much of an issue in another," comments Ryan. The need to understand local geology, hydrologic processes, land uses, and water demands in order to understand the individuality of watersheds underscores the need for SWAs and the building of similar databases.

The States and tribes are required to complete SWAs by May 2003. These SWAs will be integrated with the Forest Service Natural Resources Information System (NRIS) database.

"We will have huge databases and run the risk of being swamped by numbers," says Glasser. "But the focus of the

efforts of databases such as SWAs and the NRIS—which contains air, water, fish and wildlife, and timber data—will always be to link people with their watersheds."

The NRIS database will ultimately contain multiple characteristics of the population, with lots of economic, political, and ecological information. People will be able to see just how connected they really are with their watersheds. Policymakers and water supply and land managers will have a basis for setting priorities to protect or restore safe drinking water sources.

"Land managers and drinking water suppliers live in different worlds, with different agencies and budgets," observes Ryan. "It will be crucial for land managers to pay attention to the consequences of their actions for water quality, just as it will be crucial for utilities managers to effectively communicate the assessments to consumers once they are available."

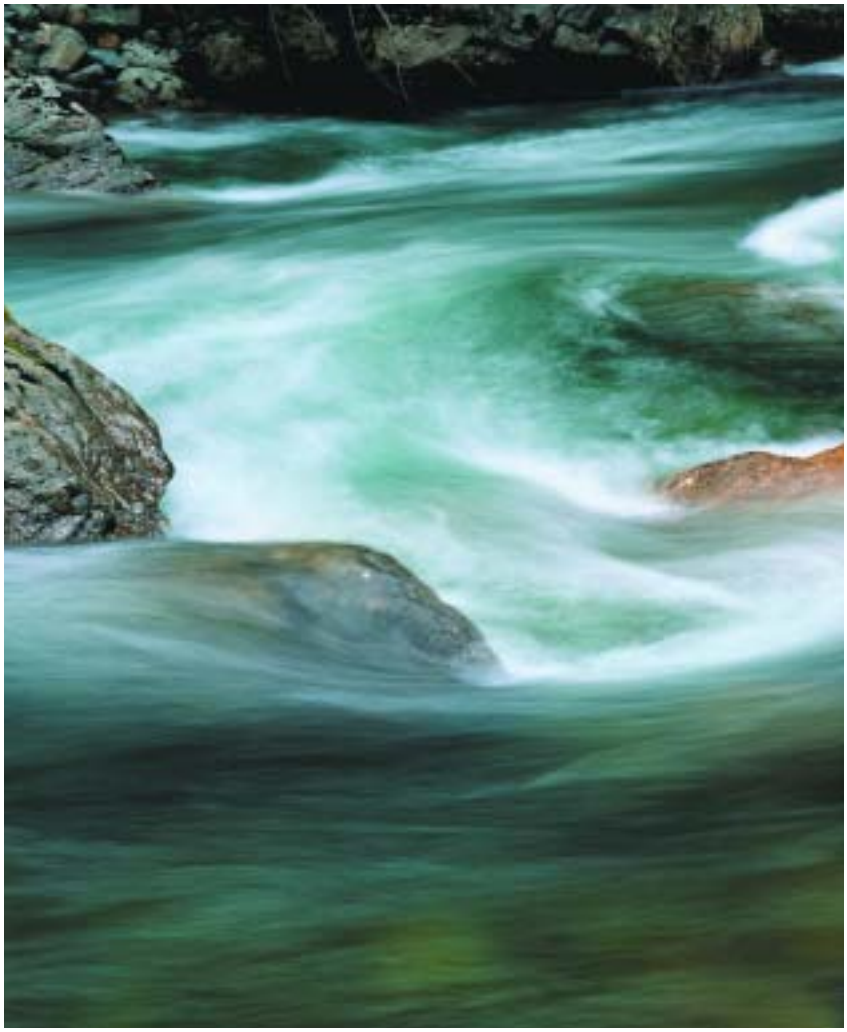
The Forest Service's Northeastern Area recently initiated a Watershed Exchange and Technology (WET) Partnership with the University of Massachusetts. One part of the WET Partnership's work will focus on conducting technical exchanges with local communities and small water providers who are struggling with source water protection planning for forested watersheds. Programs such as these help ensure the linkage of forests and water, and also emphasize cooperation between sound science and practical experience.

Achievable Goals?

How will new kinds and quantities of data affect water quality and the water rights debates that rage across the country, particularly in the West? Monitoring for an answer to that question is part of a long-term program based on increasing urban public understanding of where water comes from and that forests are more than just a scenic backdrop or pleasant place to hike and camp. Silently, our trees and forests are working hard to keep our drinking water clean. Less silent will be the campaign to research, inform, and collaborate.

The Forest Service will continue to find itself at the center of water quality and water supply questions flowing from the forests and grasslands it manages across the country. But its involvement will not be only through national forests: it will also continue to work with States and communities in the stewardship of private forest lands and to fund the research needed to better understand the critical linkage of forests and water.

Despite promising advances in monitoring surface waters and moves toward integrated watershed management, life will remain perilous for Junior Raindrop on the journey to the sea. Water SWAs and synthesis literature will make the journey for Junior and society easier. ▮



Key Issues

- Forests are critically important to protecting our surface water supplies and sustaining them in the future. Land uses common to forests and grasslands usually produce water that is cleaner than more developed urban and agricultural land uses.
- In over half the country, the proportion of the population using surface water as a municipal water source lies between 66 and 100 percent. In most of the rest of the country, surface water supplies up to two-thirds of the population with drinking water.
- Impacts on our municipal water supplies come from many sources:
  - The effects of urbanization — erosion, household pesticides and herbicides, leaking sewers and septic tanks, runoff.
  - Industrial problems — oil spills, air pollution.
  - Cropland and livestock activities on agricultural lands and grazing on rangelands.
  - Timber harvesting and recreation in forests.
  - Mining.
  - Bacterial pollution from both human and animal sources.

Land Management Implications

- It will be crucial for land managers to anticipate the consequences of their actions and balance a series of values, just as it will be crucial for water utility managers to effectively communicate their water quality data to consumers once it is available.
- Each water supply comes with a different set of risks. Assessments of risks of contamination of drinking water sources need to be done by examining land uses in each water supply watershed on a case-by-case basis.
- Water supplies often drain privately owned lands, making collaboration through all owners paramount, with a potentially crucial role for the Forest Service as facilitator.
- Landowner collaboration covers such issues as land acquisition, technical assistance to private forest landowners, policing, fire protection, and access roads. Landowners with many different objectives can be actively encouraged to become land stewards and to keep their land in forest cover wherever possible.

For Further Reading

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