WEST WIDE WILDFIRE RISK ASSESSMENT

FINAL REPORT - ADDENDUM I
DETAILED TECHNICAL METHODS

March 31, 2013

Prepared for:
Oregon Department of Forestry
Western Forestry Leadership Coalition
Council of Western State Foresters
Funded by: USDA Forest Service
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The Oregon Department of Forestry implemented conducting this assessment on behalf of the Council of Western State Foresters with funding from the USDA Forest Service. Anyone quoting from this material is asked to credit the Oregon Department of Forestry.

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Overview

This document contains details on specific data development processes implemented in the West Wide Wildfire Risk Assessment (WWA). It is meant to be a companion document to the WWA final report with the intent of keeping the final report to a manageable size. While the final report contains a fair amount of detail regarding the risk assessment process, step by step processes along with detailing of the various parameters used for all 17 states have been captured in this Addendum. In addition, excerpts from the project's Data Gap Analysis Report that are not covered elsewhere in the final report are included to ensure the reader has a full understanding of issues encountered with datasets used in the risk assessment process. **The assumption of this addendum is that the reader has read the final report and is interested in understanding the specifics of the data development process. The risk assessment process itself is not restated in this document.**

Datasets for Developing Wildfire Threat

Weather

The wildland fire behavior calculations require information on fuels, weather and topography. Weather Influences Zones (WIZ) were defined and within these WIZs, historic weather observation data was gathered. For each WIZ, a set of fuel moisture values and a wind speed was defined for four percentile weather categories: Low, Moderate, High and Extreme. Historic wildland fire ignitions were binned into the four percentile weather categories allowing for the determination of the probability of fire occurrence within the four percentile weather categories.

Data Sources

The weather stations and daily observations were gathered from the U.S. Forest Service's Fire and Aviation Management Web Applications (FAMWEB) web site. In addition, weather stations and daily observations were gathered from the weather data delivery system located at the NOAA's National Climate Data Center (CDC).

The preferred length of record for these stations was 20 years, but stations with fewer years were used if necessary. Data from the WRCC and the CDC were converted to the observation standards used for the National Fire Danger Rating System.

Data was obtained from 2,150 weather stations. The weather data was gathered from 1980 – 2008 if available but the time period used in the analysis was 1999-2008.

Data Quality Review

A software program, WRISK, was built to facilitate the development of weather data values and National Fire Danger Rating indices used to determine percentile weather. Within the program, the only observations checked for illogical values were the wind speed and relative fuel moisture. Observations with a 20-foot, 10-minute, average wind speed greater than 30 miles per hour were not included. Observations with a relative humidity less than 3 percent were also not included.

Data Processing Steps

As mentioned, a program called WRISK was built specifically for use in the WWA. It used the same equations as the FireFamilyPlus program developed by the U.S. Forest Service. WWA personnel coordinated with the computer programmer of the NFDRSvb6.dll to utilize it in the calculations of fuel moisture values and National Fire Danger Rating System Indices.

Assumptions

The following data assumptions were made.

- Station catalog values – The station catalog values were imported from FAMWEB together with the weather observations. These were used unless otherwise stated below.
- Herb type – Perennial was assumed.

- Fuel model – NFDRS fuel model G
- Greenup and freeze dates – These were adjusted as needed for consistency within a WIZ.
- Fire season start and stop dates were set by WIZ
- State of the weather – The observation value was used unless it was raining in which case it was set to 6.
- A climate class value was assigned to each WIZ.
- The calculated herbaceous fuel moisture was not used. To provide for uniformity in the herbaceous fuel moisture value and to control the fuel loading transfer in dynamic fuel models, the following herbaceous fuel moisture values were used.

Table I-1. Loading Transfer

Climate Class	Loading Transfer Percentile Weather: Low	Mod	High	Ext
3,4	0.1	0.5	0.8	0.9
2	0.2	0.6	0.9	1
1	0.2	0.6	0.9	1

Table I-2. Herb Fuel Moisture

Climate Class	Herb Fuel Moisture Percentile Weather: Low	Mod	High	Ext
3,4	111	75	48	39
2	102	66	39	30
1	102	66	39	30

- The percentile weather for Low, Moderate, High and Extreme were set at 0-15%, 16-90%, 91-97% and 98-100% respectively.

Steps

1. The weather station catalog and observations were downloaded from FAMWEB, WRCC or CDC. For observations downloaded from the WRCC or CDC, they were converted to NFDRS standard measurements.
2. Fire occurrence data was imported from 1999-2008 where the occurrence reports had a latitude and longitude.
3. An automated check was made of weather station catalog data to locate logical errors. Weather station catalog data was then reviewed and changes made if needed.
4. The fire season start and stop dates were defined for each WIZ.
5. Fuel moisture values and NFDRS spread component were calculated.
6. A GIS shapefile of the WIZs in geographic coordinates was imported.
7. Each weather station was assigned to each WIZ.
8. As necessary, manually assigned weather stations to WIZs.
9. Calculated percentile weather (Table I-3)
10. Selected the best weather station for the WIZ based on all weather stations within the WIZ. Also, selected the second and third best to be used in case a weather observation was not available on a given date. The final selected station is identified in Table I-3.

11. Spatially assigned the imported historic fires to a WIZ. (Note the historical fire occurrence process is detailed in the next section)
12. Assign each fire to one of the four percentile weather categories using the SC for the fire date and the SC breakpoints between the four percentile weather categories. When you determine the Low, Mod, High and Extreme percentile weather categories based on SC using fuel model G (not ERC), that determines the SC breakpoint between classes; i.e. Low 0-2, Mod 3-7, High 8-15, Extreme 15+. We know the SC for the day each fire occurred; hence we can assign each fire to a percentile weather category. Once done, we can divide the number of fire in a percentile weather category by the total fire occurrence to get the proportion of fires by percentile weather category.
13. Calculated proportion of fires by percentile weather category (Table I-4)

Parameters:

Selected Weather Station and Percentile Weather by WIZ

Within each WIZ, historic weather observation data was gathered. For each WIZ, a set of fuel moisture values and a wind speed was calculated for four percentile weather categories: Low, Moderate, High and Extreme. Herbaceous fuel moisture values were assigned based upon the climate class assumed for each WIZ and assumed loading transfer rates by percentile weather. Table I-3 provides this information along with the selected weather station for each WIZ.

Table I-3 – Percentile weather by WIZ and the selected weather station per WIZ

	Selected	1-hr				10-hr				100-hr				Herb				Woody				Wind Speed			
WIZ	Wx Station	L	M	H	E	L	M	H	E	L	M	H	E	L	M	H	E	L	M	H	E	L	M	H	E
AK-5001	700260	16	12	12	11	17	14	14	14	22	22	22	22	102	66	39	30	177	117	60	60	4	10	17	21
AK-5002	500215	18	9	9	10	14	10	10	9	18	14	13	13	102	66	39	30	167	128	115	89	2	8	16	19
AK-5003	500322	19	8	7	8	20	8	8	9	22	12	11	12	102	66	39	30	189	115	98	79	1	5	10	12
AK-5004	500405	12	7	6	6	11	6	5	5	17	11	10	10	102	66	39	30	143	101	76	82	1	4	9	12
AK-5005	500620	15	8	7	6	15	9	8	9	18	14	13	11	102	66	39	30	166	123	95	87	2	5	10	13
AK-5006	500738	13	7	5	5	12	5	5	7	17	11	9	9	102	66	39	30	152	101	88	71	2	4	9	11
AK-5007	500726	14	7	7	7	14	8	8	9	19	11	10	9	102	66	39	30	169	110	89	85	2	4	9	11
AK-5008	500735	15	10	8	11	23	11	10	12	24	17	12	14	102	66	39	30	190	153	128	96	5	9	20	27
AK-5009	703260	9	9	9	10	12	11	11	11	21	20	21	19	102	66	39	30	195	156	89	70	2	7	19	24
AK-5010	500924	18	8	6	5	18	9	7	7	22	13	10	12	111	75	48	39	180	103	86	83	1	3	7	9
AK-5011	500947	15	8	8	7	24	11	11	9	21	14	13	12	111	75	48	39	186	116	90	95	1	4	9	12
AK-5012	703160	13	11	10	10	16	13	12	12	24	23	21	20	111	75	48	39	200	186	156	102	4	11	23	24
AK-5013	703610	11	10	9	7	13	13	11	9	25	25	22	19	111	75	48	39	200	197	158	120	2	5	10	12
AK-5014	703810	11	10	9	9	13	12	11	11	23	23	22	20	111	75	48	39	198	198	186	185	2	5	14	18
AZ-201	020111	5	3	2	2	6	3	3	2	9	6	5	4	102	66	39	30	74	67	61	63	4	8	15	19
AZ-202	020207	7	4	2	3	9	5	3	3	15	10	6	5	102	66	39	30	122	93	68	74	4	5	7	10
AZ-203	020402	10	5	3	3	13	6	5	3	23	10	5	6	102	66	39	30	188	101	70	65	2	6	9	11
AZ-204	020402	10	5	3	3	13	6	5	3	23	10	5	6	102	66	39	30	188	101	70	65	2	6	9	11
AZ-205	020501	7	4	3	3	8	4	4	3	12	7	6	6	102	66	39	30	93	73	63	63	5	9	14	17
AZ-206	020303	8	4	3	3	9	4	3	3	16	9	6	6	102	66	39	30	134	82	67	68	4	8	13	15
AZ-207	020603	6	4	2	1	7	5	3	2	14	10	5	4	102	66	39	30	117	89	63	62	2	7	11	13
AZ-208	021105	8	3	2	2	9	4	2	2	14	6	4	4	102	66	39	30	110	64	60	60	3	6	9	10
AZ-209	021501	4	2	2	2	5	3	2	2	7	4	3	3	102	66	39	30	70	57	52	53	3	7	11	13
AZ-210	021008	6	3	2	2	7	3	2	3	12	5	3	6	102	66	39	30	83	54	50	50	3	8	14	17
CA-401	040404	9	7	6	5	11	8	7	7	15	11	9	9	111	75	48	39	148	92	79	75	4	5	10	11
CA-402	040237	8	5	4	3	9	6	5	4	13	8	7	6	111	75	48	39	143	73	71	70	3	3	7	8
CA-403	040309	5	4	4	4	7	5	5	4	11	8	8	8	102	66	39	30	95	74	70	67	5	8	14	18
CA-404	041001	9	5	5	4	11	7	7	6	16	14	12	11	102	66	39	30	139	114	106	97	5	9	13	15
CA-405	041503	7	4	3	2	8	5	4	3	14	9	7	6	102	66	39	30	118	74	76	70	2	3	8	10
CA-406	041210	6	5	3	3	8	5	5	4	13	9	10	10	102	66	39	30	106	76	86	81	4	6	12	17
CA-407	041701	7	4	4	3	7	5	4	4	10	7	6	6	102	66	39	30	88	73	71	70	2	4	9	11
CA-408	040915	5	3	3	2	6	4	3	3	9	7	6	5	111	75	48	39	83	71	71	70	3	5	8	9
CA-409	040714	5	3	3	2	5	4	3	3	8	6	6	6	102	66	39	30	76	63	63	61	4	7	12	15
CA-410	043010	8	6	6	5	9	7	7	6	14	12	11	11	102	66	39	30	115	100	97	89	4	7	13	15

	Selected	1-hr				10-hr				100-hr				Herb				Woody				Wind Speed			
WIZ	Wx Station	L	M	H	E	L	M	H	E	L	M	H	E	L	M	H	E	L	M	H	E	L	M	H	E
CA-411	042802	4	3	2	2	5	4	3	2	8	7	6	5	102	66	39	30	70	64	61	62	3	6	10	12
CA-412	044406	7	5	5	4	8	7	6	5	13	12	11	10	102	66	39	30	110	99	91	90	4	7	11	12
CA-413	044317	5	3	2	2	6	4	3	3	13	9	7	6	102	66	39	30	114	73	65	61	3	5	8	9
CA-414	044408	7	4	3	3	8	5	4	4	11	7	6	6	102	66	39	30	99	65	64	60	5	7	10	14
CA-415	044003	6	5	4	4	8	6	5	5	13	10	8	8	102	66	39	30	115	92	80	76	4	7	13	16
CA-416	044106	5	4	3	3	7	5	3	3	12	8	6	7	102	66	39	30	101	68	61	64	4	6	8	9
CA-417	044712	8	5	3	2	9	5	4	3	14	8	6	6	111	75	48	39	117	69	61	61	3	4	5	5
CA-418	044803	4	2	2	2	5	3	2	3	7	5	4	7	102	66	39	30	63	54	52	68	3	6	13	19
CA-419	045218	13	7	4	2	14	8	4	3	18	11	7	6	102	66	39	30	148	93	80	77	2	5	6	9
CA-420	045447	12	9	8	6	13	10	9	7	17	14	13	12	102	66	39	30	143	118	110	105	4	9	13	16
CA-421	045704	8	3	2	2	9	4	3	3	15	9	8	8	102	66	39	30	97	73	69	62	5	8	11	14
CA-422	045444	3	2	3	3	4	3	3	3	8	6	6	5	102	66	39	30	65	62	60	60	3	8	15	19
CA-423	045801	3	3	2	2	4	3	3	2	7	6	5	5	102	66	39	30	62	58	56	58	1	6	13	17
CA-424	045447	12	9	8	6	13	10	9	7	17	14	13	12	102	66	39	30	143	118	110	105	4	9	13	16
CO-501	050106	7	4	3	3	7	5	3	3	9	8	5	6	102	66	39	30	80	75	63	72	5	11	18	24
CO-502	051606	11	5	3	3	12	6	5	4	16	12	10	8	102	66	39	30	121	97	86	70	3	9	14	16
CO-503	050508	13	6	4	3	13	6	5	4	14	10	8	7	102	66	39	30	134	92	78	75	1	7	11	13
CO-504	051507	7	4	2	2	8	4	3	2	11	6	6	3	102	66	39	30	83	68	63	60	5	6	11	14
CO-505	052812	9	5	3	3	11	6	4	4	16	11	8	7	102	66	39	30	129	85	79	70	2	8	12	15
CO-506	055205	9	5	3	3	9	5	4	4	13	9	7	6	102	66	39	30	95	76	70	66	3	7	12	15
CO-507	055305	9	6	3	2	11	7	4	3	19	12	8	6	102	66	39	30	170	100	80	75	2	8	14	15
CO-508	056005	16	5	3	3	16	6	4	3	15	9	6	6	102	66	39	30	111	88	75	80	1	9	18	23
CO-509	053603	11	5	3	3	12	6	4	4	12	10	8	7	102	66	39	30	148	93	71	74	1	7	12	16
CO-510	725650	6	4	4	4	8	6	6	6	15	11	11	12	102	66	39	30	116	91	93	78	1	7	20	29
CO-511	056202	15	4	3	3	22	5	5	3	11	10	9	6	102	66	39	30	60	81	74	60	5	7	17	21
HI-4901	912850	9	9	8	8	12	11	10	10	22	20	19	17	111	75	48	39	197	194	188	172	2	9	14	15
HI-4902	496006	21	9	6	7	20	10	8	8	20	17	13	14	111	75	48	39	180	151	127	121	3	7	12	14
HI-4903	496016	12	8	7	6	14	8	7	5	18	14	13	12	102	66	39	30	169	136	128	112	4	18	28	30
HI-4904	911905	10	9	8	8	11	10	9	9	16	16	15	14	102	66	39	30	132	128	122	115	0	8	24	28
ID-1001	100204	15	6	4	5	15	8	6	6	17	15	13	12	111	75	48	39	151	109	99	94	2	5	9	12
ID-1002	101037	7	4	3	2	8	5	3	3	14	9	6	6	111	75	48	39	131	82	62	61	4	5	6	8
ID-1003	100714	8	5	4	4	10	7	5	5	18	14	10	9	111	75	48	39	180	114	85	80	1	2	5	6
ID-1004	101221	7	4	4	3	8	5	4	4	11	8	6	7	102	66	39	30	128	82	73	71	3	6	9	11
ID-1005	102802	5	4	3	3	6	5	4	4	10	8	6	6	102	66	39	30	83	73	73	75	3	8	16	19
ID-1006	103207	4	3	3	3	4	4	3	5	7	6	5	7	102	66	39	30	81	67	62	60	1	6	13	18

	Selected	1-hr				10-hr				100-hr				Herb				Woody				Wind Speed			
WIZ	Wx Station	L	M	H	E	L	M	H	E	L	M	H	E	L	M	H	E	L	M	H	E	L	M	H	E
ID-1007	103703	5	4	3	4	5	5	4	5	9	7	5	7	102	66	39	30	83	73	64	63	4	9	17	22
ID-1008	102105	7	5	5	4	8	7	6	5	13	12	12	9	102	66	39	30	131	101	80	112	2	5	10	20
ID-1009	104105	6	4	3	3	7	5	4	4	11	7	5	6	102	66	39	30	97	77	62	68	4	9	13	16
KS-1401	724650	6	5	4	4	8	7	6	5	15	14	12	12	102	66	39	30	135	117	109	68	2	12	25	27
KS-1402	724500	7	7	7	6	10	9	8	7	19	16	14	13	102	66	39	30	173	128	116	95	1	12	27	30
KS-1403	724560	8	7	7	6	10	9	8	7	18	16	14	13	102	66	39	30	168	123	103	60	0	8	19	22
MT-2401	240112	8	5	4	4	11	7	5	5	15	13	9	9	111	75	48	39	159	101	81	93	4	5	9	12
MT-2402	240210	9	5	3	3	12	6	5	4	17	13	11	10	111	75	48	39	164	100	82	78	2	4	7	8
MT-2403	241802	16	6	5	3	18	7	6	4	24	13	11	9	102	66	39	30	180	110	89	88	2	8	12	13
MT-2404	240809	9	6	6	5	10	6	7	6	13	10	10	9	102	66	39	30	116	90	68	66	2	9	18	22
MT-2405	244301	8	6	6	5	9	7	7	6	11	12	12	12	102	66	39	30	132	105	76	55	0	11	19	21
MT-2406	242901	9	5	4	6	12	7	6	9	13	12	10	12	111	75	48	39	131	92	81	83	3	5	7	13
MT-2407	240601	8	5	4	4	10	7	5	5	16	12	10	11	111	75	48	39	181	101	81	80	3	6	10	12
MT-2408	245412	6	4	3	3	7	5	4	4	11	9	7	8	102	66	39	30	109	84	79	77	3	10	22	26
MT-2409	245410	10	6	4	3	15	7	4	4	16	11	8	8	102	66	39	30	185	96	80	74	4	8	11	12
MT-2410	245105	10	6	5	6	11	7	6	7	15	11	11	11	102	66	39	30	155	101	78	85	2	8	15	21
ND-3201	727676	8	7	6	5	10	9	8	6	17	14	14	12	102	66	39	30	160	102	103	82	0	12	25	26
ND-3202	323804	25	6	5	5	22	7	6	6	13	13	10	11	102	66	39	30	107	106	74	83	24	12	21	28
ND-3203	727640	7	7	6	5	9	8	7	6	17	16	15	12	102	66	39	30	148	129	99	97	2	11	23	27
ND-3204	727573	8	8	6	8	9	9	8	9	16	15	13	15	102	66	39	30	140	124	114	101	2	13	25	32
ND-3205	324605	9	8	7	6	11	10	8	8	18	17	14	14	102	66	39	30	158	142	72	60	1	9	15	20
NE-2501	251905	8	6	5	4	11	7	7	8	16	12	12	14	102	66	39	30	157	113	96	86	3	7	18	26
NE-2502	252402	15	7	6	6	21	8	7	7	13	14	11	13	102	66	39	30	156	115	93	83	8	9	16	19
NE-2503	725510	7	8	6	6	9	9	8	8	17	16	14	15	102	66	39	30	160	126	116	104	0	12	24	31
NM-2901	293301	7	3	2	2	9	4	3	2	16	9	6	5	102	66	39	30	129	78	62	65	1	6	13	19
NM-2902	290702	10	5	3	3	12	6	3	3	16	10	6	6	102	66	39	30	139	88	66	68	4	6	9	11
NM-2903	291202	9	5	2	2	10	6	3	2	13	10	6	6	102	66	39	30	118	98	71	67	2	7	12	15
NM-2904	290501	11	7	6	3	9	9	12	7	14	12	12	12	102	66	39	30	164	61	50	50	2	7	17	20
NM-2905	290101	18	5	3	6	48	7	5	6	27	10	7	9	102	66	39	30	200	96	71	61	0	4	9	14
NM-2906	292103	5	4	1	3	7	5	2	4	13	10	6	7	102	66	39	30	109	81	51	53	2	5	11	19
NM-2907	293002	10	5	2	3	12	6	3	3	20	10	6	5	102	66	39	30	186	64	60	60	3	7	12	16
NM-2908	292001	8	3	2	2	9	4	3	3	15	9	6	5	102	66	39	30	111	74	65	65	4	7	13	16
NM-2909	292702	5	3	3	2	6	4	3	2	10	6	6	4	102	66	39	30	64	61	60	60	4	9	19	22
NM-2910	293002	14	5	2	2	14	6	4	3	18	10	6	6	102	66	39	30	163	63	60	60	3	7	12	16
NM-2911	292301	7	4	2	3	8	5	3	4	12	9	8	8	102	66	39	30	69	59	52	50	3	9	21	28

	Selected	1-hr				10-hr				100-hr				Herb				Woody				Wind Speed			
WIZ	Wx Station	L	M	H	E	L	M	H	E	L	M	H	E	L	M	H	E	L	M	H	E	L	M	H	E
NV-2601	725847	5	3	3	3	6	5	4	4	12	10	10	9	102	66	39	30	121	81	74	71	5	7	13	17
NV-2602	261204	4	2	2	1	4	3	3	2	8	6	6	4	102	66	39	30	63	61	66	60	3	6	14	19
NV-2603	260112	4	3	2	1	4	3	3	2	6	5	5	4	102	66	39	30	65	63	62	60	5	9	15	18
NV-2604	260402	4	2	2	2	4	3	2	3	7	5	3	5	102	66	39	30	72	58	50	52	3	8	14	20
NV-2605	260504	3	3	2	4	4	3	3	4	7	6	5	6	102	66	39	30	64	62	62	54	4	9	16	23
NV-2606	261502	2	2	1	2	3	2	2	2	4	4	3	3	102	66	39	30	52	51	51	50	4	11	17	22
NV-2607	260601	4	3	2	1	5	3	3	2	7	5	4	5	102	66	39	30	69	60	55	72	3	9	18	23
NV-2608	260807	5	3	2	2	6	4	3	2	11	7	5	5	102	66	39	30	72	65	62	65	5	9	15	18
NV-2609	261604	3	2	2	2	4	2	2	2	6	3	3	4	102	66	39	30	56	53	51	51	5	13	21	25
NV-2610	261708	5	2	2	2	6	3	2	2	7	5	4	4	102	66	39	30	64	60	61	59	2	6	14	18
NV-2611	261709	4	3	5	2	6	3	4	3	6	4	7	4	102	66	39	30	58	54	57	56	3	9	25	26
OR-3501	352024	12	8	6	5	14	9	7	6	20	15	12	11	111	75	48	39	192	151	114	96	2	4	6	7
OR-3502	353031	10	5	3	3	12	7	6	6	15	13	12	13	111	75	48	39	153	97	84	78	2	5	6	7
OR-3503	352915	22	7	5	4	22	8	6	5	22	12	9	8	102	66	39	30	169	123	91	76	2	4	7	9
OR-3504	350917	7	4	5	4	8	6	7	5	11	9	7	7	102	66	39	30	96	76	71	70	3	4	9	11
OR-3505	353344	6	5	4	4	7	5	4	5	11	9	7	8	102	66	39	30	112	77	68	74	3	6	9	12
OR-3506	351307	6	4	5	4	8	5	6	5	13	9	10	7	102	66	39	30	130	88	80	76	2	6	15	20
OR-3507	352208	9	4	3	3	10	5	4	4	13	8	7	7	102	66	39	30	128	74	64	64	3	5	9	11
OR-3508	352418	6	4	3	2	8	5	4	3	13	8	7	7	102	66	39	30	106	72	68	66	3	6	10	12
OR-3509	353521	5	3	3	3	6	4	3	4	9	6	6	6	102	66	39	30	92	67	63	64	5	7	13	17
SD-3901	726627	7	5	5	5	8	7	7	6	15	13	14	12	102	66	39	30	128	114	109	103	1	13	27	31
SD-3902	395105	9	5	3	3	10	6	4	4	14	10	8	8	102	66	39	30	133	94	78	80	3	6	9	12
SD-3903	392602	17	7	7	8	17	8	8	9	21	13	12	15	102	66	39	30	114	111	92	111	3	11	22	30
SD-3904	726560	8	8	7	9	10	10	9	10	16	15	14	13	102	66	39	30	143	104	112	75	0	11	24	27
SD-3905	726540	8	8	7	6	10	10	9	8	19	18	16	16	102	66	39	30	185	154	129	102	1	12	24	29
UT-4201	421501	5	3	2	2	5	4	2	3	8	6	4	4	102	66	39	30	76	68	64	63	4	8	15	18
UT-4202	420706	7	4	3	3	8	5	4	3	10	8	7	6	102	66	39	30	87	74	67	66	4	8	14	15
UT-4203	421301	9	4	3	3	10	6	4	4	14	12	8	8	102	66	39	30	111	89	75	70	3	5	7	9
UT-4204	421408	7	4	3	3	8	5	4	4	12	7	6	7	102	66	39	30	89	72	63	71	5	10	17	21
UT-4205	421304	8	4	3	2	8	5	4	2	11	6	6	4	102	66	39	30	89	71	60	56	4	10	16	19
UT-4206	422805	4	3	2	2	5	3	3	2	6	5	4	3	102	66	39	30	72	64	61	67	4	9	15	19
UT-4207	422604	8	4	3	3	8	5	3	3	11	8	6	6	102	66	39	30	88	73	63	64	2	7	12	15
UT-4208	422002	6	3	2	2	7	4	3	2	9	6	5	5	102	66	39	30	65	62	63	69	3	6	13	17
WA-4501	451808	10	8	7	8	12	10	9	9	18	16	14	14	111	75	48	39	191	145	132	124	1	4	9	13
WA-4502	451306	10	8	6	5	12	9	7	7	20	14	12	13	111	75	48	39	198	140	124	127	0	3	8	12

	Selected	1-hr				10-hr				100-hr				Herb				Woody				Wind Speed			
WIZ	Wx Station	L	M	H	E	L	M	H	E	L	M	H	E	L	M	H	E	L	M	H	E	L	M	H	E
WA-4503	452219	11	5	4	3	12	6	4	4	15	10	7	7	102	66	39	30	116	87	69	69	1	5	7	7
WA-4504	452132	8	5	4	4	9	5	5	5	11	8	7	6	102	66	39	30	97	68	66	64	3	5	9	11
WA-4505	452040	8	5	5	5	11	7	7	6	11	8	8	7	102	66	39	30	86	72	68	70	4	7	14	18
WA-4506	452038	9	5	4	4	10	6	5	4	14	10	8	8	102	66	39	30	116	88	76	71	3	5	7	9
WA-4507	452802	7	4	5	5	8	5	6	5	12	8	9	9	102	66	39	30	95	77	78	84	4	7	16	20
WA-4508	453803	8	5	6	5	9	6	7	5	11	8	8	7	102	66	39	30	110	81	81	63	4	6	13	16
WY-4801	481411	8	5	3	2	9	6	4	3	12	8	8	5	111	75	48	39	95	77	73	70	3	10	15	18
WY-4802	480804	8	5	3	4	9	5	4	4	12	8	7	5	102	66	39	30	110	78	78	65	4	8	15	22
WY-4803	480306	9	5	3	4	10	6	4	5	14	9	7	9	102	66	39	30	126	78	72	77	6	9	16	21
WY-4804	480502	9	5	4	4	11	6	5	5	18	10	9	9	102	66	39	30	158	95	79	66	1	9	18	24
WY-4805	480502	8	5	3	3	10	7	5	5	16	13	11	10	102	66	39	30	158	116	92	93	4	5	7	8
WY-4806	480708	9	6	4	4	12	7	5	5	13	10	7	9	111	75	48	39	123	100	87	100	3	7	11	14
WY-4807	482010	8	4	2	2	9	5	3	3	10	7	6	6	102	66	39	30	92	77	66	72	3	10	19	25
WY-4808	482106	6	5	2	4	7	6	3	5	11	10	8	10	102	66	39	30	108	86	78	85	1	12	18	25
WY-4809	482102	17	5	5	3	16	6	5	4	15	10	9	10	102	66	39	30	123	92	86	97	2	8	16	20
WY-4810	481801	5	4	3	2	6	4	4	3	10	7	6	5	102	66	39	30	81	73	68	65	1	10	17	19
WY-4811	482105	6	5	4	4	8	6	6	5	13	12	12	11	102	66	39	30	162	97	80	70	0	8	15	17
WY-4812	725645	6	5	4	4	8	6	6	5	15	13	12	11	102	66	39	30	126	110	93	80	5	13	22	26

Table I-4 – 1st, 2nd and 3rd weather stations used per WIZ

WIZCode	FireSeasonStart	FireSeasonStop	Priority 1	Priority 2	Priority 3
AK-5001	5/1	9/1	700260		
AK-5002	5/1	9/1	500215	500934	500214
AK-5003	5/1	9/1	500322	500621	500606
AK-5007	4/15	9/1	500726	500721	500742
AK-5008	4/1	9/1	500735		
AK-5009	4/1	9/1	703260	500810	
AK-5010	4/1	9/1	500924	500902	500963
AK-5011	4/1	9/1	500947	500957	500933
AK-5012	5/1	9/1	703160		
AK-5013	5/1	9/1	703610	500908	500811
AK-5014	6/1	9/1	703810	501013	
AK-5006	5/1	9/1	500738	500412	500418

WIZCode	FireSeasonStart	FireSeasonStop	Priority 1	Priority 2	Priority 3
AK-5004	5/1	9/1	500405	500321	500317
AK-5005	5/1	9/1	500620	500736	500623
AZ-203	4/23	9/15	020402		
AZ-205	4/1	10/7	020501	020511	020510
AZ-207	4/1	9/15	020603	020601	020604
AZ-208	4/15	8/24	021105	020401	
AZ-209	3/22	9/15	021501		
AZ-210	3/15	8/24	021008	021202	021007
AZ-204	4/23	9/1	020402		
AZ-206	4/15	9/7	020303	020301	020209
AZ-202	5/7	10/7	020207	020216	020211
AZ-201	5/7	10/7	020111	020217	020107
CA-424	5/1	12/31	045447		
CA-410	5/15	10/31	043010	043402	043009
CA-418	5/15	10/31	044803	043708	044722
CA-401	6/1	10/15	040404	040421	040507
CA-403	6/1	10/15	040309	040308	040306
CA-409	6/1	10/15	040714	040724	040728
CA-411	6/1	10/31	042802	041302	042607
CA-404	6/1	10/31	041001	041015	042009
CA-402	6/1	10/31	040237	040501	040218
CA-408	6/1	10/31	040915	040618	040910
CA-407	5/15	10/31	041701	040614	040615
CA-405	5/15	10/31	041503	042202	040632
CA-406	5/15	10/31	041210	040611	040814
CA-412	5/1	10/31	044406	043809	044303
CA-419	5/1	12/31	045218	045203	
CA-420	5/1	12/31	045447	045433	045442
CA-423	4/15	11/15	045801		
CA-421	5/1	12/31	045704	045729	045105
CA-413	5/1	10/31	044317	044914	043404
CA-414	5/1	10/31	044408		
CA-415	5/1	10/31	044003	043613	044602
CA-422	5/1	11/15	045444	045112	045614
CA-417	5/15	10/31	044712	044717	043605

WIZCode	FireSeasonStart	FireSeasonStop	Priority 1	Priority 2	Priority 3
CA-416	5/1	10/31	044106	043208	044505
CO-510	3/15	10/15	725650		
CO-501	6/1	10/1	050106	051407	051402
CO-502	6/1	10/1	051606	050207	051404
CO-503	5/1	10/15	050508	050507	050604
CO-504	6/1	10/1	051507	053805	052407
CO-505	6/1	10/1	052812	052902	052810
CO-506	5/1	10/1	055205	055706	052410
CO-507	5/1	10/1	055305	055901	055902
CO-508	5/1	10/1	056005		
CO-509	3/15	10/15	053603	053002	053904
CO-511	3/1	10/15	056202		
HI-4901	7/1	9/30	912850		
HI-4902	5/1	10/31	496006		
HI-4903	5/1	10/31	496016	496009	
HI-4904	5/1	10/31	911905		
ID-1001	6/15	10/15	100204	100101	100424
ID-1002	6/15	10/7	101037	100603	
ID-1003	6/15	10/7	100714	100708	101031
ID-1004	6/15	10/7	101221	101044	101708
ID-1005	6/15	10/7	102802	101314	101804
ID-1006	6/1	10/15	103207	101402	103208
ID-1007	6/1	10/15	103703	103403	102907
ID-1008	6/15	10/7	102105	102301	
ID-1009	6/1	10/15	104105	103902	103903
KS-1401	3/1	10/15	724650		
KS-1402	2/1	11/1	724500		
KS-1403	2/1	11/1	724560		
MT-2406	6/15	10/7	242901	242907	242912
MT-2403	3/15	10/1	241802		
MT-2404	3/15	10/1	240809	242303	242205
MT-2405	3/15	10/1	244301	244002	
MT-2407	6/1	10/7	240601	243403	243302
MT-2410	4/1	10/1	245105	243902	245201
MT-2409	6/15	10/1	245410	244606	245501

WIZCode	FireSeasonStart	FireSeasonStop	Priority 1	Priority 2	Priority 3
MT-2402	6/15	10/7	240210	241519	240303
MT-2401	6/15	10/7	240112	241308	241513
MT-2408	6/15	10/1	245412	245409	243204
NE-2501	3/1	10/21	251905	250105	250203
NE-2502	2/15	11/1	252402		
NE-2503	2/1	11/1	725510		
NV-2610	5/15	10/15	261708	261705	261702
NV-2602	5/21	10/15	261204	260113	260701
NV-2604	5/21	10/15	260402	260202	260503
NV-2611	5/1	10/31	261709		
NV-2607	5/21	10/15	260601	261406	261404
NV-2609	5/15	10/15	261604	261603	
NV-2606	5/21	10/15	261502		
NV-2608	5/21	10/15	260807	260308	260805
NV-2603	5/21	10/15	260112	260206	260109
NV-2601	6/1	10/7	725847		
NV-2605	5/21	10/15	260504	260309	260314
NM-2909	3/1	8/12	292702	292903	292902
NM-2911	2/1	7/1	292301	293104	293101
NM-2905	4/15	9/23	290101	291302	291301
NM-2901	4/23	10/7	293301	290705	
NM-2902	4/21	9/9	290702	290201	290207
NM-2904	2/1	7/1	290501		
NM-2907	4/1	9/9	293002		
NM-2908	4/1	8/12	292001	292010	292011
NM-2910	3/1	9/9	293002	293004	292203
NM-2903	4/21	9/9	291202		
NM-2906	3/15	10/7	292103		
ND-3201	3/15	10/24	727676		
ND-3202	3/15	10/24	323804	321703	
ND-3203	4/1	10/24	727640		
ND-3205	4/1	10/24	324605		
ND-3204	4/1	10/24	727573		
OR-3501	6/15	10/31	352024	352920	350718
OR-3502	6/15	10/31	353031	353036	353040

WIZCode	FireSeasonStart	FireSeasonStop	Priority 1	Priority 2	Priority 3
OR-3503	6/1	10/31	352915	353230	353120
OR-3504	6/1	10/15	350917	350912	352108
OR-3505	6/1	10/15	353344	353406	353310
OR-3506	6/1	10/15	351307	351001	351316
OR-3507	6/1	10/15	352208	352327	353501
OR-3508	6/15	10/15	352418	352416	352329
OR-3509	6/1	10/15	353521	353424	353616
SD-3901	3/15	10/31	726627		
SD-3902	6/1	10/1	395105	392506	393505
SD-3903	3/15	10/31	392602		
SD-3904	3/1	10/31	726560		
SD-3905	3/1	10/31	726540		
UT-4201	6/1	10/1	421501	420911	421807
UT-4202	6/1	10/1	420706	421103	421602
UT-4203	6/1	10/1	421301	420705	420805
UT-4204	6/1	10/1	421408		
UT-4206	5/1	9/15	422805	422806	422502
UT-4207	5/1	9/15	422604	422608	422903
UT-4208	5/1	9/15	422002	422711	422902
UT-4205	5/1	9/15	421304	421405	421305
WA-4501	6/15	10/7	451808	450406	451411
WA-4502	6/15	10/15	451306	451705	451115
WA-4503	6/1	10/31	452219	452206	452221
WA-4504	6/1	10/31	452132	452030	452134
WA-4506	6/15	10/15	452038	453416	453412
WA-4507	6/1	10/31	452802	453201	453102
WA-4508	6/15	10/15	453803		
WA-4505	6/1	10/31	452040	452039	452601
WY-4801	6/15	10/1	481411	480214	481410
WY-4804	4/1	10/1	480502	480501	
WY-4806	6/15	10/1	480708	480111	480102
WY-4807	6/1	10/1	482010		
WY-4810	6/1	10/1	481801	481904	482011
WY-4805	6/1	10/1	480502		
WY-4803	6/15	10/1	480306	480403	480906

WIZCode	FireSeasonStart	FireSeasonStop	Priority 1	Priority 2	Priority 3
WY-4809	5/1	10/1	482102		
WY-4812	5/1	10/1	725645		
WY-4811	6/7	10/1	482105		
WY-4808	6/1	10/1	482106	481502	481003
WY-4802	6/1	10/1	480804	480307	480212

Fire Occurrence Areas

The key input data used to develop the Fire Occurrence Areas (FOA) dataset is historical fire ignition locations. These are spatially referenced x, y coordinates (point locations) of the ignition origin of historical fires. Ignition locations are often recorded as latitude/longitude and submitted as part of the wildland fire reporting process required by state and federal agencies.

Data Sources

Fire occurrence report data was gathered from the states, the federal government and from the National Fire Incident Reporting System (NFIRS). The fire occurrence area (FOA) process is best done when the fire location is specified by latitude/longitude or Township/Range/Section. A location which can be assigned to an area such as a postal zip code is also usable but the resulting fire occurrence areas are more general. In addition, it is desirable to have a final fire size for each fire. As a standard, the WWA requested fire occurrence fire report data from the agency that has the statutory responsibility for fire protection. In some locations, the agency that has the statutory responsibility for fire protection via agreements has a different agency actually providing the initial attack of fires on their lands. This request was made to minimize the duplicate fire reports that the project might receive.

Since the state fire occurrence reports are only for lands that the state has the statutory responsibility for fire protection, it was necessary to obtain fire occurrence data for other privately owned lands. Most of these lands have wildland fire protection provided by an urban or rural fire protection district. These fire protection districts have been requested to report all fires including wildland fire to the U.S. Department of Homeland Security National Fire Incident Reporting System (NFIRS).

The years for which fire reports were provided varied based on availability. For the five federal agencies (U.S Forest Service, Bureau of Land Management, National Park Service, Fish and Wildlife Service, Bureau of Indian Affairs) , fire reports from 1999 –2008 were used. For the states, the data varied with different year time periods ranging between 1999 and 2009. The maximum period used was 10 years. For the NFIRS data, it became apparent from the number of fire reports by state that, by 2004, implementation of the reporting process was in place. Also, the reporting by fire protection districts is voluntary in most states. Hence, a complete set of report is not available but the project used what was available. For the reports that were available, the period 2004 – 2009 was used. In all cases, the process annualizes the fire occurrence. Table I-5 contains a summary of the number of fire records from the NFIRS data base by year by state. Table I-6 shows the same information for years 2004-2009.

Table I-5. - Summary of NFIRS data for all years of data provided

All Years	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	Total
AK	569	411	497	556	610	506	473	390	415	354	974	5,755
AZ			19	130	1,001	2,090	3,541	4,195	3,817	3,423	2,686	20,902
CA				435	431	631	15,986	14,322	21,108	21,410	15,867	90,190
CO	473	763	457	2,340	2,449	2,817	3,727	5,312	4,229	6,306	4,520	33,393
HI	334	621	586	179	793	1,073	1,706	1,313	1,409	1,011	1,050	10,075
ID	2,508	1,967	2,775	1,906	2,833	1,872	2,814	2,697	3,442	2,522	2,025	27,361
KS	6,548	8,409	5,607	9,768	8,175	5,355	8,906	13,260	5,787	4,997	6,837	83,649
MT	77	1,358	1,083	1,002	2,555	1,470	1,523	2,229	2,278	1,949	1,662	17,186
ND			693	1,186	1,321	952	1,000	1,595	1,294	1,254	526	9,821
NE	2,248	2,534	1,287	2,501	1,775	1,521	2,150	2,336	1,310	1,181	1,366	20,209
NM		5	50	189	354	649	1,299	2,102	2,220	3,732	3,494	14,094
NV	474	353	810	551	515	1,370	1,873	2,526	2,187	1,754	1,504	13,917
OR	4,848	4,783	1,364	5,186	6,021	4,553	4,245	5,968	5,403	4,790	4,257	51,418
SD	1,432	1,868	748	1,013	1,437	1,092	1,637	1,983	1,081	823	734	13,848
UT	3,196	2,737	2,956	2,261	2,411	1,738	1,941	2,273	2,360	1,602	1,204	24,679
WA	1,557	1,983	3,196	5,619	9,840	8,103	6,926	10,002	8,829	8,425	10,216	74,696
WY	1,344	1,021	1,665	1,498	1,289	841	942	1,709	1,187	869	755	13,120
Total	25,608	28,813	23,793	36,320	43,810	36,633	60,689	74,212	68,356	66,402	59,677	524,313

Table I-6. - Summary of NFIRS data for 2004-2009

2004-2009	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	Total
AK						506	473	390	415	354	974	3,112
AZ						2,090	3,541	4,195	3,817	3,423	2,686	19,752
CA						631	15,986	14,322	21,108	21,410	15,867	89,324
CO						2,817	3,727	5,312	4,229	6,306	4,520	26,911
HI						1,073	1,706	1,313	1,409	1,011	1,050	7,562
ID						1,872	2,814	2,697	3,442	2,522	2,025	15,372
KS						5,355	8,906	13,260	5,787	4,997	6,837	45,142
MT						1,470	1,523	2,229	2,278	1,949	1,662	11,111
ND						952	1,000	1,595	1,294	1,254	526	6,621
NE						1,521	2,150	2,336	1,310	1,181	1,366	9,864
NM						649	1,299	2,102	2,220	3,732	3,494	13,496
NV						1,370	1,873	2,526	2,187	1,754	1,504	11,214
OR						4,553	4,245	5,968	5,403	4,790	4,257	29,216
SD						1,092	1,637	1,983	1,081	823	734	7,350
UT						1,738	1,941	2,273	2,360	1,602	1,204	11,118
WA						8,103	6,926	10,002	8,829	8,425	10,216	52,501
WY						841	942	1,709	1,187	869	755	6,303
Total	0	0	0	0	0	36,633	60,689	74,212	68,356	66,402	59,677	365,969

Data Quality Review

1. Review data for spatial integrity

    a. Fire locations that were outside the jurisdiction of the reporting agency were deleted. The assumption here is that the legal description, latitude/ longitude, is incorrect and there is no reasonable way to find the correct location.

2. Review data for apparent duplicate fires

    a. Duplicate fire reports can occur if more than one agency responds to the same fire and each agency submits a report.

    b. Duplicates can frequently be recognized by comparing the fire start date, fire size and latitude/longitude. The data was reviewed and apparent duplicate fire report records were modified so that only one report for the fire was used.

Data Processing Steps

All processing was done using ESRI Grid-based modeling using floating point calculations to facilitate greater numerical precision. The modeling methods originated with the 2002 Florida Fire Risk Assessment but have been refined during the Southern Wildfire Risk Assessment and several subsequent risk assessment projects. At that time fire ignition locations in Florida were referenced to the center of sections in the Public Land Survey System (PLSS) (i.e. mile by mile fabric). The modeling process was designed to distribute the fire frequency across the burnable area within each section. It was found this approach provided sufficient resolution to support 30m outputs, in addition to addressing source data limitations. Generally neighborhood modeling functions are applied to derive an ignition rate for every burnable cell in a section using raster processing techniques within ESRI's GRID/Spatial Analyst software.

The following processing steps are involved in the development of the FOA dataset from the ignition point data.

1. Generate the baseline 1 mile by 1 mile "sections" dataset in raster (grid)[1] format. This was used instead of the PLSS in order to create a consistent grid across the entire state for distributing the ignition points. The grid cell size is 30m.

2. Generate the "ignition frequency" grid (frequency of fires per 1 mile x 1 mile section) by setting the center location of each 1 mile x 1 mile section equal to the frequency of fires in the section.

[1] Note the term raster and grid are used interchangeably.

3. Create the burnable/non-burnable mask grid from the surface fuel models dataset. Burnable areas are 1 and non-burnable are represented as NODATA. The surface fuel model data layer developed for this project was used to determine burnable and non-burnable cells.

4. Generate the "fire section" grid, which assigns the frequency of fires for the section to each 30m cell of the section.

5. Generate the "burnable section" grid, which is a count of the number of burnable grid cells in each section.

6. Generate the ignition rate grid (fires per year), which distributes the proportion of fires, represented by burnable cells only, across the section, using the following equation:

   (fire_sec_grid / burnable_sec_grid) / years

   Each burnable cell in the 1 mile x 1 mile section receives an ignition rate greater than zero and each non-burnable cell is assigned a zero. For this, the years represented the actual years of data at each cell, thus annualizing the ignition rates.

Since the NFIRS data did not have Lat/Long coordinates, the data was attached to zip code polygons for processing up through generating an ignition rate grid. These are the detailed processing steps:

1. Create Federal Land Mask
   a. convert Federal Land polygons to raster
      i. Conversion Tools - poly to raster - create grid from FedLand (ID = 0): xx_fedmask0nd
         federal lands = 0, non-fed lands = NoData
         {Alaska: polygons have IDs 0-6 so have an extra steps to make all = 0}
      ii. Spatial Analyst - reclass - NoData (non-Fed) = 1: xx_fedmask01
         federal lands = 0, non-fed lands = 1
      iii. Spatial Analyst - reclass - Fed Lands = NoData: xx_fedmask1nd
         federal lands = NoData, non-fed lands = 1

2. Attach NFIRS data to Zip Code polygons - freq of fires/zip code
   a. export worksheet for desired state to .dbf - XX_nfirs_04_09

   b. create statewide Zip Code dataset - XX_Zipcode.shp

   c. if needed add Zip Code field to XX_ZipCodes.shp, so can join with NFIRS data

   d. 'Join a table' to the NFIRS Data: 'ZIP' to XX_ZipCodes.shp 'ZipCode'
      when possible, edit zip codes in NFIRS data that do not match valid zip code polygon

   e. generate frequency table for NFIRS data on 'ZipCode' - XX_nfirs_04_09_freq

   f. Join a table to the ZipCode data: 'ZipCode' to XX_nfirs_04_09_freq 'ZipCodes_A'

   g. Export joined ZipCode data - XX_nfirs_freqAll_byZip.shp if some zip codes not editable - select freq>0and export - XX_nfirs_freqGT0_byZip.shp

check - run stats on Freq - sum equals # of nfirs records with valid zipcode

3. Create statewide firesec grids
   a. convert zipcode polygons to raster using frequency for grid value

      i. Conversion - to Raster - Polygon to Raster

         Input Features = XX_nfirsEdited_freqAll_byZip

         Value field = Frequency

         Output Raster = **XX_nfirsEdit**

         Cell size = 30, Extent = Input Feature, Snap Raster = snapr_15 (or snapr_AK)

      ii. Mask out Federal Lands

         Spatial Analyst Toolbar - Raster Calculator

            set options - working dir, cell size, extent, snap

            firesec_xx = [xx_nfirsEdit] * [xx_fedmask1nd]

4. Create statewide burnsec grids
   a. convert zipcode polygons to raster using unique ID for grid value

      i. Conversion - to Raster - Polygon to Raster

         Input Features = ZipCodes_XX_alb

         Value field = FID

         Output Raster = **ZipCodes_XX**

         Cell size = 30, Extent = Input Feature, Snap Raster = snapr_15 (or snapr_AK)

      ii. Mask out Federal Lands

         Spatial Analyst Toolbar - Raster Calculator

            set options - working dir, cell size, extent, snap

            MaskZips_XX = [ZipCodes_XX] * [xx_fedmask1nd]

      iii. Calculate burnable cells per zipcode

         Spatial Analyst Toolbar - Raster Calculator

            set options - working dir, cell size, extent, snap

            burnsec_xx = float(zonalsum([MaskZips_XX], [burn01_xx_n], data))

5. Create 2 statewide ignsec grids - noData and 0
   a. NoData ignsec Grid

      i. Spatial Analyst Toolbar - Raster Calculator

         set options - working dir, cell size, extent, snap

         ignsec_xx = float(([firesec_xx] / [burnsec_xx]) / #years)

            most are 10 yrs (pts) or 6 yrs (polys) - check documentation

   b. NoData = 0 ignsec Grid

      ii. Spatial Analyst Toolbar - Raster Calculator

         set options - working dir, cell size, extent, snap

      ignsec0_xx = con(isNull([ignsec_xx]), 0, [ignsec_xx])

The final FOA grids created by combining point and polygon ignition rate grids:

1. Combine the two types of ignition rate grids (from fire point and polygon ignition data) into one ignition rate grid with a total value per cell.

2. Set "background" cell ignition rate. Before generating the average ignition rate grid, it is necessary to address ignition rates in sections with zero ignitions but that have burnable fuel models. If a cell contains burnable surface fuels, it should have an ignition rate other than zero (i.e. there is always a possibility of ignition even if historically a fire has never occurred in that cell). Leaving these areas "as is" can result in underestimating fire occurrence rates. These are generally referred to as the "background" cells because they end up with the lowest mean fire ignition rate and make up the bulk of the area.

   Note that for areas larger than a single county, the non-zero probability value has to be the same throughout the area (or other tiling unit) so that there are no edge-matching issues with the "background" value.

   To calibrate the non-zero probability value, the 'modeled or predicted' number of fires per year is compared to the 'actual' number of fires per year. The mean FOA value across the county and the total number of burnable acres in the county are calculated and the fires/year are calculated:

   Fires per year = mean FOA * (total acres/1,000)

   A value of .000005 was applied as a background value. The results were reviewed by the fire behavior subject matter expert and determined to be appropriate and the data finalized.

3. Generate the mean ignition rate grid using a roving window with a circular window radius of 1,000 acres. NODATA cells were ignored. The 'mean' is used instead of the 'sum' function in order that it properly accounts for fewer cells on edges of the study area. The mean is multiplied by the number of cells in the 1,000 acre window. . Note that numerous other methods can be used and have been tested in past projects for this roving window technique. This includes applying decay functions using Gaussian distributions and kernels. The ESRI FOCALMEAN command provides numerous options for averaging using neighborhood filtering. Choice of the specific averaging technique should be selected based on the distribution and volume of data, and the local knowledge of fuels and fire conditions on the specific geographic landscape.

4. Generate the final FOA grid by masking out areas of non-burnable fuel models. Cells with non-burnable surface fuel models become NO DATA.

Parameters

The following input parameter tables were developed using the fire occurrence information:

1. Proportion of Fires for each percentile weather category (Table I-7)
2. Burnable area by FOA (Table I-8)
3. Average FOA Values in each FOA category (Table I-9)
4. Historic acres burned by WIZ (Table I-10)

Table I-7. Proportion (as a Percent) of Fires

WIZ	Percentile Weather Category			
	Low	Mod	High	Ext
AK-5001	0.00%	81.82%	18.18%	0.00%
AK-5002	0.00%	87.70%	11.23%	1.07%
AK-5003	9.33%	80.00%	7.20%	3.47%
AK-5004	6.75%	87.73%	2.45%	3.07%
AK-5005	6.52%	83.15%	8.70%	1.63%
AK-5006	5.85%	87.08%	4.62%	2.46%
AK-5007	6.40%	74.38%	16.19%	3.02%
AK-5008	0.00%	85.45%	12.73%	1.82%
AK-5009	0.00%	94.87%	2.56%	2.56%
AK-5010	2.99%	74.01%	15.98%	7.02%
AK-5011	5.22%	74.63%	12.69%	7.46%
AK-5012	0.00%	0.00%	100.00%	0.00%
AK-5013	0.00%	85.19%	11.11%	3.70%
AK-5014	0.00%	86.00%	12.00%	2.00%
AZ-201	24.98%	70.87%	3.56%	0.59%
AZ-202	20.97%	73.94%	2.94%	2.16%
AZ-203	15.16%	76.80%	4.65%	3.39%
AZ-204	11.90%	78.99%	6.33%	2.78%
AZ-205	17.36%	72.03%	8.02%	2.59%
AZ-206	16.72%	79.00%	2.91%	1.38%
AZ-207	9.58%	80.66%	7.61%	2.14%
AZ-208	11.74%	83.23%	3.49%	1.54%
AZ-209	9.51%	77.14%	9.32%	4.03%
AZ-210	7.14%	83.28%	7.45%	2.13%
CA-401	13.33%	74.84%	7.11%	4.72%
CA-402	12.17%	80.40%	4.22%	3.22%
CA-403	14.78%	78.81%	4.87%	1.54%
CA-404	14.50%	73.37%	9.72%	2.41%
CA-405	8.59%	79.00%	6.75%	5.67%
CA-406	10.15%	75.28%	9.72%	4.85%
CA-407	10.02%	76.77%	7.26%	5.94%
CA-408	15.38%	72.34%	6.72%	5.56%
CA-409	25.87%	70.65%	2.39%	1.09%

Table I-7. Proportion (as a Percent) of Fires

WIZ	Percentile Weather Category			
	Low	Mod	High	Ext
CA-410	18.02%	72.27%	6.67%	3.04%
CA-411	25.10%	66.15%	5.38%	3.37%
CA-412	14.48%	71.47%	8.66%	5.39%
CA-413	11.98%	76.16%	7.95%	3.91%
CA-414	10.53%	81.09%	6.58%	1.81%
CA-415	11.81%	77.19%	7.70%	3.30%
CA-416	11.15%	78.55%	6.80%	3.49%
CA-417	10.58%	80.66%	6.02%	2.74%
CA-418	9.53%	78.24%	8.53%	3.70%
CA-419	13.93%	73.26%	8.82%	3.99%
CA-420	15.05%	72.80%	7.96%	4.19%
CA-421	13.35%	75.27%	7.90%	3.48%
CA-422	10.98%	79.38%	6.31%	3.33%
CA-423	14.24%	76.42%	6.90%	2.45%
CA-424	12.12%	78.79%	3.03%	6.06%
CO-501	11.10%	82.80%	4.80%	1.30%
CO-502	9.00%	82.60%	5.70%	2.60%
CO-503	7.10%	76.30%	10.70%	5.80%
CO-504	12.20%	79.20%	4.60%	4.00%
CO-505	8.60%	79.10%	7.20%	5.10%
CO-506	14.90%	79.40%	4.20%	1.40%
CO-507	14.60%	77.70%	5.90%	1.80%
CO-508	15.50%	73.60%	8.50%	2.30%
CO-509	7.90%	80.50%	9.30%	2.30%
CO-510	6.50%	83.90%	6.50%	3.20%
CO-511	18.60%	65.70%	14.30%	1.40%
HI-4901	12.20%	80.10%	6.60%	1.10%
HI-4902	13.30%	76.10%	7.80%	2.80%
HI-4903	10.10%	80.70%	9.20%	0.00%
HI-4904	17.40%	78.30%	4.30%	0.00%
ID-1001	8.34%	80.71%	7.93%	3.02%
ID-1002	9.69%	77.52%	7.85%	4.94%
ID-1003	3.80%	80.60%	8.10%	7.50%
ID-1004	14.12%	76.82%	5.86%	3.20%
ID-1005	14.93%	75.54%	7.30%	2.24%
ID-1006	11.65%	78.23%	6.86%	3.26%
ID-1007	9.60%	81.23%	7.74%	1.43%
ID-1008	8.17%	76.98%	11.39%	3.47%
ID-1009	7.95%	76.82%	9.02%	6.21%
KS-1401	13.68%	74.74%	5.26%	6.32%
KS-1402	7.54%	65.03%	11.28%	16.15%
KS-1403	6.60%	72.14%	12.02%	9.24%
MT-2401	7.18%	78.12%	10.24%	4.46%

Table I-7. Proportion (as a Percent) of Fires

WIZ	Percentile Weather Category			
	Low	Mod	High	Ext
MT-2402	7.80%	80.60%	8.30%	3.30%
MT-2403	5.12%	79.40%	11.94%	3.54%
MT-2404	7.64%	76.96%	10.23%	5.17%
MT-2405	10.52%	78.47%	7.99%	3.02%
MT-2406	6.78%	80.16%	9.28%	3.78%
MT-2407	7.30%	81.98%	8.56%	2.16%
MT-2408	12.89%	63.07%	18.12%	5.92%
MT-2409	12.50%	73.70%	10.60%	3.20%
MT-2410	4.88%	84.33%	7.92%	2.88%
ND-3201	7.62%	71.81%	9.75%	10.82%
ND-3202	8.00%	81.48%	6.57%	3.95%
ND-3203	3.62%	75.99%	11.51%	8.88%
ND-3204	3.48%	72.04%	11.43%	13.04%
ND-3205	5.96%	77.42%	8.93%	7.69%
NE-2501	4.08%	88.71%	4.86%	2.35%
NE-2502	6.23%	80.96%	9.61%	3.20%
NE-2503	5.94%	68.82%	10.01%	15.22%
NM-2901	9.77%	78.13%	8.07%	4.03%
NM-2902	11.81%	80.01%	5.08%	3.09%
NM-2903	10.73%	78.32%	6.80%	4.14%
NM-2904	9.69%	77.33%	9.87%	3.11%
NM-2905	10.47%	80.56%	6.57%	2.40%
NM-2906	3.04%	79.28%	9.86%	7.83%
NM-2907	7.68%	81.00%	6.06%	5.26%
NM-2908	13.94%	81.39%	2.76%	1.91%
NM-2909	12.71%	77.97%	6.78%	2.54%
NM-2910	5.20%	83.44%	6.81%	4.54%
NM-2911	6.85%	76.07%	8.69%	8.38%
NV-2601	22.12%	73.08%	3.85%	0.96%
NV-2602	17.29%	75.98%	4.76%	1.97%
NV-2603	11.27%	80.72%	6.05%	1.96%
NV-2604	7.72%	73.63%	14.79%	3.86%
NV-2605	10.54%	77.73%	8.75%	2.98%
NV-2606	9.43%	77.36%	11.32%	1.89%
NV-2607	13.43%	76.73%	7.85%	1.99%
NV-2608	16.55%	78.64%	3.64%	1.17%
NV-2609	12.84%	79.50%	5.41%	2.25%
NV-2610	31.28%	61.93%	4.90%	1.90%
NV-2611	23.80%	66.97%	5.72%	3.51%
OR-3501	4.50%	79.23%	10.52%	5.76%
OR-3502	13.43%	78.97%	5.15%	2.45%
OR-3503	7.64%	83.59%	6.55%	2.22%
OR-3504	18.76%	69.63%	9.28%	2.33%

Table I-7. Proportion (as a Percent) of Fires

WIZ	Percentile Weather Category			
	Low	Mod	High	Ext
OR-3505	11.42%	76.53%	9.15%	2.89%
OR-3506	6.47%	80.00%	9.41%	4.12%
OR-3507	12.83%	80.09%	4.26%	2.82%
OR-3508	10.74%	81.32%	6.17%	1.77%
OR-3509	19.01%	69.53%	10.16%	1.30%
SD-3901	6.40%	70.64%	9.88%	13.08%
SD-3902	6.25%	75.64%	13.07%	5.03%
SD-3903	6.61%	80.23%	8.61%	4.54%
SD-3904	12.46%	74.22%	5.92%	7.40%
SD-3905	6.10%	76.42%	9.33%	8.15%
UT-4201	10.63%	76.62%	9.25%	3.50%
UT-4202	15.00%	75.70%	7.20%	2.10%
UT-4203	12.90%	75.50%	10.10%	1.50%
UT-4204	7.92%	79.32%	9.21%	3.55%
UT-4205	16.14%	75.31%	5.62%	2.93%
UT-4206	14.10%	78.50%	4.90%	2.50%
UT-4207	19.20%	76.98%	2.37%	1.45%
UT-4208	14.17%	78.07%	6.08%	1.68%
WA-4501	6.90%	80.90%	9.30%	2.80%
WA-4502	7.20%	77.60%	10.70%	4.50%
WA-4503	6.43%	82.02%	8.16%	3.39%
WA-4504	7.94%	82.63%	6.35%	3.08%
WA-4505	9.75%	79.57%	6.94%	3.74%
WA-4506	11.70%	76.70%	8.40%	3.20%
WA-4507	6.99%	81.52%	7.10%	4.40%
WA-4508	13.36%	75.58%	8.76%	2.30%
WY-4801	10.00%	81.79%	5.38%	2.82%
WY-4802	9.65%	77.41%	8.55%	4.39%
WY-4803	11.25%	72.50%	12.50%	3.75%
WY-4804	3.15%	86.38%	6.38%	4.09%
WY-4805	5.30%	89.30%	4.20%	1.20%
WY-4806	11.70%	76.70%	8.40%	3.20%
WY-4807	6.64%	80.27%	7.59%	5.50%
WY-4808	10.53%	81.92%	6.18%	1.37%
WY-4809	5.26%	87.72%	7.02%	0.00%
WY-4810	9.44%	76.87%	8.71%	4.98%
WY-4811	9.92%	80.92%	5.34%	3.82%
WY-4812	10.65%	78.11%	4.73%	6.51%

Table I-8. Number of Burnable Acres by FOA Category by WIZ

	FireOccurrenceAreaCategory									
WIZ	1	2	3	4	5	6	7	8	9	Total

Table I-8. Number of Burnable Acres by FOA Category by WIZ

	FireOccurrenceAreaCategory									
WIZ	1	2	3	4	5	6	7	8	9	Total
AK-5001	38,611,62	1,679	2,865	5,510	6,936	1,773	0	0	0	38,630,385
AK-5002	33,051,23	31,131	52,504	94,491	120,995	35,470	1,123	0	0	33,386,946
AK-5003	44,052,63	55,530	93,608	178,248	235,380	74,639	3,240	0	0	44,693,280
AK-5004	13,768,64	24,059	40,576	77,404	102,628	29,795	775	0	0	14,043,878
AK-5005	16,108,76	29,738	49,966	94,761	124,044	35,373	519	0	0	16,443,163
AK-5006	33,249,50	49,891	84,417	159,481	212,265	64,419	554	0	0	33,820,532
AK-5007	16,590,15	67,283	121,976	569,803	365,332	316,017	92,179	71,809	38,721	18,233,277
AK-5008	14,159,57	6,996	11,873	23,414	31,432	10,706	1,717	100	0	14,245,810
AK-5009	23,192,06	7,254	11,727	23,399	33,572	10,586	1,184	218	0	23,280,004
AK-5010	10,008,72	98,735	187,608	252,779	431,296	390,331	248,828	124,269	75,844	11,818,412
AK-5011	10,645,61	33,572	90,902	133,147	64,538	34,879	8,912	2,017	169	11,013,755
AK-5012	5,222,501	742	717	794	734	22	0	0	0	5,225,510
AK-5013	10,628,77	30,417	22,628	24,800	33,993	21,353	7,208	783	0	10,769,955
AK-5014	13,642,27	36,112	55,902	113,191	173,797	97,211	29,494	3,587	990	14,152,556
AZ-201	186,333	1,696,334	297,740	269,646	346,626	319,828	150,963	63,447	18,069	3,348,987
AZ-202	223,284	1,695,869	206,041	285,177	399,265	465,929	269,867	79,968	12,748	3,638,147
AZ-203	2,513,060	7,478,955	413,917	779,412	1,102,95	739,222	198,722	61,735	36,630	13,324,609
AZ-204	47,953	717,951	110,008	174,435	248,036	256,391	145,255	43,089	6,111	1,749,230
AZ-205	214,899	3,555,419	970,314	708,113	1,023,98	986,021	570,356	253,487	169,551	8,452,142
AZ-206	675	77,333	58,113	132,210	293,424	584,124	732,563	533,310	291,304	2,703,056
AZ-207	6,373	1,494,903	401,304	528,384	715,910	683,155	389,685	172,080	145,622	4,537,416
AZ-208	4,180	422,919	95,476	167,337	289,337	446,310	410,009	179,223	43,682	2,058,473
AZ-209	460,869	10,479,91	1,088,37	968,835	1,101,06	811,519	530,243	327,699	275,235	16,043,756
AZ-210	132,151	4,185,860	1,102,53	1,577,91	1,575,18	1,271,00	694,228	231,968	430,299	11,201,140
CA-401	26,837	1,285,665	258,133	367,451	497,710	453,812	240,584	118,818	93,966	3,342,975
CA-402	16,094	1,235,128	375,111	644,596	942,253	992,274	408,205	108,900	29,096	4,751,656
CA-403	162,003	787,036	262,138	466,311	703,773	760,649	346,839	89,713	15,701	3,594,164
CA-404	35,794	544,034	156,737	266,618	415,343	484,443	331,284	182,502	103,530	2,520,284
CA-405	7,887	586,377	120,369	186,765	272,168	282,199	211,922	111,008	72,733	1,851,428
CA-406	568,115	642,188	118,531	202,141	328,069	417,024	401,591	339,309	474,010	3,490,978
CA-407	5,430	295,249	85,363	156,550	272,385	385,096	407,571	350,715	308,485	2,266,845
CA-408	37,589	1,055,734	410,282	749,171	1,147,88	1,331,40	643,772	206,825	62,384	5,645,045
CA-409	115,575	970,503	151,715	238,983	340,777	339,036	147,868	32,334	7,728	2,344,518
CA-410	143,451	201,116	50,411	95,433	153,878	182,098	134,650	71,931	85,718	1,118,685
CA-411	28,327	233,260	21,536	44,969	74,350	103,631	101,993	43,198	17,257	668,521
CA-412	76,823	336,773	64,326	112,790	175,649	211,773	163,999	115,177	112,809	1,370,118
CA-413	140,130	1,736,549	214,009	321,579	425,922	349,772	168,962	84,006	46,062	3,486,991
CA-414	180,057	1,038,295	84,573	123,652	154,668	111,942	55,334	26,386	18,210	1,793,117
CA-415	936,239	601,765	122,117	227,930	380,587	477,802	474,673	380,772	525,743	4,127,627
CA-416	16,117	517,357	103,355	180,132	290,291	375,921	344,958	245,916	175,697	2,249,744
CA-417	198,832	1,152,028	286,735	531,290	840,970	1,000,34	572,965	203,830	113,898	4,900,895
CA-418	795,831	4,124,331	206,811	316,663	435,841	363,355	137,535	32,984	11,518	6,424,869

Table I-8. Number of Burnable Acres by FOA Category by WIZ

	FireOccurrenceAreaCategory									
WIZ	1	2	3	4	5	6	7	8	9	Total
CA-419	183,688	410,491	48,979	77,715	111,364	115,379	94,604	74,545	147,011	1,263,775
CA-420	115,363	219,455	46,780	84,944	138,175	182,010	178,146	162,613	458,754	1,586,241
CA-421	135,122	1,362,597	227,170	403,013	632,962	798,652	685,711	437,005	447,742	5,129,974
CA-422	2,963,216	6,282,634	238,533	330,004	410,171	275,321	124,527	70,957	109,689	10,805,052
CA-423	1,490,548	1,215,475	38,018	63,667	88,000	72,565	51,685	40,183	59,334	3,119,473
CA-424	60,067	137,729	2,498	3,615	4,254	1,613	367	257	1,648	212,046
CO-501	139,930	2,468,971	253,364	380,320	528,847	532,550	284,056	118,226	34,282	4,740,546
CO-502	358,191	3,738,339	277,536	347,641	423,808	272,778	73,935	17,377	3,775	5,513,379
CO-503	265,290	1,241,580	113,852	165,616	225,706	195,470	56,443	9,786	1,186	2,274,929
CO-504	281,574	1,372,536	173,821	269,653	370,277	355,770	168,410	61,436	13,942	3,067,419
CO-505	382,611	3,091,767	268,581	334,484	394,646	216,777	37,288	5,807	1,108	4,733,068
CO-506	243,926	1,929,755	275,578	408,489	564,580	536,035	249,037	99,987	38,488	4,345,875
CO-507	253,712	1,499,338	162,053	251,916	367,991	398,571	224,496	69,225	12,586	3,239,887
CO-508	395,939	2,523,395	89,546	106,045	124,317	62,593	3,110	0	0	3,304,944
CO-509	174,894	4,590,036	248,700	329,519	434,603	373,928	136,140	30,008	4,727	6,322,556
CO-510	4,088,737	3,285,154	8,520	12,229	15,423	11,105	2,905	95	0	7,424,168
CO-511	1,699,277	8,996,531	43,583	53,240	59,479	23,909	887	0	0	10,876,906
HI-4901	6,279	113,054	25,925	52,823	257,266	324,155	81,218	47,502	137,112	1,045,333
HI-4902	64,452	120,621	36,851	120,409	272,691	169,574	250,613	138,189	171,773	1,345,176
HI-4903	22,324	65,417	27,388	80,826	16,926	41,425	154,730	13,423	1,189	423,649
HI-4904	14,488	26,740	3,443	42,809	39,350	19,041	0	0	0	145,871
ID-1001	11,176	755,900	344,764	539,820	866,376	1,072,76	828,144	355,465	133,185	4,907,594
ID-1002	124,660	155,775	58,375	109,424	171,695	206,165	238,979	78,860	35,590	1,179,523
ID-1003	2,898	1,392,455	375,199	581,910	900,073	1,164,57	549,151	130,160	20,635	5,117,055
ID-1004	8,403	1,784,697	616,526	842,149	1,245,51	1,275,36	615,114	182,513	36,172	6,606,456
ID-1005	272,632	4,459,264	877,898	934,741	1,016,35	695,446	183,946	24,713	11,974	8,476,972
ID-1006	101,722	4,599,237	524,360	732,846	731,386	694,220	521,141	335,434	344,552	8,584,899
ID-1007	340,029	2,149,763	431,213	256,622	283,266	228,404	143,750	111,016	206,232	4,150,294
ID-1008	45,574	1,275,235	273,115	317,923	421,600	208,736	59,539	23,640	12,361	2,637,723
ID-1009	392,340	1,560,761	348,130	577,280	577,415	462,955	165,234	87,955	54,711	4,226,782
KS-1401	1,984,724	1,092,001	952,039	1,430,83	1,124,68	372,029	160,497	32,862	26,114	7,175,780
KS-1402	1,428,468	995,243	702,643	1,632,98	2,245,67	1,940,25	1,068,89	463,366	353,935	10,831,467
KS-1403	313,078	434,236	511,220	713,239	1,196,46	2,867,50	2,788,27	1,906,06	1,375,01	12,105,108
MT-2401	28,809	1,036,058	514,723	730,207	1,197,67	1,517,35	1,082,95	449,787	175,485	6,733,046
MT-2402	310,857	1,952,469	412,100	521,079	735,442	628,915	341,242	135,001	53,385	5,090,489
MT-2403	1,908,514	1,441,702	731,090	718,471	568,235	244,506	74,935	13,761	19,771	5,720,985
MT-2404	2,213,679	10,073,52	991,153	2,026,17	1,025,15	420,449	140,396	84,919	17,860	16,993,300
MT-2405	2,601,372	5,463,991	873,781	1,552,49	818,978	247,746	117,833	39,023	31,259	11,746,473
MT-2406	114,137	2,707,335	549,454	704,386	1,040,86	1,002,20	602,574	314,223	109,875	7,145,055
MT-2407	1,332,051	4,033,179	837,402	1,464,14	1,233,38	932,175	286,897	125,441	54,198	10,298,868
MT-2408	162,596	2,206,347	392,841	345,111	329,067	213,025	50,845	13,018	3,442	3,716,292
MT-2409	287,380	1,839,405	413,212	417,373	562,678	439,226	79,031	4,408	2,066	4,044,779

Table I-8. Number of Burnable Acres by FOA Category by WIZ

	FireOccurrenceAreaCategory									
WIZ	1	2	3	4	5	6	7	8	9	Total
MT-2410	290,101	2,346,402	709,946	526,663	1,069,72	609,121	332,077	138,953	45,644	6,068,629
ND-3201	939,964	238,047	197,421	325,597	336,823	192,333	147,483	61,314	41,910	2,480,891
ND-3202	1,786,042	1,755,171	923,763	1,166,82	791,656	597,041	261,658	72,734	39,942	7,394,826
ND-3203	1,593,603	431,543	289,430	307,891	196,170	154,173	87,718	21,648	13,013	3,095,188
ND-3204	739,336	127,375	107,842	189,372	285,456	256,422	148,217	94,070	174,176	2,122,267
ND-3205	1,406,316	213,111	182,819	240,865	185,243	142,095	101,567	31,479	12,866	2,516,362
NE-2501	1,754,333	5,291,749	1,335,04	548,466	644,481	292,312	307,449	151,844	78,146	10,403,821
NE-2502	2,882,762	8,508,280	952,985	846,841	596,186	726,981	227,319	134,168	72,408	14,947,930
NE-2503	965,489	364,854	208,606	453,484	660,360	477,201	327,661	233,591	169,845	3,861,092
NM-2901	851,227	2,727,353	242,457	232,805	282,291	241,211	223,544	173,139	197,049	5,171,076
NM-2902	16,591	1,361,705	278,732	436,110	675,205	814,025	491,920	180,081	65,275	4,319,644
NM-2903	22,659	998,770	321,262	462,018	574,878	562,256	264,372	70,490	34,319	3,311,023
NM-2904	162,353	8,547,508	1,778,49	2,969,19	941,467	577,202	160,168	74,827	422	15,211,636
NM-2905	42,416	4,265,804	542,493	850,454	681,512	592,593	368,678	93,287	44,964	7,482,200
NM-2906	24,988	681,477	193,280	228,129	222,579	145,893	89,339	224,957	249,061	2,059,703
NM-2907	46,054	1,500,377	759,708	1,343,23	497,284	412,950	204,893	116,587	46,713	4,927,802
NM-2908	8,965	2,876,852	1,102,36	832,810	1,062,64	1,164,14	503,491	145,609	24,556	7,721,430
NM-2909	201,800	6,214,672	1,205,53	1,453,12	1,213,18	374,735	107,898	60,919	33,886	10,865,765
NM-2910	49,307	1,488,516	222,794	293,350	377,302	398,936	209,564	80,136	35,002	3,154,908
NM-2911	87,216	1,306,523	1,863,25	2,762,09	1,292,73	1,176,23	709,739	376,299	26,845	9,600,940
NV-2601	1,224	9,091	4,425	9,145	15,933	24,477	28,683	34,071	57,464	184,513
NV-2602	135,198	1,368,694	208,084	264,621	612,847	290,471	319,306	157,022	216,165	3,572,409
NV-2603	329,673	7,980,344	677,800	681,854	519,923	396,503	89,909	6,406	5,411	10,687,823
NV-2604	182,952	3,695,709	989,029	649,163	469,636	140,718	11,198	1,152	2,049	6,141,605
NV-2605	156,053	3,984,977	2,259,47	888,250	824,167	676,915	166,488	7,572	0	8,963,895
NV-2606	155,405	4,730,364	212,280	137,987	145,594	105,233	60,286	30,467	15,775	5,593,390
NV-2607	134,266	8,198,385	854,324	565,396	556,454	299,540	73,315	16,521	891	10,699,092
NV-2608	51,879	2,863,143	664,091	491,232	503,187	335,772	112,523	28,077	1,737	5,051,643
NV-2609	29,203	3,258,875	312,936	331,434	412,457	320,717	125,551	35,401	5,870	4,832,445
NV-2610	95,310	4,627,786	100,620	82,714	119,652	135,848	107,052	62,772	32,492	5,364,246
NV-2611	801,970	2,657,101	186,305	241,950	303,274	216,765	64,869	41,837	100,488	4,614,560
OR-3501	77,835	2,077,858	695,911	1,115,16	1,916,92	2,117,93	1,388,32	812,580	716,515	10,919,039
OR-3502	4,441	375,098	280,563	441,954	635,794	780,703	387,847	94,907	74,047	3,075,354
OR-3503	1,039	511,744	122,937	206,809	377,069	549,962	577,108	349,665	379,322	3,075,655
OR-3504	32,484	683,318	147,899	287,180	626,419	700,978	476,652	261,669	262,342	3,478,942
OR-3505	153,485	1,190,727	430,380	766,303	1,272,16	1,411,00	709,733	256,208	101,220	6,291,226
OR-3506	250,535	601,882	177,542	669,273	444,715	280,583	148,168	56,830	35,956	2,665,483
OR-3507	65,973	1,429,949	327,044	544,681	890,642	1,031,75	509,899	109,833	13,778	4,923,550
OR-3508	172,138	1,153,268	478,729	894,647	1,302,25	1,451,47	569,149	82,935	3,323	6,107,915
OR-3509	760,697	11,301,04	843,735	789,714	895,248	457,962	97,246	23,157	28,475	15,197,275
SD-3901	748,989	3,446,079	481,642	602,190	602,308	245,498	31,471	7,663	1,573	6,167,413
SD-3902	6,783	116,723	91,893	194,284	349,280	503,257	478,317	259,954	201,226	2,201,718

Table I-8. Number of Burnable Acres by FOA Category by WIZ

	FireOccurrenceAreaCategory									
WIZ	1	2	3	4	5	6	7	8	9	Total
SD-3903	551,250	1,506,899	493,657	517,058	466,322	438,652	210,057	96,168	102,626	4,382,689
SD-3904	2,394,071	3,801,952	1,053,53	1,975,60	1,588,94	961,055	312,143	112,838	116,341	12,316,470
SD-3905	1,778,739	441,847	461,146	696,403	718,744	562,475	245,150	88,081	43,725	5,036,311
UT-4201	601,118	5,755,164	1,487,98	1,134,73	868,502	950,886	631,381	297,580	255,440	11,982,793
UT-4202	65,007	938,611	364,710	655,755	962,414	829,094	408,215	179,784	108,871	4,512,460
UT-4203	153,779	700,110	153,858	275,782	247,319	167,125	58,112	10,335	847	1,767,267
UT-4204	59,063	752,316	573,686	424,996	258,879	246,206	155,829	33,069	6,512	2,510,555
UT-4205	148,803	1,058,642	432,075	313,183	291,382	176,693	39,301	2,129	51	2,462,259
UT-4206	44,967	1,309,998	321,606	445,829	604,629	710,307	375,742	132,927	50,993	3,996,996
UT-4207	182,487	2,239,343	564,357	767,642	976,768	973,767	428,802	125,054	21,473	6,279,692
UT-4208	2,339,529	4,789,782	1,022,08	930,452	878,341	658,633	356,607	86,799	5,945	11,068,174
WA-4501	319,603	3,027,154	509,142	987,252	1,066,98	1,434,25	1,104,41	1,284,79	1,265,28	10,998,896
WA-4502	37,588	1,023,797	215,257	317,488	517,018	497,123	350,394	259,830	337,345	3,555,841
WA-4503	70,031	778,757	200,527	315,900	483,934	538,990	558,173	250,039	71,318	3,267,668
WA-4504	116,269	767,744	167,379	274,142	389,069	371,816	192,682	186,639	79,600	2,545,340
WA-4505	59,630	179,853	207,305	471,359	291,690	387,996	247,116	161,889	148,642	2,155,480
WA-4506	4,587	637,323	260,583	411,234	668,518	1,044,56	996,318	493,085	153,692	4,669,904
WA-4507	789,402	1,142,709	565,623	617,031	1,068,06	869,327	1,151,93	851,658	755,158	7,810,904
WA-4508	6,888	258,502	32,821	42,584	107,854	58,171	62,975	72,940	7,269	650,004
WY-4801	548,999	2,115,924	389,229	300,404	325,897	181,944	38,931	2,729	1,217	3,905,275
WY-4802	209,841	2,517,534	661,091	612,954	672,681	258,515	57,206	10,910	18,548	5,019,281
WY-4803	4,053	909,095	107,825	119,887	163,036	80,092	12,491	0	0	1,396,478
WY-4804	1,079,536	7,125,409	1,551,45	2,102,35	1,261,86	446,900	140,814	51,204	102,773	13,862,315
WY-4805	119,061	448,490	164,570	469,171	194,012	39,736	6,740	2,344	7,130	1,451,256
WY-4806	315,752	2,308,226	455,747	514,302	631,046	439,115	93,158	15,152	5,501	4,778,001
WY-4807	77,306	2,457,633	647,400	245,245	261,994	171,782	173,051	36,829	40,164	4,111,405
WY-4808	203,070	3,244,347	1,999,62	223,632	387,509	422,729	41,495	9,746	14,012	6,546,161
WY-4809	3,328	316,828	280,208	199,866	106,950	105,083	44,492	5,669	0	1,062,424
WY-4810	617,625	6,244,471	2,013,44	1,761,78	1,230,16	330,047	69,829	20,201	11,888	12,299,456
WY-4811	21,239	859,359	207,582	93,795	112,252	70,647	23,685	20,097	2,005	1,410,662
WY-4812	39,517	820,237	357,583	88,594	56,484	115,574	14,002	1,999	2,746	1,496,735

Table I-9. Fire Occurrence Rates

	Fires per 1000 ac. per year		
FOA Category	Lower Value	Upper Value	Category Average
1	≤ 0.018736		0.013358
2	0.018736	0.022485	0.021736
3	0.022485	0.029771	0.025492
4	0.029771	0.047850	0.038088
5	0.047850	0.086730	0.065488

Table I-9. Fire Occurrence Rates

	Fires per 1000 ac. per year		
FOA Category	Lower Value	Upper Value	Category Average
6	0.086730	0.158430	0.115467
7	0.158430	0.290943	0.211883
8	0.290943	0.505909	0.374148
9	≥ 0.505909		1.282772

Historic Acres Burned by WIZ

Below is a table with the annual historic number of acres burned used in calibration of the model by WIZ. Also shown is the historic annual number of acres burned divided by the total burnable acres yielding the nominal annual probability of an acre burning.

Table I-10. Annual Acres Burned

State	WIZ	Burnable AC. Total	Annual Acres Burned	Nominal Annual Prob. of an Acre Burning	Fires/1000 ac/Yr
AZ	201	3,348,987	23,343	0.007	0.03649
AZ	202	3,638,147	14,149	0.0039	0.04541
AZ	203	13,324,609	4,599	0.0003	0.01324
AZ	204	1,749,230	1,099	0.0006	0.05408
AZ	205	8,452,142	18,307	0.0022	0.03365
AZ	206	2,703,056	9,565	0.0035	0.23214
AZ	207	4,537,416	76,154	0.0168	0.08946
AZ	208	2,058,473	10,364	0.005	0.12461
AZ	209	16,043,756	14,595	0.0009	0.02431
AZ	210	11,201,140	48,350	0.0043	0.03792
CA	401	3,342,975	13,969	0.0042	0.12348
CA	402	4,751,656	80,492	0.0169	0.06865
CA	403	3,594,164	14,754	0.0041	0.07312
CA	404	2,520,284	8,054	0.0032	0.13459
CA	405	1,851,428	19,616	0.0106	0.12164
CA	406	3,490,978	15,791	0.0045	0.27459
CA	407	2,266,845	25,420	0.0112	0.24911
CA	408	5,645,045	51,280	0.0091	0.08671
CA	409	2,344,518	11,996	0.0051	0.0499
CA	410	1,118,685	1,168	0.001	0.37178
CA	411	668,521	3,772	0.0056	0.17397
CA	412	1,370,118	10,584	0.0077	0.21334
CA	413	3,486,991	22,025	0.0063	0.05675
CA	414	1,793,117	10,549	0.0059	0.04283
CA	415	4,127,627	15,871	0.0038	0.67748
CA	416	2,249,744	19,674	0.0087	0.20611
CA	417	4,900,895	35,833	0.0073	0.10876

State	WIZ	Burnable AC. Total	Annual Acres Burned	Nominal Annual Prob. of an Acre Burning	Fires/1000 ac/Yr
CA	418	6,424,869	14,576	0.0023	0.02465
CA	419	1,263,775	13,118	0.0104	0.86906
CA	420	1,586,241	36,887	0.0233	5.76583
CA	421	5,129,974	137,609	0.0268	0.26121
CA	422	10,805,052	13,494	0.0012	0.06038
CA	423	3,119,473	2,800	0.0009	0.09915
CA	424	212,046	4	0	0.01509
CO	501	4,740,546	13,863	0.0029	0.04681
CO	502	5,513,379	9,105	0.0017	0.015
CO	503	2,274,929	5,951	0.0026	0.02268
CO	504	3,067,419	7,667	0.0025	0.04443
CO	505	4,733,068	4,528	0.001	0.01272
CO	506	4,345,875	9,540	0.0022	0.05274
CO	507	3,239,887	5,792	0.0018	0.04636
CO	508	3,304,944	5,613	0.0017	0.00472
CO	509	6,322,556	11,590	0.0018	0.01738
CO	510	7,424,168	29,551	0.004	0.00053
CO	511	10,876,906	24,242	0.0022	0.00072
ID	1001	4,907,594	9,012	0.0018	0.06706
ID	1002	1,179,523	13,295	0.0113	0.10013
ID	1003	5,117,055	48,358	0.0095	0.06287
ID	1004	6,606,456	70,007	0.0106	0.05514
ID	1005	8,476,972	57,755	0.0068	0.01628
ID	1006	8,584,899	96,832	0.0113	0.01935
ID	1007	4,150,294	75,612	0.0182	0.01961
ID	1008	2,637,723	8,001	0.003	0.01729
ID	1009	4,226,782	65,046	0.0154	0.02591
KS	1401	7,175,780	514	0.0001	0.00317
KS	1402	10,831,467	1,662	0.0002	0.04028
KS	1403	12,105,108	5,319	0.0004	0.0557
MT	2401	6,733,046	26,209	0.0039	0.07673
MT	2402	5,090,489	47,682	0.0094	0.04308
MT	2403	5,720,985	21,231	0.0037	0.01666
MT	2404	16,993,300	74,642	0.0044	0.00594
MT	2405	11,746,473	21,193	0.0018	0.01417
MT	2406	7,145,055	56,092	0.0079	0.04476
MT	2407	10,298,868	28,850	0.0028	0.01428
MT	2408	3,716,292	11,217	0.003	0.01031
MT	2409	4,044,779	47,521	0.0117	0.01402
MT	2410	6,068,629	33,216	0.0055	0.04502
NE	2501	10,403,821	11,941	0.0011	0.02363
NE	2502	14,947,930	13,898	0.0009	0.01627
NE	2503	3,861,092	4,858	0.0013	0.11277
NV	2601	184,513	956	0.0052	0.15283
NV	2602	3,572,409	22,665	0.0063	0.03194
NV	2603	10,687,823	147,205	0.0138	0.00632

State	WIZ	Burnable AC. Total	Annual Acres Burned	Nominal Annual Prob. of an Acre Burning	Fires/1000 ac/Yr
NV	2604	6,141,605	61,680	0.01	0.00542
NV	2605	8,963,895	135,744	0.0151	0.01272
NV	2606	5,593,390	831	0.0001	0.00209
NV	2607	10,699,092	8,524	0.0008	0.00725
NV	2608	5,051,643	5,530	0.0011	0.0175
NV	2609	4,832,445	15,059	0.0031	0.0198
NV	2610	5,364,246	3,009	0.0006	0.01355
NV	2611	4,614,560	44,985	0.0097	0.01393
NM	2901	5,171,076	5,473	0.0011	0.01081
NM	2902	4,319,644	6,190	0.0014	0.07427
NM	2903	3,311,023	23,017	0.007	0.04038
NM	2904	15,211,636	49,646	0.0033	0.00709
NM	2905	7,482,200	4,555	0.0006	0.03304
NM	2906	2,059,703	2,939	0.0014	0.05477
NM	2907	4,927,802	6,297	0.0013	0.02044
NM	2908	7,721,430	48,456	0.0063	0.03769
NM	2909	10,865,765	26,506	0.0024	0.00288
NM	2910	3,154,908	11,721	0.0037	0.0419
NM	2911	9,600,940	49,705	0.0052	0.01603
ND	3201	2,480,891	10,576	0.0043	0.04857
ND	3202	7,394,826	21,015	0.0028	0.03955
ND	3203	3,095,188	4,338	0.0014	0.02371
ND	3204	2,122,267	8,041	0.0038	0.29454
ND	3205	2,516,362	3,526	0.0014	0.04006
OR	3501	10,918,663	2,161	0.0002	0.04084
OR	3502	3,075,354	5,375	0.0017	0.04227
OR	3503	3,075,334	15,766	0.0051	0.08724
OR	3504	3,478,942	17,714	0.0051	0.06626
OR	3505	6,290,909	14,576	0.0023	0.05904
OR	3506	2,665,483	9,599	0.0036	0.00724
OR	3507	4,923,550	14,275	0.0029	0.04493
OR	3508	6,107,901	35,349	0.0058	0.04082
OR	3509	15,196,424	52,180	0.0034	0.00534
SD	3901	6,167,413	3,807	0.0006	0.01083
SD	3902	2,201,718	13,971	0.0063	0.13966
SD	3903	4,382,689	17,965	0.0041	0.10831
SD	3904	12,316,470	16,611	0.0013	0.05165
SD	3905	5,036,311	2,388	0.0005	0.04362
UT	4201	11,982,793	54,259	0.0045	0.02346
UT	4202	4,512,460	11,739	0.0026	0.00964
UT	4203	1,767,267	2,643	0.0015	0.04323
UT	4204	2,510,555	2,192	0.0009	0.01701
UT	4205	2,462,259	16,886	0.0069	0.07481
UT	4206	3,996,996	47,608	0.0119	0.0729
UT	4207	6,279,692	21,297	0.0034	0.03336
UT	4208	11,068,174	5,025	0.0005	0.03113

State	WIZ	Burnable AC. Total	Annual Acres Burned	Nominal Annual Prob. of an Acre Burning	Fires/1000 ac/Yr
WA	4501	10,998,896	1,091	0.0001	0.01402
WA	4502	3,555,841	285	0.0001	0.05706
WA	4503	3,267,668	6,482	0.002	0.03761
WA	4504	2,545,340	43,891	0.0172	0.03748
WA	4505	2,155,480	25,427	0.0118	0.20436
WA	4506	4,669,904	8,317	0.0018	0.04625
WA	4507	7,810,904	40,553	0.0052	0.00346
WA	4508	650,004	4,889	0.0075	0.07461
WY	4801	3,905,275	19,944	0.0051	0.02602
WY	4802	5,019,281	6,249	0.0012	0.00363
WY	4803	1,396,478	3,106	0.0022	0.34222
WY	4804	13,862,315	62,680	0.0045	0.00478
WY	4805	1,451,256	6,947	0.0048	0.08269
WY	4806	4,778,001	16,835	0.0035	0.02604
WY	4807	4,111,405	5,051	0.0012	0.01296
WY	4808	6,546,161	9,369	0.0014	0.00391
WY	4809	1,062,424	5,546	0.0052	0.11201
WY	4810	12,299,456	23,235	0.0019	0.00145
WY	4811	1,410,662	1,487	0.0011	0.01793
WY	4812	1,496,735	2,920	0.002	0
HI	4901	1,045,333	7,416	0.0071	0
HI	4902	1,345,176	44,950	0.0334	0
HI	4903	423,649	3,359	0.0079	0
HI	4904	145,871	132	0.0009	0.00754
AK	5001	38,630,385	14,902	0.0004	0.00051
AK	5002	33,386,946	27,707	0.0008	0.00115
AK	5003	44,693,280	314,857	0.007	0.00036
AK	5004	14,043,878	161,262	0.0115	0.00136
AK	5005	16,443,163	211,211	0.0128	0.00209
AK	5006	33,820,532	645,100	0.0191	0.00363
AK	5007	18,233,277	281,877	0.0155	0.00035
AK	5008	14,245,810	13,586	0.001	0.00031
AK	5009	23,280,004	1,085	0	0.00684
AK	5010	11,818,412	12,325	0.001	0.00129
AK	5011	11,013,755	39	0	0.00001
AK	5012	5,225,510	1	0	0.00168
AK	5013	10,769,955	733	0.0001	0.00082
AK	5014	14,152,556	73	0	0.00113

Fuels

Wildland fuels data for the WWA project was required so that fire behavior could be calculated for each of the four percentile weather categories. The data layers that were used are as follows:

- Slope
- Aspect
- Elevation
- Canopy Cover
- Canopy Height
- (Surface) Fuel Model
- Canopy Base Height (CBH)
- Canopy Bulk Density (CBD)

The 2005 FBPS Fuel Model Set (Table I-11) was used in the analysis. A deliverable in the project also was the 1982 FBPS Fuel Model Set (Table I-12).

Table I-11. 2005 FBPS Fuel Model Set

fuel model ID	fuel model abbrev.	fuel bed depth	1-hr fuel load	10-hr fuel load	100-hr fuel load	live herb load	live woody load	1-hr dead SAV	herb SAV	live woody SAV	dead fuel Mx	dead heat cont.	live heat cont.	live heat cont.
1	FB01	1.00	0.74	0.00	0.00	0.00	0.00	3500			12	8000	8000	8000
2	FB02	1.00	2.00	1.00	0.50	0.50	0.00	3000	1500		15	8000	8000	8000
3	FB03	2.50	3.01	0.00	0.00	0.00	0.00	1500			25	8000	8000	8000
4	FB04	6.00	5.01	4.01	2.00	0.00	5.01	2000		1500	20	8000	8000	8000
5	FB05	2.00	1.00	0.50	0.00	0.00	2.00	2000		1500	20	8000	8000	8000
6	FB06	2.50	1.50	2.50	2.00	0.00	0.00	1750			25	8000	8000	8000
7	FB07	2.50	1.13	1.87	1.50	0.00	0.37	1750		1500	40	8000	8000	8000
8	FB08	0.20	1.50	1.00	2.50	0.00	0.00	2000			30	8000	8000	8000
9	FB09	0.20	2.92	0.41	0.15	0.00	0.00	2500			25	8000	8000	8000
10	FB10	1.00	3.01	2.00	5.01	0.00	2.00	2000		1500	25	8000	8000	8000
11	FB11	1.00	1.50	4.51	5.51	0.00	0.00	1500			15	8000	8000	8000
12	FB12	2.30	4.01	14.03	16.53	0.00	0.00	1500			20	8000	8000	8000
13	FB13	3.00	7.01	23.04	28.05	0.00	0.00	1500			25	8000	8000	8000
91	NB01	0.00	0.00	0.00	0.00	0.00	0.00	9999			0	8000	8000	8000
92	NB02	0.00	0.00	0.00	0.00	0.00	0.00	9999			0	8000	8000	8000
93	NB03	0.00	0.00	0.00	0.00	0.00	0.00	9999			0	8000	8000	8000
94	NB04	0.00	0.00	0.00	0.00	0.00	0.00	9999			0	8000	8000	8000
95	NB05	0.00	0.00	0.00	0.00	0.00	0.00	9999			0	8000	8000	8000
101	GR01	0.40	0.10	0.00	0.00	0.30	0.00	2200	2000		15	8000	8000	8000
102	GR02	1.00	0.10	0.00	0.00	1.00	0.00	2000	1800		15	8000	8000	8000
103	GR03	2.00	0.25	0.00	0.00	1.90	0.00	2000	1800		15	8000	8000	8000
104	GR04	3.00	1.00	0.00	0.00	5.40	0.00	2000	1800		15	8000	8000	8000
105	GR05	1.00	0.30	0.00	0.00	1.20	0.20	1800	1600	1600	40	8000	8000	8000

Table I-11. 2005 FBPS Fuel Model Set

fuel model ID	fuel model abbrev.	fuel bed depth	1-hr fuel load	10-hr fuel load	100-hr fuel load	live herb load	live woody load	1-hr dead SAV	herb SAV	live woody SAV	dead fuel Mx	dead heat cont.	live heat cont.	live heat cont.
106	GR06	2.00	0.10	0.40	0.00	1.50	0.00	1500	1300		30	8000	8000	8000
107	GR07	1.50	0.40	0.00	0.00	2.50	0.00	1800	1600		40	8000	8000	8000
108	GR08	1.50	0.10	0.00	0.00	3.40	0.00	2200	2000		40	9000	9000	9000
109	GR09	4.00	0.50	1.00	0.00	7.30	0.00	1500	1300		30	8000	8000	8000
121	GR10	5.00	1.00	1.00	0.00	9.00	0.00	1800	1600		40	8000	8000	8000
122	GS01	0.90	0.21	0.01	0.00	0.49	0.65	2000	1800	1800	15	8000	8000	8000
123	GS02	1.80	0.30	0.27	0.00	1.45	1.25	1800	1600	1600	40	8000	8000	8000
124	GS03	2.10	1.89	0.29	0.09	3.40	7.08	1800	1600	1600	40	8000	8000	8000
141	SH01	1.00	0.26	0.25	0.06	0.17	1.28	2000	1800	1600	15	8000	8000	8000
142	SH02	1.00	1.34	2.42	0.77	0.00	3.86	2000		1600	15	8000	8000	8000
143	SH03	6.00	3.60	2.10	0.00	0.00	2.90	750		1600	15	8000	8000	8000
144	SH04	6.00	3.50	5.30	2.20	0.00	3.40	750		1600	15	8000	8000	8000
145	SH05	3.00	0.87	1.17	0.22	0.00	2.55	2000	1800	1600	30	8000	8000	8000
146	SH06	2.00	2.90	1.45	0.00	0.00	1.40	750		1600	30	8000	8000	8000
147	SH07	2.40	0.46	3.00	0.00	0.00	6.20	1600		1400	40	8000	8000	8000
148	SH08	3.00	2.03	3.41	0.86	0.00	4.35	750		1600	40	8000	8000	8000
149	SH09	4.40	2.94	2.45	0.17	1.57	10.82	750	1800	1600	40	8000	8000	8000
161	TU01	0.30	0.38	0.60	0.50	0.00	2.13	2000		1600	20	8000	8000	8000
162	TU02	0.60	0.20	0.90	1.50	0.18	0.91	2000	1800	1600	20	8000	8000	8000
163	TU03	0.50	4.50	0.00	0.00	0.00	2.00	2300		2000	12	8000	8000	8000
164	TU04	1.30	1.11	0.17	0.24	0.67	1.11	1800	1600	1400	30	8000	8000	8000
165	TU05	1.00	0.97	1.78	1.26	0.00	0.18	2000		1600	30	8000	8000	8000
181	TL01	0.10	0.11	0.34	1.94	0.00	0.00	2000			15	8000	8000	8000
182	TL02	0.30	0.49	2.20	2.80	0.00	0.00	2000			20	8000	8000	8000
183	TL03	0.20	1.40	2.30	2.20	0.00	0.00	2000			25	8000	8000	8000
184	TL04	0.40	0.50	1.50	4.20	0.00	0.00	2000			25	8000	8000	8000
185	TL05	0.60	1.13	2.50	4.40	0.00	0.02	2000		1600	25	8000	8000	8000
186	TL06	0.40	0.30	1.40	8.10	0.00	0.00	2000			25	8000	8000	8000
187	TL07	0.20	1.00	2.20	3.60	0.00	0.00	2000			30	8000	8000	8000
188	TL08	0.30	5.79	1.40	1.09	0.00	0.00	1800			35	8000	8000	8000
189	TL09	0.40	1.30	2.90	5.60	0.00	0.00	2000			30	8000	8000	8000
201	SB01	1.00	1.50	3.10	11.00	0.00	0.00	2000			25	8000	8000	8000
202	SB02	1.00	4.47	4.26	3.90	0.00	0.00	2000			25	8000	8000	8000
203	SB03	1.20	5.41	2.74	3.12	0.00	0.00	2000			25	8000	8000	8000
204	SB04	2.70	5.29	3.57	5.28	0.00	0.00	2000			25	8000	8000	8000

Table I-12. 1982 FBPS Fuel Model Set

fuel model ID	fuel model abbrev.	fuel bed depth	1-hr fuel load	10-hr fuel load	100-hr fuel load	live herb load	live woody load	1-hr dead SAV	herb SAV	live woody SAV	dead fuel Mx	dead heat cont.	live heat cont.	live heat cont.
1	FB01	1.00	0.74	0.00	0.00	0.00	0.00	3500			12	8000	8000	8000
2	FB02	1.00	2.00	1.00	0.50	0.50	0.00	3000	1500		15	8000	8000	8000
3	FB03	2.50	3.01	0.00	0.00	0.00	0.00	1500			25	8000	8000	8000
4	FB04	6.00	5.01	4.01	2.00	0.00	5.01	2000		1500	20	8000	8000	8000
5	FB05	2.00	1.00	0.50	0.00	0.00	2.00	2000		1500	20	8000	8000	8000
6	FB06	2.50	1.50	2.50	2.00	0.00	0.00	1750			25	8000	8000	8000
7	FB07	2.50	1.13	1.87	1.50	0.00	0.37	1750		1500	40	8000	8000	8000
8	FB08	0.20	1.50	1.00	2.50	0.00	0.00	2000			30	8000	8000	8000
9	FB09	0.20	2.92	0.41	0.15	0.00	0.00	2500			25	8000	8000	8000
10	FB10	1.00	3.01	2.00	5.01	0.00	2.00	2000		1500	25	8000	8000	8000
11	FB11	1.00	1.50	4.51	5.51	0.00	0.00	1500			15	8000	8000	8000
12	FB12	2.30	4.01	14.03	16.53	0.00	0.00	1500			20	8000	8000	8000
13	FB13	3.00	7.01	23.04	28.05	0.00	0.00	1500			25	8000	8000	8000
91	NB01	0.00	0.00	0.00	0.00	0.00	0.00	9999			0	8000	8000	8000
92	NB02	0.00	0.00	0.00	0.00	0.00	0.00	9999			0	8000	8000	8000
93	NB03	0.00	0.00	0.00	0.00	0.00	0.00	9999			0	8000	8000	8000
94	NB04	0.00	0.00	0.00	0.00	0.00	0.00	9999			0	8000	8000	8000
95	NB05	0.00	0.00	0.00	0.00	0.00	0.00	9999			0	8000	8000	8000

Data Sources

The base data used for fuels was obtained from the LANDFIRE project and is the 2008 REFRESH version (LF_1.1.0) of the data.

Data Quality Review

On reviewing the LANDFIRE data, it was found that many acres in urban areas were mapped as a burnable fuel model (mainly TL6) when the areas were non-burnable. A process was developed and used to adjust these areas and classify them as urban. This process was described in the final report. The rule sets used for each state are listed in Table I-13 and the class ranges for WPL 6 are listed below.

Category 6 WPL	Houses/sq.km.
6.0	123.55269 - 247.40538
6.2	247.40538 - 370.65807
6.4	370.65807 - 494.21076
6.6	494.21076 - 617.76345
6.8	617.76345 - 741.31614

In examining the resultant fire type, it was determined that canopy fire, mainly passive, was occurring frequently at the low percentile weather category. This was happening due to a relatively low canopy base height, probably lower than existed in the field. To mitigate this, the modeling of canopy fire was allowed under moderate, high and extreme percentile weather categories only.

Table I-13. Rule sets used for adjusting the LANDFIRE urban fuel model in the surface fuel model dataset.

State	Rule Set
AK	1. Selected WPL classes 6.2-7 polygons > 160 acres; deselected one polygon in Anchorage area. 2. Selected WPL classes 6.2-7 polygons < 160 acres that intersect with WPL class 7 polygons; except in Sitka and Ketchikan areas; reviewed each polygon selected in the more rural areas to verify appropriateness of selection. 3. Selected WPL classes 6.0-7 polygons > 480 acres; except in Anchorage, Haines, Skagway, Homer, Sitka, and Ketchikan areas. Also deselected one polygon in Fairbanks area. 4. Selected WPL classes 6.0-7 polygons < 480 acres that intersect with WPL class 7 polygons; except in Anchorage, Haines, Skagway, Homer, Sitka, and Ketchikan areas; reviewed each polygon selected in the more rural areas to verify appropriateness of selection. 5. Selected WPL class 7 polygons that were not selected, by default, in the 4 selection steps above; reviewed each polygon selected in the more rural areas to verify appropriateness of selection. Deselected 52 polygons, 260 ac total (45 polygons each under 10 ac, 65 ac total) 6. Apparently some roads were misclassified as fuels 101. Decision made to convert these back to urban in the Anchorage, Fairbanks, and Juno areas. 7. All polygons selected in steps 1-6 were used to create the Urban Mask All holes interior to edge of the Mask Polygons were filled in when they intersected with burnable fuels.

Table I-13. Rule sets used for adjusting the LANDFIRE urban fuel model in the surface fuel model dataset.

State	Rule Set
AZ	1. Selected all WPL class 7 polygons 2. Phoenix\Tucson Area: selected WPL classes ≥ 6.2 polygons greater than 640 acres, that intersected with WPL class 7 polygons that are greater than 640 acres 3. Everywhere else: selected WPL classes ≥ 6.4 polygons greater than 640 acres, that intersected with WPL class 7 polygons that are greater than 640 acres All holes interior to the edge of the Mask Polygons filled in when they intersected with burnable fuels, EXCEPT Saddleback Mt area in Phoenix (hole greater than 10,000 acres not filled - per conversation with AZ rep)
CA	1. Selected all WPL class 7 polygons 2. Selected WPL classes 6.2-7 polygons ≥ 640 acres that also intersect class 7 polygons ≥ 640 acres
CO	1. Selected all WPL class 7 polygons 2. Selected WPL classes 6.2-7 polygons ≥ 640 acres that also intersect class 7 polygons ≥ 640 acres All holes interior to edge of the Mask Polygons were filled in when they intersected with burnable fuels. Some additional 'filling-in' occurred in the Denver area.
HI	Left as is - No Changes
ID	1. Selected all WPL class 7 polygons 2. Selected all WPL classes 6.2-7 polygons ≥ 215 acres that also intersect all class 7 polygons 3. E-W belt (Boise, Twin Falls, Idaho Falls area) plus the Lewiston-Moscow area: selected WPL classes 6.0-7 ≥ 320 acres that also intersect all WPL class 7 polygons All holes interior to edge of the Mask Polygons were filled in when they intersected with burnable fuels.

Table I-13. Rule sets used for adjusting the LANDFIRE urban fuel model in the surface fuel model dataset.

State	Rule Set
KS	1. Selected all WPL class 7 polygons 2. Selected all WPL classes 6.2-7 polygons ≥ 320 acres that also intersect all class 7 polygons All holes interior to edge of the Mask Polygons were filled in when they intersected with burnable fuels. Some additional 'filling-in' occurred in the Topeka and Kansas City areas.
MT	1. Selected all WPL class 7 polygons 2. selected WPL classes 6.2-7 polygons ≥ 640 acres that also intersect class 7 polygons ≥ 320 acres All holes interior to edge of the Mask Polygons were filled in when they intersected with burnable fuels.
ND	1. Selected all WPL class 7 polygons 2. Selected all WPL classes 6.0-7 polygons ≥ 320 acres that also intersect all class 7 polygons All holes interior to edge of the Mask Polygons were filled in when they intersected with burnable fuels.
NE	1. selected all WPL class 7 polygons 2. selected all WPL classes 6.2-7 polygons ≥ 320 acres that also intersect all class 7 polygons All holes interior to edge of the Mask Polygons were filled in when they intersected with burnable fuels. Some additional 'filling-in' occurred in the Omaha area.
NM	1. selected all WPL class 7 polygons 2. selected all WPL classes 6.4-7 polygons ≥ 320 acres that also intersect all class 7 polygons All holes interior to edge of the Mask Polygons were filled in when they intersected with burnable fuels.

Table I-13. Rule sets used for adjusting the LANDFIRE urban fuel model in the surface fuel model dataset.

State	Rule Set
NV	1. selected all WPL class 7 polygons 2. selected all WPL classes 6.2-7 polygons ≥ 640 acres that also intersect all class 7 polygons 3. Las Vegas and Reno areas: selected WPL classes 6.0-7 ≥ 640 acres that also intersect all WPL class 7 polygons All holes interior to edge of the Mask Polygons were filled in when they intersected with burnable fuels. Some additional 'filling-in' occurred in the Las Vegas and Reno areas.
OR	1. selected all WPL class 7 polygons 2. selected WPL classes 6.2-7 polygons ≥ 640 acres that also intersect class 7 polygons ≥ 640 acres All holes interior to edge of the Mask Polygons were filled in when they intersected with burnable fuels.
SD	1. selected all WPL class 7 polygons 2. selected all WPL classes 6.2-7 polygons ≥ 320 acres that also intersect all class 7 polygons 3. East of central River - 5 larger cities (Sioux Falls, Brookings, Watertown, Huron, Pierre): selected WPL classes 6.0-7 ≥ 320 acres that also intersect all WPL class 7 polygons All holes interior to edge of the Mask Polygons were filled in when they intersected with burnable fuels. Some additional 'filling-in' occurred in the Sioux Falls area.
UT	1. selected all WPL class 7 polygons 2. selected WPL classes 6.4-7 polygons ≥ 320 acres that also intersect class 7 polygons ≥ 225 acres All holes interior to edge of the Mask Polygons were filled in when they intersected with burnable fuels. Some additional 'filling-in' occurred in the Salt Lake City and Provo areas.
WA	1. selected all WPL class 7 polygons 2. selected WPL classes 6.2-7 polygons ≥ 640 acres that also intersect class 7 polygons ≥ 640 acres All holes interior to edge of the Mask Polygons were filled in when they intersected with burnable fuels.

Table I-13. Rule sets used for adjusting the LANDFIRE urban fuel model in the surface fuel model dataset.

State	Rule Set
WY	1. selected all WPL class 7 polygons 2. selected all WPL classes 6.0-7 polygons ≥ 640 acres that also intersect all class 7 polygons All holes interior to edge of the Mask Polygons were filled in when they intersected with burnable fuels.

Values Impacted Development

Drinking Water Importance Areas

The U.S. Forest Service's Forests to Faucets (F2F) project is the primary source of the Drinking Water dataset, however, F2F did not exist for Alaska and Hawaii so alternative datasets were used for these two states. The F2F data used for the project was downloaded on November 2011 called "F2F_step1_0416". The following processed was used to link and reclass the F2F data to the Watersheds data to create the DWIA dataset for the lower 15 states of the WWA project:

1. Download a statewide datasets, including 3 km buffered area beyond WWA states, of the USGS Watershed Boundary Dataset HUC-12 polygons.

2. Project nationwide dataset to the WWA regional projection system

3. Join F2F table using HUC1 field to hucs12 polygon

4. Fix missing HUC F2F values in vector data in lower 15 by interpolating from surrounding F2F values (only 5 HUC's needed this interpolation)

5. Create buffered statewide grid using F2F field as value

6. Reclass grid F2F values using following classification:

Value	F2F value
1	0 - 10
2	11 - 20
3	21 - 30
4	31 - 40
5	41 - 50
6	51 - 60
7	61 - 70
8	71 - 80
9	81 - 90
10	91 - 100

Alaska

For Alaska, the Environmental Conservation statewide data set is used for Alaska (Alaska Department of Environmental Conservation, Drinking Water Program's GIS data for the Drinking Water Systems). The information provided is a data snapshot as of November 11, 2011. This dataset had several overlapping polygons which needed to be adjusted. In communications with the state representative, it was clear that each overlap was a unique situation so each was tackled on an individual basis using the following general guidelines with the guiding principal that it would be better to overestimate the population and protect the area than underestimate and not protect:

1. **For slivers**: Slivers that were obviously from edge matching issues were merged into one of their parent polygons. There were a couple options for selecting which polygon to merge it into, but these were small enough that the analyst picked the one they thought best.
2. **For polygons with the same PWS_NAME and population:** Some of the polygons had identical names and identical population counts. Some overlapped, some didn't. Some were identical, some weren't. We saw all combinations. Summing these polygons was not appropriate, so they were handled as follows:
    a. If the polygons didn't overlap and there was some distance between them, we did not change them. Each polygon remained as is and received the population assigned to it. (It was too difficult to come up with logical reasons why they were the way they were and therefore the decision was to make no change)
    b. If they did overlap, and overlapped identically, we deleted one of the polygons.
    c. If it was some other combination, we merged the polygons and used the common population value rather than the sum for the merged poly. The City of Cordova is a good example of this scenario:

The City of Cordova had five polygons, three of which attached to a larger poly and one which overlapped with the larger polygon. The blue lines in Figure I-1 below define the five polygons and the reddish colored polygon is the one that overlapped. All of these polygons were labeled City of Cordova and all had a population of 2,700. We suspected that these showed slight changes to the boundary over the years and that the entire area is the City of Cordova and the population should be 2,700. Summing all five polygons to get a population of 13,500 did not seem appropriate. We queried the City of Cordova online and it showed a 2009 population of 2,240 which seemed to support our assumptions and the final process.

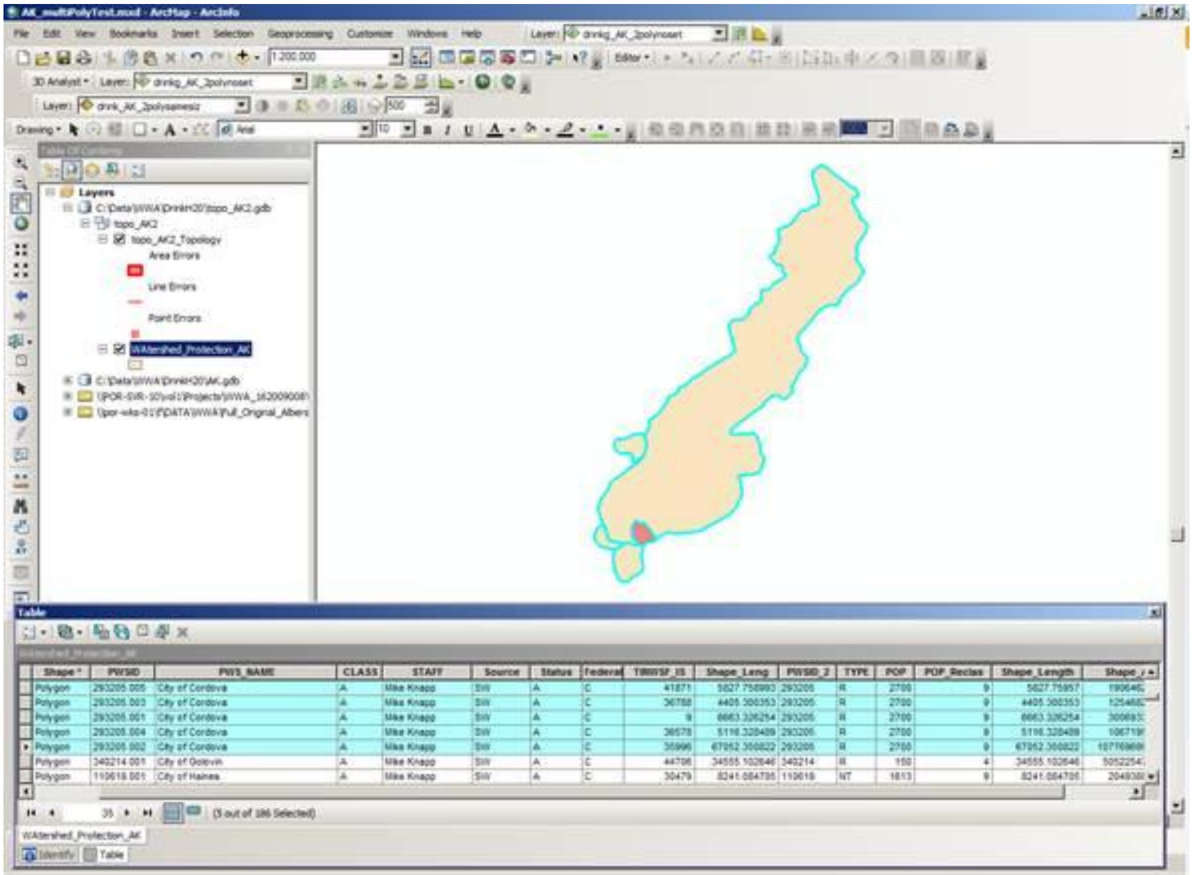

Figure I-1. Example of overlaps in the City of Cordova.

3. **For overlapping polygons that were too big to be slivers** but still looked like an overlap due to resolution rather than a water system overlap, we were conservative and retained these polygons and summed the population from its parent polygons.

4. **Remaining polygons that overlap**. We merged the polygons and applied the sum of the contributing polygons to the new area.

5. **Generate values 1-10 for DWIA classification**. We added the field (POP_RECLAS), created background values using buffered AK state boundary and set pop to 0. We then merged background dataset and edited AK_DEC data. The merged dataset was then clipped to the AK state boundary. Quantile breaks were used to determine class breaks based on POP values in AK_DEC data. 10 classes but did not include background (0) values to determine breaks. The POP_RECLAS field was then calculated based upon ESRI's Quantile 10 class breaks. The 0 background values were included in class 1. The final DWIA grid was created based on the POP_Reclas values. Below are the Quantile breaks for the classes:

AK ESRI 10 Quantile class breaks for POP	Pop_Reclass
0 - 54.00000	1
54.00001 - 95.00000	2
95.00001 - 140.00000	3
140.00001 - 198.00000	4
198.00001 - 250.00000	5
250.00001 - 354.00000	6
354.00001 - 535.00000	7
535.00000 - 904.00000	8
904.00001 - 3350.00000	9
3350.00001 - 221351.00000	10

Hawaii

For Hawaii, Hawaii Department of Land and Natural Resources, Watershed Protection Priority I and II data was used in combination with EPA Table S02 (Surface Drinking Water). The following are the steps used to generate the DWIA data for HI.

1. Create new spreadsheet with HI EPA attributes
2. Join EPA data to HI Watersheds HUC 12 data
3. Create layer with only the 1 HUC with surface water (symmetrical difference)
4. Merge two HUC layers (one layer with surface water and one with all other HUCs with no surface water)
5. Add field to new HUC layer (10 = surface water, 20 = no surface water)
6. Convert feature to raster based on EPA Priority value of 10 or 20
7. Create shapefile to get only watershed protection priority II (from two protection shapefiles)
8. Merge priority I and II individual shapefiles to get one layer
9. Add field "Prior" to newly merged protection (priority 1 = 3, priority II = 4)
10. Convert feature to raster based on "Prior" field
11. Use raster calculator to multiply the EPA data by the protection priority data
12. Reclass the raster calculations into 6 classes

13. Create grid (dwia_HI) based on classification as determined by the project team

This classification scheme followed the same classification used for the other states. Below are the class combinations and their 1-10 reclassed DWIA value:

Description of Class combination	Class (Value)
No Surface DW, Priority N/A	1
No Surface DW, Priority 2	2
No Surface DW, Priority 1	4
Surface DW, Priority N/A	6
Surface DW, Priority 2	8
Surface DW, Priority 1	10

Forest Assets Model

The Forest Assets (FA) dataset was developed to allow for the prioritization of landscapes reflecting forest assets that would be most adversely affected by fire. This includes forested lands categorized by height, cover and susceptibility, or response to wildfire. The LANDFIRE (REFRESH) vegetation datasets (EVT, EVH) were the primary inputs to this layer along with a crosswalk of the EVT dataset to a susceptibility class. This section describes the processing steps for developing this dataset.

1) Download EVT and EVH from LANDFIRE
2) COMBINE using Spatial Analyst Tools / Local / Combine
3) Join EVH fields to Combine grid
    a) Data Management Tools / Joins / Join Field
    b) Input is Combine grid
    c) Input Join Field is <cnty>_evh
    d) Join Table is EVH grid
    e) Output Join Field is VALUE
    f) Join Fields (optional) is CLASSNAMES
4) Join EVT fields to Combine grid
    a) Data Management Tools / Joins / Join Field
    b) Input is Combine grid
    c) Input Join Field is <cnty>_evt
    d) Join Table is EVT grid
    e) Output Join Field is VALUE
    f) Join Fields (optional):
        i) EVT_NAME
        ii) NVCSCLASS
        iii) SYSTMGRPPH
5) Convert FA crosswalk to a usable table (Appendix A)
    a) Note: you only need to do this once with the final table.

b) Open final FA crosswalk table in Excel

i) Delete all columns except Value and FA Code

ii) Remove all rows with FA Code = ? or FA Code = no data

iii) Save as separate spreadsheet (eg FA_Codes_Input.xls)

(1) Note: Must save as Excel97-2003 Workbook version (*.xls)

iv) Rename worksheet name to something simple

v) Close worksheet

c) Open ArcCatalog & navigate to FA code table location

d) Expand xls table, Right click on worksheet and select "Export to Geodatabase (single)"

e) Choose output location

f) Name the table

g) Skip Expression and Field Map

h) Click OK

i) Confirm FA code table exists in your selected Geodatabase (open and make sure there aren't any weird codes)

6) Join FA Codes to Combine Grid

a) Data Management Tools / Joins / Join Field

b) Input is Combine grid

c) Input Join Field is <cnty>_evt

d) Join Table is FA Codes

e) Output Join Field is VALUE

f) Join Fields (optional):

i) FA_Code

7) You now have one grid with all of the values required

8) Copy Combine Grid to create FA_temp

9) Add field Height

a) Short Integer

10) Add field Cover

a) Short Integer

11) Calculate Cover according to the following table:

Table I-14. Forest Assets cover code

NVCSCLASS	Cover
Open tree canopy	1
Sparse tree canopy	1
Closed tree canopy	2

12) Calculate Height according to the following table:

Table I-15. Forest Assets height code

CLASSNAMES	Height
Forest Height 0 – 5 meters	1
Forest Height 5 – 10 meters	1
Forest Height 10 – 25 meters	2
Forest Height 25 – 50 meters	3
Forest Height > 50 meters	3

13) Use Spatial Analyst Tools / Conditional / Con

a) Input FA_temp

b) Expression = "FA_Code" >0 AND "Height" >0 AND "Cover" >0

c) Input true raster = FA_temp

d) Input false is blank

e) output raster is FA

14) Use Data Management Tools / Raster /Raster Properties/Build Raster Attribute Table on FA (overwrite)

15) Use Data Management Tools / Joins/ Join Field

a) Input is FA

b) Input Join Field is Value

c) Join Table is FA_temp

d) Output Join Field is VALUE

e) Join Fields (optional) is Everything except Value and Count

16) Grid is now ready for Fire Effects processing. Fire Effects ratings will be based on the 3 height classes, 2 cover classes, and 3 resistance classes

Table I-16. Forest Assets Codes

Height (from CLASSNAMES)		Cover (from NVCSCLASS)		Fire Resistance (from FA_Code)	
1	0 – 10 meters	1	open or sparse canopy	1	Sensitive
2	10 – 25 meters			2	Resilient
3	> 25 meters	2	closed canopy	3	Adaptive

Riparian Assets Model (RA)

The overall purpose of this model is to provide an ecosystem, and specifically a watershed ecosystem, variable for the West Wide Wildfire Risk Assessment. This model identifies riparian areas that are important as a suite of ecosystem services, including both terrestrial and aquatic habitat, water quality and quantity, and other ecological functions. This model attempts to represent the spatial extent of riparian zones on perennial streams, intermittent streams, and wetland areas. Additionally, this model will allow the user to analyze a suite of variables in those riparian areas that may be most affected by fire.

Model Design

Establishing the Riparian Buffer Footprint:

Riparian zones vary by hydrology, topography, soils, geology, and climate. Given the scope of the West Wide Wildfire Risk Assessment, it was difficult to obtain standard datasets of all these factors.

The National Hydrography Dataset (NHD) was used to represent hydrology. A subset of streams and waterbodies which represents perennial, intermittent, and wetlands was created. Intermittent and perennial streams were buffered by 150ft and 75ft respectively on either side. Double sided intermittent and perennial streams were buffered the same distance.

The NHD waterbodies dataset was used to determine the location of lakes, ponds, swamps, and marshes (wetlands). All known constructed features[2] (such as reservoirs) were excluded. Perennial waterbodies received a buffer of 150ft and intermittent waterbodies received a buffer of 75ft. Table I-17 summarize the codes used from the NHD to create a riparian footprint for streams and rivers.

Table I-17. NHD codes

NHD Feature Set	Feature Type	FCode	Description	Buffer Width (ft)
NHDFlowline	STREAM/RIVER	46003	Intermittent	75
NHDFlowline	STREAM/RIVER	46006	Perennial	150
NHDWaterbody	Lake/Pond	39001	Intermittent	75
NHDWaterbody	Lake/Pond	39004	Perennial	150
NHDWaterbody	Lake/Pond	39009	Perennial, average water elevation	150

[2] Designating waterbodies from the NHD is problematic in that it is difficult to distinguish constructed from natural waterbodies. Using the National Wetlands Inventory may be a better way to designate waterbodies in the future

NHDWaterbody	SWAMP/MARSH	46601	Intermittent	75
NHDWaterbody	SWAMP/MARSH	46602	Perennial	150
NHDPoint	SPRING/SEEP	45800	spring or seep	75
NHDArea	STREAM/RIVER	46003	Double line intermittent	75
NHDArea	STREAM/RIVER	46006	Double line perennial	150
NHDArea	STREAM/RIVER	46007	Double line ephemeral (wash?)	75
NHDArea	WASH	48400	Wash	75

The concept of riparian was also extended to wetlands as they provide important ecosystem services such as storing and filtering water and providing aquatic and terrestrial habitat. The US Fish and Wildlife's National Wetlands Inventory (NWI) (http://www.fws.gov/wetlands/index.html) is a comprehensive dataset covering the entire US with explicitly mapped wetland areas. This dataset was used in two ways: first, to establish a wetland riparian footprint; second, to provide value information about the condition of the wetland riparian area.

The most general classification level of wetlands in the NWI is according to their aquatic system. There are 5 categories: marine, estuarine, riverine, lacustrine, and palustrine. Each category is extensively broken into subcategories. For the purpose of indentifying wetland riparian footprints, we did not want them to overlap already-identified areas, such as riverine and lacustrine (identified by perennial and intermittent streams and lakes from the NHD). For that reason, the only system used from the NWI is palustrine. Table I-18 summarizes the codes used from the NWI to establish the wetland riparian footprint. Additionally, there were a number of special modifiers that were used to eliminate constructed features such as reservoirs and impoundments[3]. Table I-19 lists these special modifiers. All wetlands delineated by the NWI received a buffer of 150ft.

Table I-18. NWI Palustrine Codes

System	Class Codes	Description	Status	Exceptions/Modifier	Buffer Width
Palustrine	Rock Bottom (RB)	primarily ponds	excluded		NA
Palustrine	Unconsolidate Bottom (UB)	primarily ponds	excluded, with exceptions	included if combined with EM, FO, or SS	150 feet
Palustrine	Aquatic Bed (AB)	primarily ponds	excluded		NA

[3] The NWI dataset was spotty in Alaska so an alternative dataset, based in part on NWI was used. There was no code in this dataset that enabled the removal of constructed features

System	Class Codes	Description	Status	Exceptions/Modifier	Buffer Width
Palustrine	Unconsolidated Shore (US)	wetlands	included, with modifiers	R (seasonally flooded - tidal) – excluded; see Table I-16	150 feet
Palustrine	Moss/Lichen (ML)	wetlands dominated by moss or lichen	included	S (temporarily flooded - tidal) – excluded; see Table I-16	150 feet
Palustrine	Emergent (EM)	wetlands dominated by emergent vegetation	included	See Table I-16	150 feet
Palustrine	Scrub-Shrub (SS)	wetlands dominated by scrub or shrub	included	See Table I-16	150 feet
Palustrine	Forested (FO)	wetlands dominated by forest vegetation	included	See Table I-16	150 feet

Table I-19: NWI Special Modifiers

Special Modifier	Description	Status
b	beaver	included
d	partly drained/ditched	excluded
f	farmed	excluded
r	artificial	excluded
s	spoint	excluded
h	diked/impounded	excluded
x	excavated	excluded

After selectively filtering the NWI for the desired palustrine wetlands the dataset was compared to the forest meadows dataset created for California's Forest and Range Lands: 2010 Assessment (CALFIRE, 2010). The forest meadows dataset used for the California assessment used a California-specific vegetation layer with vegetation classified using the WHR (wildlife habitat relationship) classifications as well as USFS meadows classifications for the Sierra Nevada. The two datasets compared favorably, with the NWI accounting for over 75% of the forest meadows dataset. It should be noted that the NWI dataset is much more specifically targeted at wetland areas while the forest meadows dataset more loosely interprets vegetation type as being wetland related and so may over-estimate the presence of forest wetlands.

Creating the Buffers and Footprints
After selecting the correct features from the NHD and NWI they were buffered. The first step in buffering was to separate lines from polygons, and intermittent from perennial.

Intermittent Polygon:
NHDWaterbody pond/lake
NHDArea double sided wash
(buffer = 75ft)

Perennial Polygon:
NHDWaterbody pond/lake
NHDArea double sided streams/rivers
(buffer = 150ft)

Intermittent Line:
NHDFlowline stream/river
(buffer = 75ft)

Perennial Line:
NHDFlowline stream/river
(buffer = 150ft)

After all the buffers were generated, they were all merged into one polygon feature class.

Fire-sensitive Variables
In addition to representing the spatial footprint of the riparian zone, this model provides the option of analyzing fire sensitive variables that occur within the riparian zone. For this assessment we chose to represent two primary ecological values: water quality and quantity and wildlife habitat.

Wildlife Habitat

LandFire vegetation classification schemes were used as a proxy for wildlife habitat. The SYSTEMGR_2 classification from vegetation type was chosen as the most suitable, representative of basic habitat types across all western states.

It was classified as follows to depict habitat quality and susceptibility to fire:

Non Vegetated = 0
Developed = 0
Agricultural = 0
Exotic Herbaceous = 1
Exotic tree-shrub = 1
Grassland = 1
Shrubland = 2

Hardwood = 3
Conifer = 3
Conifer Hardwood = 3
Riparian = 3

Water Quality and Quantity

We chose to use erosion potential (K-factor) and annual average precipitation as the key variables in modeling water quality and quantity.

Average annual precipitation is used to model the amount of available water. It is a grid developed by the PRISM climate group at Oregon State University (http://www.prism.oregonstate.edu/). The grid covers the entire continental US (sorry AK, HI, and Pacific Islands…) with 800 meter resolution and averages precipitation annuals from 1971 to 2000.

The K-factor is used in the Universal Soil Loss Equation (USLE) and represents a relative index of susceptibility of bare, cultivated soil to particle detachment and transport by rainfall. As it predicts erodibility, it also infers the probability of sediment in the stream as well as stream sedimentation. Thus, kfactor can be used as a model for effects on both water quality and aquatic habitat. In this case, we are using it to model the effect on water quality. The erosion potential (Kfactor) grid is developed by Pennsylvania State University (http://www.soilinfo.psu.edu/index.cgi?index.html). The resolution is 1000 meters.

Riparian Model

The model is built in four steps, with some initial pre-processing of the grids:

0) Pre-processing of grids:
    a. PRISM – clip to unit of analysis level; resample to 30m
    b. Kfactor – clip to unit of analysis level; resample to 30m
    c. LANDFIRE – assemble tiles; clip to unit of analysis level; join table

1.) Use of established datasets to establish riparian extent, to be called the footprint.
    a. Select codes from NHD (see table I-14)
    b. Select codes from NWI (see table I-15)
    c. Separate point, line, and polygon
        ii. Separate intermittent and perennial point, line polygon
    d. Buffer intermittent and perennial point, line polygon (see tables I-14 and I-15 for buffer widths)
    e. Merge all buffers

2.) Mask each variable grid to the established footprint; rank each grid

a. **Landfire EVT Grid**: create vegetation_rank (simple integer) field; rank on SystemGr_2 attribute as follows:
Agriculture = 0
Developed = 0
Non-vegetated = 0
Sparsely Vegetated = 0
Exotic Herbaceous = 1
Exotic Tree-Shrub = 1
Grassland = 1
Shrubland = 2
Hardwood = 3
Riparian = 3
Conifer-Hardwood = 3
Conifer = 3

b. **Landfire Slope GRID:** create slope_rank (simple integer) field; rank on value attribute (= degree slope) as follows:
0 – 5 = 1
5 – 20 = 2
>20 = 3

c. **PRISM** – rank on value (= mm x 1000) as follows:
Use natural breaks (Jenks) to categorize precipitation into 3 breaks.
Lowest category = 1
Middle category = 2
High category = 3

Note*: For west wide processing, the PRISM data for all 15 western states were categorized into the 3 natural breaks (Jenks) and ranked into the categories above.*

d. **Kfactor** – rank on kfactor as follows:
0 – 0.2 = 1
0.2 – 0.4 = 2
>0.4 = 3

3.) Create Erosion Rank by combining slope, PRISM, and kfactor grids and attribute as follows:

a. Create Erosion (float) attribute field
    i. Attribute as: (slope + PRISM + Kfactor)/3

b. Create Erosion Rank (simple integer) field, attribute as follows:
   1 – 1.6 = 1
   1.6 – 2 = 2
   >2 = 3

4.) Create Riparian Rank by combining Erosion Rank and Vegetation Rank

a. Create Riparian Index (simple integer) field
    i. Attribute as: (vegetation_rank + erosion_rank)

b. Create Riparian Rank (simple integer) field; attribute as follows:
   0 = 0
   1 – 3 = 1
   4 = 2
   5-6 = 3

(ftslprc + ftpptrc + ftkf)/3

Filling data gaps for RA modeling in Alaska and Hawaii

As noted above, RA modeling for the West Wide Wildfire Risk Assessment requires a number of input datasets. Some of these datasets, erosion data (K-Factor) and Precipitation (PPT), were not available from the primary data providers for Alaska and Hawaii; both were missing in Alaska and the latter was missing for Hawaii.

Precipitation

Precipitation for Alaska is distributed from the National Park Service, Integrated Resource Management Applications (https://irma.nps.gov/App/Reference/Profile/2170508).

Erosion

Unfortunately, the data provider for K-Factor at Penn State University and the USDA-NRCS-NSSC Geospatial Research Unit do not distribute HI and AK (http://www.soilinfo.psu.edu/index.cgi?soil_data&conus&data_cov&k). The best option for modeling the K-Factor dataset was to download the raw STATSGO data and aggregate the map unit information for the K-factor variable. Raw STATSGO data was provided by the Penn State group. Since K-Factor is a surface soil factor, modeling the multiple layers in CONUS-SOIL is unnecessary. Using the MAPUNIT and COMPPCT tables, the map unit components are factored by their percentage (COMPPCT) to create a "weighted" MAPUNIT K-factor. This method sums the surface horizon kfactor fields by map unit that have been weighted by their map unit area. Here is a summary of the model:

-Select the surface layer values. Select ‘hzname’ = “H1”

-Create area weighted value for kfactor fields.

[‘kwfact’ * (‘comppct_r’ * 0.01)] = ‘wkwf’

[‘kffact’ * (‘comppct_r’ * 0.01)] = ‘wkff’

-Sum weighted kfactor fields by map unit

arcpy.Statistics_analysis(input_table, ‘table_field.wkwf’, SUM, "mukey")

One of the main caveats of these data is that the scale of AK STATSGO2 is 1:1,000,000 whereas the Lower 48 States and HI were 1:250,000. So, averaging across the map unit has a different meaning at this scale and will likely have the effect of damping down the values in AK.

NWI

For some areas, National Wetlands Inventory data was lacking. For the most part, the absence of this data did not impact the development of the RA dataset. However, as seen in Figure I-2, there were extensive areas with abrupt edges in the extent of NWI that caused seam line issues in early versions of the RA dataset in Alaska.

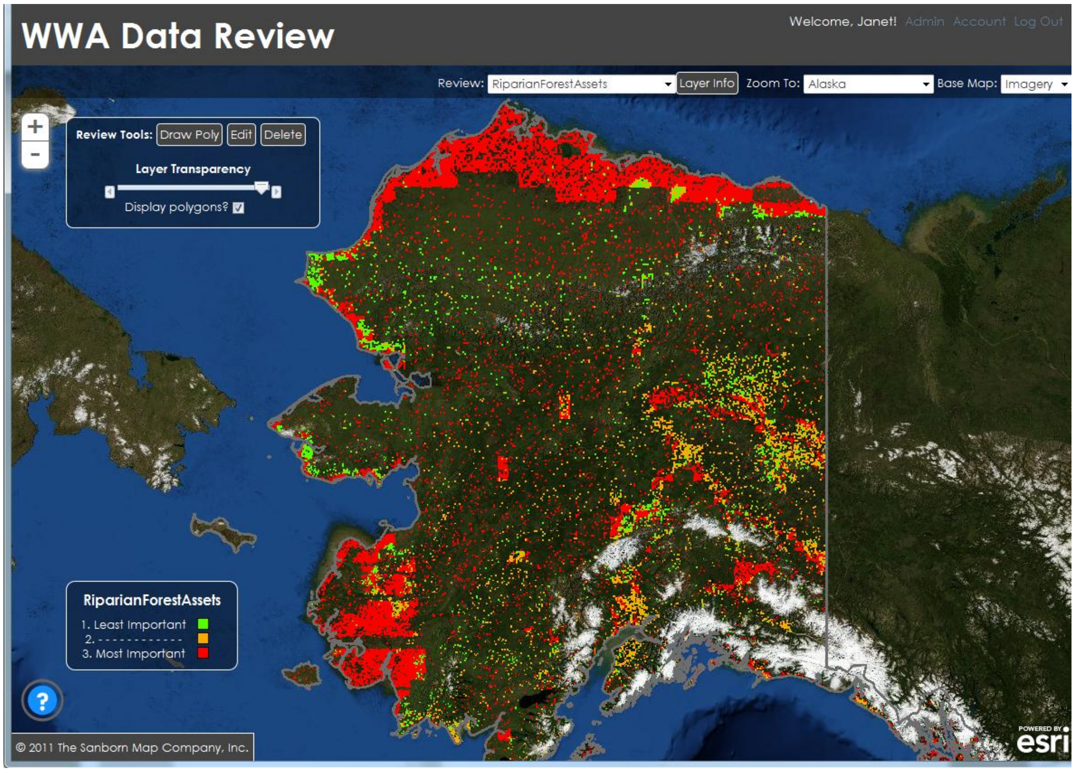

Figure I-2. Example showing stark seam lines in an early version of the Alaska RA dataset due to the extents in the NWI dataset.

Fortunately, an alternative wetlands dataset developed by NASA's Jet Propulsion Laboratory in California was available for Alaska. This dataset was developed using the NWI dataset as well as data from the Alaska Geospatial Data Clearinghouse for training data, and resulted in classes similar to the NWI classes. While this dataset lacked a few of the classes in NWI (aquatic beds and unconsolidated shore) and did not provide modifiers for eliminating constructed features, such as reservoirs and impoundments, it provided a good alternative throughout Alaska that was much more comprehensive and consistent than the NWI dataset. It could therefore be substituted quite readily for the NWI dataset in the RA process. More information on this dataset can be found at http://wetlands.jpl.nasa.gov/products/alaska_wetland.html.

The data was resampled from 100m to 30m. The 30m dataset was then converted to a polygon feature class. All palustrine classes were recoded to 1's and the rest of the classes to 0's, creating a binary mask for palustrine/non-palustrine. This mask was then used as the NWI surrogate in the main RA process stated above.

Wildland Development Areas

Introduction

Wildland Development Areas are a key input into the WWA Fire Effects process. This data is being used as a surrogate for the original WUI data layer to represent where people live in the wildland. More detailed LandScan data is being used instead of other WUI datasets (i.e. USFS Silvis, Theobold, local state datasets) to provide a better spatial delineation of wildland population patterns.

The following figure presents the basic WDA processing steps. These steps involve modeling the source LandScan data to derive population density, modeling this to derive housing density, and then applying a standard classification scheme to create the “where people live” dataset. This dataset is then refined via modeling to where people live in wildland areas that are threatened by fire from wildland fuels. This is the required classified integer WDA data required for the Fire Effects model. The primary deliverable of this process is a floating point grid representing housing density (in houses per sq. km.), and a classified integer grid.

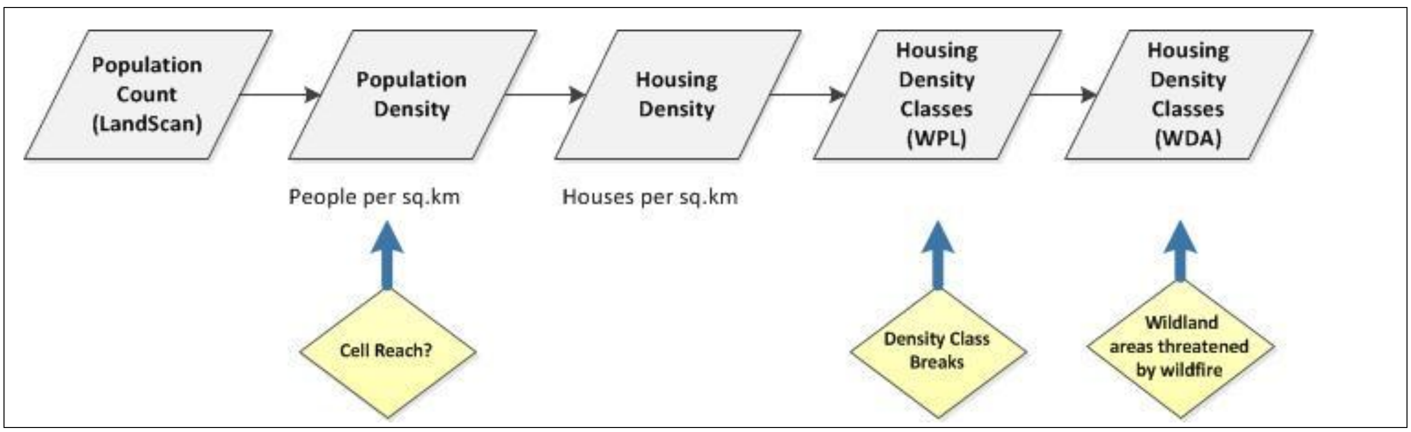

Figure I-3. Basic WDA processing steps.

Data Processing Steps

The first step involves modeling the source LandScan population count data to create a housing density dataset. This is referred to as Where People Live (or WPL). The WPL dataset can then be used to create Wildland Development Areas (WDA).

A list of data processing steps is provided. All tasks were implemented using the ArcGIS v10 Toolbox functions available within the Arc Map software.

1. **Obtain the LandScan USA 2009 dataset from the HSIP Freedom program**. This requires registration by the state agency.[4] The data is a raster GIS dataset provided in a 90m cell resolution in geographic coordinates. Note that because the population counts are compiled using forecasts from local government and modeled by the ORNL to ensure that all counts aggregate properly to match these local government source administrative boundaries, it is important that GIS staff does not attempt to implement these methods by re-projecting the LandScan data to another GIS map projection. The steps described in this section should be conducted in the native geographic coordinates of the LandScan data. Please refer to the ORNL LandScan web site for more information about these processing guidelines.[5]

   LandScan data is available for both day time and night time. The night time data, representing where people are at night (homes), is used in these methods. Day time data is not used. For more information about the LandScan data please refer to the ORNL web site.

2. **Using LandScan night time data, convert all zero values to null data**. This is required to ensure the smoothing techniques do not include zeros in the calculations.
   a. Use Set Null in the Spatial Analyst toolbox
      i. Input Raster: LandScan Night Time grid
      ii. Expression: Value = 0
      iii. Input false raster: LandScan Night Time grid
3. **Convert LandScan raster data to point data**. This step ensures population counts do not change during the reprojection process. The following ArcGIS commands can be used:
   a. Use Raster to Point tool in the Conversion Tools/From Raster toolbox
      i. Field: Value
4. **Project points to a projected coordinate system**.
   a. The following ArcGIS commands can be used:
      i. Use Data Management Tools/Projections and Transformations/Feature/Project
5. **Convert reprojected points back to 90m cell size raster, summarizing by grid code.**

[4] Note that the LandScan USA 2009 dataset was obtained by the contractor on behalf of the Oregon Department of Forestry. Accordingly, this data is provided with the pilot project results and can be utilized directly by the states to implement the new methods. Nonetheless, we suggest the individual states register for the DHS HSIP Freedom program so that future updates to LandScan can be obtained.
[5] See http://www.ornl.gov/sci/landscan/landscan_faq.shtml

a. The following ArcGIS commands can be used:
b. Use Conversion Tools/To Raster/Point to Raster
   i. Value field: grid-code
   ii. Cell Assignment: Sum
   iii. Cellsize: 90m or equivalent
c. Snap new LandScan raster to fuels
   i. Use Spatial Analyst Tools / Map Algebra / Raster Calculator
   ii. Use fuels grid as snap raster (environment settings)
   iii. LandScan / 1 = LandScan snap

6. **Create a water mask.** This mask will be used to keep population densities out of water areas.
   a. Extract "water" from LANDFIRE fuel grid using Spatial Analyst Tools/Con Tool
      i. Water = NoData
      ii. Everything else = 1
7. **Resample water mask**. The water mask must be resampled to 90m cell size to match the LandScan data.
   a. Resample 30m Water mask to 90m
      i. Data Management Tools/ Raster/ Raster Processing/Resample
      ii. Use Environment variables to snap to LandScan snap raster
8. **Create a <u>population sum map</u> by using a focal statistics sum operation**. This function will *look out* from each cell, summing all other population cells within a predefined proximity. The result is a population sum map that shows areas of population concentration. Parameters for the smoothing can vary, however the following criteria was decided by the WWA Project Steering Committee:
   a. Use Spatial Analyst Tools/Neighborhood/Focal Statistics Tool
      i. Neighborhood: Circle
      ii. Radius: 3 Cell
      iii. Statistics: Sum
      iv. Ignore NoData in calculations (default is checked)
   b. Mask output so all water areas are NoData
      i. Use Spatial Analyst Tools / Map Algebra / Raster Calculator
      ii. Use 90m water grid as mask (environment settings)
      iii. population sum / 1 = populated sum masked

9. **Create a habitable areas map using focal statistics sum operation.** This function will summarize habitable cells (i.e. non water) within the same focal area used in the population sum calculation.

a. Use Spatial Analyst Tools/Neighborhood/Focal Statistics Tool
    i. Input raster = 90m Water mask
    ii. Neighborhood: Circle
    iii. Radius: 3 Cell
    iv. Statistics: Sum
    v. Ignore NoData in calculations (default is checked)
b. Mask output so all water areas are NoData
    i. Use Spatial Analyst Tools / Map Algebra / Raster Calculator
    ii. Use 90m water grid as mask (environment settings)
    iii. habitable areas sum / 1 = habitable areas masked

10. **Create Habitable Area Sq KM grid.** Calculate the habitable (non-water) area for the focal neighborhood in square kilometers.
    a. Using Spatial Analyst Tools/Map Algebra/Raster Calculator
        i. habitable areas masked * 0.0081
            1. area of a cell is 90 * 90 = 8,100 square meters
            2. 1,000 * 1,000 meters in a square kilometer = 1,000,000
            3. 8,100 / 1,000,000 = 0.0081 square kilometers in a cell
11. **Create a <u>population density map</u> from the population sum and habitable areas sq km maps**. This involves calculating actual per area density from the sum map.
    a. Population Sum raster / Habitable Area Sq KM raster = population density per sq km
        i. This is implemented by using a simple Arc Map raster calculator equation.
12. **Create a <u>housing density map</u> from the population density map.** This step involves using the Person Per Household (PPH) values obtained from the 2010 Census to complete this calculation.
    a. Download Census 2010 Occupancy Status data for each state by county[6]
    b. Calculate People Per Housing unit (PPH) by dividing total population by total housing units (create PPH field as double precision 5 and scale 2)
    c. Join PPH table to county boundary feature class
    d. Convert county boundary polygons to 90m raster using PPH as value field
        i. Use Environment variables to snap to LandScan snap raster
    e. Housing Density = Population Density raster / PPH raster
        i. This is implemented by using a simple Arc Map raster calculator equation.
13. **Resample Housing and Population Density to 30m.** The housing and population density rasters must be resampled to 30m for final delivery and use in the Fire Effects model.

[6] This data can be downloaded from the web site at http://factfinder2.census.gov

a. Use Data Management Tools/ Raster/ Raster Processing/Resample

   i. 30m cell size

   ii. set 30m water grid as the environment mask

   iii. snap to fuels

b. Mask output so all 30 m water areas are NoData

   i. Use Spatial Analyst Tools / Map Algebra / Raster Calculator

   ii. Use 30m water grid as mask (environment settings)

   iii. Hsedens or popdens grid / 1 = hsedens or popdens masked

c. Using predefined housing density thresholds you can now create a housing density class map. It was decided that a seven (7) class map would be created to represent **Where People Live.**

d. The WWA Project Steering Committee has decided on the following classes (HU = Housing Unit):

Table I-20. Housing density classes used in the WWA

Class	From	To	Houses per acre	General Name
1	0.000001	6.177635	Less than 1 HU / 40 acres	Below Density Rating
2	6.177635	12.355269	1 HU / 40 acres to 1 HU / 20 acres	Very Low
3	12.355269	24.710538	1 HU / 20 acres to 1 HU / 10 acres	Low
4	24.710538	49.42	1 HU / 10 acres to 1 HU / 5 acres	Medium
5	49.42	123.55269	1 HU / 5 acres to 1 HU / 2 acres	Medium-High
6	123.55269	741.31614	1 HU / 2 acres to 3 HU / acre	High
7	741.31614	100,000	More than 3 HU / acre	Very High

The WPL and WDA datasets have been derived to represent the number of houses per square kilometer, consistent with Federal Register and USFS Silvis datasets. However, to aid in the interpretation and use of this data, the legends are presented in "houses per acre". This was done to adhere to traditional use and understanding of this data by planners.

14. Develop WDA

a. Because the WWA is concerned with effects of wildland fire, the “where people live” dataset was masked to represent wildland areas that are threatened by fire from wildland fuels. The WWA staff, in coordination with some state representatives and the project manager, developed rule sets and a process to define areas where people and homes are threatened by fire from wildland fuels. This process coincided with the one described previously regarding refinement of the surface fuels burnable area, and resulted in the Wildland Development Areas dataset. The final thresholds used to develop WDA are identified in Table I-13.

Output Data

The outputs for these tasks are:

- Population density raster dataset (people per sq. km). This is a floating point grid where each grid cell has a population density value. This is referred to as Population Density.
- Housing density raster dataset (houses per sq. km.). This is a floating point grid where each grid cell has a housing density value. This is referred to as WPL.
- Classified housing density (integer grid). This is the thematic WPL grid with housing densities binned into the 7 WWA housing density classes. It is referred to as classified WPL.
- Housing density in wildland areas that are threatened by fire from wildland fuels (floating point grid). This is referred to as WDA.
- Classified housing density in wildland areas that are threatened by fire from wildland fuels (integer grid). This is referred to as Classified WDA and the grid that was used in the Fire Effects model.

Potential Future Updates

In future updates to the WWA, it may be worth investigating possible data sources for vacation and secondary homes. Initial investigation has found that the 2010 Census while being a poor source for wildland population, does in fact, often capture vacation areas (i.e. around lakes) quite well. In future, the Census data for these areas could be combined with the LandScan data to accommodate for these areas. Processing techniques would have to be developed to extract this data from the Census data and combine it with the source LandScan data prior to developing WDAs.

Infrastructure Assets

This layer identifies key infrastructure assets, such as schools, airports, hospitals, roads and railroads that are susceptible to adverse effects from wildfires. These features are combined into a single data set and buffered to reflect areas of concern surrounding the assets. Roads and railroads use a 300-meter buffer while schools, airports and hospitals use a 500-meter buffer.

A cell is considered as being in the Infrastructure Asset layer if it falls in at least one of the buffers noted above. The Infrastructure Asset Value Impacted 1 represents a cell that is within one or more buffers of defined infrastructure.

Data Sources

The primary source of the infrastructure layer was the ESRI v10 Data. Feedback from state representatives during the data review stage resulted in manual adjustments to a handful of features, such as the removal of a railroad in Washington that was known to be incorrect. In addition, Alaska provided a point dataset to that was used in place of the ESRI data as it provided more coverage than the ESRI data.

Roads: ESRI 10 Streetmap Tele Atlas North America, Inc. roads data provided Level 1-3 roads. Level 1-3 roads are Arterial Classification Code (ACC) codes 1-3. ACC is the Tele Atlas® system for categorizing roads according to the level of travel mobility that they provide in the road network. Mobility refers to the volume of traffic that a stretch of road carries and the length of trip that it serves. Below are the definitions for each level:

> 1 = North America/Continental and Inter-State (and Province); Routing importance - Largest/Longest Highways, Connect Major/Largest Cities, "Coast-to-Coast" Origin to Destination, Inter-State (and Province) Commerce/Travel, and Intra-State (and Province) Commerce/Travel.
>
> 2 = Inter-Metropolitan Area; Routing importance - Long/Large Highways, Beltways/Secondary Freeways, and Connect Major Cities.
>
> 3 = Intra-State (and Province), Intra-Metropolitan Area, and Inter-Metropolitan Area; Routing importance - Medium Highways, U.S./State Highway Network, Connect Minor Cities, Intra-State (and Province) Commerce, and Recreational Travel.

Railroads: The ESRI 10Streetmap Tele Atlas North America, Inc railroads data provided by ESRI were used for the railroads dataset.

Schools: The ESRI 10 institutions data and the GNIS schools data provided by ESRI (historical schools removed) were used to develop the schools dataset. Duplicate schools between the two datasets were removed.

Hospitals: The ESRI 10 Institutions data was used for identifying hospitals. While the GNIS hospitals data from ESRI added a significant number of facilities not in the Institutions dataset, these were largely clinics, nursing homes, and urgent care and chiropractic facilities. Because the goal was to identify hospitals the source for hospitals was limited to the ESRI 10 Institutions data.

Airports: Both the point and polygon data from ESRI were used for the airports dataset. These data were merged and duplicates were removed.

Populated Alaska Places: Alaska Department of Natural Resources – Information Resource Management Section provided a point dataset called "Populated Alaska Places" representing locations of statewide towns and villages. The supplemental data for Alaska was used in addition to the standard datasets due to the sparse ESRI input data for the state.

Data Processing Steps

1. Select Road Levels 1-3 (ACC = 1, 2, and 3)
2. Remove ferry routes from selected Road Levels 1-3 (FCC = A65, A66 ,A68 and A69)
3. Buffer Airports, Hospitals, AK cultural points , and Schools by 500m
4. Buffer Road Levels 1-3 and Railroads datasets by 300m
5. Convert Airports, Schools, Hospitals, Railroads, Roads1-3, and AK cultural points buffered data to a grid with value 1
6. Mosaic grids together to create an Infrastructure grid with value 1

Other Known Data Issues

When doing a project of this scale where the use of 'best available' data is a necessity for completing the project, errors and issues with input datasets are expected. In some cases the WWA Technical Team has been able to correct these issues. In other cases this was not possible. These known errors and issues are identified in this section. Issues have been identified for the following datasets:

- LANDFIRE
- Alaska Administrative Boundaries
- Hawaii Administrative Boundaries
- Wildland Development Areas
- Weather

LANDFIRE

Surface fuels, canopy characteristics, and topography data were compiled from LANDFIRE and serve as the baseline raster data for the risk assessment. However, all risk assessment data was tiled by county using the ESRI DATA county boundaries. Notable errors discovered during the tiling process were:

- The ESRI county boundaries do not align with the coastal boundaries of the LANDFIRE datasets in OR, WA, CA, and especially noticeable in AK.
- LANDFIRE data for AK is missing islands and some coastal areas. This is a documented issue with LANDFIRE.
- LANDFIRE does not cover the westernmost Aleutian Islands.
- LANDFIRE is missing the small (0.23 square miles) island of Ka'ula in Kauai County, Hawaii.
- Seamlines in the data between LANDIFRE zones may occur.

Figure I-4 and I-5 illustrate several of these issues. Figure I-4 shows both the misalignment between the ESRI county boundaries (red line) with the coastline of Alaska and the LANDFIRE extent. In addition, it identifies areas where the LANDFIRE data appears to be clipped off, missing some coastal lands as well as islands.

Using the ESRI county boundaries to clip the LANDFIRE data in these coastal counties would exclude areas where LANDFIRE has mapped fuel models resulting in those areas being completely excluded from the risk assessment. To capture these areas in the assessment the WWA Technical Team modified the county boundaries dataset so that the county boundaries would align with the LANDFIRE coastal boundaries.

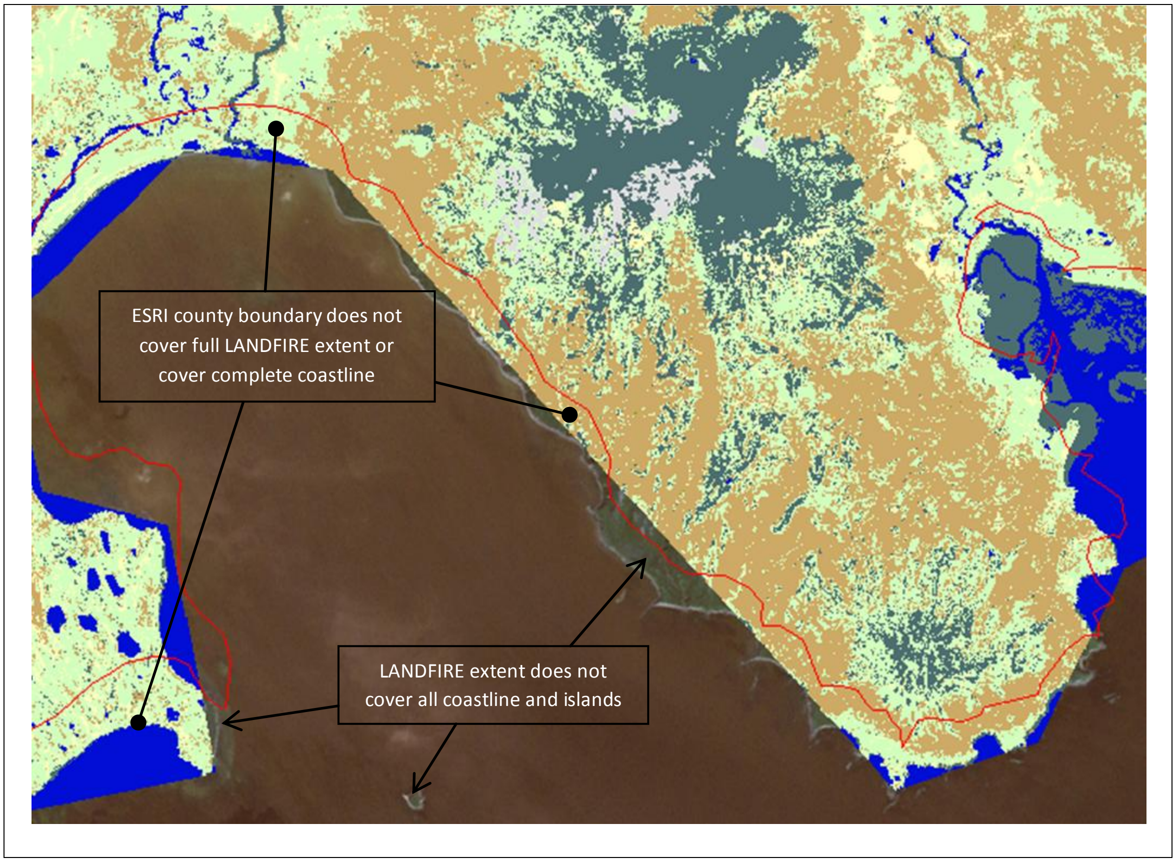

Figure I-4. Alaska example showing the misalignment of the ESRI county boundary (red) and the LANDFIRE data boundary (thematic layer) as well as areas where LANDFIRE missed classifying some coastline and islands.

Figure I-5 shows the westernmost portion of the Aleutian Islands that are not covered by LANDFIRE data. Unfortunately, there was no way to fix the missing LANDFIRE data in the Aleutian Islands and the missing Hawaiian island and therefore these areas have been excluded from the risk assessment.

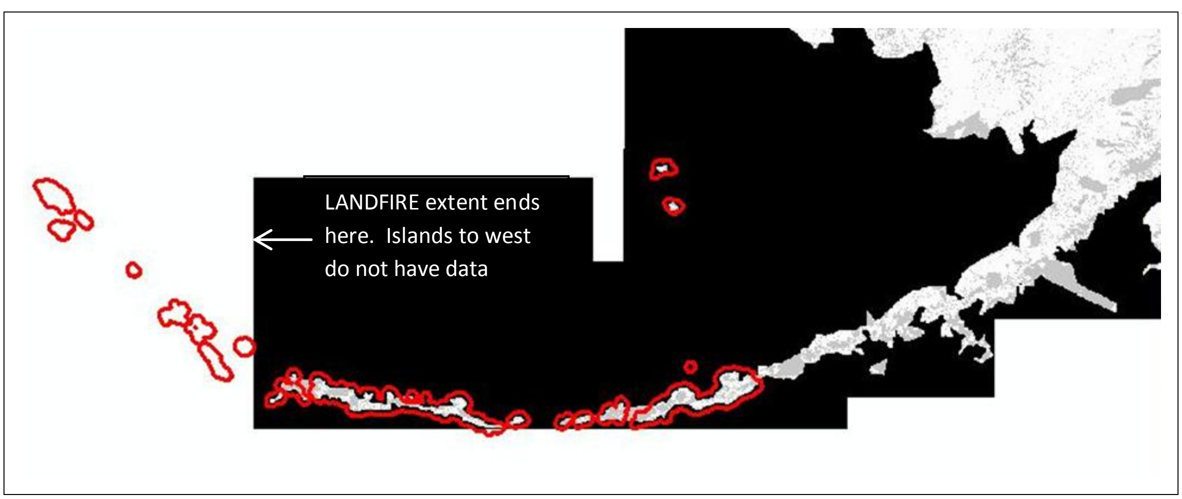

Figure I-5. Example showing missing Aleutian Islands (red) with LANDFIRE data source extent (black).

Alaska Administrative Boundaries

In addition to not coinciding with the LANDFIRE data boundaries, the ESRI county boundaries for AK do not include islands in the inner waterways. Using the ESRI county boundaries in AK would therefore result in these islands being excluded from the risk assessment. Figure I-6 presents an example with the missed islands shown in **RED**. Accordingly, the WWA Technical Team investigated two alternative data sources:

- Alaska provided a dataset of their boroughs; however, the borough dataset does not cover the entire state.
- The 2010 TigerLine census county data was obtained from the US Census Bureau. This dataset does include islands in the waterways and is complete for the entire state.

For Alaska, the TigerLine census county data was combined with the Alaska borough data and used for the assessment. This provided complete coverage and addressed the missing data issues.

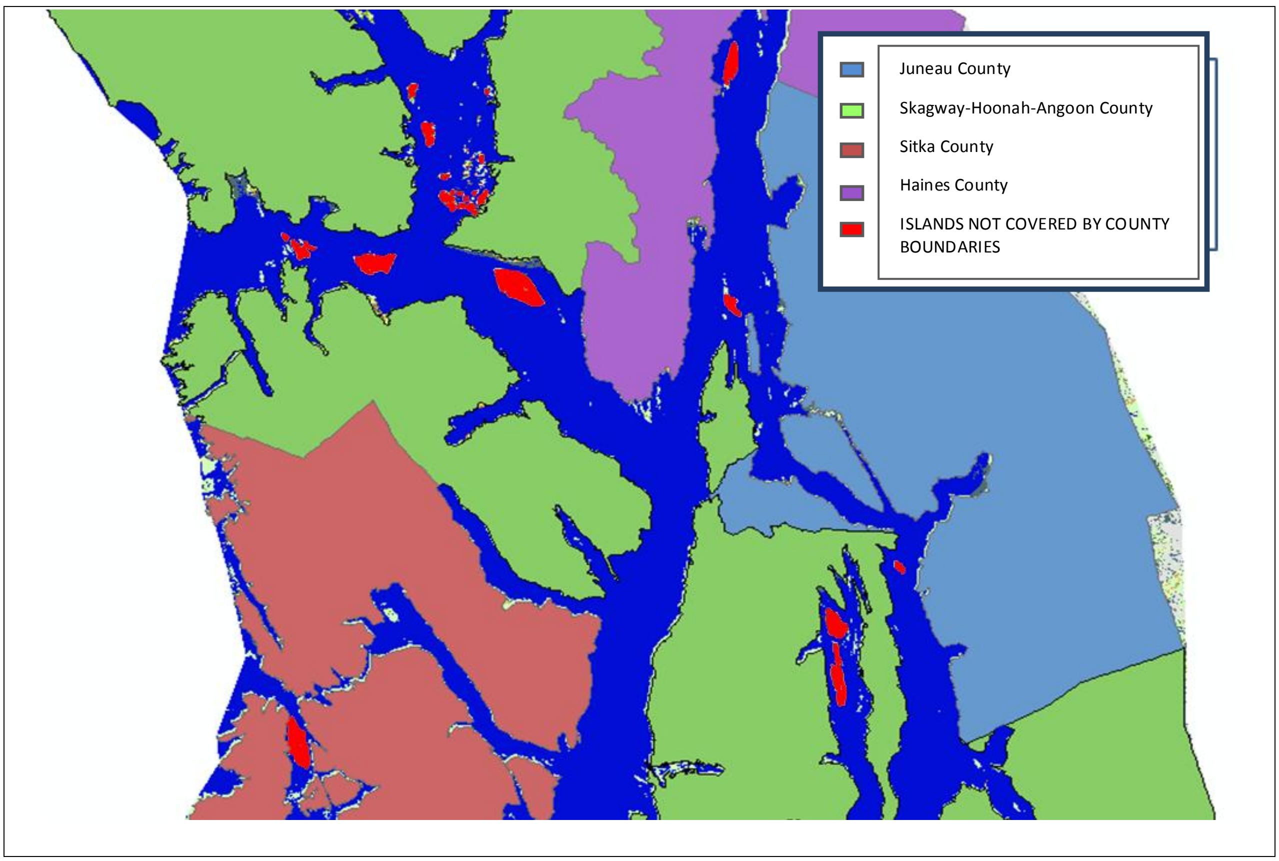

Figure I-6. ESRI county boundaries missing islands (red) in AK inland waterways.

Hawaii Administrative Boundaries

The ESRI county boundary dataset for HI does not include the small island of Lehua; however LANDFIRE data exists for this island. To address this issue the island boundary was added to the ESRI county boundary data to be used for the WWA.

Wildland Development Areas

Source data for the Wildland Development Areas (WDA) includes the Oak Ridge National Laboratory LandScan global population distribution dataset. This dataset is based on the use of night-time imagery and reflects ambient population. WDAs were derived using the LandScan data to represent housing density. The spatial resolution of this data is ideal for representing population in wildland areas.

Considerable testing and evaluation of the source LandScan data was conducted in several states across the West. It was found that due to its reliance on nighttime imagery LandScan does miss vacation and secondary home locations. This is often prevalent in vacation communities, such as those often found on lake edges. There were also areas found where LandScan data indicated population in remote areas with no population.

Weather

Weather observations are compiled for each Weather Influence Zone to support the development of percentile weather information. In most cases weather observations were obtained from NFDRS weather stations. However there were some WIZs that do not have an adequate number of NFDRS weather stations. In these WIZs, weather observations were obtained from NOAA, National Weather Service stations.

Appendix A: Forest Assets EVT Crosswalk to Susceptibility Class

EVT Value	EVT_Name	SAF_SRM	Sensitivity/ response code	Comment
2008	North Pacific Oak Woodland	SAF 233: Oregon White Oak	2	Large trees resistant, but also a sprouter
2009	Northwestern Great Plains Aspen Forest and Parkland	SAF 217: Aspen	3	sprouter
2010	Northern Rocky Mountain Western Larch Savanna	SAF 212: Western Larch	2	
2011	Rocky Mountain Aspen Forest and Woodland	SAF 217: Aspen	3	sprouter
2012	Rocky Mountain Bigtooth Maple Ravine Woodland	SRM 418: Bigtooth Maple	3	sprouter
2013	Western Great Plains Dry Bur Oak Forest and Woodland	SAF 236: Bur Oak	2	large trees resistant, but also a sprouter
2014	Central and Southern California Mixed Evergreen Woodland	SAF 249: Canyon Live Oak	3	sprouter
2015	California Coastal Redwood Forest	SAF 232: Redwood	2	
2016	Colorado Plateau Pinyon-Juniper Woodland	SRM 504: Juniper-Pinyon Pine Woodland	2	large trees resistant to low-moderate intensity, mortality depends on crown consumption, also depends on percent composition of pinyon, risk of invasive post fire
2017	Columbia Plateau Western Juniper Woodland and Savanna	SRM 107: Western Juniper-Big Sagebrush-Bluebunch Wheatgrass	2	large trees resistant to low-moderate intensity, mortality depends on crown consumption, high risk of invasive post fire
2018	East Cascades Mesic Montane Mixed-Conifer Forest and Woodland	SAF 213: Grand Fir	1	close to 2 - large trees can survive low intensity fire, may be killed by moderate intensity fire
2019	Great Basin Pinyon-Juniper Woodland	SRM 412: Juniper-Pinyon Woodland	2	large trees resistant to low-moderate intensity, mortality depends on crown consumption, also depends on percent composition of pinyon, risk of invasive post fire
2020	Inter-Mountain Basins Subalpine Limber-Bristlecone Pine Woodland	SAF 209: Bristlecone Pine	1	
2021	Klamath-Siskiyou Lower Montane Serpentine Mixed Conifer Woodland	SAF 231: Port Orford-Cedar	2	

EVT Value	EVT_Name	SAF_SRM	Sensitivity/ response code	Comment
2022	Klamath-Siskiyou Upper Montane Serpentine Mixed Conifer Woodland	SAF 248: Knobcone Pine	3	serotinous cones
2023	Madrean Encinal	SAF 241: Western Live Oak	3	some spouting
2024	Madrean Lower Montane Pine-Oak Forest and Woodland	SAF 241: Western Live Oak	3	some spouting
2025	Madrean Pinyon-Juniper Woodland	SRM 504: Juniper-Pinyon Pine Woodland	2	large trees resistant to low-moderate intensity, mortality depends on crown consumption, also depends on percent composition of pinyon, risk of invasive postfire
2026	Madrean Upper Montane Conifer-Oak Forest and Woodland	SAF 241: Western Live Oak	3	some spouting
2027	Mediterranean California Dry-Mesic Mixed Conifer Forest and Woodland	SAF 243: Sierra Nevada Mixed Conifer	2	
2028	Mediterranean California Mesic Mixed Conifer Forest and Woodland	SAF 211: White Fir	1	close to 2 - large trees can survive low intensity fire, but may be killed by moderate intensity fire
2029	Mediterranean California Mixed Oak Woodland	SAF 246: California Black Oak	2	large trees resistant, but also a sprouter
2030	Mediterranean California Lower Montane Black Oak-Conifer Forest and Woodland	SAF 246: California Black Oak	2	large trees resistant, but also a sprouter
2031	California Montane Jeffrey Pine(-Ponderosa Pine) Woodland	SAF 247: Jeffrey Pine	2	
2032	Mediterranean California Red Fir Forest	SAF 207: Red Fir	2	somewhere between Douglas-fir and grand/white fir in fire resistance, large trees able to survive low intensity fire, unclear about ability to survive moderate intensity fire
2033	Mediterranean California Subalpine Woodland	SAF 256: California Mixed Subalpine	1	whitebark pine
2034	Mediterranean California Mesic Serpentine Woodland and Chaparral	SAF 248: Knobcone Pine	3	serotinous cones
2035	North Pacific Dry Douglas-fir(-Madrone) Forest and Woodland	SAF 229: Pacific Douglas-Fir	2	
2036	North Pacific Hypermaritime Seasonal Sitka Spruce Forest	SAF 223: Sitka Spruce	1	

EVT Value	EVT_Name	SAF_SRM	Sensitivity/ response code	Comment
2037	North Pacific Maritime Dry-Mesic Douglas-fir-Western Hemlock Forest	SAF 230: Douglas-Fir-Western Hemlock	2	close to 1 but depends on percent composition of western hemlock
2038	North Pacific Maritime Mesic Subalpine Parkland	SAF 205: Mountain Hemlock	1	
2039	North Pacific Maritime Mesic-Wet Douglas-fir-Western Hemlock Forest	SAF 230: Douglas-Fir-Western Hemlock	2	close to 1, but depends on percent composition of western hemlock
2040	North Pacific Mesic Western Hemlock-Yellow-cedar Forest	SAF 224: Western Hemlock	1	
2041	North Pacific Mountain Hemlock Forest	SAF 205: Mountain Hemlock	1	
2042	North Pacific Mesic Western Hemlock-Silver Fir Forest	SAF 226: Coastal True Fir-Hemlock	1	
2043	Mediterranean California Mixed Evergreen Forest	SAF 234: Douglas-Fir-Tanoak-Pacific Madrone	2	close to 3, large percentage of sprouters typical
2044	Northern California Mesic Subalpine Woodland	SAF 205: Mountain Hemlock	1	
2045	Northern Rocky Mountain Dry-Mesic Montane Mixed Conifer Forest	SAF 210: Interior Douglas-Fir	2	
2046	Northern Rocky Mountain Subalpine Woodland and Parkland	SAF 208: Whitebark Pine	1	
2047	Northern Rocky Mountain Mesic Montane Mixed Conifer Forest	SAF 213: Grand Fir	2	large trees can survive low intensity fire and many may survive moderate intensity fire
2048	Northwestern Great Plains Highland White Spruce Woodland	SAF 201: White Spruce	1	
2049	Rocky Mountain Foothill Limber Pine-Juniper Woodland	SAF 219: Limber Pine	3	serotinous cones
2050	Rocky Mountain Lodgepole Pine Forest	SAF 218: Lodgepole Pine	3	serotinous cones
2051	Southern Rocky Mountain Dry-Mesic Montane Mixed Conifer Forest and Woodland	SAF 210: Interior Douglas-Fir	2	
2052	Southern Rocky Mountain Mesic Montane Mixed Conifer Forest and Woodland	SAF 211: White Fir	2	large trees can survive low intensity fire and many may survive moderate intensity fire

EVT Value	EVT_Name	SAF_SRM	Sensitivity/ response code	Comment
2053	Northern Rocky Mountain Ponderosa Pine Woodland and Savanna	SAF 237: Interior Ponderosa Pine	2	
2054	Southern Rocky Mountain Ponderosa Pine Woodland	SAF 237: Interior Ponderosa Pine	2	
2055	Rocky Mountain Subalpine Dry-Mesic Spruce-Fir Forest and Woodland	SAF 206: Engelmann Spruce-Subalpine Fir	1	
2056	Rocky Mountain Subalpine Mesic-Wet Spruce-Fir Forest and Woodland	SAF 206: Engelmann Spruce-Subalpine Fir	1	
2057	Rocky Mountain Subalpine-Montane Limber-Bristlecone Pine Woodland	SAF 209: Bristlecone Pine	1	
2058	Sierra Nevada Subalpine Lodgepole Pine Forest and Woodland	SAF 218: Lodgepole Pine	1	sierra lodgepole
2059	Southern Rocky Mountain Pinyon-Juniper Woodland	SRM 504: Juniper-Pinyon Pine Woodland	2	large trees resistant to low-moderate intensity fires, mortality depends on crown consumption, also depends on percent composition of pinyon, risk of invasives post fire
2060	East Cascades Oak-Ponderosa Pine Forest and Woodland	SAF 237: Interior Ponderosa Pine	2	
2061	Inter-Mountain Basins Aspen-Mixed Conifer Forest and Woodland	SAF 217: Aspen	3	sprouter
2062	Inter-Mountain Basins Curl-leaf Mountain Mahogany Woodland and Shrubland	SRM 415: Curlleaf Mountain-Mahogany	1	
2063	North Pacific Broadleaf Landslide Forest and Shrubland	SAF 221: Red Alder	3	sprouter
2112	California Central Valley Mixed Oak Savanna	SRM 201: Blue Oak Woodland	2	maybe 3, sprouter
2113	California Coastal Live Oak Woodland and Savanna	SAF 255: California Coast Live Oak	2	
2114	California Lower Montane Blue Oak-Foothill Pine Woodland and Savanna	SAF 250: Blue Oak-Digger Pine	2	maybe 3
2115	Inter-Mountain Basins Juniper Savanna	SRM 412: Juniper-Pinyon Woodland	2	Large trees resistant to low-moderate intensity, mortality depends on crown consumption, risk of invasives post fire

EVT Value	EVT_Name	SAF_SRM	Sensitivity/ response code	Comment
2116	Madrean Juniper Savanna	SRM 735: Sideoats Grama-Sumac-Juniper	2	large trees resistant to low-moderate intensity, mortality depends on crown consumption
2117	Southern Rocky Mountain Ponderosa Pine Savanna	SAF 237: Interior Ponderosa Pine	2	
2118	Southern California Oak Woodland and Savanna	SAF 255: California Coast Live Oak	2	
2119	Southern Rocky Mountain Juniper Woodland and Savanna	SRM 504: Juniper-Pinyon Pine Woodland	2	large trees resistant to low-moderate intensity, mortality depends on crown consumption, risk of invasives post-fire
2120	Willamette Valley Upland Prairie and Savanna	SAF 233: Oregon White Oak	2	large trees resistant, but also a sprouter
2151	California Central Valley Riparian Woodland and Shrubland	SRM 203: Riparian Woodland	1	assigned 1 due to 5 of 5 likelihood of invasives
2152	California Montane Riparian Systems	SRM 203: Riparian Woodland	1	assigned 1 due to3 of 5 likelihood of invasives
2154	Inter-Mountain Basins Montane Riparian Systems	SAF 235: Cottonwood-Willow	1	assigned 1 due to 3 of 5 likelihood of invasives - otherwise a spouter
2155	North American Warm Desert Riparian Systems	SRM 203: Riparian Woodland	3	assigned 1 due to 5 of 5 likelihood of invasives
2156	North Pacific Lowland Riparian Forest and Shrubland	SAF 222: Black Cottonwood-Willow	3	sprouter
2157	North Pacific Swamp Systems	SAF 222: Black Cottonwood-Willow	3	sprouter
2158	North Pacific Montane Riparian Woodland and Shrubland	SAF 222: Black Cottonwood-Willow	1	assigned 1 due to 4 of 5 likelihood of invasives -otherwise a sprouter
2159	Rocky Mountain Montane Riparian Systems	SAF 235: Cottonwood-Willow	1	assigned 1 due to 3 of 5 likelihood of invasives
2161	Northern Rocky Mountain Conifer Swamp	SAF 235: Cottonwood-Willow	3	sprouter
2162	Western Great Plains Floodplain Systems	LF 42: Great Plains Riparian	1	assigned 1 due to 4 of 5 likelihood of invasives - otherwise for black cottonwood, 1 for eastern cottonwood -
2165	Northern Rocky Mountain Foothill Conifer Wooded Steppe	SRM 109: Ponderosa Pine-Shrubland	2	
2166	Middle Rocky Mountain Montane Douglas-fir Forest and Woodland	SAF 210: Interior Douglas-Fir	2	
2167	Rocky Mountain Poor-Site Lodgepole Pine Forest	SAF 218: Lodgepole Pine	3	serotinous cones

EVT Value	EVT_Name	SAF_SRM	Sensitivity/ response code	Comment
2170	Klamath-Siskiyou Xeromorphic Serpentine Savanna and Chaparral	SAF 248: Knobcone Pine	3	serotinous cones, risk of invasives post-fire
2172	Sierran-Intermontane Desert Western White Pine-White Fir Woodland	SAF 211: White Fir	1	large trees resistant to low intensity fire, some resistance to moderate intensity fire
2173	North Pacific Wooded Volcanic Flowage	SAF 218: Lodgepole Pine	1	sierra lodgepole
2174	North Pacific Dry-Mesic Silver Fir-Western Hemlock-Douglas-fir Forest	SAF 226: Coastal True Fir-Hemlock	1	
2175	North Pacific Interior Spruce-Fir Forest and Woodland	SAF 206: Engelmann Spruce-Subalpine Fir	1	
2177	California Coastal Closed-Cone Conifer Forest and Woodland	SAF 248: Knobcone Pine	3	serotinous cones
2178	North Pacific Hypermaritime Western Red-cedar-Western Hemlock Forest	SAF 227: Western Redcedar-Western Hemlock	2	large red cedar resistant to low-moderate intensity fire, western hemlock sensitive, depends on proportion of western hemlock
2179	Northwestern Great Plains-Black Hills Ponderosa Pine Woodland and Savanna	SAF 237: Interior Ponderosa Pine	2	
2187	Introduced Upland Vegetation-Treed	LF 51: Introduced Upland Vegetation - Tree	2	No NatureServe description, AK only?, assigned 2 due to uncertain species, recently introduced, lower concern, possible invasives
2193	Recently Logged-Tree Cover	LF 64: Recently Logged - Tree	2	No NatureServe description, AK only?, assigned 2 due to uncertain species, recently introduced, lower concern, possible invasives
2194	Ruderal Upland-Treed	LF 53: Ruderal Forest	2	No NatureServe description, AK only?, assigned 2 due to uncertain species, recently introduced, lower concern, possible invasives
2197	Recently Burned-Tree Cover	LF 68: Recently Burned - Tree	2	No NatureServe description, AK only?, assigned 2 due to uncertain species, recently introduced, lower concern, possible invasives
2200	Pseudotsuga menziesii-Quercus garryana Woodland Alliance	SAF 229: Pacific Douglas-Fir	2	Large Oregon white oak resistant, but also a sprouter

EVT Value	EVT_Name	SAF_SRM	Sensitivity/ response code	Comment
2201	Quercus garryana Woodland Alliance	SAF 233: Oregon White Oak	2	large trees resistant, but also a sprouter
2202	Juniperus occidentalis Wooded Herbaceous Alliance	SRM 107: Western Juniper-Big Sagebrush-Bluebunch Wheatgrass	2	large trees resistant to low-moderate intensity, mortality depends on crown consumption, risk of invasives post-fire
2203	Juniperus occidentalis Woodland Alliance	SAF 238: Western Juniper	2	large trees resistant to low-moderate intensity, mortality depends on crown consumption, risk of invasives post- fire
2204	Tsuga heterophylla Giant Forest Alliance	SAF 224: Western Hemlock	1	
2205	Tsuga mertensiana-Abies amabilis Woodland Alliance	SAF 226: Coastal True Fir-Hemlock	1	
2206	Pseudotsuga menziesii Giant Forest Alliance	SAF 229: Pacific Douglas-Fir	2	
2207	Chamaecyparis nootkatensis Forest Alliance	SAF 228: Western Redcedar	1	Since when is western red cedar the same as Alaska yellow-cedar?
2208	Abies concolor Forest Alliance	SAF 211: White Fir	1	close to 2, large trees resistant to low intensity fire, some may survive moderate intensity fire
2224	Elaeagnus angustifolia Semi-Natural Woodland Alliance	LF 58: Introduced Woody Wetlands and Riparian Vegetation	3	russian olive
2227	Pseudotsuga menziesii Forest Alliance	SAF 210: Interior Douglas-Fir	2	
2228	Larix occidentalis Forest Alliance	SAF 212: Western Larch	2	
2229	Pinus albicaulis Woodland Alliance	SAF 208: Whitebark Pine	1	
2230	Pinus sabiniana Woodland Alliance	SAF 250: Blue Oak-Digger Pine	2	maybe 3. Note - digger pine now known as gray pine; gray pine resistant, blue oak resprouts
2231	Sequoiadendron giganteum Forest Alliance	SAF 243: Sierra Nevada Mixed Conifer	2	
2232	Abies grandis Forest Alliance	SAF 213: Grand Fir	1	close to 2, large trees resistant to low intensity fire, some may survive moderate intensity fire
2301	Boreal Aspen-Birch Forest	SAF 16: Aspen	3	sprouter
2304	Ozark-Ouachita Dry-Mesic Oak Forest	SAF 53: White Oak	2	large trees resistant to low intensity fire, sprouters
2308	Crosstimbers Oak Forest and Woodland	SAF 40: Post Oak-Blackjack Oak	2	large oaks resistant to low intensity fire, some species resistant to moderate intensity fire, also resprouters

EVT Value	EVT_Name	SAF_SRM	Sensitivity/ response code	Comment
2310	North-Central Interior Dry-Mesic Oak Forest and Woodland	SAF 52: White Oak-Black Oak-Northern Red Oak	2	large oaks resistant to low intensity fire, some species resistant to moderate intensity fire, also resprouters
2311	North-Central Interior Dry Oak Forest and Woodland	SAF 110: Black Oak	2	large oaks resistant to low intensity fire, some species resistant to moderate intensity fire, also resprouters
2314	North-Central Interior Maple-Basswood Forest	SAF 26: Sugar Maple-Basswood	1	
2331	Eastern Great Plains Tallgrass Aspen Parkland	SRM 16: Aspen	3	sprouter
2334	Ozark-Ouachita Mesic Hardwood Forest	SAF 52: White Oak-Black Oak-Northern Red Oak	2	
2341	Northwestern Great Plains Canyon	SAF 236: Bur Oak	2	
2363	Central Interior Highlands Dry Acidic Glade and Barrens	SRM 803: Missouri Glades	2	large oaks resistant to low intensity fire, some species resistant to moderate intensity fire, also resprouters
2364	Ozark-Ouachita Dry Oak Woodland	SAF 40: Post Oak-Blackjack Oak	2	large oaks resistant to low intensity fire, some species resistant to moderate intensity fire, also resprouters
2365	Boreal White Spruce-Fir-Hardwood Forest	SAF 5: Balsam Fir	1	
2367	Ozark-Ouachita Shortleaf Pine-Oak Forest and Woodland	SAF 76: Shortleaf Pine-Oak	2	Shortleaf pine resistant, large oaks resistant and resprout
2385	Western Great Plains Wooded Draw and Ravine	LF 41: Deciduous Shrubland	1	3 for ash, aspen sprouter, 1 for slippery elm - assigned 1 due to invasives
2394	North-Central Interior Oak Savanna	SAF 42: Bur Oak	2	large oaks resistant to low intensity fire, some species resistant to moderate intensity fire, also resprouters
2395	North-Central Oak Barrens	SAF 14: Northern Pin Oak	2	large oaks resistant to low intensity fire, some species resistant to moderate intensity fire, also resprouters
2401	Central Interior Highlands Calcareous Glade and Barrens	SRM 803: Missouri Glades	3	grass and chinkapin oak, susceptible and spouts
2469	Eastern Great Plains Floodplain Systems	LF 42: Great Plains Riparian	1	no veg description in EVT Legend*, no response from ecologists, 1 assigned based upon assignment given to similar riparian and wetland EVT's 2154, 2159, 2161, 2162 (http://www.fs.usda.gov/Internet/FSE_DOCUMENTS/stelprdb5317591.htm)
2471	Central Interior and Appalachian Floodplain Systems	SAF 61: River Birch-Sycamore	1	sprouters
2472	Central Interior and Appalachian Riparian Systems	SAF 61: River Birch-Sycamore	1	sprouters

EVT Value	EVT_Name	SAF_SRM	Sensitivity/ response code	Comment
2479	Central Interior and Appalachian Swamp Systems	SAF 61: River Birch-Sycamore	1	sprouters
2532	Ruderal Forest-Northern and Central Hardwood and Conifer	LF 53: Ruderal Forest	2	EVT not in EVT Legend* or NatureServe web link - Only in KS, SD, ND, NE, AK? - checked SD - less than .02 % of cell count, assigned 2 due to uncertain species, recently introduced, lower concern, possible invasives
2534	Managed Tree Plantation-Northern and Central Hardwood and Conifer Plantation Group	LF 61: Managed Tree Plantation	2	EVT not in EVT Legend* or NatureServe web link - Only in KS, SD, ND, NE, AK? - checked SD - very few cells, assigned 2 due to uncertain species, recently introduced, lower concern, possible invasives
2535	Managed Tree Plantation-Southeast Conifer and Hardwood Plantation Group	LF 61: Managed Tree Plantation	2	EVT not in EVT Legend* or NatureServe web link - Only in KS, SD, ND, NE, AK? - checked SD - very few cells, assigned 2 due to uncertain species, recently introduced, lower concern, possible invasives
2600	Western North American Boreal White Spruce Forest	SAF 201: White Spruce	1	
2601	Western North American Boreal Treeline White Spruce Woodland	SAF 201: White Spruce	1	
2602	Western North American Boreal Spruce-Lichen Woodland	SAF 204: Black Spruce	1	black spruce has semi-serotinous cones - but Lichen is a very sensitive community
2603	Western North American Boreal White Spruce-Hardwood Forest	SAF 202: White Spruce-Paper Birch	1	
2604	Western North American Boreal Mesic Black Spruce Forest	SAF 204: Black Spruce	3	semi-serotinous cones
2605	Western North American Boreal Mesic Birch-Aspen Forest	SAF 252: Paper Birch	3	sprouter
2606	Western North American Boreal Dry Aspen-Steppe Bluff	SAF 217: Aspen	3	sprouter
2607	Western North American Boreal Subalpine Balsam Poplar-Aspen Woodland	SAF 203: Balsam Poplar	3	sprouter
2614	Western North American Boreal Montane Floodplain Forest and Shrubland	SAF 203: Balsam Poplar	3	sprouter
2615	Western North American Boreal Lowland Large River Floodplain Forest and Shrubland	SAF 203: Balsam Poplar	3	sprouter

EVT Value	EVT_Name	SAF_SRM	Sensitivity/ response code	Comment
2616	Western North American Boreal Riparian Stringer Forest and Shrubland	SAF 203: Balsam Poplar	3	sprouter - only 2 of 5 likelihood of invasives
2621	Western North American Boreal Black Spruce Dwarf-Tree Peatland	LF 72: Peatland Forests	3	? black spruce, semi-serotinous cones IF larch is present - then code as a “1”sensitive
2622	Western North American Boreal Black Spruce Wet-Mesic Slope Woodland	SAF 204: Black Spruce	3	semi-serotinous cones
2623	Western North American Boreal Black Spruce-Tamarack Fen	SAF 204: Black Spruce	3	semi-serotinous cones
2630	Western North American Boreal Wet Black Spruce-Tussock Woodland	SAF 204: Black Spruce	3	semi-serotinous cones
2642	Aleutian Kenai Birch-Cottonwood-Poplar Forest	SAF 252: Paper Birch	3	sprouter
2644	Alaskan Pacific Maritime Sitka Spruce Forest	SAF 223: Sitka Spruce	1	
2646	Alaskan Pacific Maritime Western Hemlock Forest	SAF 227: Western Redcedar-Western Hemlock	1	
2648	Alaskan Pacific Maritime Mountain Hemlock Forest	SAF 205: Mountain Hemlock	1	
2649	Alaskan Pacific Maritime Subalpine Mountain Hemlock Woodland	SAF 205: Mountain Hemlock	1	
2650	Alaskan Pacific Maritime Periglacial Woodland and Shrubland	SAF 223: Sitka Spruce	1	
2654	Alaskan Pacific Maritime Sitka Spruce Beach Ridge	SAF 223: Sitka Spruce	1	
2655	Alaskan Pacific Maritime Floodplain Forest and Shrubland	SAF 203: Balsam Poplar	3	sprouter
2657	Alaskan Pacific Maritime Shore Pine Peatland	LF 71: Shrub and Herbaceous Peatlands	1	shore pine, Alaska cedar
2659	Alaskan Pacific Maritime Mountain Hemlock Peatland	LF 72: Peatland Forests	1	mountain hemlock
2677	Alaska Sub-boreal White-Lutz Spruce Forest and Woodland	SAF 201: White Spruce	1	
2678	Alaska Sub-boreal Mountain Hemlock-White Spruce Forest	SAF 201: White Spruce	1	
2679	Alaska Sub-boreal White Spruce-Hardwood Forest	SAF 202: White Spruce-Paper Birch	1	

EVT Value	EVT_Name	SAF_SRM	Sensitivity/ response code	Comment
2681	Alaskan Pacific Maritime Poorly Drained Conifer Woodland	LF 72: Peatland Forests	1	No data – assigned 1
2728	Aleutian Floodplain Forest and Shrubland	SAF 203: Balsam Poplar	3	sprouter
2808	Hawai'i Lowland Rainforest	LF 73: Hawaiian Rainforest	1	Sensitive due to invasives replacing native veg. Metrosideros polymorpha, Acacia koa
2809	Hawai'i Montane Cloud Forest	LF 73: Hawaiian Rainforest	1	Sensitive due to invasives replacing native veg. Metrosideros polymorpha
2810	Hawai'i Montane Rainforest	LF 73: Hawaiian Rainforest	1	Sensitive due to invasives replacing native veg. Metrosideros polymorpha
2813	Hawai'i Lowland Dry Forest	LF 74: Hawaiian Dry Forest	1	Sensitive due to invasives replacing native veg. Metrosideros polymorpha
2814	Hawai'i Lowland Mesic Forest	LF 75: Hawaiian Mesic Forest	1	Sensitive due to invasives replacing native veg. Metrosideros polymorpha, Acacia koa
2815	Hawai'i Montane-Subalpine Dry Forest and Woodland	LF 74: Hawaiian Dry Forest	1	Sensitive due to invasives replacing native veg. Metrosideros polymorpha; Sophora chrysophilla;Myoporum sandwicense, low fire tolerance, no sprout
2816	Hawai'i Montane-Subalpine Mesic Forest	LF 75: Hawaiian Mesic Forest	1	Sensitive due to invasives replacing native veg. Metrosideros polymorpha, Acacia koa
2836	Hawaiian Introduced Wetland Vegetation-Tree	LF 58: Introduced Woody Wetlands and Riparian Vegetation	2	Hibiscus - very wet- fire not a factor
2845	Hawaiian Introduced Dry Forest	LF 51: Introduced Upland Vegetation - Tree	1	Mix of introduced species, converts to grass with fire
2846	Hawaiian Introduced Wet-Mesic Forest	LF 51: Introduced Upland Vegetation - Tree	3	Mix of introduced species - Schinus, guava, Syzygium, etc. Medium fire tolerance
2852	Introduced Coastal Wetland Vegetation - Tree	LF 58: Introduced Woody Wetlands and Riparian Vegetation	2	Hibiscus - very wet- fire not a factor
2855	Hawaiian Managed Tree Plantation	LF 61: Managed Tree Plantation	3	Mix of introduced species - pine, eucalyptus, mango, cryptomeri

***EVT Legend** refers to the International Ecological Classification Standard: Terrestrial Ecological Systems of the United States, EVT Legend, Entire U.S. from NatureServe