Comparison Between "Trees to Tap" Report and DEQ Comments

Joshua Seeds, from the Department of Environmental Quality, commented on the Oregon Forest Resources Institute's (OFRI) "Trees to Tap" report. He left over 200 comments including substantive and copy edits. The vast majority of substantive edits were not reflected in the final report, yet OFRI listed Seeds as a reviewer.

Seeds's first comment was general: "There are a few ways to look at the effects of contemporary forest practices: In comparison to historic (i.e. 30s-80s) practices[,] in comparison to other land uses[, and] whether there is noticeable effects that could be a problem for water treatment. All of these are valid lenses, but #3 is the one that is most relevant for public water systems and drinking water provision. Often the language seems to conflate these three lenses; I suggest making it clear that these are not the same thing. I would also suggest that known or possible effects of contemporary forestry on drinking water sources should be the primary focus of the report, so a read-through with that in mind might help; I have edited to move things in that direction." Despite this comment, which clearly suggests moving away from a historic focus, OFRI frames the "Trees to Tap" report with this message on page 3: "'there's been a huge evolution in forestry practices over the past 60 years. There are still things to be concerned about, but they are different and orders of magnitude less impactful on the environment.'" This statement, placed at the beginning of the report, directs the report away from Seeds's suggested focus: "whether there [are] noticeable effects that could be a problem for water treatment."

As a response to the statement, "There are still things to be concerned about, but they are different and orders of magnitude less impactful on the environment," Seeds wrote, "[a]n order of magnitude lower is not necessarily equivalent to no meaningful impact." Nevertheless, OFRI kept the misleading phrase, "orders of magnitude less impactful" in their final report. And they included it again on page 9, writing, "While herbicide detections downstream were orders of magnitude lower than human health standards, some nearby residents have raised concerns."

Further on page 3 of the final report, OFRI continues to go against Seeds's suggestion by comparing Oregon's forestry practices to historic practices: "forest practices that minimize impacts to water quality have improved significantly in recent decades." And this quote is repeated on the last page of the report (page 23), presented as something that "bears repeating." Again, Seeds had written a comment on the draft report suggesting OFRI fix their selective emphasis: "Add language to reflect that there are current risks and that we can identify sensitive watersheds and locations?"

The draft of the report includes the U.S. Geological Survey's finding that "[t]he majority of compounds that present a documented threat to drinking water quality ... are associated with

agricultural and urban land-use applications rather than forestry.'" Seeds aptly commented, "Is the question whether forestry is better than other land uses? If so, this quote is appropriate. Is the question whether forestry has an impact on chemical composition of water? If so, then this quote is beside the point." OFRI didn't edit the report to reflect this comment (the quote about the U.S. Geological Survey's finding can be found twice on page 9).

The final "Trees to Tap" also reports on page 22 that "[t]en foot vegetated buffers are required on headwater streams that still contain water in mid-July." However, Seeds had pointed out that this doesn't apply to "small type-N streams."

The draft of the report mentions that in 2020, there was a 97% compliance rate with OFPA rules, but in a comment, Seeds suggests this is an overestimate: "Almost certainly an overestimate due to bias in non-response, and other factors. Check w/ Terry Frueh about statistical evaluation of this and what ODF plans to do." Instead of checking with Frueh and editing accordingly, OFRI deleted the paragraph and statistic about compliance entirely.

The final "Trees to Tap" report directly quotes Seeds once on page 15: "The plan [Short Start logging plan] prompted this comment from Joshua Seeds, with the Oregon Department of Environmental Quality's Drinking Water Protection Program: 'Stimson Lumber's foresters are using leave trees and buffers to protect most of these high-risk features and have done excellent field work, in my opinion.'" This quote furthers OFRI's narrative, but it isn't an accurate representation or overview of Seeds's comments. For the most part, Seeds didn't compliment lumber practices but tried to help OFRI fix their bias.

Seed's comments and OFRI's refusal to incorporate them into their final report demonstrates that OFRI knowingly used the "Trees to Tap" report to mislead the public.

Comments on OFRI's "Trees to Tap" Report by Joshua Seeds, Oregon Department of Environmental Quality

The following document shows the comments referenced in the above comparison. The comments appear on the right side of OFRI's text. Joshua Seeds, of the Oregon Department of Environmental Quality, made all the comments.

OFRI SPECIAL REPORT ON OSU'S TREES TO TAP REPORT – FINAL DRAFT 02/28/2020

COVER

TOP OF PAGE SUBHED – *TREES TO TAP*

SUB-SUBHED – UNDERSTANDING THE EFFECTS OF FOREST MANAGEMENT ON SOURCE WATER

BIG HED – KEEPING DRINKING WATER SAFE

PHOTO – PHOTO OF MEDIUM-SIZE FOREST STREAM

INSIDE FRONT COVER

HED – OUR MOST PRECIOUS RESOURCE

PHOTO – CHILDREN PLAYING IN PORTLAND WATER FOUNTAIN, INSET PHOTO OF MIKE

Up to 60 percent of the adult body is water and without it, life ceases. It is our most precious natural resource.

With so many demands on water, keeping supplies safe for drinking is a critical governmental function, one we often take for granted. Simply turn on the tap and voila!

In Oregon, over 300 public water providers rely on surface water from rivers, lakes or reservoirs as their main source to supply about 75 percent of Oregonians with safe drinking water. Because surface water is especially vulnerable to pollutants, it must be treated before it is safe to drink.

Nearly half the state is forested, so much of Oregon's surface water comes from forested watersheds. Some of these are publicly owned and managed mainly for water production. Others are privately owned and managed primarily for timber production.

Because water quality and quantity are top public concerns, the Oregon Forest Resources Institute (OFRI) commissioned a study in 2000 on the effects of forest management on water from forested watersheds. Two decades later, the OFRI Board of Directors felt it was time to refresh that work and provided grant monies to the Oregon State University (OSU) Institute of Natural Resources to lead a science-based review of the effects of forest management on drinking water.

The updated report, *Trees to Tap,* is written by faculty from the OSU College of Forestry who were guided by a statewide steering committee. This brief publication highlights key findings from the full report. In addition, we've included a few profiles of the men and women who work every day to keep Oregon's drinking water safe.

MIKE CLOUGHESY
Director of Forestry
Oregon Forest Resources Institute

Commented [JS1]: General comment: There are a few ways to look at the effects of contemporary forest practices:
1. In comparison to historic (i.e. 30s-80s) practices
2. In comparison to other land uses
3. Whether there is noticeable effects that could be a problem for water treatment.

All of these are valid lenses, but #3 is the one that is most relevant for public water systems and drinking water provision. Often the language seems to conflate these three lenses; I suggest making it clear that these are not the same thing. I would also suggest that known or possible effects of contemporary forestry on drinking water sources should be the primary focus of the report, so a read-through with that in mind might help; I have edited to move things in that direction.

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Commented [JS2]: Clarifies this point. Nothing inherently wrong with timber focus, but a difference in emphasis.

Commented [JS3]: Not much info on the PWS survey that EJ did. Can that be added?

PAGE 1 R

HED – THE MAKING OF 'TREES TO TAP'

PHOTO – JON SOUDER

CAPTION

Jon Souder served as principal investigator for *Trees to Tap*. He holds a doctorate in wildland resources science.

SUBHED – *Trees to Tap* two years in the making

The product of two years' work, *Trees to Tap* engaged a diverse team of six OSU scientists, a steering committee of representatives from 11 different organizations, and input from dozens of community water system managers via a statewide survey. The 250-page report will be published in hard copy by OSU Extension in fall 2020. Also available will be a 150-plus page atlas of water system maps and data; an annotated bibliography comprising more than 750 scientific articles; and an appendix with the results of the survey. In the meantime, the report minus the appendices is available at www.xxxx.org.

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"This report represents an opportunity to reset people's perspectives on forest management," says Jon Souder, the report's principal investigator. "A lot of the public's perspective goes back to the 1960s, but there's been a huge evolution in forestry practices over the past 60 years. There are still things to be concerned about," he continues, "but they are different and orders of magnitude less impactful on the environment."

Commented [jds4]: Highlight and expand this. In the 50s and 60s, impacts where devastating. An order of magnitude lower is not necessarily equivalent to no meaningful impact.

According to Souder, much of the research to date on the effects of forest management has taken place in upper watersheds, typically far removed from raw water intakes. Thus, he says, *Trees to Tap* exercises caution in making direct connections between forest management activities and community water supplies.

Souder, who joined the OSU faculty in 2015 after 15 years as head of the Coos Watershed Association, says he believes *Trees to Tap* will be of value both to managers of community water supplies and to landowners who manage forests within a community watershed. People engaged in policy debates about active forest management and source water quality will also find it useful, he says.

The report's finding that the highest quality source water comes from forested watersheds versus other land uses, and that forest practices that minimize impacts to water quality have improved significantly in recent decades is encouraging, he says. "We are fortunate that here in Oregon we have a preponderance of source water that comes from forested watersheds."

Commented [jds5]: Add language to reflect that there are current risks and that we can identify sensitive watersheds and locations?

The entire *Trees to Tap* report may be found at www.xxxx.org.

PULL QUOTE

"Oregon's extensive and diverse forests generally produce very high-quality water and supply most of the state's community surface water systems. Forest practices designed to minimize impacts to water quality have improved significantly in recent decades." *(Trees to Tap)*

SIDEBAR BOX

T*rees to Tap* science team:
Jon Souder, Ph.D., Principal Investigator (PI) – OSU assistant professor and extension specialist, forest watersheds
Kevin Bladon, Ph.D., Co-PI – OSU assistant professor, forest hydrology and watershed science
Emily Jane Davis, Ph.D., Co-PI – OSU assistant professor and extension specialist, collaborative natural resource management
Bogdan Strimbu, Ph.D., Co-PI – OSU assistant professor, forest engineering, resources and management
Jeff Behan, M.S. – OSU Senior Policy Research Analyst

Trees to Tap steering committee representation:
Geos Institute
National Council for Air & Stream Improvement
Oregon Association of Water Utilities
Oregon Department of Environmental Quality
Oregon Department of Forestry
Oregon Forest Industries Council
Oregon Health Authority
Oregon Stream Protection Coalition
U.S. Environmental Protection Agency
U.S. Forest Service
Oregon Forest Resources Institute *(ex officio)*
OSU Institute for Natural Resources *(ex officio)*

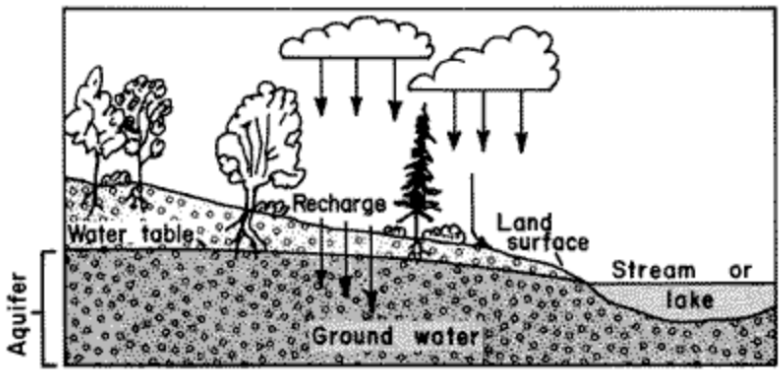
PAGES 2 L

HED – RAW WATER REQUIRES TREATMENT

ILLUSTRATION – Redo the USGS illustration below to show more forest trees

The majority of Oregon's 4.2 million residents get their drinking water from large community water systems, many of which rely on forested watersheds for their source water.

Commented [jds6]: What about smaller systems? State that many small, resource-poor communities also rely on forested watersheds for clean, easy to treat source water.



Two types of water make up our water supply: surface water and groundwater. Surface water flows over the ground or near the ground's surface into streams, rivers, ponds and lakes. This type of water is subject to both airborne pollutants and ground-based contaminants such as organic matter and eroded soil, human and animal waste, pesticides and other chemicals, and runoff from roads.

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As water seeps into the ground, it filters through rocks, roots, soil, and organic matter. The water keeps moving deeper into the ground where it fills the spaces or cracks in the soil, sand or rocks until it gets stopped by a layer of low permeability such as rock or clay. The top of the water is called the water table, and the water that fills the spaces is called groundwater. Groundwater "recharges" surface water through seeps and springs, contributing to stream and river flows. Groundwater trapped between two confining layers may rise to the surface under pressure either as a natural spring or well.

BOX

HED – WHY TREAT WATER?

Treatment removes impurities and kills small organisms that cause disease. Concerns include:

- turbidity and particles
- hardness and total dissolved solids
- color, odor and taste
- dissolved minerals such as manganese and iron
- organisms such as bacteria, algae, protozoan cysts and viruses

- man-made chemicals such as volatile organic compounds, pesticides, endocrine disruptors, nanoparticles, personal care products, and pharmaceuticals, and
- natural organic matter and resulting disinfection by-products.

SUBHED – WHAT THE REPORT FOUND

Trees to Tap found that forested watersheds, whether managed or unmanaged, produce higher quality source water than any other type of surface water source. Forest operations can increase the erosion, transport and deposition of sediment into waterways. Intensive plantation forestry and harvesting change water quantity and quality. Chemical applications result in trace levels in streams. The report found that best management practices, laws, regulations, monitoring and scientific research are all means to protect against these risks and safeguard the quality of source water.

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Commented [jds7]: Good intro

PAGE 3 R

HED – PROFILE: WATERSHED SCIENTIST

PHOTO – BEAUTY SHOT OF RAIN, FOG, OR SNOW ON FOREST

CAPTION OR SIDEBAR

Forests naturally resist erosion that creates sediment. The forest canopy reduces raindrop energy and captures rainfall that evaporates before reaching the ground. Leaves, needles, cones and small branches slow the speed of water reaching the ground. Large and fine roots stabilize the forest soil. Trees take up water via transpiration, which reduces soil moisture.

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INSET PHOTO – ASHLEY COBLE

CAPTION

Ashley Coble holds a doctorate in stream biogeochemistry and ecology. She served on the steering committee for *Trees to Tap.*

A forest watershed scientist, Ashley Coble understands firsthand the importance of research to address the pressing questions posed by the public about forest management.

Coble leads the western forest watershed research program for the National Council for Air and Stream Improvement (NCASI). The council is a non-profit formed over 75 years ago by pulp and paper companies to lessen the ecological impact of their operations. Today, NCASI's work encompasses the full spectrum of environmental topics of interest to the forest products sector.

Based in Corvallis, Coble manages a research program focused on understanding the effects of forestry activities on water quantity and quality. She develops research projects in collaboration with scientists from universities, government agencies and forest sector companies to tackle environmental issues such as understanding stream sediment contributions from natural erosion versus forest management.

Because of her expertise, Coble was invited to serve on the steering committee for *Trees to Tap*. The committee helped the scientific team narrow its scope to four issues at the intersection of forest management and source drinking water: sediment, chemicals, organic matter, and water quantity.

"Across all land uses, forestry has a pretty good story to tell because it has less of an impact on water quality," Coble says.

"We've got a good understanding of what happens in headwater streams," Coble says. "But to better understand the intersection of forest management with water supply, we need to turn some attention to downstream responses, particularly at scales relevant to drinking water intakes in medium or large watersheds."

PAGE 4 L

HED – FOREST OPERATIONS

SUBHED – Harvest, roads and chemical use pose water quality risk

PHOTO – CONTEMPORARY LOGGING OPERATION

Trees to Tap found that forested watersheds produce higher quality water than any other type of surface water source, but it cautions that timber harvest, roads and chemical use do pose a risk to source water quality. Safeguarding against this risk requires laws and regulations, constant monitoring and enforcement, and management practices based on the best available science and technology. Also, according to the report, increasing effective communication (early, open and often) between forest managers and water utilities offers the best outcomes for both parties.

The potential impact of forest management activities on a particular community water supply is related to the proportion of the watershed affected (both for a single operation and cumulatively), the characteristics of the watershed (slope, geology, rainfall), and how well operations and land management follow required best management practices. Additional management measures, put in place by skilled foresters, may be needed on identified vulnerabilities to prevent impacts.

Harvest. Timber harvest reduces canopy coverage and disturbs soils, which can cause erosion and trigger sediment movement until replanted tree seedlings or brush reach sufficient size. The loss of root reinforcement and canopy cover on steep slopes can increase slope instability and the likelihood of landslides.

Roads. Sediment from forest roads pollutes streams, carries toxic metals and petroleum products, and can clog water intakes. High-risk roads, such as those that cross unstable slopes or that either cross or run adjacent to streams are more likely to funnel sediment to the stream if not properly built, drained and maintained. So-called "legacy roads," planned and built a half-century or more ago, are more likely to cause sediment to go into streams than those built and maintained to current standards.

Chemicals. The use of chemicals in the forest raises public concerns about their effect on plants and animals, adjacent properties and downstream community water supplies. Herbicides are widely used after timber harvest to slow competing growth in clearcuts until planted trees are established. Other pesticides may be used to control for fungi or insects that attack trees. Nitrogen fertilizers may be applied in timber stands to enhance tree growth.

The following pages delve deeper into the report's findings as they relate to chemical use, sediment in streams, and the relationship between natural organic material and water treatment products.

Commented [jds8]: This is repeated a lot. See general comment above.

Commented [jds9]: The care used by skilled loggers at the ground level is really important. Can we capture that?

Commented [jds10]: Excellently stated. This does leave the impression that if current BMPs are followed, there won't be any issues. This is a good spot to state that additional management measures, put in place by skilled foresters, may be needed to ID vulnerabilities (could be based on slope, geology) and prevent trouble.

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Commented [jds11]: Pesticides is an umbrella term that includes herbicides. Including "Other" clarifies this.

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PAGE 5 R

HED – PROFILE: ODF STEWARDSHIP FORESTER

SUBHED – ODF stewardship forester monitors for compliance

PHOTO – ASHLEY LERTORA IN OR NEAR HER PICKUP TRUCK

Ashley Lertora drove about 13,000 miles on her state-issued pickup truck in 2019 working for the Oregon Department of Forestry (ODF) in Clatsop County on the Oregon Coast.

As an ODF Stewardship Forester who helps landowners and operators navigate the state's forest practices laws and regulations – and then spot checks to make sure they comply – Lertora spends 70 percent of her time on the road.

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She's one of about 50 ODF foresters statewide charged with educating forest landowners and operators about the Oregon Forest Practices Act, providing technical assistance and expert advice, monitoring their operations and citing those who fail to meet the law.

With a temperate climate, abundant rain and porous soils, Clatsop County is one of the state's largest timber producers and a center of industrial forest management. Seventy percent of the forestland is in private ownership. There are seven major watersheds, including those that serve 10 community water supplies.

Using the state's electronic notification system, FERNS, Lertora can pull up any operation on her desktop or laptop at any time, giving her full access to the landowner's plan and timeline. She reviews the 300 to 350 notifications filed annually in her region and in most cases, drops in on each operation in person. The visits are best described as community policing with a goal of preventing resource damage.

SIDEBAR

SUBHED – Best practices, laws and rules aim to lessen forestry impacts

Beginning in the 1970s, Congress and state legislatures took major steps to boost federal law, state laws and regulations, and best management practices to better protect drinking water sources.

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Best management practices. Oregon's best management practices program is mandated by the Oregon Forest Practices Act (OFPA). Multiple state agencies, including the departments of Forestry, State Lands, Agriculture, Fish and Wildlife, and Environmental Quality, hold some responsibility for best management practice policy development.

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State laws. The Legislature passed the OFPA in 1971, and its laws and rules have been modified more than three dozen times since then in response to new scientific information. Regulations that prescribe how to meet the laws are set by the Oregon Board of Forestry and enforced by the state's Department of Forestry. Most recently, in 2016 and 2017, the OFPA was updated to include 60-foot no-spray buffers for aerial herbicide use around homes and schools, a new salmon-steelhead-bull trout category of stream classification, and wider riparian buffer strips for these streams.

ODF stewardship foresters administer OFPA rules by working with forest landowners and operators to help them comply with OFPA requirements. Audits through 2017, the most recent available, indicate high compliance rates. For example, 97 percent overall compliance for 2017. However, there are some opportunity areas, according to ODF. For example, monitoring also found low compliance with disconnecting road drainage systems from streams and minimizing ground disturbance around small wetlands and headwaters streams.

Commented [jds12]: Almost certainly an overestimate due to bias in non-response, and other factors. Check w/ Terry Frueh about statistical evaluation of this and what ODF plans to do.

Federal laws. Numerous federal acts and regulations interlace with Oregon law to protect drinking water quality. These include:

- Clean Water Act (1972),
- Safe Drinking Water Act (1974),
- Oregon water quality standards, and
- Environmental Protection Administration's primary and secondary National Drinking Water Regulations.

These regulations set maximum contaminant levels on over 90 drinking water contaminants, as well as non-mandatory water quality standards for aesthetic effects (e.g., taste, color, odor) cosmetic effects (e.g., skin or tooth discoloration) and technical effects (e.g., corrosion, staining, scaling or sedimentation in distribution systems or home plumbing).

PAGES 6-7 L-R (Note two-page spread)

HED – CHEMICAL USE

SUBHED – Report studied impact to downstream water sources

Few forestry issues draw more controversy than the use of chemicals, especially aerial herbicide application in forested watersheds that feed community water supplies.

Forest landowners maintain that insecticides, fertilizers and herbicides are important tools in a forester's "toolbox" to protect the landowner's long-term investment. They believe these tools are necessary for successful reforestation and to increase tree growth and yield, allowing forestlands to remain productive and economically competitive.

Critics raise concerns about chemicals' effect on plants and animals, adjacent properties, and downstream community water supplies.

SUBHED – WHAT THE REPORT FOUND

PULL QUOTE

"The majority of compounds that present a documented threat to drinking water quality... are associated with agricultural and urban land use applications rather than forestry." – U.S. Geological Survey

Insecticides. According to *Trees to Tap,* insecticides are rarely used in Oregon's forests. Over a four-year period, 2015 to 2019, the researchers found two instances where foresters applied insecticides on a total of just 161 acres. For that reason, the report focused its attention on fertilizers and herbicides that may affect raw drinking water quality.

Fertilizers. Fertilization in Pacific Northwest Douglas-fir plantations usually means applications of nitrogen. If done at all, it generally occurs after commercial thinning to "boost" the growth of remaining trees. Generally, one or two applications is enough. It is typically applied by helicopter and most often delivered as urea pellets, an odorless solid soluble in water. Nitrogen runoff can contribute to the growth of algae, which can be problematic in streams and water supplies.

Herbicides. Forest landowners use herbicides to aid the re-establishment of tree seedlings following timber harvest. These chemicals are a cost-effective means of reducing competition during the reforestation required by Oregon law.

Herbicide treatments typically occur prior to timber harvest, after harvest but prior to planting, and after planting. The total number of treatments on a seedling plantation range from one to four, depending upon the severity of competing vegetation. Herbicides are also used to control vegetation along roadsides, to maintain visibility and reduce fire risk from vehicles. Herbicide applications are both ground-based and aerial.

Herbicides target plant life and either kill the targeted plant or suppress its growth. Landowners are prohibited from applying herbicides directly to surface water. However, chemicals can still get into

Commented [jds13]: Is the question whether forestry is better than other land uses? If so, this quote is appropriate. Is the question whether forestry has an impact on chemical composition of water? If so, then this quote is beside the point.

Commented [jds14]: There are not any exceedances of the nitrate MCL due to forestry applications. Algae (blue-green and anabaena) have been problems in recent years. Check if these are boosted by available nitrogen.

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Commented [jds16]: I was not aware of this.

Commented [jds17]: How are they prohibited? Wouldn't this vary by product label? There is nothing in FPA rules to prevent direct application to small non-fish streams and small wetlands ("other wetlands" in the FPA) and lakes. Small Type-N can be oversprayed if the label allows.

water directly by accident, drift during application, volatilization after spraying, and either surface water or groundwater runoff. While glyphosate (the most used chemical) is less mobile in soil, most of the others commonly used (e.g., Imazapyr, MSM, SMM) are moderately to very mobile in soil. Most are not volatile, meaning they don't vaporize and become airborne, and most have a relatively short half-life in water and soil, which means that they don't accumulate.

According to studies reviewed by *Trees to Tap,* traces of herbicides can reach streams via drift during application and through leaching or runoff during strong storm events. While herbicide detections downstream were orders of magnitude lower than human health standards, this does represent a reduction of water quality that concerns some residents.

In Oregon, authority for development and enforcement of water quality policies related to pesticides such as insecticides and herbicides lies with multiple state agencies. The Water Quality Pesticide Management Team (WQPMT), composed of representatives from these agencies, addresses the protection of waters of the state from pesticide contamination. The state's Pesticide Analytical and Response Center exists as a unified system of incident reporting.

SIDEBAR SUBHED – SAMPLING SHOWS TRACE IMPACTS

PHOTO – SCIENTIST IN STREAM DRAWING WATER SAMPLE

In addition to reviewing the scientific literature about insecticides, fertilizers and herbicides, *Trees to Tap* identified six locations where water quality sampling had been conducted. Sampling is done to determine chemical levels likely linked to forest management activities.

The Eugene Water and Electric Board's (EWEB) sampling of the McKenzie River is instructive. Some 88 percent of the McKenzie watershed is forested, with both public and private ownership. Industrial ownership makes up about one-third of the forested portion of the watershed. Sampling over the past decade has found detections of forest chemicals, but at extremely low levels.

According to the EWEB Strategic Plan, quoted in the report, the utility considers forested lands to produce higher quality water than from any other surface water source. Use of herbicides does constitute a risk, but according to one EWEB report, the utility considers the risk comparatively low (Morgenstern *et al,* 2017).

The U.S. Geological Survey (USGS) came to a similar conclusion, stating "these results indicate that effects of forestry pesticide use are negligible at these locations in the river system" (Kelly *et al* 2012). The USGS continued, "the majority of compounds that present a documented threat to drinking water quality... are associated with agricultural and urban land use applications rather than forestry."

Commented [jds18]: Not so. It has been found repeatedly in studies (e.g Louch et al by NCASI in the Alsea Revisited) to move into the water. So does its degradation products (AMPA).

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Commented [jds19]: This is a relative statement without a basis for comparison; give examples of half-lives.

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PAGES 8-9 L-R (Note two-page spread)

HED – SEDIMENT AND TURBIDITY

PHOTO – KEVIN BLADON

CAPTION

OSU Assistant Professor Kevin Bladon holds a doctorate in forest hydrology and wrote the chapter on sediment and turbidity for *Trees to Tap.*

SUBHED – How forest operations work to minimize sediment movement into streams

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Nobody wants dirt in their water. Water discolored by fine particles of soil or organic material lacks the clarity we expect. We find it off putting, plus the material may contain harmful bacteria or chemical pollution. That's why foresters strive to limit sediment delivery to streams from forest operations. And that's why water managers go to great lengths to filter particles from raw water as part of the water treatment process.

Turbidity is a measurement of sediment in water. As a test of water clarity and quality, it is regulated in finished drinking water under the federal Safe Drinking Water Act.

High turbidity levels can challenge the ability of water treatment operators to provide drinking water to communities safely and economically.

SUBHED – WHAT THE REPORT FOUND

Harvest. Primary sources of sediment to streams include surface erosion on slopes of the harvest area, roads and trails, stream bed and bank erosion, and landslides.

While contemporary harvesting practices are much less impactful than historic ones, any ground disturbance has the potential to generate sediment. The sediment risk is clearly related to the type of harvest operation, and by geology, soil, topography and rainfall patterns. Sediment delivery can also occur from past practices or from operations that are not using best management practices.

In the short run, timber removal can increase stream flows, which can erode stream banks, saturate soils, and scour stream beds that remobilize sediments from past logging and natural disturbance. As stumps decompose, root strength is lost that can contribute to increased landslide rates. Herbicide use may increase erosion risk by suppressing soil-covering weeds and brush. By law and best management practices, forest managers lessen the amount of sediment that gets into water sources by retaining vegetation as riparian buffers on many streams and creating smaller harvest units.

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The report listed a number of factors that contribute to the amount of sediment and turbidity likely to occur at the raw water intake: geology and topography (steepness), proportion of the area harvested, type and size of harvest (clearcut or selective harvest), yarding methods, and distance to the water intake. Erodible geology types, steeper terrain, greater area recently harvested, lack of vegetation over, and ground-based yarding are all related to greater sediment movement into water. "Distinguishing effects of modern forest practices from those used earlier, and whether increased sediment and

turbidity originates primarily from remobilized natural or human-caused sediment within streams, streambank erosion, or sources external to the waterway is difficult and complex," the report states. The report does make clear that modern logging practices can result in sediment/turbidity increases in some circumstances, especially in steep and/or erodible terrain and around unprotected headwater streams and wetlands, but that erosion and sediment movement are substantially reduced compared to pre-FPA practices.

Roads. According to *Trees to Tap,* research consistently indicates that unpaved forest roads are a primary source of sediment entering streams and estuaries in forested watersheds. Any forest road, no matter how carefully constructed, may contribute to soil erosion and potential stream sedimentation.

Over the years, best management practices have evolved for forest road design, placement, construction, maintenance, decommissioning and reclamation. Three examples where significant improvement have been made to reduce the amount of sediment entering streams are:

- actively routing runoff away from streams toward buffer areas,
- improving stream crossings by installing bridges or culverts, to keep road traffic from directly crossing stream channels, and
- upsizing culvert diameters to increase their flow capacity and reduce the likelihood of failure.

Other improvements cited by *Trees to Tap* include locating roads further away from streams, avoiding impacts to natural drainage patterns, minimizing total area disturbed by decommissioning and sometimes removing unneeded roads, avoiding steep slopes, avoiding wet areas, limiting the number of stream crossings, using more durable surfacing material, and improving routine road maintenance.

BOX

HED – Landslides & Old Roads

PHOTO – Decommissioned road with "No Entry" signage

Haul roads located on steep, unstable terrain, as well as harvest activities, can increase the risk of landslides, which cause sediment delivery to streams. But it's not clear to what extent these landslides affect downstream community water systems. There is extensive knowledge regarding the effects of forest management activities on landslides and sediment delivery to streams. Retention of trees and understory vegetation can mitigate the risk of landsliding. However, quantifying direct linkages between upstream sediment inputs from landslides and downstream fluxes of sediment relevant to community drinking water supply remains limited because of landscape variations, in-stream sediment storage and release, the episodic nature of landslide occurrence, lag time in sediment transmission, and limited research at larger spatial scales relevant to most community water supplies, according to the report.

Nationwide, state-level monitoring shows generally high levels of compliance with forestry best management practices for roads. However, older roads, also known as "legacy," forest roads remain. These roads were built without the benefit of current best management practices to minimize their impacts. Often these substandard roads were poorly sited, have unstable fills, constructed to steep grades, or have poorly designed stream crossings. These roads are gradually being either fixed or phased out. From 1997 to 2013, for example, 2,668 miles of logging roads in Oregon public and private forests were closed or decommissioned. According to *Trees to Tap,* the number of such roads exceeds the resources available to fix or decommission them but remain an issue that needs to be addressed.

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PAGE 10 L

HED – ORGANIC MATTER AND DISINFECTION PRODUCTS

SUBHED – Treating raw water creates unique issue

Live plants and animals and organic matter from decaying plants, animals and other organisms (which serve as food and nutrient sources for aquatic organisms) are important parts of natural ecosystems, but their presence in drinking water requires treatment prior to domestic use. Water system managers use a disinfectant, such as chlorine, to kill harmful bacteria and other organisms. But prolonged contact between chlorine or bromine and organic matter can cause chemical reactions that produce what are called "disinfection by-products" or DBPs.

Potential health effects of DBPs may include carcinogenicity, adverse reproductive and developmental effects, and immunotoxic and neurotoxic effects. Federal drinking water rules require treatment systems to disinfect raw water while minimizing creation of DBPs. DBPs are one of the most common water quality standard exceedances in Oregon, affecting 95 systems, large and small, from 2007 to 2017 according to the Oregon Health Authority's data.

The best way to avoid DBP production is to prevent organic matter from entering waterways in the first place. Recent BMPs, such as reducing slash in streams and reduction in erosion of organic matter-rich soil, have reduced elevations of natural organic matter in streams compared to historic practices but harvest remains a potential source of organic matter in surface water.

SUBHED – WHAT THE REPORT FOUND

T*rees to Tap* reviewed more than 100 studies regarding natural organic matter, including 30 that are relevant to Oregon. Young forest plantations seem to typically export less organic matter than older stands, but this may be related to reduction in large woody debris. Harvest removes a significant source of organic matter, particularly with whole-tree harvesting, a practice when entire trees are cable-yarded to a landing, where the branches are removed, and the tree is cut into logs. Provided that the removed branches are effectively managed, these practices can reduce the amount of natural organic matter and nutrients entering waterways. Riparian buffers prevent introduction of slash into waterways. However, harvest can also create pulses of dissolved organic carbon in water, resulting from slash in or near waterways or from respiration of carbon stocks in soil or debris following tree removal. Wetlands are effective at removing dissolved organic matter from water.

Only a few papers over the past two decades have studied the relationship between natural organic matter and forest roads. One study, in 2010, found that the main flush of natural organic matter was triggered by the first major fall rain event. Natural catastrophic events, such as wildfire and insect outbreaks, are known to release pulses of dissolved organic carbon into streams during precipitation events. How these natural disturbances impact natural organic matter concentrations are a focus of current research, especially with the increasing frequency of these events.

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PAGES 11-15

HED – CASES IN POINT

SUBHED – Case studies highlight risks, concerns, solutions

Three case studies in *Trees to Tap* illustrate different water systems, forest ownership patterns, and the partnerships of water systems, landowners and others to address risks and concerns.

PAGE 11R SUBHED – CASE STUDY: BAKER CITY

ILLUSTRATION – On each case study page, add small inset map of state showing location of the system

SUB SUBHED – Eastern Oregon city draws water from fire-prone forests

PHOTO – PHOTO FROM T2T CASE STUDY – PFB getting from USFS

The watershed. To serve a population of nearly 10,000, Baker City relies on forested watersheds within the 2.3 million-acre Wallowa-Whitman National Forest. Designated a municipal watershed in 1912 and classified as a roadless area, the watershed is closed to the public except for seasonal hunting.

Water treatment occurs in Baker City, though filtration is not required. The department employs five full-time and 20 part-time staff.

The main concern – the forest itself – is a double-edged sword. On the one hand, given the dense, overstocked stands of Ponderosa pine and mixed conifers, wildfire is an ever-present risk. Post-fire impacts such as sedimentation and its effects on water treatment infrastructure pose potential issues. However, many slopes in the watershed exceed a gradient of 30 percent and many are considered "very steep" at over 60 percent, although the well-drained soils reduce the risk of landslides. Thinning of forest stands through forest management could lead to increased erosion, turbidity and chemical changes.

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Though Baker City's population has not changed much over the years, agricultural water use has increased. Allowing enough water for producers is important given the economic significance. Years of drought and reduced snowpack have diminished reservoir supplies. A 2013 outbreak of the microscopic parasite cryptosporidium elevated concerns about straying livestock and wildlife contamination.

Addressing concerns. The Baker City Water Department and the Wallowa-Whitman National Forest are working together to address the many concerns, but such work is not easy given the strictures of forest management within a national forest, especially in a roadless area. The watershed has been designated as a Wildland-Urban Interface, or WUI. This indicates it is at high risk and increases the priority for action.

However, any action is first subject to National Environmental Policy Act analysis, a lengthy process to ensure that forest management activity does not harm the environment, including sensitive wildlife habitat. Two NEPA projects that were approved in 1995 and 2004 resulted in management actions that included selective tree removal, mechanized slash treatment, hand piling, pile burning and prescribed fire treatments.

Regular communication between the Forest Service and the city, as well as field tours and written documentation of agreements, are cited by *Trees to Tap* as effective means to maintain relationships and further proactive protection measures. There are continued efforts to use resources from the National Water Quality Initiative and Source Water Protection Funds to further reduce wildfire risk on public and surrounding private lands.

PAGE 12 L

HED REMINDER – CASE STUDIES

SUBHED – CASE STUDY: OCEANSIDE & CAPE MEARES

SUB SUBHED – Coastal towns source water from managed forests

PHOTO – Scenic shot of Oceanside from ocean (EJ Davis to provide)

The watershed. The seaside towns of Oceanside and Cape Meares, located on Oregon's north coast, get their drinking water from a two-square mile forested watershed that drains into small coastal streams west of Tillamook. Raw water is treated and supplied by the Oceanside Water District, which serves a population of 650. The watershed is nearly entirely owned by the private timber companies Stimson Lumber Co. and Green Crow Corp.

The water district operates two treatment plants: one for Cape Meares; the other for Oceanside. There are one part-time and three full-time employees.

Because of industrial forest ownership, a couple of the district's biggest concerns are application of forest chemicals, and turbidity from forest operations and forest roads. Other concerns include runoff after winter storms and landslides.

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Addressing concerns. Landowner Stimson uses an internal checklist to ensure that all drinking water suppliers with intakes on its properties are notified about chemical applications planned in accordance with the Oregon Forest Practices Act. Stimson notifies water managers using a five-step process to help water suppliers take appropriate precautions and prepare reservoir supplies,

1. a minimum of 15 days prior to application,
2. on the planned date of the application,
3. one day prior to the actual application, if it does not occur on the planned date,
4. on the day of application prior to starting the application, and
5. when it is completed.

Additionally, Stimson foresters work with water district managers and state agencies to develop harvest plans that protect source water quality. At the current time, there has been limited recent harvest in Oceanside's drinking water source area.

With 94 inches of average annual rainfall, increased turbidity in the two major creeks following seasonal storms is common. Too much sediment can clog the treatment system intake. Slope instability and potential landslides near the intake still pose a concern. Stimson is aware of these concerns and works within the Oregon Forest Practices Act, as well as adding their own additional voluntary measures based

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on site characteristics, to make sure operations meet the law, protect source water supply and maintain positive relationships with the water district and neighbors.

PAGE 13 R

HED – PROFILE: TREE FARMER

SUB HED – Forester strives to protect water quality on Oregon coast

PHOTO – JON WEHAGE

Jon Wehage is part-time engineer, supervisor, contracts manager, husband, father, community volunteer and dog-owner. But most of all, he is a farmer – a tree farmer for Stimson Lumber in Tillamook County, where 94 percent of the land is forested.

A family owned, privately held corporation with roots back to 1850, Stimson operates three lumber mills and manages about 178,000 acres of land in Oregon.

As a unit forester for Stimson, Wehage helps oversee operations on some 75,000 acres of Stimson forestland that stretch between the Nehalem and Siletz rivers along the Oregon coast.

Six water systems source their raw water from nine forested watersheds that lie within Stimson's coastal timber holdings. Keeping drinking water safe is a high priority.

"I drink that water. My family drinks that water. All of us who work here in forestry and the mill (more than 100 employees and their families) drink the water that comes off our property, so yes, we want to keep it safe," he says.

In 2019, the company was about to begin harvest in the Short Creek watershed that serves the coastal village of Oceanside. When local citizens voiced concerns about the effects of sediment, landslides and chemicals on their water supply, Wehage met with the water district manager and board members, and later with staff from the Oregon departments of Forestry and Environmental Quality to craft a plan to ensure the least impact practicable.

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The result was the Short Start logging plan, an 86-acre timber harvest area with the state-required riparian management areas turned into full buffers of unharvested trees around fish-bearing streams, plus additional buffers around non-fish streams, springs and seeps, and landslide-prone areas. Wehage will oversee replanting with native tree species spruce, hemlock and cedar. Due to the timing of harvest and reforestation, herbicides will not be required, he says.

The Short Start unit plan prompted this comment from Joshua Seeds, with DEQ's Drinking Water Protection program: "Stimson Lumber's foresters are using leave trees and buffers to protect most of these high-risk features and have done excellent field work, in my opinion." He added that the "company culture listens to the land's characteristics and gives foresters the latitude to exclude sensitive and unstable sites from harvest."

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When dealing with a skeptical public, Wehage's operating principle is basic: show them. "Let's go out into the forest," he says. "And if there's additional protection that would make you as a community water system manager feel more comfortable, then let's talk about it."

PAGE 14 L

HED REMINDER – CASE STUDIES

SUBHED – CASE STUDY: ASHLAND

SUB SUBHED – City employs unique partnership to protect watershed

PHOTO: ICONIC SHOT OF CITY OF ASHLAND, E.G., LITHIA PARK, SHAKESPEARE FEST

The watershed. The city of Ashland sources its water from a 20-square-mile forested watershed in the Rogue River-Siskiyou National Forest. Access is open to the public.

With 14 full-time staff, the department is one of the larger water agencies in the state.

The watershed faces twin challenges of geology and vegetation. Steep, decomposed granite slopes are prone to erosion and landslides. And forests, because of climate, tree species, and hazardous fuels, are prone to wildfire. The issues are many: risk of human-caused wildfire; regional tendency for lightning-caused wildfire; concern about source water contamination from fire suppression activities such as use of fire retardant; and post-fire impacts including erosion, sedimentation, loss of tree cover, and damage to water treatment infrastructure. Other concerns include the impacts of public use, including driving, hiking and camping.

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Addressing concerns. Unique to Ashland's source watershed is the Ashland Forest Resiliency Stewardship Project. This is a multi-partner project that employs forest management to restore historic fire regimes and forest health in the watershed.

The city of Ashland, led by its fire department, participates in this project that in 2009 authorized 7,600 acres, or about 60 percent of the watershed, for treatments such as hand and mechanical thinning and prescribed fire. By selectively removing timber, the project can reduce wildfire risk, especially to prevent low-elevation fires from moving to higher elevations. It can also enhance the growth of large trees and protect wildlife habitat. Implementation is done through a 10-year agreement between the city, The Nature Conservancy, and Lomakatsi Restoration Project, a nonprofit organization that develops and implements forest restoration projects. Funding comes from ratepayers through a user fee, the federal government and the Oregon Watershed Enhancement Board.

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While the management activity is expensive, sometimes involving costly helicopter logging, the alternative – devastating wildfire damage to the watershed and nearby structures – would be even more costly. By reintroducing low-intensity fire, Ashland reduces the probability of devastating high-intensity wildfires.

Page 15 R

HED – PROFILE: CITY WILDFIRE CHIEF

SUBHED – Unique role helps protect Ashland's water source

PHOTO – CHRIS CHAMBERS

CAPTION

Chris Chambers is the city of Ashland's wildfire division chief

In a position unique in Oregon, Chris Chambers works as the city of Ashland's wildfire division chief.

Since the city created the position in 2006 and put Chambers in charge, he has helped create Ashland's first-ever Community Wildfire Protection Plan, which set the stage for the city's involvement in the Ashland Forest Resiliency Stewardship Project *(see case study)*.

Chambers says one challenge to keeping water supplies safe is leveraging data and using collective scientific and management knowledge to chart a course for the watershed that will soften the impact of climate-driven wildfire risk.

"We know there will be more severe fire," he warns.

Potential solutions include forest thinning, an action Chambers says could increase snowpack and groundwater to streams. Though the watershed rises to 7,500 feet in elevation, snow in treetops evaporates before it can reach the ground and infiltrate soils. Managing tree stocking levels could increase water supplies, he says.

A second challenge is re-introducing periodic, low-intensity fire within the federally owned watershed and nearby city and private lands using prescribed burns. Chambers says that southern Oregon's historic fire cycle was every seven to 12 years throughout much of the region's dry forests, a natural cycle that removed excess fuels and diminished the risk of catastrophic fire and the associated negative impacts to water quality.

"We are behind the curve on burn maintenance," Chambers says, also noting that public communication and education are keys to public acceptance of preventive fire.

Page 16 L

HED – WILDFIRE

SUBHED – Fire among top concerns of water system managers

PHOTO – Eagle Creek Fire showing stream through blackened forest, e.g., https://pamplinmedia.com/images/artimg/00003601019659.jpg

ILLUSTRATION – Map of Eagle Creek Fire and Bull Run Watershed boundaries, e.g., https://www.google.com/url?sa=i&source=images&cd=&ved=2ahUKEwjh3NeiroHnAhWdJTQIHU1AA-IQjRx6BAgBEAQ&url=https%3A%2F%2Fsandyriver.org%2Feagle-creek-fire%2F&psig=AOvVaw35UkC1g_eDSxdpP-q89K3W&ust=1579031873953107

For three months in early fall of 2017, the Eagle Creek Fire ravaged the Columbia Gorge east of Portland, spewing hazardous smoke and jeopardizing the city's Bull Run Watershed, the water source for nearly one million people.

Prevailing winds pushed the 50,000-acre fire west, away from the watershed. And although wildfire did enter the northern boundary of the Bull Run Management Unit, it did not enter the Bull Run watershed itself or endanger reservoirs and water supply infrastructure. Firefighters contained the blaze only with the help of cooler temperatures and autumn rains.

One could say that Portland dodged a bullet. Wildfires burn up vegetative cover, including the leaves, needles and branches built up over years. High heat can create hydrophobic soil layers that repel water, reducing the amount that infiltrates the ground. Temperatures of about 200 degrees Fahrenheit cause this effect. The average surface fire on the forest fire can reach temperatures of more than 1,400 degrees Fahrenheit.

Decreased soil infiltration results in increased overland and stream flow. This can lead to erosion and increased sediment, clogging stream channels and lowering water quality.

SUBHED – WHAT THE REPORT FOUND

While fire effect was not a primary topic for the *Trees to Tap* science review, the OSU team did collect bibliographic information which was used in specific chapters. Among the top wildfire concerns identified by community water system managers are increased wildfire risk, wildfire impacts and effects of wildfire suppression. Wildfires can also contribute to concerns for drinking water, including water quantity and erosion; increases in organic matter and sediment; and the addition of chemicals to the watershed if fire suppressants are aerially applied.

As part of the *Trees to Tap* project, U.S. Forest Service fire scientists modeled the wildfire risk for all 156 community water systems to provide information for an atlas that will be incorporated into the report as an appendix.

The models showed that rare, large and severe wildfires will continue to occur, especially in the southwest, eastern Cascades, and eastern portions of the state. Risk is tied to land ownership. According

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to model predictions, public lands will be the leading contributor to area burned in all but the coastal region, where private industrial lands will be the largest contributor.

The report concluded that a coordinated, collaborative, multi-agency, and multi-landowner response is required to reduce the risk of fire exposure to drinking water sources. This can involve thinning out young trees and ladder fuels and reintroducing fire into fire-dependent forest ecosystems. It cited novel tax funding mechanisms to fund fuel treatments, such as that used by the city of Ashland, to strategically treat areas that are at high risk to fire events.

Commented [jds27]: Why? Is this simply because those ownerships make up most of the forestland? Or is it because of forest structure, and if so, is that structure driven by management (or lack thereof) or by natural vegetation and climate?

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Page 17 R

HED – PROFILE: STATE FORESTER

SUBHED – Fire season length, severity influenced by climate change

PHOTO – STATE FORESTER PETER DAUGHERTY

State Forester Peter Daugherty is unequivocal that climate change is affecting forest conditions in Oregon and elsewhere, but he says it's a change that's difficult to quantify.

But one impact of climate change – increased wildfire – is well-documented, he says.

"We have experienced increased severity and duration of fire seasons in recent years, and the cost of protecting forests from wildfire during those seasons is increasing," Daugherty says.

Indeed, the threat of wildfire and worries about the state's reaction have grown so large, that in January 2019 Governor Kate Brown created the Council on Wildfire Response. In its report issued November 2019, the Council underlined the need for "comprehensive change."

Among its 36 recommendations, the council called for over 100 new staffing positions at various state agencies, $20 million in initial investments in non-staffing related costs, and $200 million annually to treat 300,000 acres per year to restore and maintain fire-resilient landscapes.

Daugherty says the forest sector can take steps now to protect future water quality and fish habitat in the face of climate change.

"If we are serious about understanding the effects of climate impacts on the quality of riparian systems, we must establish and support long-term monitoring and assessments," he says. "Planning, collaboration and integrated research will enhance the speed and ease with which we learn."

SIDEBAR HED – WHAT THE REPORT FOUND

Although the *Trees to Tap* steering committee did not make climate change one of the four focus topics of the report. Instead, climate change effect was a scientific literature search topic, and is addressed where it will likely affect those topics. Additionally, the issue was mentioned by some managers in the survey of community water systems. Wildfire is one example of the increased frequency of extreme events expected as a result of a changing climate and is therefore a concern for water suppliers.

PAGE 18 L

THE TREATMENT PROCESS

SUBHED – Treatment required before raw water considered safe to drink

POSSIBLE ILLUSTRATION
This illustration of the Hillsboro system could be modified generically to show the "treatment train."
https://images.app.goo.gl/2Y1NxKRdEXKQUeGV9

Converting raw source water into safe drinking water entails a series of steps called the "treatment train." These steps provide an integrated approach, so that if any one step fails there is redundancy to reduce the likelihood of contamination.

Common to treatment processes is the removal of particles and the addition of disinfectants. These can include compounds such as chlorine, ozone or hydrogen peroxide that help control taste and odor, remove particles and disinfect.

Treatment can be any combination of screening, mixing, sedimentation and filtration. Some systems use ultraviolet (UV) rays to destroy illness-causing microorganisms. UV purification may be used with other forms of filtration such as reverse osmosis system or carbon block filters.

Three community water systems – Portland, Baker City and Reedsport – do not filter their drinking water, though they do disinfect it. Portland's system, which serves more than 950,000 metro-area residents, is under federal order to add a filtration plant to remove cryptosporidium, a parasite that can cause respiratory and gastrointestinal illness. Recent estimates put the cost of such a plant as high as $1.2 billion. City officials hope to have a new plant operational by 2027.

Regulation of drinking water. The Oregon Health Authority (OHA) regulates the treatment and distribution of drinking water under the Federal Safe Drinking Water Act, while the Oregon Department of Environmental Quality (DEQ) has regulatory authority under the Federal Clean Water Act and state law for point and non-point sources of pollution and attainment of water quality standards. Meeting water quality standards should result in source water that can be readily treated using available and affordable treatment technology. DEQ provides reports, general information and technical assistance for surface water systems. OHA supplies these services for groundwater systems.

Point-source pollution comes from a specific, identifiable source. For example, a manufacturing or sewage treatment operation that discharges treated wastewater into a water body. Non-point source pollution, from forestry for example, comes from runoff, precipitation, drainage, seepage or changes to waterways.

Since 1972, the Oregon Department of Forestry addresses non-point source pollution from forest operations through implementation of the Oregon Forest Practices Act (OFPA), which regulates logging and other forestry activities to help safeguard drinking water sources.

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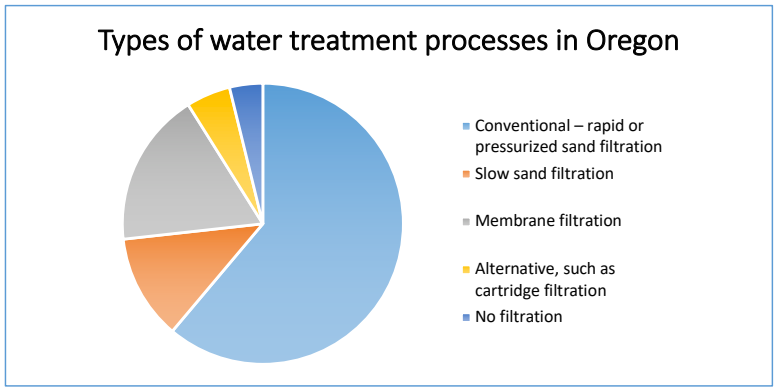
PIE CHART ILLUSTRATION – IF SPACE ALLOWS



PAGE 19 R

HED – PROFILE: CITY WATER MANAGER

SUBHED – Astoria water manager has seen plenty of change

PHOTO – JIM HATCHER

In supplying about 15,000 people with safe drinking water, the city of Astoria has an edge over most other systems. The city owns its own watershed.

Over 30-plus years working for the city, Astoria Public Works Department Superintendent Jim Hatcher has seen plenty of changes to how raw water gets made into water that's clean, safe and reliable.

Improved filtration, covered reservoirs and dealing with "disinfectant byproducts" are all changes that Hatcher and his team of 25 city employees have dealt with over the years. Astoria's water, plus that of five smaller systems, comes from the city-owned Bear Creek Watershed, east of town. It's a forested watershed the city manages primarily for water production, but also for some timber value.

Hatcher is proud of the city's forest stewardship. Acquired from a private timber company in the mid-1950s, the once-cut over forest is managed carefully to avoid contributing sediment and organic matter to streams that feed the reservoirs. Harvest is selective with thinning and some patch-cuts where native tree species are planted after timber is harvested. The oldest trees are 60-plus years old, but stands of young trees dot the forest, which is managed under standards set by the Forest Stewardship Council (a third-party forest certification program).

Heavy gates bar public access to the 3,700-acre watershed. With an average of 72 inches of rain annually but no snow, Hatcher jokes about the region's "rain-pack." Three large reservoirs capture the raw water – more than 350 million gallons – then feed it to four slow-sand filtration ponds installed in 1993, where natural biological processes filter and clean the water. It's a centuries old, but slow process well-suited to the system's relatively small size.

Once the water leaves the ponds, it's chlorinated to kill remaining organisms and fluoridated to help prevent tooth decay. The water is then stored in two primary reservoirs, which the city covered in 2010 at a cost of about $1.8 million. Covering reservoirs serves a dual purpose. It protects the water from tampering and keeps out natural organic matter such as leaves, needles and animal waste. Daily monitoring ensures that the water stays safe at the tap.

"The city is very, very fortunate to own its own watershed," Hatcher says.

SIDEBAR

HED – H_2O HELP

Community water system managers have a lifeline they can turn to for help and advice: the Oregon Association of Water Utilities.

The Oregon association offers some 400 hours of training annually, hosts five major conferences throughout the year, and publishes a quarterly magazine for members. Through its "Circuit Rider" program, it provides on-site technical assistance to help with distribution, collections, disinfection, treatment and operator certification, among others.

Deputy Director Mike Collier says he welcomes active forest management in forested watersheds provided it's done using best management practices that prevent delivery of sediment and organic material to waterways.

"Ideally, there should be a strong relationship and good communication between the water system manager and the forestland owner," he says.

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PAGE 20 L

HED – WHAT THE REPORT FOUND – A SUMMARY

PHOTO – Stream in upper watershed

SUBHED – Forest management's effects require continued study

Trees to Tap includes an extensive chapter on Findings and Recommendations, which can be accessed online at xxx.org. Though it's clear that forested watersheds produce higher quality raw water than other land uses, concerns remain, prompting calls for continued study.

Sediment from Forestry Operations

The authors found little *direct* quantitative evidence that forestry activities and forest roads impact community drinking water in Oregon, such as studies that show timber harvest causing immediate sedimentation at intakes. But they point out there is considerable *indirect* evidence that forestry can have such effects, inferred from the following, among others:

- Extensive findings regarding linkages between past and current forest harvest activities, forest roads and landslides in upper watersheds.
- Cumulative and legacy effects of past harvesting, site preparation and forest road construction and use when best management practices were not as robust.
- "The inherent connectivity of hillslopes, headwaters and larger downstream waterways" along with the easy movement of fine sediment and turbidity, especially during high flows.
- The lack of provisions to protect small, non-fish bearing and intermittent streams during harvesting.

The authors state that the potential for forest operations to affect drinking water quality or quantity is higher for operations in steep, landslide-prone terrain, in areas with relatively more erodible soil and rock types, areas with a significant extent of unbuffered small streams, or where previous operations have left significant amounts of soil or sediment stored in streams.

Commented [JS29]: This is excellent.

Forest Chemicals

According to studies reviewed by *Trees to Tap,* traces of herbicides can reach streams during strong storm events, especially the first flush from heavy fall rains.

Most studies on the effects of forest chemicals were conducted on the active ingredient only. In actual use, these chemicals are usually mixed with other ingredients to improve their effectiveness and application. The effects of these mixes are often unknown.

According to *Trees to Tap,* perennial streams can make up a significant portion of a watershed but may be unprotected by a forested buffer. As noted, foresters may not apply chemicals directly to protected riparian vegetation. Ten-foot vegetated buffers are required on headwater streams that still contain water in mid-July in some georegions, but these buffers do not include large trees. Other georegions (e.g. the coastal zone) do not require any vegetation retention on small non-fish-bearing streams, leaving them vulnerable to direct herbicide application. Studies show that without larger trees and understory vegetation to slow or stop chemical drift, chemicals could drift into protected stream reaches during application or migrate into streams and flow into lower parts of the watershed, especially during and immediately following post-application storm events.

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Water Quantity

Water quantity, also known as "water yield," following timber harvest is a concern because water system managers need reliable, predictable and sustainable sources of raw water. Modifying factors include geology, soil type, harvest size and harvest proximity to stream channels. According to *Trees to Tap,* study results on this topic vary widely, with some watersheds showing large increases in water yield after harvest and others showing little to none. Generally, extensive harvest results in short-term (1-10 years) increases in summer low flows and smaller peak flow events.

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Complicating the picture are long-term effects where young, vigorously growing plantations of Douglas-fir yield less water flow during the summer dry season than adjacent old-growth watersheds.

The difficulty of consistently predicting the effects of forest harvest and regeneration on water yield have prompted calls for an expanded research agenda to study the relationship between timber harvest and processes that affect watershed storage.

INSIDE BACK COVER

HED – A TOAST

PHOTO – A group of 1-3 hands raising glasses of crystal-clear water with forests in the background

A quote from *Trees to Tap* bears repeating: "Oregon's extensive and diverse forests generally produce very high-quality water and supply most of the state's community surface water systems. Forest practices designed to minimize impacts to water quality have improved significantly in recent decades."

Timber has been harvested for more than a century in Oregon watersheds, historically without best management practices and often with little regard for the consequences. But as in all areas of human endeavor, and as the *Trees to Tap* report demonstrates, we have come a long way in our knowledge of human impact and how to live more in harmony with the environment. Moreover, the report suggests ways to continue improving forestry practices and to conduct research that can guide management actions in the future.

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Commented [JS32]: One of the takeaways for me from this effort is that often we can identify discrete factors or landscape pieces that are more vulnerable—risk is not evenly distributed. This lets us tailor practices to reduce risk even further.

The men and women who work in the forests drink treated water from the forests. They want safe drinking water, just like everyone else. And as much as anyone, they want to protect source water.

That doesn't mean the water in our streams is safe to drink without treatment. So, hats off to the 156 community water systems and managers who make sure that surface water is captured, filtered and treated before it reaches our faucets. They perform an invaluable service not only ensuring our water is safe to drink but also ensuring it is available year-round.

As Oregonians in 2020, this where we find ourselves: with high-quality water, significantly improved forest practices, and the ability to continue improving. And that, I believe, is worth a toast, not only to our forests that supply the raw water, but to those who keep the water safe – from trees to tap.

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For the forest,

Erin Isselmann
Executive Director
Oregon Forest Resources Institute

BACK COVER

PHOTO – DRINKING FOUNTAIN BUBBLER WITH FORESTED BACKGROUND

ACKNOWLEDGEMENTS

OFRI is grateful to the people who agreed to be featured here and others who gave their time, expertise, insights and comments during development of this report: Marganne Allen, Oregon Department of Forestry; Jerry Anderson, Hancock Forest Management; Paul Barnum, past OFRI executive director; Ashley Coble, National Council for Air and Stream Improvement; Jim Gersbach, Oregon Department of Forestry; Mike Collier, Oregon Association of Water Utilities; and Jon Souder, Oregon State University.

ABOUT THE OREGON FOREST RESOURCES INSTITUTE

The Oregon Forest Resources Institute (OFRI) was created by the Oregon Legislature in 1991 to advance public understanding of forests, forest management and forest products, and to encourage sound forestry through landowner education. A 13-member board of directors governs OFRI. It is funded by a portion of the forest products harvest tax.

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