EQCMeeting1of1DOC20041021

OREGON
ENVIRONMENTAL QUALITY
COMMISSION MEETING
MATERIALS 10/21/2004

DEQ

State of Oregon
Department of Environmental Quality

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The Willis Auxiliary Power System provides all the power requirements for a typical Class 8 truck, except pulling the load.

The Willis APU is lightweight and fits comfortably on the frame rail.

WILLIS
AUXILIARY POWER SYSTEM

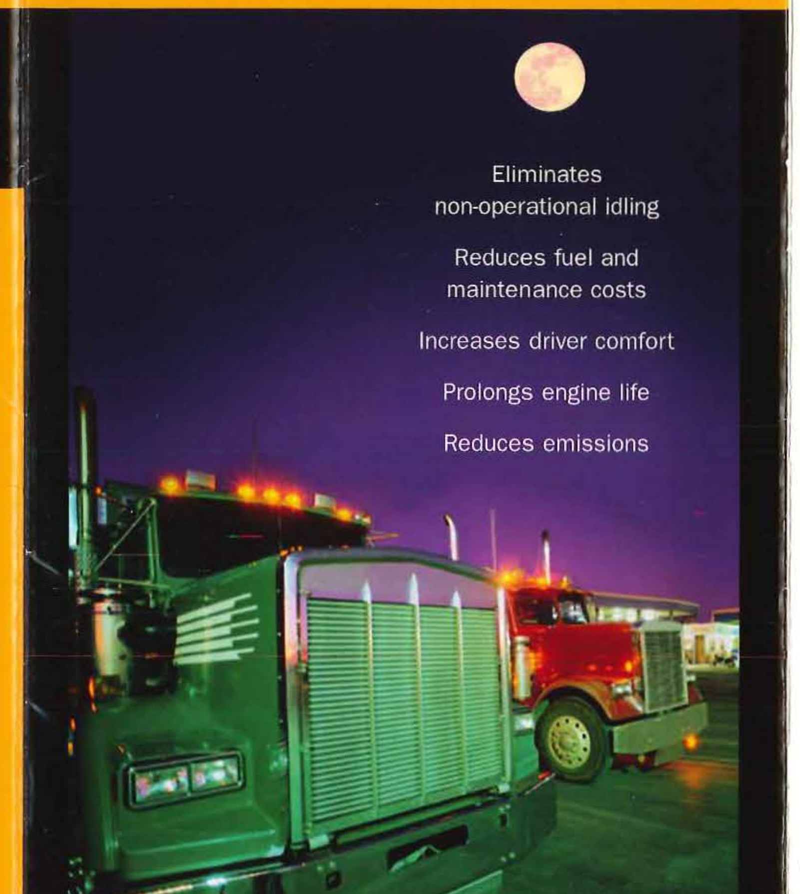
Auxiliary Power Dynamics, LLC
2060 E. Greg St.
Sparks, NV 89431-6560
(775) 825-4566
(800) 825-4631 (toll free)
Fax (775) 331-0278
www.willisapu.com

Willis Auxiliary Power System exclusively from Auxiliary Power Dynamics
(U.S. Patent #5,528,901)

Auxiliary Power Dynamics was founded by Eldon Willis, a man who personally experienced the rigors of travel as a corporate jet pilot and long-haul trucker. The Willis Auxiliary Power System is a patented system that brings the efficiencies and comfort of aerospace technology to the trucking industry.

Willis Auxiliary Power System.

It does everything but pull the load.



WILLIS
AUXILIARY POWER SYSTEM

Stop idling and start saving. Details inside.

It truly pays to have Willis on board.

The Willis Auxiliary Power System eliminates non-operational idling, resulting in fuel and maintenance cost savings that far exceed your investment.

Fuel Cost Savings

- Immediate monthly savings *after* product payments are subtracted
- Substantial product lifetime savings
- Call for a **FREE** fuel savings estimate based on your current fuel cost and usage

Maintenance Cost Savings

- No more jump starts
- Fewer battery replacements
- Extended engine and accessory life
- Optional back-up air supply supports truck air systems
- And much more

A fully integrated, one-of-a-kind system.
No other truck APUs can match the versatility of the Willis Auxiliary Power System. The baseline unit includes an alternator, A/C compressor and coolant circulation through a heat exchanger. Options found only on the Willis system include an oil pump, air compressor and air starter.

The Willis Auxiliary Power System is:

- Economical—uses less than 1/6 of a gallon of fuel an hour (with a full load)
- Easy to use—heating and A/C operates through existing truck cab controls, APU control requires minimum driver input
- Quiet—noise measures only 50-53 db in cab (Peterbilt 387), 63-66 db 10 feet from cab
- Lightweight—weighs just 260 lbs. with optional air starter (when batteries and electric starter are removed)
- Long-lasting—estimated service life is more than 20,000 hours

Technical Data

Dimensions (APU enclosure):	
Height:	23 inches
Width:	29 inches
Depth:	23 inches
Weight installed:	
Baseline unit:	340-360 lbs.
With options:	400-420 lbs.
With air starter substituted for the electric starter:	260 lbs. net
Service life:	20,000 plus hours
Oil change interval:	500 hours
Service environment:	Same as truck
Truck coolant:	At -20 degrees Fahrenheit, the Willis system heats the truck engine crankcase to 68 degrees Fahrenheit

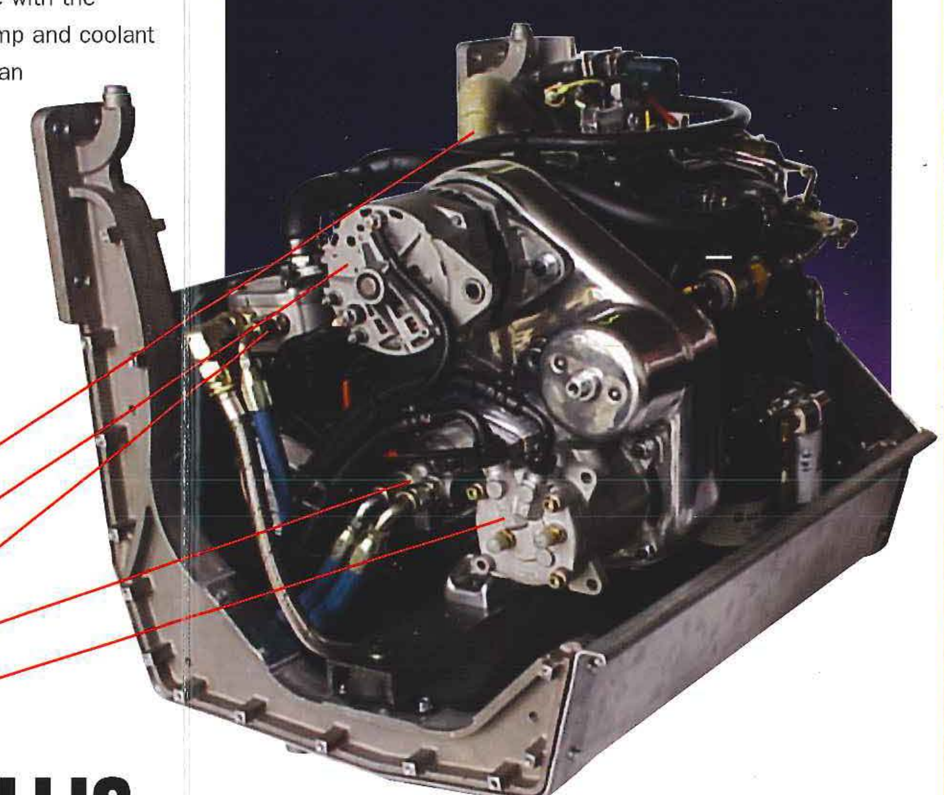
Spend parking hours in total comfort.
And spend a lot less.

It's the premier auxiliary power system in the trucking industry. Simply set the parking brake and the Willis Auxiliary Power System automatically starts up providing comfortable heating and air conditioning and full electrical power to run parking lights, communications, TVs, microwaves, personal computers and more—all without costly fuel-guzzling idling.

Reliable, engine-preserving starts. Only available with the Willis Auxiliary Power System, the optional oil pump and coolant circulation eliminate dry and cold starts so you can confidently crank the main engine at any time in any conditions.

The only APU design that:

- Pre-oils the main engine to eliminate dry starts
- Can be equipped with an optional air starter
- Provides a complete back-up air supply for truck air systems, including brakes



WILLIS
AUXILIARY POWER SYSTEM

Stop idling and start saving. Call today.
(775) 825-4566 Toll free: (800) 825-4631 Email: info@willisapu.com

The only loud noise comes from customers.

Here's what they're saying about the Willis Auxiliary Power System:

"The other units we've tried only cool the sleeper. The Willis APU cools and heats both the cab and the sleeper comfortably."

Mike Couch, safety director and maintenance consultant, Fundis Co., Sparks, NV

"Before I was running my profits out of the stack. But with the Willis Auxiliary Power System, I'm using less than a quart of fuel an hour to heat or cool my truck."

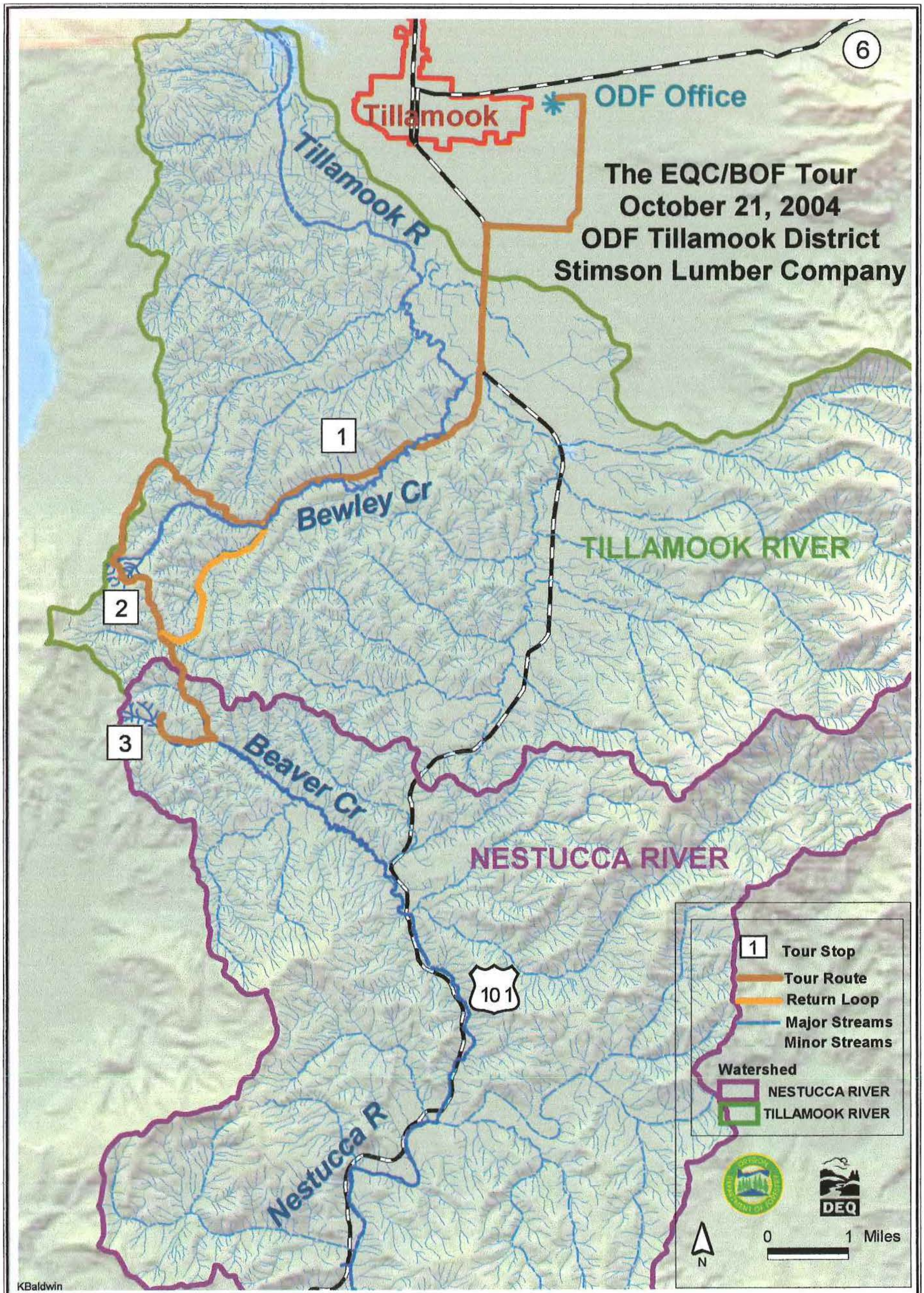
Kevin Jackson, owner operator based in Altha, FL

"The Willis Auxiliary Power System pumps oil through the engine, so I don't have to start a cold or dry engine. It's the best APU design I've ever seen."

John Naylor, owner operator in Colville, WA

"By eliminating idling, you're getting a bigger payoff. And our drivers love this unit."

John Lawson, John Lawson Rock and Oil, Fresno, CA


6
ODF Office
Tillamook
The EQC/BOF Tour
October 21, 2004
ODF Tillamook District
Stimson Lumber Company
Tillamook R
1
Bewley Cr
2
3
TILLAMOOK RIVER
Beaver Cr
NESTUCCA RIVER
101
Nestucca R
1 Tour Stop
Tour Route
Return Loop
Major Streams
Minor Streams
Watershed
NESTUCCA RIVER
TILLAMOOK RIVER
DEQ
N
0 1 Miles
KBaldwin

Board of Forestry / Environmental Quality Commission
Joint Field Tour
Thursday, October 21, 2004
ODF Tillamook District Office
5005 East 3rd Street, Tillamook

Tour Goal

For Board of Forestry and Environmental Quality Commission members to view and discuss key concepts of Water Quality Standards and related Forest Practices Best Management Practices (BMPs) in the field.

Tour Objectives

1. Present information within a field context on key issues surrounding the protection of small non-fish bearing streams (Type N).
2. Understand and Discuss outstanding issues identified by looking at conditions in the field.
3. View riparian areas pre-harvest, immediately post harvest, and following stand reestablishment.
4. View examples of current/ proposed forest practices.
5. View examples of monitoring methods that are used to verify TMDL modeling.
6. View examples of voluntary measures applied in addition to current BMPs.

<u>Tour Itinerary</u>

7:30 a.m.	**Meet at ODF Tillamook District Office**
7:30-7:45a.m.	**Welcome and Introductions: Ted Lorensen, Holly Schroeder**
7:45-8:00a.m.	**Tour Overview: Gregg Cline, Bob Baumgartner, Scott Gray**
8:00a.m.	**Leave Tillamook**
8:30a.m.	**Stop 1: Planned Harvest**

This stop illustrates activities undertaken in planning a harvest. Efforts include determining end of fish use and riparian management area layout.

- Greeting and background information of the tour sites: Stimson Lumber
- Current and proposed basal area requirements: Gregg Cline

- Determining end of fish use: Dan Cotton, and Dave Plawman
- TMDL process/ field check: Eric Nigg and Bruce Apple

9:15a.m. **Depart Stop 1**

9:30a.m. **Stop 2: Recent Harvest**

This stop illustrates conditions immediately following harvest. View small non-fish bearing streams (perennial and intermittent) examples of voluntary measures, and vegetation control procedures.

- Harvest objectives, voluntary stream protection, reforestation and vegetation control: Stimson Lumber
- Small Type N stream protection: current requirements, FPAC and ERFAC recommendations: Jim Paul
- Water quality standards, holistic review: Bob Baumgartner

10:15a.m. **Depart Stop 2**

10:25a.m. **Drive By**

Landowner accomplishments through voluntary projects - upgrade road systems, stream crossings and restore fish access. Refer to handout material in tour packet.

- Voluntary projects: Stimson Lumber
- Report on landowner accomplishments statewide: Jo Morgan

10:40a.m. **Stop 3: Recovery Following Harvest**

This stop illustrates recovery of vegetation on a clear-cut site six years after harvest.

- Harvest objectives, voluntary stream protection, reforestation and vegetation control: Stimson Lumber
- Dynamic forest concepts, reforestation requirements - established conifer: Ted Lorensen
- Demonstration of shade monitoring with solar pathfinder, TMDL Target and water quality standards: Eric Nigg and Bruce Apple

11:45a.m. **Depart Stop 3**:

Return to Tillamook Office - Lunch in route

Stop One – 2005 Planned Harvest – 66 acres

- Acres: 22ac Cable ground, 44ac of shovel ground

- Unit has a small Type F stream running in it for a distance of 300 ft. A 50' buffer has been flagged on both sides with pink "Timber Harvest Boundary" ribbon and orange reserve area tags.

- The unit has 2500' of small N streams in it. Leave trees have been tagged along the N streams with yellow wildlife tree tags.

TABLE 2. General Prescription for Type F streams: Streamside Tree Retention for Harvest Type 2 or Type 3 Units (OAR 629-640-0100 (~~6~~7) (a) & (b))

Geographic region	SQUARE FEET OF BASAL AREA PER 1000 FEET OF STREAM, EACH SIDE					
	LARGE Type F RMA = 100 feet		MEDIUM Type F RMA = 70 feet		SMALL Type F RMA = 50 feet	
	Standard Target	Active Mgt. Target	Standard Target	Active Mgt. Target	Standard Target	Active Mgt. Target
Coast Range & S. Coast	230	170	~~120~~ 160	120	~~40~~ 85	40
Interior & W. Cascade	270	200	~~140~~ 190	150	~~40~~ 100	50
Siskiyou	220	170	~~110~~ 155	125	~~40~~ 85	40
Eastern Cascade & Blue Mountain	170	130	90	70	50[1]	50[2]

1. The maximum live conifer tree basal area that must be retained is 40 square feet. The remaining basal area may come from snags, dying or recently dead or dying trees, or hardwood trees if available within the riparian management area.

2. Live conifer tree basal area may be reduced to 30 square feet for the active management target. The remaining portion of the basal area requirement must come from snags, dying or recently dead or dying trees, or hardwood trees if available within the riparian management area.

TABLE 2. General Prescription for Type F streams: Streamside Tree Retention for Harvest Type 2 or Type 3 Units (OAR 629-640-0100 (~~6~~7) (a) & (b))

Geographic region	SQUARE FEET OF BASAL AREA PER ACRE, EACH SIDE					
	LARGE Type F RMA = 100 feet		MEDIUM Type F RMA = 70 feet		SMALL Type F RMA = 50 feet	
	Standard Target	Active Mgt. Target	Standard Target	Active Mgt. Target	Standard Target	Active Mgt. Target
Coast Range & S. Coast	100	74	~~75~~ 100	75	~~33~~ 71	33
Interior & W. Cascade	117	87	~~88~~ 119	94	~~33~~ 83	42
Siskiyou	96	74	~~69~~ 97	78	~~33~~ 71	33
Eastern Cascade & Blue Mountain	74	57	56	44	42[1]	42[2]

1. The maximum live conifer tree basal area that must be retained is 40 square feet. The remaining basal area may come from snags, dying or recently dead or dying trees, or hardwood trees if available within the riparian management area.

2. Live conifer tree basal area may be reduced to 30 square feet for the active management target. The remaining portion of the basal area requirement must come from snags, dying or recently dead or dying trees, or hardwood trees if available within the riparian management area.

TABLE 3. General Prescription for Type F Streams: Streamside Tree Retention for Harvest Type 1, Partial Harvest, or Thinning Units (OAR 629-640-0100 (~~6~~7) (a) & (b))

Geographic region	SQUARE FEET OF BASAL AREA PER 1000 FEET OF STREAM, EACH SIDE					
	LARGE Type F RMA = 100 feet		MEDIUM Type F RMA = 70 feet		SMALL Type F RMA = 50 feet	
	Standard Target	Active Mgt. Target	Standard Target	Active Mgt. Target	Standard Target	Active Mgt. Target
Coast Range & S. Coast	300	270	~~160~~ 210	185	~~50~~ 110	65
Interior & W. Cascade	350	310	~~180~~ 245	220	~~50~~ 130	80
Siskiyou	290	260	~~140~~ 205	175	~~50~~ 110	65
Eastern Cascade & Blue Mountain	220	200	120	100	50[1]	50[2]

The maximum live conifer tree basal area that must be retained is 40 square feet. The remaining basal area may come from snags, dying or recently dead or dying trees, or hardwood trees if available within the riparian management area.

TABLE 3. General Prescription for Type F Streams: Streamside Tree Retention for Harvest Type 1, Partial Harvest, or Thinning Units (OAR 629-640-0100 (~~6~~7) (a) & (b))

Geographic region	SQUARE FEET OF BASAL AREA PER ACRE, EACH SIDE					
	LARGE Type F RMA = 100 feet		MEDIUM Type F RMA = 70 feet		SMALL Type F RMA = 50 feet	
	Standard Target	Active Mgt. Target	Standard Target	Active Mgt. Target	Standard Target	Active Mgt. Target
Coast Range & S. Coast	130	117	~~100~~ 131	116	~~42~~ 92	54
Interior & W. Cascade	152	135	~~113~~ 153	138	~~42~~ 108	67
Siskiyou	126	113	~~88~~ 128	109	~~42~~ 92	54
Eastern Cascade & Blue Mountain	96	87	75	63	42[1]	42[2]

The maximum live conifer tree basal area that must be retained is 40 square feet. The remaining basal area may come from snags, dying or recently dead or dying trees, or hardwood trees if available within the riparian management area.

TABLE 4. Basal Area for Various Diameter Classes (OAR 629-640-0100 (10))

Diameter Breast Height (inches)	Basal Area (square feet)	Diameter Breast Height (inches)	Basal Area (square feet)
6 to 10	0.3	41 to 45	10.1
11 to 15	0.9	46 to 50	12.6
16 to 20	1.8	51 to 55	15.3
21 to 25	2.9	56 to 60	18.3
26 to 30	4.3	61 to 65	21.6
31 to 35	5.9	66 to 70	25.2
36 to 40	7.9	71 to 75	29.0

Sufficiency Analysis Recommendations	Draft Rule Concepts	ODF Recommendation	Board of Forestry Decision	Next BOF/ODF Action	DEQ Comments
1- revise basal area (size and number of trees) targets / achieve mature forest conditions and provide large wood and shade	8- basal area increase for small and medium fish-bearing streams (west)	Rule change	Continue on regulatory path 10/03	1/05 BOF will make a decision for formal rule making based on 527.714 findings	support rule change
	14- basal area targets (east)	No rule change - insufficient science	Not proceed approved 3/04	ODF will revise monitoring priority list	neutral, encourage monitoring
	10- no harvest within 1/2 riparian management area (RMA) (west)	Non regulatory - insufficient science	Voluntary path approved 9/03	10/04-7/05 ODF will develop voluntary measures through Oregon Plan	prefer rule, encourage monitoring
	11- retain largest trees within RMA (west)	Non regulatory - insufficient science	Voluntary path approved 9/03	10/04-7/05 ODF will develop voluntary measures through Oregon Plan	prefer rule, encourage monitoring
	9- limit harvesting within RMA to 40% (west)	Non regulatory - insufficient science	Voluntary path approved 9/03	10/04-7/05 ODF will develop voluntary measures through Oregon Plan	prefer rule, encourage monitoring
2- revise current practices so desirable amounts of large wood is available along small stream channels that can deliver debris torrents to fish bearing streams. Ensure that adequate shade is maintained or rapidly recovered for riparian areas along small perennial non-fishbearing streams with the potential to impact downstream fish-bearing waters	4- Wood from debris flows and landslides	Rule change	Continue on regulatory path 9/03	1/05 BOF will make a decision for formal rule making based on 527.714 findings	support rule change
	12- small non fish-bearing streams (west)	Rule change	Deferred decision 4/04	1/05 ODF will present draft rule language to BOF	rule language uncertain, BOF action uncertain, prefer rule change
	16- small non fish-bearing streams (east)	No rule change - insufficient science	Not proceed approved 4/04	ODF will revise monitoring priority list	prefer rule, encourage monitoring
	18- small non fish-bearing stream monitoring	(Rule change) - house cleaning, remove obsolete references	Continue on regulatory path 7/03	1/05 BOF will make a decision for formal rule making based on 527.714 findings. ODF will also revise their monitoring priority list	support rule change and encourage monitoring
3- provide additional large wood to streams by actively placing wood to benefit salmonids	7- Large wood placement (also increase active management basal area target)	Rule change	Continue on regulatory path 4/04	1/05 BOF will make a decision for formal rule making based on 527.714 findings	support rule change for west side, neutral on east side
	17- Fish habitat incentives	Non regulatory - statewide initiative	Not required	10/04-7/05 ODF will develop language along with voluntary measures for Oregon Plan	initiative language uncertain
10- provide riparian functions along stream reaches above impassable culverts that are likely to be recolonized by salmonids after structures are removed or improved 12- revise the FPA rule definition of fish bearing and non fish-bearing streams by using physical habitat approach to classify fish use and no fish streams	3- provide habitat above human caused fish barriers	Rule change	Continue on regulatory path 4/04	1/05 BOF will make a decision for formal rule making based on 527.714 findings	support rule change
Other	1- clarify water protection rules policy statement	Uncertain	Continue on regulatory path 7/03, then deferred decision 7/04	1/05 ODF will determine its recommendation after internal discussion	ODF/ BOF action uncertain, prefer rule change with TMDL language
	2- treat medium and large non fish-bearing streams as same size fish-bearing streams	Non regulatory - insufficient science	Voluntary path approved 3/04	10/04-7/05 ODF will develop voluntary measures through Oregon Plan	prefer rule, encourage monitoring
	5- channel migration zones	Non regulatory - insufficient science	Voluntary path approved 9/03	10/04-7/05 ODF will develop voluntary measures through Oregon Plan	prefer rule, encourage monitoring
	6- treat dense stands within RMA	Guidance on rules	Address through guidance	ODF will develop guidance	guidance language uncertain
	13- revision of desired future condition (east)	No rule change - insufficient science	Further policy discussion approved 3/04	This topic will be included in the Dynamic Ecosystem white paper discussion	support no rule change
	15- provide harvesting alternatives (east)	No rule change - insufficient science	Not proceed approved 3/04	ODF will revise monitoring priority list	support no rule change

Rule package	Voluntary measures

notes

WATER CLASSIFICATION
OAR 629-635-0200

(11) (b) (B) The department will approximate the upstream extent of fish use in a watershed by considering the connection of the water with downstream waters where fish use is known. Fish use will be assumed to occur upstream of the known fish use until the first natural barrier to fish use is encountered.

RULE COMPLIANCE:

This paragraph is not subject to enforcement action.

ADMINISTRATION AND IMPLEMENTATION:

The intent of this paragraph is to allow the department to classify fish use for streams with unknown fish use in the interim (until a physical survey **for fish presence/absence** is conducted). The "approximation" process can be applied when a notification is received or prior to receiving a notification on a broader mapping scale so long as the proper process is applied.

In applying the approximation process, it was the intent of this paragraph to assume fish use in streams that have connection with a stream with known fish use (any stream that was previously classified as Class I and any stream where a survey has confirmed fish presence) **up to the first natural barrier**. A natural barrier is defined by OAR 629-600-0100(39) as:

> "Natural barrier to fish use" is a natural feature such as a waterfall, increase in stream gradient, channel constriction, or other natural channel blockage that prevents upstream fish passage.

Applying "upstream of the known fish use until the first natural barrier to fish use is encountered" will result in not classifying some fish use that can occur above a natural barrier to fish use. However, the intent was to provide an equitable process that could be applied on short timelines until the comprehensive survey is done. The conservative results of the interim process will help ensure that landowners will not be required to apply Type F protection on streams that in reality do not have fish use. In addition, this approach was also intended to maintain incentives to complete the comprehensive survey for actual fish use. More accurate classification will result when the comprehensive fish use survey is completed.

Even when fish use has been surveyed, and fish use has been verified up to a man-made barrier, the following policies apply. When a crossing structure that creates an upstream Type N stream segment is replaced, it is required to provide fish passage. When this allows fish to occupy the upstream segment, the classification will be changed from Type N to Type F. ***[REVISED 12-98—this paragraph added.]***

The most important consideration in applying the interim process is that Forest Practices Foresters are not experts about barriers to fish passage. The department has final authority to make decisions about barriers. Apply your best judgment based upon the information available to you about barriers, but recognize that this is an interim process.

Fish use will be assumed up to the first natural barrier. Natural barriers include waterfalls or other **natural channel** features. Natural barriers **do not** include beaver dams, log jams, or woody debris piles. Such "organic" obstructions are temporary and in most cases do not block fish. Culverts **do not** count as natural barriers unless located at a natural barrier. A falls, chute, channel gradient change, or lack of livable space **should be considered a barrier if it is more likely that fish could not pass above the channel feature than pass the feature**. The rule very clearly states we **assume fish use only up to the first barrier**.

In order of priority, a barrier to fish use can be determined two ways. First, the stream channel from its confluence with fish use waters can be physically surveyed up to the first natural barrier. This approach can be applied if an actual fish presence survey cannot be conducted due to timing issues; that is, fish may be there at other times of the year, but due to such factors as seasonality of flow, they are not likely to be there at the time the survey must be conducted. Generally, the stream channel should be observed for falls, chutes, and steep channel sections that are likely to prevent upstream fish passage. A map can be examined to prioritize sections of stream to observe in the field for barriers. If barriers are found above confirmed fish use, fish use should be assumed to end there unless fish are observed above the barrier.

The second method is to determine barriers to fish use based upon a map analysis. This method may be applied on a broad scale (in a manner unrelated to receipt of a notification) or on an operation-specific basis. One advantage of the broader scale approach is that landowners and other interested parties will be able to know ahead of time where we will assume fish use if a fish presence or channel survey is not conducted. Therefore, districts are encouraged on a broad scale to map assumed fish on the district maps following the guidance in the mapping section.

The map method is to be applied in the context of "barriers" and not in the context of "the probability of fish use". That is, the channel should be analyzed on the map from its confluence with known fish use to find the first channel feature on the map that is likely to block fish passage.

The notion of probability of fish use can be used in selecting the **methodology** to determine fish use; that is, whether to do a fish survey, a channel survey, or use the map process. However, if physical fish presence surveys cannot be conducted, the only criterion for determining the upstream extent of fish use is the location of the first natural barrier to fish use.

The following criteria are established to define natural barriers that are more likely to not pass fish than to pass fish for either field and/or map application. In applying the criteria, if there are no known waterfalls or chutes, then channel gradient and physical habitat (lack of livable space due to no pools or inadequate water volume) should be considered in determining barriers.

In applying these factors, we should again be assuming a barrier when it is more likely that fish cannot move through a steep channel segment or that the lack of livable space is a barrier. When evaluating a potential barrier, the expected flows during high spring or winter flows should be considered. Conditions for fish passage at a site during low summer flow can be very different from what occurs during high flows. For example, a falls that appears five feet high during low summer flows may be less than three feet high during higher flows. Stream levels based upon bankfull width should be used as points of reference in measuring channel drops.

Barriers to fish use:

a. Falls - physical survey

For salmon and steelhead streams, any falls or steep bedrock chute with eight feet or greater vertical drop is a barrier.

For resident trout streams, any falls or steep bedrock chute with four feet or greater vertical drop is a barrier.

Any falls or steep bedrock chute with less than a two-foot vertical drop is not a barrier.

For falls or steep chutes with vertical drops between those described above, if the falls or chute is without a jump pool or the jump pool depth (estimated to be there during high flow periods) is less than 1.25 times the height of the falls or chute, a barrier exists. For example, a fish *can* jump a two-foot vertical falls if there is a pool 2.5 feet deep at the bottom of the falls, and the falls would not be considered a barrier in this case.

b. Falls - map survey

Any waterfall marked on a map should be considered a barrier.

c. Channel Steepness - physical survey

Any channel segment (30 feet or longer on salmon/steelhead streams and 20 feet or longer for resident trout streams) with a gradient that exceeds 20 percent is a barrier.

Any channel segment (using same length segments as above) with a gradient that exceeds 12 percent should be considered a barrier if the channel is bedrock without pools or low velocity areas, or otherwise does not have pools. This can vary between 12 and 20 percent depending upon channel form (frequency of step pools versus bedrock channel without pools). One advantage of the physical channel survey is that judgment and local experience can be applied in determining whether or not channel steepness is reasonably likely to prevent fish passage. In the map approach, decisions will be based solely upon gradient and not channel form.

d. Channel steepness - map survey

Any channel segment with a gradient that exceeds 20 percent is a barrier to fish use.

Not all steep channel segments will be apparent on a map. Local knowledge should be applied in appropriate situations. For example, if side streams to a main stream with fish characteristically drop steeply to the main stream and these drops have been found to be barriers to fish use even though they may not show on a map, this information should be used to establish a barrier. However, in this situation it is recommended that the expected drop be confirmed by a field visit.

e. Lack of livable space - physical survey

A channel has inadequate livable space to pass fish if it does not contain pools that are approximately a foot or more in depth during spring spawning season or other periods of high flow when fish would normally be expected. During low water periods the channel can be observed for indications that such pools exist during higher spring flows.

f. Lack of livable space - map survey

Coast Range Geographic Region: Basins with a drainage area of 60 acres or less are barriers to fish.

South Coast Geographic Region: Basins with a drainage area of 80 acres or less are barriers to fish.

Interior, and West Cascade Geographic Regions: Basins with a drainage area of 100 acres or less are barriers to fish.

Siskiyou Geographic Region: Basins with a drainage area of 300 acres or less are barriers to fish.

Blue Mountain and East Cascade Geographic Regions: Basins with a drainage area of 350 acres or less are barriers to fish. Streams with known perennial stream flow in these geographic regions, regardless of basin size, should be a high priority for fish surveys.

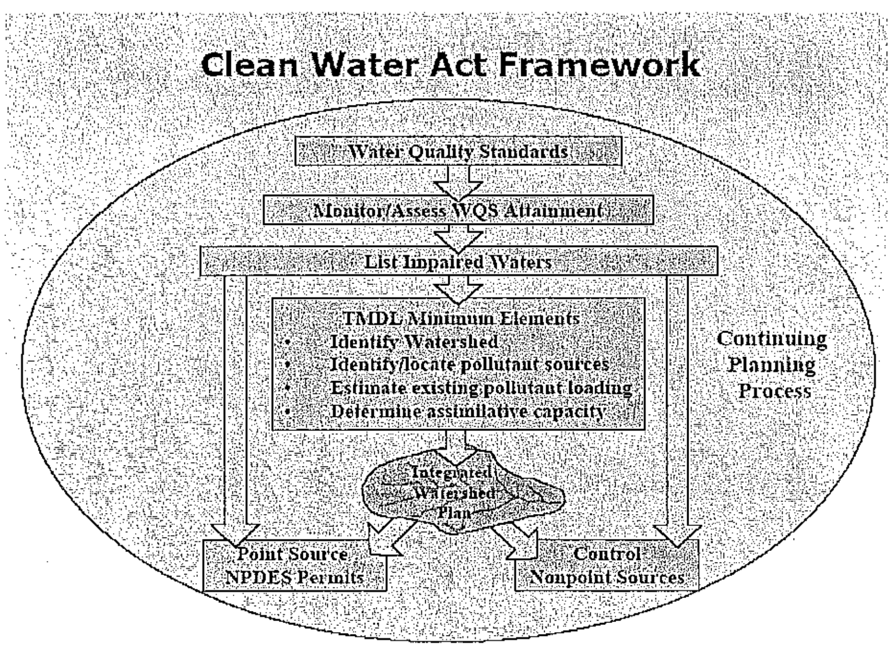
The criteria related to lack of livable space were developed using limited fish presence survey data. These criteria should be used until additional fish presence survey data are locally available. However, as such data are developed locally, districts in coordination with local ODFW biologists may adjust these criteria. Such adjustments must be supported by local data and be consistent with the policies in this guidance related to fish presence. For example, if SWO District and the ODFW district fish biologist agree that actual fish presence data indicates that basins of 400 acres are more likely to prevent fish passage than allow fish passage in areas of the district with less than 20 inches of rainfall, then that criteria may be used in place of the criteria in this guidance.

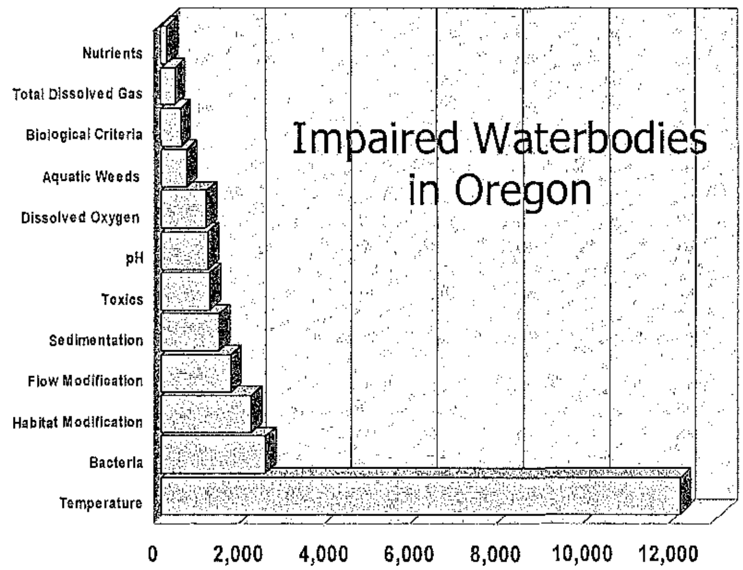
Table 1: Summary Of Interim Process
For Determining Approximate Upstream Extent of Fish Use

<table>
<tr><th colspan="2">Type of Barrier</th><th colspan="2">Physical Survey</th><th>Map Analysis</th></tr>
<tr><td colspan="2" rowspan="3">Falls & Chutes</td><td>Salmon & Steelhead</td><td>Resident Trout</td><td rowspan="3">Any waterfall marked on a map.</td></tr>
<tr><td>8'+</td><td>4'+</td></tr>
<tr><td colspan="2">2'+ require a jump pool 1.25 times the fall or chute height.</td></tr>
<tr><td rowspan="2">Channel Steepness</td><td>With Pools</td><td>30' or more @ 20%+</td><td>20' or more @ 20%+</td><td rowspan="2">20%+</td></tr>
<tr><td>W/O Pools</td><td>30' or more @ 12%+</td><td>20' or more @ 12%+</td></tr>
<tr><td colspan="2">Lack of Livable Space</td><td colspan="2">No pools approximately 12" or more in depth during spring spawning.</td><td>60 Acres or Less (Coast
80 Acres or Less (South Coast)
100 Acres or Less (Interior)
300 Acres or Less (Siskiyou)
350 Acres or Less (Blue Mountain and East Cascade)</td></tr>
</table>

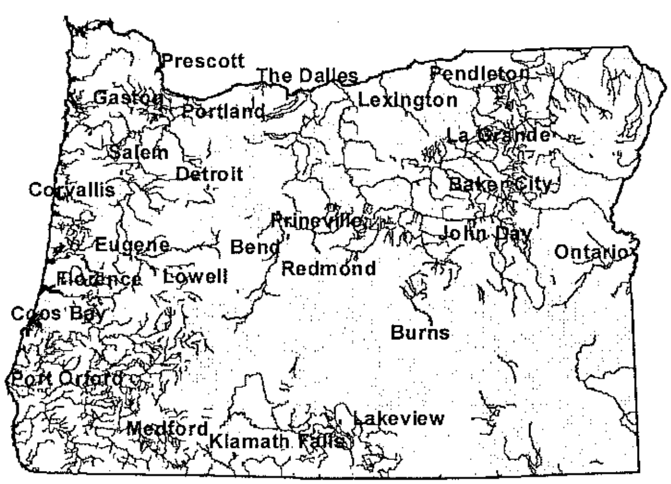
CWA Requires the States to

1. Protect sensitive **Beneficial Uses** by developing **Water Quality Standards.**
2. Classify water bodies that do not meet **Water Quality Standards** as **303(d) Water Quality Limited.**
3. Determine **TMDLs** for **303(d) Water Quality Limited** water bodies.
4. Implement **TMDLs** through NPDES Permits and **Water Quality Management Plans**





1998 303 (d) Listed Streams



Total Maximum Daily Load

- CWA requires to Determine TMDLs for 303(d) Water Quality Limited water bodies.

- A TMDL is for a particular pollutant
- A TMDL represents the amount of pollution a water body can assimilate - the amount beyond which a beneficial use is impaired
- A TMDL is calculated based on the beneficial use that is most sensitive to that pollutant

Total Maximum Daily Load

$$TMDL = WLA + LA_{nps} + LA_{bg} + MOS + RC$$

Waste Load Allocation	Load Allocation Nonpoint Source	Load Allocation Background	Margin of Safety	Reserve Capacity

How do we get there?

- Involve others
- Assemble existing data & gather more data to fully understand streams and pollutant source impacts
- Calculate stream Loading Capacities (how much load before WQ standards exceeded?)
- Allocate allowable inputs
- Document calculations, decisions and plans for reducing pollution
- Submit to EPA for approval

DEQ

TMDL Responsibilities

DEQ calculates TMDLs, sets allocations to reach water quality compliance

Carry out WQMPs

SB1010
Agricultural prohibited conditions
(ODA)

Point Source
Permits
(DEQ)

Forest Practices Act
Forestry prescriptions
(ODF)

Other
urban and rural NPS management
(Local Government)

Federal Land Management Agencies

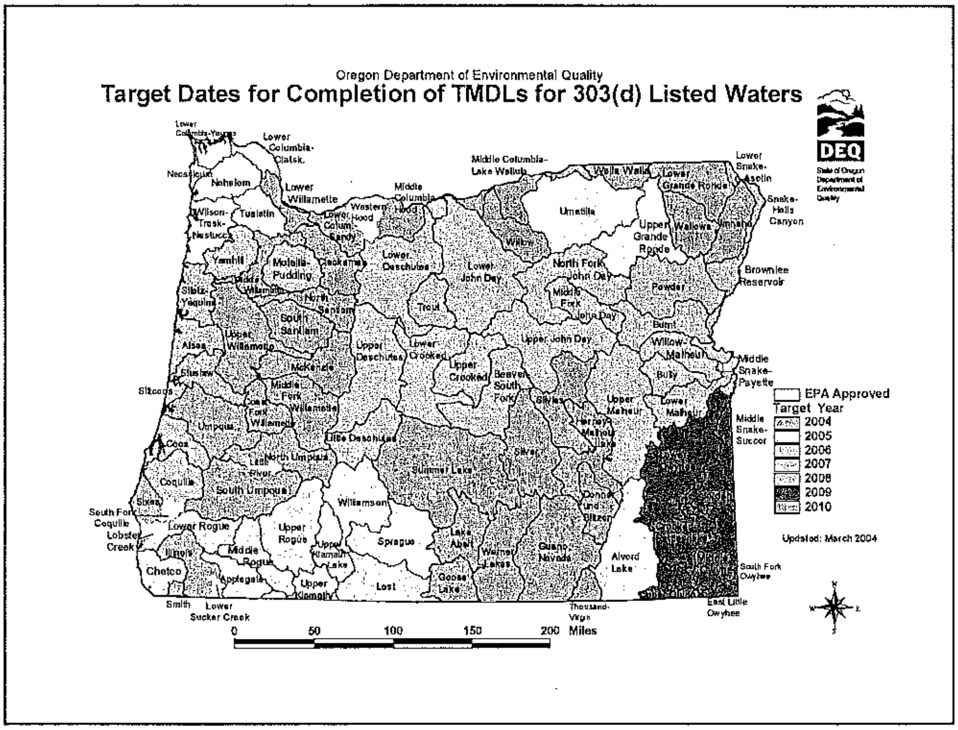
BOF Responsibilities

- 340-042-0080
- Implementing a Total Maximum Daily Load

- (2) The Oregon Department of Forestry will develop and enforce implementation plans addressing state and private forestry sources as authorized by ORS 527.610 through 527.992 and according to OAR chapter 629, divisions 600 through 665.

TMDL Challenges

- Time constraints
- What models to use
- Selecting relevant & understandable indicators
- Allocations
- Reserve Capacity for growing needs
- Adaptive management
- Mixed land use
- Long term enthusiasm
- Funding for implementation


Oregon Department of Environmental Quality
Target Dates for Completion of TMDLs for 303(d) Listed Waters
DEQ
EPA Approved
Target Year
2004
2005
2006
2007
2008
2009
2010
Updated: March 2004
0 50 100 150 200 Miles

Stop Two -- 2002 – 2003 Timber Harvest – 70 acres

- 52ac Tower logging, 18ac shovel logging
- Unit was logged in December of 2002 through February 2003.
- Unit was logged using a small yarder and shovel.
- A small type N tributary of Bewely creek runs through the Unit for a distance of 2600'. A 50' buffer was left on both sides of the west fork of the small N for a distance of 900' and additional wildlife trees tagged along the N for another 200'. Along the East fork a 50' buffer was flagged along one side with pink timber harvest boundary ribbon for a distance of 800' and a 25'wide leave tree buffer was tagged for a distance of 700' along the remainder of the stream.
- <u>Site Preparation</u>
- Herbicide application – September 2003
- Brush Piling- 30 acres October 2003
- Pile Burning – October 2003
- Planting – March 2004
- Trees Planted– 386 Trees/acre

Western Hemlock = 76%
Sitka Spruce = 9%
Noble Fir = 8%
Western Red Cedar = 7%

notes

Small Type N Streams

Current Rule

629-640-0200
General Vegetation Retention Prescription for Type D and Type N Streams
(6) Operators shall retain all understory vegetation and non-merchantable conifer trees (conifer trees less than six inches DBH) within 10 feet of the high water level on each side of small perennial Type N streams indicated in **Table 5**.
(a) The determination that a stream is perennial shall be made by the State Forester based on a reasonable expectation that the stream will have summer surface flow after July 15.
(b) The determination in subsection (6)(a) of this rule can be made based on a site inspection, data from other sources such as landowner information, or by applying judgment based upon stream flow patterns experienced in the general area.
(c) Operators are encouraged whenever possible to retain understory vegetation, non-merchantable trees, and leave trees required within harvest type 2 or harvest type 3 units (pursuant to Section 9, Chapter 9, Oregon Laws 1996 Special Session) along all other small Type N streams within harvest units.

TABLE 5. Vegetation Retention for Specified Small Type N Streams (OAR 629-640-0200 (6))

Geographic Region	Retain Understory Vegetation and Unmerchantable Conifers 10 Feet Each Side of Stream for:
Eastern Cascades and Blue Mountains	All perennial streams.
South Coast	Portions of perennial streams where the upstream drainage area is greater than 160 acres.
Interior	Portions of perennial streams where the upstream drainage area is greater than 330 acres.
Siskiyou	Portions of perennial streams where the upstream drainage area is greater than 580 acres.
Coast Range and Western Cascades	No retention required.

FPAC Recommendation

Type N Streams (Nonfish Bearing) Forest Practice Forester Discretion

a. Small Type NT streams are: 1) Perennial Small Type N (temperature) streams that are tributary and contribute at least 30% of the flow to small and medium Type F streams and that have a drainage area larger than "X" acres (basin size to be set by georegion, 40 acres for the coast range). Initial classification will be based on basin size, but landowners may delist streams or stream segments verified as nonperennial. 2) Small Type N (torrent) streams with drainage basins greater than 30 acres, in which more than 75% of the basin has been mapped as "high" or 50 % "extreme" debris flow hazard (by the State Forester) and which have a high probability of wood delivery to Type F streams.
b. Small NT stream protection: 1) Up to the first 500 feet of Type NT (temperature) stream above the confluence with a Type F stream will have a 50-foot search zone, each side. Within the search zone, retain 4 square feet of trees per each 100 feet of perennial flow (up to 500 feet) and all non-merchantable conifer on each side of the stream. Trees left along these streams to satisfy the basal area requirement can be counted as in-0unit leave trees. 2) "Torrent" type NT streams will be protected as follows – FPF, working with the landowner, has discretion to direct retention of in-unit trees to 50' X 500' search zone (each side).

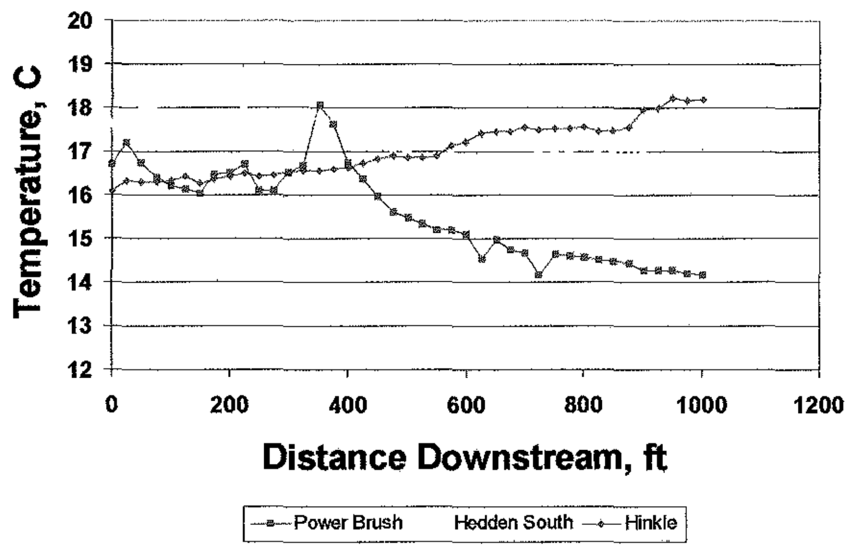
SA Recommendation & Basis for Recommendation

Recommendation #2: Revise current practices so desirable amounts of large wood is available along small stream channels that can deliver debris torrents to Type F streams. Ensure that adequate shade is maintained or rapidly recovered for riparian areas along small perennial Type N streams with the potential to impact downstream Type F waters.

Basis: There is increasing scientific evidence that small non-fish–bearing streams prone to debris flows provide an important source of large wood for downstream fish habitat. It is also known that the removal of shade-producing vegetation along small perennial Type N streams temporarily increases stream temperatures, until regeneration occurs. While these streams are providing some level of functional large wood inputs and shade production under the current rules, the rules were not specifically designed to retain significant sources of large wood and shade in these areas. Current research and monitoring results show the current practices may result in short-term temperature increases in some Type N streams that feed into fish-bearing streams, however, the significance of the potential temperature increases at a watershed (or sub-basin) scale is uncertain.

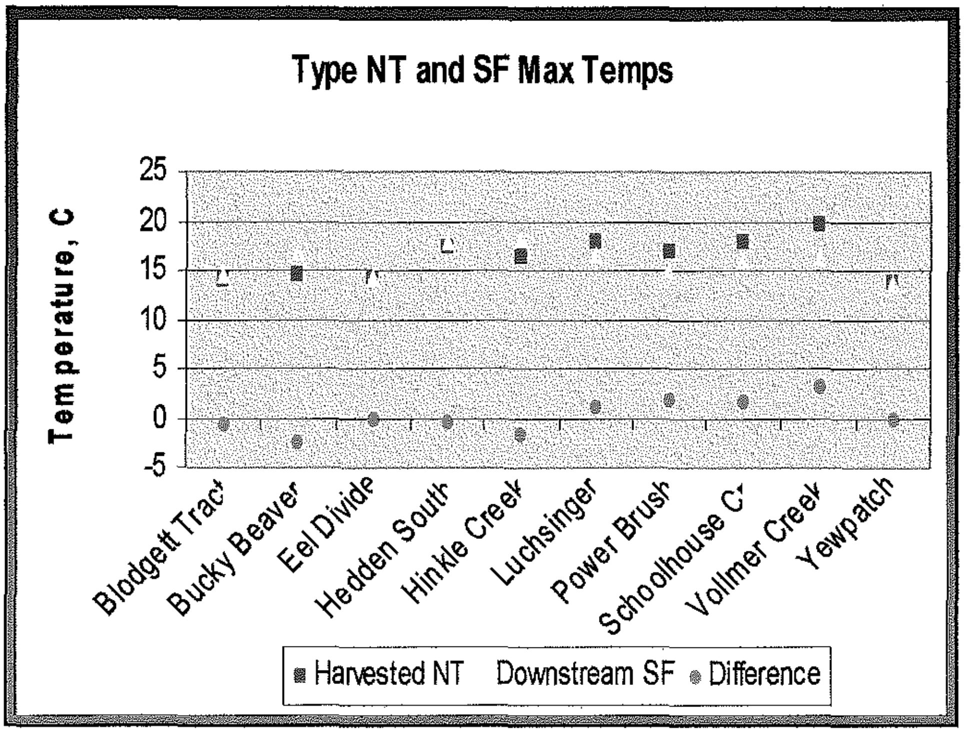
Temperature Profiles

Slides from Arne Skaugset's Presentation to the BOF on 9/7/04



Longitudinal Velocities

	Velocity (fps)	3 hours	8 hours
Blodgett	0.086	930	2,500
Bucky Beaver	0.025	270	720
Eel Divide	0.047	508	1,350
Hedden S.	0.038	410	1,094
Hinkle	0.068	734	1,960
W. Luchsinger	0.009	97	260
Power Brush	0.072	778	2,074
Yew Patch	0.20	2,160	~1 mile
Vollmer	0.28	3,024	~1.4 miles



Some Final Thoughts

- It appears that it will be hard to propagate significantly warm water downstream to fish-bearing streams.
- Small discharges = high heat loads but small velocities.
- Larger velocities = lower heat loads and higher discharges.
- Sub-surface exchange can trump all.
- Predictability is limited

Temperature Standard – Type N streams protection

Although salmonids do not inhabit type N streams, many type N streams are designated for cold-water use on DEQ's fish use designation maps (adopted by reference in OAR 340-041-0101 to 340-041-0340 and accessible on the DEQ website http://www.deq.state.or.us/wq/standards/WQStdsBeneficialUses.htm) because these streams flow into fish bearing waters downstream and thus support the fish uses that occur there. Also, there are likely to be other cold water aquatic organisms present. Therefore, the biologically based numeric criteria or natural conditions criterion apply unless a site specific criteria is adopted to replace them, or unless the use designation is changed via an EQC rulemaking.

In addition to the biologically based numeric criteria and the natural conditions criterion, the Oregon temperature standard contains a cold water protection criterion. This narrative criterion limits the amount of warming allowed due to human activity when stream temperatures are colder than the numeric criteria. This was an important component of the temperature standard for three reasons. First, the criteria are set at the upper end of the temperature range considered optimal for fish health and rearing, whereas access to waters at a variety of temperatures throughout their optimal range is considered most desirable and protective. Second, the colder water reaches provide refugia for fish when lower or warmer reaches exceed desired conditions for part of the day or part of the year. And third, the colder water reaches supply cold water to downstream reaches.

It is this third concern that is most relevant to non-fish bearing streams. If the colder water reaches are allowed to warm up to the numeric criteria, the added heat will be transferred downstream some distance (which will vary depending on individual stream characteristics). Any additional warming from either natural processes or additional human activity within that distance would cause an exceedance of the criterion downstream and the upstream heat load contributes to that exceedance. There is also an equity issue. If the fist activity high in a watershed is allowed to warm the stream up to the criterion, essentially using up all the assimilative capacity, this leaves no assimilative capacity for other activities and sources downstream.

The cold water protection criterion limits the allowed increase from all sources to 0.3 above the current ambient stream temperature at the point of maximum impact in a stream that contains salmon, steelhead or bull trout. This means that at no point along the stream should the cumulative impact of all anthropogenic activity cause the temperature to be raised more than 0.3°C. Typically there are multiple activities in a watershed that may contribute heat loading to the stream, including logging, roads, grazing, recreational facilities and rural residential development. Forest practices do not necessarily need to be set to meet the 0.3°C increase limit at the base of a clear cut on a type N stream, but they should likewise not be set under the assumption that one single clear cut is the only activity contributing heat to the fish bearing segment of the stream.

notes

Clean Water Act of 1972

- Objective: to restore and maintain the chemical, physical and biological integrity of the Nation's waters.

Purpose of Water Quality Standards

- **Set goals for the Nation's waters**
- **Regulatory basis for pollution control**
- **Protect the public health or welfare, enhance the quality of water and serve the purposes of this Act (CWA)**
- **Fully protect beneficial uses**

Beneficial Uses

- Drinking Water
- Industrial Use
- Irrigation and & Livestock Watering
- Aquatic Life
- Wildlife and Hunting
- Fishing and Boating
- Water Contact Recreation
- Aesthetic Quality
- Hydro Power
- Navigation and Transportation

WQS Parameters

- Bacteria
- Biological Criteria
- Dissolved Oxygen
- Nuisance Phytoplankton Growth
- pH
- Temperature
- Total Dissolved Gas
- Total Dissolved Solids (TDS)
- Toxic Substances
- Turbidity

Triennial Standards Review

- Use best scientific information available
- Numeric criteria set to protect the use of the water body
- Standards are set for wide application
- Local circumstances may be unique - when there is reliable evidence, a specific criteria supersedes the general

Technical Analysis

- Identify sensitive beneficial uses
- Determine needs of sensitive uses
- Identify levels that fully protect sensitive uses
- Create technical options for providing full protection

Use Not Supported	Some Impact	No Measurable Impact	Natural Condition

Policy Analysis

- Work with Policy Advisory Committee
- Evaluate impacts of technical options
  - to regulated community
  - to public
- Recommend level of protection desired, within legal sideboards of CWA, ESA
- Recommend standards to EQC

"Alaska" Rule/ EPA Approval

- Standards adopted or revised after May 2000, will not be effective for CWA purposes until approved by EPA
- States may apply standards more stringent than previous standards prior to approval

FOUR TYPES OF TEMPERATURE CRITERIA

- Biologically based numeric criteria
- Natural conditions narrative
- Existing cold water protection
- Site-specific criteria

COLD WATER PROTECTION

- Prevents cold streams from being warmed more than 0.3°C above the *current ambient stream* summer temperature
  - Fish need range of cold temperatures
  - Warming these reaches may lead to summer exceedance of criteria downstream
- Does not apply if no T/E species present, and cold water not required to meet criteria downstream
- Up to 1°C increase limit applies to spawning reaches in fall, winter and spring

Temperature Monitoring Conclusions: Based on ODF monitoring results and other studies, the following general conclusions can be made regarding forest harvesting and stream temperature, as it pertains to the water protection rules.

- For small, headwater streams, while stream temperatures can increase after harvest, there is the potential for temperature increases due to canopy removal to diminish within 500 feet downstream of the harvest activity (Caldwell et al. 1991). It should be noted, however, that magnitude of recovery of cooler temperatures in downstream shaded reaches is highly variable, and dependent on reach-specific heat exchange processes.

- For stream reaches through managed RMAs and RCRs on medium and large streams, Dent and Walsh (1997) found that 90 percent of the time, those streams that were monitored had temperatures at or below the 64°F numeric criteria. Dent and Walsh (1997) could not separate out the proportion of the temperature increase that is attributable to a partial decrease in shade versus the proportion that is attributable to any expected downstream increases in stream temperatures. Further study of the effects of RMA prescriptions and RCRs on stream temperatures with pre-harvest data and a basin-wide perspective is needed to more adequately estimate the range of harvesting effects on stream temperature. The Oregon Department of Forestry will be analyzing their complete temperature monitoring database in 2003. This may help address some of the unresolved issues.

Shade Monitoring Information

To the extent that current practices may result in changes in shade, thereby influencing stream temperatures due to change in solar radiation inputs to the stream, the ODF Technical Report on the Riparian Functions Study (ODF 2001a) provides some additional information relevant to FPA effectiveness (Figure 3). Findings from this study indicate that shade levels along large Type F streams are likely to remain relatively unchanged following harvest activities, where observed variations in shade are within the range of measurement error (± 10%). Most medium Type F streams also did not have changes in shade levels outside the range of measurement error, with only two out of eight sites resulting in shade reductions greater than 10 percent. A substantial proportion of the small Type F streams (four out of nine), exhibited shade reductions in excess of 10 percent in the year following harvest activity.

The ODF Shade Study (ODF 2001b) also provides some additional information relative to FPA effectiveness. (See Appendix I for additional information on this study.) It is important to note this study was not designed to compare pre- and post-harvest conditions, given the fact that data was collected over a single season. There is also a high degree of variability in site characteristics between some sites monitored in this study. Any attempt to draw specific conclusions about the importance of an individual riparian characteristic's influence on shade can be problematic. Despite these caveats, a qualitative comparison of shade conditions observed between site categories is presented in Table 5 and Figure 6 (ODF 2001b). The following are excerpts from the Shade Study final report:

"For those sites monitored in this study, shade was general[ly] lower on large streams than on small and medium streams. For unharvested streams[1], shade was lower on large streams than on small and medium streams by an average of 5% and 9% in the Blue Mountain and Coast Range Georegions, respectively. However, the small sample size and wide range in shade on large streams limits the explanatory power of stream size on shade [Table 5 and Figure 6]. There was considerable overlap between shade values over small and medium size streams for both harvested and unharvested streams in both georegions. Two extreme points are displayed in the box plots [Figure 6] for the harvested Blue Mountain and Coast Range streams. While the low shade value in the Coast Range may be explained by blowdown, there is no readily apparent reason for the extreme point in the Blue Mountains. . ."

"Average stream shade in harvested stands was 15% and 11% less than unharvested stands in the Blue Mountain and Coast Range Georegions, respectively. In the Blue Mountain Georegion, the average shade was 58% and 73% for harvested and unharvested streams, respectively. In the Coast Range Georegion, the average shade was 73% and 84% for harvested and unharvested streams, respectively. Differences in shade between harvested and unharvested reaches ranged from 44% lower to 6% greater and 38% lower to no difference in the Blue Mountain and Coast Range Georegions, respectively. Harvested stands also had greater variability than unharvested stands for both georegions. While the upper ranges of shade are comparable to unharvested stands, shade over streams adjacent to harvested stands had much lower minimum shade levels (-21%)."(ODF 2001b)

Cold-Water Refugia

Oregon forested watersheds exhibit a high degree of variability in water temperature. The existence of 'cold-water refugia' is an important component of salmonid habitat because they provide holding (resting) and rearing habitat for juveniles and adult fish. Types of cold-water refugia include, but are not limited to: tributary mouths; lateral seeps; pool bottom seeps; and groundwater-to-surface interaction zones (Bilby, 1984).

Bilby (1984) determined the mouths of tributaries in a western Washington stream (Thrash Creek) averaged 8.5°F lower than the average stream temperatures of the receiving waters fed by the tributaries. Cool water pockets located at tributary mouths of western Washington streams constituted less than 1.5 percent of the overall flow volume of the watershed, while cool water areas of all types accounted for approximately 2.9 percent of the total water volume (Bilby, 1984).

[1] "Unharvested" streams are defined in this study as having not been disturbed for at least 25 years and a maximum of 160 years. Fire may have been excluded from some of these stands, especially in the Blue Mountain region.

Table 1. Water quality parameters, applicable standards and/or criteria, and applicable FPA rule objectives. (See Appendix E and F for a complete description of the standards and criteria.)

<table>
<tr><th>Para-meter</th><th>Paraphrase of State Standards and/or Criteria</th><th>FPA Goals and Objectives</th></tr>
<tr><td>Temperature</td><td>Various numeric and narrative standards to protect beneficial uses.

OAR 340-41-(basin)(2)(b)</td><td>"The desired future condition for streamside areas along fish use streams is to grow and retain vegetation so that, over time, average conditions across the landscape become similar to those of mature streamside stands." OAR 629-640-0000(2)

"The desired future condition for streamside areas that do not have fish use is to have sufficient streamside vegetation to support functions and processes that are important to downstream fish use waters and domestic water use . . ." OAR 629-640-0000(4)</td></tr>
<tr><td>Sedimentation</td><td>The formation of [any] deposits deleterious to fish or other aquatic life or injurious to public health, recreation, or industry shall not be allowed.
Documentation should indicate that there are conditions that are deleterious to fish or other aquatic life.
OAR 340-41-(basin)(2)(j)</td><td rowspan="2">"The purpose of the road construction and maintenance rules is to . . . provide the maximum practical protection to maintain forest productivity, water quality, and fish and wildlife habitat." OAR 629-625-0000(3)

"The purpose of the harvesting rules is to establish standards for forest practices that will maintain the productivity of forestland, minimize soil and debris entering waters of the state, and protect wildlife and fish habitat." OAR 629-630-0000(3)</td></tr>
<tr><td>Turbidity</td><td>A systematic or persistent increase (of greater than 10%) in turbidity due to an operational activity that occurs on a persistent basis (e.g. dam release or irrigation return, etc).
OAR 340-41-(basin)(2)(c)</td></tr>
<tr><td>Habitat Modification</td><td>The creation of . . . conditions that are deleterious to fish or other aquatic life . . . shall not be allowed.
Documentation that habitat conditions are a significant limitation to fish or other aquatic life.
OAR 340-41-(basin)(2)(i)</td><td rowspan="2">"The desired future condition for streamside areas along fish use streams is to grow and retain vegetation so that, over time, average conditions across the landscape become similar to those of mature streamside stands." OAR 629-640-0000(2)

"The desired future condition for streamside areas that do not have fish use is to have sufficient streamside vegetation to support functions and processes that are important to downstream fish use waters and domestic water use . . ." OAR 629-640-0000(4)

"The purpose of the road construction and maintenance rules is to . . . provide the maximum practical protection to maintain forest productivity, water quality, and fish and wildlife habitat." OAR 629-625-0000(3)

"The purpose of the harvesting rules is to establish standards for forest practices that will maintain the productivity of forestland, minimize soil and debris entering waters of the state, and protect wildlife and fish habitat." OAR 629-630-0000(3)</td></tr>
<tr><td>Biological Criteria</td><td>Waters of the state shall be of sufficient quality to support aquatic species without detrimental changes in the resident biological communities.
OAR 340-41-027</td></tr>
</table>

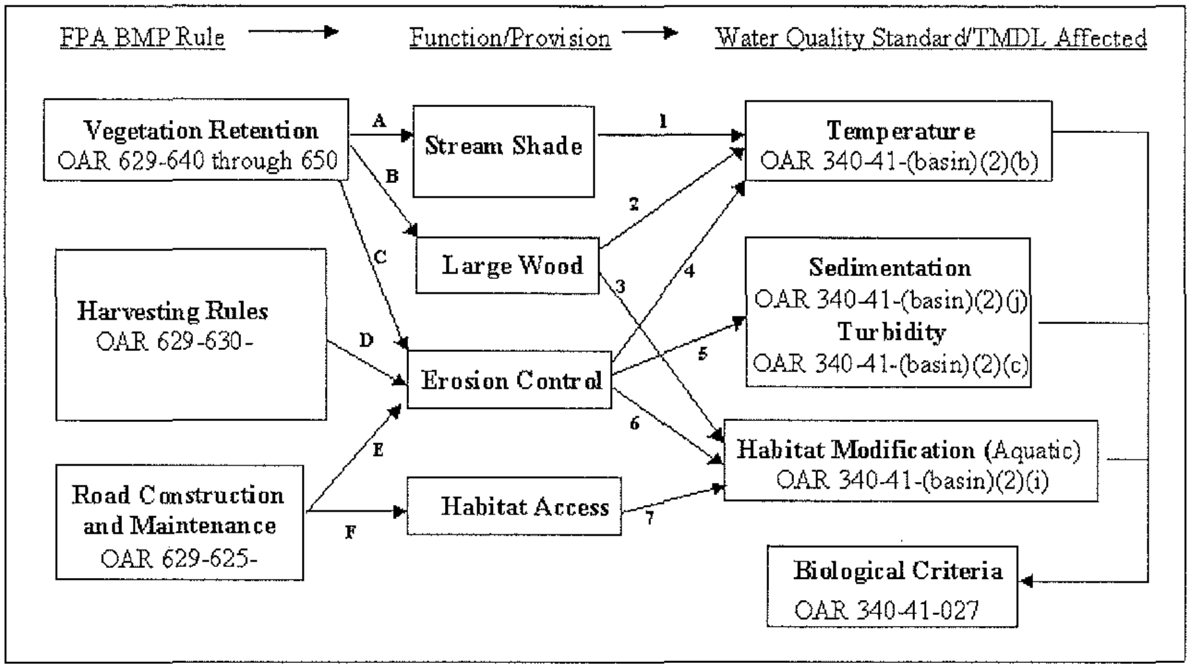


Figure 1. Water quality function pathways between the FPA and water quality criteria and standards.

Table 2. Overview of potential water-quality-protective functions related to forest practices (see Figure 1).

Flowchart Pathway	*Function/Provision Description for Specified Parameter*
	Water Temperature
A1	Retained trees and understory vegetation in riparian areas adjacent to streams provide shade to streams. Shade reduces heat loading from solar radiation at levels corresponding to the percent effective shade on the stream, and can attenuate diurnal maximum and minimum stream temperatures.
B2	Large wood, placed or fallen into streams from retained riparian vegetation and positioned in the stream channel, may increase the complexity of in-channel habitat, creating pools and riffles. Deep-water areas of cooler temperatures, or cold-water refugia, can also result from large wood in streams.
C4	Vegetation retention on banks can decrease channel bank erosion and prevent channel widening. Narrow channels receive less solar radiation and stream heating relative to wider channels (all else being equal).
D4, E4	Road construction and maintenance practices that minimize sediment inputs to streams, such as location, drainage control, hard surfacing, and choice of hauling time, may prevent channel widening and temperature increases as described in C4.
	Sedimentation and Turbidity
C5	Vegetation retention on banks can decrease channel bank erosion, decreasing sediment inputs.
D5, E5	Road construction and maintenance practices that minimize sediment inputs to streams, such as location, drainage control, hard surfacing, and choice of hauling time, reduce undesirable levels of sediment and turbidity inputs.
	Habitat Modification
B3	Tree retention in riparian areas may provide future recruitment of large wood to streams. Historically, large wood in channels recruited from fallen trees has been a valuable component of aquatic habitat. Managed placement of large wood can be an effective means to accelerate inputs.
C6, D6	Large wood, placed or fallen into or near streams from retained riparian vegetation may serve to trap sediments in place, influencing habitat quality.
E6	The movement of large wood and sediment downstream is an important function that provides for, and maintains, fish habitat. Stream crossings that are designed to accommodate this function can have a positive influence on habitat quality.
F7	Culverts that block fish passage reduce the amount of fish habitat available.
	Biological Criteria
Interrelated	Forest practices that influence water quality with respect to temperature, sedimentation, turbidity, and habitat modification may also affect biotic populations with respect to the biological criteria standard.

notes

STIMSON LUMBER COMPANY'S TILLAMOOK TREE FARM

Stimson Lumber Company is a privately owned company that traces its roots back to the 1850s, making it one of the oldest, continuously operated forest products companies in the United States. Stimson's corporate office is located in Portland and has operations in Oregon, Washington, Idaho and Montana. Stimson has a long tradition of responsible forest management and is committed to the practice of sustainable forestry. To further this commitment, we support the comprehensive program of forestry and conservations practices called the Sustained Forestry Initiative (SFI[sm]) program. The SFI program defines how the forest and related resources shall be sustained. For example, the SFI program requires protection of water and air quality, prompt reforestation after harvest, promoting wildlife conservation, and continuously improving our practices and forest management activities to ensure long-term forest productivity and usage. To ensure these resources are protected, the program has specific requirements that must be met in order for a landowner or company to prove compliance. Stimson has undergone a number of audits by independent, third-party auditors to verify that we are in compliance with the principles and objectives of the SFI program. Stimson Lumber Company purchased the 26,000-acre Tillamook Tree Farm in the fall of 2002 from Weyerhaeuser Corp. and this property was included in our 2003 SFI audit.

Stimson Lumber Company takes an active role in improving fish habitat and voluntary replacing and up-grading fish passing pipes. Since acquiring this Tillamook tract, Stimson has voluntary replaced approximately 20 culverts that were blocking fish passage. As part of their yearly management plans and company policies Stimson Lumber Company actively identifies fish blockages from past practices and restores fish habitat across their ownership through replacing pipes, creating structure, leave tree retention, and excellent riparian management practices. As an on going part of the commitment to the SFI program, the Salmon Recovery Plan and Stimson's long-standing stewardship philosophy, we are currently scheduled to replace over 600 relief and fish-friendly culverts over the next five years on the Tillamook Tree Farm. The estimated cost is approximately $150,000 to $200,000 per year. As a whole, the company has been actively replacing culverts on their lands for the last ten years and has completed over 90% of their lands in Oregon.

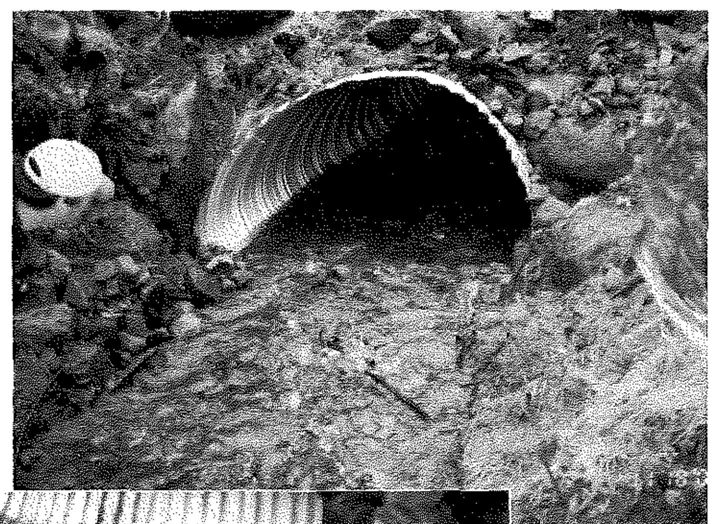
At this location two old pipes were a significant fish impediment and barrier. Both of the old pipes were undersized and had outlet drops in excess of 7 plus feet, not allowing fish to pass into the upper reaches of the Tillamook River System. These two pipes had been blocking fish passage for trout and salmon species for almost 2 decades.

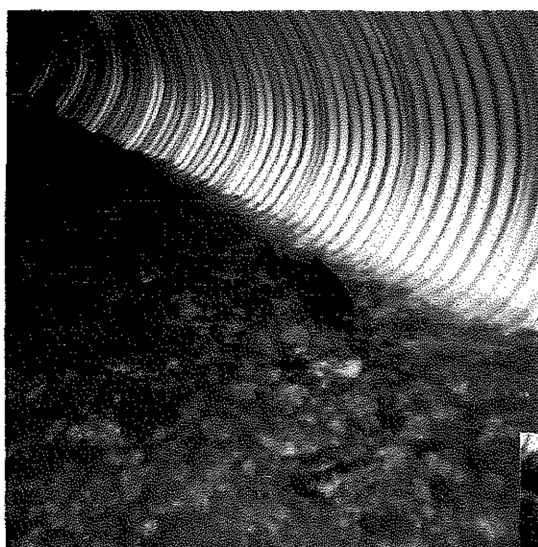
The old existing pipes were approximately 60 and 48 inches in diameter and not adequate for the 50-year flood event or fish passage. In 2001, Willamette Industries replaced the first pipe with a 114 inch diameter by 100 feet long structure, which is twice a big as the previous. The second pipe was replaced with a 84 inch by 90 feet pipe, again twice as big as the previous pipe. The extremely large pipes accomplish two objectives. First, the pipes are large enough to pass a 100-year flood event and secondly, both pipes were counter sunk so they could develop a "natural bottom" making fish use for both adults and juveniles outstanding.

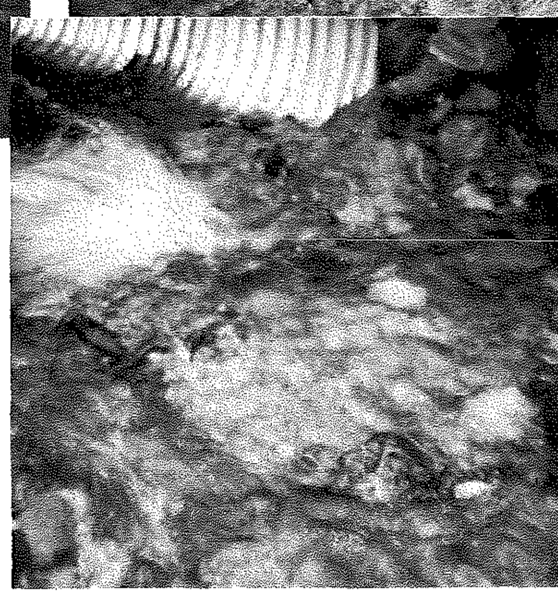
Willamette Industries forest road engineer who designed the layout of the pipes specifically for fish use was in consultation with the ODF Stewardship Forester and ODFW. The installation of the fish pipes was in accordance with the Fish Passage Guidance and the overall goal being to increase access into the upper reaches of the Tillamook River System. By voluntary replacing and up-grading these pipes it opened up additional spawning habitat for adult salmon and trout species.

Success Story: Within the first month of installation adult salmon were able to pass through both of the newly installed pipes and spawn in the upper end of the Tillamook river system, something that had not been done in the previous decades. The installation of these two pipes opened up approximately 1.25 miles of new spawning beds. Lampreys, a species not present before the installation of the new pipes, now are present in upper reaches of the Tillamook River.

Four years later, another voluntary "fish friendly" pipe was replaced in the Tillamook River system on this property. This installation took place approximately a half mile up stream from the first two and was also impeding fish passage. Once again, within the first two weeks adult Salmon were able to pass through the newly installed fish pipe and access another three quarters of a mile of new spawning ground. The operator's received letters of accommodation for their installation of the new fish pipes. Also, Stimson Lumber Company was recognized for its outstanding management practices, stream enhancement, and fish passage and was nominated for a Landowner Stewardship award in 2004.







Oregon Plan Accomplishments*

Road Erosion and Risk Project

Industrial & Non-industrial Landowner Reported Projects

Year	Road Miles Surveyed	Road Miles Improved	Vacated	Closed	Relocated	Peak Flow	Surface Drainage	Fish Passage
1997	2684	309	12	17	.81	492	999	140
1998	6828	382	17	32	.83	894	2064	214
1999	3694	465	57	36	1.46	1074	2301	210
2000	1096	403	28	62	.96	1109	2752	180
2001	855	377	30	55	1.00	1068	2570	196
2002	418	376	21	20	.44	1150	2307	133
2003	654	199	5	28	.28	450	1088	91

Definition of Terms

Surveyed	Protocol has been developed in a joint effort among ODFW, OSU, ODF and OFIC. The protocol addresses risks from road surface, fill and cut slopes, and stream crossing structures. Training on protocol was provided in 1997.
Improved	Road associated landslide & debris flow stabilization.
Vacated	Roads reclaimed. Can range from only grading & seeding to complete reclamation to 'original contour'.
Closed	Roads closed to eliminate deterioration due to traffic.
Relocated	Miles of roads relocated outside RMA or stream banks or to reduce washout potential.
Peak Flow	Structures installed to meet 50+ year peak flow requirements
Surface Drainage	Cross-drains or culverts installed to improve sediment filtration. Includes erosion protection of outlets & road surface.
Fish Passage	Road/Stream crossings improved for juvenile & adult fish passage, side channel access, fish ladders, removal of push-up dams, &/or fish screens installed.

*Figures courtesy of Oregon Watershed Enhancement Board's Watershed Restoration Inventory database. Numbers reflect work that was voluntarily done.

Oregon Plan Accomplishments*

Riparian Management & Instream Habitat Projects

Industrial & Non-industrial Landowner Reported Projects

Year	Riparian Management	Conifer Restoration	Place Large Wood
1997	139	20	76
1998	173	11	92
1999	242	15	50
2000	233	4	57
2001	253	4	26
2002	196	2	39
2003	201	1	24

**Only one of the reported riparian management activities was conducted by a non-industrial landowner.

Project Descriptions

Riparian Management:	
• Additional Conifer Retention on Fish Streams	Speed the rate the desired future condition is reached to provide large wood and other riparian functions – no more than 25% basal area exceeding the standard target is harvested.
• Increase RMA on Small Non-Fish Streams	Establish 20-foot RMA to increase potential large wood delivery to fish bearing streams
• Leave Tree Placement & Additional Voluntary Retention	Landowner opts to leave more than the required 25% of leave trees within the RMA.
• Voluntary No-Harvest RMA	Landowner elects to not harvest within the RMA even though the FPA allows harvesting to occur.
Conifer Restoration	Establish conifers where conifers are preferred for long-term habitat needs.
Place Large Wood	Place large wood in stream during harvest operations to provide immediate habitat benefits in economically efficient manner.

Fish Passage Requirements: Overview

Since August 2001, the owner or operator of an artificial obstruction located in waters in which native migratory fish are currently or were historically present must address fish passage requirements prior to certain trigger events. Laws regarding fish passage may be found in ORS 509.580 through 910 and in OAR 635, Division 412.

Trigger events include installation, major replacement, a fundamental change in permit status (e.g., new water right, renewed hydroelectric license), or abandonment of the artificial obstruction. Further details concerning triggers can be requested from the Oregon Department of Fish and Wildlife (ODFW).

Native migratory fish include native salmon, trout, lamprey, sturgeon, and suckers, as well as a few other species. It is ODFW's responsibility to determine the current or historical presence of native migratory fish; for streams lacking data this determination may be based on professional judgement. If the owner/operator knows that native migratory fish are or were present at the site, then the owner/operator does not need to contact ODFW for this determination and may proceed with meeting fish passage requirements on their own information. However, if the owner/operator does not think native migratory fish are or were present, or is unsure of presence, ODFW should be contacted to make the determination.

Addressing fish passage requirements entails the owner/operator obtaining from ODFW: 1) approval for a passage plan when passage will be provided, 2) a waiver from providing passage, or 3) an exemption from providing passage. It is the intent of state fish passage laws (ORS 509.585(1)) that, in most cases, option #1 should be sought and passage should be provided at the artificial obstruction.

Note that complying with ODFW's fish passage requirements is likely not the only regulatory approval needed to perform many actions at or in relation to an artificial obstruction. Oregon Department of State Lands, Oregon Water Resources Department, US Army Corps of Engineers, NOAA Fisheries, other ODFW sections (e.g., habitat and fish salvage), or other local, state, or federal agencies may also have permits or requirements which must be met.

Stop Three – Recovery Following Harvest

- 82 acre harvest – Weyerhaeuser Corp.
- Logged 2001
- Planted spring 2002

Key Policy Implications of the White Paper - Forest Practices "Protection" on Forestlands in a Context of Dynamic Ecosystems

It may be ironic that we describe forests within a context of disturbance, followed by "recovery" through succession to mature forest. In my ongoing evolution of thought on this matter, I am beginning to think that it is just as reasonable to view disturbance as the "recovery." In any case, terms like protection and recovery reinforce the thought processes that have created and maintained a static view of forests and reinforce the view that protection means preventing change. There is a very strong and legitimate ongoing scientific debate around this issue. There is a lot of research that is pointing the way to a paradigm shift. However, the process to collect and synthesize this research and to force meaningful dialogue has not yet occurred. Creating the scientific foundation for this change is critical and strong leadership is needed. Both the Department and Board will need to work with OSU College of Forestry to help create the conditions for building the necessary scientific foundation.

From a policy perspective, the Board of Forestry has a unique responsibility to seek cost-effective resource protection solutions. Trying to emulate the "historic range of natural conditions" on private forestlands is no longer possible or likely desirable given their roles. Thus, an alternative way to view protection is to, consistent with the applicable land management objectives, emulate key functions and processes, or subsets of key functions and processes, as is determined to be necessary to adequately maintain fish habitat and water quality. With this in mind, vegetation can be retained more efficiently if retention emphasizes specific locations where disturbance will occur and where interaction with the vegetation and disturbance events will do the most good for habitat values. Retention should also have in mind production of trees with adequate size based upon the type of disturbance interaction, likely functions and depletion rates. We probably have or will soon have the technical tools to better retain vegetation with these objectives in mind. Both active and passive approaches are legitimate methods in the private forestland setting and some processes may be more efficiently maintained through active management or from the more "engineered perspective." However, these approaches are much more complex than the current forest practice rules. Since we do not know yet what is "adequate" or what will be effective in the longer-term we should seek out forest managers willing to apply different approaches and apply research or monitoring requirements.

Listed below are additional conclusions and specific recommendations.

1. We should work with OSU College of Forestry and others to create and implement a process to build the scientific foundation necessary to support policy and technical changes that improve consistency of forest practices and forest management with the concepts of dynamic forest ecosystems and "primary purpose". Tools are also needed to: (a) better analyze short- and long-term risks; and (b) better analyze, at different scales, how well the different forest ownerships integrate to provide necessary resource protection.

2. It is important to recognize that considerable intellectual and scientific "horsepower" will be needed to think out of the box and avoid falling back into the more comfortable approach of "protection means preventing change."

3. The different roles that federal, state and private lands should play in "overall maintenance" of fish and wildlife when determining the degree that forest practices on private lands should contribute to the overall maintenance, or with maintenance of specific resource sites, should be better described in forest practice statutes.

4. To be successful in making changes to implementation of forest practices, we will need to consider the existing limitations of current overarching policies, especially the ESA, CWA and resultant water quality standards. In this context, protection means, "limit disturbance." The challenge of these limitations should not be underestimated. To begin to address these limitations, the "dynamic ecosystem" and "primary purpose of the land" concepts needs to be better promoted as state conservation policy and, especially, as federal policy.

5. Wildfire, the dominant "natural" change agent is not acceptable in wood production, urban and some multi-resource forests, i.e., managed forests. Managed forests do not have an analog for severe stand replacement fires or most other fire regimes. Managed forests also are by policy meeting a different purpose than emulation of natural conditions. There is no analog in nature for 50-year rotations and riparian buffers. Thus, managed forest cannot reasonably be expected under current policies to emulate all or even most natural conditions.

6. Practices on managed forests that do not emulate natural conditions or that result in changes to delivery of functions and processes cannot be considered failures because those are not the primary purposes for those forests. However, research is needed to document that the modified processes compatible in managed forests will appropriately maintain fish and wildlife. The Hinkle Creek Paired watershed study and its replications are critical in this effort. Hinkle Creek and other sites need to be used to experiment with different designs and approaches to riparian and aquatic ecosystem protection. At this point in time, investments in Hinkle Creek style research appear to be a better use of resources than arguing about incremental increases to riparian protection. Nonetheless, we need to be humble by acknowledging that managed forests are an adaptive experiment.

7. New incentive tools to encourage private landowners to actively manage riparian areas may be needed. Forest Practices Monitoring shows that the majority of landowners are not entering riparian areas along fish-use streams, under current rules. A new, disturbance-based approach to long term resource maintenance cannot be successful without landowners and operators actively engaged in it. To this end, "canned" site-specific prescriptions may be necessary to assist landowners to try alternative practices when site conditions are appropriate. These canned prescriptions could address such other factors as inner gorges, slope, unstable sites, floodplain and terrace configuration.

8. The existing water protection system is generally functioning well. Monitoring data indicate high levels of compliance and outcomes consistent with protection objectives. Nonetheless, the system is dominated by limiting disturbance in riparian areas. Thus, we fundamentally need to change viewing resource protection as trying to prevent disturbance. While there is logic for not accelerating some types of disturbance; e.g., the rate of landslides due to some forest practices, there is an equal logic that we need to be "causing" disturbance (landslides) in some locations, possibly by loading the sites with wood. Similarly, in most cases wind throw of buffers should not be viewed as a failure. Alternatively, retaining standing buffers may not always be the best approach. It may be better to allow felling or pulling trees into a ('transport") channel to mimic a disturbance pulse, while allowing enough disturbances to permit reforestation.

9. Applying resource protection based on the concept of a desired future condition for riparian vegetation as described dominantly by conifer basal area is probably an inadequate concept. Key processes need to be considered and maintained. Key processes will be different in different regions of the state. Upslope processes for delivery of wood and sediment are highly important in some regions. Moderate to large pulses that are a combination of downed wood and sediment are needed in many areas for both protection and restoration.

10. A broader range of desired conditions for stands and landscapes that can be applied on a site-specific basis appears highly desirable. As stated above, to implement such a system may require a range of "canned prescriptions" based upon stand type and existing conditions. Riparian foresters may be required to help landowners implement such a system. A mix of desired future conditions along with some form of PFC or other assessment may be useful at the site and watershed level to implement or develop site-specific prescriptions.

11. Approaches such as "stewardship agreements" may be useful tools to provide landowners a watershed framework for implementing a range of alternative riparian protection strategies.

12. Tools are developed that can allow us to prioritize locations that have a high probability of delivery of sediment and wood from upslope sources to areas with high fish habitat potential. These tools might allow a remix of trees currently allocated for retention along streams to be better allocated elsewhere.

13. While this paper provides a starting point for a technical and intellectual basis for making modifications to forest practice program implementation, it is just a start and this work requires critical evaluation and discussion.

Tillamook Bay Watershed

State of Oregon
Department of Environmental Quality

(Portions extracted from "Tillamook Bay Environmental Characterization: A Scientific and Technical Summary", Tillamook Bay National Estuary Project, July 1998)

WATER QUALITY CONCERNS: The federal Clean Water Act (CWA) requires each state to undertake specific activities to protect the quality of their rivers, estuaries and lakes. DEQ is required to develop and implement water quality standards that protect sensitive beneficial uses of waters throughout Oregon. Section 303(d) of the CWA requires each state to develop a list of waters that do not meet the water quality standards. These are called Water Quality Limited waters. The Tillamook Bay Watershed was included as Water Quality Limited for Temperature and Bacteria on the 1998 303(d) list. The number of segments and parameters that exceed water quality standards in the Tillamook Watershed are summarized below. In addition, sedimentation is a parameter of concern throughout the basin and several sloughs in the lower watershed have low dissolved oxygen levels. For more information on streams that are listed in the Tillamook watershed, go to: http://waterquality.deq.state.or.us/WQLData/SubBasinList98.asp.

Water Quality Limited Waters in Tillamook (from 1998 303(d) List)	
Total Number of Water Bodies Listed	20
Parameter	**Number of Segments Listed**
Bacteria	15
Temperature	12

Total Maximum Daily Loads: The CWA further requires DEQ to develop Total Maximum Daily Loads (TMDLs) for all water quality limited waters. Generally speaking, TMDLs define the maximum amount of controllable impacts a water body can accept and still assure that designated beneficial uses are being adequately protected. DEQ has developed TMDLs for temperature and bacteria in the Tillamook Bay Watershed. These were approved by EPA on July 31, 2001.

Available Documents:
Tillamook Bay Watershed Total Maximum Daily Load and Water Quality Management Plan
Tillamook TMDL Appendices
Response to Public Comments Document
Fact Sheet: Implementation and Enforcement of TMDLs
Fact Sheet: Tillamook Bay Watershed Bacteria TMDL
Fact Sheet: Tillamook Bay Watershed Temperature TMDL

DEQ Tillamook Basin Coordinator: Please contact the following people for more information about the Department's efforts in the Tillamook watershed:

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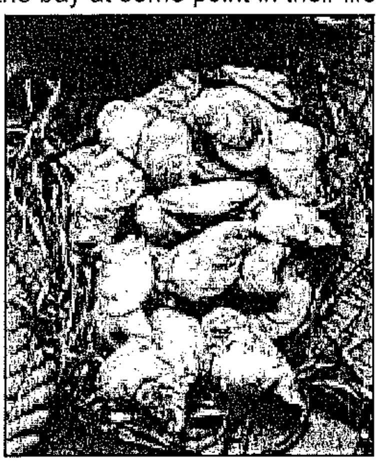
<u>**THE SETTING:**</u>

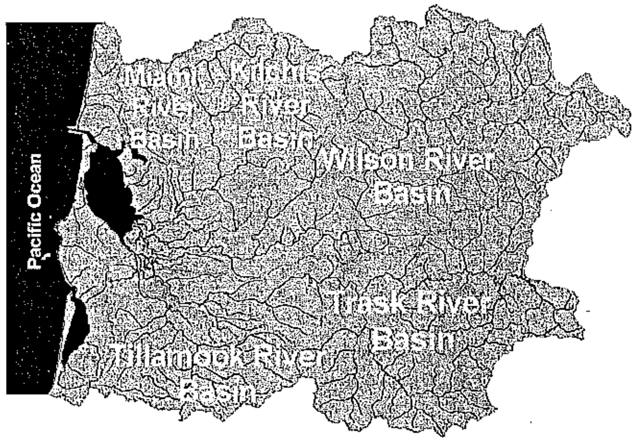
<u>Tillamook Bay and its Uses:</u> Tillamook Bay is a small, shallow estuary about 60 miles west of Portland on the Oregon Coast. Approximately 6.2 miles long and 2.1 miles wide, the Bay averages only 6.6 feet depth. At low tide, about 50% of the bottom is exposed as intertidal mud flats.

Since the first European settlements in the 1850's, humans have altered the estuary and surrounding watershed. Heavy sediment loads convinced the U.S. Army Corp of Engineers to abandon its activities in the southern end of the bay shortly after the turn of the century. The last ocean-bound ship left the town of Tillamook in 1912 and today only the Port of Garibaldi, at the northern end of the bay, serves deep-water traffic. However, for recreational boating, the Tillamook watershed is ranked second to the Rogue River system in the amount of income generated by recreational fishing in coastal watersheds, the most widely used bay in Oregon, and the sixth most-used waterbody statewide. Virtually all of the boating visitor-days are spent fishing.

The bay provides habitat for numerous fish, shellfish, crabs, birds, seals and sea grasses. 53 species of fish have been identified in the bay at various times of the year. Five species of anadromous salmon use the bay at some point in their life cycle.



Oysters have been grown commercially in Tillamook Bay since the 1930s. Tillamook Bay has been one of the leading oyster producing bays in Oregon, with an average annual production of about 21,200 shucked gallons during the 1970s and 1980s. Beginning in 1990, the level of production dropped off sharply and has remained low due to reduced production by several Oyster Companies. Reductions in oyster production have resulted from business closures, bacterial contamination of the beds where they are grown, flooding, siltation and infestations of burrowing shrimp. Some years, shellfish beds are closed to harvest for commercial sale for more than 100 days due to risk of bacterial contamination.



The Rivers and their Uses: Five rivers enter Tillamook Bay from the south, east and north – Tillamook, Trask, Wilson, Kilchis and Miami. These rivers still provide some of the West Coast's most productive fishing. The Tillamook Watershed is home to Summer and Winter Steelhead, Coho, Chum, Spring and Fall Chinook and sea-run Cutthroat Trout. Coho Salmon are currently listed as threatened by the National Marine Fisheries Service under the Endangered Species Act and Coastal Cutthroat are currently candidates being considered by the U.S. Fish and Wildlife Service. These fish are generally in decline in the basin and have been lost from some tributaries due to a variety of factors that also include changes in habitat and water quality.

The Upper Watershed and its Uses: The Tillamook Watershed is part of the coastal, temperate rain forest ecosystem. With a mean annual precipitation around 90 inches per year in the lower basin and close to 200 inches per year in the uplands, the watershed's coniferous forests – with trees such as Douglas fir, true fir, spruce, cedar and hemlock – cover about 89% of the total land area. Hardwood species such as alder and maple grow throughout, especially as second growth in riparian areas.

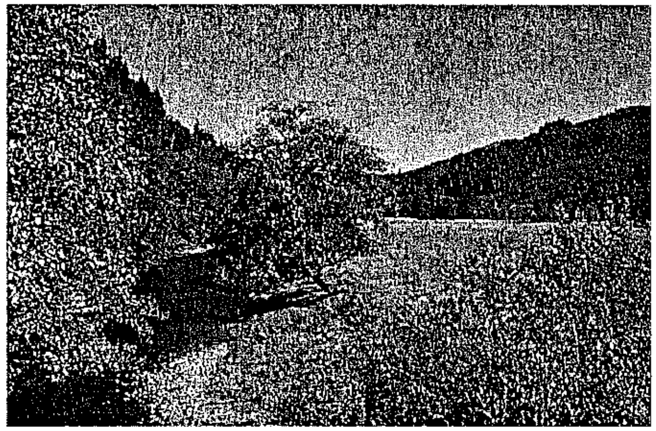
The Tillamook Burn, a series of forest fires from 1933-1951, affected the use of forestlands in the region. The fires killed about 200,000 acres of old-growth timber in the Wilson and Trask River watersheds. Road building followed the fires, for salvage logging, fire protection and replanting purposes. Much of the upper watershed (64%) is deeded to the State and managed by the Oregon Department of Forestry as the Tillamook State Forest.

Since 1960, most timber harvesting in the basin has occurred on private and federal lands because the state trust lands replanted after the burns are still developing into mature, harvestable stands. The timber products industry generated 11% ($37 million) of Tillamook County personal income in 1993. Harvest rates and forestry-related employment in Tillamook County are expected to rise over the next 25 years as stands reach harvestable age. Two-thirds of the proceeds from State Trust land timber harvesting is distributed among county schools (73%), general fund (22%) and other taxing districts (5%).

Recreation (camping, hunting, hiking, biking and off-road vehicle usage) is popular, especially given the proximity to the Portland metropolitan area, and is increasing. The Tillamook State Forest represents 1/3 of the acreage available for riding in the entire State.

The Lower Watershed and its Uses: In the lower watershed, forest gives way to rich alluvial plains, which are used primarily for dairy agriculture. About 6.5% of the basin is agricultural, 1.5% is urban or rural development (approximately 23,300 people live in Tillamook County (1995)) and the remaining 3% is covered by water.

Early settlers recognized the rich agricultural potential of the lowlands and drained the area with numerous dikes, levees and ditches. Once characterized by tree-lined meandering rivers and networks of small channels that provided fish habitat, woody debris and organic matter, the lowlands now support about 28,600 dairy cattle (Pedersen, B. 1998) and produce about 95% of Oregon's cheese. In 1995, agricultural commodity sales from Tillamook County totaled $75.8 million with dairy products generating 82% of the county's agricultural income. While the total number of dairy farms has declined since the 1940s (e.g. 30% decline from 1977 to 1993) due to conversion and combination of small farms to larger commercial farms, milk production among the Tillamook county Creamery Association (TCCA) has increased (e.g. 60% increase between 1984 and 1995).



Some Actions Addressing Water Quality in the Tillamook Watershed:

Tillamook Performance Partnership: In 1992, EPA designated Tillamook Bay as an estuary of national significance and included it in the National Estuary Program (NEP). A Comprehensive Conservation and Management Plan (CCMP) was developed for the basin and approved by EPA in December 1999. The CCMP lays out 62 specific actions that will address and solve the most significant environmental problems in the Tillamook Bay Watershed. These 62 actions relate to four-priority problems and citizen involvement: Habitat Loss and Simplification; Water Quality; Erosion and Sedimentation; and Flooding. For further information, see the NEP website: http://www.co.tillamook.or.us/countygovernment/estuary/tbnep/nephome.html.

The Tillamook County Performance Partnership was formed to track and help implement the plan. The Partnership is a group of 120 members representing community leaders, state and federal agencies, citizens, industries and municipalities. For more information, see the Tillamook County Performance Partnership website: http://www.co.tillamook.or.us/countygovernment/Estuary/TCPP/performance.html.

The Partnership is an active part of the Oregon Plan (http://www.oregon-plan.org/) and works activity with the Tillamook Watershed Council.

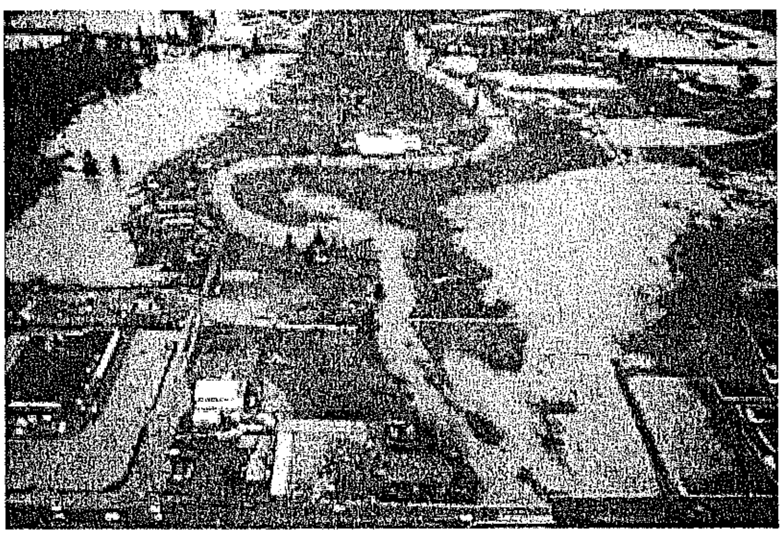
Upper Watershed – Forestry: Legacy practices (prior to the Forest Practices Act) from log drives, splash dams, widespread clear-cutting of timber stands and salvage logging after the Tillamook Burn led to serious erosion, sedimentation and channel modification. Roads built in the 1950's to salvage timber are still the largest potential cause of erosion and sedimentation. During severe storm events, old culverts and roads may fail possibly leading to significant erosion and major sedimentation. In addition, old culverts bar the passage of salmon.

ODF has put a large effort into improving the roads in the Tillamook State Forest (for example, it spent a record $3.6 million on road improvements in 1995). The Tillamook State Forest is currently developing a Habitat Conservation Plan that should address both endangered species and water quality issues as well as provide a sustainable yield of timber from the forest. For more information, see the Tillamook State Forest website: http://www.odf.state.or.us/TSF/TSFhome.htm.

Lower Watershed – Agricultural and Urban Impacts: The most obvious potential water quality impact of the dairies is from the manure. Manure can enter the rivers, streams, sloughs and ditches directly from cows or via runoff from pastures on which manure has been spread. A typical cow can produce 7-20 tons of manure annually and with approximately 90 inches of rainfall and about 28,600 dairy cattle, there is a high risk of contamination. Other sources of bacteria include sewage treatment facilities and on-site septic systems. Reductions in all of these sources will be needed to achieve bacterial standards for the bay. In addition, many streams in the lower watershed have limited shading due to alterations in the riparian area.

In 1981 the Tillamook Watershed received funding through the Rural Clean Water Program (RCWP) as part of a national effort to help clean up agricultural wastes. The RCWP covered 23,540 acres and provided funding to install such best management practices as manure storage facilities, roofing, gutters, fencing and other management practices on farms. In addition, there have been many efforts in recent years to fence and improve riparian and stream habitat sponsored by DEQ, ODFW, OWEB, TCCA and participants in the Hire-the-Fisherman program.

The North Coast Basin Agricultural Water Quality Management Area Plan (SB1010 Plan) was developed and went into rule in 2000. In addition, Tillamook County is reviewing its Riparian Ordinance. Tillamook County recently found an area with a high failure rate of on-site sewage systems and will either extend sewers to the area or require corrections. For more information, see the Tillamook County Soil & Water Conservation website:
http://www.tbcc.cc.or.us/~tcwrc/swcd ODA Natural Resources Division website:
http://www.oda.state.or.us/nrd/water_quality/areapr.html or the Tillamook County website:
http://www.co.tillamook.or.us/.



Other Challenges: Flooding has been an on-going concern in Tillamook County. In the aftermath of the 1996 flood, Tillamook County produced a comprehensive Flood Hazard Mitigation Plan that provides a comprehensive strategy for reducing the flood hazards in Tillamook County.

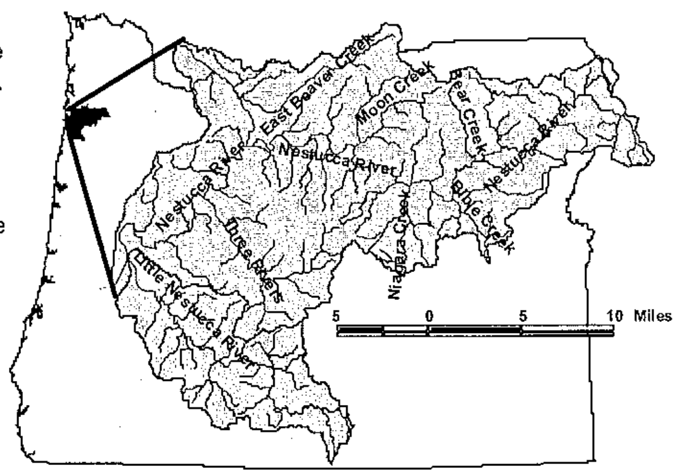
Management efforts will need to satisfy multiple objectives: to reduce flood-related hazards and damages, while minimizing the potential long-term environmental impacts and economic costs of flood control and flood plain management practices. Some flood control practices, such as the use of structural measures such as dikes, levees and dredging, may conflict with various resource management plans and would involve regulatory approvals. The North Coast Community Solutions Team, an inter-agency group of managers that meet on a frequent basis, is examining flood control in the Tillamook Basin in an attempt to reduce potential regulatory conflicts. For more information, see the U.S. Army Corp of Engineer website: http://usace.co.tillamook.or.us/.

Nestucca Bay Watershed TMDLs and Water Quality Management Plan

State of Oregon
Department of Environmental Quality

Where is the Nestucca Bay Watershed?

The Nestucca River runs mostly east to west through southern Tillamook County. The river is about 50 miles long and receives water from many tributaries in the steep coast range before running through lower gradient lands on its way to Nestucca Bay and the Pacific Ocean. The Little Nestucca River also drains to Nestucca Bay.



The Nestucca Bay Watershed encompasses approximately 370 square miles that are largely covered by forests. Lowland areas where the river valley widens have been turned largely to agricultural purposes (mostly livestock). The watershed is contained mostly in Tillamook County, but a small area at the headwaters of the Nestucca River is in Yamhill County and the uppermost reaches of the Little Nestucca River pass through Yamhill and Polk Counties. Major rivers in the watershed are the Nestucca, Little Nestucca, Three Rivers, and Beaver Creek. These surface waters and all other tributaries that ultimately flow to Nestucca Bay are within Hydrologic Unit Codes (USGS) 1710020301 and 1710020302, subbasins within the same basin that includes rivers that flow to Tillamook Bay.

What pollutants are being addressed in this series of TMDLs?

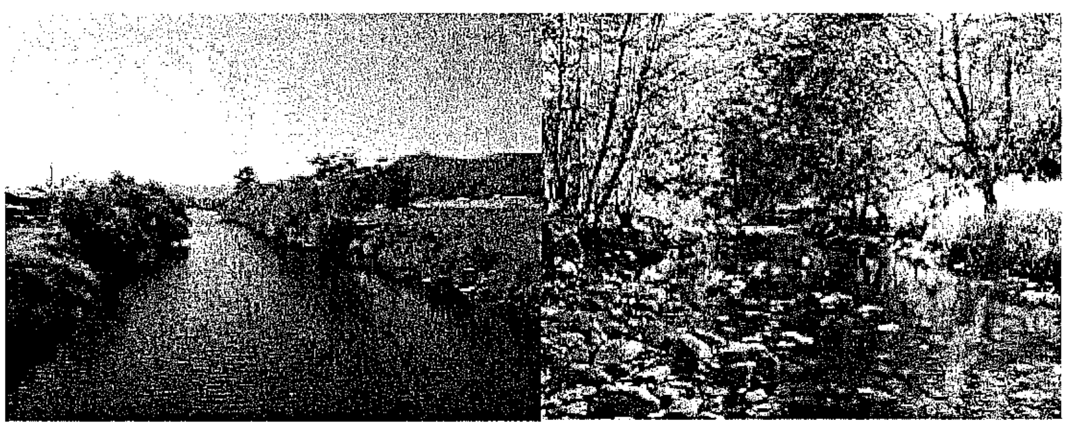
The Clean Water Act requires that the State of Oregon list surface waters that do not meet water quality standards adopted to protect legally defined beneficial uses. Information collected in the basin over the years indicates that some surface waters are water quality limited in three ways: many reaches are too warm to protect salmon and trout; some reaches have excessive fine sediments in their streambeds, which also can harm salmon and trout; and fecal bacteria concentrations in Nestucca Bay are occasionally too high to protect human consumption of shellfish harvested from the Bay (**Table 1**).

Table 1. Water bodies in the Nestucca Bay Watershed listed as water quality limited under section 303(d) of CWQ (DEQ 1998)

Waterbody Name	Boundaries	Parameter	Criteria	Season
Niagara Creek	Mouth to Headwaters	Temperature	Rearing 64 F (17.8 C)	Summer
Powder Creek	Mouth to Headwaters	Temperature	Rearing 64 F (17.8 C)	Summer
Nestucca River	Mouth to Powder Creek	Temperature	Rearing 64 F (17.8 C)	Summer
Nestucca Bay	Bay	Bacteria (fecal coliform)	Marine and shellfish growing area	Year Around
Beaver Creek, East Fork	Mouth to Headwaters	Sedimentation	Narrative	Year Around
Nestucca River	Powder Creek to Headwaters	Sedimentation	Narrative	Year Around
Beaver Creek, East Fork	Mouth to Headwaters	Habitat Modification	Narrative	Year Around
Nestucca River	Powder Creek to Headwaters	Habitat Modification	Narrative	Year Around
Nestucca River	Mouth to Powder Creek	Flow Modification	Narrative	Year Around

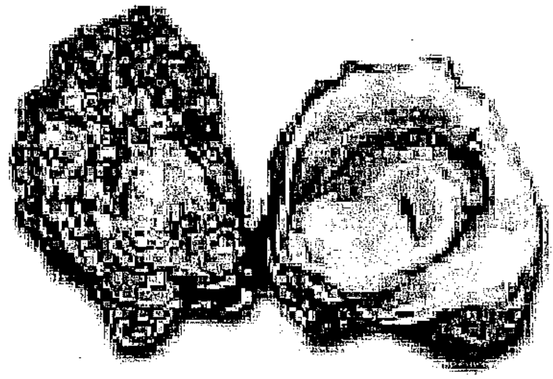
Temperature

In the Rivers, the migration, rearing and spawning of salmonid (salmon and trout) fish are put at risk by high water temperatures (those that exceed 64°F for migration and rearing, or 55°F for spawning) in the summer. In the Nestucca Bay Watershed, 41.5 miles of surface waters were listed as water quality limited for temperature. These water bodies included Powder Creek, Niagara River, and Nestucca River downstream of Powder Creek. Sources of temperature in these streams are primarily from solar radiation that hits the surface of the water due to the widespread removal of riparian vegetation. Although there are three wastewater treatment plants in the watershed, flows from these facilities have a relatively small impact.



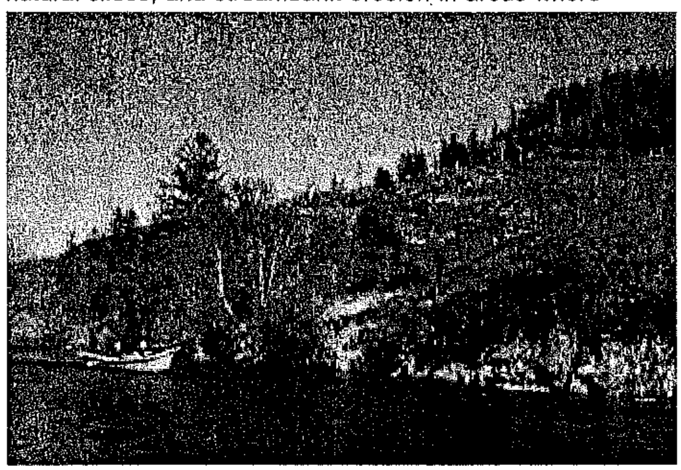
Bacteria

Shellfish harvesting in Nestucca Bay is dependent on waters with minimal concentrations of fecal bacteria. Fecal coliform bacteria in concentrations exceeding a log mean of 14 MPN/100 ml ("most probable number per 100 ml of sample") or when more than 10% of samples have concentrations exceeding 43 MPN/100 ml) cause excessive risk for consumption of shellfish by humans. Bacteria in the rivers are the primary source of the impairment of Bay waters, which support recreational shellfish harvesting. The principal sources of fecal bacteria in the watershed are runoff from livestock operations, urban runoff, rural residential runoff, an undetermined number of failing septic systems in the watershed, and wastewater treatment plant discharges. Due to the relative area under livestock management, this use has a larger impact on water quality. Wildlife in the watershed probably provide a relatively low contribution to fecal bacterial loads except in areas surrounding the Bay itself, where concentrations of waterfowl may have a significant effect.



Sedimentation

The upper reaches of the Nestucca River (above Powder Creek) and East Beaver Creek (a total of 34.3 miles of streams) are listed as impaired due to excessive sedimentation. Excessive sedimentation can result in streambeds that are unsuitable for spawning of salmonid fishes. There is not a numeric criterion defining excessive sedimentation, although the State of Oregon does have a narrative standard barring accumulation of deposits that would make the streambed unsuitable for support of beneficial uses. Excessive sedimentation is principally from poorly constructed or maintained forest roads, natural slides, and streambank erosion in areas where riparian vegetation has been removed. Road-building techniques and forest management practices have been improved in the last decade with the implementation of new rules under the Northwest Forest Plan (federal lands) and the Forest Practices Act (State- managed lands). Natural slides can be expected to continue at historical though variable rates. Streambanks in lower gradient reaches of the watershed are currently a continuing source of sedimentation. Stabilization of these areas with riparian vegetation will result in decreased sedimentation, narrower channels, and better habitat for fish.



What is being done to address pollutants?

In response to the listing of these waterbodies as water quality limited, the Department of Environmental Quality (DEQ) has developed Total Maximum Daily Loads for each of the pollutants defined. These TMDLs have determined the amounts of each pollutant that can be discharged to the watershed without causing an impairment of beneficial uses. These pollutants are allocated among various sources to ensure an equitable solution to the problems.

Temperature: A system potential shade and channel width has been allocated to the entire watershed. This requires riparian vegetation along all streams and rivers that will provide shade and stabilize streambanks. The direct provision of shade will cool rivers and narrower stream channels resulting from stable streambanks will also reduce the amount of solar radiation (sunlight) that reaches stream surfaces. The temperature of discharges from wastewater treatment plants will also be limited as new permits are developed for these facilities.

System Potential: The height and density of riparian vegetation that can potentially grow in a given area based on average growth of local species of riparian trees.

Bacteria: Fecal coliform bacterial loading was modeled for the entire watershed. Contributions from all sources were included in the mathematical model and reductions relative to current loads were allocated. Load allocations were developed for each landuse type; Urban and Residential, Commercial, and Pastures. Due to the large area in the basin supporting livestock operations, reductions are most evident in these allocations.

Sedimentation: System Potential riparian vegetation will result in system potential channel widths, which will result in stable streambanks and less erosion. This will result in a reduction of sedimentation in the watershed.

Who came up with all of this?

TMDLs for the Nestucca Bay Watershed were developed by DEQ. However, many other agencies and private parties have also contributed to this effort.

- Nestucca-Neskowin Watershed Council and provided considerable information through development of a watershed assessment and action plan. The council also has collected much of the data that was used for the assessment of current conditions and in support of the temperature and bacterial monitoring.
- United States Forest Service and Bureau of Land Management have collected a considerable amount of data over the years pertaining to the lands they manage in the watershed. Given that this accounts for approximately two-thirds of the watershed, that effort has been substantial.

Who will be responsible for implementing changes that need to be made?

- **USFS/BLM** will implement features of the Northwest Forest Plan on lands that they manage.
- **Oregon Department of Forestry** will implement the Forest Practices Act in forests managed by the State of Oregon and on privately owned forest lands.
- **Oregon Department of Agriculture** will implement the Agricultural Water Quality Management Area Plan for the North Coast Basin that was adopted in 1999.
- **DEQ** will require dischargers to comply with permits that set limits on the quality of wastewater effluent to meet the wasteload allocations provided in the TMDL.
- **Counties and Local Governments** will implement practices to the extent of their authorities (i.e., ordinances).

What happens now that TMDLs have been developed?

DEQ has developed these TMDLs to meet requirements of the Federal Clean Water Act. These documents were released for a public review period and comments have been addressed in the final TMDL. This final document, including public comments was submitted to the EPA for approval in April 2002. Upon submission to the EPA, the measures of the TMDL are in place under Department Order. EPA has the option to approve the TMDLs as submitted or to deny them. If it approves the TMDLs, they become the federally approved TMDLs as well. If EPA finds sufficient fault to disapprove a TMDL, they have 60 days to establish a TMDL of their own.

To Find Out More About these Plans

Documents are available on this website. Documents are also available by request from Eric Nigg [(503) 229-5325] at 2020 SW 4th Avenue, Suite 400, Portland, OR 97201-4987 or e-mail at: nigg.eric@deq.state.or.us

Tillamook County Agriculture

Tillamook County is perhaps best known for its dairy industry. Tillamook County has 35,600 acres of farmland primarily in permanent pasture for over 24,000 head of livestock, but including 9,750 "harvested" acres. On today's tour we will first pass through some of this lowland agricultural area, entering the Bewley Creek drainage, a tributary of the Tillamook River. As we leave the Highway, Bewley Creek flows across the pasturelands to the west towards its confluence with the Tillamook River.

Agriculture users are guided by the North Coast Basin Agricultural Water Quality Management Area Plan (AWQMAP). These Area Plans commonly referred to as "1010 Plans" " . . . identify strategies to reduce water pollution from agricultural lands through a combination of educational programs, suggested land treatments, management activities and prohibitions." Enforcement by Oregon Department of Agriculture is based on administrative rules for the North Coast Basin Management Area.

The agricultural water quality program is described as being "condition based", as contrasted with the "practices based" Forest Practices Act. Agricultural operations for the most part are continuous while forest operations are more episodic, occurring infrequently on any particular parcel. While both focus on outcomes, they contrast in the way the outcome is achieved. The FPA provides a more defined array of practices that landowners must use. The SB 1010 program identifies the outcome to be achieved and
the landowners identify the suite of practices they will use. Whatever agricultural practices are used, however, the landowner must achieve the conditions identified in the North Coast Basin Administrative Rules.

The following information is primarily excerpted from the North Coast Basin, AWQMAP updated in March 2004, and is included as a matter of interest. The Prevention and Control Measure for Healthy Riparian Streambank Condition is the agricultural equivalent to the riparian protection topics which are the focus of this tour on forestland.

"North Coast Basin agriculture is located primarily on the rich alluvial floodplains of the area's many river systems."

"Much of the agricultural lowland in the area was originally covered by riparian and tidal forests of cottonwoods, spruce hemlock, maple, alder, yellow fir, cedar, and crab apple as well as various understory species (Benner, no date). In the 1850s European-American settlers recognized the great agricultural potential of the lowlands, and began clearing the forest lands, installing drainage ditches, dikes, levees, and tide gates. These actions made the rich soils available for row crops and pasture. Significant lowland areas and intertidal and freshwater wetlands were cleared by the early 1900s. This made much land available for agricultural production, but changed the water flow, sedimentation patterns, and fish habitat."

Of the five rivers in the Tillamook watershed, the Tillamook River flows through the most agricultural acres of the five Tillamook coastal plain rivers. It is also the slowest with the most meanders, making its way through the area's poorest drained soils. . . . There are nine drainage districts in Tillamook County, incorporating several hundred acres in tidal lands. It is estimated that at least one-quarter of Tillamook agricultural lands are in these drainage districts (B. Pedersen, Basin Team Leader, USDA NRCS, per. Comm.).

" . . . DEQ has developed Total Maximum Daily Loads (TMDLs) for temperature, bacteria, and sedimentation for North Coast subbasins that had listings for these parameters . . .. Plans to meet Total Maximum Daily Load (TMDL) – allocations are required for industry, municipalities, forestry, and agriculture to improve water quality so that all beneficial uses are supported. The North coast Basin AWQMAP is designed to meet TMDL allocations."

As part of the federal Coastal Zone Amendments Reauthorization Act (CZARA), Section 6217(g) specifically addresses the impacts of nonpoint source pollution in coastal areas. Each state . . . must develop a Coastal Nonpoint Pollution control Program. The purpose of the program is " . . . to develop and implement management measures for nonpoint pollution to restore and protect coastal waters . . .." The ODA SB 1010 Rules for the North Coast provides the means to achieve the coastal zone expectations. These Pollution Prevention and Control Measures (PCMs) were developed to address water pollution from agricultural operations. When combined with pollution control efforts from other land uses in the planning area, they are expected to address the TMDL parameters when the DEQ defines them. The PCMs identify Required and Prohibited Conditions from the North Coast Basin Agricultural Water Quality Management Area Rules (Area Rules), and the plan suggests ways they may be achieved through flexible management solutions."

Agricultural landowners are directed to review the Area Rules cited in the box within each PCM to evaluate their operations and determine if they are in compliance with the rules. The plan provides ideas to improve water quality through management activities."

"Based upon this assessment, landowners should develop their own site-specific adaptive management strategy to meet these conditions. The PCMs are intended to be flexible enough for landowners to develop feasible and affordable approaches to meet water quality standards."

Healthy Riparian Streambank Condition

Required and Prohibited Conditions
OAR 603-095-0840

(2) Healthy Riparian Streambank Condition. Effective upon rule adoption.
- (a) Allow the natural and managed regeneration and growth of riparian vegetation – trees, shrubs, grasses, and sedges – along natural waterways (as defined in OAR 141-085-0010(27)) to provide shade to moderate water temperatures and bank stability to maintain erosion near background levels.
- (b) The technical criteria to determine compliance with OAR 603-095-0840(2)(a) are:
  - (A) Ongoing renewal of riparian vegetation that depends on natural processes (including processes such as seed fall, seed bank in soil, or sprouting from roots, rhizomes, or dormant crowns) is evident.
  - (B) Ongoing growth of riparian vegetation that has a high probability of remaining or becoming vigorous and healthy is evident.
  - (C) Management activities minimize the degradation of established native vegetation while allowing for the presence of nonnative vegetation.
  - (D) Management activities maintain at least 50% of each year's new growth of woody vegetation – both trees and shrubs.
  - (E) Management activities are conducted in a manner so as to maintain streambank integrity through 25-year storm events.
- (c) Exemptions:
  - (A) Levees and dikes are exempt from the Healthy Riparian Streambank Condition OAR 603-095-0840(2)(a) and (b), except for areas on the river-side of these structures that are not part of the structures and which can be vegetated without violating U.S. Army Corps of Engineers vegetation standards.
  - (B) Drainage areas where the only connection to other waterbodies are through pumps shall be exempt from the Healthy Riparian Streambank Condition OAR 603-095-0840(2)(a) and (b).
  - (C) Access to natural waterways for livestock watering and stream crossings are allowed such that livestock use is limited to only the amount of time necessary for watering and crossing the waterway.
  - (D) Drainage and irrigation ditches managed in compliance with OAR 603-095-0840(3) are exempt from the Healthy Riparian Streambank Condition OAR 603-095-0840(2)(a) and (b).

Benefits of a Healthy Riparian Streambank Condition
In the landscape, riparian areas comprise a small percentage of total land area but are essential for maintaining water quality and quantity, for ground water recharge, and for dissipating stream energy. It is anticipated that the Healthy Riparian Streambank Condition (HRSC) will protect and enhance water quality through establishment, maintenance, and protection of healthy riparian areas on agricultural lands.

HRSCs benefit both the landowner and the environment. Riparian areas are often indicators of watershed health, as they are among the first landscape features to reflect damage from improper management or natural events within the watershed (National Riparian Service Team, 1997). Landowners benefit from riparian streambank stabilization through soil deposition on streambanks and vegetative bank stabilization, prevention or rate reduction of crop and pasture land damaged or lost to floods, and prevention or reduction of flood debris deposited on fields. The environmental benefits of a HRSC include more shade to improve water temperature moderation and reduce heating, enhanced habitat for wildlife, and a reduction in the quantity of sediment, chemicals, bacteria, and nutrients contained in surface water runoff reaching a stream.

General Description of Healthy Riparian Streambank Condition
A stream in Healthy Riparian Streambank Condition (HRSC) provides the following functions:

- shade to help maintain cool water temperatures;
- streambank stabilization and protection;
- filtering of sediment, animal waste, and chemicals in surface runoff; and
- sources of food, hiding, and resting places for fish, including large wood for fish habitat.

To provide these functions, North Coast Basin riparian areas need the following:

- Complex Vegetation Structure and Diverse Species Composition
  - The riparian area supports a diverse assortment of plants, trees, shrubs/groundcover, in two or more vertical layers. Riparian areas should be dominated by native species with a diverse age class distribution. Where suitable, conifers are the preferred dominant tree species.
- Vegetative Cover
  - Vegetation should cover approximately 90% of the soil surface, with less than 10% bare soil or impervious surfaces.
- Width
  - Riparian area width should be sufficient to fulfill site-specific functions, and meet Healthy Riparian Streambank Conditions.
- Stream Shading
  - Riparian vegetation should shade 75% of a Natural Waterway where the water body is not too wide and when achievable in the summer.
- Streambank Stability
  - Streambanks should be stable without the use of rip rap or other artificial structures when feasible. Streambank vegetation is comprised of those plants and plant communities that have root masses capable of withstanding 20 to 25 year storm events.

The Conservation Reserve Enhancement Program (CREP) is a State-Federal partnership that provides a modest rental payment and substantial cost share to encourage protection of riparian areas on agricultural lands. Participation in this program would meet or exceed the Healthy Riparian Streambank Condition. Landowners are encouraged to contact the local Soil and Water Conservation District or USDA Natural Resources Conservation Service office for more information. See Attachment B for contact information.

OREGON ADMINISTRATIVE RULES
OREGON DEPARTMENT OF AGRICULTURE
CHAPTER 603, DIVISION 95

North Coast Basin

603-095-0800
Purpose
(1) These rules have been developed to implement a water quality management area plan for the North Coast Basin pursuant to authorities vested in the department through ORS 568.900-568.933. Development of this plan is due to a determination by the Environmental Quality Commission to establish Total Maximum Daily Loads (TMDL) and allocate loads to agricultural water pollution sources. This plan also contributes to the state's program to restore and protect coastal waters in response to the federal Coastal Zone Management Act. The area plan is known as the North Coast Basin Agricultural Water Quality Management Area Plan.
(2) The purpose of these rules is to outline requirements for landowners in the North Coast Basin Agricultural Water Quality Management Area for the prevention and control of water pollution from agricultural activities and soil erosion. Compliance with these rules is expected to aid in the achievement of applicable water quality standards in the North Coast Basin.
(a) Failure to comply with any provisions of the North Coast Basin Agricultural Water Quality Management Area Plan:
(A) does not constitute a violation of OAR 603-090-0000 to 603-090-0120, or of OAR 603-095-0010 to OAR 635-095-0860;
(B) is not intended by the department to be evidence of a violation of any federal, state, or local law by any person.
(b) Nothing in the North Coast Basin Agricultural Water Quality Management Area Plan shall be:
(A) construed as an effluent limitation or standard under the federal Water Pollution Control Act 33, USC §§ 1251-1376;
(B) used to interpret any requirement of OAR 603-095-0800 through 603-095-0860.
Statutory Authority: ORS 568.909
Stats. Implemented: ORS 568.900-568.933
603-095-0820
Geographic and Programmatic Scope
(1) The physical boundaries of North Coast Basin subject to these rules are indicated on the map included as Appendix A of these rules.
(2) Operational boundaries for the land base under the purview of these rules include all lands within the North Coast Basin in agricultural use, agricultural and rural lands which are lying idle or on which management has been deferred, and forested lands with agricultural activities, with the exception of public lands managed by federal agencies and activities which are subject to the Oregon Forest Practices Act.
(3) Current productive agricultural use is not required for the provisions of these rules to apply. For example, highly erodible lands with no present active use are within the purview of these rules.
(4) The provisions and requirements outlined in these rules may be adopted by reference by Designated Management Agencies with appropriate authority and responsibilities in other geographic areas of the North Coast Basin.

(5) For lands in agricultural use within other Designated Management Agencies' or state agency jurisdictions, the department and the appropriate Local Management Agency shall work with these Designated Management Agencies to assure that provisions of these rules apply, and to assure that duplication of any services provided or fees assessed does not occur.
Statutory Authority: ORS 568.909
Stats. Implemented: ORS 568.900-568.933

603-095-0840

Required and Prohibited Conditions

(1) All landowners or operators conducting activities on lands in agricultural use shall be in compliance with the following criteria. A landowner or operator shall be responsible for only those required and prohibited conditions caused by activities conducted on land managed by the landowner or operator. Criteria do not apply to conditions resulting from unusual weather events or other exceptional circumstances that could not have been reasonably anticipated.
(2) Healthy Riparian Streambank Condition. Effective upon rule adoption.
(a) Allow the natural and managed regeneration and growth of riparian vegetation trees, shrubs, grasses, and sedges along natural waterways (as defined in OAR 141-085-0010(27)) to provide shade to moderate water temperatures and bank stability to maintain erosion near background levels.
(b) The technical criteria to determine compliance with OAR 603-095-0840(2)(a) are:
(A) Ongoing renewal of riparian vegetation that depends on natural processes (including processes such as seed fall, seed bank in soil, or sprouting from roots, rhizomes, or dormant crowns) is evident.
(B) Ongoing growth of riparian vegetation that has a high probability of remaining or becoming vigorous and healthy is evident.
(C) Management activities minimize the degradation of established native vegetation while allowing for the presence of nonnative vegetation.
(D) Management activities maintain at least 50% of each year's new growth of woody vegetation -- both trees and shrubs.
(E) Management activities are conducted in a manner so as to maintain streambank integrity through 25-year storm events.
(c) Exemptions:
(A) Levees and dikes are exempt from the Healthy Riparian Streambank Condition OAR 603-095-0840(2)(a) and (b), except for areas on the river-side of these structures that are not part of the structures and which can be vegetated without violating U.S. Army Corps of Engineers vegetation standards.
(B) Drainage areas where the only connection to other waterbodies are through pumps shall be exempt from the Healthy Riparian Streambank Condition OAR 603-095-0840(2)(a) and (b).
(C) Access to natural waterways for livestock watering and stream crossings are allowed such that livestock use is limited to only the amount of time necessary for watering and crossing the waterway.
(D) Drainage and irrigation ditches managed in compliance with OAR 603-095-0840(3) are exempt from the Healthy Riparian Streambank Condition OAR 603-095-0840(2)(a) and (b).
(3) Drainage and irrigation ditches (channels legally constructed). Effective upon rule adoption.
(a) Construction, maintenance, and use of surface drainage ditches shall not result in sediment delivery to waters of the state from soil erosion caused by excessive channel slope, unstable channel cross section, or placement of disposed soils.
(b) Ditch bank vegetation shall be present to stabilize earthen ditch banks.

(c) Technical criteria to determine compliance with OAR 603-095-0840(3)(a) and (b) are:
(A) Construction and maintenance of drainage and irrigation ditches utilize ditch slope and ditch cross section that are appropriate to the site.
(B) Disposed soils from construction and maintenance of drainage and irrigation ditches are placed such that sediment delivery to waters of the state from the placement of these soils is consistent with natural background sediment delivery from these sites.
(d) Exemptions:
(A) Bank vegetation damaged and soils exposed during maintenance (as defined in OAR 141-085-0010(22)) and construction, in accordance with Division of State Lands rules. Bank vegetation must be reestablished as soon as practicable after construction and maintenance are completed. However, sediment delivery to waters of the state shall not result from inappropriate ditch slope and cross section or from placement of disposed soils.
(4) Tide Gates. Effective upon rule adoption.
(a) Tide gates shall open and close as designed.
(5) Erosion and Sediment Control. Effective upon rule adoption.
(a) No cropland erosion in excess of the soil loss tolerance factor (T) for the subject field, as determined by the Revised Universal Soil Loss Equation (RUSLE) for soil loss, will occur.
(A) Exceptions: The department shall establish an alternate erosion control standard for croplands which the department determines cannot practically or economically achieve the soil loss tolerance factor. Any alternate erosion control standard for croplands established by the department shall assure that delivery of sediment to adjacent water sources is reduced to the maximum extent practicable.
(b) Private roads that traverse rural lands or private roads used for agricultural activities shall be constructed and maintained such that road surfaces, fill and associated structures are designed and maintained to limit contributing sediment to waters of the state. All private roads on agricultural lands not subject to the Oregon Forest Practices Act are subject to this regulation.
(A) Exceptions: Roads subject to the Oregon Forest Practices Act.
(c) Agricultural lands shall be managed to prevent and control runoff of sediment to public road drainage systems.
(d) Except for operations governed by the Oregon Forest Practices Act, no activities related to the conversion of woodland to non-woodland agricultural uses that require removal of the majority of woody material from a parcel of land, such that the land no longer meets the definition of woodland, shall be conducted in a manner which results in the placement of soil, the delivery of sediment, the sloughing of soil into waters of the state, the initiation or aggravation of streambank erosion, or the loss of an adequate vegetative buffer, in the near-stream management area.
(6) Manure and Nutrients. Effective upon rule adoption.
(a) No person conducting agricultural land management shall cause pollution of any waters of the state or place or cause to be placed any wastes in a location where such wastes are likely to escape or be carried into the waters of the state by any means (ORS 468B.025(1)(a)).
(b) No person conducting agricultural land management shall discharge any wastes into the waters of the state if the discharge reduces the quality of such waters below the water quality standards established by rule for such waters by the Environmental Quality Commission (ORS 468B.025(1)(b)).
(c) No person shall violate the conditions of any waste discharge permit issued pursuant to ORS 468B.050.

(d) Exceptions:
(A) Access to natural waterways for livestock watering and stream crossings are allowed such that livestock use is limited to only the amount of time necessary for watering and crossing the waterway.
(7) Pesticide Management
(a) Pesticides shall be used in accordance with label requirements as required in ORS 634 (Oregon Pesticide Control Law).
Statutory Authority: ORS 568.909
Stats. Implemented: ORS 568.900-568.933

603-095-0860

Complaints and Investigations

(1) When the department receives notice of an alleged occurrence of agricultural pollution through a written complaint, its own observation, or through notification by another agency, the department may conduct an investigation. The department may, at its discretion, coordinate inspection activities with the appropriate Local Management Agency.
(2) Each notice of an alleged occurrence of agricultural pollution shall be evaluated in accordance with the criteria in ORS 568.900 to 568.933 or any rules adopted thereunder to determine whether an investigation is warranted.
(3) Any person allegedly being damaged or otherwise adversely affected by agricultural pollution or alleging any violation of ORS 568.900 to 568.933 or any rules adopted thereunder may file a complaint with the department.
(4) The department will not evaluate or investigate a complaint filed by a person under section OAR 603-095-0N80(3) unless the complaint is in writing, signed and dated by the complainant and indicates the location and description of:
(a) The property and waters of the state allegedly being damaged or impacted; and
(b) The property allegedly being managed under conditions violating criteria described in ORS 568.900 to 568.933 or any rules adopted thereunder.
(5) As used in section OAR 603-095-0860(4), "person" does not include any local, state or federal agency.
(6) Notwithstanding OAR 603-095-0860, the department may investigate at any time any complaint if the department determines that the violation alleged in the complaint may present an immediate threat to the public health or safety.
(7) Actions based on investigation findings:
(a) If the department determines that a violation of ORS 568.900 to 568.933 or any rules adopted thereunder has occurred and a Voluntary Water Quality Farm Plan approved by the department or its designee exists and the landowner or operator is making a reasonable effort to comply with the plan:
(A) The department shall inform the landowner of the non-compliance with ORS 568.900 to 568.933 or any rules adopted thereunder.
(B) The department may acknowledge the existence of the approved Voluntary Water Quality Farm Plan and direct the landowner to seek appropriate technical assistance and revise the plan and its implementation in a manner necessary to eliminate the violation.
(C) The landowner may be subject to the enforcement procedures of the department outlined in OARs 603-090-0060 through 603-090-0120.
(b) If the department determines that a violation of ORS 568.900 to 568.933 or any rules adopted thereunder has occurred and a Voluntary Water Quality Farm Plan approved by the department or its designee does not exist:

(A) The department shall inform the landowner of the non-compliance with ORS 568.900 to 568.933 or any rules adopted thereunder.
(B) The landowner may be subject to the enforcement procedures of the department outlined in OARs 603-090-0060 through 603-090-0120.
Statutory Authority: ORS 568.915, 568.918, and 568.933
Stats. Implemented: ORS 568.900 - 568.933

Wayne Giesy
Consultant

PO Box 772 Philomath, OR 97370 **Telephone** 541 929-4170
Fax 541 929-4174

October 26, 2004

Stephanie Hallock, Director
811 SW Sixth Avenue
Portland, OR 97204-1390

Dear Director Hallock:

This October 23rd the members of EQC toured some of the Tillamook Forest and afterwards met with the Board of Forestry.

I was unable to attend on the 23rd and presented my material the following day on the 24th. I am enclosing the following:

Giesy letter to the Board of Forestry.

Jana Compton, EPA Corvallis, Red Alder Study.

Pacific Northwest Research Station, Red Alder Study.

Dr. William Krueger of OSU, Rangeland Department letter of rejection of IMST Water Quality Standards Report.

John Beuter Study on Tillamook Forest.

There are several research studies being conducted presently and these studies will stand peer review. The Forest Industry needs a moratorium on more rules.

Hopefully, you will see fit to urge your Department to be restrained on rule making. Oregon needs jobs not more rules.

Sincerely yours,

Wayne Giesy

Wayne Giesy

cc:
Mark Reeve
Deirdre Malarkey
Lynn Hampton
Ken Williamson

Wayne Giesy
Consultant

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October 22, 2004

BOARD OF FORESTRY

Chairman Hobbs, Board Members and State Forester Brown.

My name is Wayne Giesy and I represent my family, a son and daughters, my grand children and on great grand child.

You represent the citizens of the State of Oregon. Among other things the decisions you make now will affect the revenue to the State Treasury for the next 10 to 20 years.

You are now asked to impose four (4) more requirements on timber growers relative to riparian areas and water quality. Why areyou put into this position. The largest portion of the blame lies with the Independent Multi-disciplinary Science Team (IMST). Who is IMST, in my opinion during the last few years several agenda scientists.

IMST has presented many forestry recommendations to the Forest Practices Advisory Committee(FPAC). Again in my opinion the IMST work has been shoddy. Please review IMST recommendations. I am sure you will find many ideas, but no peer reviewed science to back up their recommendations. Oregon State University Rangeland Department has recently declared the IMST 2004 Water Temperature Standards report as unacceptable.

At present the Hinkle Creek Study is addressing riparian area functions and water quality. The Forestry Department of Oregon State University is very much involved and the results will answer questions and stand peer review. This type of science should be used to decide if more regulations are needed. Other studies in the United States are looking into the benefits of shade and the need for sunlight on the streams to start the food chain for fish.

Now let us put this in perspective. The State of Oregon for all practical purposes is broke. The John Beuter report shows that we create directly 18 to 19 full time jobs for each million feet of logs harvested from Oregon forests.

For each of the direct jobs and additional 2 jobs are created. Until Oregon creates enough jobs so the Tax Revenue to the State pays our way, I am absolutely opposed to any more regulations.

Surely, it would be a prudent move for the Board of Forestry to delay the decisions on the Riparian and water quality proposed regulations, at least until the Hinkle Creek Study is completed.

I am leaving with yourSecretary a copy of the Beuter Report, Jana E. Compton-Alder Study, PNW Red Alder Study, OSU Rangeland paper and I wish to thank you for allowing my remarks.

Wayne Giesy

Wayne Giesy

Ecosystems (2003) 6: 773–785
DOI: 10.1007/s10021-002-0207-4

ECOSYSTEMS

Nitrogen Export from Forested Watersheds in the Oregon Coast Range: The Role of N_2-fixing Red Alder

Jana E. Compton,[1*] M. Robbins Church,[1] Scott T. Larned,[2] and William E. Hogsett[1]

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Abstract

Variations in plant community composition across the landscape can influence nutrient retention and loss at the watershed scale. A striking example of plant species importance is the influence of N_2-fixing red alder (*Alnus rubra*) on nutrient cycling in the forests of the Pacific Northwest. To understand the influence of red alder on watershed nutrient export, we studied the chemistry of 26 small watershed streams within the Salmon River basin of the Oregon Coast Range. Nitrate and dissolved organic nitrogen (DON) concentrations were positively related to broadleaf cover (dominated by red alder: 94% of basal area), particularly when near-coastal sites were excluded ($r^2 = 0.65$ and 0.68 for nitrate-N and DON, respectively). Nitrate and DON concentrations were more strongly related to broadleaf cover within entire watersheds than broadleaf cover within the riparian area alone, which indicates that leaching from upland alder stands plays an important role in watershed nitrogen (N) export. Nitrate dominated over DON in hydrologic export (92% of total dissolved N), and nitrate and DON concentrations were strongly correlated. Annual N export was highly variable among watersheds (2.4–30.8 kg N ha^{-1} y^{-1}), described by a multiple linear regression combining broadleaf and mixed broadleaf–conifer cover ($r^2 = 0.74$). Base cation concentrations were positively related to nitrate concentrations, which suggests that nitrate leaching increases cation losses. Our findings provide evidence for strong control of ecosystem function by a single plant species, where leaching from N saturated red alder stands is a major control on N export from these coastal watersheds.

Key words: nitogen leaching; nitrogen fixation; red alder; nitrate; streams; Oregon Coast Range; nitrogen saturation; dissolved organic nitrogen; cation leaching.

Introduction

Human activities have more than doubled the supply of nitrogen (N) to terrestrial and aquatic ecosystems on a global scale, resulting in important changes in ecosystem structure and function in many regions (Vitousek and others 1997). In areas where the N supply exceeds the ecosystem demand, a collection of processes termed "N saturation" can occur, by which nitrate accumulates in soils and is lost to groundwater, lakes, and streams (Aber and others 1998). High rates of N leaching can then lead to cation losses and nutrient imbalances in terrestrial ecosystems and eutrophication in aquatic eco-

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systems (Murdoch and Stoddard 1992; Likens and others 1996; Vitousek and others 1997).

Although the concept of N saturation originated in the context of human-accelerated N deposition, biological processes can also alter N availability and losses at several scales. Plant community composition influences nutrient cycling and soil fertility (Hobbie 1992; Binkley and Giardina 1998), and these effects on cycling rates can translate into differences in ecosystem nutrient retention and watershed-scale losses (Lovett and others 2000). One dramatic example of species effects on terrestrial ecosystem function is the role of symbiotic N_2-fixing species. Tree species with symbiotic N_2-fixing *Frankia* or *Rhizobium* bacteria can fix 50–200 kg N ha^{-1} y^{-1} in pure stands (Boring and others 1988; Binkley and others 1994). These fixation inputs can be greater than atmospheric N loading in industrial regions (Wright and Rasmussen 1998), and result in leaching losses that exceed rates from N-saturated forests of polluted regions (Van Miegroet and others 1992; Gundersen and Bashkin 1994).

In the Pacific Northwest of North America, N_2-fixing red alder (*Alnus rubra*) colonizes areas of infrequent but intense disturbance, such as clearcuts, landslides, and burned areas, as well as repeatedly disturbed riparian areas (Harrington and others 1994). This native tree forms stands that are pure or mixed with conifers and has a relatively short life span (less than a century). Red alder can increase soil N content and cycling rates in pure stands or in mixtures with conifers (Binkley and others 1992, 1994). The high rates of nitrification and organic matter cycling under alder generally accelerate cation leaching and soil acidification when compared to native conifer stands (Van Miegroet and Cole 1984, 1985; Bormann and others 1994). Red alder can also impart a legacy of lower cation and phosphorus (P) availability for future stands of both alder and conifers (Brozek 1991; Compton and others 1997). Although alder stands can influence N concentrations of adjacent streams and lakes (Goldman 1961; Binkley and others 1982; Stottlemyer and Toczydlowski 1999), the landscape-scale influence of alder distribution on stream chemistry has not been clearly demonstrated.

Here we examine the influence of upland and riparian alder stands on dissolved N and cations in Oregon Coast range streams. We conducted monthly sampling of 26 small-watershed (less than 3000 ha) streams to test the hypothesis that stream nitrate and dissolved organic nitrogen (DON) are influenced by the areal cover of red alder stands within the watershed. Riparian alder could be an important source of N to streams; for this reason, we compared stream N concentrations with vegetation cover of both riparian areas and the entire watershed. Because soil nitrate leaching may accelerate cation leaching (Aber and others 1989; Vitousek and others 1997), nitrate losses associated with alder stands might result in increased cation levels in stream water. Losses of N and cations from forested watersheds have important implications for long-term terrestrial and aquatic ecosystem function.

Methods

Basin Description

The study was conducted in the Salmon River basin, which drains from the Oregon Coast Range Mountains westward into the Pacific Ocean, approximately 5 km north of Lincoln City, Oregon, USA. This 200-km^2 basin is 95% forested, with a mosaic of private industrial conifer plantations, mixed and pure alder stands, and patches of older forests originating after the Nestucca fire in 1845–49 (Greene and others 1992). Ownership in the lower watershed is dominated by private non-industrial and federal landholders (for example, Cascade Head Experimental Forest, Siuslaw National Forest). Private industrial forest plantations occupy most of the upper basin. There are very few buildings or other developments above our sampling sites. Dominant soils within the basin are moderately deep to deep Inceptisols and Andisols (Humitropepts, Fulvudands, and Haplocryands) formed in colluvium from Miocene and Eocene age sedimentary or volcanic rocks (USDA 1997). The basin covers an area from less than 1 km to approximately 20 km from the ocean and ranges in elevation from sea level to 910 m.

The forests are dominated by sitka spruce (*Picea sitchensis*) and western hemlock (*Tsuga heterophylla*) near the coast, shifting to western hemlock and Douglas-fir (*Pseudotsuga menziesii*) further inland. Red alder is the dominant broadleaf canopy tree within approximately 40 km of the coast, with big leaf maple (*Acer macrophyllum*) increasing further inland and at higher elevations (Ohmann and Gregory 2002). At low elevations, red alder stands can blanket entire hillsides of the Coast Range (Franklin and Dyrness 1988), particularly in areas that were clear-cut or burned in the 20th century.

Stream Sampling, Flow Measurements, and Chemical Analyses

Within the Salmon River basin, we sampled 26 first- to third-order streams with a range of watershed areas and runoff (Table 1). Sampling sites were

Table 1. Study Watershed Characteristics and Stream Chemistry, Salmon River Basin

Stream Code	Name	Watershed Area (ha)	Distance to Coast (km)	Runoff (mm/y)	Broadleaf Cover (%)	Broadleaf percent Alder[a]	Mixed Cover (%)
SM 45	Teal Creek	77	0.6	1300	14	98	44
SM 44	[b]	26	1.0	965[c]	10	92	56
SM 32	Crowley Creek	391	1.3	1284	19	96	39
SM 43	[b]	45	1.8	1114[c]	70	99	8
SM 11	[b]	90	2.6	1200[c]	74	98	8
SM 40	Baxter Creek	46	3.8	2061[c]	21	95	72
SM 31	Calkins Creek	129	4.0	1338	32	98	30
SM 46	Salmon Creek	69	4.6	1360[c]	3	99	40
SM 39	[b]	35	4.7	2200[c]	53	98	28
SM 38	Willis Creek	361	5.9	1909[c]	39	98	11
SM 37	[b]	115	6.2	1281[c]	27	96	26
SM 36	Curl Creek	141	6.8	1218[c]	32	93	22
SM 27	Toketa Creek	212	7.0	1132	25	98	14
SM 28b	N. Fork Deer Creek	111	7.3	1090	33	94	17
SM 28a	S. Fork Deer Creek	97	7.3	1031	23	91	18
SM 22	Morton Creek	128	8.3	2009	27	97	21
SM 10	Bear Creek	1250	8.4	2000	25	94	20
SM 21	Panther Creek	447	9.1	1006	37	95	25
SM 23	Callow Creek	54	9.5	3053	12	81	30
SM 35	Widow Creek	807	11.5	1491	45	92	17
SM 34	Alder Brook	289	12.2	1487	25	93	27
SM 33	Treat Creek	748	12.5	2285	19	89	14
SM 24	Slick Rock	1861	14.5	2469	3	95	12
SM 7	Deer Creek 2	644	14.7	1449	17	96	26
SM 25	Sulphur Creek	302	15.2	1440	26	92	49
SM 25b	Prairie Creek	310	15.5	1451	17	91	39
SM 26	Salmon River	2617	17.6	1431	7	89	17
Mean		422	7.9	1558	27%	94%	27%
SD		608	4.9	516	18%	4%	15%

[a]*Percent of basal area occupied by alder in this cover type (J. Ohmann and M. Gregory personal communication)*
[b]*Unnamed stream*
[c]*Estimated flows*

generally at the lower end of the watershed above a major confluence or road crossing. We sampled stream water for chemical analysis monthly from January through December 2000. Watersheds were not nested, except for Callow Creek, a small tributary of Bear Creek, where discharge differs by an order of magnitude. Discharge was estimated on each sampling date at a subset of 16 sites by the velocity area method, with a stream velocity meter and top-setting wading rod (Swoffer Instruments, Seattle, WA, USA).

Stream water was collected in 1-L containers and stored on ice until returning to the lab. Samples were filtered within 24 h of sampling (0.25-μm polycarbonate membrane filters; Whatman, Newton, MA, USA). Water samples were analyzed for ammonium and nitrite plus nitrate using automated colorimetric continuous flow autoanalyzer (Lachat method 10-107-06-3-D for ammonium and USEPA [1987] method 353.2 for nitrate+nitrite; Lachat Instruments, Milwaukee, WI, USA). Nitrite-N ranged from 0 to 1.4% of nitrate-N concentrations in a subset of samples from all sites (n = 50); therefore, nitrite plus nitrate was considered equivalent to nitrate. Total dissolved N was determined using persulfate digestion (Cabrera and Beare 1993), followed by automated colorimetric analysis for nitrate as described above. DON was calculated as total dissolved N minus nitrate and ammonium. If DON was negative by less than 0.005 mg N L^{-1}, the value was set to zero. Samples were reanalyzed if DON was negative by more than 0.005 mg N L^{-1}. Dissolved calcium, magnesium, sodium, and potassium were determined in HNO_3 acidified aliquots using flame atomic absorption spectrophotometry (Perkin-Elmer Instruments, Norwalk, CT, USA) (USEPA 1987). Chloride concentrations were determined by ion chromatography (Dionex Corporation, Sunnyvale, CA, USA). Cation concentrations were adjusted for sea salt contributions using sea salt chloride ratios (Hedin and others 1995).

Watershed and Riparian Zone Vegetation Cover

Land cover within the Salmon River basin was obtained from the Coastal Lands Assessment and Monitoring Study (CLAMS) (http://www.fsl.orst.edu/clams/index.htm, obtained June 2001). This raster vegetation layer integrates field plots, environmental data, and 1996 Landsat TM imagery (Ohmann and Gregory 2002) to produce forest classes based on land cover (forest, open, and woodlands), forest type (broadleaf, conifer, and mixed broadleaf–conifer), and size of conifer and mixed forests (small, medium, large, and very large).

To categorize watershed area above the sampling point, we checked perimeters using the 10-m digital elevation model and 1:24,000 hydrology layer and clipped out the vegetation layer. In addition to creating data layers of land cover, Ohmann and Gregory (2002) also modeled stand characteristics for large areas of the Coast Range. In our study watersheds, red alder averaged 94% (range, 81%–98%) of the basal area in the portion of the watershed categorized as broadleaf (Table 1). For this reason, we conclude that broadleaf cover within the watersheds is dominated by red alder stands and that red alder is the major broadleaf species occurring in mixed broadleaf–conifer stands. To examine the relationship between riparian zone land cover and stream chemistry, we used the vegetation cover data to create three riparian buffers from the center of the stream channel (30, 60, or 120 m on both sides). Distance to the ocean for each watershed was measured from the stream sampling location.

Calculations and Statistical Analyses

Flow-weighted annual average concentrations were calculated from the instantaneous discharge measurements and water chemistry at each sampling date. To determine annual runoff, we used linear regressions between the instantaneous flow measurements for individual streams and for a continuously gauged site on the Salmon mainstem near Otis, Oregon. These linear regression relationships were used in combination with the average daily discharge at the gauged site (L s^{-1}) (obtained from Oregon Water Resources Department) and then divided by watershed area to generate an annual water flux per unit area. On sampling dates or streams where discharge was not measured, water flux was calculated using the specific yield (L s^{-1} ha^{-1}) for adjacent watersheds with similar soils and precipitation. Annual dissolved N export per unit area was calculated by multiplying the runoff by the flow-weighted average annual N concentration for each stream.

Initial examination of the data indicated that stream nitrate concentrations were highest within 5 km of the coast, coincident with high chloride concentrations, suggesting that sea salt inputs may directly affect stream nitrate concentrations in the near-ocean watersheds (M. R. Church and others unpublished). Therefore, to examine the broader landscape role of red alder, a subset of streams more than 5 km from the coast was used for some analyses ($n = 18$). All linear regressions were performed using the General Linear Model in SYSTAT for Macintosh v. 10 (SPSS., Chicago, IL, USA). Normal probability plots indicated that all variables were normally distributed. Because there is little evidence that N_2- fixation rates vary systematically with stand age (Binkley and others 1994), all four mixed-cover classes were summed to create the mixed category for analysis. Mixed and broadleaf covers were not correlated.

Results

Flow-weighted average annual nitrate concentrations ranged from 0.074 to 2.043 mg N L^{-1} (Table 2). Nitrate was the dominant N form, with annual average concentrations ranging from 76% to 96% of total dissolved N. Ammonium concentrations were very low, often near the detection limit of 0.002 mg L^{-1}. N losses among the watersheds were highly variable, ranging from 2.4 to 30.8 kg N ha^{-1} y^{-1} (Table 1). The average loss was 13.6 kg N ha^{-1} y^{-1}.

The proportion of broadleaf cover in each watershed was positively related to stream N concentrations, explaining approximately 51% of the variation in nitrate and 45% of the variation in DON. Nitrate concentrations were highest within 5 km of the coast (Tables 1 and 2); therefore, we also conducted the analysis after excluding these sites. Broadleaf cover explained approximately 66% of the variation in nitrate (Figure 1a) and 68% of the variation in DON (Figure 1b) after excluding the sampling sites within 5 km of the ocean. Including mixed stands in a multiple regression increased the

Table 2. Stream Chemistry

Stream Code	NH_3-N (μg/L)	NO_3-N (mg/L)	DON (mg/L)	NO_3-N: TDN (%)	Cl (μeq/L)	Ca (μeq/L)	Mg (μeq/L)	Na (μeq/L)	K (μeq/L)
SM 45	4	1.352	0.052	96	635	363	207	638	18
SM 44	7	1.424	0.088	94	580	261	175	553	22
SM 32	6	1.388	0.103	93	396	316	193	459	18
SM 43	7	2.043	0.090	95	290	273	163	415	23
SM 11	6	2.429	0.129	95	332	222	190	359	18
SM 40	7	1.203	0.063	95	135	71	85	162	12
SM 31	5	1.358	0.083	94	255	205	172	287	15
SM 46	3	0.359	0.020	94	174	159	109	196	9
SM 39	3	1.240	0.065	95	118	132	65	166	11
SM 38	3	0.726	0.046	94	116	211	132	185	8
SM 37	4	0.852	0.061	93	169	376	211	308	6
SM 36	5	0.875	0.048	94	163	356	200	291	6
SM 27	5	0.498	0.037	92	223	159	94	240	11
SM 28b	5	0.758	0.057	92	216	315	141	273	11
SM 28a	5	0.830	0.044	94	205	487	273	329	10
SM 22	5	0.762	0.056	93	167	374	237	289	11
SM 10	5	0.652	0.047	93	138	274	192	243	11
SM 21	6	0.978	0.055	94	184	401	253	319	9
SM 23	4	0.452	0.030	93	157	292	163	234	12
SM 35	5	0.771	0.087	89	114	371	167	203	8
SM 34	4	0.502	0.040	92	114	210	128	166	6
SM 33	3	0.314	0.028	91	66	174	101	130	5
SM 24	4	0.074	0.020	76	83	133	65	110	4
SM 7	5	0.406	0.034	91	113	338	143	202	8
SM 25	5	0.877	0.053	94	139	291	119	211	11
SM 25b	4	0.529	0.043	92	131	251	123	197	9
SM 26	4	0.167	0.033	82	102	151	92	140	4
Mean	5	0.882	0.056	92	204	265	155	271	11
SD	1	0.544	0.026	4	139	100	56	127	5

DON, dissolved organic nitrogen; TDN, total dissolved nitrogen; Cl, chlord; Ca, calcium; Mg, magnesium; Na, sodium; K, potassium
Concentrations are flow-weighted averages of monthly samples during 2000.

explanatory value to 77% of the variation in nitrate and 72% of the variation in DON (Table 3).

In watersheds with more than 20% broadleaf cover, stream nitrate concentrations were relatively high throughout the year; the lowest values occurred in late summer, followed by broad peaks in the fall (Figure 2; three streams shown as an example). Stream DON concentrations were lower and less temporally variable than nitrate (Figure 2). Both nitrate and DON concentrations were positively related to broadleaf cover, and nitrate concentrations increased more dramatically with broadleaf cover, based on the regression slopes (Figure 1).

To examine the influence of riparian alder on stream chemistry, we compared broadleaf cover–N relationships for the riparian areas of varying width and for the entire watershed. Linear regressions of nitrate and DON as a function of broadleaf are shown in Table 4. Broadleaf cover within the entire watershed explained a much greater proportion of the variability in nitrate (66%) and DON (69%) than broadleaf cover in any of the riparian buffer widths (less than 42%).

Of the cations, calcium (Ca) and sodium (Na) had the highest concentrations (Table 2). Total magnesium concentrations (unadjusted for sea salt contribution) were intermediate, and total potassium concentrations consistently were very low. Total sodium concentrations were much higher in the near-coastal streams, with the highest values (more than 10 mg Na L^{-1}) occurring in sites within 2 km of the ocean. Other cations were slightly higher near the coast. For sites more than 5 km from the ocean, non–sea salt calcium and sodium concentrations were significantly related to the proportion of broadleaf cover ($P < 0.10$ and $P < 0.05$, respectively), but r^2 values were low (less than 0.25).

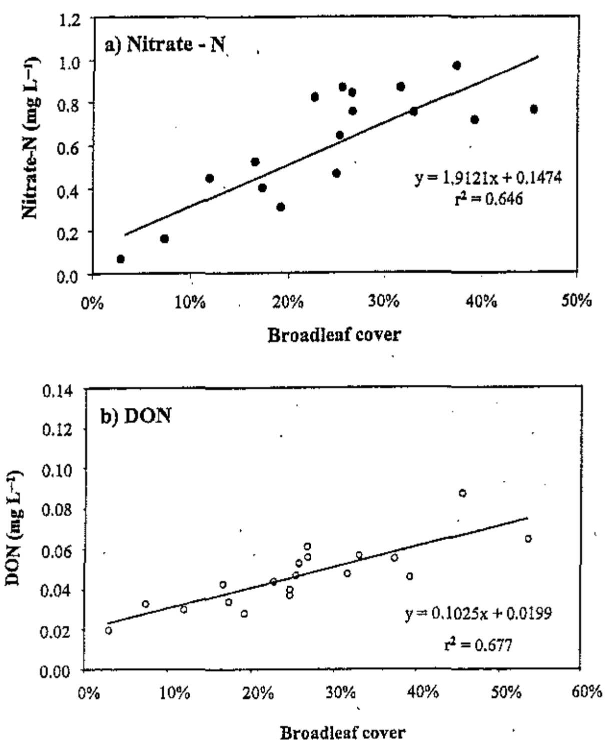

Figure 1. Relationship between broadleaf cover and flow-weighted average annual stream nitrate and dissolved organic nitrogen (DON) concentrations for sites more than 5 km from the ocean. Stream concentrations are flow-weighted averages of monthly samples during 2000.

Non–sea salt calcium, magnesium, and sodium concentrations were strongly related to nitrate concentrations ($r^2 \geq 0.50$) (Figure 3).

Annual N export (kg N ha^{-1} y^{-1}) from all study watersheds in the Salmon River basin was strongly related to broadleaf cover within the watershed (Figure 4a). Annual N export was best described by the following equation:

$$\text{Annual N export} = -4.8 + 39.0\ (\text{broadleaf}) + 29.0\ (\text{mixed})\quad r^2 = 0.74 \quad (1)$$

where "broadleaf" and "mixed" represent the proportion of the watershed in each cover type. The intercept is not significantly different from zero (Table 3). Because we sampled few sites with less than 15% or more than 90% combined alder and mixed cover, the intercept and maximum estimates are highly uncertain. Figure 4b shows the relationship between broadleaf plus mixed cover and total N export from the study watersheds. N export was described as a polynomial relationship, where export is low in watersheds with few alder stands and increases rapidly as alder and mixed cover increases.

Discussion

Does the Landscape Distribution of Alder Influence Stream N?

Stream nitrate and DON concentrations were strongly positively related to broadleaf cover in individual watersheds. The broadleaf cover category was dominated by red alder in our study watersheds, averaging 94% of the basal area (Table 1). Leaching of N from alder and mixed alder–conifer stands clearly has the potential to influence stream chemistry. Most published rates of N_2 fixation range from 100 to 200 kg N ha^{-1} y^{-1} for pure stands (Binkley and others 1994). Soil N and soil solution N leaching are much higher in pure and mixed red alder stands than under associated pure conifer stands (Van Miegroet and Cole 1984; Bormann and others 1994). The highest export in the Salmon basin was 30.8 kg N ha^{-1} y^{-1} from a watershed with 74% broadleaf cover, which suggests that N inputs by red alder can result in very high rates of N export.

Because red alder is associated with particular disturbances and management practices, it is important to consider whether the relationship between alder cover and stream N is causal or indirect as a result of other influences, such as disturbance history. Areas that have experienced more intense disturbances (intense fires, log skidding) may be more likely to be dominated by alder. Although it is difficult to reconstruct the long-term disturbance history of a given site, large areas of the study watershed were burned in the Nestucca fire (between 1845 and 1849), and 150-year-old Sitka spruce and western hemlock forests currently occupy much of this burned area (Greene and others 1992). There does not appear to be a strong spatial link between broadleaf cover and the extent of this historic fire. In addition, the long-term legacy of fire is expected to be less dissolved N export as compared to unburned areas (Silsbee and Larson 1982; Hornbeck and others 1997) rather than increased export, as is the trend with alder. Studies in the Oregon Coast Range have not identified a dramatic effect of clear-cut logging on watershed-scale N export (Brown and others 1973; Miller and Newton 1983). For these reasons, disturbance alone would not be expected to contribute large amounts of N to streams. In the Salmon River basin, watershed export can be very high, ranging from 2.4 to 30.8 kg N ha^{-1} y^{-1}. Although disturbance factors may drive

Table 3. Regressions of Stream Nitrogen (N) Concentrations and Fluxes as Related to Watershed Broadleaf and Mixed Cover

Dependent Variable	Intercept[a]	Broadleaf Coefficient	SE	Mixed Coefficient	SE	r^2
Nitrate (mg L^{-1})	−0.349	2.824[d]	0.379	1.716[d]	0.434	0.70[d]
DON (mg L^{-1})	0.003	0.125[d]	0.021	0.069[c]	0.024	0.59[d]
TN loss (kg ha^{-1} y^{-1})	−1.8	39.0[d]	4.9	29.0[d]	5.6	0.74[d]
Nitrate (mg L^{-1})	−0.077	1.977[d]	0.297	0.929[b]	0.331	0.77[d]
DON (mg L^{-1})	0.010	0.118[d]	0.019	0.030	0.021	0.72[d]
TN loss (kg ha^{-1} y^{-1})	1.5	22.7	7.2	13.2	8.1	0.44[b]

DON, dissolved organic nitrogen; TN, total nitrogen
Significance values for coefficients and slopes are the results of two-tailed t-tests. The significance of the overall regressions accompanies the r^2 value.
[a]Intercept values were not significantly different from zero.
[b]$P \leq 0.05$ for coefficients and overall regression
[c]$P \leq 0.01$ for coefficients and overall regression
[d]$P \leq 0.001$ for coefficients and overall regression

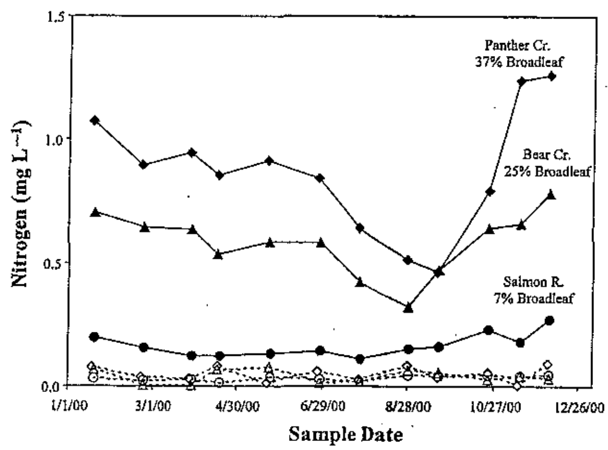

Figure 2. Seasonal trends in stream nitrate (*solid symbols*) and dissolved organic nitrogen (*open symbols*) concentrations for three streams within the Oregon coastal Salmon River basin. Distance to the coast for each stream is given in Table 1.

Table 4. Regressions of Stream Nitrogen (N) and Broadleaf Cover within Riparian Buffers More than 5 km from the Ocean

Buffer Width (m)	Broadleaf Cover (mean ± SE, %)[a]	Nitrate r^2	DON r^2
30	34 ± 18	NS	0.30[c]
60	33 ± 17	0.23[c]	0.31[c]
120	30 ± 15	0.34[c]	0.41[d]
Watershed[b]	25 ± 15	0.66[e]	0.69[e]

DON, dissolved organic nitrogen
[a]Mean (±) SD given for percentage of the buffer area occupied by broadleaf forest
[b]Entire area for each watershed sampled
[c]$P < 0.05$
[d]$P < 0.01$
[e]$P < 0.001$

the distribution of alder stands, it is the exceptionally high rates of N fixation and leaching from alder stands that appear to yield high rates of N export at the watershed scale.

Red alder could supply N to aquatic ecosystems via several pathways: direct inputs of particulate organic matter via litterfall in riparian zones (Volk and others 2003), movement of soluble nutrients from riparian alder stands through groundwater and hyporheic zones (Goldman 1961; Wondzell and Swanson 1996), and leaching and lateral transport from upland stands of pure alder and alder–conifer stands. In contrast to the common view of riparian zones as filters (Peterjohn and Correll 1984; Hill 1996), Naiman and others (2000) suggested that riparian forests in the Pacific Northwest could act as either N sources or sinks, depending on the distribution of alder and hyporheic connections. Nitrate and DON concentrations were much more strongly related to areal cover of alder in the entire watershed than to cover in any of the riparian buffer widths by themselves (Table 3). The N leaching from upland stands reaches ground and surface waters and apparently is not removed by biological uptake or denitrification along the flowpath. Based on the high stream nitrate concentrations and the strong positive relationship of nitrate with alder stands in the Salmon River basin, we believe that leaching and lateral transport from upland red alder is the major source of N to our study streams.

Red alder may play a keystone role in N biogeochemistry, where the presence of alder in mixed alder–conifer stands can also result in high rates of N leaching. Most of the variation in stream nitrate and DON concentrations among our study water-

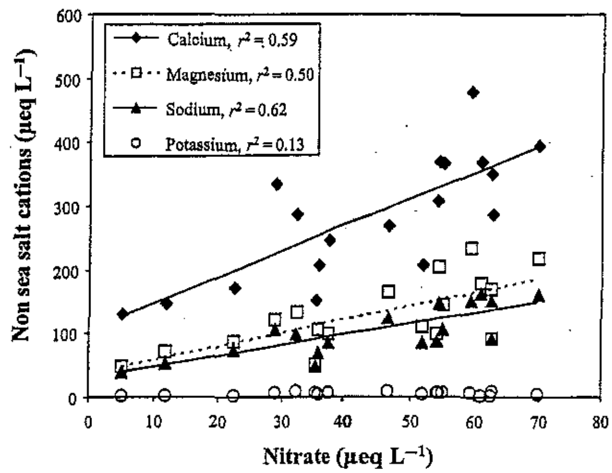

Figure 3. Stream cations as a function of nitrate in sites more than 5 km from the coast. Concentrations are flow-weighted averages of monthly samples during 2000, corrected for sea salt–derived cations. All regressions are significant ($P < 0.001$), except for potassium.

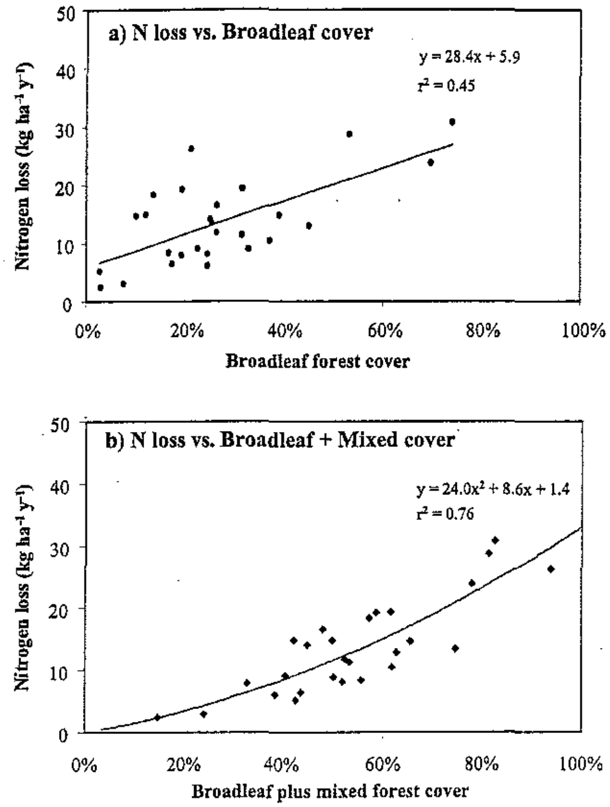

Figure 4. Watershed nitrogen (N) export as a function of a broadleaf and b broadleaf plus mixed (conifer–broadleaf) cover. Data are from all study watersheds within the Salmon River basin in 2000.

sheds was explained by the relationship with pure alder stands (Figure 4a), but including mixed stands improved the relationship by approximately 10% (Table 2). Using Eq. (1) we estimated that a watershed with 100% alder cover might have a loss rate of 39 kg ha^{-1} y^{-1} (SE ± 5), and watersheds with 100% mixed cover might export 29 kg N ha^{-1} y^{-1} (SE ± 7). Although these rates are highly uncertain because we sampled no watersheds with these cover characteristics, they are clearly within the range of leaching losses observed for stand-level studies of pure and mixed alder stands. For example, losses were 39 kg N ha^{-1} y^{-1} from a pure alder stand at Cedar River, Washington (below 0.4 m soil depth) (Van Miegroet and others 1992). Binkley and others (1992) found total N leaching of 26 kg N ha^{-1} y^{-1} below 0.8-m soil depth in mixed alder–conifer stands at Wind River, Washington, and 50 kg N ha^{-1} y^{-1} in mixed alder–conifer stands at Cascade Head, Oregon (within the Salmon River basin). The nonlinear relationship in Figure 4b suggests that in watersheds with low alder cover (less than 20%), rates of N removal may match the rates of N supply from upland alder stands, when the supply is less than 5 kg ha^{-1} y^{-1}. For watersheds with high proportions of alder, we suggest that N inputs reach a level exceeding the capacity for removal by plant and microbial uptake, abiotic retention, and denitrification.

Influences on Stream Cation Levels

Sea salt contributions to sodium, magnesium, and potassium were high within 5 km of the ocean (85%, 55%, and 45%, respectively), but they were very low for calcium across all sites (less than 10%). Systematic variations in bedrock and sea salt inputs can influence stream cations, making it difficult to identify the direct effects of red alder on stream cation concentrations within the basin. Precipitation inputs of sodium were highest near the ocean on the Olympic Peninsula (Blew and Edmonds 1995), and stream sodium concentrations were highest in near-coastal sites in the Salmon River (Table 1). By removing the sea salt contributions, we attempted to more directly isolate the relationship between stream cations derived from soil weathering or mineralization processes and those derived from nitrate-driven leaching.

Stream nitrate concentrations were positively related to non–sea salt concentrations of calcium, magnesium, and sodium in the study streams (Figure 3), suggesting that nitrate leaching may be an important control on watershed-scale cation losses. Although bicarbonate and sulfate dominate the anion charge in these streams (unpublished data), variations in nitrate appear to play a role in cation leaching. In a study of Coast Range streams, Stednick and Kern (1992) suggested that alder-derived nitrate increased stream cation fluxes, particularly since bicarbonate concentrations were similar among watersheds. Mineral weathering may be enhanced under alder (for example apatite) (Compton and Cole 1998), and cation uptake, cycling, and losses are clearly enhanced where alder is present (Binkley and others 1992; Homann and others 1992). Although broadleaf and mixed cover were only weakly related to watershed cation losses, the strong relationships between stream nitrate and dominant cations suggest that nitrate leaching from red alder stands could help drive cation losses at the watershed scale.

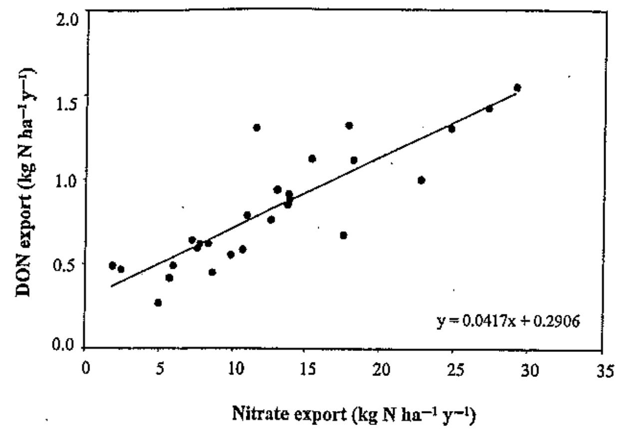

Figure 5. Relationship between nitrate and dissolved organic nitrogen (DON) export for all study watersheds within the Salmon River basin. Pearson correlation coefficient is 0.89.

N Accumulation and Export in Oregon Coast Range Watersheds

In temperate forests with low atmospheric N inputs, the predominant form of N export is DON (Sollins and others 1980; Hedin and others 1995; Perakis and Hedin 2002). In contrast, nitrate often dominates N export in watersheds impacted by accelerated N deposition (Ohrui and Mitchell 1997). As N inputs shift ecosystems from N limitation to saturation, nitrate may become a more important component of the N cycle (Aber and others 1989). Nitrate accounted for an average of 92% of total dissolved N export from all study watersheds of the Salmon River basin and accounted for more than 85% when broadleaf cover was greater than 10%. The dominance of nitrate and high, relatively aseasonal nitrate concentrations (Figure 2) indicate that many of our study watersheds are N-saturated (Stoddard 1994).

Increased N availability may also increase DON export. Although N additions enhanced DON leaching from the forest floor at the Harvard Forest chronic N study (McDowell and others 1998), DON leaching from the deeper mineral soil did not respond (Currie and others 1996). Sorption or biotic uptake was hypothesized to maintain a constant flux of DON in response to N additions (McDowell and others 1998). In the Salmon River basin, DON export increased with watershed-scale nitrate export (Figure 5). Alder stands could increase DON losses directly through root or symbiont exudation or indirectly by increasing soil N availability. Long-term N additions via N_2 fixation increased the export of DON, but the resulting DON losses do not offset the high rates of N inputs and associated patterns of nitrate leaching.

Oregon Coast Range streams have high nitrate concentrations relative to other small forested watersheds in the Pacific Northwest and other temperate regions. The average N export from watersheds within the Salmon River (13.6 kg N ha^{-1} y^{-1}) is nearly an order of magnitude greater than the export from a small coniferous watershed in the Oregon Cascades (1.5 kg N ha^{-1} y^{-1}) (Sollins and others 1980). In a survey of streams across the Coast Range during a fall storm, the variation in nitrate concentrations (from less than 0.005 to 2.4 mg NL^{-1}) was hypothesized to be controlled by forest vegetation and specifically N_2 fixation by red alder (Wigington and others 1998). Small watersheds within the Alsea basin of the western Coast Range had losses of up to 20 kg nitrate-N ha^{-1} y^{-1} (Stednick and Kern 1992); and Flynn Creek, with approximately 68% alder cover, exported 25–35 kg nitrate-N ha^{-1} y^{-1} (Brown and others 1973). In contrast, forested watershed streams in the western Cascades and Olympics have very low dissolved N concentrations and loss rates of less than 2 kg N ha^{-1} y^{-1}, where DON dominates N losses (Triska and others 1989; Edmonds and others 1995). Variations in red alder cover across the region may explain the patterns of nitrate leaching across the Oregon Coast Range. In the Cascade and Olympic mountains of western Oregon and Washington, red alder generally is restricted to riparian areas and does not play the same broad landscape role as in the Coast Range. Rates of N export from Salmon River watersheds (2.4–30.8 kg N ha^{-1} y^{-1}) generally are greater than those from small forested watersheds in more polluted regions of the northeastern United States [1–2.5 kg N ha^{-1} y^{-1} in New Hampshire (Goodale and others 2000); 3.8 kg N ha^{-1} y^{-1} in the Catskills (Lovett and others 2000)] and are more similar to N-saturated forests in Europe and Asia [10–31 kg N ha^{-1} y^{-1} (Gundersen and Bashkin 1994; Ohrui and Mitchell 1997)].

Coast Range soils also have particularly high N content relative to other areas of western Oregon (Cromack and others 1999; Remillard 2000). In the Salmon River basin, soil N content was 13,720 kg ha^{-1} in mixed alder–conifer stands and 9,800 kg ha^{-1} in pure conifer stands (Binkley and others 1992). These are among the highest values of forest soil N content globally (Cole and Rapp 1981). Export from watershed SM-11, with 74% alder cover, was 30.8 kg N ha^{-1} y^{-1}. If pure alder stands fix 100–200 kg N ha^{-1} y^{-1} (Binkley and others 1994), then at least 55% of the fixed N was retained within the watershed, since denitrification is a relatively small vector of N loss in alder stands (less than 0.3 kg N ha^{-1} y^{-1}) (Binkley and others 1992). Although alder-dominated watersheds are relatively open with respect to N cycling (high inputs and outputs), substantial N accumulation does occur within these ecosystems. The mechanisms for maintaining this continued ecosystem N retention and accumulation over the long term are not understood, but they are probably linked to the high carbon storage under alder (Cole and others 1995). Although extremely high N export may be related to the present-day distribution of red alder stands, large-scale fires with a frequent rotation time (approximately 200 years) (Long and others 1998) could have enabled alder to colonize these disturbed areas during the last several thousand years. Fire may be an important vector of short-term N loss, and the long-term effect may be to increase ecosystem N content by promoting alder colonization. The widespread and shifting distribution of red alder could leave a legacy of high soil and stream N across much of the Oregon Coast Range.

Implications of Large N Export for Terrestrial and Aquatic Ecosystems

Due to their long growing seasons, relatively low drought stress, and abundant N availability, the forests of the Oregon Coast Range are among the most productive conifer forests on Earth (Waring and Franklin 1979). Rapid colonization and high rates of N_2 fixation by red alder after disturbance may be in large part responsible for the high N availability in these forests. However, the rapid accumulation of N beyond ecosystem demands can lead to N saturation, and the consequences of alder-driven N saturation are not widely recognized or understood.

It is not clear whether N leaching associated with red alder will manifest itself in widespread cation deficiencies or declining forest productivity, as proposed and observed in polluted regions of the northeastern United States and Europe (Aber and others 1989, 1998; Likens and others 1996). In alder-dominated watersheds, biological inputs drive N saturation rather than the anthropogenic deposition inputs specified in the original model (Aber and others 1989). The processes associated with N saturation appear to be similar, in that N supply exceeds the watershed capacity to retain or remove this N, leading to nitrate losses that can in turn accelerate cation losses and soil acidification. The expansion of *Alnus* approximately 8000 years ago in southwestern Alasaka has been linked to increased N availability in lakes and their watersheds and with increased aquatic productivity and soil acidification at this time (Hu and others 2001). There is recent evidence linking high soil N to increased severity of fungal pathogens and reduced needle retention in the Oregon Coast Range (Maguire and others 2000). Increases in fire, logging, and land clearance since European settlement may have allowed red alder to expand across the disturbed landscape during the 20th century (Heusser 1964; Davis 1973; Carlton 1988). Given its influence in regulating N and possibly cation supply, it is important to consider the role of alder when assessing the long-term impact of human activities on forest ecosystem productivity.

N export from alder-dominated watersheds may also affect aquatic ecosystem function. N or P can limit autotrophic production in Pacific Northwest streams and rivers (Hill and Knight 1988; Welch and others 1998); therefore, high inorganic N loads could produce high N:P ratios and P limitation. In the highly shaded headwater streams of the Salmon River basin, instream processing retained only a small proportion of nitrate inputs (S. T. Larned unpublished). Because coastal waters are N-limited for at least part of the year (Bernhard and Peele 1997; Wheeler and Björnsäter 1992), nitrate loading to coastal areas from alder-dominated watersheds could influence estuarine algal blooms, community composition, and other symptoms of eutrophication (Cloern 2001).

In the Pacific Northwest, human activities have altered watershed-level nutrient budgets in relatively unique ways. Although declining salmonid returns have reduced inputs of marine-derived N to Pacific coastal watersheds by approximately an order of magnitude (Finney and others 2000), changes in land cover in the 20th century could have accelerated terrestrial-derived N inputs from red alder. A positive feedback has been suggested for Pacific coastal streams, where the N and P supplied by returning Pacific salmon increase the productivity of riparian forests, freshwater ecosystems, and juvenile salmon (Johnston and others 1990; Bilby and others 1996; Helfield and Naiman 2001). The relative role of alder versus salmon inputs to stream productivity is not known. However, even if the amount of N delivered is similar, watershed-derived nitrate and DON are not expected to play the same role in aquatic ecosystems as the protein-rich particulate organic N derived from the decay of returning salmon. The role of terrestrial versus marine-derived nutrients is of particular interest since stream amendments are being suggested as a fisheries management practice in this region (Stockner and Ashley 2003) The effects of such amendments superimposed on the inherently high levels of watershed N export in the Oregon Coast Range are unknown. Clearly, more attention needs to be paid to the collective influence of human activities on watershed-scale nutrient cycling and aquatic productivity in the Pacific Northwest coastal region.

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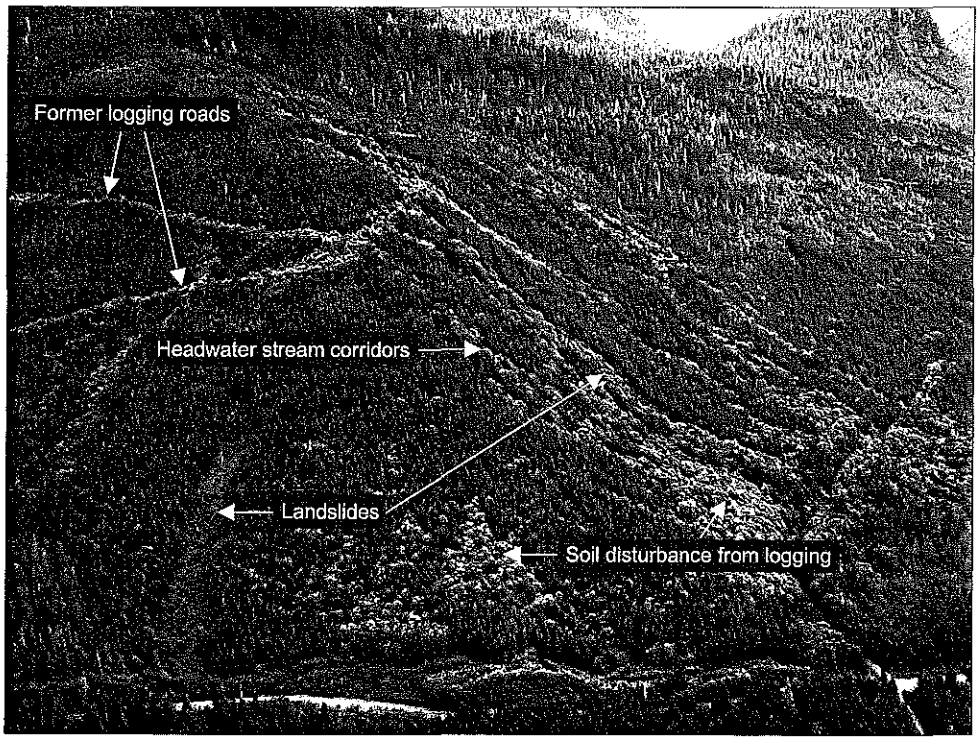
INSIDE

"Science affects the way we think together."

Lewis Thomas

ECOLOGICAL PAYOFFS FROM RED ALDER IN SOUTHEAST ALASKA



Red alder, the lighter-colored tree species in this photograph, regenerates in disturbed soils.

IN SUMMARY

Clearcutting has been the primary timber management practice in southeast Alaska forests since large-scale commercial forestry began in the 1950s. The dense, even-aged conifer stands that subsequently develop, however, may have undesirable consequences for some nontimber resources, most notably fish and wildlife.

Red alder is frequently established in these young-growth conifer stands and appears to provide different forest structural attributes and improved biodiversity that may mitigate some negative effects of harvesting. However, to date, it has been unclear what the ecological functions of red alder are in these ecosystems. Understanding the ecological role of alder in young stands will help aid restoration and management of young forest ecosystems.

Recent findings from the PNW Research Station in Alaska, funded by the Station's Wood Compatibility Initiative, suggest that red alder may leave a legacy of more open stand conditions, increase forest understory plant and wildlife biodiversity and abundance, and enhance productivity and biological function of headwater streams.

"What is a weed? A plant whose virtues have not been discovered."

—Ralph Waldo Emerson (1803–1882)

In parts of southeast Alaska it is not unusual to see distinct bands of light green leafy trees marching down the hillsides in spring. The trees are red alder, contrasting with the darker colors of the hemlock/spruce/cedar forests of these northern latitudes. These bands are following streams, where erosion exposes the mineral soils the species prefers for regeneration.

For decades red alder has reliably colonized recent clearcuts, landslides, and blowdown patches for the same reason—exposed mineral soil. The species has until recently been branded a weed by southeast Alaska timber interests, based on its propensity for "interfering with" early conifer growth. However, in the Pacific Northwest, red alder is now a highly valued crop tree with a small but thriving hardwood lumber market.

A native component of the southeastern Alaska and the Pacific Northwest landscape, and similar to other alder species found in forests throughout the world, red alder exhibits rapid early height growth, and for the first 20 to 30 years of its life, can dominate other conifer trees established following both natural and human-caused disturbances.

"When you see the extent of these bands, and their coverage across the landscape, you begin to understand how they produce such a remarkable amount of food for fish, and productivity for stream and forest in general," says Mark Wipfli, an associate professor at the University of Alaska, Fairbanks, and formerly a research aquatic ecologist at the PNW Research Station. "It is a real eye-opener now to learn about the benefits coming from this poorly understood tree species."

The very abundance of the species on the landscape led Wipfli and other researchers to wonder about the ecological implications of such vegetation. Upon investigating the state of knowledge about red alder, they found a significant gap in the scientific literature, so they developed a primary set of questions to guide subsequent research: Does red alder affect understory development, tree growth, and timber production? How does it influence food and habitat for fish and wildlife? How does red alder function in stream and riparian habitats? Does it influence forest ecosystem diversity and productivity?

KEY FINDINGS

- Red alder is dynamic in young-growth stands, exhibiting rapid early height growth. As it becomes overtopped by conifers as early as 20 to 25 years, it may leave a legacy of more open stand conditions characteristic of mature forests.
- Mixed red alder-conifer stands provide more heterogeneous structures than pure conifer stands with different tree sizes, multiple canopy layers, and similar numbers of large-diameter conifers.
- Red alder increases forest understory plant biodiversity and abundance, providing more cover and browse for deer and other wildlife such as songbirds and terrestrial invertebrates.
- Headwater streams with riparian red alder appear to be more productive, providing more food (invertebrates) for fish and birds.
- Red alder seems to provide critical biological function (food) to forested ecosystems, whereas conifer species provide more physical function (habitat), especially in streams.

With Bob Deal, a research silviculturist with the Station's Portland, Oregon, lab, and others, Wipfli coordinated the ensuing research into the ecosystem role of this common and little known species.

FOLLOWING THE CLEARCUTS

Clearcutting has been the primary timber management practice in forests of southeastern Alaska since commercial timber harvesting began in the 1950s. Conifer forests in southeast Alaska have no trouble at all regenerating after harvest, and rarely need artificial planting, Deal explains. In fact, they're rather too good at it, resulting in dense forests that quickly shade out other understory species that might provide browse or cover for wildlife.

"The dense, uniform, even-aged stands that develop after clearcutting have many negative consequences for wildlife and fish," says Wipfli. "Forest canopy closure generally occurs 25 to 35 years after cutting and is followed by a nearly complete elimination of understory vegetation for 100 years or longer."

From this point, there's a cascade of effects relating back to clearcutting. The resulting even-aged conifer forests have simple, uniform stand structures, lack the diverse structures of mature forests, and are poorly suited for many wildlife species.

When the canopy closes over small streams, the nature of the food web changes, affecting overall aquatic productivity. Removal of streamside timber can, in some cases, reduce the amount and size of large wood in a stream, with resultant loss of bird and fish habitat. Changes in forest structure brought about by clearcutting may, in some circumstances, also alter supply, storage, and transport of woody debris and sediment through processes such as landslides, windsnap and blowdown, and bank erosion.

"Consequently, there is increasing interest in developing forest management practices that maintain or enhance biodiversity and assure long-term sustainability of forest products, wildlife, and aquatic resources," says Deal.

Purpose of PNW Science Findings

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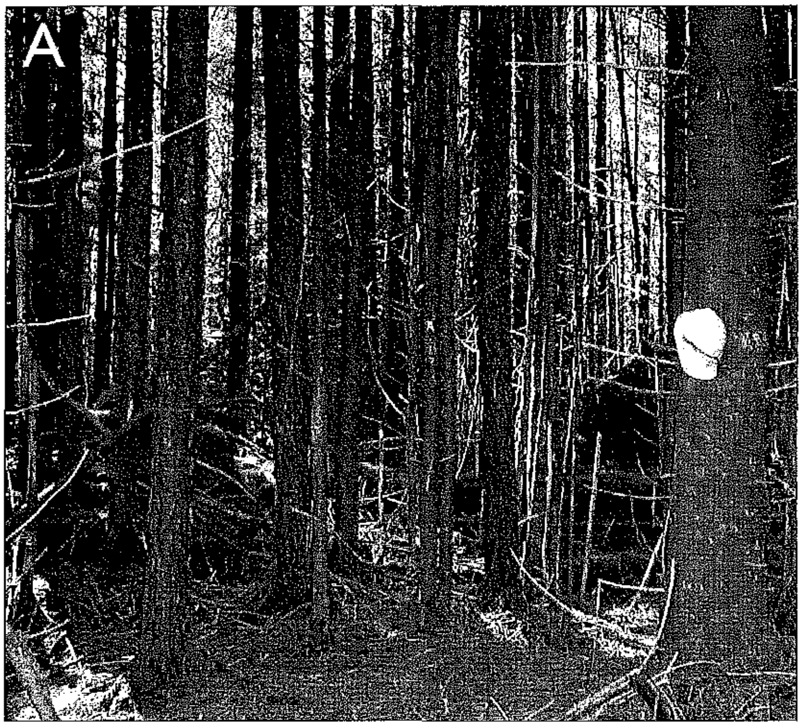


Credit: Bob Deal

Biologically simplified, 40-year-old, even-aged conifer ecosystem (A), and a mixed red alder-conifer ecosystem of the same age (B) showing the more diverse stand structure and abundant understory.

RED ALDER TO THE RESCUE?

Which brings us back to red alder. Red alder is the most common hardwood tree in the Pacific Northwest, extending from southern California to southeast Alaska. It is a short-lived, shade-intolerant pioneer with rapid juvenile growth and the ability to fix atmospheric nitrogen. The soil disturbance generated by logging, log landings, skid trails, or avalanche paths exposes mineral soil, inviting the deciduous species to put down roots to form both pure and mixed stands.

"Other recent studies of young-growth stands of red alder mixed with conifers indicate that the presence of alder may mitigate some of the negative impacts of clearcutting in southeast Alaska," he says. "Mixed alder-conifer stands have species-rich, highly productive understory vegetation with biomass similar to that of old-growth stands of the region, and habitat quality for small mammals in these mixed stands may be equal to that of old-growth forests."

Although inclusion of alder will not mitigate all wildlife habitat problems, it may provide more benefits than would thinning of even-aged conifer stands, Deal points out. Attempts to establish understory herbs and shrubs through thinning often lead to yet more conifer regeneration, with little new herbaceous colonization.

The results in riparian areas are particularly notable. "Riparian forests with some red alder appear to produce more prey for fishes than conifer riparian forests," Wipfli says. "This is significant because over half of the prey biomass ingested by juvenile salmonids in southeast Alaska is terrestrial and originates from adjacent riparian vegetation." If similar processes occur in upland forests, he adds, the presence of red alder may contribute to an increase in invertebrate production, providing more food for animals such as birds, bats, small mammals, and fish, in turn affecting their abundance and production.

The irony now is that harvest methods since the 1970s have focused on reducing soil disturbance, and the resulting decrease in red alder coverage after harvest is a known pattern in southeast Alaska.

It's one thing to recognize that a "weed" species might have something more to offer than its poor reputation suggests, it's another to find out what that something might be. A number of recent studies, including several by Wipfli, Deal and others, have begun to fill in the many holes in understanding red alder's ecosystem role.

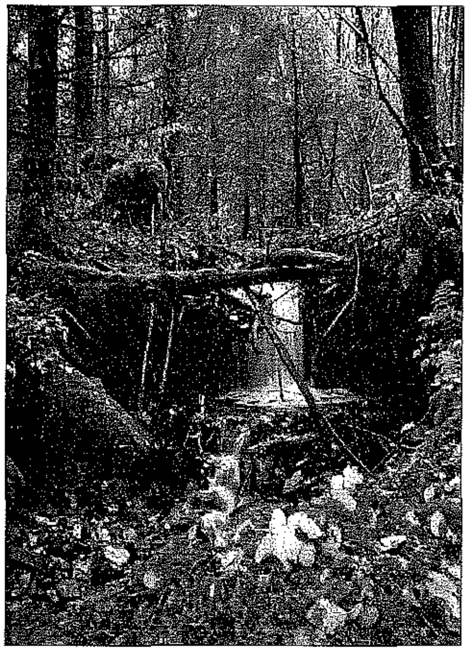
FILLING THE KNOWLEDGE GAP

Among the studies, three themes emerged: the influence of red alder on specific ecosystem components, the flow and use of wood among habitats, and the influence of red alder on ecosystem linkages and processes.

"We hypothesized that red alder increases the abundance and diversity of understory plants, which in turn influences aquatic and terrestrial invertebrate communities in terms of abundance and species richness, and the bird and fish communities that feed on those prey," Wipfli explains. "We also predicted that dead wood, especially red alder, serves important biological functions affecting invertebrate communities in riparian and aquatic habitats."

The investigations tracked interactions in seven major resource areas: geomorphic processes, wood production, understory vegetation, avian ecology, terrestrial invertebrates, aquatic and riparian ecology, and fish ecology. The researchers believe this series of investigations is the first to concurrently cover stream, riparian, and nonriparian habitats in southeast Alaska. To date, they note, most information about red alder in the region is speculative or based on data from other regions.

Among findings from the studies: these mixed red alder-conifer stands provided more variable structures than pure conifer stands with different tree sizes, multiple tree canopy layers, and similar numbers of large-diameter conifers. Understory plant diversity and abundance were significantly higher in these mixed alder-conifer forests, and most of the increase in understory biomass was in vascular plants important for deer forage and other small wildlife species. Further, mixed red alder-conifer stands potentially provide more food for songbirds, more and safer nest sites, and reduced susceptibility to nest predation, based on work by Toni DeSanto, an avian ecologist with the PNW Research Station in Juneau, Alaska.



Credit: Rick Edwards

Headwater stream draining an upland forest where it has already transitioned into a lower gradient, fish-bearing reach.

RED ALDER AND STREAM PRODUCTIVITY

Little is yet known about the influence of plant communities developing along upland riparian areas on stream productivity and downstream fish, according to Wipfli, but red alder could have a variety of impacts, such as changes in light penetration and litter inputs. "These effects could lead to changes in aquatic productivity and input of terrestrial invertebrates to streams. Some riparian tree species contribute more invertebrate mass to streams than others, and red alder appears to support relatively high levels of prey for fish."

Red alder and other vegetation types along streams can also have major influences on stream riparian soil nutrient levels, he says. The nitrogen fixed by red alder can affect soils for many years, and can be moved by hyporheic activity into adjacent streams. In addition, because red alder decays faster than conifers and is a desirable source for invertebrates, it is likely to affect the detritus and invertebrates exported from headwaters to downstream habitats.

Wipfli and Deal's study sites encompassed a range of red alder abundance in two adjoining watersheds on Prince of Wales Island, southeastern Alaska. Two distinct types of sites were selected: nonriparian where the focus was to evaluate the influence of red alder on vegetation, birds, and invertebrates; and stream-riparian, where the focus was the effect of red alder on vegetation, stream nutrients, organic detritus, invertebrates, woody debris, and fish.

"The proportion of red alder was the independent variable common to all aspects of sampling," Deal says. "One of our goals was to construct an empirical model to show how resources might differ along the continuum of red alder dominance. This information could then be used by managers as a predictive tool for selecting the proportion of red alder to be managed in association with single or multiple resource objectives, at the stand, stream reach, or watershed scale."

RED ALDER AND WOODY DEBRIS

Total wood production decreased significantly with increasing proportion of red alder basal area, according to Deal. In contrast, tree density did not differ with red alder composition, and the largest conifer trees in mixed stands were likely to achieve the same size as in pure conifer stands. He describes a very different forest structure in the mixed alder-conifer stands than in pure conifer forests that have more uniform size distributions: these mixed alder-conifer stands created a multilayered forest canopy with a few dominant overstory conifers, a midcanopy level of red alder, and a lower canopy level of small-diameter conifers. Also, most dead trees died standing regardless of size or species.

A significant ecological downside of alder is the lesser volume of large woody debris it provides to the system, being shorter lived and decaying faster than conifers.

The number of red alder, large woody debris pieces in streams increased with increasing proportion of red alder in the riparian stand, according to findings by Takashi Gomi, a post-doctoral researcher with the University of British Columbia. However, significant relationships between the volume of large woody debris and sediment stored behind these pieces and the proportion of red alder in riparian zones were not found.

Because of the faster decay, and the fact that it is a desirable food source for invertebrates, red alder likely affects the volume of detritus and invertebrates exported from headwaters to downstream habitats. However, again red alder appeared to have no direct relationship with salmonid densities. The limiting factor on salmonid populations in these streams, according to Wipfli, is more likely to be amount and quality of habitat.

WRITER'S PROFILE

Sally Duncan is a science communications specialist and writer focusing on forest resource issues. She is also a candidate for a Ph.D. in Environmental Sciences at Oregon State University in Corvallis, Oregon, where she lives.

In the end, there's a balance to be considered in how red alder affects the ecosystem.

"An increase in red alder in riparian forest canopies may have both positive and negative impacts on aquatic communities," Wipfli points out. "Higher aquatic productivity and more food for fish and wildlife may be outweighed by loss of fish habitat resulting from decreased large woody debris inputs, wood longevity, and increased sediment loading from fewer large conifers."

LAND MANAGEMENT IMPLICATIONS

- Red alder can be managed to help mitigate some of the potential effects of forest clearcutting, increasing habitat quality for wildlife, stream productivity, and food for fishes, amphibians, songbirds, and other invertivores.
- Growing red alder in patches, rather than dispersed in stands where it must compete directly with neighboring conifers, may extend its ecological function for decades.
- Findings have broad implications for multiple resource objectives (forests, wildlife, fishes) and are applicable across the broad geographic regions worldwide where other alder species with similar ecological properties are found.

DEVELOPING MANAGEMENT TOOLS

Two successional trajectories for young, regenerating forests appear to follow clearcuts or other disturbance. Pure or nearly pure conifer forests (with low soil disturbance) develop a sparse and nondiverse plant understory, which in turn leads to little wildlife browse and sparse foliage for herbivorous invertebrates, Wipfli says.

"Nearly pure conifer forests also provide less nitrogen and light for stream producers and consumers, which can lead to fewer aquatic invertebrates in the associated headwater streams, ultimately providing less food for birds and downstream fish. They also provide fewer nesting sites for songbirds and support lower songbird density."

The alternative trajectory, with more red alder, leads to the benefits to the stream outlined above. In addition, the more rapid life cycle of red alder offers greater opportunity for complexity in forest structure to develop. For example, younger alder start to die off around 35 years, when conifers overtop them. Being deciduous, they allow more light penetration to the forest floor for a longer period. And gaps created where one or more large red alders have died between age 60 and 100 years, leave conifer stands more open; these gaps could also allow invasion of new trees, thereby creating a new canopy.

This kind of complexity, according to Paul Hennon, Forest Service research forest pathologist with State and Private Forestry of the Alaska Region in Juneau, Alaska, can occur decades earlier in mixed stands than in pure conifer stands where overstory death of conifers may not begin until around age 150 years. "The longer term benefit of red alder may be that its death accelerates the transition to a mature forest structure."

Larger red alders provide an intermediate source of woody debris for streams, and the species provides both nitrogen and high-quality organic matter for decomposers and invertebrates. Thus red alder increases food abundance in its immediate vicinity and in downstream reaches.

How might resource managers respond to these data?

"We're getting a great deal of interest from managers on the Tongass and other parts of southeast Alaska on this work," Wipfli says. "They're looking for opportunities to increase red alder reproduction, they're establishing some red alder planting trials to check against our restrospective study, and they're looking for ways to keep streams productive."

Further research questions abound. How much alder is good from an ecosystem management perspective? Should we be planting alder now that logging methods are less likely to disturb mineral soil? What are the long-term successional dynamics between alder and conifers? And, is there a timber market for red alder in southeastern Alaska?

Wipfli cautions against hailing red alder as the salvation species. "We shouldn't go overboard into thinking of it as a quick fix," he says. "Although it does mitigate a number of the effects of clearcutting, there are some things it can't address, such as loss of large woody debris, as well as erosion and sedimentation."

Nonetheless, the widespread occurrence of alder throughout the Pacific Northwest and around the world suggests that these results may offer insights into numerous other ecosystems, the researchers say. The "weed" is coming of age.

FOR FURTHER READING

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Johnson, A.C.; Edwards, R.T. 2002. *Physical and chemical processes in headwater channels with red alder.* In: Johnson, A.C.; Haynes, R.W.; Monserud, R.A., eds. Congruent management of multiple resources: Proceedings from the wood compatibility workshop. Gen. Tech. Rep. PNW-GTR-563. Portland, OR: U.S. Department of Agriculture, Forest Service, Pacific Northwest Research Station: 101–108.

Orlikowska, E.H.; Deal, R.L.; Hennon, P.E.; Wipfli, M.S. [In press]. *The role of red alder in riparian forest structure along headwater streams in southeastern Alaska.* Northwest Science.

Wipfli, M.S. [and others]. 2003. *Compatible management of red alder-conifer ecosystems in southeast Alaska.* In: Monserud, R.A. [and others], eds. Compatible forest management. Dordrecht, The Netherlands: Kluwer Academic Publishers.

Wipfli, M.S.; Musslewhite, J. [In press]. *Density of red alder (Alnus rubra) in headwaters influences invertebrate and organic matter subsidies to downstream fish habitats in Alaska.* Hydrobiologia.

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July 15, 2004

Representative Bob Jenson
Chair, House Subcommittee on Water
2126 NW Despain
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Dear Representative Jenson,

In Mid-June Representative Jeff Kropf asked me to have my faculty review the recent IMST report entitled "Oregon's Water Temperature Standard and its Application: Causes, Consequences, and Controversies Associated with Stream Temperature". IMST Technical Report 2004-1. He requested that I send the results of this review to you by July 15, 2004. Representative Kropf's request came at a very busy time for us and we were only able to do a partial review in the time available. The faculty has spent about 100 hours of time reviewing and checking references in the report. In order to do a full and comprehensive review that includes checking the references for correctness of the citations and evaluating the interpretations made from references would take about 6 months of full time work that we cannot do without additional staff help.

Based on our review, we do have several concerns about the accuracy of the report and the bias that we see in the presentation and interpretation of "scientific findings". For example, some of the work referenced in the IMST report indicates findings that were not in the references cited, the cited work is skewed to non-scientific publications, and important references that would add balance to the IMST report are not used. The consequence is that the report is not a balanced presentation of science and viewpoints related to stream temperatures but rather has a bias that supports the viewpoint of the authors. I have included a reprint of a paper published four years ago that explains the difference between science and viewpoints in natural resources literature. This will help explain how different kinds of reports should be evaluated and used by professional resource managers.

We do not accept the IMST Technical Report 2004-1 as a valid balanced scientific review of existing scientific work related to temperature dynamics in Oregon streams. We think it needs significant outside review for accuracy and it needs to provide a more balanced presentation of the current state of knowledge.

Sincerely,

William C. Krueger, Head
Department of Rangeland Resources

cc: Representative Jeff Kropf
Dr. Roy Arnold
Dr. Stan Gregory, Co-chair IMST

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To: Representative Bob Jenson

A Partial Review of: Oregon's Water Temperature Standard and its Application: Causes, Consequences, and Controversies Associated with Stream Temperature IMST Technical Report 2004-1

In 2000 the IMST invited members of the Rangeland Resources Department to participate in a Temperature Workshop to examine issues surrounding the Oregon temperature standards for water quality. As participants we have taken note of deficiencies provided in Technical Report 2004-1 entitled "Oregon's Water Temperature Standard and its Application: Causes, Consequences, and Controversies Associated with Stream Temperature. The report offers recommendations to agencies using the premise that the 2004 IMST report sets a factual and scientific basis for Oregon's water quality temperature standards.

While we intend no criticism toward the authors of the IMST report, our review of the document left us with many concerns about the types of literature reviewed. The IMST 2004 report dismissed studies that were in conflict with Oregon temperature standards and failed to examine many of the fundamental research manuscripts regarding grazing and grazing impacts. The IMST 2004 report includes references of questionable scientific merit to support the "scientific basis" for Oregon's water quality standards.

Defining science - The IMST uses the word science and scientific nearly 200 times in the final report. The term science is never defined and a framework/criteria for evaluating the 'science' they reference in their review is never discussed. This issue is basic and critical. It was raised at the initial workshop and during the review of the draft of the final document. The response of the team to this concern is the following footnote: 'Graduate theses, Masters theses and Ph.D. dissertations, undergo peer-review by a committee of university faculty or other scientists. The level of review for government documents varies widely. Reports are sometimes subjected to extensive external and internal technical review, but this is not a universal practice.' This response is grossly inadequate.

The IMST reviewed a wide range of documents the team described as 'best available science' and followed with an interpretation of scientific fact from the manuscripts. These documents come from a variety of sources and represent a mix of science, speculation, and opinion. Since the report was prepared without using a method for assessing the classification or quality of the literature, there is no mechanism for the reader to separate literature with credible data and an objective analysis from literature that reflects personal bias and opinion. At a minimum literature should be categorized to contain all of the following criteria: Was experimental data collected in a structured way that allowed a valid statistical analysis to be made? Was the level of uncertainty (probability of being correct) calculated for the analysis? Were the author's conclusions supported by the experimental results or did they extend beyond the results and reflect speculation and opinion? Was the literature subjected to a national/international blind peer review, an internal agency review, or simply an editorial review? Was a qualified neutral referee used to assess the merits of peer review comments or were reviewer comments evaluated solely by the authors? While none of these criteria are 100% satisfactory they establish a framework for separating opinion from the conclusions drawn from designed experiments that have been established with statistical confidence based on objective analyses.

To illustrate these and other concerns about the report consider the following: The report (a state document) was prepared and reviewed in an environment that is not transparent to public review. The IMST did not articulate or apply a quality control screen to the literature they describe as best available science. A preliminary review of the cited literature indicates that 42% of the citations come from peer reviewed (mostly blind) professional journals, 38% are reports that may or may not have been subjected to outside review or even contain data, 8% are book chapters that typically summarize literature, 7% are conference proceedings which tend to be minimally reviewed, 4% are theses that are developed to train students and do not necessarily contribute to science and 2% are unpublished sources of information. Reviewers selected by the IMST team conducted technical reviews of the report and the IMST report authors controlled the impact of the reviews. Each of these points raise concerns about the credibility of the report.

Literature Bias - Failure of the IMST to screen their literature sources resulted in numerous forms of bias. Documents containing opinion and/or speculation are cited as valid sources of science. Similarly, examples can be found in the cited literature that meet the criteria of science but are minimized or misrepresented.

One of a number of examples of an opinion article can be found on p. 85 paragraph 2. 'Greene (1950) showed a stream temperature decrease from 80 to 68°F after a stream, flowing through an agriculturally dominated watershed, traveled only 400 feet through a forested reach.' The article does not contain elements of the scientific method, experimental control, and is 2 pages in length. The report provides a statement that a 12°F drop in stream temperature was observed within 400 feet of stream length after entering a forest environment. No information was provided about how or when 12°F change was observed. Thermal changes of this type and magnitude over 400 feet are highly unlikely unless a substantial volume of cold water is being added with respect to the volume of the stream. This citation is also used on page 84 to document the influence of shade on winter stream temperatures and on page 86 as an example of a valid empirical study that demonstrates the influence of vegetation shade on stream temperature. The Greene (1950) report is not a sufficient or appropriate reference to support any of these statements.

In contrast on pages 86, 89, and 125 a blind (national) peer reviewed article by Borman and Larson (2003) containing a literature review, data collected over a 2 year period, an experimental design, and an analysis including uncertainty calculations is portrayed as being of less scientific value. This example represents a bias that minimizes valid scientific results. Specifically, that as streams approach equilibrium with the thermal environment, weather patterns exert a dominant influence on stream temperature and in this case an influence of land use on stream temperature could not be detected. Similarly, the IMST report discounts science reported by Krueger et al. (2003) on pages 83 and 84. Krueger et al. (2003) results do not support the theory promoted in the IMST assertion that shade controls stream temperature. It appears that since Krueger et al. (2003) findings are not in accord with the majority of papers cited by IMST, it is discounted.

Scientific knowledge progresses because of the willingness of scientists to acknowledge and seek out credible scientific data. The fact that the IMST report minimizes valid scientific studies suggests that members of the IMST do not believe that there is additional knowledge to be gained from research regarding the control of stream temperature with shade. An objective review of this literature would have noted that additional research is warranted in order to document how stream temperatures respond to environmental conditions.

An example of misrepresentation occurs on page 67 where a box is provided to emphasize the IMST position on the relationship between air and stream temperature. In the first paragraph they cite Larson and Larson (1996) twice as a literature source that they disagree with and argue against in the following 4 paragraphs. Larson and Larson (1996) uses standard thermodynamic equations to calculate temperature change in a volume of water using documented radiation (combined solar and atmospheric) inputs and calculates the amount and direction of shade generated by specific solar angles and tree heights. The article does not discuss or mention a relationship between air and water temperature. The IMST error demonstrates poor quality control and is inexcusable given the attention directed toward the IMST by the governor, state legislature, and state agencies. The absence of quality control during the preparation of this document raises concerns regarding the familiarity of the science team with the literature they reference and the content of their report.

A second example of misrepresentation occurs on page 96 where a box is again provided to emphasize an IMST position. In this case the emphasis is being placed on the value of FLIR technology. In this section they describe Larson et al. (2002) dismissively as a conceptual paper (The term conceptual paper is not used to describe any other piece of literature used in the report but is an improvement over the term 'opinion paper' which was used to describe the article in the first draft of the report). The article, a feature article, received a blind national/international peer review. It documents an actual FLIR interpretation by Oregon DEQ where stream temperature change associated with shade was reported to be approximately 4°F over a distance of several yards. Larson et al. (2002) calculated the amount of temperature change expected to occur using standard thermodynamic principles and equations. The results were validated through field-testing using a designed experiment and the uncertainty of the experimental results was determined. Based on the magnitude of the error in the DEQ interpretation, Larson et al.

(2002) suggest that care must be taken in the interpretation of FLIR imagery, especially in the absence of direct ground truthing in the image area and that more robust methods need to be applied when attempting to predict instantaneous water temperature profiles within a basin (Larson et al. 2003). The study was an empirical evaluation of interpretations by Oregon DEQ and while the results may not agree with the views of IMST, the data and mathematical derivations are unchallenged. An objective assessment of this literature would have noted the potential for error in Oregon in other cases and encouraged steps that would improve quality control when applying FLIR technology.

The section on Upland Management on page 79 and 80 of the IMST report indicates a superficial and in some aspects incorrect knowledge of the literature reviewed. Certainly, logging, livestock grazing, recreational vehicles plus other soil disturbing activities (hiking, mountain bike riding, horseback riding etc.) can reduce soil infiltration. However, the linkage between these activities, infiltration, subsurface flow or surface flow and stream temperature has not been quantified scientifically. Questions regarding timing, duration and extent of the impact of the listed activities plus the issue of soil resiliency and resistance to change must be factored into the question of impact. IMST leads the reader to believe that these activities affect subsurface flow, "Management of upland vegetation and soils can affect the volume of subsurface flows by altering both infiltration and percolation of water from rainfall and snowmelt. Soil compaction from ground-based logging, livestock grazing, or recreational vehicles can reduce infiltration." (p. 79 IMST). These statements are made without any citations – not even opinion papers. Therefore these are opinions held by the IMST team that have not been substantiated by their review.

Page 80, second paragraph. Miller and Wigand 1994 stated on page 468, "The factors most frequently implicated in the recent expansion of juniper species…are climate, fire and grazing." All three factors are discussed within the Miller and Wigand (1994) manuscript without an absolute conclusion drawn. The authors of the IMST report on page 80, second paragraph stated conclusively, "In eastern Oregon, fire suppression and overgrazing has replaced native bunchgrass…with western juniper/sagebrush communities." The Miller and Wigand (1994) paper is cited. Secondly, many papers by Miller and others, listed below but not utilized in the IMST report would have educated the authors on the sagebrush steppe ecosystem. It is apparent from the IMST report on page 80 that the authors believe open bunchgrass rangelands were encroached by sagebrush and juniper after contact by European settlers. The climax plant community in the sagebrush steppe system is a sagebrush/bunchgrass community not a grassland. Certainly, western juniper has increased significantly probably due to the influence of climate change, grazing and fire suppression but to imply sagebrush has encroached is a significant misunderstanding.

Miller, R.F., T.J.Svejcar, and J.A. Rose. 2000. Impacts of Western Juniper on plant community composition and structure. J. of Range Management 53:574-585.

Bates, J.D., R.F. Miller and T.J. Svejcar. 1998. Understory patterns in cut western juniper woodlands. Great Basin Naturalist 58:363-374.

Bates, J.D., R.F. Miller and T.J. Svejcar. 2000. Understory dynamics in cut and uncut Western juniper woodlands. J. of Range Management 53:119-126.

Miller, R.F. and J.A. Rose. 1999. Fire history and western juniper encroachment in sagebrush steppe. J. of Range Management 52:550-559.

Page 80, second paragraph. "This shift to juniper/sagebrush communities on large areas of basins can increase storm runoff and soil erosion, and decrease subsurface flows (Miller and Wigand 1994). The Miller and Wigand (1994) paper reads on page 469, "The shift of plant community structure from shrub steppe communities to juniper woodland may affect the hydrologic cycle. Plant community structure can influence infiltration rates, overland and subsurface flow of water, evapotranspiration, and precipitation interception." On page 470, "A contested issue is the influence of juniper woodlands on subsurface flow of water. Subsurface water flow provides an important source of water to springs, streams, and rivers, helping to maintain summer water flows and cooler water temperatures. Results from the southwestern pinyon-juniper zone generally showed only marginal increases in water yields following tree removal (Clary et al. 1974, Schmidt 1987)."

The IMST report misleads the reader into believing that science has proved that overgrazing and fire suppression have led to an increase in western juniper/sagebrush communities at the expense of open bunchgrass communities and furthermore that this change in plant community structure leads to a change in the hydrologic cycle thus impacting subsurface flow and potentially channel flow. The Miller and Wigand (1994) paper does not support the IMST report and should not be cited as the authority for such statements. The IMST team used portions of the report out of context to support their opinion of the impacts of human settlement on eastern Oregon rangelands.

Limitations of Different Sites – Site-specific differences are the normal situation in natural systems. Ecological relationships in one area are different in other areas. In order to aid in making predictions ecologists and hydrologists have developed classification systems to allow inferences to be made within similar environments. The differences in sites and sites potential are important in assessing environmental impacts of specific forces. This is not considered important in the IMST report. For example, page 81: In the section on Influence of Riparian Vegetation on Channel Morphology the importance of site conditions is ignored. However, it is critical when discussing the influence of riparian vegetation on channel dimension, pattern or profile to bound the comments by the geomorphology of the system under consideration. Channels in open, alluvial valleys with low gradients are hypothesized to rely heavily on riparian vegetation for maintenance of channel form whereas channels in V-shaped or U-shaped valleys with structural controls (rock) influencing form rely less on riparian vegetation. Understanding stream channel classification, either Montgomery or Rosgen systems, aids the reader in interpreting the role of vegetation. The authors of the IMST team provide a nice, pleasant, college lecture type paragraph on the role of riparian vegetation in maintenance of channel form but provide little science to support their statements.

Conflicting Statements - The IMST report contains a number of conflicting statements on the subject of stream temperature. In the executive summary they stated that stream temperature is a product of complex interactions involving geomorphology, soil, hydrology, vegetation, climate, elevation, and aspect, which is repeated on pages 11, 16, 18, 36, 66, and 93. However, the theme throughout the document is an emphasis on the importance of riparian shade. This emphasis is stated clearly on page 125 where it is stated that a majority of published studies document that riparian shade has a significant effect on stream temperature. However, we suggest that shade is not always a primary driver and that the influence of shade requires additional research. In our opinion, the relative importance of shade in influencing stream temperature is simply not known at this time. Recent research has suggested that factors other than shade may have more influence than shade on stream temperature (Carr et al. 2003, Krueger et al. 2003). Carr et al. (2003) studied stream temperature on four morphologically similar streams, two of which were in southeastern Oregon and two in northeastern Oregon. The southeastern Oregon streams flowed through sagebrush/juniper rangelands. The two northeastern Oregon streams flowed through ponderosa pine/Douglas fir forests. Location in the watershed (i.e. elevation) and climatic influence, from both maximum and minimum air temperatures, emerged as the dominant factors with respect to stream thermal patterns. The influence of groundwater influx and subsurface flow was also prevalent, particularly with respect to their ability to significantly cool maximum stream temperatures and reduce rates of stream heating. Preliminary results reported by Krueger et al. (2003) suggested that the lack of clear response patterns in streams studied suggests a high level of compensation for influences of temperature driving forces. Their results did not provide evidence that shade is a driving force in temperature change on the streams studied.

Examples of Factual Errors – On pages 70 – 71 the section on livestock grazing implies that all grazing causes problems with channel morphology. The references used, with one exception, are not scientific.

The Duff (1977) paper, conference proceeding, compares one exclosure to areas immediately above and below the exclosure. No statistical analysis was possible because of the lack of replication. Grazing outside the exclosure was season long with no management. Results reported by IMST from this paper were inaccurate and misleading. IMST reported that mean water width increased and water depths decreased in the grazed section and water depths increased within the exclosure. Water width did not increase at both grazed stations, one station decreased by 4.0 ft. Water depth did not increase within the exclosure, it decreased. Water depth did not decrease at both grazed stations; it increased at one of the two stations. These results are discussed and reported in a table on pages 133 and 134 of the Duff presentation.

IMST indicated Platts et al. reported that livestock overuse of riparian zones results in the loss of riparian vegetation, stream bank trampling, bank erosion, soil compaction, and increased sedimentation. The Platts et al. (1977) paper is a proceedings report on presentations given at a workshop. The citation by IMST was referencing Platts et al.'s introduction, that says, "when overuse occurs, grazing results in vegetation removal, streambank trampling, soil compaction, unfavorable seasonal water temperatures, increased sedimentation, decreased water quality, and lower forage productivity". These were introductory comments not the results of the research in the proceedings report. Platts et al. also stated in the same report: "With proper riparian management it is possible to maintain high quality soil, water, vegetation, and other habitat values within this zone. Unfortunately, inappropriate management results in grazing overuse, and subsequent degradation of all the above values." The implication of the uncited opinion statement is that appropriate grazing management can be compatible with riparian values, including fisheries habitat. The balance of the original Platts et al. paper is lost when the selective citation is used to emphasize the IMST authors point of view. This should be as important to the IMST authors as the viewpoint on overuse.

The Kauffman et al. (1983) paper does represent a scientific paper with data analyzed statistically. Kauffman et al. did report greater streambank losses, bank erosion, and disturbance to undercut banks in grazed vs. ungrazed portions of Catherine Creek in northeastern Oregon. The study was begun immediately following the erection of exclosures. The authors speculated that the streambank differences they observed were a function of the exclosures concentrating animal access to a shorter length of stream, effectively doubling the animal use on the available stream. They also observed that banks were unchanged within the exclosures, suggesting that grazing management (prior to the construction of exclosures) was not detrimental to bank integrity.

The Platts (1981) citation is an abstract and is used to document deteriorating channel characteristics under intensive grazing by sheep. The original paper notes that the study area was used as a holding area for approximately 200,000 sheep per year for several decades on a sheep driveway and received extreme use from the late 1800s through the 1960s. This type of unmanaged grazing is not representative, yet the IMST report describes it as intensive grazing.

IMST stated that the Gunderson (1968) paper (no statistical analysis) "reported that an ungrazed section of a creek had more undercut banks [indicating low erosion of banks and stability provided by vegetation] than grazed sections." While there was a numerical difference with more undercuts in the ungrazed area, Gunderson concluded "The amount per acre of undercut bank was little different between sections [grazed vs. ungrazed], and miscellaneous cover was most abundant in the grazed section."

On page 78 Li et al. (1994) is cited as having 'found that damage from severe cattle grazing (amount and type of grazing not specified) along Alder Creek caused the creek to become intermittent.' In fact the authors' statement was not based on field observations (i.e., data collection) related to grazing or to the potential for hyporheic flow. The authors reported no data on current or historical grazing and did not have any data relating to subsurface channel characteristics.

These examples demonstrate a definite bias against grazing as a riparian land use. No attempt was made in the report to describe the influence of grazing management (timing, intensity, and duration) in riparian systems from research that studied grazing activities. The IMST report lumps grazing into two categories, grazed and ungrazed. The grazed examples cited were typically unmanaged and do not reflect results expected from appropriately designed and managed grazing. Other publications (observation) could have been cited to provide some balance to illustrate that appropriate grazing management and desired riparian conditions, including streambank morphology, are compatible. Examples of those publications include Borman et al. (1999), Ehrhart and Hansen (1997), Leonard et al. (1997), Masters et al. (1996a,b).

Literature Reviews - The IMST report cites a literature review by Belsky et al. (1999) as a source of scientific evidence that livestock use has degraded riparian ecosystems. The Belsky et al. document is a summary developed from over 140 citations. The authors did not sort the literature and failed to provide the reader with a mechanism to separate credible data and analysis from unsupported bias. The problem is compounded in the IMST report because they summarize Belsky et al. (1999) rather than referencing original works. A good scientific literature review is one that examines and reports facts with considerable restraint on personal comments.

Temperature Standard - The IMST asked the question: Is the Oregon temperature standard technically sound? Part of that answer requires an assessment of the statistical validity associated with the application of numerical standards across the entire state. Their conclusion is that Oregon's evaluation of water quality and approach to TMDL/WQMP development is credible (see pages 10 and 11). Credibility is not defined but we think the authors mean scientifically valid. If this is true, this conclusion does not agree with research reports from several reliable sources.

The National Research Council, in 2001, in a general evaluation of the science that underpins TMDL modeling, stated that 'few models (computer models i.e. Heat Source) have undergone thorough uncertainty analysis' and for many parameters (including temperature) there are insufficient data to have confidence in model results. Oregon was not excluded from the NRC study and the IMST report does not offer any evidence that would indicate the state 303 (d) list and Oregon approach do not contain the errors reported by the NRC.

Gibbons (2003) published an evaluation of the effectiveness of water quality impairment assessments by states. He noted that the tally method of assessment (method used by Oregon) had an error rate that exceeded 35%. In other words, over 1/3 of the declared violations made by the state are likely to be wrong. He used a robust statistical comparison and found that comparisons based on statistical calculations had error rates of less than 5%. The IMST report does not acknowledge or consider that the state method of determining water impairment may contain an unacceptable error rate.

These issues are important because they impact citizens of the state. The regulatory action of listing a stream on the 303 (d) list triggers TMDL and WQMP development, monitoring, and implementation. Smith et al. (2001) reported that in national testimony to EPA the typical cost of developing a TMDL was between $300,000.00 and $400,000.00 (cost does not include monitoring or implementation). It is premature for the IMST report to describe the Oregon water temperature standard and the modeling approach to developing a TMDL and WQMP as effective without first evaluating the error rate associated with the state 303 (d) list and the cost of these errors to the state.

Concluding Remarks -- Understanding the relationships among the various factors that influence stream temperatures in Oregon is important to improving habitat quality for salmonids. The scientific base for making generalizations in this area is not generally well defined, because much of the literature available is opinion and observation that is only as good as the powers of observation of the author. IMST treated all written material as if it was all of the same scientific quality and consequently made errors of interpretation. In some sections the authors misquoted the references cited in the report. The extent of this needs to be evaluated for the entire report. Overall, the report has a general bias towards a point of view that is not well substantiated by the scientific work available to the IMST for review. The question of temperature change in streams is more complex than the authors of the IMST report suggested. While scientific work is the primary information needed to answer most of the questions still existing about the relationships of environmental variables that drive temperature change in Oregon streams, if only the scientific reports related to the subject were used by IMST in their analysis the report would undoubtedly be much shorter and much less certain of the state of knowledge of this subject.

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Refer to the IMST report for a listing of their references that we have discussed in this review. The references listed below are additional citations that we have included in our discussion.

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ECONOMIC IMPACT OF ~~INITIATIVE 120~~ BALLOT MEASURE 34 AIMED AT CURTAILING TIMBER HARVEST ON OREGON'S CLATSOP AND TILLAMOOK STATE FORESTS

by

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EXECUTIVE SUMMARY

The Initiative

Initiative 120 proposes that 50-percent of the Clatsop and Tillamook State Forests be managed to permanently restore old growth forest (the 50-50 proposal). It is being circulated by its sponsors seeking signatures needed to qualify the measure for Oregon's General Election ballot in November, 2004.

The initiative seeks to have Oregon voters undo a forest management plan approved in 2001 by the Oregon Board of Forestry (BOF) and instead commence a new planning process to be guided by the 50-50 proposal. The initiative specifies that planning will be done by an "independent restoration science team" (IRST) to be appointed by the chairpersons of biology departments from the three largest state universities. The IRST would have two years to complete its plan and present it to the BOF. The BOF would have one year to accept and implement the plan, or justify any modification of it.

The Board of Forestry Plan

The initiative comes on the heels of a $2.2 million, seven-year planning process that culminated in January 2001 when the BOF approved a management plan for Northwest Oregon state forests and issued a statement of findings that led to the decision. The BOF plan is based on up-to-date scientific information and public involvement sought at every stage of the planning process. The BOF is spending an additional $1.5 million to gather new information to refine the plan by 2005.

The BOF plan selection is guided by the Greatest Permanent Value Rule (OAR 629-035: 000-0110), meaning the obligation to seek a balance of public interests among environmental, economic and social objectives, such that, in aggregate, the public interest is maximized in perpetuity.

The Forests

BOF ownership in the Clatsop and Tillamook state forests amounts to about 510 thousand acres.[1] The forests lie in four counties in the northwest corner of Oregon: 60 percent in Tillamook County, 29 percent in Clatsop County, 10 percent in Washington County, and the remainder in Columbia County. The Clatsop SF lies mostly in Clatsop County and the Tillamook SF lies mostly in Tillamook County. Most of the two state forests had been privately-owned land that had burned or been logged before the state acquired ownership in the 1940s. The Oregon Department of Forestry (ODF) was given the job of rehabilitating the mostly devastated landscape. The forests of today resulted from ODF management and protection.

Relationship to the Counties

When the private land went tax-delinquent, ownership went to the counties. The counties, lacking the resources to rehabilitate the land, turned ownership over to the state. The counties retained a financial interest in the forests: a county gets 63.75 percent of the revenue generated from BOF forest land in that county. The other 36.25 percent goes to ODF for management

[1] In addition the BOF ownership, there are about 8,000 acres of Common School Forest Land on the two forests (not included in Initiative 120), bringing the total acreage of the forests to about 518 thousand.

and protection costs. Out of their share of the revenue, the counties are obligated to repay the rehabilitation bonds issued by the state.

The BOF is obligated to achieve "the greatest permanent value to the state," while acknowledging the counties "have a protected and recognizable interest in receiving revenue from these lands." The BOF defines greatest permanent value to mean "healthy, productive and sustainable forest ecosystems that over time and across the landscape provide a full range of social, economic and environmental benefits to the people of Oregon . . . [including] . . . sustainable and predictable production of forest products that generate revenues for the benefit of the state, counties and local taxing districts . . ."

Community Importance of State Timber

Clatsop and Tillamook counties have the most at stake when it comes to state timber. The economies of these rural counties have always depended heavily on natural resources. Today, manufacturing jobs make up only 11 percent of the employment in those counties (as compared to 23 percent for Oregon as a whole), and 53 percent of the manufacturing jobs are in the forest industry.

The state owns 40 percent of the timberland in the two counties and state timber harvest has become relatively more important to the economy as federal harvests, which were 30 percent of the total in the counties, dropped to insignificance during the 1990s because of the spotted owl and other environmental issues.

Revenues distributed to the two counties from state timber sales averaged $24.4 million a year over the past five years, about 25 percent of county budgets. Sixty-five percent of timber revenue goes to support schools, the rest to support county government and local taxing districts.

The state general fund benefits from the allocation of timber revenues to schools because the state obligation to fund the schools in those counties is reduced by the timber revenue contribution. That leaves more money in the general fund school budget to be distributed to schools around the rest of the state.

Economic Impact of Initiative 120

If the 50-50 proposal is approved by voters, the potential annual harvest from the Clatsop and Tillamook state forests would be reduced 137 million board feet compared to the BOF plan, a cost of an estimated $70 million in timber revenues that would be foregone each year (see table on page v). The state general fund would suffer the greatest net loss at an estimated $30 million each year, because of the general fund obligation to fund schools in the four counties that would otherwise have been funded by timber revenue distributed to the counties.

ODF would receive an estimated $26 million less each year under the 50-50 proposal, but that's not a net loss because some of that would have been used to cover the cost of the additional timber sales needed to make the higher harvest volume of the BOF plan.

The four counties stand to lose a net of about $14 million, with the assumption that the state would pick up the cost of schools that would otherwise have been paid with timber revenue.

Summary of the Economic Impacts of Initiative 120.

CATEGORY OF BENEFIT	ALTERNATIVE		ANNUAL IMPACT OF INITIATIVE 120
	BOF	50-50	
TIMBER			
Harvest (MMBF)	250	113	**-137 MMBF**
Timber revenue ($million)	109	39	**-70 million dollars**
Timber revenue distribution:			
To counties	22	8	**-14 million dollars**
To state general fund	47	17	**-30 million dollars**
To ODF forest management & protection	40	14	**-26 million dollars**
NORTHWEST OREGON ECONOMIC BENEFITS			
Jobs Directly Supported by Timber Revenue (number)	4,701	2,051	**-2,650 Jobs**
Total Personal Income ($million)	222	99	**-123 million dollars**
Wages & salary of jobs directly supported by timber	162	71	**-91 million dollars**
Proprietors' income	60	28	**-32 million dollars**

Throughout Northwest Oregon, it is estimated that Initiative 120 would cost about 2,650 jobs foregone because of the reductions in timber sale activity and timber revenue. The loss of personal income associated with the jobs foregone is an estimated $123 million each year. Assuming the average state income tax rate is seven percent for the workers covered by this analysis, the state general fund stands to lose another $8-9 million each year, bringing cost to general fund at close to $40 million each year.

Other Considerations

It should be emphasized that what is analyzed here is long-term opportunity, not short-term axe-wielding or instantaneous job creation. There are other forces at play in the economy that might influence the eventual outcome.

Perhaps the most compelling reasons for favoring the BOF plan over the 50-50 proposal have to do with comparative advantage. One of most important advantages of Northwest Oregon has been, and continues to be, the capability of the land to grow high-quality timber. It's not only timber-growing productivity that gives the region a global advantage, but also the knowledge about and commitment to sustainable, environmentally-responsible timber production. Nowhere is that more true than for Oregon's state-owned forests.

The loss of manufacturing jobs in the U.S. and outsourcing are a central focus of almost every political stump speech on the economy this year. Timber creates manufacturing, family-wage jobs. Timber from state lands has a higher multiplier effect for jobs throughout Oregon's economy because virtually all the revenue generated circulates within Oregon, unlike out-of-state corporate owners and the federal government.

It's not a bad idea for a duly-appointed Board of Forestry to determine the course of action that gives "the greatest permanent value" to the state, making use of the best scientific information and input from the public. As former governor John Kitzhaber once said, "Ballot initiatives are a poor way to make forest policy."

INTRODUCTION

Initiative 120 proposes that 50-percent of the Clatsop and Tillamook State Forests be managed to permanently restore old growth forest (reserves). It is being circulated by its sponsors seeking signatures needed to qualify the measure for Oregon's General Election ballot in November, 2004. The initiative would theoretically allow sustainable timber production on the other 50 percent of the forests, but timber production potential on 20 to 30 percent of the two forests is already limited by environmental considerations. The entire 50 percent in reserves essentially would be off-limits to timber management and revenue generation.

The idea of a 50-50 plan originated in the public involvement stage of the Oregon Department of Forestry (ODF) management planning process for state-owned forests in Northwest Oregon. The seven-year process culminated in January 2001 with the Oregon Board of Forestry (BOF) selecting a management alternative and issuing a statement of findings that led to the decision. The 50-50 alternative (Alternative 6), along with several others, was rejected in favor of Alternative 1C-2 that provides for management under principles of "structure-based management" (SBM). SBM is premised on long-term targets for maintaining a variety of forest structure across the landscape, suitable for sustainable production of fish and wildlife, environmental protection, and forest resource uses, including timber production and its associated socio-economic benefits.

The initiative aims to have voters overturn the decision of the Board of Forestry for the Clatsop and Tillamook State Forests and instead mandate, by law, the 50-50 proposal. But, as will be seen, the voters would not be choosing the ODF's 50-50 planning alternative; instead the initiative proposes to give a group selected by biology department chairs at Oregon's three largest universities three years to come up with a presumably different 50-50 plan. So, the initiative aims not only to overturn the BOF decision, but also to abandon ODF's public planning process upon which the BOF decision was based.

ESSENCE OF THE INITIATIVE

Planning and management on state-owned forests is guided by the Greatest Permanent Value Rule (GPV) (OAR 629-035: 000-0110). That means a balance of public interests must be sought among environmental, economic and social objectives, such that, in aggregate, the public interest is maximized in perpetuity. The initiative is premised on the 50-50 proposal being the best way to achieve the GPV, without acknowledging that the BOF was bound in its deliberation to choose the alternative that best met the GPV objective. The initiative is presented as though the state forests are managed on whim and the voters need to take action to save them from destruction.

Premises

Most of the findings (premises) in the preamble of the initiative are non-controversial facts (*Whereas, Oregon school children help plant the Tillamook Burn . . .*) and platitudes (*Whereas, restoration of native forests is a legacy to future Oregonians . . .*). But, a few evoke distorted images of irresponsible forest management and forest destruction, presumably to convince voters to support the proposed action:

Whereas, the vast majority of Tillamook and Clatsop State Forests will be logged unless citizens act to protect them . . . Images of impending forest devastation. **FACT:** Virtually all of the Clatsop and Tillamook State Forests already has been logged (or denuded by fire) during the first half of the 20th century, much of the logging having been done in ways that are illegal under today's forest practices laws. It is true that under the BOF plan, logging will occur eventually on a majority of the forests. But that will be the case also for the 50-50 proposal if the intent is to accelerate development of old growth structure by thinning the reserves. The point is the forests have recovered impressively from fires and the potentially destructive logging that occurred in the past. Logging today is carefully executed in the context of planned objectives and controls. Short of a natural catastrophe, the devastation visited on the Clatsop and Tillamook forests in the past will never occur again, even under a management plan that emphasizes timber production, which the current BOF plan does not. Logging on state-owned forests will be paced over a long period of time under the BOF plan, with reforestation accomplished at the same pace. The objective is to ensure the sustainability of forest structure needed for fish and wildlife across the landscape, as well as the sustainability of other environmental and socio-economic values.

Whereas, a forest management plan developed by a team of independent scientists must be favored over the current untested and controversial management plan . . . Images of ODF and BOF incompetence. **FACT:** The BOF plan was seven years in the making and is still being refined as new knowledge and information are accumulated. Here's a partial listing of what has gone into the effort (Source: ODF):

7	Years of planning.
68	Technical experts: scientists (most independent) and resource specialists.
36	Public meetings with about 1,000 participants.
18	Board of Forestry meetings to consider aspects of the plan.
7	Field tours for the general public.
Over 5,000	Written comments on the draft plan & administrative rule.
2	Separate public citizen advisory committees.
2	Scientific peer reviews.
1	Clear BOF statement of intent justifying its decision.
2	Additional years of refinement ending in 2005.

At least $2.2 million spent to date;
$1.5 million more expected to be spent by 2005

It's hard to take seriously the assertion that a "team of independent scientists must be favored" over this transparent, very public process. As for the current BOF plan being "untested," the plan was conceived blending the best scientific knowledge and advice with many years of practical forestry field experience. It's as far from "untested" as it is possible to be. As for the plan being "controversial," it's hard to imagine any plan conceived to balance many public interests that wouldn't be "controversial." The ballot initiative itself is a self-fulfilling prophesy of controversy.

Whereas, the Tillamook and Clatsop State Forests are the largest contiguous unprotected temperate rainforest in the lower 48 states . . . Images of unique forests that are unprotected. **FACT:** The statement is patently false in several regards. First, the Clatsop and Tillamook State Forests are not "unprotected," they're just being managed in ways different from the preference of the proponents of the initiative.

There are over 3 million acres of "temperate rainforest" in coastal counties of Northwest Oregon, including all public and private ownerships. About two-thirds is in private ownership, most of that being managed primarily for sustainable timber production, subject to Oregon's strict forest practices laws that regulate forest practices to PROTECT environmental values.

The Clatsop and Tillamook State Forests combine to about 510 thousand acres of BOF land ownership. State forests are subject to Oregon's forest practices laws, but generally adopt more restrictive practices than required by law to ensure that the wide spectrum of public interests are accounted for and protected.

The largest contiguous single ownership comparable in nature and history to the Clatsop and Tillamook State Forests is the 630 thousand acres of the Siuslaw National Forest, most of which is now off-limits to timber harvesting. Like the state forests, the Siuslaw is mainly second-growth forest, but is generally older forest, most of it having originated from mid-19th century fires.

Again, there are over 3 million acres of "temperate rainforest" in the coastal counties of Northwest Oregon being managed for a variety of owner objectives, but all subject to, at least, Oregon's forest practice laws that protect environmental values.

Whereas, a portion of the revenue derived from timber harvests in the Tillamook and Clatsop State Forests should be dedicated to the Common School Fund to benefit all Oregon schools and families . . . Implies that the revenues from the Clatsop and Tillamook State Forests are being misallocated and passage of the 50-50 proposal will benefit the whole state. **FACT:** This has nothing to do with the primary focus of the initiative: HOW the forests are to be managed. This gets into the question of FOR WHOM they're being managed. A bit of history is required.

There are two kinds of state forest land: Common School Forests and BOF forests. The former originated from land granted to the state by the federal government, and are managed by Oregon Land Board under guidance in the Oregon Constitution. All revenues from these lands go to the Common School Fund. The initiative does not pertain to these lands, which comprise about 17 percent of state-owned forest across the state.

Most of the BOF forests came to state ownership as tax-delinquent private land that reverted to county ownership. The counties, with no resources to manage these largely cut-over lands during the Great Depression, turned them over to the state for management on behalf of the counties. The state sold bonds to finance rehabilitation of the lands, with the counties obligated to reimburse the state from future timber revenues. The guidance for management is the Greatest Permanent Value Rule, with, by statute, 63.75 percent of revenues going to the county in which the revenue was generated to support county government, schools and local taxing districts within the county. The remaining 34.75 percent goes to the state to cover costs of forest management and protection. The initiative proposes, without justification, to break this bond between the counties and the state and reallocate a portion of the county revenues to the state as a whole. This is a major statutory and policy departure that should not be done without policy debates and informed public participation.

Provisions

If the initiative gets on the ballot and passes, the 50-50 proposal would be mandated for the Clatsop and Tillamook State Forests by law. Ironically, the voters would have no way of knowing what that means for the various public interests until the following provisions of the measure are implemented over, at least, the next three years.

Independent Restoration Science Team

The development of a 50-50 plan would be the responsibility of a nine to 13-member "Independent Restoration Science Team" (IRST). The IRST is to be appointed within six months by a "Selection Committee" made up of chairpersons of biology departments from the three largest state universities. There being no mention of oversight by state government, the determination of public interest balance and Greatest Permanent Value for the half-million acres of Clatsop and Tillamook State Forests is in the hands of three university biology department heads and their appointees. Unlike decisions made by the BOF, there is no requirement that the IRST conduct its deliberations in public view or invite public involvement. Is that a better idea than representative state government working through a duly appointed Board of Forestry?

The measure directs that the selection committee and IRST members will be paid for their services, presumably out of funds that would otherwise have gone to the counties for schools and other local public benefit, or to ODF for managing and protecting the forests. In addition, the measure directs that "The Oregon Department of Forestry, the Oregon Board of Forestry and the State Forester shall provide administrative support and services to assist" the IRST. Essentially, these state government offices would be subservient to the needs and wants of the IRST.

The IRST has two years to present its recommendations to the BOF. The BOF is required to "give the rationale for any departures from those recommendations." Presumably, the BOF would need more time to justify any departures, and based on experience with planning on other public forests, one has to wonder if litigation is inevitable if the BOF departs from IRST recommendations.

The IRST service ends upon presentation of the recommendations to the BOF, presumably two years after their appointment. There is no way of telling how much more time will be needed to resolve any differences that emerge from their recommendations.

Permanent Native [sic] Old Growth Reserves

The IRST is directed to "guide the permanent restoration of a native old growth forest on 50% of the Board of Forestry land in Tillamook and Clatsop State Forests over time . . ." It is impossible to restore "native" old growth that has been logged or burned; it is possible to restore an old-growth forest structure over time. The measure proposes to do this by protecting "groups of trees 70 years or older." This mechanistic focus on preserving older stands guarantees insensitivity to the socio-economic interests of the counties and the interdependencies of ecosystem composition, structure and function across the landscape and over time. Furthermore, such arbitrary rules insult the integrity of the idea of a team of independent, competent scientists who are supposed to rely on their expertise to "guide" the process.

Timber 70 years or older predates the Tillamook Burn restoration, which means most of those stands are likely to be on the Clatsop State Forest and in Clatsop County. It is certain the interests of Clatsop County would not be served by arbitrarily concentrating the reserves in that county, thereby limiting the potential for harvesting and revenue generation. But, there would be no option under the measure's mandate that those stands be protected.

Arbitrary Earmarking

The measure earmarks some timber revenues at the expense of either the counties or ODF, and even the state general fund:

1. The measure directs that 10 percent of all BOF land timber revenues from the Clatsop and Tillamook State Forests be devoted for 10 years to the old-growth restoration area. That could amount to about $5 to $7 million dollars out of the counties' revenues, or alternatively, earmark 40 percent of ODF's management budget for the two forests for restoration, at the expense of other forest management and protection responsibilities.

2. The measure directs that five percent of BOF land timber revenues from the two forests be deposited in the Common School Fund. Most likely, this would come out of the counties' share of timber revenues.

There is no reasoning evident for all this earmarking and shifting of revenues. If not arbitrary, it is most likely aimed at enhancing passage of the initiative by the appearance of providing something for everyone. Shifting money to the Common School Fund appears aimed at spreading benefits to the state as a whole at the expense of the four counties in which the two state forests lie (Fig. 1). The initiative has the appearance of a shell game.

Finally, the measure directs that bidder eligibility for restoration contracts on the two forests be linked to the bidder's participation in an apprenticeship program, and that certain work on the forests be set aside for apprenticeship training. The measure also directs the monitoring of wage rates paid to workers engaged in restoration work. Without second-guessing the merit of these provisions, one has to wonder why they are included in the measure if not to provide the appearance of something for everyone.

FORESTS AND COMMUNITIES

Prior to the 1930s, almost all of Northwest Oregon forest land was in private ownership, having been homesteaded or acquired from the public domain through other Federal land-grant programs aimed at developing and settling the western U.S. The forests under private ownership had no explicit relationship to local communities, except as part of the property tax base. That would change starting in the 1930s.

Creation of the State Forests

BOF land ownership in the Clatsop and Tillamook state forests amounts to about 510 thousand acres.[1] The forests lie in four counties in the northwest corner of Oregon: 60 percent in Tillamook County, 29 percent in Clatsop County, 10 percent in Washington County, and the remainder in Columbia County (Fig. 1). The Clatsop SF lies mostly in Clatsop County and the Tillamook SF lies mostly in Tillamook County.

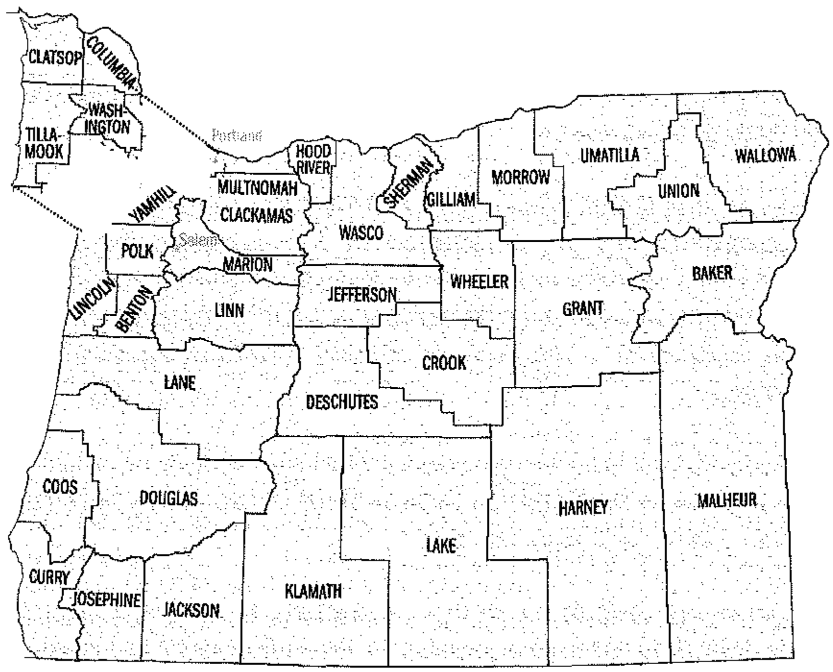

Fig. 1. State of Oregon, with four-county area delineated.

While in private ownership, the land was heavily logged, some for conversion to pasture and cropland, but more often the logging was exploitive—cut out and get out. Early logging often devastated the environment. Splash dams were used to store logs in streams and then blown up in the spring freshet allowing huge logs to scour stream beds on their run to the Columbia River or coastal inlets. With the advent of steam yarders and railroad logging, Clatsop and Columbia Counties were virtually clearcut between 1910 and 1940. As the exploiters moved on or went broke, property taxes went unpaid and more and more forest land ended up in county ownership. The counties didn't have the resources to rehabilitate the land, so in the 1940s they began to transfer ownership of the land to the state with the understanding that forests would be rehabilitated and managed on behalf of the counties. The counties were to reimburse the state for the costs of rehabilitation with future timber revenues. This pretty much covers the origins of the Clatsop SF, which has been expanded and consolidated over the years through land trades and purchases.

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[1] In addition the BOF ownership, there are about 8,000 acres of Common School Forest Land on the two forests, bringing the total to about 518 thousand acres.

The Tillamook SF has a similar history, but private ownership abandonment mostly followed devastating forest fires in the 1930s and 1940s instead of logging. Following the fires, the counties acquired ownership of much of the burned area through property tax delinquency, and eventually passed ownership to the state to manage on the counties' behalf.

The thing to keep in mind is the condition of the forest land in the 1940s when ownership transferred the state. By today's standards, it was an environmental disaster—thousands of contiguous acres devoid of vegetation, uncontrolled erosion, no riparian protection, and little or no habitat for many species that had previously occupied the forest. Prior to that time, most cut-over and burned forests were left to regenerate on their own. ODF mustered the resources to figure out how to accelerate the process by seeding and planting, which had never done before on such a grand scale. The testimony to their success is the existence of the two forests in contention in the initiative. Ironically, the initiative aims to "save" the forests by overriding the management planning of ODF and the Board of Forestry, the folks that have had the most to do with the forests being what they are today.

State Forest Relationship with the Counties

The relationship between the BOF lands on state forests was not quite clear at the outset. The state owns the land and, by law, a county gets 63.75 percent of the revenue generated from BOF forest land in that county. The other 36.25 percent goes to ODF for management and protection costs. In 1998, following much study and deliberation, it was ruled that the primary obligation in managing BOF land was to achieve "the greatest permanent value to the state," while acknowledging the counties "have a protected and recognizable interest in receiving revenue from these lands." The BOF defined greatest permanent value to mean "healthy, productive and sustainable forest ecosystems that over time and across the landscape provide a full range of social, economic and environmental benefits to the people of Oregon . . . [including] . . . sustainable and predictable production of forest products that generate revenues for the benefit of the state, counties and local taxing districts . . ." This defines the balance that the BOF thought was best met by the planning alternative they selected for Northwest Oregon state forests—Alternative 1C-2.

County Profiles

This analysis focuses on Clatsop and Tillamook counties which are by far the biggest beneficiaries among the four counties occupied by the Clatsop and Tillamook State Forests, and also the counties most dependent on timber revenues from the two state forests. The combined population of the two counties is about 60,000, with 60 percent in Clatsop County. The two-county economic base is historically dependent on natural resources: timber, fishing and agriculture. The region is isolated from the diverse economic base of Portland and the Willamette Valley but not independent of it, as can be seen from trends in unemployment rates (Table 1). Prosperity in Oregon during the 1990s brought the state's unemployment rate down from 5.5 percent in 1990 to 4.9 percent in 2000, the trend mirrored by the two-county drop from 6.6 percent to 4.5 percent during the same period. As of February 2004, Oregon's unemployment rate stood at 7.1 percent and the two-county rate was 7.5 percent, the effect of the downturn in the state's economy washing over into the two counties, likely because of a drop in tourism visits and vacation home construction.

Table 1. County statistics, 1990 and 2000.

	Clatsop County			Tillamook County			Both counties combined			OREGON
	1990	2000	% change 1990-2000	1990	2000	% change 1990-2000	1990	2000	% change 1990-2000	% change 1990-2000
Population	33301	35630	7%	21570	24262	12%	54871	59892	9%	21%
Civilian Labor Force	16360	17490	7%	9550	11290	18%	25910	28780	11%	21%
Unemployment rate										
County	7.0%	4.6%	-34%	5.9%	4.4%	-25%	6.6%	4.5%	-31%	n/a
Oregon	5.5%	4.9%	-11%	5.5%	4.9%	-11%	5.5%	4.9%	-11%	-11%
Nonfarm Payroll Employment:										
Total number of jobs	13,600	15,450	14%	6,140	7,940	29%	19,740	23,390	18%	29%
Manufacturing	3,090	2,510	-19%	1,090	1,470	35%	4,180	3,980	-5%	10%
Manufacturing as % of total	23%	16%	n/a	18%	19%	n/a	21%	17%	n/a	n/a
Forest industry	1,990	1,570	-21%	400	550	38%	2,390	2,120	-11%	-23%
Forest industry as % of manufacturing.	64%	63%	n/a	37%	37%	n/a	57%	53%	n/a	n/a
Nonmanufacturing	10,510	12,940	23%	5,050	6,470	28%	15560	19410	25%	32%
Per Capita Income ($ per year):										
County/State	17,386	24,491	41%	14,796	22,500	52%	16,368	23,684	45%	51%
Oregon	18,253	27,649	51%	18,253	27,649	51%	18,253	27,649	51%	n/a
U.S.	19,584	29,900	53%	19,584	29,900	53%	19,584	29,900	53%	n/a
Personal income profile ($/year):										
Total personal income	581,151	867,994	49%	320,255	548,318	71%	901,406	1,416,312	57%	83%
Wage & salary disbursements	283,068	411,601	45%	109,131	206,328	89%	392,199	617,929	58%	98%
Manufacturing	117,415	119,482	2%	27,145	56,522	108%	144,560	176,004	22%	79%
Lumber & wood products	27,434	25,444	-7%	11,043	25,846	134%	38,477	51,290	33%	4%
Government	68,160	115,118	69%	39,615	68,802	74%	107,775	183,920	71%	68%
Transfer payments	86,768	145,445	68%	66,192	114,620	73%	152,960	260,065	70%	89%
Transfer payments as % of total pers. inc.	15%	17%	n/a	21%	21%	n/a	17%	18%	n/a	13%

Source: Oregon Employment Dept. (2002); personal income data from US Dept. of Commerce (BEA).

Most of the employment growth in the two counties has been service jobs. Manufacturing jobs declined by five percent during the 1990s, and relatively from 21 percent to 17 percent of all jobs in the counties (Table 1).

Reflecting the shift to lower-wage service jobs in the two counties, per capita income dropped relative to the state as a whole: from 90 percent of state capita income in 1990 to 86 percent in 2000 (Table 1).

Personal income growth in the two counties during 1990s also did not keep up with the state: 57 percent compared to the state's 83 percent (Table 1). The sectors in the two counties with the highest personal income growth were government employment (71%) and transfer payments (mostly government subsidies) (70%).

Although the manufacturing sector accounts for relatively few jobs in the two counties (about 17 percent), it accounts for a much higher proportion of wage and salary disbursements—28 percent, reflecting higher wage and salary rates paid in that sector (Table 2). Annual wage rates for the manufacturing sector in the two counties average $41,258 compared to an overall average $25,977 and an average for nonmanufacturing industries of $23,433 (Table 2). The

Table 2. Jobs and annual wage rates by industrial sector, 2002.

	Clatsop County		Tillamook County		Both counties	
Sector	Jobs (number)	Average annual wage ($)	Jobs (number)	Average annual wage ($)	Jobs (number)	Average annual wage ($)
ALL INDUSTRY	14,999	26,288	8,094	25,402	23,093	25,977
Manufacturing	1,983	47,053	1,314	32,512	3,297	41,258
Forest industry	1,256	59,185	413	38,797	1,669	54,140
Nonmanufaturing	13,016	23,124	6,780	24,024	19,796	23,433

Source: Oregon Employment Department (2003).

The forest industry sector, which makes up about half the manufacturing jobs, averages $54,140. The disparity of manufacturing and forest industry wage rates between Clatsop and Tillamook counties is because Clatsop County has a pulp and paper plant which employs professional skills that command higher salaries than typical for other lumber and wood products plants.

Community Importance of State Timber Harvest

No place in Oregon has experienced as much forest devastation in as short a time as Clatsop and Tillamook counties. Fires and timber harvesting took their toll. The high harvest levels of the 1920s were eclipsed by salvage logging following the devastating fires of 1933 and 1939. Harvest in the two counties peaked in 1940 at over one billion board feet, just as the transition from private to state ownership was occurring (Fig. 2).

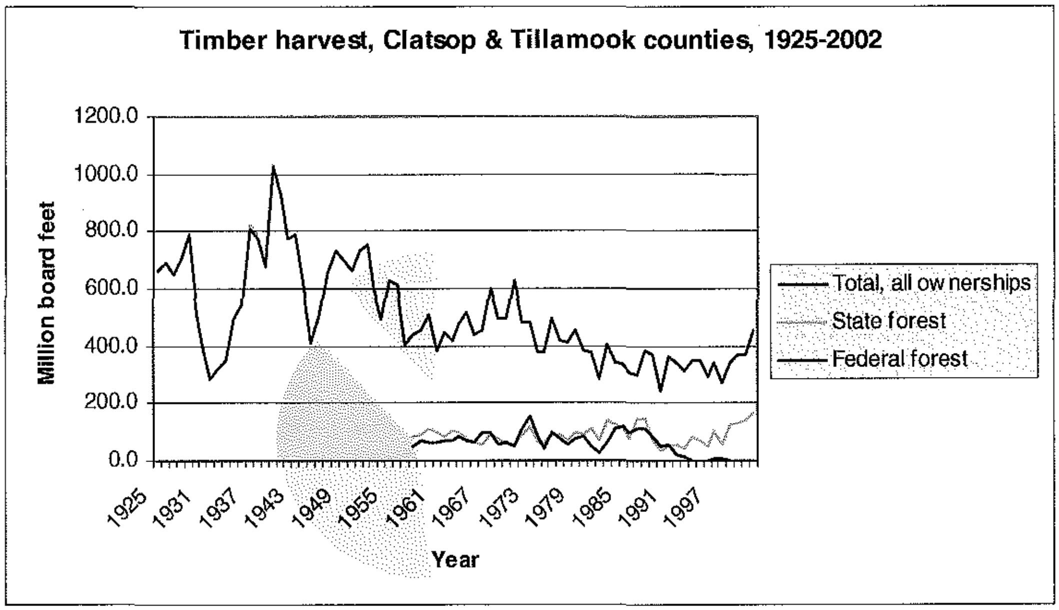

Fig. 2. Timber harvest in Clatsop and Tillamook counties, 1925-2002; state and federal harvest shown for 1958-2002.
Source: Oregon Department of Forestry (1978-2003), USDA Forest Service (1959-1977) & Wall (1972).

Harvest Trends

Prior to the 1940s, almost all the harvest in the counties came from private lands. During the 1950s, as private lands became depleted (in terms of acres, timber volume and tax base), harvest from state and federal lands became increasingly important for financing the county government and schools.[1] The state and federal land share of the harvest went from about 30 percent in the late 1950s to as much as 89 percent in 1987 (Fig. 2).

The 1990s brought the Endangered Species Act listing of the northern spotted owl and marbled murrelet, causing state timber sales to sputter and federal timber sales to become almost non-existent (the federal harvest was zero in 1995 and 2001, compared to an average of 78 mil-

[1] Twenty-five percent of receipts from US Forest Service timber sales goes to the counties in which the timber is harvested; for most Bureau of Land Management timber sales, the county share is 50 percent.

lion board feet per year from 1958 to 1987). State sales recovered and began an upward trend in 1992 (Fig. 2). Harvesting on private lands increased to pick up the slack left by the federal harvest reductions. Today, the main sources of timber in the two counties is from state and private lands, with state lands gaining in relative importance as trees mature in areas reforested in the 1940s and 1950s.

The state owns about 40 percent of the timberland in the two counties; 46 percent is in private ownership (Fig. 3). Over the past 10 years, the state forests produced 26 percent of the timber harvested in the two counties; private lands 72 percent (Fig. 4). More will be said in a later section of this report about the relative potential for state and private lands to produce timber in the future, but it is clear these two owner classes are the key to the timber-based economic sector of Clatsop and Tillamook counties, now and in the future.

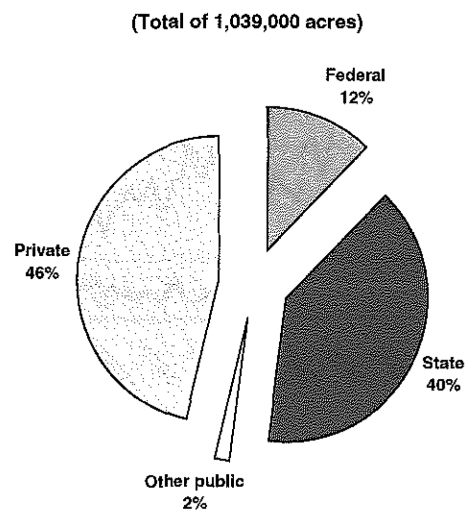

Fig.3.Timberland ownership in Clatsop and Tillamook counties, 1997.
Source: Oregon Dept. of Forestry (personal communication with Gary Lettman).

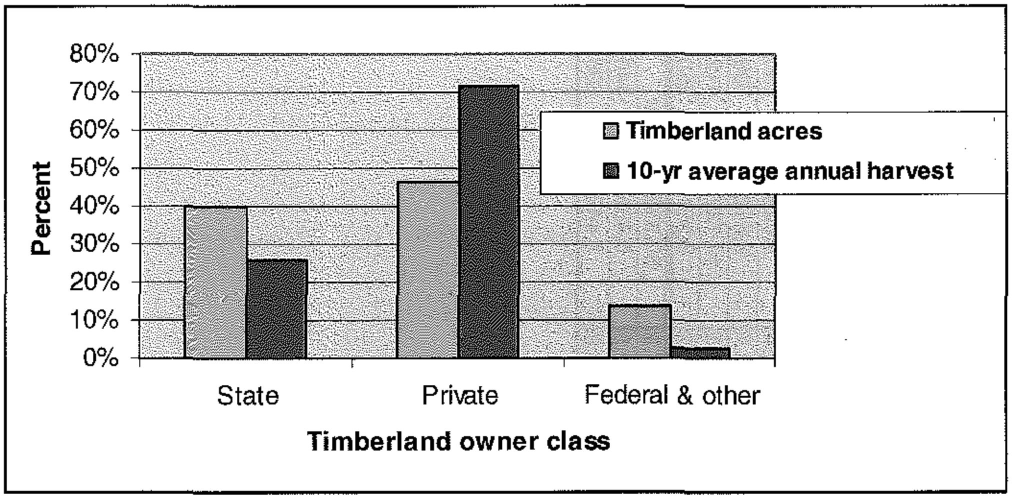

Fig. 4. Comparison of percent of acres owned with percent of average annual harvest volume from 1993-2002, by owner class, in Clatsop and Tillamook counties.

Impact of State Timber Harvest on County Finances

When timber is harvested from the Clatsop and Tillamook State Forests, 63.75 percent of the net revenue goes to the county in which the timber came from. The beneficiary counties for the two forests, in order of future potential revenues, are Tillamook, Clatsop, Washington and Columbia. In fiscal year 2002, state forest timber sales provided 24 percent of Clatsop County's general fund revenue and 27 percent in Tillamook County (Oregon Dept. of Forestry 2003b).

Over the past 11 years, the 1.2 billion board feet of timber harvested off the Clatsop and Tillamook State Forests generated over $265 million for the county beneficiaries, with 82 percent going to Clatsop and Tillamook counties (Table 3). Although state timber revenues are of less relative importance to Washington and Columbia counties, they are not insignificant—annual revenues have averaged $5.5 million and $1.2 million, respectively, to those two counties.

The average annual harvest for two forests over the past 11 years was 113.1 million board feet (MMBF). Over the past five years, it averaged 159.3 MMBF. There are at least two reasons for the increase in recent years. The first is an increasing capability to harvest because of the maturing of timber that was regenerated in the 1930s and 1940s, particularly on the Tillamook SF. The second reason is that the pace of state timber sales sputtered in the 1990s while foresters collaborated with regulatory agencies to figure out how best to plan timber sales to protect imperiled and threatened wildlife species. Those efforts produced interim measures that gave confidence to regulators and foresters that they would do no harm while ODF developed its more comprehensive long-range plan for state forests in northwest Oregon, the plan that is the subject of this report.

This completes the overview of the two state forests, the county beneficiaries of timber sales and results in the recent past. It provides a foundation for the next section of this report that looks to the future and compares the BOF plan with the 50-50 proposal in Initiative 120.

Table 3. State timber sale volume and revenues from the Clatsop and Tillamook State Forests, 1993-2003.[2]

Fiscal Year	Clatsop County				Tillamook County				Washington County			
	Volume (MMBF)	BidValue ($M)	Bid Price ($/MBF)	County Share ($M)	Volume (MMBF)	BidValue ($M)	Bid Price ($/MBF)	Actual County Share ($M)	Volume (MMBF)	BidValue ($M)	Bid Price ($/MBF)	Actual County Share ($M)
1993	27.0	7,755	288	4,933	18.9	6,078	322	4,207	2.6	905	346	545
1994	39.2	13,907	355	11,282	22.7	6,401	281	3,860	1.9	700	372	364
1995	40.0	18,488	462	12,286	21.5	8,765	407	5,083	5.2	2,532	491	1,930
1996	32.6	15,524	476	10,701	18.9	8,101	429	4,341	13.3	8,047	606	4,695
1997	54.0	25,166	466	15,339	41.0	15,977	390	8,607	14.2	7,925	560	5,137
1998	29.4	13,153	448	6,999	36.0	11,806	328	7,598	5.9	3,015	512	1,974
1999	39.5	14,076	357	8,929	51.2	14,826	290	7,694	11.2	4,289	383	2,315
2000	69.2	24,317	351	14,184	68.5	20,603	301	11,109	22.8	9,023	396	4,879
2001	71.3	24,041	337	13,347	57.3	16,955	296	6,951	21.7	8,612	398	4,035
2002	72.8	24,271	333	12,124	67.3	20,276	301	10,056	28.5	11,722	412	7,391
2003	131.2	45,864	350	27,952	58.8	18,233	310	9,765	10.2	3,561	350	2,087
Total	606.1	226,562	n/a	138,076	462.1	148,021	n/a	79,272	137.2	60,332	n/a	35,352
11-yr ave.	55.1	20,597	374	12,552	42.0	13,456	320	7,207	12.5	5,485	440	3,214
Last 5-yr ave.	76.8	26,514	345	15,307	60.6	18,178	300	9,115	18.9	7,442	395	4,141

Table 3. (continued).

Fiscal Year	Columbia County				All Counties/ODF Districts			
	Volume (MMBF)	BidValue ($M)	Bid Price ($/MBF)	County Share ($M)	Volume (MMBF)	BidValue ($M)	Bid Price ($/MBF)	Actual County Share ($M)
1993	7.8	3,011	386	1,932	56.2	17,749	316	11,617
1994	3.2	1,589	497	1,259	67.0	22,598	337	16,765
1995	2.4	2,506	1,035	1,644	69.1	32,292	467	20,943
1996	4.3	3,107	718	1,573	69.1	34,780	503	21,310
1997	5.4	3,699	686	2,211	114.5	52,767	461	31,294
1998	0.0	0	0	46	71.3	27,974	392	16,617
1999	1.6	797	512	280	103.4	33,988	329	19,219
2000	3.1	1,509	494	1,082	163.5	55,452	339	31,254
2001	1.1	439	413	403	151.4	50,047	331	24,736
2002	6.5	2,835	437	1,444	175.1	59,104	338	31,014
2003	3.0	1,364	458	831	203.1	69,023	340	40,635
Total	38.3	20,858	n/a	12,704	1243.8	455,773	n/a	265,404
11-yr ave.	3.5	1,896	545	1,155	113.1	41,434	366	24,128
Last 5-yr ave.	3.0	1,389	459	808	159.3	53,523	336	29,372

Source: Compiled from information provided by Oregon Department of Forestry.

[2] County shares for FY 2003 are estimates.

ECONOMIC IMPACT OF THE PROPOSED INITIATIVE

The primary issues that determine the economic benefit to the direct county beneficiaries and indirectly to the broader Oregon economy are the volume and value of timber harvested off the Clatsop and Tillamook State Forests. To be sure, forests provide other than monetary values, but timber is the primary source of revenues so badly needed by the counties to support schools and provide other services of local government. Harvest revenues also help pay for development of recreational resources, fish and wildlife habitat protection, clean water management and forest fire protection.

Proponents of 50-50 the plan argue that "aggressive" timber harvesting will significantly diminish other values of the forest (Power & Ruder 2003), but they ignore the history of the forests (see page 6) and the fact that the state's comprehensive, science-based, seven-year ongoing planning process (see page 2) took all the other values into account in determining the best course of action. They narrowly crafted their economic analysis to minimize the monetary and employment benefits of the BOF plan, while asking the reader to accept on faith their alleged trade-off values for the timber harvest reductions in their plan. The following analysis sets the record straight.

Regional Perspective

The report so far has focused on the four counties that are direct beneficiaries of timber harvesting off the Clatsop and Tillamook State forests, and particularly Clatsop and Tillamook counties which stand to lose the most if the 50-50 proposal is approved by voters. But the losses of the 50-50 proposal extend much more widely into Oregon's economy. ODF identified a broader region of northwest Oregon for its planning process to encompass all the state forests in the planning region (Fig. 5). The region coincides with the marketing area for almost all the

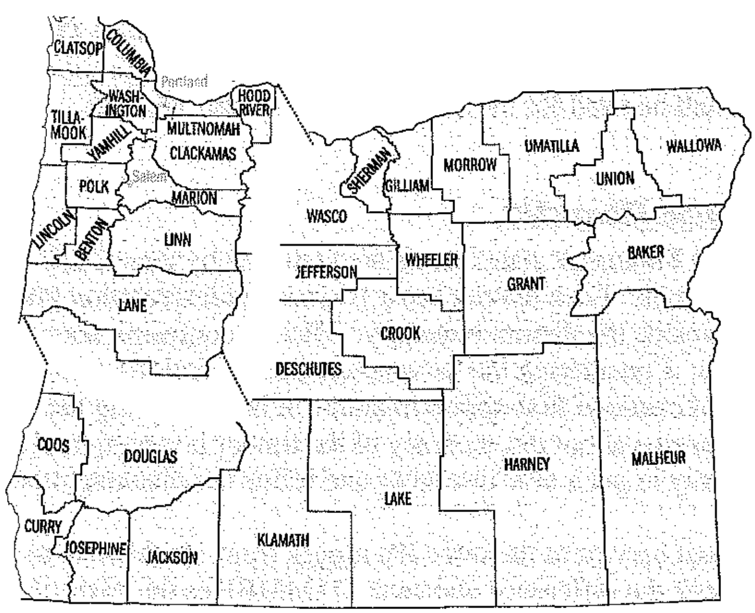

Fig. 5. State of Oregon, with ODF's Northwest Oregon analysis area delineated.

timber sold from the Clatsop and Tillamook State Forests (Lettman 1996). It is into this broad region that the bulk of indirect economic benefits of timber harvesting from the two forests flow. State timber sales are sold on the open market by competitive bidding and a substantial proportion is bought to be milled outside the four-county area occupied by the forests, including Washington.

Other benefits flow to the Northwest planning area and beyond, even some of the revenue allocated to the four counties. In 1991 when Oregon shifted most funding for schools to the state's general fund, it also provided for offsets for any school funding generated locally, such as state timber sale distributions. So, the timber revenue that the counties allocate to schools is offset by an equivalent reduction in funding for schools to those counties from the state general fund. In effect, that leaves the state general fund with more dollars for schools to spread around other areas of the state. Harvest revenues from the Tillamook and Clatsop State Forests benefit schools throughout Oregon.

The analysis of economic impact starts with projected harvest levels.

Alternative Harvest Levels

The obvious comparison is between the 50-50 alternative proposed by the ballot initiative and the BOF-approved plan. But harvest levels for these two alternatives are not known for certain, so it is prudent to hedge a bit by comparing a logical range of harvest levels representing likely scenarios and perspective on a range of possibilities. The four alternatives considered are discussed in order, from lowest projected harvest to the highest.

The 50-50 Proposal (50-50)

This alternative has the most harvest-level uncertainty because, if implemented by ballot initiative, there's no telling how the plan will turn out. Proponents of the initiative used current district implementation plans and planning projections to come up with **113 million board feet (MMBF)** as an estimate of sustainable annual harvest for the 50-50 proposal (Power & Ruder 2003). This volume will be used for the 50-50 proposal in this analysis.

District Implementation Plans (IP)

The Clatsop and Tillamook state forests are managed by three ODF districts: Astoria, Forest Grove and Tillamook. Each district has a 10-year implementation plan (IP) for the portion of the two forests inside the district boundary. There's confusion about how the IPs relate to the BOF-approved plan. Considering the harvest scheduling analysis of BOF-approved plan, the IPs might be considered cautious first-approximations in implementing the BOF plan. Caution is in order because of concerns about the accuracy of the timber inventory and planning assumptions. Work is under way to get a new inventory and refine the planning model.

Aggregate annual harvest in the three IPs ranges from 136 MMBF to 223 MMBF. The initiative proponents split the difference and used 175MMBF as the basis of their comparison with the BOF plan (Power & Ruder 2003). This analysis also splits the difference, using the more accurate average annual harvest of **179 MMBF**.

Board of Forestry Plan (BOF)

The BOF plan is characterized by ODF planners as "SBM with HCP, SNC harvests." That means structure-based management (SBM) with a habitat conservation plan (HCP)[5] and harvest priority in the first decade aimed at mitigating the Swiss needle cast (SNC) disease problem on the coast. This plan was subjected to intensive long-range analysis to assure timber harvest sustainability **and** sustainability and enhancement of fish and wildlife habitat and other environmental values. The resource balance appealed to the BOF, as did the assurance of a thorough review of the plan by state and federal regulators in the HCP process.

The planning analysis for BOF came up with a first decade annual harvest of 279 MMBF, but there was uneasiness about that level of harvest because of questions about the accuracy of the timber inventory. This analysis will use an annual harvest of **250 MMBF** for this alternative on the judgment of the author that if the inventory used by the planners was high, it wasn't by more than 10 to 15 percent. In the author's experience, re-inventories of coastal forests tend to come out higher than expected.

Intensive Wood Production (IWP)

IWP is a legal alternative for private owners, conforming to state and federal laws, rules and regulations pertaining to forest practices and environmental protection. It is being practiced on 412 thousand acres of private industrial timberland intermingled with and adjacent to the 414 thousand acres of state-owned forest in Clatsop and Tillamook counties.

The reason for including this alternative here is because proponents of the initiative largely base their argument for the 50-50 proposal on the charge that the BOF plan represents "aggressive harvesting" that is harmful to the environment. In fact, the harvest levels of the BOF plan are far less than could be legally achieved, testimony to the extra measures the BOF plan has already taken to protect and enhance environmental values. Including this alternative will reveal the cost Oregonians already have borne in moving state forest management away from more aggressive wood production to the BOF plan. This puts the 50-50 proposal in the proper perspective of whether there are additional benefits that justify the additional cost of moving from the BOF plan to the 50-50 proposal.

The annual harvest level for this alternative is **370 MMBF**, based on a "what if" analysis by ODF of the economic benefits for the Clatsop and Tillamook SFs if they were managed as industrial forests (as reported to the Oregon Senate in Oregon Department of Forestry 2003a).

Now the analysis turns to comparing the impact on jobs and income in Northwest Oregon associated with the alternative harvest projections (Table 4).

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[5] An HCP is a long-term commitment (e.g. 50 years) by a landowner to protect or enhance plant and animal habitat in conjunction with commercial forest operations. HCPs are particularly valuable where species listed under the Endangered Species Act already occupy habitat on or adjacent to the subject forest. As long as operations comply with the HCP, the landowner is relieved from surveying for listed species in operating areas and inoculated from legal liability for "taking" a listed species by modifying its habitat.

Table 4. Data used in the calculation of annual harvest, by alternative.

Item	Alternative			
	50-50	IP	BOF	IWP
Partial cut acres per year	6400	6806	3000	2000
Clearcut acres per year	500	6022	4500	6840
Partial cut vol/acre (MBF)	15	13	12	15
Clearcut vol/acre (MBF)	35	15	48	50
Partial cut harvest (MMBF)	95	87	35	30
Clearcut harvest (MMBF)	18	92	215	340
Total annual harvest (MMBF)	**113**	**179**	**250**	**370**

Source: IP data from ODF district IPs; data for other alternatives based author's experience and judgment after studying ODF planning documents.

Jobs and Income

In 1996, ODF commissioned a team of regional economic experts to lay the groundwork for assessing economic impacts for the various alternatives being considered in the planning for state forests in northwest Oregon (Lettman 1996). This analysis tiers off that work by using the same employment categories for northwest Oregon with recently updated job multipliers (Hovee 2004). Income multipliers from the ODF study were updated to account for the revised job multipliers and increases in personal income from 1993 to 2002 (Table 5). Employment figures in the table represent jobs that directly benefit from timber harvest. Lumber and wood products represents logging and milling jobs; Schools and government are jobs supported by the payments to counties, as well as ODF forest workers; and the Other category represents tree planters,

Table 5. Employment and income multipliers per million board feet of timber (MMBF) harvested in Northwest Oregon.

	Partial cutting	Clearcutting
Employment (number):		
Lumber & wood products	5.79	4.66
Schools & government	4.11	5.60
Other	8.04	8.51
Total employment	17.94	18.77
Personal income (2002 $):		
Wages & salary	$652,284	$683,057
Proprietors' income	$251,402	$234,413
Total personal income	$903,686	$917,470
Average wage per job[a]	$36,359	$36,391

[a]Average of wages & salary for the categories of employment in upper part of table.

Source: Job multipliers from Hovee 2004; income multipliers updated by author using Lettman 1996 as a base and accounting for updated job multipliers and income trends since 1996 (Oregon Department of Employment 2003).

truckers and other support jobs before and after harvesting that are energized by the harvesting operation taking place. In summary, each million board feet of harvest directly supports between 18 and 19 jobs in northwest Oregon. Those jobs pay an average of over $36,000 a year, amounting to over $650,000 per million board feet of timber harvest (Table 5).

Spending by those workers supported directly by timber and their families, in turn, supports jobs and income of workers throughout northwest Oregon who provide the goods and services of everyday life, e.g. retail trade, banks, barber and beauty shops, etc. That indirect contribution to the economy is classified as proprietors' income, and amounts to an additional personal income of over $235,000 per MMBF of timber harvest, bringing the total timber harvest contribution to personal income in northwest Oregon to over $900,000 per MMBF (Table 5), or about 90 cents per board foot.

These multipliers are now used to compare jobs and income among the four harvest alternatives (Table 6 and 7). Adopting the 50-50 proposal would cost between 1,300 and 2,600

Table 6. Comparison of jobs supported by the four alternatives.

	Employment (numbers)			
Alternative	Lumber & wood	Schools & Gov't	Other	Total
50-50	637	493	921	2,051
IP	1,038	875	1,485	3,398
BOF	1,215	1,358	2,128	4,700
IWP	1,767	2,039	3,152	6,958
DIFFERENCES:				
IP to 50-50	-401	-382	-564	-1,347
BOF to 50-50	-578	-865	-1,207	-2,649
BOF to IWP	552	681	1,024	2,257

Source: Derived from data in Tables 4 & 5.

Table 7. Comparison of annual personal income derived from the four alternatives, 2002$.

Alternative	Direct Wages and Salary ($million)				Proprietors' income ($million)	TOTAL ($million)
	Lumber & wood	Schools & Gov't	Other	Total		
50-50	22	17	31	71	28	99
IP	36	31	50	117	44	161
BOF	42	48	72	162	60	222
IWP	62	72	106	240	88	328
DIFFERENCES:						
IP to 50-50	-14	-14	-19	-47	-15	-62
BOF to 50-50	-20	-31	-41	-91	-31	-123
BOF to IWP	20	24	34	78	28	106

Source: Derived from data in Tables 4 & 5.

jobs and between $62 million and $123 million of personal income per year in northwest Oregon, depending on whether implementation plans (IP) or the BOF plan serves as the basis for comparison. In contrast, the cost of the additional environmental protection and other public benefits already provided on the two state forests is about 2,300 jobs and $106 million of personal income annually (the difference between IWP and BOF in Tables 6 and 7). In effect, it could be said that adoption of the 50-50 proposal would likely double the economic cost of measures the state forests are already taking to provide public benefits beyond legal and regulatory requirements.

Now, the comparisons turn to timber revenues and distributions to the counties and the state.

Timber Revenues and Distributions

Assuming stumpage values of $450 per MBF for clearcutting and $330 per MBF for partial cutting,[6] adoption of the 50-50 proposal would diminish timber revenues from the Clatsop and Tillamook SFs between $31 million and $70 million per year, depending on whether IP or the BOF serves as the basis for comparison (Table 8). The county share would drop between $18 million and $40 million per year. Comparing, IWP to BOF, additional public benefits on the two state forests are already costing $55 million in foregone timber revenue per year, with the counties' share of that being $32 million per year.

Table 8. Timber revenues and distributions from the Clatsop and Tillamook SFs under the four alternatives.[7]

Alternative	Harvest volume	Timber revenue	County share[a]	State general fund[b]	ODF mgt. & protection
	(MMBF)	($million)			
50-50	113	40	23	2	14
IP	179	70	41	4	25
BOF	250	109	63	6	40
IWP	370	164	95	9	59
DIFFERENCES:					
IP to 50-50	-66	-31	-18	-2	-11
BOF to 50-50	-137	-70	-40	-4	-25
BOF to IWP	120	55	32	3	20

[a] County share is 58.1% instead of 63.75%. That represents the overall average distribution for past 11 years, the difference being primarily road construction credits and bond repayments on rehabilitated lands. Without better information, it was assumed the average for the next 10 years would be the same 58.1%.
[b] Distributions to state general fund are repayments to the state by the counties for bonds the state paid off on behalf of the counties (see footnote a above).

[6] Stumpage sales on the two forests have averaged $336 per MBF over the last five years (Table 3). That period is below the 10-year average of $366 per MBF (Table 3) which, in the author's opinion, is the more likely average for the next ten years; hence the use of $450 per MBF for clearcuts and $330 per MBF for partial cuts.
[7] Numbers may not add to totals because of rounding.

As mentioned earlier, the county share going to schools is offset by an equivalent reduction of state school financing in those counties. In 1996, 65 percent of the timber revenue distribution to Clatsop and Tillamook counties went to schools (Lettman 1996). Using the 1996 percentages for sake of illustration, Table 9 shows what is likely to be a typical distribution of the county share of timber revenues. The point to be made is that the "schools" portion of the distribution actually pertains to the state general fund because if the counties don't get it from timber revenue, the state general fund is committed to covering the school budget. The 50-50 proposal could have a budgetary impact for the state general fund of between $12 million and $26 million per year, or as much $30 million including the general fund impact from Table 8.

Table 9. Distribution of county share to schools and other county services.[8]

Alternative	Schools	County gov't	Other taxing districts	Total
	($million)			
50-50	15	5	3	23
IP	26	9	5	41
BOF	41	14	9	63
IWP	62	21	13	95
DIFFERENCES:				
IP to 50-50	-12	-4	-2	-18
BOF to 50-50	-26	-9	-5	-40
BOF to IWP	21	7	4	32

Source: County share from Table 8 distributed based on Table 53 in Lettman 1996.

[8] Numbers may not add to totals because of rounding.

SUMMARY AND DISCUSSION

The difference between the plan approved by the Board of Forestry and the 50-50 proposal of Initiative 120 is the principal comparison for voters to consider—that represents the cost of the initiative. If the 50-50 proposal is approved by voters, the potential annual harvest from the Clatsop and Tillamook state forests would be reduced 137 million board feet, a cost of an estimated $70 million in timber revenues that would be foregone each year (Table 10). The state general fund would suffer the greatest net loss at an estimated $30 million each year, largely because the general fund obligation to fund schools in the four counties (Fig. 1, page 6) that would otherwise have been funded by timber revenue distributed to the counties.

Table 10. Summary of the comparison between the BOF plan and the 50-50 alternative.

CATEGORY OF BENEFIT	ALTERNATIVE BOF	ALTERNATIVE 50-50	ANNUAL IMPACT OF INITIATIVE 120
TIMBER			
Harvest (MMBF)	250	113	**-137 MMBF**
Timber revenue ($million)	109	39	**-70 million dollars**
Timber revenue distribution:			
To counties	22	8	**-14 million dollars**
To state general fund	47	17	**-30 million dollars**
To ODF forest management & protection	40	14	**-26 million dollars**
NORTHWEST OREGON ECONOMIC BENEFITS			
Jobs Directly Supported by Timber Revenue (number)	4,701	2,051	**-2,650 Jobs**
Total Personal Income ($million)	222	99	**-123 million dollars**
Wages & salary of jobs directly supported by timber	162	71	**-91 million dollars**
Proprietors' income	60	28	**-32 million dollars**

Source: Derived from Tables 6, 7, 8 and 9.

ODF would receive an estimated $26 million less each year under the 50-50 proposal, but that's not a net loss because it's likely a good portion of that would have been used to cover the cost of the additional timber sales needed to make the higher harvest volume of the BOF plan.

The counties stand to lose a net of about $14 million, with the assumption that the state would pick up the cost of schools that would otherwise been paid with timber revenue.

Throughout Northwest Oregon, it is estimated that Initiative 120, would cost about 2,650 jobs foregone because of the reductions in timber sale activity and timber revenue. The loss of personal income associated with the jobs foregone is an estimated $123 million each year. Assuming the average state income tax rate is seven percent for the workers covered by this analysis, the state general fund stands to lose another $8-9 million each year, bringing cost to general fund at close to $40 million each year.

Caveats

Planning analysis already accomplished by ODF provides a reasonably good estimate of the harvest potential for the BOF plan and the potential for at least one version of a 50-50 plan.

It is the opinion of the author that the Table 10 comparison provides a reasonable estimate of the revenue, employment and income that would be foregone under the 50-50 proposal. It should be emphasized that what is analyzed here is long-term opportunity, not short-term axe-wielding or instantaneous job creation. There are other forces at play in the economy that might influence the eventual outcome. And critics will likely argue about estimates being too high or too low.

The body of the report (Tables 6-9) provides the basis for other comparisons that would yield both higher and lower estimates of impact. The fact remains, no matter what comparison is made, passage of Initiative 120 represents a substantial opportunity cost for the state at a time when state government is desperately seeking new economic opportunities, particularly in rural areas with chronic high unemployment and limited economic opportunity. At least two of the counties (Clatsop and Tillamook) fit that description in this case, and those are counties that would be hurt most by Initiative 120.

The argument that the BOF plan represents "aggressive harvesting" that will harm the environment just doesn't hold water. This analysis has documented that the BOF plan already has foregone economic opportunity to provide greater protection and enhancement of environmental resources on the Clatsop and Tillamook state forests. From the district implementation plans, it is estimated that 20 to 30 percent of the area of those forests is already set aside for environmental reasons: riparian areas, wildlife habitat protection area, and scenic and recreation areas. The opportunity costs of the extra environmental protection already in the BOF plan amount to $55 million in timber revenue each year, 2,257 jobs, and $106 million in personal income foregone each year (comparison between BOF and IWP in Tables 6, 7 and 8).

The central question for proponents of Initiative 120 is whether there are additional environmental benefits that justify the additional costs shown in Table 10. The Board of Forestry, through its process of a comprehensive analysis of alternatives (including the 50-50 proposal), and with ample opportunity for public involvement, decided that the BOF plan best met the criterion of "greatest permanent value" to the state. This means that the Board concluded the other alternatives were of lesser permanent value to the state, including ODF's 50-50 alternative.

Competition, Leakage, Manufacturing Jobs, and Outsourcing

Perhaps the most compelling reasons for favoring the BOF plan over the 50-50 proposal have to do with comparative advantage. Comparative advantage refers to attributes for economic activity that favor one region over others. One of most important comparative advantages of Northwest Oregon has been, and continues to be, the capability of the land to grow high-quality timber. Timber played a major role in the economic development of the region, and can continue to play a major role sustaining a healthy regional economy (Beuter 1998).

It's not only timber-growing productivity that gives the region a global advantage, but also the knowledge about, and commitment to sustainable, environmentally-responsible timber production (Beuter 1998). Nowhere is that more true than Oregon's state-owned forests.

Beyond the comparative advantage of responsible timber production, there are other advantageous factors favoring the BOF plan over the 50-50 proposal.

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TESTIMONY OF MICHAEL GEARHEARD,
DIRECTOR, OFFICE OF WATER & WATERSHEDS,
ENVIRONMENTAL PROTECTION AGENCY, REGION 10

BEFORE THE OREGON BOARD OF FORESTRY/ENVIRONMENTAL QUALITY COMMISSION
OCTOBER 21, 2004

Good afternoon Chairs Reeve and Hobbs and Commission and Board members. My name is Mike Gearheard. I'm the Director for the Office of Water and Watersheds for the Environmental Protection Agency's Region 10 office. Thank you for the opportunity to share our thoughts with Commission and Board members.

Today I intend to discuss the EPA's role in Oregon water quality issues, our general support of the proposed forestry rule changes under consideration by the Board of Forestry, as well as some areas where we believe additional rule changes are important to assure adequate protection for water quality and fish.

EPA's role. The EPA has the overall national responsibility to implement the Clean Water Act, in partnership with states and tribes. Important responsibilities include approving state Water Quality Standards, overseeing delegated state point-source permit programs, approving Total Maximum Daily Loads (TMDLs) and TMDL listings, and approving state non-point source and coastal zone management programs. We work very closely with the Oregon Department of Environmental Quality (DEQ) on these efforts.

In addition, EPA provides technical and financial support to states and tribes. Where states and tribes fail to carry out Clean Water Act responsibilities, or when directed by the Courts, EPA is required to take the actions needed to meet national water quality goals.

Finally, EPA is responsible for overall implementation of the Safe Drinking Water Act, in partnership with the Oregon Department of Human Services and DEQ.

Relationship of ESA and CWA. Due to the extensive Endangered Species Act (ESA) listings of fish throughout much of Oregon, EPA must consult with the National Oceanic and Atmospheric Administration (NOAA) Fisheries and the U.S. Fish and Wildlife Service on a wide range of EPA actions under the Clean Water Act and other federal regulatory laws. Much of our review and approval work in Oregon (e.g., State water quality standards and non-point source control programs) is done in close coordination with NOAA Fisheries and the U.S. Fish and Wildlife Service. We place significant importance on the needs of the ESA listed species and use the best available science and detailed peer review to support EPA's approval actions.

Legal and Other Constraints. There are other constraints on EPA besides the ESA. For example, EPA's review of proposed water quality standards and TMDLs takes place in the context of a national program subject to headquarters guidance and legal precedent. EPA also needs to meet trust responsibilities to tribes. Moreover, Oregon is well known for its environmental advocacy and related litigation. Many of the decisions made by regulatory agencies have been subject to legal challenge. Recent court decisions here in the Ninth Circuit may have the effect of blurring the distinction between how point sources and nonpoint sources, including activities such as forestry, are regulated. I fully expect legal challenges will continue.

Forestry and Water Quality. EPA recognizes that Oregon has been a pioneer in developing forest practice rules and regulations. We also understand that Oregon's forest practices and the riparian protection rules are key to ensuring that drinking water sources, water quality standards, and aquatic habitat are protected on 12 million acres of non-federal forest land in Oregon. Because forest practices have such a direct and important affect on water quality and salmonid spawning and rearing habitat, the proposed forest practices rule changes have significant implications for the EPA. We have closely tracked the long and complex effort to review and amend forest practices regulations in Oregon.

Studies conducted in Oregon of current forest practices indicate that existing forestry rule best management practices (BMPs) do not consistently meet water quality standards or fully provide riparian functions important to water quality and fish. EPA has also independently assessed the Oregon Department of Forestry's Shade Study data, TMDLs, and the broader body of science related to forestry in the Pacific Northwest and concluded that water quality is not fully protected under Oregon's existing forest practices.

It is our position that protecting water quality and meeting salmon recovery goals on private forest lands in Oregon will require changes to State Forest Practices. The EPA believes that the effort currently underway provides the Board and EQC the opportunity to revise forest practice rules in a way that can make a significant positive difference in protecting Oregon's water quality, for its uses as a drinking water source and habitat for salmon and trout .

EPA strongly supports the Oregon Plan and the proposed Forest Practices Act (FPA) improvements - but with important caveats. We recognize voluntary efforts on the part of forest landowners, watershed councils, soil and water conservation districts, and others are an important part of the water quality, salmon, and watershed restoration program. But adequate agency programs, including the Forest Practice Rules, are also critical to successful protection and restoration efforts, as one of the four foundations of the Oregon Plan. Science oversight and monitoring with adaptive management are the two other key foundations of the Oregon Plan and successful watershed restoration. These last two components are necessary for demonstrating forest practice adequacy.

The rule-making and voluntary measures proposed by the Board of Forestry are improvements over the existing Forest Practice Rules; however, we are not confident that they can be relied upon to meet Oregon's water quality standards. Besides the proposed rule changes under consideration we believe that additional improvements to the rules are needed to ensure that water quality standards will be met and that beneficial uses such as domestic water supplies and fish habitat will be fully protected. The primary areas where additional rule improvements are needed include riparian protection and protection of high risk, landslide prone areas.

Riparian management areas are the primary Forest Practice Rule mechanism for protecting water quality. Expert reviews and research have identified the need for increased protection of riparian management areas in Oregon for both fish and non-fish streams to provide riparian functions important for fish and water quality. Protection for high risk, landslide prone areas has also been identified as key for water quality and aquatic habitat protection. Increased protection for these two critical areas could help address well documented impacts from forest practices to shade, large wood delivery, sediment retention and routing, and stream channel conditions that directly and indirectly affect water quality and aquatic habitat for fish.

Attached to my written testimony are several past EPA comment letters, from 1999, 2001, and 2003, related to Oregon Forest Practices that provide additional information and explanation for the above recommendations and conclusions.

I want to again thank Chairs Reeve and Hobbs and the rest of the Commission and Board members for the opportunity to provide this testimony and would be happy to answer questions you may have at this time. Dave Powers, our Regional Manager for Forests and Rangelands, and I are both available at any time to discuss these issues further with you.

UNITED STATES ENVIRONMENTAL PROTECTION AGENCY
REGION 10
1200 Sixth Avenue
Seattle, WA 98101

AUG 20 2003

Reply To
Attn Of: OW-134

Stephanie Hallock, Director
Oregon Department of Environmental Quality
811 SW Sixth Avenue
Portland, OR 97204-1390

Re: Approval of Temperature and Bacteria TMDLs for the North Coast Subbasins

Dear Ms. Hallock:

The U.S. Environmental Protection Agency (EPA) is pleased to approve the 50 temperature and 6 bacteria Total Maximum Daily Load (TMDLs) for the North Coast Subbasins as submitted on June 28, 2003, and received by EPA on June 30, 2003. An additional letter from Eric Nigg, North Coast Basin coordinator, ODEQ to Helen Rueda, TMDL manager at EPA dated July 19, 2003, provides further clarification to the North Coast Subbasins TMDL submittal. A list of TMDLs approved by this action are attached.

This approval includes all waste load and load allocations assigned to heat and bacteria sources on listed waters and their tributaries since all of these allocations are required to attain applicable water quality criteria in the listed waters within the North Coast Subbasins (fourth field hydrologic unit codes 17100202, 17100201, 17080006 and 17080003). Our analysis indicates that these allocations have been established at a level that, when fully implemented, will lead to the attainment of the criteria addressed by the TMDL in all perennial streams in the North Coast Subbasins, the exception being bacteria in the Lower Columbia/Youngs River Subbasin which was not addressed. Therefore, if any additional waters in the areas addressed by these TMDLs are found to be water quality limited for temperature or bacteria, the state need not include these waters on its next Section 303(d) list. However, if in the future, new sources are to be introduced into the subbasins, the TMDL may need to be revised.

The temperature TMDL addresses anthropogenic sources of thermal gain from riparian vegetation removal, reduction in shade from logging and extensive fires, forest and road management activities, and point sources including treated industrial and municipal waste water discharges. The TMDL addresses heat inputs to all perennial streams from the headwaters to the bay. This approach recognizes that the effects of stream heating are cumulative over a waterbody and watershed and that sources in the upper portion of the watershed need to be addressed if water quality standards are to be attained.

The bacteria TMDL addresses bacteria loading from both point and nonpoint sources associated with a variety of urban, agricultural and rural/forested land uses. The TMDLs address seasonal variation and the most sensitive of the beneficial uses which is the marine and shellfish growing areas. Significant reductions in bacteria loadings (up to 95%) are called for by these TMDLs.

On June 30, 2003, EPA also received, from DEQ, a TMDL for biocriteria. The South Fork of Goble Creek is listed on Oregon's 2002 303(d) List for biocriteria. EPA is required to approve or disapprove TMDLs for pollutants. However, biocriteria is not identified as a pollutant under Section 304(a)(2)(D) of the Clean Water Act. Therefore, EPA is taking no action to approve or disapprove the TMDL submitted for biocriteria.

While we are not taking a 303(d) approval action on biocriteria, we recognize the importance of addressing all water quality impairments and encourage DEQ to continue to address all sources of impairments. We believe that addressing the factors leading to the biocriteria listing are critical to the restoration of beneficial uses in waterbodies in the Northwest and encourage DEQ to continue to pursue actions which will address these impairments.

The June 30, 2003, submittal also included the North Coast Subbasins Water Quality Management Plan (WQMP, Appendix D). This plan was developed and submitted as an update to the State's WQMP pursuant to 40 CFR 130.6(e) and the February 1, 2000, Memorandum of Agreement between EPA and the Oregon Department of Environmental Quality (DEQ). EPA currently has no duty to approve or disapprove implementation plans under Section 303(d) of the Clean Water Act (CWA) and therefore, EPA is not taking action on the WQMP. Nonetheless, we believe implementation is the critical next step for realizing improvements in water quality called for in the TMDL. Implementation plans should rely on management practices that are effective and sufficient to achieve load reductions called for in the TMDL.

The Water Quality Management Plan (WQMP) is the key to getting measures on the ground where needed in order to meet specific targets and goals laid out in the TMDL. We are pleased that development of WQMPs is an integral part of Oregon's TMDL process. We recognize that while the Water Quality Management Plan is developed by DEQ as part of the TMDL process, the WQMP builds on components developed by groups and agencies who have related management responsibilities and authorities (designated management agencies, DMAs). Therefore, the following comments on this Plan are directed not only to ODEQ, but also toward the applicable DMAs.

We are pleased that DEQ and the DMAs will work cooperatively in the development of the TMDL Implementation Plans and that DEQ intends to regularly review progress on the Implementation Plans. The WQMP indicates that DMA-developed implementation and monitoring plans will be submitted by the end of 2004. With this in mind, we offer the following thoughts regarding agriculture and forestry for consideration as these plans are being developed:

As the Agriculture plan is being done it would seem an opportune time to revise the North Coast Basin Agricultural Water Quality Management Area Plan to incorporate explicit reference to the site potential shade surrogate measures and bacteria load allocations of this TMDL. This Plan was first completed in July 2000 and was to be assessed for progress every two years and modifications made as appropriate; July 2004 would be its four year anniversary.

Any revision of the Agriculture Plan should also strengthen aspects related to measures under Section 6217 of the Coastal Zone Re-authorization Act Amendments of 1990 (CZARA 6217) mentioned in the memo of September 2002 from EPA and NOAA to Amanda Punton, Oregon Coastal Management Program, and Don Yon, Oregon Department of Environmental Quality.

The North Coast Subbasin TMDL covers lands within Oregon's Coastal Nonpoint Management Area under CZARA 6217. EPA and NOAA made a determination that additional management measures are needed to strengthen Oregon's forest practices with respect to several areas critical to water quality protection. These areas include harvest in high risk, landslide prone areas, riparian protection, and cumulative effects. Our concerns about harvest in landslide prone areas have been further exacerbated by a recent Board of Forestry rule that removes the Board's requirement to review and approve timber sales in these areas.

The preponderance of monitoring, assessment, and research efforts demonstrate that Oregon's existing forest practice rules will not adequately protect water quality or recover fisheries. The December 2000 DEQ/Oregon Department of Forestry (ODF) Temperature Sufficiency Analysis found that there are water quality impairments due to forest management activities even with Forest Practice Act (FPA) rules and BMPs in place. An October 2002 DEQ/ODF Temperature Sufficiency Analysis indicates that for some medium and small streams current riparian management area prescriptions for western Oregon may result in short-term temperature increases. In addition, data from the DEQ/ODF CWA Section 319 shade study demonstrates that harvest allowed under the FPA in RMAs can significantly reduce shade below the levels necessary to achieve the North Coast Subbasins temperature TMDL load allocations.

Since the WQMP for the North Coast Subbasins TMDL does not currently provide additional management measures or recommendations that address the above concerns, we encourage DEQ to work with ODF to initiate North Coast Subbasin-specific forest practice rule changes (under OAR 629-635-0120 Watershed Specific Practices for Water Quality Limited Watersheds and Threatened or Endangered Aquatic Species), or begin state-wide rule revisions to ensure that forest management practices in Oregon will meet TMDL targets and WQS.

EPA commends Eric Nigg for preparing a very well articulated document that clearly illustrates the research and data that went into the TMDLs. We look forward to the receipt of future TMDLs covering the remaining listings in these subbasins.

By EPA's approval, these TMDL's are now incorporated into the State Water Quality management Plan under Section 303(e) of the Clean Water Act. If you have any questions or comments, please feel free to contact me at (206) 553-1261, or Helen Rueda of my staff at 503) 326-3280.

Sincerely,

for Robert R. Reichard

Randall F. Smith
Director
Office of Water

Enclosure
cc: Greg Aldrich, ODEQ
Andy Schaedel, ODEQ
Eric Nigg, ODEQ

UNITED STATES ENVIRONMENTAL PROTECTION AGENCY
REGION 10
1200 Sixth Avenue
Seattle, WA 98101

Reply To
Attn Of: ECO-087

Ann Hanus
Assistant State Forester
Oregon Department of Forestry
2600 State Street
Salem, OR 97310

Dear Ms. Hanus:

Thank you for the opportunity to review the draft Riparian Function Issue Paper. An earlier draft of the comments was provided to Jim Paul last week by Dave Powers. Enclosed is a copy of our completed comments. A few additional comments were added to the earlier draft.

Questions on EPA comments should be directed to Dave Powers in our Portland office at(503)326-5874.

Sincerely,

Kenneth D. Feigner
Manager, Forest Team

cc: Jim Paul, w/ enclosure (e-mailed on 11/03/99)

EPA Comments -- Riparian Function Issue Paper
October 29, 1999

Introduction: The EPA appreciates the opportunity to comment on the Riparian Function Issue Paper developed for the Forest Practices Advisory Committee (FPAC). We realize that the Issue Paper is a work in progress and offer our comments to help provide the FPAC with science-based information that can be considered in its deliberations on the Issue Paper and the Oregon Forest Practices Act (OFPA).

General Observations: The Riparian Function Issue Paper bibliography includes a significant number of sources but appears to reach conclusions and make statements which are not consistent with the full body of that literature and other available literature. Additionally, there are several major forestry related reports that are relevant to the Issue Paper that were either not completed in time to include in the Issue Paper or that the authors of the paper may not have had access to. Three reports in particular should be used to develop the next version of the Riparian Function Issue Paper. These reports are extremely important to include because they are: 1) developed by individuals with forestry, riparian, water quality, and fisheries expertise; 2) based on a review of a broad range of the available scientific literature; and 3) directly relevant to forest practices on state and private lands. The three reports are: The September 1999 Independent Multidisciplinary Science Team (IMST) Technical Report 1999-1 "Recovery of Wild Salmonids in Western Oregon Forests: Oregon Forest Practices Act Rules and Measures in the Oregon Plan for Salmon and Watersheds"; the June 1999 "Report of the Scientific Review Panel on California forest Practice Rules and Salmonid Habitat" prepared by the Scientific Review Panel; and the April 1999 "Forests and Fish Report" prepared by federal and state agencies, the timber industry, tribes (some) and the Association of Counties in Washington.

Based on the collective body of the best available science, the above reports make specific recommendations regarding riparian protection and landscape scale needs for the respective states' forest practices. The recommendations relevant to riparian and wetland functions in the IMST report are discussed in more detail below. However, all three papers identify the need for a landscape scale or cumulative effects framework, wider riparian management areas (RMAs) and/or higher post-harvest levels of shade and wood within the RMAs, and the need to better address road-related and fish passage issues.

The Riparian Function Issue Paper is misleading in that it may leave the FPAC with the impression that there really is not "conclusive" evidence regarding whether the current OFPA fully protects and restores riparian functions and wetland functions. It is not uncommon for there to be divergent points of view within the body of scientific literature. And rarely, even in controlled laboratory studies, can one measure or make findings with 100% assurance. However, the preponderance of scientific knowledge and evidence indicates that changes to both the OFPA framework (to address landscape scale issues) and individual OFPA provisions (such as RMA, road restoration, and basal area measures) are needed to protect and restore fisheries and water quality. Oregon's state forest practices are not unique in this respect...Washington and California have either formally proposed or have recommended changes to their respective state forest practices that would better protect and restore riparian functions than either of those states' or Oregon's current forest practices. Also, current forest management requirements on Oregon's federal forestlands, based on the 1993 Forest Ecosystem Management Assessment Team (FEMAT) Report and on PACFISH and INFISH, provide a significantly greater degree of riparian, wetland, and landscape level protection for water quality and fisheries than the OFPA, in large part to meet Clean Water Act (CWA) and Endangered Species Act (ESA) requirements.

The IMST Report (Technical Report 1999-1), which evaluated how well the OFPA is meeting the goals of the Oregon Plan for Salmon and Watersheds, recommends a number of changes to the OFPA as necessary to ensure salmonid recovery. These and other major State and Federal efforts related to forestry in the Pacific Northwest clearly demonstrate that measures, beyond those provided by the OFPA, are needed to fully maintain and restore riparian and wetland functions, meet water quality standards (WQS), and restore fisheries and aquatic habitat. We are encouraged that the Board of Forestry (BOF) is undertaking a review of current forest practices in Oregon and look forward to working with the State as the OFPA is revised to meet Oregon Plan goals and CWA requirements.

Wetlands and other Issue Papers: The full spectrum of silvicultural activities, including activities not covered in the Issue Paper, can affect riparian and wetland functions. Accordingly, the EPA comments on the Riparian Function issue paper apply, where relevant, to the collective set of Forest Practices Act Committee (FPAC) issue papers. Also, the Riparian Function Issue Paper does not expressly address wetland functions. Given the importance of wetlands to water quality, hydrology, and fisheries, EPA recommends that the next version of the Riparian Function Issue Paper also address wetlands. EPA's comments regarding riparian functions in this letter also apply to wetland functions.

"Historic" Conditions of Riparian Buffers: The Riparian Issue Paper estimates that mature forests (older than 100 years of age) covered 50-70% of the region between 1850 and 1940 and that on average 15-25% of the forest in the Central Oregon Coast Range would have been in early successional stages due to fire disturbance. Currently there are 27.5 million acres of forestland in Oregon with almost 40% in private ownership (Oregon Forest Resources Inst. 1999). Mature and old growth forests on private lands in Oregon have been largely cut over so federal lands contain most of the existing mature and old growth forests today (FEMAT 1993). Today there are approximately 4.9 million acres of old growth on forestlands in Oregon and 7.4 million acres of federal forestlands with stands over 100 years in age in Oregon (Oregon Forest Resources Inst. 1999). These estimated totals represent about 18% (old growth) and 27% (mature) of Oregon's 27.5 million acres of forestland, respectively. Since private forestlands contain a far lower proportion of mature and old growth forests than federal forestlands these percentages would be even lower for private forestlands.

Given natural disturbances within the system and the range of conditions that existed historically, the Issue Paper recommends caution in determining the types of buffers that are effective or ideal. We agree that natural disturbance across the region played a role in shaping forest structure, seral class distribution, and the species composition of riparian and upslope stands. However, at the landscape scale forest practices have substantially modified species and age class composition, including within riparian areas (Bisson et. al 1987). As indicated above the amount of mature forest across the State is far lower than it was historically, especially on private lands. The riparian functions provided by mature forests (e.g., large wood inputs, shade, food inputs) are clearly important to salmonid fishery health and water quality (Bisson et. al. 1987, FEMAT 1993, PACFISH 1995, INFISH 1995, Spence et.al. 1996, Eastside DEIS 1997). Habitat degradation has been associated with over 90% of the documented extinctions or declines of Pacific salmon species (Nehlsen 1991). While the "ideal" or most "effective" type of riparian buffer will vary depending on site-potential and landscape scale conditions, this variation does not preclude the need for OFPA measures to limit departure from mature forest stand conditions within riparian areas and other upslope areas that contribute to riparian functions.

Riparian and Wetlands Management Areas: The stated purpose of the ODF's Water Protection Rules at OAR 629-635-100(3) is protecting, maintaining, and where appropriate improving the functions and values of streams, lakes, wetlands, and riparian management areas. Although the timing, location, and intensity of forestry-related activities throughout a watershed can significantly affect water quality, protection of zones adjacent to riparian and wetland areas is a critical component of any legitimate framework for maintaining and restoring water quality and fisheries. In addition, best management practices (BMPs) within riparian zones, along with the full provisions of the OFPA and the CWA, are the legal mechanism for meeting State WQS and fully maintaining beneficial uses (e.g., salmonid spawning, public water supply, shellfish propagation). When monitoring, research, assessments or other information demonstrate that BMPs are not meeting WQS or fully maintaining (or restoring) beneficial uses, BMPs need to be adjusted. The FPAC process provides and important opportunity to adjust the OFPA BMPs. The existing OFPA rules also include a provision for basin specific rule changes that, if used, could enable riparian and wetland function issues relevant to a particular watershed, subbasin, or georegion to be addressed.

Riparian and Wetland Functions: Based on the full body of studies and assessments relevant to forest practices and water quality, the level of wetlands and riparian management area (RMA) protection under the OFPA is not adequate for maintaining riparian and wetland functions (IMST Report 1999, Ligon et. al. 1999, NMFS 1998, Eastside Draft EIS 1997, Spence et. al. 1996, FEMAT 1993). There is a well-established body of science supporting the use of RMAs around streams, lakes, and wetlands to maintain primary and secondary processes and functions related to water quality and fisheries health. These processes or functions include shade for regulating water and air temperatures, large wood delivery, sediment filtering, organic matter inputs, nutrient and mineral cycling, bank stability, flood attenuation, seasonal ground water inputs, and provision of habitat for riparian, wetland, and aquatic species. Because of the significant influence of vegetation to riparian and wetland functions, there is a solid rationale for using RMA widths equal to site-potential tree heights as an option to or in conjunction with predetermined linear RMA widths (FEMAT 1993, Eastside DEIS 1997). If linear RMA widths are used, they need to be of sufficient size to provide for the above riparian functions. Depending on the size of the water body this distance would need to approach or exceed the height of a site-potential tree to fully provide for many of the above functions. Site potential tree heights for Eastern Oregon range from 90' in high elevation cold forest to 150' in moist forest (Eastside DEIS 1997). In Western Oregon site-potential tree heights exceed those for Eastern Oregon (FEMAT 1993).

In addition to height, riparian vegetation density is also important. Multi-strata vegetation that provides groundcover for sediment trapping and nutrient uptake (both from overland flow sources and overbank flooding), and shading from multiple layers of vegetation (e.g., canopy, understory, and shrub layers) can have a greater effect on the temperature of the air column above the stream and hence, the heat exchange dynamics affecting stream temperature.

The current OFPA RMA widths are substantially narrower than the height of site-potential trees for most size classes of streams and OFPA BMPs do not require retention of overstory trees (except unmerchantable conifers < 6" dbh in three georegions) within RMAs around small non-fish bearing streams. In addition, the removal of a substantial portion of the basal area is allowed within RMAs for all size classes of streams (up to 20' from streams) if basal area targets are met. The OFPA basal area targets for regeneration harvest within RMAs allow the removal of approximately two thirds of the basal area that is estimated for fully stocked mature stands. This seriously compromises riparian and wetland functions and does not ensure that water quality standards will be met. Sensitive beneficial uses, such as salmonid spawning and rearing and domestic water supply are not fully maintained in many areas under the current OFPA rules.

IMST Recommendations: The IMST found that the current OFPA in Oregon "is not sufficient to accomplish the recovery of wild salmonids". Beneficial uses, such as salmonid spawning and rearing, are also part of the State's WQS. We assume that the IMST Report will be used in determining the sufficiency of the current OFPA in meeting CWA requirements. The September 1999 IMST report titled "Recovery of wild Salmonids in Western Oregon Forests: Oregon forest Practices Act rules and the Measures in the Oregon Plan for Salmon and Watersheds" contains a number of recommendations related to Riparian Buffers. Board of Forestry adoption of the IMST recommendations would provide both a higher level of riparian protection and a much higher likelihood that salmonid recovery will occur and that WQS would be met. The IMST recommendations specifically related to riparian and wetland RMAs that can be accommodated within the existing OFPA framework include: 1) treat all classes of non-fish-bearing streams the same as fish-bearing streams with respect to determining buffer-width protection; 2) provide increased protection for 100-year floodplains and islands; 3) increase the conifer basal area requirement and the number-of-trees requirement for

RMAs, with increases in these requirements for both fish and non-fish-bearing streams; 4) complete the study of the effectiveness of rules in providing large wood for the short- and long-term; 5) provide enhanced certainty of protection for "core areas"; 6) retain trees on high risk slopes and in likely debris torrent tracks to increase the potential for large wood transport to streams; and 7) apply current BMPs for forest lands with landslide potential and develop a case history for BMP effectiveness in this area.

Two additional IMST recommendations that could help address current OFPA inadequacies with respect to RMAs, but that may require shifts in the policy framework include: 1) explicitly incorporate the policy objective of the Oregon Plan and Executive Order 99-01 into the OFPA and 2) include landscape scale goals, assessment, monitoring, adaptive management, and coordination in the OFPA's policy framework.

All of the road related IMST recommendations could directly and/or indirectly benefit riparian functions. Two of these recommendations in particular are relevant to riparian functions and, because they are specifically focused on stream/riparian/wetland crossings, have CWA legal implications. The two recommendations are: 1) modify culverts and other structures to permit the passage of juvenile and adult salmonids upstream and downstream at forest road crossings and 2) develop forest road-stream crossing strategies that facilitate the passage of wood downstream. These recommendation clearly have a nexus with riparian functions. In addition, the Clean Water Act, Section 404(f)(1)(E) requires that the discharge of dredge or fill material associated with forest road construction or maintenance: a) not impair flow and circulation patterns and chemical and biological characteristics of navigable waters and b) not reduce the reach of navigable waters. This Section states that in addition to the above two provisions, any adverse effect on the aquatic environment will be otherwise minimized and provides for BMPs including the following baseline provision: "The design, construction and maintenance of the road crossing shall not disrupt the migration or other movement of those species of aquatic life inhabiting the water body." Given this specific CWA requirement and the widespread distribution of anadromous fishes in Oregon it is important to modify the OFPA to ensure that both the intent and substance of the Section 404 provision are met. This includes the need for provisions that protecting wetlands and their associated riparian areas.

Large Wood, Shade, and Temperature: As noted in the Riparian Function Issue Paper large wood (LW) is an important component of salmonid habitat. In addition to providing cover, food substrate, energy conservation and other biological needs of salmonids, LW strongly influences stream morphology and therefore temperature. Water temperature within a stream system is a function of both external factors, such as solar radiation, air temperature, and precipitation/flow and internal factors such as width to depth ratios, connection to ground water, and hyporheic flow (Bilby 1991, Bilby 1998, Ward 1998, Poole and Berman 1999). Forest practices within RMAs affect external factors such as the solar radiation inputs (e.g., by removing shade) as well as internal factors such as width to depth ratios (e.g., by adding or removing LW which affects pool formation and sediment distribution).

The influence of forest practices on some of the external factors such as solar radiation inputs are extensively documented in a large number studies. It is not clear why the Issue Paper indicates that only Caldwell et. al. 1991, Robison et. al. 1995, and Dent and Walsh 1997 are directly or indirectly applicable to the performance of current forest practices and possible temperature effects. A number of additional studies and assessments completed over the last three decades have both direct and indirect relevance to the possible temperature effects of the current forest practices (Lantz 1971, Summers 1982, Hall et. al. 1987, Beschta et. al. 1995, Sucker Grayback TMDL 1999). These studies and assessments document increases in stream temperatures of up to 30 degrees F following regeneration harvest (and burning) in RMAs (Hall et. al. 1987). The timeline for returning to preharvest shade levels varies by zone and forest type with recovery of riparian areas to old-growth shading levels taking from 10 to more than 40 years (Beschta et. al. 1995). It should be noted that recovery of shade around some small streams can be provided by understory vegetation within a few years following harvest. While shade provided by understory vegetation would limit the amount of solar radiation entering a stream, it would not provide other riparian functions, such as delivery of large wood, which also affect stream temperature and habitat quality.

Under the OFPA rules regeneration harvest can occur directly up to a stream's edge on small non-fish bearing streams, and the removal of trees within RMAs can substantially reduce shade and large wood, especially along small and medium streams. The Riparian Function Issue Paper indicates that LW levels in 60% of surveyed streams (2,000miles) on industrial forestland are rated as poor and that large conifer stocking levels in RMAs are poor on 94% of these streams. While factors other than the current forest practices have significantly contributed to these current and future LW deficiencies, some of the current OFPA's RMA widths and basal area targets perpetuate LW deficiencies.

The Riparian Function Issue Paper references studies which indicate that 80% to 99% of on-site LW input potential originates within 100' of streams. The OFPA includes RMA widths for non-fish bearing streams that range from 0 to 70 feet and RMA widths for fish bearing streams ranging from 50 to 100 feet. For all of these stream types the removal of LW can occur within the RMA up to 20 feet (up to 0 feet for small non-fish-bearing streams) from streams provided active management targets are met. About two thirds of the basal area that could be expected in mature stands can be removed from RMAs under the OFPA rules and there are no basal area requirements for small non-fish bearing streams. The retention of additional basal and shade levels within wider RMAs to provide riparian functions is supported by the existing literature (Ligon et. al. 1999, IMST 1999, Forests and Fish Report 1999).

The active management targets under the OFPA, as noted above, would provide substantially less LW than the normal yields from mature stands. For example, small fish-bearing streams have an active management target of 20 square feet of basal area per 1000 linear feet of stream, each side. This equates to retention of about 9 conifers that are 20"dbh (or 2 plus 40"dbh conifers) within a 50 foot wide RMA over a 1000' reach of stream, each side. This number of conifers could be further reduced if specific hardwood basal area and snag conditions are met. Additionally, the OFPA does not provide measures to ensure that LW upslope of RMAs and adjacent to intermittent streams is retained.

Large Wood Sources: The Riparian Function Issue Paper mentions that McGarry (1994) found about a 50/50 split between transported and non-transported LW in Cummins Creek. While this is important by itself, the next version of the Issue Paper should include the additional significant conclusions from McGarry's study. McGarry found that hillslope processes were important to the creation and persistence of quality habitat along the majority of a stream's mainstem. For example, although fluvially delivered LW (transported) constituted a significant volume of total LW within a system, the majority of that transported volume occurs in aggregations at a few locations. The presence of distributed LW over most of the mainstem was a function of hillslope delivered (non-transported) wood (McGarry 1994). In addition, McGarry found that outside of the few locations that had large aggregations of LW, non-transported wood occurred 87% of the time within Zone 4 (outside of the bankfull width on adjacent hillslopes and floodplains). Large wood within Zone 4 is more likely to persist within the system. It provides an important function of anchoring the portion of LW within the active channel and bankfull width (Robison and Beschta, 1990).

The Riparian Function Issue Paper section on LW sources needs to discuss the implications of riparian and upslope management on sources of LW regardless of whether each source can be specifically quantified. Currently the RMAs for small and intermittent streams, and upslope areas with a high potential for landslide or debris flow, have limited or no requirements for LW retention. This, combined with the lack of a landscape scale analysis requirement in the OFPA, precludes the ability to effectively ensure that adequate LW will be delivered to streams with a resultant effect on both water temperature and the other biological and physical needs of salmonids. The IMST report recommendations described above could help address upslope wood delivery.

Temperature Hypotheses: The Riparian Function Issue Paper states that there are two general hypotheses on stream temperature. While we did not have access to the unpublished consultant's report (Smith 1999) which appears to be source of the two hypothesis theory, EPA and the state water quality agencies have undertaken extensive stream temperature monitoring, modeling, and analyses. These water quality efforts have gone beyond theory, providing actual stream temperature data for many miles of stream systems. The results of these efforts demonstrate major flaws with both of the theories as described in the Riparian Function Issue Paper. Rather than characterizing two "opposing" theories, the Stream Temperature section of the Riparian Function Issue Paper could better inform the FPAC on stream temperature issues by providing a discussion on actual temperature dynamics and how riparian management might affect temperature dynamics.

Temperature Dynamics: The ultimate source of heat energy is solar radiation, both diffuse and direct. Secondary sources of heat energy include long-wave radiation, from the atmosphere and streamside vegetation, streambed conduction and groundwater exchange at the water-stream bed interface. Several processes, such as evaporation, convection and back radiation, dissipate heat energy at the air-water interface. Stream temperatures increase when the amount of heat energy entering the stream is greater than the amount of heat energy leaving the stream. Cooler ground water inputs and hyporheic flow can reduce stream temperature. Stream temperature is a function of the total heat energy contained in a given volume and can be described in terms of energy per unit volume. This means that high flow streams are less responsive to energy inputs than low flow streams. Because water has a relatively high heat capacity it acts as a heat sink. Heat energy that is quickly gained by a stream is retained and then gradually released back to the surrounding environment. Recent temperature studies indicate that temperatures are quite variable and do not follow either of the two theories described in the Riparian Function Issue Paper (Torgersen et. al. 1999). This variability should not be confused with uncertainty. There are over three decades of research on temperature dynamics that support the fundamental relationships presented below. In addition, recent advances in temperature assessment tools (e.g., forward looking infrared radiation–FLIR) provide continuous spatial coverages of temperatures across large watersheds and subbasins. FLIR data, which is accurate to half a degree F and can be correlated with instream monitors, graphically demonstrates the variability in stream temperatures associated with fluctuations of energy inputs throughout a stream system. The inclusion of FLIR data in the Riparian Function Issue Paper would clearly explain the temperature dynamics of streams to the FPAC.

In general, the net energy flux experienced by all stream/river systems follows two cycles: a seasonal cycle and a diurnal cycle. In the Pacific Northwest, the seasonal net energy cycle experiences a maximum positive flux during summer months (July and August), while the minimum seasonal flux occurs in winter months (December and January). Cloud cover and precipitation can seriously alter the energy relationship between the stream and its environment.

Net Heat Energy can be expressed by the following:

$$\Phi_{total} = \Phi_{solar} + \Phi_{longwave} + \Phi_{convection} + \Phi_{evaporation} + \Phi_{streambed} + \Phi_{groundwater}$$

The heat transfer processes that control stream temperature include solar radiation, longwave radiation, convection, evaporation and bed conduction (Wunderlich, 1972; Jobson and Keefer, 1979; Beschta and Weatherred, 1984; Sinokrot and Stefan, 1993; Boyd, 1996). With the exception of solar radiation, which only delivers heat energy, these processes are capable of both introducing and removing heat from a stream. When a stream surface is exposed to midday solar radiation, large quantities of heat will be delivered to the stream system (Brown 1969, Beschta et al. 1987). Removal of riparian vegetation, and the shade it provides, contributes to elevated stream temperatures (Rishel et al., 1982; Brown, 1983; Beschta et al., 1987). The principal source of heat energy delivered to the water column is solar energy striking the stream surface directly (Brown 1970). Exposure to direct solar radiation will often cause a dramatic increase in stream temperatures. The ability of riparian vegetation to shade the stream throughout the day depends on vegetation height, width, density (both percent closure and layering), and position relative to the stream, as well as stream aspect.

Both the atmosphere and vegetation along stream banks emit longwave radiation that can heat the stream surface. Longwave radiation has a cooling influence when emitted from the stream surface. The net transfer of heat via longwave radiation usually balances so that the amount of heat entering is similar to the rate of heat leaving the stream (Beschta and Weatherred, 1984; Boyd, 1996).

Evaporation occurs in response to internal energy of the stream (molecular motion) that randomly expels water molecules into the overlying air mass. Evaporation is the most effective method of dissipating heat from water (Parker and Krenkel, 1969). As stream temperatures increase, so does the rate of evaporation. Air movement (wind) and low vapor pressures increase the rate of evaporation and accelerate stream cooling (Harbeck and Meyers, 1970).

Convection transfers heat between the stream and the air via molecular and turbulent conduction (Beschta and Weatherred, 1984). Heat is transferred in the direction of warmer to cooler. Air can have a warming influence on the stream when the stream is cooler. The opposite is also true. The amount of convective heat transfer between the stream and air is low (Parker and Krenkel, 1969; Brown, 1983). Nevertheless, this should not be interpretted to mean that air temperatures do not affect stream temperature.

Depending on streambed composition, shallow streams (less than 20 cm) may allow solar radiation to warm the streambed (Brown, 1969). Large cobble (> 25 cm diameter) dominated streambeds in shallow streams may store and conduct heat as long as the bed is warmer than the stream. Bed conduction may cause maximum stream temperatures to occur later in the day, possibly into the evening hours.

The Issue Paper should discuss the implications of the OFPA provisions that affect riparian and upland management to the above processes. Given the physics of stream heating, the focus should be on solar radiation and channel characteristics influenced by large wood. In addition to the discussion on large wood above, the implications of OFPA to reductions in shade levels should be provided. The data and analysis from the CWA Section 319 funded riparian shade study and the results of shade analyses from DEQ TMDL efforts should also be provided in the Issue Paper. A riparian shade calculation effort currently underway in Washington State could also provide information relevant to an Issue Paper discussion on the OFPA and shade levels.

<u>Landscape Scale and Cumulative Effects</u>: The absence of a landscape scale/cumulative effects framework in the OFPA does not ensure consideration of critical broader-scale water quality and fisheries effects related to the timing, location, and intensity of harvest and road related activities. The Oregon Board of Forestry and ODF's 1995 Forestry Program Report for Oregon states that "[T]imber management policy has often been considered on a site-specific basis, without making links to the effects of such management on the forest as a whole—without a "big-picture" or landscape view...Truly "fixing the problem," however, requires a broader approach—an approach that considers

forests as ecosystems that can be carefully managed to achieve a variety of objectives, rather than a collection of resources that can be managed in isolation." (OBF & ODF 1995 pp. 21 and 22). The Board and ODF conclusion is reinforced by numerous other studies (FEMAT 1993, Spence 1996, Eastside EIS 1997, IMST Report 1999, Ligon 1999.)

Because of the proximity to streams riparian activities within RMAs have the greatest potential to adversely affect salmonids. Additionally, upslope activities affect surface erosion, mass wasting, hydrologic processes, and nutrient dynamics and therefore need to be considered (Spence et. al. 1996). "Since streams are tightly linked to the terrestrial landscape they flow through, when reivewing land use practices and their effects on salmonid habitat, it is necessary to analyze impacts on both adjacent and distant components of the landscape. Analysis and adjustment of management practices in riparian forests has received a lot of attention. However, considering the interrelated components of the entire landscape, a similar analysis and adjustment in management practices must occur in upslope forests throughout the watershed. " (IMST 1999, p.13).

Adoption of the IMST recommendations detailed earlier in these comments would help address landscape scale issues providing a big-picture or landscape view. Landscape scale approaches, such as the approach used for Augusta Creek (described in FEMAT) and the approach used for the Umpqua Land Exchange analysis, would help ensure that the full range of riparian functions are maintained over time and across the landscape.

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February 28, 2001

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Ted Lorensen
Forest Practices Program Director
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Dear Mr. Pedersen and Mr. Lorensen:

The Environmental Protection Agency (EPA), and the National Marine Fisheries Service and U.S. Fish and Wildlife Service (Services) appreciate the opportunity to review and comment on the December 2000 draft report titled *ODF/DEQ Sufficiency Analysis: Stream Temperature* (SAST) by the Oregon Departments of Forestry and Environmental Quality (ODF and DEQ). The agencies have completed this review (Attachment 1) in order to provide technical assistance to the state of Oregon, and to provide guidance about the adequacy of the state's Forest Practices Act (FPA) for meeting the goals of the Clean Water Act (CWA) with respect to water temperature, particularly as they relate to providing functional freshwater habitat for salmonid fishes listed under the Endangered Species Act (ESA).

The SAST is an "[e]valuation of the adequacy of ...[Oregon's] forest practices act in the achievement and maintenance of water quality standards." The SAST is clearly the product of a great deal of work and presents a significant amount of data. Determining whether the FPA is sufficient to meet the Oregon water quality standards (WQS) for temperature requires examination of the effects of forest practices on stream temperatures to determine if numeric and narrative criteria are being attained, designated beneficial uses (e.g., salmonid spawning and rearing) are being protected, and antidegradation provisions are being met. Since the "best management practices" under the FPA are used as the legal mechanism for meeting all three components of WQS (attainment of criteria, protection of designated beneficial uses, and antidegradation), our review looks at the SAST data and conclusions within the context of these three components.

Our review of the SAST and the body of scientific literature related to forestry effects on factors affecting water temperature (see Attachment 1) confirms, with a high degree of confidence, that practices under the FPA adversely affect temperature-related factors such as shade levels, surface erosion, landslide rates, stream morphology and substrate, and landscape-scale conditions. Therefore, we concur with ODF and DEQ that "there are water quality impairments due to forest management activities even with FPA rules and BMPs" (SAST, p. 58 and Table 9). Scientific research and temperature assessments completed in Oregon and the Pacific Northwest also indicate that these adverse effects affect water quality and fisheries on small, medium and large streams.

While it is not clear how the stream temperature effects determinations for forest practices were made in the SAST (Tables 5, 6, 7, 8, and 9), shade appears to be the only factor considered. We agree that shade is an important factor for stream temperature, and that the FPA will result in reduced shade and increased stream temperatures in Oregon's streams. However, the SAST also needs to consider the cumulative effects of other temperature-related factors in determining whether the FPA meets the three components of WQS. The SAST also needs to clearly describe the rule set, criteria, or logic used to arrive at the effects determinations in Tables 5, 6, 7, 8, and 9. For example, the determination that FPA basal area targets in riparian areas, which range from zero to less than one third of the basal area found in mature forest, pose a very low to moderate risk of not meeting temperature standards (SAST Table 8) needs to be better explained. Our submittal includes a comparison of riparian protection strategies proposed or in effect under several categories of land ownership in Oregon (see Attachment 2).

The sections related to equilibrium temperature would significantly benefit from a re-examination of the two studies that appear to form the basis for the SAST conclusions regarding forest activity effects on downstream temperature. In addition, the importance of cold water refugia to salmonids and the existing impaired conditions of watersheds should be factored in to any conclusions reached about the significance of downstream effects from forestry activities. The SAST discounts the importance of both site-specific and cumulative effects from forest practices, which is contrary to the scientific literature and extensive temperature assessment efforts completed as part of DEQ's total maximum daily loads (TMDLs) (see Attachment 3).

We realize that it is not possible to determine the exact magnitude of forest practice effects to stream temperature for specific stream reaches in a statewide sufficiency analysis. The evidence is, however, overwhelming that forest practices on private lands in Oregon contribute to widespread stream temperature problems and degraded salmonid habitat conditions. These effects of forest practices do not meet the goals of the CWA or ESA. EPA and the Services are committed to working with ODF and DEQ to ensure that the best available science is used to support the changes to forest practices that are necessary to protect water quality and fisheries. To this end, we would welcome an opportunity to work with you during the Board of Forestry's review of the proposals from the Forest Practices Advisory Committee. Also, the FPA rules include a provision for basin-specific rule changes that can address water quality issues in a particular watershed, subbasin, or georegion. Based on the substantial body of scientific literature demonstrating that Oregon forest practices likely adversely affect water quality and threatened species of salmonids, we recommend initiation of the basin-specific rule change process.

Please feel free to contact us if you have questions regarding our comments or would like to set up a meeting. We would appreciate your sending us the final version of the SAST.

Sincerely,

Dan Opalski, Director
Environmental Protection Agency
Oregon Operations Office

Kemper McMaster, State Supervisor
U.S. Fish and Wildlife Service
Oregon Fish and Wildlife Office

Michael Tehan, Chief
National Marine Fisheries Service
Oregon Branch, Habitat Conservation Division

Attachments:
Attachment 1: Review of the December 2001 Draft Sufficiency Analysis
Attachment 2: Comparison of Riparian Protection Measures
Attachment 3: TMDL Shade Comparison
cc:
Stephanie Hallock, Director, Oregon Department of Environmental Quality
Melinda Eden, Chair, Environmental Quality Commission
James E. Brown, State Forester
David E. Gilbert, Chair, Oregon Board of Forestry
Peter Green, Governor's Natural Resources Office
Chuck Findley, Acting Regional Administrator, Environmental Protection Agency, Region X
Donna Darm, Acting Regional Administrator, National Marine Fisheries Service, Northwest Region
Anne Badgley, Regional Director, U.S. Fish and Wildlife Service, Region 1

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Donna Darm, Acting Regional Administrator, National Marine Fisheries Service, Northwest Region
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Attachment 1

Review of the December 2001 Draft Sufficiency Analysis: Stream Temperature (Oregon Departments of Forestry and Environmental Quality)

by the

Environmental Protection Agency, National Marine Fisheries Service, and U.S. Fish and Wildlife Service

February 2001

GENERAL COMMENTS

Introduction

The Environmental Protection Agency (EPA) and the National Marine Fisheries Service and U.S. Fish and Wildlife Service (Services) have reviewed the December, 2000 draft report titled *ODF/DEQ Sufficiency Analysis: Stream Temperature* (SAST) by the Oregon Departments of Forestry and Environmental Quality (ODF and DEQ). The SAST is an "[e]valuation of the adequacy of ...[Oregon's] forest practices act in the achievement and maintenance of water quality standards." Under the Federal Clean Water Act (CWA), state water quality standards (WQS) define the water quality goals of a waterbody by designating the beneficial use or uses to be made of the water, by setting numeric or narrative criteria necessary to protect the uses, and by preventing or limiting degradation of water quality through antidegradation provisions. Determining whether the Forest Practices Act (FPA) is sufficient to meet the Oregon WQS for temperature requires examination of the effects of forest practices on stream temperatures to determine if numeric and narrative criteria are being attained, designated beneficial uses (e.g., salmonid spawning and rearing, and public water supply) are being protected, and the antidegradation provisions are being met. Since the "best management practices" under the FPA are used as the legal mechanism in Oregon for meeting all three components of WQS (attainment of criteria, protection of designated beneficial uses, and antidegradation), our review looks at the SAST data and conclusions within the context of these three components. The agencies have completed this review in order to provide technical assistance to the state of Oregon, and to provide guidance about the adequacy of the FPA for meeting the goals of the Clean Water Act and Endangered Species Act (ESA) related to water temperature.

Portions of the draft are well written and provide useful information related to stream temperature. However, many conclusions and statements in the SAST are not consistent with the general background information provided, related supporting literature, or other available literature. The SAST analysis contains conflicting statements and findings regarding the relative importance of shade and other potential factors (such as erosion and sedimentation, channel widening, loss of large wood, reduction in upwelling, disturbance or alteration of groundwater, and microclimate). Throughout most of this analysis, shade appears to be generally assumed as the only important factor concerning stream temperatures and attaining WQS. The SAST considered only shade, stream temperatures, and attainment of numeric, fixed temperature targets, rather than how forest practices affect the suite of temperature-related factors relevant to riparian and stream channel functions that are critical to supporting designated beneficial uses such as salmonid spawning and rearing. While several sections in the SAST recognize the importance of factors other than shade, these sections do not appear to be considered in the final findings and effects determinations. For example, shade alone is analyzed with respect to basal area and is the only temperature-related factor substantively discussed in the context of FPA buffer widths. Therefore, it appears that many of the SAST conclusions regarding risk of temperature changes from forest practices for all stream designations may be understated, due to this analytical approach.

It is very difficult to interpret some of the data and figures in the SAST (e.g., p. 38 - 53). The conclusions and risk ratings (p. 57-58) do not appear to flow directly from the data that are presented in the draft analysis (Figures 14-18). For example, there are no data presented in the analysis to support the contention that large streams would not experience temperature increases or that large streams are "likely to be influenced only by legacy effects" from past management practices. However, based on the full body of science we reviewed, we concur with the SAST finding that there are water quality impairments due to forest management activities, even with FPA rules and best management practices (SAST Table 9, p. 58). We also support ODF and DEQ use of the basin rule change process to create watershed specific protection rules to ensure that forest management activities do not impair water quality (SAST Table 9, p. 58).

Statewide Forest Practice Analyses

The SAST appears to rely almost exclusively on data from 28 monitoring sites along 7 streams in western Oregon in its sufficiency findings. While data from these sites do confirm that forestry activities increase stream temperatures, the FPA sufficiency determinations should also utilize other scientific reports that evaluate the adequacy of forest practices in Oregon and California. These reports: 1) were developed by individuals with forestry, riparian, water quality, and fisheries expertise; 2) are based on a review of a broad range of several hundred research and monitoring efforts; and 3) are directly relevant to forest practices on private lands. Relevant reports include IMST (1999), Ligon et al. (1999), Beschta et al. (1995), Botkin et al. (1995), and Murphy (1995).

Based on the collective body of the best available science, the above reports make specific recommendations regarding riparian protection and landscape scale needs for the respective states' forest practices. These reports identify the need for increased riparian management area protection for salmon and water quality. The IMST report (IMST 1999), which evaluated how well the FPA is meeting the goals of the Oregon Plan for Salmon and Watersheds, specifically looked at FPA adequacy for salmon recovery. It recommended a number of changes to the FPA as necessary to ensure salmonid recovery. The Oregon Forest Practices Advisory Committee (FPAC) developed recommendations that, while not based on meeting CWA and ESA requirements, would improve water quality and fishery protection through voluntary measures and FPA rule changes. The State of Washington recently adopted forest practice rules that increase protection for water quality and fisheries substantially beyond the level provided by the FPA.

Some of the SAST determinations are misleading, leaving the reviewer with the impression that there really is not "conclusive" evidence regarding whether the FPA rules and BMPs increase stream temperatures or fully protect designated beneficial uses at the statewide level. Part of the problem is the SAST's reliance on incomplete data from a limited number of specific monitoring sites to make a statewide determination. Data from individual sites may or may not show significant shade and temperature changes from forestry activities. This is especially true where factors such as changes in ground water inputs, yearly temperature variation, forest conditions in the upper watershed, changed channel morphology, and various other site-specific conditions are not considered in the studies. Questionable site-specific measurements may also be misleading (e.g., short-term shade level increases after harvesting, Figure 19). At the broad scale, the preponderance of existing scientific knowledge and evidence indicates that forest practices under the FPA are likely to adversely affect the factors that elevate stream temperatures, contributing to WQS violations and adverse effects to beneficial uses such as salmonid spawning and rearing.

Landscape Scale and Cumulative Effects

The FPA lacks a landscape scale/cumulative effects framework that would ensure consideration of critical broader-scale water quality and fisheries effects related to the timing, location, and intensity of harvest and road related activities. The Oregon Board of Forestry (OBF) and Oregon Department of Forestry (ODF) 1995 Forestry Program Report for Oregon states that "[T]imber management policy has often been considered on a site-specific basis, without making links to the effects of such management on the forest as a whole—without a "big-picture" or landscape view... Truly "fixing the problem," however, requires a broader approach—an approach that considers forests as ecosystems that can be carefully managed to achieve a variety of objectives, rather than a collection of resources that can be managed in isolation" (OBF & ODF 1995). This conclusion is reinforced by numerous other studies and assessments (FEMAT 1993, Botkin et al. 1995, Murphy 1995, National Research Council 1996, Spence et al. 1996, Quigley and Arbelbide 1997, IMST 1999, Ligon et al. 1999.)

Because of their proximity to streams, riparian activities have a high potential to adversely affect salmonids and water quality. However, upslope forestry activities affect surface erosion, mass wasting, hydrologic processes, and nutrient dynamics and therefore need to be considered in determining fish habitat and water quality effects (Spence et. al. 1996). Further, the IMST (1999) pointed out that:

> Since streams are tightly linked to the terrestrial landscape they flow through, when reviewing land use practices and their effects on salmonid habitat, it is necessary to analyze impacts on both adjacent and distant components of the landscape. Analysis and adjustment of management practices in riparian forests has received a lot of attention. However, considering the interrelated components of the entire landscape, a similar analysis and adjustment in management practices must occur in upslope forests throughout the watershed (p.13).

The IMST report also states that "[t]he historic range of ecological conditions in the Pacific Northwest, both of habitat and salmonid stocks, is important because it provides a framework for developing policy and management plans for the future." The IMST report concludes "that the goal of management and policy should be to emulate (not duplicate) natural processes within their historic range." The SAST (p. 28) suggests that riparian buffers designed to maintain physical habitat may result in average shade levels that exceed historic shade levels and result in less productive salmon habitat. While this could be true for a single or several specific sites, the SAST discussion on disturbance is misleading if the landscape scale is considered. Natural disturbance across the region played a significant role in shaping forest structure, seral class distribution, and the species composition of riparian and upslope stands. However, at the landscape scale, forest practices have substantially modified vegetation species and age class composition, including within riparian areas (Bisson et al. 1987, Botkin et al. 1995, National Research Council 1996, Oregon Coastal Salmon Restoration Initiative [OCSRI] 1997, Quigley and Arbelbide 1997).

The Riparian Issue Paper developed as part of the FPAC process estimated that mature forests (older than 100 years of age) covered 50-70% of the region between 1850 and 1940, and that on average 15-25% of the forest in the Central Oregon Coast Range would have been in early successional stages due to fire disturbance. Private lands where the FPA is applied have been largely cut over, resulting in many watersheds having a very small component of mature forest (Lorensen et al. 1994, FEMAT 1993). The FPA tree retention requirements within riparian management areas (RMAs) represent the only substantial opportunity for mature forest regeneration on private lands at the landscape scale. Depending on stream density and fish presence, RMAs under the FPA constitute approximately 2% to 9% of the total acreage within a watershed. Depending on the stream type and size, the FPA rules for regeneration harvest allow the removal of two-thirds to essentially all of the existing mature riparian forest (basal area) within RMAs, provided minimal tree retention requirements are met. The basal area retention targets are far below the level expected in mature forest. In the Coast Range, for example, 100 $ft^2 ac^{-1}$ is the standard basal area target for large fish bearing streams while mature forest would generally contain at least 332 $ft^2 ac^{-1}$. Standard basal area targets are substantially lower for medium and small stream RMAs, ranging from zero to 75 $ft^2 ac^{-1}$. Outside of RMAs (> 90% of the total acreage in a typical watershed) even lower amounts of mature forest would be retained under the FPA.

A 1995 temperature study on the Olympic Peninsula looked at the relationship between landscape-scale forest conditions and stream temperatures (Hatten and Conrad 1995). Temperatures of 11 streams in unmanaged sub-basins (less than 15% of the mature forest in the sub-basin logged and no harvest within the riparian corridor) and 15 streams in managed sub-basins (more than 15% of forest logged, or harvest had occurred within riparian corridor) were monitored continuously during the summer of 1992. Water temperatures in the managed group were significantly warmer than in the unmanaged group. The difference was not explained statistically by elevation or the amount of shade in the monitored reach. Among sites with similar shade levels, those in managed sub-basins had warmer temperatures than those in unmanaged sub-basins. The most important predictor of temperature was the proportion of the sub-basin in late seral stage forest, regardless of whether the basin was managed or unmanaged. This indicates that the proportion of late-seral stage forest in a sub-basin could represent a surrogate for the cumulative effects of logging activities within a sub-basin. The study concludes that stream temperatures cannot be successfully managed at the reach level unless basin-wide harvest activities are carefully considered.

Shade

The influence of forest practices on shade and stream temperatures is extensively documented in a large number of studies. The SAST appears to rely heavily on studies by Caldwell et. al. (1991) and Dent and Walsh (1997) in reaching conclusions about the effects of the FPA on shade and stream temperature. These studies provide some insights, but, as discussed below, have some significant problems. The SAST conclusions and sufficiency determinations should consider a number of additional studies and assessments completed over the last three decades that address shade and stream temperature (Lantz 1971, Summer 1982, Hall et. al. 1987, Beschta et. al. 1995, DEQ 2000, DEQ 2001a, DEQ 2001b, §319 ODF-DEQ shade study). Some of these studies document increases in stream temperatures of up to 30 degrees F following regeneration harvest (and burning) in RMAs (Hall et. al. 1987). The timeline for returning to pre-harvest shade levels varies by zone and forest type with recovery of riparian areas to old-growth shading levels taking from 10 to more than 40 years (Beschta et. al. 1995). While shade around some small streams can be provided by understory vegetation within a few years following harvest, understory vegetation does not provide large wood, or attenuate landslides, sedimentation rates, hydrologic regimes, and air temperature in a manner similar to mature forest. These factors are relevant to stream temperatures and protection of beneficial uses (e.g. salmonid spawning and rearing) as discussed in the next section.

The CWA §319-funded Shade Study (discussed in Appendix E of the SAST) was expressly designed to "[m]onitor the effectiveness of the Forest Practices in providing a range of shade conditions that are predicted to meet DEQ Standards for water quality" (§319 Shade Study Statement of Work). The ODF application for the §319 grant specifically focused on the need to 1) provide data to test the validity of shade targets developed in total maximum daily loads (TMDLs) and 2) determine the effectiveness of FPA basal area requirements in maintaining shade levels that meet TMDL shade targets. ODF took extensive shade and basal area measurements from 122 riparian management areas within recently harvested and "other" (not recently harvested) sites. Sites could not be randomly selected due to harvest timing, land owner willingness, and other factors. Basal area levels retained on recently harvested sites were in many cases significantly higher than FPA rule requirements. In spite of this, the quality of data from the 319 shade study is very sound and the data strongly validate the site-potential shade targets in DEQ TMDLs. Shade levels from the study track very closely with TMDL site potential shade targets (Attachment 3).

The shade study also demonstrates a significant difference between harvested sites and "other" sites both in terms of shade levels and the variability of shade levels for the two populations of sites. Median shade levels for harvested sites were 6.5% to 21.5% lower than shade levels on "other" sites when stratified by stream size (large, medium, small). For each of the stratified stream size data sets, 70% to 100% of the "other" sites had shade levels that were higher than the median shade level of the harvested sites. Pre-harvest basal area and shade measurements would have been necessary to determine exactly how much FPA harvest reduced basal area and shade. Harvest down to the standard FPA basal area targets would also be needed to test the full effects of applying the FPA requirements. Regardless, the shade study clearly demonstrates that there is high likelihood that the FPA requirements will reduce shade significantly below site-potential shade levels. Meeting the site-potential shade targets in TMDLs is necessary to meet the WQS for temperature in Oregon. This should be factored into the SAST sufficiency determinations.

Downstream Effects - Re-equilibrium

DEQ has completed subbasin-scale temperature analyses for several TMDLs. The TMDL temperature analyses incorporate extensive temperature, stream channel morphology, vegetation and shade information for entire subbasins. Forward looking infrared radiation technology accurate to within 0.5° C, dozens to several hundred instream temperature monitors per subbasin, 1-m resolution digital orthophotos, and hundreds of shade measurements taken with solar pathfinders are used in the DEQ temperature analyses. The DEQ analyses clearly demonstrate that stream temperature changes within a subbasin are cumulative in nature and that a number of factors such as shade, stream channel morphology, flows, and tributary/groundwater inputs cause changes in stream temperatures. The SAST (p. 26) provides the temperature profiles for the Grande Ronde, Umatilla and Tualatin rivers. These profiles clearly demonstrate the cumulative effects of stream heating and cooling at the subbasin scale. As noted above, under the FPA over 90% of private forest lands in a watershed receive very minimal protection. Shade, slope and bank stability, erosion levels, air temperatures, and large wood levels can also be adversely affected on the remaining 2% to 9% of the watershed with RMAs under the FPA. The DEQ TMDLs clearly demonstrate that the impacts of forestry and other land and water use practices can overwhelm stream heating and cooling processes throughout a watershed.

The SAST relies heavily on Caldwell et al. (1991) to dismiss the risk of cumulative downstream temperature impacts. This study states that "As long as there is at least a 150-m shaded reach between these streams where the canopy has been removed, there is minimal risk of cumulative downstream temperature impact (Caldwell et al. 1991)." The authors indicated that the re-equilibration of stream temperature would occur over a 150-m reach, which would represent one hour's travel time. This is approximately 0.14 ft sec^{-1}. A reasonable stream flow velocity during a low flow period would be 1.0 to 2.0 ft sec^{-1} with a resultant one-hour distance of 1,100 to 2,200 m. This is ten times the estimation by Caldwell et al. (1991). Even if their assumption were correct, further assumptions that there are sufficient groundwater inputs and substantial hyporheic interactions would be necessary to bring down the water temperature.

Just as importantly, Caldwell et al. (1991) looked at water temperatures downstream of unshaded reaches which entered reaches whose riparian zones were already degraded. The downstream comparison to a mature forest that contained some conifers was only done in one case. Measurements of re-equilibration were made along "control" reaches having artificially high stream and air temperatures. Heat energy that is quickly gained by a stream is retained and then gradually released back to the surrounding environment because water has a relatively high heat capacity. Given the forest conditions and flawed assumptions described above, Caldwell et al. (1991) provides little insight into the temperature regimes and dynamics provided by undisturbed forests.

The SAST also appears to rely heavily on data from one or more ODF monitoring efforts and technical reports. While the ODF monitoring efforts clearly show overall decreased shade levels and increased stream temperatures, there are significant questions about the methods and outcomes of these efforts (see page-specific comments below). For example, shade levels increased on two small streams, two large streams, and three medium streams after harvest in the riparian zone. It is not clear how this would be possible, especially over the short term. The SAST provides no clear statement of the sampling design, comparability or representativeness of selected field sites, or details of the particular field methods they used for gathering information on the characteristics of temperature in various streams. It is not clear whether the BMP effectiveness determinations are relying on the broad body of science related to forestry and stream temperature, a small number of studies, or whether the data cited is solely from the 1997 study by Dent and Walsh. The sample size apparently used seems small (n = 7 different streams) for extrapolating results broadly, and the sites are not necessarily comparable given the absence of geomorphic stratification for the sites, either before or after selection. It is not clear whether climatic factors such as seasonal temperatures, summer-time precipitation, snowpack and snowmelt influences, or others factors affected observed outcomes.

There are also questions about comparability among treatments in the different treated sites and whether they actually reflect the "maximum" riparian harvest allowed under the FPA. It not clear whether the condition of "untreated" downstream riparian areas as well as riparian areas upstream of the treatment sites were mature forest. If mature forest conditions were not present above and below treated (harvested) riparian areas, stream temperatures entering treated sites may be warmer than "normal" and the benefits of riparian areas to stream temperatures below treated sites may be less than expected for riparian areas in mature forest condition. The above factors could cause a substantial under representation of the adverse effects of harvest in riparian zones to stream temperatures.

Other Factors Affecting Temperature

Water temperature within a stream system is a function of both external factors, such as solar radiation, air temperature, and precipitation/flow, and internal factors such as width to depth ratios, connection to ground water, and hyporheic flow (Bilby 1991, Bilby 1998, Ward 1998, Poole and Berman 2000). Forest practices can affect external factors (e.g., by removing shade) as well as internal factors (e.g., by adding or removing large wood, which affects sediment routing and pool formation).

The riparian and upland functions provided by mature forests are clearly important influences on habitat structure (particularly provision of key pieces of large wood; Ralph et al. 1994, Abbe and Montgomery 1996, Bilby and Bisson 1998), water quality, and salmonid fishes (Bisson et. al. 1987, FEMAT 1993, Spence et al. 1996, Quigley and Arbelbide 1997). Habitat degradation has been associated with many of the documented extinctions or declines of anadromous and resident salmonid fishes in the Pacific Northwest, including Oregon (Nehlsen et al. 1991, FEMAT 1993, Henjum et al. 1994, Botkin et al. 1995, Independent Scientific Group 1996, National Research Council 1996, OCSRI 1997, Quigley and Arbelbide 1997). As noted above, the distribution of mature forest on private lands is extremely limited and significantly departs from historic levels. This condition impacts numerous factors related to stream temperature. As the draft SAST indicates, stream channel morphology is an important determinant of water temperature. As streams become wider and shallower, with fewer and shallower pools and fewer connections to floodplains and groundwater, they become more susceptible to warming. The SAST includes only a brief mention of bank stability (p. 30) and sediment dynamics (p. 31), and does not relate bank stability or sediment to forest practices. As described below, forest practices that affect large wood recruitment, sediment yield, storage, and routing also affect channel morphology. This needs to be considered in evaluating the adequacy of the FPA in achieving and maintaining water temperature standards.

Sedimentation and lack of current and potential large wood are key factors degrading fish habitat in western Oregon (FEMAT 1993, OCSRI 1997). Thom et al. (1999) describe results of a survey of randomly-selected sites in western Oregon in 1998. Survey sites were compared with reference reaches located mainly in unmanaged watersheds and wilderness areas, primarily in the upper portions of watersheds and on Federal lands. The areal extent of silt and sand on the surface of low gradient riffles was selected to typify potential accumulation of fine sediments in a stream. All of the areas had higher fine sediment levels than the reference reaches. Over 70% of the sites surveyed in the North Coast area had over 20% fine sediments in low gradient riffle units. The number of riparian conifers observed also differed markedly from the reference reaches. All of the areas showed low conifer numbers compared to reference reaches, with over 30% of the stream lengths surveyed having no large conifers in the riparian zone. The numbers of pieces of wood in the stream in survey reaches were similar to those in reference reaches. However, the number of key pieces of wood (over 10 m length, 60 or more cm diameter) in survey reaches was lower than reference reaches, with 50% of the stream length surveyed in each basin having less than 1 key piece per 100 m of stream channel (compared with the median value for reference reaches of 1.8 key pieces per 100 m of stream channel).

Large Wood

As noted in the SAST, large wood is an important component of salmonid habitat. In addition to providing cover and structural complexity, large wood strongly influences sediment storage, pool frequency, and pool volume (Bisson et al. 1987, Bilby and Bisson 1998). Large wood in streams has been reduced through a variety of human activities that include past timber harvest practices and associated activities, as well as the mandated cleanup activities that removed wood from streams throughout the region from the 1950s through the 1970s (FEMAT 1993, Botkin et al. 1995, Bilby and Bisson 1998). On forested lands in the Oregon Coast Range, non-random surveys conducted by the Oregon Forest Industries Council indicate that only 17% of the area's stream miles are at "desirable" levels (as defined by ODFW) for large wood pieces/mile, and that only 23% are in a "desirable" condition for large wood volume (OCSRI 1997). Large riparian conifers are at desirable levels along less than 1% of the streams on industrial and non-industrial private forest lands (OCSRI 1997).

Forest management activities within a distance equal to one site-potential tree height of streams (approximately 170 to 240 feet for mature conifer trees west of the Cascades, FEMAT 1993) have the potential to change the distribution, size, and abundance of large wood available for recruitment into streams (Hicks et al. 1991, Ralph et al. 1994, Murphy 1995, Spence et al. 1996). Because large wood recruitment potential declines rapidly moving away from the stream, a buffer of 100 feet includes about 80-98% of streamside large wood recruitment potential, depending on stand age and other factors (McDade et al. 1990, Van Sickle and Gregory 1990). The FPA includes RMA widths for non-fish bearing streams that range from 0 to 70 feet, and RMA widths for fish-bearing streams that range from 50 to 100 feet. For all of these stream types the removal of riparian treees can occur within the RMA to within 20 feet of streams (or within 0 feet for small non-fish-bearing streams). About two thirds of the basal area that could be expected in mature stands can be removed from RMAs under the FPA rules, and there are no basal area requirements for small non-fish bearing streams in the Coast Range and western Cascades.

Additionally, the FPA does not provide measures to ensure that potential large wood from unstable areas upslope of RMAs and adjacent to small non-fish streams is retained. Landslides and debris flows traveling down small steam channels can be important sources of large wood for fish-bearing streams in the Oregon Coast Range (McGarry 1994). McGarry (1994) found that about half of the large wood in Cummins Creek had been fluvially-delivered (transported), and determined that hillslope processes were important to the creation and persistence of quality habitat along the majority of a stream's mainstem. In addition, McGarry (1994) found that outside of the few locations that had large aggregations of large wood, non-transported wood occurred 87% of the time outside of the bankfull width on adjacent hillslopes and floodplains. Large wood within this area is more likely to persist within the system, and provides an important function of anchoring the portion of large wood within the active channel and bankfull width (Robison and Beschta 1990). Other studies examining riparian zone wood recruitment have purposely avoided stream reaches recently affected by landslides, or acknowledged the inability to account for the origin of about half the wood found in small stream channels (Van Sickle and Gregory 1990, McDade et al. 1990).

The SAST section on large wood sources needs to discuss the implications of riparian and upslope management on sources of large wood, regardless of whether each source can be specifically quantified, and the attendant effects on stream temperature and salmonid habitat. The FPA rules and practices do not ensure adequate recruitment of large wood from RMAs, unstable areas, or debris flow paths (Botkin et al. 1995, Murphy 1995, IMST 1999).

Sediment and Landslides

Log yarding and subsequent prescribed burning activities can increase soil exposure, runoff, and surface erosion, particularly when soils are compacted (Sullivan et al. 1987, Chamberlin et al. 1991). Removal of riparian trees can reduce bank stability, thereby increasing sediment delivery (Sullivan et al. 1987, Gregory et al. 1991). Large wood in small headwater streams retains sediment by forming depositional areas and dissipating energy (Bisson et al. 1987, Sullivan et al. 1987, Bisson and Bilby 1998). Sediment yields from headwater channels were greatly influenced by channel storage provided by large wood (Swanson and Fredriksen 1982). Without abundant channel storage elements, virtually all of the sediment entering a channel was routed downstream, while a channel with many storage sites from large wood only routed about 10% of the delivered sediments annually. Large in-channel wood also delays surface water passage, allowing it to be cooled by mixing with ground water (Bisson et al. 1987).

Clearcut logging on unstable landforms increases landslide frequency (Swanston and Swanson 1976, Sidle 1985, Swanston 1991, Robison et al. 1999). Based on an investigation of three streams in the Oregon Coast Range, Reeves et al. (1995) concluded that under a natural disturbance regime, periodic inputs of coarse sediment (boulders, cobble and gravel) and large wood in landslides may help create productive salmonid habitat, as these materials can be depleted in stream channels over long periods of time. However, landslides originating from harvested hillslopes, and debris flows that travel along stream channels where trees have been removed by harvesting, will deliver primarily sediment rather than large wood to streams (Hicks et al. 1991, Reeves et al. 1995). The FPA rules and practices do not preclude road construction or logging on unstable slopes or along debris flow paths, except where human life and property are at risk. The SAST sufficiency determinations should address the effects of the FPA on landslide rate and composition, sediment delivery, stream morphology, and temperature.

Road Effects

Construction of a road network can greatly accelerate erosion rates and sediment yield in a watershed (Haupt 1959, Swanson and Dyrness 1975, Swanston and Swanson 1976, Beschta 1978, Gardner 1979, Furniss et al. 1991, FEMAT 1993). Cederholm et al. (1981) reported that the percentage of fine sediments in spawning gravels increased above natural levels when more than 2.5% of a basin area was covered by roads.

On unstable slopes, road construction or improper maintenance can greatly increase landslide rates relative to undisturbed forest (Swanson and Dryness 1975, Swanston and Swanson 1976, Furniss et al. 1991, Robison et al. 1999), delivering large pulses of sediment to streams. Unpaved road surfaces continually erode fine sediments (Reid and Dunne 1984, Swanston 1991). Road networks can intercept, divert, and concentrate surface and subsurface water flows, providing a direct conduit for sediment into streams (Hauge et al. 1979, Furniss et al. 1991, Wemple et al. 1996). Stream crossing fills can also be a source of sedimentation, especially if culverts fail or become plugged with debris (Furniss 1991, Murphy 1995). Roads built near streams often eliminate part of the riparian vegetation (Furniss 1991), reducing large wood recruitment and shade, and may disconnect streams from floodplains and groundwater sources of cold water.

Reduction in large wood recruitment, increased landslide rates and sediment yield, more efficient sediment routing, and reduced bank and channel stability from logging, road construction, and road use can combine to make streams wider and shallower, with fewer and shallower pools (Sullivan et al. 1987, Swanston 1991, Furniss 1991, Gregory et al. 1987, Hicks et al. 1991). Such streams are more susceptible to warming. The FPA rules do not provide adequate measures to address the above sediment-related factors. The SAST sufficiency determinations should address these factors given their relationship to stream temperature.

Water Quality Standards and FPA Goals and Purpose

The stated purpose of ODF's Water Protection Rules at OAR 629-635-100(3) is protecting, maintaining, and where appropriate improving the functions and values of streams, lakes, wetlands, and RMAs. Protection, maintenance, and improvement of these functions and values is largely dependent on the total acreage within RMAs and the types, intensities and frequencies of forest management activities, both inside and outside of the RMAs. RMA width and tree retention requirements are key determinants of riparian functions that can affect stream temperature, such as shade, large wood recruitment, erosion control, and moderation of microclimate. The RMAs are, therefore, critical to meeting water quality standards. Based on an analysis of RMAs required under Federal, state, private, and tribal forest practices, the FPA provides inadequate protection of RMAs and the attendant functions and values they provide for Oregon's streams, lakes, and wetlands (see Attachment 2). The SAST validates the findings of the IMST that the FPA "is not sufficient to accomplish the recovery of wild salmonids" (IMST 1999).

The SAST and other studies and assessments indicate that forest practices under the FPA rules likely contribute to violations of Oregon's numeric water temperature criteria, and of the criteria at 340-041-0205(2)(b)(A) that are intended to implement the state's antidegradation policy and to protect threatened salmonids in Oregon[1]. When monitoring, research, assessments or other information demonstrate that practices under the FPA rules do not meet WQS, the rules need to be revised. The rules could be revised so that practices fully meet WQS and provide functional habitat for ESA-listed fishes during the BOF's consideration of the FPAC proposals. Also, the FPA rules include a provision for basin-specific rule changes that can address water quality issues in a particular watershed, subbasin, or georegion. Based on the substantial body of scientific literature demonstrating that Oregon forest practices likely adversely affect water quality and threatened species of salmonids, we recommend initiation of the basin-specific rule change process.

[1]To accomplish the goals identified in OAR 340-041-0120 (11), unless specifically allowed under a Department-approved surface water temperature management plan as required under OAR 340-041-0026(3)(a)(D), no measurable surface water temperature increase resulting from anthropogenic activities is allowed:

(i) In a basin for which salmonid fish rearing is a designated beneficial use, and in which surface water temperatures exceed 64° F (17.8 ° C);

(iii) In waters and periods of the year determined by the Department to support native salmonid spawning, egg incubation, and fry emergence from the egg and from the gravels in a basin which exceeds 55° F (12.8° C);

(iv) In waters determined by the Department to support or be necessary to maintain the viability of native Oregon bull trout, when surface temperatures exceed 50° F (10.0° C);

(vi) In stream segments containing federally listed Threatened and Endangered species if the increase would impair the biological integrity of the Threatened and Endangered population.

PAGE-SPECIFIC COMMENTS

The location of the referenced text in the specific comments is by page number and paragraph from the SAST.

Page 4, Paragraph 5
Last sentence, add timing of rearing of bull trout and cutthroat trout. Bull trout may rear in stream gravels for 220+ days out of 365.

5, 3 Sentence 3. Last sentence should read: "Riparian buffers of roughly 30 m (100 ft) are generally acknowledged in the scientific literature as minimum for protection of many riparian functions."

5, 4 The second sentence should identify the "various results" being referred to.

P. 6-10 This section of the Executive Summary is based on the main text of the document. Comments on the main text provided below also apply to the Executive Summary as appropriate.

13, Chart 1. The analysis decision tree in Chart 1 (left arm, third tier down) is flawed in cases where the current effects of BMPs are masked by past practices (legacy effects). This approach will fail if the legacy effects mask the new effects enough so that statistically significant findings can not be reached.

14 In general, this section should rely on a broader range of literature, and should more thoroughly describe the potential sublethal effects of water temperature on salmonids, since those effects likely are more prevalent than lethal effects in forested landscapes. Also, we disagree with the implication that only summer maximum temperatures are of concern. Stream temperatures in late summer or early fall, while occurring after the summer maximum, may be warm enough in managed landscapes to adversely affect salmonids that hold and spawn at that time (such as spring chinook in the Grande Ronde, Imnaha, John Day, Willamette, and Rogue River basins; Lichatowich et al. 1993, Myers et al. 1998). Another consideration outside of the summer maximum period is temperatures during out-migration and smoltification. Temperatures must be cooler than the Oregon rearing standard to fully support the outmigration of steelhead, spring chinook, and coho salmon, which occurs in spring and summer (Bell 1991, DEQ 1995, Weitkamp et al. 1995, Spence et al. 1996). Spring chinook require temperatures of 3.3-12.2°C for smoltification and outmigration (DEQ 1995). The preferred smoltification temperature range for coho salmon is 12.0-15.5°C (Brett et al. 1958). The upper limit for parr-smolt transformation and out-migration of steelhead trout is in the range of 11.3 to13.0°C (Zaugg and McClain 1972, Adams et al. 1975, Zaugg and Wagner 1973, Zaugg 1981, McCullough 1999). DEQ (1995(b)) states "It is recommended for all salmonids that temperature not exceed 54°F (12.2°C) to maintain the migratory response and seawater adaptation in juveniles..." If spring temperatures are too high, salmon smolts will revert to a pre-smolt physiology and remain in fresh water (Spence et al. 1996, McCullough 1999).

14, 1-2 Information for steelhead and cutthroat trout needs to be included in this discussion. Summer steelhead in Oregon enter freshwater from spring to summer and hold until spawning in late winter or spring in the following year (Busby et al. 1996). Incubation of eggs and fry may extend into summer for a number of steelhead stocks including Lower Columbia River steelhead, Middle Columbia River steelhead, and Snake River steelhead (Howell et al. 1985, Busby et al. 1996). The rearing period for all of these stocks, as well as other steelhead populations, includes the summer.

14 Footnote 3. We would appreciate an opportunity to review a draft of Dr. Danehy's work on thermal requirements of bull trout.

15, 3 Some important sublethal effects are not mentioned in this section. Temperatures above 15.6-17.8°C (60-64°F) can contribute to increased pre-spawning mortality; out-migration from unsuitable areas; increased disease virulence; reduced disease resistance; and delay, prevention or reversal of smoltification (Berman 1990, Marine 1992, DEQ 1995, McCullough 1999).

15, 4 If there is a direct connection between the lethal limits in Table 2 and the State's temperature standard, this connection should be made clearer.

20, 5 Stream channel widening can also be an important heating factor. This should be discussed and integrated into the final analysis.

23, Figure 5. It is not clear what the black boxes with arrows to the lines refer to.

23, 3 The last paragraph should be used to summarize the data provided in Figure 5 (e.g., what is happening to both curves at width=100 ft.), rather than to present a hypothetical example of something that is not shown in the Figure.

25, Figure 7. Note that the state water quality standard for bull trout (from Table 1, p. 14) is considerably below the recorded temperature values in both stream segments. Thus, neither of these stream segments would support bull trout spawning, egg incubation, or emergence. It would be helpful if the figures were summarized or interpreted, and related to something that is biologically meaningful if possible.

25,3 The SAST lists five primary factors controlling stream temperature, then appears to only consider shade in the SAST determinations.

26, The x-axis of figures 8 and 9 is not readable.

27, 2 Suggest modification of sentence 4 to "Floodplain roughness is increased by riparian vegetation which slows stream velocities and increases retention time of water on the floodplain while reducing local shear stresses and bank erosion."

28, 3 Sentence 2. The SAST should avoid sentence constructions/phrases such as "some argue" or "various results". A valid analysis needs citations and actual presentation of findings for the reader to compare. Also, when using or referencing findings, a summary of those findings should be provided. The paragraph as a whole leaves the reader uncertain of the foundation for the argument being presented.

29, 5 In contrast to the "conclusion" of Caldwell, Beschta's statement (above paragraph 4) is presented as an hypothesis. The contrast in information provided or analyzed by both Caldwell and Beschta should be a bit clearer.

29-31 In discussing factors that control temperature, the role of basin hydrology is understated and the relationship of channel form to its valley form is not addressed. The TMDL prepared for Simpson forest lands in Washington included analysis which demonstrated that lithology and topography, which ultimately defined the character of the valley through which streams flow, was paramount in defining the range of channel conditions found within a given area. This landscape stratification scheme, with refinements in channel type based on basin area, relative channel confinement and gradient, allowed for a much more tailored means to observe and predict how streams would respond to differing levels of shade and sediment input. The data on temperature from > 400 mi^2 area suggests that shade is not always the most important determinant of stream temperatures everywhere, and that streams and their characteristic temperature signatures can differ significantly in their response to riparian timber harvests. Other studies suggest that factors such as total basin area harvested within a short period may be a more important determinant of stream temperatures than riparian zone stand conditions alone (Hatten and Conrad 1995). The SAST discussion should be broadened to include the above valley form and landscape scale factors relevant to stream temperature.

30, 1 Add to paragraph 1 "Greater vertical variability exists in streams with a well defined pool/riffle sequence, which causes more water to be forced into the hyporheic zone due to hydraulic pressure."

30, 3 Second sentence should not limit the known occurrence of hyporheic zones to the downstream end of riffles. Hyporheic zones can occur almost anywhere along a stream gradient, depending on factors that are not fully understood.

30, 3 Last sentence also should indicate that we cannot currently predict where hyporheic zones are to be found. Interruption or alteration of hyporheic flows is a possible side effect of ground disturbance; ground disturbance is not evaluated in final risk determinations when comparing the likelihood of attaining temperature standards.

30, 4 Stream Bank Stability/Instability. This section should be more inclusive of various stream bank failure mechanisms. The discussion of stream bank erosion is limited to one failure mechanism and is too simplistic to be of use. The statement "Stream bank erosion reflects looseness of bank soil, rock and organic particles. The opposite condition is cohesion of stream bank soil, rock and organic particles" implies that cohesive banks are more stable. While it is true that cohesive banks are less likely to erode due to single particle detachment, they are more likely to erode because of mass failure from saturation, over-steepening, or undercutting.

According to Thorne (1990) "mass failure of non-cohesive banks occurs by shearing along shallow, planar or slightly curved surfaces. The motivating force is shear stress on the potential failure plane due to the downslope component of weight..." He continues that "most mass failures of cohesive banks occur following rather than during high flows in the channel. This is because the switch from submerged to saturated conditions that accompanies drawdown in the channel approximately doubles the bulk unit weight of the bank material, increasing the motivating force on the potential failure surface in about the same proportion." Later in the same paragraph, the statement "vegetation strengthens particle cohesion by increasing rooting strength that helps bind the soil and add structure to the stream bank" is unclear. It implies that vegetation merely increases a rooting strength that the soil already contains – the vegetation provides rooting strength. Again from Thorne (1990): "Soil is strong in compression, but weak in tension. Plant roots are weak in compression, but strong in tension. When combined, the soil-root matrix produces a type of reinforced earth which is much stronger than the soil or roots separately.....roots are effective in both adding tensile strength to the soil and, through their elasticity, distributing stresses through the soil, so avoiding local stress build-ups and progressive failures."

31, 2 Stream bed roughness is more important than bank roughness in determining Manning's N values. The SAST discusses only bank stability.

31, 4 Modify sentence 2 to include: "The degree of sinuosity is related to **landscape position**, channel dimensions, sediment load, stream flow, and the bed and bank materials."

32, 1 The discussion of riparian characteristics and hyporheic flow should expanded to include a more detailed discussion regarding in-flow (upwelling) and out-flow (downwelling) that is associated with functional hyporheic/surface flow interactions.

32-33 The information on these pages suggests that other factors besides shade— i.e. groundwater, floodplain connectivity, microclimate, etc., can affect stream temperatures. This information should be included in making risk evaluations.

33, 2 Add to "Energy lost through evaporative heat transfer can result in a decrease in stream temperatures if heat losses are greater than heat gains (Benner & Beschta 2000)" ...<u>which is important during winter months when streams lacking riparian cover are exposed to severe cold.</u>

34, 1 Add "fire, wind, insects, pathogens" etc. to "wildlife, etc," (list of disturbances), and consider other references besides Swanston (1991) as necessary. Perhaps "wildfire" was intended instead of "wildlife"?

34, 3 Need to introduce the definitions of Type F, N, small, large, etc. here or prior to regional summaries. The RCR terminology also should be defined and explained.

34,3 There is no clear statement of the sampling design, comparability or representativeness of selected field sites, or details of the particular field methods used for gathering information on the characteristics of temperature in various streams. It is not clear whether the BMP effectiveness determinations are relying on a number of studies or whether the data cited is from the 1997 study by Dent and Walsh. This is especially problematic if the determinations are being made based on one or a few studies that provide very limited data and the determinations are then extrapolated to the wider universe of streams in Oregon. The sample size apparently used seems too small (n = 7 different streams, with sampling sites distributed within them), and the sites are not necessarily comparable given there is no geomorphic stratification for the sites, either before or after selection. For example, if as described for Dent and Walsh (1997) on p. 36-37, there were eight "sampling sites", all on one stream, and all within one year (1995), what conclusions may be drawn? This will depend on whether 1995 was a typical or atypical year with respect to climatic factors such as seasonal temperatures, summer-time precipitation, snowpack and snowmelt influences, or others factors that could affect the observed outcome. The sufficiency determination should consider a range of conditions including a worst case scenario (i.e., a year with low snowpack, and warmer than usual spring and summer temperatures). It is not clear what features of the study streams are universally applicable to the myriad of other stream types subjected to the general treatments afforded by the BMP's. The sensitivities of all streams would likely vary depending on channel condition, ground water inputs, orientation, substrate composition, and a host of other factors.

35, 2 List of reports. Identify how can they be obtained, which are most relevant, and what parts of each is relevant. Some of the ODF Technical Reports do not seem to be in the "References" section at end, while Caldwell (1991), which is Washington Department of Forestry "grey" literature, is in the references section. For the first report, the parenthetical statement (Small Type N Streams) conflicts with the statement in the following paragraph that the monitoring sites included in this study are mostly medium and large streams.

35, 3 It would be helpful if this paragraph ("A review of...") established a context for the discussion that follows. For example, how does it relate to the questions on p. 13? The usage "pre-post" should be explained.

35, 5 Sentence 3 ("For each reach...") should state how far downstream of the harvest unit the temperature probes were placed.

36, 1 Unclear presentation of findings, compared to tables. Using the ANOVA method, did temperatures actually decrease in treated streams that were located higher in the basin? Was this a reliable finding, or could it have been due to sampling error, or lack of adequate control for time? The reader needs to understand what types of streams these findings are specific to. Do the ANOVA and Wilcoxon non-parametric tests agree on these specific findings? The text suggests that additional sampling locations downstream of the treatments may have been used. The data for these additional downstream reaches do not appear to be included in Table 4, which includes only T (treated) and U (upstream controls?) reaches.

36, 3 Table 3 should read "Table 4". Also, the question as originally posed is related to the analysis framework on p. 13 (not p. 6 as referenced). The approach in the chart and with respect to this question is flawed (see comment on p. 13, Chart 1).

37, 1 Last two sentences: The described approach to determining if a change in temperature is due to a treatment effect or to a temporal shift in climate is not exactly appropriate, given that it seems there was considerable overlap (as described on the previous page and as shown at least in Figures 11 and 13) in time between the pre- and post- samples. Only if there was poor overlap or if the pre- or post- samples could <u>not</u> be compared (in time) would this be important. It is unclear whether, for each category of stream tested, controls for time effects were adequate. It appears that controls for time were adequate, at least for the small stream category. Figure 16-1 (small streams upstream; upstream controls) showed no change in temperature with time. Therefore there is a clear test of the null hypothesis for small streams.

38 Table 4 displays summary information about the sites at which the data were collected. There is no explanation to decipher the meaning of various column headings, e.g. rate type—is this the rate of change in temperature? What do the letter codes mean? Although the "post harvest year" is given, there is no information on when the "treatment" actually occurred. Also, since no information is given on years in which pre-harvest data were collected it appears that there were different periods of time between the "treatment" or harvest and the post-harvest field data collection. If this is the case, it brings into question some of the apparent conclusions reflected in Figure 19. The bar graph in Figure 19 shows a net increase in shade shortly following harvesting in 2 of 9 small streams, 3 of 7 medium streams, and 2 of 7 large streams. These results are counterintuitive. Since the SAST does not describe how "shade" was measured, it is not clear if the methods used have sufficient inherent inaccuracy to explain this result or if those particular sites had more time to recover before they were measured post-harvest.

38 It is not clear how treatments applied to the selected sites were standardized. Evidently, there were 3 riparian treatment types, CC = clearcut, TH = thinning, and hardwood conversion, here described as RCR = riparian conifer restoration. According to Table 4, some treatment sites had both sides of the native riparian zone subject to the treatment, while other sites had only one side (which side and its aspect are important) harvested. Also, it is unclear what the "upstream" sites represent, since they too appeared to have some sort of pre- and post-harvest data collection. Were the riparian areas in the upstream sites in mature forest condition? Was this meant to illustrate changes *not* attributable to treatments, or were upstream sites subjected to treatments? The graphical displays of the analysis results (Figures 16 - 17) don't explain how much time lapsed between pre- and post- sampling, and whether there was inter-annual variability in weather patterns that might explain differences. Additional narrative explanation for the figures should be provided.

39 It appears that the bulk of the sample analysis involved data from seven streams, with 28 sites distributed among these seven streams. It is incorrect to represent 6,740 individual measurements as the sample number. Figures 11-13 are intended to show how these "samples" are distributed over time at each site, for pre- and post-harvest, and for both "upstream" and treatment sites. The

graphs are very unclear—there is no legend to explain what information the reader is expected to glean from them.

54,3-5 The fact that elevated temperatures in small streams still remained below temperature standards does not reduce the potential cumulative effects of such temperature increases, or address the antidegradation standard.

55 The effects determinations appear to be derived through an analytical approach that considered only shade and stream temperatures and attainment of numeric, fixed temperature targets, rather than how the whole suite of forestry BMPs affects riparian and stream channel functions and support of beneficial uses. There may be some evidence to suggest that a given riparian harvest provides adequate shade along a stream, in some years. That falls short of demonstrating that a designated beneficial use, such as salmonid spawning, is protected. Shade is just one factor affecting temperature and temperature is but one criterion set to ensure beneficial use support. Other in-channel and riparian features may provide compensatory factors that ameliorate less-than-ideal temperatures. Industrial-scale timber harvesting has and will likely continue to impose a multitude of effects that change the overall, long-term suitability of instream habitats required for recovery of salmonids (see Ralph et al. 1994, and others referred to in General Comments). These include the input and routing of organic matter (small and large wood, detrital organic materials), water, and sediment (from yarding, roads and landslides).

The determinations should specifically identify the data that they are based on. As noted below, the statements in the determinations do not seem to be fully justified by the data presented. The determinations should consider factors other than shade and should be based on the full body of science rather than a single or several limited studies.

55, 2 Based on the data, sentence 1 should read "it is likely..." or "it is very likely" not "has the potential to...result in some increases in stream temperatures."

55, 2 Last sentence: the last sentence should simply say "stream temperature increases are likely..." , not "it is likely...[that] increases are also possible..." Based on the data, and the true (and highly significant) test which discounted the null hypothesis, "likely" also fits the data better than "also possible."

55,2 Need to explain the "Mixed" finding for Medium Streams in Table 5 (see Figures 16-3 and 16-6 for medium streams).

55,3 What is the likelihood that the downstream reach will not have also been harvested, or be harvested within a reasonably short period of time?

55,3 Cumulative effects have not been addressed. If ten of these "small type N" streams drain into a larger stream, the combined total of their input could be nearly equal to the flow of the larger stream. This **would** have a significant impact on stream temperature. Accordingly, the last sentence: should read: "...10 percent of the receiving stream are unlikely to **individually** influence temperatures..." (add the word "individually").

55, 4 The statement that the current BMPs are likely to be effective in minimizing temperature increases seems to overstate the case based on the variable nature of the data presented.

55 Footnote 7: We disagree that stream flow and/or channel width are not likely to be affected. An alteration in watershed cover may affect hydrology. Typical changes in hydrology due to watershed changes, especially where there are roads, will be an increase in the frequency and

magnitude of high flow events. This increase may lead to channel widening, and channel widening is acknowledged in this document to lead to stream temperature increases.

56, Table 5 is premised only on shade, i.e., on relatively short-term responses of streams to changes in shade alone, using no information about any other mechanism for temperature increase (see General Comments). Also, it appears that some of the entries (e.g., Large streams) are based on opinion, not on data provided here.

57, Therefore, Tables 6 and 7 may be invalid. Table 6 appears questionable, especially in the Large (all treatments) category.

58, The risk findings in Table 8 are not all supported by data presented in the draft, or else supporting data were not readily evident.

58 Based on the full body of the best available science we agree with the conclusion in Table 9 that small and medium sized streams (both F & N types) are not adequately protected when the "treatment" involves clearcut and hardwood conversions. The full body of science supports the same conclusion for large type F and N streams under the FPA rules. While the ODF monitoring study did show a decrease in shade levels and an increase in stream temperatures for most of the sites monitored, the shortcomings of the overall sampling design and methods used by ODF need to be addressed.

58 Tables 8 and 9, while seeming reasonable in some cases, may be invalid in others, because they are premised on Tables 5, 6, and 7. There is no basis or rationale presented for Tables 7 and 8. For example, for small type N streams under Clear Cut management, it is hard to understand how to get from Table 5 (Is forest harvesting under current BMPs a potential cause of stream temperature increases...Very Likely) to Table 8 (What is the level of risk that current BMPs are the cause of temperature standards not being met... Low to Moderate). These do not seem to be consistent responses, and no explanation is provided. These qualitative conclusions should be backed up with and related to the box and whisker plots presented earlier.

59, 1 Last sentence. This interpretation implies that if grazing and water withdrawal adversely affect stream temperatures, then contributing increases due to timber management practices do not need to be assessed. This is not consistent with the CWA or ESA. Under these laws forest practices need ensure that WQS are met and that harvest activities avoid "take" of ESA-listed species.

59, 7 The discussion of coldwater refugia in four above paragraphs is fine. However, if a specific definition for coldwater refugia is lacking, how can the standard to protect these be met?

60, 1 First 2 sentences: As stated previously, these conclusions are not well supported in the document. Sentence 3, "Relative to other streams...": This sentence seems to run counter to the regulatory requirement. A more important question to address is: will streams of various types and sizes, and with various beneficial uses, meet the temperature requirements under current BMPs?

60, 4 The third sentence in this paragraph is an example of the mis-use of the assumption that shade is the only factor affecting stream temperature, despite the fact that elsewhere in the draft it is acknowledged that there are other important factors.

APPENDICES

- Some of the key information on important disturbance processes (in Appendix D) need to be brought up front, or at least summarized better in the main body of the analysis.

- There is not enough information on other mechanisms besides shade for thermal changes—especially the relationship between streamflow and temperature, increased sedimentation, potential channel changes, and disruption or reduction in groundwater inflows from ground disturbance (see general and specific comments above). Also, large wood has been known to sort and build gravels and lead to increased local upwelling (areas of upwelling can be important low temperature refugia for bull trout and other cold-water species.

- See the Antidegradation Policy for Surface Waters and High Quality Waters Policy (p. 79). How are these going to be implemented?

- The BMPs and underlying assumptions are not consistent with a "holistic approach" and clearly do not achieve a desired future conditions similar to that of a mature forest. As noted in the comments above, shade, large wood inputs, and sediment filtration are significantly compromised functions under the FPA rules and BMPS.

Literature Cited

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Attachment 2

Comparison of Riparian Protection Measures in Oregon

Forest management practices for private, State, Tribal, and Federal forest lands in Oregon include riparian protection measures to provide water quality, fish and wildlife protection. Riparian areas, given their proximity to streams, lakes, and wetlands, are critical for large wood recruitment, shade, stream bank and slope stability, sediment retention, and air temperature moderation. As discussed in detail in Attachment 1, there is extensive scientific research and analysis that documents the importance of riparian functions to water quality and fisheries. The areal extent and configuration of riparian management areas (RMAs) and the management requirements applied within those RMAs are the primary determinants of RMA functionality.

Figure 1 provides a relative comparison of the acreage designated as RMA under the "rules" for private, State, Tribal, and Federal forest lands in Oregon. The RMAs from the forestry rules for westside Federal forest lands (NWFP), forest lands managed by the Confederated Tribes of the Warm Springs (Warm Springs), forest lands under the proposed habitat conservation plan (HCP) for the Northcoast State Forests, and private forest lands under the Oregon Forest Practices Act (FPA) are compared for the North Fork Kilches watershed. The forestry rules for the NWFP would designate the largest amount of acreage as RMA (100%) of the forest practice rules in Oregon. In Figure 1, the RMA acreage required under rules for private, State, and Tribal forest lands is expressed as a percentage of the RMA acreage for the NWFP. For example, RMA acreage required under the FPA would constitute approximately 7% of the acreage required under the rules for NWFP RMAs for the stream network in the North Fork Kilches watershed. The percentage number above each bar in the figure represents the comparative RMA acreage for each of the four sets of forestry rules.

The Figure 2 provides a relative comparison of tree retention requirements within RMAs under the forestry rules for private, State, Tribal, and Federal forest lands in Oregon. In Figure 2, tree retention is expressed as basal area to allow comparison of the various rules. The forestry rules for the NWFP would require retention of the largest number of trees or basal area within RMAs (100%) of the forest practice rules in Oregon. Under the NWFP the entire RMA is managed specifically for aquatic conservation and other late-successional and old-growth associated species. In Figure 2, the basal area retained within RMAs under rules for private, State, and Tribal forest lands is expressed as a percentage of the basal area that would be retained under the NWFP rules. For example, the basal area retention requirements within RMAs under the FPA would constitute approximately 3% of the basal area that would be retained under the NWFP rules in RMAs within the stream network in the North Fork Kilches watershed. The percentage number above each bar in the figure represents the comparative basal area retained within RMAs for each of the four sets of forestry rules. As shown in Figures 1 and 2, the FPA designates substantially less area as RMA and require retention of substantially fewer trees (basal area) within those RMAs than do the forestry rules for State, Federal, and Tribal lands in Oregon. The resultant reduced riparian function adversely affects both water quality and salmonid fisheries as described in Attachment 1.

Figure 1.

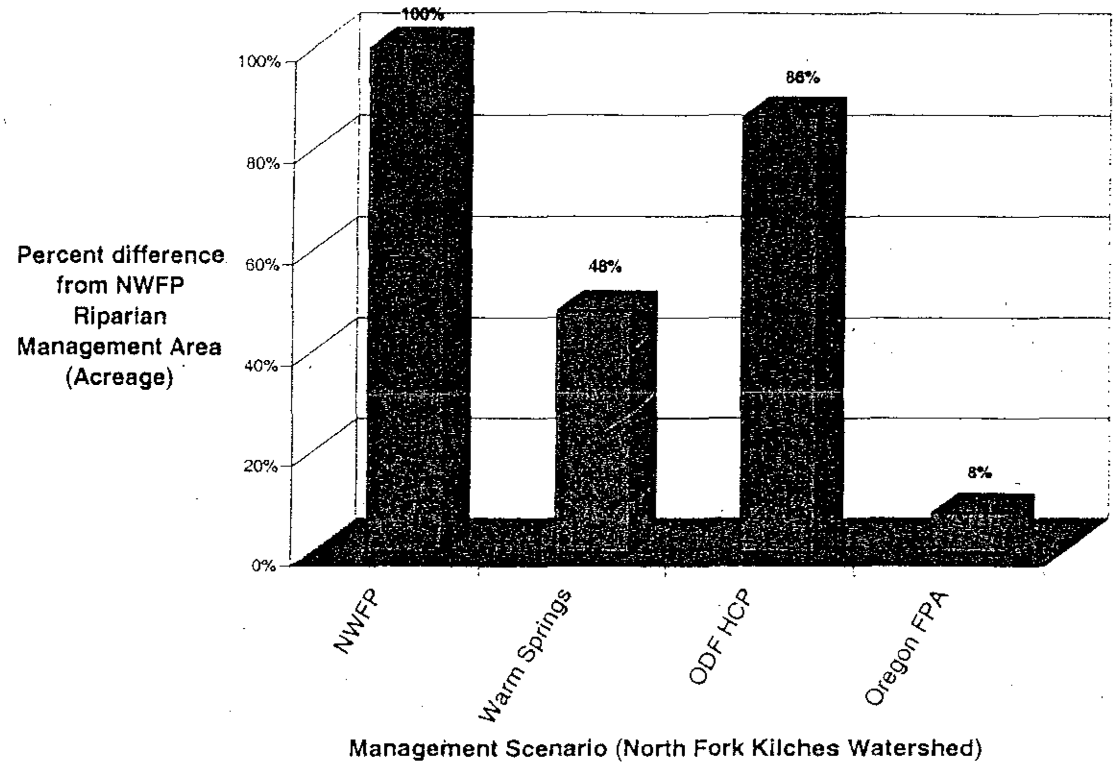
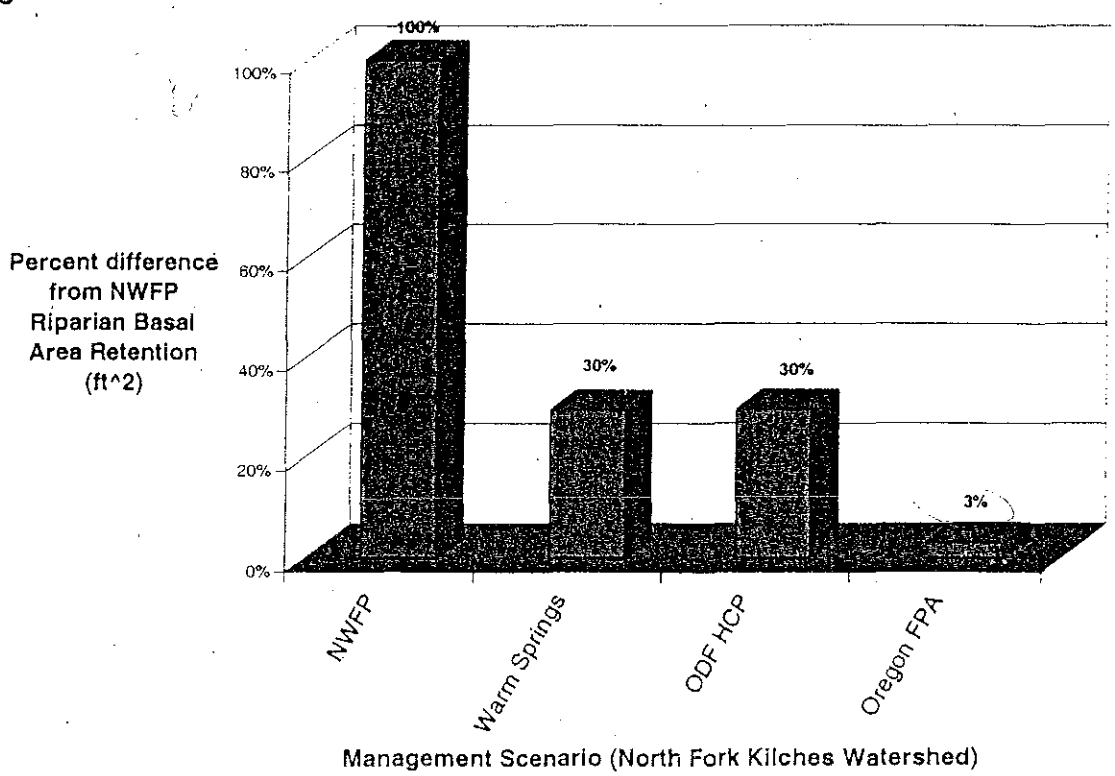


Figure 2.



Attachment 3

Total Maximum Daily Load (TMDL) Shade Comparison

Figures 1 and 2 compare the site-potential shade targets from the Upper Grande Ronde River and Tualatin River subbasin TMDLs with the shade data from an Oregon Department of Forestry 1999/2000 shade study funded under Clean Water Act Section 319. The shade study measured shade on recently harvested sites (FPA Treatment) in riparian areas and other riparian sites which had not been harvested recently, including sites with late-seral forest (Control). The numbers along the left margin of the first two figures in Attachment 3 denote shade levels (% Effective Shade). The numbers along the bottom margin of the figures approximate the active stream channel width (Near-Stream Disturbance Zone Width). The "shade curve" (descending line in the upper portion of the figures) shows the site-potential effective shade levels for varying near-stream disturbance zone widths. The potential shade level gets lower as the near-stream disturbance zone gets wider. The vertical bars along the site-potential shade curve indicate the differences in effective shade levels that occur due to stream aspect (e.g., stream running north to south, east to west). The control sites (shaded diamond symbols) in both the Grande Ronde and Tualatin River Subbasin figures correlate very well with the TMDL site-potential shade curves. The FPA Treatment sites (circle and triangle symbols) provide lower effective shade levels, falling below the site-potential shade curves. The basic relationship between shade levels at Control sites and lower median shade levels at FPA Treatment sites holds true for the full body of data sets (122 sites) from the shade study.

Figure 3 demonstrates how far shade levels at FPA Treatment sites and Control sites deviate from site-potential shade targets in the Tualatin River Subbasin TMDL. The numbers along the left margin of the figure indicate the deviation from the TMDL site-potential shade levels (both above and below potential). On the left margin 0% correlates with the TMDL site-potential shade target as does the horizontal line to the right of 0%. The bottom margin of the figure shows specific FPA Treatment sites and Control sites that match up with the bars in the figure. All of the unshaded bars matched with the FPA Treatment sites show shade levels below the TMDL shade target. The average deviation of FPA Treatment sites from TMDL shade targets is -23.8%. The shaded bars, which align with the Control sites, fall both above and below the TMDL shade targets and have an average deviation of 0.2% above the TMDL shade targets.

The data from the 122 sites in shade study consistently show higher median shade levels at Control sites than at FPA Treatment sites for all the data sets for all stream sizes. The data from the FPA Treatment sites also consistently have a higher deviation from median shade levels than do Control sites. The lack of preharvest basal area and shade measurements at FPA Treatment sites precludes a precise analysis of how much harvest affected basal area and shade levels. In addition, the basal area levels at many of the FPA Treatment sites are higher than the current Oregon FPA basal area requirements potentially understating the shade reduction that would result from meeting the FPA requirements. On some of the sites grazing, disease, and other natural disturbance may also have affected shade levels, particularly on some Eastern Oregon sites. These non-harvest disturbances would not likely be significant on most Western Oregon sites given the absence of grazing in the Coast Range and the longer disturbance return intervals.

Figure 1. Tualatin River Subbasin TMDL Effective Shade Surrogate Measures (DEQ Data) and Measured Effective Shade Data (ODF Data, 1999)

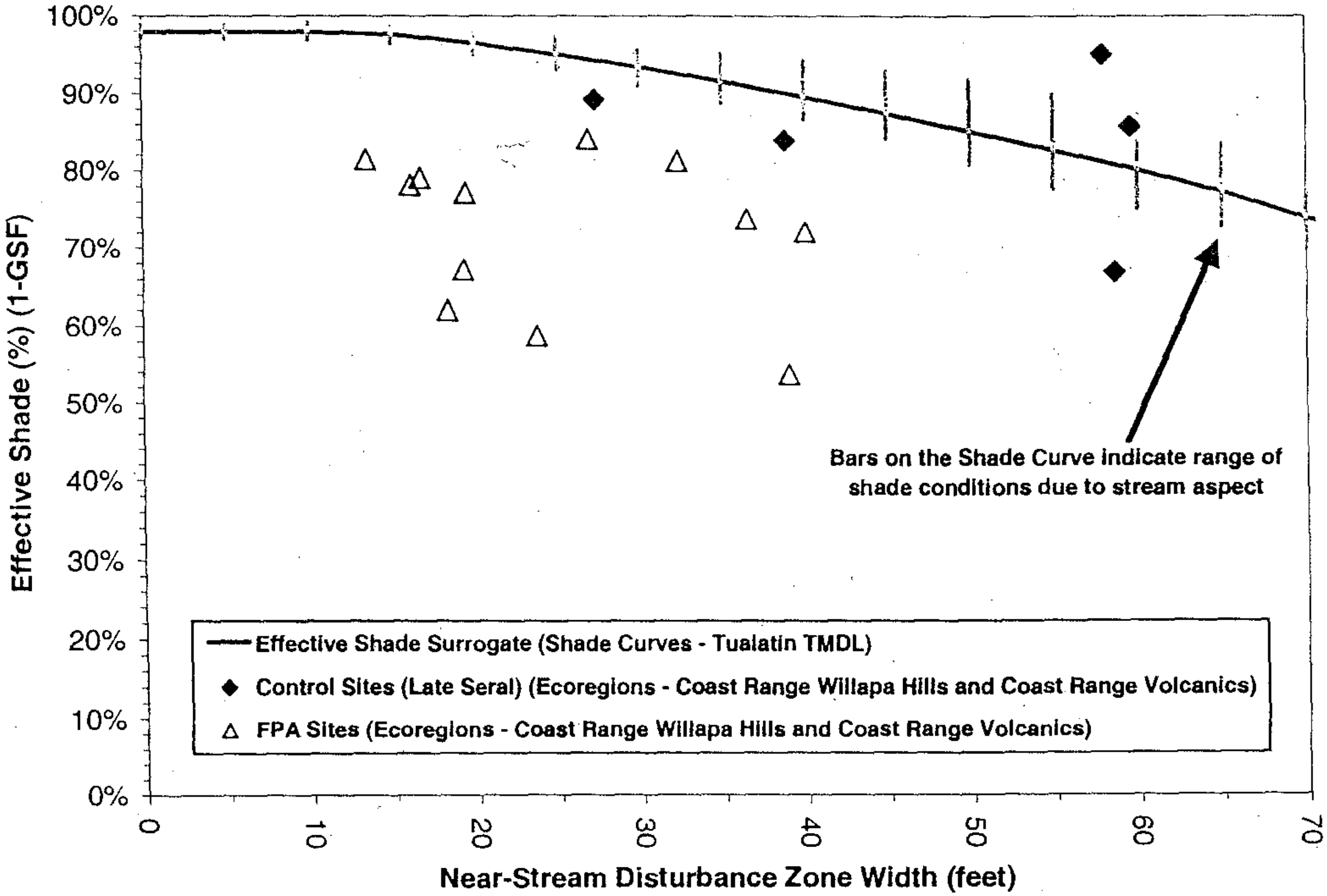


Figure 2. Grande Ronde River Subbasin TMDL Effective Shade Surrogate Measures (DEQ Data) and Measured Effective Shade Data (ODF Data, 1999)

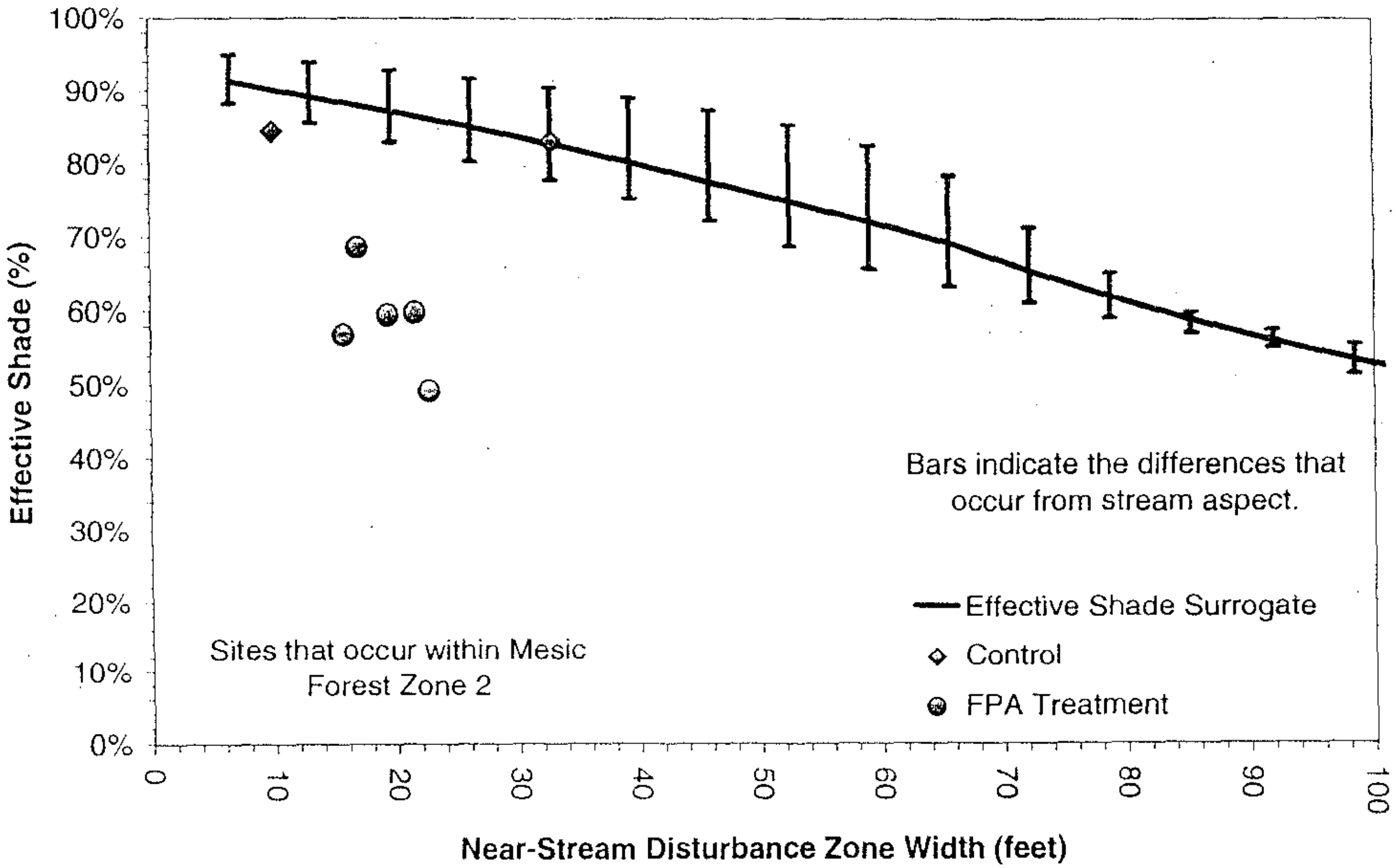
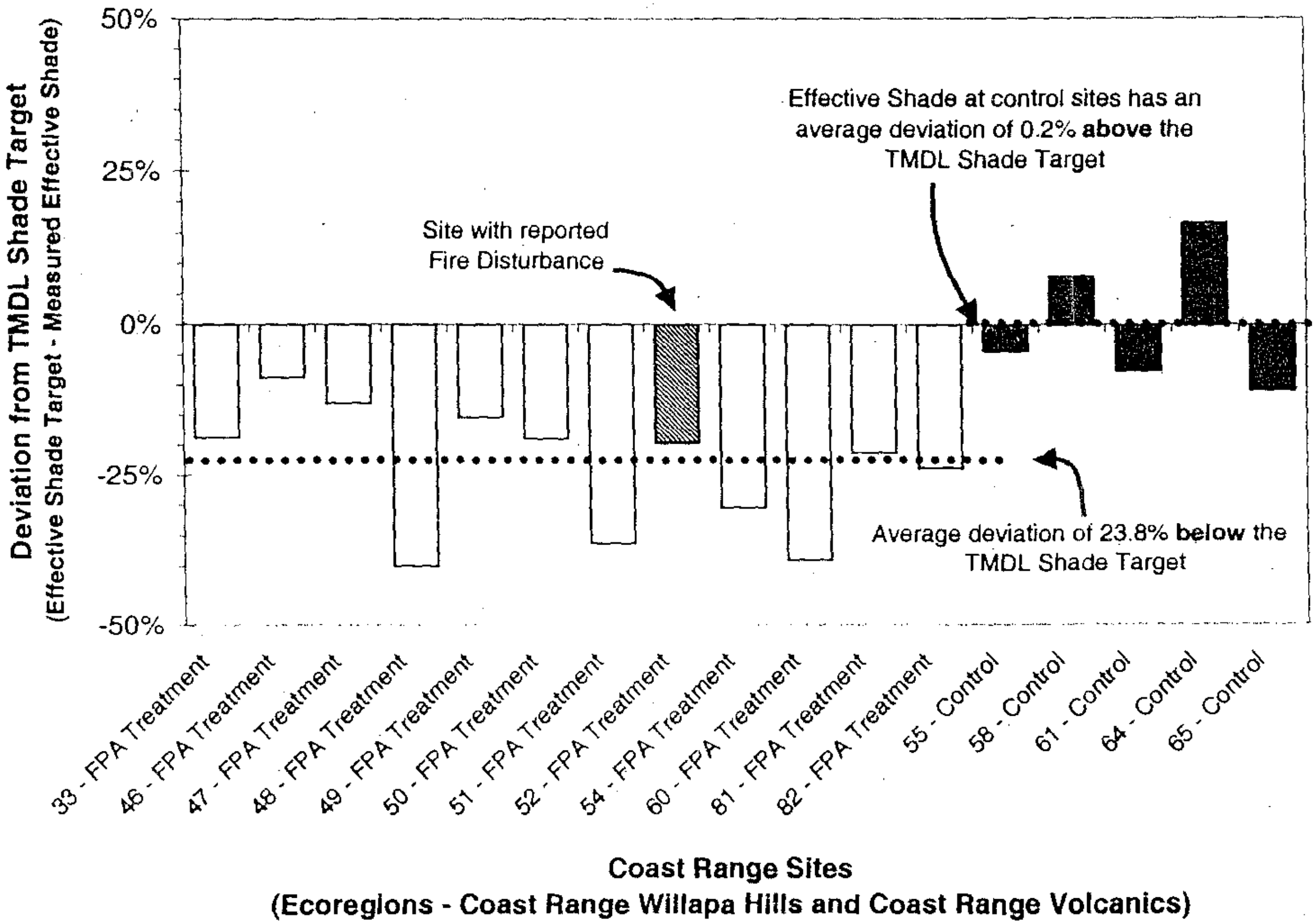


Figure 3. Deviation of Measured Effective Shade Data (ODF Data, 1999) from Tualatin River Subbasin TMDL Effective Shade Surrogate Measures (DEQ Data)



Oct. 21, 2004

Members of the Board of Forestry and Members of the Environmental Quality Commission:

Thank you for this opportunity to present my views on the subject at hand. My name is Bill Arsenault. My wife and I manage a tree farm near Elkton, Douglas County, Oregon. I am a member of several organizations and sit on advisory committees related to forestry. I come to you today representing only myself as both a family forestland owner and as a former member of the Forest Practices Advisory Committee (FPAC).

As part of this meeting you received a memo from Stephanie Hallock, Director, and Marvin Brown, State Forester. In it (Page 8) it was stated that four members of FPAC no longer supported the FPAC recommendations to provide additional protection on small Type N perennial streams. In my case, this is not entirely accurate. I no longer support the requirement that 4 square feet of basal area in trees six inches DBH or larger per 100 feet of stream, each side, be retained. I do support the draft recommendations of ODF staff to retain all understory vegetation and non-merchantable vegetation. This is added protection. As I understand it, the requirements to leave merchantable trees was at the insistence of DEQ.

My beliefs today do differ from what I agreed to in the FPAC report. I enclose copies of two reports I presented to the Board of Forestry on April 25, 2003 and April 23, 2004 dealing with the subject. In the 2003 report I pointed out how the situation has changed since the FPAC process was completed. We entered the process under a heavy cloud. The National Marine Fisheries Service (NMFS) was threatening to implement onerous forestry regulations under the 4(d) rule. In the middle of the FPAC process the IMST issued their forestry report which implicitly assumed that freshwater impacts were responsible for the decline in salmon and were limiting their recovery.

On the last page of the 2003 report is a graphic showing coho returns over a 12 year period and points to other events during this period. It is significant that in 2002, Bob Lohn, Regional Director of what is now NOAA Fisheries, is quoted as saying "Near record returns of most salmon and steelhead populations in recent years have led a majority of credible scientific researchers to conclude that ocean conditions are by far the biggest factor affecting salmon and steelhead populations". Thus, one of the basic reasons for some of the FPAC recommendations went away.

This is a very welcome change in the attitude of NOAA Fisheries, almost too overwhelming to comprehend. I sat in the Governor's conference room just a few years ago along with some other members of the Oregon Small Woodlands Association (OSWA), members of the Oregon Forest Industries Council (OFIC), the Governor and some his staff while Will Stelle, former NMFS Regional Director, stood up, with finger pointing, lectured us that there was irrefutable scientific evidence that forest practices were the cause of the decline and potential extinction of the salmon populations and demanded major changes in the Oregon Forest Practices Act.

The attached 2004 report represents the opinion of the Committee For Family Forestlands (CFF). The CFF is a permanent advisory committee to the Board of Forestry(BOF) representing some 40,000 owners on family forestland issues. In addition to pointing out the record returns of salmonids to Oregon streams, the report pointed out that we knew little about stream temperatures, particular on small Type N streams. Recent data shows that stream temperatures are not cumulative but come into a natural equilibrium with their downstream environment.

Several of the recommendations where included as *added assurance* by FPAC given the knowledge of the various issues at the time. I still support some of them as regulations but feel that others should be dropped or made voluntary in that the *added assurance* is no longer needed.

Violations of the water quality standard seems to be a driving factor in DEQ requesting the added basal area retention in Type N streams. The Department of Environmental Quality has never explained to landowners the basis of these standards and the scientific evidence supporting them, either the 64° F criteria or the 0.5° limit on increases. Included in my 2004 report are two charts of temperature data taken with a data logger placed in Paradise Creek at various times. The first shows the daily variations in water temperature for several days near the end of July 2000. It can be seen that the temperature varies from 6° to 8° F in a 24 hour period. The second chart shows the 7 day running average of peak values for the summers of 1998 and 1999. As can be seen, the year to year variation is as much as 4° F. How then are you going to tell a family forestland owner that they are violating the water quality standards if they take an action that increases water temperature by 0.5° F and that more of their land and trees are to be confiscated because of a perceived risk?

I strongly support the Forest Practices Act statute (ORS 527.714) which requires that scientific documentation be available that shows degradation of a resource is likely before added regulations can be implemented. We are already seeing land conversion out of forestry and into other uses, some of this in part because of current regulations and the uncertainty of future regulations. In Oregon, we are losing some 20,000 acres a year out of family ownership. We only need to look to our neighbors to the North and the South to see the effects of onerous regulations (Hallock-Brown memo, September 24, 2004, Attachment B, Page 7). For private lands, I strongly subscribe to the view that "since it cannot be determined with certainty that a set of practices *is not* achieving a given water quality standard, there is no reason for a change in practices until further monitoring and/or research can prove a significant risk does, in fact, exist" (op. cit., Page 6).

In closing I urge the Board and the Commission to take into account the social and economic consequences of any proposed new regulations in order to avoid the unintended negative consequences of accelerating land conversion out of forestry. Conversion to other uses will not provide anywhere near the resource protection that forestlands provide, both now and in the future.

Bill Arsenault
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Attached: Testimony to The Board of Forestry, April 25, 2003
Comments and Suggestions to The Board of Forestry, April 23, 2004

Testimony to The Board of Forestry
April 25, 2003
Agenda Item 3: Implementation of Riparian Function
and Water Classification Recommendations

Mr. Chairman and Members of the Board:

Thank you for this opportunity to present my views on the subject at hand. My name is Bill Arsenault. My wife and I manage a tree farm near Elkton, Douglas County, Oregon. I am a member of several organizations and sit on several advisory committees related to forestry. I come to you today representing only myself as both a family forestland owner and as a former member of the Forest Practices Advisory Committee (FPAC).

As a result of Governor Kitzhaber's Executive Order No. EO 99-01, the Board of Forestry created the FPAC in late 1998 to (1) determine what, if any, changes to forest practices, both regulatory and voluntary, are necessary to meet water quality standards and to protect and restore salmonids; and (2) make specific recommendations to the Board of Forestry. As a member, I can attest that this committee struggled long and hard for over a year and a half before making recommendations.

- <u>The Biological Atmosphere During the FPAC Process</u>

One of the most difficult parts of the FPAC process was knowing that the fish were in trouble, but not having much data to determine the adequacy (or lack of) of rules which had only been implemented in 1994. Adult Coho numbers had been low for years (see attached graph). Coho had been listed as threatened on, first, the south coast and, then, the north coast by the National Marine Fisheries Service (NMFS). The preponderance of opinion by fish biologists was that fresh water habitat, and in particular forest habitat, was the limiting factor.

The Independent Multidisciplinary Science Team (IMST) (appointed by the Oregon Legislature and Governor Kitzhaber) was tasked with identifying problems for salmonids recovery in regards to all facets of salmonids life history. The "forestry" report, issued in 1999, midway through the FPAC process, was the most visible of the IMST products and included nineteen recommendations "necessary to restore salmonids". Some of these recommendations called for significant increases in tree retention along small fish and non-fish bearing streams. The report did not identify factors limiting to fish directly related to current forest practices or provide a cause/effect rationale for their recommendations. The IMST authors acknowledged that "the current riparian strategies have not been in place long enough for long term monitoring". In spite of these limitations, the influence of the IMST report on the FPAC recommendations was significant. The forestry report implicitly assumed that freshwater impacts were responsible for the decline in salmon and were limiting their recovery

- The Political Atmosphere During the FPAC Process

  Prior to the FPAC, an attempt was made to review the Oregon Forest Practices Act by another committee. The committee was known as the MOA Advisory Committee and was based on an memorandum of agreement between Governor Kitzhaber and Will Stelle, then Regional Director of NMFS. This was supposed to be a collaborative processes and included both state and federal agency people. In the middle of the process, NMFS issued there own version of what Oregon forest practices should look like in a document titled "A Draft Proposal Concerning Oregon Forest Practices", Feb. 17,1998. An analysis by the Oregon Small Woodlands Association (OSWA) and the Oregon Forest Industries Council (OFIC) showed that if the recommendations were implemented, up to 70% of the private forestlands in Oregon would be taken out of production. Governor Kitzhaber agreed that at least 50% would be taken out.

  Along with NMFS issuing this unilateral document, a federal judge decided that the Oregon Plan For Salmon and Watersheds was not sufficient to assure recovery of listed salmon and ordered NMFS to reconsider their earlier decision not to list. The north coast Coho were then listed and the MOA activity broke down.

  We then entered the FPAC process under a heavy cloud with the possibility of NMFS implementing their proposal under a 4(d) rule. As mentioned above, in the middle of the FPAC process the IMST issued their forestry report which implicitly assumed that freshwater impacts were responsible for the decline in salmon and were limiting their recovery

  The FPAC process continued on with the final issues surrounding riparian protection. Little data was available regarding riparian functions, particularly water temperature of small streams. Negotiations were intense particularly with the four members of the "environmental coalition". In the end and after a year and a half of effort, two of the members of the "environmental coalition" walked from the table. The governor insisted that at least two members of the coalition must agree or he would not support the results. This meant that both of the remaining two had to agree with the recommendations or FPAC would collapse. As a result, several of the recommendations having to do with riparian functions were "politically" driven.

- The Atmosphere Today

  We have had a ten fold increase in the returns of coastal Coho since 1997 and 1998 and a five-fold increase since forest practices rules were strengthened in 1994 (see attached graph). This would not have occurred if freshwater habitat had been the primary factor causing the declines in the 1990s.

  The record returns throughout the state has led Bob Lohn, Regional Director of the National Marine Fisheries Service to state "Near record returns of most salmon and steelhead populations in recent years have led a majority of credible scientific researchers to conclude that ocean conditions are by far the biggest factor affecting salmon and steelhead populations", as reported in the Capital Press on Feb. 1, 2002. "--- NMFS's past focus on habitat restoration activities were somewhat misguided". "We will look at populations of hatchery and wild fish together". "The real opportunity you'll find us engaging in is relying on local organizations".

It is worth noting in the FPAC and IMST reports, recommendations resulting in the biggest changes to riparian tree retention were made for the areas where data were the most limited - small streams. We believe that there is significant new information on fish populations, temperature, and large wood, and that this information is available to the ODF staff and relevant to possible forest practice rule changes being discussed.

Given the change in atmosphere between the issuing of the FPAC report in August 2000 and the current record fish returns and current knowledge base, I would make different recommendations today than were contained in the FPAC report, particularly with regard to riparian functions. Referring to AGENDA ITEM 3, Attachment 1, "PROPOSED RIPARAIN RULE CONCEPTS AND INITIATIVES", I would make the following comments:

1. **Add the riparian protection policy statement to the purpose and goals of the Water Protection Rules that was adopted by the department and the Board in 1994.**
   I support this.

2. **Use the same stream prescriptions for large and medium Type N streams that are used for equivalent sized Type F streams.**
   Today I oppose this recommendation. It is only *to provide added assurance.* Given the population returns, this added assurance is not needed. There was no basis for the recommendation in the first place. It was there because the IMST called for it. In what I call convoluted science, the IMST conclude that "there is no scientific basis for treating fish and non-fish streams differently". That was their only justification.

3. **Revise the water classification rules (OAR 629-635-0200) so those stream segments classified as non-fish use streams due to artificial fish passage barriers are classified as fish-use streams using the interim guidance criteria for fish presence.**
   This had strong support from everyone and still does.

4. **Provide a menu of methods for landowners to leave trees or downed wood in locations where it can be moved by debris flows into fish-use streams, depending upon likelihood of wood delivery and operational efficiency. A single strategy should not be relied upon to provide this potential source of large wood, allowing the operator to select an appropriate option in cooperation with ODF.**
   This had strong support and still does.

5. **Measure the riparian management area from the current points of measurement except for areas designated by the State Forester as a channel migration zone. A channel migration zone is an unconstrained reach of stream that is likely to have channel movement that can go outside the riparian management area widths within the period of a harvest rotation. Within the channel migration zone, the no-touch area would be measured from the high-water mark of the channel (same as current rules). The outer edge of the channel migration zone would be based upon guidance to be developed by the department. Retained trees in the channel migration zone would be no less than the basal area standard target (on a per-acre basis).**

   Still support this.

6. **Allow for the stratification of riparian management areas so that appropriate management occurs in areas with conifer 'over stocking' to achieve the desired future condition. Stratification would allow riparian management areas to be divided into segments with a different management approach applied to each segment based on the specific conditions in the segment. All trees would be retained in segments of the riparian management area that are below the standard basal area target, and trees retained within the 'overstocked' area could be at or above the standard target.**

7. **Create a viable incentive for landowners to place large wood in streams where it provides the greatest benefits to salmonids, ensuring that it is done in a manner that increases the likelihood of the timely achievement of the desired future condition in riparian management areas. This may require revising the current rules for the live tree retention credit**

   This continues to have strong support and is a valuable tool. The problem is that federal permit requirements are discouraging people from doing wood placement. It's a shame that valuable resources are being used to inhibit good work.

8. **For western Oregon geo-regions, recalculate the standard target for small fish-use streams, using 75% of the per-acre basal area target for large fish-use streams. Recalculate the standard target for medium fish-use streams, using the same per-acre basal area target for large fish-use streams.**

9 **For western Oregon geo-regions, manage any harvesting within the riparian management area so that the retained conifer basal meets the standard target as defined in rule concept #8, or is 60 percent of the pre-harvest basal area, whichever is greater.**

10 **For western Oregon geo-regions, designate the no-touch width as equal to one-half the width of the riparian management area.**

   This recommendation <u>should not</u> be implemented. It is listed *to provide added assurance.* This was one of the final concessions to obtain two environmental votes. Implementing this would be counter productive to fish enhancement. If we want large trees to provide future large wood in our streams then they need to be actively managed.

11 **For western Oregon geo-regions, retain five of the ten largest trees along medium fish-use streams outside of the no-touch area and within 50 feet of the stream, and 10 of the 20 largest trees outside of the no-touch area along small fish-use streams that will best achieve aquatic riparian functions.**

12 **For western Oregon geo-regions, along small Type N streams above the end-point of Type F streams: retain all understory vegetation and trees less-than six inches in diameter within 20 feet of the high water level on each side. This protection would extend upstream of the end of fish–use for a distance of 500 feet, or to where perennial flow begins, whichever is less.**

I support this version for protecting small N-Type streams.

I request that each of the FPAC riparian recommendations be analyzed for compliance with ORS 527.714, <u>across each stream size</u>, using the latest information. This was not done during FPAC and was requested by landowners as part of the package. Each recommendation should evaluate the cost and benefit for addressing factors limiting to fish, based on data, in the context of a dynamic forest system. With regard to recommendations for small streams, it is requested that the recommendations be further stratified by south side / north side to determine rule sufficiency. Ecological function of buffers (shade in particular) varies depending on which side of the creek is being protected. It is not sufficient in my opinion to simply analyze the cost/benefit by simply determining that the recommendations will contribute to the "desired future condition of mature forests", or provide "added assurance", because we have the data to do a much better job now of identifying actual limiting factors. For example, we now have monitoring data on small streams that shows that current rules are providing temperatures within a range that is near optimal for fish. If the limiting factor is deemed to be large wood, I would rather actively place wood in a small channel than leave 10 out of the largest trees along a channel so small I can straddle it.

I continue to support most of the FPAC recommendations during this incredible rebound in fish but now ask that the Board to take a new look given the new conditions.

Thank you for your time and patience,

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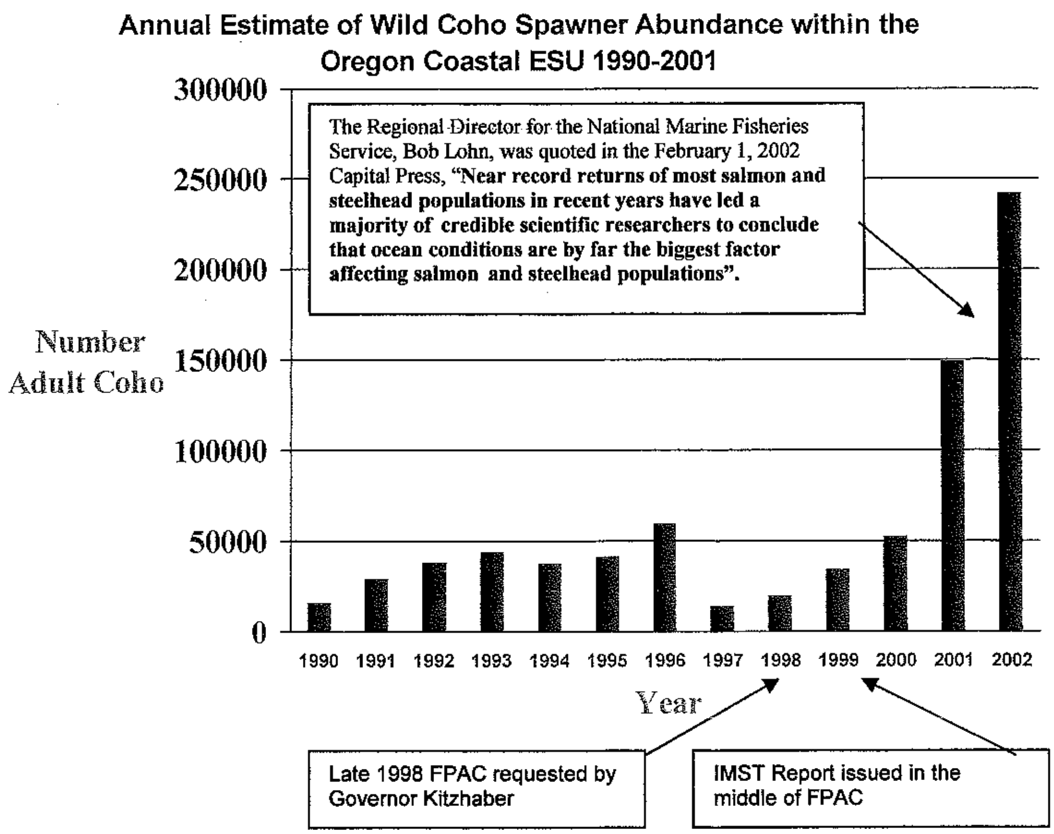
Testimony to The Board of Forestry
April 25, 2003
Agenda Item 3: Implementation of Riparian Function and Water Classification Recommendations

by
Bill Arsenault

Figure 1
(source: S. Jacobs, ODFW, 2003)



Comments and Suggestions to The Board of Forestry
April 23, 2004
Agenda Item 11: Draft Concepts for Water Protection and Riparian Functions

Mr. Chairman and Members of the Board:

The Committee For Family Forestlands (CFF) has closely followed the development of the draft concepts language. A number of our members attended several of the Regional Forest Practices Committee meetings, which were held subsequent to the BOF meeting on April 25, 2003. Gary Springer and Bill Arsenault represented the CFF on the Forest Practices Rules Subcommittee meeting held on June 5. In addition ODF staff members reviewed the Draft Rules at our regular CFF meetings held on July 16, Aug. 20, Oct. 8, 2003 and Feb. 18, 2004.

The CFF has made comments to the Board of Forestry on the draft concepts during your July and October 2003 and March 2004 meetings. These comments have been generally supportive of the recommendations presented to you by the ODF staff. Some of the Concepts are proposed as new regulations and some as non-regulatory Oregon Plan measures. This mix of suggested new regulations and voluntary proposals is entirely in keeping with the *Charter Of The Forest Practices Advisory Committee (FPAC) on Salmon and Watersheds*, as directed by the Board of Forestry. Contained within the Charter is the following:

- Parameters and Assumptions: Recommendations may include regulatory or statutory changes, incentives and/or voluntary measures.
- Charge From Board: Item 6. Evaluate the relative costs and benefits of additional practices that might further support the Oregon Salmon Plan recovery objectives. This evaluation would include an analysis of the relative impacts on landowners, the relative contributions of other land uses, consideration of alternatives including non-regulatory approaches and alternatives, which achieve the desired level of protection and are least burdensome to the landowners.

The success of voluntary restoration efforts by Oregonians is well documented in *The Oregon Plan for Salmon and Watersheds, 2001-2003 Biennial Report*, by OWEB. In forwarding these concepts for further action, we hope that the Board will take into account the success of these voluntary efforts under the Oregon Plan along with ever increasing complexity of the current and proposed concepts and the ever decreasing technical assistance available to forest landowners.

As to the specific concepts being considered by the board today, we have the following comments:

Rule Concept 3: Riparian Management Area Above Fish Passage Barriers

- The proposed language in 629-635-0200 (Agenda Item 11, Attachment 2, Page 1) is not clear that it applies to streams above "artificial fish passage barriers". The reference is to "upstream of the known fish use". This could apply to any number of reasons that there is no fish use, including an interstate highway or a dam 20 miles downstream. Virtually every stream meeting the "appropriate protocol" would be classified Type F.
- The intent of the FPAC and later confirmed in review by the Regional Forest Practices Advisory Committees was that the fish presents had to be at a blockage on the forestland. If the blockage is downstream in an agricultural or urban area, maybe 20 miles away and for whatever reason, the forestland owner has no control of the situation and no knowledge as to whether there will ever be fish in the stream. Yet here we are again penalizing the landowner strictly because it is forestland; no other land use has these same obligations.
- Under proposed language, there is ultimately no obligation on the part of ODF to do a survey. If requested and 24 months passes without a survey, the stream is declared to be Type F and there appears to be no further obligation on the part of ODF.

  Attachment 2, Page 3 cites the difficulties in carrying out a survey: time consuming, limited to a short operating season, obtaining incidental take permits, etc. So the burden then switches the landowner if he wants a determination, costly to all but a particular burden to the family forestland owner.
- The FPAC report, page A-19, Option #4, addresses the issue of burdensome costs to the family forestland owner:
  - Objective: To identify and restore fish passage problems on family forestland owners (5000 acres or less).
  - Description: Create a funding source for family forestland owners or assist family forestland owners in obtaining funds from existing sources to expand the road assessment effort to family forestland owners. This financial assistance would also be used to help family forestland owners replace stream crossings that are not adequately passing fish. The program might be similar to the Forest Resource Trust.

We seem to be willing to continue to pass new regulations because it is relatively easy and neglect the associated recommendations that would ease the burdensome consequences. I have been on field trips viewing new culvert systems that cost upwards of $10,000, prohibitive to virtually all family forestland owners. It is hereby requested that these concepts imposing new requirements on fish passage <u>not be implemented</u> on non-industrial/family forestland owners until adequate funding and an administrative system is in place to assist in the implementation.

Rule Concepts 12 & 16: Vegetation Retention Along Small Type N Streams

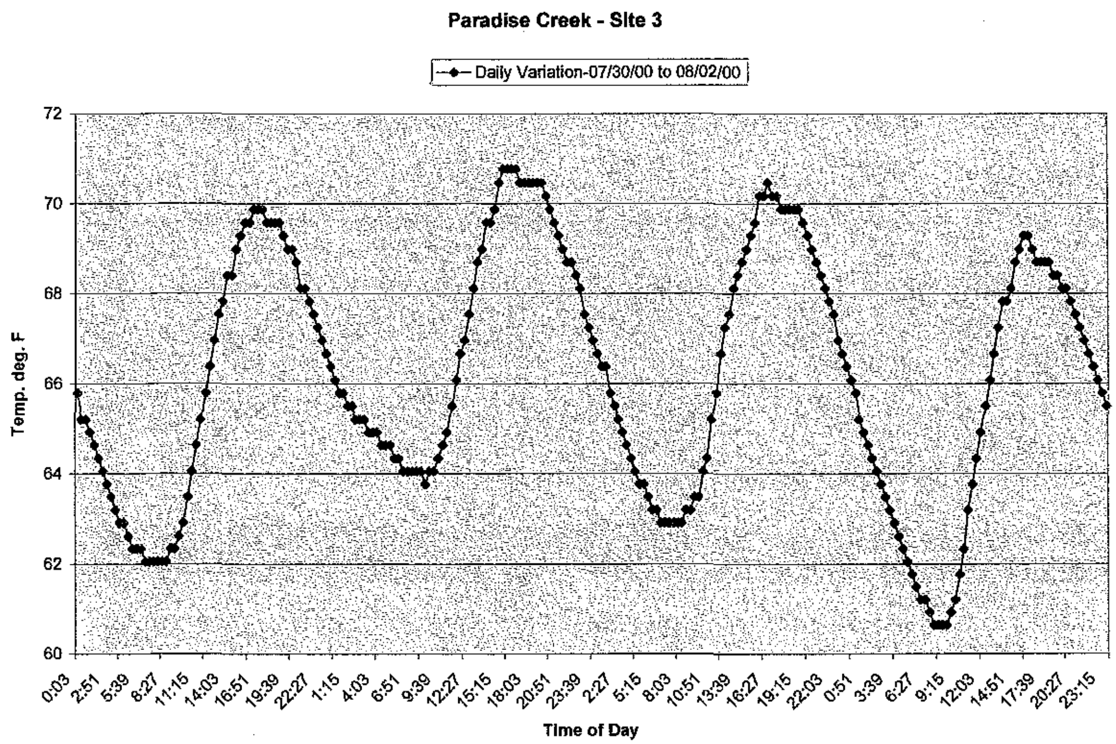
- The proposed requirement for additional vegetation as stated in Agenda Item 2, Attachment 2, 629-640-0200, (7), stems directly, with a few exceptions, from FPAC recommendations. When this was proposed by FPAC, fish populations had been low for years and the coho were listed as threatened. The preponderance of

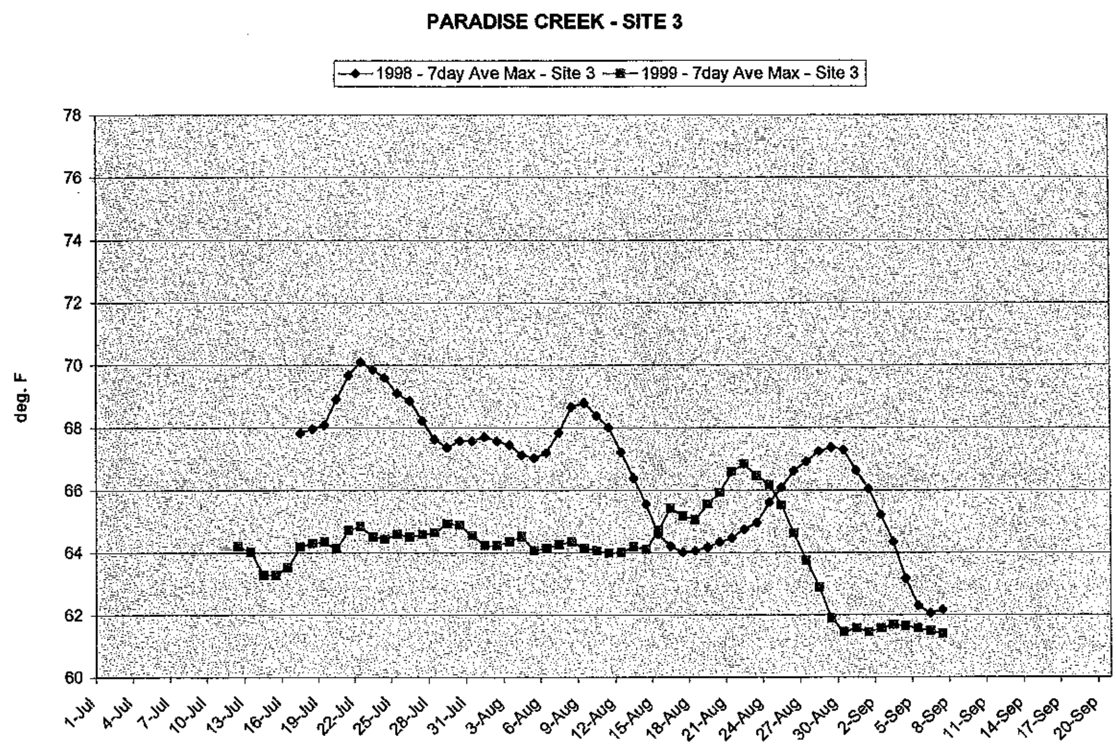
opinion by fish biologist was that fresh water habitat, and in particular forest habitat, was the limiting factor. There was little or no data on water temperature of small streams and in particular small Type N streams. Because of the assumed prevailing conditions and the then political atmosphere, several of the recommendations were included as *added assurance.*
Given the current record fish returns, fresh water habitat could not have been the limiting factor. The record returns throughout the state has led Bob Lohn, Regional Director of the National Marine Fisheries Service (now NOAA Fisheries) to state "Near record returns of most salmon and steelhead populations in recent years have led a majority of credible scientific researchers to conclude that ocean conditions are by far the biggest factor affecting salmon and steelhead populations", as reported in the Capital Press on Feb. 1, 2002. Combining this with new data showing that stream temperatures are not cumulative but come into a natural equilibrium with their downstream environment, there appears no longer a need for this *added assurance.* The recommendation that extra basil area be left in these Type N reaches was for *added assurance.*

- Violations of the water quality standard seems to be a driving factor in requiring this added basil area retention in Type N streams. The Department of Environmental Quality has never explained to landowners the basis of these standards and the scientific evidence supporting them, either the 64° F criteria or the 0.5° limit on increases. (Agenda Item 11, Attachment 2, Page 16).
Included are two charts of temperature data taken with a data logger placed in Paradise Creek at various times. The first shows the daily variations in water temperature for several days near the end of July 2000. It can be seen that the temperature varies from 6° to 8° in a 24 hour period. The second chart shows the 7 day running average of peak values for the summers of 1998 and 1999. As can be seen, the year to year variation is as much as 4° F. How then are you going to tell a family forestland owner that they are violating the water quality act if they take an action that increases water temperature by 0.5 ° F.
- The added basal area requirement of 4 square feet per 100 feet of stream adds up to 40 sq. ft. for the 500 feet proposed. This converts to approximately 6 mbf per 500 ft. At $500/mbf it would cost the landowner $3,000 per stream segment in forgone income. Every fish bearing stream, tributary, branch in Oregon will have at least one of these segments and many will have two or more.
In recommending this option (FPAC final report, pg. 67), the committee recognized at least in part the potential cost. As such, the option stated, "Trees left along these streams to satisfy the basal area requirement can be counted as in-unit leave trees". It was also recognized that family forestland owners never harvest enough acres to require in-unit leave trees. If the board decides they must include the extra basal area requirement, current wording should be revised to include in-unit leave trees and some consideration for non-industrial owners.

The CFF urges the board to adapt 629-640-0200 (6), retain all understory vegetation and non-merchantable conifer, but not adopt (7), the additional basal area requirement. This was an *added assurance* at the time of FPAC but the fish are back and subsequent data has shown it to be unnecessary.

Currently the Forest Practices Act enjoys great support from the vast majority of forest landowners. This suport will continue so long as regulations are believable, supported by monitoring data and *verifyable* science. They should be adaptable and take into account the latest informaton so landowners don't feel they are being burdened by *agenda* science.





Submitted by Bill Arsenault
Member, Committee for Family Forestlands

Application of Water Quality Standards to Dynamic Forests
Dan Newton
October 21, 2004

The Board of Forestry is charged with implementing rules that comply with the water quality standards "to the maximum extent practicable". While the intent of maintaining water quality for fish is sound, is the rigid application of a static standard to a dynamic forest good policy? I would like to offer a few thoughts in this discussion.

Fish and forests have evolved in dynamic, not static systems. Ted Lorensen's White Paper is an excellent paper on this topic. Natural disturbance, sometimes on a grand scale, caused wildly fluctuating environmental conditions, including shade levels. Impacts on water quality and fish productivity were certainly significant in the short term, but an important part of the natural history and health of fish and forests in the long term. I believe it would be a mistake to pick the endpoint of a rotation to evaluate change and then call it "degradation". Would it not be more valid (and fair) to look at the impact of forestry over an entire rotation rather than simply at harvest? Our managed, second growth forests provide an abundance of shade and high quality water across the landscape. Through most of a rotation, our planted forests provide very high levels of shade – higher than any other land use. A rigidly applied water quality standard would attempt to hold the endpoint of our crop static, even though it was acknowledged in the DEQ's and ODF's Sufficiency Analysis report that shade levels may be above historic levels.

Early successional species of trees that we value to provide large wood for fish as well as humans depend on disturbance and near-full sunlight for regeneration. This is true in managed as well as unmanaged forests. Rigid application of a static standard necessitates that shade levels be maintained in the riparian management areas to the exclusion of timely and effective regeneration of most species of conifer.

Change does not equate with degradation. The definition of degradation needs to be more inclusive than a static temperature metric, which is independent of food supply and other variables. Numerous studies indicate a positive relationship of canopy opening and food supply. One thing to keep in mind is that if shade levels are above historic levels, then both stream temperature and productivity (food) may be below historic levels. Antidegradation is a legitimate water quality goal, but degradation must be defined in ways that are meaningful to beneficial uses such as fish. The 0.5-degree F increase over background allowance is not a meaningful criterion for protection of salmonid fish species in headwater streams.

While monitoring data show temperature often increases with canopy removal, it appears that temperatures generally remain in a range consistent with fish needs in the small fish streams when Type N feeder streams are harvested under current rules. Also, temperature increases due to timber harvest along Type N streams are of brief duration (due to forest regeneration) and of limited spatial extent (streams cool to equilibrium conditions within 1000 ft).

Even the upper extent of fish use is dynamic. During summer low flows, the upper extent of fish use often moves downstream as the fish seek pools with enough livable space. Since we currently leave buffers to the upper extent of fish use (determined in the spring) the buffer can extend beyond fish use during low flow periods. Stream temperatures tend to maximize during summer low flow. The end result is that in many cases the buffer already extends above the upper extent of fish during the warmest stream temperatures.

Regarding Type N protection

A recommendation to leave buffers along some non-fish streams was made by the Forest Practices Advisory Committee (FPAC). At the time the IMST/FPAC recommendations were made:

- Implicit was the notion that freshwater habitat was a primary limiting factor.
- Little or no temperature data on small and N streams existed. Populations of fish were very low during the FPAC process, but have since increased 10 fold.
- Most of the recommendations had their origin in the IMST Forestry Report. The unpeer-reviewed IMST Report did not provide data to support their recommendations, nor did they provide a cause/effect rationale for their recommendations. The IMST Report omitted discussion on the benefits of canopy opening to productivity (food).
- The landowner FPAC members, including myself, have rescinded support of additional proposed regulations for non-fish bearing streams.

There are very significant costs associated with the kind of proposal being considered by the BOF. Valuable timber is lost. If hardwoods are left, there is a seed source for alder and maple – which will either cost future productivity or necessitate more herbicide spraying simply to comply with reforestation rules. Shade from the buffers will dramatically interfere with successful regeneration of native conifers adjacent to streams. Longer buffers (i.e. extending upstream along type N streams) make logging more difficult and can lead to additional road construction. All of this might be worth it if the data showed that present practices are harming fish, but I am not aware of any data that support this notion.

When considering the use of static water quality standards to force landowners to leave longer buffers, I wonder why we bother with the expense of watershed research like Hinkle Creek? More research will not likely help in discussions of future regulations if small temperature increases are deemed degradation. We already know that using a static metric is inconsistent with dynamic ecosystems.

Another question to consider: "Why write more regulations now on limited data, when we will have excellent data in 3-4 more years from Hinkle Creek and other research"? I am not advocating a temporary rule here. In my experience, rules do not go away. They just become a foundation for future increases. In 3-4 years, we will have much greater understanding of: 1) Temperature response to harvest, 2) How far downstream the change persists and 3) What the effects may be (positive or negative) on the fish.

The requirements of ORS 527.714 are reasonable and were written to screen out regulatory proposals that are of high cost and low benefit. The regulations must be based on data and be proportional to the problem they are intended to address. From my perspective, recently collected data show little if any benefit to the fish, but the proposed regulation would cost landowners thousands of dollars each time the regulation is invoked. In contrast, for the price of a fishing license, a fisherman can catch a limit of fish every day. This is not proportional in any way. One of the stated principles of the Oregon Plan for Salmon and Watersheds is to emphasize "improving compliance with existing environmental laws rather than arbitrarily establishing new protective laws".

The salmon are back. We have more data now that helps explain how freshwater habitat was not the limiting factor in the decrease in salmon. Ted's white paper and its proposal to build a new model of resource protection could be a very positive step toward further increases in fish productivity. We very much appreciate the work that Ted and others in the Department of Forestry have done to lay out the need for a model that could recognize more than one alternative to achieve resource protection. We would like the opportunity to work with ODF, ODFW and DEQ to apply different approaches, coupled with monitoring and research.

Thank you,

Dan Newton

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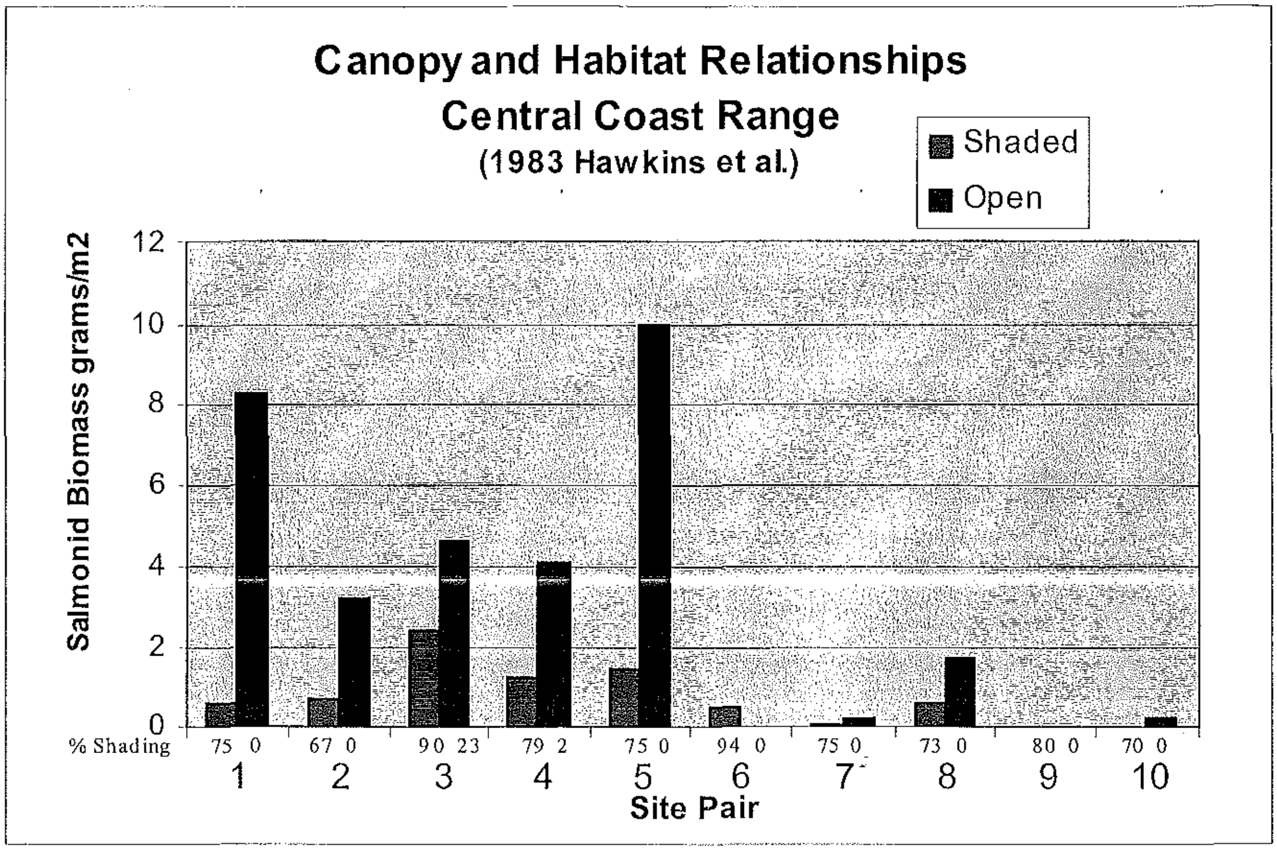

On the above graph, note the percent shade is listed for each stream pair. For example, on the first stream pair, one reach has 75% shade, and the other 0%. Note the consistently higher fish productivity on the reaches with lower shade levels.

General Comments on the issue of canopy opening and stream productivity:

- This issue was not even addressed in the IMST Report
- ODF did a nice job of summarizing the literature in a letter sent to DEQ in July 2003. Thirteen studies were summarized in an annotated bibliography. The majority of these studies showed positive increases in productivity with canopy opening. ODF concluded that "**Maximum shade likely to be detrimental to fish productivity**"

Excerpt from Beschta et al. 1987. "Increased algal productivity leading to higher invertebrate production, and consequently to elevated food availability for fish, has been hypothesized as a cause of the **frequent observation of increased salmonid production in streams exposed to sunlight** (Murphy and Hall 1981, Weber 1981, Hawkins et al. 1983, Bisson and Sedell 1984)

Joint Meeting of Oregon Board of Forestry and Environmental Quality Commission
October 21, 2004. Tillamook, OR

Testimony of Dr. Michael Newton

Members of the Board of Forestry and Environmental Quality Commission:

I am Michael Newton, Professor Emeritus of Forest Ecology at Oregon State University. I am currently leading a research program within the Watershed Research Cooperative that inquires about how management of streamside forests influences streams. Below, I will outline a few underlying scientific principles that may warrant attention in the regulatory process, both for linking science with silvicultural practice and for protection in headwaters streams and also reducing economic burden as per ORS-527.714. My goal is to facilitate the customizing of rule applications for improved fit to the problems they address.

- Streams differ greatly in many respects. Whereas all streams tend to warm with distance from their sources, some Oregon streams are above, and some below optimum temperature for fish before any harvest. If temperatures are favorable, and type N stream treatment does not change this, then type N buffers are not needed to maintain downstream quality. *Buffer designs to minimize temperature are not equally applicable to all streams. One can adapt to the local problem, providing shade where high temperature export to fish-bearing waters is a problem.*
- Buffers placed where tree shadows do not fall on the stream (i.e. shadows are north of stream) provide no protection from direct solar radiation. Buffers do inhibit conifer regeneration, especially of Douglas-fir. Those with shrubby understories virtually exclude regeneration. *Utilitarian buffers can be designed specific to stand and stream features so that they place continuous shade on the stream, and preserve maximum opportunity for regeneration of conifers close to the stream.*
- Headwaters westside streams above fish habitat are nearly all cold. They may warm somewhat if exposed directly to the sun, but I am not aware of evidence that they consistently cause excess warming downstream, and there is evidence to the contrary. Peak temperatures decrease quickly once water moves under forest or shrub cover. *There is incentive to learn which features lead to export of excess heat, how far excess heat persists downstream, and when and where different forms of protection are needed in order to maintain downstream quality in an optimum range. There is incentive to have those features guide application of rules.*
- Woody debris provides pool habitat and control of sediment movement. A very small percentage of naturally falling wood actually provides such benefits in fish-bearing streams, and maintenance of stands of large timber on speculation that occasional trees will fall into a useful role is extremely costly in terms of lockup of our most productive woodlands. The option of placing slash or logs in streams, with guidelines for placement, may be among the most cost-effective means of providing structure in fish-bearing streams. In headwaters streams, small logs and slash are of negligible commercial value and may be readily placed where they can serve a useful purpose without requiring more than a shrub buffer. *This approach deserves attention as a means of reducing sediment transport.*

Thank you.

Use of Natural Temperature Patterns to Identify Achievable Stream Temperature Criteria for Forest Streams

George G. Ice, *National Council for Air and Stream Improvement, Inc., P.O. Box 458, Corvallis, OR 97339-0458;* **Jeff Light,** *Plum Creek Timber Company, PO Box 216, Toledo, OR 97391; and* **Maryanne Reiter,** *Weyerhaeuser Company, 785 N 42nd Street, Springfield, OR 97478.*

ABSTRACT: *Almost 90% of the streams listed on the EPA's nationwide database as water-quality impaired for temperature are in the Northwest. Historic records, monitoring of streams in federal wilderness areas in Oregon, and available data for least-impaired streams in Oregon, Washington, and Idaho show that many of these streams cannot achieve state temperature criteria. Forest management often is cited as a cause for increased stream temperature above state standards. The expectation that all forested streams should be below state targets has led to unnecessary listing of streams as impaired, wasting limited watershed protection resources. State water-quality programs should base water temperature criteria on natural patterns of stream temperature and on factors that have biological relevance to beneficial uses. West. J. Appl. For. 19(4):252–259.*

Key Words: Fish habitat, forest practices, least-impaired streams, temperature, water quality.

Water temperature is one of the most important factors affecting habitat quality for fish and is an important benchmark used to assess the effectiveness of forest practice rules. Water temperature influences fish in three important ways: by directly controlling physiological rates; by affecting interspecies competition and fish pathogens; and by determining biochemical rates and gas solubilities in the water environment (Lantz 1971). Like many environmental parameters, stream temperatures vary in time and space, which complicates development and use of numeric criteria in water-quality standards. Historic records in the Pacific Northwest, monitoring of streams in federal wilderness areas in Oregon, and available data for least-impaired streams in Oregon, Washington, and Idaho indicate that many of these streams cannot achieve state temperature criteria.

State water-quality standards, including those for temperature, are designed to restore or protect water quality and fish habitat. Under §303 of the federal Clean Water Act (CWA), states are required to establish and periodically review water-quality standards. The US Environmental Protection Agency (EPA) has oversight and must approve these standards. Water-quality standards include designated beneficial uses of the water, numeric or narrative water-quality criteria, and anti-degradation provisions to avoid lowering water quality. The criteria for water temperature have become especially important in recent years with listings of numerous runs of cold-water-loving salmon and trout as threatened and endangered and with increased use of Total Maximum Daily Load (TMDL) assessments under §319 of the CWA. Waters not achieving water-quality criteria often are presumed to be impaired and not protecting beneficial uses. A survey of the EPA's database for waterbodies listed as water-quality limited (updated in 2002) found that 86% of the listings nationwide for temperature occur in the northwestern states of Oregon (48%), Washington (23%), and Idaho (14%). The importance of stream-temperature criteria in this region is highlighted by EPA Region X attempts to draft guidance for states and tribes on approaches to setting temperature criteria (US EPA, www.epa.gov/r10earth/water.htm, Nov. 28, 2001). Water-quality criteria become benchmarks to assess the condition of streams and the performance of water-quality protection programs, including the Forest Practices Acts of this region. In this article, we suggest that the high incidence of temperature exceedences in the Northwest is due to criteria being applied in places or at times that temperatures are naturally warmer than the criteria. To remedy this, we believe that state water-quality programs should use modeling tools to predict natural patterns of stream temperature to set achievable temperature criteria (see discussion on identifying natural stream patterns).

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State Water-Quality Criteria for Temperature

Under the CWA, states are required to develop water-quality standards to protect beneficial uses, with the EPA providing oversight to these standards. Yet, even decades ago, some warned that water-quality standards were difficult to apply to nonpoint sources. Harper (1987) observed that "standards were developed primarily to address point source types of pollutants and. . . existing standards in most States do not adequately reflect natural background conditions, nor do they address natural variability." Most water-quality standards fail to consider the temporal and spatial variability in water quality that occurs naturally in a watershed.

Water temperature probably seems one of the easiest parameters for which to develop an appropriate water-quality standard. Low-cost temperature-recording devices allow widespread deployment of monitoring instruments. Heat-load models are available to predict stream temperatures at the reach and watershed scales, as well as their response to management (Brown 1969, Theurer et al. 1984, Beschta and Weatherred 1984, Boyd 1996, HDR Engineering 2002). Research on the temperature requirements of many fish species is available (Brett 1952, Bjornn and Reiser 1991, Selong et al. 2001). Best management practices (BMP) such as the use of streamside management zones to maintain shade are available (Ice et al. 1994); yet, we find the Pacific Northwest embroiled in a debate about appropriate standards, and many of the streams in the region listed as impaired due to excess temperature. At least part of the problem is that standards were set for what were judged to be optimal or preferred temperatures for cold-water fish, including trout and salmon, without regard for what is possible.

Each of the three northwest states described here has similar but unique water-quality standards.

Oregon

In Oregon, three criteria are especially important for forest managers and landowners. There is a general 64° F criterion for basins where salmonid rearing is a designated beneficial use. There is a 55° F criterion ". . . in waters and periods of the year determined by the Department to support native salmon spawning, egg incubation, and fry emergence from the egg and from the gravels in a basin. . ."; the Oregon Department of Environmental Quality relies on the Oregon Department of Fish and Wildlife to identify reaches and times of salmon spawning, egg incubation, and emergence. Finally, there is a 50° F criterion for waters with native Oregon bull trout. Each of these criteria is based on the annual maximum of the 7-day moving mean of the daily maximum stream temperatures (hereafter 7-day maximum). No measurable increase in surface water temperature is allowed if these criteria are being exceeded. Also, no measurable increase is allowed where the Oregon Department of Environmental Quality has determined there to be ecologically significant cold-water refugia or the presence of federally listed threatened and endangered species (if increases in water temperature would impair "the biological integrity" of the threatened and endangered population).

Oregon water-quality regulations recognize that exceedances of these three criteria (64, 55, and 50° F) are not automatically water-quality standards violations. When natural conditions cause the water temperatures to exceed the numeric criteria, the natural temperature becomes the numeric standard. In addition, the criteria can be exceeded under extreme climatic conditions. These are defined as 7Q10 low flow (lowest 7-day consecutive average flows with a 10-year recurrence interval) or 7-day average maximum air temperatures above the 90th percentile.

Idaho

In Idaho, most forest streams fall under a cold-water aquatic life (CWAL) category. The water temperature criteria for these streams is 71.6° F for an instantaneous maximum and 66.2° F for a maximum daily average. A subset of these cold-water streams (mostly larger streams) also are protected for salmonid spawning. The criteria for these streams is 55.4° F instantaneous maximum or a maximum average for the day of 48.2° F, when and where spawning occurs. There are additional criteria for seasonal cold- and warm-water fisheries, but only a few streams are classified as such. Natural background conditions are addressed under provisions that waters are not to vary from the criteria due to human activities. All the criteria are relaxed during exceptionally hot weather conditions, when the air temperature exceeds the 90th percentile for the maximum weekly average air temperature. When natural background conditions exceed temperature criteria, a 0.5° F increase due to human activity is allowed.

Washington

The surface water-quality standards in Washington recently have been revised significantly. The older standards (used for the 2002 §303D list) were structured around five classes of water (AA, A, B, C, and Lake), with designated uses assigned to each. Class AA (extraordinary) waters were regarded as of the highest quality and were assigned a 1-day maximum temperature criterion of 60.8° F. The criteria for Class A (excellent), B (good), and C (fair) waters were 64.4, 69.8, and 71.6° F, respectively. The water-quality standard for lakes was no measurable change from background. Class AA and A waters represented the majority of forested streams in the state, and salmonid fishes were the chief beneficial use. Class B and C waters usually included larger mainstems. Where temperatures from least-disturbed drainages exceeded the numeric criteria, these "natural" temperatures prevailed as the local standard. An incremental increase of 0.5° F was allowed for human warming of these naturally warm waters. Where streams were colder than the criteria, an incremental increase of up to 5.0° F was allowed, provided the thresholds were not exceeded. There was no provision for unusually warm climatic conditions.

Washington's new standards are structured to better recognize natural patterns of stream temperatures. The class-based system is now a use-based system, organized by the temperature requirements of different species and life stages of salmonid fishes. The new criteria are based on the 7-day maxium. The coldest criterion, 53.6° F, was designed to protect spawning and juvenile rearing of native char (*Salvelinus* spp.). Pacific salmon and trout (*Oncorhynchus* spp.) are assigned a 60.8° F criterion for the spawning and rearing life stages in core areas. A 63.5° F criterion is used for noncore rearing and migration. Separate criteria for the spawning life stages of salmon, trout, and char are assigned when the rearing criteria are not fully protective. Nonanadromous interior redband trout are protected with an 64.4° F criterion. Warm water species are protected with a 68° F criterion (typically not streams in forested basins). Because different fish species and life stages are adapted to natural thermal regimes, application of these temperature criteria to times and locations where these beneficial uses occur has the inherent benefit of fitting criteria to where they are more likely to be attainable.

Washington's new standards incorporate other features to address natural variability of temperatures in forested streams. The criteria were set at the upper end of the range of temperatures thought to represent full protection, and they are expected to be met only 9 out of every 10 years on average. Provisions for temperatures that naturally exceed the numeric criteria and for incremental warming from human disturbances are the same as in the older standards.

Despite allowances for warm weather and other natural conditions in the water-quality standards described, the number of waterbodies listed in Oregon, Idaho, and Washington as water quality limited due to temperature (unless the source of runoff is clearly from a reference watershed without any management impacts) implies that human activities are contributing widely to temperature problems (Park and Boyd 1998, Whiley and Cleland 2003; see also USDA and US Department of the Interior Bureau of Land Management, www.icbemp.gov, Aug. 4, 2003). To determine if this accurately portrays human influences on thermal regimes of surface waters, particularly in forested environments, it is important to understand just what types of patterns in stream temperatures we can expect.

Temperature Patterns in Unmanaged and Least-Impaired Forested Streams

There is historical evidence that some northwest streams experienced periodic high temperatures even before extensive development of the region. Spangrude (2003), in an article published in the Columbia Bulletin, summarized the findings of some key surveys of stream temperatures prior to 1900, including monitoring by Gilbert and Evermann (1895) and Stone (1878). Spangrude states that the Gilbert and Evermann report includes single-value water temperatures measured at discrete locations along various rivers and waterbodies (Table 1).

Measurements by Gilbert and Evermann (1895) for the Clearwater River in Lewiston, ID, are particularly interesting. Temperature measurements in the morning (10:00 am) were 63.5° F, while by 4:00 pm the temperature was 83.5° F, a remarkable 20° F increase in just 6 h. If these data are valid, they could only occur with very low flows and exposed stream reaches, conditions that could have preceded construction of Dworshak Dam.

Spangrude reported that Stone (1878) found that water temperatures for the Columbia River at Clifton, OR, exceeded 68° F from Jul. 17, 1875 to the middle of Aug. of that year. While these data are scattered and some only represent data for a single day, they indicate that stream temperatures were probably at or above the water-quality standards currently set for the northwestern states.

Reference or least-impaired watersheds have long been used to identify expected watershed conditions and water quality (Dissmeyer 1994). Data from monitoring and research efforts using control and reference forest watersheds are presented below. In addition, during the summer of 2001 we deployed VEMCO 8-bit temperature probe/data loggers in a number of streams within or immediately downstream from federal wilderness areas. The 2001 water year represented a period of very low flows. Duncan (2002) reported that summer as the second worst drought on record in Oregon. Based on a review of gaging station records for Oregon, some streams approached the 7Q10 low flow in 2001, although the lowest flows appear to have occurred in early autumn after peak stream temperature days. Data were collected at 10-minute intervals and probe performance was verified prior to deployment using protocol prescribed by the Oregon Salmon Plan (www.oregon-plan.org/cdrom/monguide2001.pdf, Oct. 6, 2003). The following is a summary of site conditions and results from this monitoring and other relevant data.

Table 1. Single value temperatures reported by Gilbert and Evermann (1895) for 1891 from Spangrude (2003).

Location	Date	Temperature (°F)
Yakima River at North Yakima, WA	Aug. 23	64
Yakima River near Prosser, WA	Aug. 24	70
Walla Walla River near Wallula, WA	Aug. 23	70
Palouse River near Colfax, WA	Aug. 17	74
Pataha River (Creek) near Starbuck, WA	Aug. 14	68
Ross Fork of the Snake River, near Pocatello, ID	Aug. 4	72.5
Portneuf River near Pocatello, ID	Aug. 2	76
Boise River near Caldwell, ID	Aug. 8	66
Clearwater River near Lewiston, ID	Aug. 15	83.5
Columbia River near Kettle Falls, ID	Aug. 16	62
Coeur d'Alene Lake, ID, near the outlet	Aug. 21	75
Umatilla River near Pendleton, OR	Aug. 12	70

Boulder Creek, OR

In the summer of 2001, a set of three recording temperature probes were placed in Boulder Creek in the Oregon Cascades east of Roseburg. The monitoring sites were all within the Boulder Creek Wilderness Area, and flow in Boulder Creek above the monitoring sites is entirely within the Wilderness Area. Boulder Creek drains 31 mi^2. Based on only 3 years of continuous discharge monitoring and some spot discharge measurements, the average annual flow for Boulder Creek is just over 70 cfs with a minimum flow measured of 3.0 cfs (Holaday 1992). Less than 5% of the watershed has been harvested, with most of the harvest in the headwaters (Holaday 1992). Holaday reported that the watershed is in the western hemlock zone. The uppermost site experienced a maximum temperature of just under 70° F and a 7-day maximum of 69.3° F. The maximum 7-day moving mean of the MINIMUM daily water temperatures was 65° F. The lower sites had slightly higher temperatures (maximum of 71° F, 7-day maximum of 70.6° F). This is warmer than reported by Holaday for 1992, but may reflect the unusually low flow year of 2001. All these sites would fail Oregon's temperature criteria.

City Creek, OR

Holaday (1992) looked at the level of forest management in tributaries to Steamboat Creek, a tributary of the Umpqua River, OR. City Creek, which is located in the upper reaches of the Steamboat Creek Basin, had only 6.7% of the watershed harvested between 1955 and 1990. None of the harvest was adjacent to streams. City Creek is a small stream draining a basin of 160 ac with an average discharge in July and Aug. (1969–1990) of 2.5 cfs. Still, maximum temperatures July 27, 1969 and 1990, were 67 and 64° F, respectively (1-day monitoring results rather than 7-day maximum). These temperatures, if experienced for 7 consecutive days, would exceed the criterion for Oregon (64° F).

Drift Creek, OR

Drift Creek flows though the Drift Creek Wilderness area near Tidewater in coastal Oregon. The Drift Creek Wilderness contains one of the largest stands of old-growth forest in the Coast Range, providing a lush forest environment. Drift Creek drains both managed and unmanaged forest land. By the time Drift Creek enters the 5,800-ac Wilderness, it is already draining several square miles of watershed. During the summer, the 20-ft wide creek is wadeable. In the summer of 2001, two probes were deployed at the southwest (downstream) corner of the Wilderness. Both monitoring sites were located within the Wilderness several miles below where Drift Creek enters it. The lowest site had a maximum temperature of 70° F and a 7-day maximum of 66.7° F. The second site, located upstream, experienced a maximum of 67° F and a 7-day maximum of 65.5° F. These temperatures exceed the criteria for Oregon.

Mule Creek, OR

Mule Creek, a tributary to the Rogue River, flows through Forest Service and Bureau of Land Management-managed forest land and wilderness. Three probes were deployed above Tucker Flat Campground within the Wild Rogue Wilderness. Flow at this site has either originated within or been flowing through the Wilderness for several miles. The watershed draining to this location is about 40 mi^2, and the creek is 20 ft wide with areas of exposed bedrock. Vegetation is dense along the channel near the monitoring sites. Maximum temperatures measured were 67, 67, and 68.5° F. Seven-day maximum temperatures for the three probes were 66.5, 66.3, and 68.1° F. The higher temperatures were recorded in a backwater pool, while the other probes were in glides downstream from riffles. None of these sites would have achieved the criteria for Oregon.

Lochsa River and Tributaries, ID

HDR Engineering (2002) recently prepared a report for the Idaho Department of Environmental Quality assessing water temperatures in the Lochsa River and selected tributaries. This involved calibration of the Stream Network Temperature Model (SNTEMP) (Theurer et al. 1984) with existing stream temperature data and interpretation of potential and existing canopy cover. The Lochsa River is one of two branches that join to form the Middle Fork of the Clearwater River. The Lochsa flows 70 river miles to the junction with the Middle Fork through forests and canyons and drains an area of around 1,500 mi^2. During snowmelt runoff, flows at the mouth of the Lochsa River can be several thousand cfs, but flows are far lower during critical water temperature periods. The report concluded that the Lochsa cannot now, nor is it likely that it ever will, achieve the state cold-water biota (CWB) criteria of 71.6° F instantaneous maximum and 66.2° F daily average maximum (for 90th percentile air temperature day). Temperature reductions appear to be possible with increased shade along the Lochsa, but the model indicates that neither increased shade nor reduced tributary temperatures are likely to reduce stream temperatures enough to meet the CWB criteria. Regarding the role of tributaries, the report states that ". . . many of the tributaries to the Lochsa River drain wilderness areas or unmanaged watersheds, and an [14.4° F] 8° C decrease in water temperature [necessary to achieve CWB criteria in the Lochsa River] is likely not physically possible in these areas." In fact, the measured stream temperature for Boulder Creek, a tributary to the Lochsa that drains a wilderness area of about 50 mi^2, is itself above the CWB criteria. After reviewing the factors causing reduced canopy cover the report finds that ". . . between 75% and 97% of the differences in water temperature between the existing and full potential canopy cover conditions in the Lochsa River basin is due to natural disturbances."

Olympic Peninsula Small Streams, WA

Black (2001) measured summer temperatures for headwater streams in the Olympic Peninsula, WA. These nonfish-bearing headwater streams were ≤2 ft wide. She found that streams with diffuse marshy sources tended to be warmer than streams with concentrated sources (springs). Black concluded that "a majority of sources and streams in this study do not comply with current or proposed standards for mean weekly maximum temperature (MWMT). This is true for streams in unlogged as well as logged units." No streams or sources exceeded 68° F, but streams with marsh sources regularly had water temperatures exceeding 61° F.

USGS Western Oregon Small Reference Stream Temperature Project

Because of concerns about stream temperature impacts on cold-water fisheries and the proliferation of TMDL assessments in Oregon, the US Geological Survey (USGS) initiated a project to estimate "... physically achievable water temperatures that reflect 'natural' or undisturbed conditions. . ."; (Risley and Roehl 2002). Data for 148 sites on first-, second-, and third-order streams in western Oregon are being used to develop neural network models of estimated "natural" water temperatures for small streams. Data for about half of these streams are available on the World Wide Web, and we analyzed the data to determine compliance with Oregon water-quality standards. About one-third of the 73 sites tested exceeded the 64° F general temperature standard for salmonid streams in Oregon. Risley (USGS, July 30, 2002) noted that some of these streams have experienced some management, but they reflect the best reference streams available.

Table 2 summarizes the results from monitoring of reference streams in Oregon, Washington, and Idaho for 7-day maximum stream temperatures (City Creek is not included). This shows that some least-impacted streams exceeded the applicable state water temperature criteria.

These data are not a random sample. Streams where VEMCO probes were deployed in 2001 were expected to be warm. Data from other studies were selected because they display naturally high temperatures. Still, this indicates that we have an intuitive understanding of where we can expect warm stream temperatures.

Are Current Temperature Standards Achievable for Forest Streams?

No one who has experience with forested watersheds is surprised that some streams are naturally warmer than others. Watershed specialists are beginning to explain these patterns based on elevation, latitude, flow path (short pathway to return flow or delayed, deep groundwater source), natural channel exposure to solar radiation, and residence time of water in the channel. These patterns are well known and can be incorporated into regulations. For example, the Washington Forest Practices Board (WFPB) adopted forest practice rules that require greater shade on low elevation streams than on high elevation streams because higher elevation streams tended to be cooler initially (Washington Forest Practices Board 1997). In Montana, Isaak and Hubert (2001) found a similar relationship. They explained 82% of variations in maximum stream temperatures for 26 sites on second- to fourth-order streams using elevation, canopy, and grazing intensity.

Geology also plays an important role in moderating stream temperatures. Research by Grant and Tague (as summarized by Duncan 2002) has shown a significant influence of geology on stream temperatures in the Oregon Cascades. These streams spanned a wide range of sizes, from headwaters to large rivers. Groundwater inputs in the High Cascades geologic region are characterized by strong springs or "gushers." Flows tend to be relatively "steady," allowing development of near-channel vegetation. Higher flows and shade lead to lower stream temperatures in the summer. In contrast, Western or Middle Cascades geology has shallow subsurface runoff and a dense stream network that creates flashy runoff. Stream temperatures are characteristically higher in this region.

An exhaustive compilation of regional stream temperature data across northern California found that a single stream temperature pattern is difficult to apply across a broad region because of variations in stream size, drainage area, geographical location, prevailing climatic conditions, stream orientation, natural riparian vegetation diversity, and other factors (Lewis et al. 2000). Based on this extensive data set and reviews of past research, they concluded that air temperature affects stream temperature and stream water temperatures tend to increase with distance from the watershed divide. Given these patterns, lower-elevation streams located far from their headwaters were expected to be warmer than higher-elevation, headwater streams in the region. However, Lewis et al. (2000) pointed out the importance of understanding local climatic influences. In northern California, the coastal fog belt can result in lower-elevation, higher-order streams actually experiencing cooler maximum temperatures than the headwater tributary streams outside the fog belt.

In British Columbia, Mellina et al. (2002) found that streams with their headwaters in small lakes or swamps tended to cool as they flowed downstream. In contrast, headwater streams without these features warmed as they flowed downstream regardless of whether streamside timber harvesting had taken place.

Disturbance history can include not only forest management but also natural disturbances such as debris torrents,

Table 2. Stream temperatures for wilderness and least-impaired streams in the Pacific Northwest. Seven-day maximum stream temperatures (°F), unless otherwise indicated.

Stream	Temperature (°F)
Boulder Creek, OR (2001)	69.3–70.6
Drift Creek, OR (2001)	65.5–66.7
Mule Creek, OR (2001)	66.3–68.1
USGS reference streams for western Oregon	One-third cannot meet 64
Olympic Peninsula small streams, WA (2000)	Marsh source streams without harvesting regularly exceed 60.8
Lochsa River, ID (1994)	77.4 instantaneous maximum
Boulder Creek, ID (1994)	68.2 maximum daily average

ice flows and floods, insect outbreaks, windthrow, and wildfire (Ice and Schoenholtz 2003). These events can remove riparian vegetation and expose channels to direct solar radiation. McGreer (1996) describes photographs of the North Fork of the Clearwater River 21 years after the 1919 reburn of the 1910 wildfire. The photos show a river nearly totally exposed to the sun, with only low brush and an occasional snag near the river. Vanderheyden et al. (1989) used Brown's (1969) equation to calculate how stream temperatures responded to the Silver Fire in southwestern Oregon. The Alsea Watershed Study, which studied the effects of logging and prescribed fire in Needle Branch Creek, showed the potential for large increases in maximum stream temperatures with removal of riparian vegetation near small streams regardless of the cause (Moring and Lantz 1975).

These observations demonstrate that disturbance can affect stream temperature regimes, but long-term patterns are sometimes unexpected. As part of a Watershed Analysis, Weyerhaeuser Company (1995) found a temperature difference between Wet Gulch (about a 5-mi^2 watershed with a bankfull width of 20.5 ft), a relatively unmanaged watershed, and nearby Johnson Creek (about a 7-mi^2 watershed with a bankfull width of 21.5 ft), a stream that experienced debris torrents in 1986. The debris torrents in Johnson Creek resulted in extensive impacts to the channel and riparian vegetation. Nevertheless, monitoring now shows that stream temperatures are lower in the recently disturbed Johnson Creek than in the unmanaged Wet Gulch. In 2002, maximum stream temperatures were 64.2° F for the unmanaged Wet Gulch and 62.8° F for Johnson Creek. Rapid regrowth of riparian vegetation (red alder, *Alnus rubra*) is presumed to be the cause of the lower water temperatures in Johnson Creek. In forested watersheds, unlike point sources, disturbance effects can moderate over time.

These findings show that we should not expect stream temperatures to be uniformly cool. There are natural patterns as a result of climate, geology, geography, vegetation, and hydrology that determine stream temperatures. Even these patterns may change over time with disturbance to the channel and riparian vegetation and subsequent recovery. The findings from least-impaired streams along with the patterns described here show that stream systems can experience temperatures that exceed temperature criteria due to natural causes. How often this occurs is not known, but the situation suggests that some streams in managed areas are erroneously being labeled as impaired, solely because an inappropriate standard is being applied. This diverts attention from larger problems and wastes limited monitoring and restoration resources.

Discussion and Conclusions

How can natural variability be incorporated into water-quality standards? To some degree it already is, as evidenced by the allowances made for unusually warm weather or for naturally warm streams draining undisturbed lands. However, these allowances only partly account for spatial and temporal variance in thermal regimes. We believe that standards could fit their landscapes even better through a combination of physical modeling of temperatures that incorporates local and regional patterns and information on the biology of beneficial uses. To begin with, no temperature standards should be based solely on the needs of beneficial uses or simply on what is physically attainable. The biology-only approach lacks context for determining achievability, and the physical-only approach lacks relevance to beneficial uses.

Biologically Relevant Water-Quality Criteria

Land managers want to know that regulations affecting their operations are meaningful and reasonable. Water temperature criteria that accurately reflect the needs of fish or other aquatic organisms are therefore important. Of the many ways that biologically based criteria are selected, those that employ risk assessment tools are preferred. Methods like this have the advantage of being objective and repeatable, and they allow quantification of the effect of different temperatures on aquatic organisms. One such approach was recently developed and tested by Sullivan et al. (2000). They used growth loss as an indicator of the prolonged sublethal effects of temperature on fish. Growth is a reliable and measurable integrator of a variety of physiological responses to temperature (Brett 1971, Iverson 1972, Brungs and Jones 1977). Sullivan et al. (2000) proposed that temperatures associated with either a 10 or 20% growth loss in fish could be used as an index for deriving chronic temperature criteria. This type of approach for setting criteria may also help identify an acceptable frequency of exceedences (years) during unusually warm weather (i.e., to address temporal variability in thermal regimes).

Identifying Natural Temperature Patterns

Once the temperature needs of beneficial uses have been established, some form of physical model should be used to identify what thermal regimes are possible for streams in an area. Several models are available (e.g., SNTEMP, Heat Source, QUAL2K, BasinTemp), and others are being developed that can, under some circumstances, predict with reasonable error bounds what the expected temperatures would be in a given stream reach. It is beyond the scope of this article to discuss the assumptions, strengths, and weaknesses of these models, but readers are encouraged to read reports by Sullivan et al. (1990) and HDR Inc. (2002) for a comparison of several available models. Ideally, these models would be applied to every watershed in a state or region, and the "thermal potentials" so derived would set expectations for every reach or basin (US EPA, www.epa.gov/r10earth/water.htm, Nov. 28, 2001). However, this would probably be cost prohibitive and unnecessary.

An alternative approach would be to start with criteria developed to protect beneficial uses and then use models to refine where to expect such criteria to be attainable. Thus, the need for modeling would be much reduced. The temperature criteria in Washington's revised standards are well suited for this type of model application. A second alternative would be to use models for specific instances; for example, for general stream temperature patterns such as those described by Isaak and Hubert (2001), Duncan (2002), and Risley and Roehle (2002). Only where significant departures from expected temperature patterns are found would a detailed Use Attainability Analysis (UAA) be triggered. Major departures from expected patterns could ultimately trigger either more detailed thermal potential modeling or a TMDL assessment. Thermal modeling for TMDL development is already occurring in Oregon, California, Idaho, and Washington (Park and Boyd 1998, US EPA 1999, HDR 2002, Whiley and Cleland 2003). With prudent use of temperature prediction models and information on temperature requirements of beneficial uses, some common patterns of stream temperature variability could be woven into water-quality standards.

Temporal variability is another facet of stream temperatures that should be better addressed in water-quality standards. As shown in the review of state standards, some allowance for this is given, usually to acknowledge unusually warm weather. This is appropriate, but seldom are the allowances directly linked to the health of fish populations or other beneficial uses. Where a statistical "one in ten" year exceedence of criteria is allowed without claiming a water body is impaired, the beneficial uses may fully tolerate "two in ten" or "three in ten" year exceedences. To better judge how often a water body could be out of compliance without adversely affecting the beneficial uses, quantitative risk assessments are needed. This would help produce more objective and reproducible guidelines for "duration of exposure" across multiple years

These ideas are not new or unique to forest watershed specialists. The National Academy of Science report on TMDLs (National Research Council 2001) recognized that "all chemical criteria and some biological criteria should be defined in terms of magnitude, frequency, and duration" and that ". . . use attainability analysis should be considered for all waterbodies before a TMDL is developed." Similarly, the EPA (www.epa.gov/r10earth/water.htm, Nov. 28, 2001) recognizes that some streams may not be capable of meeting current or proposed water-quality criteria because of natural conditions or changes (such as construction of dams or stream channelization) that are functionally irreversible, necessitating assessment of a stream's thermal potential. These are important findings, but they may be difficult and expensive to apply. UAA inherently is expensive and controversial. Despite the National Academy of Science recommendations citing the need for UAAs, environmental organizations have called UAAs a "polluter tactic to watch out for. . . " (Clean Water Network 2001). Temperature modeling, called for by the EPA to predict thermal potential, is data-intensive and can be expensive (www.epa.gov/r10earth/water.htm, Nov. 28, 2001). If a full TMDL is required the costs are even greater.

Antidegradation elements in state water-quality standards for temperature create another problem in assessing even well-designed forest operations. As described earlier, some states allow a *deminimus* increase in stream temperatures from management activities of 0.5° F. This is probably achievable for larger fish-bearing streams. In nonfish-bearing streams increases in stream temperatures associated with timber harvesting can exceed this value. For small forest streams it is likely that these standards cannot be achieved even for unmanaged watersheds because of natural disturbances to streams (Ice and Schoenholtz 2003). Interpreting the biological implications of changes in headwater stream temperatures is not easy and largely has been ignored. In some cases, increases in headwater stream temperatures following timber harvesting are compensated for with reduced temperatures downstream due to increased flows with reduced evapotranspiration. Jackson et al. (2001) found the reverse trend during monitoring of headwater streams in Washington, with cooler water upstream and warmer water downstream. Holaday (1992), Zwieniecki and Newton (1999), and Johnson and Jones (2000) have shown that maximum temperature increases do not transport downstream unabated, especially for small streams. Furthermore, these small streams can experience very rapid recovery from lost shade (Andrus and Froehlich 1988). Temperature changes of 2–4° F for small headwater streams once every 30–50 years are likely to have little cumulative effect on fish populations and should not be considered equivalent to permanent changes due to other land uses or industrial discharges.

At a June 19, 2003, House subcommittee meeting, Bruninga (2003) reported that several witnesses called for EPA to issue guidance to clarify and streamline the process for revising water-quality criteria. John Stephenson, director of the Government Accounting Office Natural Resources and Environment Division, is quoted as stating that, "the nation risks wasting valuable resources by overprotecting some waters while overlooking others." Linda Eichmiller, deputy director of the Association of State and Interstate Water Pollution Control Administrators, reported to the subcommittee that changing standards is a lightning rod for controversy but that the states are making progress. She indicated that this is important so that "we can end up spending money on real problems where there is a real risk involved." We agree that setting unachievable water-quality standards has the potential to frustrate effective nonpoint source control programs like the forest practice programs of the West.

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Water Protection Issues on Forestland

Testimony by Rex Storm, Certified Forester
Forest Policy Manager, Associated Oregon Loggers, Inc.

before the joint meeting of
Oregon Board of Forestry and Oregon Environmental Quality Commission
October 21, 2004

Board and Commission members, my name is Rex Storm, Forest Policy Manager for Associated Oregon Loggers (AOL). I am a professional forester and 27-year member of the Society of American Foresters. As a Certified Forester, I am ethically bound to advocate and practice land management consistent with ecologically sound principles. Furthermore, my remarks today are qualified by 15-years prior experience as a resource planning forester and Certified Silviculturist.

I make these comments on behalf of more than 1,000 member companies of AOL, representing logging and allied forest management operators working across Oregon – most of which are small forest businesses and independent contractors.

We commend both the Board and Commission for meeting together, in what I hope is the beginning of a fruitful relationship of ongoing collaboration to better achieve shared goals. The reason I am speaking today is because of our concern that the temptation to further ratchet-up stream and water protection rules would jeopardize the existing success of Oregon's forest practices program. Through your mutual efforts, we urge that you both weigh four important factors in the coming months as you seek to validate legal sufficiency in water quality and fish habitat forest protection. These four important factors are:

- Achieving stakeholder cooperation for mutual goals
- Recognize dynamic ecosystems
- Shift paradigm to integrated standards
- Seek partnership of business-government-society

Stakeholder Cooperation

AOL member companies share the Board and Commission's goal of assuring that Oregon's Forest Practices Act & Rules [FPA&R] provide sufficient water quality and fish habitat protection. While we share this common goal, we also are encouraged that the Board of Forestry indeed recognizes how resource protection is most successful when private landowners and operators are motivated to voluntarily practice good stewardship—stewardship derived from an atmosphere of cooperation, incentives and pragmatic regulation. I believe that forest industry accomplishments in the *Oregon Plan for Watersheds & Salmon* are an example of how major stewardship benefits are derived through voluntary action of motivated landowners & operators. It is these same motivated landowners & operators that make the FPA&R a stewardship success.

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The Forest Practices Act & Rules accomplish monumental resource protection because of the atmosphere of cooperation, incentives and pragmatic regulation amongst landowners & operators. We are concerned that the temptation to further ratchet-up stream and water protection rules would jeopardize this "atmosphere of cooperation."

How should we proceed in our mutual effort to craft water protection standards in a way that values the stewardship of forest stakeholders, or enhance the "atmosphere of cooperation?" Forest stakeholders would cooperate when the following situations exist:

1. Best science applied
2. Least cost regulations-- least impact to landowners and operators
3. Recognize voluntary contributions
4. Involve stakeholders in the solution
5. Practices/protections are believable & practical
6. Stakeholder agreement sought

Dynamic Ecosystems

There is much debate in the scientific and policymaking communities surrounding what amount of water protection is adequate, and how to attain and measure that adequacy. There are old science findings, and there are more recent science findings—all or most isolate single parameters; they typically evaluate past practices; and they rarely demonstrate the dynamic and integrated context of real-life forest situations and professional decisions to be made. Existing science fails to integrate contemporary practices and dynamic landscapes.

There is emerging scientific evidence that the basic underlying premises about forest protection in Oregon are flawed. The Department of Forestry White Paper, authored by Ted Lorensen, [White Paper – Forest Practices "Protection" on Forestlands in the Context of Dynamic Ecosystems] explains the need for policymakers to consider forest dynamics in their deliberations. The focus of forest resource protection needs to shift from disturbance prevention to utilizing— to managing, to influencing, to emulating— ecosystem disturbances through active management practices. It would behoove us to recognize in our policymaking that isolating a single dynamic ecosystem function into an over-simplified discrete standard—irrespective of its connection to other environmental, social or economic parameters—is a flawed strategy.

Shift Paradigm to Integrated Standards

Is it time for a fresh look at how water quality and fish habitat standards are administered? The discussion about, and evolution of, dynamic ecosystems begs for us to create a new paradigm. We applaud the Board for its recognition that ecosystem functions and stewardship of forest streams are intertwined *and* inseparable. It is in this vain that we look forward to the joint deliberation of both Board and Commission, for a thoughtful re-direction away from previous debates toward a new paradigm—integrated water AND fish habitat goals.

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Such a new paradigm could expand the discussion, for example, away from a discrete water temperature standard, and instead could weigh the relative importance of many dynamic factors influencing water and fish. An integrated approach to water resource protection could meld factors such as water temperature though life-cycles, seasons and reaches, and in conjunction with fish productivity, nutrition or fecundity. Furthermore, the relative importance to downstream uses could be weighed.

For contemporary forest riparian management, the rigid water temperature standard [as it exists today] is no longer effective as a metric for resource protection. And there are other water and fish protection thresholds that are impractical and not responsive to field implementation. In isolation, discrete standards are increasingly failing to deliver the scientific and operable credibility necessary for forest application. Forest stakeholders need a new paradigm.

New paradigms demand new and contemporary science. The Watershed Research Cooperative [WRC] is the type of research necessary to integrate protection well beyond simply water temperature. The Coop is beginning to yield useful information for this integrated approach. AOL is a cooperator in the WRC, and encourage the Board and Commission to support further replicates of the Hinkle Creek project elsewhere in Oregon.

Partnership of Business-Government-Society

We urge the Board and Commission to consider that stewardship accomplished through an atmosphere of cooperation demand that no one entity [business, government or society] necessarily dictates resource protection values over the other two entities. Without the value and stewardship generated by the activities of profitable forest business, there are no resources for government, nor are there public goods available for society. Although a civics lesson is not warranted in this discussion, nonetheless I mention the interdependence to reinforce its importance to optimizing water protection. A partnership with business means that forest stakeholders—private landowners & operators—must be motivated to continue making investments in sustainable forestry; otherwise the temptation would be to convert their forests to other uses. Without the contributions by forest business, resources and their protection would go wanting.

AOL suggests that the Board and Commission have a unique opportunity to consider these concepts of riparian protection--in tandem with your deliberations surrounding FPA riparian rules.

Thank you for this opportunity to comment before you concerning water protection concepts and the Forest Practices Rules. We look forward to working with the Department and Commission through our journey to discover well-managed forest streams.

1) The **best available scientific information** on thermal requirements of salmonid fishes and landscape influences on water temperature was used in developing the new water quality standards for **water temperature, dissolved oxygen, and intergravel dissolved oxygen** . The water temperature information used was peer reviewed, and the public had an opportunity to review and comment on the scientific information and the proposed standards.

2) Should the BOF decide it wants to try to change the temperature standard, **any changes would need EPA review and approval.** EPA would need to **reinitiate ESA consultation**, so NOAA Fisheries would have to be convinced that any changes approved by EPA were based on significant new scientific information, and that they met ESA requirements to avoid jeopardy and minimize the "take" of listed species.

3) NOAA Fisheries previously documented our concerns with the existing rules regarding water quality effects on salmonids, and we can provide copies of the correspondence. Although we have not thoroughly analyzed the latest ODF proposal for changes to forest practices, **in general riparian management on small non-fish streams, effects of forest practices on landslide rates and delivery of large wood to streams, and cumulative watershed effects likely will remain concerns** with respect to ESA-listed salmon and steelhead.

4) Oregon Coast coho are not currently listed under the EA, but other species of coho, Chinook, chum, sockeye and steelhead remain listed in Oregon, and are proposed for re-listing. Both OC coho and Lower Columbia River coho are proposed for listing. Effects of forest practices on water quality remain an ESA concern with respect to the species that breed, rear and migrate in Oregon waters.

5) NOAA Fisheries' February, 2004 biological opinion found that the new DEQ water quality standards approved by EPA were compliant with the ESA ***in waters that meet the standards***. In waters where TMDLs have been completed, the TMDL establishes the water quality targets under the standard.

6) The state of Oregon has been working with NOAA Fisheries to explore options for providing ESA "assurances" to state agencies and landowners in areas where Oregon Coast coho occur. In a sense, agencies and landowners statewide already have received implicit ESA coverage through the consultation with EPA on the standards mentioned earlier ***in waters that meet the standards***. However, **improvements to management of small non-fish streams, landslide prone areas, and cumulative watershed effects** would be necessary to convincingly argue that forest practices meet the standards and TMDLs.

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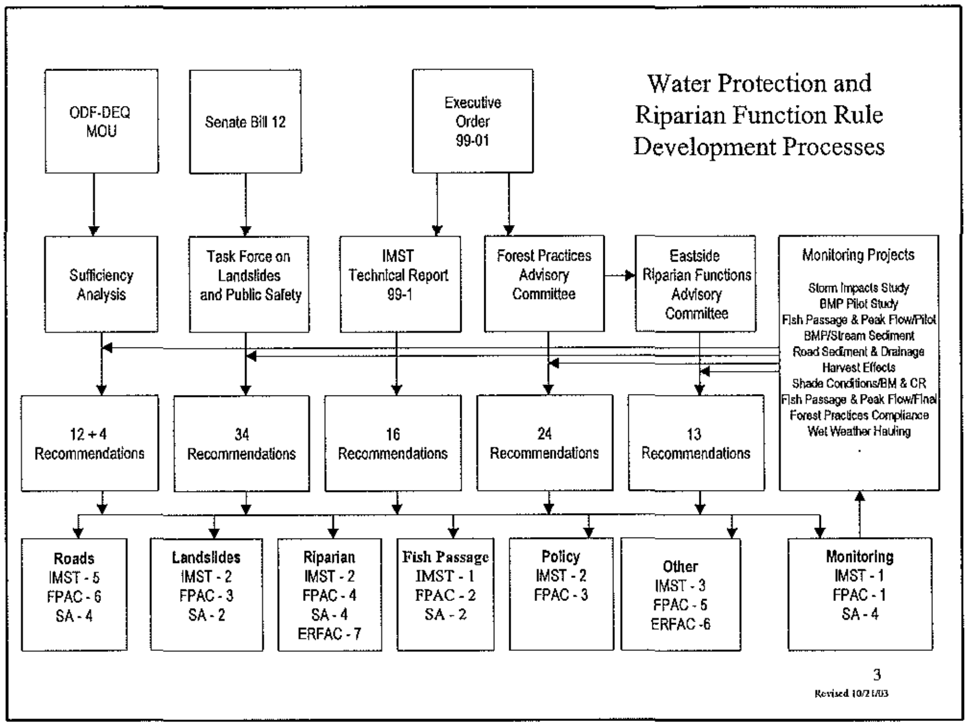
Water Protection Rules & Riparian Functions
Rule Concepts

1

Input Processes to Date

- Executive Order 99-01 - January 1999
- Independent Multidisciplinary Science Team Report 1999-1 - September 1999
- Forest Practices Advisory Committee - August 2000
- Sufficiency Analysis ODF- DEQ - October 2002
- Eastside Riparian Functions Advisory Committee - February 2003

2



Categories of Recommendations

- Roads - Rules Adopted July 2002
- Landslides - Rules Adopted October 2002 as part of Shallow Rapidly Moving Landslides and Public Safety Rule Package
- Riparian Functions - Current Discussion
- Fish Passage - Current Discussion
- Policy Recommendations

4

DEQ Involvement – prior to current rulemaking process

- ODF/DEQ joint effort – Sufficiency Analysis: A Statewide Evaluation of Forest Practices Act Effectiveness in Protecting Water Quality
- Technical Assistance – ERFAC, FPAC
- Participated in the development of Road Rule revision

5

Rule Development Timeline

- January 2003 - FPAC Review
- March 2003 - ERFAC Recommendations
- April 2003 - Rule Concepts
- June 2003-April 2004 - Individual Concepts
- June 2004 - Draft Rule Package
- January 2005 - ORS 527.714 Analysis
- January 2005 - Formal Rule Making Process
- July 2005 – Formal Rule Adoption?

6

DEQ Involvement – current rulemaking process

- Attended ODF staff meetings
  - » Ongoing – Spring 2003 to present
- Testified at Board Meetings
  - » May 2003, April 2004, July 2004
- Participated in FPA/ CWA workshop for the BOF
  - » September 2004 – Presented historical relationship between the Board and Commission

7

Current Rulemaking Status

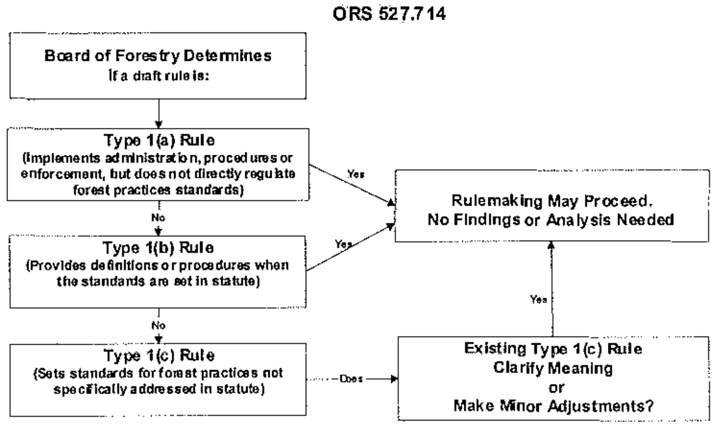
- ODF presented 18 concepts to the Board
- The Board reviewed scientific information and public comments - partial 527.714 analysis
- Board determined tentative pathway for concepts

8

Statewide	1. Clarify Water Protection Rules policy statement	Draft rule language approved July 2003
	2. Use Type F prescriptions for large and medium Type N streams	Non-regulatory path approved March 04
	3. Riparian management areas (RMA) above fish barriers	April-04
	4. Wood from debris flows and landslides	Draft rule language approved Sept. 2003
	5. Channel migration zones	Non-regulatory path approved Sept. 2003
	6. Stratification	Not proceed March 04
	7. Large wood placement	April-04
Western Oregon	8. Basal area target increase for medium and small Type Fs	Draft rule language approved Oct. 2003
	9. 60% Basal area cap	Non-regulatory path approved Oct.2003
	10. No harvest within ½ RMA	Non-regulatory path approved Oct.2003
	11. Retain largest trees within the RMA	Non-regulatory path approved Oct.2003
	12. Small Type N streams	April-04
Eastern Oregon	13. Desired future condition	Further discussion March 04
	14. Basal area targets	Not proceed March 04
	15. No harvest alternative	Not proceed March 04
	16. Small Type N streams	April-04
Statewide Initiatives	17. Fish habitat incentives	
	18. Small Type N stream monitoring	
		9

FPA Rulemaking Procedures

ORS 527.714



ORS 527.714(5)

- *Is there monitoring or research evidence that documents that degradation of resources maintained under ORS 527.710(2) or (3) is likely, if forest practices continue to be conducted under existing regulations?*

-and-

- *Does the proposed rule reflect available scientific information, the results of relevant monitoring and, as appropriate, adequate field evaluation at representative locations in Oregon?*

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Sufficiency Analysis Recommendations	Draft Rule Concepts	Next BOF/ODF Action	DEQ Comments
1- revise basal area (size and number of trees) targets / achieve mature forest conditions and provide large wood and shade	8- basal area increase for small and medium fish-bearing streams (west)	1/05 BOF will make a decision for formal rule making based on 527.714 findings	support rule change
	14- basal area targets (east)	ODF will revise monitoring priority list	neutral, encourage monitoring
	10- no harvest within 1/2 riparian management area (RMA) (west)	10/04-7/05 ODF will develop voluntary measures through Oregon Plan	prefer rule, encourage monitoring
	11- retain largest trees within RMA (west)	10/04-7/05 ODF will develop voluntary measures through Oregon Plan	prefer rule, encourage monitoring
	9- limit harvesting within RMA to 40% (west)	10/04-7/05 ODF will develop voluntary measures through Oregon Plan	prefer rule, encourage monitoring
2- revise current practices so desirable amounts of large wood is available along small stream channels that can deliver debris torrents to fish bearing streams. Ensure that adequate shade is maintained or rapidly recovered for riparian areas along small perennial non-fishbearing streams with the potential to impact downstream fish-bearing waters	4- Wood from debris flows and landslides	1/05 BOF will make a decision for formal rule making based on 527.714 findings	support rule change
	12- small non fish-bearing streams (west)	1/05 ODF will present draft rule language to BOF	rule language uncertain, BOF action uncertain, prefer rule change
	16- small non fish-bearing streams (east)	ODF will revise monitoring priority list	prefer rule, encourage monitoring
	18- small non fish-bearing stream monitoring	1/05 BOF will make a decision for formal rule making based on 527.714 findings. ODF will also revise their monitoring priority list	support rule change and encourage monitoring

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3- provide additional large wood to streams by actively placing wood to benefit salmonids	7- Large wood placement (also increase active management basal area target)	1/05 BOF will make a decision for formal rule making based on 527.714 findings	support rule change for west side, neutral on east side
	17- Fish habitat incentives	10/04-7/05 ODF will develop language along with voluntary measures for Oregon Plan	initiative language uncertain
10- provide riparian functions along stream reaches above impassable culverts that are likely to be recolonized by salmonids after structures are removed or improved	3- provide habitat above human caused fish barriers	1/05 BOF will make a decision for formal rule making based on 527.714 findings	support rule change
12- revise the FPA rule definition of fish-bearing and non fish-bearing streams by using physical habitat approach to classify fish use and no fish streams			
Other	1- clarify water protection rules policy statement	1/05 ODF will determine its recommendation after internal discussion	ODF/ BOF action uncertain, prefer rule change with TMDL language
	2- treat medium and large non fish-bearing streams as same size fish-bearing streams	10/04-7/05 ODF will develop voluntary measures through Oregon Plan	prefer rule, encourage monitoring
	5- channel migration zones	10/04-7/05 ODF will develop voluntary measures through Oregon Plan	prefer rule, encourage monitoring
	6- treat dense stands within RMA	ODF will develop guidance	guidance language uncertain
	13- revision of desired future condition (east)	This topic will be included in the Dynamic Ecosystem white paper discussion	support no rule change
	15- provide harvesting alternatives (east)	ODF will revise monitoring priority list	support no rule change

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Proposed Rule Package

- Provide habitat above human caused fish barriers
- Provide wood for debris flows
- Revise the large wood placement rule and active management basal areas (size and number of trees)
- Increase basal area for medium and small fish bearing streams in Western Oregon

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Proposed Voluntary Measures

- Treat medium and large non-fish bearing streams as same size fish bearing streams
- Provide protection for channel migration zones
- Limit harvesting within the riparian management areas to no more than 40 percent of the basal area
- Limit harvesting to the outer half of the riparian management area
- Retain the largest trees within the riparian management area

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Further Monitoring Required

- Modify protection on small non-fish bearing streams for Eastern Oregon
- Revise desired future condition for Eastern Oregon
- Revise basal area retention for Eastern Oregon
- Provide harvesting alternatives for Eastern Oregon

16

Undecided

- Clarify the policy statement that outlines the goals of the Forest Practices Act's water protection rules
- Increase protection on small non-fish bearing streams for Western Oregon

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Remaining Concepts

- Treat dense stands within RMA
  - Guidance revision
- Statewide Initiative for fish habitat incentives
  - Incorporate into other process
- Small non fish-bearing stream monitoring
  - House cleaning rule change
  - Included in 2005-07 biennial budget request

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Next Steps

- October 2004 to July 2005 - Oregon Plan Voluntary Measures development
- October 2004 to March 2005 - Guidance revision
- January 2005 - ORS 527.714 Analysis
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Water Protection Rules & Riparian Functions
Rule Concepts

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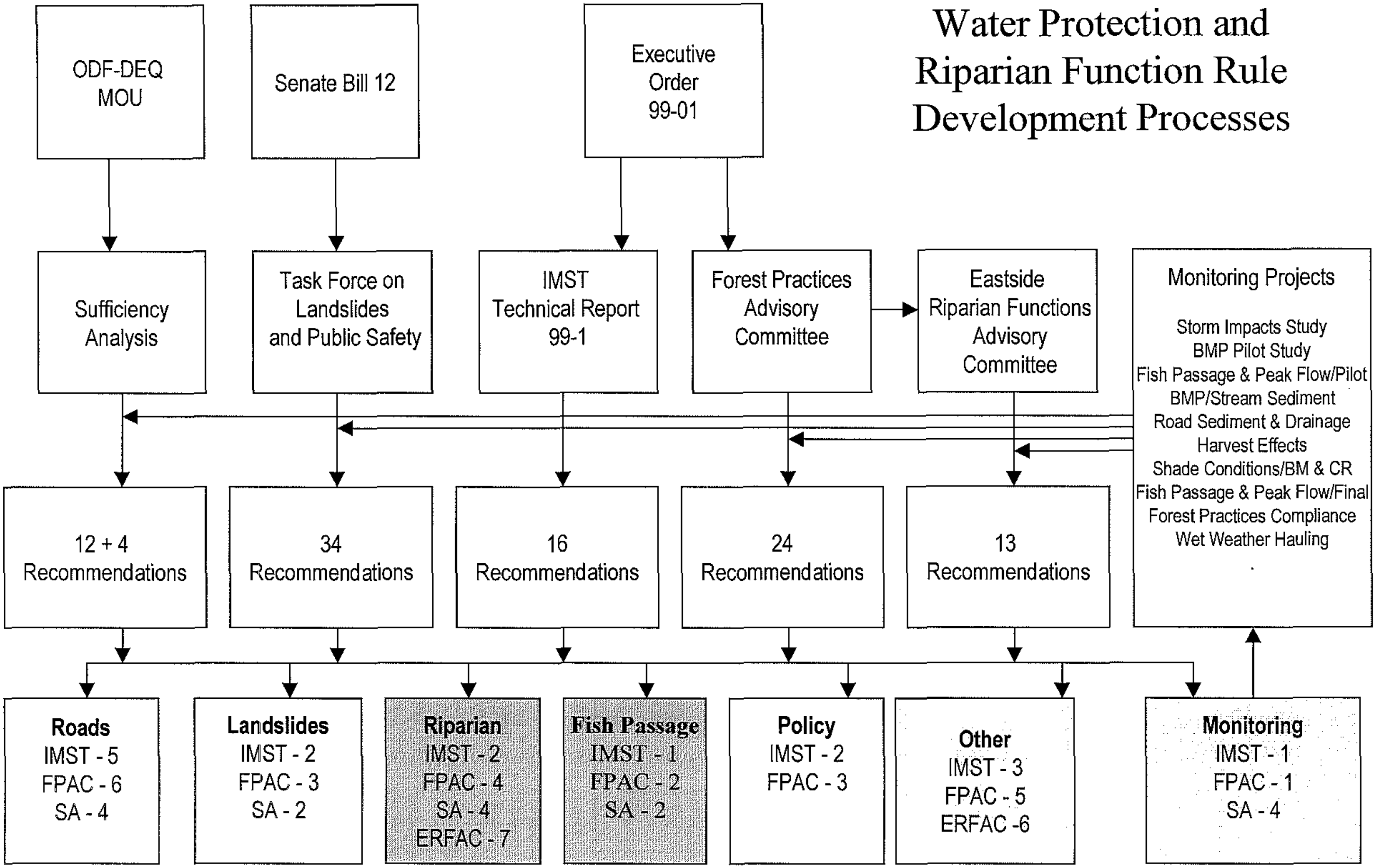
Water Protection and Riparian Function Rule Development Processes



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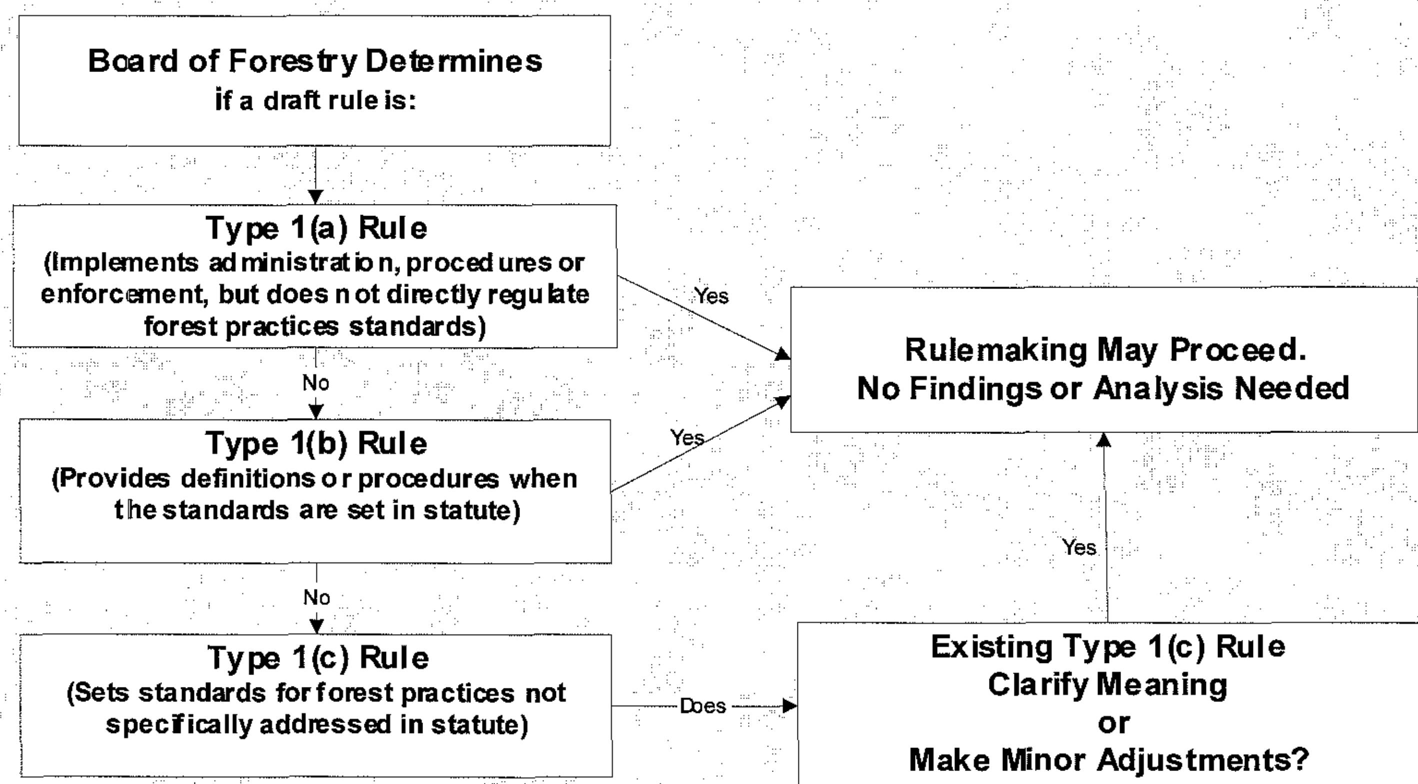
	10. No harvest within ½ RMA	Non-regulatory path approved Oct.2003
	11. Retain largest trees within the RMA	Non-regulatory path approved Oct.2003
	12. Small Type N streams	April-04
Eastern Oregon	13. Desired future condition	Further discussion March 04
	14. Basal area targets	Not proceed March 04
	15. No harvest alternative	Not proceed March 04
	16. Small Type N streams	April-04
Statewide Initiatives	17. Fish habitat incentives	
	18. Small Type N stream monitoring	

FPA Rulemaking Procedures

ORS 527.714



ORS 527.714(5)

- *Is there monitoring or research evidence that documents that degradation of resources maintained under ORS 527.710(2) or (3) is likely, if forest practices continue to be conducted under existing regulations?*

-and-

- *Does the proposed rule reflect available scientific information, the results of relevant monitoring and, as appropriate, adequate field evaluation at representative locations in Oregon?*

Sufficiency Analysis Recommendations	Draft Rule Concepts	Next BOF/ODF Action	DEQ Comments
1- revise basal area (size and number of trees) targets / achieve mature forest conditions and provide large wood and shade	8- basal area increase for small and medium fish-bearing streams (west)	**1/05** BOF will make a decision for formal rule making based on 527.714 findings	support rule change
	14- basal area targets (east)	ODF will revise monitoring priority list	neutral, encourage monitoring
	10- no harvest within 1/2 riparian management area (RMA) (west)	**10/04-7/05** ODF will develop voluntary measures through Oregon Plan	prefer rule, encourage monitoring
	11- retain largest trees within RMA (west)	**10/04-7/05** ODF will develop voluntary measures through Oregon Plan	prefer rule, encourage monitoring
	9- limit harvesting within RMA to 40% (west)	**10/04-7/05** ODF will develop voluntary measures through Oregon Plan	prefer rule, encourage monitoring
2- revise current practices so desirable amounts of large wood is available along small stream channels that can deliver debris torrents to fish bearing streams. Ensure that adequate shade is maintained or rapidly recovered for riparian areas along small perennial non-fishbearing streams with the potential to impact downstream fish-bearing waters	4- Wood from debris flows and landslides	**1/05** BOF will make a decision for formal rule making based on 527.714 findings	support rule change
	12- small non fish-bearing streams (west)	**1/05** ODF will present draft rule language to BOF	rule language uncertain, BOF action uncertain, prefer rule change
	16- small non fish-bearing streams (east)	ODF will revise monitoring priority list	prefer rule, encourage monitoring
	18- small non fish-bearing stream monitoring	**1/05** BOF will make a decision for formal rule making based on 527.714 findings. ODF will also revise their monitoring priority list	support rule change and encourage monitoring

3- provide additional large wood to streams by actively placing wood to benefit salmonids	7- Large wood placement (also increase active management basal area target)	**1/05** BOF will make a decision for formal rule making based on 527.714 findings	support rule change for west side, neutral on east side
	17- Fish habitat incentives	**10/04-7/05** ODF will develop language along with voluntary measures for Oregon Plan	initiative language uncertain
10- provide riparian functions along stream reaches above impassable culverts that are likely to be recolonized by salmonids after structures are removed or improved	3- provide habitat above human caused fish barriers	**1/05** BOF will make a decision for formal rule making based on 527.714 findings	support rule change
12- revise the FPA rule definition of fish-bearing and non fish-bearing streams by using physical habitat approach to classify fish use and no fish streams			
Other	1- clarify water protection rules policy statement	**1/05** ODF will determine its recommendation after internal discussion	ODF/ BOF action uncertain, prefer rule change with TMDL language
	2- treat medium and large non fish-bearing streams as same size fish-bearing streams	**10/04-7/05** ODF will develop voluntary measures through Oregon Plan	prefer rule, encourage monitoring
	5- channel migration zones	**10/04-7/05** ODF will develop voluntary measures through Oregon Plan	prefer rule, encourage monitoring
	6- treat dense stands within RMA	ODF will develop guidance	guidance language uncertain
	13- revision of desired future condition (east)	This topic will be included in the Dynamic Ecosystem white paper discussion	support no rule change
	15- provide harvesting alternatives (east)	ODF will revise monitoring priority list	support no rule change

Proposed Rule Package

- Provide habitat above human caused fish barriers
- Provide wood for debris flows
- Revise the large wood placement rule and active management basal areas (size and number of trees)
- Increase basal area for medium and small fish bearing streams in Western Oregon

Proposed Voluntary Measures

- Treat medium and large non-fish bearing streams as same size fish bearing streams
- Provide protection for channel migration zones
- Limit harvesting within the riparian management areas to no more than 40 percent of the basal area
- Limit harvesting to the outer half of the riparian management area
- Retain the largest trees within the riparian management area

Further Monitoring Required

- Modify protection on small non-fish bearing streams for Eastern Oregon
- Revise desired future condition for Eastern Oregon
- Revise basal area retention for Eastern Oregon
- Provide harvesting alternatives for Eastern Oregon

Undecided

- Clarify the policy statement that outlines the goals of the Forest Practices Act's water protection rules

- Increase protection on small non-fish bearing streams for Western Oregon

Remaining Concepts

- Treat dense stands within RMA
  - Guidance revision
- Statewide Initiative for fish habitat incentives
  - Incorporate into other process
- Small non fish-bearing stream monitoring
  - House cleaning rule change
  - Included in 2005-07 biennial budget request

Next Steps

- October 2004 to July 2005 - Oregon Plan Voluntary Measures development
- October 2004 to March 2005 - Guidance revision
- January 2005 - ORS 527.714 Analysis
- January 2005 - Formal Rule Making Process
- July 2005 - Formal Rule Adoption

Board of Forestry/Environmental Quality Commission 10/21/04

SIGN-IN SHEET

1:10pm - 5:20pm
10-21-04
Tillamook, OR

NAME	AFFILIATION/ORG.	ADDRESS	PHONE	MAKE PUBLIC COMMENT? (If YES, check box. If NO, leave blank.)
Barrett Brown	Chair SFAC	PO Box 1280 North Plains, OR 97133	503-647-6499	[ ] Yes, I wish to comment
Dana Clay	Green Diamond	PO Box 190 Tillamook, Or 97141		[ ] Yes, I wish to comment
Susan Ash	SFAC/Audubon			[ ] Yes, I wish to comment
Jeff Mettler	TRC			[ ] Yes, I wish to comment
Jake Gibbs	Lone Rock Timber	PO Box 1127 Roseburg OR 97470		[ ] Yes, I wish to comment
Lomer Clark	Governor's ofc			[ ] Yes, I wish to comment
Ralph Saperstein	Boise	524 Cottage St Salem 97301	503 581 1223	[ ] Yes, I wish to comment

Board of Forestry/Environmental Quality Commission 10/21/04

SIGN-IN SHEET

NAME	AFFILIATION/ORG.	ADDRESS	PHONE	MAKE PUBLIC COMMENT? (If YES, check box. If NO, leave blank.)
Barrett Brown	Chair SFAC	PO Box 1280 North Plains, OR 97133	503-6476499	[ ] Yes, I wish to comment
Dana Clay	Green Diamond	po Box 190 Tillamook, Or 97141		[ ] Yes, I wish to comment
Susan Ash	SFAC/Audubon			[ ] Yes, I wish to comment
[illegible]	TRC			[ ] Yes, I wish to comment
Jake Gibbs	Lone Rock Timber	PO Box 1127 Roseburg OR 97470		[ ] Yes, I wish to comment
[illegible] Clark	Governor's ofc			[ ] Yes, I wish to comment
Ralph Saperstein	Boise	524 Cottage st Salem 97301	503 5811223	[ ] Yes, I wish to comment

Board of Forestry/Environmental Quality Commission 10/21/04

SIGN-IN SHEET

NAME	AFFILIATION/ORG.	ADDRESS	PHONE	MAKE PUBLIC COMMENT? (If YES, check box. If NO, leave blank.)
Kevin Godbout	Weyerhaeuser	on record	—	[ ] Yes, I wish to comment
Larry Knudsen	ODOT	—	—	[ ] Yes, I wish to comment
Bill Arsenault		on record		[X] Yes, I wish to comment
Rob Markle	NOAA	525 NE Oregon St PDX 97232	503 230 5419	[X] Yes, I wish to comment
David Light	Oregon Insider	2600 N. Polk ST Eugene 97402	541-343-8504	[ ] Yes, I wish to comment
Paul Engelmeyer		PO Box 694 Yachats OR 97498	541-547-4097	[~~✓~~] Yes, I wish to comment
Rick Shepard	Appl. Ecosyst. Svcs., Inc.	2404 SW 22 Troutdale, OR 97060	503 667-4517	[ ] Yes, I wish to comment

Board of Forestry/Environmental Quality Commission 10/21/04

SIGN-IN SHEET

NAME	AFFILIATION/ORG.	ADDRESS	PHONE	MAKE PUBLIC COMMENT? (If YES, check box. If NO, leave blank.)
Alan Thayer	OSWA	2204 SE 144th Av Vancouver WA 98683	360-254-2902	[✓] Yes, I wish to comment
Aaron Borisenko	DEQ	2020 SW 4rth Ave, Port. OR 97201	503 229-5161	[✓] Yes, I wish to comment
Gary Springer	Starker Forests			[✓] Yes, I wish to comment
Rex Storm	Associated OR Loggers	P.O. Box 12339 Salem		[X] Yes, I wish to comment
Chris Jarmer	OFIC			[ ] Yes, I wish to comment
Wayne Naillon	SFAC			[ ] Yes, I wish to comment
Jon Germond	ODFW			[ ] Yes, I wish to comment

Board of Forestry/Environmental Quality Commission 10/21/04

SIGN-IN SHEET

NAME	AFFILIATION/ORG.	ADDRESS	PHONE	MAKE PUBLIC COMMENT? (If YES, check box. If NO, leave blank.)
Joel Salter	US EPA R10 - Portland		503 326 2653	[ ] Yes, I wish to comment
Dan Newton	RFP		5416292689	[X] Yes, I wish to comment
Mike Newton	Oregon State U.		541-737-6076	[X] Yes, I wish to comment
Dennis Creel	HAMPTON		503-365-8400	[ ] Yes, I wish to comment
Mike Brenchenerd	EPA		206 553 7151	[X] Yes, I wish to comment
Jeff Light	Plum Creek Timber Co.		541 336 6227	[ ] Yes, I wish to comment
Socorro Rodriguez	EPA		503 326 3250	[ ] Yes, I wish to comment

Board of Forestry/Environmental Quality Commission 10/21/04

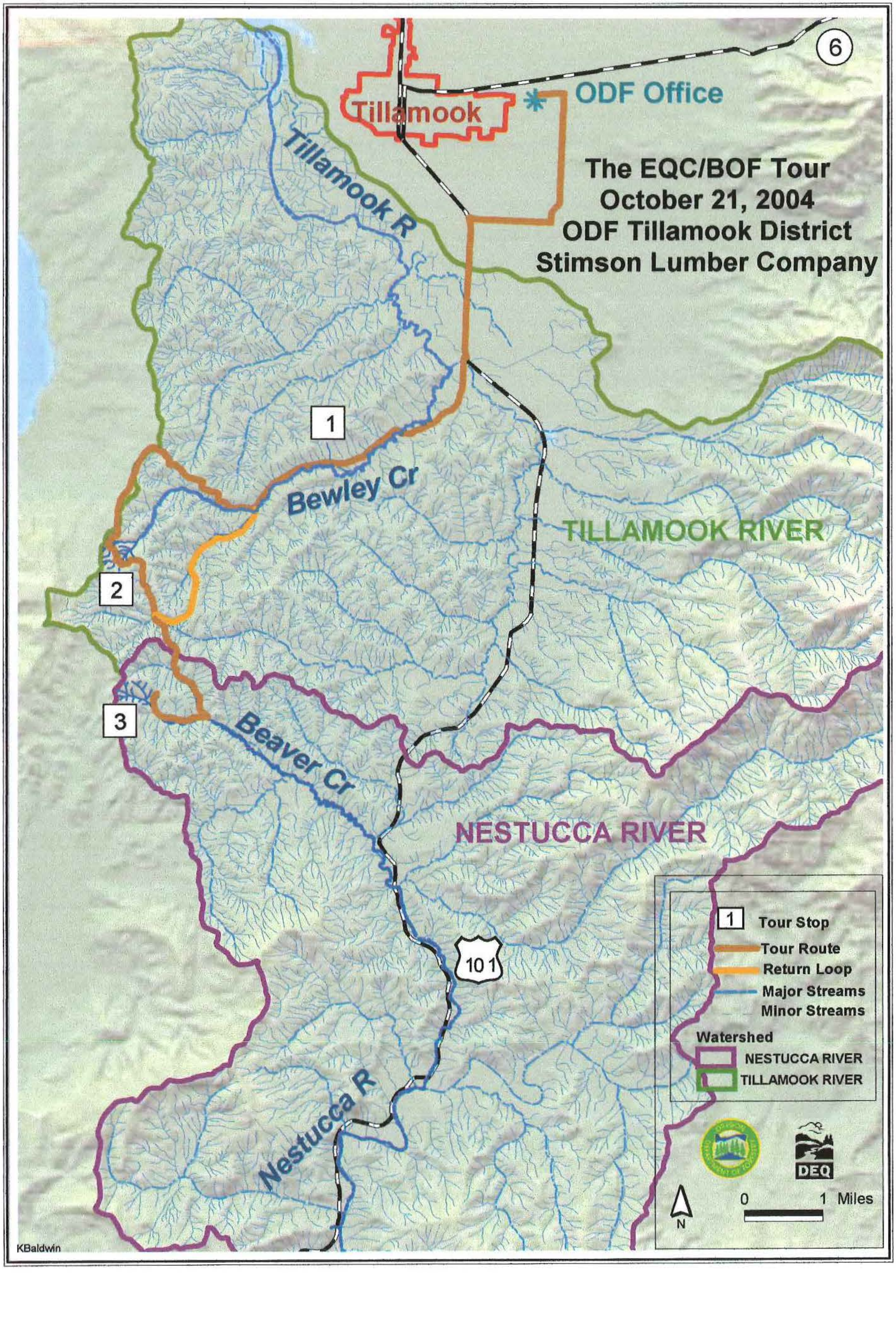
SIGN-IN SHEET

NAME	AFFILIATION/ORG.	ADDRESS	PHONE	MAKE PUBLIC COMMENT? (If YES, check box. If NO, leave blank.)
Sally Clay	TDA	2003 2ND TILL. 97141	503 842-5421	[ ] Yes, I wish to comment
Brad Knotts	ODF	Salem		[ ] Yes, I wish to comment
Brent Davies	Ecotrust	721 NW 9th Ave, Ste 200 Portland 97209	503.467.0761	[ ] Yes, I wish to comment
David Moskowitz	Wild Salmon Center	721 NW Ninth Ste. 290 PDX, OR	503 222 1804	[X] Yes, I wish to comment
				[ ] Yes, I wish to comment
				[ ] Yes, I wish to comment
				[ ] Yes, I wish to comment

Board of Forestry/Environmental Quality Commission 10/21/04

SIGN-IN SHEET

NAME	AFFILIATION/ORG.	ADDRESS	PHONE	MAKE PUBLIC COMMENT? (If YES, check box. If NO, leave blank.)
DAVE POWERS	USEPA			[ ] Yes, I wish to comment
Terry Luecker	ODF	Salem		[ ] Yes, I wish to comment
Neil Mullane	DEQ	Portland		[ ] Yes, I wish to comment
Ray Wilkeson	OFIC	Salem		[ ] Yes, I wish to comment
David Adams	TBWC			[X] Yes, I wish to comment
				[ ] Yes, I wish to comment
				[ ] Yes, I wish to comment



6
ODF Office
Tillamook
The EQC/BOF Tour
October 21, 2004
ODF Tillamook District
Stimson Lumber Company
Tillamook R
1
Bewley Cr
TILLAMOOK RIVER
2
3
Beaver Cr
NESTUCCA RIVER
101
Nestucca R
1 Tour Stop
Tour Route
Return Loop
Major Streams
Minor Streams
Watershed
NESTUCCA RIVER
TILLAMOOK RIVER
DEQ
N
0 1 Miles
KBaldwin

Board of Forestry / Environmental Quality Commission
Joint Field Tour
Thursday, October 21, 2004
ODF Tillamook District Office
5005 East 3rd Street, Tillamook

Tour Goal

For Board of Forestry and Environmental Quality Commission members to view and discuss key concepts of Water Quality Standards and related Forest Practices Best Management Practices (BMPs) in the field.

Tour Objectives

1. Present information within a field context on key issues surrounding the protection of small non-fish bearing streams (Type N).
2. Understand and Discuss outstanding issues identified by looking at conditions in the field.
3. View riparian areas pre-harvest, immediately post harvest, and following stand reestablishment.
4. View examples of current/ proposed forest practices.
5. View examples of monitoring methods that are used to verify TMDL modeling.
6. View examples of voluntary measures applied in addition to current BMPs.

Tour Itinerary

7:30 a.m.	**Meet at ODF Tillamook District Office**
7:30-7:45a.m.	**Welcome and Introductions: Ted Lorensen, Holly Schroeder**
7:45-8:00a.m.	**Tour Overview: Gregg Cline, Bob Baumgartner, Scott Gray**
8:00a.m.	**Leave Tillamook**
8:30a.m.	**Stop 1: Planned Harvest**

This stop illustrates activities undertaken in planning a harvest. Efforts include determining end of fish use and riparian management area layout.

- Greeting and background information of the tour sites: Stimson Lumber
- Current and proposed basal area requirements: Gregg Cline

- Determining end of fish use: Dan Cotton, and Dave Plawman
- TMDL process/ field check: Eric Nigg and Bruce Apple

9:15a.m. **Depart Stop 1**

9:30a.m. **Stop 2: Recent Harvest**

This stop illustrates conditions immediately following harvest. View small non-fish bearing streams (perennial and intermittent) examples of voluntary measures, and vegetation control procedures.

- Harvest objectives, voluntary stream protection, reforestation and vegetation control: Stimson Lumber
- Small Type N stream protection: current requirements, FPAC and ERFAC recommendations: Jim Paul
- Water quality standards, holistic review: Bob Baumgartner

10:15a.m. **Depart Stop 2**

10:25a.m. **Drive By**

Landowner accomplishments through voluntary projects - upgrade road systems, stream crossings and restore fish access. Refer to handout material in tour packet.

- Voluntary projects: Stimson Lumber
- Report on landowner accomplishments statewide: Jo Morgan

10:40a.m. **Stop 3: Recovery Following Harvest**

This stop illustrates recovery of vegetation on a clear-cut site six years after harvest.

- Harvest objectives, voluntary stream protection, reforestation and vegetation control: Stimson Lumber
- Dynamic forest concepts, reforestation requirements - established conifer: Ted Lorensen
- Demonstration of shade monitoring with solar pathfinder, TMDL Target and water quality standards: Eric Nigg and Bruce Apple

11:45a.m. **Depart Stop 3**:

Return to Tillamook Office - Lunch in route

Stop One – 2005 Planned Harvest – 66 acres

- Acres: 22ac Cable ground, 44ac of shovel ground
- Unit has a small Type F stream running in it for a distance of 300 ft. A 50' buffer has been flagged on both sides with pink "Timber Harvest Boundary" ribbon and orange reserve area tags.
- The unit has 2500' of small N streams in it. Leave trees have been tagged along the N streams with yellow wildlife tree tags.

TABLE 2. General Prescription for Type F streams: Streamside Tree Retention for Harvest Type 2 or Type 3 Units (OAR 629-640-0100 (~~6~~7) (a) & (b))

Geographic region	SQUARE FEET OF BASAL AREA PER 1000 FEET OF STREAM, EACH SIDE					
	LARGE Type F RMA = 100 feet		MEDIUM Type F RMA = 70 feet		SMALL Type F RMA = 50 feet	
	Standard Target	Active Mgt. Target	Standard Target	Active Mgt. Target	Standard Target	Active Mgt. Target
Coast Range & S. Coast	230	170	~~120~~ 160	120	~~40~~ 85	40
Interior & W. Cascade	270	200	~~140~~ 190	150	~~40~~ 100	50
Siskiyou	220	170	~~110~~ 155	125	~~40~~ 85	40
Eastern Cascade & Blue Mountain	170	130	90	70	50[1]	50[2]

1. The maximum live conifer tree basal area that must be retained is 40 square feet. The remaining basal area may come from snags, dying or recently dead or dying trees, or hardwood trees if available within the riparian management area.

2. Live conifer tree basal area may be reduced to 30 square feet for the active management target. The remaining portion of the basal area requirement must come from snags, dying or recently dead or dying trees, or hardwood trees if available within the riparian management area.

TABLE 2. General Prescription for Type F streams: Streamside Tree Retention for Harvest Type 2 or Type 3 Units (OAR 629-640-0100 (~~6~~7) (a) & (b))

Geographic region	SQUARE FEET OF BASAL AREA PER ACRE, EACH SIDE					
	LARGE Type F RMA = 100 feet		MEDIUM Type F RMA = 70 feet		SMALL Type F RMA = 50 feet	
	Standard Target	Active Mgt. Target	Standard Target	Active Mgt. Target	Standard Target	Active Mgt. Target
Coast Range & S. Coast	100	74	~~75~~ 100	75	~~33~~ 71	33
Interior & W. Cascade	117	87	~~88~~ 119	94	~~33~~ 83	42
Siskiyou	96	74	~~69~~ 97	78	~~33~~ 71	33
Eastern Cascade & Blue Mountain	74	57	56	44	42[1]	42[2]

1. The maximum live conifer tree basal area that must be retained is 40 square feet. The remaining basal area may come from snags, dying or recently dead or dying trees, or hardwood trees if available within the riparian management area.

2. Live conifer tree basal area may be reduced to 30 square feet for the active management target. The remaining portion of the basal area requirement must come from snags, dying or recently dead or dying trees, or hardwood trees if available within the riparian management area.

TABLE 3. General Prescription for Type F Streams: Streamside Tree Retention for Harvest Type 1, Partial Harvest, or Thinning Units (OAR 629-640-0100 (~~6~~7) (a) & (b))

	SQUARE FEET OF BASAL AREA PER 1000 FEET OF STREAM, EACH SIDE					
Geographic region	LARGE Type F RMA = 100 feet		MEDIUM Type F RMA = 70 feet		SMALL Type F RMA = 50 feet	
	Standard Target	Active Mgt. Target	Standard Target	Active Mgt. Target	Standard Target	Active Mgt. Target
Coast Range & S. Coast	300	270	~~160~~ 210	185	~~50~~ 110	65
Interior & W. Cascade	350	310	~~180~~ 245	220	~~50~~ 130	80
Siskiyou	290	260	~~140~~ 205	175	~~50~~ 110	65
Eastern Cascade & Blue Mountain	220	200	120	100	50[1]	50[2]

The maximum live conifer tree basal area that must be retained is 40 square feet. The remaining basal area may come from snags, dying or recently dead or dying trees, or hardwood trees if available within the riparian management area.

TABLE 3. General Prescription for Type F Streams: Streamside Tree Retention for Harvest Type 1, Partial Harvest, or Thinning Units (OAR 629-640-0100 (~~6~~7) (a) & (b))

	SQUARE FEET OF BASAL AREA PER ACRE, EACH SIDE					
Geographic region	LARGE Type F RMA = 100 feet		MEDIUM Type F RMA = 70 feet		SMALL Type F RMA = 50 feet	
	Standard Target	Active Mgt. Target	Standard Target	Active Mgt. Target	Standard Target	Active Mgt. Target
Coast Range & S. Coast	130	117	~~100~~ 131	116	~~42~~ 92	54
Interior & W. Cascade	152	135	~~113~~ 153	138	~~42~~ 108	67
Siskiyou	126	113	~~88~~ 128	109	~~42~~ 92	54
Eastern Cascade & Blue Mountain	96	87	75	63	42[1]	42[2]

The maximum live conifer tree basal area that must be retained is 40 square feet. The remaining basal area may come from snags, dying or recently dead or dying trees, or hardwood trees if available within the riparian management area.

TABLE 4. Basal Area for Various Diameter Classes (OAR 629-640-0100 (10))

Diameter Breast Height (inches)	Basal Area (square feet)	Diameter Breast Height (inches)	Basal Area (square feet)
6 to 10	0.3	41 to 45	10.1
11 to 15	0.9	46 to 50	12.6
16 to 20	1.8	51 to 55	15.3
21 to 25	2.9	56 to 60	18.3
26 to 30	4.3	61 to 65	21.6
31 to 35	5.9	66 to 70	25.2
36 to 40	7.9	71 to 75	29.0

Sufficiency Analysis Recommendations	Draft Rule Concepts	ODF Recommendation	Board of Forestry Decision	Next BOF/ODF Action	DEQ Comments
1- revise basal area (size and number of trees) targets / achieve mature forest conditions and provide large wood and shade	8- basal area increase for small and medium fish-bearing streams (west)	Rule change	Continue on regulatory path 10/03	**1/05** BOF will make a decision for formal rule making based on 527.714 findings	support rule change
	14- basal area targets (east)	No rule change - insufficient science	Not proceed approved 3/04	ODF will revise monitoring priority list	neutral, encourage monitoring
	10- no harvest within 1/2 riparian management area (RMA) (west)	Non regulatory - insufficient science	Voluntary path approved 9/03	**10/04-7/05** ODF will develop voluntary measures through Oregon Plan	prefer rule, encourage monitoring
	11- retain largest trees within RMA (west)	Non regulatory - insufficient science	Voluntary path approved 9/03	**10/04-7/05** ODF will develop voluntary measures through Oregon Plan	prefer rule, encourage monitoring
	9- limit harvesting within RMA to 40% (west)	Non regulatory - insufficient science	Voluntary path approved 9/03	**10/04-7/05** ODF will develop voluntary measures through Oregon Plan	prefer rule, encourage monitoring
2- revise current practices so desirable amounts of large wood is available along small stream channels that can deliver debris torrents to fish bearing streams. Ensure that adequate shade is maintained or rapidly recovered for riparian areas along small perennial non-fishbearing streams with the potential to impact downstream fish-bearing waters	4- Wood from debris flows and landslides	Rule change	Continue on regulatory path 9/03	**1/05** BOF will make a decision for formal rule making based on 527.714 findings	support rule change
	12- small non fish-bearing streams (west)	Rule change	Deferred decision 4/04	**1/05** ODF will present draft rule language to BOF	rule language uncertain, BOF action uncertain, prefer rule change
	16- small non fish-bearing streams (east)	No rule change - insufficient science	Not proceed approved 4/04	ODF will revise monitoring priority list	prefer rule, encourage monitoring
	18- small non fish-bearing stream monitoring	(Rule change) - house cleaning, remove obsolete references	Continue on regulatory path 7/03	**1/05** BOF will make a decision for formal rule making based on 527.714 findings. ODF will also revise their monitoring priority list	support rule change and encourage monitoring
3- provide additional large wood to streams by actively placing wood to benefit salmonids	7- Large wood placement (also increase active management basal area target)	Rule change	Continue on regulatory path 4/04	**1/05** BOF will make a decision for formal rule making based on 527.714 findings	support rule change for west side, neutral on east side
	17- Fish habitat incentives	Non regulatory - statewide initiative	Not required	**10/04-7/05** ODF will develop language along with voluntary measures for Oregon Plan	initiative language uncertain
10- provide riparian functions along stream reaches above impassable culverts that are likely to be recolonized by salmonids after structures are removed or improved 12- revise the FPA rule definition of fish bearing and non fish-bearing streams by using physical habitat approach to classify fish use and no fish streams	3- provide habitat above human caused fish barriers	Rule change	Continue on regulatory path 4/04	**1/05** BOF will make a decision for formal rule making based on 527.714 findings	support rule change
Other	1- clarify water protection rules policy statement	Uncertain	Continue on regulatory path 7/03, then deferred decision 7/04	**1/05** ODF will determine its recommendation after internal discussion	ODF/ BOF action uncertain, prefer rule change with TMDL language
	2- treat medium and large non fish-bearing streams as same size fish-bearing streams	Non regulatory - insufficient science	Voluntary path approved 3/04	**10/04-7/05** ODF will develop voluntary measures through Oregon Plan	prefer rule, encourage monitoring
	5- channel migration zones	Non regulatory - insufficient science	Voluntary path approved 9/03	**10/04-7/05** ODF will develop voluntary measures through Oregon Plan	prefer rule, encourage monitoring
	6- treat dense stands within RMA	Guidance on rules	Address through guidance	ODF will develop guidance	guidance language uncertain
	13- revision of desired future condition (east)	No rule change - insufficient science	Further policy discussion approved 3/04	This topic will be included in the Dynamic Ecosystem white paper discussion	support no rule change
	15- provide harvesting alternatives (east)	No rule change - insufficient science	Not proceed approved 3/04	ODF will revise monitoring priority list	support no rule change

Rule package	Voluntary measures

notes

WATER CLASSIFICATION
OAR 629-635-0200

(11) (b) (B) The department will approximate the upstream extent of fish use in a watershed by considering the connection of the water with downstream waters where fish use is known. Fish use will be assumed to occur upstream of the known fish use until the first natural barrier to fish use is encountered.

RULE COMPLIANCE:

This paragraph is not subject to enforcement action.

ADMINISTRATION AND IMPLEMENTATION:

The intent of this paragraph is to allow the department to classify fish use for streams with unknown fish use in the interim (until a physical survey **for fish presence/absence** is conducted). The "approximation" process can be applied when a notification is received or prior to receiving a notification on a broader mapping scale so long as the proper process is applied.

In applying the approximation process, it was the intent of this paragraph to assume fish use in streams that have connection with a stream with known fish use (any stream that was previously classified as Class I and any stream where a survey has confirmed fish presence) **up to the first natural barrier**. A natural barrier is defined by OAR 629-600-0100(39) as:

> "Natural barrier to fish use" is a natural feature such as a waterfall, increase in stream gradient, channel constriction, or other natural channel blockage that prevents upstream fish passage.

Applying "upstream of the known fish use until the first natural barrier to fish use is encountered" will result in not classifying some fish use that can occur above a natural barrier to fish use. However, the intent was to provide an equitable process that could be applied on short timelines until the comprehensive survey is done. The conservative results of the interim process will help ensure that landowners will not be required to apply Type F protection on streams that in reality do not have fish use. In addition, this approach was also intended to maintain incentives to complete the comprehensive survey for actual fish use. More accurate classification will result when the comprehensive fish use survey is completed.

Even when fish use has been surveyed, and fish use has been verified up to a man-made barrier, the following policies apply. When a crossing structure that creates an upstream Type N stream segment is replaced, it is required to provide fish passage. When this allows fish to occupy the upstream segment, the classification will be changed from Type N to Type F. ***[REVISED 12-98—this paragraph added.]***

The most important consideration in applying the interim process is that Forest Practices Foresters are not experts about barriers to fish passage. The department has final authority to make decisions about barriers. Apply your best judgment based upon the information available to you about barriers, but recognize that this is an interim process.

Fish use will be assumed up to the first natural barrier. Natural barriers include waterfalls or other **natural channel** features. Natural barriers **do not** include beaver dams, log jams, or woody debris piles. Such "organic" obstructions are temporary and in most cases do not block fish. Culverts **do not** count as natural barriers unless located at a natural barrier. A falls, chute, channel gradient change, or lack of livable space **should be considered a barrier if it is more likely that fish could not pass above the channel feature than pass the feature.** The rule very clearly states we **assume fish use only up to the first barrier.**

In order of priority, a barrier to fish use can be determined two ways. First, the stream channel from its confluence with fish use waters can be physically surveyed up to the first natural barrier. This approach can be applied if an actual fish presence survey cannot be conducted due to timing issues; that is, fish may be there at other times of the year, but due to such factors as seasonality of flow, they are not likely to be there at the time the survey must be conducted. Generally, the stream channel should be observed for falls, chutes, and steep channel sections that are likely to prevent upstream fish passage. A map can be examined to prioritize sections of stream to observe in the field for barriers. If barriers are found above confirmed fish use, fish use should be assumed to end there unless fish are observed above the barrier.

The second method is to determine barriers to fish use based upon a map analysis. This method may be applied on a broad scale (in a manner unrelated to receipt of a notification) or on an operation-specific basis. One advantage of the broader scale approach is that landowners and other interested parties will be able to know ahead of time where we will assume fish use if a fish presence or channel survey is not conducted. Therefore, districts are encouraged on a broad scale to map assumed fish on the district maps following the guidance in the mapping section.

The map method is to be applied in the context of "barriers" and not in the context of "the probability of fish use". That is, the channel should be analyzed on the map from its confluence with known fish use to find the first channel feature on the map that is likely to block fish passage.

The notion of probability of fish use can be used in selecting the **methodology** to determine fish use; that is, whether to do a fish survey, a channel survey, or use the map process. However, if physical fish presence surveys cannot be conducted, the only criterion for determining the upstream extent of fish use is the location of the first natural barrier to fish use.

The following criteria are established to define natural barriers that are more likely to not pass fish than to pass fish for either field and/or map application. In applying the criteria, if there are no known waterfalls or chutes, then channel gradient and physical habitat (lack of livable space due to no pools or inadequate water volume) should be considered in determining barriers.

In applying these factors, we should again be assuming a barrier when it is more likely that fish cannot move through a steep channel segment or that the lack of livable space is a barrier. When evaluating a potential barrier, the expected flows during high spring or winter flows should be considered. Conditions for fish passage at a site during low summer flow can be very different from what occurs during high flows. For example, a falls that appears five feet high during low summer flows may be less than three feet high during higher flows. Stream levels based upon bankfull width should be used as points of reference in measuring channel drops.

Barriers to fish use:

a. Falls - physical survey

For salmon and steelhead streams, any falls or steep bedrock chute with eight feet or greater vertical drop is a barrier.

For resident trout streams, any falls or steep bedrock chute with four feet or greater vertical drop is a barrier.

Any falls or steep bedrock chute with less than a two-foot vertical drop is not a barrier.

For falls or steep chutes with vertical drops between those described above, if the falls or chute is without a jump pool or the jump pool depth (estimated to be there during high flow periods) is less than 1.25 times the height of the falls or chute, a barrier exists. For example, a fish *can* jump a two-foot vertical falls if there is a pool 2.5 feet deep at the bottom of the falls, and the falls would not be considered a barrier in this case.

b. Falls - map survey

Any waterfall marked on a map should be considered a barrier.

c. Channel Steepness - physical survey

Any channel segment (30 feet or longer on salmon/steelhead streams and 20 feet or longer for resident trout streams) with a gradient that exceeds 20 percent is a barrier.

Any channel segment (using same length segments as above) with a gradient that exceeds 12 percent should be considered a barrier if the channel is bedrock without pools or low velocity areas, or otherwise does not have pools. This can vary between 12 and 20 percent depending upon channel form (frequency of step pools versus bedrock channel without pools). One advantage of the physical channel survey is that judgment and local experience can be applied in determining whether or not channel steepness is reasonably likely to prevent fish passage. In the map approach, decisions will be based solely upon gradient and not channel form.

d. Channel steepness - map survey

Any channel segment with a gradient that exceeds 20 percent is a barrier to fish use.

Not all steep channel segments will be apparent on a map. Local knowledge should be applied in appropriate situations. For example, if side streams to a main stream with fish characteristically drop steeply to the main stream and these drops have been found to be barriers to fish use even though they may not show on a map, this information should be used to establish a barrier. However, in this situation it is recommended that the expected drop be confirmed by a field visit.

e. Lack of livable space - physical survey

A channel has inadequate livable space to pass fish if it does not contain pools that are approximately a foot or more in depth during spring spawning season or other periods of high flow when fish would normally be expected. During low water periods the channel can be observed for indications that such pools exist during higher spring flows.

f. Lack of livable space - map survey

Coast Range Geographic Region: Basins with a drainage area of 60 acres or less are barriers to fish.

South Coast Geographic Region: Basins with a drainage area of 80 acres or less are barriers to fish.

Interior, and West Cascade Geographic Regions: Basins with a drainage area of 100 acres or less are barriers to fish.

Siskiyou Geographic Region: Basins with a drainage area of 300 acres or less are barriers to fish.

Blue Mountain and East Cascade Geographic Regions: Basins with a drainage area of 350 acres or less are barriers to fish. Streams with known perennial stream flow in these geographic regions, regardless of basin size, should be a high priority for fish surveys.

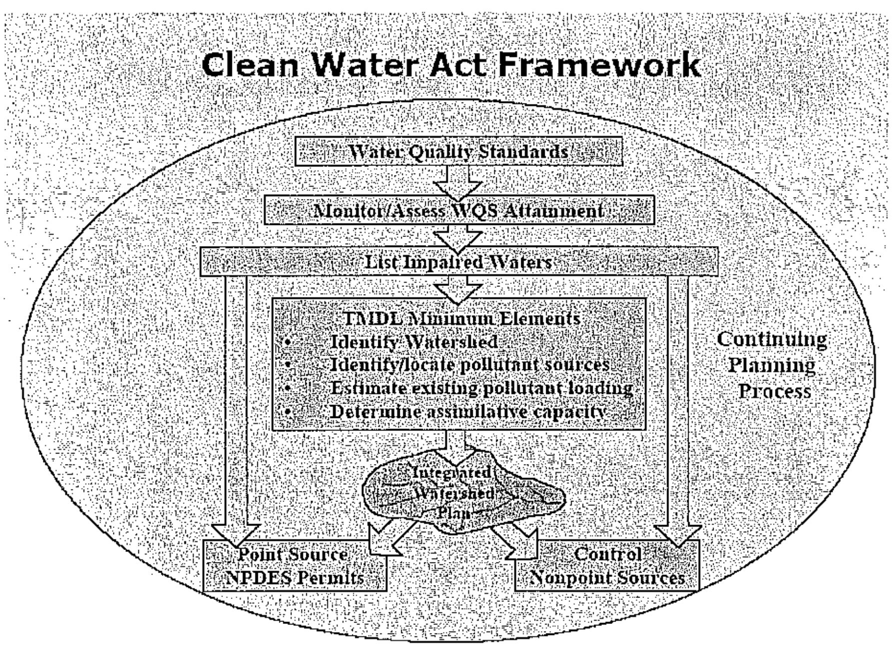
The criteria related to lack of livable space were developed using limited fish presence survey data. These criteria should be used until additional fish presence survey data are locally available. However, as such data are developed locally, districts in coordination with local ODFW biologists may adjust these criteria. Such adjustments must be supported by local data and be consistent with the policies in this guidance related to fish presence. For example, if SWO District and the ODFW district fish biologist agree that actual fish presence data indicates that basins of 400 acres are more likely to prevent fish passage than allow fish passage in areas of the district with less than 20 inches of rainfall, then that criteria may be used in place of the criteria in this guidance.

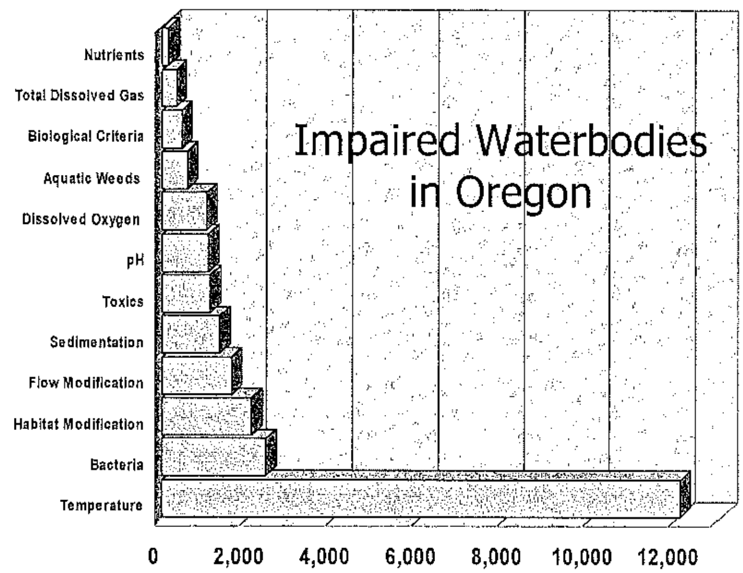
Table 1: Summary Of Interim Process
For Determining Approximate Upstream Extent of Fish Use

<table>
<tr><th colspan="2">Type of Barrier</th><th colspan="2">Physical Survey</th><th>Map Analysis</th></tr>
<tr><td colspan="2" rowspan="3">Falls & Chutes</td><td>Salmon & Steelhead</td><td>Resident Trout</td><td rowspan="3">Any waterfall marked on a map.</td></tr>
<tr><td>8'+</td><td>4'+</td></tr>
<tr><td colspan="2">2'+ require a jump pool 1.25 times the fall or chute height.</td></tr>
<tr><td rowspan="2">Channel Steepness</td><td>With Pools</td><td>30' or more @ 20%+</td><td>20' or more @ 20%+</td><td rowspan="2">20%+</td></tr>
<tr><td>W/O Pools</td><td>30' or more @ 12%+</td><td>20' or more @ 12%+</td></tr>
<tr><td colspan="2">Lack of Livable Space</td><td colspan="2">No pools approximately 12" or more in depth during spring spawning.</td><td>60 Acres or Less (Coast
80 Acres or Less (South Coast)
100 Acres or Less (Interior)
300 Acres or Less (Siskiyou)
350 Acres or Less (Blue Mountain and East Cascade)</td></tr>
</table>

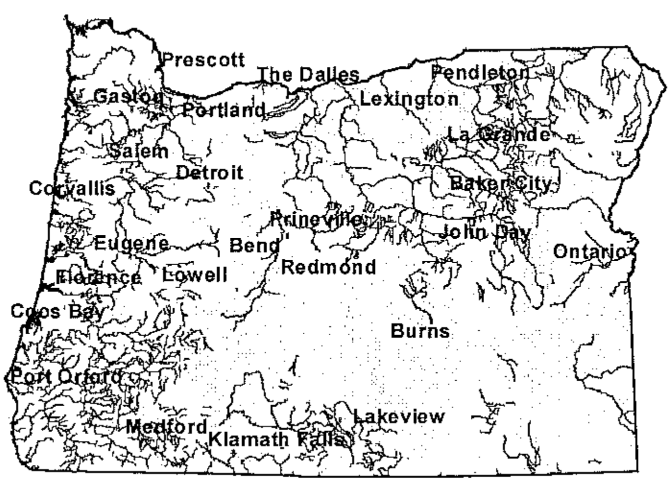
CWA Requires the States to

1. Protect sensitive **Beneficial Uses** by developing **Water Quality Standards.**
2. Classify water bodies that do not meet **Water Quality Standards** as **303(d) Water Quality Limited.**
3. Determine **TMDLs** for **303(d) Water Quality Limited** water bodies.
4. Implement **TMDLs** through NPDES Permits and **Water Quality Management Plans**





1998 303 (d) Listed Streams

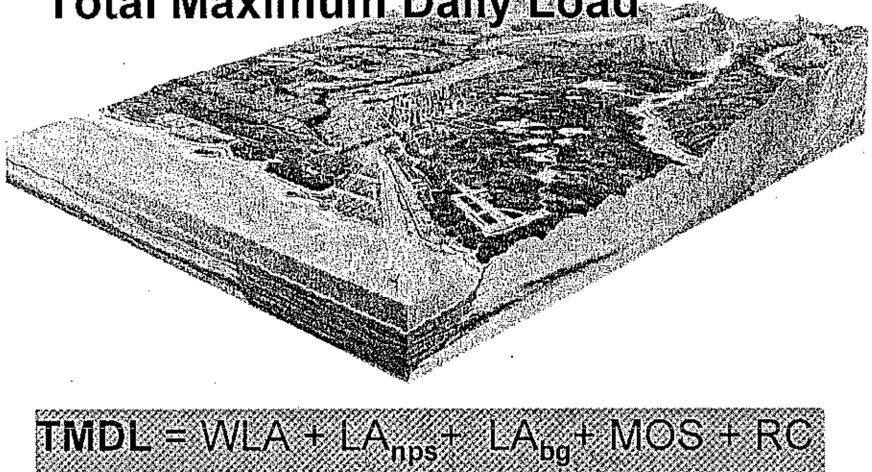


Total Maximum Daily Load

- CWA requires to Determine TMDLs for 303(d) Water Quality Limited water bodies.

- A TMDL is for a particular pollutant
- A TMDL represents the amount of pollution a water body can assimilate - the amount beyond which a beneficial use is impaired
- A TMDL is calculated based on the beneficial use that is most sensitive to that pollutant

Total Maximum Daily Load



$$TMDL = WLA + LA_{nps} + LA_{bg} + MOS + RC$$

WLA	LA_{nps}	LA_{bg}	MOS	RC
Waste Load Allocation	Load Allocation Nonpoint Source	Load Allocation Background	Margin of Safety	Reserve Capacity

How do we get there?

- Involve others
- Assemble existing data & gather more data to fully understand streams and pollutant source impacts
- Calculate stream Loading Capacities
  (how much load before WQ standards exceeded?)
- Allocate allowable inputs
- Document calculations, decisions and plans for reducing pollution
- Submit to EPA for approval

DEQ

TMDL Responsibilities

DEQ calculates TMDLs, sets allocations to reach water quality compliance

Carry out WQMPs

SB1010
Agricultural prohibited conditions
(ODA)

Point Source Permits
(DEQ)

Forest Practices Act
Forestry prescriptions
(ODF)

Other
urban and rural NPS management
(Local Government)

Federal Land Management Agencies

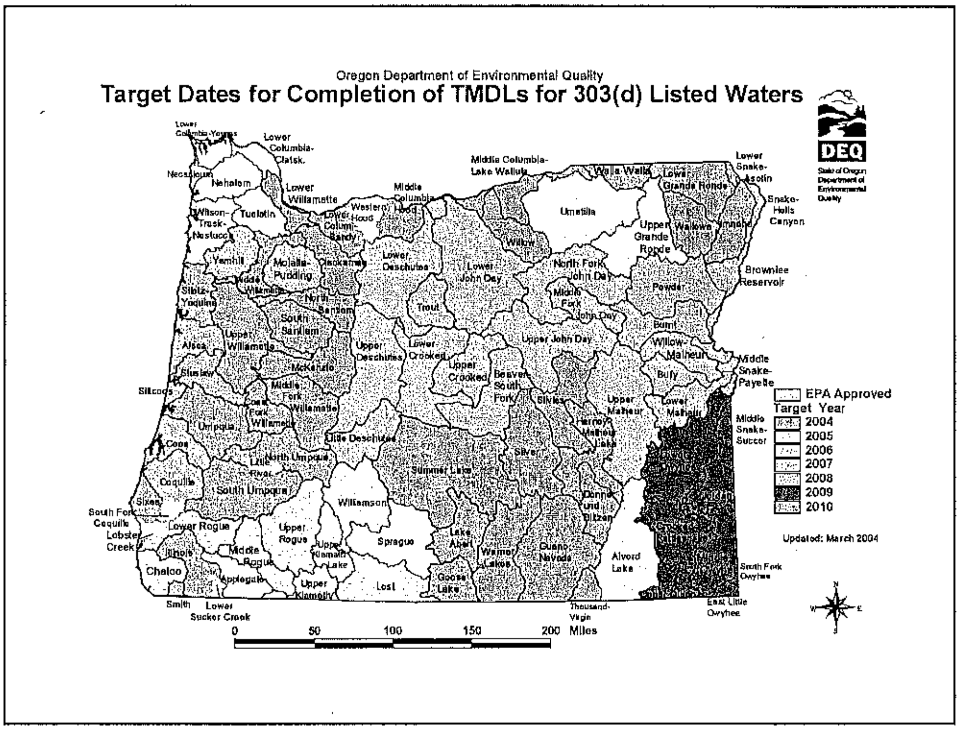
BOF Responsibilities

- **340-042-0080**
- **Implementing a Total Maximum Daily Load**

- **(2) The Oregon Department of Forestry will develop and enforce implementation plans addressing state and private forestry sources as authorized by ORS 527.610 through 527.992 and according to OAR chapter 629, divisions 600 through 665.**

TMDL Challenges

- Time constraints
- What models to use
- Selecting relevant & understandable indicators
- Allocations
- Reserve Capacity for growing needs
- Adaptive management
- Mixed land use
- Long term enthusiasm
- Funding for implementation


Oregon Department of Environmental Quality
Target Dates for Completion of TMDLs for 303(d) Listed Waters
DEQ
EPA Approved
Target Year
2004
2005
2006
2007
2008
2009
2010
Updated: March 2004
0 50 100 150 200 Miles

Stop Two -- 2002 – 2003 Timber Harvest – 70 acres

- 52ac Tower logging, 18ac shovel logging
- Unit was logged in December of 2002 through February 2003.
- Unit was logged using a small yarder and shovel.
- A small type N tributary of Bewely creek runs through the Unit for a distance of 2600'. A 50' buffer was left on both sides of the west fork of the small N for a distance of 900' and additional wildlife trees tagged along the N for another 200'. Along the East fork a 50' buffer was flagged along one side with pink timber harvest boundary ribbon for a distance of 800' and a 25'wide leave tree buffer was tagged for a distance of 700' along the remainder of the stream.
- <u>Site Preparation</u>
- Herbicide application – September 2003
- Brush Piling- 30 acres October 2003
- Pile Burning – October 2003
- Planting – March 2004
- Trees Planted– 386 Trees/acre

Western Hemlock = 76%
Sitka Spruce = 9%
Noble Fir = 8%
Western Red Cedar = 7%

notes

Small Type N Streams

Current Rule

629-640-0200
General Vegetation Retention Prescription for Type D and Type N Streams
(6) Operators shall retain all understory vegetation and non-merchantable conifer trees (conifer trees less than six inches DBH) within 10 feet of the high water level on each side of small perennial Type N streams indicated in **Table 5**.
(a) The determination that a stream is perennial shall be made by the State Forester based on a reasonable expectation that the stream will have summer surface flow after July 15.
(b) The determination in subsection (6)(a) of this rule can be made based on a site inspection, data from other sources such as landowner information, or by applying judgment based upon stream flow patterns experienced in the general area.
(c) Operators are encouraged whenever possible to retain understory vegetation, non-merchantable trees, and leave trees required within harvest type 2 or harvest type 3 units (pursuant to Section 9, Chapter 9, Oregon Laws 1996 Special Session) along all other small Type N streams within harvest units.

TABLE 5. Vegetation Retention for Specified Small Type N Streams (OAR 629-640-0200 (6))

Geographic Region	Retain Understory Vegetation and Unmerchantable Conifers 10 Feet Each Side of Stream for:
Eastern Cascades and Blue Mountains	All perennial streams.
South Coast	Portions of perennial streams where the upstream drainage area is greater than 160 acres.
Interior	Portions of perennial streams where the upstream drainage area is greater than 330 acres.
Siskiyou	Portions of perennial streams where the upstream drainage area is greater than 580 acres.
Coast Range and Western Cascades	No retention required.

FPAC Recommendation

Type N Streams (Nonfish Bearing) Forest Practice Forester Discretion

a. Small Type NT streams are: 1) Perennial Small Type N (temperature) streams that are tributary and contribute at least 30% of the flow to small and medium Type F streams and that have a drainage area larger than "X" acres (basin size to be set by georegion, 40 acres for the coast range). Initial classification will be based on basin size, but landowners may delist streams or stream segments verified as nonperennial. 2) Small Type N (torrent) streams with drainage basins greater than 30 acres, in which more than 75% of the basin has been mapped as "high" or 50 % "extreme" debris flow hazard (by the State Forester) and which have a high probability of wood delivery to Type F streams.
b. Small NT stream protection: 1) Up to the first 500 feet of Type NT (temperature) stream above the confluence with a Type F stream will have a 50-foot search zone, each side. Within the search zone, retain 4 square feet of trees per each 100 feet of perennial flow (up to 500 feet) and all non-merchantable conifer on each side of the stream. Trees left along these streams to satisfy the basal area requirement can be counted as in-0unit leave trees. 2) "Torrent" type NT streams will be protected as follows – FPF, working with the landowner, has discretion to direct retention of in-unit trees to 50' X 500' search zone (each side).

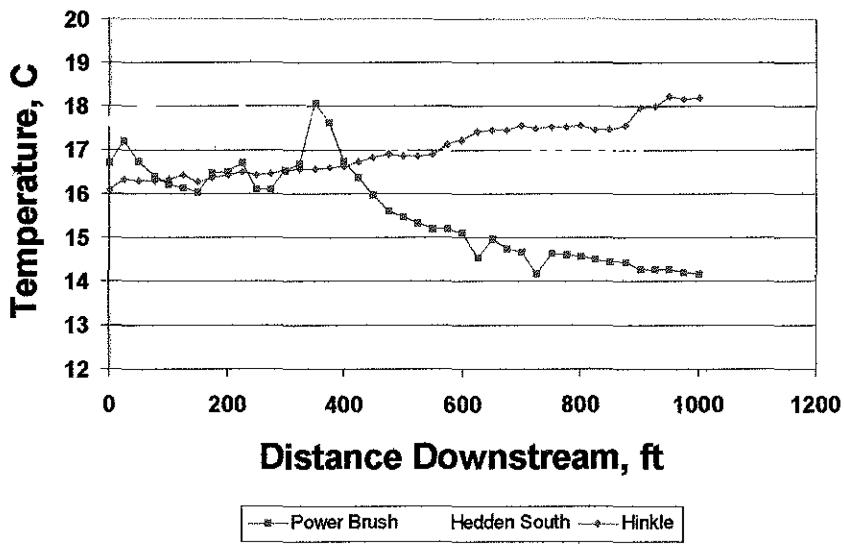
SA Recommendation & Basis for Recommendation

Recommendation #2: Revise current practices so desirable amounts of large wood is available along small stream channels that can deliver debris torrents to Type F streams. Ensure that adequate shade is maintained or rapidly recovered for riparian areas along small perennial Type N streams with the potential to impact downstream Type F waters.

Basis: There is increasing scientific evidence that small non-fish–bearing streams prone to debris flows provide an important source of large wood for downstream fish habitat. It is also known that the removal of shade-producing vegetation along small perennial Type N streams temporarily increases stream temperatures, until regeneration occurs. While these streams are providing some level of functional large wood inputs and shade production under the current rules, the rules were not specifically designed to retain significant sources of large wood and shade in these areas. Current research and monitoring results show the current practices may result in short-term temperature increases in some Type N streams that feed into fish-bearing streams, however, the significance of the potential temperature increases at a watershed (or sub-basin) scale is uncertain.

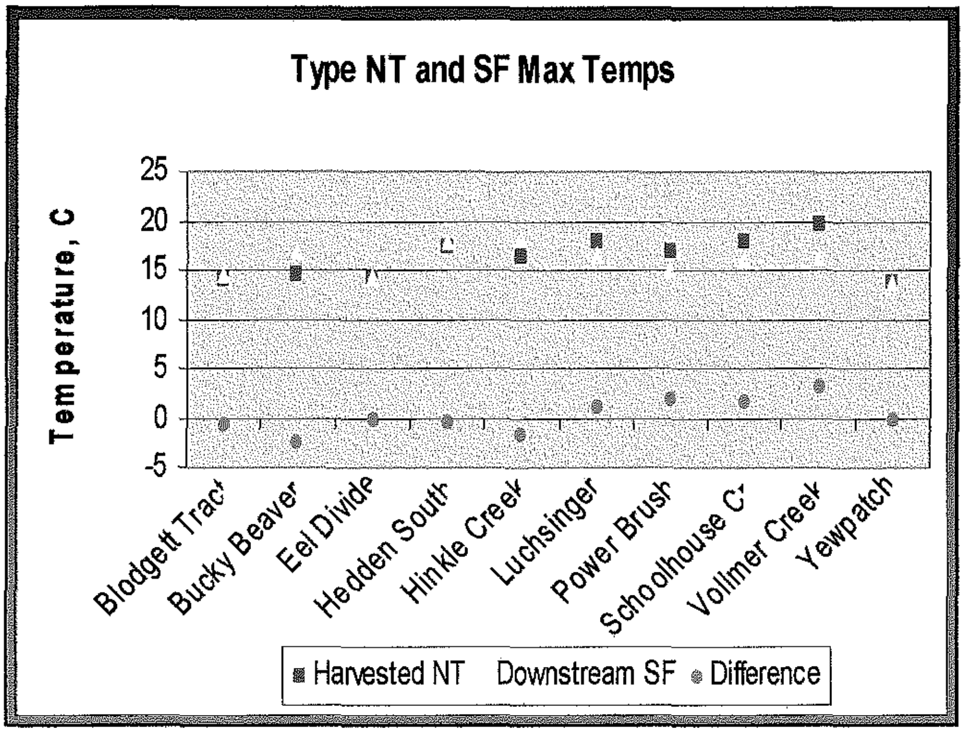
Temperature Profiles

Slides from Arne Skaugset's Presentation to the BOF on 9/7/04



Longitudinal Velocities

	Velocity (fps)	3 hours	8 hours
Blodgett	0.086	930	2,500
Bucky Beaver	0.025	270	720
Eel Divide	0.047	508	1,350
Hedden S.	0.038	410	1,094
Hinkle	0.068	734	1,960
W. Luchsinger	0.009	97	260
Power Brush	0.072	778	2,074
Yew Patch	0.20	2,160	~1 mile
Vollmer	0.28	3,024	~1.4 miles



Some Final Thoughts

- It appears that it will be hard to propagate significantly warm water downstream to fish-bearing streams.
- Small discharges = high heat loads but small velocities.
- Larger velocities = lower heat loads and higher discharges.
- Sub-surface exchange can trump all.
- Predictability is limited

Temperature Standard – Type N streams protection

Although salmonids do not inhabit type N streams, many type N streams are designated for cold-water use on DEQ's fish use designation maps (adopted by reference in OAR 340-041-0101 to 340-041-0340 and accessible on the DEQ website http://www.deq.state.or.us/wq/standards/WQStdsBeneficialUses.htm) because these streams flow into fish bearing waters downstream and thus support the fish uses that occur there. Also, there are likely to be other cold water aquatic organisms present. Therefore, the biologically based numeric criteria or natural conditions criterion apply unless a site specific criteria is adopted to replace them, or unless the use designation is changed via an EQC rulemaking.

In addition to the biologically based numeric criteria and the natural conditions criterion, the Oregon temperature standard contains a cold water protection criterion. This narrative criterion limits the amount of warming allowed due to human activity when stream temperatures are colder than the numeric criteria. This was an important component of the temperature standard for three reasons. First, the criteria are set at the upper end of the temperature range considered optimal for fish health and rearing, whereas access to waters at a variety of temperatures throughout their optimal range is considered most desirable and protective. Second, the colder water reaches provide refugia for fish when lower or warmer reaches exceed desired conditions for part of the day or part of the year. And third, the colder water reaches supply cold water to downstream reaches.

It is this third concern that is most relevant to non-fish bearing streams. If the colder water reaches are allowed to warm up to the numeric criteria, the added heat will be transferred downstream some distance (which will vary depending on individual stream characteristics). Any additional warming from either natural processes or additional human activity within that distance would cause an exceedance of the criterion downstream and the upstream heat load contributes to that exceedance. There is also an equity issue. If the fist activity high in a watershed is allowed to warm the stream up to the criterion, essentially using up all the assimilative capacity, this leaves no assimilative capacity for other activities and sources downstream.

The cold water protection criterion limits the allowed increase from all sources to 0.3 above the current ambient stream temperature at the point of maximum impact in a stream that contains salmon, steelhead or bull trout. This means that at no point along the stream should the cumulative impact of all anthropogenic activity cause the temperature to be raised more than 0.3°C. Typically there are multiple activities in a watershed that may contribute heat loading to the stream, including logging, roads, grazing, recreational facilities and rural residential development. Forest practices do not necessarily need to be set to meet the 0.3°C increase limit at the base of a clear cut on a type N stream, but they should likewise not be set under the assumption that one single clear cut is the only activity contributing heat to the fish bearing segment of the stream.

notes

Clean Water Act of 1972

- Objective: to restore and maintain the chemical, physical and biological integrity of the Nation's waters.

Purpose of Water Quality Standards

- **Set goals for the Nation's waters**
- **Regulatory basis for pollution control**
- **Protect the public health or welfare, enhance the quality of water and serve the purposes of this Act (CWA)**
- **Fully protect beneficial uses**

Beneficial Uses

- Drinking Water
- Industrial Use
- Irrigation and & Livestock Watering
- Aquatic Life
- Wildlife and Hunting
- Fishing and Boating
- Water Contact Recreation
- Aesthetic Quality
- Hydro Power
- Navigation and Transportation

WQS Parameters

- Bacteria
- Biological Criteria
- Dissolved Oxygen
- Nuisance Phytoplankton Growth
- pH
- Temperature
- Total Dissolved Gas
- Total Dissolved Solids (TDS)
- Toxic Substances
- Turbidity

Triennial Standards Review

- Use best scientific information available
- Numeric criteria set to protect the use of the water body
- Standards are set for wide application
- Local circumstances may be unique - when there is reliable evidence, a specific criteria supersedes the general

Technical Analysis

- Identify sensitive beneficial uses
- Determine needs of sensitive uses
- Identify levels that fully protect sensitive uses
- Create technical options for providing full protection

Use Not Supported	Some Impact	No Measurable Impact	Natural Condition

Policy Analysis

- Work with Policy Advisory Committee
- Evaluate impacts of technical options
  - to regulated community
  - to public
- Recommend level of protection desired, within legal sideboards of CWA, ESA
- Recommend standards to EQC

"Alaska" Rule/ EPA Approval

- Standards adopted or revised after May 2000, will not be effective for CWA purposes until approved by EPA
- States may apply standards more stringent than previous standards prior to approval

FOUR TYPES OF TEMPERATURE CRITERIA

- Biologically based numeric criteria
- Natural conditions narrative
- Existing cold water protection
- Site-specific criteria

COLD WATER PROTECTION

- Prevents cold streams from being warmed more than 0.3°C above the *current ambient stream* summer temperature
  - Fish need range of cold temperatures
  - Warming these reaches may lead to summer exceedance of criteria downstream
- Does not apply if no T/E species present, and cold water not required to meet criteria downstream
- Up to 1°C increase limit applies to spawning reaches in fall, winter and spring

Temperature Monitoring Conclusions: Based on ODF monitoring results and other studies, the following general conclusions can be made regarding forest harvesting and stream temperature, as it pertains to the water protection rules.

- For small, headwater streams, while stream temperatures can increase after harvest, there is the potential for temperature increases due to canopy removal to diminish within 500 feet downstream of the harvest activity (Caldwell et al. 1991). It should be noted, however, that magnitude of recovery of cooler temperatures in downstream shaded reaches is highly variable, and dependent on reach-specific heat exchange processes.

- For stream reaches through managed RMAs and RCRs on medium and large streams, Dent and Walsh (1997) found that 90 percent of the time, those streams that were monitored had temperatures at or below the 64°F numeric criteria. Dent and Walsh (1997) could not separate out the proportion of the temperature increase that is attributable to a partial decrease in shade versus the proportion that is attributable to any expected downstream increases in stream temperatures. Further study of the effects of RMA prescriptions and RCRs on stream temperatures with pre-harvest data and a basin-wide perspective is needed to more adequately estimate the range of harvesting effects on stream temperature. The Oregon Department of Forestry will be analyzing their complete temperature monitoring database in 2003. This may help address some of the unresolved issues.

Shade Monitoring Information

To the extent that current practices may result in changes in shade, thereby influencing stream temperatures due to change in solar radiation inputs to the stream, the ODF Technical Report on the Riparian Functions Study (ODF 2001a) provides some additional information relevant to FPA effectiveness (Figure 3). Findings from this study indicate that shade levels along large Type F streams are likely to remain relatively unchanged following harvest activities, where observed variations in shade are within the range of measurement error (± 10%). Most medium Type F streams also did not have changes in shade levels outside the range of measurement error, with only two out of eight sites resulting in shade reductions greater than 10 percent. A substantial proportion of the small Type F streams (four out of nine), exhibited shade reductions in excess of 10 percent in the year following harvest activity.

The ODF Shade Study (ODF 2001b) also provides some additional information relative to FPA effectiveness. (See Appendix I for additional information on this study.) It is important to note this study was not designed to compare pre- and post-harvest conditions, given the fact that data was collected over a single season. There is also a high degree of variability in site characteristics between some sites monitored in this study. Any attempt to draw specific conclusions about the importance of an individual riparian characteristic's influence on shade can be problematic. Despite these caveats, a qualitative comparison of shade conditions observed between site categories is presented in Table 5 and Figure 6 (ODF 2001b). The following are excerpts from the Shade Study final report:

"For those sites monitored in this study, shade was general[ly] lower on large streams than on small and medium streams. For unharvested streams[1], shade was lower on large streams than on small and medium streams by an average of 5% and 9% in the Blue Mountain and Coast Range Georegions, respectively. However, the small sample size and wide range in shade on large streams limits the explanatory power of stream size on shade [Table 5 and Figure 6]. There was considerable overlap between shade values over small and medium size streams for both harvested and unharvested streams in both georegions. Two extreme points are displayed in the box plots [Figure 6] for the harvested Blue Mountain and Coast Range streams. While the low shade value in the Coast Range may be explained by blowdown, there is no readily apparent reason for the extreme point in the Blue Mountains. . ."

"Average stream shade in harvested stands was 15% and 11% less than unharvested stands in the Blue Mountain and Coast Range Georegions, respectively. In the Blue Mountain Georegion, the average shade was 58% and 73% for harvested and unharvested streams, respectively. In the Coast Range Georegion, the average shade was 73% and 84% for harvested and unharvested streams, respectively. Differences in shade between harvested and unharvested reaches ranged from 44% lower to 6% greater and 38% lower to no difference in the Blue Mountain and Coast Range Georegions, respectively. Harvested stands also had greater variability than unharvested stands for both georegions. While the upper ranges of shade are comparable to unharvested stands, shade over streams adjacent to harvested stands had much lower minimum shade levels (-21%)."(ODF 2001b)

Cold-Water Refugia

Oregon forested watersheds exhibit a high degree of variability in water temperature. The existence of 'cold-water refugia' is an important component of salmonid habitat because they provide holding (resting) and rearing habitat for juveniles and adult fish. Types of cold-water refugia include, but are not limited to: tributary mouths; lateral seeps; pool bottom seeps; and groundwater-to-surface interaction zones (Bilby, 1984).

Bilby (1984) determined the mouths of tributaries in a western Washington stream (Thrash Creek) averaged 8.5°F lower than the average stream temperatures of the receiving waters fed by the tributaries. Cool water pockets located at tributary mouths of western Washington streams constituted less than 1.5 percent of the overall flow volume of the watershed, while cool water areas of all types accounted for approximately 2.9 percent of the total water volume (Bilby, 1984).

[1] "Unharvested" streams are defined in this study as having not been disturbed for at least 25 years and a maximum of 160 years. Fire may have been excluded from some of these stands, especially in the Blue Mountain region.

Table 1. Water quality parameters, applicable standards and/or criteria, and applicable FPA rule objectives. (See Appendix E and F for a complete description of the standards and criteria.)

<table>
<tr><th>Para-meter</th><th>Paraphrase of State Standards and/or Criteria</th><th>FPA Goals and Objectives</th></tr>
<tr><td>Temperature</td><td>Various numeric and narrative standards to protect beneficial uses.

OAR 340-41-(basin)(2)(b)</td><td>"The desired future condition for streamside areas along fish use streams is to grow and retain vegetation so that, over time, average conditions across the landscape become similar to those of mature streamside stands." OAR 629-640-0000(2)

"The desired future condition for streamside areas that do not have fish use is to have sufficient streamside vegetation to support functions and processes that are important to downstream fish use waters and domestic water use . . ." OAR 629-640-0000(4)</td></tr>
<tr><td>Sedimentation</td><td>The formation of [any] deposits deleterious to fish or other aquatic life or injurious to public health, recreation, or industry shall not be allowed.
Documentation should indicate that there are conditions that are deleterious to fish or other aquatic life.
OAR 340-41-(basin)(2)(j)</td><td rowspan="2">"The purpose of the road construction and maintenance rules is to . . . provide the maximum practical protection to maintain forest productivity, water quality, and fish and wildlife habitat." OAR 629-625-0000(3)

"The purpose of the harvesting rules is to establish standards for forest practices that will maintain the productivity of forestland, minimize soil and debris entering waters of the state, and protect wildlife and fish habitat." OAR 629-630-0000(3)</td></tr>
<tr><td>Turbidity</td><td>A systematic or persistent increase (of greater than 10%) in turbidity due to an operational activity that occurs on a persistent basis (e.g. dam release or irrigation return, etc).
OAR 340-41-(basin)(2)(c)</td></tr>
<tr><td>Habitat Modification</td><td>The creation of . . . conditions that are deleterious to fish or other aquatic life . . . shall not be allowed.
Documentation that habitat conditions are a significant limitation to fish or other aquatic life.
OAR 340-41-(basin)(2)(i)</td><td rowspan="2">"The desired future condition for streamside areas along fish use streams is to grow and retain vegetation so that, over time, average conditions across the landscape become similar to those of mature streamside stands." OAR 629-640-0000(2)

"The desired future condition for streamside areas that do not have fish use is to have sufficient streamside vegetation to support functions and processes that are important to downstream fish use waters and domestic water use . . ." OAR 629-640-0000(4)

"The purpose of the road construction and maintenance rules is to . . . provide the maximum practical protection to maintain forest productivity, water quality, and fish and wildlife habitat." OAR 629-625-0000(3)

"The purpose of the harvesting rules is to establish standards for forest practices that will maintain the productivity of forestland, minimize soil and debris entering waters of the state, and protect wildlife and fish habitat." OAR 629-630-0000(3)</td></tr>
<tr><td>Biological Criteria</td><td>Waters of the state shall be of sufficient quality to support aquatic species without detrimental changes in the resident biological communities.
OAR 340-41-027</td></tr>
</table>

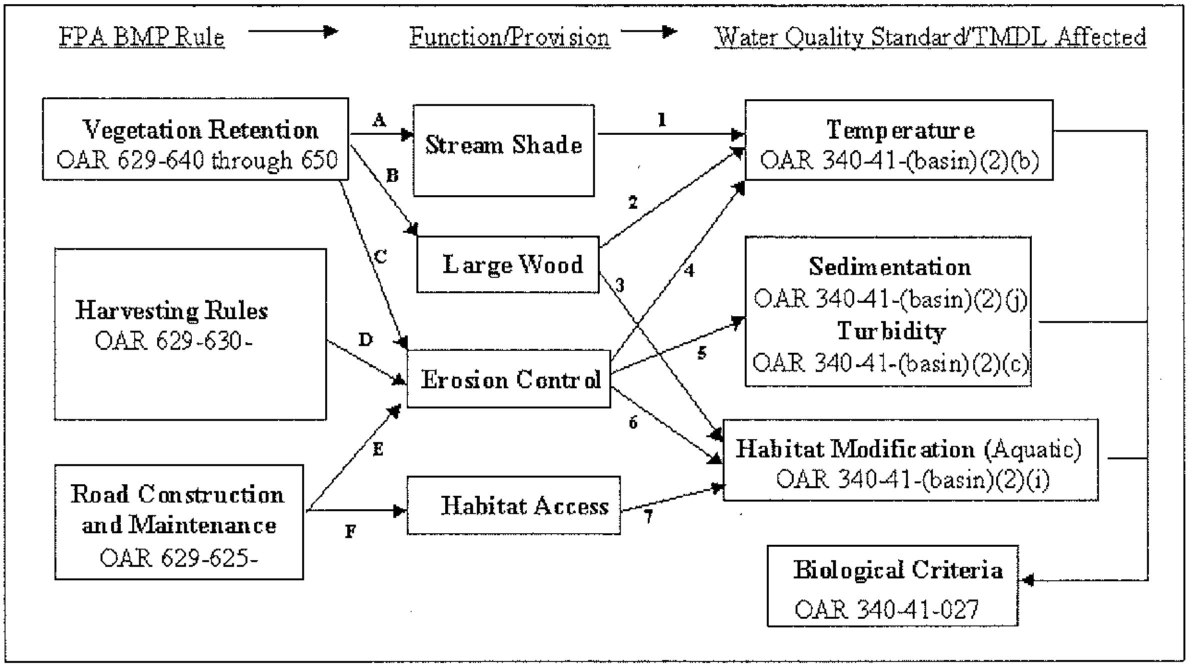


Figure 1. Water quality function pathways between the FPA and water quality criteria and standards.

Table 2. Overview of potential water-quality-protective functions related to forest practices (see Figure 1).

Flowchart Pathway	*Function/Provision Description for Specified Parameter*
	Water Temperature
A1	Retained trees and understory vegetation in riparian areas adjacent to streams provide shade to streams. Shade reduces heat loading from solar radiation at levels corresponding to the percent effective shade on the stream, and can attenuate diurnal maximum and minimum stream temperatures.
B2	Large wood, placed or fallen into streams from retained riparian vegetation and positioned in the stream channel, may increase the complexity of in-channel habitat, creating pools and riffles. Deep-water areas of cooler temperatures, or cold-water refugia, can also result from large wood in streams.
C4	Vegetation retention on banks can decrease channel bank erosion and prevent channel widening. Narrow channels receive less solar radiation and stream heating relative to wider channels (all else being equal).
D4, E4	Road construction and maintenance practices that minimize sediment inputs to streams, such as location, drainage control, hard surfacing, and choice of hauling time, may prevent channel widening and temperature increases as described in C4.
	Sedimentation and Turbidity
C5	Vegetation retention on banks can decrease channel bank erosion, decreasing sediment inputs.
D5, E5	Road construction and maintenance practices that minimize sediment inputs to streams, such as location, drainage control, hard surfacing, and choice of hauling time, reduce undesirable levels of sediment and turbidity inputs.
	Habitat Modification
B3	Tree retention in riparian areas may provide future recruitment of large wood to streams. Historically, large wood in channels recruited from fallen trees has been a valuable component of aquatic habitat. Managed placement of large wood can be an effective means to accelerate inputs.
C6, D6	Large wood, placed or fallen into or near streams from retained riparian vegetation may serve to trap sediments in place, influencing habitat quality.
E6	The movement of large wood and sediment downstream is an important function that provides for, and maintains, fish habitat. Stream crossings that are designed to accommodate this function can have a positive influence on habitat quality.
F7	Culverts that block fish passage reduce the amount of fish habitat available.
	Biological Criteria
Interrelated	Forest practices that influence water quality with respect to temperature, sedimentation, turbidity, and habitat modification may also affect biotic populations with respect to the biological criteria standard.

notes

STIMSON LUMBER COMPANY'S TILLAMOOK TREE FARM

Stimson Lumber Company is a privately owned company that traces its roots back to the 1850s, making it one of the oldest, continuously operated forest products companies in the United States. Stimson's corporate office is located in Portland and has operations in Oregon, Washington, Idaho and Montana. Stimson has a long tradition of responsible forest management and is committed to the practice of sustainable forestry. To further this commitment, we support the comprehensive program of forestry and conservations practices called the Sustained Forestry Initiative (SFI^{sm}) program. The SFI program defines how the forest and related resources shall be sustained. For example, the SFI program requires protection of water and air quality, prompt reforestation after harvest, promoting wildlife conservation, and continuously improving our practices and forest management activities to ensure long-term forest productivity and usage. To ensure these resources are protected, the program has specific requirements that must be met in order for a landowner or company to prove compliance. Stimson has undergone a number of audits by independent, third-party auditors to verify that we are in compliance with the principles and objectives of the SFI program. Stimson Lumber Company purchased the 26,000-acre Tillamook Tree Farm in the fall of 2002 from Weyerhaeuser Corp. and this property was included in our 2003 SFI audit.

Stimson Lumber Company takes an active role in improving fish habitat and voluntary replacing and up-grading fish passing pipes. Since acquiring this Tillamook tract, Stimson has voluntary replaced approximately 20 culverts that were blocking fish passage. As part of their yearly management plans and company policies Stimson Lumber Company actively identifies fish blockages from past practices and restores fish habitat across their ownership through replacing pipes, creating structure, leave tree retention, and excellent riparian management practices. As an on going part of the commitment to the SFI program, the Salmon Recovery Plan and Stimson's long-standing stewardship philosophy, we are currently scheduled to replace over 600 relief and fish-friendly culverts over the next five years on the Tillamook Tree Farm. The estimated cost is approximately $150,000 to $200,000 per year. As a whole, the company has been actively replacing culverts on their lands for the last ten years and has completed over 90% of their lands in Oregon.

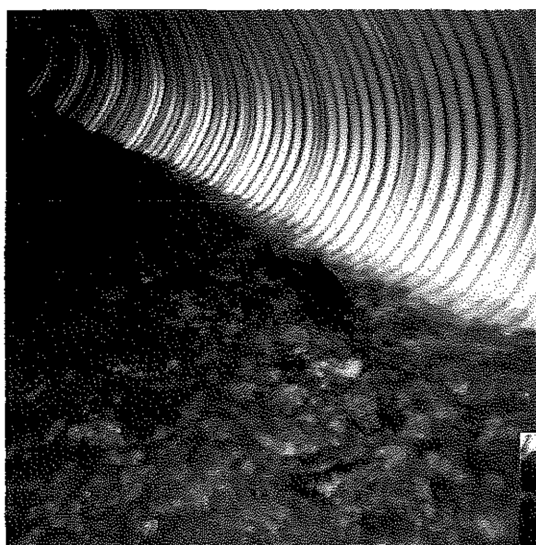
At this location two old pipes were a significant fish impediment and barrier. Both of the old pipes were undersized and had outlet drops in excess of 7 plus feet, not allowing fish to pass into the upper reaches of the Tillamook River System. These two pipes had been blocking fish passage for trout and salmon species for almost 2 decades.

The old existing pipes were approximately 60 and 48 inches in diameter and not adequate for the 50-year flood event or fish passage. In 2001, Willamette Industries replaced the first pipe with a 114 inch diameter by 100 feet long structure, which is twice a big as the previous. The second pipe was replaced with a 84 inch by 90 feet pipe, again twice as big as the previous pipe. The extremely large pipes accomplish two objectives. First, the pipes are large enough to pass a 100-year flood event and secondly, both pipes were counter sunk so they could develop a "natural bottom" making fish use for both adults and juveniles outstanding.

Willamette Industries forest road engineer who designed the layout of the pipes specifically for fish use was in consultation with the ODF Stewardship Forester and ODFW. The installation of the fish pipes was in accordance with the Fish Passage Guidance and the overall goal being to increase access into the upper reaches of the Tillamook River System. By voluntary replacing and up-grading these pipes it opened up additional spawning habitat for adult salmon and trout species.

Success Story: Within the first month of installation adult salmon were able to pass through both of the newly installed pipes and spawn in the upper end of the Tillamook river system, something that had not been done in the previous decades. The installation of these two pipes opened up approximately 1.25 miles of new spawning beds. Lampreys, a species not present before the installation of the new pipes, now are present in upper reaches of the Tillamook River.

Four years later, another voluntary "fish friendly" pipe was replaced in the Tillamook River system on this property. This installation took place approximately a half mile up stream from the first two and was also impeding fish passage. Once again, within the first two weeks adult Salmon were able to pass through the newly installed fish pipe and access another three quarters of a mile of new spawning ground. The operator's received letters of accommodation for their installation of the new fish pipes. Also, Stimson Lumber Company was recognized for its outstanding management practices, stream enhancement, and fish passage and was nominated for a Landowner Stewardship award in 2004.



Oregon Plan Accomplishments*

Road Erosion and Risk Project

Industrial & Non-industrial Landowner Reported Projects

Year	Road Miles Surveyed	Road Miles Improved	Vacated	Closed	Relocated	Peak Flow	Surface Drainage	Fish Passage
1997	2684	309	12	17	.81	492	999	140
1998	6828	382	17	32	.83	894	2064	214
1999	3694	465	57	36	1.46	1074	2301	210
2000	1096	403	28	62	.96	1109	2752	180
2001	855	377	30	55	1.00	1068	2570	196
2002	418	376	21	20	.44	1150	2307	133
2003	654	199	5	28	.28	450	1088	91

Definition of Terms

Surveyed	Protocol has been developed in a joint effort among ODFW, OSU, ODF and OFIC. The protocol addresses risks from road surface, fill and cut slopes, and stream crossing structures. Training on protocol was provided in 1997.
Improved	Road associated landslide & debris flow stabilization.
Vacated	Roads reclaimed. Can range from only grading & seeding to complete reclamation to 'original contour'.
Closed	Roads closed to eliminate deterioration due to traffic.
Relocated	Miles of roads relocated outside RMA or stream banks or to reduce washout potential.
Peak Flow	Structures installed to meet 50+ year peak flow requirements
Surface Drainage	Cross-drains or culverts installed to improve sediment filtration. Includes erosion protection of outlets & road surface.
Fish Passage	Road/Stream crossings improved for juvenile & adult fish passage, side channel access, fish ladders, removal of push-up dams, &/or fish screens installed.

*Figures courtesy of Oregon Watershed Enhancement Board's Watershed Restoration Inventory database. Numbers reflect work that was voluntarily done.

Oregon Plan Accomplishments*

Riparian Management & Instream Habitat Projects

Industrial & Non-industrial Landowner Reported Projects

Year	Riparian Management	Conifer Restoration	Place Large Wood
1997	139	20	76
1998	173	11	92
1999	242	15	50
2000	233	4	57
2001	253	4	26
2002	196	2	39
2003	201	1	24

**Only one of the reported riparian management activities was conducted by a non-industrial landowner.

Project Descriptions

Riparian Management:	
• **Additional Conifer Retention on Fish Streams**	**Speed the rate the desired future condition is reached to provide large wood and other riparian functions – no more than 25% basal area exceeding the standard target is harvested.**
• **Increase RMA on Small Non-Fish Streams**	**Establish 20-foot RMA to increase potential large wood delivery to fish bearing streams**
• **Leave Tree Placement & Additional Voluntary Retention**	**Landowner opts to leave more than the required 25% of leave trees within the RMA.**
• **Voluntary No-Harvest RMA**	**Landowner elects to not harvest within the RMA even though the FPA allows harvesting to occur.**
Conifer Restoration	**Establish conifers where conifers are preferred for long-term habitat needs.**
Place Large Wood	**Place large wood in stream during harvest operations to provide immediate habitat benefits in economically efficient manner.**

Fish Passage Requirements: Overview

Since August 2001, the owner or operator of an artificial obstruction located in waters in which native migratory fish are currently or were historically present must address fish passage requirements prior to certain trigger events. Laws regarding fish passage may be found in ORS 509.580 through 910 and in OAR 635, Division 412.

Trigger events include installation, major replacement, a fundamental change in permit status (e.g., new water right, renewed hydroelectric license), or abandonment of the artificial obstruction. Further details concerning triggers can be requested from the Oregon Department of Fish and Wildlife (ODFW).

Native migratory fish include native salmon, trout, lamprey, sturgeon, and suckers, as well as a few other species. It is ODFW's responsibility to determine the current or historical presence of native migratory fish; for streams lacking data this determination may be based on professional judgement. If the owner/operator knows that native migratory fish are or were present at the site, then the owner/operator does not need to contact ODFW for this determination and may proceed with meeting fish passage requirements on their own information. However, if the owner/operator does not think native migratory fish are or were present, or is unsure of presence, ODFW should be contacted to make the determination.

Addressing fish passage requirements entails the owner/operator obtaining from ODFW: 1) approval for a passage plan when passage will be provided, 2) a waiver from providing passage, or 3) an exemption from providing passage. It is the intent of state fish passage laws (ORS 509.585(1)) that, in most cases, option #1 should be sought and passage should be provided at the artificial obstruction.

Note that complying with ODFW's fish passage requirements is likely not the only regulatory approval needed to perform many actions at or in relation to an artificial obstruction. Oregon Department of State Lands, Oregon Water Resources Department, US Army Corps of Engineers, NOAA Fisheries, other ODFW sections (e.g., habitat and fish salvage), or other local, state, or federal agencies may also have permits or requirements which must be met.

Stop Three – Recovery Following Harvest

- 82 acre harvest – Weyerhaeuser Corp.
- Logged 2001
- Planted spring 2002

Key Policy Implications of the White Paper - Forest Practices "Protection" on Forestlands in a Context of Dynamic Ecosystems

It may be ironic that we describe forests within a context of disturbance, followed by "recovery" through succession to mature forest. In my ongoing evolution of thought on this matter, I am beginning to think that it is just as reasonable to view disturbance as the "recovery." In any case, terms like protection and recovery reinforce the thought processes that have created and maintained a static view of forests and reinforce the view that protection means preventing change. There is a very strong and legitimate ongoing scientific debate around this issue. There is a lot of research that is pointing the way to a paradigm shift. However, the process to collect and synthesize this research and to force meaningful dialogue has not yet occurred. Creating the scientific foundation for this change is critical and strong leadership is needed. Both the Department and Board will need to work with OSU College of Forestry to help create the conditions for building the necessary scientific foundation.

From a policy perspective, the Board of Forestry has a unique responsibility to seek cost-effective resource protection solutions. Trying to emulate the "historic range of natural conditions" on private forestlands is no longer possible or likely desirable given their roles. Thus, an alternative way to view protection is to, consistent with the applicable land management objectives, emulate key functions and processes, or subsets of key functions and processes, as is determined to be necessary to adequately maintain fish habitat and water quality. With this in mind, vegetation can be retained more efficiently if retention emphasizes specific locations where disturbance will occur and where interaction with the vegetation and disturbance events will do the most good for habitat values. Retention should also have in mind production of trees with adequate size based upon the type of disturbance interaction, likely functions and depletion rates. We probably have or will soon have the technical tools to better retain vegetation with these objectives in mind. Both active and passive approaches are legitimate methods in the private forestland setting and some processes may be more efficiently maintained through active management or from the more "engineered perspective." However, these approaches are much more complex than the current forest practice rules. Since we do not know yet what is "adequate" or what will be effective in the longer-term we should seek out forest managers willing to apply different approaches and apply research or monitoring requirements.

Listed below are additional conclusions and specific recommendations.

1. We should work with OSU College of Forestry and others to create and implement a process to build the scientific foundation necessary to support policy and technical changes that improve consistency of forest practices and forest management with the concepts of dynamic forest ecosystems and "primary purpose". Tools are also needed to: (a) better analyze short- and long-term risks; and (b) better analyze, at different scales, how well the different forest ownerships integrate to provide necessary resource protection.

2. It is important to recognize that considerable intellectual and scientific "horsepower" will be needed to think out of the box and avoid falling back into the more comfortable approach of "protection means preventing change."

3. The different roles that federal, state and private lands should play in "overall maintenance" of fish and wildlife when determining the degree that forest practices on private lands should contribute to the overall maintenance, or with maintenance of specific resource sites, should be better described in forest practice statutes.

4. To be successful in making changes to implementation of forest practices, we will need to consider the existing limitations of current overarching policies, especially the ESA, CWA and resultant water quality standards. In this context, protection means, "limit disturbance." The challenge of these limitations should not be underestimated. To begin to address these limitations, the "dynamic ecosystem" and "primary purpose of the land" concepts needs to be better promoted as state conservation policy and, especially, as federal policy.

5. Wildfire, the dominant "natural" change agent is not acceptable in wood production, urban and some multi-resource forests, i.e., managed forests. Managed forests do not have an analog for severe stand replacement fires or most other fire regimes. Managed forests also are by policy meeting a different purpose than emulation of natural conditions. There is no analog in nature for 50-year rotations and riparian buffers. Thus, managed forest cannot reasonably be expected under current policies to emulate all or even most natural conditions.

6. Practices on managed forests that do not emulate natural conditions or that result in changes to delivery of functions and processes cannot be considered failures because those are not the primary purposes for those forests. However, research is needed to document that the modified processes compatible in managed forests will appropriately maintain fish and wildlife. The Hinkle Creek Paired watershed study and its replications are critical in this effort. Hinkle Creek and other sites need to be used to experiment with different designs and approaches to riparian and aquatic ecosystem protection. At this point in time, investments in Hinkle Creek style research appear to be a better use of resources than arguing about incremental increases to riparian protection. Nonetheless, we need to be humble by acknowledging that managed forests are an adaptive experiment.

7. New incentive tools to encourage private landowners to actively manage riparian areas may be needed. Forest Practices Monitoring shows that the majority of landowners are not entering riparian areas along fish-use streams, under current rules. A new, disturbance-based approach to long term resource maintenance cannot be successful without landowners and operators actively engaged in it. To this end, "canned" site-specific prescriptions may be necessary to assist landowners to try alternative practices when site conditions are appropriate. These canned prescriptions could address such other factors as inner gorges, slope, unstable sites, floodplain and terrace configuration.

8. The existing water protection system is generally functioning well. Monitoring data indicate high levels of compliance and outcomes consistent with protection objectives. Nonetheless, the system is dominated by limiting disturbance in riparian areas. Thus, we fundamentally need to change viewing resource protection as trying to prevent disturbance. While there is logic for not accelerating some types of disturbance; e.g., the rate of landslides due to some forest practices, there is an equal logic that we need to be "causing" disturbance (landslides) in some locations, possibly by loading the sites with wood. Similarly, in most cases wind throw of buffers should not be viewed as a failure. Alternatively, retaining standing buffers may not always be the best approach. It may be better to allow felling or pulling trees into a ('transport") channel to mimic a disturbance pulse, while allowing enough disturbances to permit reforestation.

9. Applying resource protection based on the concept of a desired future condition for riparian vegetation as described dominantly by conifer basal area is probably an inadequate concept. Key processes need to be considered and maintained. Key processes will be different in different regions of the state. Upslope processes for delivery of wood and sediment are highly important in some regions. Moderate to large pulses that are a combination of downed wood and sediment are needed in many areas for both protection and restoration.

10. A broader range of desired conditions for stands and landscapes that can be applied on a site-specific basis appears highly desirable. As stated above, to implement such a system may require a range of "canned prescriptions" based upon stand type and existing conditions. Riparian foresters may be required to help landowners implement such a system. A mix of desired future conditions along with some form of PFC or other assessment may be useful at the site and watershed level to implement or develop site-specific prescriptions.

11. Approaches such as "stewardship agreements" may be useful tools to provide landowners a watershed framework for implementing a range of alternative riparian protection strategies.

12. Tools are developed that can allow us to prioritize locations that have a high probability of delivery of sediment and wood from upslope sources to areas with high fish habitat potential. These tools might allow a remix of trees currently allocated for retention along streams to be better allocated elsewhere.

13. While this paper provides a starting point for a technical and intellectual basis for making modifications to forest practice program implementation, it is just a start and this work requires critical evaluation and discussion.

State of Oregon
Department of Environmental Quality

Tillamook Bay Watershed

(Portions extracted from "Tillamook Bay Environmental Characterization: A Scientific and Technical Summary", Tillamook Bay National Estuary Project, July 1998)

WATER QUALITY CONCERNS: The federal Clean Water Act (CWA) requires each state to undertake specific activities to protect the quality of their rivers, estuaries and lakes. DEQ is required to develop and implement water quality standards that protect sensitive beneficial uses of waters throughout Oregon. Section 303(d) of the CWA requires each state to develop a list of waters that do not meet the water quality standards. These are called Water Quality Limited waters. The Tillamook Bay Watershed was included as Water Quality Limited for Temperature and Bacteria on the 1998 303(d) list. The number of segments and parameters that exceed water quality standards in the Tillamook Watershed are summarized below. In addition, sedimentation is a parameter of concern throughout the basin and several sloughs in the lower watershed have low dissolved oxygen levels. For more information on streams that are listed in the Tillamook watershed, go to: http://waterquality.deq.state.or.us/WQLData/SubBasinList98.asp.

Water Quality Limited Waters in Tillamook (from 1998 303(d) List)	
Total Number of Water Bodies Listed	20
Parameter	**Number of Segments Listed**
Bacteria	15
Temperature	12

Total Maximum Daily Loads: The CWA further requires DEQ to develop Total Maximum Daily Loads (TMDLs) for all water quality limited waters. Generally speaking, TMDLs define the maximum amount of controllable impacts a water body can accept and still assure that designated beneficial uses are being adequately protected. DEQ has developed TMDLs for temperature and bacteria in the Tillamook Bay Watershed. These were approved by EPA on July 31, 2001.

Available Documents:
Tillamook Bay Watershed Total Maximum Daily Load and Water Quality Management Plan
Tillamook TMDL Appendices
Response to Public Comments Document
Fact Sheet: Implementation and Enforcement of TMDLs
Fact Sheet: Tillamook Bay Watershed Bacteria TMDL
Fact Sheet: Tillamook Bay Watershed Temperature TMDL

DEQ Tillamook Basin Coordinator: Please contact the following people for more information about the Department's efforts in the Tillamook watershed:

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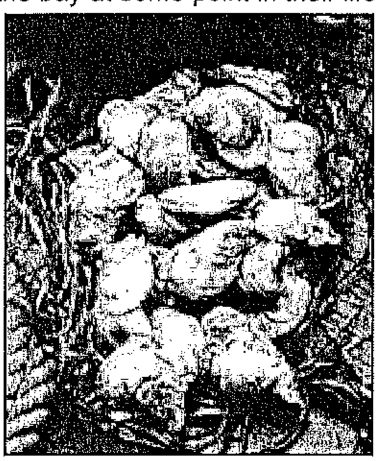
THE SETTING:

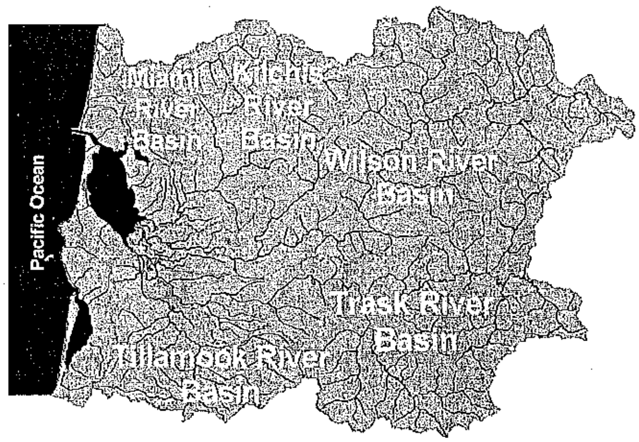
Tillamook Bay and its Uses: Tillamook Bay is a small, shallow estuary about 60 miles west of Portland on the Oregon Coast. Approximately 6.2 miles long and 2.1 miles wide, the Bay averages only 6.6 feet depth. At low tide, about 50% of the bottom is exposed as intertidal mud flats.

Since the first European settlements in the 1850's, humans have altered the estuary and surrounding watershed. Heavy sediment loads convinced the U.S. Army Corp of Engineers to abandon its activities in the southern end of the bay shortly after the turn of the century. The last ocean-bound ship left the town of Tillamook in 1912 and today only the Port of Garibaldi, at the northern end of the bay, serves deep-water traffic. However, for recreational boating, the Tillamook watershed is ranked second to the Rogue River system in the amount of income generated by recreational fishing in coastal watersheds, the most widely used bay in Oregon, and the sixth most-used waterbody statewide. Virtually all of the boating visitor-days are spent fishing.

The bay provides habitat for numerous fish, shellfish, crabs, birds, seals and sea grasses. 53 species of fish have been identified in the bay at various times of the year. Five species of anadromous salmon use the bay at some point in their life cycle.



Oysters have been grown commercially in Tillamook Bay since the 1930s. Tillamook Bay has been one of the leading oyster producing bays in Oregon, with an average annual production of about 21,200 shucked gallons during the 1970s and 1980s. Beginning in 1990, the level of production dropped off sharply and has remained low due to reduced production by several Oyster Companies. Reductions in oyster production have resulted from business closures, bacterial contamination of the beds where they are grown, flooding, siltation and infestations of burrowing shrimp. Some years, shellfish beds are closed to harvest for commercial sale for more than 100 days due to risk of bacterial contamination.



The Rivers and their Uses: Five rivers enter Tillamook Bay from the south, east and north – Tillamook, Trask, Wilson, Kilchis and Miami. These rivers still provide some of the West Coast's most productive fishing. The Tillamook Watershed is home to Summer and Winter Steelhead, Coho, Chum, Spring and Fall Chinook and sea-run Cutthroat Trout. Coho Salmon are currently listed as threatened by the National Marine Fisheries Service under the Endangered Species Act and Coastal Cutthroat are currently candidates being considered by the U.S. Fish and Wildlife Service. These fish are generally in decline in the basin and have been lost from some tributaries due to a variety of factors that also include changes in habitat and water quality.

The Upper Watershed and its Uses: The Tillamook Watershed is part of the coastal, temperate rain forest ecosystem. With a mean annual precipitation around 90 inches per year in the lower basin and close to 200 inches per year in the uplands, the watershed's coniferous forests – with trees such as Douglas fir, true fir, spruce, cedar and hemlock – cover about 89% of the total land area. Hardwood species such as alder and maple grow throughout, especially as second growth in riparian areas.

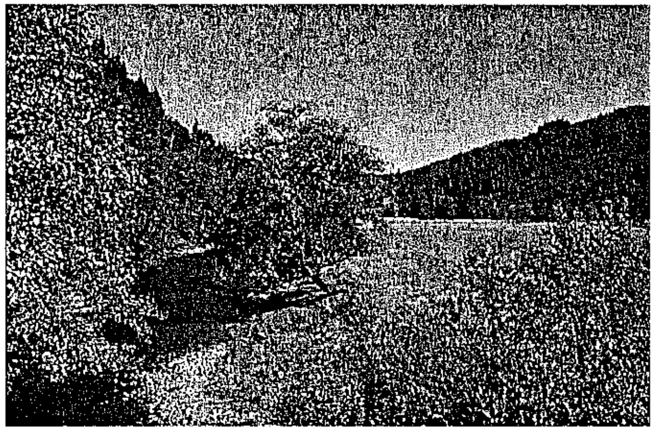
The Tillamook Burn, a series of forest fires from 1933-1951, affected the use of forestlands in the region. The fires killed about 200,000 acres of old-growth timber in the Wilson and Trask River watersheds. Road building followed the fires, for salvage logging, fire protection and replanting purposes. Much of the upper watershed (64%) is deeded to the State and managed by the Oregon Department of Forestry as the Tillamook State Forest.

Since 1960, most timber harvesting in the basin has occurred on private and federal lands because the state trust lands replanted after the burns are still developing into mature, harvestable stands. The timber products industry generated 11% ($37 million) of Tillamook County personal income in 1993. Harvest rates and forestry-related employment in Tillamook County are expected to rise over the next 25 years as stands reach harvestable age. Two-thirds of the proceeds from State Trust land timber harvesting is distributed among county schools (73%), general fund (22%) and other taxing districts (5%).

Recreation (camping, hunting, hiking, biking and off-road vehicle usage) is popular, especially given the proximity to the Portland metropolitan area, and is increasing. The Tillamook State Forest represents 1/3 of the acreage available for riding in the entire State.

The Lower Watershed and its Uses: In the lower watershed, forest gives way to rich alluvial plains, which are used primarily for dairy agriculture. About 6.5% of the basin is agricultural, 1.5% is urban or rural development (approximately 23,300 people live in Tillamook County (1995)) and the remaining 3% is covered by water.

Early settlers recognized the rich agricultural potential of the lowlands and drained the area with numerous dikes, levees and ditches. Once characterized by tree-lined meandering rivers and networks of small channels that provided fish habitat, woody debris and organic matter, the lowlands now support about 28,600 dairy cattle (Pedersen, B. 1998) and produce about 95% of Oregon's cheese. In 1995, agricultural commodity sales from Tillamook County totaled $75.8 million with dairy products generating 82% of the county's agricultural income. While the total number of dairy farms has declined since the 1940s (e.g. 30% decline from 1977 to 1993) due to conversion and combination of small farms to larger commercial farms, milk production among the Tillamook county Creamery Association (TCCA) has increased (e.g. 60% increase between 1984 and 1995).



<u>Some Actions Addressing Water Quality in the Tillamook Watershed:</u>

<u>Tillamook Performance Partnership:</u> In 1992, EPA designated Tillamook Bay as an estuary of national significance and included it in the National Estuary Program (NEP). A Comprehensive Conservation and Management Plan (CCMP) was developed for the basin and approved by EPA in December 1999. The CCMP lays out 62 specific actions that will address and solve the most significant environmental problems in the Tillamook Bay Watershed. These 62 actions relate to four-priority problems and citizen involvement: Habitat Loss and Simplification; Water Quality; Erosion and Sedimentation; and Flooding. For further information, see the NEP website: http://www.co.tillamook.or.us/countygovernment/estuary/tbnep/nephome.html.

The Tillamook County Performance Partnership was formed to track and help implement the plan. The Partnership is a group of 120 members representing community leaders, state and federal agencies, citizens, industries and municipalities. For more information, see the Tillamook County Performance Partnership website: http://www.co.tillamook.or.us/countygovernment/Estuary/TCPP/performance.html.

The Partnership is an active part of the Oregon Plan (http://www.oregon-plan.org/) and works activity with the Tillamook Watershed Council.

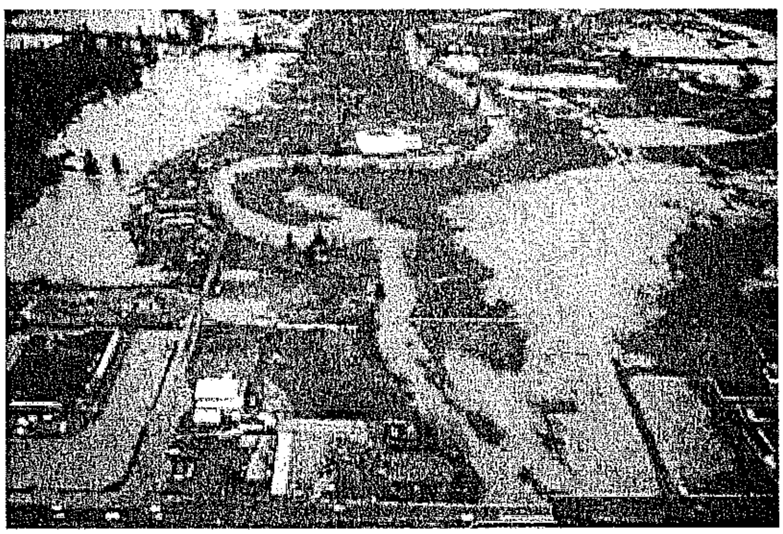
<u>Upper Watershed – Forestry:</u> Legacy practices (prior to the Forest Practices Act) from log drives, splash dams, widespread clear-cutting of timber stands and salvage logging after the Tillamook Burn led to serious erosion, sedimentation and channel modification. Roads built in the 1950's to salvage timber are still the largest potential cause of erosion and sedimentation. During severe storm events, old culverts and roads may fail possibly leading to significant erosion and major sedimentation. In addition, old culverts bar the passage of salmon.

ODF has put a large effort into improving the roads in the Tillamook State Forest (for example, it spent a record $3.6 million on road improvements in 1995). The Tillamook State Forest is currently developing a Habitat Conservation Plan that should address both endangered species and water quality issues as well as provide a sustainable yield of timber from the forest. For more information, see the Tillamook State Forest website: http://www.odf.state.or.us/TSF/TSFhome.htm.

<u>Lower Watershed – Agricultural and Urban Impacts:</u> The most obvious potential water quality impact of the dairies is from the manure. Manure can enter the rivers, streams, sloughs and ditches directly from cows or via runoff from pastures on which manure has been spread. A typical cow can produce 7-20 tons of manure annually and with approximately 90 inches of rainfall and about 28,600 dairy cattle, there is a high risk of contamination. Other sources of bacteria include sewage treatment facilities and on-site septic systems. Reductions in all of these sources will be needed to achieve bacterial standards for the bay. In addition, many streams in the lower watershed have limited shading due to alterations in the riparian area.

In 1981 the Tillamook Watershed received funding through the Rural Clean Water Program (RCWP) as part of a national effort to help clean up agricultural wastes. The RCWP covered 23,540 acres and provided funding to install such best management practices as manure storage facilities, roofing, gutters, fencing and other management practices on farms. In addition, there have been many efforts in recent years to fence and improve riparian and stream habitat sponsored by DEQ, ODFW, OWEB, TCCA and participants in the Hire-the-Fisherman program.

The North Coast Basin Agricultural Water Quality Management Area Plan (SB1010 Plan) was developed and went into rule in 2000. In addition, Tillamook County is reviewing its Riparian Ordinance. Tillamook County recently found an area with a high failure rate of on-site sewage systems and will either extend sewers to the area or require corrections. For more information, see the Tillamook County Soil & Water Conservation website:
http://www.tbcc.cc.or.us/~tcwrc/swcd ODA Natural Resources Division website:
http://www.oda.state.or.us/nrd/water_quality/areapr.html or the Tillamook County website:
http://www.co.tillamook.or.us/.



Other Challenges: Flooding has been an on-going concern in Tillamook County. In the aftermath of the 1996 flood, Tillamook County produced a comprehensive Flood Hazard Mitigation Plan that provides a comprehensive strategy for reducing the flood hazards in Tillamook County.

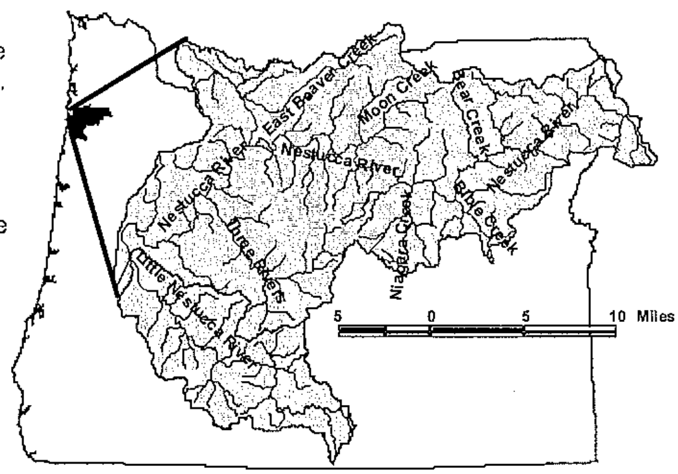
Management efforts will need to satisfy multiple objectives: to reduce flood-related hazards and damages, while minimizing the potential long-term environmental impacts and economic costs of flood control and flood plain management practices. Some flood control practices, such as the use of structural measures such as dikes, levees and dredging, may conflict with various resource management plans and would involve regulatory approvals. The North Coast Community Solutions Team, an inter-agency group of managers that meet on a frequent basis, is examining flood control in the Tillamook Basin in an attempt to reduce potential regulatory conflicts. For more information, see the U.S. Army Corp of Engineer website: http://usace.co.tillamook.or.us/.

State of Oregon
Department of
Environmental
Quality

Nestucca Bay Watershed TMDLs and Water Quality Management Plan

Where is the Nestucca Bay Watershed?

The Nestucca River runs mostly east to west through southern Tillamook County. The river is about 50 miles long and receives water from many tributaries in the steep coast range before running through lower gradient lands on its way to Nestucca Bay and the Pacific Ocean. The Little Nestucca River also drains to Nestucca Bay.



The Nestucca Bay Watershed encompasses approximately 370 square miles that are largely covered by forests. Lowland areas where the river valley widens have been turned largely to agricultural purposes (mostly livestock). The watershed is contained mostly in Tillamook County, but a small area at the headwaters of the Nestucca River is in Yamhill County and the uppermost reaches of the Little Nestucca River pass through Yamhill and Polk Counties. Major rivers in the watershed are the Nestucca, Little Nestucca, Three Rivers, and Beaver Creek. These surface waters and all other tributaries that ultimately flow to Nestucca Bay are within Hydrologic Unit Codes (USGS) 1710020301 and 1710020302, subbasins within the same basin that includes rivers that flow to Tillamook Bay.

What pollutants are being addressed in this series of TMDLs?

The Clean Water Act requires that the State of Oregon list surface waters that do not meet water quality standards adopted to protect legally defined beneficial uses. Information collected in the basin over the years indicates that some surface waters are water quality limited in three ways: many reaches are too warm to protect salmon and trout; some reaches have excessive fine sediments in their streambeds, which also can harm salmon and trout; and fecal bacteria concentrations in Nestucca Bay are occasionally too high to protect human consumption of shellfish harvested from the Bay (**Table 1**).

Table 1. Water bodies in the Nestucca Bay Watershed listed as water quality limited under section 303(d) of CWQ (DEQ 1998)

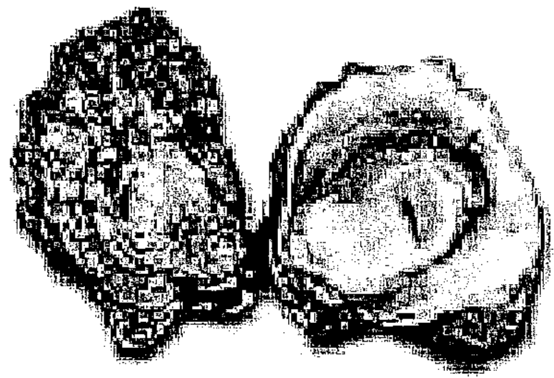
Waterbody Name	Boundaries	Parameter	Criteria	Season
Niagara Creek	Mouth to Headwaters	Temperature	Rearing 64 F (17.8 C)	Summer
Powder Creek	Mouth to Headwaters	Temperature	Rearing 64 F (17.8 C)	Summer
Nestucca River	Mouth to Powder Creek	Temperature	Rearing 64 F (17.8 C)	Summer
Nestucca Bay	Bay	Bacteria (fecal coliform)	Marine and shellfish growing area	Year Around
Beaver Creek, East Fork	Mouth to Headwaters	Sedimentation	Narrative	Year Around
Nestucca River	Powder Creek to Headwaters	Sedimentation	Narrative	Year Around
Beaver Creek, East Fork	Mouth to Headwaters	Habitat Modification	Narrative	Year Around
Nestucca River	Powder Creek to Headwaters	Habitat Modification	Narrative	Year Around
Nestucca River	Mouth to Powder Creek	Flow Modification	Narrative	Year Around

Temperature

In the Rivers, the migration, rearing and spawning of salmonid (salmon and trout) fish are put at risk by high water temperatures (those that exceed 64°F for migration and rearing, or 55°F for spawning) in the summer. In the Nestucca Bay Watershed, 41.5 miles of surface waters were listed as water quality limited for temperature. These water bodies included Powder Creek, Niagara River, and Nestucca River downstream of Powder Creek. Sources of temperature in these streams are primarily from solar radiation that hits the surface of the water due to the widespread removal of riparian vegetation. Although there are three wastewater treatment plants in the watershed, flows from these facilities have a relatively small impact.

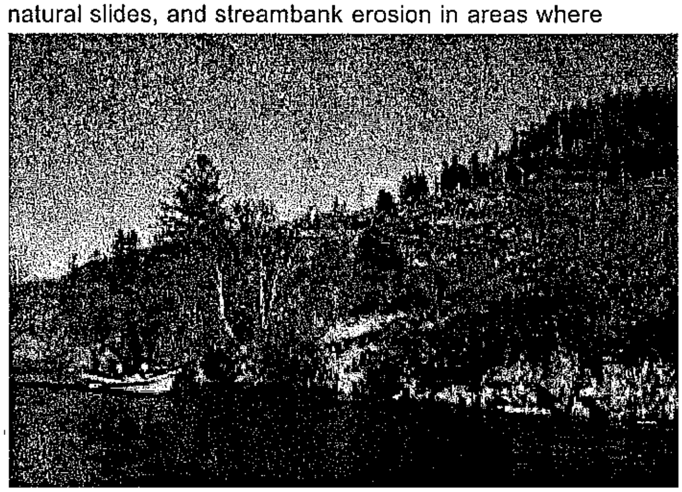
Bacteria

Shellfish harvesting in Nestucca Bay is dependent on waters with minimal concentrations of fecal bacteria. Fecal coliform bacteria in concentrations exceeding a log mean of 14 MPN/100 ml ("most probable number per 100 ml of sample") or when more than 10% of samples have concentrations exceeding 43 MPN/100 ml) cause excessive risk for consumption of shellfish by humans. Bacteria in the rivers are the primary source of the impairment of Bay waters, which support recreational shellfish harvesting. The principal sources of fecal bacteria in the watershed are runoff from livestock operations, urban runoff, rural residential runoff, an undetermined number of failing septic systems in the watershed, and wastewater treatment plant discharges. Due to the relative area under livestock management, this use has a larger impact on water quality. Wildlife in the watershed probably provide a relatively low contribution to fecal bacterial loads except in areas surrounding the Bay itself, where concentrations of waterfowl may have a significant effect.



Sedimentation

The upper reaches of the Nestucca River (above Powder Creek) and East Beaver Creek (a total of 34.3 miles of streams) are listed as impaired due to excessive sedimentation. Excessive sedimentation can result in streambeds that are unsuitable for spawning of salmonid fishes. There is not a numeric criterion defining excessive sedimentation, although the State of Oregon does have a narrative standard barring accumulation of deposits that would make the streambed unsuitable for support of beneficial uses. Excessive sedimentation is principally from poorly constructed or maintained forest roads, natural slides, and streambank erosion in areas where riparian vegetation has been removed. Road-building techniques and forest management practices have been improved in the last decade with the implementation of new rules under the Northwest Forest Plan (federal lands) and the Forest Practices Act (State- managed lands). Natural slides can be expected to continue at historical though variable rates. Streambanks in lower gradient reaches of the watershed are currently a continuing source of sedimentation. Stabilization of these areas with riparian vegetation will result in decreased sedimentation, narrower channels, and better habitat for fish.



What is being done to address pollutants?

In response to the listing of these waterbodies as water quality limited, the Department of Environmental Quality (DEQ) has developed Total Maximum Daily Loads for each of the pollutants defined. These TMDLs have determined the amounts of each pollutant that can be discharged to the watershed without causing an impairment of beneficial uses. These pollutants are allocated among various sources to ensure an equitable solution to the problems.

Temperature: A system potential shade and channel width has been allocated to the entire watershed. This requires riparian vegetation along all streams and rivers that will provide shade and stabilize streambanks. The direct provision of shade will cool rivers and narrower stream channels resulting from stable streambanks will also reduce the amount of solar radiation (sunlight) that reaches stream surfaces. The temperature of discharges from wastewater treatment plants will also be limited as new permits are developed for these facilities.

System Potential: The height and density of riparian vegetation that can potentially grow in a given area based on average growth of local species of riparian trees.

Bacteria: Fecal coliform bacterial loading was modeled for the entire watershed. Contributions from all sources were included in the mathematical model and reductions relative to current loads were allocated. Load allocations were developed for each landuse type; Urban and Residential, Commercial, and Pastures. Due to the large area in the basin supporting livestock operations, reductions are most evident in these allocations.

Sedimentation: System Potential riparian vegetation will result in system potential channel widths, which will result in stable streambanks and less erosion. This will result in a reduction of sedimentation in the watershed.

Who came up with all of this?

TMDLs for the Nestucca Bay Watershed were developed by DEQ. However, many other agencies and private parties have also contributed to this effort.

- Nestucca-Neskowin Watershed Council and provided considerable information through development of a watershed assessment and action plan. The council also has collected much of the data that was used for the assessment of current conditions and in support of the temperature and bacterial monitoring.
- United States Forest Service and Bureau of Land Management have collected a considerable amount of data over the years pertaining to the lands they manage in the watershed. Given that this accounts for approximately two-thirds of the watershed, that effort has been substantial.

Who will be responsible for implementing changes that need to be made?

- **USFS/BLM** will implement features of the Northwest Forest Plan on lands that they manage.
- **Oregon Department of Forestry** will implement the Forest Practices Act in forests managed by the State of Oregon and on privately owned forest lands.
- **Oregon Department of Agriculture** will implement the Agricultural Water Quality Management Area Plan for the North Coast Basin that was adopted in 1999.
- **DEQ** will require dischargers to comply with permits that set limits on the quality of wastewater effluent to meet the wasteload allocations provided in the TMDL.
- **Counties and Local Governments** will implement practices to the extent of their authorities (i.e., ordinances).

What happens now that TMDLs have been developed?

DEQ has developed these TMDLs to meet requirements of the Federal Clean Water Act. These documents were released for a public review period and comments have been addressed in the final TMDL. This final document, including public comments was submitted to the EPA for approval in April 2002. Upon submission to the EPA, the measures of the TMDL are in place under Department Order. EPA has the option to approve the TMDLs as submitted or to deny them. If it approves the TMDLs, they become the federally approved TMDLs as well. If EPA finds sufficient fault to disapprove a TMDL, they have 60 days to establish a TMDL of their own.

To Find Out More About these Plans

Documents are available on this website. Documents are also available by request from Eric Nigg [(503) 229-5325] at 2020 SW 4th Avenue, Suite 400, Portland, OR 97201-4987 or e-mail at: nigg.eric@deq.state.or.us

Tillamook County Agriculture

Tillamook County is perhaps best known for its dairy industry. Tillamook County has 35,600 acres of farmland primarily in permanent pasture for over 24,000 head of livestock, but including 9,750 "harvested" acres. On today's tour we will first pass through some of this lowland agricultural area, entering the Bewley Creek drainage, a tributary of the Tillamook River. As we leave the Highway, Bewley Creek flows across the pasturelands to the west towards its confluence with the Tillamook River.

Agriculture users are guided by the North Coast Basin Agricultural Water Quality Management Area Plan (AWQMAP). These Area Plans commonly referred to as "1010 Plans" " . . . identify strategies to reduce water pollution from agricultural lands through a combination of educational programs, suggested land treatments, management activities and prohibitions." Enforcement by Oregon Department of Agriculture is based on administrative rules for the North Coast Basin Management Area.

The agricultural water quality program is described as being "condition based", as contrasted with the "practices based" Forest Practices Act. Agricultural operations for the most part are continuous while forest operations are more episodic, occurring infrequently on any particular parcel. While both focus on outcomes, they contrast in the way the outcome is achieved. The FPA provides a more defined array of practices that landowners must use. The SB 1010 program identifies the outcome to be achieved and the landowners identify the suite of practices they will use. Whatever agricultural practices are used, however, the landowner must achieve the conditions identified in the North Coast Basin Administrative Rules.

The following information is primarily excerpted from the North Coast Basin, AWQMAP updated in March 2004, and is included as a matter of interest. The Prevention and Control Measure for Healthy Riparian Streambank Condition is the agricultural equivalent to the riparian protection topics which are the focus of this tour on forestland.

"North Coast Basin agriculture is located primarily on the rich alluvial floodplains of the area's many river systems."

"Much of the agricultural lowland in the area was originally covered by riparian and tidal forests of cottonwoods, spruce hemlock, maple, alder, yellow fir, cedar, and crab apple as well as various understory species (Benner, no date). In the 1850s European-American settlers recognized the great agricultural potential of the lowlands, and began clearing the forest lands, installing drainage ditches, dikes, levees, and tide gates. These actions made the rich soils available for row crops and pasture. Significant lowland areas and intertidal and freshwater wetlands were cleared by the early 1900s. This made much land available for agricultural production, but changed the water flow, sedimentation patterns, and fish habitat."

Of the five rivers in the Tillamook watershed, the Tillamook River flows through the most agricultural acres of the five Tillamook coastal plain rivers. It is also the slowest with the most meanders, making its way through the area's poorest drained soils. . . . There are nine drainage districts in Tillamook County, incorporating several hundred acres in tidal lands. It is estimated that at least one-quarter of Tillamook agricultural lands are in these drainage districts (B. Pedersen, Basin Team Leader, USDA NRCS, per. Comm.).

" . . . DEQ has developed Total Maximum Daily Loads (TMDLs) for temperature, bacteria, and sedimentation for North Coast subbasins that had listings for these parameters . . .. Plans to meet Total Maximum Daily Load (TMDL) – allocations are required for industry, municipalities, forestry, and agriculture to improve water quality so that all beneficial uses are supported. The North coast Basin AWQMAP is designed to meet TMDL allocations."

As part of the federal Coastal Zone Amendments Reauthorization Act (CZARA), Section 6217(g) specifically addresses the impacts of nonpoint source pollution in coastal areas. Each state . . . must develop a Coastal Nonpoint Pollution control Program. The purpose of the program is " . . . to develop and implement management measures for nonpoint pollution to restore and protect coastal waters . . .." The ODA SB 1010 Rules for the North Coast provides the means to achieve the coastal zone expectations. These Pollution Prevention and Control Measures (PCMs) were developed to address water pollution from agricultural operations. When combined with pollution control efforts from other land uses in the planning area, they are expected to address the TMDL parameters when the DEQ defines them. The PCMs identify Required and Prohibited Conditions from the North Coast Basin Agricultural Water Quality Management Area Rules (Area Rules), and the plan suggests ways they may be achieved through flexible management solutions."

Agricultural landowners are directed to review the Area Rules cited in the box within each PCM to evaluate their operations and determine if they are in compliance with the rules. The plan provides ideas to improve water quality through management activities."

"Based upon this assessment, landowners should develop their own site-specific adaptive management strategy to meet these conditions. The PCMs are intended to be flexible enough for landowners to develop feasible and affordable approaches to meet water quality standards."

Healthy Riparian Streambank Condition

Required and Prohibited Conditions
OAR 603-095-0840

(2) Healthy Riparian Streambank Condition. Effective upon rule adoption.
- (a) Allow the natural and managed regeneration and growth of riparian vegetation – trees, shrubs, grasses, and sedges – along natural waterways (as defined in OAR 141-085-0010(27)) to provide shade to moderate water temperatures and bank stability to maintain erosion near background levels.
- (b) The technical criteria to determine compliance with OAR 603-095-0840(2)(a) are:
  - (A) Ongoing renewal of riparian vegetation that depends on natural processes (including processes such as seed fall, seed bank in soil, or sprouting from roots, rhizomes, or dormant crowns) is evident.
  - (B) Ongoing growth of riparian vegetation that has a high probability of remaining or becoming vigorous and healthy is evident.
  - (C) Management activities minimize the degradation of established native vegetation while allowing for the presence of nonnative vegetation.
  - (D) Management activities maintain at least 50% of each year's new growth of woody vegetation – both trees and shrubs.
  - (E) Management activities are conducted in a manner so as to maintain streambank integrity through 25-year storm events.
- (c) Exemptions:
  - (A) Levees and dikes are exempt from the Healthy Riparian Streambank Condition OAR 603-095-0840(2)(a) and (b), except for areas on the river-side of these structures that are not part of the structures and which can be vegetated without violating U.S. Army Corps of Engineers vegetation standards.
  - (B) Drainage areas where the only connection to other waterbodies are through pumps shall be exempt from the Healthy Riparian Streambank Condition OAR 603-095-0840(2)(a) and (b).
  - (C) Access to natural waterways for livestock watering and stream crossings are allowed such that livestock use is limited to only the amount of time necessary for watering and crossing the waterway.
  - (D) Drainage and irrigation ditches managed in compliance with OAR 603-095-0840(3) are exempt from the Healthy Riparian Streambank Condition OAR 603-095-0840(2)(a) and (b).

Benefits of a Healthy Riparian Streambank Condition
In the landscape, riparian areas comprise a small percentage of total land area but are essential for maintaining water quality and quantity, for ground water recharge, and for dissipating stream energy. It is anticipated that the Healthy Riparian Streambank Condition (HRSC) will protect and enhance water quality through establishment, maintenance, and protection of healthy riparian areas on agricultural lands.

HRSCs benefit both the landowner and the environment. Riparian areas are often indicators of watershed health, as they are among the first landscape features to reflect damage from improper management or natural events within the watershed (National Riparian Service Team, 1997). Landowners benefit from riparian streambank stabilization through soil deposition on streambanks and vegetative bank stabilization, prevention or rate reduction of crop and pasture land damaged or lost to floods, and prevention or reduction of flood debris deposited on fields. The environmental benefits of a HRSC include more shade to improve water temperature moderation and reduce heating, enhanced habitat for wildlife, and a reduction in the quantity of sediment, chemicals, bacteria, and nutrients contained in surface water runoff reaching a stream.

General Description of Healthy Riparian Streambank Condition
A stream in Healthy Riparian Streambank Condition (HRSC) provides the following functions:

- shade to help maintain cool water temperatures;
- streambank stabilization and protection;
- filtering of sediment, animal waste, and chemicals in surface runoff; and
- sources of food, hiding, and resting places for fish, including large wood for fish habitat.

To provide these functions, North Coast Basin riparian areas need the following:

- Complex Vegetation Structure and Diverse Species Composition
  - The riparian area supports a diverse assortment of plants, trees, shrubs/groundcover, in two or more vertical layers. Riparian areas should be dominated by native species with a diverse age class distribution. Where suitable, conifers are the preferred dominant tree species.
- Vegetative Cover
  - Vegetation should cover approximately 90% of the soil surface, with less than 10% bare soil or impervious surfaces.
- Width
  - Riparian area width should be sufficient to fulfill site-specific functions, and meet Healthy Riparian Streambank Conditions.
- Stream Shading
  - Riparian vegetation should shade 75% of a Natural Waterway where the water body is not too wide and when achievable in the summer.
- Streambank Stability
  - Streambanks should be stable without the use of rip rap or other artificial structures when feasible. Streambank vegetation is comprised of those plants and plant communities that have root masses capable of withstanding 20 to 25 year storm events.

The Conservation Reserve Enhancement Program (CREP) is a State-Federal partnership that provides a modest rental payment and substantial cost share to encourage protection of riparian areas on agricultural lands. Participation in this program would meet or exceed the Healthy Riparian Streambank Condition. Landowners are encouraged to contact the local Soil and Water Conservation District or USDA Natural Resources Conservation Service office for more information. See Attachment B for contact information.

OREGON ADMINISTRATIVE RULES
OREGON DEPARTMENT OF AGRICULTURE
CHAPTER 603, DIVISION 95

North Coast Basin

603-095-0800
Purpose
(1) These rules have been developed to implement a water quality management area plan for the North Coast Basin pursuant to authorities vested in the department through ORS 568.900-568.933. Development of this plan is due to a determination by the Environmental Quality Commission to establish Total Maximum Daily Loads (TMDL) and allocate loads to agricultural water pollution sources. This plan also contributes to the state's program to restore and protect coastal waters in response to the federal Coastal Zone Management Act. The area plan is known as the North Coast Basin Agricultural Water Quality Management Area Plan.
(2) The purpose of these rules is to outline requirements for landowners in the North Coast Basin Agricultural Water Quality Management Area for the prevention and control of water pollution from agricultural activities and soil erosion. Compliance with these rules is expected to aid in the achievement of applicable water quality standards in the North Coast Basin.
(a) Failure to comply with any provisions of the North Coast Basin Agricultural Water Quality Management Area Plan:
(A) does not constitute a violation of OAR 603-090-0000 to 603-090-0120, or of OAR 603-095-0010 to OAR 635-095-0860;
(B) is not intended by the department to be evidence of a violation of any federal, state, or local law by any person.
(b) Nothing in the North Coast Basin Agricultural Water Quality Management Area Plan shall be:
(A) construed as an effluent limitation or standard under the federal Water Pollution Control Act 33, USC §§ 1251-1376;
(B) used to interpret any requirement of OAR 603-095-0800 through 603-095-0860.
Statutory Authority: ORS 568.909
Stats. Implemented: ORS 568.900-568.933
603-095-0820
Geographic and Programmatic Scope
(1) The physical boundaries of North Coast Basin subject to these rules are indicated on the map included as Appendix A of these rules.
(2) Operational boundaries for the land base under the purview of these rules include all lands within the North Coast Basin in agricultural use, agricultural and rural lands which are lying idle or on which management has been deferred, and forested lands with agricultural activities, with the exception of public lands managed by federal agencies and activities which are subject to the Oregon Forest Practices Act.
(3) Current productive agricultural use is not required for the provisions of these rules to apply. For example, highly erodible lands with no present active use are within the purview of these rules.
(4) The provisions and requirements outlined in these rules may be adopted by reference by Designated Management Agencies with appropriate authority and responsibilities in other geographic areas of the North Coast Basin.

(5) For lands in agricultural use within other Designated Management Agencies' or state agency jurisdictions, the department and the appropriate Local Management Agency shall work with these Designated Management Agencies to assure that provisions of these rules apply, and to assure that duplication of any services provided or fees assessed does not occur.
Statutory Authority: ORS 568.909
Stats. Implemented: ORS 568.900-568.933

603-095-0840

Required and Prohibited Conditions

(1) All landowners or operators conducting activities on lands in agricultural use shall be in compliance with the following criteria. A landowner or operator shall be responsible for only those required and prohibited conditions caused by activities conducted on land managed by the landowner or operator. Criteria do not apply to conditions resulting from unusual weather events or other exceptional circumstances that could not have been reasonably anticipated.

(2) Healthy Riparian Streambank Condition. Effective upon rule adoption.

(a) Allow the natural and managed regeneration and growth of riparian vegetation trees, shrubs, grasses, and sedges along natural waterways (as defined in OAR 141-085-0010(27)) to provide shade to moderate water temperatures and bank stability to maintain erosion near background levels.

(b) The technical criteria to determine compliance with OAR 603-095-0840(2)(a) are:

(A) Ongoing renewal of riparian vegetation that depends on natural processes (including processes such as seed fall, seed bank in soil, or sprouting from roots, rhizomes, or dormant crowns) is evident.

(B) Ongoing growth of riparian vegetation that has a high probability of remaining or becoming vigorous and healthy is evident.

(C) Management activities minimize the degradation of established native vegetation while allowing for the presence of nonnative vegetation.

(D) Management activities maintain at least 50% of each year's new growth of woody vegetation -- both trees and shrubs.

(E) Management activities are conducted in a manner so as to maintain streambank integrity through 25-year storm events.

(c) Exemptions:

(A) Levees and dikes are exempt from the Healthy Riparian Streambank Condition OAR 603-095-0840(2)(a) and (b), except for areas on the river-side of these structures that are not part of the structures and which can be vegetated without violating U.S. Army Corps of Engineers vegetation standards.

(B) Drainage areas where the only connection to other waterbodies are through pumps shall be exempt from the Healthy Riparian Streambank Condition OAR 603-095-0840(2)(a) and (b).

(C) Access to natural waterways for livestock watering and stream crossings are allowed such that livestock use is limited to only the amount of time necessary for watering and crossing the waterway.

(D) Drainage and irrigation ditches managed in compliance with OAR 603-095-0840(3) are exempt from the Healthy Riparian Streambank Condition OAR 603-095-0840(2)(a) and (b).

(3) Drainage and irrigation ditches (channels legally constructed). Effective upon rule adoption.

(a) Construction, maintenance, and use of surface drainage ditches shall not result in sediment delivery to waters of the state from soil erosion caused by excessive channel slope, unstable channel cross section, or placement of disposed soils.

(b) Ditch bank vegetation shall be present to stabilize earthen ditch banks.

(c) Technical criteria to determine compliance with OAR 603-095-0840(3)(a) and (b) are:
(A) Construction and maintenance of drainage and irrigation ditches utilize ditch slope and ditch cross section that are appropriate to the site.
(B) Disposed soils from construction and maintenance of drainage and irrigation ditches are placed such that sediment delivery to waters of the state from the placement of these soils is consistent with natural background sediment delivery from these sites.
(d) Exemptions:
(A) Bank vegetation damaged and soils exposed during maintenance (as defined in OAR 141-085-0010(22)) and construction, in accordance with Division of State Lands rules. Bank vegetation must be reestablished as soon as practicable after construction and maintenance are completed. However, sediment delivery to waters of the state shall not result from inappropriate ditch slope and cross section or from placement of disposed soils.
(4) Tide Gates. Effective upon rule adoption.
(a) Tide gates shall open and close as designed.
(5) Erosion and Sediment Control. Effective upon rule adoption.
(a) No cropland erosion in excess of the soil loss tolerance factor (T) for the subject field, as determined by the Revised Universal Soil Loss Equation (RUSLE) for soil loss, will occur.
(A) Exceptions: The department shall establish an alternate erosion control standard for croplands which the department determines cannot practically or economically achieve the soil loss tolerance factor. Any alternate erosion control standard for croplands established by the department shall assure that delivery of sediment to adjacent water sources is reduced to the maximum extent practicable.
(b) Private roads that traverse rural lands or private roads used for agricultural activities shall be constructed and maintained such that road surfaces, fill and associated structures are designed and maintained to limit contributing sediment to waters of the state. All private roads on agricultural lands not subject to the Oregon Forest Practices Act are subject to this regulation.
(A) Exceptions: Roads subject to the Oregon Forest Practices Act.
(c) Agricultural lands shall be managed to prevent and control runoff of sediment to public road drainage systems.
(d) Except for operations governed by the Oregon Forest Practices Act, no activities related to the conversion of woodland to non-woodland agricultural uses that require removal of the majority of woody material from a parcel of land, such that the land no longer meets the definition of woodland, shall be conducted in a manner which results in the placement of soil, the delivery of sediment, the sloughing of soil into waters of the state, the initiation or aggravation of streambank erosion, or the loss of an adequate vegetative buffer, in the near-stream management area.
(6) Manure and Nutrients. Effective upon rule adoption.
(a) No person conducting agricultural land management shall cause pollution of any waters of the state or place or cause to be placed any wastes in a location where such wastes are likely to escape or be carried into the waters of the state by any means (ORS 468B.025(1)(a)).
(b) No person conducting agricultural land management shall discharge any wastes into the waters of the state if the discharge reduces the quality of such waters below the water quality standards established by rule for such waters by the Environmental Quality Commission (ORS 468B.025(1)(b)).
(c) No person shall violate the conditions of any waste discharge permit issued pursuant to ORS 468B.050.

(d) Exceptions:
(A) Access to natural waterways for livestock watering and stream crossings are allowed such that livestock use is limited to only the amount of time necessary for watering and crossing the waterway.
(7) Pesticide Management
(a) Pesticides shall be used in accordance with label requirements as required in ORS 634 (Oregon Pesticide Control Law).
Statutory Authority: ORS 568.909
Stats. Implemented: ORS 568.900-568.933

603-095-0860

Complaints and Investigations

(1) When the department receives notice of an alleged occurrence of agricultural pollution through a written complaint, its own observation, or through notification by another agency, the department may conduct an investigation. The department may, at its discretion, coordinate inspection activities with the appropriate Local Management Agency.
(2) Each notice of an alleged occurrence of agricultural pollution shall be evaluated in accordance with the criteria in ORS 568.900 to 568.933 or any rules adopted thereunder to determine whether an investigation is warranted.
(3) Any person allegedly being damaged or otherwise adversely affected by agricultural pollution or alleging any violation of ORS 568.900 to 568.933 or any rules adopted thereunder may file a complaint with the department.
(4) The department will not evaluate or investigate a complaint filed by a person under section OAR 603-095-0N80(3) unless the complaint is in writing, signed and dated by the complainant and indicates the location and description of:
(a) The property and waters of the state allegedly being damaged or impacted; and
(b) The property allegedly being managed under conditions violating criteria described in ORS 568.900 to 568.933 or any rules adopted thereunder.
(5) As used in section OAR 603-095-0860(4), "person" does not include any local, state or federal agency.
(6) Notwithstanding OAR 603-095-0860, the department may investigate at any time any complaint if the department determines that the violation alleged in the complaint may present an immediate threat to the public health or safety.
(7) Actions based on investigation findings:
(a) If the department determines that a violation of ORS 568.900 to 568.933 or any rules adopted thereunder has occurred and a Voluntary Water Quality Farm Plan approved by the department or its designee exists and the landowner or operator is making a reasonable effort to comply with the plan:
(A) The department shall inform the landowner of the non-compliance with ORS 568.900 to 568.933 or any rules adopted thereunder.
(B) The department may acknowledge the existence of the approved Voluntary Water Quality Farm Plan and direct the landowner to seek appropriate technical assistance and revise the plan and its implementation in a manner necessary to eliminate the violation.
(C) The landowner may be subject to the enforcement procedures of the department outlined in OARs 603-090-0060 through 603-090-0120.
(b) If the department determines that a violation of ORS 568.900 to 568.933 or any rules adopted thereunder has occurred and a Voluntary Water Quality Farm Plan approved by the department or its designee does not exist:

(A) The department shall inform the landowner of the non-compliance with ORS 568.900 to 568.933 or any rules adopted thereunder.
(B) The landowner may be subject to the enforcement procedures of the department outlined in OARs 603-090-0060 through 603-090-0120.
Statutory Authority: ORS 568.915, 568.918, and 568.933
Stats. Implemented: ORS 568.900 - 568.933