Northern Forest Fire Compact

Working Paper

The Northeast's Great Sixties Drought: the Fire Outbreak

Zero Draft

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Introduction

A large part of the northeastern US experienced record-setting drought during the early 1960s'. This drought developed in a different time pattern in different parts of the region. Its intensity caused low reservoir water levels and at least initial levels of interstate conflict over water – a rare development in this generally well-watered region. One effect of the drought was that it coincided with an outburst of forest fire in much of the region. It seems evident that drought was an underlying cause of this elevated fire experience, but there are mysteries in this association that cannot be resolved with the data readily at hand. But the experience is of practical interest since it represents the last significant regional surge of fire activity region prior to an unprecedented settling down of fire to very low levels by the 1990's.

This Working Paper assembles the evidence on fire experience and on the drought conditions of this period. Because the drought's timing varied across the region, the peaks in fire activity did not coincide across states. Significantly, the intensity of burning did not coincide with the intensity of drought, either across space or over time. Some of the material in this paper recounts information also contained in the individual State working papers. For further data and context those can be consulted.

The Regional Drought

Of the 19 northeastern climate zones analyzed by the Northeastern Regional Climate Center, 13 experienced their worst individual drought month during the 60's drought (Table 1). Further, the proportion of months in severe or extreme drought varies widely around the region. Some of the coastal areas rank the highest. In 5 of these Divisions, more than 7.5% of months experienced severe or extreme drought over this period. The northerly areas of most states rank the lowest. These states may not have "asbestos forests", so much as they have less fireprone climates.

Table 1.

Table. Regional Drought Extremes Since 1895.

	NOAA Clim Div	Lowest ever	Date	Pct of time in Severe or Extreme	Location
Maine	1	-4.94	Dec-55	2.6	north
	2	-4.74	Dec 2001	4	So interior
	3	-5.08	Sep-65	3.7	coastal
New Hampshire	1	-3.99	Oct-48	2.4	north
	2	-4.43	Aug-65	4.4	southern
Vermont	1	-4.44	May-65	2.6	northeast
	2	-5.47	May-65	3.3	western
	3	-5.11	Jun-65	2.9	southeastern
New York	3	-4.18	Jul-65	2.8	northern plateau
	4	-5.63	Dec-65	5.3	coastal
	5	-6.66	Nov-64	5.3	Hudson valley
	10	-6.35	Jan 1931	11	western plateau
Connecticut	1	-5.34	Jul-65	7.7	northwest
	2	-5.2	may 1911	8.5	central
	3	-5.19	Dec-65	6.2	coastal
Rhode Island	entire	-4.54	Apr-66	4.5	state
Massachusetts	1	-5.44	Nov-64	6.2	western
	2	-5.36	May-11	9.9	central
	3	-5.16	Dec-65	9.3	coastal
	Source: Northeastern Regional Climate Center.				
	http://www.nrcc.cornell.edu/page_drought.html				
	visited June 5, 2012.				

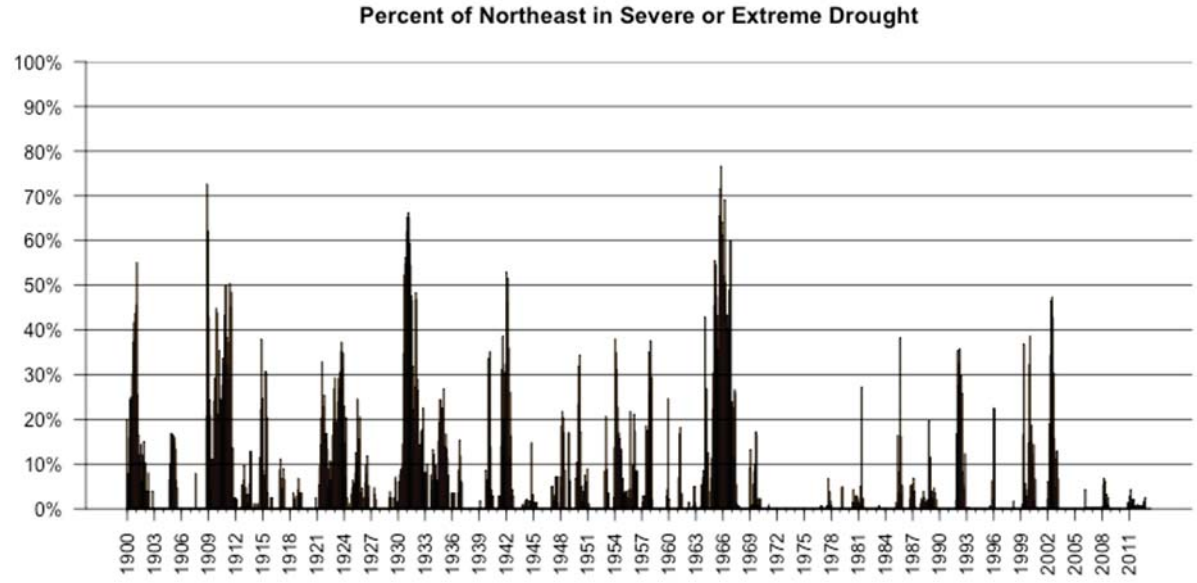
Note: for Climate Divisions, see Appendix Map.

Many of the states experienced dry fall weather in 1968, which were associated with higher area burned, but here will focus on the severe regional drought early in the decade.

Multiyear spells of drought affecting a large proportion of the Northeast have been historically common (Fig. 1) Four such spells, covering more than half of the region, occurred after 1900 and prior to the Great 60s Drought. Several of these lasted about as long and were nearly as intense. Since then, a break in pattern is evident. Drought periods are about as frequent but do not extend over so wide a part of the region, and they do not last as long. This fact no doubt explains the limited amount of research on drought in the region since 1970—

there has not been much to study!

Figure 1.



Comparable climate data for Canada is not readily available at present.

An analysis of regional drought patterns for the period 1929-67 concluded:

"In terms of frequency, the general expectancy is for moderate drought (-2.00 to -2.99) once in five years, severe (-3.00 to -3.99) once in ten years, and a severity of -5.00 to -7.00 once in 50 years. The stated values of the Index are expected on the average to be equalled or exceeded once in the periods given but no periodicity is implied. While these expectancies generally apply to the

Northeast there is significant variation within the region. (Dickerson and Dethier, 1970, p. 4.)

According to Seager, et al, (n.d) who provide a detailed history and climate reconstruction, "The post drought wetter climate remains a mystery ..." This conclusion does not differ from a thorough analysis done soon after the event (Namias, 1966).

These and other studies (see refs) suggest that the expected return period of drought similar to the 1960s drought would be 30 to 50 years. That no such event has occurred since does not invalidate those predictions.

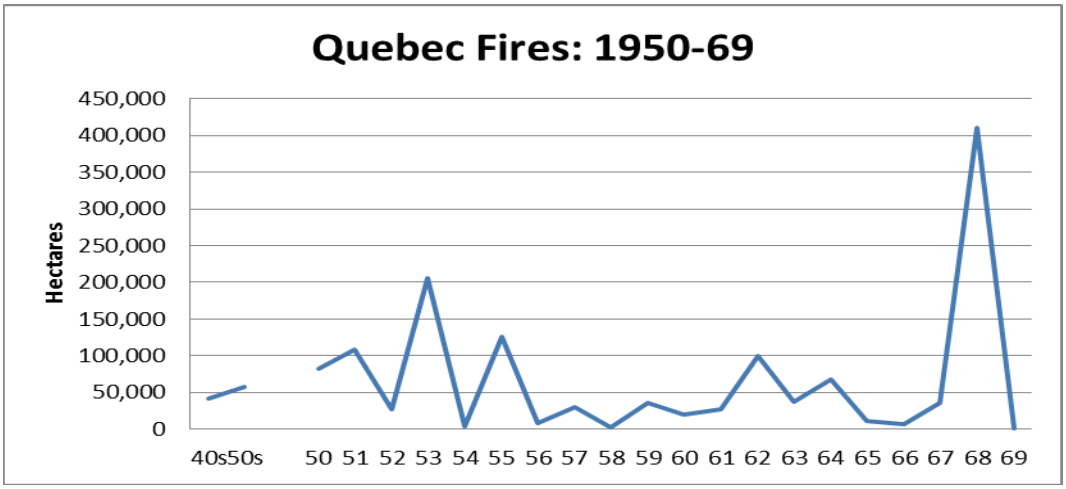
Provinces and States

Comprehensive and longterm weather data are not readily available for Canada, so that we cannot readily compare precipitation and drought indices. We will instead have to rely on a shorthand review of the fire history data. A useful summary on Canada drought history is Richards and Burridge, 2006.

Quebec

Since so much of Quebec's area burned occurs far north of the St. Lawrence, one would not expect a close association between fire season weather there with the situation in New England and New York. Further, much of the southerly portion of the Province is not included in the fire statistics we are using. And, no association is what we see. (Fig 2). In Quebec, the year 1968 was the main event of the decade, while it was a faint "echo", in most the northeastern US. Quebec experienced a very mild hump in area burned but at an extremely low level. One is tempted to wonder if the mild hump in fire numbers at that time was a coincidence. In any case, this period was not such as to strain firefighting capabilities at all – fire levels were below previous peaks.

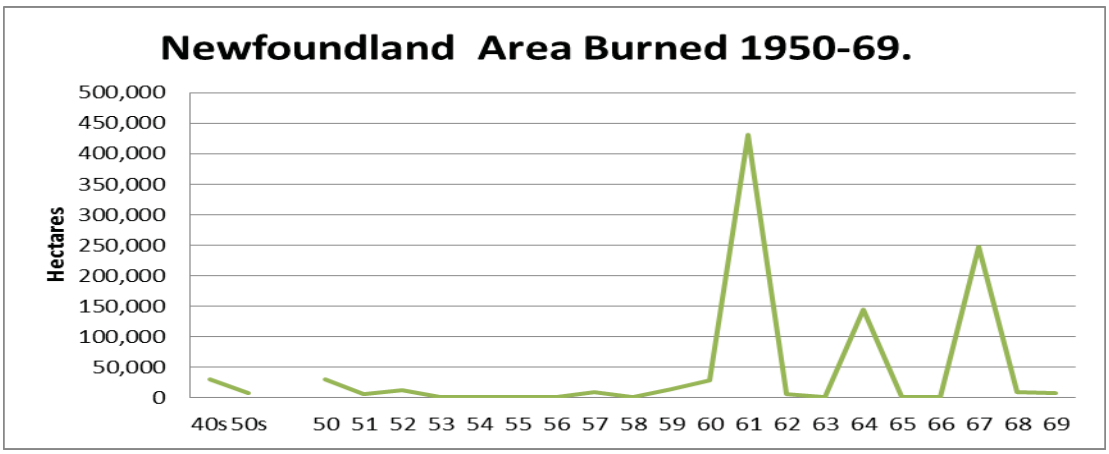
Figure 2.



Newfoundland

Much of Newfoundland's land area is geographically similar to adjacent Quebec (Labrador), but regional weather systems along the coast do not abide by the international boundary. It is not at all clear that this chart reflects a common meteorological cause, without analyzing weather data much more intensely than we can do at the moment. But it is important that in several years, Newfoundland was dealing with peak firefighting needs at a time when northeastern states were also doing so. The 1961 peak was a decade away from Quebec's 1968 peak.

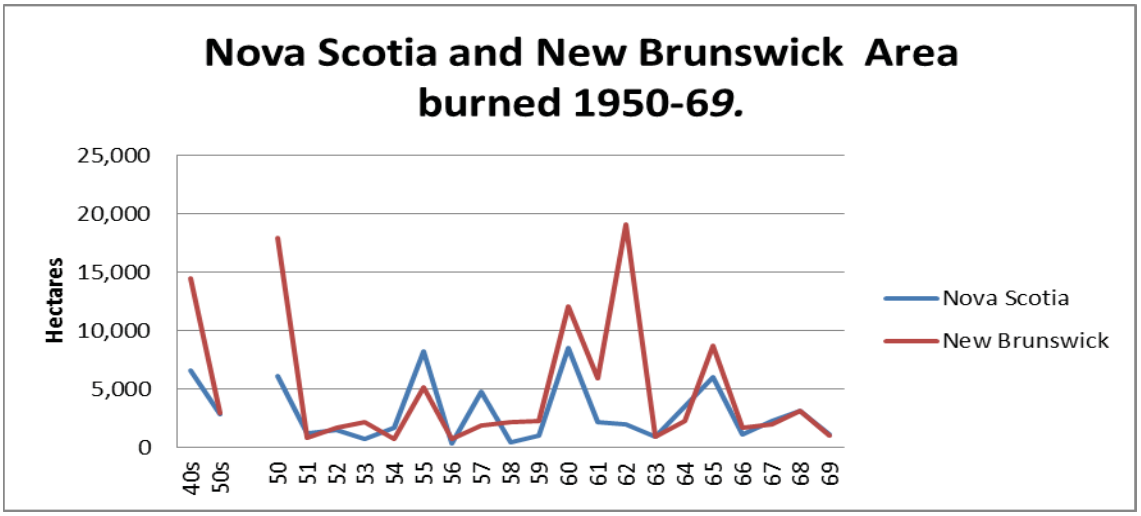
Figure 3.



Nova Scotia and New Brunswick

These two provinces often share weather systems with the Northeast, but their fire histories of this period differ notably (Fig 4). Both provinces saw an earlier rise in area burned, and New Brunswick shared a 1962 peak with New York. Later 1965 peaks resemble Maine's peak in that year. No real 'echo" in 1968 is visible, however, tho Nova Scotia experienced its record number for fires for the decade in that year.

Figure 4



So, whatever the underlying causes, the 3 Atlantic provinces did experience fire peaks during the same general period as the US Compact members did, thought they did not always coincide by years.

Maine

The USGS rated the 60s as the most severe drought of record in the state. In retrospect this proved to be true only for the Coastal Division, while the northern division experienced its most severe drought in 1955, and the southern Interior in 2001. WSP 2375 rated several other Maine droughts as extremely severe, with return periods of 30 yr or more: 1938-43, 1947-50 in southern Maine; 1955-57 over entire state, and the later drought of 1984-88. In every one of these drought periods, there occurred peaks in area burned relative to adjacent years. In the early 60's, Maine area burned varied between 1,800 and 3,600 acres, and in 1965 it jumped fourfold to reach 16,480 acres, a level not even approached ever since. So, Maine's fire experience lagged several other states in time. There was no prolonged fire outbreak. Its 1965 peak was also well below the 1957 peak of 31,000 acres.

New Hampshire

New Hampshire data are on a FY basis so direct comparisons for timing of the fire experience vs other states and climate indicators is impossible without primary research to recover monthly data. Still, as to broad pattern, the state shows a response to the drought. It experienced 2 years, FY 1962 and 63, that exceeded 1961 by a factor of six, and well exceeded the 1950's average. For 3 years running, fire numbers were three times the 1950's average. The state did not experience a later echo of the fire peaks as did Maine. An excellent graphic drought chronology for New Hampshire is in NH Dept of Environmental Services, 2008.

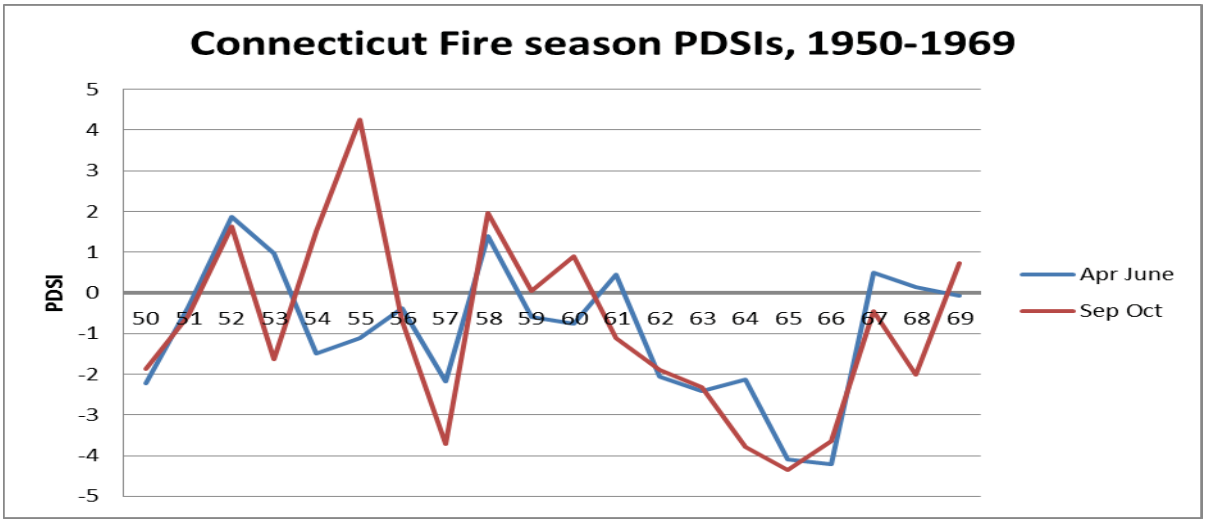
Vermont

In Vermont, fire experience has been extremely mild for many decades. While drought severity peaked in early summer of 1965, area burned peaked in 1964 according to state data. Both 1964 and 1965 area burned exceeded the state's 1950's average. Fire numbers exceeded their 50's average in several years. A 1968 drought echo led to the decadal peak in area burned, which exceeded that of 1965. For the severity of the drought that occurred there, the response in fire experience was quite mild.

Connecticut

Connecticut experienced fire peaks above 4,000 acres twice in the 50's, and its 60s fires did not match those. In 1960 and 61, area burned fell below 1,000 acres for the first time on record since 1905. The area burned then jumped in 1962 to reach a 1963 peak of 3700 acres; reported fire numbers rose to 943 in 1964. All told, 4 successive years exceeded 2,000 acres, and there was a mild echo in 1968. The 1963 peak in area was revisited several times in the 80's, before fire experience declined to historic lows in the 90's. Fig. 5 shows a rough relationship between this pattern and the April to June average PDSI's of the same period. But it is not a uniform one. In 1952, the drought indicators showed moist conditions, but fire experience was high. The worst of the burning was over before the worst of the drought. This could be explained by heightened control over burning and higher alertness and skill in the fire services. Also the echo of 1968 did not occur in a dry period. Explanations might emerge from more detailed exploration of monthly/weekly data.

Figure 5.



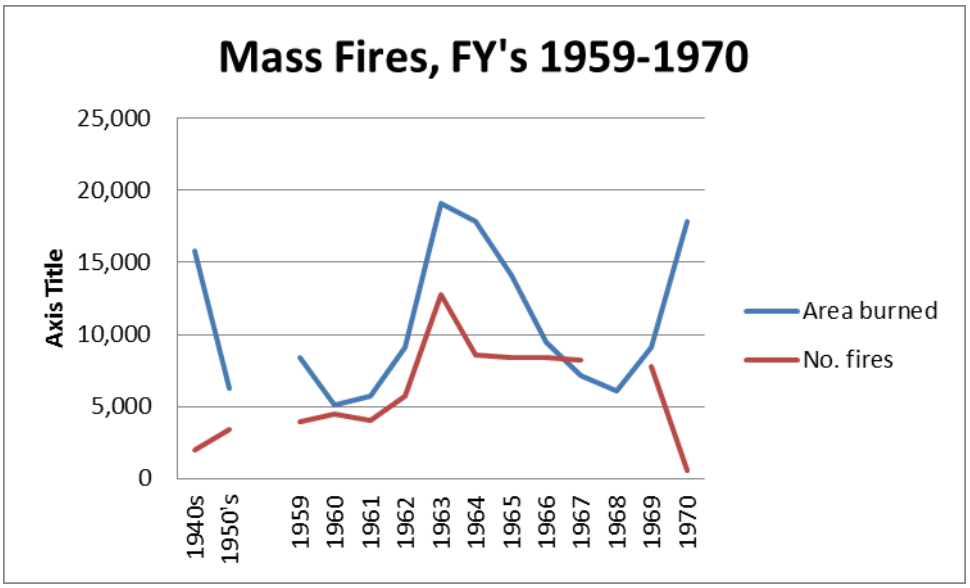
Rhode Island

Unfortunately, a fire history data gap for Rhode Island leaves the years 1965 to 69 invisible to us. Yet, RI did experience a dramatic upsurge in fire from 1961 to 1962—area burned increased almost fivefold. A later peak, much more severe, occurred in 1970. Conditions were moderately dry in 1962-64. Fall 1965 was dry at -3.43. The Apr-June PDSI set a record low in 1966, at -4.03, and recovered the next year to positive territory.

Massachusetts

Comparing the Mass data is hindered by the data compilation based on fiscal years. Typically the major fire activity (each spring) falls in the same years as the identified FY. Despite the additional problem of some missing data, we can see that fire numbers in the state far exceeded previous decadal averages, and area burned reached an FY 1963 peak (Fig 6). A very strong echo that returned in 1970, was not associated with especially dry fire season PDSI's (not charted).

Fig. 6



From reports supplied by DCR archivist Sean Fisher, we have monthly data for this period, unfortunately missing the key fiscal year 1964. We have reformatted the primary monthly data to calendar years. But the data do capture the extreme 1963 spring fire season (Fig 7; Tables 2, 3). Unfortunately, we do not have the key 1964 spring fire season at all. For the record the monthly data are supplied in Table 3.

Fig. 7

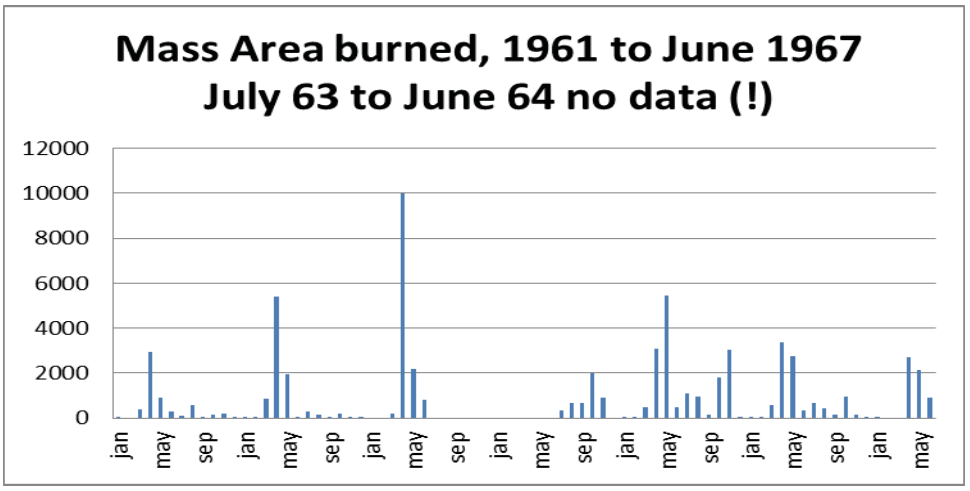


Table 2

Table Mass. Fire Data, Calendar Yr Basis, 1961-1967. Note '63 and '64 are partial		
Year	**Area Burned**	**No. fires**
1961	5,683	4,001
1962	9,092	5,709
1963(partial)	13,200	8,376
1964 (partial)	4,591	3,638
1965	16,623	11,037
1966	9,489	8,397
1967	6,072	5,842

Table 3 –

	Table	Monthly Massachusetts Fire data, 1961-1967 (partial)					
1961	jan	4	5	1965	jan	2	15
	feb	0	1		feb	14	52
	mar	380	474		mar	498	562
	apr	2,930	1,454		apr	3,096	2,244
	may	920	768		may	5,452	2,402
	june	308	242		june	485	719
	july	109	188		july	1,105	1,393
	aug	562	324		aug	938	954
	sep	68	102		sep	155	332
	oct	139	174		oct	1,816	1,355
	nov	207	200		nov	3,037	924
	dec	56	69		dec	25	85
1962	jan	19	64	1966	jan	14	23
	feb	5	17		feb	6	5
	mar	867	937		mar	599	634
	apr	5,394	2,418		apr	3,386	2,574
	may	1,940	979		may	2,738	1,419
	june	76	129		june	338	515
	july	312	409		july	688	1,025
	aug	162	246		aug	446	796
	sep	71	141		sep	174	331
	oct	193	241		oct	944	840
	nov	39	93		nov	151	215
	dec	14	35		dec	5	20
1963	jan	0	0	1967	jan	36	54
	feb	0	0		feb	0	1
	mar	219	424		mar	0	1
	apr	9,986	5,645		apr	2,688	2,648
	may	2,188	1,559		may	2,121	1,595
	june	807	748		june	911	688
	july				july	24	97
	aug				aug	24	67
	sep				sep	62	190
	oct				oct	73	213
	nov				nov	38	79
	dec				dec	95	209
1964	jan						
	feb						
	mar						
	apr						
	may						
	june						
	july	355	389				
	aug	683	652				
	sep	653	686				
	oct	1,986	911				
	nov	914	1,000				
	dec						
	Source: State Forester reports , from DCR archives, per Sean Fisher, Archivist.						

Charts of the PDSI's for Massachusetts show the depth and duration of the 1962-66

event well, and hint at slight differences between Zone 3 and the state as a whole, which would be expected Fig 8, 9). It is hard to see from the charts but 1964-66 seasons were drier on the Cape.

Figure 8.

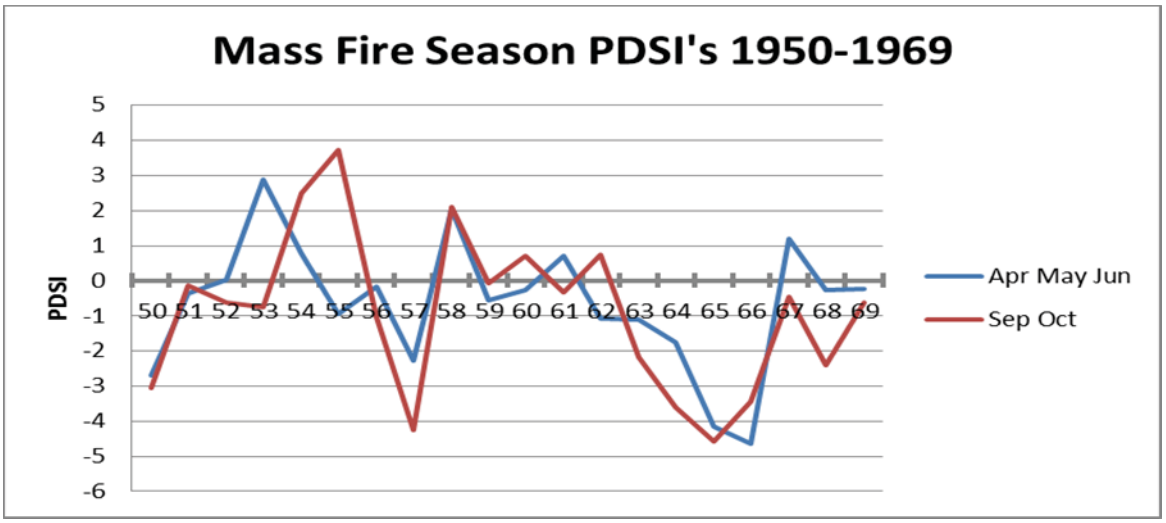
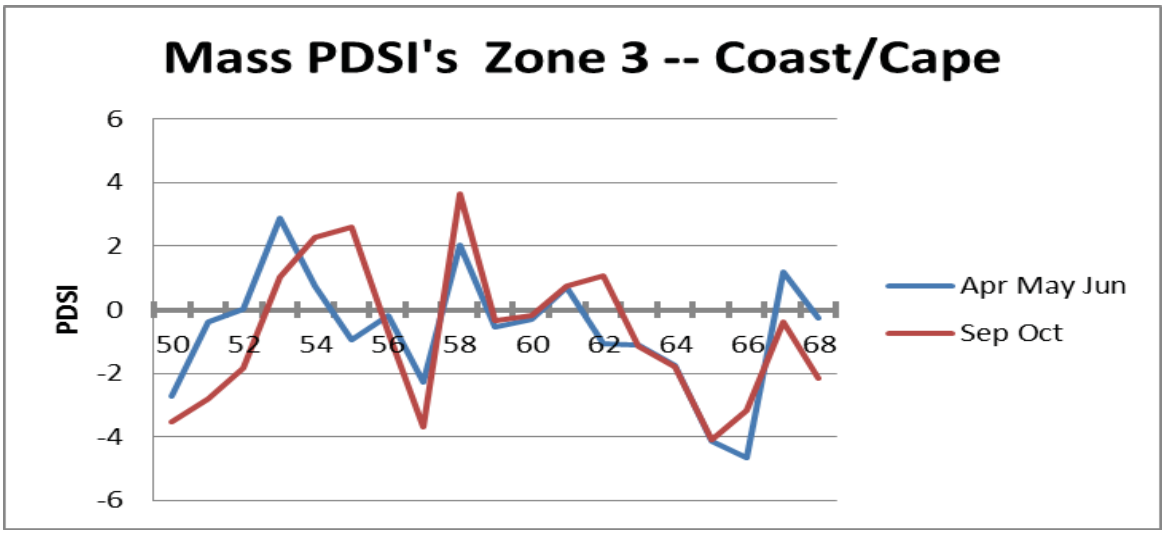


Figure 9



New York

Because New York's Drought and fire experience were substantial, and there is a good supply of detailed data, we discuss it at length here. The Great Sixties Drought profoundly affected New York. It was newsworthy nationwide for its effects on New York City's water supply. Less well remembered today was the fact that this extraordinary event also helped trigger a four year fire outbreak there. Across the region, drought records were set (lowest in 1389 months since 1895) for the PDSI during this period; no New York climate region was spared:

Eastern Plateau	-5.99	Nov 64
Northern Plateau	-4.18	July 65
Coastal	-5.63	Dec 65
Hudson Valley	-6.66	Nov 64
Champlain Valley	-4.61	July 65

Source: Cornell Univ, NE Regional Climate Center.

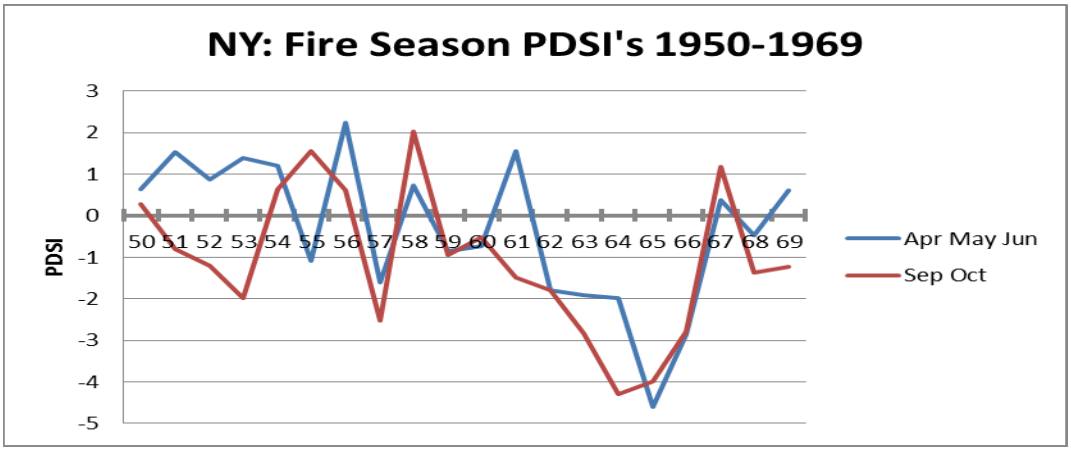
Over the years 1962-654, precipitation at NYC (Namias, 1966) was at the following percentages of normal:

Winter	92
Spring	58
Summer	62
Fall	67

Unexpectedly, temperatures were lower than would have been normal in a drought condition, instead of warmer than usual.

Figure 10 shows the deep and sustained nature of this drought.

Figure 10



A longer term perspective on the 60s drought in New York is provided by work at Columbia. The severity of this episode in both severity and duration is shown in Figs 11 and 12.

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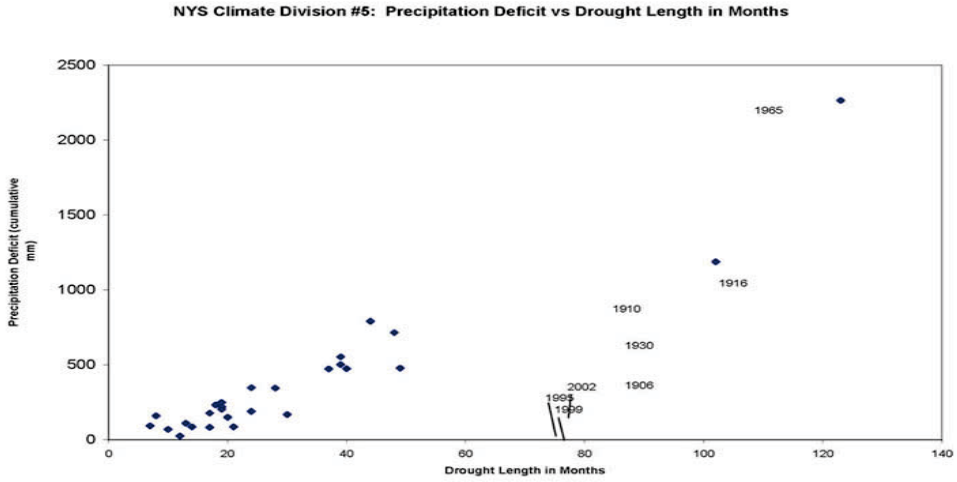
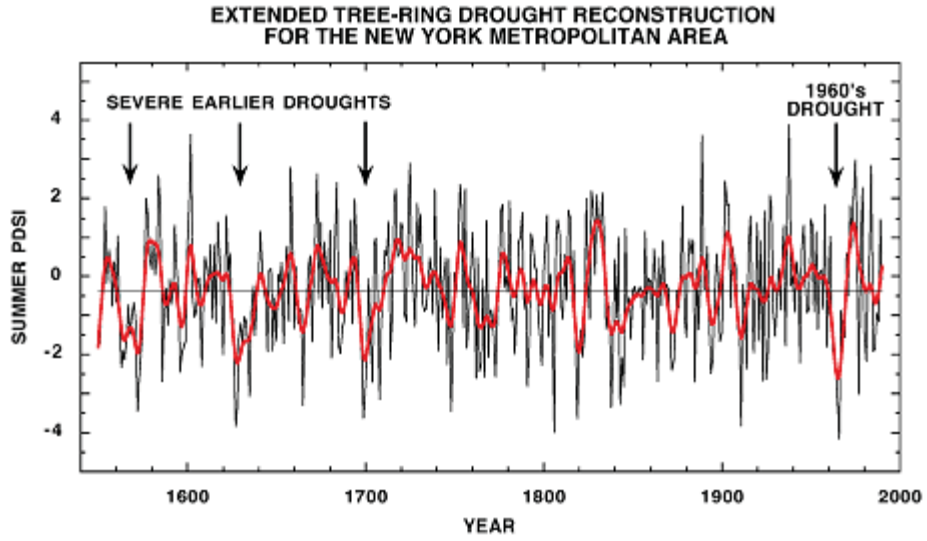
Fig 11



Source: CIESIN

Figure 12



Source: Petersen, 2012.

Not only do we see that NY was severely affected by drought but we have fairly detailed monthly data on fire occurrence, so we will devote some space to the Empire state.

The response of fire to the drought was immediate, with area burned jumping in 1962 to a multiple of the previous year. Over the 4 years, there occurred 5,903 fires burning 59,000 acres. Interestingly, this fire outbreak was one of fire sizes and not fire numbers, as fire numbers were not extraordinary. It seems that more of them escaped control due to extreme fuel conditions.

The monthly fire calendar (Fig 13A) shows the rapid jump in fire numbers in the spring fire season of 1962, compared to a fairly ordinary previous year. It also shows that the Drought affected monthly patterns in different ways in each year. Large fires increased in number dramatically (Figs. 13 -15; Table 4), jumping from 3 in 1961, to 29 in 1962. (no data for 1964).

Figure 13A.

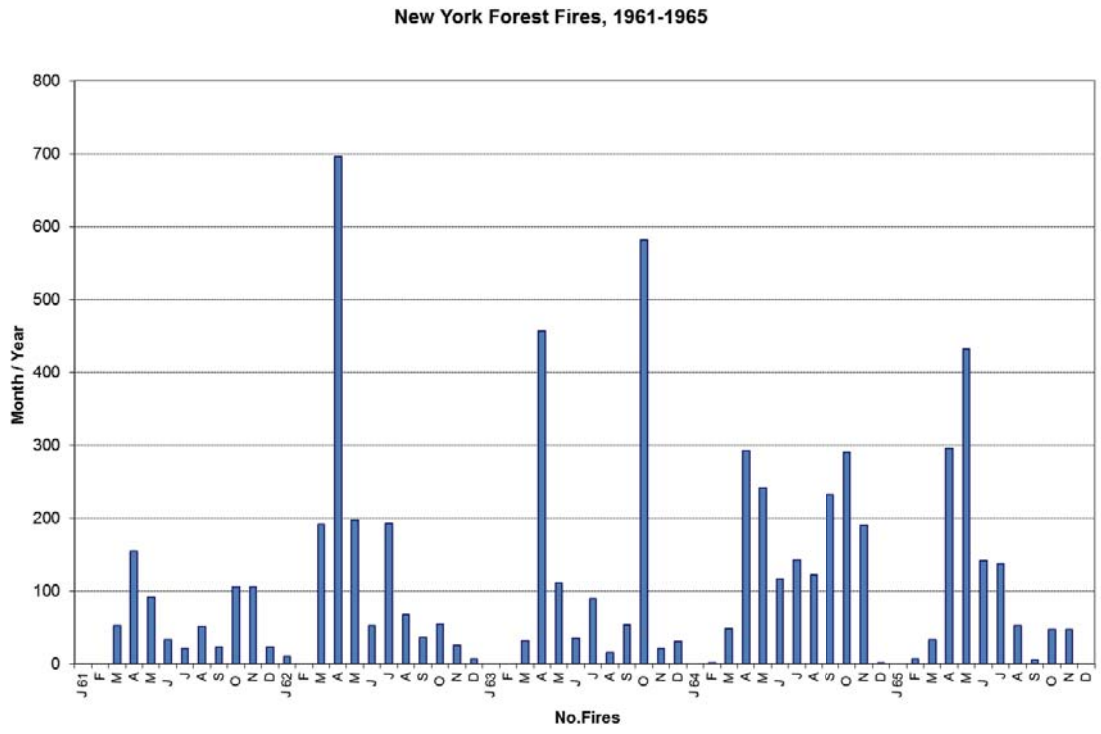

New York Forest Fires, 1961-1965
Month / Year
No.Fires

Figure 13B

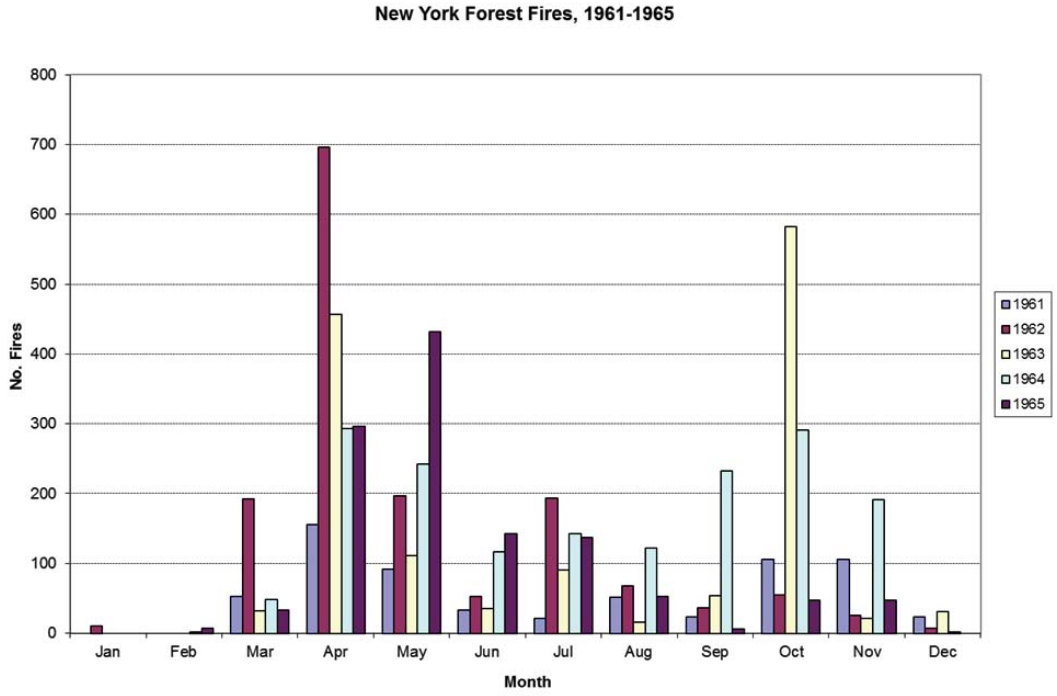

New York Forest Fires, 1961-1965
No. Fires
Month
Jan
Feb
Mar
Apr
May
Jun
Jul
Aug
Sep
Oct
Nov
Dec
1961
1962
1963
1964
1965

Figure 14

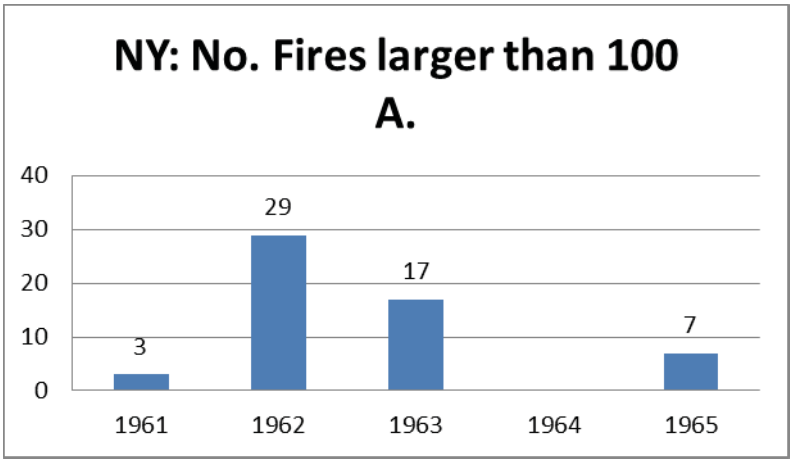


Figure 15.

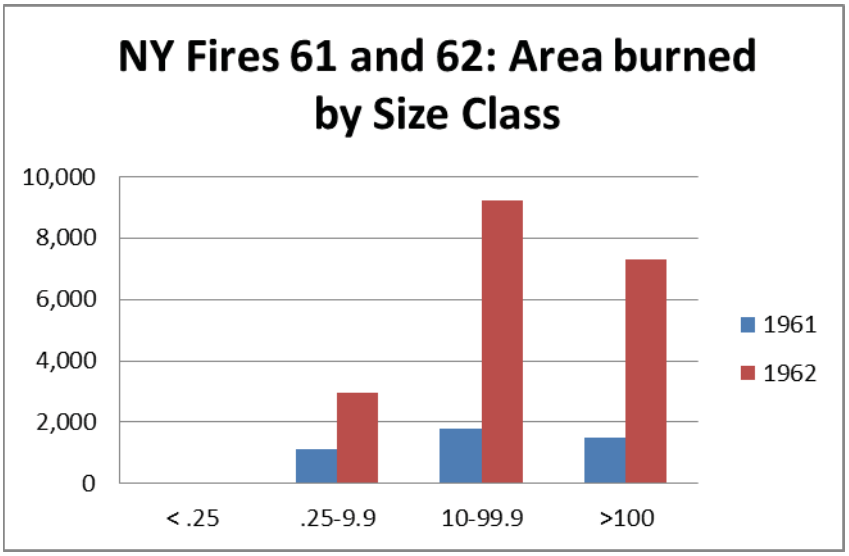


Table 4.

No. Fires Statewide:					
		1961	1962	1963	1965
up to .25 A		167	230	299	272
.25-9.9 a.		430	986	938	800
10-99.9 a		63	287	175	121
100 a +		3	29	17	7
	Total	663	1,532	1,429	1,200

The fire outbreak was not confined to the coastal sections but occurred in the western portion of the state as well (Figs 27-29). The northerly region, where so many fierce, epic fires are still remembered, was largely unscathed. The western portion of the state saw its fire siege peak in 1962, then trail off, while in the Hudson Valley/Catskills area a second peak in 1964 exceeded 1962 in fire numbers and nearly matched it in area burned.

New York: Regional Analysis

Availability of regional fire occurrence data enables us to further explore patterns within the state**.** The map for 1962 (Fig 16) shows that the bulk of the impact was in the west and the Hudson Valley. Figs 17 A and B show how fire numbers and area burned reached an early 1962 peak, declined in 1963, and peaked once again.

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Figure 16 New York Forest Fires
Acres Burned by Districts, 1962

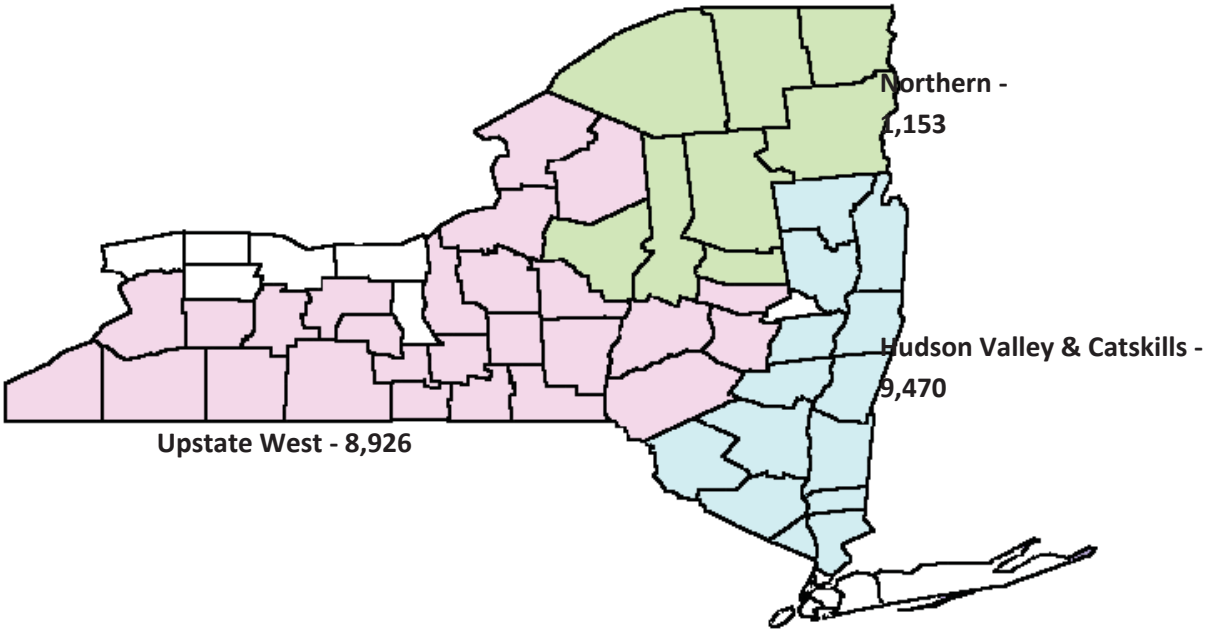


Figure 17A

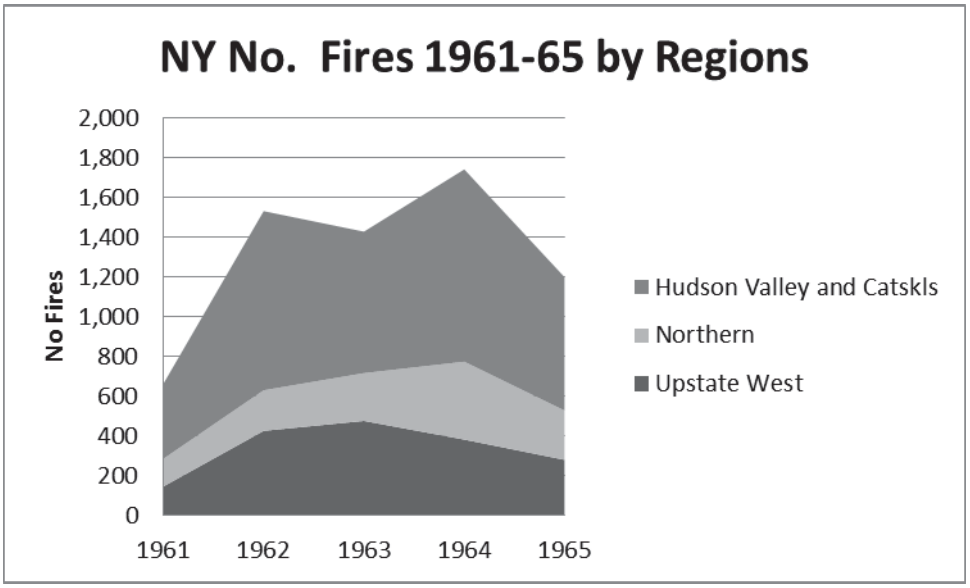
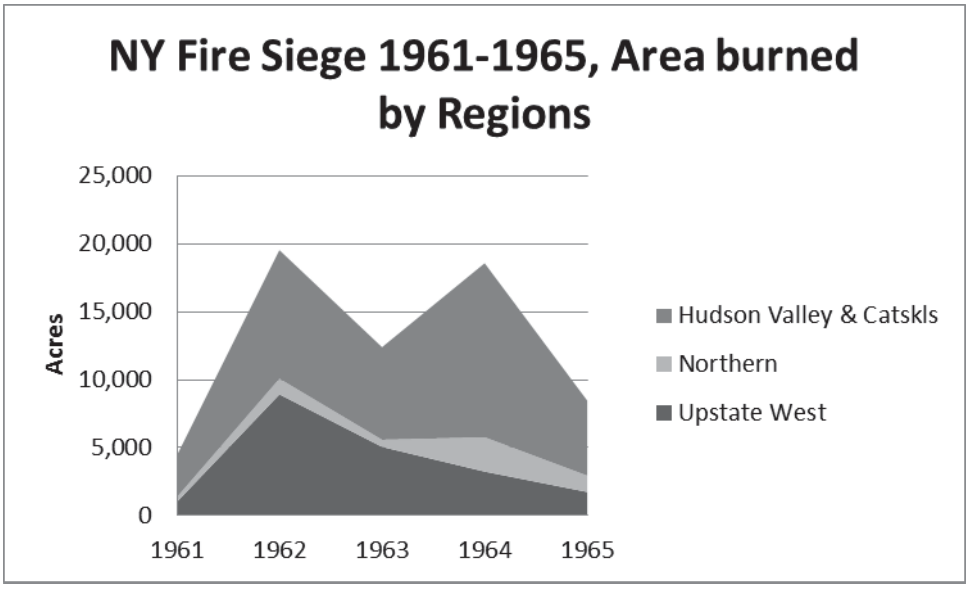


Figure 17B



A key mystery of this fire-drought experience is highlighted by looking at regional and seasonal rainfall anomalies (Fig 18 A-C). Several points emerge:

The majority of the burning was in the spring fire season, yet the spring season was often not very dry.

Fall seasons showed the most serious drought, but only in 1963 and in 1964 was fall burning at high levels.

The North showed similar rainfall patterns to the other 2 divisions and yet experienced a low level of fire.

This analysis shows how elusive are the connections between drought indicators and forest fire activity. Clearly a wider range of information is needed to understand trends.

Fig 18A

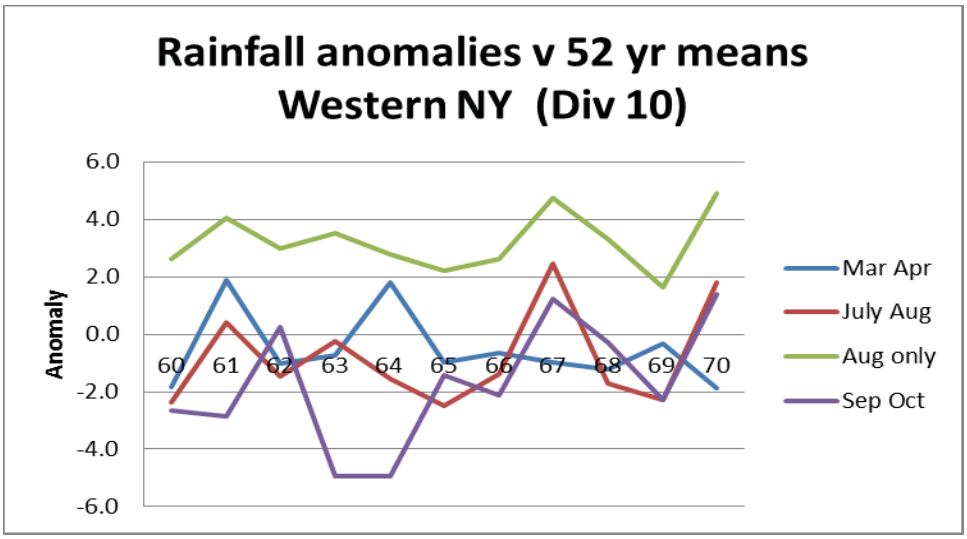


Fig 18B

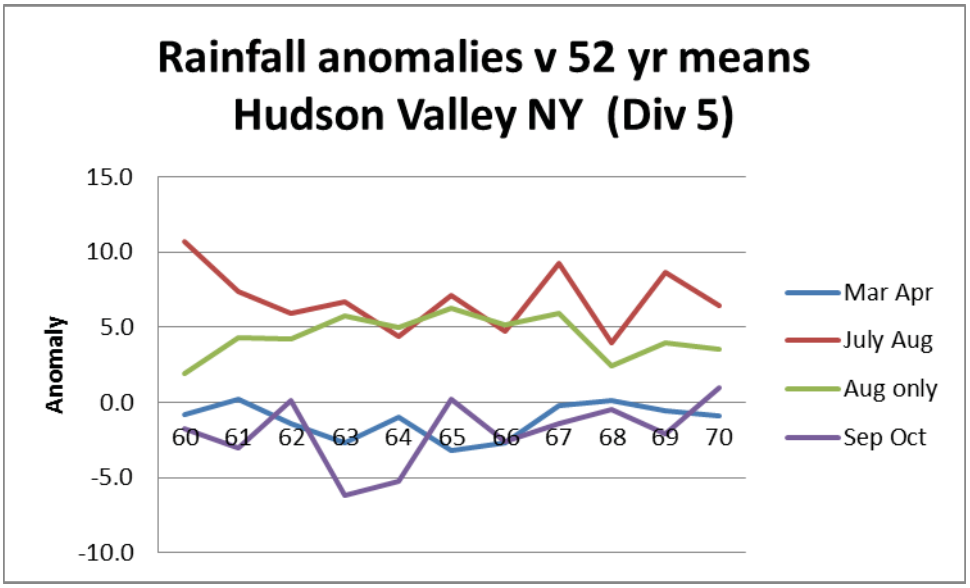
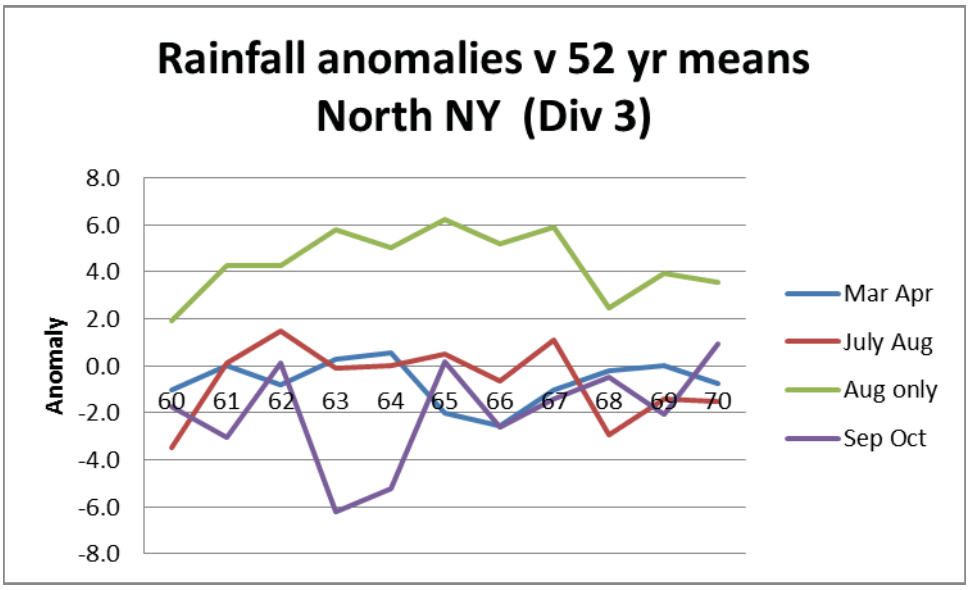


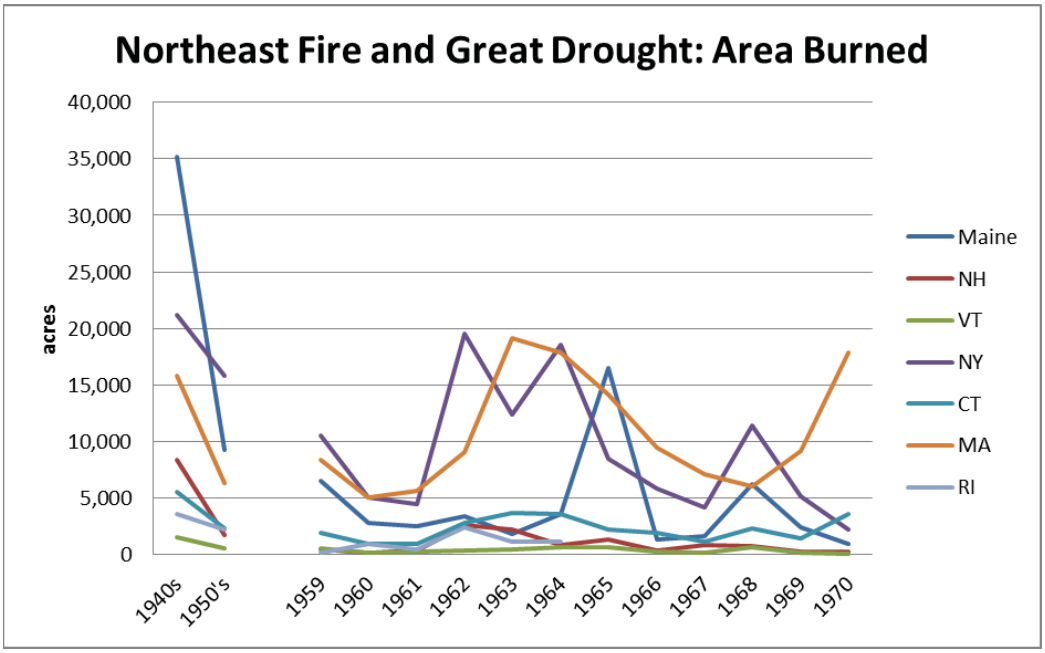
Fig 18C


Rainfall anomalies v 52 yr means
North NY (Div 3)
Anomaly
8.0
6.0
4.0
2.0
0.0
-2.0
-4.0
-6.0
-8.0
60
61
62
63
64
65
66
67
68
69
70
Mar Apr
July Aug
Aug only
Sep Oct

Region Overview

While the patterns varied from state to state, and within states, in the Northeast US, a definite surge in area burned accompanied the Great 60s Drought.

Figure 19.



In terms of the Compact's concerns for allocation of resources, comparing Canada to the US states showed a happy situation – the US period of elevated fire occurrence fell between two high fare activity periods in Canada (Fig 20). But on a more granular level, Nova Scotia and New Brunswick did have high fire experience during the same general period as did the Northeast US. The peaks in Canada occurred in Quebec (1968) and Newfoundland (1961)

Figure 20 A

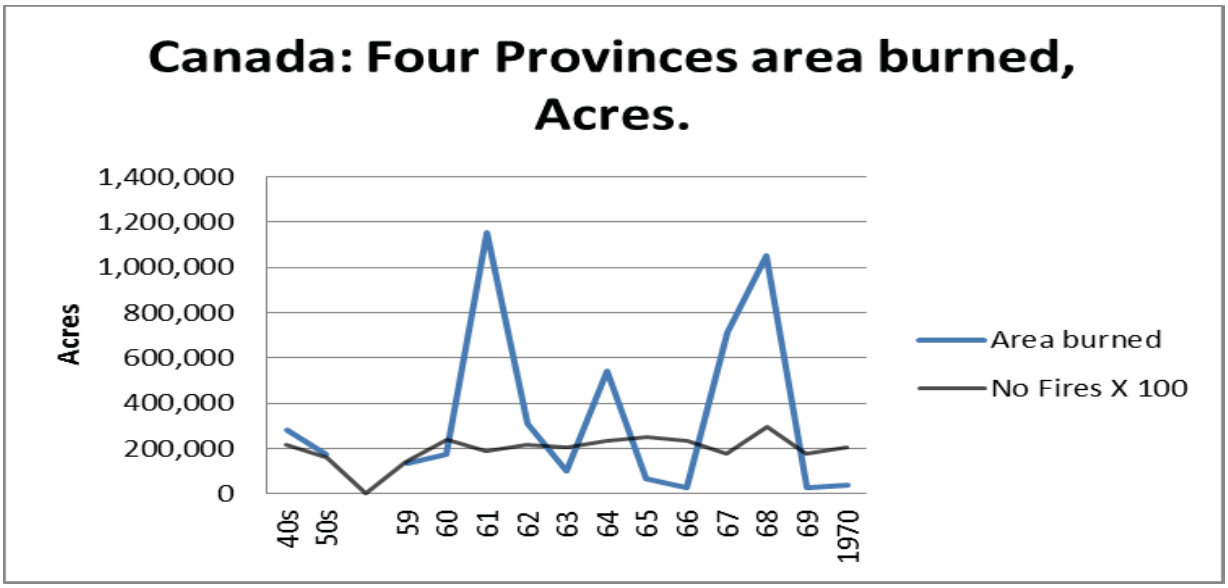
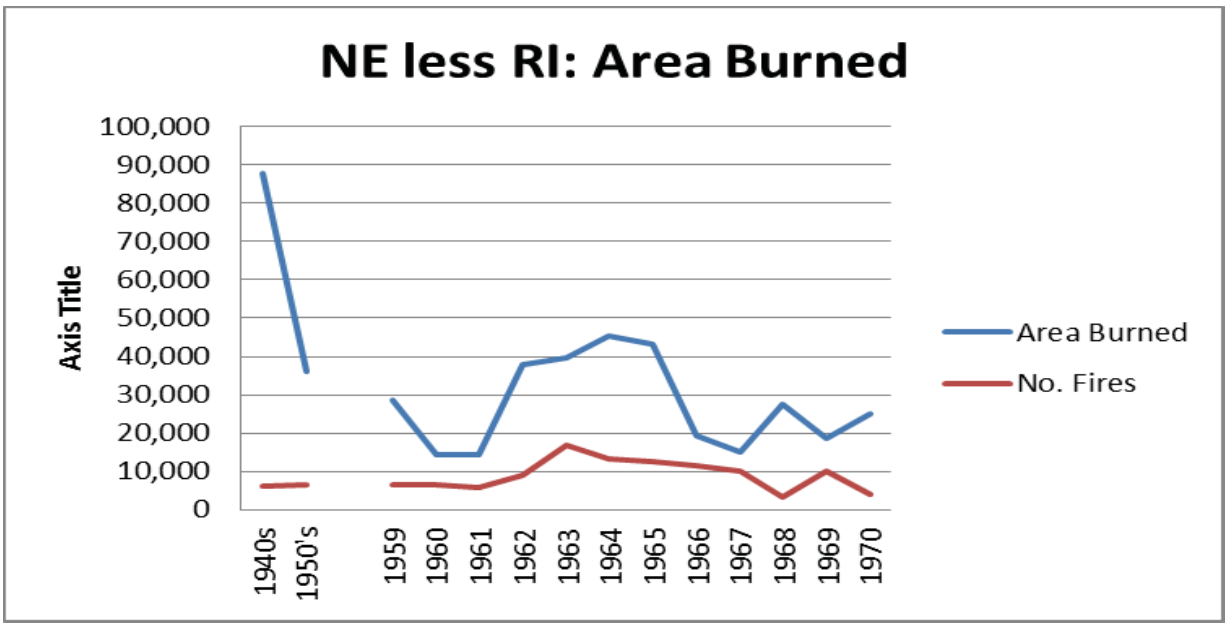


Figure 20B



Some Key Points:

Portions of this region spend more than 5% of time in severe or extreme drought. This suggests a 20-year return period for such drought conditions. Past analyses have rated severe or extreme droughts for portions of the region as 30 to 50 year events.

Since the 60s, droughts have covered less of the region and been shorter in duration. This is likely related to generally higher precipitation in most of the region since then.

Missing data for 1964 in New York, Rhode Island, and Massachusetts limits our ability to understand events at a monthly time scale.

The Drought and Outbreak developed at different time paths and intensities across the region and even within States.

The response of fire was somewhat baffling: it began immediately in 1962 in some states, whereas the drought worsened significantly after that. As fire managers often say, “you can have fire without drought, and drought without fire”.

Some areas with severe and prolonged drought and had only mild fire experience.

Clearly more than just drought is involved in these patterns.

Several hypotheses suggest themselves:

(1) Factors such as open burn permitting, woods closures, and sources of ignitions, lightning, wind and relative humidity were certainly involved.
(2) In addition, it is likely that a learning effect took place in the areas most strongly affected: after initial severe years, capacity was expanded, alertness improved, and lessons learned that enabled the fire protection services to maintain better control over small fires.

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Note: we consulted a massive study by NTSERDA for New York but its primary focus was on other matters and we did not find a great deal of drought and rainfall trend information directly useful for our purposes. Document is New York Climate Action Council Interim Report. 2010.

Appendix:

NOAA Climate Divisions of Northeast US.


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