

Monitoring Restoration Progress on Oregon's Eastside National Forests During the Federal Forest Restoration Program

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Executive summary

The U.S. Forest Service and the State of Oregon continue to commit substantial effort and resources to support restoration on the 11 national forests in Oregon. Notable programs include the Forest Service Eastside Restoration Strategy and Oregon's Federal Forest Restoration Program (FFRP). These programs focus on the national forests east of the Cascade Mountains, where the need is greatest to actively restore forest landscapes and to contribute to economic health of rural communities.

Along with coordinated restoration activities, management agencies and various forest partners recognize that monitoring changes in forest landscapes is an essential component of any restoration strategy. In 2015, the Oregon Department of Forestry (ODF) contracted with the Ecosystem Workforce Program (EWP) at the University of Oregon to design and conduct monitoring work in association with the recent Federal Forest Restoration Program.¹ At the same time, the Forest Service entered into an agreement with EWP to develop a monitoring plan to help support the Eastside Restoration Strategy. FFRP and the Eastside Restoration Strategy occurred in concert and pursued similar goals, and EWP coordinated monitoring across the two programs. Impacts of the respective programs therefore cannot be differentiated through measures reported here.

This working paper presents the results of monitoring restoration measures on Oregon's six eastside federal forests: the Deschutes, Fremont-Winema, Malheur, Ochoco, Umatilla, and Wallowa-Whitman National Forests. We adopt a "baseline" period from FY 2009-2011 and "first investment" period from FY 2012-2014, which were established during previous monitoring.¹ To these periods we add a "second investment" period from FY 2015-2016 in order to continue to track trends in restoration over the three comparison periods. Building on previous work, we report the following measures: watershed restoration treatments conducted, timber contracts sold, value and type of restoration contracts implemented, and economic impacts generated from these activities. A second working paper reports on the specific strategies of the Federal Forest Restoration Program under ODF.²

Summary findings from the eastside forests (FY 2009-2016) include the following:

Trends in restoration treatment activities exhibited notable declines. The American Recovery and Reinvestment Act (ARRA) supported abnormally high levels of activities in FY 2010, which led to declines in fuels and watershed treatments between the baseline and first investment periods. Modest declines in fuels treatments, and large declines in watershed treatments, persisted between the first and the second investment periods.

Annual timber sales on Eastside forests averaged 197.06 mmbf during the baseline, 229.38 mmbf during the first investment period, and 169.21 mmbf during the second investment period. Sales of sawtimber exhibited a similar trend on all forests, with the highest volumes in the first investment period. The percentage of non-sawtimber sold, relative to total timber volume, declined across all three periods. Sales of non-sawtimber declined across the three comparison periods on nearly all forests. Timber volume under contract shows an increasing trend over this timeframe.

Local businesses purchased the majority of timber during the three comparison periods. However, degree of local capture and trends across comparison periods varied among eastside forests.

Restoration contracts on eastside forests decreased slightly across the three comparison periods. Across FY 2009-2016 years, approximately half of the value of restoration contracts remained in local counties.

During the current second investment period, timber sales and service contracts valued at \$25.77 million annually resulted in an estimated 1,186 jobs and \$196.04 million per year in economic activity in local counties. The outcomes are the result of direct effects such as jobs in forests and mills, along with secondary effects such as purchased supplies and associated economic activity, from the portion of timber sales and service contracts that stayed in local counties.



Scientists, managers, and stakeholders widely recognize the need to actively manage U.S. federal forests for greater resilience. In Oregon, approximately 60% of the State's 30 million acres of forestlands are publically owned, with the majority managed by the Forest Service, and many forests east of the Cascade Mountains crest experience heightened risk of fire and disease outbreak. A recent study estimated that approximately 45% of eastside public forestlands require active restoration to reduce fire and disease risk and to maintain ecosystem services supporting clean water and wildlife habitat.^{3,4}

Investment in forest restoration has the potential both to increase ecological health on public lands and to improve economic health in rural communities. Against this backdrop, the Forest Service began the Eastside Restoration Strategy in late 2012, targeting the dry forests of eastern Oregon and Washington and the nearby communities that have traditionally depended on forests for their livelihoods. To increase the pace, scale, and quality of forest restoration statewide, the Federal Forest Working Group developed a legislative con-

cept which became the Federal Forest Restoration Program (FFRP).⁵ This program represents recognition that coordinated efforts are needed for the achievement of restoration goals, and signals an enhanced role for the State of Oregon in promoting resilience on federal forestlands and in Oregon's communities.

During the first State biennium (2013-2015), FFRP financial investments focused on forests of the Blue Mountains Ecoregion, with smaller investments in the dry forests of southwest Oregon. During the second biennium (2015-2017), the Oregon Department of Forestry (ODF) directed increased financial investment from the State Legislature to include all of Oregon's federal forestlands, though the majority of funds still went to eastside forests. Since 2013, the State has directed \$7.19 million toward accelerated restoration on federal forests through the FFRP. Concurrently, the Forest Service continues to commit substantial resources in support of the Eastside Restoration Strategy, representing the large majority of funds supporting restoration activities.

Approach

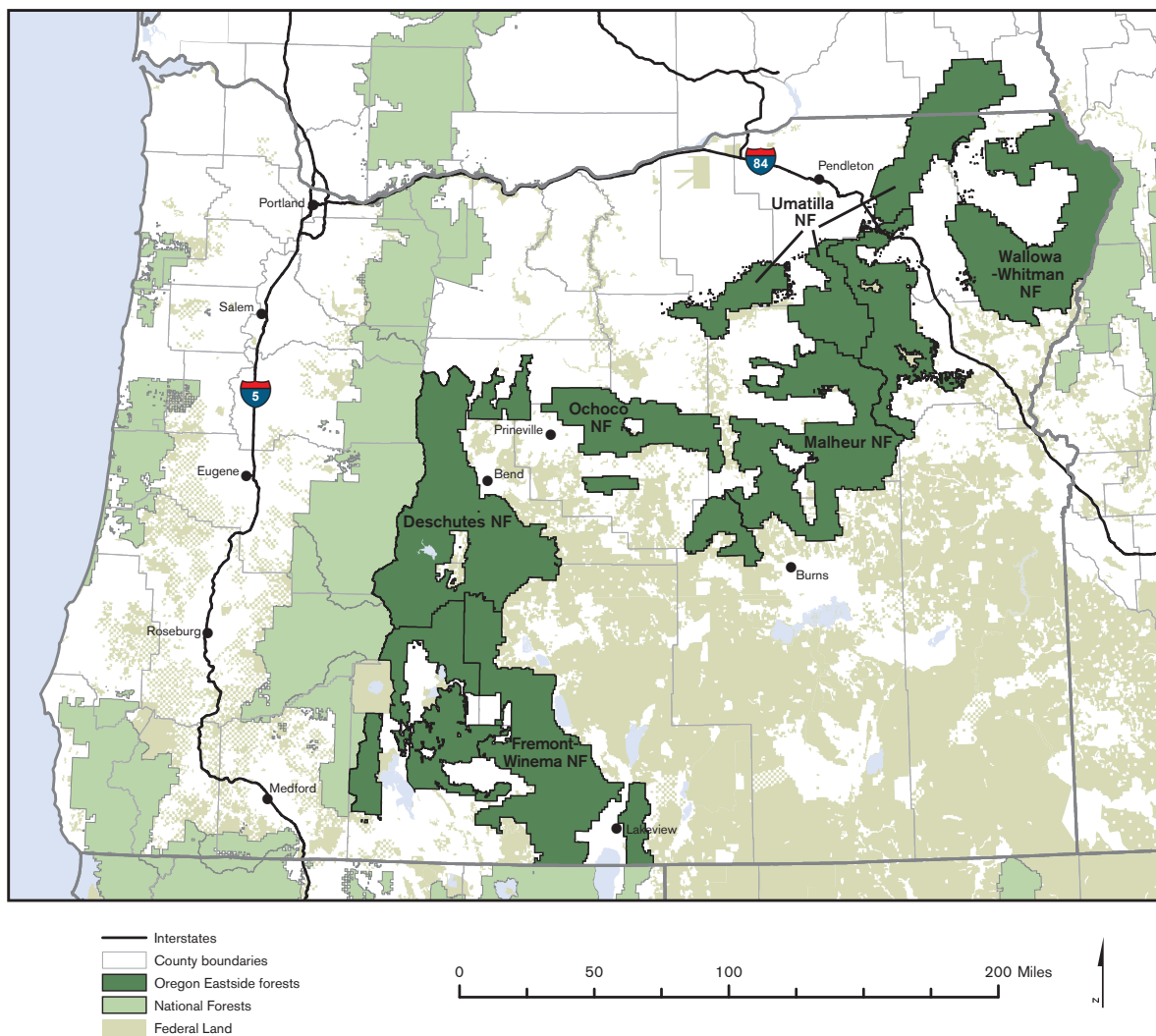
This working paper reports accomplishments on six eastside Oregon national forests—the Deschutes, Fremont-Winema, Malheur, Ochoco, Umatilla, and Wallowa-Whitman National Forests—from FY 2009 to FY 2016 (see Figure 1, below). We report restoration efforts and estimate the economic impacts of these efforts in nearby communities before and during the investment years of FFRP and the Eastside Restoration Strategy. This paper updates monitoring of restoration efforts in Oregon's Blue Mountains forests reported previously in 2015.⁶ A companion working paper details the State's investments in accelerated res-

toration through the FFRP during the 2015-2017 biennium, which included all the federal forests in Oregon.⁷

We provide an overview of the measures and approach used for monitoring below. Additional details regarding methods, as well as more comprehensive reporting of forest- and year-specific data, are provided in the Appendix.

We note that the majority of FFRP investments during both biennia focus on decision-making and planning in support of restoration activities on federal forests. Impacts of decision and planning efforts in terms of measures reported in this

Figure 1 Eastside national forests of Oregon



working paper are likely observed after multiple years and over the long-term. Therefore, one goal of this report is to maintain consistent monitoring, particularly during the baseline and early periods of the program. In addition, it is important to reiterate that the FFRP and Eastside Restoration Strategy occurred in concert and pursued similar goals. Impacts of the respective programs in terms of the measures reported here therefore cannot be differentiated.

Performance measures

This working paper reports a subset of the measures identified in the 2015 monitoring report,⁸ namely the area and type of fuels and watershed restoration treatments conducted, the volume of timber sold (timber contract value is also reported but in less detail), the value and type of restoration contracts implemented, and the economic impacts (jobs supported and business sales created) of these activities (see Table 1, below). Data sources are also noted at the beginning of each section.

Monitoring reported here intends to build on earlier efforts from the Federal Forest Working Group (FFWG), among others, to evaluate progress toward forest restoration goals of multiple stakeholder groups. The FFWG produced a set of management and restoration indicators: area and severity of wildfire, NEPA decisions, stewardship contracts, forest product volume, watershed treatment projects, and forest treatment projects.¹⁰ These indicators were designed to produce, over time, consistently measured information that would be useful to multiple parties involved in restoration planning and practice. The indicators were not developed explicitly to evaluate state or federal investments in restoration. In 2015, ODF worked with the University of Oregon and Oregon State University researchers to operationalize a set of performance measures and corresponding data. The work intended to complement and expand upon FFWG indicators, allowing for the continued tracking of restoration performance and for the evaluation of state or federal investments to improve restoration performance.

Table 1 Performance measures and data sources

Performance measures	Data reported	Data source
Treatment activities	Area of fuels treatment completed (acres)	FACTS
	Area of watershed treatment completed (acres)	FACTS
Timber supply	Volume of timber sold (mmbf)	TIM
	Value of timber sold	TIM
Restoration activities	Value of restoration contracts	FPDS
	Type of restoration contracts	FPDS
Economic impact	Jobs created through: mills and processing facilities; timber harvest; restoration contracts	Economic modeling using IM-PLAN; ⁹ inputs include data from USFS TIM and FPDS
	Business sales created through: mills and processing facilities; timber harvest; restoration contracts	Economic modeling using IM-PLAN; inputs include data from USFS TIM and FPDS

Comparing restoration investment against a baseline

As stated above, this working paper extends monitoring that was published in 2015. The previous report established a baseline (FY 2009-2011) and comparison period (2012-2014; termed the “investment” period) in order to measure the performance of the FFRP (then the Federal Forest Health program), although the report notes that data reflect cumulative state and federal investments. A companion report extended this monitoring approach from the Blues forests to all six eastside forests.¹¹ For continuity of monitoring, we adopt the values reported previously, along with the established baseline (FY 2009-2011) and investment (2012-2014) periods, and we append FY 2015 and 2016. We use “first investment” and “second investment” periods throughout to refer to FY 2012-2014 and 2015-2016, respectively.

When looking across comparison periods, it is important to consider the impact of the American Recovery and Reinvestment Act (ARRA) of 2009, which directed significant funding toward contracts on federal forests. Federal agencies awarded contracts totaling abnormally high values, which are reflected primarily in FY 2010 in both FACTS treatment activities and FPDS service contract data. For example, in some cases, services contracts in FY 2010 totaled twice the FY 2011-2016 annual mean value.

Following previous monitoring, we retain FY 2010 in the FY 2009-2011 baseline period when calculating percent-change in treatment activities and timber sales across the comparison periods. However, the method from the previous reports omitted FY 2010 service contract data; this step was applied in calculating percent-change in service contract value between comparison periods and in calculating the economic impacts of restoration activities. FY 2010 timber sales were included in these previous calculations; treatment activities are not involved in impact calculations in any way. Therefore, following from the previous approach, we include FY 2010 in data reported for treatment

activities (FACTS) and timber sales (TIM), but we omit FY 2010 restoration contract data (FPDS) when reporting service contracts and when calculating economic impacts. See the detailed description of methods used in economic impact estimation in the below section.

It is important to also consider that the state and federal fiscal years differ. This presents a challenge when reporting performance measures corresponding to the federal fiscal year (October-September) and interpreting them in the context of the FFRP investment period corresponding to the state fiscal year (July-June). In this working paper, all data presented correspond to the federal fiscal year in order to maintain comparability to other Forest Service data, as well as to maintain reproducibility. Hereafter, all reference to fiscal year (FY) corresponds to the federal fiscal year, unless otherwise noted.

Finally, we draw attention to the first investment period (corresponding to federal fiscal years 2012-2014) including 18 months prior to the start of FFRP investments, from October 2011 through July 2013. The timing is particularly relevant when considering that FFRP projects, once funded in July of 2013, did not reach implementation stages for an additional length of time.





Monitoring restoration progress, 2009-2016

Treatment activities

Maintaining progress toward restoration goals on federal forests requires active restoration treatments, including fuels and watershed management. We monitor treatment activities in this report by tracking the area and type of fuels and watershed treatments conducted on eastside forests, FY 2009-2016. All treatment data are reported from the Forest Service Activity Tracking System (FACTS; see Appendix for details). Activities are completed primarily through restoration-related service contracts, as well as through restoration-related activities conducted as part of commercial timber sales.

We report fuels treatments in seven aggregated categories: broadcast burning, commercial timber sale, pile burning, piling forest material, pre-commercial thinning, salvage timber sales, and surface treatments. We report watershed health activities in eight aggregated categories: animal damage control, fish habitat inventory and improvement, insect and disease surveys and control, invasive plants control, range fencing, range fence removal,

tree encroachment control, and wildlife habitat improvement. We do not sum the total area treated across categories, because a particular area often undergoes treatment multiple times and with multiple activities, and so summing would overestimate total spatial area treated. We do, however, note trends across the three comparison periods as an indication of restoration treatment effort. As documented in other reports, the FFRP did not directly fund treatment activities in either investment period.^{12,13}

Fuels treatments

Fuels reduction activities decreased 17% between the baseline period, FY 2009-2011, and the first investment period, FY 2012-2014, in annual mean acres treated (see Figure 2, page 7). Fuels activities decreased 5% between the first investment and second investment, FY 2015-2016, periods. Fuels activities decreased 21% across all years, from baseline through the second investment period.

The declining trend across all years is primarily accounted for by the relatively large number of total acres treated in the FY 2009-2010 ARRA years. While annual mean treated acres increased 21% between the baseline and second investment periods on the Fremont-Winema National Forest, all other forests experienced declines.

Pre-commercial thinning was the most common fuels treatment activity reported during the FY 2009-2011 baseline and 2012-2014 first investment periods (annual means: 67,810 and 49,432 acres, respectively), while mechanical and hand piling was most common during the second investment period (annual mean: 52,427 acres; see Table 2, below). These two activities, along with broadcast burning, burning piled materials, and commercial sales, were all relatively common over the whole FY 2009-2016 monitoring period, with each activ-

ity conducted on more than 20,000 acres annually. Regarding trends in these common treatments from the baseline to second investment periods, pile burning remained constant, broadcast burning decreased 10%, larger declines existed with commercial sales (21%) and pre-commercial thinning (53%), while mechanical and hand piling increased 33%. Surface treatments and salvage timber sales were less common and not conducted on all forests each year.

Figure 2 Fuels reduction restoration treatments on eastside national forests, FY 2009-2016

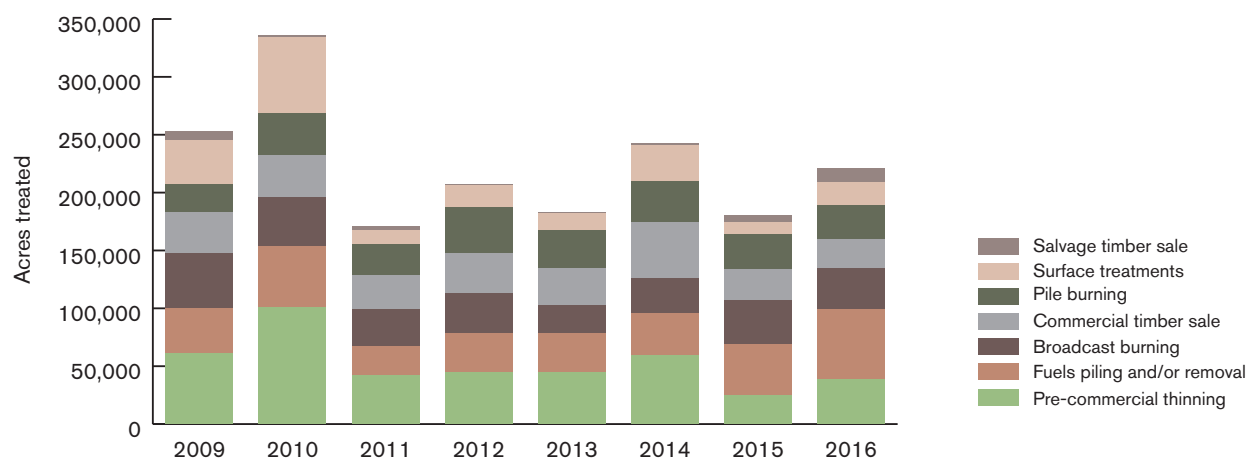


Table 2 Fuels treatments, in acres, on eastside national forests, FY 2009-2016

Fuels Treatments	2009	2010	2011	2012	2013	2014	2015	2016
Broadcast burning	47,405	42,430	31,645	34,437	23,335	29,519	37,676	35,309
Commercial timber sale	36,237	35,744	28,683	34,744	32,432	48,513	27,605	25,146
Pile burning	23,831	36,374	27,459	39,517	32,796	35,661	29,673	28,914
Fuels piling and/or removal	38,951	53,294	25,768	34,269	34,477	36,806	44,072	60,781
Pre-commercial thinning	61,006	100,474	41,949	44,391	44,491	59,414	24,915	38,509
Salvage timber sale	8,481	1,810	2,755	110	564	1,243	6,836	11,390
Surface treatments	37,340	65,920	12,165	19,328	14,961	31,075	10,176	20,555

Note: Surface treatments in the table above includes mechanical surface treatments, chipping of fuels, and other surface treatments.

Table 3 Watershed health restoration treatments on eastside national forests, FY2011-2016 (acres)

Watershed treatment	2009	2010	2011	2012	2013	2014	2015	2016
Animal damage control	6,412	6,863	2,086	3,277	2,522	2,252	2,320	1,775
Inland fish habitat inventory and improvement	134	5	168	-	-	-	1	4
Insect and disease surveys and control	53	-	20	25	5	49	-	211
Invasive treatments	21,083	25,100	18,374	20,649	18,208	24,914	24,092	24,011
Range fence removal	-	2,000	160	-	-	-	-	-
Range fencing	93,620	115,855	61,998	74,824	51,190	27,665	14,401	3,860
Tree encroachment control	216	2,443	178	367	-	-	-	-
Tree planting	15,558	11,823	10,744	7,776	8,740	15,092	11,926	5,821
Wildlife habitat treatments	4,734	45,025	3,142	5,749	3,913	12,048	3,349	8,845

2016. Tree planting and wildlife habitat treatments were conducted on appreciable numbers of acres each year FY 2009-2016, and both activities remained relatively constant (ignoring the large area of wildlife habitat treatments in 2010; Table 3). Other watershed activity types were conducted on less than 3,500 acres annually.

As with fuels treatments above, specific watershed treatments on individual forests typically differed across the three comparison periods. For example, on the Deschutes National Forest, wildlife habitat treatments were most common in the baseline compared to invasive treatments in the second investment period. Conversely, on the Malheur National Forest, range fencing treatments were most across all three comparison periods. The Appendix includes systematic reporting of acres treated annually by activity and forest.

Timber supply

Commercial timber harvest is an important component of active forest restoration. We monitored timber sales, with a focus on volume of contracts sold annually from eastside forests, FY 2009-2016. Sales are reported as sawtimber and non-sawtimber (the latter including green biomass and poles; non-timber products such as cones and fuelwood are excluded). Local sales are designated as those contracts purchased by a buyer located in a county adjacent to the national forest selling the timber. Data are reported from the contract product descriptions of the Forest Service Timber Information Manager (TIM) system; see Appendix.

The mean annual volume of timber sold on eastside forests was 197.06 million board feet (mmbf) during the baseline (FY 2009-2011), 229.38 mmbf during the first investment period (FY 2012-2014),

and 169.21 mmbf during the second investment period (FY 2015-2016). Changes between the periods amounted to a 16% increase and 26% decrease, respectively, and a 14% overall decrease across all years (see Figure 4, below). The observed trends were largely due to the relatively high volume sold in FY 2012 (294.24 mmbf), specifically the abnormally large volume sold on the Fremont-Winema National Forest in that year (124.91 mmbf). It is outside the scope of this report to speculate as to the cause of the observed high volume. See the appendix for additional forest-specific values.

The majority (77%) of total timber volume sold during the FY 2009-2016 period was in the form of sawtimber (see Figure 5, below). The mean percentage of sawtimber volume to total volume increased across the three comparison periods (65% to 82% to 90% sawtimber), mean the percentage of non-sawtimber decreased correspondingly. The mean annual volume of sawtimber was highest on all forests in the first investment period, as compared to both the baseline and the second investment periods (except the Umatilla, on which mean annual sawtimber volume remained constant from the

Figure 4 Total volume of timber sales on eastside national forests by county, FY 2009–2016

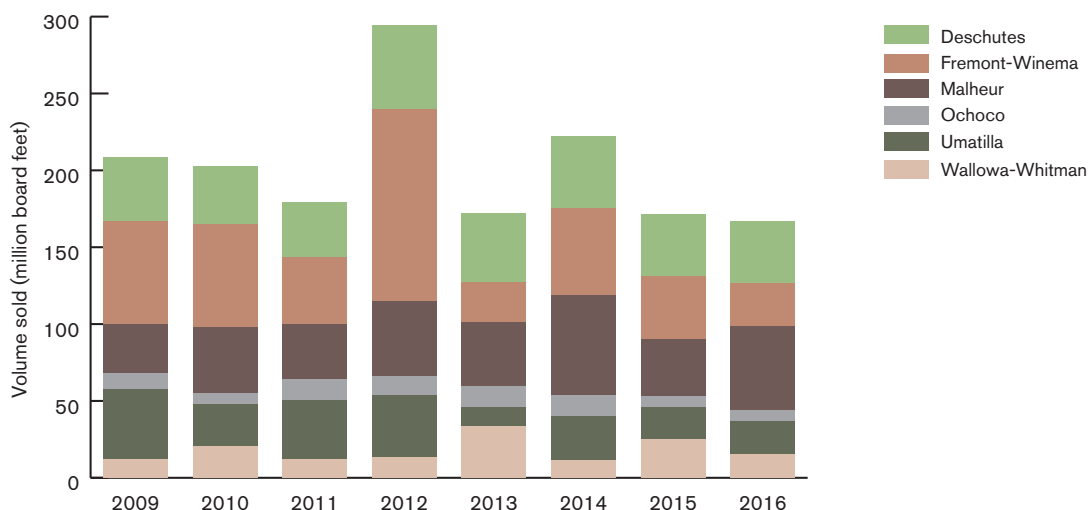
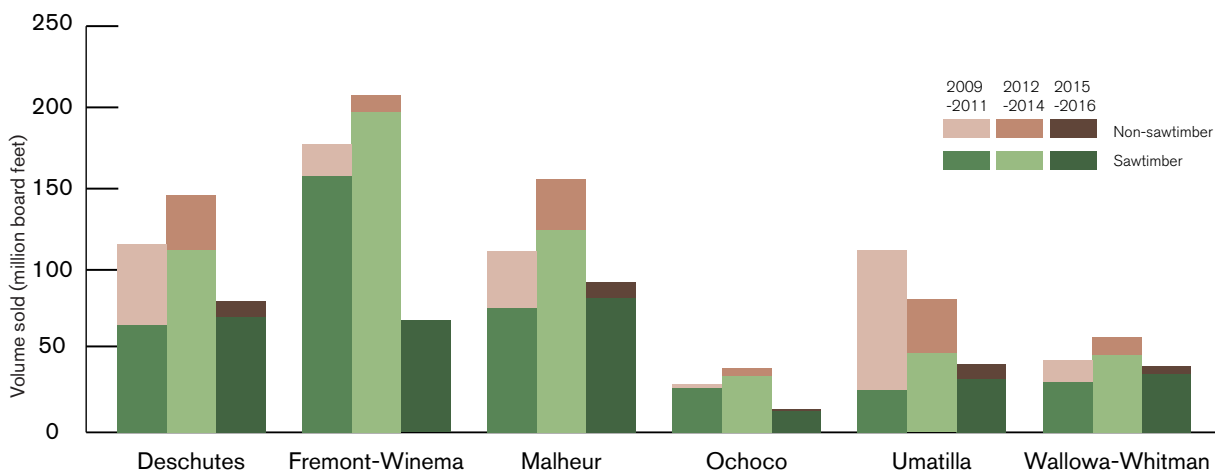


Figure 5 Total volume of timber sales on eastside national forests, sawtimber and non-sawtimber by county, FY 2009-2016



first to the second investment period). The mean annual volume of non-sawtimber declined across the three periods on all forests except the Ochoco National Forest, but declines varied in degree; for example, larger, consistent declines occurred on the Deschutes, Malheur, and Umatilla National Forests, while smaller declines occurred on the Fremont-Winema and Wallowa-Whitman National Forests.

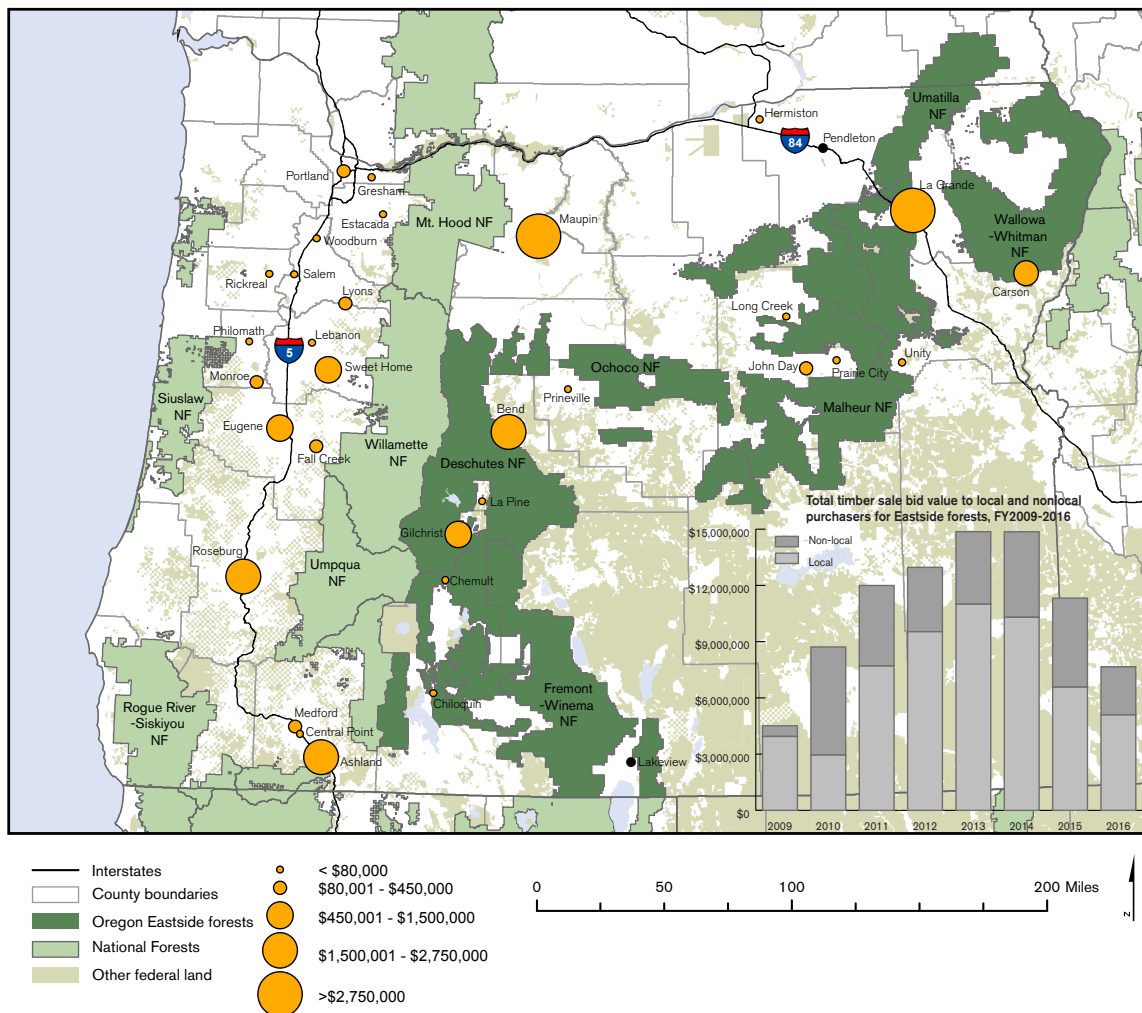
The mean annual value of timber sales during the baseline, first investment, and second investment periods was \$8.41, 14.23, and 9.49 million, respectively. This pattern in timber sales across the three periods was evident on all forests, except the Umatilla National Forest, on which mean an-

nual sales were highest during the baseline (\$2.86 million) and declined in both the first investment (\$2.12 million) and second investment (\$1.34 million) periods.

Local purchasers accounted for more than half of the timber sales in terms of volume during each of the baseline, first investment, and second investment periods (53%, 75%, and 62%, respectively). Local capture of sawtimber in the three comparison periods mirrored local capture of total volume.

Purchasers of timber contracts on eastside forests were largely headquartered in Oregon, though they are geographically distributed throughout the state (see Figure 6, below). Among eastside

Figure 6 Total value and purchaser location of timber sales on eastside national forests, FY 2011–2016



forests, local capture of timber sales varied substantially, particularly in terms of sale value. For example, timber sales on the Deschutes National Forest had relatively high annual value with high local capture across baseline (93%), first investment (90%), and second investment (82%) periods. Timber sales on the Ochoco National Forest had relatively low annual value with low local capture across all three periods (7%, 19%, and 24%, respectively). On the Fremont-Winema and Umatilla National Forests, both the annual value and the local capture of value varied substantially across the comparison periods (ranging from 35% to 60% on the Fremont-Winema and 13% to 78% on the Umatilla). For the Malheur National Forest, the annual value sold increased modestly in the second investment period, while local capture rose sub-

stantially across all three periods (23%, 66%, 83%, respectively). See Appendix for details.

Following the date of a timber sale, purchasers have several years to harvest the timber, so tracking sales does not reflect harvested timber. Timber under contract refers to the volume of timber sold but not yet harvested. The increasing trend of timber volume under contract since FY 2011 (with the exception of FY 2016; see Figure 7, below) suggests that timber harvests may increase in coming years. While the Deschutes and Umatilla National Forests show modest increases over FY 2009-2011 (48.49-89.38 and 37.79-62.75 mmbf, respectively), the overall positive trend in timber under contract is due primarily to an increase on the Malheur National Forest (28.56-141.89 mmbf; see Table 4, below).

Figure 7 Volume of timber under contract by forest, Oregon eastside forests, FY 2009–2016

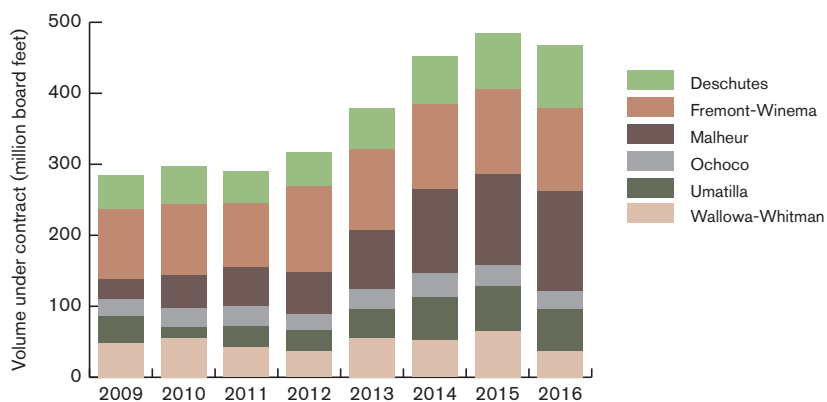


Table 4 Volume of timber under contract (million board feet), Oregon eastside forests, FY2009-2016

County	2009	2010	2011	2012	2013	2014	2015	2016
Deschutes	48.49	53.55	44.01	48.68	58.44	68.21	78.98	89.38
Fremont-Winema	97.40	100.28	91.08	119.91	113.78	119.78	119.00	115.51
Malheur	28.56	45.90	54.49	59.94	83.49	118.44	128.03	141.89
Ochoco	23.84	26.07	28.68	22.07	28.41	32.89	30.63	24.68
Umatilla	37.79	16.16	29.47	30.32	39.77	61.50	62.75	58.62
Wallowa-Whitman	48.28	54.99	42.16	36.22	55.47	51.76	65.28	37.42
TOTAL	284	297	290	317	379	453	485	468



Service contracts for restoration work

Forest restoration includes activities conducted through restoration-related service contracts. Service contracts can be tendered individually or as part of stewardship contracts, in which case they are integrated with timber sales. We monitored service contracts as specific activities including natural resources and conservation work (e.g., environmental remediation, tree planting, site preparation, seed collection, seedling production), tree thinning, forest and rangeland post-fire rehabilitation, scientific study and analysis (e.g., biological surveys, water quality assessments), and construction and maintenance of roads and infrastructure, among others. We included the service portion of stewardship contracts in these data (i.e., Integrated Resource Service Contracts). We omitted all activities related to fire suppression. As with tim-

ber sales, we designated local service contracts as those awarded to contractors located in a county adjacent to the national forest where the work is to be conducted. All data are reported from the Federal Procurement Data System (FPDS). See Appendix for details on methods, including the FPDS Product Service Codes used to define restoration-related activities.

On average, the Forest Service awarded restoration contracts on eastside forests for approximately \$17.70 million annually during the baseline period (recall FY 2010 is omitted from calculations; see Approach and Appendix), \$16.55 million annually during the first investment period, and \$16.28 million annually during the second investment period. These changes represent a 7% decrease between the baseline and first investment periods and a 2% decrease between the first and second investment periods.

Individual forests awarded contracts variably across the FY 2009-2016 period (see Figure 8, below), though the Ochoco National Forest consistently awarded the lowest annual contract value. Mean annual contract value increased on the Fremont-Winema National Forest across the three comparison periods (from \$1.44 to \$3.72 to \$4.01 million, respectively), and value remained relatively constant on the Wallowa-Whitman National Forest at approximately \$3 million. Contract value declined on the Ochoco (from \$0.75 to \$0.55 to \$0.52 million) and Umatilla (from \$3.39 to \$1.70 to \$1.59 million) National Forests. Across the three periods, the first investment years represented low relative investment on the Deschutes and high relative investment on the Malheur National Forests.

Across eastside forests, local contractors were awarded 51% of the value of restoration service contracts during the baseline period and 44% during both the first and second investment periods. Mean local capture remained relatively constant across all three comparison periods (see Figure 9, page 15). Annually, local capture was relatively low for the Ochoco (29%) and high for the Malheur (61%) National Forests. During the FY 2009-2016 period, the Malheur National Forest received considerably higher restoration service contract value with relatively high local capture, a feature likely affected by the onset of the Malheur 10-year Stewardship Contract in FY 2013.¹⁴

Economic impacts

Monitoring economic impacts from forest restoration is challenging. Restoration activities, including timber sales and service contracts reported above, result in economic impacts in many ways. Both sales and contracts involve jobs created in the woods, with timber sales also supporting significant numbers of jobs in mills and processing facilities. These are termed “direct effects,” and they may be concentrated locally if sales and contracts are purchased and awarded to forest-adjacent communities, or effects can be dispersed non-locally. Timber sales and service contracts also result in “indirect effects,” meaning all the associated services and supplies required to support work such as fuel, food, equipment and repair, and other timber harvester and contractor business needs. Finally, income generated through jobs in the direct and indirect sectors is spent in communities, resulting in “induced effects” (see Figure 10, page 15).

By conceptualizing the economic impacts of restoration in this way, it is possible to estimate employment and business sales resulting from timber sales and service contracts on eastside forests. To do this, previous monitoring efforts in partnership with the Forest Service and ODF generated economic functions using forest sector specific data

Figure 8 Service contract value on eastside forests, FY 2009–2016

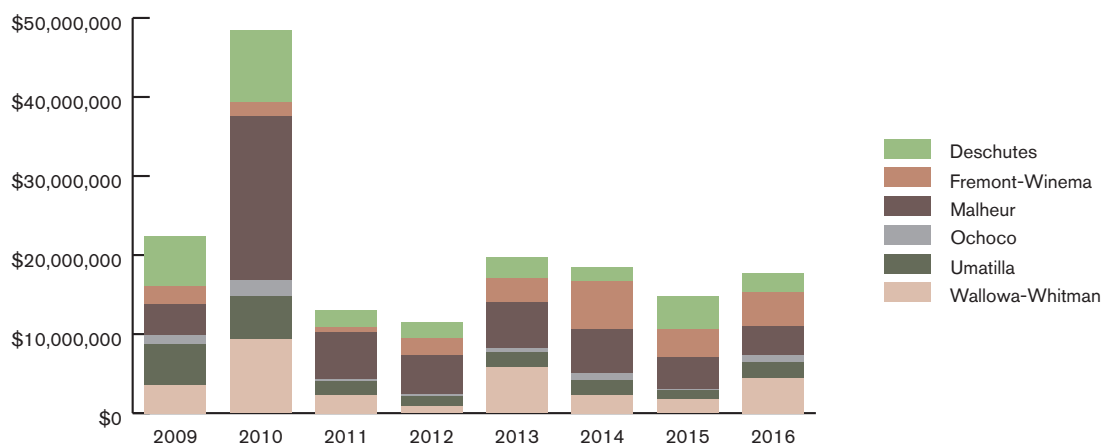


Figure 9 Eastside forests restoration contract value awarded to local and nonlocal contractors, FY 2009–2016

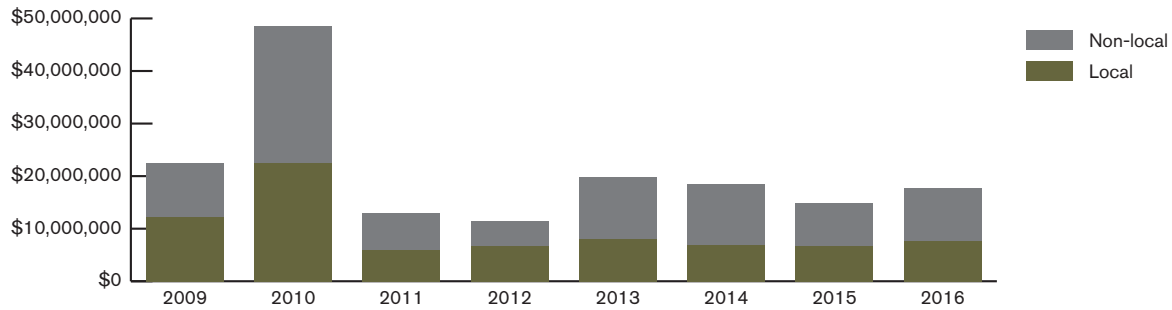
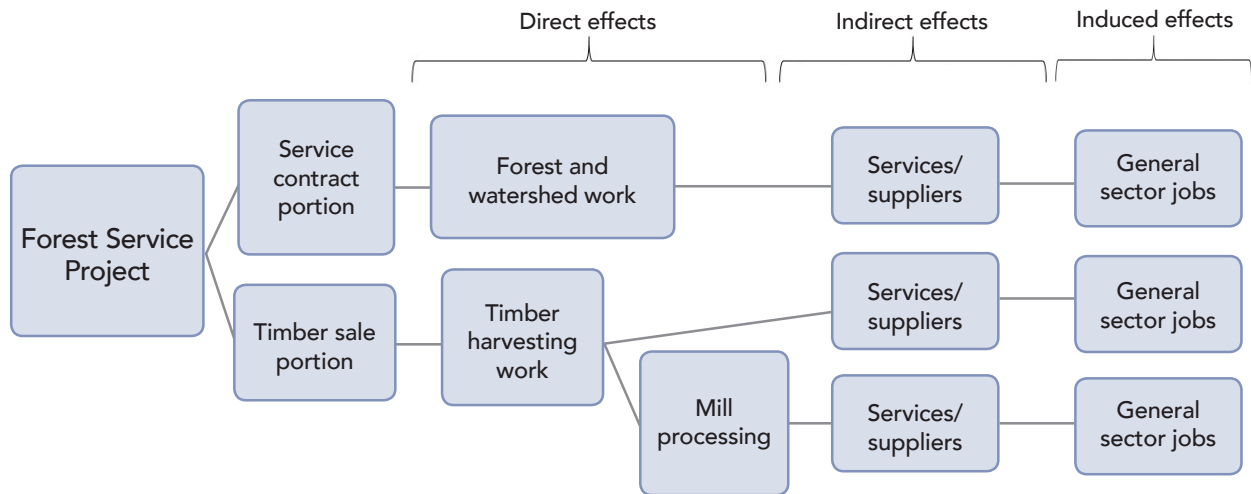


Figure 10 Conceptual model of the economic impacts of forest restoration projects



combined with the software IMPLAN. These functions produced values associated with timber sold and service contracts awarded (represented in Figure X above) and were combined into a single model, or calculator.¹⁵ The resulting economic impact calculator produces estimates of direct and secondary effects (the sum of indirect and induced) of restoration activities in terms of jobs and business sales created.

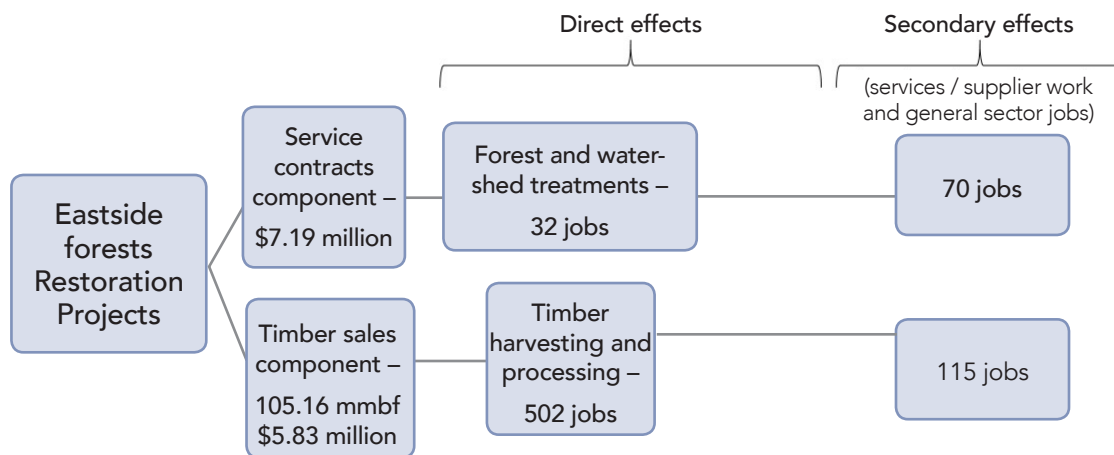
Here, we calculated impacts generated in eastern Oregon counties annually during FY 2015-2016 from restoration work conducted on the six eastside forests. Impacts generated during FY 2009-2014 are presented in a previous monitoring report.¹⁶

Restoration activities on eastside forests supported an estimated average of 1,186 jobs annually and

generated \$196.04 million of total economic activity annually in local eastern Oregon counties over FY 2015-2016 (See Figure 10, below and Table 5, page 17). Estimated jobs are full-time or part-time, annualized, and the sum of direct jobs in the woods and mills (534) as well as jobs supported by secondary effects (652). Estimated annual economic activity includes the wages from these jobs (\$42.68 million), as well as from the direct and secondary (including both indirect and induced) effects of timber sales and service contracts. These outcomes result from the annual mean local timber sales of 105.16 mmbf and service contracts of \$7.19 million.

Estimates assume that all the timber sales and service contracts in FY 2015 and 2016 were completed, in other words, that the timber was cut and the service contracts were fulfilled. This is often not the case, such as with the trend of increasing timber under contract since FY 2011, driven primarily by the accumulation on the Malheur National Forest. Therefore, the economic impacts should be viewed as estimates of outcomes that would result over multiple years following timber sales and service contracts.

Figure 10 Employment throughout eastern Oregon from restoration projects on eastern Oregon national forests, FY 2015-2016



Mean annual jobs,
FY 2015-2016: 1,186

Table 5 Estimated annual economic output from restoration activities on eastside national forests

Breakdown of local impacts by year	Mean annual impacts
Economic output generated (\$)	\$196,040,472
Direct effects	\$105,561,301
Secondary effects	\$90,479,171
Amount of wages generated (\$)	\$42,677,983
Direct effects	\$17,150,545
Secondary effects	\$25,527,438
Number of jobs supported	1,186
Direct effects	534
Secondary effects	652





Summary and conclusions

Federal and state efforts continue to work toward active restoration on eastside public forestlands. Efforts include the Eastside Restoration Strategy of the Forest Service and the State-funded FFRP. Since July 2013 the FFRP, managed through ODF, has committed state personnel and resources to work on federal forests as well as provided capacity to public and private lands collaboratives. This working paper reported on a set of restoration performance measures from FY 2009-2016 to track accomplishments on the six eastside national forests in Oregon.

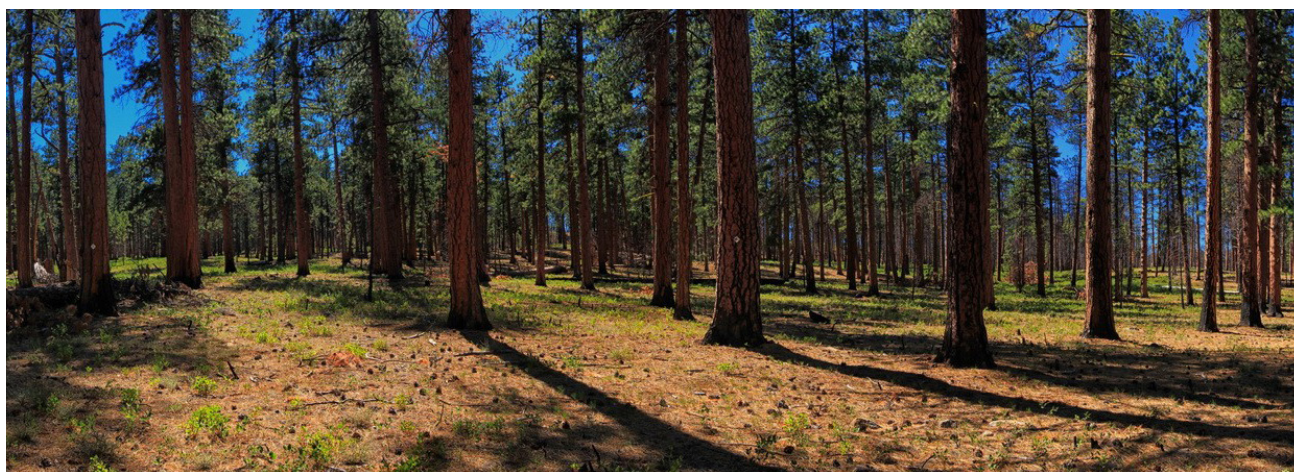
- Fuels reduction activities decreased 17% between the baseline (FY 2009-2011) and first investment period (FY 2012-2014) and decreased 5% between the first and second investment (FY 2015-2016) periods. Pre-commercial thinning was the most common fuels treatment activity reported during the baseline and first investment periods, while mechanical and hand piling was most common during the second investment period.
- Watershed health activities decreased 38% between the baseline and first investment periods and decreased 46% between the first and second investment periods. Range fencing exhibited a substantial decline in terms of acres treated across the comparison periods, largely contributing to overall declines in watershed treatments.
- Annual mean timber sales on eastside forests increased 16% between the baseline and first investment periods and decreased 26% between the first and second investment periods. Sawtimber accounted for the majority of these sales, yet the percentage of non-sawtimber sold relative to total timber volume declined across all three periods. Volume of timber under contract increased from FY 2011-2015 but decreased slightly from FY 2015 to 2016.

- Local purchasers accounted for the majority of the timber sales in terms of value during the three comparison periods. Local capture varied among eastside forests both in the degree of local capture and in trends across the comparison periods.
- Restoration service contracts on eastside forests included primarily natural resources and conservation work (e.g., environmental remediation, tree planting, site preparation, seed collection, seedling production), tree thinning, forest and rangeland post-fire rehabilitation, scientific study and analysis (e.g., biological surveys, water quality assessments), and construction and maintenance of roads and infrastructure. Restoration contracts on eastside forests decreased 6% between the baseline and first investment periods and decreased 2% between the first and second investment periods.
- Multiple ongoing initiatives support restoration on Oregon's six eastside forests. During FY 2015-2016, eastside restoration supported an estimated 1,186 jobs annually and generated \$196.04 million annually of total economic activity in local eastern Oregon counties. These outcomes resulted from annual timber sales and service contracts totaling \$16.88 million, of which \$6.96 million were spend locally.

The overall impacts of the FFRP on forest restoration on eastside forests remain unclear. None of the performance measures exhibited consistent

increasing trends across the comparison periods. Some measures, such as fuels and watershed treatment activities, decreased across all years from FY 2009-2016. Certain measures of restoration consistently increased, such as the percentage of local capture of timber contracts on the Fremont-Winema National Forest. A key point is that the majority of restoration program investments focus on long-term restoration goals. For example, the FFRP's state-federal partnership and collaborative support activities target decision-making and planning processes of projects on national forests. Therefore, based on the measures reported here, the impacts of the FFRP in particular would likely not be observed for multiple years. Moreover, separating impacts of the FFRP from other ongoing restoration activities, such as the Eastside Restoration Strategy, will remain challenging.

The State of Oregon, the Forest Service, and other stakeholders must continue their investments in long-term monitoring of consistent measures of restoration progress. Short-term, comparative approaches, such as those conducted for this working paper, may offer insights into trends. However, understanding mechanisms behind apparent trends or impacts of programs and interventions requires controlled studies and/or analyses of long-term data, particularly data on direct economic and biophysical outcomes of restoration. Efforts in coordinated monitoring, such as those made by the Federal Forests Working Group, represent essential components of forest policy and should be continued.



Endnotes

- 1 White, E.M., E.J. Davis, D. Bennett, and C. Moseley. 2015. Monitoring of outcomes from Oregon's Federal Forest Health Program. Ecosystem Workforce Program, University of Oregon. Working Paper #57. Available at http://ewp.uoregon.edu/sites/ewp.uoregon.edu/files/WP_57.pdf.
- 2 Salerno, J., H. Huber-Stearns, K. Jacobson, and C. Moseley. 2017. Monitoring Oregon's Investments in the Federal Forest Restoration Program. Working Paper #78. Available at http://ewp.uoregon.edu/sites/ewp.uoregon.edu/files/WP_78.pdf.
- 3 Haugo R, Zanger C, DeMeo T, Ringo C, Shlisky A, Blankenship K, Simpson M, Mellen-McLean K, Kertis J, Stern. 2015. A new approach to evaluate forest structure restoration needs across Oregon and Washington, USA. *For. Ecol. Manag.* 335:37–50.
- 4 Federal Forest Working Group. 2017. Federal forest dashboard: management and restoration indicators for six National Forests in eastern Oregon. Available at <http://orsolutions.org/wp-content/uploads/2011/08/Dashboard-1-31-17-version.pdf>
- 5 The FFRP was initiated during the 2013-2015 biennium as the Federal Forest Health Program, and the program was expanded during the 2015-2017 biennium under its current name, the Federal Forest Restoration Program. For clarity, this report refers to the State's efforts across both biennia as the FFRP.
- 6 White, E.M., E.J. Davis, D. Bennett, and C. Moseley. 2015. Monitoring of outcomes from Oregon's Federal Forest Health Program. Ecosystem Workforce Program, University of Oregon. Working Paper #57. Available at http://ewp.uoregon.edu/sites/ewp.uoregon.edu/files/WP_57.pdf.
- 7 Salerno, J., H. Huber-Stearns, K. Jacobson, and C. Moseley. 2017. Monitoring Oregon's Investments in the Federal Forest Restoration Program. Working Paper #78. Available at http://ewp.uoregon.edu/sites/ewp.uoregon.edu/files/WP_78.pdf .
- 8 White, E.M., E.J. Davis, D. Bennett, and C. Moseley. 2015. Monitoring of outcomes from Oregon's Federal Forest Health Program. Ecosystem Workforce Program, University of Oregon. Working Paper #57. Available at http://ewp.uoregon.edu/sites/ewp.uoregon.edu/files/WP_57.pdf.
- 9 Implan Pro. See <http://www.implan.com>.
- 10 Federal Forest Working Group. 2017. Federal forest dashboard: management and restoration indicators for six National Forests in eastern Oregon. Available at <http://orsolutions.org/wp-content/uploads/2011/08/Dashboard-1-31-17-version.pdf>.
- 11 White, E.M., D. Bennett, E.J. Davis, and C. Moseley. 2016. Economic outcomes from the U.S. Forest Service eastside strategy. Ecosystem Workforce Program, University of Oregon. Working Paper #64. Available at http://ewp.uoregon.edu/sites/ewp.uoregon.edu/files/WP_64.pdf.
- 12 White, E.M., E.J. Davis, D. Bennett, and C. Moseley. 2015. Monitoring of outcomes from Oregon's Federal Forest Health Program. Ecosystem Workforce Program, University of Oregon. Working Paper #57. Available at http://ewp.uoregon.edu/sites/ewp.uoregon.edu/files/WP_57.pdf.
- 13 Salerno, J., H. Huber-Stearns, K. Jacobson, and C. Moseley. 2017. Monitoring Oregon's Investments in the Federal Forest Restoration Program. Working Paper #78. Available at http://ewp.uoregon.edu/sites/ewp.uoregon.edu/files/WP_78.pdf
- 14 White, E.M., D. Bennett, E.J. Davis, and C. Moseley. 2016. Economic outcomes from the U.S. Forest Service eastside strategy. Ecosystem Workforce Program, University of Oregon. Working Paper #64. Available at http://ewp.uoregon.edu/sites/ewp.uoregon.edu/files/WP_64.pdf.
- 15 Forest Restoration and Utilization Calculator. See <http://ewp.uoregon.edu/calculate>.
- 16 White, E.M., D. Bennett, E.J. Davis, and C. Moseley. 2016. Economic outcomes from the U.S. Forest Service eastside strategy. Ecosystem Workforce Program, University of Oregon. Working Paper #64. Available at http://ewp.uoregon.edu/sites/ewp.uoregon.edu/files/WP_64.pdf.



Appendix

Treatment activities

We obtained Forest Service ACTivity Tracking Systems (FACTS) data through a direct data request to the Forest Service. We aggregated individual activities by activity code (see Tables A1 and A2, pages 22-23), which follows a strategy based on previous reporting.^{1,2} However, small discrepancies may exist between the categorization of activity codes (i.e., the crosswalk) used in this current report and previous reports due to ambiguous activity labels (e.g., Tree Encroachment Control (Activity Code 2400) potentially conducted as both watershed health and fuels treatment activities).

In the main text, we caution against summing total acres across treatment type categories, because a particular area often undergoes treatment multiple times and with multiple activities, and so summing would overestimate total spatial area treated. We do, however, report annual mean acres treated of individual treatment categories. This averaging involves the same multiple-counting of acres (e.g., the broadcast burning category includes four separate FACTS activity codes; Table A1). As in the main text, we report acres as an indication of restoration treatment effort; values should not be interpreted as spatial area.

Table A1 Crosswalk used to aggregate FACTS fuels reduction activities into reported treatment categories

Activity	Activity code	Fuel or watershed	Aggregated activity
Broadcast Burning - Covers a majority of the unit	1111	fuel	Burning
Control of Understory Vegetation- Burning	4541	fuel	Burning
Jackpot Burning - Scattered concentrations	1112	fuel	Burning
Underburn - Low Intensity (Majority of Unit)	1113	fuel	Burning
Burning of Piled Material	1130	fuel	Burning of Piled Material
Chipping of Fuels	1154	fuel	Chipping of Fuels
Commercial Thin	4220	fuel	Commercial Sale
Group Selection Cut (UA/RH/FH)	4152	fuel	Commercial Sale
Improvement Cut	4210	fuel	Commercial Sale
Overstory Removal Cut (from advanced regeneration) (EA/RH/FH)	4143	fuel	Commercial Sale
Patch Clearcut (w/ leave trees) (EA/RH/FH)	4115	fuel	Commercial Sale
Sanitation Cut	4232	fuel	Commercial Sale
Seed-tree Seed Cut (with and without leave trees) (EA/RH/NFH)	4132	fuel	Commercial Sale
Shelterwood Establishment Cut (with or without leave trees) (EA/RH/NFH)	4131	fuel	Commercial Sale
Shelterwood Removal Cut (w/ leave trees) (EA/NRH/FH)	4145	fuel	Commercial Sale
Single-tree Selection Cut (UA/RH/FH)	4151	fuel	Commercial Sale
Stand Clearcut (EA/RH/FH)	4113	fuel	Commercial Sale
Stand Clearcut (w/ leave trees) (EA/RH/FH)	4117	fuel	Commercial Sale
Fuel Break	1180	fuel	Mechanical Surface Treatment
Prune	4530	fuel	Other
Pruning to Raise Canopy Height and Discourage Crown Fire	1136	fuel	Other
Rearrangement of Fuels	1150	fuel	Other
Piling of Fuels, Hand or Machine	1153	fuel	Piling of Fuels, Hand or Machine
Yarding - Removal of Fuels by Carrying or Dragging	1120	fuel	Piling of Fuels, Hand or Machine
Precommercial Thin	4521	fuel	Precommercial Thin
Thinning for Hazardous Fuels Reduction	1160	fuel	Precommercial Thin
Tree Release and Weed	4511	fuel	Precommercial Thin
Salvage Cut (intermediate treatment, not regeneration)	4231	fuel	Salvage
Wildlife Habitat Precommercial thinning	6103	fuel	Wildlife habitat treatments

Table A2 Crosswalk used to aggregate FACTS watershed health activities into reported treatment categories

Activity	Activity code	Fuel or watershed	Aggregated activity
Animal Damage Control for Reforestation	4460	watershed	Animal damage control
Inland Fish habitat inventory	6610	watershed	Inland fish habitat inventory and improvement
Inland Fish Tree planting for fisheries habitat improvement	6676	watershed	Inland fish habitat inventory and improvement
Inland Fisheries Habitat Improvement Activities	6600	watershed	Inland fish habitat inventory and improvement
Insect and Disease Surveys	8010	watershed	Insect and disease surveys and control
Insect Control	8200	watershed	Insect and disease surveys and control
Invasives - Biocontrol, Classic	2550	watershed	Invasive treatments
Invasives - Biocontrol, Livestock	2560	watershed	Invasive treatments
Invasives - Cultural /Fire	2540	watershed	Invasive treatments
Invasives - Mechanical /Physical	2530	watershed	Invasive treatments
Invasives - Pesticide Application	2510	watershed	Invasive treatments
Invasives - Treatment Activity Monitoring	2520	watershed	Invasive treatments
Range Fence Obliteration - Area	2121	watershed	Range fence removal
Range Fences - Area	2111	watershed	Range fencing
Tree Encroachment Control	2400	watershed	Tree Encroachment Control
Fill-in or Replant Trees	4432	watershed	Tree planting
Plant Trees	4431	watershed	Tree planting
Watershed Resource Non-Structural Improvements Riparian	5520	watershed	Watershed resource improvements
Wildlife Habitat Activities	6000	watershed	Wildlife habitat treatments
Wildlife Habitat Improvement	6050	watershed	Wildlife habitat treatments
Wildlife Habitat Nest structures, dens development	6210	watershed	Wildlife habitat treatments
Wildlife Habitat Prescribed fire	6101	watershed	Wildlife habitat treatments
Wildlife Habitat Release and weeding	6102	watershed	Wildlife habitat treatments
Wildlife Habitat Snags created	6213	watershed	Wildlife habitat treatments
Wildlife Habitat Water development	6220	watershed	Wildlife habitat treatments

Table A3 Fuels treatment activities by forests, FY 2009-2016 (acres).

Forest	Treatment Activity	2009	2010	2011	2012	2013	2014	2015	2016
Deschutes	Broadcast burning	2,732	5,189	1,322	3,083	2,230	4,020	4,877	3,814
	Commercial timber sale	10,718	12,404	5,842	8,005	7,445	10,787	8,632	7,849
	Pile burning	9,090	8,860	10,252	13,242	12,681	9,634	9,301	9,473
	Piling, Machine or hand	13,681	15,183	5,740	7,340	7,598	10,645	8,241	14,475
	Pre-commercial thinning	10,047	36,359	18,247	10,709	7,289	7,545	10,687	9,190
	Salvage timber sale	48	245	161	35	0	1,120	517	223
	Surface treatments	9,605	56,450	7,454	10,720	6,398	7,449	7,402	5,669
	Total	55,921	134,690	49,018	53,134	43,641	51,200	49,658	50,693
Fremont-Winema	Broadcast burning	13,600	20,982	8,401	11,085	2,665	6,499	7,789	8,203
	Commercial timber sale	7,083	9,148	8,871	12,706	5,522	12,773	5,032	11,567
	Pile burning	3,563	10,115	3,687	7,658	3,754	7,531	8,024	7,801
	Piling, machine or hand	9,200	9,137	8,849	16,560	6,930	18,057	26,384	37,498
	Pre-commercial thinning	25,938	18,695	10,789	20,864	13,657	28,578	5,621	14,192
	Salvage timber sale	180	390	212	0	0	0	5,680	0
	Surface treatments	14,986	3,080	2,171	8,433	6,593	19,951	2,193	13,110
	Total	74,550	71,547	42,980	77,305	39,121	93,388	60,723	92,371
Malheur	Broadcast burning	8,275	3,907	6,546	3,223	5,159	7,341	2,746	8,798
	Commercial timber sale	8,172	7,556	6,999	5,422	10,239	16,614	6,282	3,257
	Pile burning	3,631	6,762	3,614	8,184	6,611	11,397	7,315	7,722
	Piling, machine or hand	5,164	15,821	5,890	4,771	14,153	3,643	2,432	3,185
	Pre-commercial thinning	6,196	20,020	4,287	5,685	14,826	8,055	3,651	3,290
	Salvage timber sale	7,235	105	1,311	0	0	0	0	4,687
	Surface treatments	8,799	610	61	0	238	0	39	0
	Total	47,472	54,781	28,708	27,285	51,226	47,049	22,465	30,939

Forest	Treatment Activity	2009	2010	2011	2012	2013	2014	2015	2016
Ochoco	Broadcast burning	8,584	4,489	4,803	5,263	2,073	2,474	3,472	4,357
	Commercial timber sale	2,842	1,932	3,745	3,743	2,618	3,637	915	1,496
	Pile burning	94	3,172	3,937	2,248	3,160	2,757	386	726
	Piling, machine or hand	2,662	3,403	377	0	585	426	797	1,927
	Pre-commercial thinning	7,614	5,419	2,983	1,718	3,114	6,121	481	5,418
	Salvage timber sale	262	12	0	0	0	0	626	0
	Surface treatments	588	2,512	117	0	0	1,538	0	0
	Total	22,646	20,939	15,962	12,972	11,550	16,953	6,677	13,924
Umatilla	Broadcast burning	6,696	3,814	5,415	5,676	4,683	1,375	8,530	4,961
	Commercial timber sale	2,741	343	2,178	2,163	2,088	2,684	2,129	668
	Pile burning	740	2,559	2,046	777	1,579	1,245	1,021	1,008
	Piling, machine or hand	1,756	4,702	654	1,688	804	1,163	1,153	1,496
	Pre-commercial thinning	4,763	5,659	2,680	2,214	1,718	3,516	1,907	1,968
	Salvage timber sale	675	959	1,071	75	564	0	13	5,314
	Surface treatments	2,071	1,737	2,158	0	1,153	1,960	468	552
	Total	19,442	19,773	16,202	12,593	12,589	11,943	15,221	15,968
Wallowa-Whitman	Broadcast burning	7,518	4,049	5,158	6,107	6,525	7,810	10,261	5,176
	Commercial timber sale	4,681	4,361	1,048	2,705	4,520	2,019	4,615	309
	Pile burning	6,713	4,906	3,924	7,408	5,012	3,097	3,626	2,185
	Piling, machine or hand	6,489	5,048	4,258	3,911	4,407	2,873	5,065	2,200
	Pre-commercial thinning	6,448	14,322	2,963	3,201	3,887	5,599	2,568	4,450
	Salvage timber sale	81	99	0	0	0	123	0	1,165
	Surface treatments	1,291	1,531	204	175	580	177	74	1,224
	Total	33,221	34,316	17,555	23,507	24,930	21,698	26,209	16,709

Table A4 Watershed treatment activities by forests, FY 2009-2016 (acres).

Forest	Treatment Activity	2009	2010	2011	2012	2013	2014	2015	2016
Deschutes	Animal damage control	6,334	6,819	1,295	2,953	1,526	2,081	1,269	814
	Inland fish habitat inventory and improvement	0	0	0	0	0	0	0	0
	Insect and disease surveys and control	0	0	0	0	0	0	0	0
	Invasive treatments	6,504	6,282	4,177	6,041	5,710	8,419	8,428	6,629
	Range fence removal	0	0	160	0	0	0	0	0
	Range fencing	0	12,374	681	0	0	0	0	0
	Tree encroachment control	30	0	0	0	0	0	0	0
	Tree planting	5,282	2,396	2,171	1,457	1,820	3,065	3,084	1,937
	Wildlife habitat treatments	1,245	42,585	1,705	1,479	565	0	0	0
Total	19,395	70,456	10,189	11,929	9,621	13,565	12,781	9,380	
Fremont-Winema	Animal damage control	0	0	0	0	0	0	0	0
	Inland fish habitat inventory and improvement	0	0	0	0	0	0	0	0
	Insect and disease surveys and control	0	0	0	0	0	0	0	0
	Invasive treatments	2,220	2,697	1,797	3,451	2,247	2,740	2,762	2,571
	Range fence removal	0	0	0	0	0	0	0	0
	Range fencing	28,229	80	0	0	9,571	10,970	8,456	0
	Tree encroachment control	0	0	0	0	0	0	0	0
	Tree planting	1,449	890	438	440	537	5,251	3,679	0
	Wildlife habitat treatments	2,276	1,141	1,298	4,162	3,340	9,345	1,064	778
Total	34,174	4,808	3,533	8,053	15,695	28,306	15,961	3,349	
Malheur	Animal damage control	0	0	0	0	0	0	0	0
	Inland fish habitat inventory and improvement	0	0	4	0	0	0	0	0
	Insect and disease surveys and control	0	0	0	0	0	0	0	100
	Invasive treatments	424	448	256	96	322	442	465	1,000
	Range fence removal	0	0	0	0	0	0	0	0
	Range fencing	35,594	29,311	50,668	27,994	24,593	16,695	5,945	1,372
	Tree encroachment control	186	2,443	126	367	0	0	0	0
	Tree planting	4,582	3,581	4,009	3,850	3,985	4,251	1,747	1,726
	Wildlife habitat treatments	37	63	10	65	8	0	0	0
Total	40,823	35,847	55,072	32,372	28,907	21,388	8,157	4,198	

Forest	Treatment Activity	2009	2010	2011	2012	2013	2014	2015	2016
Ochoco	Animal damage control	0	0	3	0	0	0	0	0
	Inland fish habitat inventory and improvement	134	5	164	0	0	0	1	4
	Insect and disease surveys and control	53	0	0	0	0	0	0	0
	Invasive treatments	3,683	4,214	3,159	4,189	2,945	4,088	4,075	3,620
	Range fence removal	0	0	0	0	0	0	0	0
	Range fencing	0	0	0	0	0	0	0	2,488
	Tree encroachment control	0	0	12	0	0	0	0	0
	Tree planting	239	603	64	0	0	3	1,585	0
	Wildlife habitat treatments	1,175	1,156	129	43	0	1,363	465	1,533
Total	5,284	5,978	3,531	4,232	2,945	5,454	6,126	7,645	
Umatilla	Animal damage control	0	0	788	324	996	171	1,051	961
	Inland fish habitat inventory and improvement	0	0	0	0	0	0	0	0
	Insect and disease surveys and control	0	0	0	0	0	0	0	111
	Invasive treatments	5,393	4,771	4,293	4,143	4,425	6,455	5,888	6,572
	Range fence removal	0	2,000	0	0	0	0	0	0
	Range fencing	0	37,681	0	21,962	0	0	0	0
	Tree encroachment control	0	0	0	0	0	0	0	0
	Tree planting	4,006	4,183	3,612	1,936	2,283	2,198	1,831	2,158
	Wildlife habitat treatments	0	0	0	0	0	256	20	0
Total	9,399	48,635	8,693	28,366	7,704	9,080	8,790	9,802	
Wallowa-Whitman	Animal damage control	78	44	0	0	0	0	0	0
	Inland fish habitat inventory and improvement	0	0	0	0	0	0	0	0
	Insect and disease surveys and control	0	0	20	25	5	49	0	0
	Invasive treatments	2,859	6,688	4,693	2,729	2,560	2,770	2,473	3,620
	Range fence removal	0	0	0	0	0	0	0	0
	Range fencing	29,797	36,409	10,649	24,868	17,026	0	0	0
	Tree encroachment control	0	0	40	0	0	0	0	0
	Tree planting	0	170	450	93	115	324	0	0
	Wildlife habitat treatments	1	80	0	0	0	1,084	1,800	6,534
Total	32,735	43,391	15,852	27,715	19,706	4,227	4,273	10,154	

Timber supply

We obtained Forest Service Timber Information Manager (TIM) system data through a direct data request to the Forest Service. Timber contract sale data are reported in multiple relational data files, and for reporting we utilized product description, bid value, and bidder location information. Following previous protocols,^{3,4} we converted all TIM-reported volumes to CCF using conversion factors based on the original unit of measurement (MBF*1.92; Ton*0.325). We then converted CCF values into MMBF (applying a conversion factor of 0.52), which we report throughout. We report sawtimber and non-sawtimber from sale product descriptions, with non-sawtimber including green biomass and poles. We determined local and nonlocal sales based on TIM-reported bidder locations, and whether or not the bidder is based in a county adjacent to the national forest from where the bid is sold (see Table A5, below).

For each forest, we checked annual timber volumes reported in TIM against volumes reported in Periodic Timber Sale Accomplishment Reports (PTSARs; obtained through a direct data request to the Forest Service). Although TIM and PTSARs are not identical, comparison may allow for the identification of errors. In doing so, we found a systematic discrepancy in FY 2015 and 2016 sale volumes reported on the Deschutes, Fremont-Winema and Malheur National Forests, and in FY 2016 on the Umatilla National Forest, for only those sales reported in tons in TIM. After consultation with the Region 6 Timber Program Manager, we replaced sale volumes originally reported in tons in TIM with volumes from the PTSARs, using the proportion of sale volume in each product description from TIM reports.

Table A5 Counties local to eastern Oregon national forests

National Forest	County
Deschutes	Crook, Deschutes, Klamath
Fremont-Winema	Klamath, Lake
Malheur	Baker, Crook, Grant, Harney
Ochoco	Crook, Deschutes, Jefferson, Wheeler
Umatilla	Grant, Morrow, Umatilla, Union, Wallowa
Wallowa-Whitman	Baker, Union, Wallowa

Table A6 Volume of sawtimber and non-sawtimber sold from eastside national forests (in million board feet), FY 2009-2016

Forest		2009	2010	2011	2012	2013	2014	2015	2016
Deschutes	Sawtimber	22.6	21.6	21.8	33.8	37.2	41.5	35.8	35.1
	Non-sawtimber	19.7	16.6	13.9	20.8	7.4	5.3	4.1	5.6
	Total	42.3	38.2	35.7	54.6	44.6	46.8	39.9	40.7
Fremont-Winema	Sawtimber	62.3	57.9	37.7	115.3	25.6	56.2	41.5	27.4
	Non-sawtimber	4.4	8.6	6.5	9.6	0.5	0.1	0.06	-
	Total	66.7	66.5	44.2	124.9	26.1	56.3	41.5	27.44
Malheur	Sawtimber	20.6	30.4	25.7	32.6	31.5	60.3	32.1	50.6
	Non-sawtimber	11.4	13.0	10.2	16.0	10.1	5.3	4.7	4.7
	Total	32.0	43.3	35.9	48.5	41.7	65.6	36.8	55.3
Ochoco	Sawtimber	9.5	5.6	12.1	11.3	12.0	11.3	7.1	6.2
	Non-sawtimber	0.8	0.9	1.0	1.3	1.3	1.8	0.4	0.5
	Total	10.2	6.5	13.1	12.7	13.3	13.1	7.5	6.7
Umatilla	Sawtimber	13.6	7.9	4.4	19.3	7.6	21.7	16.4	16.4
	Non-sawtimber	32.3	19.9	34.1	20.6	5.0	7.5	4.0	5.1
	Total	45.8	27.9	38.5	39.9	12.6	29.2	20.4	21.5
Wallowa-Whitman	Sawtimber	10.1	14.0	6.7	11.4	26.9	9.2	21.0	14.9
	Non-sawtimber	1.9	6.3	5.4	2.2	6.7	2.0	4.3	0.5
	Total	11.9	20.3	12.2	13.6	33.6	11.1	25.2	15.4
All 6 east-side forests	Sawtimber	138.7	137.5	108.3	223.7	140.8	200.1	153.8	150.7
	Non-sawtimber	70.3	65.2	71.2	70.6	31.0	22.0	17.5	16.4
	Total	209.0	202.7	179.5	294.2	171.8	222.1	171.4	167.1

Restoration contracts

We obtained Federal Procurement Data System (FPDS) data through the publically accessible US-Aspending.gov web portal. We maintain a restoration contracts database, which subsets all FPDS records based on Product Service Codes (PSCs) specific to restoration contracts conducted on national forests (see Table A7, below) and is updated

annually. Restoration contracts included in this analysis are related to forest restoration, as defined by EWP based on Product Service Code (PSC), and categorized systematically (Table A7, column 1). For this working paper and previous reporting specific to restoration work, we omit all federal contracts related to fire suppression (PSC F003).

Table A7 Crosswalk used to aggregate FPDS restoration contracts into restoration categories

Category	PSC Category	Services included in this study and associated PSCs
Special studies and analyses	B	Special studies/analysis – archeological/paleontological (B503)
		Special studies/analysis - environmental assessments (B510)
		Special studies/analysis - animal/fisheries (B516)
		Special studies/analysis - natural resource (B525)
		Special studies/analysis - soil (B532)
		Special studies/analysis - water quality (B533)
Design and engineering	C	Highways, Roads, Streets, Bridges, and Railways (C122)
		Architect and Engineering- General: Landscaping, Interior Layout, and Designing (C211)
Natural resources and conservation	F	Natural resources/conservation - forest/range fire rehabilitation (non-construction) (F004)
		Natural resources/conservation - forest tree planting (F005)
		Natural resources/conservation - land treatment practices (F006)
		Natural resources/conservation - seed collection/production (F009)
		Natural resources/conservation - seedling production/transplanting (F010)
		Natural resources/conservation - tree thinning (F014)
		Natural resources/conservation - other forest/range improvements (non-construction) (F018)
		Natural resources/conservation - other wildlife management (F019)
		Natural resources/conservation – site preparation (F021)
		Natural resources/conservation - other (F099)
		Environmental systems protection - water quality support (F103)
		Environmental systems protection - environmental remediation (F108)
		Other environmental services (F999)
Construction of roads and facilities	Y	Construction of other conservation and development facilities (Y1KZ)
		Construction of highways, roads, streets, bridges, and railways (Y1LB)
		Construction of recreation facilities (non-building) (Y1PA)
		Construction or restoration of real property (public or private) (Y1QA)
Maintenance of roads and facilities	Z	Repair or alteration of highways/roads/streets/bridges/railways (Z2LB)
		Repair or alteration of parking facilities (Z2LZ)
		Repair or alteration of unimproved real property (land) (Z2PC)

Table A8 Service contract value on eastside forests, FY 2009-2016

Forest	2009	2010	2011	2012	2013	2014	2015	2016
Deschutes	\$6,366,056	\$9,084,853	\$2,179,780	\$2,063,769	\$2,611,937	\$1,781,046	\$4,167,151	\$2,385,248
Fremont-Winema	\$2,269,916	\$1,803,815	\$604,776	\$2,063,227	\$3,030,943	\$6,059,971	\$3,657,240	\$4,369,903
Malheur	\$3,851,559	\$20,744,073	\$6,008,487	\$4,923,715	\$5,875,872	\$5,584,367	\$3,941,638	\$3,703,889
Ochoco	\$1,230,581	\$1,967,580	\$261,669	\$265,324	\$514,702	\$881,763	\$213,210	\$829,168
Umatilla	\$5,107,935	\$5,523,000	\$1,676,308	\$1,309,145	\$1,943,482	\$1,844,094	\$1,161,473	\$2,014,531
Wallowa-Whitman	\$3,561,131	\$9,329,091	\$2,288,153	\$846,968	\$5,742,907	\$2,304,562	\$1,682,985	\$4,429,110
Total	\$22,387,179	\$48,452,411	\$13,019,174	\$11,472,147	\$19,719,842	\$18,455,803	\$14,823,698	\$17,731,849



Economic impacts

As described in the main text, we calculate economic impacts with the Forest Restoration and Utilization Calculator⁵ using local and non-local timber sales and local and non-local restoration service contracts. In terms of timber, calculations assume that 23% of all sawtimber is utilized as plywood. Calculations are made for eastside coun-

ties and as annual estimates. For restoration contracts, work type inputs are based on FPDS PSCs following Table A9 (below). This categorization was developed by EWP and utilized in previous reports,^{6,7} but the method requires some manual error checking and re-categorization, and so worktypes may not be entirely consistent across years.

Table A9 Crosswalk used to aggregate FPDS restoration contracts into work type categories to estimate restoration impacts

PSC	Product Service Code - description	Calculator worktype
B503	Special studies/analysis- Archeological/paleontological	Technical
B510	Special studies/analysis- Environmental assessments	Technical
B516	Special studies/analysis- Animal/fisheries	Technical
B525	Special studies/analysis- Natural resource	Professional
B532	Special studies/analysis- Soil	Technical
B533	Special studies/analysis- Water quality	Technical
C122	Architect and engineering- Construction: Highways, roads, streets, bridges, and railways	Professional
C211	Architect and engineering- General: Landscaping, interior layout, and designing	Professional
F004	Natural resources/conservation- Forest/range fire rehabilitation (non-construction)	Equipment
F005	Natural resources/conservation- Forest tree planting	Labor
F006	Natural resources/conservation- Land treatment practices	Labor
F009	Natural resources/conservation- Seed collection/ production	Technical
F014	Natural resources/conservation- Tree thinning	Equipment
F018	Natural resources/conservation- Other forest/range improvements (non-construction)	Equipment
F019	Natural resources/conservation- Other wildlife management	Technical
F021	Natural resources/conservation- Site preparation	Equipment
F099	Natural resources/conservation- Other	Technical
F103	Environmental systems protection - water quality support	Technical
F108	Environmental systems protection - environmental remediation	Technical
F999	Other environmental services	Technical
Y1KZ	Construction of other conservation and development facilities	Equipment
Y1LB	Construction of highways, roads, streets, bridges, and railways	Material
Y1PA	Construction of recreation facilities (non-building)	Labor
Y1QA	Construction/restoration of real property	Material
Z2LB	Repair or alteration of highways/roads/streets/bridges/railways	Material
Z2LZ	Repair or alteration of parking facilities	Material
Z2PC	Repair or alteration of unimproved real property (land)	Material

Appendix endnotes

- 1 White, E.M., E.J. Davis, D. Bennett, and C. Moseley. 2015. Monitoring of outcomes from Oregon's Federal Forest Health Program. Ecosystem Workforce Program, University of Oregon. Working Paper #57. Available at http://ewp.uoregon.edu/sites/ewp.uoregon.edu/files/WP_57.pdf.
- 2 White, E.M., D. Bennett, E.J. Davis, and C. Moseley. 2016. Economic outcomes from the U.S. Forest Service eastside strategy. Ecosystem Workforce Program, University of Oregon. Working Paper #64. Available at http://ewp.uoregon.edu/sites/ewp.uoregon.edu/files/WP_64.pdf.
- 3 White, E.M., E.J. Davis, D. Bennett, and C. Moseley. 2015. Monitoring of outcomes from Oregon's Federal Forest Health Program. Ecosystem Workforce Program, University of Oregon. Working Paper #57. Available at http://ewp.uoregon.edu/sites/ewp.uoregon.edu/files/WP_57.pdf.
- 4 White, E.M., D. Bennett, E.J. Davis, and C. Moseley. 2016. Economic outcomes from the U.S. Forest Service eastside strategy. Ecosystem Workforce Program, University of Oregon. Working Paper #64. Available at http://ewp.uoregon.edu/sites/ewp.uoregon.edu/files/WP_64.pdf.
- 5 See <http://ewp.uoregon.edu/calculate>.
- 6 White, E.M., E.J. Davis, D. Bennett, and C. Moseley. 2015. Monitoring of outcomes from Oregon's Federal Forest Health Program. Ecosystem Workforce Program, University of Oregon. Working Paper #57. Available at http://ewp.uoregon.edu/sites/ewp.uoregon.edu/files/WP_57.pdf.
- 7 White, E.M., D. Bennett, E.J. Davis, and C. Moseley. 2016. Economic outcomes from the U.S. Forest Service eastside strategy. Ecosystem Workforce Program, University of Oregon. Working Paper #64. Available at http://ewp.uoregon.edu/sites/ewp.uoregon.edu/files/WP_64.pdf.

