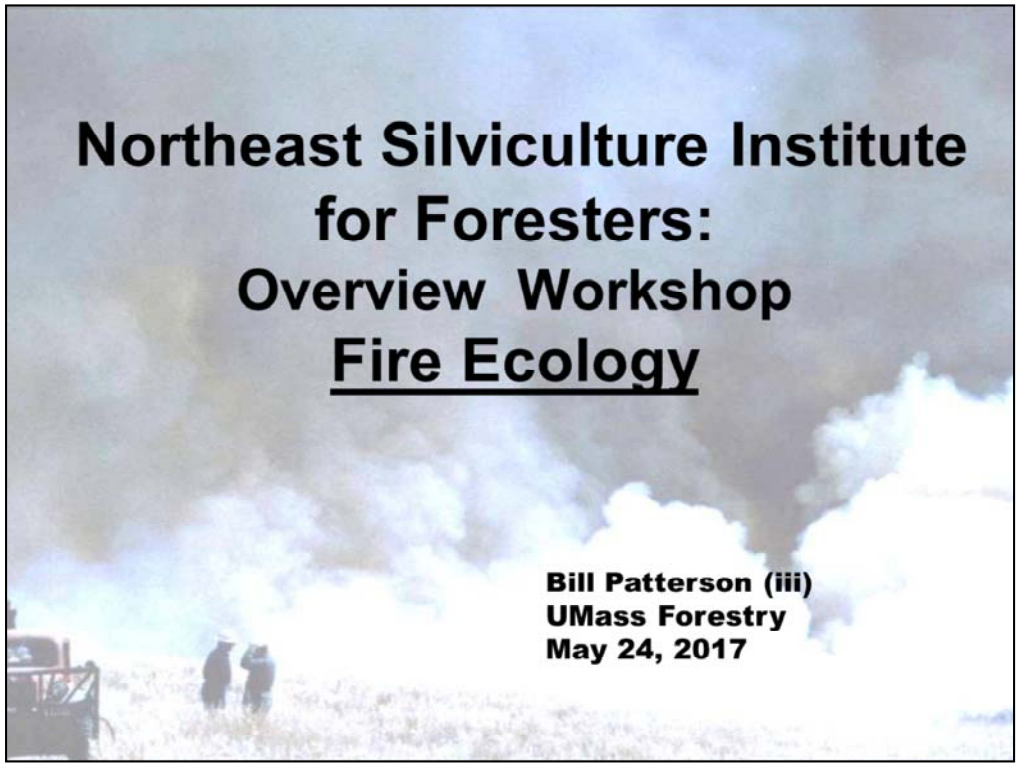
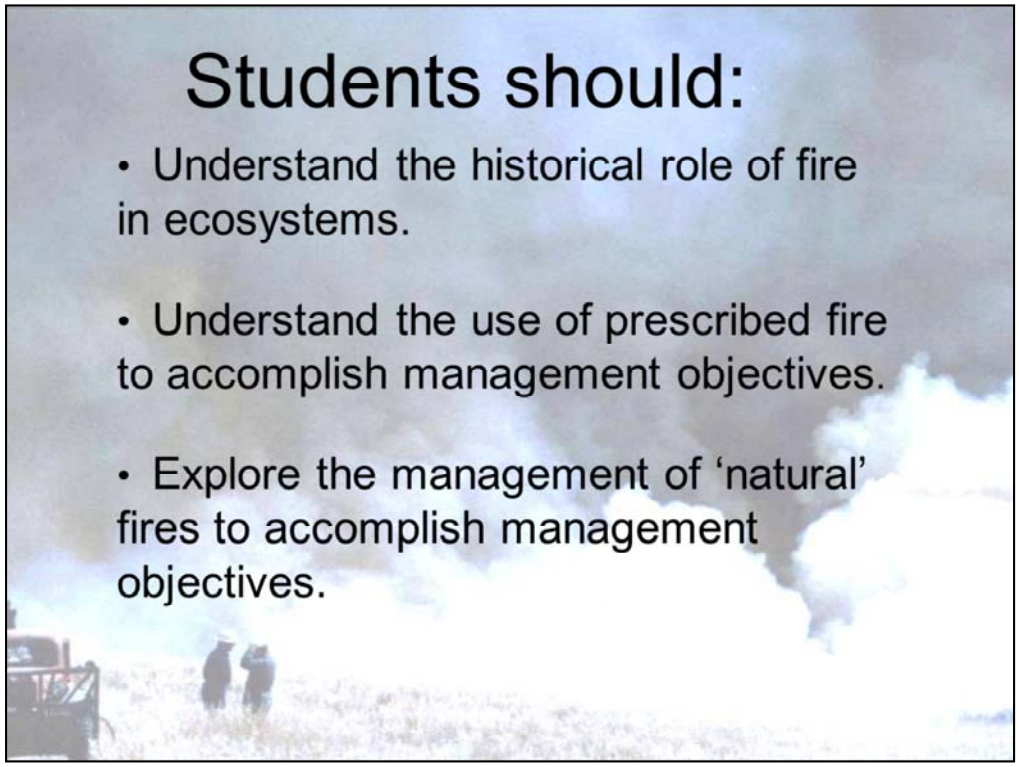


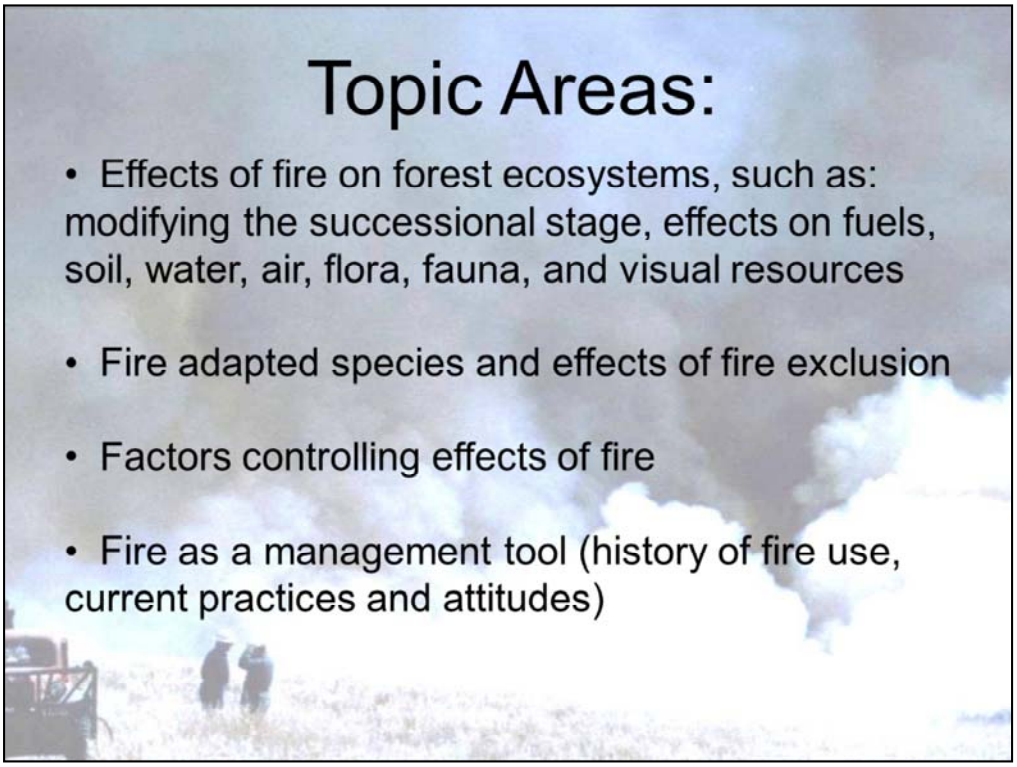
Who are you? Course in Forest Protection? Fire Ecology/Management? S-130/190? Wildland fire experience? Prescribed burn experience?

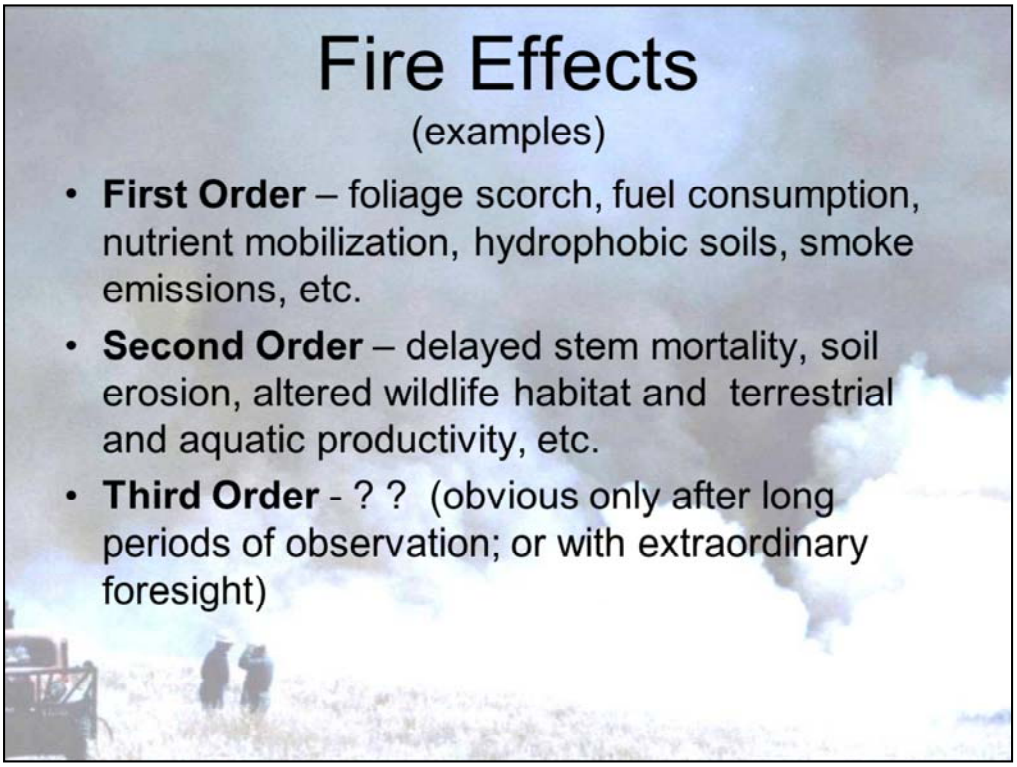
My background in fire. Who am I to be talking to silviculturalists about Fire Management in the Northeast? WAP(iii), Silvics and Silviculture from Ralph Griffin (U-ME) and Henry Hansen (U-MN); Bob Frank introduced me to fire effects while at U-ME. Managed family woodlots in MN and MA for 40+years; Qualified as burn boss by TNC and NPS. Have taught Fire Management and Forest Fire Control for 30+ years.

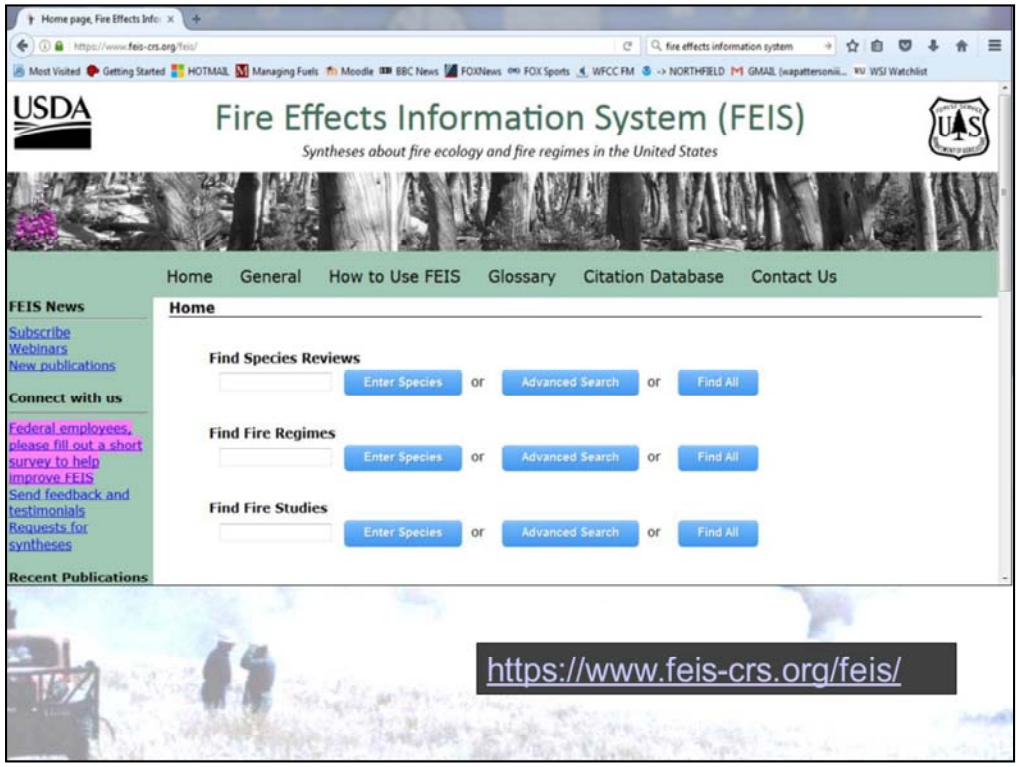

Silviculture[1]
Applied Disturbance Ecology
in Forested Landscapes
• Restoration and/or
• Maintenance
[1] Implies a Fundamental Understanding of Silvics



Skeptics: Employer (UMASS), Colleagues (esp. in Forestry), the fire suppression community (local state, federal), the public. NOT – National Guard, TNC, Mass Audubon, NPS, AND students in particular!


Topic Areas:
• Effects of fire on forest ecosystems, such as: modifying the successional stage, effects on fuels, soil, water, air, flora, fauna, and visual resources
• Fire adapted species and effects of fire exclusion
• Factors controlling effects of fire
• Fire as a management tool (history of fire use, current practices and attitudes)


Fire Effects
(examples)
• First Order – foliage scorch, fuel consumption, nutrient mobilization, hydrophobic soils, smoke emissions, etc.
• Second Order – delayed stem mortality, soil erosion, altered wildlife habitat and terrestrial and aquatic productivity, etc.
• Third Order - ? ? (obvious only after long periods of observation; or with extraordinary foresight)


Fire Effects Information System (FEIS)
Syntheses about fire ecology and fire regimes in the United States
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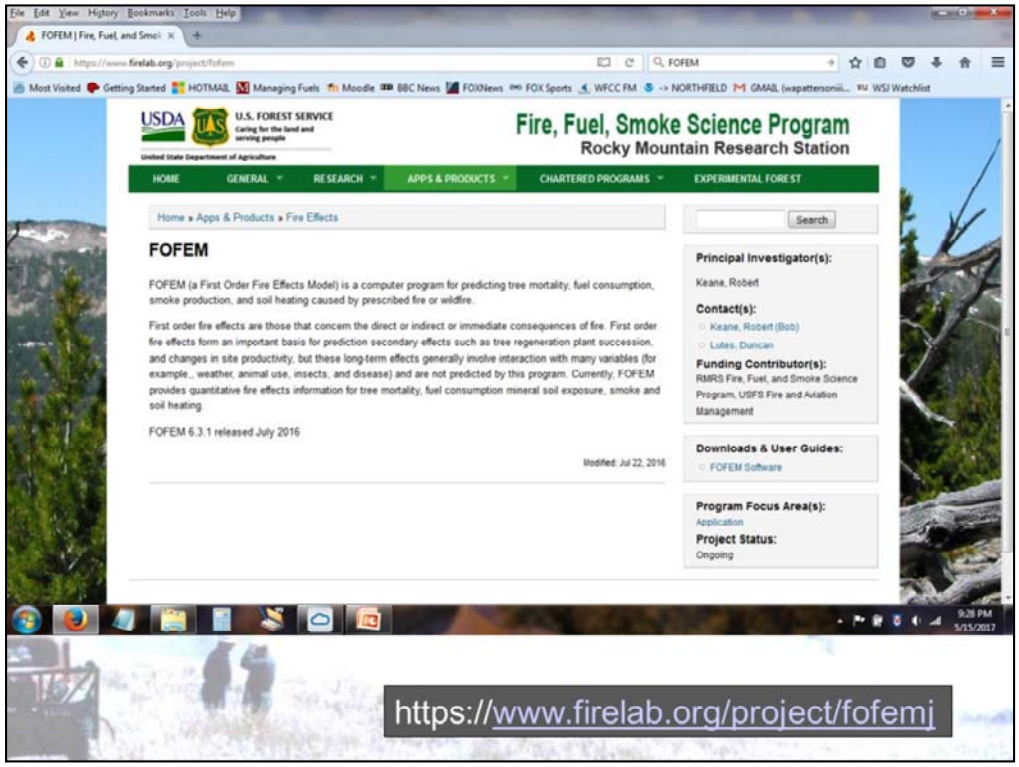
https://www.feis-crs.org/feis/


FOFEM | Fire, Fuel, and Smoke
https://www.firelab.org/project/fofem
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Fire, Fuel, Smoke Science Program
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FOFEM
FOFEM (a First Order Fire Effects Model) is a computer program for predicting tree mortality, fuel consumption, smoke production, and soil heating caused by prescribed fire or wildfire.
First order fire effects are those that concern the direct or indirect or immediate consequences of fire. First order fire effects form an important basis for prediction secondary effects such as tree regeneration plant succession, and changes in site productivity, but these long-term effects generally involve interaction with many variables (for example,, weather, animal use, insects, and disease) and are not predicted by this program. Currently, FOFEM provides quantitative fire effects information for tree mortality, fuel consumption mineral soil exposure, smoke and soil heating.
FOFEM 6.3.1 released July 2016
Modified: Jul 22, 2016
Principal Investigator(s):
Keane, Robert
Contact(s):
Keane, Robert (Bob)
Lutes, Duncan
Funding Contributor(s):
RMRS Fire, Fuel, and Smoke Science Program, USFS Fire and Aviation Management
Downloads & User Guides:
FOFEM Software
Program Focus Area(s):
Application
Project Status:
Ongoing
9:28 PM
5/15/2017
https://www.firelab.org/project/fofemj


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Wildland Fire in Ecosystems: Effects of Fire on Soil and Water
Wildland Fire in Ecosystems: Effects of Fire on Fauna
Wildland Fire in Ecosystems: Effects of Fire on Air
Wildland Fire in Ecosystems: Effects of Fire on Cultural Resources and Archaeology
The Basics
Fire Science Info
Partners
What is FireScience.gov?
http://www.firescience.gov/JFSP_rainbow_series.cfm


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7-Day Forecast for Latitude
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Bridging the Gap between Science and Management
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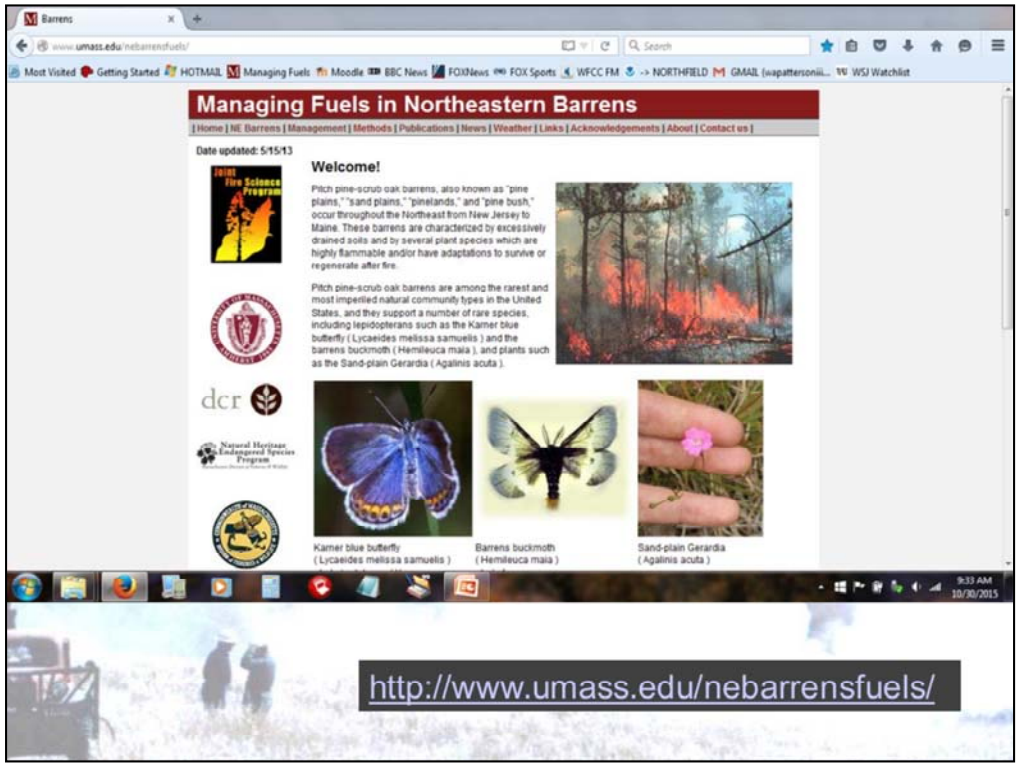
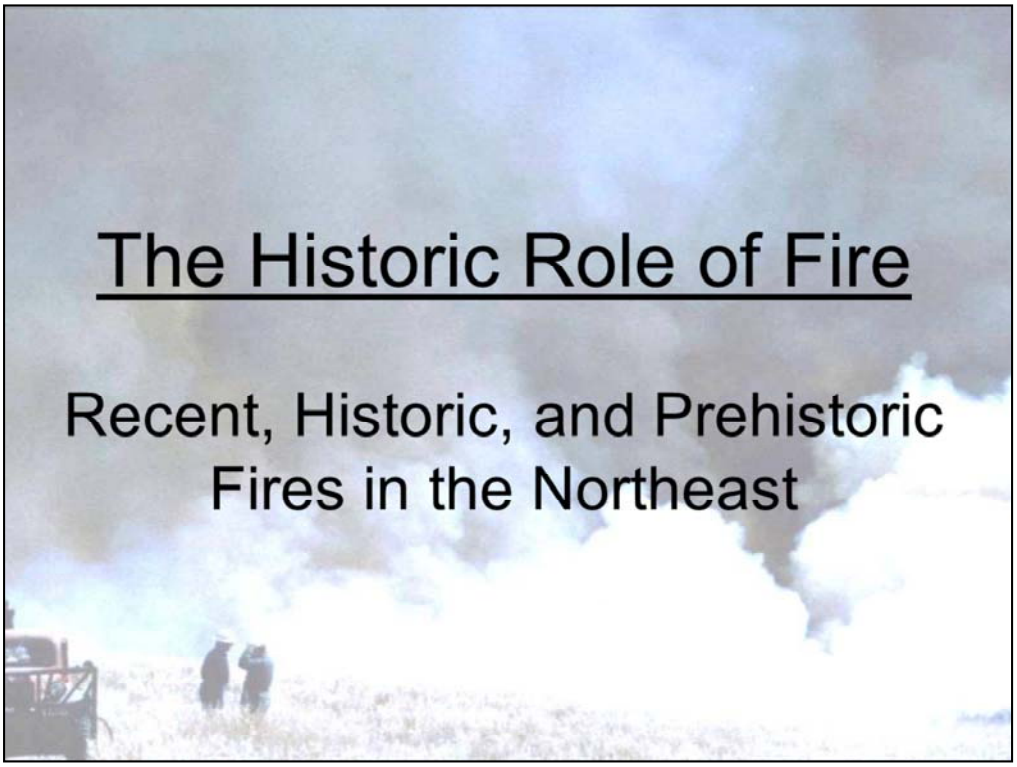
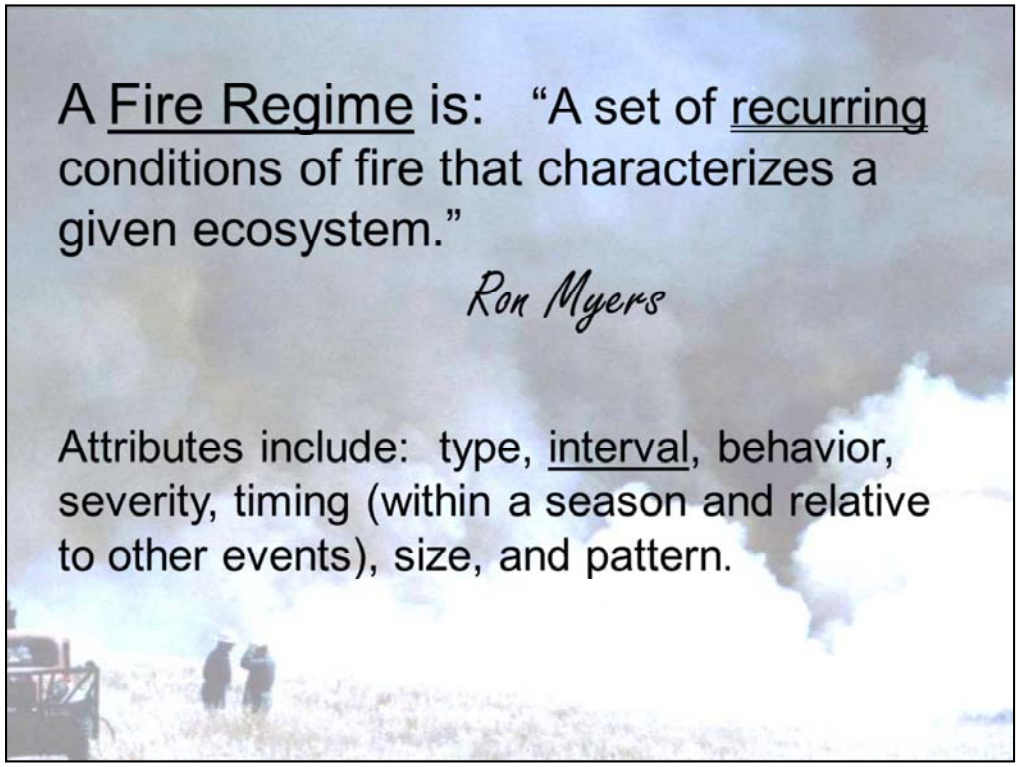
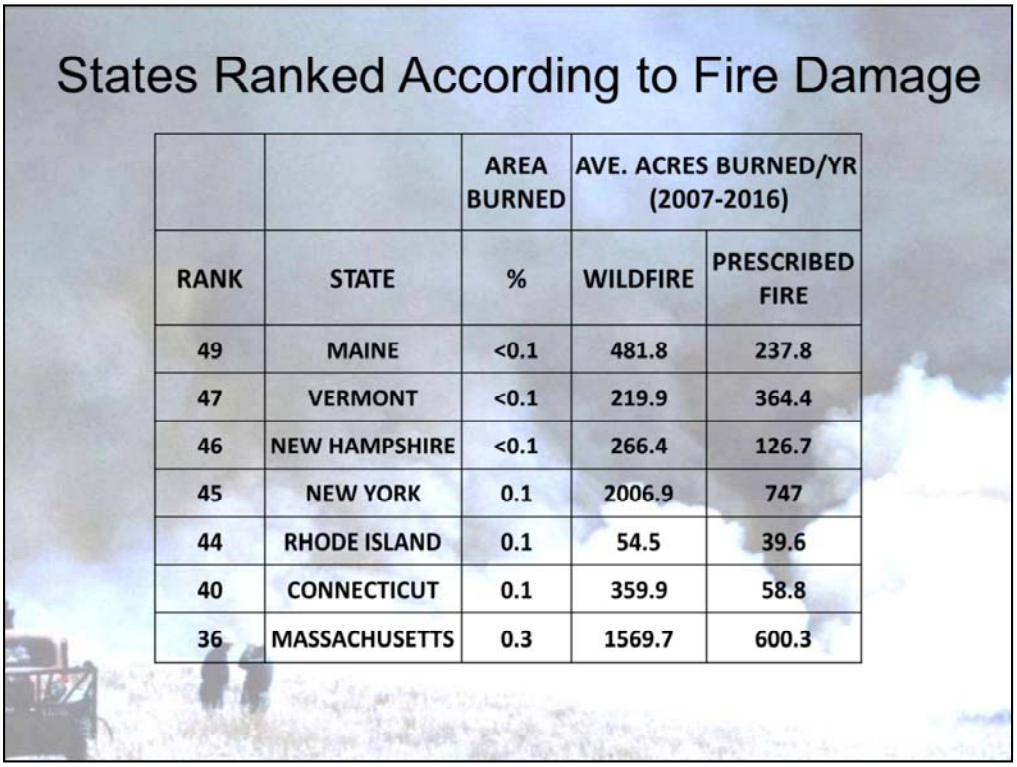
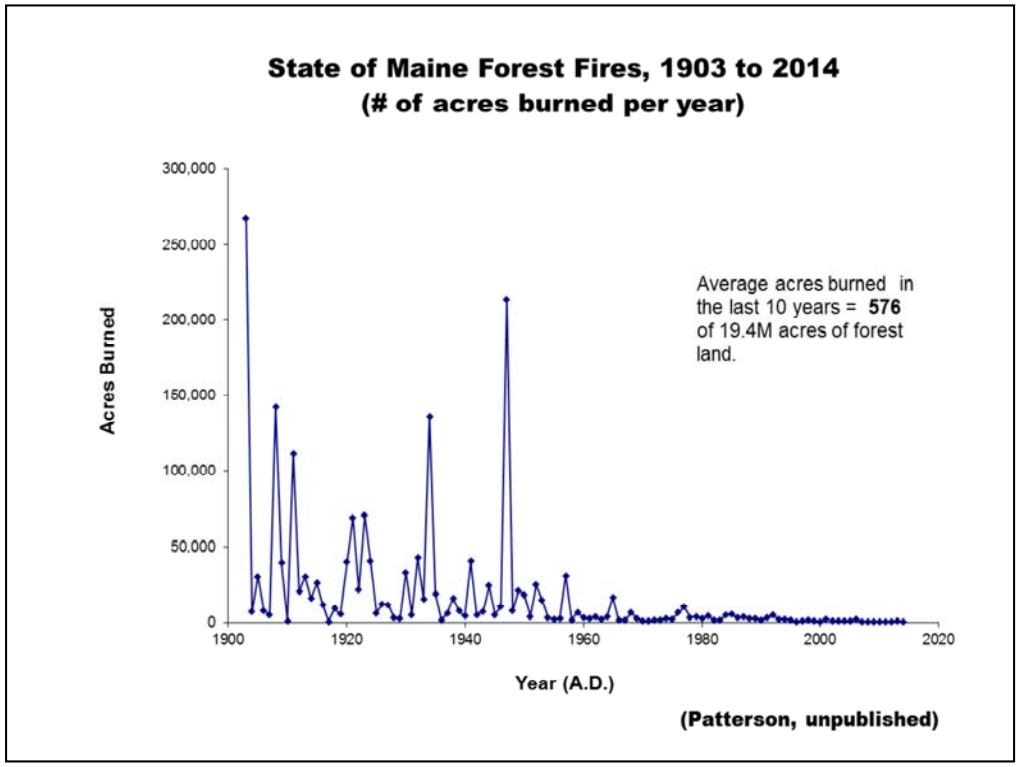

Managing Fuels in Northeastern Barrens
Home | NE Barrens | Management | Methods | Publications | News | Weather | Links | Acknowledgements | About | Contact us |
Date updated: 5/15/13
Welcome!
Pitch pine-scrub oak barrens, also known as "pine plains," "sand plains," "pinelands," and "pine bush," occur throughout the Northeast from New Jersey to Maine. These barrens are characterized by excessively drained soils and by several plant species which are highly flammable and/or have adaptations to survive or regenerate after fire.
Pitch pine-scrub oak barrens are among the rarest and most imperiled natural community types in the United States, and they support a number of rare species, including lepidopterans such as the Karner blue butterfly (Lycaeides melissa samuelis) and the barrens buckmoth (Hemileuca maia), and plants such as the Sand-plain Gerardia (Agalinis acuta).
dcr
Karner blue butterfly (Lycaeides melissa samuelis)
Barrens buckmoth (Hemileuca maia)
Sand-plain Gerardia (Agalinis acuta)
http://www.umass.edu/nebarrensfuels/


The Historic Role of Fire
Recent, Historic, and Prehistoric Fires in the Northeast


A Fire Regime is: "A set of recurring conditions of fire that characterizes a given ecosystem."
Ron Myers
Attributes include: type, interval, behavior, severity, timing (within a season and relative to other events), size, and pattern.



		AREA BURNED	AVE. ACRES BURNED/YR (2007-2016)	
RANK	STATE	%	WILDFIRE	PRESCRIBED FIRE
49	MAINE	<0.1	481.8	237.8
47	VERMONT	<0.1	219.9	364.4
46	NEW HAMPSHIRE	<0.1	266.4	126.7
45	NEW YORK	0.1	2006.9	747
44	RHODE ISLAND	0.1	54.5	39.6
40	CONNECTICUT	0.1	359.9	58.8
36	MASSACHUSETTS	0.3	1569.7	600.3

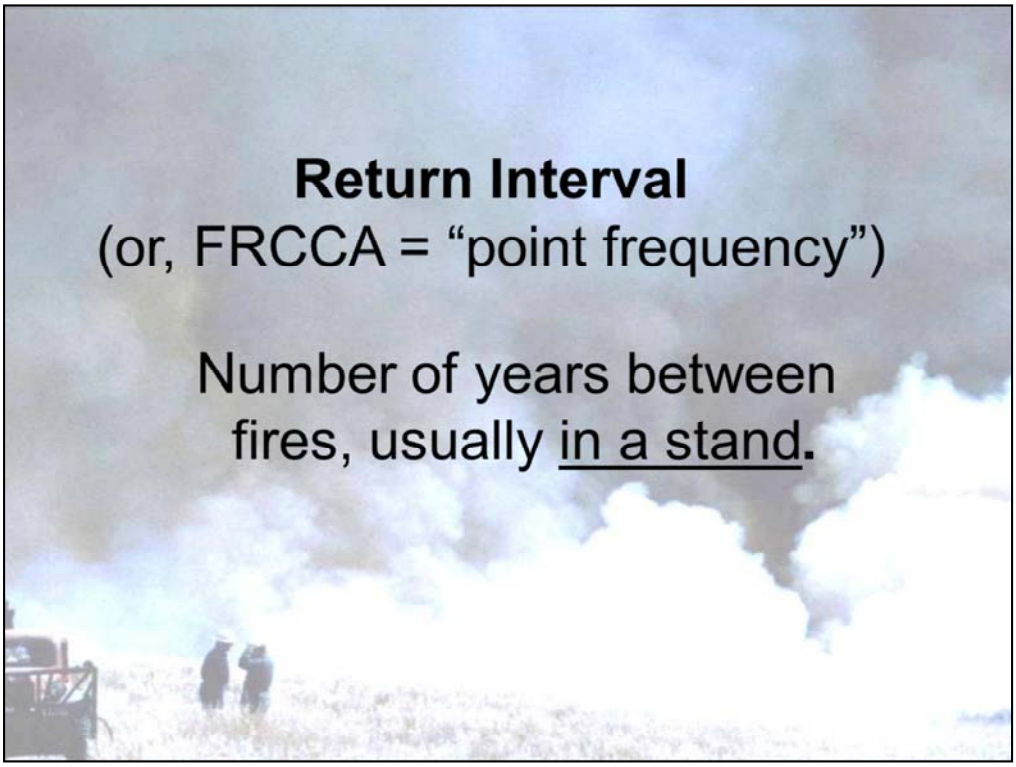


In the last ten years, an average of 490 forest fires have burned an average of 576 acres/yr in Maine, which has an area of 35,385 mi^2 – 85.8% (19.4 M acres) of which is forested.

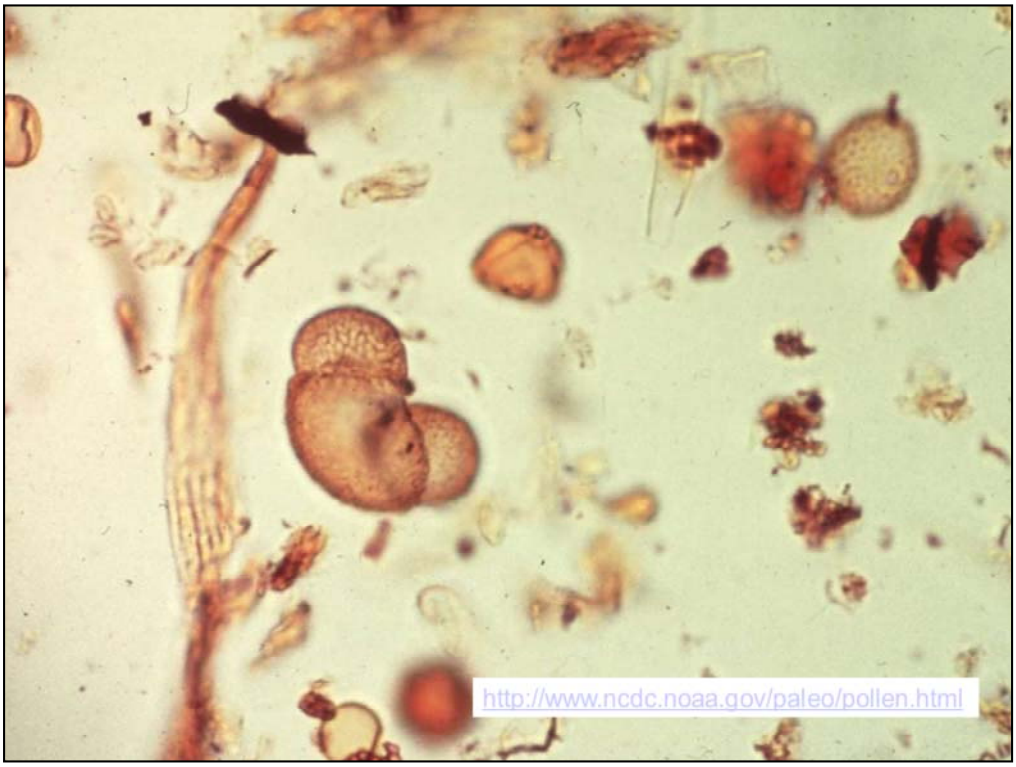
Lloyd Irland has updated records for the past 50 years or more for much of the Northeast. (Irland, L.C. 2013.Extreme value analysis of forest fires from New York to Nova Scotia, 1950-2010. Forest Ecology and Management 294:150-157.)

Post-1947 Fire, ANP - ME


Fire history to most fire managers
means fire scar analysis

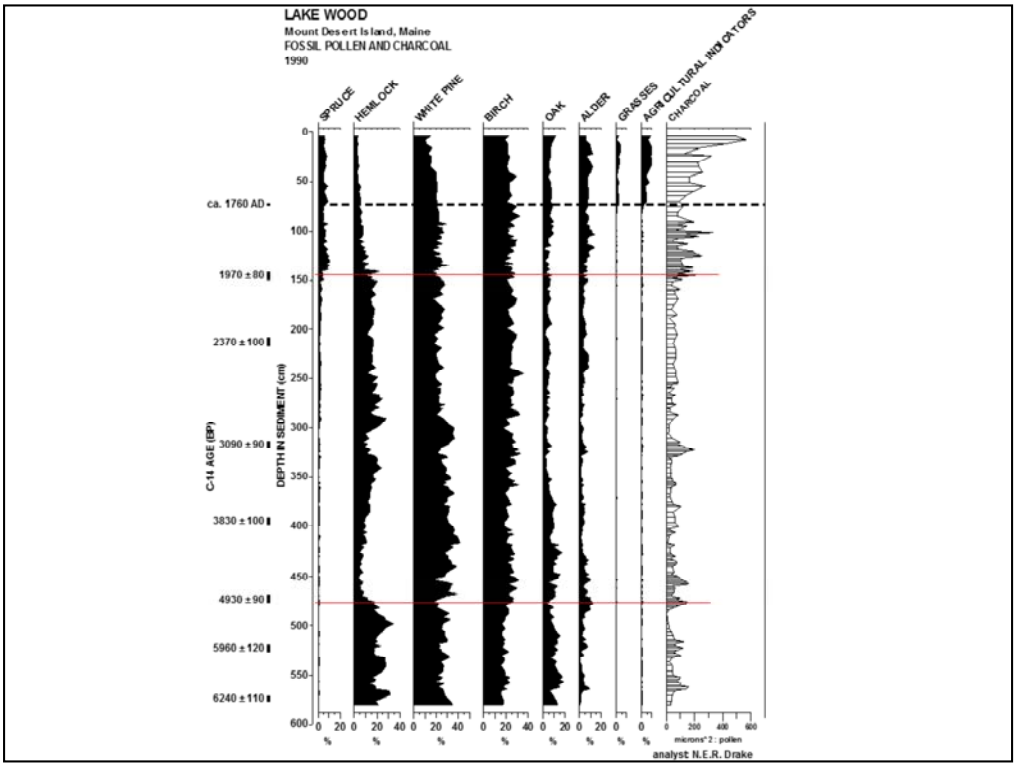


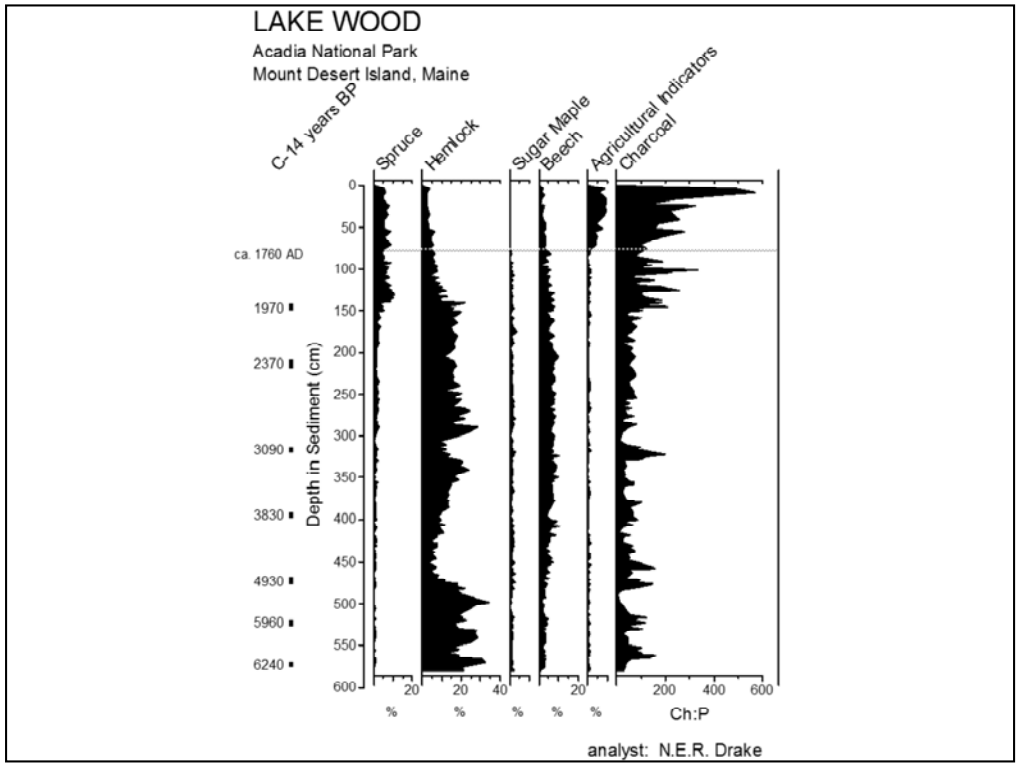
FRCC = Fire Regime Condition Class



10,000-year-old pollen and charcoal from lake near Twin Cities, MN (courtesy of E.J. Cushing, U of MN).

The Bowl in early 1980's. Stand in previous slide is to the left, out of picture. Entire watershed burned in 1947.


LAKE WOOD
Mount Desert Island, Maine
FOSSIL POLLEN AND CHARCOAL
1990
SPRUCE
HEMLOCK
WHITE PINE
BIRCH
OAK
ALDER
GRASSES
AGRICULTURAL INDICATORS
CHARCOAL
ca. 1760 AD
1970 ± 80
2370 ± 100
3090 ± 90
3830 ± 100
4930 ± 90
5960 ± 120
6240 ± 110
C-14 AGE (BP)
DEPTH IN SEDIMENT (cm)
%
microns^2 : pollen
analyst: N.E.R. Drake



We have two long cores; one from The Bowl back to 9,000 b.p. and this from Lake Wood. LW core truncated at bottom by Marine sediments. Watersheds of both ponds burned in ‘47 fire. (Charcoal peak at top). Prior to ca. 2K y.a. climate was warmer and hardwoods prevailed. Little fire except on a roughly millennial cycle of hemlock “declines”. Note fire followed declines. Several short cores from the island show sequence of alder, birch, spruce following historic fires. More detail in long cores shows replacement of NH/HEM by oak and pine until replaced again by (yellow) Birch/SM/Beech/Hemlock (BAFT pollen assemblage).

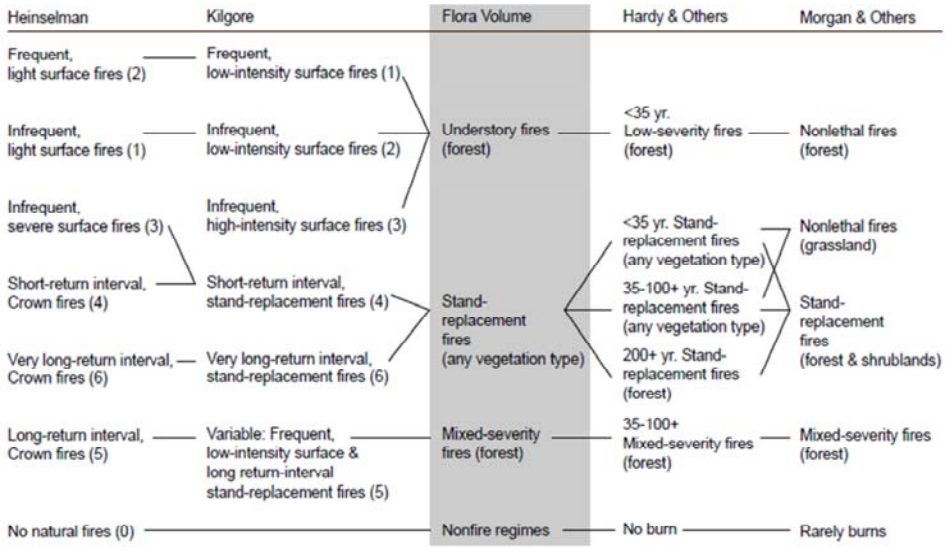
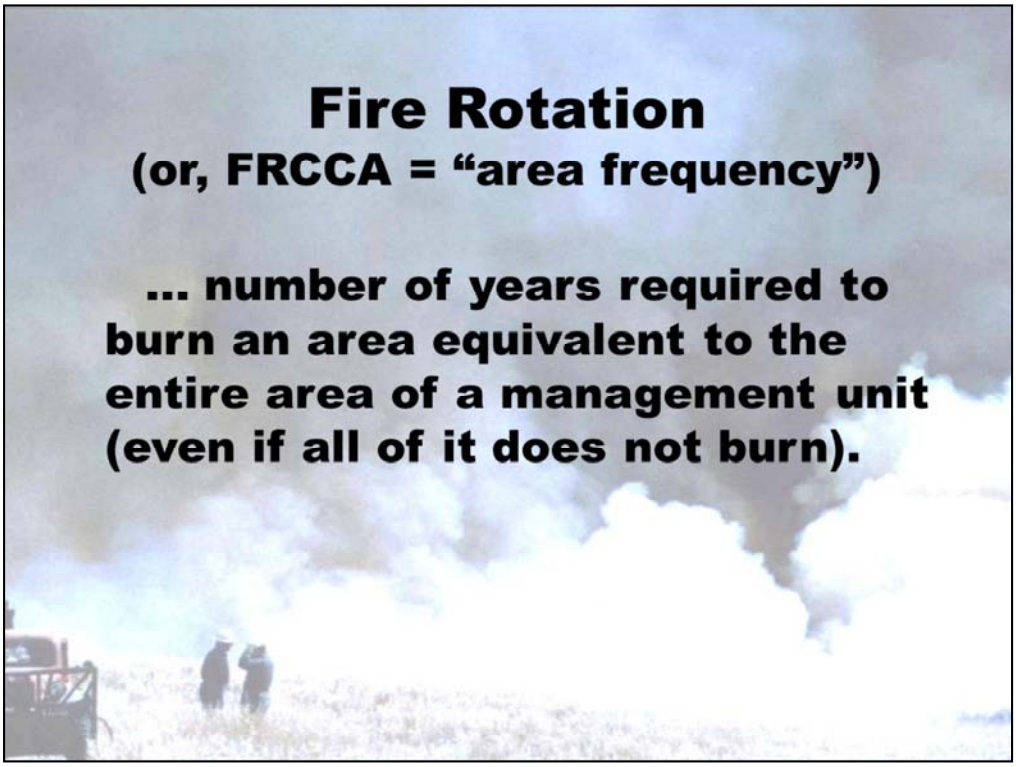
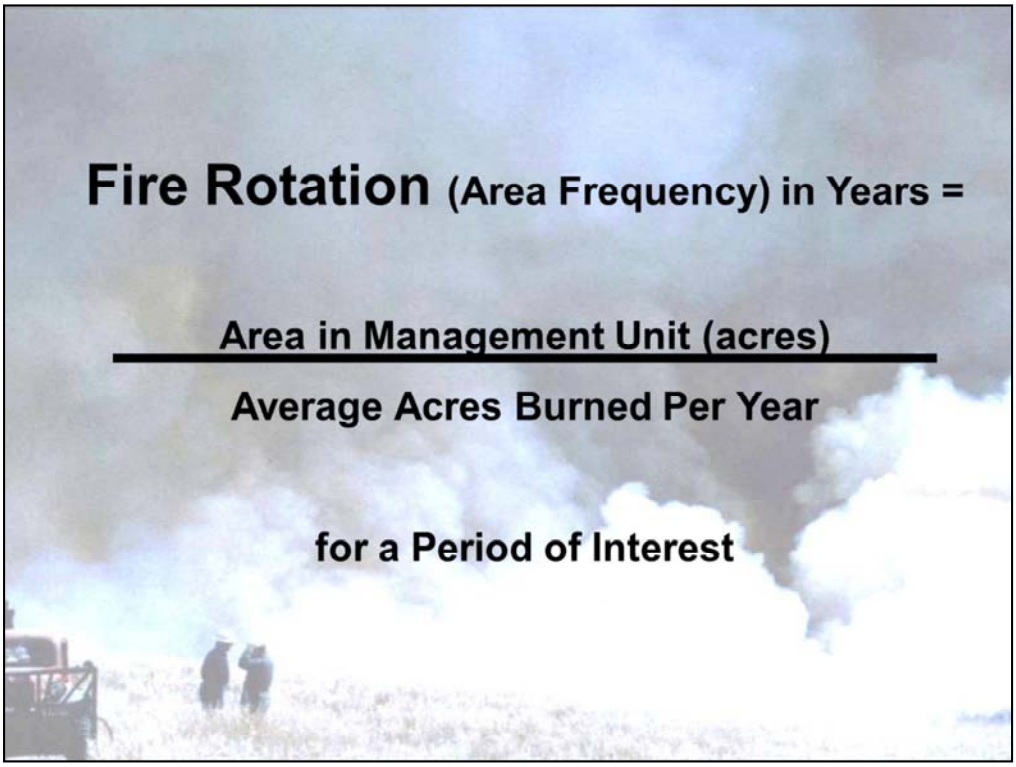


Table 3.1: Comparison of North American fire regime classifications by (Heinselman 1981) Kilgore (1981), Hardy and others (1998), Morgan and others (1998), and Brown and Smith (2000). Lines connect similar fire regime types. In parentheses, forest includes woodlands and grassland includes shrublands. Adapted from Figure 1-1 in Brown and Smith, 2000.

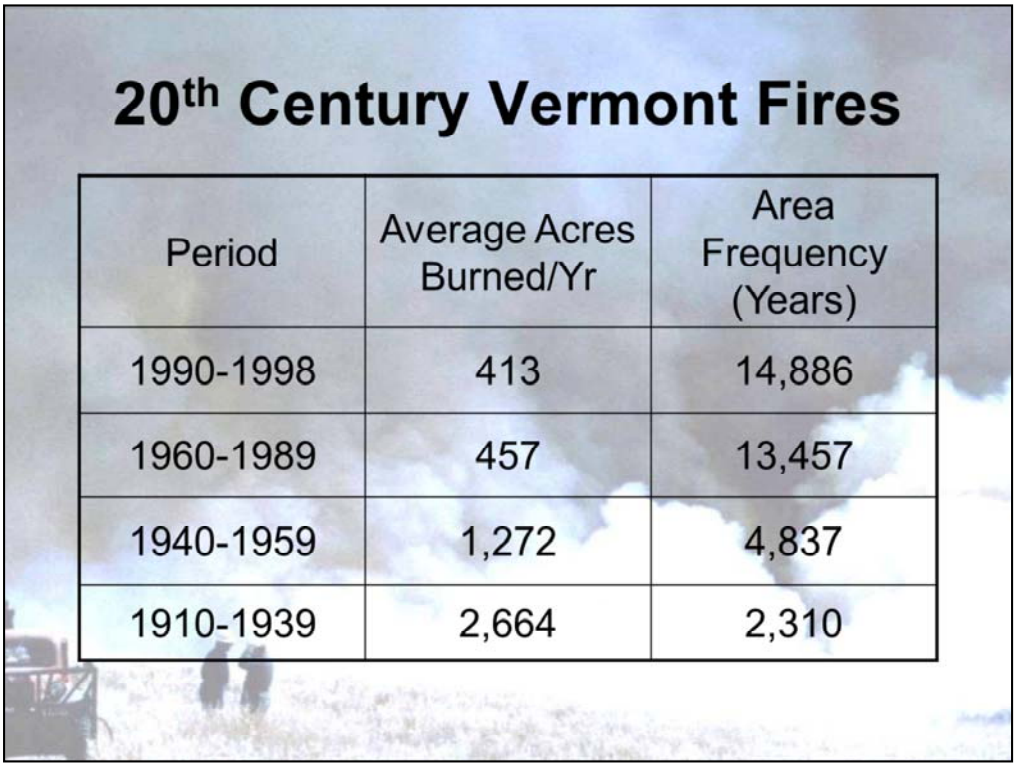
The Bowl RNA, White Mountain NF, NH (HFR)



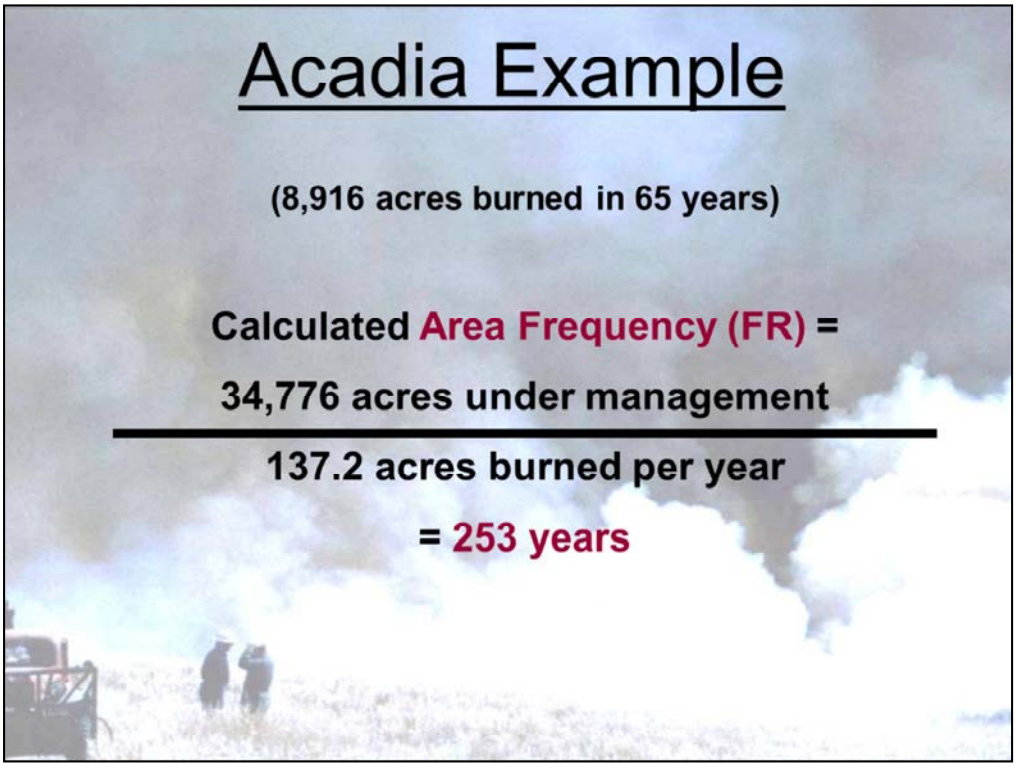
Define and explain difference between FR and RI and relate to current terminology (FRCC)



FR defined - useful at large landscape (i.e. National Park or Forest, Preserve) level.
Background – 120 acre prescribed burn on Naushon Island – 1992.

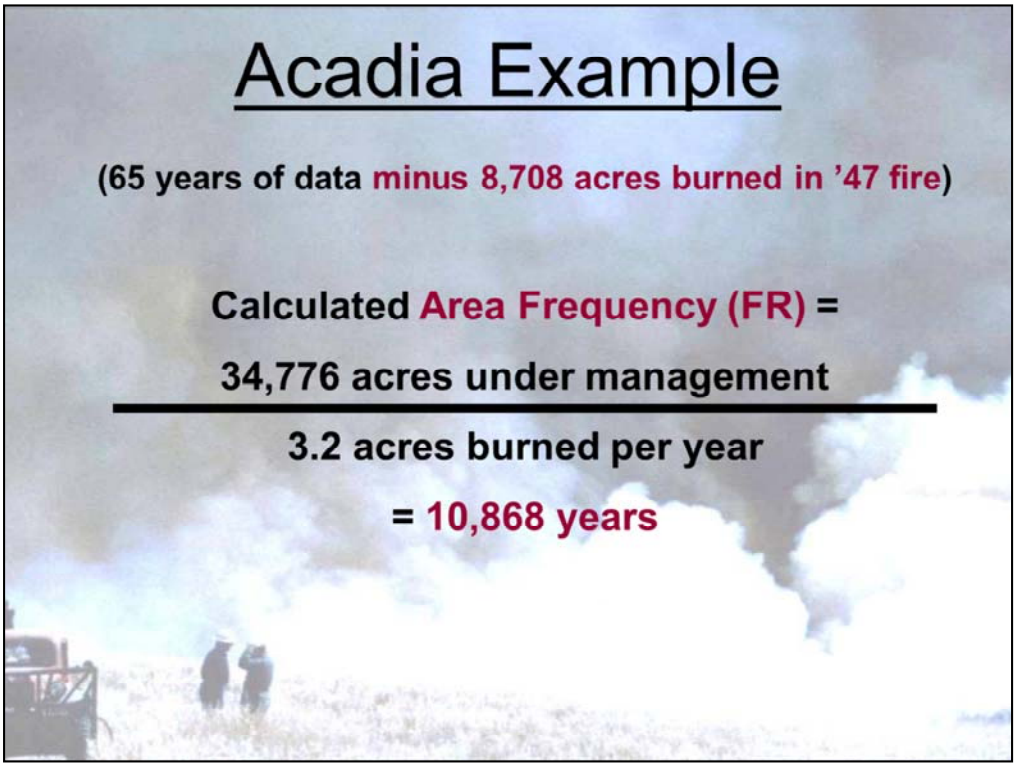


As close as you can get to Heinselman's FR 0 !



We used fire records from 1916 to estimate fire rotation. Figure of 253 yrs. approximates the longevity of red spruce on the island. All fires burning more than a single tree (only three of those) were of human origin.


1947 Bar Harbor Fire



But, some argue that the '47 fire was an anomaly that "could not happen again" (in a thousand years). Fire Rotation of 10,868 years is not consistent with sedimentary record.


Fire Use to
Accomplish
Management Objectives

Red Pine (HFR 2/3)

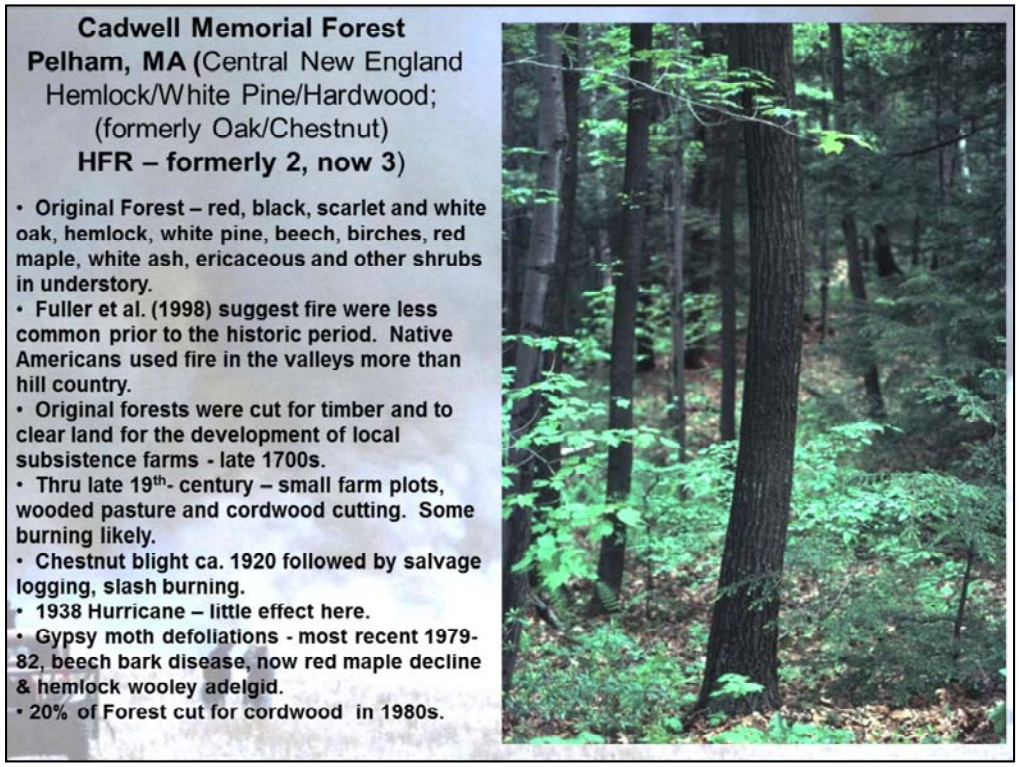
Quabbin Reservoir - central Massachusetts, 1981
Bruce Spencer with 'flamethrower'


May, 1981
May, 198


05/22/2017


05/22/2017


05/22/2017

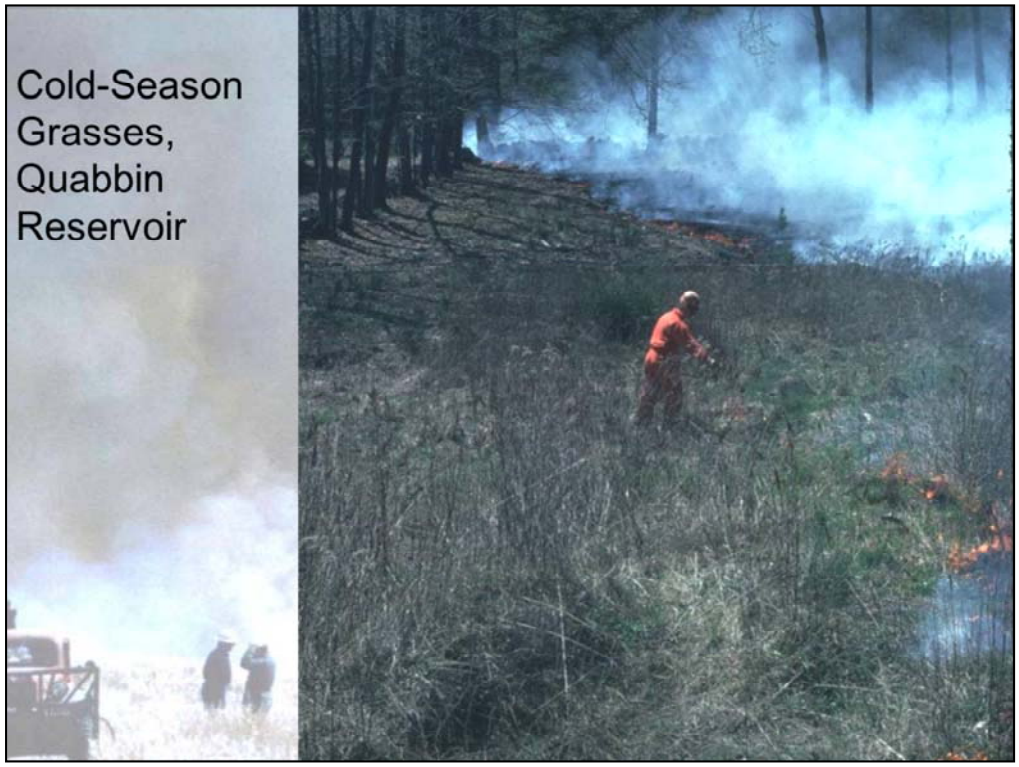


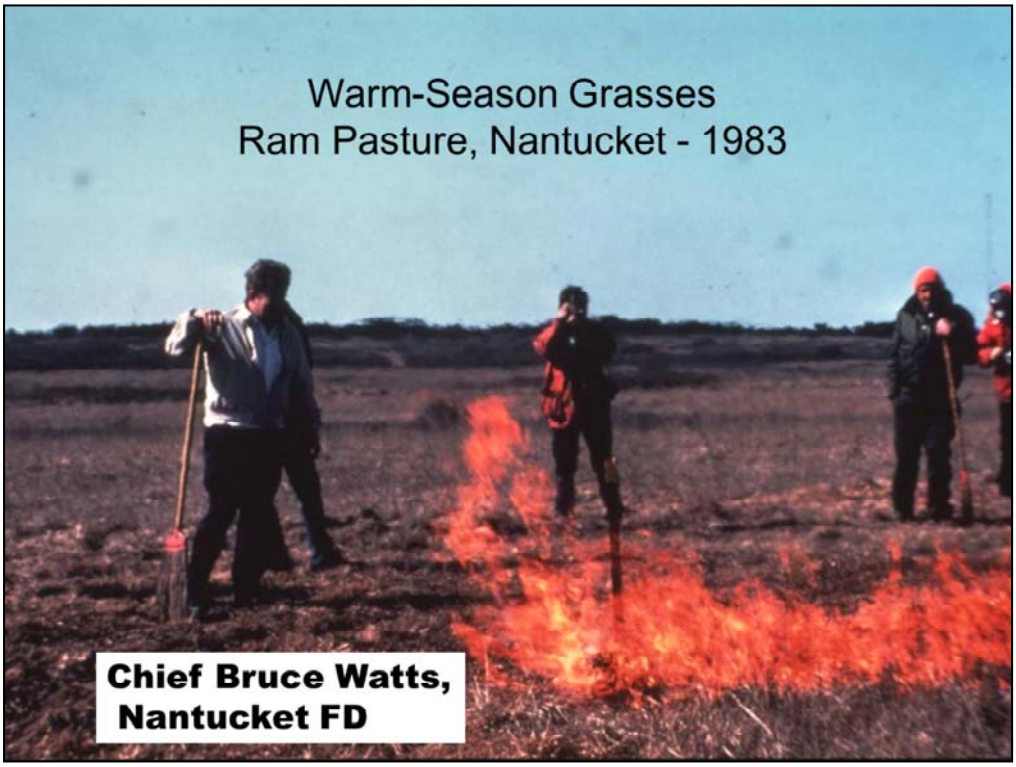
At the UMass/Amherst Cadwell Memorial Forest in the Pelham Hills east of the Connecticut Valley, oak/conifer stands which regenerated after Chestnut blight mortality and salvage cutting ca. 1920 are now maturing. Less than 10 acres(4 ha) have burned in 90 years.


06/13/2016


05/21/2017


Slash Disposal (Quabbin Reservoir, 1982)

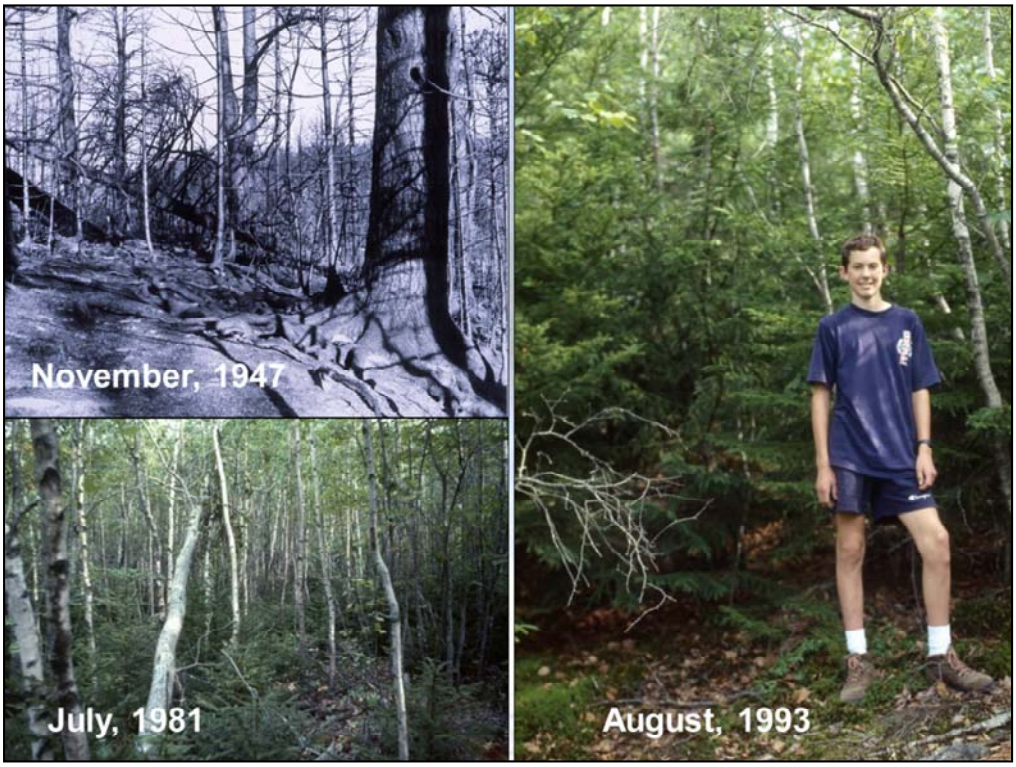

Cold-Season
Grasses,
Quabbin
Reservoir



Bob Zaremba and Mass Audubon. Four 0.5 acre plots; a control and two plots treated every other year with dormant or growing season burn plus one with growing season mow. By 1997, it was clear that only growing season burning or mowing accomplished the objective of reducing shrub invasion and maintaining coastal grassland non-woody species.

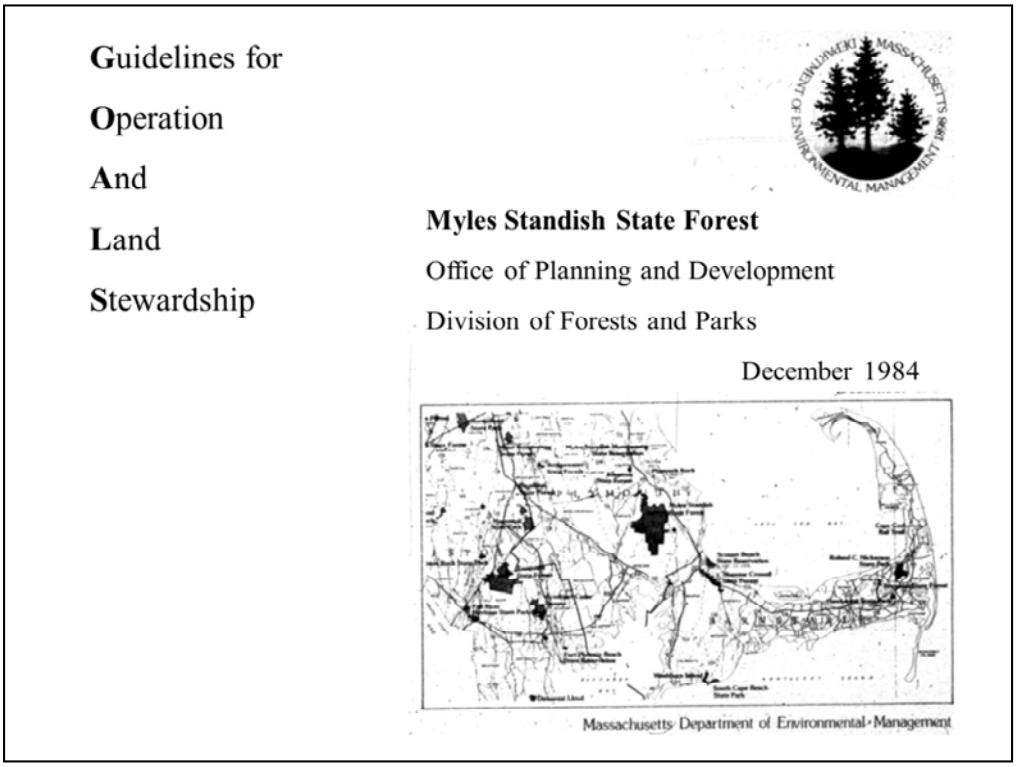
Hiram Fox Wildlife Management Area - May,1989

Cathedral Pines - Cornwall, CT - 1989


November, 1947
July, 1981
August, 1993

Mature Spruce/Fir Forest, Acadia National Park, ME (HFR 5/6)

Hazard Fuel Reduction Project - ANP
Southwest Harbor, ME



Virtually all of the Forest, which is the largest SF in Massachusetts, burned in the great Plymouth Fire of May 8, 1957.

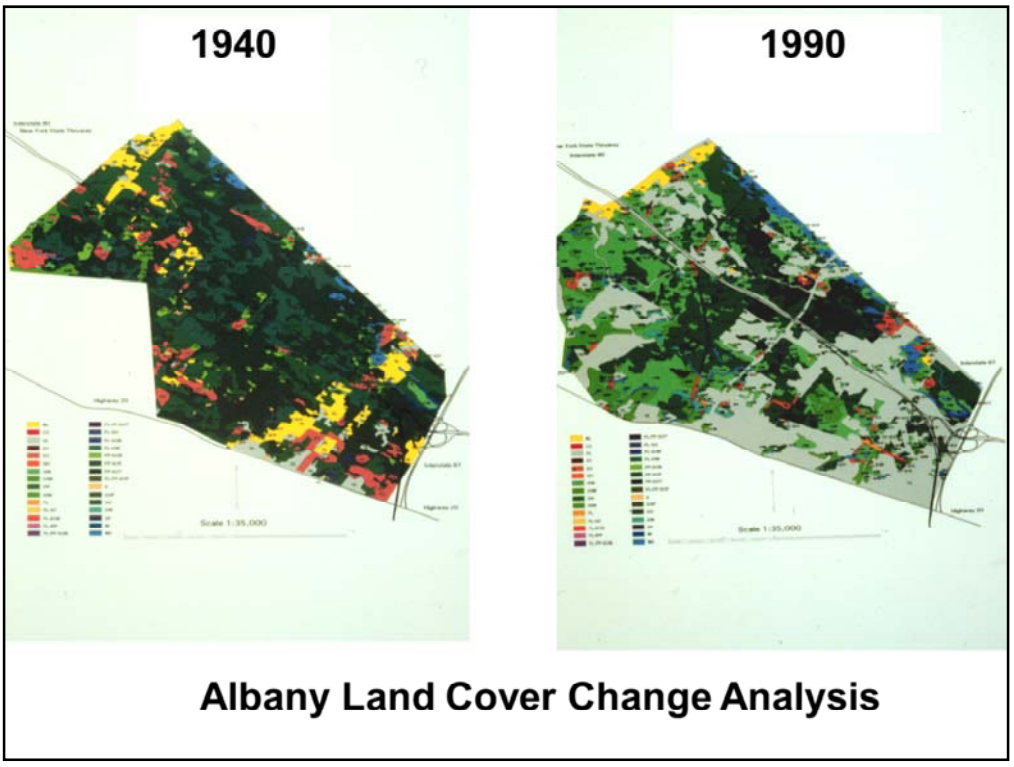
Looper Infested Pine: 1957 Plymouth Fire Area - 1987

Fuel Loads in this area were measured at 35 tons/acre

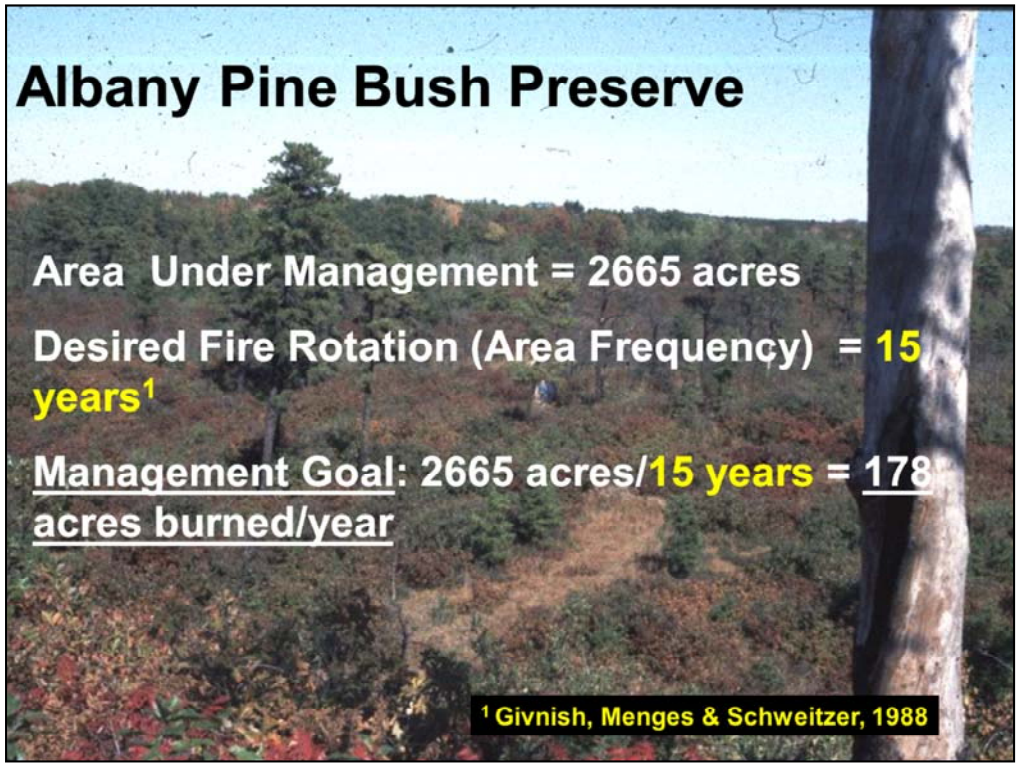

Myles Standish State Forest, Plymouth MA, 1989

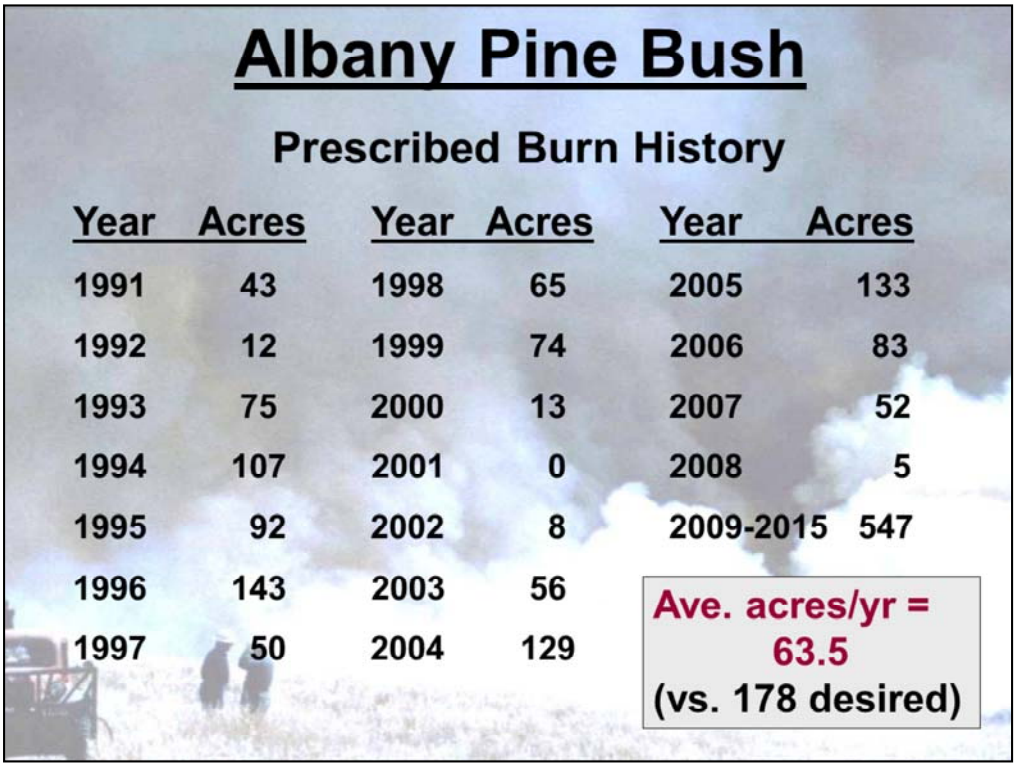
MSSF (initial prescribed burn – April 12,1989)

1990 air photo of Albany (NY) Pine Bush Preserve.

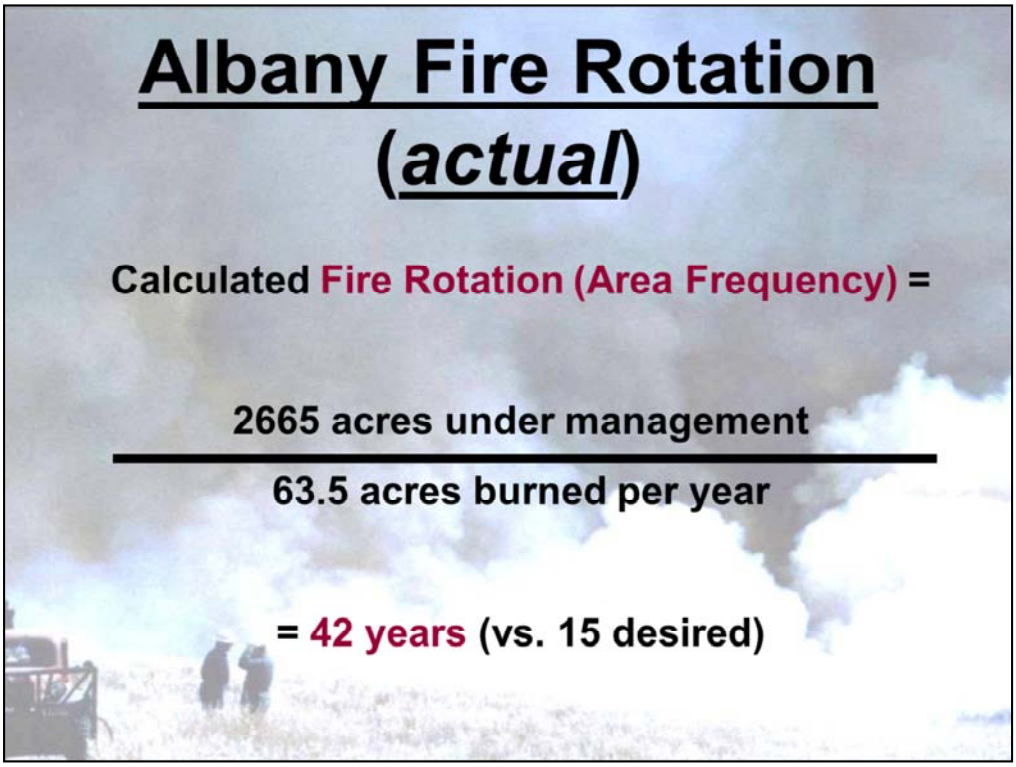


Photos back as far as 1928 (for Albany) were interpreted by the same person using mapping standards applicable throughout that matched best that could be done with lowest quality photos. Similar analysis done for Montague (MA), Ossipee (NH), Waterboro (ME) Marthas Vinyard SF (MA), Long Island Pine Barrens (see Jordan et al. 1993)


Albany Pine Bush Preserve
Area Under Management = 2665 acres
Desired Fire Rotation (Area Frequency) = 15 years[1]
Management Goal: 2665 acres/15 years = 178 acres burned/year
[1] Givnish, Menges & Schweitzer, 1988

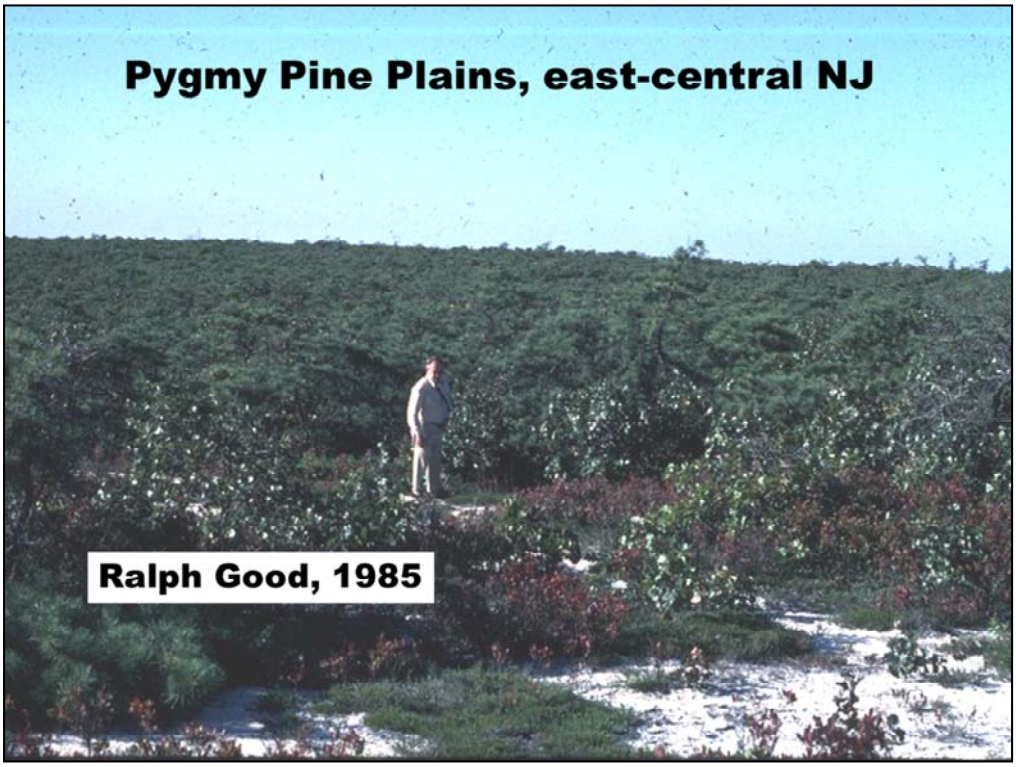


74 acres were burned in 1999 largely the result of escaped prescribed fire. Consequences for management are seen in acreages for next three years.

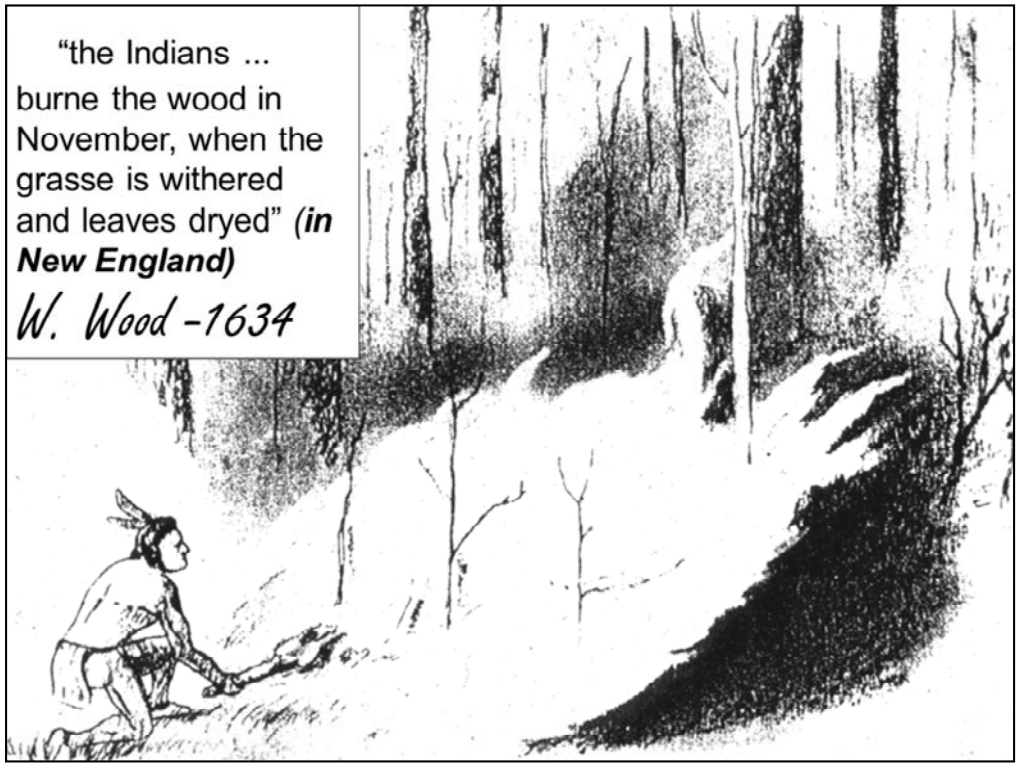


Concusion, not practical to burn at a level to meet goal of 200 acres/year. ABPP began to augment burning with mechanical treatments.


Management of Natural Fires
in the Northeast

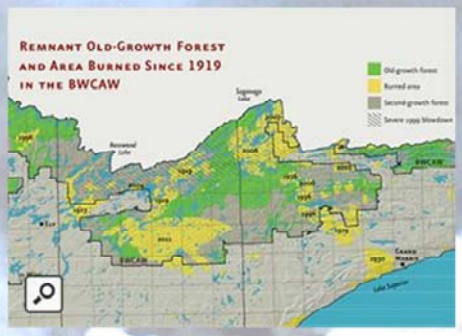


Harshberger 1911, S. Little, M. Buell, R. Good, R. Foreman – collectively compiled a comprehensive understanding of fire and pine barrens ecology in the 1900's. In New England, Moore and Taylor – ANP-ME (1928), Chapman and Lutz at Yale, Niering and Goodwin at CT College, and Dave Smith and Dick Waring at UNH all proceeded me in studying various aspects of fire ecology in the Northeast. Bromley and Day added historical perspectives.



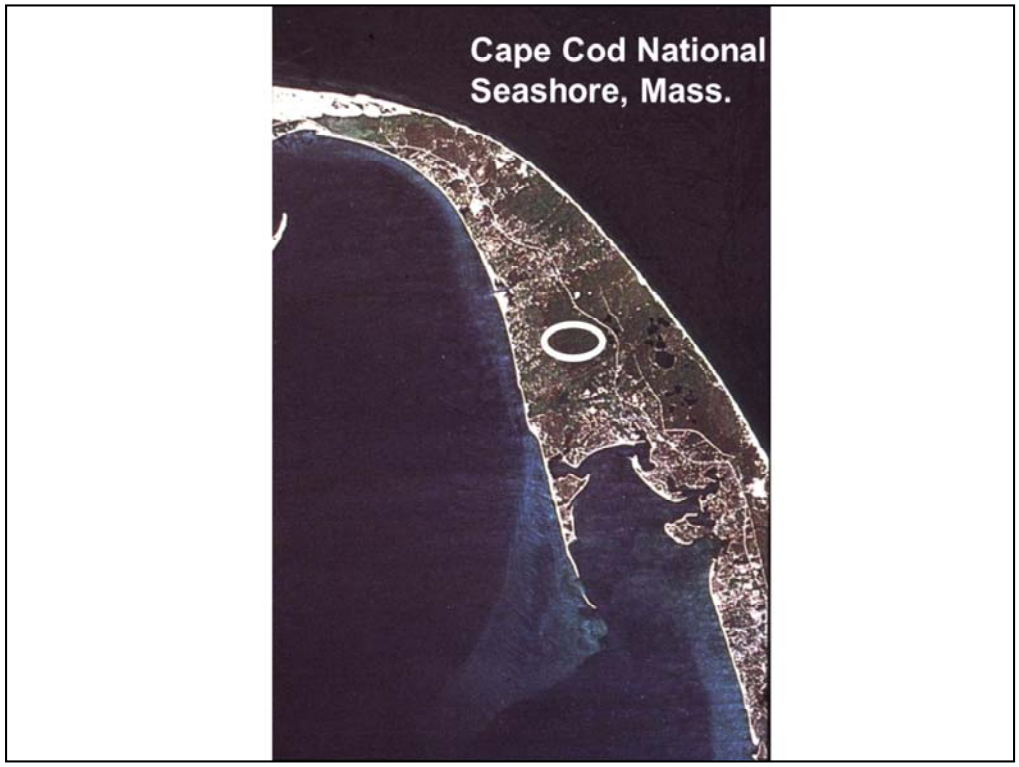
All reports mention NAI use of fire.

What is Wilderness? Examining tree rings, researchers reconsider the history of human influence in the Boundary Waters. Evan Larson, Minnesota Conservation Volunteer March-April 2017.

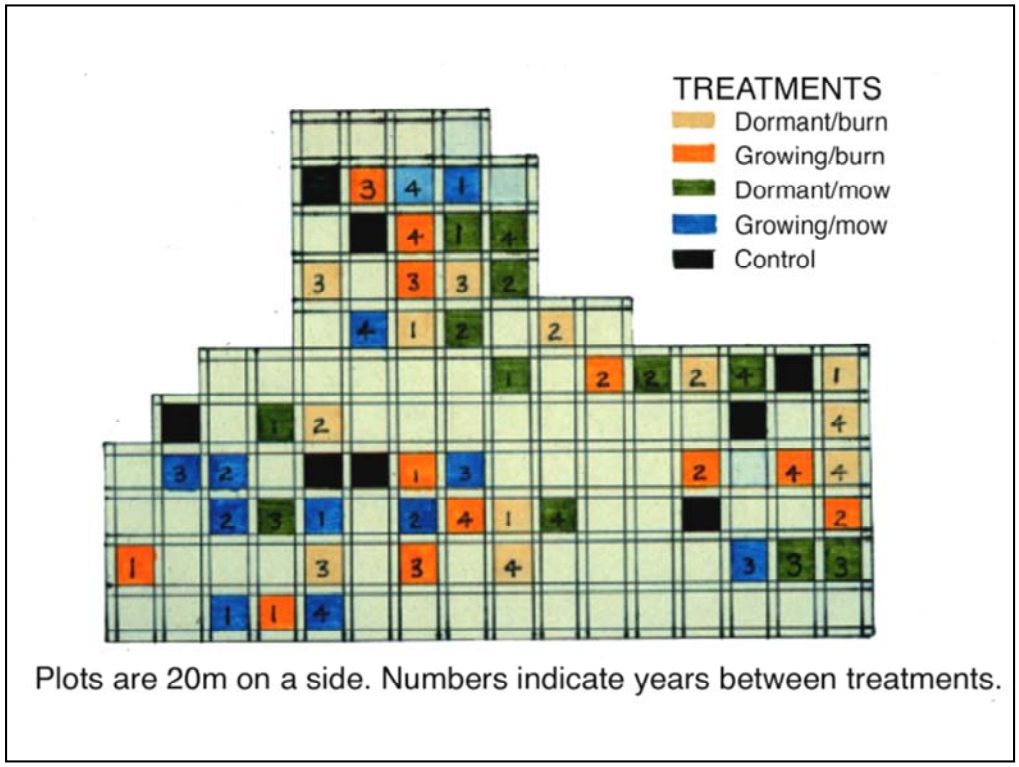


"The stands of ancient pines on Lac La Croix embody the ideal of wilderness, yet they have felt the tread of moccasins and boots on their roots for centuries. Recognizing the role of past human influences in creating these magnificent stands may help people learn how to be better stewards of wilderness today."


Prescribed Fire Experiments



Truro experiment established in 1985 and continuing. Intensive data collection of fuels, fire behavior, forest composition and abundance completed through 2010.



Experimental design. Mowing included because CCNS initially said they would "never" use PF. See earlier comment. CCNS wanted 2m by 2m plots. We compromised on 20x20. Causes some limitations in interpretation of results, but we were eventually able to burn plots up to an acre or so in size.

This and following slides self explanatory, but see NE Barrens web site for data. (GAYBAC understory 0.75-1.5 m tall.)

Annual dormant season burn effects – KBDI (drought) always low; but after 15-20 burns duff was exhausted and huckleberry sprouting declined.


BW1 after 5 spring burns


BW1 after 31 spring burns
09/16/2016


BS1 after 1 summer burn (August, 1986)
G14
BS1
8-86


BS1 after 2 summer burns (July, 1987)
G14
BS1B
7-87

Annual growing season burn effects. 2nd burn (1987) was done with high KBDI. NAIs could not have burned the same plot of land 24 years in a row and converted to grassland. Annual burning was only possible due to litter from canopy. 3- to 4-year burns are most practical from standpoint of reducing fire hazard caused by flammable huckleberry shrub understory.

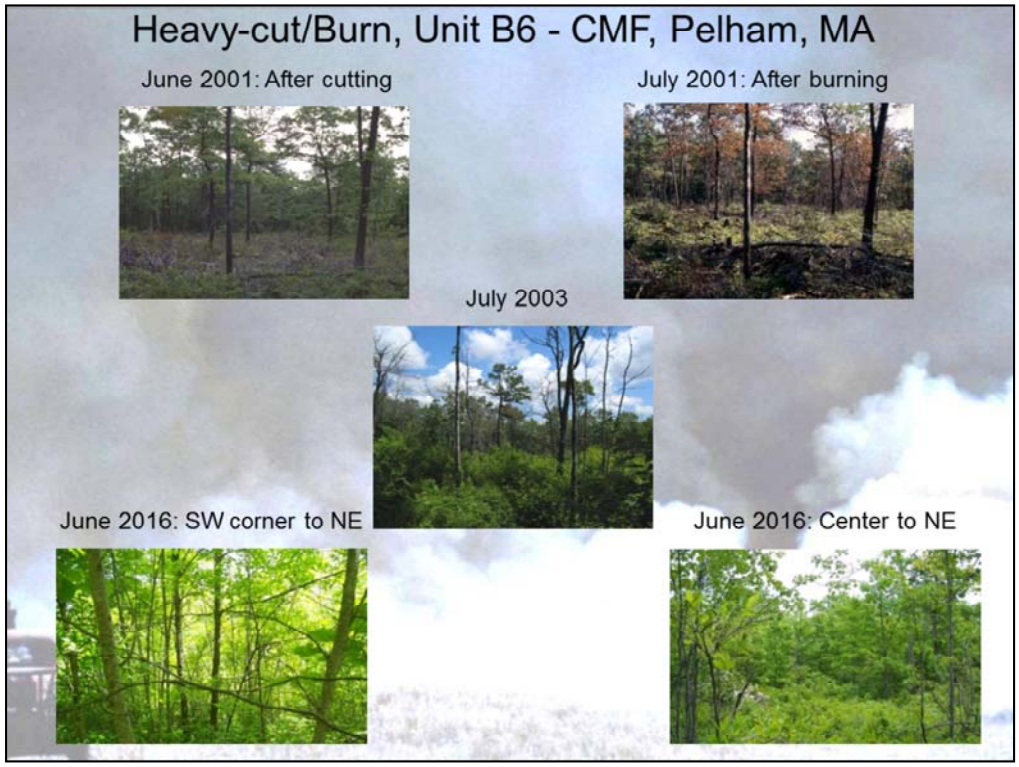


Photo documentation of all research units started after thinning treatments. Little oak seedling establishment occurred following treatments, but sprouts regeneration is abundant where canopy reduction was greatest. Chestnut sprouts and shrubs are providing competition for oaks. Moose populations increased dramatically during a 20-year period, but have now declined. Deer hunting is allowed in the Forest, and browse pressure is low.

See thesis by Hawthorn (2004) available as pdf on Northeastern Barrens website.

Total Available Carbohydrates – Huckleberry Roots

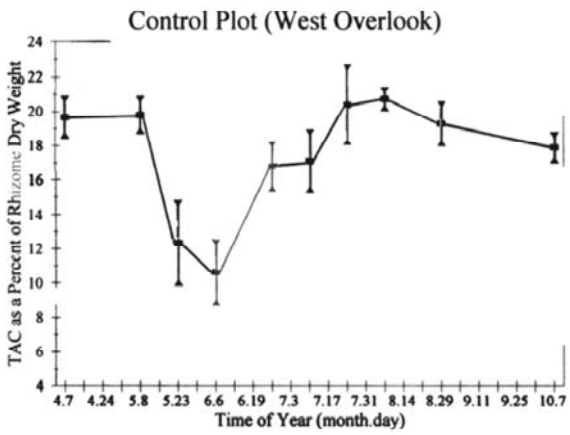
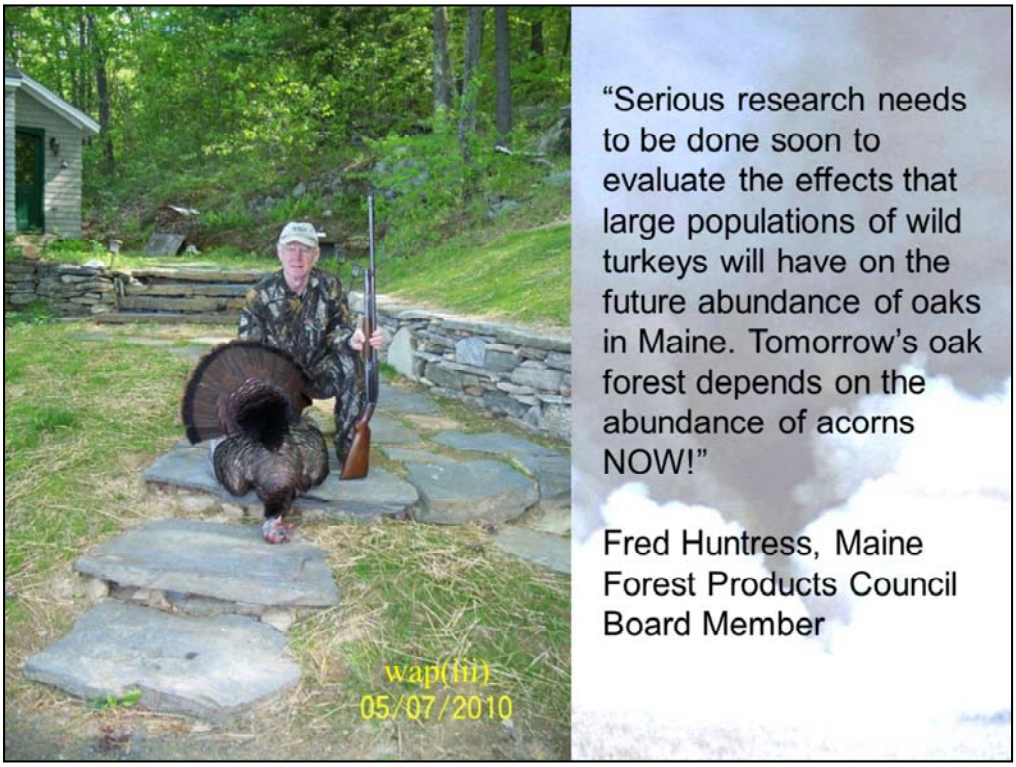
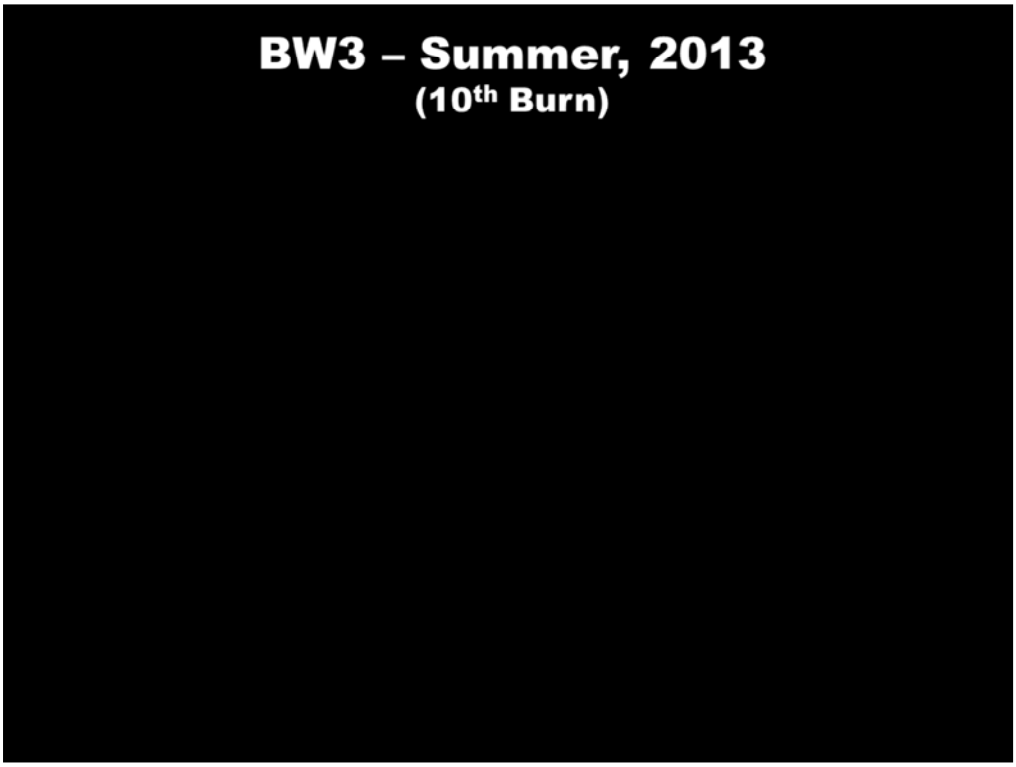


Figure 5. Seasonal fluctuation in total available carbohydrates (%) in huckleberry rhizomes collected in West Overlook plot. Error bars are 95% confidence limits. Means are significantly different when confidence limits do not overlap.

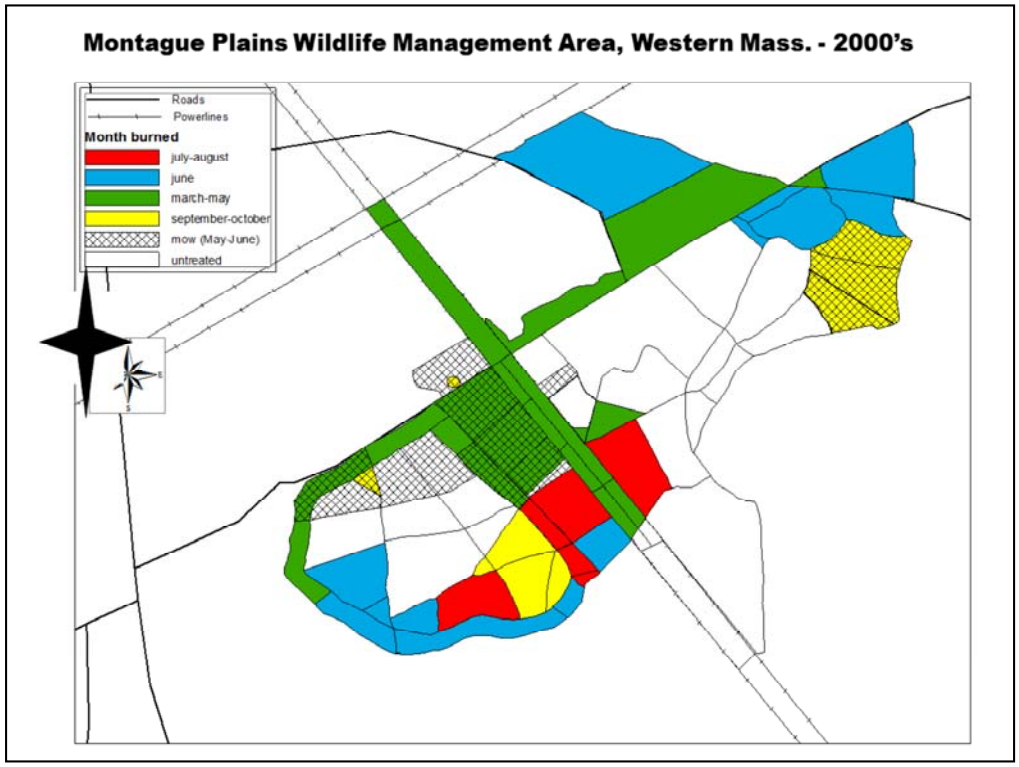
My view…..

My view…..


wap(iii)
05/07/2010
"Serious research needs to be done soon to evaluate the effects that large populations of wild turkeys will have on the future abundance of oaks in Maine. Tomorrow's oak forest depends on the abundance of acorns NOW!"
Fred Huntress, Maine Forest Products Council Board Member



K15 (BS3) BURN - APRIL 8, 2013: MOVIE


Montague Plains Wildlife Management Area, Western Mass. - 2000's
Roads
Powerlines
Month burned
july-august
june
march-may
september-october
mow (May-June)
untreated

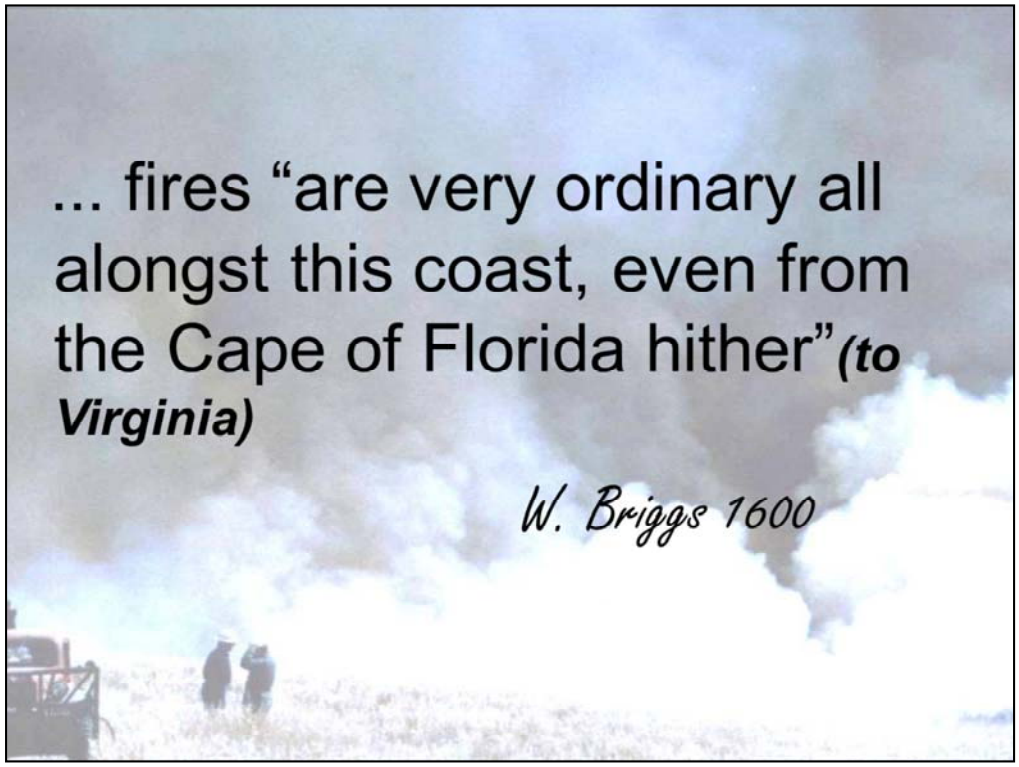
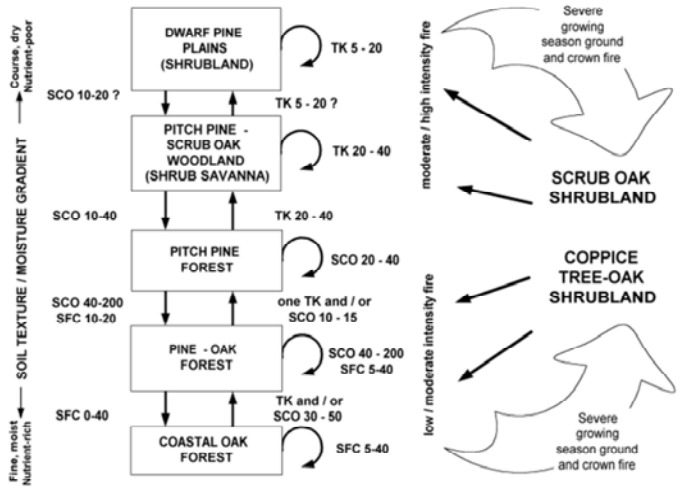
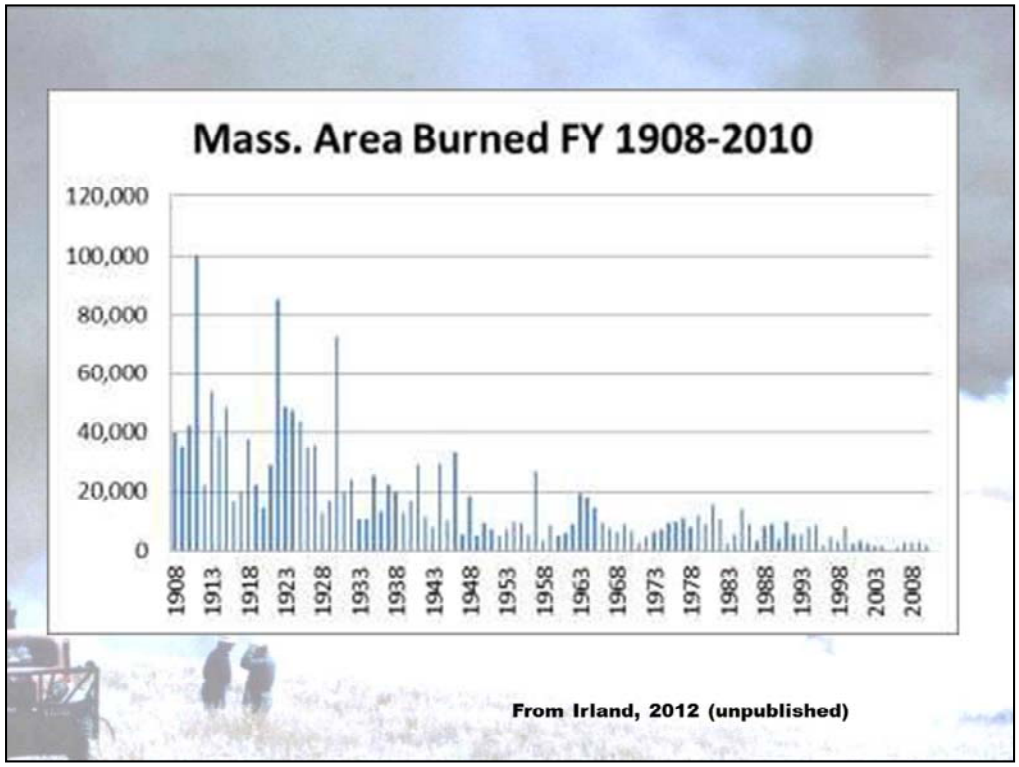
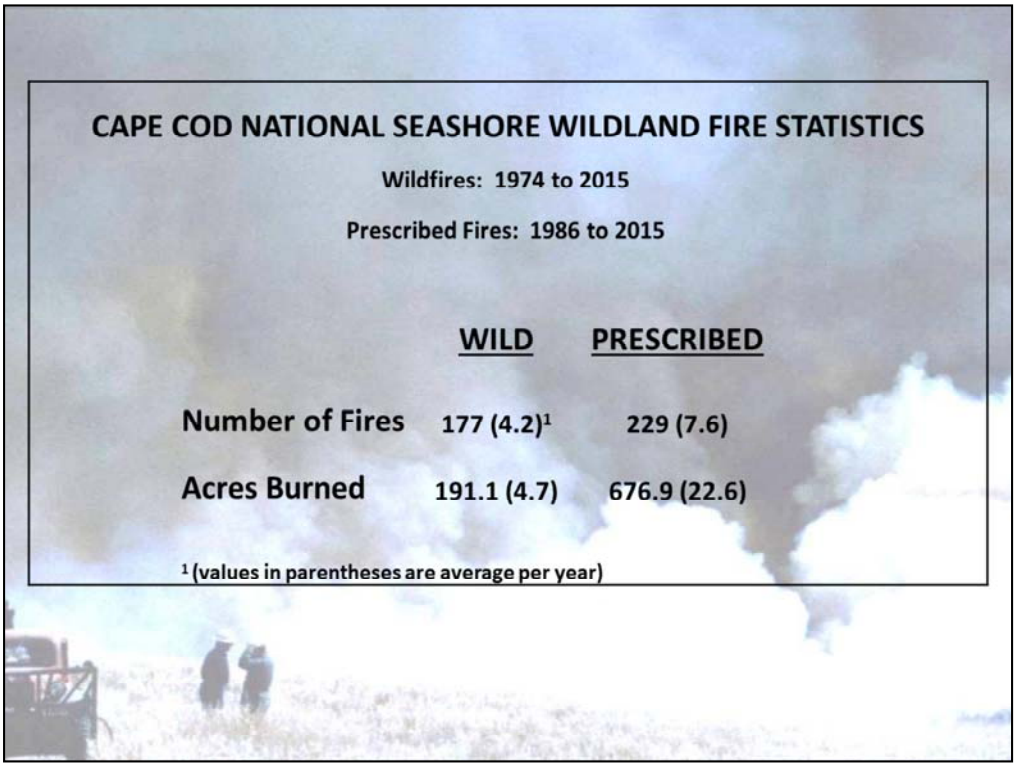

... fires “are very ordinary all alongst this coast, even from the Cape of Florida hither”(to Virginia)
W. Briggs 1600

Figure 5. State-transition model depicting fire regimes that maintain pine barrens ecological community types. (from: Jordan, Patterson & Windisch 2003)



Models like this developed for all sites, No one model adequately describes all sites (Finton thesis).


Mass. Area Burned FY 1908-2010
120,000
100,000
80,000
60,000
40,000
20,000
0
1908
1913
1918
1923
1928
1933
1938
1943
1948
1953
1958
1963
1968
1973
1978
1983
1988
1993
1998
2003
2008
From Irland, 2012 (unpublished)

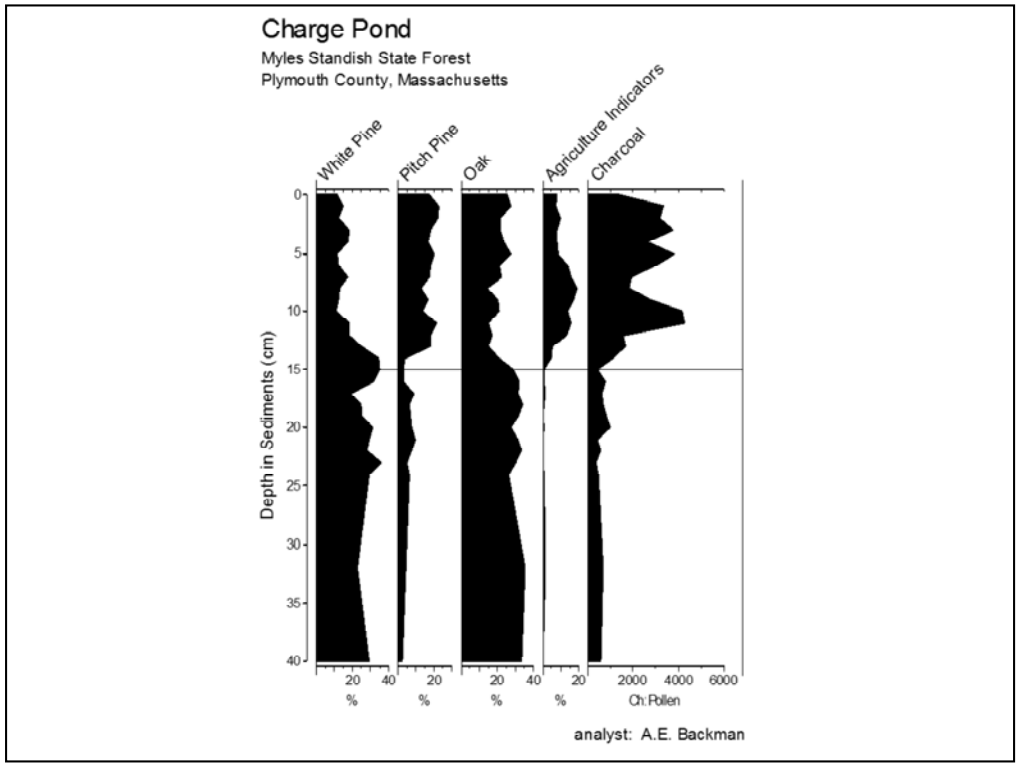


Approximately 5% of fires in Maine are caused by lightning. There are no recorded lightning ignitions for CCNS in 52 years

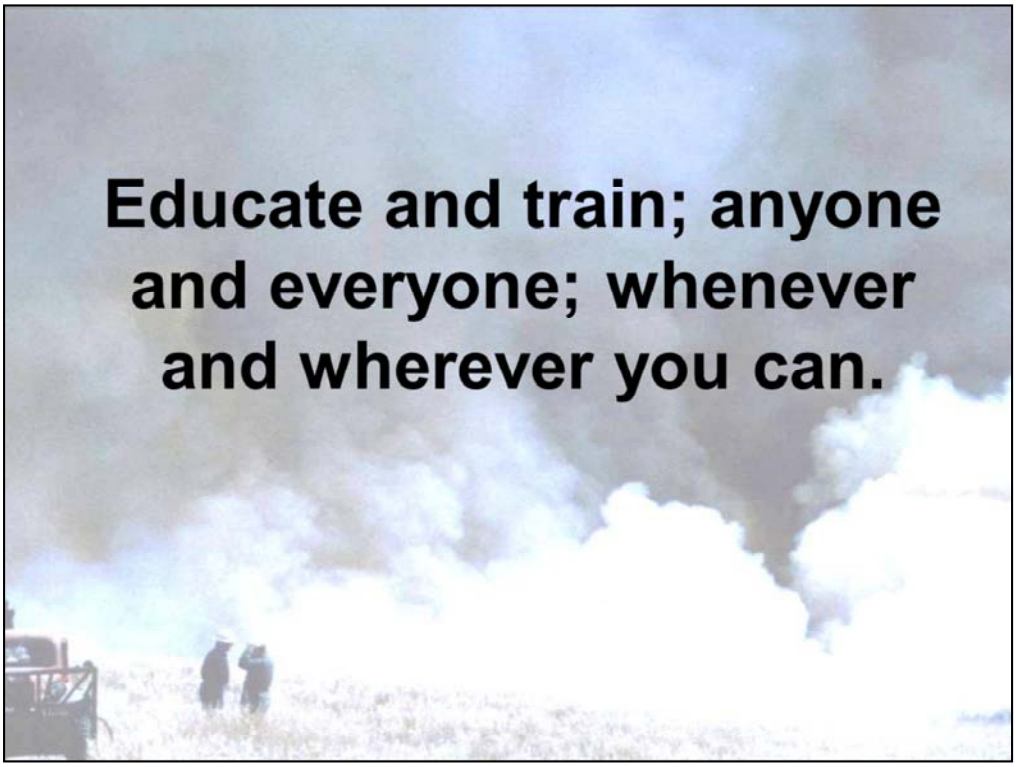
K15 (BS3) BURN - APRIL 8, 2013: MOVIE


Interagency
Cooperation is
essential.
It is the only way we can
succeed in the Northeast.

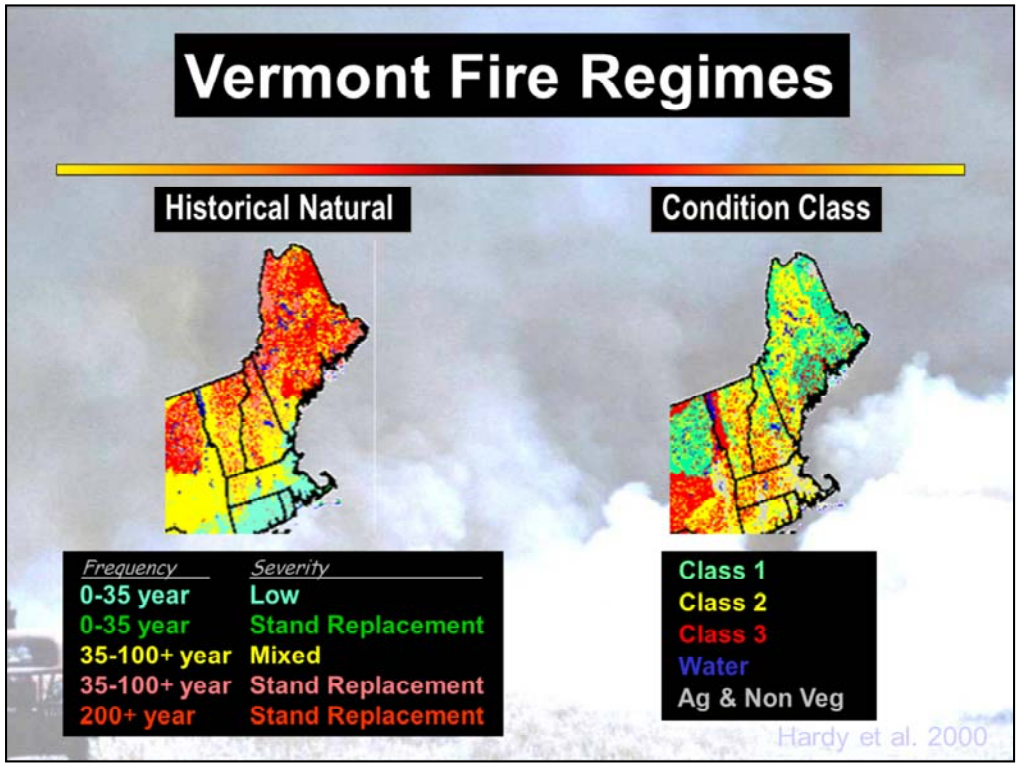
My view…..



Sedimentary studies contributed to changing management of MSSF from fire protection to fire management (next slide). (Backman, 1983) and published elsewhere.


Educate and train; anyone and everyone; whenever and wherever you can.

My view…..



Hardy' et al. maps.. Western concept applied to New England makes little sense. Class 1 is consistent with "natural'. 2 and 3 become increasingly "out of whack". Largely a misapplication of a concept applied nationally that does not work where 200+ year stand replacement fires are not realistic for northern hardwoods (except when hemlock dies off at millennial or more intervals). See Acadia NP Lake Wood example later.

Albany Pine Bush Land Cover Change: 1940-1990

Class	Total Acres	Acres in 1990 by Class											
1940	(1940)	AL	DL	GH	HW	IHW	MW	PP-SOB	PP-SOF	PP-SOT	SO	SW	Wt	Total
AL	336.1	36.8	136.5	17.5	97.9	5.6	3.3	0	29.2	0.8	0	0.6	8.1	336.3
DL	174.1	1.8	129.3	4.4	15.4	1.2	3.2	0	13.4	1.9	0	0.2	3.2	174
GH	352.2	3.2	188.9	21.3	50.2	7.6	14.2	0.8	49.4	0.1	0	3.9	12.4	352
HW	50.4	0.1	3.1	0	24	0	2.7	0	8.3	0.4	0	2	9.9	50.5
IHW	8.2	0	0	0	6.9	0	1	0	0.3	0	0	0	0	8.2
MW	65.9	0	19	0.5	27.3	0	15.3	0	0.6	0	0	1.7	1.4	41.5
PP-SOB	105.8	0	37.9	0.5	13.2	1.1	1	0	49.1	0	0	1.1	1.8	104.7
PP-SOF	1085.2	4.3	460.7	20.3	196.9	7.3	34.5	0	295.4	2.9	0	14.3	48.6	1085.2
PP-SOT	2022.4	0	745.3	37.4	321.7	30.5	22.3	0	514.2	293	9.8	4.7	43.4	2022.3
SO	513.5	0	160.4	5.4	136.4	3.6	4.7	0	52.7	111.8	34	0	4.4	513.4
SW	0	0	0	0	0	0	0	0	0	0	0	0	0	0
WT	84.1	0.1	7	2	4.3	0	0.5	0	4.8	0.5	0	0	64.9	84.1
Total	4797.9	46.3	1888.1	109.3	894.2	56.9	102.7	0.8	1017.4	411.4	43.8	28.5	198.1	4797.5

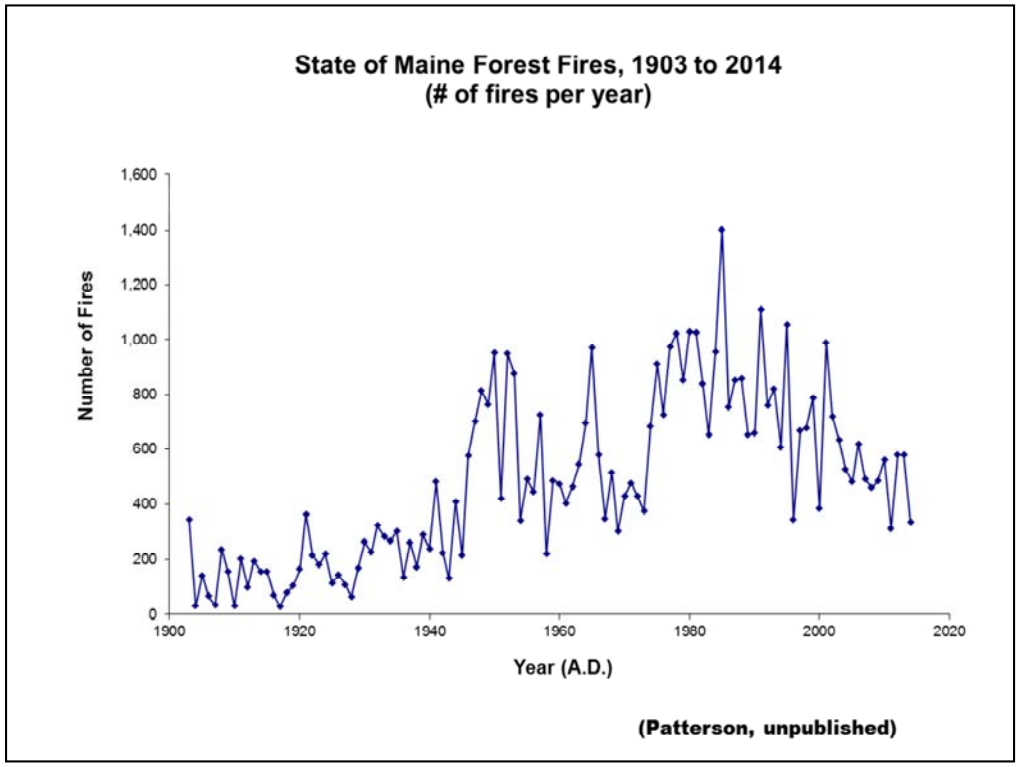
Data matrix generated for Albany.

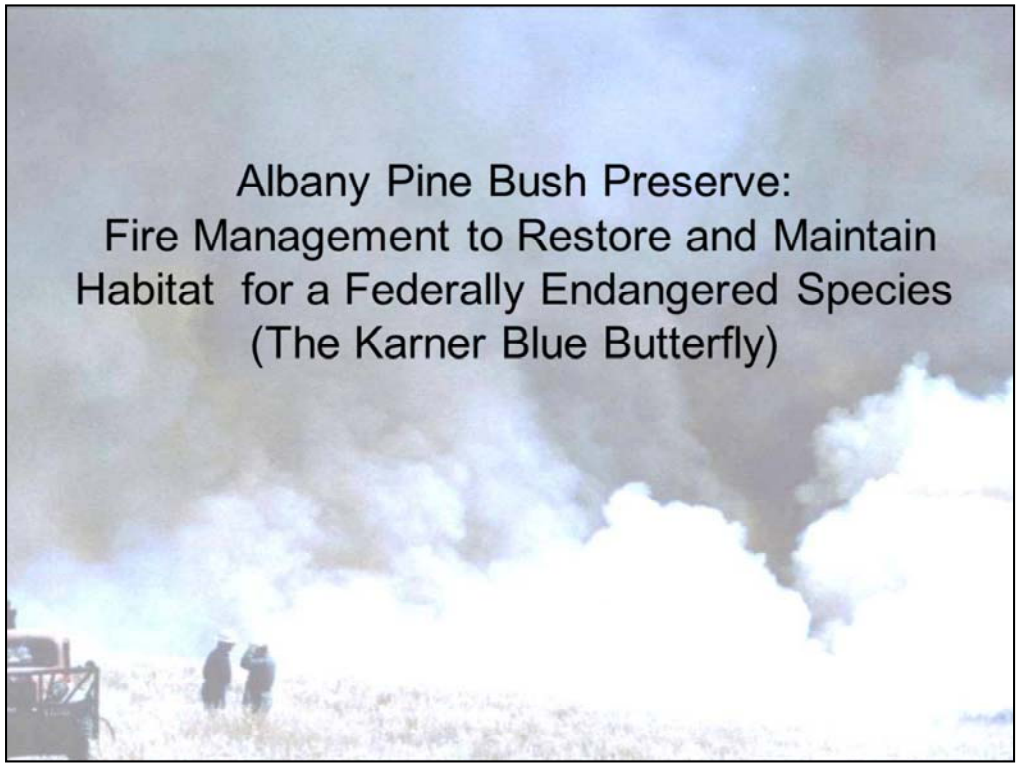
ALBANY PINE BUSH
LAND COVER CHANGE ANALYSIS

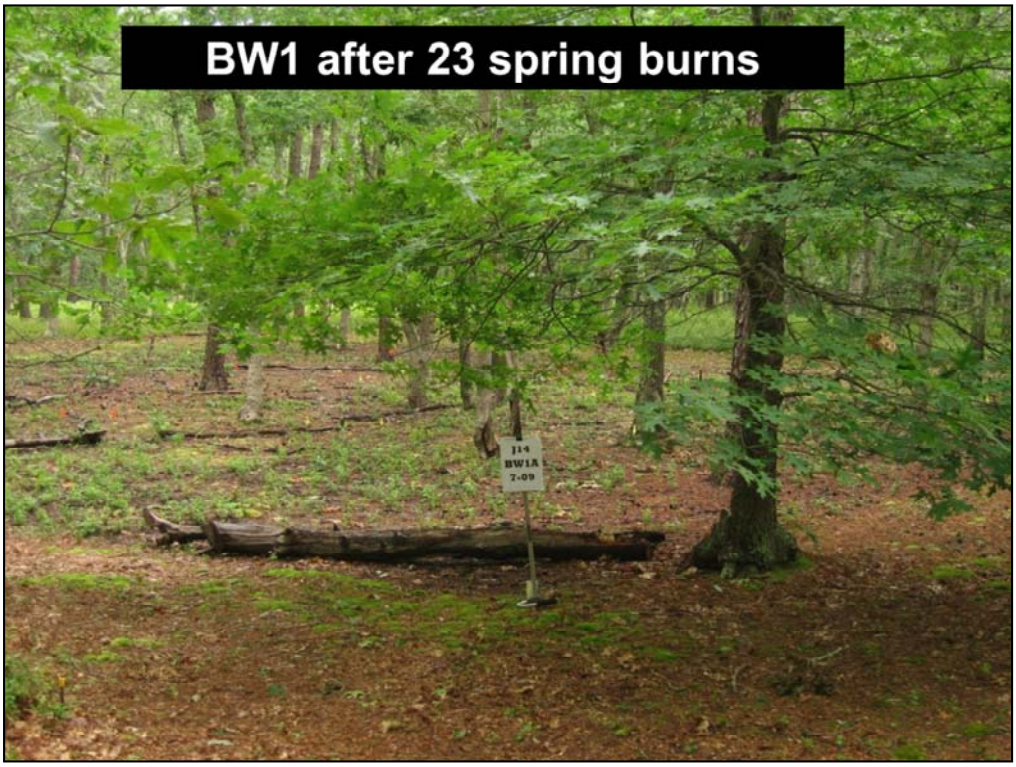
Cover Class	ACRES in 1940		1990
PP-SO Barren(-)	105.8	→	0.8
Scrub Oak(-)	513.5	→	43.8
Developed Land(+)	174.1	→	1,888.1
Successional Hardwoods(+)	50.4	→	894.2

Examples of state changes (PP-SO Barren is preferred habitat for federally endangered Karner Blue Butterfly).

‘Human Factors’ in Burning Practices

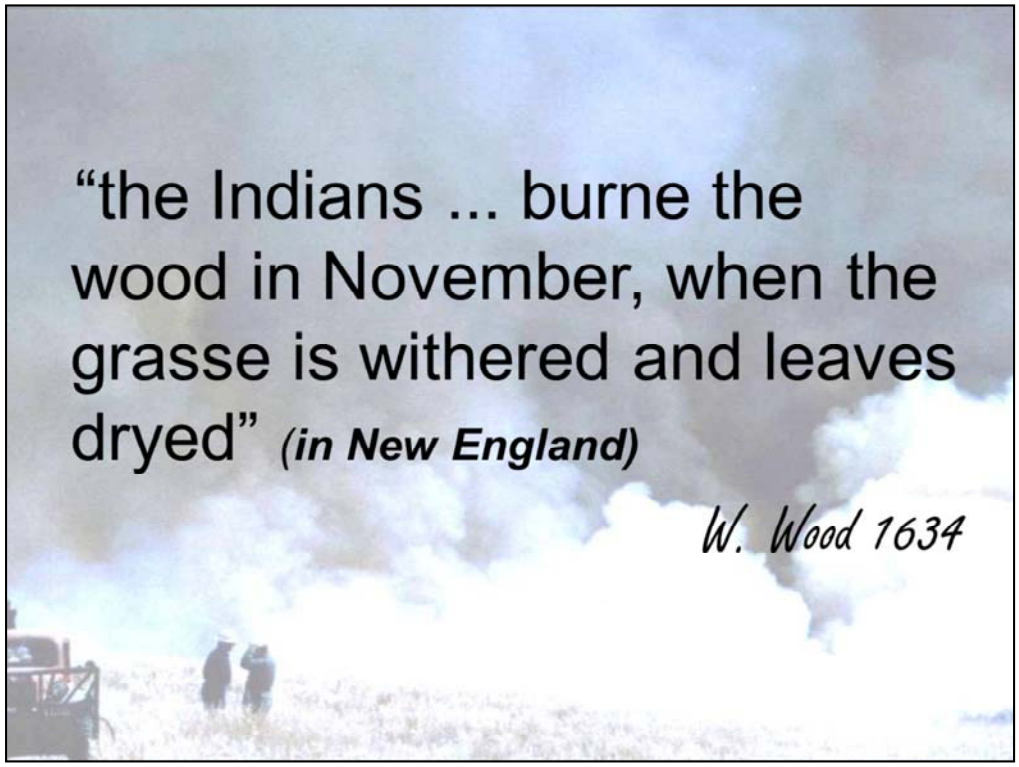

State of Maine Forest Fires, 1903 to 2014
(# of fires per year)
Number of Fires
1,600
1,400
1,200
1,000
800
600
400
200
0
1900
1920
1940
1960
1980
2000
2020
Year (A.D.)
(Patterson, unpublished)


Albany Pine Bush Preserve:
Fire Management to Restore and Maintain
Habitat for a Federally Endangered Species
(The Karner Blue Butterfly)


BW1 after 23 spring burns

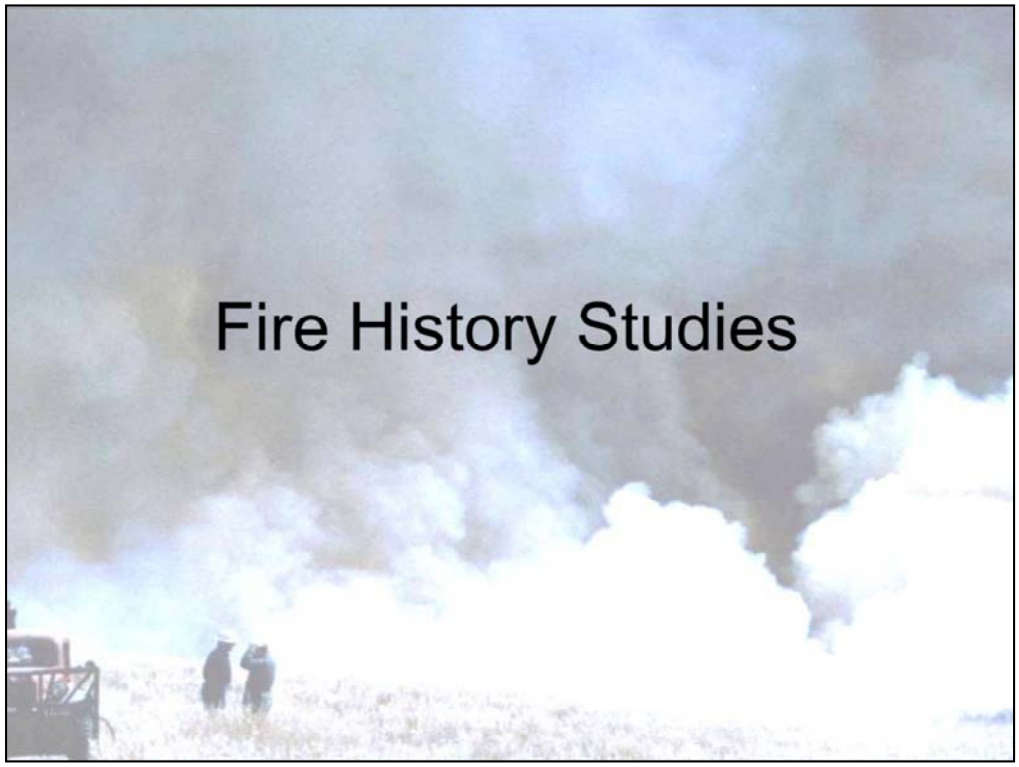

BW1 after 2 spring burns (July, 1987)
J14
BW1A
7-87


BS1 after twelve July burns (1998)


"the Indians ... burne the wood in November, when the grasse is withered and leaves dryed" (in New England)
W. Wood 1634

Heinselman's original fire regime categories:

Class 0 - Very little or no natural fire
Class 1 - Infrequent, light surface fires; > 25-year return intervals
Class 2 - Frequent, light surface fires; 1- to 25-year return intervals
Class 3 - Infrequent, severe surface fires; > 25-year return intervals
Class 4 - Short return interval crown fires/severe surface fires in combination; 25-100 year return intervals
Class 5 - Long return interval crown fires and severe surface fires in combination ; 100-300 year return intervals
Class 6 - Very long return interval crown fires and severe surface fires in combination ; > 300 year return intervals


Fire History Studies