

# *In situ* and transmitted housing-unit exposure to wildfire in the Pacific Northwest

Joe H. Scott, Pyrologix

Julie Gilbertson-Day, Pyrologix

Richard D. Stratton, USDA Forest Service

## **Purpose and background**

At the request of the United States Forest Service Pacific Northwest Regional Office, Pyrologix assessed the exposure of housing units to wildfire in Oregon and Washington. There are two approaches to such an assessment. The first—called an *in situ* analysis—rates the exposure of housing units where they exist on the landscape. The second approach rates the potential for wildfires originating in one part of the landscape to expose housing units in another. This second approach is often referred to as a wildfire transmission, risk-source, or exposure-source analysis. This report presents results for both approaches.

This work was completed as a companion to the ‘Exposure of human communities to wildfire in the Pacific Northwest’ report (Scott et al., 2018). The purpose of the assessment was to identify the counties and land ownerships on which damaging wildfire tend to occur and originate. These results can be used in wildfire management and mitigation planning by identifying counties with the greatest annual exposure of housing units.

## **Housing unit data**

We leveraged a spatial dataset called Where People Live (WPL) produced by The West Wide Wildfire Risk Assessment (Sanborn Map Company 2013). The WPL layer represents the estimated density of housing units across the 17 western states; it was generated by processing LANDSCAN and U.S. Census data. We converted those housing-unit density values into housing-unit counts. Summing the housing-unit count values for all locations within a simulated fire perimeter provides an estimate of the total number of housing units exposed to a simulated wildfire event. By using a complete event set of wildfire perimeters we can produce estimates of annual housing-unit exposure.

For this assessment, housing units were considered *directly* exposed to wildfire if they were located on burnable land cover<sup>1</sup>. Housing units were considered *indirectly* exposed to wildfire if they were located on nonburnable land cover (other than open water) but within 150 m of burnable land cover. Only directly or indirectly exposed housing units are summarized in this report. Nonexposed housing units (those within an urban core, for example) are not included.

## **Wildfire hazard simulations**

This assessment relies on simulated fire perimeters produced using a comprehensive wildfire occurrence, growth and behavior simulation system called FSim (Finney and others 2011). The FSim

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<sup>1</sup>Burnable and nonburnable land cover is characterized by the LANDFIRE 2014 FBFM40 data layer ([www.landfire.org](http://www.landfire.org)), with minor calibration edits informed by local expert knowledge. Burnable land cover includes land covered by grasses, forbs, shrubs, tree litter, understory trees, or logging slash. Nonburnable land cover includes urban areas, irrigated agricultural land, permanent snow or ice, bare ground, and open water.

results for Washington and Oregon were produced as part of the Pacific Northwest Region Quantitative Wildfire Risk Assessment (QWRA), completed in 2018 (Gilbertson-Day and others 2018). The FSim model works by simulating 10,000 or more “iterations” to produce spatial data representing annual burn probability—the annual likelihood that a wildfire will reach a given point on the landscape. Each iteration is a possible realization of a complete calendar year.

In addition, for each simulated fire perimeter, FSim records the start location and final perimeter shape for each of its simulated wildfires, enabling us to attribute housing-unit exposure to the origin location, and evaluate the source of exposure of housing units to wildfire.

### Land ownership

We summarize the source locations of housing unit exposure to the county and land ownership level. Land ownership information was obtained primarily from Atterbury Consultants, Inc. and used with permission from the Washington Department of Natural Resources (DNR) and Oregon Department of Forestry. Where Atterbury data was missing from the Columbia Basin portion of eastern Washington, ownership information from Washington Major Public Lands<sup>2</sup> and Washington DNR-managed parcels<sup>3</sup> were used, and any remaining gaps filled with BLM Surface Management Agency data<sup>4</sup>. We collapsed the number of ownerships to a list of eight in each state (Table 1). Table 1 shows total acreage and percentage of land-area each ownership covers by state. Figure 1 shows the final ownership map used for spatial overlay in the subsequent analyses. Though Figure 1 lists both ‘Water’ and ‘Undetermined’ ownership categories, for reporting purposes we combined these and labeled all as ‘Undetermined’ or ‘UND.’ Wildfire ignitions in ‘Water’ exist because of a spatial mismatch between ignition location on fuel mapped as burnable in the landscape data used in wildfire modeling and the ownership boundary map.

**Table 1. Land area (acres) by land ownership (or category) used in the exposure analysis.**

Land Owner/Category	Oregon	Percent of total	Washington	Percent of total
Bureau of Land Management	15,725,226	25	438,753	1
Industrial Timber	4,386,860	7	4,496,757	10
Local Government	154,709	0	460,699	1
Other Federal	1,963,227	3	5,872,166	14
Private	21,903,297	35	18,227,095	42
State lands	1,818,554	3	4,085,620	9
U.S. Forest Service	15,657,114	25	9,266,903	21
Undetermined	388,944	1	371,390	1
Total	61,997,930		43,219,384	

<sup>2</sup> Washington Major Public Lands data can be downloaded from: <https://data-wadnr.opendata.arcgis.com/datasets/wa-major-public-lands-non-dnr>

<sup>3</sup> Washington DNR-managed parcels can be downloaded from: <https://data-wadnr.opendata.arcgis.com/datasets/wa-dnr-managed-land-parcels>

<sup>4</sup> BLM Surface Management Agency data is available at: [https://gis.blm.gov/BER\\_LayerPackages/BLM\\_SMA\\_FS\\_update.lpk](https://gis.blm.gov/BER_LayerPackages/BLM_SMA_FS_update.lpk)

## Housing-unit exposure

### In situ housing-unit exposure

Traditional *in situ* exposure analysis evaluates the likelihood that housing units will be visited by wildfire (and sometimes includes fire intensity). Here we focused exclusively on wildfire likelihood. The *in situ* exposure analysis is conducted at the native 30-m cell size of the WPL dataset, then summarized to estimate the annual number of housing units exposed to wildfire in each ownership.

We first summarize exposure by state and land ownership. Housing-units are expected to primarily occur on private lands and as such, private land holds 88 percent of the *in situ* housing-unit exposure in both states (Table 2 and Table 3). Overall exposure in other ownerships is minimal and may even be due to mapping imprecisions in ownership boundaries and/or errors in housing-unit locations.

We next overlaid housing-unit exposure with county boundaries in Washington and Oregon to evaluate patterns of exposure by land ownership at a more localized spatial extent (Table 4 and Table 5). For each county we list the total number of exposed housing-units in the county in the first column, along with the percentage of housing-unit exposure from all wildfire reaching the housing units by ownership. . The table is sorted with the counties containing the greatest housing-unit exposure listed first. The final row of the table reports the state-total number and percentage of housing-units exposed by ownership category. For map display, we show the expected annual housing-unit exposure—the product of burn probability and exposed housing units (Figure 3), with counties containing orange and red pixels ranking highest in each state.

At the county level, however, the percentage of exposure in Private ownership ranges from as much as 98 percent in Garfield County, Washington and Gilliam County, Oregon to as little as 66 percent in Whatcom County, Washington and 48 percent in Jefferson County, Oregon (Table 4 and Table 5). Though these results can be summarized and presented tabularly, they are best understood and evaluated spatially. The counties with the greatest proportion of *in situ* exposure in non-private land ownerships tend to be those with very little overall exposure, where the relative proportion of housing-units overlapping non-private land is greatest. Some exceptions exist however, with 42 percent of the housing-unit exposure in Jefferson County, Oregon located in the Other Federal category (Table 5). This is due to the community of Warm Springs being located within the Warm Springs Indian Reservation. Elsewhere the most likely explanation for *in situ* housing-unit exposure in non-private land ownerships is the location of communities proximate to public or non-private lands. Though some housing units are mapped fully within the non-private ownership boundaries, most of the non-private exposure comes from housing-unit overlap from private land immediately adjacent to the public land boundaries and not from communities or clusters of housing units within the public land boundaries.

### Transmitted housing-unit exposure

In contrast to the *in situ* approach, a wildfire transmission analysis associates the housing-unit exposure to the ignition locations of the fires that cause the exposure. Such an analysis helps to understand where damaging fires can originate. For this transmitted-exposure analysis we determined the number of housing units located within each simulated wildfire perimeter and attributed that housing-unit exposure to the fire's ignition location. The ignitions were then overlaid with ownership information by county.

In both states, privately-owned land is the greatest source of housing unit exposure (Table 2 and Table 3) with greater than 60 percent of the total housing-unit source exposure occurring on private land. In Washington, ignitions on U.S. Forest Service land result in 12 percent of the exposure, while State-lands result in 11 percent. All other ownerships produce less than 10 percent or a fractional share of the exposure. In Oregon, the Bureau of Land Management produces 19 percent of the exposure, and all other ownerships produce less than 10 percent of the total exposure. The full list of housing-unit exposure by county and ownership for all of Washington is located in Table 6, and the full list for Oregon is in Table 7. For each county we list the total number of exposed housing-units in the first column, along with the percentage of transmitted housing-unit exposure by ownership. The table is sorted with the counties containing the greatest housing-unit exposure listed first. The final row of the table reports the state-total number and percentage of housing-units exposed by ownership category. For map display, we smoothed the resulting point features (fire-ignition locations) to generate a map showing the propensity for wildfires to expose housing units (Figure 4).

At the county-level, transmitted exposure varies widely due to the spatial arrangement of housing units and land ownerships. In Washington, exposure transmitted from privately-owned land ranges from as much as 93 percent in Clark County, to as little as 21 percent in Skamania County (Table 6), where Industrial Timber and the US Forest Service are the primary sources of wildfire exposure. In Chelan County, the U.S. Forest Service is the primary land owner (Figure 1) and transmits 41 percent of the wildfire exposure – similar to the exposure from private land (45 percent). In Oregon, exposure transmitted from private land ranges from 95 percent in Gilliam County, to as little as 13 percent in Curry County (Table 7). Douglas County has only 28 percent of its wildfire exposure transmitted from private land, while 42 percent is transmitted from the Bureau of Land Management and 22 percent from Industrial Timber lands. Though the percent of wildfire exposure transmitted from various land ownerships varies widely by county, ignitions from private land in only the top ten counties in each state (by housing-unit exposure) hold approximately 50 percent of the total statewide housing-unit exposure (based on calculations from Table 6, Table 7, and supplemental materials referenced in the next section). This holds true in both states.

## Discussion

The share of *in situ* exposure on private land is greater than the share of transmitted exposure because *in situ* exposure includes wildfires originating on any ownership, while transmitted exposure isolates only those wildfires igniting on private land. Using both *in situ* and transmitted exposure metrics to evaluate housing-unit exposure identifies where in the county the exposure is greatest and where wildfires originate that reach homes.

This analysis provides a generalized summary of the landscape potential for wildfires that damage homes, summarized to land ownership. Though the results are displayed tabularly for each ownership, this is a spatial situation where a wildfire can only expose housing-units if it ignites near homes or grows large enough to reach homes. The proportion of exposure by ownership varies by county, however, the general theme emerges that the majority of wildfire exposure to housing units is from ignitions on private land. Although other sources of housing-unit exposure exist, the greatest opportunity for wildfire loss reduction exists on private lands. This is not to say that there is no potential for destructive fires igniting on public lands, as history has demonstrated. The simulated wildfires that reach housing units and originated on public lands are indeed part of this analysis. However, when all simulated fires are

evaluated for their potential to reach housing units without restriction to land ownership, as in this analysis, a large proportion of the ignitions that reach housing units start nearby, and that land tends to be under private ownership.

In the current fire management framework where the importance of fire's natural role is recognized while fire managers are simultaneously working to prevent disastrous wildfires that damage homes and infrastructure, these types of analyses are crucial. Wildfire transmission analyses identify where on the landscape ignitions occur that have potential to reach and damage homes, and where ignitions have little potential for reaching homes and infrastructure. Scaling these analysis results to the local scale can facilitate improved local land and fire management decision making.

The results presented here (and in the linked spreadsheet) can be used to answer several questions about the ownerships and/or counties exposure comes from, to evaluate the share of exposure held by each county, to explore the spatial inequality or concentration of home exposure in certain parts of the landscape, and so on.

To illustrate a few examples of the many questions that can be asked of the data, we step through sample analyses and provide results.

**Q1. What share of the wildfire exposure to housing units in Washington is from fires originating in Okanogan County?**

A1. From Table 6 we find the total housing-unit exposure for Okanogan County to be 148.75 and the total for the State of Washington to be 832.31, so Okanogan County contributes to  $148.75/832.31 = 0.18$  or 18 percent of the statewide housing unit exposure.

**Q2. What fraction of *in situ* wildfire exposure occurs on private land in Oregon and Washington? What fraction of wildfire exposure originates on private land?**

A2. From Table 2 we find that 88.1 percent of wildfire exposure occurs on private land in Washington but only 63.7 percent originates there. From Table 3, we see that 87.6 percent of wildfire exposure occurs on private land in Oregon but only 60.9 percent originates there.

**Q3. What proportion of total *in situ* and transmitted housing-unit exposure in Oregon exists in Jackson and Josephine Counties?**

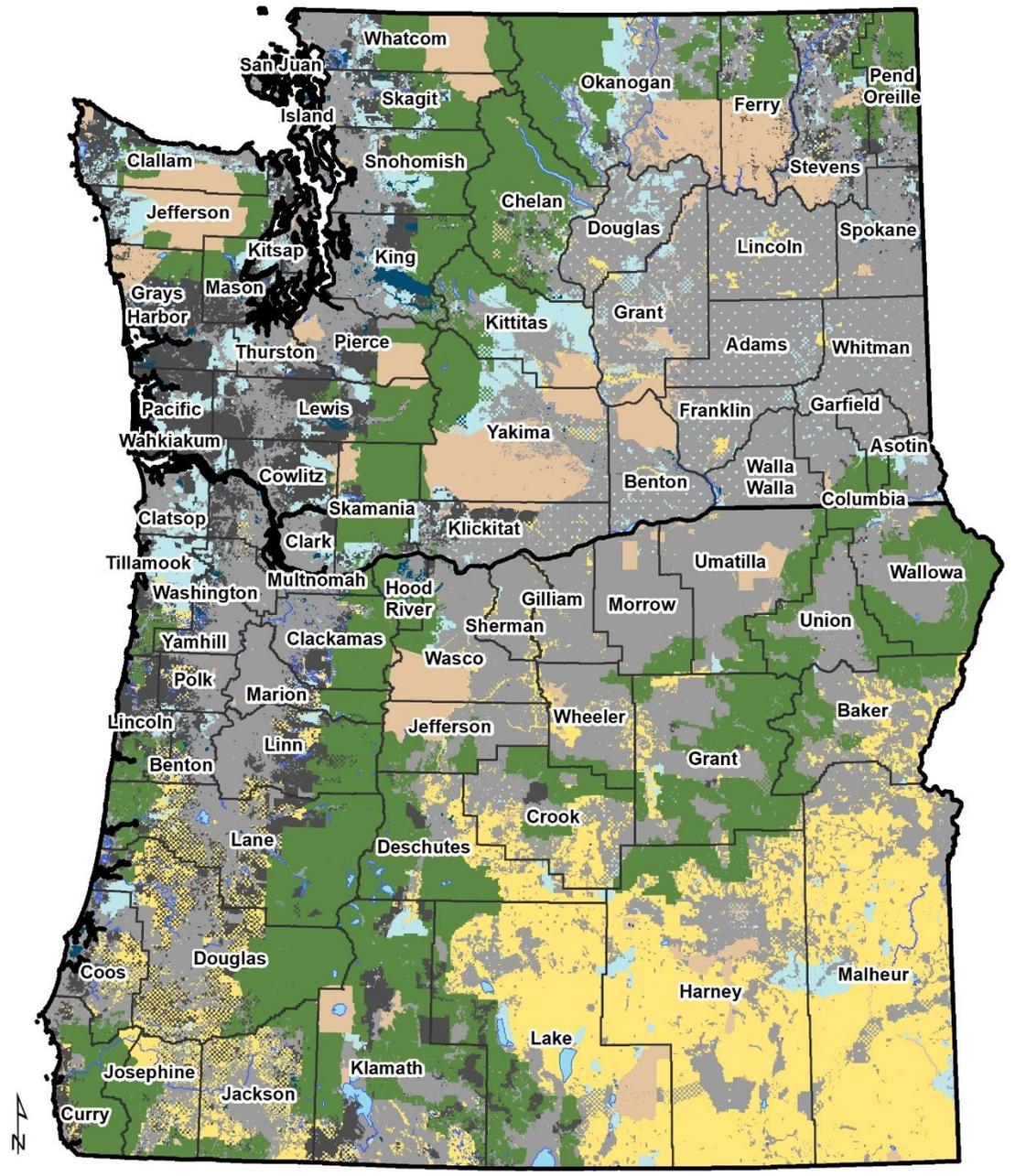
A3. From Table 7 we find the sum of transmitted exposure for Jackson and Josephine counties to be 363.97, representing 50.4 percent of the statewide total (722.43). From Table 5 we find the sum of *in situ* housing unit exposure to be 352.46, representing 48.3 percent of the statewide total. Jackson and Josephine counties comprise only 4.5 percent of the land area in Oregon, so wildfire exposure is highly concentrated in those counties.

**More information**

The full list of results and percentage of both *in situ* and transmitted exposure by ownership and county for Washington and Oregon is available [here](#) as a Microsoft Excel workbook.

## References

- Gilbertson-Day, Julie; Scott, Joe; Vogler, Kevin; Brough, April. 2018. Pacific Northwest Quantitative Wildfire Risk Assessment: Methods and Results. Final report. Available:  
[http://pyrologix.com/ftp/Public/Reports/PNRA\\_QuantitativeWildfireRiskReport\\_08\\_27\\_18.pdf](http://pyrologix.com/ftp/Public/Reports/PNRA_QuantitativeWildfireRiskReport_08_27_18.pdf)
- Sanborn Map Company. 2013. West wide wildfire risk assessment: FINAL REPORT. Available:  
[http://www.odf.state.or.us/gis/data/Fire/West\\_Wide\\_Assessment/WWA\\_FinalReport.pdf](http://www.odf.state.or.us/gis/data/Fire/West_Wide_Assessment/WWA_FinalReport.pdf)



Ownership data sources reclassified to Pyrologix legend categories:

**Washington**  
 Washington Department of Natural Resources with permission from source: Atterbury Consultants, Inc. 2017. All Rights Reserved.  
 Washington State Non-Department of Natural Resources Major Public Lands  
 Washington DNR Managed Land Parcels

**Oregon**  
 Atterbury Consultants, Inc. 2017. Used with permission from Oregon Department of Forestry.

State boundaries	County boundaries	Other Federal	Private
<b>Land Ownership</b>		Bureau of Land Management	U.S. Forest Service
Local Government	State lands	Undetermined	Water
Industrial Timber			

Figure 2. General land ownership in Washington and Oregon.

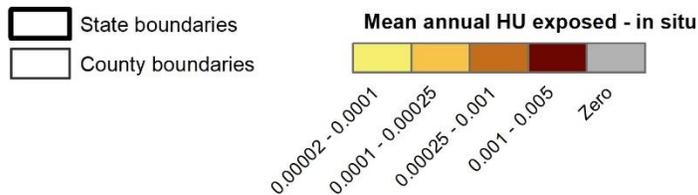
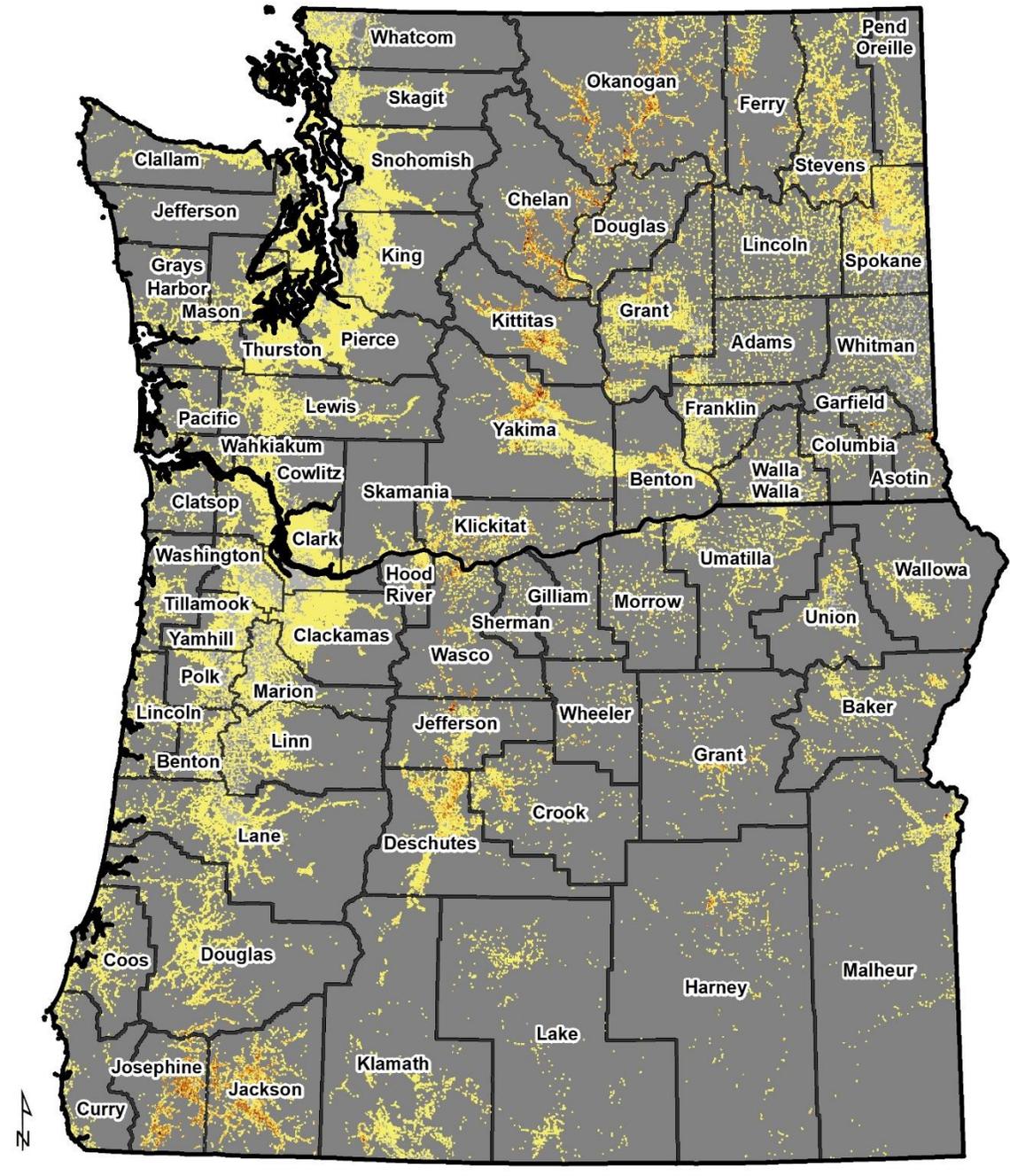


Figure 3. *In situ* wildfire exposure to housing units across Oregon and Washington. Light yellow areas reflect lower likelihood of wildfire and/or fewer housing units, while darker orange or red areas reflect higher likelihood of wildfire and/or more housing units.

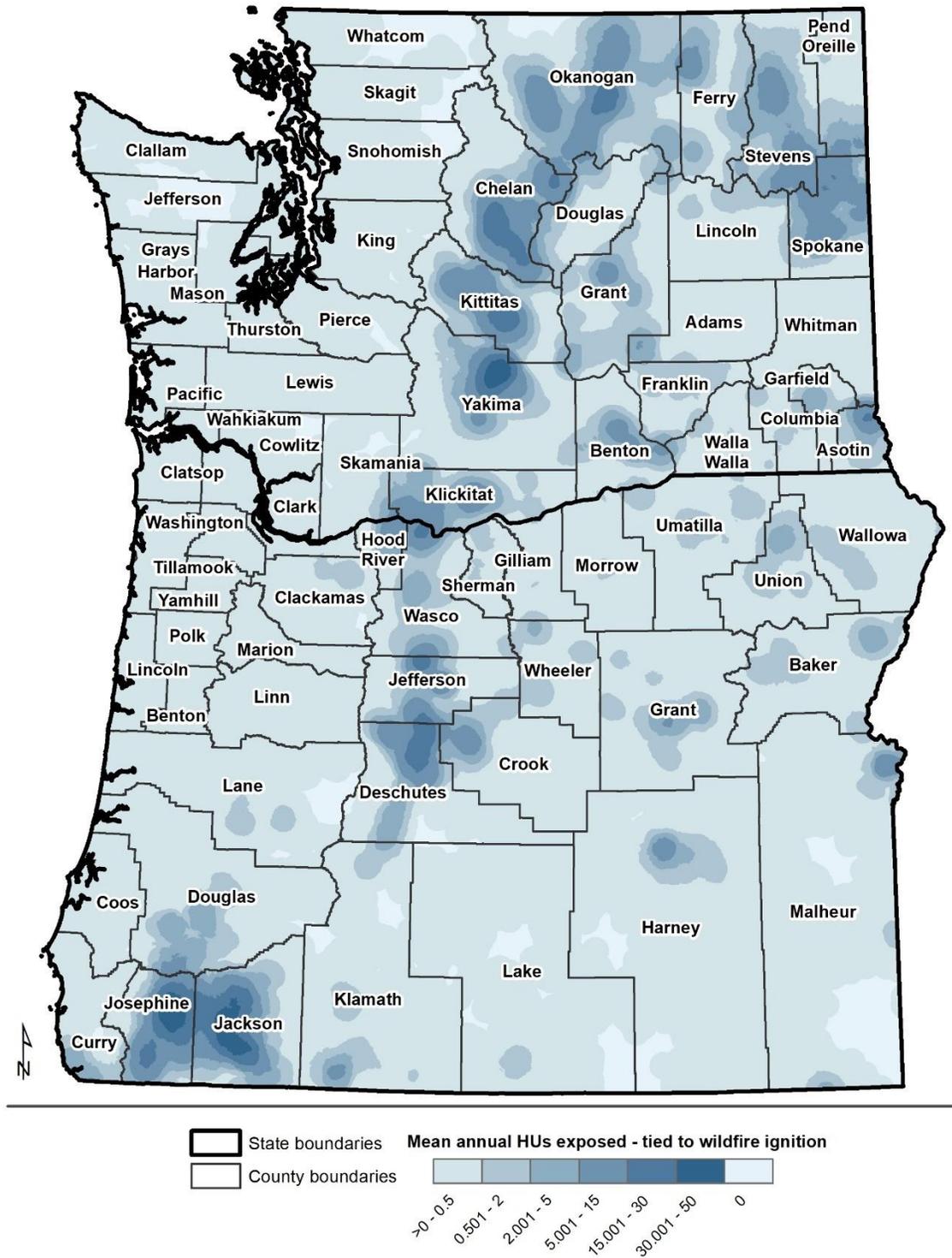


Figure 4. Transmitted wildfire exposure to housing units across Washington and Oregon. Dark blue areas of the map tend to produce greater annual housing-unit exposure.

**Table 2. *In situ* and transmitted housing-unit exposure by ownership in Washington.**

Ownership	<i>In situ</i> exposure		Transmitted exposure	
	Share of total	Rank	Share of total	Rank
Private	88.1%	1	63.7%	1
Other Fed.	4.3%	2	6.4%	4
State	3.1%	3	11.1%	3
USFS	2.0%	4	12.2%	2
Indus. Timber	1.1%	5	4.3%	5
Local Govt	1.0%	6	0.7%	7
BLM	0.3%	7	1.4%	6
UND	0.1%	8	0.1%	8

**Table 3. *In situ* and transmitted housing-unit exposure by ownership in Oregon.**

Ownership	<i>In situ</i> exposure		Transmitted exposure	
	Share of total	Rank	Share of total	Rank
Private	87.6%	1	60.9%	1
Other Fed.	3.8%	2	4.1%	5
BLM	3.3%	3	19.2%	2
USFS	2.7%	4	8.6%	3
Indus. Timber	1.4%	5	5.0%	4
State	0.8%	6	1.4%	6
Local Govt	0.2%	7	0.7%	7
UND	0.1%	8	0.0%	8

**Table 4. *In situ* housing-unit exposure for Washington counties and land ownerships.**

County	Total housing units	Percent of Total							
		BLM	Indus. Timber	Local Govt	Other Fed.	Private	State	USFS	UND
Okanogan	149.82	0.47%	0.19%	0.00%	8.25%	83.93%	4.78%	2.01%	0.35%
Chelan	146.31	0.36%	0.85%	1.79%	0.23%	86.63%	2.32%	7.79%	0.03%
Yakima	118.96	0.14%	0.01%	1.21%	6.75%	89.61%	1.62%	0.65%	0.00%
Kittitas	87.66	0.03%	0.00%	0.12%	0.38%	97.15%	1.45%	0.87%	0.00%
Spokane	81.58	0.02%	0.22%	2.70%	0.27%	94.78%	2.01%	0.00%	0.00%
Stevens	65.26	0.14%	2.75%	0.62%	9.41%	83.79%	2.91%	0.32%	0.06%
Klickitat	47.54	0.15%	6.59%	0.18%	0.55%	87.93%	4.22%	0.37%	0.01%
Grant	32.31	0.60%	0.00%	0.85%	6.43%	84.06%	8.06%	0.00%	0.01%
Benton	29.74	0.59%	0.00%	1.64%	0.72%	94.77%	2.27%	0.00%	0.02%
Ferry	29.60	0.34%	5.32%	1.03%	21.86%	66.83%	2.30%	2.23%	0.08%
Asotin	24.53	0.60%	0.88%	0.00%	1.48%	96.29%	0.54%	0.18%	0.04%
Douglas	16.22	0.38%	0.00%	0.63%	1.25%	87.07%	10.53%	0.00%	0.14%
Pend Oreille	12.94	0.03%	3.06%	1.65%	1.00%	90.92%	1.21%	2.13%	0.00%
Franklin	7.97	0.11%	0.00%	0.00%	3.77%	84.60%	11.30%	0.00%	0.22%
Lincoln	7.46	1.52%	0.00%	0.00%	1.15%	92.73%	4.58%	0.00%	0.02%
Adams	6.87	0.00%	0.00%	0.11%	1.06%	87.48%	4.72%	0.00%	6.63%
Walla Walla	5.94	0.00%	0.19%	4.75%	6.06%	86.74%	1.87%	0.30%	0.09%
Garfield	4.78	0.00%	0.07%	0.22%	0.34%	98.03%	1.08%	0.25%	0.00%
Skamania	2.62	0.00%	18.76%	0.14%	1.47%	71.99%	1.28%	6.34%	0.02%
Columbia	2.34	0.00%	1.67%	0.00%	3.29%	89.82%	1.49%	3.73%	0.00%
Pierce	2.16	0.01%	0.99%	1.28%	3.53%	89.50%	3.85%	0.83%	0.02%
Thurston	2.02	0.00%	1.63%	0.53%	2.26%	93.06%	2.48%	0.00%	0.03%
King	1.60	0.00%	0.74%	6.29%	0.25%	88.60%	2.65%	1.46%	0.00%
Lewis	1.36	0.00%	6.07%	0.37%	0.00%	84.20%	0.85%	8.51%	0.00%
Mason	1.12	0.00%	17.79%	1.09%	1.28%	70.54%	9.16%	0.11%	0.03%
Whitman	1.07	0.34%	0.00%	0.79%	0.71%	91.40%	6.77%	0.00%	0.00%
Kitsap	0.96	0.00%	2.64%	1.49%	4.75%	88.94%	2.18%	0.00%	0.00%
Clark	0.89	0.00%	0.34%	0.26%	0.81%	96.94%	1.64%	0.00%	0.01%
Snohomish	0.69	0.00%	1.60%	2.08%	2.02%	91.49%	1.63%	1.18%	0.00%
Grays Harbor	0.46	0.01%	12.91%	1.23%	4.17%	78.48%	2.37%	0.84%	0.00%
Cowlitz	0.41	0.28%	7.00%	0.01%	0.00%	91.58%	0.75%	0.37%	0.00%
Whatcom	0.24	0.00%	5.47%	7.55%	7.78%	66.44%	2.38%	10.27%	0.10%
Jefferson	0.21	0.00%	6.39%	2.11%	1.04%	81.27%	7.37%	1.82%	0.00%
Skagit	0.20	0.00%	7.65%	5.12%	2.85%	79.71%	2.85%	1.76%	0.05%
Island	0.18	0.00%	1.31%	1.27%	0.89%	95.74%	0.78%	0.00%	0.01%
Pacific	0.18	0.00%	9.81%	0.12%	1.01%	84.72%	4.29%	0.00%	0.05%
Clallam	0.17	0.00%	1.97%	0.80%	3.86%	83.79%	8.32%	1.25%	0.01%
San Juan	0.08	0.03%	0.00%	0.85%	0.31%	97.09%	1.72%	0.00%	0.00%
Wahkiakum	0.06	0.00%	16.16%	1.49%	1.55%	77.51%	3.22%	0.00%	0.06%
<b>Total</b>	<b>894.51</b>	<b>0.27%</b>	<b>1.11%</b>	<b>0.98%</b>	<b>4.29%</b>	<b>88.15%</b>	<b>3.08%</b>	<b>1.99%</b>	<b>0.13%</b>

**Table 5. *In situ* housing-unit exposure for Oregon counties and land ownerships.**

County	Total housing units	Percent of Total							
		BLM	Indus. Timber	Local Govt	Other Fed.	Private	State	USFS	UND
Jackson	193.24	2.49%	0.51%	0.06%	0.25%	95.90%	0.24%	0.41%	0.13%
Josephine	159.22	3.90%	1.92%	0.04%	0.06%	91.46%	0.16%	2.33%	0.12%
Deschutes	92.29	6.39%	0.14%	0.24%	0.00%	88.55%	1.26%	3.43%	0.00%
Jefferson	41.09	1.12%	0.00%	0.00%	42.60%	48.21%	0.21%	7.85%	0.00%
Wasco	38.39	1.08%	1.33%	0.87%	15.04%	79.13%	0.93%	1.62%	0.00%
Douglas	24.55	3.07%	6.83%	0.02%	0.63%	85.14%	0.56%	3.66%	0.09%
Crook	22.12	4.44%	0.16%	0.00%	0.06%	82.74%	2.79%	9.81%	0.00%
Klamath	18.32	1.70%	9.70%	0.05%	1.35%	81.91%	2.34%	2.73%	0.22%
Harney	17.38	7.39%	0.00%	0.07%	6.31%	83.29%	2.71%	0.22%	0.00%
Grant	16.91	1.80%	0.96%	0.00%	0.17%	91.85%	0.73%	4.48%	0.00%
Malheur	14.24	7.29%	0.00%	0.00%	0.42%	85.46%	6.81%	0.00%	0.03%
Baker	13.78	3.22%	0.00%	0.00%	1.01%	89.24%	0.55%	5.96%	0.02%
Hood River	13.45	0.00%	4.75%	4.61%	0.11%	87.27%	0.70%	2.55%	0.00%
Umatilla	11.72	0.41%	0.00%	0.00%	15.12%	82.32%	1.50%	0.65%	0.00%
Union	11.23	0.03%	0.00%	0.00%	0.00%	97.73%	1.52%	0.72%	0.00%
Wheeler	6.75	8.42%	0.00%	0.00%	2.29%	88.89%	0.12%	0.29%	0.00%
Wallowa	6.14	0.08%	0.00%	0.00%	0.23%	86.46%	2.35%	10.88%	0.00%
Curry	5.56	0.88%	11.20%	0.00%	0.00%	77.60%	1.99%	7.78%	0.56%
Lane	4.69	2.75%	8.15%	0.07%	0.39%	78.72%	0.39%	7.85%	1.70%
Clackamas	3.76	1.43%	6.68%	1.06%	0.07%	74.19%	0.14%	16.40%	0.05%
Lake	3.68	7.42%	1.52%	0.72%	0.42%	85.59%	0.81%	3.32%	0.19%
Morrow	2.82	0.00%	0.00%	0.00%	2.53%	96.17%	0.05%	1.25%	0.00%
Sherman	2.49	4.41%	0.00%	0.00%	0.00%	93.60%	1.99%	0.00%	0.00%
Gilliam	2.20	1.24%	0.00%	0.00%	0.04%	98.08%	0.65%	0.00%	0.00%
Marion	0.55	1.33%	6.89%	0.11%	0.46%	78.80%	1.61%	10.41%	0.39%
Multnomah	0.48	0.72%	1.10%	4.46%	0.66%	88.53%	2.48%	2.01%	0.03%
Coos	0.43	2.95%	7.07%	0.09%	0.23%	84.17%	3.48%	0.59%	1.43%
Linn	0.43	0.09%	17.83%	0.66%	0.99%	69.80%	0.45%	10.06%	0.11%
Columbia	0.23	0.05%	6.32%	0.65%	0.04%	92.82%	0.11%	0.00%	0.00%
Benton	0.20	0.57%	13.45%	2.49%	0.06%	77.12%	5.74%	0.56%	0.00%
Washington	0.16	0.35%	4.41%	0.60%	0.27%	92.88%	1.46%	0.00%	0.03%
Yamhill	0.15	0.51%	4.37%	0.06%	0.45%	94.54%	0.04%	0.01%	0.02%
Lincoln	0.15	0.17%	26.02%	0.06%	0.71%	60.00%	2.20%	10.68%	0.16%
Polk	0.13	0.42%	5.63%	0.73%	1.19%	91.62%	0.40%	0.00%	0.00%
Tillamook	0.08	1.05%	7.09%	1.57%	0.43%	62.95%	21.21%	5.65%	0.05%
Clatsop	0.06	0.00%	1.81%	1.21%	0.14%	90.34%	6.48%	0.00%	0.01%
<b>Total</b>	<b>729.08</b>	<b>3.32%</b>	<b>1.45%</b>	<b>0.20%</b>	<b>3.80%</b>	<b>87.63%</b>	<b>0.83%</b>	<b>2.69%</b>	<b>0.09%</b>

**Table 6. Transmitted wildfire exposure to housing-units for Washington counties and land ownerships.**

County	Total housing units	Percent of Total							
		BLM	Indus. Timber	Local Govt	Other Fed.	Private	State	USFS	UND
Okanogan	148.75	2.89%	2.40%	0.00%	8.08%	52.06%	18.56%	15.76%	0.24%
Chelan	130.19	1.95%	3.98%	1.01%	0.95%	44.94%	5.70%	41.42%	0.03%
Yakima	112.84	0.49%	0.07%	0.71%	12.31%	71.97%	11.63%	2.83%	0.00%
Kittitas	83.90	0.27%	0.08%	0.02%	0.99%	67.70%	19.79%	11.15%	0.00%
Spokane	73.18	0.08%	2.99%	2.49%	0.86%	90.63%	2.96%	0.00%	0.00%
Stevens	67.16	0.46%	14.67%	1.08%	12.43%	58.55%	10.56%	1.70%	0.55%
Klickitat	45.27	0.46%	15.41%	0.28%	1.38%	68.56%	10.70%	3.18%	0.04%
Ferry	28.54	1.17%	13.52%	0.02%	26.67%	33.81%	5.52%	19.27%	0.03%
Grant	27.92	3.50%	0.00%	0.26%	16.70%	66.76%	12.77%	0.00%	0.01%
Benton	22.04	3.10%	0.00%	0.71%	4.78%	82.00%	9.41%	0.00%	0.00%
Asotin	20.70	0.46%	0.30%	0.00%	0.85%	88.10%	9.44%	0.84%	0.01%
Douglas	14.47	4.76%	0.00%	0.70%	0.43%	80.34%	13.03%	0.00%	0.74%
Pend Oreille	13.63	0.04%	12.54%	0.36%	0.13%	71.01%	4.37%	11.55%	0.00%
Lincoln	6.45	6.35%	0.00%	0.00%	1.17%	86.22%	6.26%	0.00%	0.00%
Franklin	6.40	1.18%	0.00%	0.00%	5.00%	88.70%	4.88%	0.00%	0.24%
Adams	6.14	0.20%	0.00%	0.02%	17.82%	76.33%	1.57%	0.00%	4.06%
Walla Walla	5.12	0.00%	0.82%	12.02%	11.36%	70.76%	4.60%	0.11%	0.33%
Garfield	4.85	0.00%	0.06%	1.88%	0.19%	91.90%	4.94%	1.04%	0.00%
Skamania	3.07	0.00%	42.24%	0.00%	1.22%	21.24%	6.00%	29.31%	0.00%
Columbia	2.48	0.18%	1.69%	0.00%	1.59%	87.09%	5.47%	3.97%	0.01%
Thurston	1.42	0.00%	7.08%	0.83%	5.02%	81.67%	5.40%	0.00%	0.00%
Pierce	1.38	0.00%	4.23%	2.47%	4.20%	82.60%	4.10%	2.37%	0.02%
Lewis	1.05	0.00%	15.85%	0.72%	0.01%	62.03%	1.66%	19.73%	0.00%
King	0.87	0.00%	2.40%	17.19%	0.16%	66.26%	8.33%	5.66%	0.00%
Whitman	0.81	0.34%	0.00%	0.43%	0.26%	89.15%	9.82%	0.00%	0.00%
Mason	0.79	0.00%	32.34%	1.43%	0.96%	54.77%	10.00%	0.46%	0.04%
Kitsap	0.61	0.00%	7.05%	4.60%	4.67%	75.20%	8.48%	0.00%	0.00%
Clark	0.58	0.00%	0.58%	1.29%	1.16%	92.85%	4.11%	0.00%	0.00%
Snohomish	0.36	0.01%	4.85%	3.56%	4.17%	81.15%	3.05%	3.22%	0.00%
Grays Harbor	0.31	0.00%	31.22%	1.78%	4.29%	53.84%	7.48%	1.38%	0.00%
Cowlitz	0.26	0.03%	23.11%	0.00%	0.17%	75.10%	1.54%	0.05%	0.00%
Jefferson	0.13	0.00%	15.42%	4.43%	1.87%	58.10%	11.41%	8.77%	0.00%
Whatcom	0.12	0.00%	17.44%	18.79%	9.62%	42.40%	6.97%	4.79%	0.00%
Pacific	0.12	0.00%	23.60%	0.23%	0.57%	66.42%	9.14%	0.00%	0.03%
Skagit	0.11	0.00%	14.33%	10.22%	2.16%	57.59%	10.47%	5.12%	0.12%
Island	0.10	0.00%	3.10%	1.78%	0.64%	91.76%	2.73%	0.00%	0.00%
Clallam	0.10	0.00%	2.86%	3.92%	4.09%	59.22%	25.03%	4.88%	0.00%
San Juan	0.05	0.00%	0.00%	0.83%	0.18%	88.95%	10.03%	0.00%	0.00%
Wahkiakum	0.04	0.00%	29.07%	2.94%	2.77%	55.45%	9.70%	0.00%	0.07%
<b>Total</b>	<b>832.31</b>	<b>1.38%</b>	<b>4.31%</b>	<b>0.75%</b>	<b>6.43%</b>	<b>63.70%</b>	<b>11.14%</b>	<b>12.15%</b>	<b>0.14%</b>

**Table 7. Transmitted wildfire exposure to housing-units for Oregon counties and land ownerships.**

County	Total housing units	Percent of Total							
		BLM	Indus. Timber	Local Govt	Other Fed.	Private	State	USFS	UND
Jackson	199.90	20.48%	4.49%	0.16%	0.14%	72.36%	0.39%	1.95%	0.04%
Josephine	164.07	29.62%	5.62%	0.42%	0.01%	54.59%	0.54%	9.16%	0.04%
Deschutes	80.17	18.93%	1.56%	1.03%	0.00%	66.12%	1.61%	10.74%	0.01%
Jefferson	43.75	4.96%	0.00%	0.00%	37.67%	37.95%	0.73%	18.70%	0.00%
Wasco	37.85	2.70%	5.05%	1.51%	23.10%	49.27%	5.79%	12.58%	0.00%
Douglas	27.26	42.37%	22.31%	0.00%	0.01%	28.07%	3.50%	3.73%	0.01%
Crook	19.29	9.40%	0.22%	0.00%	0.01%	76.15%	3.80%	10.42%	0.00%
Harney	17.58	19.22%	0.00%	0.00%	5.28%	72.84%	2.26%	0.40%	0.01%
Grant	17.08	4.18%	1.39%	0.00%	0.36%	77.23%	0.36%	16.47%	0.00%
Klamath	16.94	14.82%	25.63%	0.01%	2.60%	40.62%	7.08%	8.87%	0.37%
Baker	13.48	12.21%	0.00%	0.00%	0.11%	55.85%	0.78%	31.05%	0.00%
Malheur	13.41	27.71%	0.00%	0.00%	2.25%	64.24%	5.79%	0.00%	0.01%
Hood River	12.93	0.14%	4.54%	21.58%	0.32%	66.79%	0.49%	6.00%	0.15%
Union	10.10	0.14%	0.50%	0.00%	0.02%	83.63%	1.31%	14.40%	0.00%
Umatilla	9.56	2.13%	0.04%	0.00%	16.79%	73.20%	0.97%	6.88%	0.00%
Curry	7.00	21.90%	26.23%	0.00%	0.00%	13.31%	2.51%	35.98%	0.07%
Wheeler	6.62	21.25%	0.00%	0.00%	2.73%	73.96%	0.32%	1.73%	0.00%
Wallowa	5.70	0.70%	0.05%	0.00%	0.18%	69.62%	1.01%	28.42%	0.02%
Lane	4.20	17.29%	25.34%	0.01%	0.18%	30.04%	0.34%	26.54%	0.26%
Lake	3.52	15.89%	3.31%	0.07%	0.40%	66.87%	0.63%	11.84%	0.98%
Clackamas	3.15	9.99%	9.99%	2.59%	0.06%	40.07%	0.14%	37.03%	0.13%
Morrow	2.23	0.12%	0.00%	0.00%	10.64%	87.24%	0.18%	1.82%	0.00%
Sherman	2.16	5.17%	0.00%	0.00%	0.06%	92.82%	1.94%	0.00%	0.00%
Gilliam	2.13	4.89%	0.00%	0.00%	0.17%	94.69%	0.24%	0.00%	0.00%
Multnomah	0.41	0.88%	1.12%	13.09%	0.07%	79.85%	3.35%	1.59%	0.05%
Marion	0.41	3.54%	15.54%	0.04%	0.05%	35.29%	3.06%	42.46%	0.03%
Linn	0.36	4.30%	31.65%	0.14%	0.34%	36.97%	3.78%	22.73%	0.08%
Coos	0.34	14.00%	11.61%	0.05%	0.71%	68.36%	3.62%	0.74%	0.90%
Columbia	0.17	0.10%	25.01%	1.81%	0.08%	72.61%	0.38%	0.00%	0.01%
Benton	0.15	3.68%	34.21%	2.63%	0.02%	44.78%	14.15%	0.52%	0.00%
Yamhill	0.12	2.24%	14.85%	0.01%	0.26%	81.64%	0.87%	0.03%	0.09%
Washington	0.11	0.72%	25.10%	1.09%	0.20%	70.33%	2.56%	0.00%	0.00%
Lincoln	0.11	0.29%	38.45%	0.00%	0.97%	36.44%	5.68%	18.11%	0.05%
Polk	0.09	2.09%	16.20%	0.27%	1.53%	78.58%	1.32%	0.00%	0.00%
Tillamook	0.05	4.49%	11.41%	0.62%	0.18%	36.82%	34.21%	12.27%	0.00%
Clatsop	0.04	0.00%	1.77%	0.16%	0.02%	83.85%	14.19%	0.00%	0.00%
<b>Total</b>	<b>722.43</b>	<b>19.15%</b>	<b>5.05%</b>	<b>0.74%</b>	<b>4.07%</b>	<b>60.89%</b>	<b>1.44%</b>	<b>8.62%</b>	<b>0.04%</b>