DRAFT FOR COMMENT

Oregon and California Lands:

Wild Salmon Conservation & Drinking Water Protection Policy Recommendations

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INTRODUCTION

This paper highlights the critical role that Bureau of Land Management (BLM) lands in Western Oregon play in providing clean drinking water and in sustaining a regional network of healthy wild salmon rivers. Our goal is to provide initial recommendations to decision makers considering policies effecting the riparian management of O&C lands. We provide an overview of existing information on priority drinking water source areas, salmon-bearing rivers, and aquatic habitats.* We are also committed to providing more detailed information and working toward a comprehensive and balanced forest management approach that allows increased timber harvest for the benefit of local communities while preserving and enhancing aquatic habitats and the essential clean water services these O&C lands provide.

Key Recommendations:

- **Ensure the highest level of statutory protection for critical areas within Oregon Department of Environmental Quality "drinking water protection areas," and watersheds supporting core centers of wild salmon abundance and diversity or high salmon intrinsic potential.**
  - Build on the Northwest Forest Plan's Riparian Reserves and priority watersheds.
- **Develop adequate levels of protection for aquatic systems to allow increased timber harvest in areas less important for drinking water and without strong populations of salmon or high salmon intrinsic potential.**
  - Without adversely affecting key conservation values, stabilize timber harvest at higher than current levels in select regions and provide greater certainty.
  - The Oregon Forest Practices Act does not meet minimum management standards.
- **Establish a high-level Science-Management Working Group to propose specific aquatic conservation management standards to meet the ecosystem-based goals for areas less important for drinking water and without strong populations of salmon or high salmon intrinsic potential.**
- **With appropriate environmental safeguards, expand the policy "tool box" to provide greater flexibility to achieve ecological and economic goals.**
  - Employ flexible policy instruments including land exchanges and consolidation, ecosystem service payments, and permanent protection for the highest value conservation areas, and create tax and regulatory incentives for private land owners within priority areas.
  - Capitalize a dedicated fund with a portion of timber revenue for voluntary land acquisition, conservation easements, restoration, road obliteration and decommissioning, and incentive-based stewardship targeted for private lands within priority conservation areas.

*While we limit our analysis and recommendations to wild salmon ecosystems and drinking water, we urge decision-makers to employ the best available science to consider any proposals to alter current land management or ownership of lands by considering impacts on multiple conservation values. Information derived from the maps, databases, and expert opinions in this paper should be refined at finer scales.

POLICY CONTEXT

The BLM manages 2.4 million acres of public lands distributed across 18 counties in Western Oregon. These so-called "O & C Lands", named after the 19th century railroad companies originally granted ownership of these parcels before they revested to federal ownership in the decades that followed, comprise 87% of these lands. Public domain lands cover 10% of BLM-managed lands in Western Oregon, with the remaining 3% managed as the Coos Bay Wagon Road lands (see Western Oregon BLM Lands Map). Most of these lands occur in a checkerboard pattern, though 40% measure less than a full section – one square mile or 640 acres. This ownership pattern poses significant challenges in terms of ecosystem scale management, as well as marketable timber harvesting.

Together, these lands provide Oregonians with multiple ecological, economic, and cultural benefits. They safeguard critical sources of drinking water, support fish and wildlife habitat, and provide opportunities for hunting, fishing, hiking, and wildlife viewing.[1] These lands also provide timber, and have the potential to generate renewable energy from biomass, wind, and geothermal sources.

The interplay and convergence of several factors - ESA listings, declining timber harvest levels coupled with lower prices and reduced demand, economic recession, high unemployment, and uncertainty about the continuation of federal county payments - has culminated in concerns about the fiscal health of several counties and has led to well publicized proposals from county and congressional leaders to alter the ownership and management of O&C Lands in Western Oregon.

While all O&C Lands in Western Oregon have important conservation value, these lands are not all equal. Some of these lands warrant robust conservation protections, while others are less vulnerable to the disturbances created by activities such as timber harvest. Additionally, managing only O&C Lands in Western Oregon is not sufficient to adequately protect and restore species and systems, like salmon and watersheds, which are pervasive across the entire landscape. If conservation and recovery goals are going to be met, environmental management must also be improved on the private lands outside of the O&C ownership checkerboard.

OVERARCHING CONSIDERATIONS

The vital importance of these lands warrants thoughtful and transparent consideration of the multiple economic and conservation values at stake with full recognition of the trade-offs implicit in any proposal to manage these lands differently.[2] In order to move forward and achieve real change, a series of basic considerations should be understood and accepted by all involved parties. What follows are four principles that should help guide policymaking:

- **All stakeholders should "put something on the table" to seek a durable, long-term solution to reconcile competing visions for the ownership and management of O&C Lands in Western Oregon.**

  Re-stating fixed positions is unlikely to lead to constructive and enduring solutions. Flexibility and new approaches will be required to address the complex issues concerning management of these lands. We recognize that forest management regimes should accommodate varying levels of ecological risk. We propose utilizing new concepts and tools to identify high value aquatic resources, including key drinking water areas and priority wild salmon rivers.

- **Recognizing the national, state, and local importance of these lands, all levels of government should seek an equitable and balanced formula for funding those counties most affected by O&C Lands.**

  To supplement revenue from timber harvest, increase federal and state financial support for select counties with a large percentage of BLM-managed lands (and protected high conservation value lands). Decrease federal support for less impacted counties. Explore financing strategies, including bonds, for targeted areas to increase the revenue stream for rural economic development, watershed and forest protection and restoration, private landowner incentive programs, and payment for ecosystem services. County funding should be contingent on meeting minimum thresholds for tax rates.

- **Make priority aquatic and terrestrial protections permanent, optimizing for selected conservation values including drinking water, salmon, and old growth forests.**

  The aquatic conservation strategy in the Northwest Forest Plan (NWFP) has proven effective.[3] Several of its key provisions should be made permanent for priority aquatic habitats. The suite of mechanisms noted in recommendation #4 (page 12) should be considered.

- **A solution should seek timber harvest at higher than current levels in select regions, provide greater certainty, and maintain key aquatic ecosystem values.**

  We realize that the contentious history of timber harvest from the O&C lands is not a model for future management. To advance constructive policy, the following considerations pertaining to timber harvest should be realized:

  1. A broad set of goals recognizing the many values at stake.
  2. Clear conservation standards that both protect important ecological values and bring clarity to permitted timber harvest activities and rates.
  3. Institutional capacities to enable the planned activities to take place, monitor actions and effects, and provide mechanisms for change if ecological goals are not met.

KEY WILD SALMON VALUES ON O&C LANDS

Wild Pacific salmon are a central part of the culture, economy, and environment of Oregon. Pacific salmon generate 28 million dollars of economic activity in Oregon, providing hundreds of jobs.[4]

BLM lands in Western Oregon support a myriad of aquatic resources, including several watersheds containing strong and diverse populations of salmon and steelhead. Salmon are a keystone species and an indicator of ecosystem health for Oregon and the greater Pacific Northwest. Healthy wild salmon ecosystems support hundreds of species and provide fresh drinking water, flood control, carbon sequestration, and other ecosystem services that become increasingly important in the face of continued population growth and climate change. The Oregon Plan for Salmon and Watersheds acknowledges that "agriculture, forestry, recreation, fisheries, and industry all need healthy watersheds, along with every person and community in Oregon."[5]

While the U.S. government and Oregon have taken important steps to halt steep declines in salmon populations from their historic levels of abundance, 15 populations of salmon remain listed as "threatened" or "endangered" under the Endangered Species Act (ESA). Currently, NOAA and USFWS have designated "critical habitat" for threatened species of Chinook, coho, and steelhead that occur on BLM lands in Western Oregon. Critical habitat is defined by the ESA as areas that contain habitat features that are essential for the survival and recovery of a species listed as threatened or endangered, and which may require special management considerations or protections (see Important Salmon Habitat with BLM Management Map).

Despite the challenge that wild salmon face within the region, BLM lands in Western Oregon contain some of the healthiest wild Pacific salmon and steelhead populations remaining on the West Coast, outside of Alaska and British Columbia. 1.9 million acres of BLM land supports one or more strong populations of salmon (see Strong Salmon Populations Map). This includes a large concentration of largely undammed rivers that includes the Illinois, Chetco, Siuslaw, Wilson, Nestucca and Trask. Of the 14,662 salmon bearing river miles in Western Oregon, 1,414 miles are on BLM land (see Western Oregon BLM Lands in Relation to Salmon Bearing Streams Map). Salmon depend on these rivers to provide spawning, rearing, and migrational habitat for populations of Chinook (Fall, Spring, and Summer), chum, coho, and steelhead (Winter and Summer).

Comprehensive watershed-wide management is crucial to protecting and maintaining wild salmon populations. While salmon only use a portion of the watershed throughout their life cycles, maintaining water quality from upstream sources is vital to retaining healthy and genetically diverse populations. Salmon's strong natal homing instinct creates distinct, locally adapted populations with a high degree of adaptive specialization to individual stream conditions.[6] Maintaining a mosaic of habitat types on O&C Lands is critical to building resilience against environmental stressors such as climate change.[7]

The North American Salmon Stronghold Partnership has led an effort to identify strong wild salmon and steelhead populations throughout the region. In 2011, experts conducted a survey of Oregon's strong salmon and steelhead populations based on viability, life history diversity, and percent wild. Experts rated 171 salmonid populations and identified 63 to be "strong, diverse, and wild" across the state of Oregon. 56 of the 63 strong populations spend a portion of their life cycle on BLM land in Western Oregon (see Strong Salmon Populations Map).

Map 4 identifies the relative ranking of Intrinsic Potential for Chinook, coho, and steelhead. Intrinsic Potential estimates the potential for a stream to provide productive habitat using landscape attributes of channel gradient, valley constraint, and mean annual flow, which are known to be associated with salmonid productivity. The Map highlights areas of high Intrinsic Potential on BLM land in Western Oregon for Chinook, coho, and steelhead. These areas should be assessed more closely to determine the extent to which they currently provide high quality habitat for target species or, if restored, could one day provide highly productive habitat (see Watersheds with Intrinsic Potential for Salmon Habitat Map).

DRINKING WATER SOURCE AREAS

The majority of Oregon source water areas are located in forested watersheds, which provide some of the highest quality drinking water. Natural forest and hydrologic processes store, filter and deliver water to downstream users. A change in forest management practices that increase harvest rates beyond current levels may negatively affect critical drinking water sources and increase costs for downstream communities. Degradation of water quality, in particular turbidity and suspended sediment, has long been recognized as one of the most significant risks from timber harvest. Further, pesticide application to forest land can degrade both surface and ground water sources.

Seventy-three present of the BLM lands in Western Oregon are located in areas identified by the Oregon Department of Environmental Quality as drinking water protection areas (see Drinking Water Protection Map).[8] Overall, there are 81 public water supplies (PWSs) that have O&C lands within their drinking water source area (DWSA). In some instances, the percentage of O&C Lands is minimal, such as in Portland, however, in many cases the DWSA contains a significant percentage of O&C Lands. If you exclude Portland population numbers, there are 80 PWSs serving a combined total of over 1,800,000 people that will be affected by management of BLM's O&C Lands.

Key sites within these drinking water source areas warrant significant protection because of the large number of people who rely on clean water from these lands, and the high economic cost of water quality degradation. It is economically advantageous for municipalities to protect their drinking water sources. Water quality degradation from activities such as industrial logging operations have the potential to cause expensive remedial efforts and water treatment expenditures. A recent U.S Environmental Protection Agency study determined that the ratio of contaminant cleanup costs to basic prevention and protection ranges from 5:1 to 200:1. Investing in forest and watershed protection can result in significant savings to a utility in treatment costs.

O&C Lands that require the highest level of protection to ensure clean drinking water supply can be identified by key parameters including those where the O&C lands are close to the drinking water supply intake or those deemed "sensitive areas". Sensitive areas include areas with high erosion or runoff potential (e.g. steep slopes, erodible soils), and areas that have historic or existing landslides. We are in the process of identifying these critical drinking water areas of concern.

Importantly, it is not only PWSs that are affected by management of O&C Lands. There are numerous private domestic drinking water intakes located on O&C Lands as well. These private homeowners are responsible for their own drinking water supplies and will have to address any adverse impacts resulting from any weakening of existing land management protections.

ATTAINING AQUATIC CONSERVATION

To achieve aquatic conservation goals for wild salmon and drinking water supplies, several concepts pertaining to land management perspectives and timber harvest practices on O&C Lands should be incorporated into the management decision-making process. These concepts warrant special attention because of the failures of past environmental management.

- The adoption of ecosystem management strategies at the landscape scale (i.e. – watersheds) is necessary to maintain healthy ecosystem function and habitat connectivity. For salmon, this includes establishing a network of interconnected freshwater and estuarine habitats. The network should support an interconnected set of distributed metapopulations that are resilient to long term changes in climate and habitat suitability. Moreover, different levels of protection at the watershed-level and finer scales (i.e. – riparian buffers, stand retention requirements, roadless areas) are necessary to recognize site-specific characteristics and species needs. This includes the highest levels of protection for key drinking water source areas and core centers of salmon abundance and diversity (species, run-timing, and life histories), key spawning and rearing habitat, and areas of high intrinsic potential.

- When optimizing for ecological, economic, recreational, and cultural values on O&C Lands, an assessment of "ecosystem services" should be included. Such an evaluation should account for the benefits, as well as the avoidance of costs caused by habitat or freshwater degradation (i.e. – secondary water treatment, flood control). This type of calculation will put the value of these resources into perspective for the public and for policymakers.

- Regarding land use practices, the Oregon Forestry Practices Act (OFPA) does not afford sufficient protection to aquatic ecosystems, including salmon, and should not be adopted as the management standard for lands dedicated primarily to timber harvest. Numerous scientific studies and court rulings have found that the OFPA fails to adequately protect water quality. For example, the Oregon Independent Multidisciplinary Science Team (IMST) concluded that the OFPA does not incorporate the objectives of the Oregon Plan for Salmon and Watersheds into its existing framework.[9] And the recent RipStream study, conducted by Oregon State University and the Oregon Department of Forestry, also found that the state's minimum riparian protection requirements fail to protect fish bearing streams from increases in water temperature.[10] On the other hand, the Aquatic Conservation Strategy within the NWFP has been effective at enhancing and restoring ecosystem function for salmon-bearing rivers, helping to stabilize populations of salmon and trout in areas with a high percentage of federally managed lands. The principles of this policy should help guide the protection of the most important salmon river systems and aquatic habitats.

RECOMMENDATIONS

Given the importance of aquatic conservation across the Western Oregon landscape and the many social elements influencing the O&C Lands policy debate, we propose a series of basic recommendations. Our recommendations focus on the ecological values we hope to protect on high-priority and lower-priority lands and waters, the methods and expertise required to achieve these goals in relation to increased timber harvest, and a suite of flexible mechanisms that have the potential to enable the desired ecological and economic outcomes.

Recommendation #1: Ensure the highest level of statutory protection for critical areas within Oregon Department of Environmental Quality "drinking water protection areas," and watersheds supporting core centers of wild salmon abundance and diversity or high salmon intrinsic potential.

- Governed by management prescriptions determined to be consistent with the prevention of management-induced alterations to natural watershed functions and processes, including for example, water quality and temperature, delivery of large woody debris, sediment, and food (i.e. – insects).
- Protection measures designed for ecosystem function and processes at watershed scale, including large and small streams, (perennial and seasonal), lakes, ponds, wetlands and bogs. Primary goal of ensuring aquatic health and ecosystem function at landscape scale.
- Management practices will ensure a high level of certainty that near-stream areas and critical contributing upslope areas are not degraded by management.
- Prioritization of highest value conservation and restoration actions required to maintain or strengthen system resilience.
- Retain and make permanent core provisions of NWFP aquatic conservation strategy, including "key watersheds" and "watershed restoration."

Recommendation #2: Develop adequate levels of protection for aquatic systems to allow increased timber harvest in areas less important for drinking water and without strong populations of salmon or high salmon intrinsic potential.

- Governed by adequate management prescriptions to meet Clean Water Act, Endangered Species Act, and other relevant federal laws.
- Not likely to lead to degradation of aquatic systems or the protection goals and objectives upstream or downstream in the aquatic system.
- The survival and recovery of extant population units of native salmon and trout is not jeopardized.

- Drinking water sources will not be degraded or diminished by forest management such that communities are required to conduct additional water treatment or find alternative sources.
- Current aquatic protection measures in the OFPA are inadequate and insufficient to satisfy minimum water quality and quantity parameters.

Recommendation #3: Establish a high-level Science-Management Working Group to propose specific aquatic conservation management standards to meet the ecosystem-based goals for areas less important for drinking water and without strong populations of salmon or high salmon intrinsic potential.

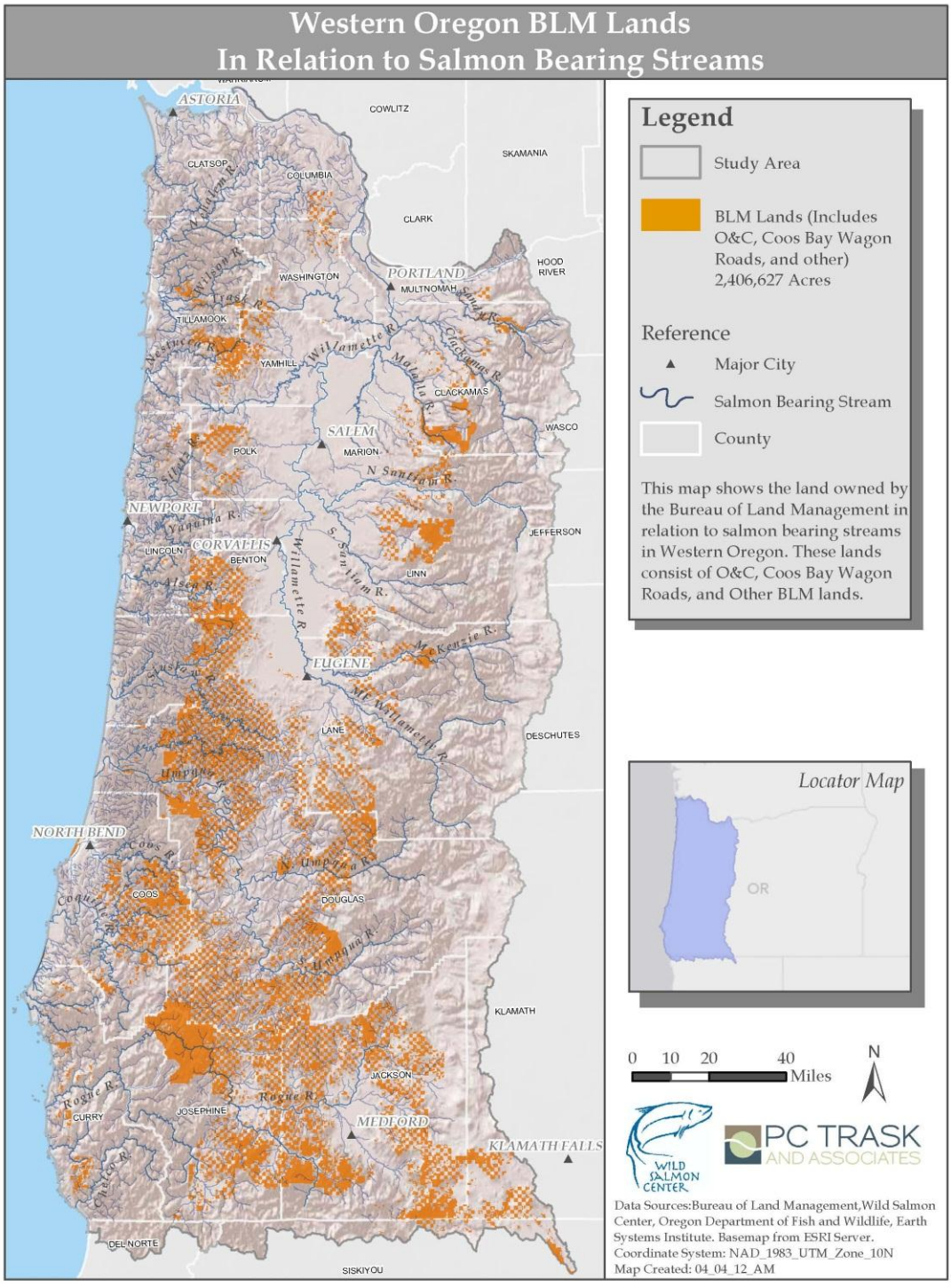
- Recognized experts should recommend appropriate aquatic conservation standards and identify key conservation priorities for recovery efforts on non-federal lands.
- Experts will base their recommendations in part on a review of the comparative effectiveness of the aquatic conservation strategies in effect under the Northwest Forest Plan, the Oregon Department of Forestry, the State of Washington Department of Natural Resources, (see comparative tables and figures in Appendix C) and other relevant standards.

Recommendation #4: With appropriate environmental safeguards, expand the policy "tool box" to provide greater flexibility to achieve ecological and economic goals.

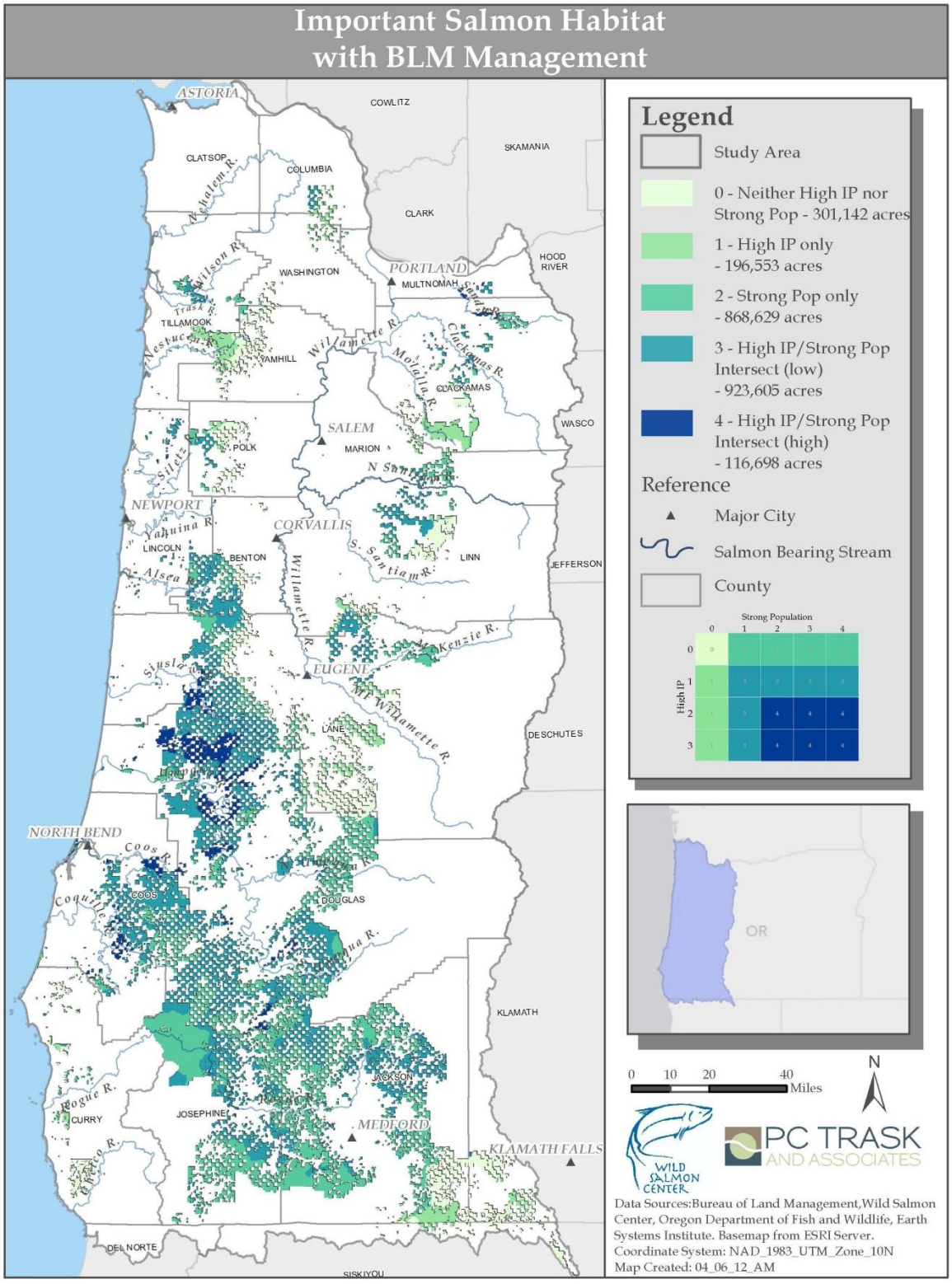
- Establish a Land Exchange Facility to enable exchange and consolidation of identified federal, state and private lands with BLM-managed holdings in Western Oregon to optimize economic, land management and conservation values. The facility would identify and facilitate opportunities to consolidate or "block up" high conservation lands for salmon and other target species and/or facilitate more efficient and effective management for selected tracts, including high conservation value coastal lowland and estuarine areas.
- Increase and target incentive-based programs administered by the National Resource Conservation Service (U.S. Dept. of Agriculture), EPA, DEQ and other agencies and department to protect and restore high priority landscapes on private lands in Western Oregon.
- Aggressively explore state mechanisms to increase funding levels for counties with the highest percentage of O&C Lands coupled with increased state funding for the highest value conservation actions identified in these counties (including salmon conservation).
- Create tax and regulatory incentives for private land owners within priority conservation areas.
- Capitalize a dedicated fund with a portion of timber revenues for voluntary land acquisition, conservation easements, restoration, road obliteration, decommissioning and repair, and incentive-based stewardship targeted for private lands within priority conservation areas.

Appendices

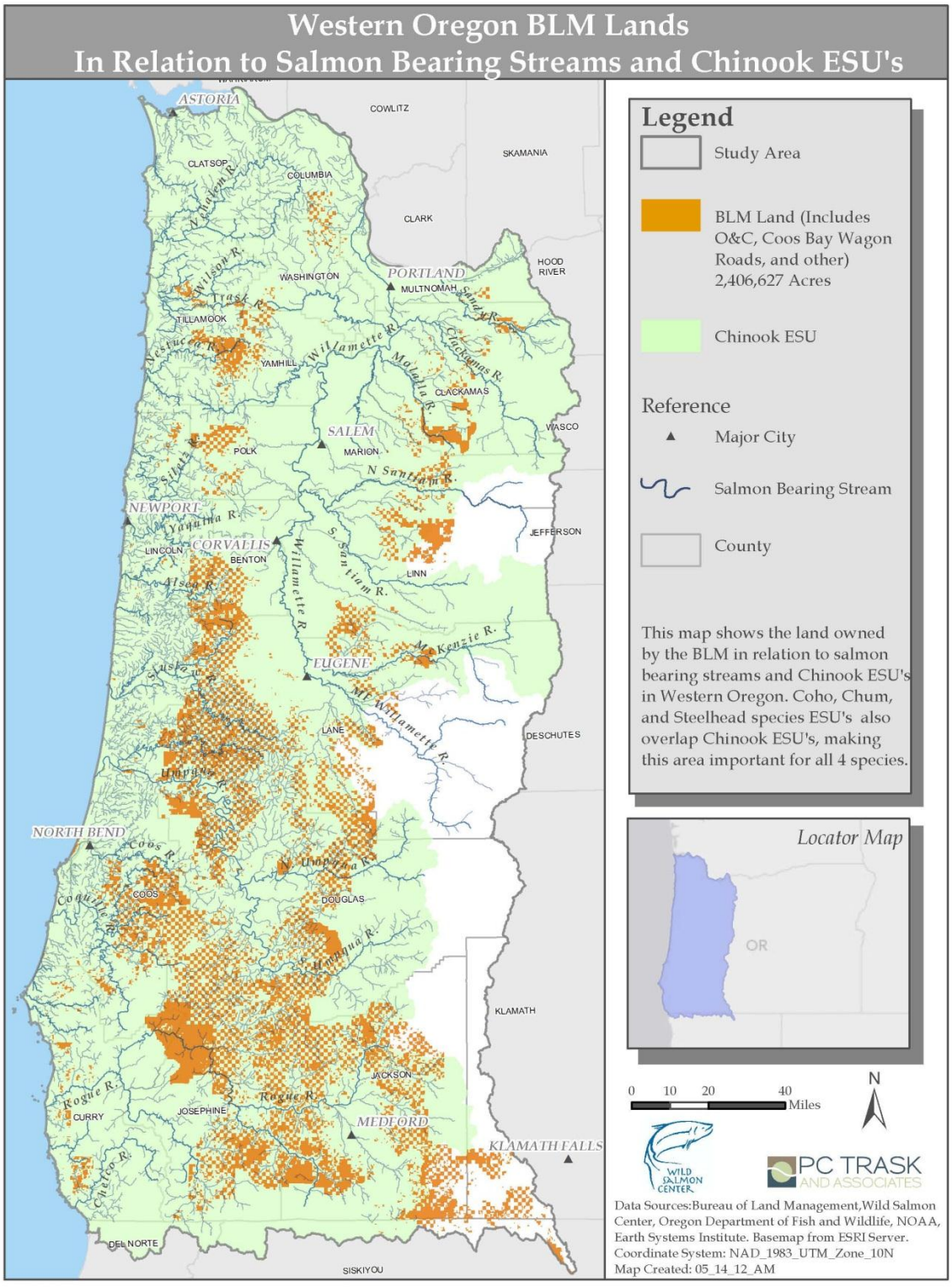
Appendix A: Maps



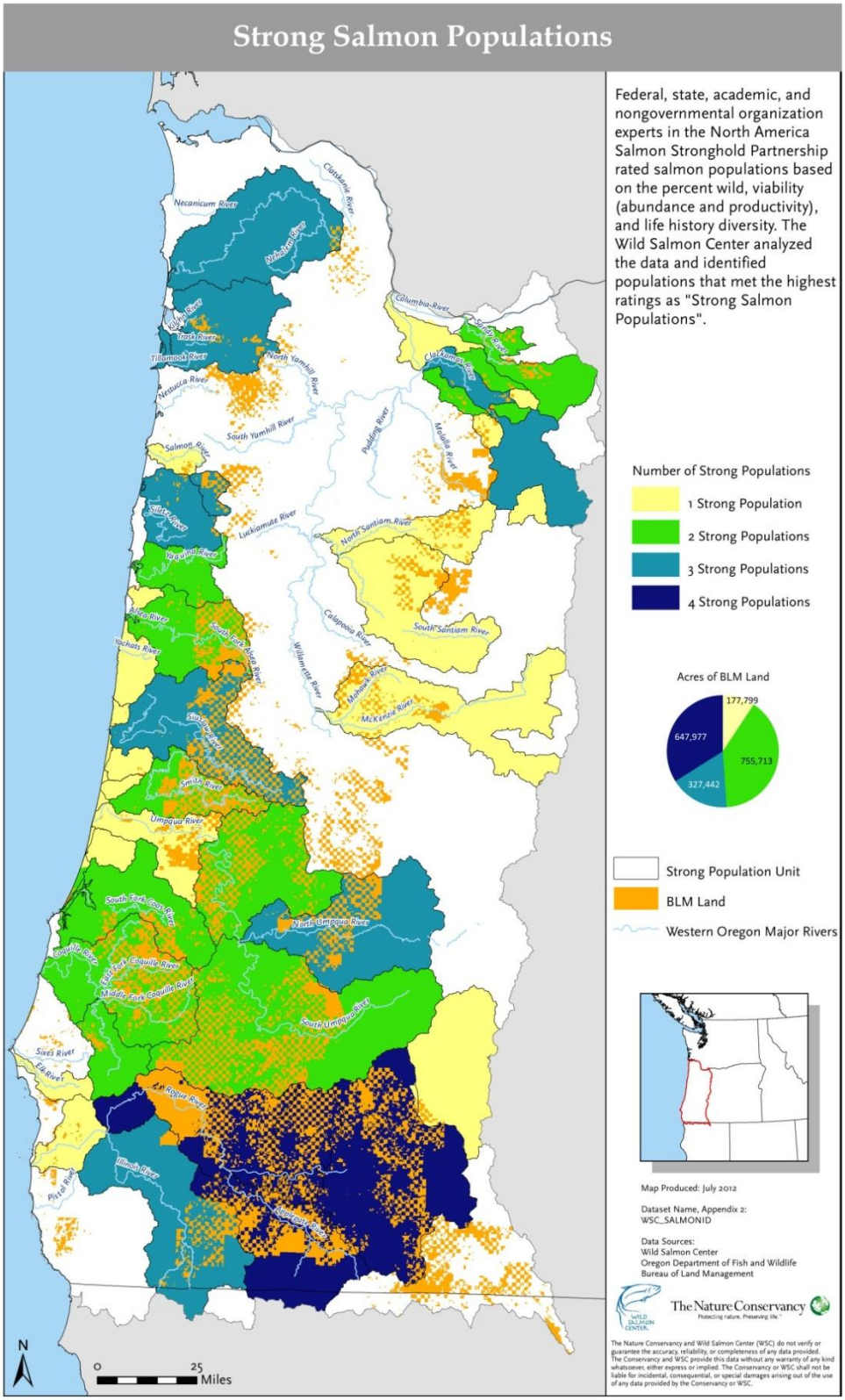
Map 1. Western Oregon BLM Lands in relation to salmon bearing streams.



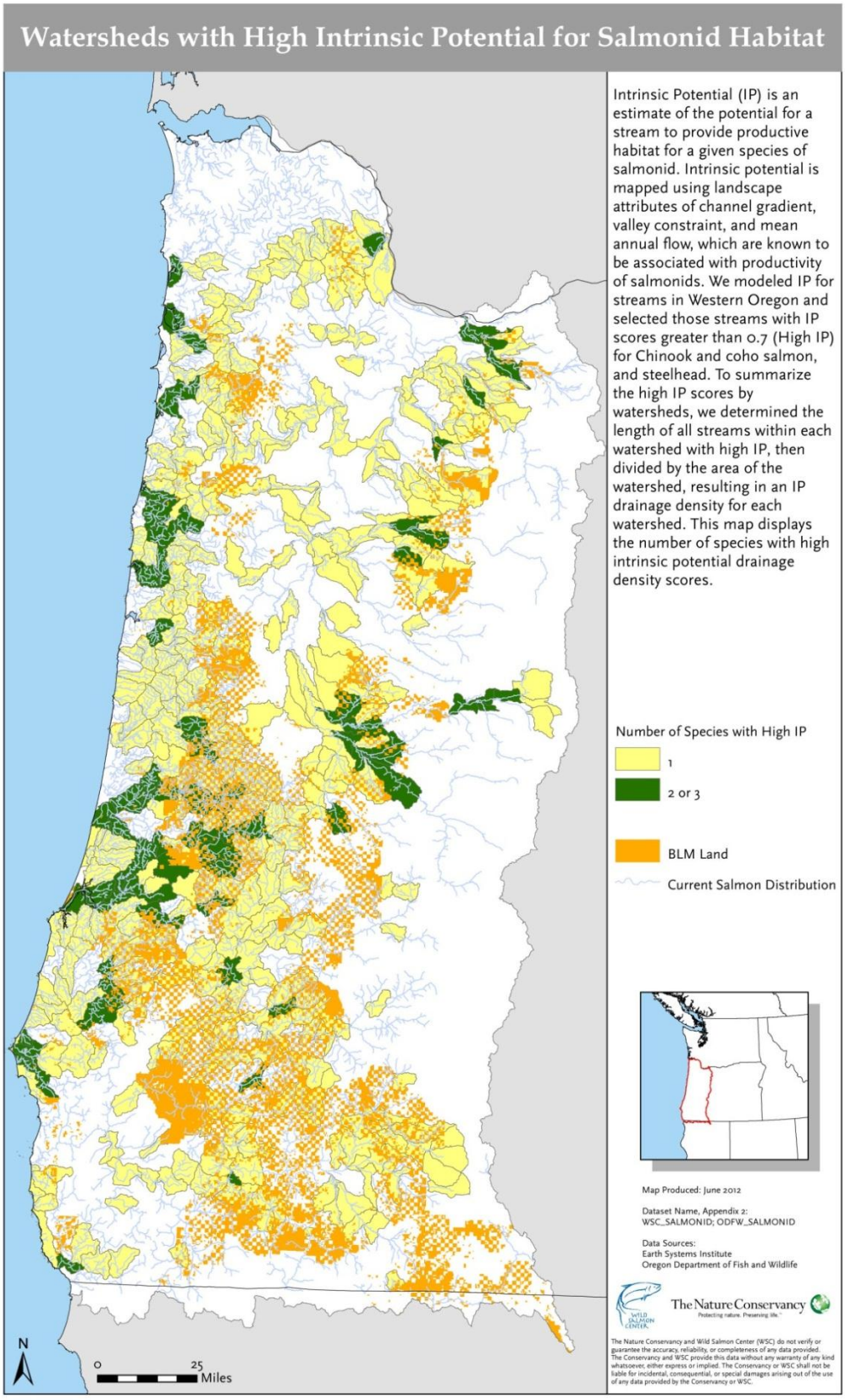
Map 2. Important salmon habitat under BLM management with strong salmon populations and high intrinsic potential.



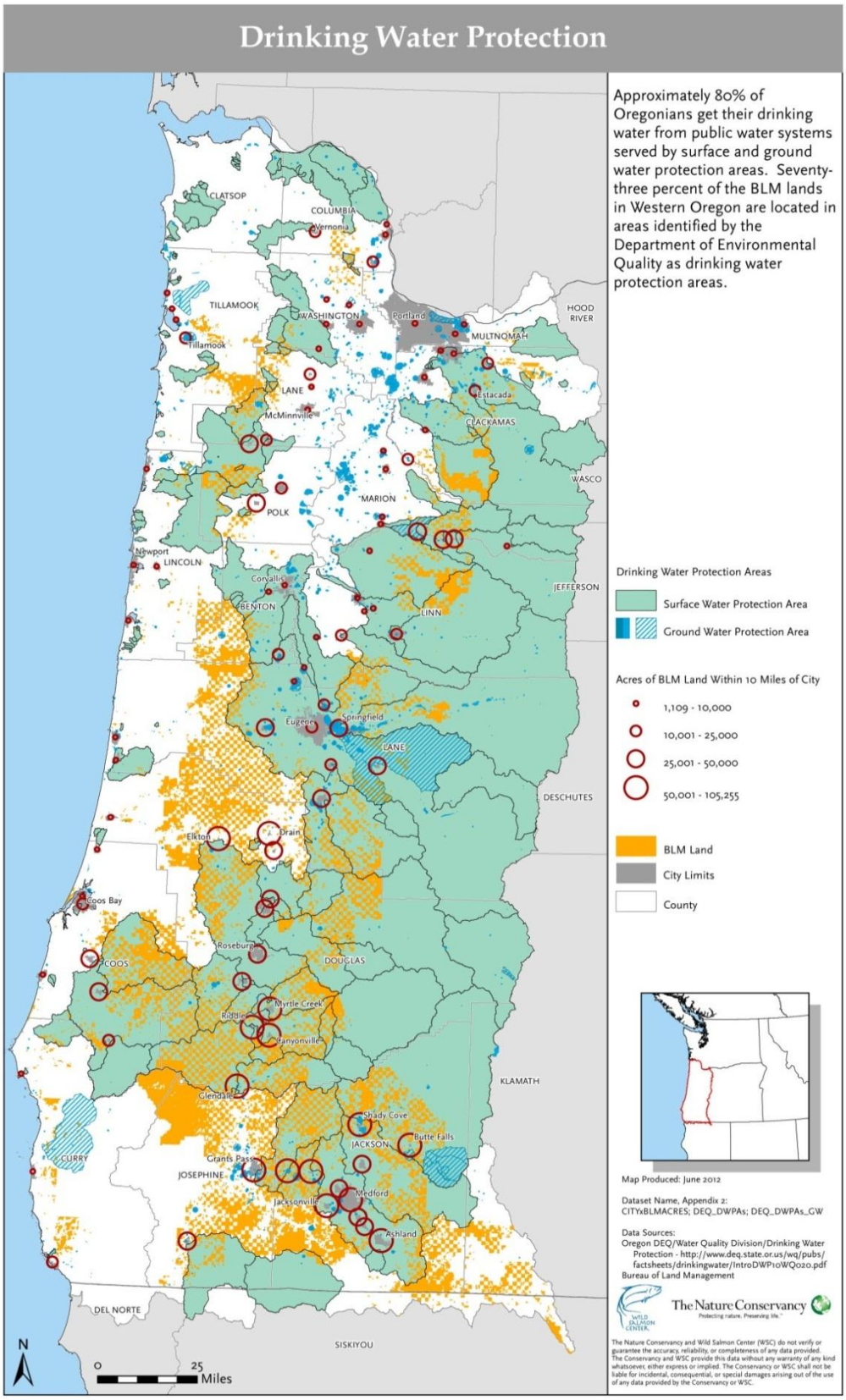
Map 3. Western Oregon BLM lands in relation to salmon bearing streams and Chinook evolutionarily significant units. Similar maps for chum salmon, coho salmon, and steelhead are available upon request.



Map 4. Strong salmon populations across Western Oregon.

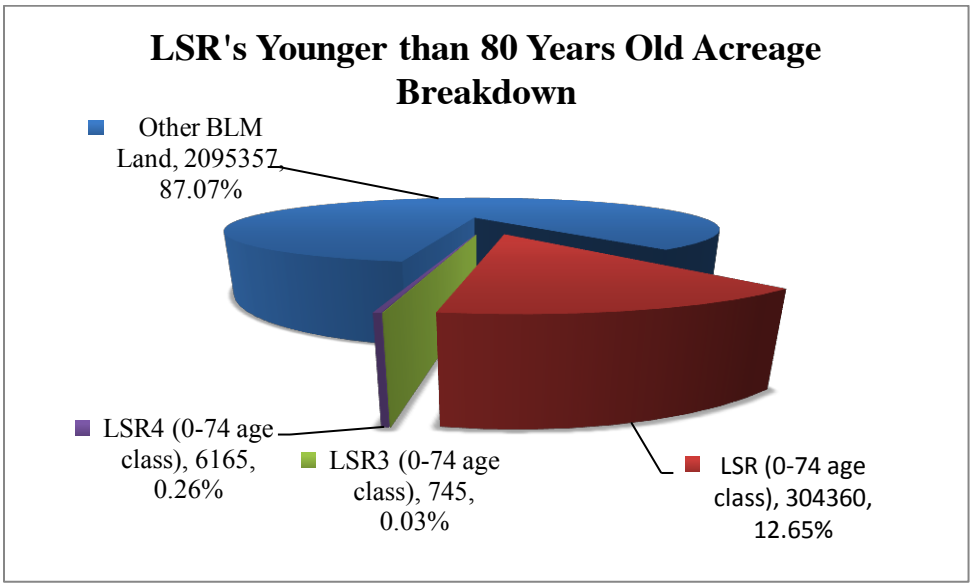


Map 5. Watersheds with high intrinsic potential for salmon habitat across Western Oregon.

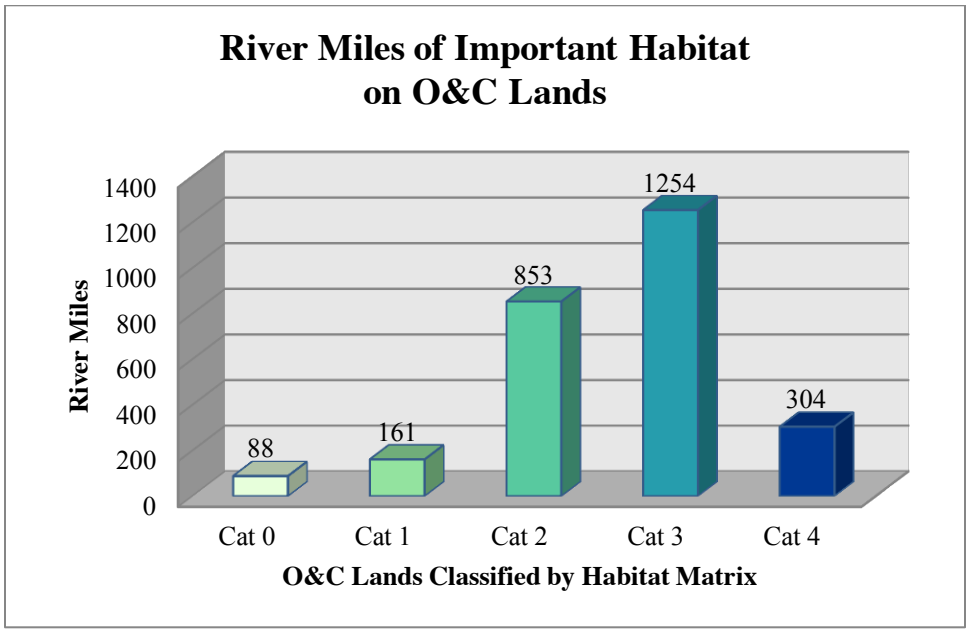


Map 6. Drinking water protection areas and acres of BLM land with 10 miles of a city.

Appendix B: Graphs



Graph 1. Acreage Breakdown of LSR's (LSR, LSR3, LSR4) and other BLM lands younger than 80 years old.



Graph 2. River miles of important salmon habitat and high intrinsic potential on O&C lands. See Map 5: Important Salmon Habitat with BLM Management.

Appendix C: Tables and Figures of Stream Buffers

Forestry Policy	No Cut Area	Higher Tree Retention Prescription	Lower Tree Retention Prescription
Northwest Forest Plan	NA	• 2 Site Potential Tree (SPT) heights (300-440 feet) to attain aquatic conservation strategy • Thinning allowed to create late successional characteristics after a watershed analysis	NA
California Private Lands	0-30 feet	• From 30-100 feet • 70%-80% canopy retained	• From 100-150 Feet • If abutting an even aged stand, retain 50% of canopy • Buffer can vary in range from 100-150 feet out
Oregon Private Lands	0-20 feet	• From 20-100 feet • Retain 20-230 square feet of basal area per 1000 feet of stream (varies by flow) • Buffer may vary in range from 50-100 feet	NA
Washington Private Lands	0-50 feet	• From 50-150 feet • Create mature forest (varies by site class) • Buffer can vary in range from 69-150 feet	• From 70-200 feet • Retain 20 trees per acre (varies by site class) • Buffer can vary in range from 70-200 feet
California State Lands	0-25 feet	• From 25-150 feet • Retain 70% or more of canopy • Develop late seral forest	NA
Oregon State Lands	0-25 feet	• From 25-100 feet • Develop mature forest conditions	• From 100-160 feet • Retain 10-45 trees per acre
Washington State Lands	0-25 feet	• From 25-100 feet • Minimal harvest (10% of volume removed)	• Low harvest (25% volume removed) • Buffer may vary between 150-160 feet • Additional possible wind buffer from 150- 200 feet

Table 1. Buffers on fish bearing streams.

Information adopted from National Marine Fisheries Service. 2009. Untitled table comparing riparian management strategies. Oregon State Habitat Office, Portland, Oregon. 3p; and work prepared by Bob Van Dyk following the method of display in Dent (2010).

Forest Policy	No Cut Area	Higher Tree Retention Prescription	Lower Tree Retention Prescription
Northwest Forest Plan	NA	• 1 Site Potential Tree (SPT) height (150-220 feet) to attain aquatic conservation strategy • Thinning allowed to create late successional characteristics after a watershed analysis	NA
California Private Lands	0-30 feet	• From 30-100 feet • 70%-80% canopy retained	NA
Oregon Private Lands	None	None	None
Washington Private Lands	0-50 feet (for 50% of reach)	None	None
California State Lands	0-25 feet	• From 25-100 feet • Buffer can vary in range from 50-100 feet	NA
Oregon State Lands	0-25 feet (for 75% of reach)	NA	• From 25-100 feet, retain 15-25 trees per acre • If target is not met from 0-100' retain from 100-160 feet
Washington State Lands	0-25 feet	• From 25-100 feet • Minimal harvest (10% of volume removed)	• From 100-160 feet • Low harvest (25% volume removed) • Buffer may vary between 150-160 feet • Additional wind buffer up to 200 feet

Table 2. Buffers on small, non-fish bearing perennial streams.

Information adopted from National Marine Fisheries Service. 2009. Untitled table comparing riparian management strategies. Oregon State Habitat Office, Portland, Oregon. 3p; and work prepared by Bob Van Dyk following the method of display in Dent (2010).

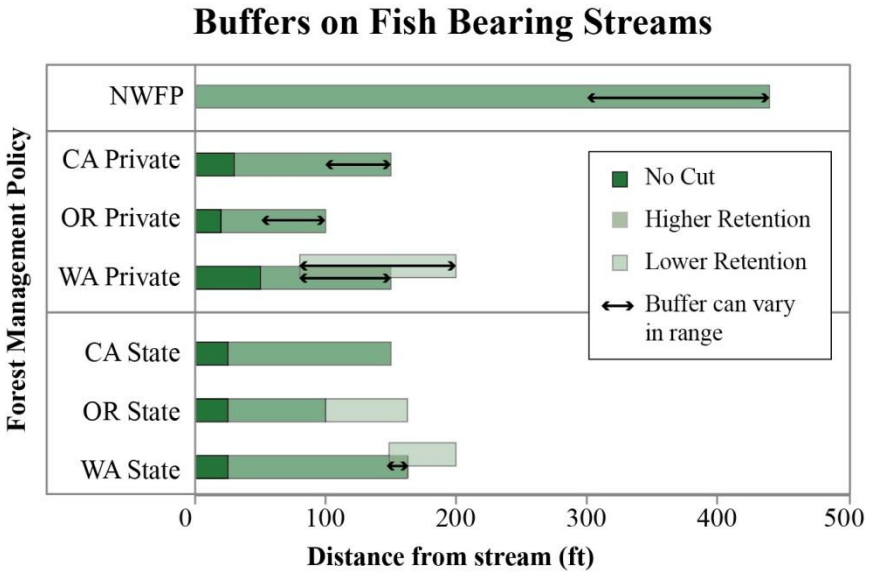


Figure 1. Forest buffers on fish bearing streams for state and private lands in California, Oregon, Washington, and for the Northwest Forest Plan (NWFP). *See table on page 21 for more specific information.*

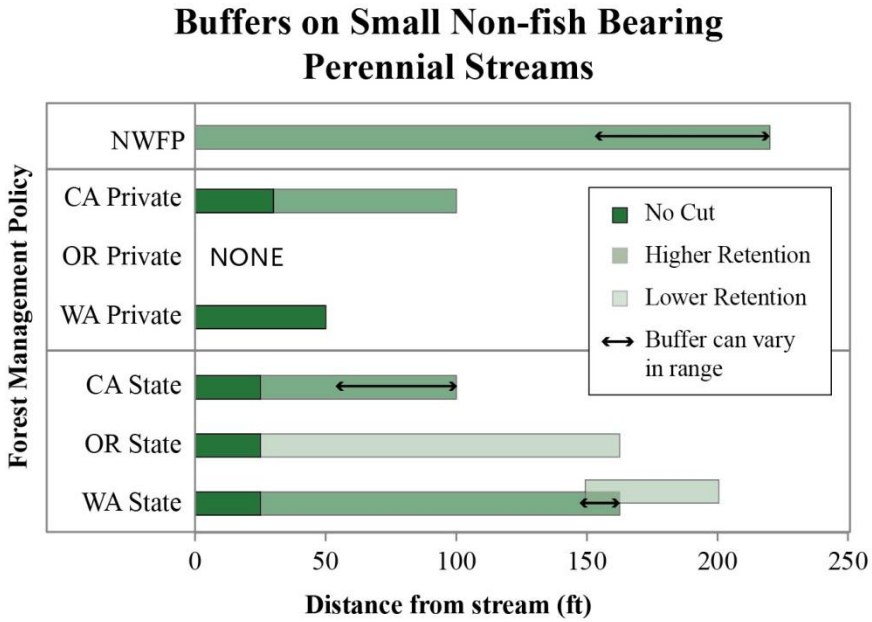


Figure 2. Forest buffers on small, non-fish bearing perennial streams for state and private lands in California, Oregon, Washington, and for the Northwest Forest Plan (NWFP). *See page 22 for more specific information.*

Appendix D: Endnotes

[1] The Nature Conservancy and Wild Salmon Center. 2012. An Atlas of Conservation Values. on Bureau of Land Management Holdings in Western Oregon, Oregon Explorer http://oe.oregonexplorer.info/ExternalContent/TNC/.

[2] The Nature Conservancy and Wild Salmon Center. 2012. An Atlas of Conservation Values. on Bureau of Land Management Holdings in Western Oregon, Oregon Explorer http://oe.oregonexplorer.info/ExternalContent/TNC/.

[3] Reeves, Gordon H., Jack E. Williams, Kelly M. Burnett, and Kirsten Gallo. "The Aquatic Conservation Strategy of the Northwest Forest Plan." *Conservation Biology* 20.2 (2006): 319-29.

[4] Calculated from statistics in: *North Pacific Salmon Fisheries Economic Measurement Estimates*. Version. 1.2. Portland: Wild Salmon Center, 2009; and date from: http://www.salmonnation.com/.

[5] State of Oregon. Coastal Salmon Restoration Initiative. The Oregon Plan for Salmon and Watersheds, submitted to the National Marine Fisheries Service. Salem, Oregon. March 1997.

[6] Hilborn, R.,T. Quinn, D. Schindler, and D. Rogers. 2003 Biocomplexity and fisheries sustainability. *Proceedings of the National Academy of Sciences* 100(11):6564-6568.

[7]Stanford, J. A., M. S. Lorang and F. R. Hauer. 2005. The shifting habitat mosaic of river ecosystems. Plenary Lecture. *Proceedings of the International Society of Limnology* 29(1):123-136.

[8] The Nature Conservancy and Wild Salmon Center. 2012. An Atlas of Conservation Values. on Bureau of Land Management Holdings in Western Oregon, Oregon Explorer http://oe.oregonexplorer.info/ExternalContent/TNC/.

[9] Independent Multidisciplinary Science Team. 1999. Recovery of Wild Salmonids in Western Oregon Forests: Oregon Forest Practices Act Rules and the Measures in the Oregon Plan for Salmon and Watersheds. Technical Report 1999-1 to the Oregon Plan for Salmon and Watersheds, Governor's Natural Resources Office, Salem, Oregon.

[10] State of Oregon. Department of Forestry. Private Forests Monitoring Report: Riparian Function and Stream Temperature (Ripstream) Project, Project Background, Status, and Findings to Date. Salem, Oregon. November 3, 2011.