July 8, 2003

THE BISCUIT FIRE:

Management Options for Forest Regeneration, Fire and Insect Risk Reduction and Timber Salvage

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Executive Summary

Forest and Rangeland Health

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Economic Issues

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Acknowledgments

Introduction

Approach

Land use definitions, issues and reporting categories

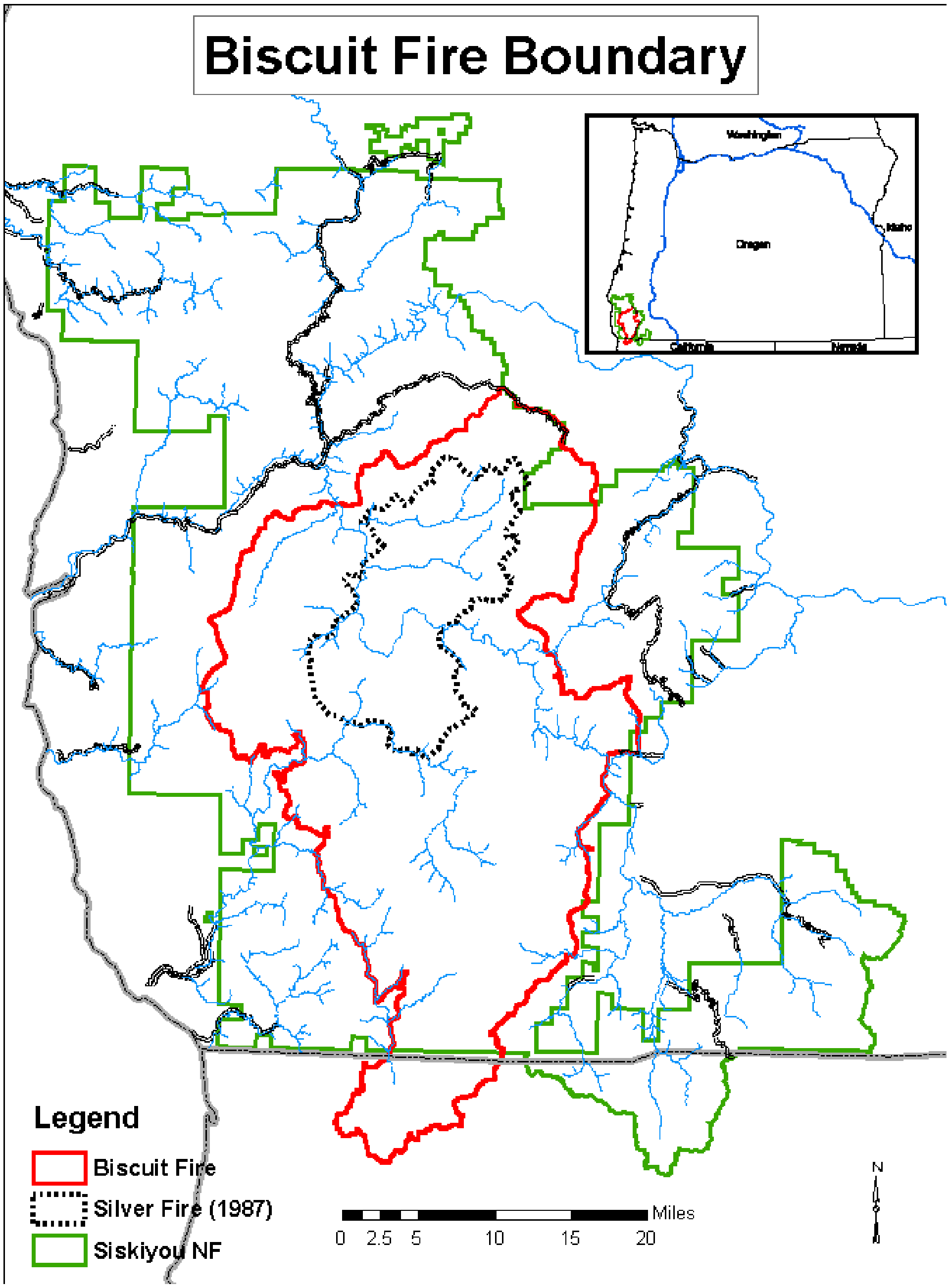

Figure 1. A map of the 2002 Biscuit Fire perimeter, including the 1987 Silver Fire perimeter. (Adapted from USDA Forest Service 2003)

Development of vegetation and spatial statistics

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The Biscuit Fire Forests–Prefire and Present

Geology and soils

Forest vegetation

Pre-fire conditions

Figure 2. Prefire landscape view inside the Biscuit Fire area, Kalmiopsis Wilderness, looking west from Hayward Peak toward the Big Craggies. (Photo by Kevin Johnson)

Table 1. Estimates of combined conifer and hardwood volume (million board feet, gross scale, 32-foot log length basis) existing pre-fire on National Forest lands within the Biscuit Fire perimeter.

		Distance from road		
Land Allocation	Ground slope (%)	<2 miles	>2 miles	Total
Congressionally Reserved	0–30	59	161	220
	30–60	342	2323	2665
	60+	75	1030	1105
	Subtotal	476	3514	3990
Administratively Withdrawn	0–30	83	26	109
	30–60	528	368	896
	60+	203	184	387
	Subtotal	814	578	1392
Late Successional Reserves	0–30	309	43	352
	30–60	2008	433	2441
	60+	544	253	797
	Subtotal	2861	729	3590
Matrix	0–30	185	6	191
	30–60	700	31	731
	60+	61	6	67
	Subtotal	946	43	989
Total		**5097**	**4864**	**9961**

Current conditions

Figure 3. Panoramic view of the Biscuit Fire, April 2003. Much of the 400,000 burned acres looks like this. (Photo by J. Sessions)

Table 2. Estimate of acres burned, derived from USDA Forest Service (2003) photo interpretation intersected with digital terrain model attributes and Siskiyou Forest land use allocations. The estimates do not include private lands; non-forest, unburned; and lightly burned National Forest land within the fire perimeter; and BLM forest lands. Estimates deviate somewhat from USDA Forest Service sources (USDA 2003), primarily in the interpretation of unburned and lightly burned forest. The Forest Service reports 460,000 acres of burned forest land.

Land Allocation	Ground slope (%)	Canopy killed (%)					Total
		1–10	10–25	25–50	50–75	75+	
Congressionally Reserved	0–0	-	900	1,000	2,100	8,600	12,600
	30–60	1,300	11,200	12,700	11,500	63,200	99,900
	60+	400	7,300	5,600	4,800	22,300	40,400
	Subtotal	1,700	19,400	19,300	18,400	94,100	152,900
Administratively Withdrawn	0–30	-	200	600	1,300	5,900	8,000
	30–60	100	2,300	5,800	8,500	24,100	40,800
	60+	-	700	2,600	3,900	8,100	15,300
	Subtotal	100	3,200	9,000	13,700	38,100	64,100
Late Successional Reserves	0–30	-	800	2,100	1,700	11,100	15,700
	30–60	300	7,400	20,500	14,600	49,000	91,800
	60+	100	2,100	7,100	4,900	12,000	26,200
	Subtotal	400	10,300	29,700	21,200	72,100	133,700
Matrix	0–30	100	1,100	1,300	800	2,600	5,900
	30–60	100	2,400	3,600	5,800	12,600	24,500
	60+	-	100	300	800	1,400	2,600
	Subtotal	200	3,600	5,200	7,400	16,600	33,000
Total		**2,400**	**36,500**	**63,200**	**60,700**	**220,900**	**383,700**

Table 3. Estimate of combined conifer and hardwood fire-killed timber (million board feet, gross scale, 32-foot log length basis) on National Forest lands within the Biscuit Fire perimeter.

	Ground slope	Distance from road		
Land Allocation	(%)	<2 miles	>2 miles	Total
Congressionally Reserved	0–30	29	83	112
	30–60	165	910	1075
	60+	40	396	436
	Subtotal	234	1389	1623
Administratively Withdrawn	0–30	47	15	62
	30–60	267	166	433
	60+	100	90	190
	Subtotal	414	271	685
Late Successional Reserves	0–30	157	22	179
	30–60	847	195	1042
	60+	219	109	328
	Subtotal	1223	326	1549
Matrix	0–30	57	3	60
	30–60	286	22	308
	60+	29	5	34
	Subtotal	372	30	402
Total		**2243**	**2016**	**4259**

What are the options?

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or

- *or*

- *or*

- *or*

- *or*

  or

Forest wildlife

Pre-fire wildlife habitat

Current wildlife habitat

Figure 4. Late Successional Reserve outside Onion Camp. Grasses in foreground are sprouting from hay bales dropped by helicopter to prevent soil erosion. (Photo by J. Sessions, May 2003)

What are the options?

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Forest Regeneration

Natural conifer recovery

Competition

Climate

Time to recovery

Human-aided conifer regeneration

Aerial seeding

Seedling choices

Combating non-native tree diseases

Cronartium ribicola

Phytophthora lateralis

Planting on shrub-dominated sites

Stand maintenance

Figure 5. Young plantation on private land (background, left) and plantation on federal land (right foreground) near Gold Hill, Oregon, established following the 1994 Hull Mountain Fire. Private plantation received vegetation management using herbicides; federal plantation has had mechanical release. (Photo by J. Sessions, October 2002).

The herbicide dilemma

Costs of regeneration

Table 4. Cost of reforestation practices in establishing 200 trees per acre free to grow, and probability of success when beginning in years shown, on north and south slopes, Biscuit Fire sites.

			Probability of success, by year of establishment and slope									
			2004		2005		2006		2007		2008	
	Practice[1]	$/acre	N	S	N	S	N	S	N	S	N	S
a)	Aerial seed	$100	50	20	40	10	20	5	10	5	0	0
b)	Seed/bait	115	70	25	45	15	30	5	20	10	20	10
c)	Plant plugs	200	80	60	70	50	40	30	20	10	20	10
d)	Planting plugs+1	220	85	70	75	60	60	40	40	20	30	10
e)	Planting 2+0	130	75	65	65	55	50	25	30	15	20	10
f)	Plant plugs+SP[2]	268	80	70	80	70	75	60	70	50	65	55
g)	Plant plugs+1+SP[2]	288	90	80	85	75	80	65	80	65	80	65
h)	(f) plus release	315	80	70	80	70	80	65	80	65	80	65
i)	(g) plus release	335	90	80	85	70	85	70	85	70	85	70
j)	(e + SP[2])+ release	245	85	75	80	60	80	55	80	55	70	50

[1] Practices are as follows:

- a) Aerial seeding entails 0.5 lb Douglas-fir seed, treated with malachite green, seed @ $180/lb, application at $10/acre (see discussion, Aerial Seeding section)
- b) Seeding plus prior baiting with 1 lb/ac oats treated with 0.75% chlorophacinone @ $5/lb and $10/acre application.
- c) Planting plug 615 container seedlings at $0.45 ea plus $0.55 labor x 200 trees per acre
- d) Planting plug + 1 transplants at $0.45/tree, plus $0.65 each for labor
- e) Planting 2 + 0 seedlings at $0.20/tree, plus $0.45 for labor
- f) Planting plugs, plus chemical site preparation
- g) Planting transplants, plus chemical site preparation
- h) Planting plugs, plus site prep and release with atrazine 2,4-D
- i) Planting transplants, plus site prep and release
- j) Plant 2 + 0 seedlings, plus site prep and release

[2] Site preparation (SP) with 1.5 lb/ac hexazinone plus 2 lb/acre 2,4-D plus $25/acre application cost

Table 5. Estimated regeneration cost (dollars per acre) to successfully establish 200 conifer trees per acre considering initial cost, probability of success (Table 4) and cost of restocking failures. Bold italic values show the most cost-effective method for year of establishment. Cost effectiveness considers only tree survival, not substantial costs of later controlling shrub competition (see Stand Maintenance section)

	North slope				South slope			
Regeneration method	2004	2005	2006	2007	2004	2005	2006	2007
Plant plugs	***250***	***286***	667	1000	333	400	1000	2000
Plant plugs +1	259	293	***367***	733	***314***	***367***	550	2200
Plant plugs + chemical prep	335	335	357	383	383	383	447	536
Plant plugs +1+ chemical prep	320	339	360	***360***	360	384	***443***	***443***
Plant plugs + 1 + chemical prep + chemical release	372	394	394	394	419	479	479	479

Table 6. Estimated cost (million dollars) of artificial regeneration by planting 225,000 acres with best techniques, including herbicides when needed, or without herbicides.

	2004		2005		2006		2007	
Land allocation	<2 mi	>2mi	<2mi	>2 mi	<2 mi	>2 mi	<2 mi	>2mi
Congressionally Reserved (87,400 ac)								
Best	2.5	20.3	2.8	23.5	3.5	28.7	3.5	28.9
Without herbicides	2.5	20.3	2.8	23.5	4.0	33.4	13.6	111.3
Administratively Withdrawn (30,800 ac)								
Best	4.0	2.9	4.6	3.4	5.6	4.0	5.7	3.2
Without herbicides	4.0	2.9	4.6	3.4	6.6	4.7	22.0	15.6
Late Successional Reserves (85,600 ac)								
Best	12.4	4.4	14.4	5.2	17.6	6.2	17.7	6.4
Without herbicides	12.4	4.4	14.4	5.2	20.2	7.2	64.4	22.8
Matrix (20,800 ac)								
Best	3.9	0.3	4.6	0.3	5.6	0.4	5.6	0.4
Without herbicides	3.9	0.3	4.6	0.3	6.5	0.4	21.5	1.6
All (224,600 ac)								
Best	22.8	27.9	26.4	32.4	32.3	39.3	32.5	38.9
Without herbicides	22.8	27.9	26.4	32.4	37.3	45.7	121.5	151.3

Note: Does not include cost of regenerating 127,000 acres of serpentine soils that burned nor stands on non-serpentine soils that had less than 25% canopy mortality. Derived using area estimates from Table 2 and cost estimates from Table 5. Acres to be regenerated are assumed proportional to percent canopy mortality. Unit costs for planting acres at less than 2 miles from a road are from Table 5. Planting costs at distances greater than 2 miles are assumed to be 30% higher than Table 5.

Size of the job

Conclusions

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Insect Infestation and Future Fires

Insect infestation risks

Table 7. Projections of mortality (million board feet, gross scale, 32-foot log length basis) from insect attack in fire-stressed trees, excluding very severely burned and lightly burned areas.

Land allocation	Douglas-fir	Pines	Other conifers	Total
Congressionally Reserved	203	17	15	235
Administratively Withdrawn	117	9	10	136
Late Successional Reserves	336	24	25	385
Matrix	75	5	9	89
Total	**731**	**55**	**59**	**845**

Heavy fuels and fire potential

Current conditions and future estimates

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Table 8. Projected average number of standing dead trees (snags) per acre within the Biscuit Fire Perimeter on National Forest lands not considering contributions from pre-fire snags, epidemic insect attack, salvage, or future fires.[1]

	Diameter class (dbh, inches)				
Year	<12	12–18	18–24	24+	Total
2005	122	22	10	11	165
2010	95	14	6	6	121
2020	66	11	5	5	87
2030	40	7	4	5	56
2040	9	4	3	4	20
2050	6	3	3	4	16
2060	4	3	2	4	13
2070	3	3	2	4	12
2080	8	2	2	4	16
2090	6	2	2	4	14
2100	5	2	2	4	13

[1] Snag numbers include recruitment from living trees that are projected to die "naturally" over the coming decades.

Table 9. Projected average down wood volume (cubic feet per acre) within the Biscuit Fire Perimeter not considering contributions from pre-fire dead trees, epidemic insect attack, salvage, or future fires.[1]

	Log Diameter (inch)					
Year	3 to 6	6 to 12	12 to 18	18 to 24	24 plus	Total
2010	67	350	208	101	74	800
2020	75	427	283	219	250	1254
2030	82	511	407	310	420	1730
2040	86	540	465	372	519	1982
2050	65	552	496	455	632	2200
2060	52	387	434	454	704	2031
2070	52	270	398	463	789	1972
2080	23	241	369	408	704	1745
2090	26	234	351	375	685	1671
2100	26	222	338	346	660	1592

[1] Down wood includes recruitment from living trees that are projected to die naturally over the coming decades.

Conclusions

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Goals for Future Forests

Timber Salvage

Costs and time constraints

Table 10. Estimate of fire-killed volume of conifers, million board feet, gross scale, 32-foot log length basis, after deductions for deterioration by species group by year.

Year	Douglas-fir	Pines	Other Conifers	Total Conifers
2002	2610	642	299	3551
2003	2182	341	221	2744
2004	1831	295	90	2216
2005	1440	251	69	1760
2006	1149	232	46	1427
2007	908	210	26	1144

Soil erosion: Crucial considerations

Planning and possibilities

Accessibility

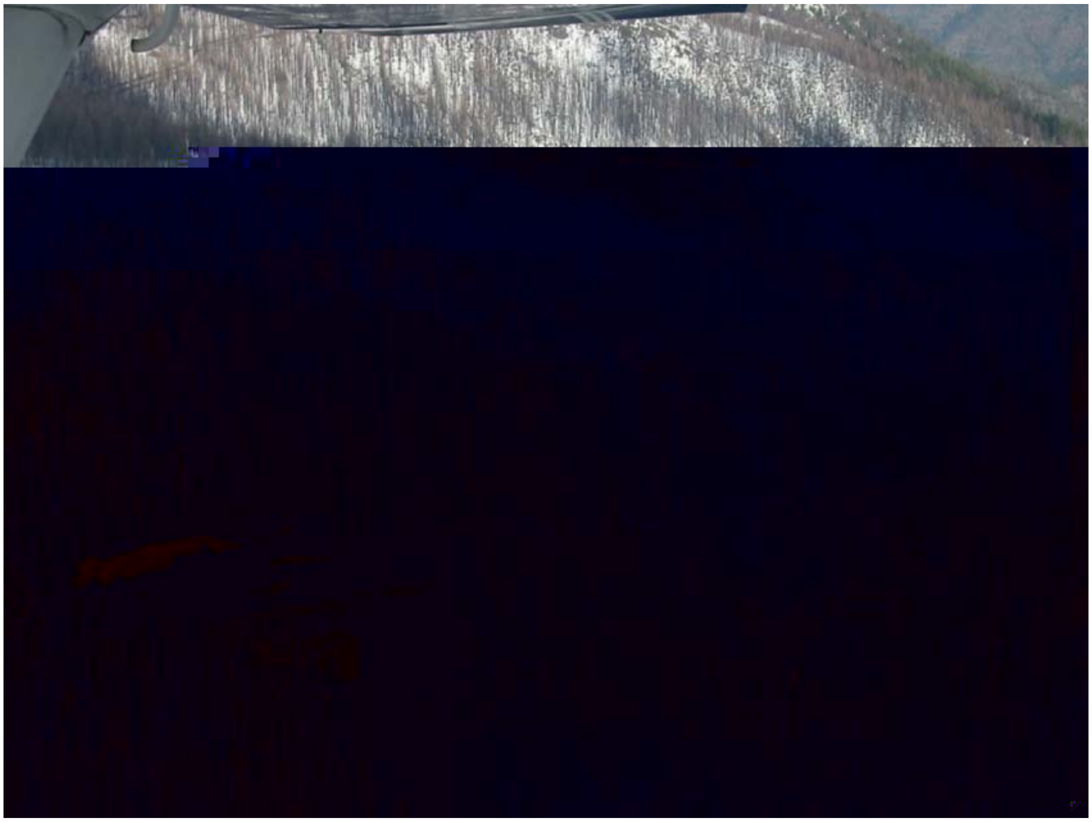

Figure 6. Road access exists in much of the Matrix and some of the Administratively Withdrawn and Late Successional Reserves. (Photo by J. Sessions, April 2003)

Harvesting systems

Figure 7. Timber salvage by helicopter. (TTTT Forestry Pictures www.foresters.org/photos/helicopter.htm accessed July 4, 2003).

Processing capacity

Sound, science-based strategy

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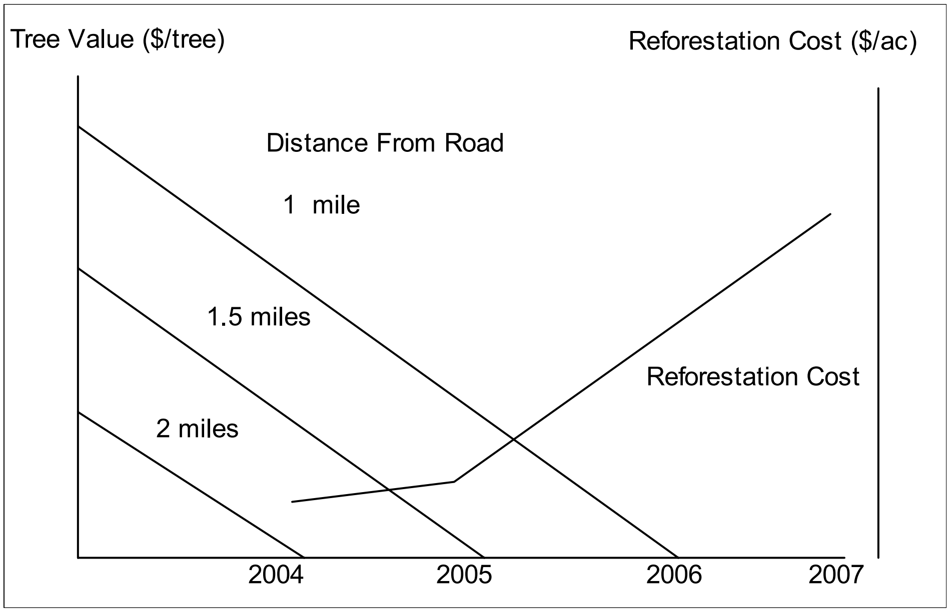

Figure 8. Average salvage value of fire-killed trees as a function of distance from road and year, using helicopter logging, and cost of reforestation.

Conclusions

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Closing Comments

Lessons from other recent catastrophic events

Can decision making be accelerated?

Figure 9. Northern spotted owl, an endangered species that requires mature forest habitat. (Photo by John and Karen Hollingsworth, courtesy of the U.S. Fish and Wildlife Service.)

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