Chapter 4 – Supplemental Information

Figures and Tables

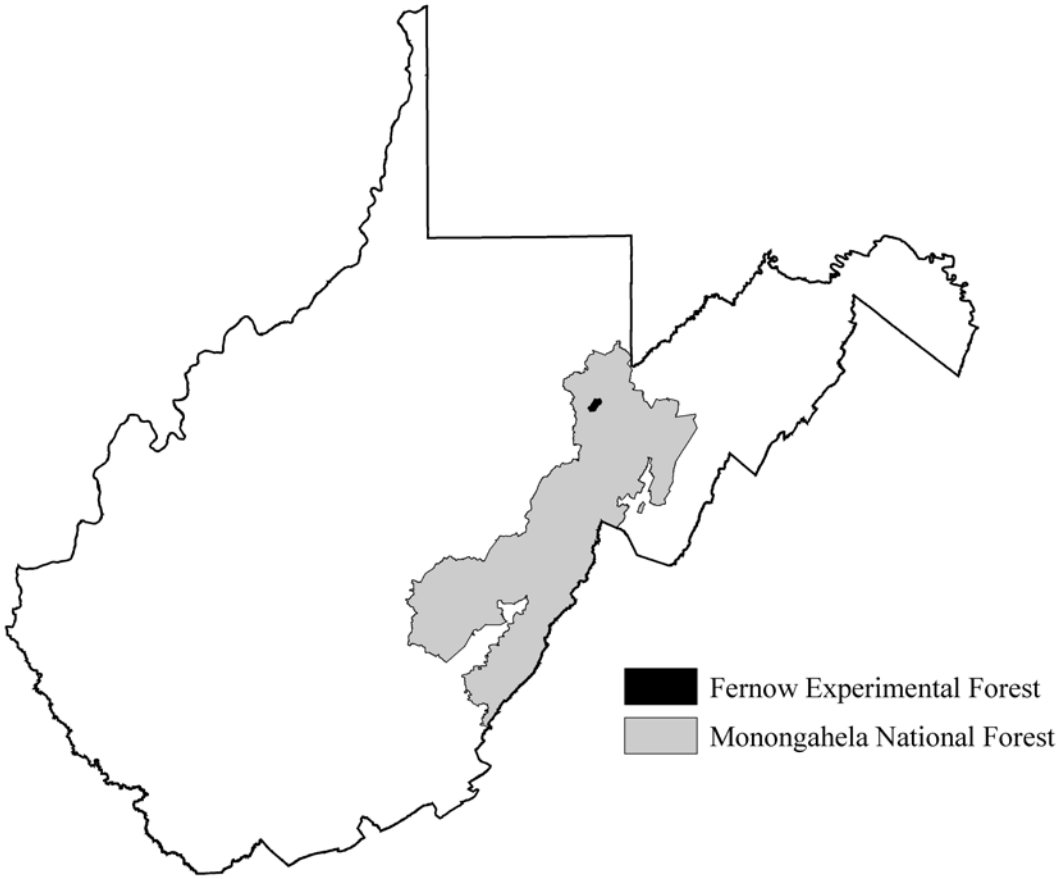

Figure 1-1. Map of West Virginia with locations of Monongahela National Forest and Fernow Experimental Forest.

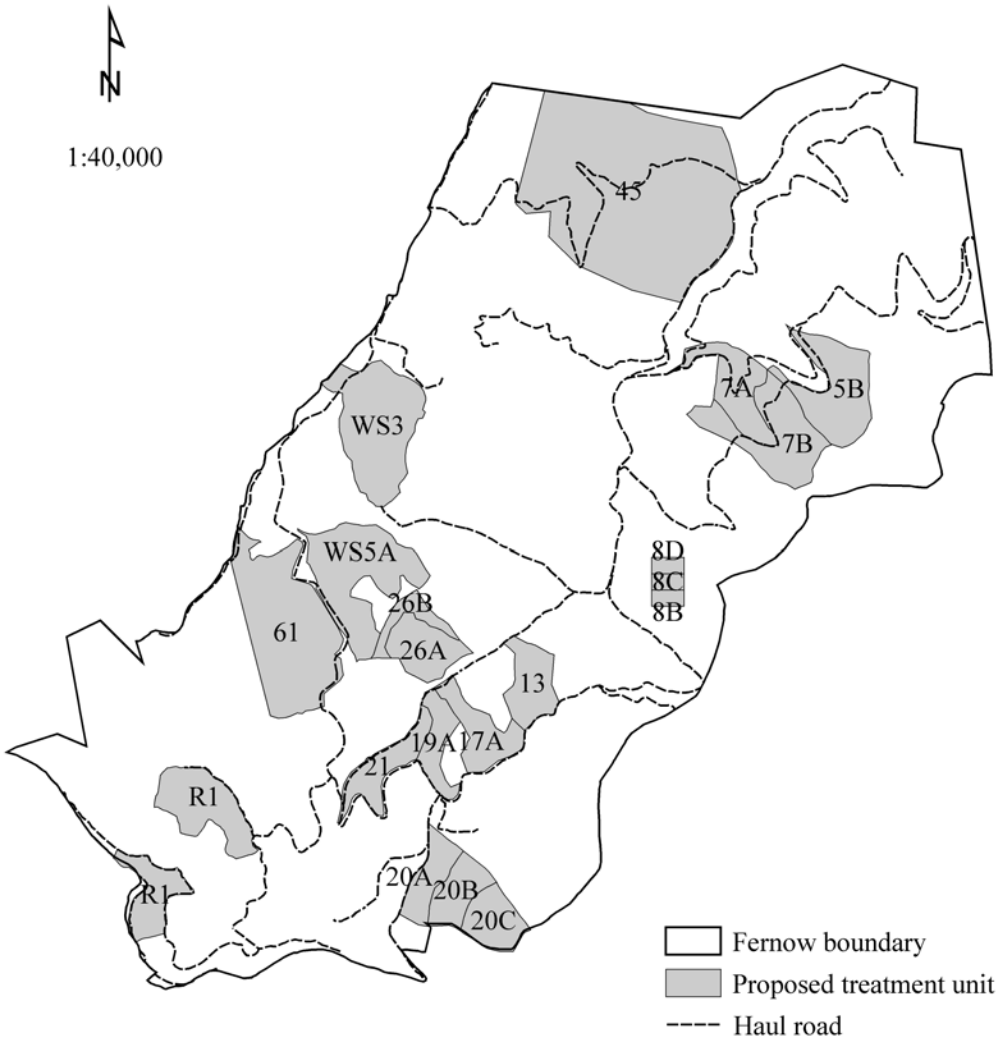

Figure 2-1. Fernow Experimental Forest, with locations of areas proposed for treatment. See text for details of treatments and compartment descriptions.

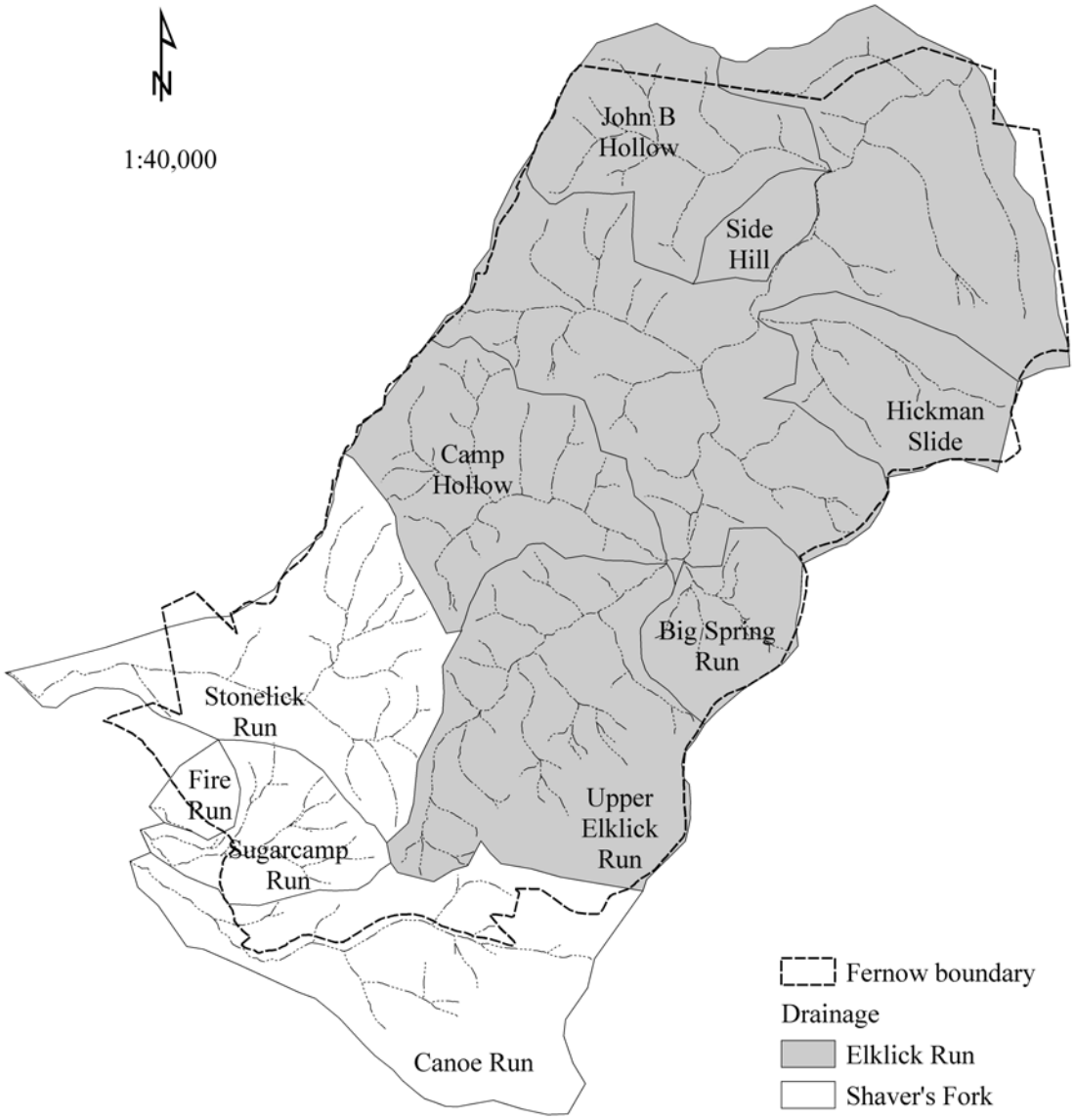

Figure 3-1. Drainages and subdrainages of the Fernow Experimental Forest, as used in analyses in Section 3.1. See text for details.

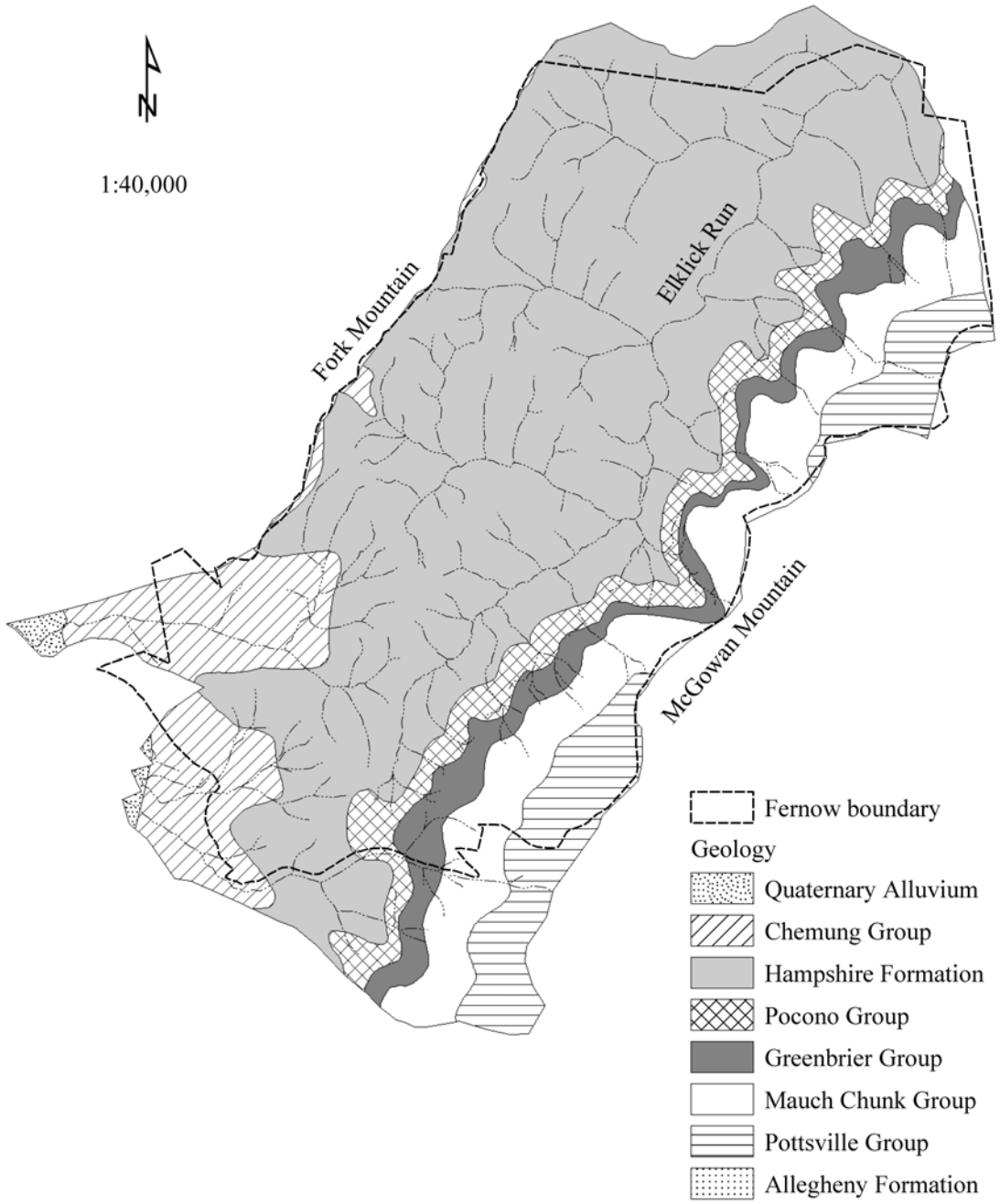

Figure 3-2. Geology underlying the Fernow Experimental Forest. See text (Section 3.4) for description and details.

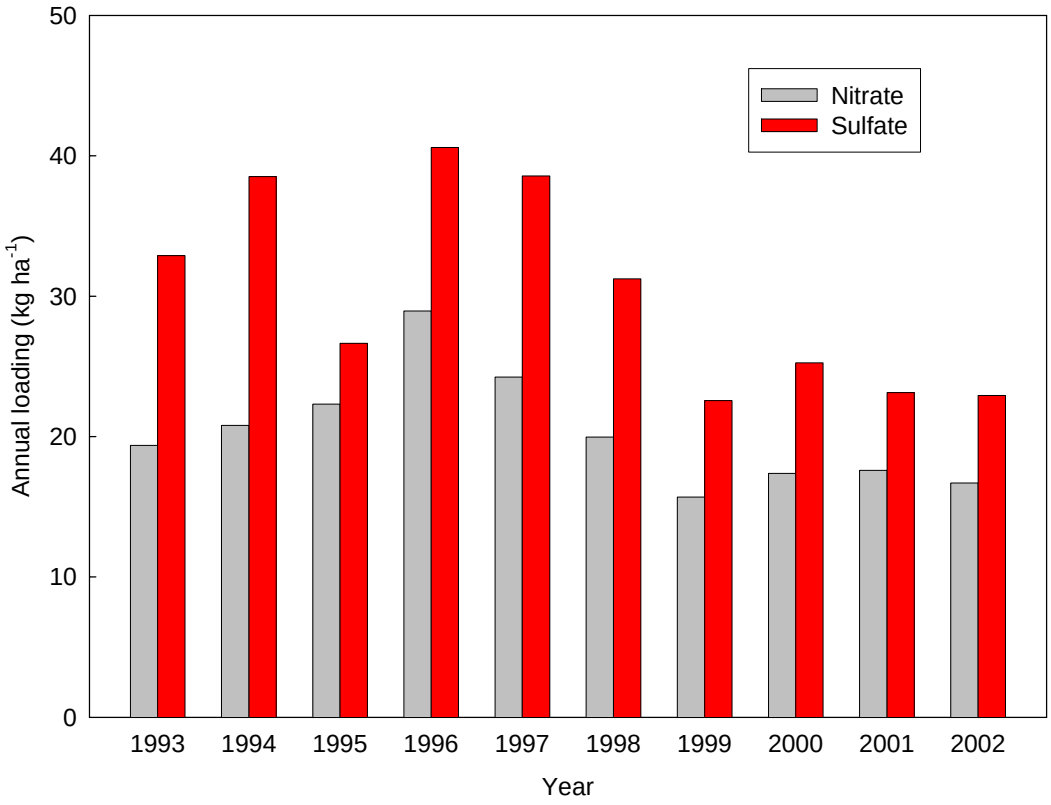

Figure 3-3. Trends in bulk deposition of sulfate and nitrate at Bearden Knob air quality monitoring site.

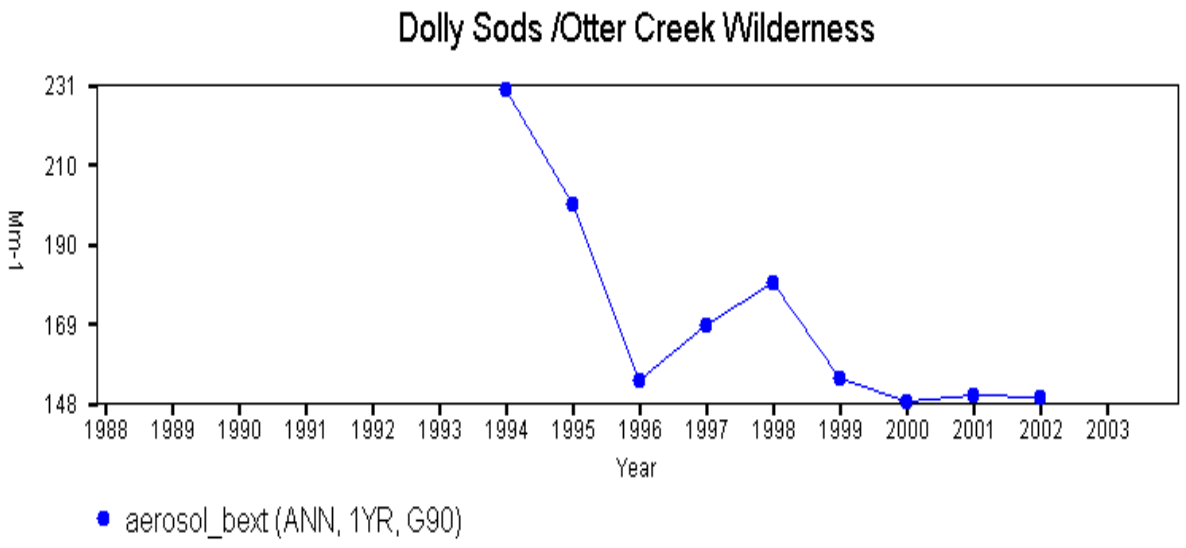

Figure 3-4. Trend in extinction values at Bearden Knob IMPROVE site, 20% worst days.

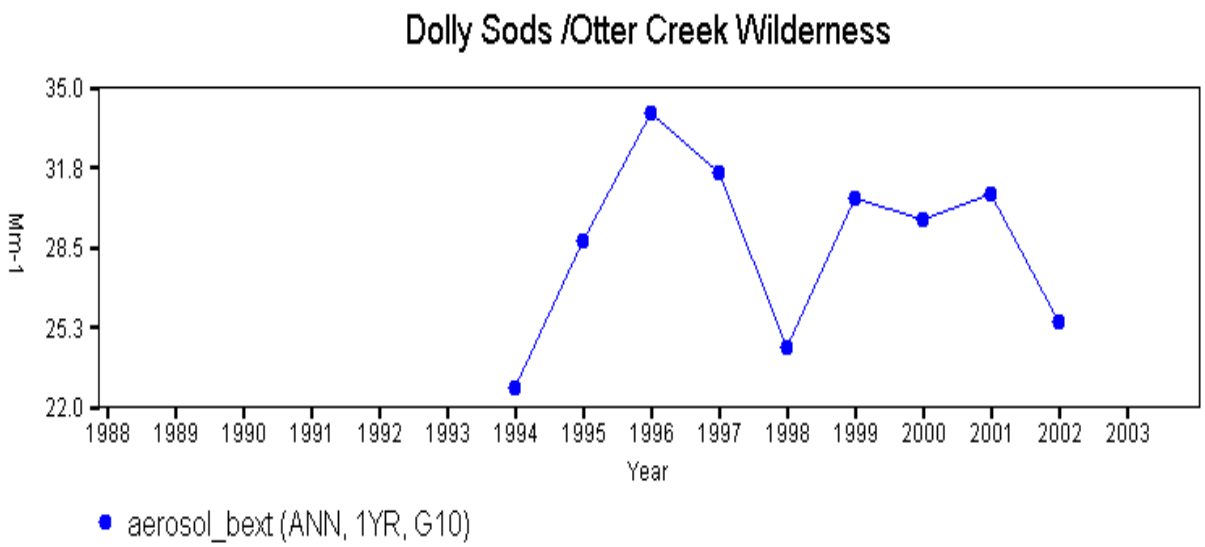

Figure 3-5 Trend in extinction values at Bearden Knob IMPROVE site, 20% best days.

Table 2-1. Proposed Action (Alternative B)

Compartment/ Subcompartment	Treatment	Study number	Date established	Acres to be treated
5B	Single-tree selection	4110-FS-NE-1103-2	1956	56.5
7A&B	Patch clearcut	4110-FS-NE-1103-2	1956	13.6
WS5A	Single-tree selection	4110-FS-NE-1103-2	1955	78.2
17A	Patch clearcut	4110-FS-NE-1103-2	1957	4.0
19A	Patch cut	4110-FS-NE-1103-2	1957	3.2
20A	Single-tree selection	4110-FS-NE-1103-2	1952	25.2
20B	4% Financial maturity – extensive selection	4110-FS-NE-4101-62	1952	25.3
20C	Diameter-limit cut (17.0”)	4110-FS-NE-1103-2	1952	27.7
R1	Shelterwood cut,prescribed fire	4300-FS-NE-4353-12	2000	74.0
8B	Diameter limit cut (15.6”)	4110-FS-NE-4101-8	1949	5.0
8C	Single-tree selection	4110-FS-NE-4101-8	1949	5.0
8D	Single-tree selection	4110-FS-NE-1103-8	1949	5.0
26A	6% Financial maturity cut	4110-FS-NE-4101-62	1951	32
26B	6% Financial maturity cut	4110-FS-NE-4101-62	1951	14
61	3% Financial maturity cut	4110-FS-NE-4101-62	1975	118.4
WS3	Fertilization with ammonium sulfate at twice ambient levels	4300-FS-NE-4301-59 and 4300-FS-NE-4301-63	1988	84.7
45,13, 21	Overstory mortality, and prescribed burning	Study number to be assigned	2006	392

Table 3-1. Subdrainages of the Fernow Experimental Forest, decription and proposed treatments

		Ownership		Compartment			Treatment			
Subdrainage	Area (ac)	Federal (%)	Private (%)	Name	Area (ac)	% Subdrainage	Type	Area (ac)	% Subdrainage	BA Reduct per Comp (%)
Side Hill	83.0	100.0	0.0	45	75.5	91.0	Prescribed fire, overstory mortality	44.2	53.3	50-75
				Other	7.5	9.0		--	--	
				Total	83.0	100.0		44.2	53.3	
John B Hollow	398.9	87.3	12.7	45	238.4	59.8	Prescribed fire, overstory mortality	107.9	27.0	50-75
				Other	160.5	40.2		--	--	
				Total	398.9	100.0		107.9	27.0	
Camp Hollow	487.6	100.0	0.0	WS3	84.7	17.4	Artificial acidification	84.7	17.4	0
				WS5A	78.2	16.0	Single-tree selection	78.2	16.0	20
				Other	324.7	66.6		--	--	
				Total	487.6	100.0		162.9	33.4	
Hickman Slide	294.5	100.0	0.0	5B	56.4	19.2	Single-tree selection	56.4	19.2	30
				7A	37.1	12.6	Patch clearcut	6.0	2.0	28
				7B	59.7	20.3	Patch clearcut	10.0	3.4	27
				Other	141.3	48.0		--	--	
				Total	294.5	100.0		72.4	24.6	
Big Spring	200.0	100.0	0.0	8B	5.0	2.5	Diameter-limit	5.0	2.5	50
				8C	5.0	2.5	Single-tree selection	5.0	2.5	23
				8D	5.0	2.5	Intensive single-tree selection	5.0	2.5	20
				Other	185.0	92.5		--	--	
				Total	200.0	100.0		15.0	7.5	
Upper Elklick	735.8	100.0	0.0	13	31.3	4.3	Prescribed fire, overstory mortality	17.2	2.3	50-75
				17A	31.4	4.3	Patch clearcut	4.0	0.5	16
				19A	22.4	3.0	Patch clearcut	3.2	0.4	16
				20A	18.7	2.5	Single-tree selection	18.7	2.5	23

	Ownership			Compartment			Treatment			
Subdrainage	Area (ac)	Federal (%)	Private (%)	Name	Area (ac)	% Subdrainage	Type	Area (ac)	% Subdrainage	BA Reduct per Comp (%)
				20B	18.0	2.4	4% financial maturity	18.0	2.4	21
				20C	9.9	1.3	Diameter-limit	9.9	1.3	35
				21	30.9	4.2	Prescribed fire, overstory mortality	9.2	1.3	50-75
				26A	32.0	4.3	6% financial maturity	32.0	4.3	31
				26B	14.2	1.9	6% financial maturity	14.2	1.9	31
				Other	527.0	71.6		--	--	
				Total	735.8	100.0		46.2	6.3	
Stonelick	620.1	87.9	12.1	61	118.4	19.1	3% financial maturity	118.4	19.1	20
				R1	8.8	1.4	Prescribed fire, shelterwood cut	8.8	1.4	50
				Other	492.9	79.5		--	--	
				Total	620.1	100.0		127.2	20.5	
Canoe	691.5	100.0	0.0	20A	6.5	0.9	Single-tree selection	6.5	0.9	23
				20B	7.3	1.1	4% financial maturity	7.3	1.1	21
				20C	17.8	2.6	Diameter-limit	17.8	2.6	35
				Other	659.9	95.4		--	--	
				Total	691.5	100.0		31.6	4.6	
Sugarcamp	221.3	99.9	0.1	R1	65.8	29.7	Prescribed fire, shelterwood cut	65.8	29.7	50
				Other	155.5	70.3		--	--	
				Total	221.3	100.0		65.8	29.7	
Fire	55.2	99.8	0.2	R1	2.5	4.5	Prescribed fire, shelterwood cut	2.5	4.5	50
				Other	52.7	95.5		--	--	
				Total	55.2	100.0		2.5	4.5	

Table 3-2 Subdrainages of the Fernow Experimental Forest, length and area in roads and decks.

		Haulroads			Skidroads			Decks		Total	
Subdrainage & acres	Comp.	Length (mi)	Area (ac)	% Subdrainage	Length (mi)	Area (ac)	% Subdrainage	Area (ac)	% Subdrainage	Area (ac)	% Subdrainage
Lower Elklick 856.0	Total	7.21	17.48	2.04	3.96	6.24	0.73	0.00	0.00	23.72	2.77
Side Hill 83.0	45	0.00	0.00	0.00	0.69	1.09	1.31	0.00	0.00	1.09	1.31
	Other	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	Total	0.00	0.00	0.00	0.69	1.09	1.31	0.00	0.00	1.09	1.31
John B Hollow 398.9	45	1.70	4.12	1.03	2.31	3.64	0.91	0.00	0.00	7.76	1.95
	Other	0.98	2.38	0.60	0.00	0.00	0.00	0.00	0.00	2.38	0.60
	Total	2.68	6.50	1.63	2.31	3.64	0.91	0.00	0.00	10.14	2.54
Camp Hollow 487.6	WS3	0.14	0.34	0.07	2.22	3.50	0.72	0.00	0.00	3.84	0.79
	WS5A	0.25	0.61	0.12	2.32	3.66	0.75	0.16	0.03	4.42	0.91
	Other	1.56	3.78	0.78	1.95	3.07	0.63	0.28	0.06	7.13	1.46
	Total	1.95	4.73	0.97	6.49	10.23	2.10	0.44	0.09	15.39	3.16
Hickman Slide 294.5	5B	0.30	0.73	0.25	1.79	2.82	0.96	0.08	0.03	3.63	1.23
	7A	0.68	1.65	0.56	0.63	0.99	0.34	0.11	0.04	2.75	0.93
	7B	0.34	0.82	0.28	1.82	2.87	0.97	0.11	0.04	3.80	1.29
	Other	0.70	1.70	0.58	3.25	5.12	1.74	0.15	0.05	6.97	2.37
	Total	2.02	4.90	1.66	7.49	11.80	4.01	0.44	0.15	17.14	5.82
Big Spring 200.0	8B	0.00	0.00	0.00	0.07	0.11	0.06	0.00	0.00	0.11	0.06
	8C	0.00	0.00	0.00	0.25	0.39	0.20	0.00	0.00	0.39	0.20
	8D	0.00	0.00	0.00	0.17	0.27	0.13	0.00	0.00	0.27	0.13
	Other	1.49	3.61	1.81	1.50	2.36	1.18	0.07	0.04	6.05	3.02
	Total	1.49	3.61	1.81	1.99	3.14	1.57	0.07	0.04	6.82	3.41
Upper Elklick	13	0.00	0.00	0.00	1.40	2.21	0.30	0.00	0.00	2.21	0.30

		Haulroads			Skidroads			Decks		Total	
Subdrainage & acres	Comp.	Length (mi)	Area (ac)	% Subdrainage	Length (mi)	Area (ac)	% Subdrainage	Area (ac)	% Subdrainage	Area (ac)	% Subdrainage
735.8	17A	0.00	0.00	0.00	0.82	1.29	0.18	0.18	0.02	1.47	0.20
	19A	0.00	0.00	0.00	0.94	1.48	0.20	0.12	0.02	1.60	0.22
	20A	0.00	0.00	0.00	0.70	1.10	0.15	0.15	0.02	1.25	0.17
	20B	0.00	0.00	0.00	0.62	0.98	0.13	0.00	0.00	0.98	0.13
	20C	0.00	0.00	0.00	0.33	0.52	0.07	0.00	0.00	0.52	0.07
	21	0.00	0.00	0.00	0.75	1.18	0.16	0.02	0.00	1.20	0.16
	26A	0.00	0.00	0.00	1.00	1.58	0.21	0.00	0.00	1.58	0.21
	26B	0.00	0.00	0.00	0.77	1.21	0.16	0.00	0.00	1.21	0.16
	Other	4.00	9.70	1.32	9.38	14.78	2.01	0.48	0.07	24.96	3.39
	Total	4.00	9.70	1.32	16.71	26.33	3.58	0.95	0.13	36.98	5.03
Stonelick	61	0.00	0.00	0.00	3.30	5.20	0.84	0.56	0.09	5.76	0.93
620.1	R1	0.00	0.00	0.00	0.10	0.16	0.03	0.07	0.01	0.23	0.04
	Other	2.93	7.10	1.15	1.42	2.24	0.36	0.22	0.04	9.56	1.54
	Total	2.93	7.10	1.15	4.82	7.60	1.22	0.85	0.14	15.55	2.51
Canoe	20A	0.00	0.00	0.00	0.10	0.16	0.02	0.00	0.00	0.16	0.02
691.5	20B	0.00	0.00	0.00	0.14	0.22	0.03	0.00	0.00	0.22	0.03
	20C	0.00	0.00	0.00	0.57	0.90	0.13	0.00	0.00	0.90	0.13
	Other	3.25	7.88	1.14	0.58	0.91	0.13	0.00	0.00	8.79	1.27
	Total	3.25	7.88	1.14	1.39	2.19	0.32	0.00	0.00	10.07	1.46
Sugarcamp	R1	0.00	0.00	0.00	0.50	0.79	0.36	0.10	0.05	0.89	0.40
221.3	Other	1.41	3.42	1.54	0.01	0.02	0.01	0.00	0.00	3.43	1.55
	Total	1.41	3.42	1.54	0.51	0.80	0.36	0.10	0.05	4.32	1.95
	R1	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Fire	Other	0.91	2.21	4.00	0.00	0.00	0.00	0.00	0.00	2.21	4.00
55.2	Total	0.91	2.21	4.00	0.00	0.00	0.00	0.00	0.00	2.21	4.00

Table 3-3. Subdrainages of the Fernow Experimental Forest, length of perennial and nonperennial stream reaches.

Subdrainage	Comp.	Perennial Length (mi)	Perennial % Subdrainage	Nonperennial Length (mi)	Nonperennial % Subdrainage	Total Length (mi)	Total % Subdrainage
Lower Elklick	Total	3.04	100.0	4.27	100.0	7.31	100.0
Side Hill	45	0.00	0.0	0.00	0.0	0.00	0.0
	Other	0.00	0.0	0.00	0.0	0.00	0.0
	Total	0.00	0.0	0.00	0.0	0.00	0.0
John B Hollow	45	1.29	97.0	1.25	54.8	2.54	70.4
	Other	0.04	3.0	1.03	45.2	1.07	29.6
	Total	1.33	100.0	2.28	100.0	3.61	100.0
Camp Hollow	WS3	0.05	4.4	0.98	21.9	1.03	18.3
	WS5A	0.13	11.4	0.97	21.7	1.10	19.6
	Other	0.96	84.2	2.53	56.5	3.49	62.1
	Total	1.14	100.0	4.48	100.0	5.62	100.0
Hickman Slide	5B	0.00	0.0	0.36	25.9	0.36	16.1
	7A	0.32	37.6	0.48	34.5	0.80	35.7
	7B	0.00	0.0	0.23	16.5	0.23	10.3
	Other	0.53	62.4	0.32	23.0	0.85	37.9
	Total	0.85	100.0	1.39	100.0	2.24	100.0
Big Spring	8B	0.00	0.0	0.05	3.8	0.05	2.7
	8C	0.00	0.0	<0.01	0.0	<0.01	0.0
	8D	0.00	0.0	0.03	2.3	0.03	1.6
	Other	0.58	100.0	1.22	93.8	1.80	95.7
	Total	0.58	100.0	1.30	100.0	1.88	100.0
Upper Elklick	13	0.05	2.7	0.44	7.3	0.49	6.2
	17A	0.06	3.2	0.77	12.7	0.83	10.5

Subdrainage	Comp.	Perennial Length (mi)	Perennial % Subdrainage	Nonperennial Length (mi)	Nonperennial % Subdrainage	Total Length (mi)	Total % Subdrainage
	19A	0.03	1.6	0.55	9.1	0.58	7.3
	20A	0.00	0.0	0.00	0.0	0.00	0.0
	20B	0.00	0.0	0.00	0.0	0.00	0.0
	20C	0.00	0.0	0.00	0.0	0.00	0.0
	21	0.65	34.8	0.10	1.7	0.75	9.5
	26A	0.00	0.0	0.41	6.8	0.41	5.2
	26B	0.00	0.0	0.01	0.2	0.01	0.1
	Other	1.08	57.8	3.78	62.4	4.86	61.3
	Total	1.87	100.0	6.06	100.0	7.93	100.0
Stonelick	61	0.00	0.0	1.85	37.9	1.85	28.9
	R1	0.00	0.0	0.00	0.0	0.00	0.0
	Other	1.53	100.0	3.03	62.1	4.56	71.1
	Total	1.53	100.0	4.88	100.0	6.41	100.0
Canoe	20A	0.00	0.0	0.00	0.0	0.00	0.0
	20B	0.00	0.0	0.00	0.0	0.00	0.0
	20C	0.00	0.0	0.00	0.0	0.00	0.0
	Other	2.25	100.0	2.45	100.0	4.70	100.0
	Total	2.25	100.0	2.45	100.0	4.70	100.0
Sugarcamp	R1	0.17	26.6	0.63	21.6	0.80	22.5
	Other	0.47	73.4	2.28	78.4	2.75	77.5
	Total	0.64	100.0	2.91	100.0	3.55	100.0
Fire	R1	0.00	0.0	0.00	0.0	0.00	0.0
	Other	0.00	100.0	0.22	100.0	0.22	100.0
	Total	0.00	100.0	0.22	100.0	0.22	100.0

Table 3-4. Subdrainages of the Fernow Experimental Forest, geologic formations.

Subdrainage	Comp.	Alluvium	Chemung	Hampshire	Pocono	Greenbrier	Mauch Chunk	Pottsville	Allegheny	Total
		acres								
Lower Elklick	Total	0	0	701.7	47.3	32.2	50.3	24.5	0	856.0
Side Hill	45	0	0	75.5	0	0	0	0	0	75.5
	Other	0	0	7.5	0	0	0	0	0	7.5
	Total	0	0	83.0	0	0	0	0	0	83.0
John B Hollow	45	0	0	239.2	0	0	0	0	0	239.2
	Other	0	1.4	158.3	0	0	0	0	0	159.7
	Total	0	1.4	397.5	0	0	0	0	0	398.9
Camp Hollow	WS3	0	<0.1	84.7	0	0	0	0	0	84.7
	WS5A	0	0	78.2	0	0	0	0	0	78.2
	Other	0	9.7	315	0	0	0	0	0	324.7
	Total	0	9.7	477.9	0	0	0	0	0	487.6
Hickman Slide	5B	0	0	0.1	1.9	10.5	41.6	2.3	0	56.4
	7A	0	0	22	10.6	4.2	0.3	0	0	37.1
	7B	0	0	<0.1	12.7	12.9	30.4	3.6	0	59.6
	Other	0	0	25.7	15	5.8	3.1	91.7	<0.1	141.3
	Total	0	0	47.8	40.2	33.4	75.4	97.6	<0.1	294.4
Big Spring	8B	0	0	0	0	0.3	4.7	0	0	5.0
	8C	0	0	0	<0.1	0.8	4.2	0	0	5.0
	8D	0	0	0	1.4	3.5	0.1	0	0	5.0
	Other	0	0	30.2	44.5	32.5	77.8	0	0	185.0
	Total	0	0	30.2	45.9	37.1	86.8	0	0	200.0
Upper Elklick	13	0	0	14.8	12.1	4.4	0	0	0	31.3
	17A	0	0	9.5	13.1	8.8	0	0	0	31.4
	19A	0	0	0	5.5	16.9	0	0	0	22.4

Subdrainage	Comp.	Alluvium	Chemung	Hampshire	Pocono	Greenbrier	Mauch Chunk	Pottsville	Allegheny	Total
						acres				
	20A	0	0	0	0	7.8	10.9	0	0	18.7
	20B	0	0	0	0	0	17.5	0.5	0	18.0
	20C	0	0	0	0	0	0.6	9.3	0	9.9
	21	0	0	30.9	0	0	0	0	0	30.9
	26A	0	0	32	0	0	0	0	0	32.0
	26B	0	0	14.2	0	0	0	0	0	14.2
	Other	0	0	237.4	61.6	38.7	87.7	101.7	0	527.1
	Total	0	0	338.8	92.3	76.6	116.7	111.5	0	735.9
Stonelick	61	0	11.9	106.5	0	0	0	0	0	118.4
	R1	0	0	8.8	0	0	0	0	0	8.8
	Other	18.4	268.2	206.3	0	0	0	0	0	492.9
	Total	18.4	280.1	321.6	0	0	0	0	0	620.1
Canoe	20A	0	0	0	0	0.7	5.8	0	0	6.5
	20B	0	0	0	0	0	7.3	0	0	7.3
	20C	0	0	0	0	0	1.8	16	0	17.8
	Other	5.2	80.2	144.6	70.1	79.2	140.7	139.9	0	659.9
	Total	5.2	80.2	144.6	70.1	79.9	155.6	155.9	0	691.5
Sugarcamp	R1	0	27.7	38.0	0	0	0	0	0	65.7
	Other	3	67.2	83.4	1.9	0	0	0	0	155.5
	Total	3	94.9	121.4	1.9	0	0	0	0	221.2
Fire	R1	0	2.5	0	0	0	0	0	0	2.5
	Other	1.8	49.7	1.1	0	0	0	0	0	52.6
	Total	1.8	52.2	1.1	0	0	0	0	0	55.1

Table 3-5. Tucker County emission sources, in tons per year (Source: EPA, AIRSData; www.epa.gov/airsdata/srcaddr.htm).

Source	Area Source Emissions					Point Source Emissions				
	CO[1]	NOX[2]	PM10[3]	SO_2[4]	VOC[5]	CO	NOX	PM10	SO_2	VOC
Industrial fuel combustion	11	68	2	57	2	0	0	0	0	0
Residential fuel combustion	999	23	118	8	189	0	0	0	0	0
Commercial fuel combustion	1	10	1	10	0	0	0	0	0	0
Chemical & allied product manufacturing	0	0	0	0	0	14	202	0	28	66
Solvent utilization	0	0	0	0	147	0	0	0	0	0
Storage and transport (Service Stations)	0	0	0	0	33	0	0	0	0	0
Waste Disposal/ Recycling	95	6	23	1	29	0	0	0	0	0
Highway vehicles	1911	368	13	13	185	0	0	0	0	0
Off-Highway vehicles	267	61	5	12	30	0	0	0	0	0
Natural sources	0	0	0	0	0	0	0	0	0	0
Agriculture/ Forestry	1	0	0	0	0	0	0	0	0	0
Fugitive Dust	0	0	647	0	0	0	0	0	0	0
Total	3285	536	836	100	614	14	204	0	28	67

[1]CO= carbon monoxide
[2] NOX= Nitrogen oxides
[3] PM10= particulate matter less than 10 microns in diameter
[4] SO_2= Sulfur dioxide
[5] VOC= Volatile Organic Carbon (hydrocarbons)

Table 3-6. Comparison of total annual emissions from timber harvesting activities and regional emissions.

	NOx	VOC	PM ($PM_{2.5}$+PM10)
Total Regional Emissions	150,132	58,440	64,543
Total Emissions from Timber Harvest Activities	0.39	0.45	0.02
% Harvest Emissions Comprise of Total Pollution Load	$2.6 * 10^{-4}$ %	$7.8 * 10^{-4}$ %	$3.4 * 10^{-5}$ %

Table 3-7. Comparison of total emissions from prescribed fires and regional emissions.

	NOx	PM ($PM_{2.5}$+PM10)
Total Regional Emissions	150,132 TPY	64,543 TPY
Total Emissions from Prescribed Fires (Over 5-yr Period)	3.89 tons	31.23 tons
% Prescribed Fire Emissions Comprise of Total Pollution Load	.003 %	.048 %

Table 3-8. Soil series found on the Fernow Experimental Forest, distribution and characteristics.

Series	Acres on FEF	% of Area	Erodibility	Water Holding Capacity
Belmont	419.03	9.08	High	High
Calvin	2526.24	54.76	Moderate	Low to Moderate
Cateache	326.74	1.09	High	Moderate
Dekalb	997.94	21.63	Low	Very low to moderate
Gilpin	54.49	1.18	Moderate	Moderate to High
Meckesville	104.41	2.26	High	Moderate
Other	186.15	10		

Table 3-9. Summarized Water Quality Data from Streams on the Fernow Experimental Forest.

Stream	Size (acres)	Gradient (%)	NO_3 conc. (mg/L)	pH	Alkalinity (mg/L)	Ca (mg/L)	Fine Sediment (% <2 mm diameter)	Large woody debris (m^3/ha)
Upper Elklick	1394	1.3	0.50 - 55	7.1	24.1 - 32.5	12.8	11.9 – 12.5	-
Middle Elklick	2503	2.6	0.52	7.2	35.0	14.4	7.3	-
Lower Elklick	3640	1.5	0.59-0.65	7.0	25.7-37.1	1.0	12.0 – 15.4	-
Elklick Run	1420	1.2	0.6	7.3	41.1	15.5	-	-
Wilson Hollow	316	-	0.5	6.3	1.1	1.9	-	130
Hickman Slide	178	-	0.8 – 1.4	7.7	33.4	15.8	-	-
Camp Hollow - #3	94	-	0.9	6.1	0.9	1.5	-	-
Camp Hollow - #4	99	-	1.4	7.5	40.8	17.7	-	-
Camp Hollow	440	2.7	0.6	6.8	12.2	15.5	-	-
Stonelick	598	7	0.6	6.5	2.7	2.3	-	32
Canoe Run	692	6	0.5	7.4	27.7	12.0	-	137