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CONSERVATION GAINS AND LOSSES OF SENATOR RON WYDEN'S PROPOSED OREGON AND CALIFORNIA LAND GRANT ACT COMPARED TO THE NORTHWEST FOREST PLAN

Dominick A. DellaSala, Ph.D.
Chief Scientist, Geos Institute
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photos (left to right): K. Schafer, KS Wild, D. DellaSala

EXECUTIVE SUMMARY

photo: "Buck Rising" BLM Pilot near Roseburg, D. DellaSala

Using GIS analysis and best available science, Geos Institute conducted a spatially explicit analysis of the estimated conservation gains and losses proposed by Senator Ron Wyden's (D-OR) "Oregon and California Land Grant Act of 2013" (S.1784; 113th Congress) within only the BLM portion of the Northwest Forest Plan (NWFP) area as Forest Service and other BLM additions to S.1784 proposed on November 3 were not made publicly available until just before the scheduled markup of the bill (November 13). Here, we quickly updated analyses of prior versions of the bill by examining the "amendment in the nature of a substitute" (S.1784ANS) and qualitatively updating our prior analyses. Our current analysis compares how over two million acres of federal public lands (generally known as "O&C" lands) in Western Oregon administered by the Bureau of Land Management (BLM) would be managed under S.1784ANS compared to the

Northwest Forest Plan (NWFP) based on our interpretation of the bill's forestry and conservation provisions. S.1784ANS also included 200,000 acres of Forest Service lands recently added to the bill that were examined qualitatively given the lack of maps at the time and time constraints.

BLM Lands Contain Irreplaceable Public Benefits

BLM lands in western Oregon are of great importance to conservation groups because they contain:

- Surface water source areas that supply clean water to over 1.5 million people.
- Evolutionary Significant Units for the recovery of imperiled salmonids.
- Key Watersheds important for aquatic ecosystem integrity region-wide.
- Older (>85 years) lower elevation forests as habitat for federally threatened species that are important landscape connections between the Cascades and Coast ranges
- Older high biomass forests that store the CO_2 equivalent of nearly 40 times Oregon's annual greenhouse gas pollution.
- Areas likely to act as refugia in a changing climate (e.g., valley bottoms, stream corridors, north-facing older forests).

Thus, legislative proposals that change land allocations in this area are of great conservation interest, particularly given the irreplaceable role that BLM lands play in implementation of the NWFP in the so-called "checkerboard" ownerships and decades of conservation investments in the successful implementation of the NWFP.

To assess net gains and losses from the proposed legislation, we compared legislative changes to the NWFP on BLM lands with respect to the land area generally protected from logging vs. that generally unprotected from logging; changes to land allocations of importance to federally threatened (e.g., critical habitat) and at-risk species; Key Watersheds, Evolutionary Significant Units and Riparian Reserves; and areas important to climate change resilience.

Conservation Gains

Trees marked for retention – BLM Buck Rising pilot– D. DellaSala

Overall, S.1784 would result in a slight increase (not including recent Forest Service lands) in net conservation gains compared to the NWFP as follows:

- ~14,830 ac (1%) increase in conservation status of BLM lands mainly from "matrix" lands switching to Conservation Emphasis Area (CEAs).
- ~495,194 ac and 200 miles of Wild and Scenic river miles added to the National Landscape Conservation System, including:
    - Rogue Canyon and Molalla National Recreation Areas
    - Illinois Valley Salmon and Botanical Area
    - Kilchis Salmon Emphasis Area
    - Several Areas of Environmental Concern (BLM category)
    - Cathedral Hills Recreation and Natural Area
    - Cascade-Siskiyou National Monument expansion
    - Wild Rogue and Devils Staircase Wilderness (separate designations)
    - Several Primitive Backcountry Areas
- Tighter restrictions on grazing, mining, and Off Road Vehicles either in all designations or portions of them.
- Prohibition on post-fire logging in CEAs and limitations on it to trees <150 years old in FEAs.
- ~250,000 acres of moist late successional old growth (>85 years upon date of enactment) permanently protected, and all old-growth trees (>150 years old; acreage not available) in either dry or moist forests.
- Elevated conservation status for ~95,000 acres of Evolutionary Significant Units (ESUs) of salmonids (mostly Southern Oregon/Northern California Coast Coho and Klamath Mountains Steelhead), Key Watersheds (6% increase in protections),

and Designated Water Supply Management Units (16,862 acres) – although this is partially offset by Forestry Emphasis Areas (FEAs) elsewhere.

Not examined in GIS analysis, but placed in the conservation gains column:

- Elevated conservation status of ~170,000 ac of BLM lands in eastern Klamath County that are not O&C lands but are under the NWFP and included in the bill.
- Approximately two-thirds of 200,000 acres of National Forest lands transferred to BLM would go into CEAs (mostly older forests) and placed within the National Landscape Conservation System.
- The ability to use pesticides is highly restrained.

Conservation Losses

S.1784 would approximately double logging levels on BLM lands over NWFP levels from areas changing land allocations to FEAs, reduced stream buffer widths, and reduced tree volume retentions within FEAs among other changes.

photo: Ecoforestry as implemented by BLM on Buck Rising pilot – D. DellaSala

- ~388,000 acres of Late-Successional Reserves (LSR) move to FEAs offset somewhat by ~400,000 acres of "matrix" moving to CEAs.
- Slight increase (6%) in land allocations of benefit to the Northern Spotted Owl but likely offset by increased number of small forest patches as large blocks are broken up (fragmented) by FEAs, and offset by increased edge metrics of forest patches that may trigger Barred Owl related extirpation risks to Northern Spotted Owl territories and the need for future up-listing of spotted owls to "endangered."

- Reduction of 20% of critical habitat and 23% of estimated suitable habitat of Marbled Murrelet and Oregon Coast Range population of the Red Tree Vole, respectively, that could lead to future up-listing (murrelet) or listing (vole).
- Reduction in ESUs for Oregon Coast Coho and Upper Willamette Steelhead and Key Watersheds (~15% change in status).
- Reductions in riparian buffer widths by one-tree height distance for FEAs and streams determined to be of not "great ecological significance" (undefined).
- Reductions in tree retention standards in logging units from one-third of standing volume under the NWFP to ~one-quarter but not less than 15% if not within a NWFP key Watershed, critical habitat, or Source Water Emphasis Area.
- Approximately one-third of 200,000 acres of National Forest lands with trees <85 years old transfer to BLM as FEAs (most of these lands are plantations).
- Approximately 32,630 acres of federal public forestlands transferred to the Confederate Tribes of the Coos, Lower Umpqua and Siuslaw, and the Cow Creek Band of Umpqua Tribe (these include older forests, some with wilderness quality, and critical owl habitat areas).

PURPOSE AND NEED

Western Oregon includes ~2.5 million acres of lands managed by the Bureau of Land Management (BLM) across six districts (Eugene, Salem, Coos Bay, Roseburg, Medford, and Lakeview). About 2.1 million acres of these lands are managed under the requirements of the O&C Lands Act of 1937 with the remainder (406,600 acres) managed

as "public domain" and "acquired" lands managed under the Federal Land Policy and Management Act (FLPMA). Almost all of these BLM lands are managed under the provisions of the NWFP with nearly one third (739,000 acres) designated as late-successional reserve (LSR). S.1784ANS pertains specifically to: (1) a subset of BLM lands managed under the NWFP (within the range of the Northern Spotted Owl) in western Oregon; (2) BLM lands in eastern Klamath County not under the NWFP; and (3) 200,000 acres of National Forest lands (maps not available during our analysis). Our analysis focuses quantitatively on the BLM lands under the NWFP and qualitatively on other lands.

For the purpose of context, every acre of BLM land in western Oregon has conservation potential, some are realized more than others, mainly because of the highly fragmented and degraded context within which BLM lands occur (see Figure 1 checkerboard). Thus, the conservation value of all BLM western Oregon lands is greater than the-sum-of their ecosystem parts because of the relatively high conservation value compared to the nonfederal surroundings (although BLM plantations are also highly degraded and need restoration). Based on prior analyses[1], BLM western Oregon lands contain the last of the region's older forests, low-elevation unlogged forested blocks, north-facing older forests (potential climate refugia), salmon strongholds, functional watersheds and riparian areas, and large intact watersheds important in connectivity and wildlife dispersal particularly under a changing climate (Appendix A). BLM western Oregon older forests are also among the most carbon dense ecosystems in North America and the long-term storage of carbon in these "high-biomass forests"[2] is of immediate urgency in helping to stem global climate change.

Because of the high conservation status of BLM lands in western Oregon generally and controversy over timber vs. conservation, Geos Institute and Oregon Wild performed a GIS analysis (see Appendix B for methods) of prior iterations, updated qualitatively on November 3, 2014, of Senator Ron Wyden's (D-OR) proposed "Oregon and California Land Grant Act of 2014" (S.1784ANS) [3] to determine the net conservation gains and losses if the legislation becomes law as compared with the status quo NWFP. A companion assessment of the bill's forestry effects on estimated CO_2 emissions was previously sent to Senator Wyden and conservation groups indicating that the bill's logging provisions of 350-400 million board feet annually would result in the equivalent CO_2 emissions of 6.3 million barrels of oil annually[4]. Although the conservation

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[1]Staus, N.L., J. R. Strittholt, and D. A. DellaSala. 2010. Evaluating areas of high conservation value in western Oregon with a decision-support model. *Conservation Biology* 24: 711–720.

[2]Krankina, O., D.A. DellaSala, J. Leonard, and M. Yatskov. 2014. High biomass forests of the Pacific Northwest: who manages them and how much is protected? *Environmental Management*. DOI 10.1007/s00267-014-0283-1

[3]For this analysis, we used a prospective "amendment in the nature of a substitute" (ANS) dated November 3, 2014.

[4]Krankina, O., and D.A. DellaSala. Projected CO_2 emissions due to increased logging under Senator Ron Wyden's "Oregon and California Land Grant Act of 2013." http://www.geosinstitute.org/press-room-sp/press-releases/1186-increased-logging-on-bureau-of-land-management-lands-in-western-oregon-would-rival-carbon-dioxide-pollution-from-cars-and-power-plants.html

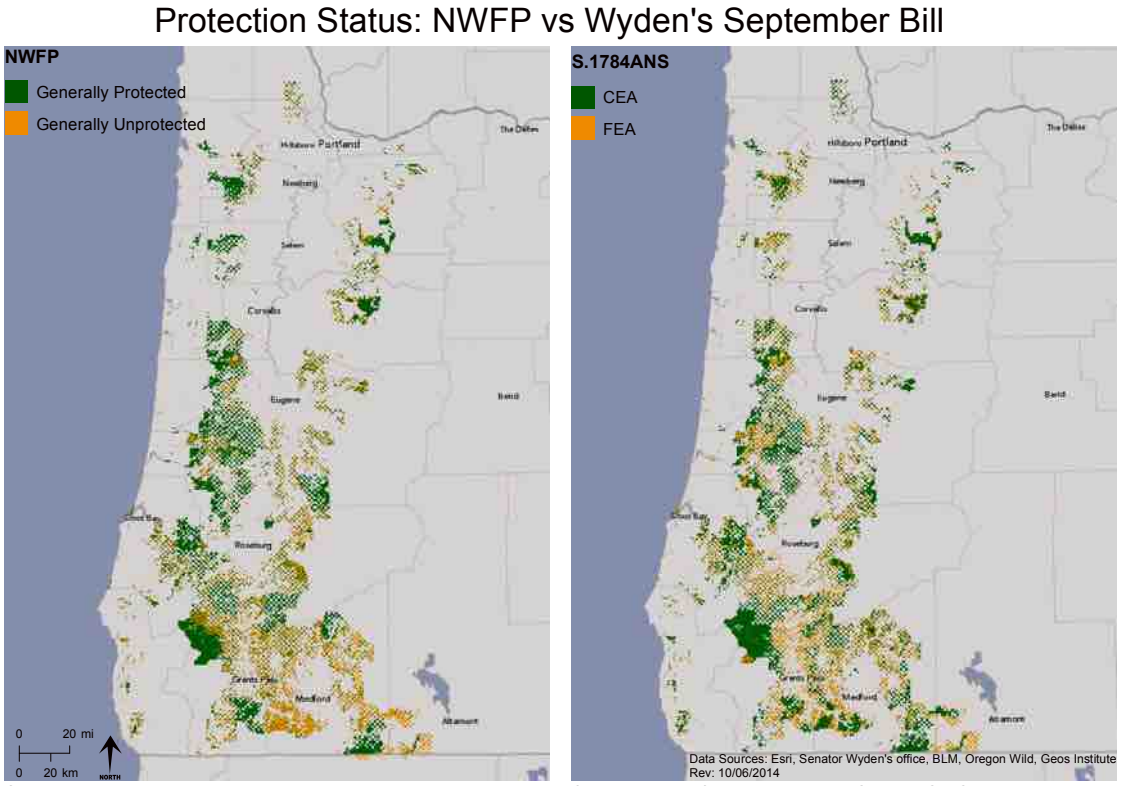
measures added to prior versions of Senator Wyden's bill are important and appreciated, they do not make up for the estimated emissions from doubling of logging levels.

For this assessment, we did not have time to have our findings peer reviewed but instead conducted a rapid GIS assessment of how the bill would generally impact the NWFP. We provided all data layers to conservation groups (for their own analyses and reporting) and Senator Wyden's staff to aid in assessments of likely conservation outcomes and outreach strategies.

This analysis examines four major provisions of S.1784ANS compared to the NWFP:

(1) land area generally protected from logging vs. generally unprotected from logging (other stressors examined qualitatively);
(2) potential effects of conservation and forestry provisions on Northern Spotted Owl (federally threatened), Marbled Murrelet (federally threatened), Coast Range population of Red Tree Vole (warranted for ESA-listing but precluded by U.S. Fish & Wildlife Service due to higher priorities), and Evolutionary Significant Units (ESUs) of at-risk salmonids;
(3) Riparian Reserves and Key Watersheds; and
(4) climate change resilience and refugia in relation to connectivity, forest-patch sizes, edge metrics, and low-elevation moist forests.

For the protected area status, we chose as a baseline the NWFP as conceived (NWFPc) given that the plan is administrative and subject to revisions (e.g., BLM Western Oregon Plan Revisions (WOPR) II). For the conservation biology analysis (i.e., fragmentation, edge metrics, connectivity), we used the NWFP as implemented (NWFPi) given the resulting forest patches are fixed features on the landscape and are most germane to the bill's fragmentation effects in the checkerboard (Figure 1).



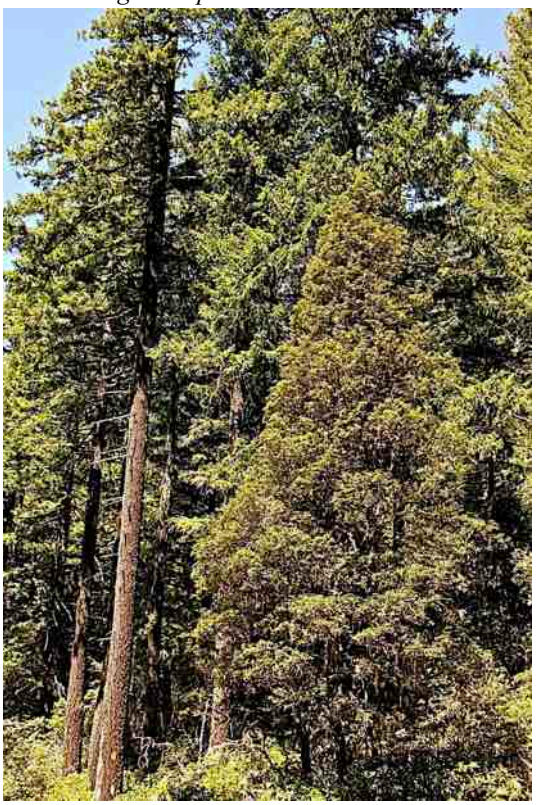
Generally protected in the NWFP includes: Administratively Withdrawn, Late Successional Reserves, AMR, Congressionally Withdrawn, and Riparian Reserves. Generally unprotected includes: Adaptive Management and Matrix within BLM land allocations.

CEAs and FEAs reflect changes made to S.1784ANS in September and clipped to the NWFP BLM lands. CEAs also include riparian reserves, old growth network.

Figure 1. Distribution of Conservation Emphasis Areas (CEAs) and Forestry Emphasis Areas (FEAs) proposed by S.1784ANS for BLM lands vs. NWFPc. Note the fragmented (checkerboard) landownership pattern throughout the region.

LAND AREA GENERALLY PROTECTED FROM LOGGING VS. GENERALLY UNPROTECTED

Buck Rising BLM pilot – D. DellaSala



Generally protected lands include both legislative and administrative allocations that either preclude logging or limit it to thinning to accelerate late-successional characteristics in degraded plantations (moist forests) or for fuel reductions in dry forests among other measures. Specifically, S.1784ANS would create a network of Conservation Emphasis Areas (CEAs) mostly consisting of the Dry Area Conservation Network (~292,000 acres, DACN) and Moist Area Conservation Network (~403,000 acres, MACN; Figure 1).

Thus, S.1784ANS allocates slightly (~14,830 ac, 1%) more land to conservation than does the $NWFP_C$ and provides a net conservation benefit overall (Tables 1, 2). The difference between the two approaches comes mainly from re-designating some land allocations that are generally protected under the NWFP to FEAs and vice-versa. In general, the lands what would go to S.1784ANS as CEAs from the NWFP matrix are the older, natural, forest stands, while those going to S.1784ANS as FEAs are from NWFP LSRs that weren generally previously logged (mostly plantations).

Table 1. Federal public forestlands that are or would be generally protected vs. generally unprotected from logging only (other protections are discussed below but not included here).

	$NWFP_C$		***S.1784ANS***	
	Acres	*Percentage*	*Acres*	*Percentage*
Generally Protected (Conservation)	1,467,975	62.1%	1,482,805	62.8%
Generally Unprotected (Timber)	896,654	37.9%	877,222	37.2%
Total Acres*	**2,364,629**		**2,360,027**	
*Time did not allow total reconciliation of the GIS layers to resolve the differences in data set total acreages. Nonetheless, it is <0.2% discrepancy.				

Table 2. Changed conservation and timber status proposed by S.1734ANS vs. the NWFPc.

	NWFP Status	S.2734ANS Status	Acres
Conservation Status Elevated	Matrix	Conservation Emphasis	404,954
Conservation Status Lowered	Reserve	Forestry Emphasis	387,985
Conservation Status Unchanged	Reserve	Conservation Emphasis	1,077,851
Timber Status Unchanged	Matrix	Forestry Emphasis	489,237
Total			**2,360,027**

S.1784ANS also designates BLM lands (~495,194 ac; ~200 miles Wild and Scenic Rivers) of conservation importance in the CEAs (Table 3) and additional BLM lands outside of the NWFP in eastern Klamath County Oregon (Table 4).

Table 3. Estimated conservation status of BLM lands protected under S.1784ANS.

Conservation Status	Acres (ac) or River Miles (RM)	Importance
Rogue Canyon and Molalla NRA	118,000 ac	Unique and nationally important recreational, ecological, scenic, cultural, watershed, and fish and wildlife values of the areas
Special Management Areas	160,267 ac	Protecting, preserving and enhancing natural character, scientific use, and botanical, recreational, ecological, fish and wildlife, scenic, and cultural values along with opportunities for primitive recreation
Illinois Valley Salmon and Botanical Area	7,200 ac	Extraordinary plant diversity (many endemics), fish stronghold
Kilchis Salmon Emphasis Area	5,000 ac	Popular fishing area (salmon/steelhead) in Coast Range
Special Environmental Zone	95,767 ac	Mostly Areas of Critical Environmental Concern (BLM category)
Primitive Backcountry Areas	52,300 ac	Grizzly Peak (2100 ac); Dakubetede (21,200 ac); Wellington Wildlands (5,700 ac); Mungers Butte (10,200 ac); Brumitt Fir (2,000 ac); Crabtree (2,100 ac); Applegate (9,000 ac)
Cathedral Hills Recreation and	560 ac	Popular trail system just outside Grants Pass

Natural Area		
Cascade-Siskiyou National Monument Expansion	2,050 ac	Biological crossroads connecting surrounding physiographic provinces recognized for extraordinary importance
Wild Rogue and Devils Staircase Wilderness	56,100 ac (Wild Rogue) 6,800 ac Devils Staircase	Intact roadless areas and important for fish
Wild and Scenic Rivers	77.8 RM total: Molalla River and Table Rock Fork Molalla River (21.3 RM); Nestucca River, Walker Creek, North Fork Silver Creek, Jenny Creek, Spring Creek, Lobster Creek and Elk Creek (52.3 RM); Upper Wasson Creek WSR (4.2 RM)	Headwaters, undeveloped, fish strongholds, popular for recreation
Tributary streams added to Wild and Scenic system	37 segments totaling 121.0 RM added to lower Rogue Wild and Scenic River	Headwaters, undeveloped, fish strongholds, popular for recreation
Conservation Emphasis Areas and Old-Growth Forest Heritage Areas	see acreages in Table 1	Added to the National Landscape Conservation System (Dept. of Interior)

Table 4. Federal public lands (acres or river miles) and waters outside of BLM Lands under the NWFP that would receive elevated conservation status under S.1784ANS

Eastern Klamath County BLM Lands	Part of Dry Area Conservation Network and the National Landscape Conservation System.	170,000 ac
Various Parcels	Transfer to the National Forest System.	25,000 ac
Devil's Staircase Wilderness	Forest Service portion of new Wilderness.	23,600 ac
Franklin and Wasson Creek Wild and Scenic Rivers	Total of 14.6 miles.	3,392 ac
Elk Wild and Scenic River Additions	Total of 35.2 miles	11,264 ac
O&C "Controverted" Lands	Elimination of any residual O&C status for the National Forest System lands.	500,000 ac
Chetco River Protection	Protect Wild and Scenic River from mining and upgrade classification.	11,360 ac
Elk Creek (Rogue River Basin) Lands	Transfers lands to BLM CEA management from US Army Corps of Engineers. (In addition, the Elk Creek Dam is de-authorized.)	3,502 ac
Total non-BLM NWFP Area with an elevated status *Some lands overlay and some already have some elevated status.		**748,188 ac**

Above and beyond the NWFPc, S.1734ANS addresses critical land-use stressors to BLM lands such as mining, livestock grazing, off-road vehicle use, utility corridors and roads (Table 5). Notably, these gains in conservation certainty could be substantial given that post-fire logging is a significant source of timber volume and degradation of complex early seral forests on BLM lands[5], especially during active fire seasons (e.g., droughts) as there is potential that post-fire logging will scale-up in response to anticipated increases in fire in dry forests. Mining is also a significant threat on BLM lands in western Oregon and this prohibition will help with related efforts to protect some of the at-risk watersheds in the area. As an example, new mining or water projects would be prohibited on 19.7 miles of Rogue River tributaries (portions of Kelsey Creek, Grave Creek, Centennial Gulch and Quail Creek).

[5]DellaSala, D.A., R.G. Anthony, M.L. Bond, E. Fernandez, C.T. Hanson, R.L. Hutto, and R. Spivak. 2013. Alternative views of a restoration framework for federal forests in the Pacific Northwest. *Journal of Forestry 111:402-492*.

Table 5. Land-use stressors addressed in generally protected lands under the NWFP vs. S.1784ANS.

Stressor	***NWFP Reserves***	***S.1784ANS CEAs***
Logging for Production of Logs	Prohibited	
Logging as Byproduct of Ecological Restoration Thinning	Allowed in certain land allocations, not in others	
Post-Disturbance Logging	Implicitly discouraged	Implicitly prohibited
Mining (new)	No restriction	Prohibited
Roads	Implicitly restricted in reserves; explicitly limited in Key Watersheds	New roads implicitly prohibited plus road decommissioning*
Off-Road Vehicles	Underlying local management plans limit ORVs in some areas, but not comprehensively	Explicitly banned in certain areas and implicitly banned in others*
Utility Corridors	No significant restriction	Implicitly prohibited
Livestock Grazing	Implicitly limited in Riparian Reserves only	Implicitly limited in all areas
* S.1784ANS requires all activities in CEAs be "consistent with the purposes and values for which the area was designated."		

Finally, S.1784ANS includes three important protection measures not in the NWFP: (1) late successional old growth forest heritage areas consisting of moist forest stands >85 years at the date of enactment; (2) old growth trees >150 years on dry or moist forests; and (3) prohibitions on logging (including post-fire), mining, grazing, and ORVs within CEAs. The prohibition on logging fire-killed stands in CEAs would allow for development of complex early seral forests and replacement of older forests disturbed by natural factors, which is an exceedingly important measure given rarity and ecological importance of recently burned un-logged landscapes[6]. S.1784ANS; however, would mandate untested ecological forestry in fish and wildlife habitat.

[6]Swanson, M.E., J. F. Franklin, R.L. Beschta, C. M. Crisafulli, D.A. DellaSala, R.L. Hutto, D. B. Lindenmayer, and F. J. Swanson. 2011. The forgotten stage of forest succession: early-successional ecosystems on forested sites. *Frontiers in Ecology and Environment* 9:117-125 doi:10.1890/090157

CONSERVATION BIOLOGY IN RELATION TO S.1784ANS

The above analysis was mainly about comparing net acres under the two approaches (S.1784ANS vs. NWFPc). Here, we expand on that approach by comparing land status in the NWFPi vs. S.1784ANS with respect to at-risk species based on well-established scientific constructs in conservation biology developed over decades of detailed observations and models of the main drivers of species and habitat losses worldwide. Some of the more notable conservation biology tenets used by scientists in land-use scenarios like this one include: (1) large reserves are better at maintaining biodiversity than smaller ones – although small ones are also important if well-distributed and connected across regions; (2) extinction risks increase as the level of landscape fragmentation increases (i.e., context matters); and (3) connectivity among large blocks is important for movement of species along gradients (latitudinal, elevation). In this region, low-elevation mature forests, especially on north-facing slopes, along with river corridors, valley bottoms, and enduring landscape features are hypothesized as refugia for drought-intolerant species[7]. Thus, for this analysis we examined a suite of metrics related to fragmentation and climate change resilience to determine if S.1734 is consistent with widely accepted conservation biology principles. By resilience, we mean the ability of a species or particular ecosystem to withstand a disturbance without shifting to a degraded ecosystem state. Fundamental to resilience theory, is the need for connectivity (to allow movement of species in response to changes in their climate envelope), climatic refugia (areas likely to maintain extant microclimates), and management constraints that reduce land-use stressors (to minimize cumulative effects that may push species and ecosystems to the brink)[8].

At-Risk Species Metrics

Likely impacts to three at-risk wildlife species from S.1734ANS were estimated by comparing the bill's provisions to critical or estimated suitable habitat (Table 6) and this was supplemented with forest fragmentation metrics given that at least two of the at-risk species (spotted owl, murrelet) are known to be adversely impacted by fragmentation of large blocks into smaller ones (Table 7). We also conducted an analysis of elevation (2000 foot intervals) to determine whether low-elevation areas (0-2000 feet) are differentially impacted by the bill's FEA provisions, which generally appears to be the case as more low elevation lands are moved into FEAs (Table 8).

[7]Olson, D.M., D.A. DellaSala, R.F. Noss, et al. 2012. Climate change refugia for biodiversity in the Klamath-Siskiyou ecoregion. Natural Areas Journal 32:65-74.
[8]See Paine, R.T., M.J. Tegner, and E.A. Johnson. 1998. Compounded perturbations yield ecological surprises. Ecosystems 1: 535-545.

Table 6. Changed habitat area status of three terrestrial species of concern from NWFPc to S.1734ANS.

Conservation Status Change	NWFPc	S.1784ANS	Northern Spotted Owl Critical Habitat	Marbled Murrelet Critical Habitat	Estimated Red Tree Vole Habitat
Elevated	Matrix	Conservation Emphasis	210,898	20,996	879
Lowered	Reserve	Forestry Emphasis	159,802	82,328	110,432
No Change-Protected	Reserve	Conservation Emphasis	668,194	181,028	369,269
No Change-Unprotected	Matrix	Forestry Emphasis	127,524	22,382	556
Total			**1,166,418**	**306,735**	**481,135**
Net Acreage Change in Critical Habitat Underlying Land Allocation Conservation Status			51,096	(61,331)	(109,553)
Net Acreage Change in Critical Habitat Underlying Land Allocation Conservation Status			4%	-20%	-23%

*There is significant overlap of officially designated and estimated designated Critical Habitat for Northern Spotted Owl, Marbled Murrelet and North Oregon Coast Range distinct population segment of the red tree vole (habitat was mapped based on EPA ecoregion level 4 for Oregon Coast Range where the species occurs).

Table 7. Forest fragmentation metrics comparing S.1784ANS to the $NWFP_C$.

Fragmentation Metric	NWFPc Generally Protected	NWFPc Generally Unprotected	Wyden CEAs Generally Protected	Wyden FEAs Generally Unprotected
No. Patches	18,282	20,380	23,714	31,842
Mean Patch Size (ac)	32	18	25	11
Patch Size Standard Deviation	487	117	391	38
Mean Perimeter-Area Ratio	9,130	37,923	44,496	134,170
Edge Density	45	48	60	57

*Note: increases in fragmentation occur when large patches are broken into more and smaller ones, higher perimeter to area ratios (meaning more edge is present), and greater edge density (amount of edge across a given landscape). Standard deviation

represents the variability in patch sizes. Not all the analysis performed in Appendix B were included in this table to keep the report simple (additional analyses are available by request).

Table 8. Change in conservation status of elevation bands (2,000 foot increments) from S.1784ANS as compared to the NWFPc.

Elevation Class in feet	Conservation Status Elevated	Conservation Status Lowered	No change-Protected	No change-Unprotected
0 - 2000	152,004.93	227,556.40	643,660.65	211,617.38
2001 - 4000	208,197.42	150,979.01	378,726.01	232,269.82
4001 - 6000	43,904.30	9,383.01	55,281.51	43,481.54
> 6000	845.66	66.09	167.09	1,859.72

Northern Spotted Owl

photo: US Fish & Wildlife Service

The Northern Spotted Owl was listed as federally threatened in 1990 due primarily to destruction and adverse modification of its older forest habitat. Spotted owls primarily nest, roost, and forage in older forests, although they also forage (and sometimes nest) in complex early seral forests that include large patches of high severity burns (presumably due to high prey densities). Thus, actions that protect older forests (including mature) and prohibit post-fire logging contribute to owl recovery; those that convert either older and/or complex early seral forests to plantations, particularly at the expense of critical or suitable owl habitat, impede recovery. Notably, high levels of forest fragmentation have

been associated with increased territorial extirpations of spotted owls due to competitive interactions[9]. Thus, any additional fragmentation of the checkerboard area is likely to trigger increased pressure from Barred Owls at the expense of occupied spotted owl territories. S.1784ANS would result in a slight (6%) increase in overall conservation status of the land allocations related to critical habitat for spotted owls (Table 5); however, several fragmentation metrics go up, including a greater number of forest patches (because large ones get broken into smaller ones), smaller average patch sizes, and increases in edge metrics (Table 7). Notably, the area south of Roseburg was singled out in our analysis because it is already a known "bottleneck" where owl dispersal to and from the Cascades and Coast ranges is constricted by the checkerboard arrangement of ownerships. Increased fragmentation in this location is especially problematic to owl recovery goals as the Tyee demographic study area near Roseburg was the only study area of 11 demographic areas in the range of the owl with an annual change in mean population size that was not declining (as of 2006)[10]. Thus, increased fragmentation from S.1784ANS may reverse the relatively stable trend in owl populations in this area by cutting off an important corridor for owl dispersal between mountain ranges. Greater habitat losses coupled with the advance of Barred Owls, particularly in fragmented areas, may trigger the future need to up-list the owl as "endangered." However, it is not known whether some of these losses would be compensated for by gains in young natural forests (complex early seral if not salvage logged) and Old-Growth Heritage Areas that may fill in some of the gaps in a highly fragmented landscape. Nonetheless, even with these additional measures in place, we hypothesize that owl population trajectories will increase as smaller CEAs fill up with Barred Owls, potentially rendering otherwise suitable older forests a mortality sink for spotted owls.

[9]Dugger, K.M., R.G. Anthony, and L.S. Andrews. 2011. Transient dynamics of invasive competition: bared owls, spotted owls, habitat, and the demons of competition. Ecol. Applications 21:2459-2468

[10]Forsman, E.D. et al. 2011. Population demography of Northern Spotted Owls. Studies in Avian Biology No. 40. 106pp.

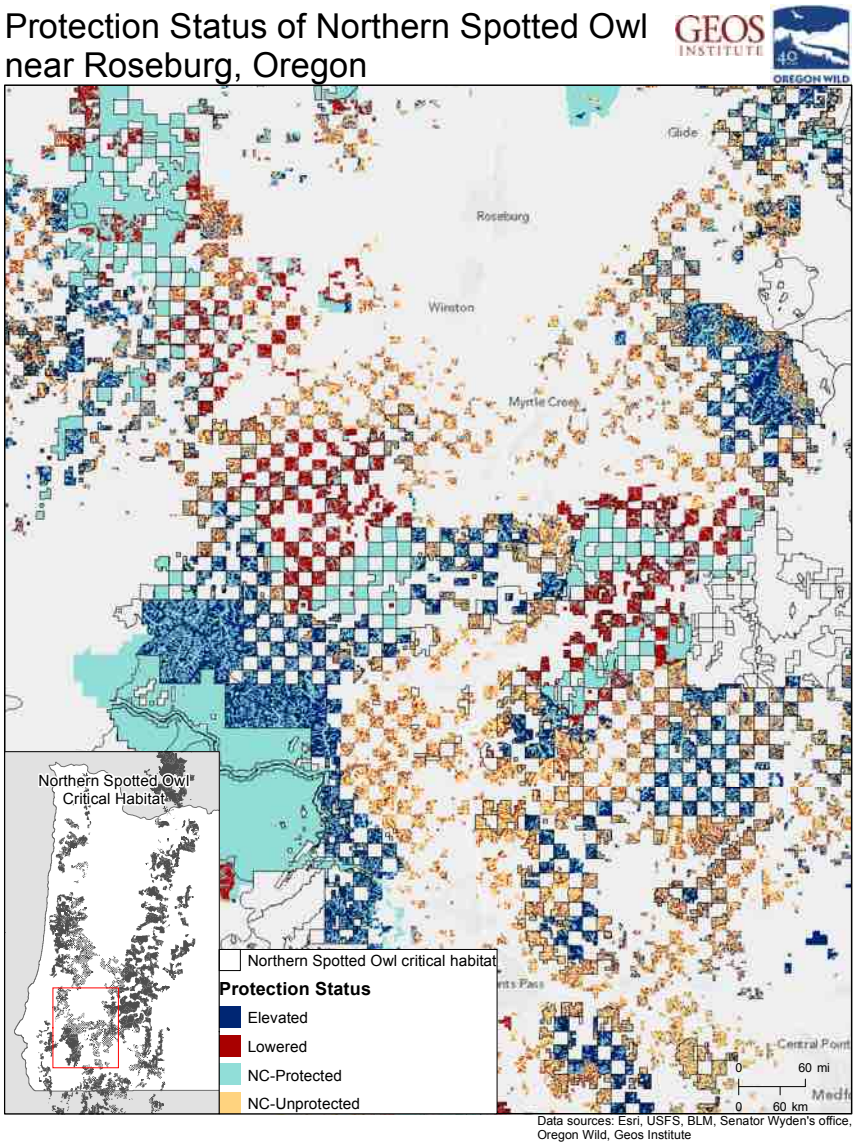


Figure 2. Changes to critical habitat of the Northern Spotted Owl proposed by S.1784 with a zoom-in on a potential "bottleneck" in the Roseburg area where habitat is already highly fragmented (red areas).

Marbled Murrelet

The Marbled Murrelet is a coastal seabird that nests in old-growth forests. It was listed as federally threatened in 1992 due, in part, to destruction of coastal older forests by logging. In contrast to slight gains in spotted owl habitat generally protected, S1784ANS would result in a net loss of 20% in the conservation status of the underlying land allocation in designated critical habitat as compared to $NWFP_C$. Notably, the murrelet is especially vulnerable to habitat fragmentation, mainly from increased nest-site predation by corvids (crows, ravens). Thus, fragmentation effects may accumulate in space and time against the backdrop of large losses in forests generally protected in the NWFPc (Table 6,7). Potential corridors for murrelet populations (e.g., coast to inland) will become increasingly fragmented (Figure 3). This could trigger future up-listing to endangered; however, it is not know whether the net conservation gains discussed above would offset some of these losses.

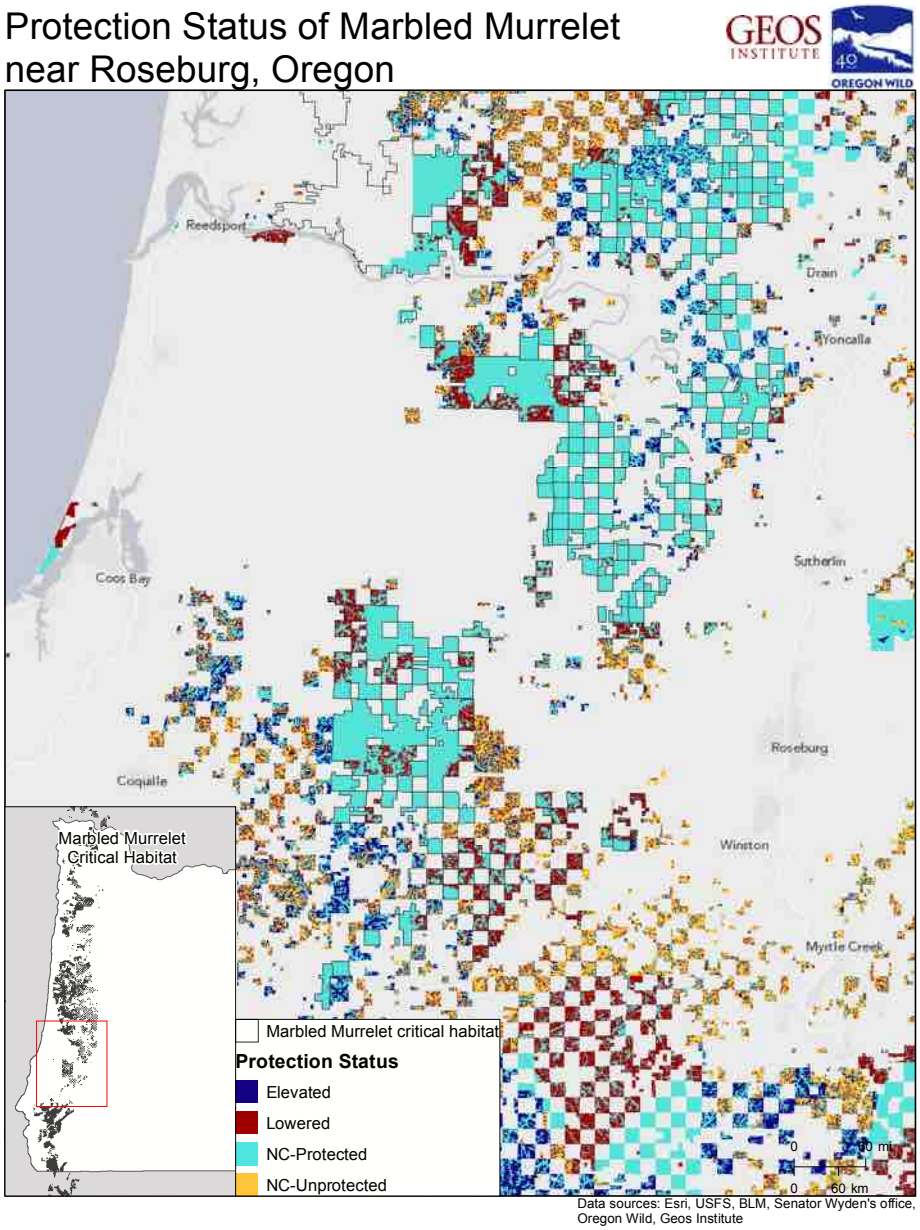


Figure 3. Changes to critical habitat of the Marbled Murrelet proposed by S.1784 with a zoom-in on a potential "bottleneck" where habitat is highly fragmented (proposed red areas).

North Oregon Coast Range Red Tree Vole (photo: U.S. Fish & Wildlife Service)

The North Oregon Coast Range distinct population segment (DPS) of the Red Tree Vole is mainly a nocturnal rodent that uses older forests in the Oregon Coast Range. The species was "warranted" for listing under the Endangered Species Act, but "precluded" by the U.S. Fish & Wildlife Service because of higher listing priorities. The state of Oregon also listed it as a sensitive-vulnerable species in the Coast Range ecoregion. S.1784ANS would result in ~23% net loss in the conservation status of the underlying estimated land allocation in potential habitat of this species as compared to the NWFPc. Loss of habitat along with fragmented areas (Table 6,7; Figure 4, red areas) will likely increase the need for future ESA-listing. Notably, the vole is an important prey item for spotted owls, particularly in the Coast Range, and thus any declines in the owl-vole food chain would have reverberating effects on owl recovery as well.

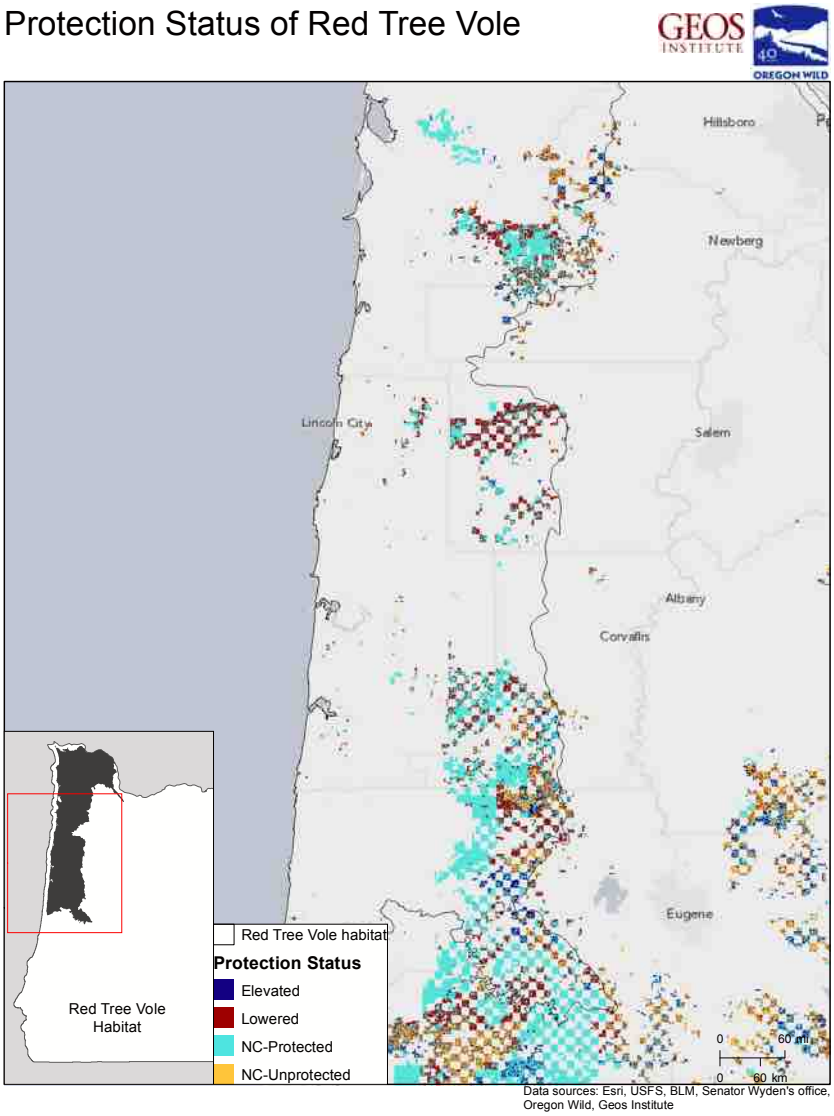


Figure 4. Protection status (mainly LSRs) of the Red Tree Vole within the known distribution of this species compared with the NWFPc (EPA Ecoregion 4 – Coast Range).

It is important to note that while the underlying land allocation in the designated or potential critical habitat for these ESA species of concern would be degraded, BLM obligations under the ESA to conserve the species would be undiminished for the federally listed species. However, both the owl recovery plan and critical habitat determinations have been openly criticized by scientific societies[11] for adopting untested ecoforestry provisions in owl habitat. Further, scientists have openly criticized the new

[11] http://www.fws.gov/oregonfwo/Species/Data/NorthernSpottedOwl/Recovery/Library/Documents/TWSDraftRPReview.pdf; http://www.conbio.org/images/content_policy/2012-7-16_TWS_Spotted_Owl_CH_Review.pdf

regulatory adverse modification standard recently adopted by the Fish & Wildlife Service as not protective enough of critical habitat.

Finally, while we did not analyze potential impacts to the Pacific Fisher, the U.S. Fish & Wildlife Service is considering the west coast population for federal listing (90 day review initiated on October 6, 2014). This population is declining mainly due to timber harvest, mortality from rodenticide exposure, and presumed wildfire habitat losses[12]. Because fishers use both complex early seral and late seral forests similar to the requirements of spotted owls, net gains and losses are anticipated to be similar.

EVOLUTIONARY SIGNIFICANT UNITS, KEY WATERSHEDS, RIPARIAN RESERVES

photo:westernrivers.org

Evolutionary Significant Units (ESUs)

ESU is a term that has largely been used to identify populations that are considered distinct for the purposes of conservation or endangered species listings as the ESA includes protection for distinct population segments. Because many salmonid runs are localized to specific watersheds or even watershed segments, they represent distinct population segments such that the loss of any single population is a reduction in unique genetic variability that in turn may increase extinction risks if gene flow is restricted

[12]Recent studies show fishers using post-fire habitats in the Sierra region, thus, whether fire is a significant threat remains to be seen. Hanson, C.T., Habitat use of Pacific Fishers in a heterogeneous post-fire and unburned forest landscape on the Kern Plateau, Siera Nevada, California. The Open For. Science J 6:24-30.

among nearby populations. Four salmonids have ESUs within the study area affected by S.1784ANS (Table 9). Coho (16% of the Oregon Coast ESU) and steelhead (9% of the Klamath Mountains ESU) have the highest percentages of the total ESUs for those species within the larger region. Overall, ESU status is elevated by ~95,000 acres by S.1784ANS. In general, net gains are highest (in absolute acres) for Coho Southern Oregon/Northern California Coasts and Steelhead Klamath Mountains vs. net losses that are greatest for Coho Oregon Coast and Steelhead Upper Willamette.

Table 9. Evolutionary Significant Units affected by S.1784ANS compared to the NWFPc.

ESU Name	Elevated	Lowered	NC-Protected	NC-Unprotected	Study Area Acres	Entire ESU Acres
Chinook						
Lower Columbia	5,537.92	821.82	12,631.76	1,091.48	20,082.98	3,464,768
Upper Willamette	54,468.71	68,937.06	141,449.43	69,241.43	334,096.63	4,874,167
Chum						
Columbia	3,731.90	766.96	5,014.66	896.53	10,410.04	2,786,249
Coho						
Lower Columbia	8,551.14	3,202.40	18,079.47	4,649.21	34,482.22	4,187,838
OR Coast	128,852.68	219,168.52	570,548.77	158,803.57	1,077,373.53	6,795,556
So. OR/ No. CA Coasts	179,780.21	82,374.17	263,232.33	204,288.52	729,675.24	11,530,796
Steelhead						
Klamath Mountains	179,780.21	82,374.26	263,232.33	204,288.52	729,675.32	8,310,565
Lower Columbia	8,527.88	3,017.37	17,546.09	4,648.45	33,739.79	3,241,880
Upper Willamette	26,461.38	40,822.08	86,855.55	29,911.84	184,050.84	3,124,699
	595,692	501,485	1,378,590	677,820	3,153,587	48,316,517

Key Watersheds

The Aquatic Conservation Strategy (ACS) of the NWFP is a region-wide conservation plan for halting further degradation of aquatic ecosystems through protection and restoration. Generally, the ACS has five main objectives: (1) watershed analysis; (2) Riparian Reserves (protection of stream buffers – see below); (3) Key Watersheds

(discussed here); (4) watershed restoration; and (5) forest plan standards and guidelines[13]. Tier 1 Key Watersheds provide strongholds for fish and high restoration potential while Tier 2 Key Watersheds primarily provide high quality water sources. For the purpose of this analysis, we did not distinguish Tier 1 vs. 2 watersheds and for the most part S.1784ANS carries over the standards and guidelines and restoration objectives of the NWFP with notable exceptions in the Riparian Reserves (discussed below). Under S.1784ANS a net increase in protection of Key Watersheds (6.3%) comes at the expense of reductions (-14.7%) elsewhere (Table 10).

Table 10. Comparison of Key Watersheds in the NWFPc vs. S.1784ANS. Note: percentages do not sum to zero (gain/loss) given they were based on different category totals.

Category	Acres	Percent Change
NWFPc		
Protected	296,141	-
Unprotected	126,007	-
Wyden		
CEAs	314,690	6.3
FEAs	107,458	-14.7*

*Comparison refers to going to S.1784ANS from NWFPc

[13]Reeves, G.H., J.E. Williams, K.M. Burnett, and K. Gallo. 2006. The aquatic conservation strategy of the Northwest Forest Plan. Conservation Biology 20:319-329.

Riparian Reserves (photo: K. Schaffer)

Riparian Reserves include the area from the stream to the outer boundary of the riparian ecosystem that is tightly linked to water quality and functioning of stream ecosystems (ibid #13). These reserves also are designed to link terrestrial with aquatic systems by acting as corridors for wildlife movements, providing shade for aquatic organisms, acting as potential climate refugia, and providing woody debris for streams. They are also places where both wildlife and cattle congregate, setting up conflicts over riparian degradation.

A mapped-based layer for Riparian Reserves and proposed changes was beyond the scope of this analysis given the short timeline and ambiguities in interpreting some of the standards in S.1784ANS for mapping purposes. However, qualitative comparisons were made of the bill's provisions vs. standards and guidelines of the NWFPc (Table 11). In general, S.1784ANS represents a net reduction in riparian buffers from 2 site-potential tree distances under the NWFPc to 1-site potential tree distance for the FEAs as the CEAs retain the buffers. Buffers within FEAs shrink even further if the stream is determined to be not of "great ecological importance" (category undefined) and/or non-fish bearing. Other logging provisions would also occur within an unspecified outer zone.

Table 11. Riparian protections for streams within Forestry Emphasis Areas Compared to Northwest Forest Plan as Conceived.

	S1784 August 2014 Wyden Staff Revision		Northwest Forest Plan
S.1784ANS Revision Stream Type	Riparian Reserve Width	Management Required in Riparian Reserves	Riparian Reserve Width

Fish-bearing streams of "great ecological importance"	1 site-potential tree distance or at least 150 feet	NWFP ACS Objectives	2 site-potential tree distance or at least 300 feet
Non-fish-bearing streams of "great ecological importance"	1 site-potential tree distance or at least 150 feet	NWFP ACS Objectives	1 site-potential tree distance or at least 150 feet (perennial) or at least 100 feet (seasonal)
Fish-bearing streams *not* of "great ecological importance"	100 feet	NWFP ACS Objectives	2 site-potential tree distance or at least 300 feet
Non-fish-bearing streams not of "great ecological importance"	50 feet	NWFP ACS Objectives	1 site-potential tree distance or at least 150 feet (perennial) or 100 feet (seasonal)
Outer Riparian Zone	*Revision language:* "The outer riparian zone is the area between the riparian reserve and one site-potential tree height"; we interpret here to mean that strip of land upslope from the edge of the specified riparian reserve and also within 1 site-potential tree distance from stream.	Variable retention harvest in moist forests under 80-years old (generally plantations) and logging dry forests of any age is allowed, plus, tree tipping is required. For thinning, minimum retention requirements, will be determined by BLM, in consultation with USFWS, NOAA and EPA.	No comparable land allocation
Compiled by Francis Eatherington, Cascadia Wildlands, 8-28-14			

It is not known if proposed legislative reductions in stream buffers would be offset by increased protections of Key Watersheds or ESUs in places and whether offsets would accrue sufficiently from grazing restrictions in CEAs as these measures are clearly an improvement over the NWFP writ-large. This is because the ACS with its intact buffers remains scientifically sound as it stands[14], and any reductions in buffer widths would diminish its effectiveness in recovering degraded streams already underway throughout the region as well as providing habitat for a broad suite of riparian obligates in the outer riparian zone, particularly in a changing climate. Scientists with backgrounds in aquatic science (ibid #14), for instance, recently recommended that large areas of forest protection are needed to prevent warming of shallow groundwater, continuous no-cut zones (exceeding 160 feet) for shading and wildlife habitat, cessation of livestock grazing

[14]Frissell, C.A., R.J. Baker, D.A. DellaSala et al. 2014. Conservation of aquatic and fishery resources in the Pacific Northwest: Implications of new science for the Aquatic Conservation Strategy of the Northwest Forest Plan. http://www.coastrange.org

to prevent riparian zone degradation from livestock (which is very significant throughout the region), and analysis of nutrient loading effects of management actions among other recommendations.

In sum, the net gains and losses to aquatic systems are complicated by gains in protection of some ESUs and Key Watersheds and losses to others and the narrowing of Riparian Reserves in FEAs and this is not a zero sum given how degraded most of the checkerboard lands are due to cumulative effects. Further, fully retaining the NWFP standards and guidelines is essential for climate change resilience given that climate models show increases in winter precipitation and more rain-on-snow events in this region and thus smaller buffers may exacerbate flooding impacts[15].

DRINKING WATER

Photo: B. Barr

In a prior analysis, Geos Institute estimated the importance of BLM lands in western Oregon to drinking water supplies and determined that 26 watersheds are providing high-quality drinking water to over 1.5 million people[16]. Senator Wyden responded to calls for the safety of drinking water supplies with designation of ~16,862 acres as "Drinking

[15]http://www.geosinstitute.org/climatewise-program/completed-projects/799-rogue-river-basin.html
[16]D.A. DellaSala. 2013. Ecological importance of Bureau of Land Management O&C and Coos Bay Wagon Road Holdings in western Oregon with special attention to surface water source areas. http://www.geosinstitute.org/images/stories/pdfs/Publications/FederalLandsManagement/BLMOCvaluesJune2013opt.pdf

Water Special Management Units" (DWSMUs) in four municipalities (Eugene, Springfield, Hillsboro, and metropolitan areas of Clackamas County). DWSMUs would be managed "for the purposes of ensuring the protection of the watersheds as a source of clean drinking water, to safeguard the water quality and quantity in the area, and to allow visitors to enjoy the special scenic, natural, cultural, and fish and wildlife values of the watersheds. Thus, DWSMUs would be established and a net benefit to water quality and biodiversity would accrue from prohibitions on livestock grazing.

CONCLUSIONS

Murrelet chick –mariaruthbooks.com

Geos Institute, with GIS assistance from Oregon Wild prepared, an analysis of the net conservation gains and losses that would take place if S.1784ANS becomes law based on comparing the bill's provisions to the NWFP within BLM NWFP lands. Conservation groups will be deciding whether the conservation gains and greater the certainty of legislation offset losses and uncertainty in forthcoming BLM Resource Management Plan revisions. Further, regardless of the conservation provisions of S.1784ANS, the estimated timber volume of 350-400 million board feet annually will have consequences to the region's climate equivalent to annual CO_2 emissions of adding nearly a half-million additional vehicles to Oregon's highways, or burning over 6 million barrels of oil, or increasing CO_2 emissions by 50% from Oregon's coal-fired Boardman power plant (ibid #4). Any change in management philosophy on BLM lands will result in winners and losers with respect to fish and wildlife habitat, ecosystem services, and other public values as compared to the NWFP. That is precisely why the NWFP is considered a global model in biodiversity conservation and ecosystem management and as a floor from which to build additional protections[17].

[17]DellaSala, D. A., and J. Williams. 2006. Northwest Forest Plan Ten Years Later – how far have we come and where are we going. *Conservation Biology* 20:274-276.

Photo: Cascwild.org

On the plus side of the ledger, net protections for late-successional forests would be an important win for conservation as slight increases (~14,830 ac, 1%); some ESUs and Key Watersheds would be elevated in protection particularly for Coho and Steelhead; numerous new and expanded special designations would be enacted (e.g., Wilderness, Wild and Scenic, National Recreation Areas, Botanical/Salmon Areas, Primitive Backcountry Areas among others); mining, grazing, post-fire logging and ORV use prohibited in CEAs; Old-Growth Heritage Areas established in FEAs; young naturally regenerating forests protected in CEAs; and important drinking water supplies protected, particularly from logging and grazing. These all represent very significant conservation gains and improvements over the NWFP.

Photo: flickr.com

On the minus side of the ledger, some ESUs and Key Watersheds would be placed in the FEAs, protections for at-risk species such as the Marbled Murrelet and Red Tree Vole would drop substantially (by nearly a quarter of current habitat protections), habitat fragmentation would increase for the Northern Spotted Owl (although a slight increase of 6% in habitat protected might offset some of this loss) and Marbled Murrelet, and stream buffers would shrink in FEAs and areas that are not considered of "great ecological significance." Increased logging could result in the need for future listings (vole and perhaps fisher) and up-listings (murrelet, spotted owl) and greater fragmentation would elevate extinction risks for both imperiled terrestrial and aquatic species.

In closing, part of the reason why conservation organizations value the NWFP so highly, even with its ecological flaws (e.g., not all of the older forests were protected, post-fire logging can occur in reserves, mining, grazing can occur in reserves), is because the plan remains the best science of our time (ibid #17). Thus, any changes to the NWFP that lower its conservation standards are viewed with close scrutiny and potential precedent setting on other public lands. Nonetheless, S.1784ANS contains important improvements over the NWFP that provide more conservation certainty than administrative protections. Some of our concerns to at-risk species are addressed in the bill's sections on "Monitoring Assessments" (Section 15) and "Reevaluation and Modification"

(Subsection 7 (f)). However, to reduce conservation uncertainties, should opportunities arise to improve the bill, we recommend:

- Restore riparian buffer widths within FEAs to ACS standards and refer back to the ACS objectives to comply fully with the successful ACS and limit fragmentation in aquatic areas.
- Create a scientist panel of academics and researchers with backgrounds in at-risk species to determine appropriate safeguards for retention of closed-canopy forest conditions in dry forests (e.g., research shows that spotted owls require >70% overstory canopy closure (ibid#10) and this canopy threshold is incompatible with ecoforestry and most thinning projects) (this concern should be added to Section 15 or Subsection 7 (f)).
- Replace FEAs with CEAs in the Roseburg area, as the owl population in this area will increasingly become cut off from the Coast and Cascade ranges.
- Move more of the FEAs into CEAs in low elevation areas to allow for connectivity and protection of climate refugia and to minimize edge and fragmentation effects in the BLM checkerboard.

APPENDIX A.CONSERVATION VALUE OF ALL BLM LANDS UNDER THE NORTHWEST FOREST PLAN (*INCLUDES O&C AND PUBLIC DOMAIN BUT NOT THE BLM LANDS IN EASTERN KLAMATH COUNTY)[18]

- **Late-successional Reserves (LSRs) and Riparian Reserves** designated under NWFP that are essential habitat for hundreds of plant and wildlife species associated with unlogged older forest conditions that have been greatly reduced across the entire region, especially on non-federal lands.
- **Most of the region's last older forests especially near the Oregon Coast.** Approximately 900,000 acres of old growth (>150 years) and 590,000 acres of mature (80-150 years) forest, 22% and 15% of the old and mature forests in western Oregon, respectively.
- **Essential habitat for recovery of the federally threatened terrestrial wildlife.** Western Oregon contains 3.7 million acres of critical owl habitat, 1 million acres (27%) of which is on BLM land. BLM LSRs contain nearly 600,000 acres of owl habitat—which is 58% of the suitable owl habitat on BLM land in western Oregon. Western Oregon BLM lands contain 1.5 million acres of Marbled Murrelet critical habitat—nearly 40% of the total critical habitat in the Pacific Northwest—mostly in the Coast Range. BLM lands contain 485,000 acres (32%) of critical murrelet habitat, 83% of which is found within LSRs.
- **Lands important to the Oregon Plan for Salmon and Watersheds.** There are 1.8 million acres for the Coho (*Oncorhynchus kisutch*) Evolutionary Significant Unit and 650,000 acres of Coho ESU's in BLM LSRs—35% of the ESU area on BLM land. Of the 6,297 miles of spawning and rearing habitat within western Oregon, 12% of it is located on BLM lands, 100% is in Riparian Reserves, and 44% of which is within LSRs. There are 370,000 acres of Chinook (*O. tshawytscha*) ESU habitat on BLM land in western Oregon: 16% of BLM land in western Oregon contains Chinook ESU's and half of the BLM lands in Salem and Eugene districts contain Chinook ESU habitat. Further, there are 63,000 acres of Chinook ESU habitat in BLM LSRs—17% of the total ESU area on BLM land. Additionally, there are 218,000 acres of Steelhead (*O. mykiss*) ESU habitat on BLM land in western Oregon, all of which is found in the Salem and Eugene districts. Nine percent of BLM land in western Oregon contains steelhead ESU acres with 35,000 steelhead ESU acres in BLM LSRs—16% of the total ESU area across BLM land. BLM lands play a critical role in efforts to conserve imperiled salmonids.
- **Significant inclusions of Key Watersheds that act as a network of reserves for aquatic species and are important to proper stream functions.** Western Oregon contains 3.9 million acres of Key Watersheds, 154,000 (4%) of which are located within BLM LSRs. In the Coast Range, LSRs protect 9% of Key

[18]Based on prior analysis by Geos Institute as also summarized by Staus, N.L., J. R. Strittholt, and D. A. DellaSala. 2010. Evaluating areas of high conservation value in western Oregon with a decision-support model. *Conservation Biology* 24: 711–720.

Watersheds overall, encompassing over 25% of 10 of the 38 key watersheds in this area.

- **Riparian Reserves on BLM lands are essential to the proper functioning of terrestrial and aquatic ecosystems and stream flows.** These reserves help maintain connectivity across aquatic and terrestrial ecosystems and improve travel and dispersal conditions for hundreds of species that depend on them. They are also vital to proper ecological function and stream flow. BLM needs to map these areas and protect them as specified in the NWFP.
- **Essential habitat for over 400 rare species.** Of the 404 survey and manage species (primarily rare species at risk of local extirpation) recognized in the NWFP, 149 species are found on BLM land and 93 are found within BLM LSRs. LSRs in the Salem BLM District contain the highest concentration of these species (54), followed by Roseburg (39), and Coos Bay (35). Species include red tree vole (*Arborimus longicaudus*, an important food source for spotted owls), and many species of vascular plant, mollusk, lichen, fungi, and bryophyte.
- **Important roadless areas that are a vital salmon stronghold and refugia for sensitive species.** BLM lands contain 268,181 acres of unroaded areas (>1,000 acres) spread over 146 areas across all BLM allocations; 76 of these are small unroaded areas totaling 105,000 acres within BLM LSRs. The majority of unroaded acres are within one large LSR adjacent to Wild Rogue Wilderness and Siskiyou National Forest in the Medford BLM District – the Zane Grey Roadless Area. This area is threatened by logging and should receive consideration as an Area of Critical Environmental Concern (ACEC) or Wilderness Study Area (WSA).

APPENDIX B: GIS METHODOLOGY (PERFORMED BY JESSICA LEONARD, GEOS INSTITUTE, WITH ASSISTANCE OF ERIC FERNANDEZ, OREGON WILD)

Data Layers

- True_FEA: I'm referring to the "September bill" as being what we understand to include the true CEA and FEA categories. Attached are the layers for each. Consider these the updates to the official BLM data I previously sent you. Again, the main changes I made are to move FEA old-growth network into the CEA category and did the same with the natural stands (70-120)/moist/FEA.
- True_FEA_rrs: FEAs without Riparian Reserves
- FEA_Moist_70_120a; intersect of latest BLM/Wyden GIS data for FEA with moist and 70-120 year old stands
- True_CEA: Mapped CEAs AND FEA areas that are moist and 70-120 years old as well as FEA areas that are in the old-growth network. I'm referring to the "September bill" as being what we understand to include the true CEA and FEA categories. Attached are the layers for each. Consider these the updates to the official BLM data I previously sent you. Again, the main changes I made are to move FEA old-growth network into the CEA category and did the same with the natural stands (70-120)/moist/FEA.
- True_CEA_rrs: CEAs with Riparian Reserves
- NewRRs: in the new September bill to be. These impact what is "true" FEA and true CEA as the FEA RRs should go into the CEA category for analysis. I'm sending you the before and after on these as each iteration might have value if we have to backtrack or someone wants to slice and dice these differently. As for the riparian reserves layer goes, I'm sure there are multiple ways this could be refined and updated, but this layer should have the main pieces correctly intact. As with all of this let me know if you disagree or see any flaws in what I'm doing.

Other Layers:

- NWFP_7_2012: NWFP updated by Oregon Wild. Obtained from Erik Fernandez.
- BLM OR Management Ownership Polygon- downloaded via http://www.blm.gov/or/gis/data-details.php?id=9 on September 10, 2014. Updated date August 20, 2014.
- Northern Spotted Owl: Layer from the US FWS Critical Habitat Portal. Downloaded via http://ecos.fws.gov/crithab/ on September 11, 2014.
- Marbled Murrelet: Layer from the US FWS Critical Habitat Portal. Downloaded via http://ecos.fws.gov/crithab/ on September 11, 2014.
- Red Tree Vole: Habitat created from Andy Kerr's description. EPA ecoregion III for Oregon Coast using the Siuslaw River as the southern boundary.
- Elevation: 30m DEM obtained from Esri Elevation Layers group on ArcGIS.com on September 22, 2014. Last modified July 9, 2014. http://geos.maps.arcgis.com/home/item.html?id=0383ba18906149e3bd2a0975a0afdb8e

Projection
NAD_1927_UTM_Zone_10N

Calculations

Major Land Allocations

- Generally Protected
  - NWFP = Administratively + LSR + AMR + Congressionally + Riparian Reserves
  - Wyden = True CEAs + Riparian Reserves (clipped to NWFP/September bill)

- Generally Unprotected
  - NWFP = Adaptive Management + Matrix
  - Wyden = True FEAs – Riparian Reserves (clipped to NWFP/September bill)

We obtained the NWFP layer for the BLM by downloading the latest BLM layer, adjusting the NWFP so it lined up with the BLM layer, and clipping the NWFP to the BLM boundary. The resulting layer was then dissolved on the LUA field and a Protection field added for the lumping protected vs. unprotected land. Protected and unprotected lands were separated into their own shapefiles and dissolved for intersection calculations. Resulting shapefiles were exploded to ensure correct patches for landscape connectivity analysis.

The NWFP protected/unprotected layer was intersected with the Wyden CEA/FEA layer. A field named 'Status' was added to attribute the conservation status as below:

- Elevated: Generally unprotected in NWFP to CEA
- Lowered: Generally protected in NWFP to FEA
- NC- protected: No change: generally protected in NWFP and CEA
- NC- unprotected: No change: generally unprotected in NWFP and FEA

The NWFP/Wyden layer was then intersected with the following boundaries to determine the status of critical habit, key watersheds, essential species units and elevation. After the intersection tool was run, the geometry was recalculated and the tables were exported as dbf files to open in Excel. Pivot tables were used to sum the acreages.

Critical Habitat for ESA-Protected Species

- Conservation status elevated: Generally unprotected to CEA
- Conservation status lowered: Generally protected to FEA

NWFP Key Watersheds

- Conservation status elevated: Generally unprotected to CEA
- Conservation status lowered: Generally protected to FEA

ESUs of ESA-Listed Salmonids

- Conservation status elevated: Generally unprotected to CEA
- Conservation status lowered: Generally protected to FEA
  - salmon, chinook (*Oncorhynchus tshawytscha*), Lower Columbia River population
  - salmon, chinook, Upper Willamette River population
  - salmon, chum (*Oncorhynchus keta*), Columbia River population

- salmon, coho (*Oncorhynchus kisutch*), Oregon Coast population
- salmon, coho, Lower Columbia River population
- salmon, coho, Southern Oregon–Northern California Coast population
- steelhead (*Oncorhynchus mykiss*), Klamath Mountains population
- steelhead, Lower Columbia River population
- steelhead, Upper Willamette River population

ELEVATION

- Conservation status elevated: Generally unprotected to CEA
- Conservation status lowered: Generally protected to FEA
  - 0-2000ft
  - 2001-4000ft
  - 4001-6000ft
  - > 6000ft

Landscape Connectivity
How would the new reserve system of S.2734 compare with the current reserve system of NWFP? In particular:

- How adequate is the "largeness" of the new reserves?
- How adequate is the distance between the new reserves?
- How adequate is the habitat quality of the connecting lands between reserves (factoring in OGFHAs, natural stands, riparian reserves, etc.)?
- Will fragmentation increase or decrease?
- What of old growth patch sizes and distances?
- How does low-elevation (0-2000 feet) forest fare?

PATCH ANALYST

Patch Analyst is an extension to the ArcView GIS system that facilitates the spatial analysis of landscape patches, and modeling of attributes associated with patches. It is used for spatial pattern analysis, often in support of habitat modeling, biodiversity conservation and forest management.
http://www.cnfer.on.ca/SEP/patchanalyst/Patch5_1_Install.htm.
http://www.webpages.uidaho.edu/rsgis/docs/Fragmentaiton.pdf
Manual: http://www.scribd.com/doc/234905309/Patch-Analyst-Manual

GETTING LAYERS READY FOR PROCESSING:

1. Extract BLM lands from NWFP
2. Field added for protection status
3. Dissolve on protected status (generally protected vs generally unprotected)
4. Start editing session and use explode tool
5. Calculate acres field

EDGE METRIC DEFINITION

AREA WEIGHTED MEAN SHAPE INDEX (AWMSI)

AWMSI is equal to 1 when all patches are circular (for polygons) or square (for rasters (grids)) and it increases with increasing patch shape irregularity.

AWMSI equals the sum of each patch's perimeter, divided by the square root of patch area (in hectares) for each class (when analyzing by class) or for all patches (when analyzing by landscape), and adjusted for circular standard (for polygons), or square standard (for rasters (grids)), divided by the number of patches. It differs from the MSI in that it's weighted by patch area so larger patches will weigh more than smaller ones.

Mean Shape Index (MSI)

Shape Complexity.
MSI is equal to 1 when all patches are circular (for polygons) or square (for rasters (grids)) and it increases with increasing patch shape irregularity.
MSI = sum of each patch's perimeter divided by the square root of patch area (in hectares) for each class (when analyzing by class) or all patches (when analyzing by landscape), and adjusted for circular standard (for polygons), or square standard (for rasters (grids)), divided by the number of patches.

Mean Perimeter-Area Ratio (MPAR)

Shape Complexity. Example: Mean perimeter-area ratio Conifer (Class Level)

Mean Patch Fractal Dimension (MPFD)

Shape Complexity.
Mean patch fractal dimension (MPFD) is another measure of shape complexity. Mean fractal dimension approaches one for shapes with simple perimeters and approaches two when shapes are more complex.

Area Weighted Mean Patch Fractal Dimension (AWMPFD)

Shape Complexity adjusted for shape size.
Area weighted mean patch fractal dimension is the same as mean patch fractal dimension with the addition of individual patch area weighting applied to each patch. Because larger patches tend to be more complex than smaller patches, this has the effect of determining patch complexity independent of its size. The unit of measure is the same as mean patch fractal dimension.

Total Edge (TE)

Perimeter of patches.

Edge Density (ED)

Amount of edge relative to the landscape area.

Mean Patch Edge (MPE)

Average amount of edge per patch.

Patch Metric Definitions

Number of Patches (NumP)

Total number of patches in the landscape if "Analyze by Landscape" is selected, or Number of Patches for each individual class, if "Analyze by Class" is selected.

Mean Patch Size (MPS)

Average patch size.

Median Patch Size (MedPS)
The middle patch size, or 50th percentile.

Patch Size Coefficient of Variance (PSCoV)
Coefficient of variation of patches.

Patch Size Standard Deviation (PSSD)
Standard Deviation of patch areas.