

SMOKE MANAGEMENT

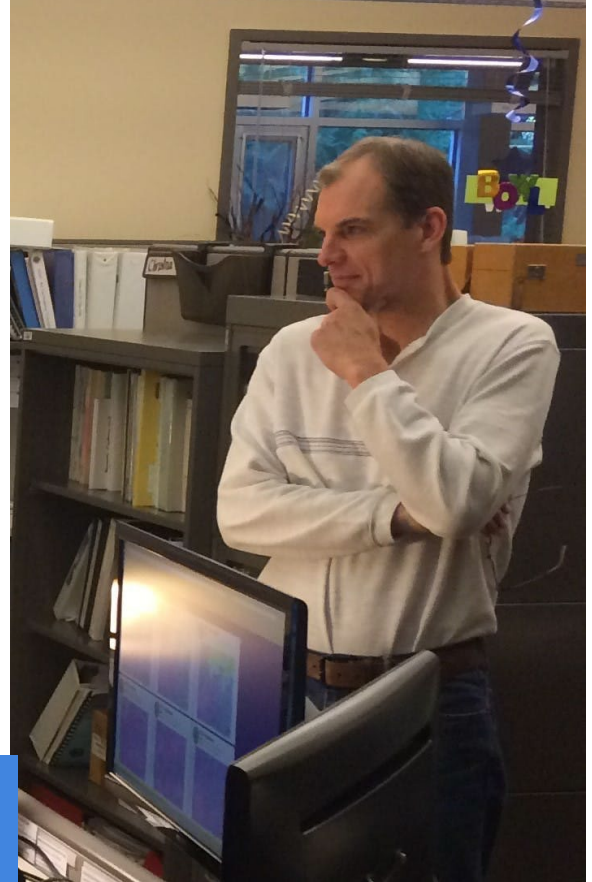
PROTECTION DIVISION

2021

MITIGATION & POLICY DEPT.



Smoke Management wishes 30-year veteran Meteorologist Nick Yonker; former program manager, a bitter-sweet farewell as he and his wife retire to the sunny state of Idaho. Nick developed the Enhanced Smoke Management program of Oregon into what it is today. Nick leaves a huge gap in the corporate knowledge databank and is already missed greatly. His outstanding leadership and cheery demeanor; however, has allowed all his former staff to keep in contact with him and ask questions to keep the Smoke Management program a well-oiled machine.



Cover photo: Nick Yonker, working dad at beginning of his ODF career on the left, Program Manager at the completion of his career on the right.

Oregon Smoke Management Annual Report 2021

TABLE OF CONTENTS

2021 Summary	1
Program Overview	1
Program Summary	2
Audits	2
Meteorological Services	2
Program Accomplishment Data	2
Alternatives to Burning and Emission Reduction Techniques Tracking	2
Prescribed Burning Statistics	3

FIGURES

1 Smoke Management Regulated Areas	4
2A Length of Intrusion	5
2B Accumulated Intrusion Hours	5
3 Yearly Intrusion Summary	6
4A Prescribed Burning Emissions Estimate (PM2.5)	7
4B Wildfire Emissions Estimate (Carbon and PM2.5)	7
5 Total Forestland Burning Emissions (PM2.5) ...	8
6 Historical Accomplishment -- Total Acres Burned (Statewide)	11
7 Historical Accomplishment -- Total Tons Burned (Statewide)	11
8 Monthly Prescribed Burn Acres Burned	12
9 Piled vs Broadcast vs. Underburn Acres Burned	12

TABLES

1 2011 – 2021 Accomplishment Summary	4
2 Smoke Intrusion Summary -- 2021	6
3A Broadcast Burning PM2.5 Emissions by District	9
3B Pile Burning PM2.5 Emissions by District	9
3C Underburning PM2.5 Emissions by District	10
4 Burn Summary by District -- 2021	13
5 Tons Burned by Month by District - 2021	14
6 Acres Burned by Month by District - 2021	15
7 2021 Burn Data by Owner Type	16

EXECUTIVE SUMMARY REPORT

2021

Acres burned – Statewide 143,653 acres were ignited. Due to the continuing COVID-19 pandemic and another year of epic wildfires, this was the lowest number of acres burned during the last 10 years. The 10-year average is 171,469 acres. Both the 10-year average, and the 2021 acres burned, have decreased from the 2020 yearly acres since the start of the pandemic.

Intrusions – There were 2 smoke intrusions into Smoke Sensitive Receptor Areas (SSRAs) based on the new 2019 definition (see below) of a smoke intrusion. This represents a lower number of intrusions recorded. The 10-year average is 8 intrusions.

Smoke impacts – There were 46 smoke impacts (smoke incidents) recorded with highest impacts in Burns at 15%, Bend, La Pine, and Sunriver at 13% each.

Emissions - Emissions were 9,987 tons of PM 2.5. This is considerably less than the 10-year average of 11,223 tons.

OREGON DEPARTMENT OF FORESTRY
FIRE PROTECTION DIVISION
SMOKE MANAGEMENT AND FUELS

PROGRAM OVERVIEW

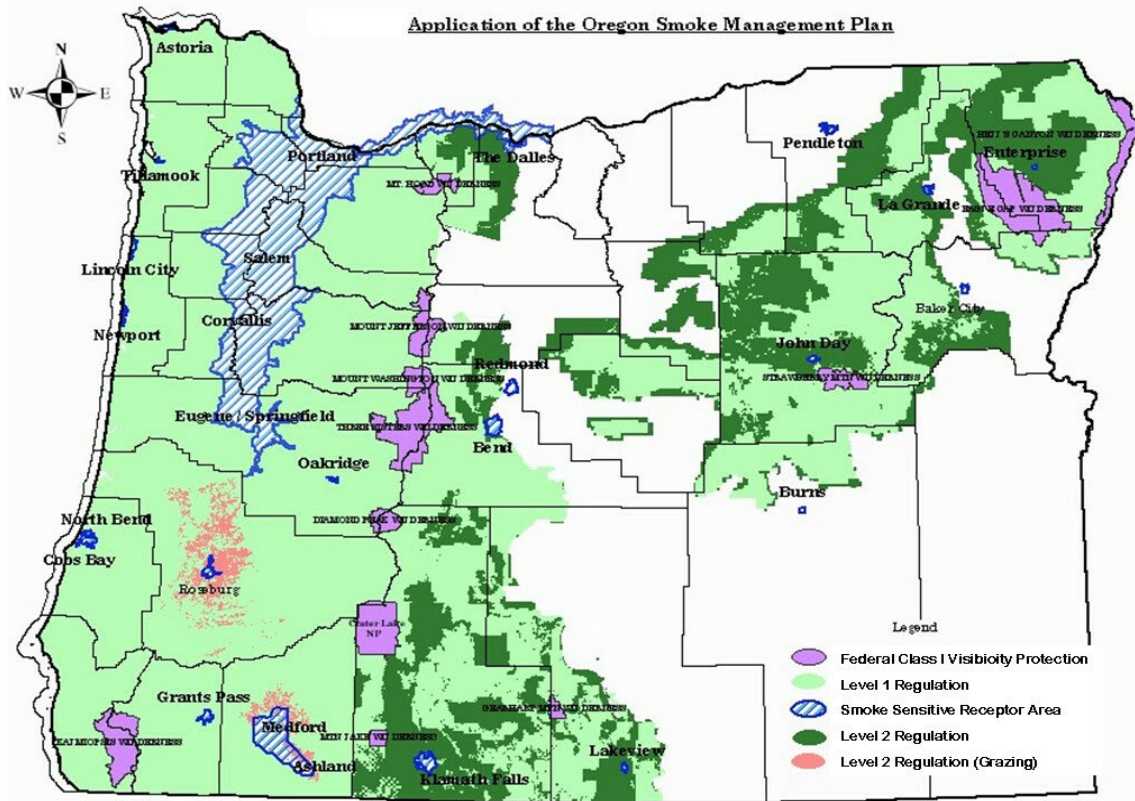
The Oregon Smoke Management Plan was developed as a voluntary program in 1969 and adopted as a regulatory program by the State Forester and the Environmental Quality Commission (EQC) in 1972. The plan has gone through several major revisions since then. The last revision to the plan was completed in early 2019. Implementation started March 1 of that year.

Key elements changed in the plan include: *

1. The definition of a smoke intrusion to include a threshold for a short-term (hourly) smoke impact and a threshold for a 24-hour average impact.
2. Development of a communication framework and community response plans. Approved community response plans will allow for an exemption to the one-hour threshold of a smoke intrusion.



SMOKE MANAGEMENT ANNUAL REPORT



- Promote the further development of alternatives to burning and emission reduction techniques.

PROGRAM SUMMARY

Audits:

The Oregon Smoke Management Plan goal is an annual audit of approximately one percent of the prescribed burns conducted in the Regulated Area (see map on left). Approximately half of the audits are conducted on the day of the burn and half are conducted prior to ignition. The purpose of these audits is to maintain consistent data reporting and monitor the effectiveness of the Oregon Smoke Management program.

The Smoke Management Field Coordinator devotes significant time to overseeing the audit program and improving the compliance for conducting audits. This year 34 audits were completed, for a total of 39,210 audited tons. The audit breakout was 18 pre-burn audits and 16 burn-day audits. Forest Service, BLM, state, and private units were audited. One of these audits were mutually agreed upon and performed on a non-regulated neighboring agency in a successful relationship building and information-sharing visit. This experimental burn was in partnership with Oregon State University which provided excellent footage of dry-covered piles vs. wet-uncovered piles.

Trends continue to show that reported tons are generally within the acceptable range of audited tons. This is an improvement from the under reporting of tons in past years.

The Smoke Management Field Coordinator continues to teach both agency and non-agency personnel the proper way to estimate fuel loading through on-the-job training during site visits, ... - continued

PROGRAM OVERVIEW CONTINUED

- Increasing the amount of polyethylene sheeting allowed to cover burn piles to keep them dry in order to reduce smoke emissions.

**See OAR 629-048 for the details of these changes.*

The plan's overall purposes are:

- To improve the management of prescribed burning as a forest management and protection practice.
- To minimize emissions from prescribed burning consistent with the air quality objectives of the federal Clean Air Act.

The plan applies to all lands classified as forestland and all federally managed forestland, whether classified or not, within a forest protection district.

In general, all federal forestland and Class I forestland in western Oregon is regulated at a higher level but all forestland owners and managers must comply with most or all aspects of the program.

The Oregon Smoke Management Plan contains six principal objectives. These objectives are to:

- Minimize smoke emissions resulting from prescribed burning.
- Provide maximum opportunity for essential forestland burning.
- Protect public health by avoiding intrusions.
- Coordinate with other state smoke management programs.
- Comply with state and federal air quality and visibility requirements; and

PROGRAM SUMMARY CONTINUED



Collaborating with OSU on ERT experiments.

Continued: ... burn boss refresher training courses, the regional Rx-301/341, and Rx-410 Smoke Management Techniques course, and fuel-load estimation briefing papers.

An entire series of video tutorials on how to do a fuels transect, estimate tonnage, and use tools to help burners have also been advertised and published to the field.

In addition, the SIMPLE fuel-loading calculator has been accepted by Forest Service and BLM researchers. Research and testing are ongoing as the field continues to use the new fuel-loading tool. Our federal partners have adopted its use and ODF's fuel-loading estimation methodology as their standard operating procedures. A white paper on the technique and where to get more information was developed by the Smoke Management Field Coordinator in consultation with the Forest Service's Regional Air Quality Program Manager. It's anticipated this outreach and education effort will lead to more precise fuel-load estimates.

Meteorological Services:

Oregon Department of Forestry meteorologists provide written daily

Smoke Management forecasts and burning instructions statewide from October – June, as well as year around phone consultation for prescribed burning operations.

Through a cooperative agreement with DEQ they are making the open burning forecast for the Willamette Valley north of Lane County throughout the year. In addition, ODF provides the Department of Agriculture field burning forecasts for the north Willamette Valley, Jefferson County, and Union County during the summer field burning season (July 1- October 15).

Other forecast services include weather support for significant weather events (heavy rain, wind, etc.) and for weather events that may increase the chances for wildfire and its spread.



PROGRAM ACCOMPLISHMENT DATA

ALTERNATIVES TO BURNING, EMISSION REDUCION TECHNIQUES

As part of a recommendation from the 2013 review of the Smoke Management Plan, the program is tracking acres of treated forestland where alternatives to burning were employed instead of using prescribed fire. In addition, emission reduction techniques of prescribed burn units are also tracked. See results:

Total statewide acres using emission reduction techniques including landing, grapple, hand-piled, and right-of-way piles: 120,378.

Alternative to burning techniques include biomass removal, scattering material, chipping, crushing, firewood removal, non-treatment, or other techniques for reducing fire hazards and/or creating planting spots without using prescribed fire.

Emission reduction techniques including piling clean piles instead of broadcast or underburning, use of rapid ignition techniques, covering piles with polyethylene sheeting to keep the piles dry, and other techniques used to reduce particulate and gaseous emissions while burning.

The goal is to show the program is not exclusively focused on prescribed burning but all treatment methods that most effectively reduce fire hazard, maintain productive and resilient forests, and keep or improve air quality.

PRESCRIBED BURNING STATISTICS

The following tables and figures provide detailed information about the Smoke Management program. The data details accomplishments for 2021 and compares them with previous years.

**TABLE 1
2012-2021 ACCOMPLISHMENT SUMMARY**

Year	Total No. Units (Registered)	No. Units Burned	Acres Burned	Tons Burned	Incidents	Intrusions	Intrusion/ignition%
2012	3,651	3,092	141,892	1,086,214		7	.19 [^]
2013	3,890	3,104	182,189	1,308,114		3	.08 [^]
2014	4,095	3,492	208,593	1,405,349		13	.31 [^]
2015	3,601	3,101	179,613	1,371,114		9	.24 [^]
2016	3,484	2,928	181,800	1,228,107		11	.30 [^]
2017	3,597	2,868	159,624	1,004,108		10	.29 [^]
2018	4,307	3,388	185,702	1,270,725		18	.42 [^]
2019*	3,726	3,319	200,629	1,245,128	39	6	.14 [^]
2020	3,146	2,287	130,997	863,875	1	0	.00 [^]
2021	3,253	2,476	143,653	996,496	43	2	.06 [^]
Average	3,675	3,006	171,469	1,177,923	28	8	.21 [^]

*Based on new smoke incident and intrusion definitions implemented in the 2019 rule change.
[^]Values were all recalculated from 2012 to intrusions per ignition.

Figure 2A

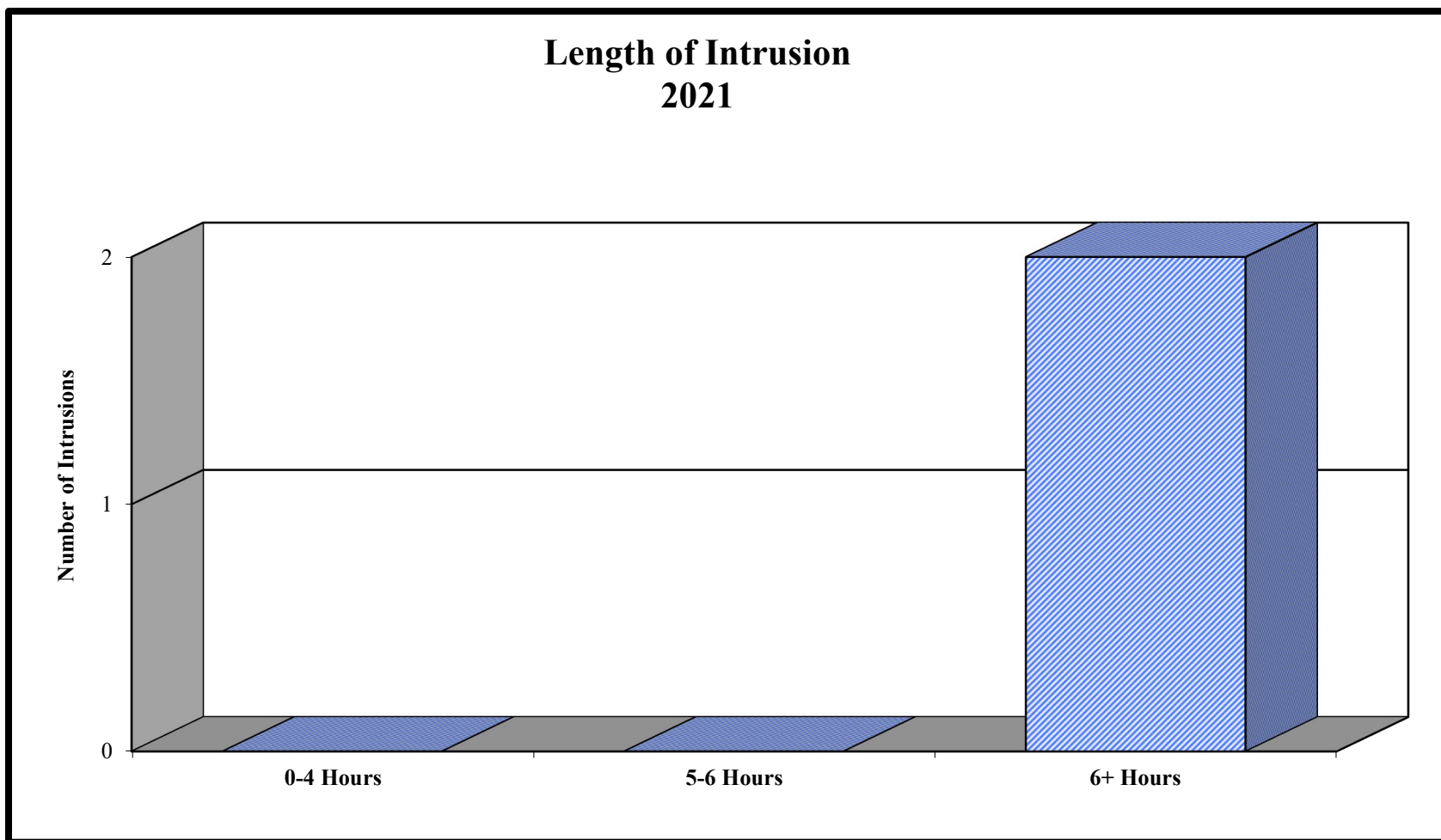
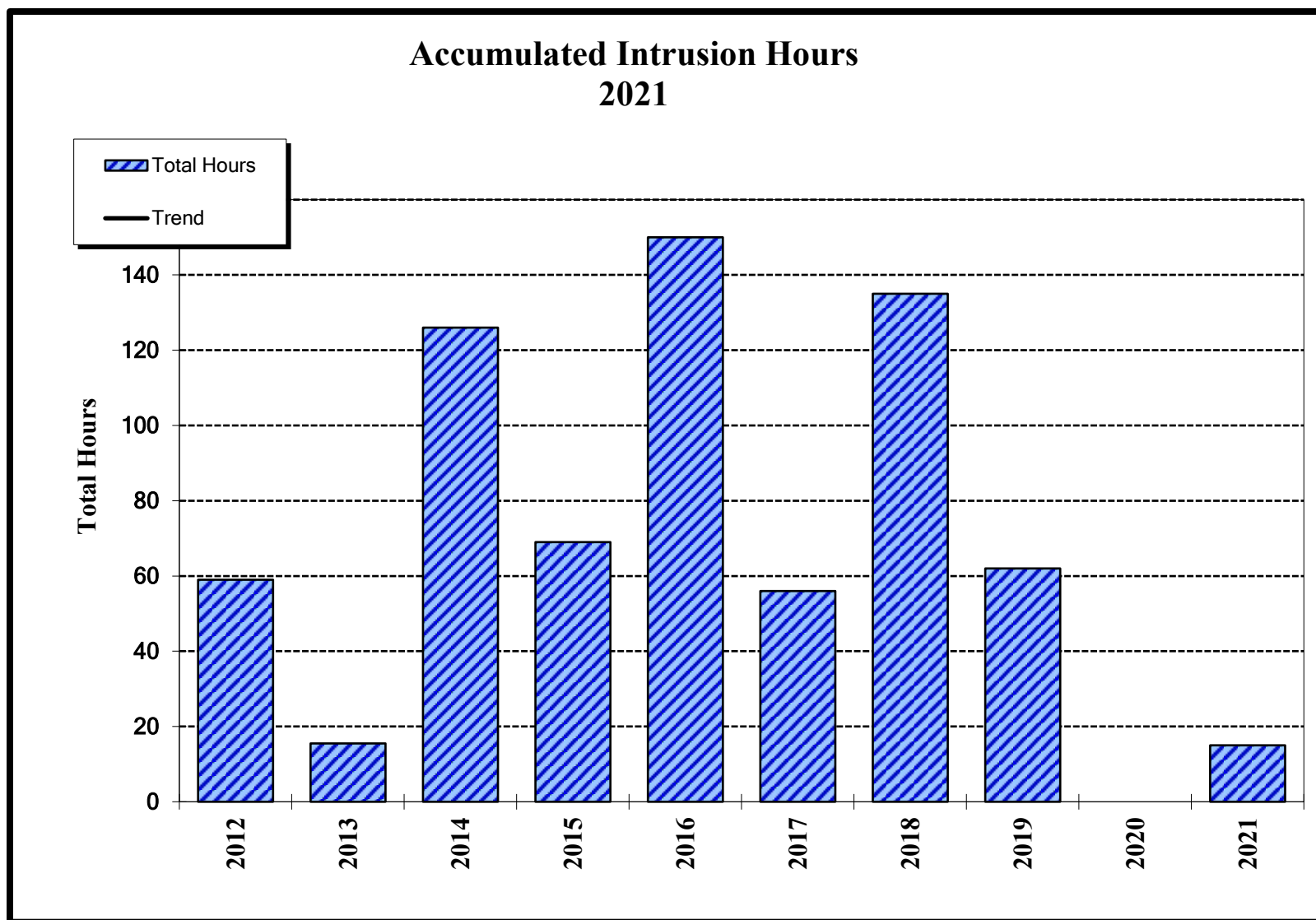


Figure 2B

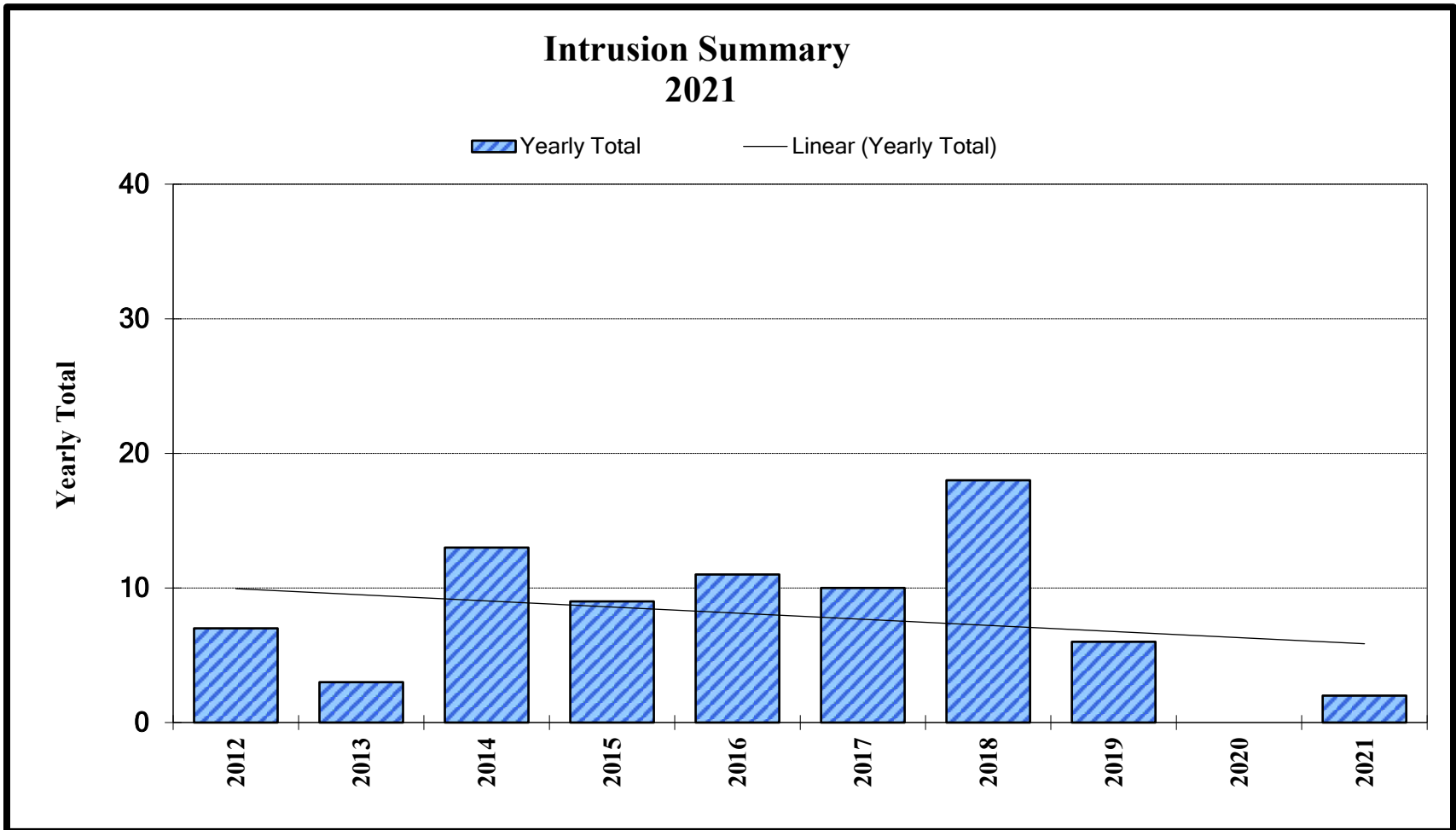


No trend data available due to zero intrusions in 2020.



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Figure 3



*No trend data available due to zero intrusions in 2020.

TABLE 2
SMOKE INTRUSION SUMMARY – 2021

Date	District/ Forest	Primary Area Affected	Unit No.	Owner Class	Max hrly	
					Max 24 hr	Length
4/16/21	Deschutes NF; Bend Ft Rock RD	Bend	21-01	USFS	199 (max hr) / 34.6 (24hr. ave.)	7 hrs.*
5/11/21	Deschutes NF; Bend Ft Rock RD	South and West Bend, along Deschutes river	21-02	USFS	466.4 (max hr) / 75 (24hr. ave.)	8 hrs.*

*24 hour intrusions

Figure 4A

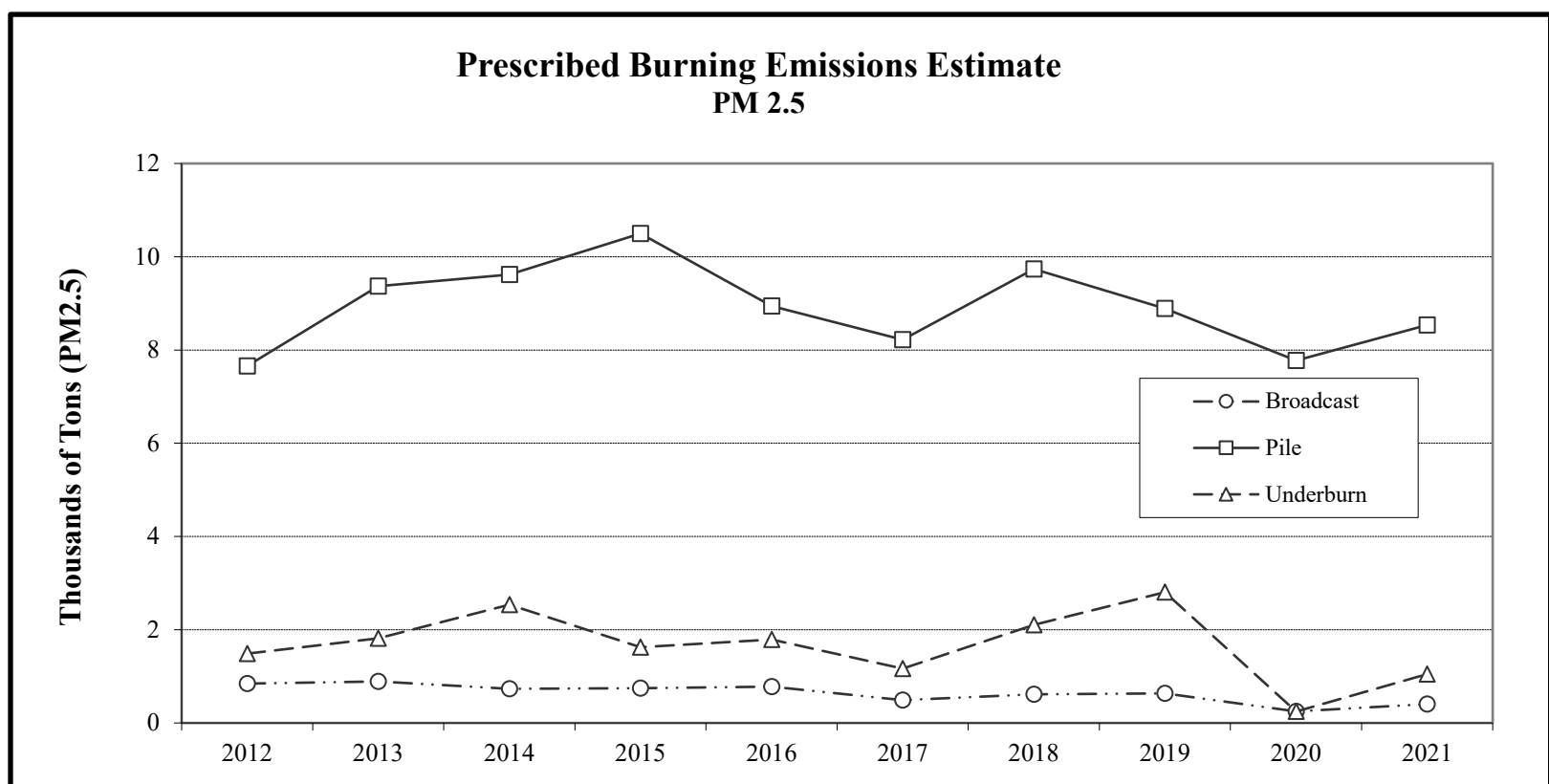


Figure 4B

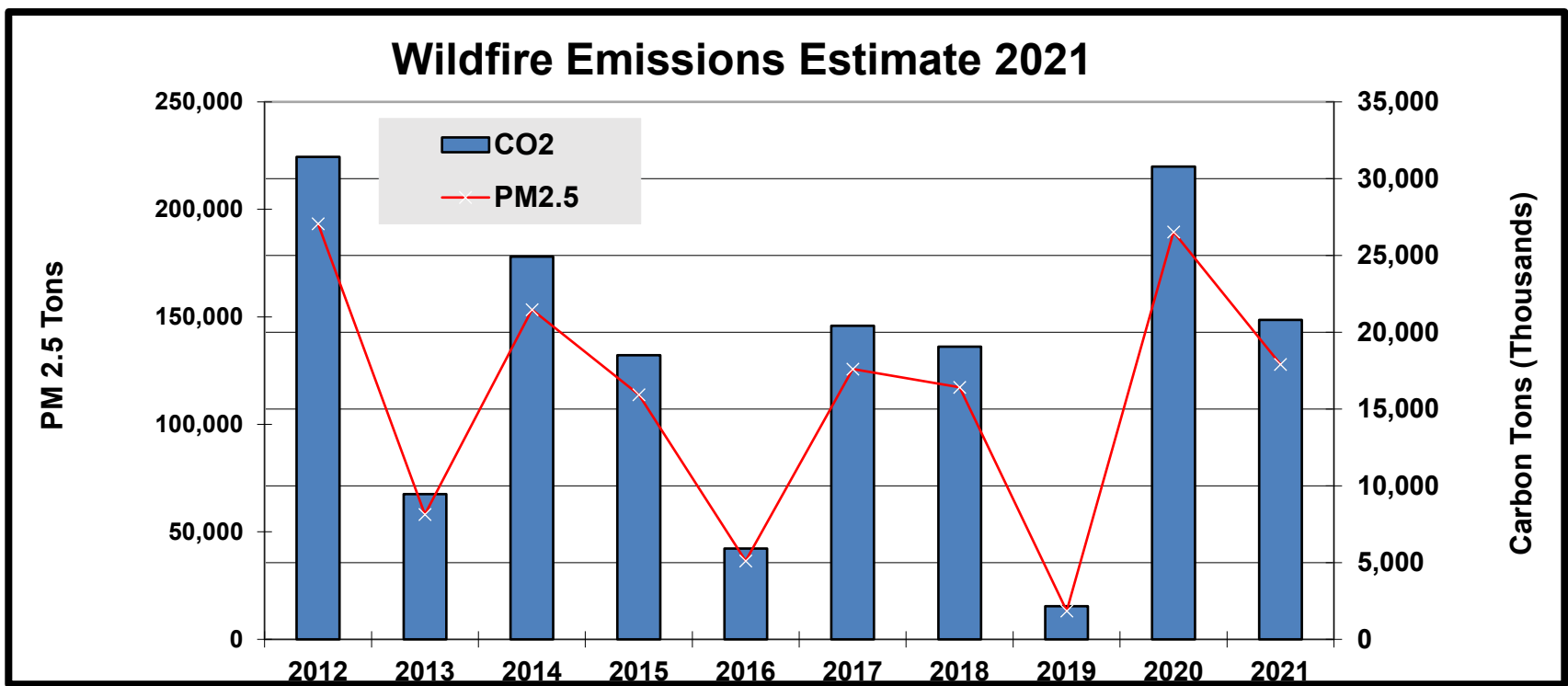
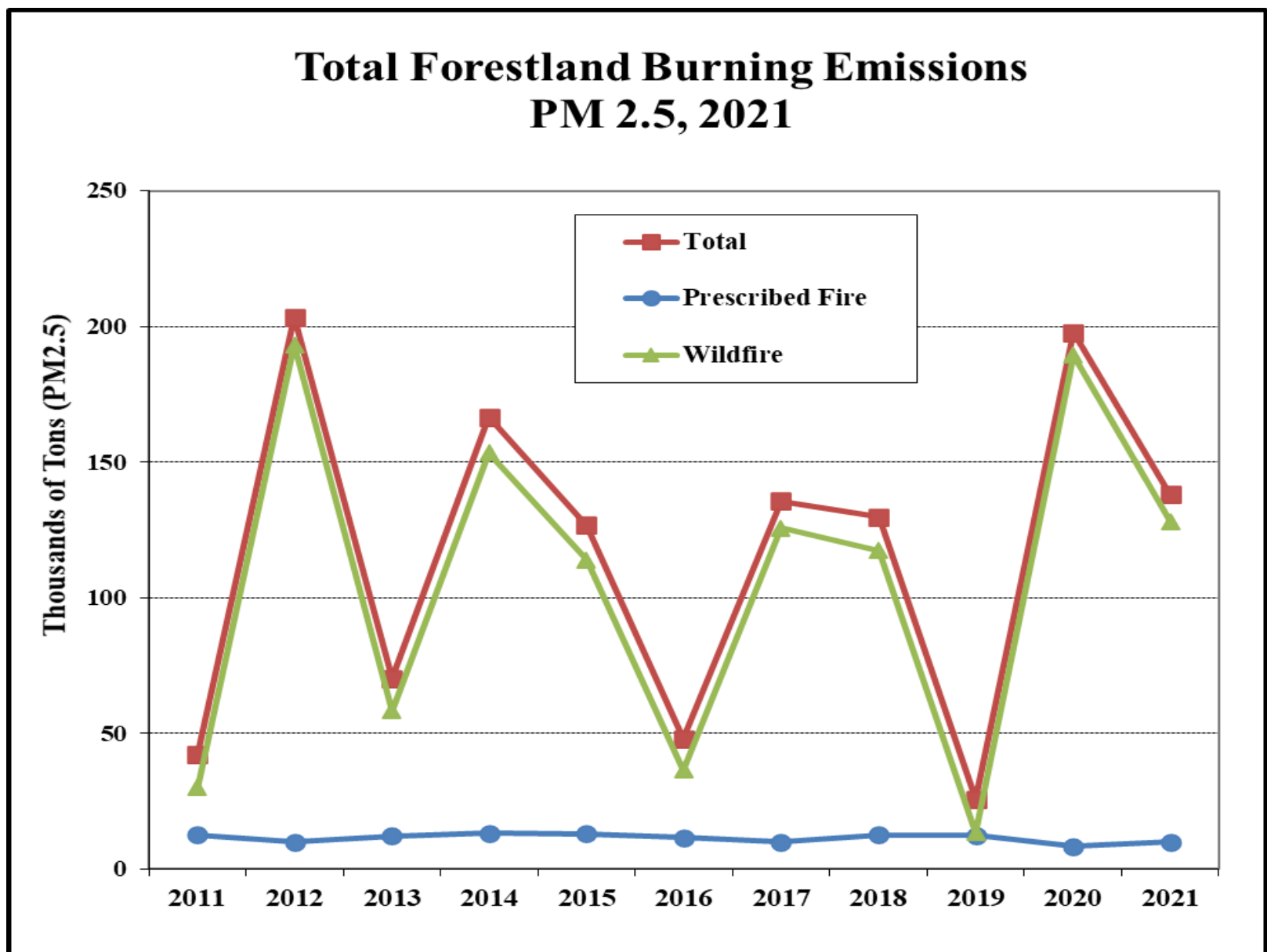


Figure 5



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SPRING SMOKE

Rising through rainforest canopy.

Left photo

WINTER PILES

Greyback crews are able to burn covered piles during winter weather.

Right photo



Table 3A

PM 2.5 Emissions (Tons) Broadcast

	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020	<u>2021</u>
Astoria	305	490	525	326	377	446	559	654	508	662	0
Central Oregon	151	174	148	295	256	294	48	72	97	178	0
Coos District	0	0	0	0	0	4	1	5	0	0	0
Coos FPA	837	915	1125	1266	1259	1130	1122	1289	1323	1191	32
Douglas FPA	533	515	815	1223	1180	934	1065	1281	728	668	0
Forest Grove	250	311	545	351	299	196	311	318	458	516	0
Klamath-Lake	139	54	80	292	871	338	59	93	52	77	0
North Cascade	213	283	465	306	405	216	196	687	487	170	0
Northeast Oregon	1436	312	1276	829	438	952	823	813	477	402	0
South Cascade	1130	754	886	778	934	708	596	780	648	664	8
Southwest Oregon	453	632	463	683	576	519	483	505	750	643	9
Tillamook	235	138	296	236	236	144	211	174	184	164	0
Walker Range	0	0	0	1	0	0	0	0	0	0	0
West Oregon	918	898	1117	1230	1261	917	1012	1184	904	1046	8
Western Lane	149	119	118	196	156	90	477	562	391	217	123
Columbia Gorge SA	0	0	0	0	0	0	0	0	0	0	0
Crater Lake NP	0	0	1	0	3	2	0	0	1	0	0
Deschutes NF	253	230	185	208	306	170	245	377	348	49	44
Fremont NF	8	10	24	73	83	117	3	2	182	82	0
Klamath NF	4	2	6	10	5	14	5	1	0	0	0
Malheur NF	722	185	251	309	389	603	323	89	127	349	2
Mt. Hood NF	51	21	33	74	51	23	47	18	47	23	0
Ochoco NF	1	105	75	0	21	6	3	0	0	10	163
Rogue/Siskiyou NF	601	741	261	346	521	241	87	225	298	92	0
Siuslaw NF	34	23	22	33	22	22	4	2	26	0	0
Umatilla NF	18	25	15	30	150	75	58	167	107	97	0
Umpqua NF	46	201	115	83	133	75	32	23	50	77	4
Wallowa-Whitman NF	559	353	327	244	165	388	266	227	390	384	14
Willamette NF	72	128	143	107	280	252	126	113	307	6	0
Winema NF	101	37	49	89	118	65	59	76	3	6	0
Total	9219	7656	9366	9618	10495	8941	8221	9737	8893	7773	407

SMOKE MANAGEMENT ANNUAL REPORT

Table 3B
PM 2.5 Emissions (Tons) PILE

	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021
Astoria	305	490	525	326	377	446	559	654	508	662	436
Central Oregon	151	174	148	295	256	294	48	72	97	178	27
Coos District	0	0	0	0	0	4	1	5	0	0	10
Coos FPA	837	915	1125	1266	1259	1130	1122	1289	1323	1191	1634
Douglas FPA	533	515	815	1223	1180	934	1065	1281	728	668	887
Forest Grove	250	311	545	351	299	196	311	318	458	516	433
Klamath-Lake	139	54	80	292	871	338	59	93	52	77	16
North Cascade	213	283	465	306	405	216	196	687	487	170	952
Northeast Oregon	1436	312	1276	829	438	952	823	813	477	402	466
South Cascade	1130	754	886	778	934	708	596	780	648	664	644
Southwest Oregon	453	632	463	683	576	519	483	505	750	643	543
Tillamook	235	138	296	236	236	144	211	174	184	164	176
Walker Range	0	0	0	1	0	0	0	0	0	0	0
West Oregon	918	898	1117	1230	1261	917	1012	1184	904	1046	801
Western Lane	149	119	118	196	156	90	477	562	391	217	197
Columbia Gorge SA	0	0	0	0	0	0	0	0	0	0	0
Crater Lake NP	0	0	1	0	3	2	0	0	1	0	4
Deschutes NF	253	230	185	208	306	170	245	377	348	49	77
Fremont NF	8	10	24	73	83	117	3	2	182	82	103
Klamath NF	4	2	6	10	5	14	5	1	0	0	0
Malheur NF	722	185	251	309	389	603	323	89	127	349	11
Mt. Hood NF	51	21	33	74	51	23	47	18	47	23	21
Ochoco NF	1	105	75	0	21	6	3	0	0	10	68
Rogue/Siskiyou NF	601	741	261	346	521	241	87	225	298	92	125
Siuslaw NF	34	23	22	33	22	22	4	2	26	0	0
Umatilla NF	18	25	15	30	150	75	58	167	107	97	278
Umpqua NF	46	201	115	83	133	75	32	23	50	77	5
Wallowa-Whitman NF	559	353	327	244	165	388	266	227	390	384	563
Willamette NF	72	128	143	107	280	252	126	113	307	6	1
Winema NF	101	37	49	89	118	65	59	76	3	6	54
Total	9219	7656	9366	9618	10495	8941	8221	9737	8893	7773	8532



SMOKE MANAGEMENT ANNUAL REPORT

Table 3C, PM 2.5 Emissions (Tons) UNDERBURN

	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021
Astoria	0	0	0	0	0	0	0	0	0	0	0
Central Oregon	0	20	1	10	0	0	0	0	0	0	0
Coos District										0	0
Coos FPA	0	0	0	0	0	0	1	0	0	0	0
Douglas FPA	0	0	0	0	0	0	0	0	0	0	0
Forest Grove	0	0	0	0	0	0	0	0	0	0	0
Klamath-Lake	9	0	0	0	0	0	0	0	15	0	6
North Cascade	0	0	0	0	0	0	0	0	0	0	0
Northeast Oregon	0	0	0	0	0	0	0	0	0	0	0
South Cascade	0	0	0	0	0	0	0	0	0	0	0
Southwest Oregon	11	26	31	5	17	17	2	11	21	0	17
Tillamook	0	0	0	0	0	0	0	0	0	0	0
Walker Range	0	0	0	0	0	0	0	0	0	0	0
West Oregon	0	0	0	0	0	0	0	0	0	0	0
Western Lane	0	0	0	0	0	0	0	0	0	0	0
Crater Lake NP	0	0	0	0	0	0	0	0	0	0	0
Deschutes NF	129	58	143	292	200	129	225	307	496	23	210
Fremont NF	248	190	142	209	680	294	233	389	193	7	374
Klamath NF	0	0	0	0	0	0	0	0	0	0	0
Malheur NF	34	524	514	533	11	481	268	549	182	92	24
Mt. Hood NF	28	14	43	8	1	20	0	0	0	0	7
Ochoco NF	91	0	89	79	103	65	99	123	160	82	81
Rogue/Siskiyou NF	157	4	25	49	59	88	48	23	83	5	58
Siuslaw NF	0	0	0	0	0	0	0	0	0	0	0
Umatilla NF	170	232	355	411	267	1	0	108	179	0	0
Umpqua NF	0	33	58	139	10	60	28	57	2	0	10
Wallowa-Whitman NF	83	228	330	495	162	475	67	306	193	36	166
Willamette NF	59	45	40	164	81	92	97	108	20	0	81
Winema NF	76	116	45	138	34	68	97	125	1259	0	14
Total	1095	1490	1816	2532	1625	1790	1165	2106	2803	245	3069

Figure 6



Figure 7



Figure 8

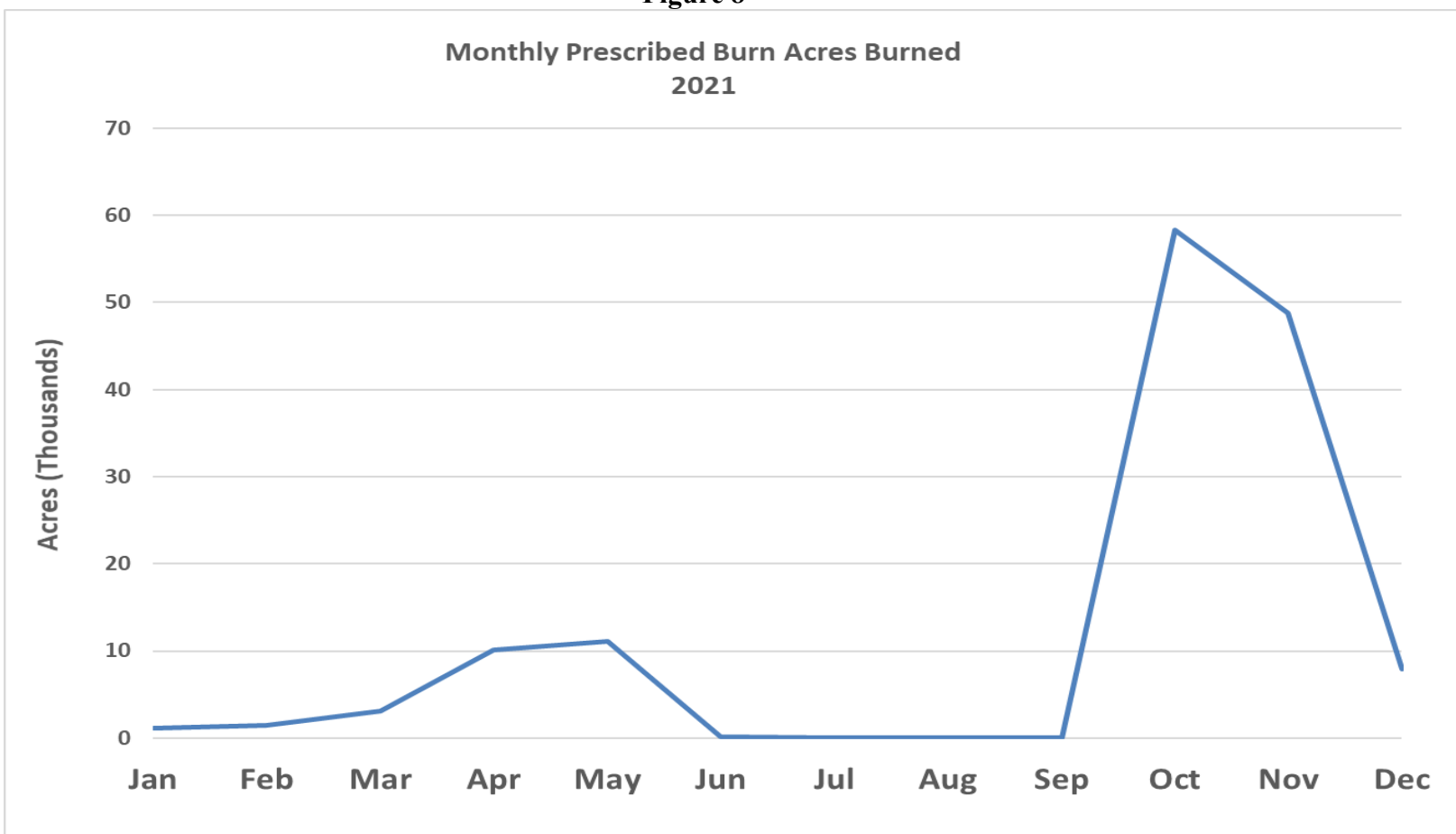
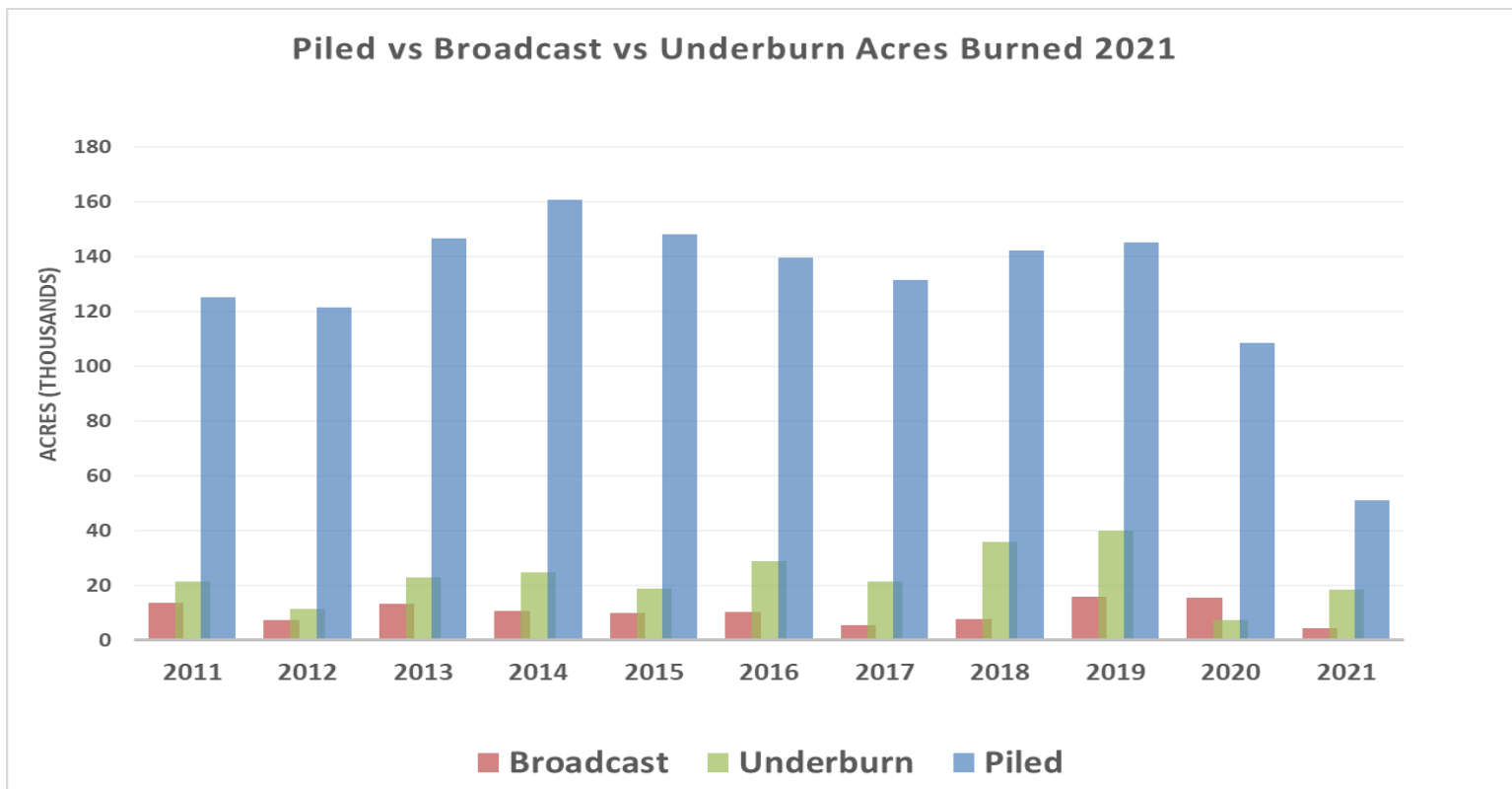


Figure 9



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**Table 4
Accomplished by District Summary 2021**

<i>District Name</i>	<i>Tons Burned</i>	<i>Acres Burned</i>	<i>Units Burned</i>
Astoria	40,528	3,594	101
Central Oregon	4,135	577	61
Coos	1,114	734	10
Coos FPA	133,538	8,957	442
Deschutes NF	16,588	7,641	79
Douglas FPA	79,458	18,674	569
Forest Grove	39,309	3,840	410
Fremont NF	47,421	9,119	233
Klamath-Lake	2,081	418	22
Malheur NF	2,395	665	11
Mt. Hood NF	1,235	449	26
North Cascade	87,800	10,882	162
Northeast	50,174	5,740	58
Ochoco NF	27,532	4,174	7
Oregon Caves NM	44	12	1
Rogue-Siskiyou NF	19,628	2,813	83
South Cascade	59,074	15,993	420
Southwest	47,049	6,809	596
Tillamook	18,053	3,627	67
Umatilla NF	22,445	1,195	73
Umpqua NF	1,822	52	12
Wallowa-Whitman NF	64,710	6,264	208
West Oregon	72,917	8,005	308
Western Lane	24,969	4,673	815
Willamette NF	4,014	128	3
Winema NF	5,597	1,053	62
All Districts Total:	873,630	126,088	4,839



SMOKE MANAGEMENT ANNUAL REPORT

**Table 5
Tons Burned by Month by District
2021**

	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEPT	OCT	NOV	DEC
Astoria	80									33493	2817	4518
Central Oregon	262	86	1288							3391	528	42
Coos											680	434
Coos FPA	1630	1015	3140	550						92465	57173	14153
Crater Lake N.P.				80	369					6		
Deschutes NF			882	10962	5842					5063	3302	
Douglas FPA	2315	78	60	30						39573	46961	2093
Forest Grove	156	31	309	235	50					26433	12453	133
Freemont			7390	9374	25970					1744	2151	792
Klamath-Lake			167							630	444	840
Malheur NF						520				3000		
Mt. Hood NF	389	146			666					634	1010	107
North Cascade	204	475		3021						39224	44688	3728
Northeast											53844	700
Ochoco NF				3125	4700					14832	8000	
Oregon Caves NM			44									
Rogue-Siskiyou NF	598	4558	3193	6124						4526	629	
South Cascade	67	69	602	209	19	770				37511	17062	6806
Southwest	1577	3083	942	2483	6					10102	36812	4788
Tillamook										16601	1292	160
Umatilla NF	1229			3674						6438	21239	
Umpqua NF		564		1267								
Walker Range										28		
Wallowa-Whitman NF				13865	1610					21239	27520	7556
West Oregon			104	308						59291	13735	3637
Western Lane	868	187	752	4071						15219	9152	1243
Willamette NF			60	1910	5524							
Winema NF				1175	100						2291	2331



SMOKE MANAGEMENT ANNUAL REPORT

**Table 6
Acres Burned by Month by District
2021**

	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEPT	OCT	NOV	DEC
Astoria	9									3273	122	213
Central Oregon	32	10	646							344	158	19
Coos											469	265
Coos FPA	155	74	157	28						6034	4010	1228
Crater Lake N.P.				10	53					2		
Deschutes NF			441	2926	4533					1936	513	
Douglas FPA	146	13	4	2						9613	9755	460
Forest Grove	8	7	16	28	13					2390	1393	24
Fremont NF			912	1549	5132					446	612	468
Klamath-Lake			114							90	74	140
Malheur NF						130				1034		
Mt. Hood NF	149	29			222					221	316	65
North Cascade	14	15		880						6373	4464	315
Northeast											6028	400
Ochoco NF				625	940					1236	1998	
Oregon Caves NM			12									
Rogue-Siskiyou NF	122	532	418	596						575	570	
South Cascade	38	11	66	19	1	77				9142	5569	1898
Southwest	356	708	248	465	2					1345	5413	780
Tillamook										3235	375	17
Umatilla NF	64			238						391	1349	
Umpqua NF		14	44									
Walker Range										14		
Wallowa-Whitman NF				2473	257					1716	2120	761
West Oregon			16	28						6371	1361	644
Western Lane	45	13	37	257						2544	2090	287
Willamette NF			2	80	199							
Winema NF				105	10						657	331



***TIMELAPSE
OF COLUMN***



SMOKE MANAGEMENT ANNUAL REPORT

**Table 7
Burn Data by Owner Type
2021**

Private						Federal (Except USFS)			USFS			
District Name	Total Tons Burned	Acres Burned	Units Burned	Total Tons Burned	Acres Burned	Units Burned	Total Tons Burned	Acres Burned	Units Burned	Total Tons Burned	Acres Burned	Units Burned
Astoria	36027	2040	74	4881	1577	23						
Central Oregon				4397	609	21	1200	600	1			
Coos				243	61	2	871	673	8			
Coos FPA	169769	11547	221				45	100	1	312	39	1
Crater Lake N.P.							455	65	2			
Deschutes NF				2823	967	16				23228	9409	88
Douglas FPA	85084	18982	246	2309	128	4	3717	883	29			
Forest Grove	37894	3636	122	1906	243	6						
Fremont NF										47421	9119	15
Klamath-Lake	167	114	1				1914	304	2			
Malheur NF				2395	665	3				1125	499	7
Mt. Hood NF										2952	1002	43
North Cascade	90896	11763	175	444	299	2						
Northeast				54544	6428	63						
Ochoco NF				22832	3234	3				7825	1565	2
Oregon Caves NM							44	12	1			
Rogue-Siskiyou NF	116	95	1							19512	2718	54
South Cascade	58435	16097	341	299	40	3	4362	673	19			
Southwest	52062	7558	138	2251	422	12	5480	1337	23			
Tillamook	14193	1947	43	3860	1680	24						
Umatilla NF										23980	1589	66
Umpqua NF										1831	58	5
Umatilla NF				8600	453	2	16065	1693	57			
Walker Range										28	14	1
Wallowa-Whitman NF										55725	5634	103
West Oregon	76615	8044	255	190	243	4	270	133	1			
Western Lane	30436	4871	121	637	177	2	411	221	1			
Willamette NF										7494	281	8
Winema NF										5897	1103	8

THANK YOU!