

Bluewater Forest Restoration Project – Desired Condition Demonstration, Cibola National Forest

Purpose of Visit:

- Discuss the concepts and various aspects of the desired conditions including: the degree of structural openness; the grass/forb/shrub matrix; the size (area, number of trees), shape, and spacing of tree groups; the interlocking crowns of trees within groups; the diversity and interspersion of tree structural (age, size) stages, and the sustainability of the desired conditions.
- Discuss and discuss the value of the desired conditions for wildlife habitat and food webs.
- Discuss how key elements of the desired conditions relate to natural disturbances.
- Discuss specific differing existing conditions that are moving towards the desired conditions.
- Discuss the ecological, social, and economic outcomes of achieving the desired conditions.

Background:

- Demonstration site (stand 5A) represents a ponderosa pine forest growing on moderately-productive (average) site. This site has had fire exclusion since the early 1900s; with the exception of slash burning following cutting 25+ years ago.
- Past management: this site was cut 25+ years ago to remove diseased, dying and poorly-formed trees (sanitation/salvage cutting). Pre-treatment (2010) stand condition: uneven-aged structure/high-density, modeled fire behavior - high-intensity crown fire.
- Prescribed cutting treatment (focused on the desired conditions and restoration) were implemented during summer 2010. Prescribed burning treatments are scheduled for fall/winter 2011/12.

Demonstration Stand (post-treatment):

- Uneven-aged stand structure (3+ ages): within the stand, there are roughly balanced areas of young, mid, and old age trees with provision of suitable openings between tree groups for development of grass/forb/shrub component and localized recruitment of trees.
- Desired spatial patterns are similar to natural conditions
 - Tree groups with interlocking crowns
 - Fine-scale dispersion of tree groups
 - Grass/forb/shrub openings
- Small diameter woody debris abundance is higher than desired (pre-burning).
- Downed logs and snags are less than desired.
- Tree densities (within group and per unit area) are within desired ranges (overall avg. 40-80 sq. feet basal area).
- Seedlings have not yet established in desired locations.
- Desired grass/forb/shrub cover has not yet established.
- Modeled fire behavior is low-intensity surface fire.

Bluewater Forest Restoration Project – Desired Condition Demonstration Data

1) Aerial photos

Pre-treatment



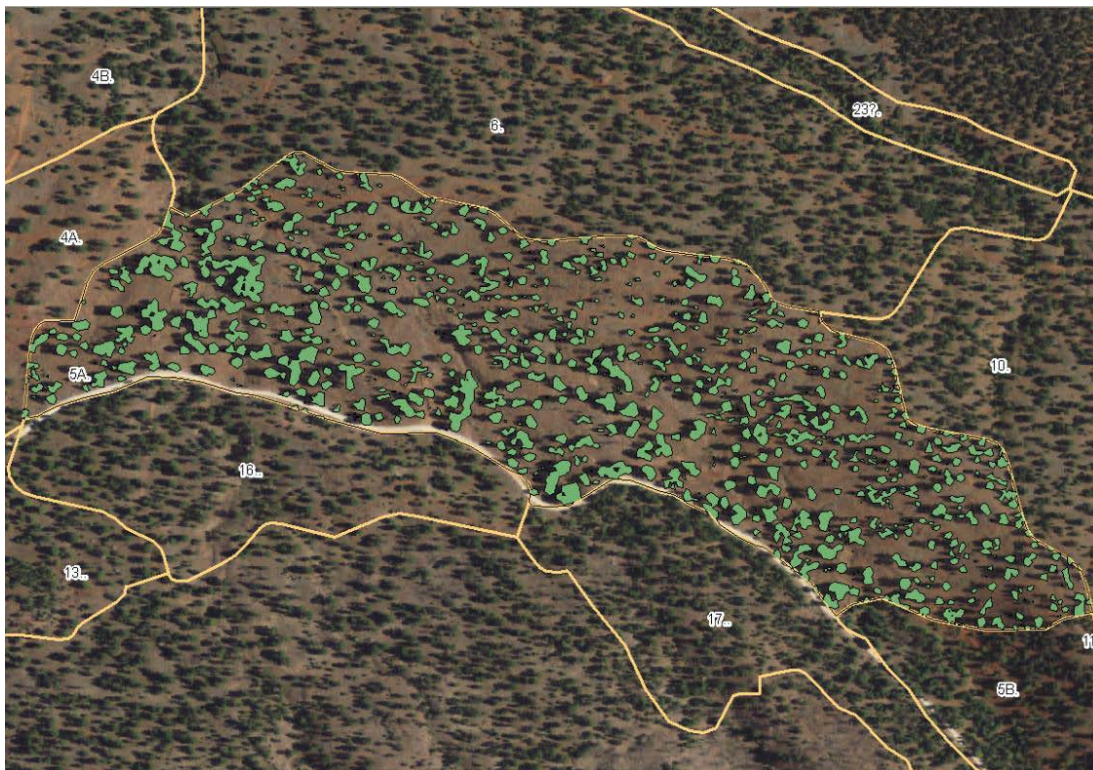
Post-treatment



2) Stand 5A exam data (post-treatment)

All Species Diameter Class	Trees/Acre	Basal Area/Acre
1 - 4.9 in	3.3	0.4
5 - 8.9 in	16.7	4.6
9 - 12.9 in	23.3	16.2
13 - 16.9 in	5.0	6.1
17 - 20.9 in	5.0	10.2
21 - 24.9 in	1.7	4.3
25 + in	1.6	6.1
Total	56.6	47.9

3) Current conditions (post-treatment) - spatial patterns



Spatial analysis results (Stand 5A)

- 48% of the area to be managed for tree cover
 - 28% of the area is currently represented under mid-old tree crowns (tree drip-line measurement)
 - 20% of the area to be managed for recruitment and/or development of tree seedlings/saplings
- 52% of the area to be managed as open grass/forb/shrub

3) Modeled future conditions

a. Forest structure (FVS simulation)

FVS SIMULATION: natural growth, no treatments											
SIMULATION DONE: 10-11-2011											
AVERAGE* SUMMARY STATISTICS BY COMMON CYCLE											
year	trees/ acre	basal area	stand density Index	dominant ht	quadratic mean diameter	total cubic ft.	merch. cubic ft.	merc. board ft.	years	cubic ft. growth	cubic ft. mortality
2011	57	47	72	48	11.6	786	676	3075	10	37	1
2021	198	57	118	53	7.2	1149	1017	4993	10	41	2
2031	195	71	141	58	8.2	1547	1387	7081	10	43	2
2041	264	87	176	63	7.8	1963	1786	9306	10	44	2
2051	259	102	200	67	8.5	2379	2185	11570	10	44	2
2061	269	118	226	70	9	2801	2574	13847	10	41	4
2071	261	131	244	73	9.6	3171	2930	15998	10	38	10
2081	240	139	252	76	10.3	3449	3246	17887	10	36	9
2091	223	147	259	78	11	3717	3547	19354	10	34	8
2101	210	154	266	79	11.6	3968	3815	20799	10	31	8
2111	199	161	273	81	12.2	4196	4057	22137	0	0	0

- This simulation **assumes no treatments or fire occurrence for 100 years**. Natural regeneration is imputed at intervals, based upon stand density and characteristic ponderosa pine development. Numbers of trees reflect in-growth without the thinning effects of fire or other management. The limited assumptions of this simulation (no fire occurrence or tree-cutting) does not imply management intent, but is presented to show projected growth without disturbances for discussion purposes.

b. Fire Behavior (Flam Map simulation –based on 2011 conditions)

- Predicted surface fire on 99% of the area
- Predicted passive crown fire (torching) on 1% of the area

Campbell Blue River -Ponderosa Pine Forest Ecology, Apache National Forest

Purpose of Visit:

- View a ponderosa pine site where fire has shaped forest structure (natural regulation of regeneration).
- Discuss how and why the Wallow Fire affected the trajectory of this site towards the desired conditions.
- Discuss desired conditions for species composition, structure, and relationships to ecological function.

Background:

- Fire exclusion starting in the early 1900s.
- Probable light selection cutting during 1940-1990s period?
- Last harvest was a light cut in 1995 designed to promote tree regeneration in patches. Slash was piled and burned.
- Broadcast burned in 1999 (site preparation for regeneration).
- Natural regeneration observed to be established (2007).
- Wallow fire impacted the stand with a running head fire on May 31st.

Stand Data

1) Aerial photo



2) Current conditions

a. stand exam data, 10/2011)

Current averages per acre

All Species Diameter Class	Trees/Acre	Basal Area/Acre
1 - 4.9 in	16.7	1.1
5 - 8.9 in	15	3.9
9 - 12.9 in	5	2.6
13 - 16.9 in	3.3	3.5
17 - 20.9 in	6.7	14.4
21 - 24.9 in	15	43.8
25 - 28.9 in	5	17
29 - 32.9 in	3.3	16.4
33 + in	3.3	20.3
Total	73.3	123.1

Range of plot data:

current trees per acre = 0 to 140

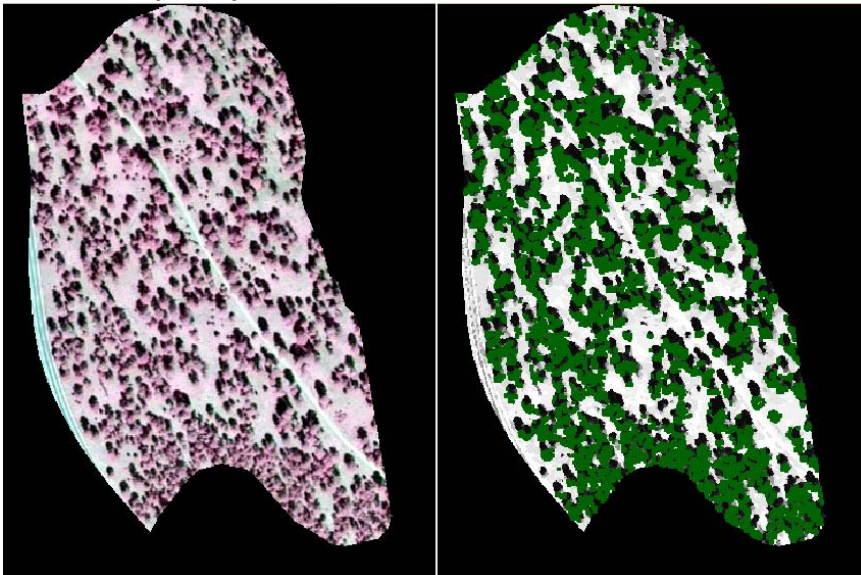
current basal area = 0 to 161 square feet/acre

historic reference condition trees per acre (based on current + historic evidences)

average = 33

range = 0 to 70

b. spatial patterns



- 39% of the area is under tree canopy (9.6 acres)
- 61% of the area is open grass/forb/shrub (14.8 acres)

3) Modeled future conditions (FVS simulation)

FVS SIMULATION: natural growth, no treatments											
SIMULATION DONE: 10-11-2011											
AVERAGE* SUMMARY STATISTICS BY COMMON CYCLE											
year	trees/ acre	basal area	stand density Index	dominant ht.	quadratic mean diameter	total cubic ft.	merch. cubic ft.	merc. board ft.	years	cubic ft. growth	cubic ft. mortality
2011	73	123	181	83	17.5	3990	4005	23827	10	24	26
2021	134	124	205	83	13	3967	3986	23556	10	24	21
2031	131	126	206	82	13.3	3993	4011	23797	10	22	27
2041	157	126	214	81	12.1	3941	3955	23391	10	22	21
2051	153	128	216	80	12.4	3952	3967	23395	10	21	24
2061	171	129	221	80	11.7	3924	3933	23256	10	22	19
2071	167	131	223	80	12	3956	3966	23401	10	22	15
2081	173	134	230	80	11.9	4025	4031	23807	10	22	10
2091	171	140	236	80	12.2	4144	4138	24562	10	20	11
2101	166	144	241	80	12.6	4236	4218	25136	10	19	10
2111	161	148	245	80	13	4325	4315	25649	0	0	0

- This simulation **assumes no treatments or fire occurrence for 100 years**. Natural regeneration is imputed at intervals, based upon stand density and characteristic ponderosa pine development. Numbers of trees reflect in-growth without the thinning effects of fire or other management. The limited assumptions of this simulation (no fire occurrence or tree-cutting) does not imply management intent, but is presented to show projected growth without disturbances for discussion purposes.

Dry Mixed Conifer Forest Ecology, Apache National Forest

Purpose of Visit:

- Discuss classification and ecological differences between dry mixed conifer & wet mixed conifer forest types.
- View a dry mixed conifer forest site where the tree species composition and function has changed over time as a result of fire suppression and past vegetation management.
- Discuss desired forest species composition for dry mixed conifer forests, and relationships to ecological function.

Forest Type Classification - Southwestern Forest Types and Dominant Characteristic (Historical) Disturbance Regimes

Forest Type	Fire Regime ^{1,2}	Fire Type ²	Forest Structure	Seral Species	Climax Species
Ponderosa pine (and sub-types)	frequent/ low severity 2-17 yrs. (regime I)	surface	uneven-aged, grouped, open	ponderosa pine	ponderosa pine
Dry Mixed conifer/ frequent fire (warmer/drier)	relatively frequent/ low-mod severity 9-22 yrs. (regime I)	surface (common) mixed (rare)	uneven-aged, grouped, open uneven-aged, patched, open	dominant -ponderosa pine subdominant - aspen and/or oak (sub- stand scale patches)	fire dis-climax historic condition- shade intolerant species: dominant – ponderosa pine; subdominant - Douglas-fir, Southwestern white pine or limber pine
Wet Mixed Conifer/ infrequent fire (cooler/wetter)	relatively infrequent/ mod-high severity variable, 22-150 yrs. (regime III, IV)	mixed (common) stand-replacing (rare)	uneven-aged, patched, closed even-aged, closed	dominant – aspen or Douglas-fir, depending upon plant association habitat type	shade tolerant species, depending upon plant association habitat type: white fir, blue spruce
Spruce-fir (mixed, lower sub-alpine)	infrequent/ mod-high severity 150-400 yrs. (regime III, IV)	mixed/stand- replacing	even-aged, closed	dominant – aspen or Douglas-fir, depending upon plant association habitat type	shade tolerant species, depending upon plant association habitat type: Engelmann spruce, white fir
Spruce-fir (upper sub-alpine)	infrequent/ high severity 150-400 yrs. (regime IV, V)	stand-replacing	even-aged, closed	dominant – aspen, Douglas-fir or Engelmann spruce, depending upon plant association habitat type	shade tolerant species: Engelmann spruce and corkbark or sub-alpine fir co-dominate

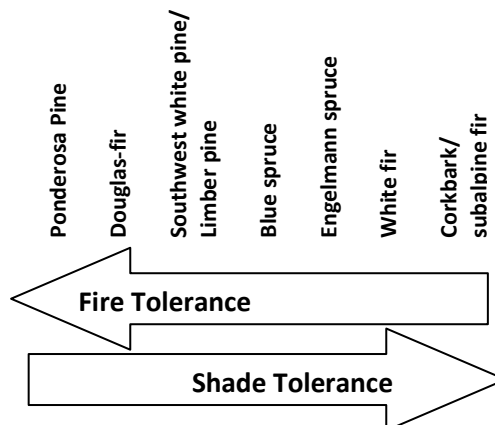
¹ Schussman et al. 2006.

² Historical Range of Variation and State and Transition Modeling of Historic and Current Landscape Conditions for Potential Natural Vegetation Types of the Southwest. The Nature Conservancy: Southwest Forest Assessment Project. 2006.

Species Composition (on-site)

Tree Species (conifer)	Current age range of the most mature individuals on site	Estimated historic (1880) % of composition
Ponderosa pine	120 - 210 yrs. Avg. = 192	70%
Douglas-fir	180-220 yrs. Avg. = 200	25%
SW white pine	140-180 yrs. Avg. = 156	< 5%
Blue spruce	32-76 yrs. Avg. = 52	< 1%
White fir	0-20 yrs.	< 1%

Relative shade and fire tolerance of common conifer tree species in mixed conifer and spruce-fir forests



Eagar South Forest Restoration Project, Apache National Forest

Purpose of Visit:

- Discuss the concepts and various aspects of the desired conditions including: the degree of structural openness; the grass/forb/shrub matrix; the size (area, number of trees), shape, and spacing of tree groups; the interlocking crowns of trees within groups; the diversity and interspersed of tree structural (age, size) stages; and the sustainability of the desired conditions.
- Discuss and discuss how the Wallow Fire responded to the desired conditions for ponderosa pine forests.

Background:

- Demonstration sites represent ponderosa pine forests growing on moderately-productive (average) sites. Both sites have had fire exclusion since the 1890s; with the exception of slash burning following cutting in 1960 and 1988 and broadcast burns starting in 1994, and continuing through 1996.
- Area was part of the Mexican Hay Timber Sales (1959 and 1986), treated with light sanitation/salvage cutting (removal of diseased, dying and poor-formed trees). Visual buffer along Hwy 261 was left uncut. Some thinning of sapling trees (< 5 inches diameter) was completed in 1990 and 1991.
- Prescribed cutting treatments were implemented winter of 2007/2008. Treatments focused on moving towards desired conditions and ecosystem restoration; the variable outcomes among treated locations reflect natural variability in existing conditions and local treatment emphasis. Prescribed burning treatments were scheduled for fall/winter 2011/12.

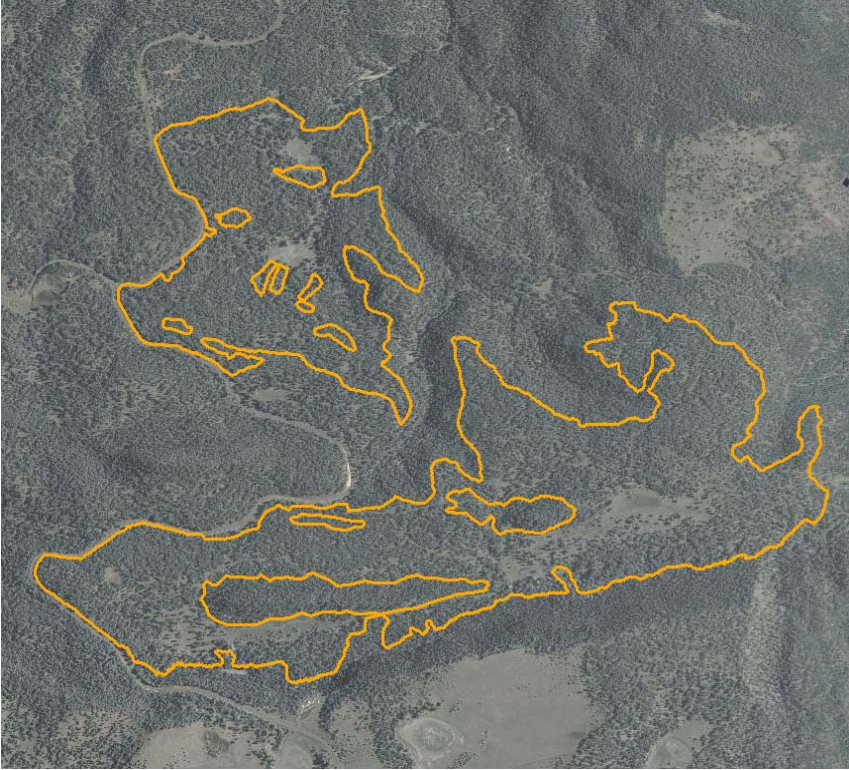
Treatment Areas (post-treatment):

- Uneven-aged structure (3+ ages), roughly balanced area of young, mid, and old aged trees with provision of suitable openings for development of grass/forb/shrub component and localized recruitment of trees. Old age trees were below desired proportional representation before treatment, therefore none were cut.
- Desired spatial patterns are similar to natural conditions
 - Tree groups with interlocking crowns
 - Fine-scale dispersion of tree groups
 - Grass/forb/shrub openings
- Woody debris abundance is lower than desired.
- Tree densities (within group and per unit area) are within desired ranges (overall averages 30-70 sq. feet basal area).
- Seedlings have not yet established in desired locations.
- Desired grass/forb/shrub cover has not yet fully established.
- Modeled **and observed** fire behavior is low-intensity surface fire.
- Wallow Fire impacted the site on June 4th and 5th, drastically changing fire behavior from a running wind driven crown fire to a ground fire. 100% of the treatment areas were burned with variable, but primarily low severity fire effects.

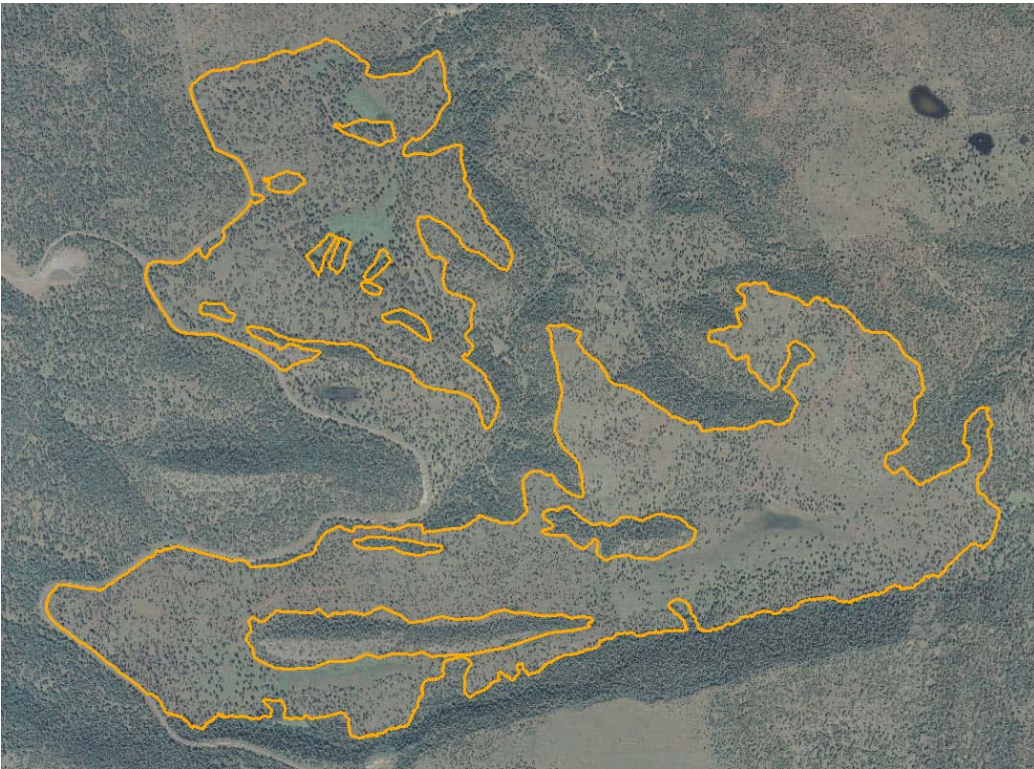
Eagar South Forest Restoration Project – Data

1) Aerial photos

Pre-treatment



Post-treatment



Pre-treatment

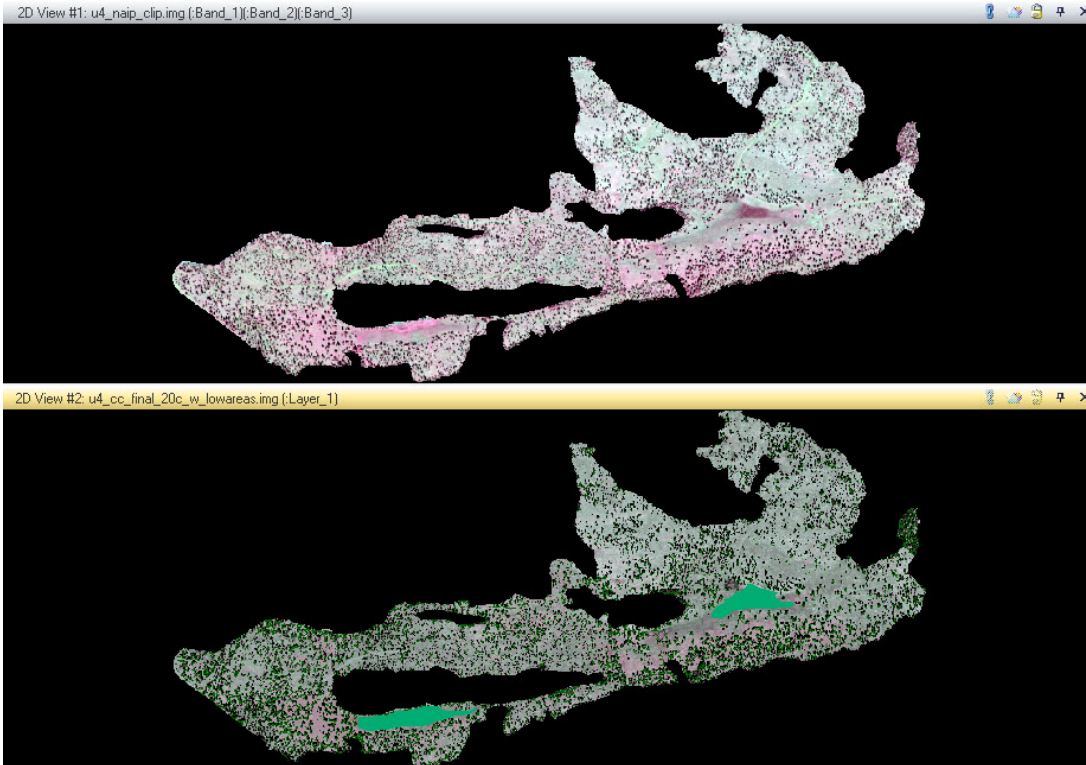


Post-treatment



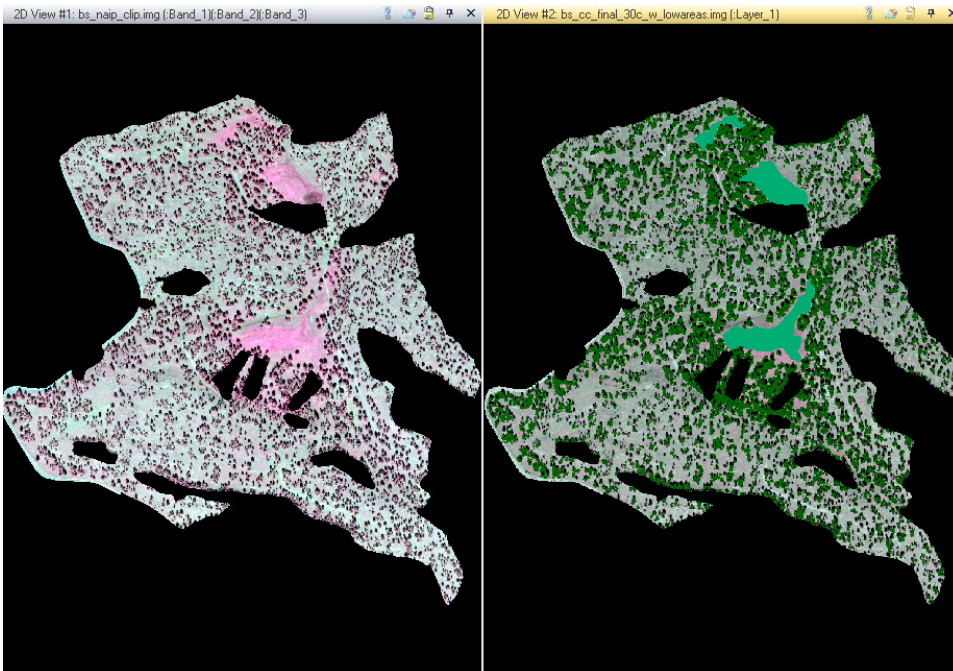
2) **Current conditions (post-treatment)**
a. Spatial analysis from aerial photos

• Point of the Mountain Site



- 11.5% of the area represented under mid-old tree crowns (tree drip-line measurement)
- 88.5% of the area represented as open grass/forb/shrub (not including meadow areas shown in green)

• Brown's Sawmill site



- 25% of the area is currently represented under mid-old tree crowns (tree drip-line measurement)
- 20% of the area to be managed for recruitment and/or development of tree seedlings/saplings
- 65% of the area to be managed as open grass/forb/shrub (not including meadow areas)

b. Stand exam data (2008)

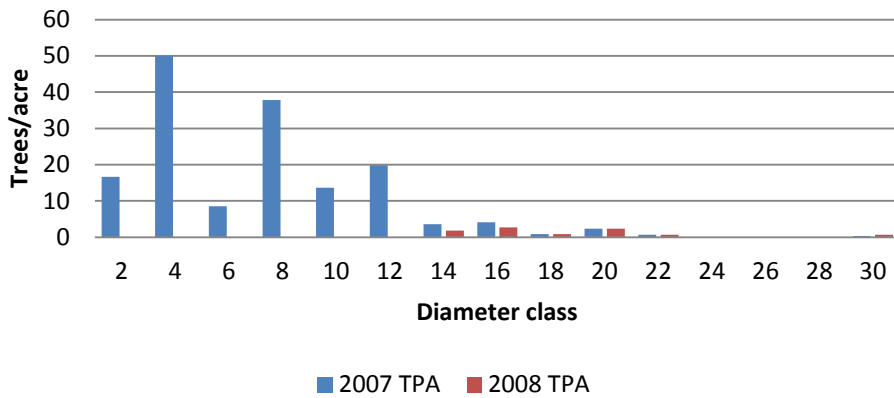
Point of the Mountain Stand, post-treatment

All Species Diameter Class	Trees/Acre	Basal Area/Acre (ft ²)
1 - 4.9 in	0	0
5 - 8.9 in	0	0
9 - 12.9 in	9.3	5.8
13 - 16.9 in	6.4	6.7
17 - 20.9 in	7.9	14.2
21 - 24.9 in	0.6	1.7
25 + in	0	0
Total	24.2	28.3

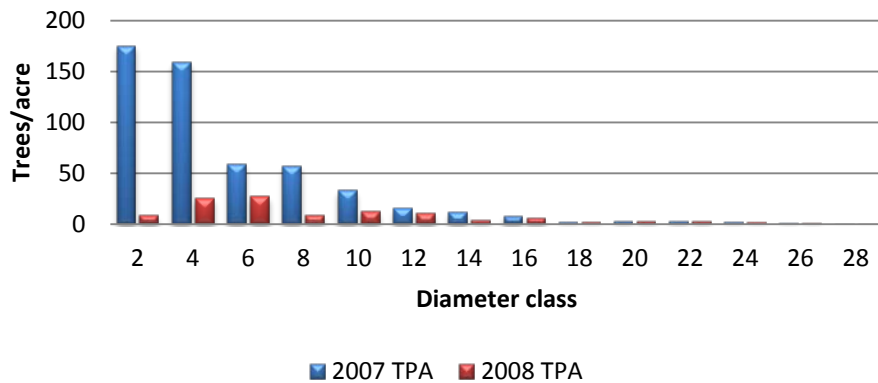
Brown's Sawmill Stand, post-treatment

All Species Diameter Class	Trees/Acre	Basal Area/Acre (ft ²)
1 - 4.9 in	33.3	2.0
5 - 8.9 in	35.0	6.7
9 - 12.9 in	23.2	13.3
13 - 16.9 in	10.0	11.7
17 - 20.9 in	4.4	8.3
21 - 24.9 in	4.3	11.7
25 + in	1.4	5.0
Total	111.7	58.7

Eagar South, Point of the Mountain Stand, pre and post-treatment



Eagar South, Brown's Sawmill Stand - Pre and Post Treatment



3) Modeled future conditions (FVS simulation)

Point of the Mountain stand

year	trees/acre	basal area	stand density Index	dominant ht.	quadratic mean diameter	total cubic ft.	merch. cubic ft.	merc. board ft.	years	cubic ft. growth	cubic ft. mortality
2008	24	28	45	55	14.7	593	521	2530	10	28	1
2018	166	38	83	39	6.5	857	776	3925	10	30	3
2028	162	48	98	43	7.3	1129	1035	5568	10	31	4
2038	276	58	129	46	6.2	1402	1303	7085	10	33	6
2048	263	70	147	50	7	1670	1535	8457	10	34	10
2058	316	81	173	52	6.9	1916	1791	9845	10	33	16
2068	291	90	184	54	7.5	2083	1983	10549	10	33	19
2078	306	97	198	56	7.6	2224	2109	11022	10	32	24
2088	274	101	200	58	8.2	2301	2174	11375	10	30	31
2098	279	101	200	59	8.1	2294	2150	11627	10	30	31
2108	241	100	194	60	8.7	2285	2151	11555	0	0	0

- This simulation assumes no treatments or fire occurrence for 100 years. Natural regeneration is imputed at intervals, based upon stand density and characteristic ponderosa pine development. Numbers of trees reflect in-growth without the thinning effects of fire or other management. The limited assumptions of this simulation (no fire occurrence or tree-cutting) does not imply management intent, but is presented to show projected growth without disturbances for discussion purposes.

Brown's Sawmill stand

year	trees/acre	basal area	stand density Index	dominant ht.	quadratic mean diameter	total cubic ft.	merch. cubic ft.	merc. board ft.	years	cubic ft. growth	cubic ft. mortality
2008	112	59	108	54	9.8	1231	1085	5126	10	38	3
2018	231	74	150	58	7.7	1577	1426	6760	10	40	4
2028	224	88	173	61	8.5	1939	1777	8629	10	41	5
2038	261	103	201	63	8.5	2298	2103	10604	10	39	3
2048	255	117	222	65	9.2	2654	2446	12502	10	38	9
2058	244	128	237	67	9.8	2943	2721	14281	10	34	11
2068	226	136	245	69	10.5	3172	2926	15775	10	32	13
2078	211	143	251	71	11.1	3364	3112	16868	10	31	11
2088	199	151	259	72	11.8	3565	3333	17965	10	30	12
2098	188	157	265	72	12.4	3748	3533	19047	10	27	11
2108	179	163	270	73	12.9	3905	3695	19891	0	0	0

- This simulation assumes no treatments or fire occurrence for 100 years. Natural regeneration is imputed at intervals, based upon stand density and characteristic ponderosa pine development. Numbers of trees reflect in-growth without the thinning effects of fire or other management. The limited assumptions of this simulation (no fire occurrence or tree-cutting) does not imply management intent, but is presented to show projected growth without disturbances for discussion purposes.