Connecticut Forest Fire History and Analysis 1905-2010: Working Paper

Revised May 18 2012

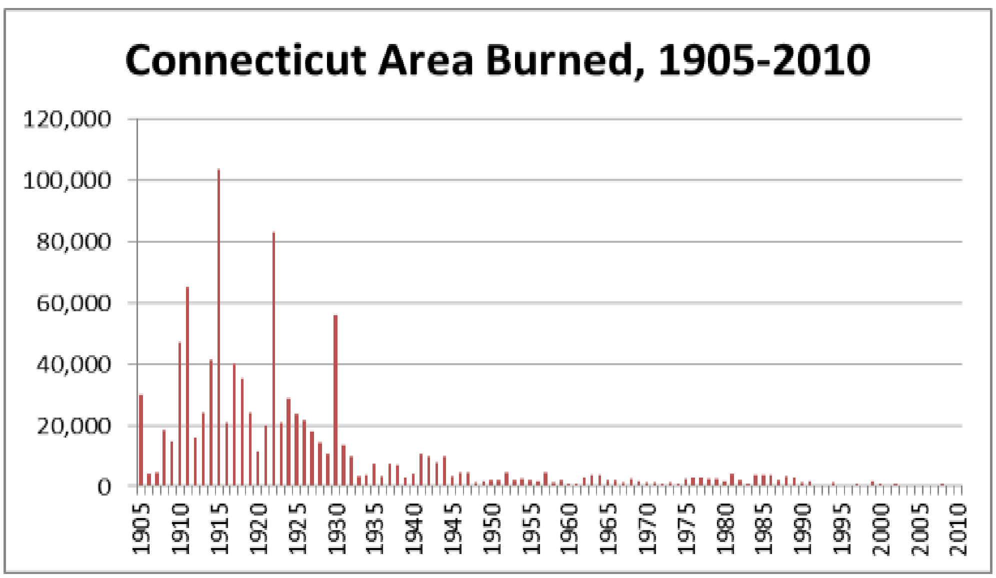
Lloyd C. Irland, The Irland Group

This note is an initial summary of key data on Connecticut's twentieth century forest fire history. We reach back into history for several reasons. First, it is useful to see whether major fire years are synchronous across states or not, and if so to associate those with weather or other factors to the extent we can. Second, the history can yield clues to important associations with weather that might not be evident from a short period of records. Analyzing this kind of information is subject to the usual caveats; especially for the older data, completeness and accuracy of coverage cannot always be assured. For example, it is easy to find in the literature widely differing estimates of the area for the same fire! Even today it is believed that not all wildfires make it into the statistical reporting system. Most importantly we must take care in making casual extrapolations to the future. Ultimately we hope to analyze circumstances surrounding the very largest fires in the region, and hope to use the annual fire occurrence data to identify years when those occurred[1].

As a policy matter, the number of acres burned annually may not be a sensible way to discuss policy. A year is an arbitrary unit of time. Would it make more sense to think in terms of area burned per decade or even longer, given resource and property values involved? Also, in this research we are searching for general empirical regularities to the extent they can be observed, but our purpose is not to develop methods for prediction.

According to these records, the worst fire year since 1905 occurred in 1915 (Fig 1). 1922 and 1930 were also terrible fire years, after which the era of heavy burning of 1905-30 came to a close. To better see the variations since 1932, we plot another chart (Fig 2). The data are given in the Appendix.

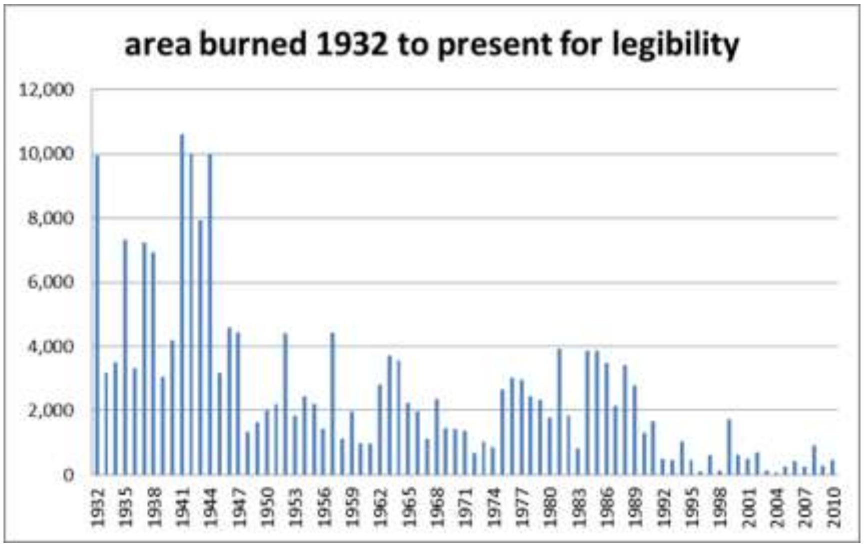
Figure 1.



[1] Our forest fire history is based on records from various sources, as tabulated by Jeff Ward of CTAES, supplemented by our own archival research to fill gaps. Assistance from Emery Gluck of CT DEP Forestry Unit is acknowledged. From 1984 we use the standardized reports from USFS. For certain details we rely on standardized reports by the USFS. Review and suggestions by Paul Waggoner, Jeff Ward, and Chris Martin are appreciated.

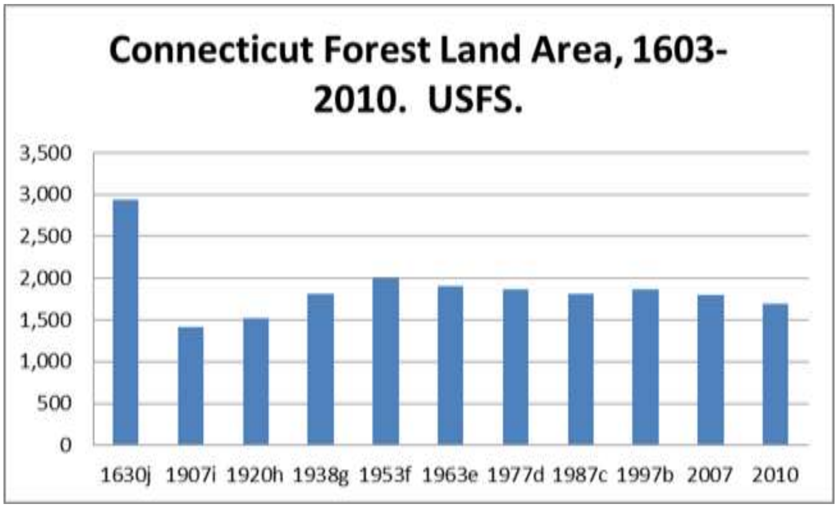
This shows a burst of fire in the early War years, another during the Great 1960's Drought, and a late high period from 1975 to 1989. Fire experience since 1985 has been very light.

Figure 2.



In the first half of the century, there was much more farmland in CT than today, and estimates of fire areas often included pasture and other nonforest land. Further, in large fires, unburned patches often survive. Many area estimates include the entire area within the perimeter. Because of these issues, it is necessary to avoid making too many strong statistical statements in comparing individual fire years. Still, the broad changes shown by time periods (Table 1) may fairly represent what actually happened. As farms area fell, forest area increased, from a low of 1.4 million acres in 1907 to just under 2 million by 1953. (Fig. 3) . Had the annual burning rate of forest remained the same, the area burned would have risen accordingly. Plainly, major forces were restraining forest fires in this period. Still, according to these data, by 1984-2010, Connecticut still burns at an annual rate of 0.04% of forest area, far higher than for Maine, New York, New Hampshire, and Vermont.

Figure 3.



Since 1905, fully 987,000 acres of forest fires have occurred in the state. As some of these burned the same area more than once, we cannot say that 1/3 of the state's area, or even half of its current forest are actually was affected by fire over this period. At the same time, in the first half of the period, fire must have had some effect on the vegetation at a landscape scale, if only locally. The decadal averages offer a way to screen out some of the variability (Table 1). This sorts out the picture into four fairly rough periods:

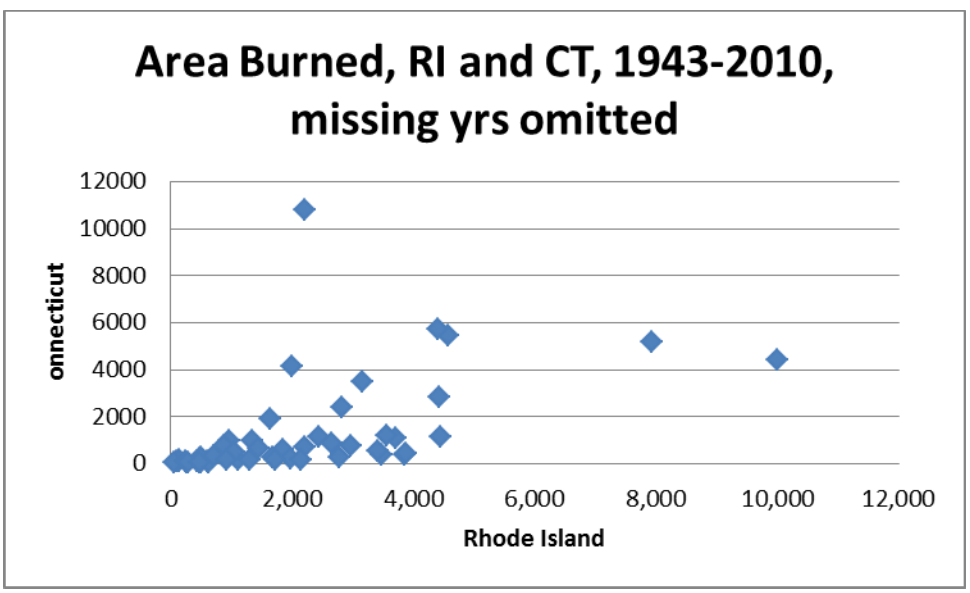
(1) 1900 to 1930, the period of high fire activity;
(2) 1931-1950, when fire activity fell by a factor of roughly 5 in both peaks and averages;
(3) 1951-1990, a rough plateau at about half the previous level, and
(4) 1991 to present, a dramatic decline in activity, by roughly a factor of four.

Table 1. Connecticut Fire: Decadal Averages		
Decade	**Area Burned**	**No. Fires**
1901-1910	19,772	1,615
1911-1920	38,142	842
1921-1930	29,667	829
1931-1940	6,218	1,091
1941-1950	5,565	1,113
1951-1960	2,308	576
1961-1970	2,165	582
1971-1980	1,919	924
1981-1990	2,745	1,306
1991-2000	735	214
2001-2011	403.3	275.8

Providing a satisfactory explanation of these changes is beyond the scope of this work , but will likely engage interested students in the future.

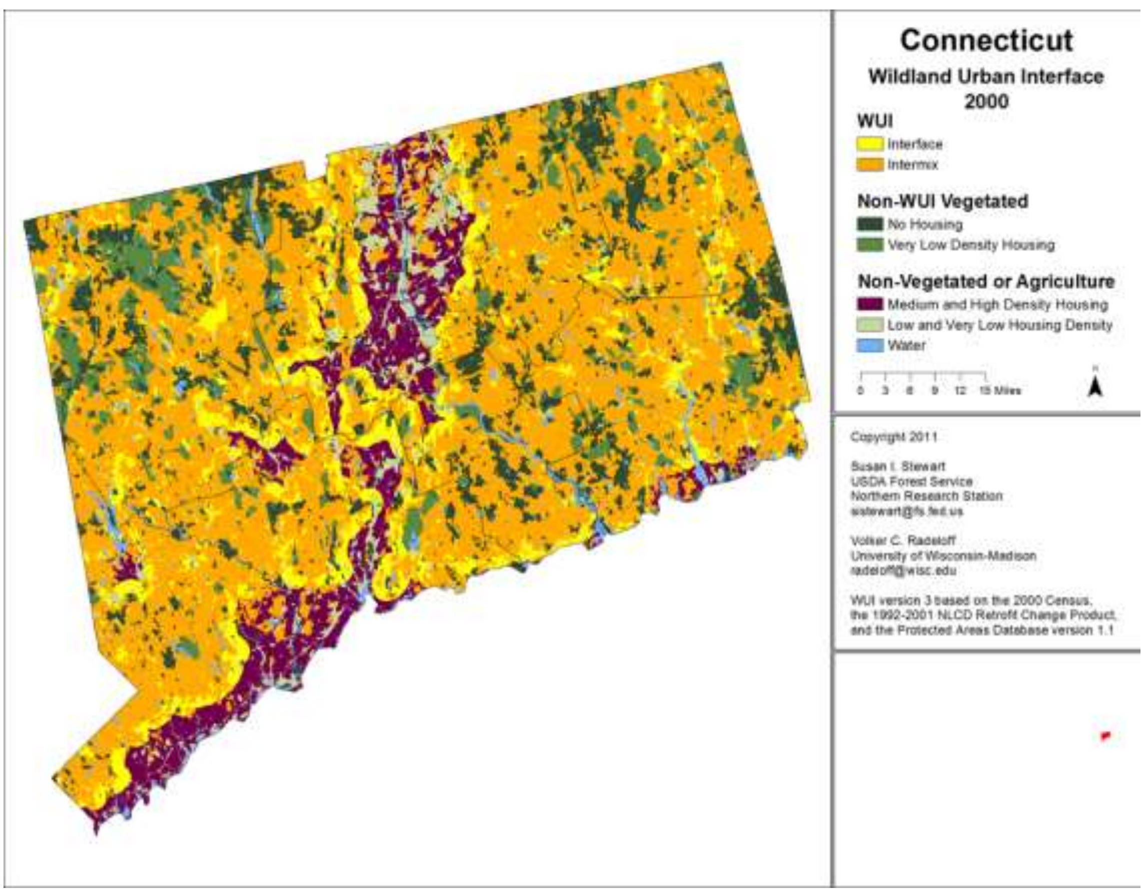
Comparisons to Massachusetts fire experience are barred by the fact that the Commonwealth reports fire data on a fiscal year basis, which means that the worst of the fire season appears in the following fiscal year. In addition, Massachusetts reports far more fire per unit area than does Connecticut, which some attribute to more thorough reporting in the Commonwealth. Comparisons to Rhode Island are hindered by about ten years of missing data in the 60's and 80's. Yet it will not be a surprise that there is a tendency for both state to have concurrent bad years (Fig 4).. In the 20's and 30's it was not uncommon for fires to burn across their common state line!

Fig. 4



The pulse of fires 1905-early 30's likely reflects rural life at that time, with much debris burning on farms, small scale logging with much slash, etc. After 1926 or so, lumbering in southern collapsed due to the housing recession and the Depression, reducing ignitions and fuel loads from logging slash. It has never returned to its levels from the 1920s. Fire detection and suppression capabilities were steadily built up, and perhaps began to make a substantial difference by the mid 30's, as unemployment programs and CCC efforts bolstered many conservation efforts. Certainly officials at the time thought so. On the other side, railroad fires did not go away, until the later dieselization and electrification. Expanding number of cars on the road meant more cigarette butts tossed into the grass by motorists. As we note below, arson continues to be implicated , especially in the larger, more dangerous fires. Lower fire experience since 30s reflects changes in these factors, plus suburbanization and likely the strengthening of fire services in urban fringe areas. According to analysis of Census 2000 data by Volker Radeloff and colleagues, virtually the entire state outside of urban areas was in intermix and interface categories by 2000; surely by 2010 the interface area has increased (Fig 5).

Fig. 5.



http://silvis.forest.wisc.edu//maps/wui/state

Average fire sizes were high during the high burning years of the 20's and 30's, falling thereafter to low levels, and roughly 2 acres by the 1990's (Fig 6) . Since 1984, there has been a marked reduction in the number of fires reaching large sizes (Fig. 7). In a number of years after 1994, there were no fires exceeding 100 acres. In 1996, just under 100 acres of fires were recorded.

Fig. 6.

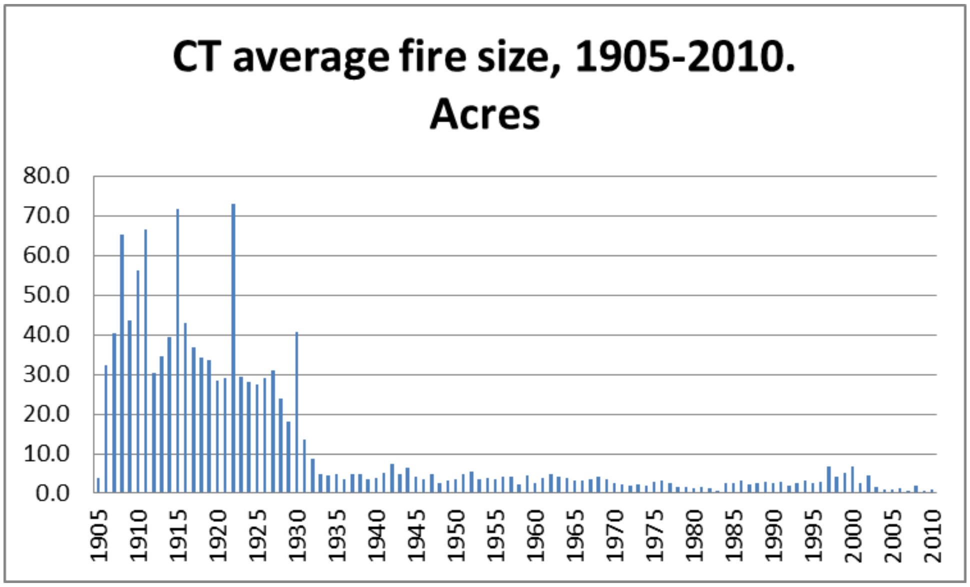
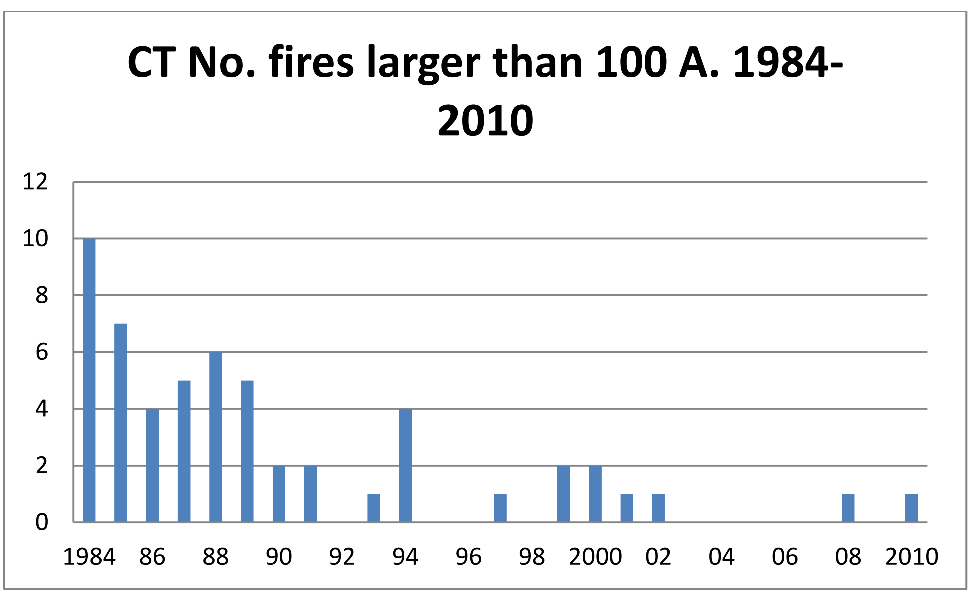


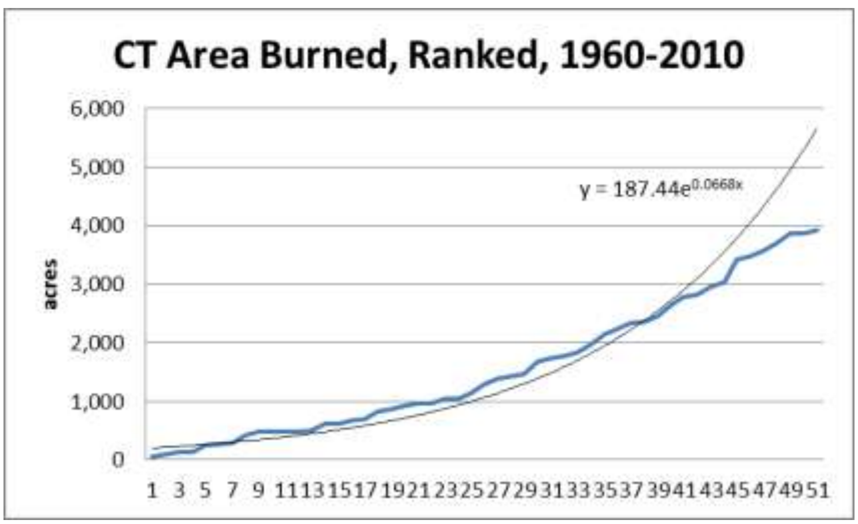
Fig. 7.



Extreme Value Analysis and Return Periods

We have performed an extreme value analysis on the Connecticut annual fire record, using only data from 1960 (Fig 8). Connecticut's post-1960 fire experience differs dramatically from other parts of the Northeast, where the successive highest area burned years differ markedly when ranked in order. In Connecticut, by contrast, the highest area burned years fall on a mildly increasing line. Why the shape of Connecticut's ranking of fire years by area burned should be so different is a puzzle. It could be that with the state's dense population, there is always a fire hydrant nearby. Also, as we see below, climate factors have recently been unusually favorable.

Fig. 8.



Standard ways of depicting variability are depicted in Table 2. Comparing the entire period to the most recent portion:

(1) The means did not change all that much;
(2) For area burned the ratio of maximum to mean fell, but not fore no. of fires;

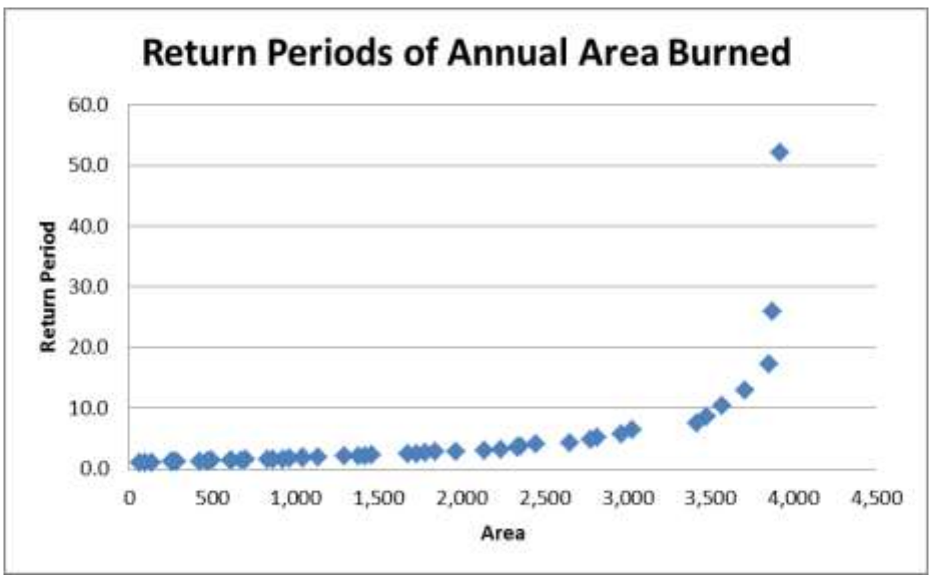
(3) Variability as measured by the ratio of mean to median and CV are as high or higher recently compared to the entire period. *Variability*, then, has not declined in relative terms despite the large decline in the averages.

Table 2. Connecticut Analysis of Variability and Extremes, 1944 to 2010

	Area Burned	**No. Fires**
1944-2010	Acres	
Maximum 1944-2010	10,009.0	2,683.0
Mean	1,938.4	669.5
Median	1,679.0	547.0
SD	1,596.5	485.0
Ave + 1 SD	3,534.9	1,154.5
Ave + 2 SD	5,131.5	1,639.5
Ratios:		
Max /mean	5.2	4.0
Mean/Median	1.2	1.2
CV	0.8	0.7
1970-2010		
Maximum 1970-2010	3,918.0	2,683.0
Mean	1,449.8	676.9
Median	1,044.0	460.0
SD	1,184.3	574.3
Ave + 1 SD	2,634.1	1,251.2
Ave + 2 SD	3,818.5	1,825.4
Ratios:		
Max./ mean	2.7	4.0
Mean/median	1.4	1.5
CV	0.8	0.8

Many people, especially along the lower CT River, with all the recent focus on hurricanes and tornadoes, will understand the idea of return periods for extreme events. Nobody would think of designing levees in Hartford for the *average* of past floods. In the case of forest fire experience, we can perform the same analysis used to identify return intervals for floods. When we do this, we obtain a chart like Fig. 9. This uses data from 1960 only, to capture the effects of the Great 60's drought, which has not recurred since. The period average for area burned was about 1500 acres. Recent years have been much lower. This analysis suggests that if one were to plan for an area burned level that recurs on average once every decade, one should plan for annual peak area burned of 3500 acres, more than double the period average. Because of the state's mild fire experience since the Great 60's Drought, the longer return periods do not correspond to far higher levels of annual area burned.

Fig. 9.



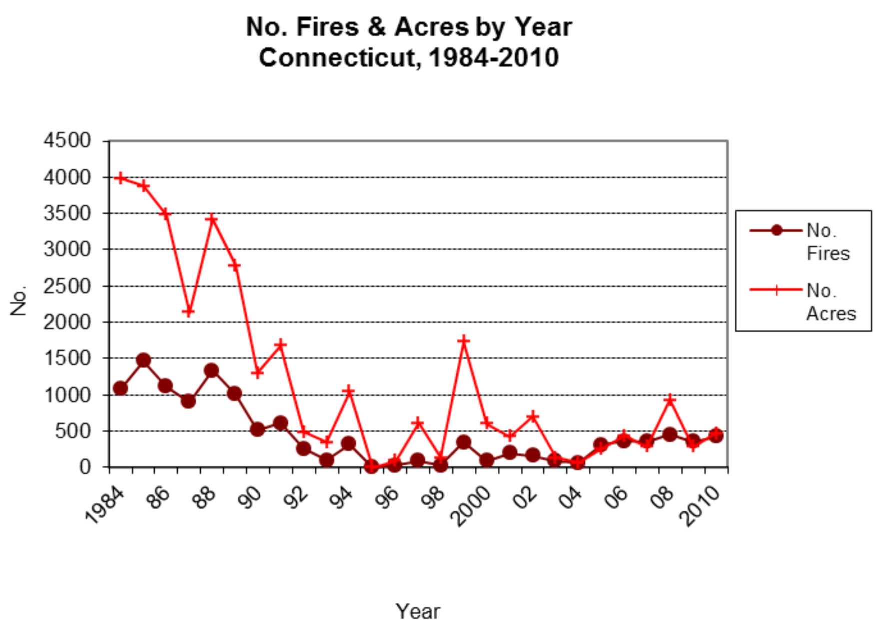
We have not shown the same analysis including all years from 1905. For that time period, the largest fires follow the expected pattern -- each successively large fire year exceeds the previous by a large margin. Until this is better understood, however, it may not be wise to assume that the relationship shown in Fig 9 will continue to hold, regardless of future weather conditions.

Detailed Review 1984-2010.

Compilations of data supplied by the USFS enable us to examine fire history 1984 to the present in greater detail. Averages do not tell whole story. In 27 seasons, there were 544 patches of fires larger than 10 acres. These amounted to 2/3 of the total area burned. This is a cumulatively small but perhaps not insignificant ecological effect. Just looking at the average fire size – or the average "fire rotation" over this period overlooks this effect. Given that these patches likely occurred in higher fire risk areas, their local impact could be noticeable over long time periods. Fires do NOT destroy the forest, though some fires may be more intense and damaging than "natural" ones would have been in presettlement times. Further, some of the fires reported affected the same area more than once.

Considering the larger ones (Fig 6 above) -- 100 A is not much in forestry. But 100 acres could be up to 100 one-acre lots – the property values in most parts of the state would be very large. And such a fire could become large enough to escape control at least for a period. Figure 10 shows area burned and fire numbers since 1984 for context for succeeding charts.

Fig. 10.



Forest fires virtually disappeared in Connecticut in 1995-1996 (Fig 11) . Further analysis would be desirable to see if it is possible to identify the cause of the upswing after 1994, as well as the patterns indicated in Figs 12 and 13 for area burned. According to this information, even when total fire area is low, fires large enough to be considered serious continue to occur.

Fig. 11.

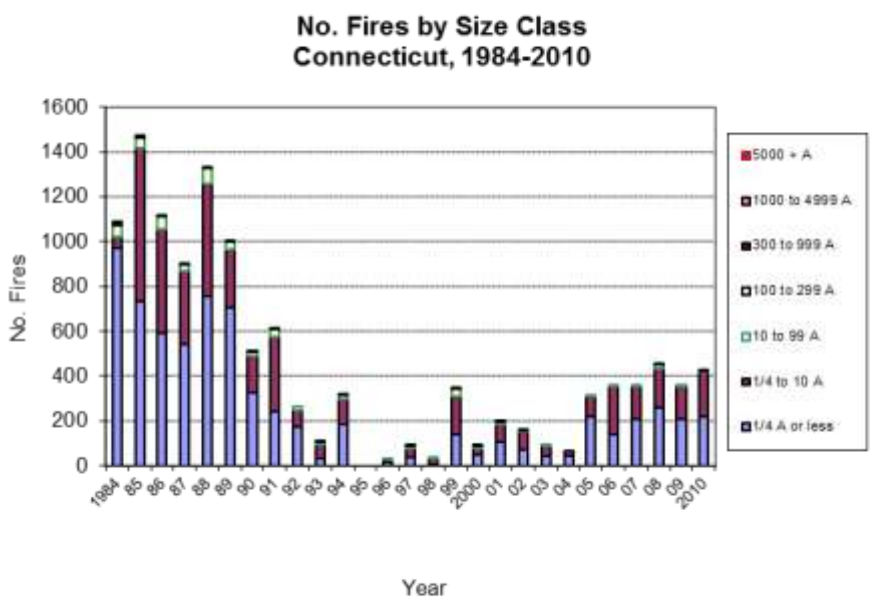


Fig. 12.

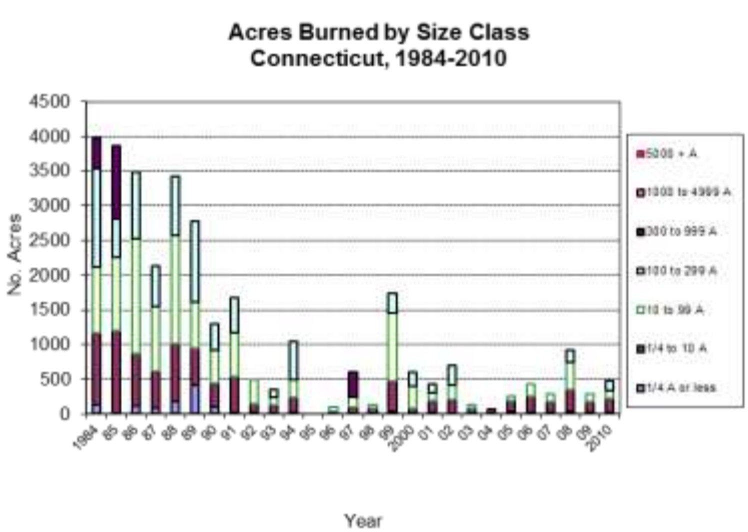


Fig. 13.

Despite the small number of large fires, fully 68% of the cumulative area burned over this period was in fires ten acres or larger.

Fire Causes

Longterm comparisons of trends in fire causes are hindered by the fact that in many past years a large proportion of fires and area were rated as “unknown”. Some forest fire professionals think that “smoking” has been exaggerated as a diagnosis in the past; currently, cigarettes are less likely to ignite fires than in the past.

Lightning, RR’s are basically unimportant and cause small fires. **Arson fires** are numerous in bad years, and account for ½ to 2/3 of area burned.

For example, in 1999, the most recent year with area burned exceeding 1000 A, 937 acres out of 1,733 were attributed to arson. It is believed that fire investigations have improved in recent years and that attributions to arson at present may be better founded than they were in the past.

A through exploration of existing fire cause data would doubtless be rewarding but is not possible for this project.

Relation of Annual Area Burned to Weather

The influence on weather on fire occurrence and intensity was an early preoccupation of foresters and the meteorological community. Examples are shown in the Box on next page.

Using NOAA's 1895-present monthly database, we can analyse important connections to weather patterns. Plainly, detailed data on relative humidity, wind, and fire danger ratings would be needed for an authoritative analysis. Also, monthly or weekly data on fire occurrence would be needed. Yet, these are not available in convenient form for longterm comparisons. While it is impossible to be precise with available data and using monthly indicators, a bit of exploratory analysis is of interest. As an example, here we present Palmer Drought Severity Indexes for the spring, April May June fire season, as well as for fall, summarizing by decade (Table 3).

Table 3.

SUMMARY											
Apr May Jun	1901-1910	1911-1920	1921-1930	1931-1940	1941-1950	1951-1960	1961-1970	1971-1980	1981-1990	1991-2000	2001-2010
lower than minus 2	3	6	4	2	2	1	5	1	1	0	0
minus 2 to zero	6	3	6	2	5	6	2	2	4	6	3
zero to plus 2	0	1	0	6	3	3	3	5	2	4	6
plus 2 or higher	1	0	0	0	0	0	0	2	3	0	1
Sep Oct											
lower than minus 2	2	5	7	1	1	1	5	0	0	0	0
minus 2 to zero	3	3	2	4	6	3	4	2	5	3	3
zero to plus 2	5	2	1	3	3	5	1	4	3	6	2
plus 2 or higher	0	0	0	2	0	1	0	4	2	1	5

This shows that spring drought was far more common from 1911 to 1930 than subsequently. In fact since 1990, there have been no spring periods with PDSI less than +2. The springs have not been unusually wet. In fall, there has been no year since 1971 with PDSI below 2. From 1901 to 1930, there were only 2 springs with PDSI above zero, whereas since 1970 they have been frequent. A more detailed picture is seen in Fig. 14.

Connecticut Fire Weather in the 1930's and 1940's

Excerpts from Wooden Nutmeg

June 1931:

SPRING FIRE SEASON OF 1931
Only 547 fires have been reported this spring as against twice that number last year. This, of course, is due largely to weather conditions, especially to the snow in the woods late into the spring. However, the comparatively small area burned, only 10,700 acres, indicates real progress in fire control. Not only have the Wardens been more efficient, but the trained fire crews, made possible by the unemployment appropriation, and the trained crews organized by the district wardens in the various districts, did excellent service. In many cases these crews reached the fire within fifteen minutes after its start, and controlled it to a few acres. The average area per fire was therefore only 19 acres

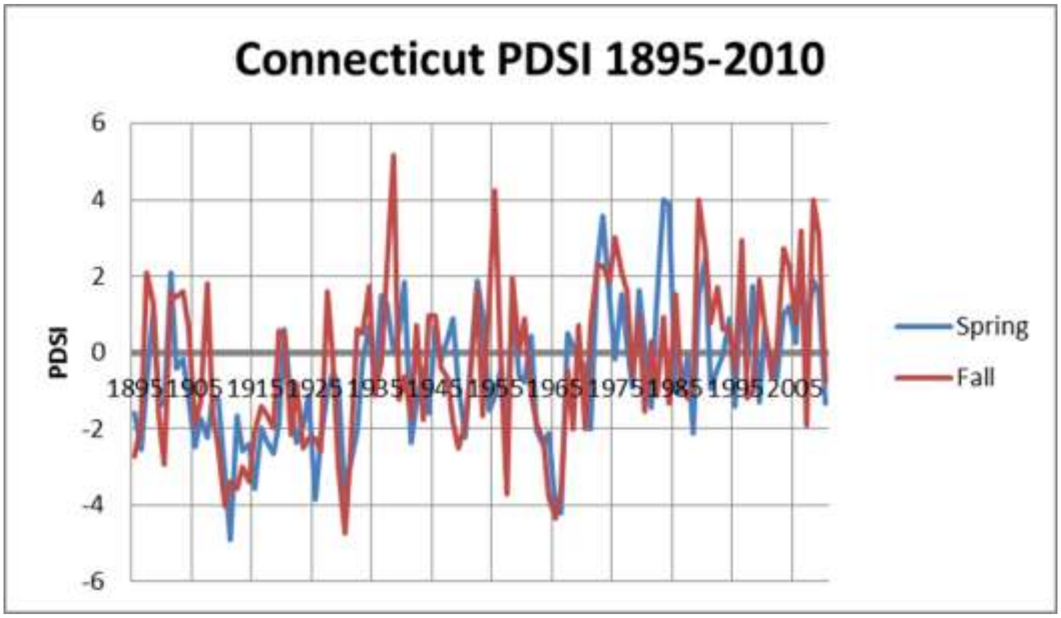
July 1931:

FOREST FIRES AND ATMOSPHERIC HUMIDITY
Mr. T. E. Reed, in charge of the New England Fire Weather Service, has compiled interesting figures on the relation of relative humidity to forest fires in Connecticut in 1930. He shows that between March 1 and December 31 slightly over half of the 306 days had relative humidity below 49 per cent. It is therefore not surprising that 86 per cent of the fires of the year occurred on these days. On the forty-two days with relative humidity of less than 29 per cent, 53 per cent of the fires occurred. Only four days in the ten months covered had relative humidities of less than 19 per cent, and these were all in March, April and May. Similarly of the 38 days with humidities less than 29 per cent., 26 days were in these three spring months. During the summer months of June, July and August the humidity did not go below 30 per cent. These figures explain in part why the worst fire season is in the spring.

June 1941:

By the end of April, 824 fires had been reported for the month as compared to 282 last year, 149 the previous year, 227 in 1938 and 354 in 1937. This unusually large number is undoubtedly closely related to the weather conditions, for there were sixteen High Hazard days. The rainfall for the year up to May 1 was the lowest since 1868 and was less than half the normal amount. Analysis of fires in April and May 1940 shows that there were nine days which had over 25 fires a day although only four of them were predicted as High Hazard. On these nine days there was an average of 57.5 fires burning 293 acres per day. On the other forty days there were only seven fires per day.

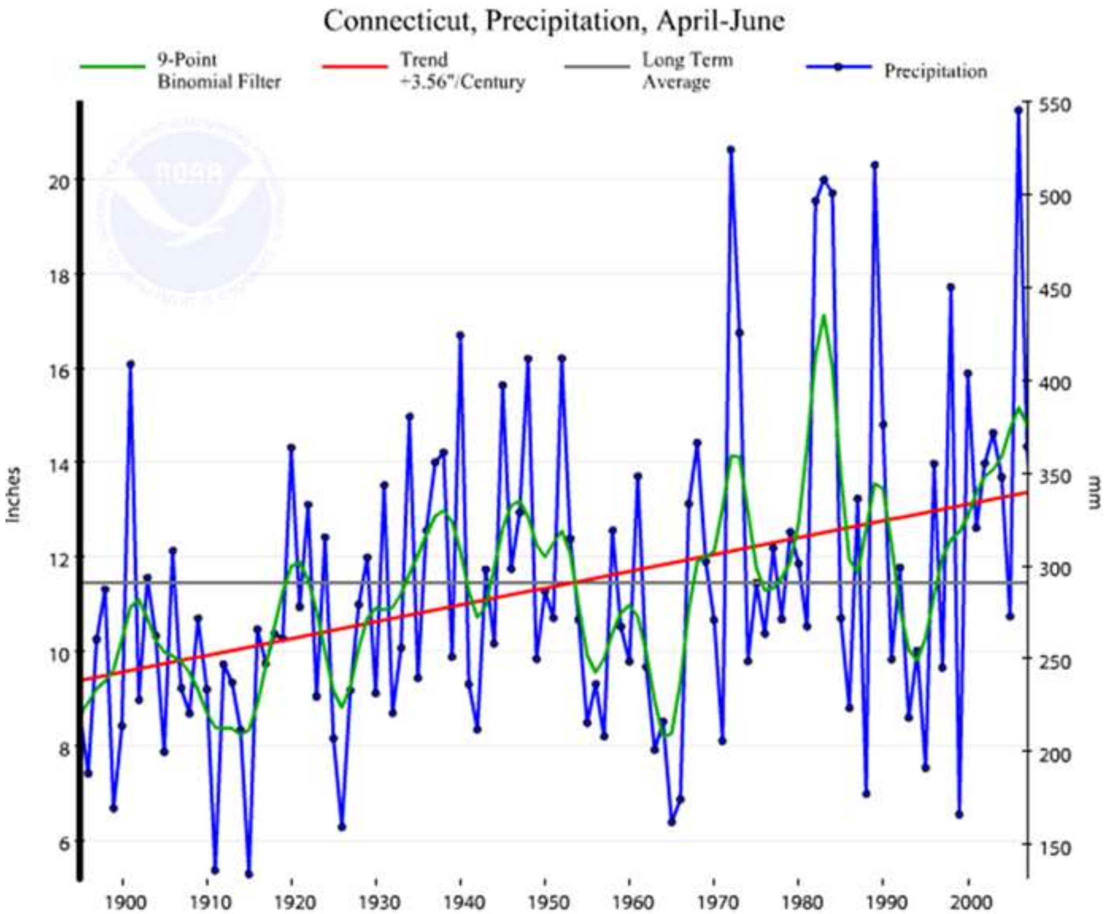
Fig. 14.



Source: NCDC website

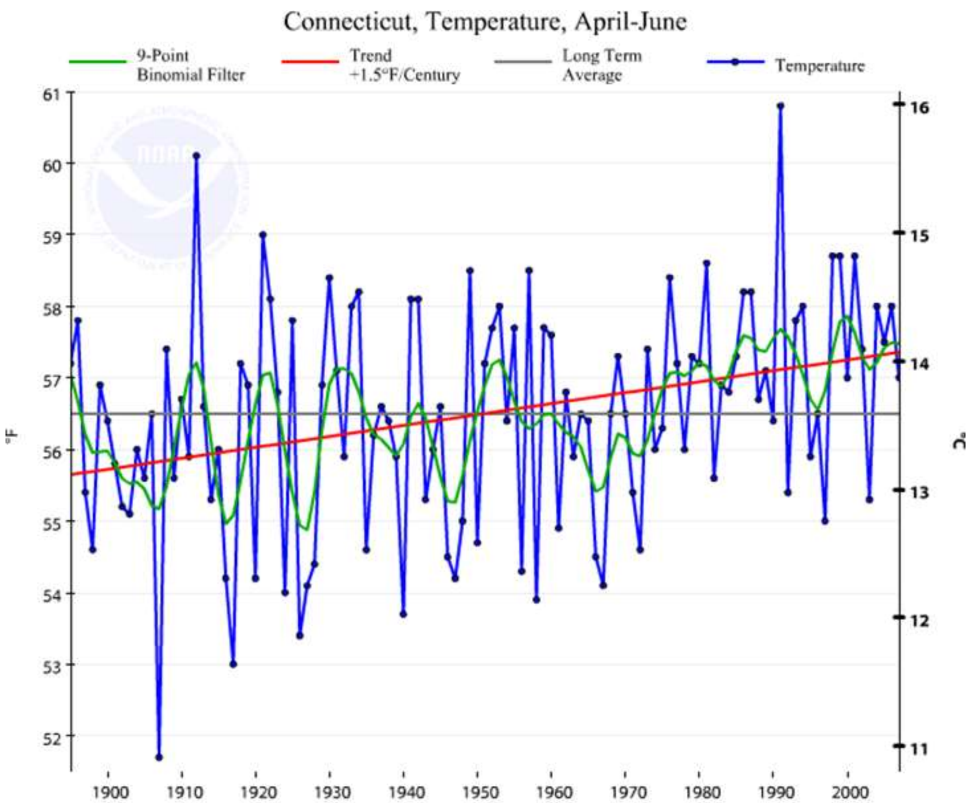
Connecticut has seen a strong uptrend in average springtime rainfall since 1895; temperatures on average have also risen (Figs 15, 16).

Fig 15



Source: NCDC website.

Fig 16



Paul Waggoner has kindly read an earlier draft of this paper and suggested several comparisons to us (Figs 17-18.). Figure 17 shows the period of high area burned and frequent spring drought in a different way than above. In Fig 18, a scatter of spring PDSI is shown in which the pre 1940 and post 1940 periods are color coded. This shows a quite different connection between drought and fire activity in the two periods, suggesting that other factors have been important.

If we could obtain similar data on windiness and RH it might shed light on these relationships. It would also be valuable to obtain fire data by months, so that connections to weather can be more closely examined. We would not expect annual totals to match closely with weather for just one season.

Figure 17. Area burned and PDSI 1905-2010. (Paul Waggoner analysis)

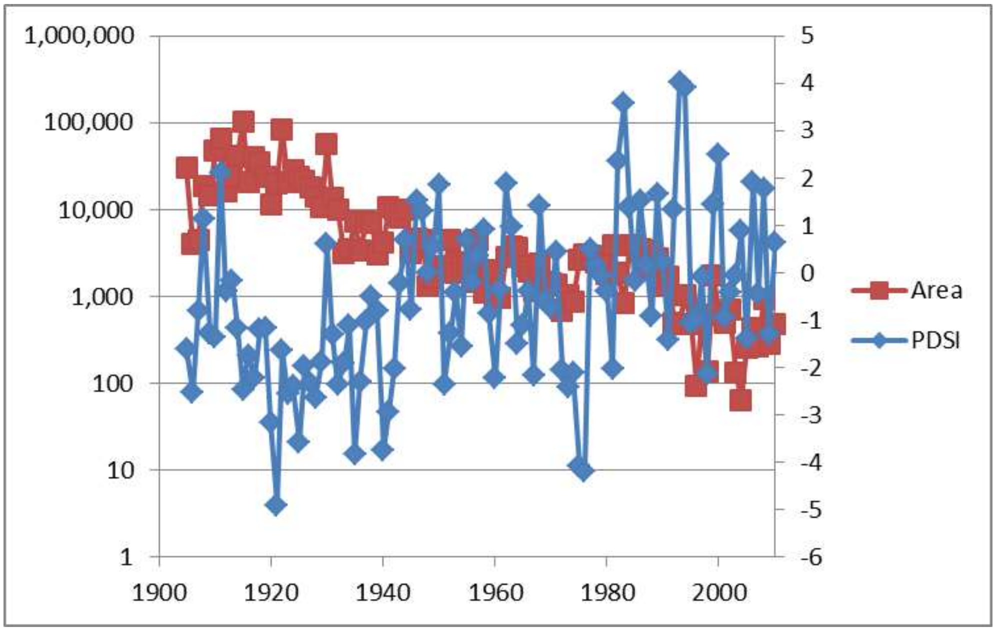
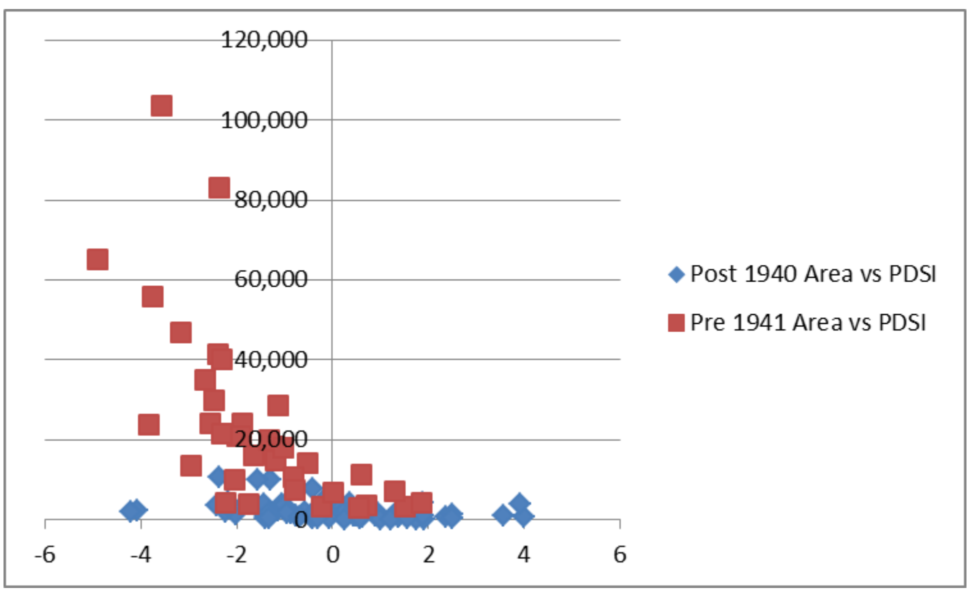


Fig. 18.



All of these comparisons show the extremely loose connections between seasonal area burned totals and rough measures of weather. Important forces have constrained the number of very large fires in the Connecticut landscape since 1930. Fire protection services have improved in coverage and capability and response times. Farmland has contracted and perhaps management practices rely less on open burning than in the past[2]. Yet it remains true that the current system has not recently been tested by difficult weather conditions.

Some Ponderings…Why are There Fewer Forest Fires in Connecticut?

Suburbanization Spreads -- Since the post war baby boom in the 1950s and 1960s people have been migrating from the cities to the suburbs. Between 1953 and 1998, the population of Connecticut grew 51 percent, to 3.3 million people. This means fires are noticed sooner.

Road access improves -- In 1930, of Connecticut 's 14,000 miles of roads, only 26% were improved, By 1959, of a larger total mileage, more than 90% were improved (Stat Abs of US.). This is key for prompt access for heavy equipment like fire engines.

Logging changes – After the mid 20's, logging plummeted. Since the 50's machinery and methods have changed, making sparks less likely, Also, utilization in the woods is typically much more complete, leaving less slash for a fire hazard than was true in the teens and 20s. At that time numerous portable sawmills would leave behind piles of slash and sawdust that were recognized fire hazards.

Forests are less flammable – According to Emery Gluck at State Forestry, **"**With the absence of fire, copious understory hardwood saplings seed in creating an understory canopy that shades the fuels further and increase the humidity, lessens with wind in the understory and thus lengthens the time for fuels to dry out. Unlike in the West or other places with conifers proliferating in the understory where fuel load increases with the absence of fire, our forests become *less* flammable with the absence of fire."

Grasslands decline -- By the middle of the 19th century, 2/3rds of Connecticut's original forest had been cleared. Since then, forests have been steadily reclaiming farmland. Connecticut's forests of oak, hickory, maple, birch are probably less fire-prone than the previous pastures and haylands.

---

[2] See challenging analysis of Wallenius, 2011. I owe this reference to Paul Waggoner. A deeper study along Wallenius' lines would be desirable for southern New England but is not practice within the resources for this project.

Changes in Agriculture – Related to above, the decline in number of farms likely has reduced the number or rural activities involving burning of fields and debris.

Fire burn permits enforced -- The fire burn permit system was established in the early 1900s. Over time this system was backed with stronger government support and today all towns require residents to obtain an open burning permit prior to burning. Open burning is prohibited when fire danger risk is high.

Smokey the Bear educates -- In the early 1900s it was commonplace to throw cigarettes out the window and leave campfires unattended. Education and publicity have altered the American mentality – who hasn't heard that "only you can prevent forest fires"?

Coal-Burning Trains disappear-- From 1910 to 1926, sparks caused by railways caused 1/3 of forest fires in Litchfield County and 1/6 of fires (by acres) in the state. Electrification of railroads after 1925, and shrinkage of the rail net after the 1950's, nearly eliminated this risk.

Fire Warden System grows -- The fire warden system was established in 1906. In 1923 the Litchfield County Forest Fire Wardens' Association was formed, the first of its kind in the country. It allowed for greater cooperation between wardens and increased efficiency.

Technology improves -- In the early 20th century, a number of technological advancements changed the face of forest firefighting, not the least of which was the internal combustion engine and thus – firetrucks and high volume pumps. Other advancements in fire fighting technology include portable gasoline-powered pumps, radio communication, aircraft, satellite imagery for lightning detection, among many others. Widespread cellphone use now results in many prompt fire reports.

From: Wooden Nutmeg.

Summary Observations:

1. Wildfire was an ongoing reality in rural CT from 1905- early 1930's. By the 60's it had become an unusual event. Cumulatively, an area equal to half of the state's current forest area burned over, but some of this was nonforest, and some was burned multiple times.
2. A number of factors brought about the reductions in area burned over this period.
3. Connecticut's post 1960 fire history has been extremely unusual, in that it does not exhibit the extreme value behavior that is common to fire histories elsewhere in the country.
4. Tentative analysis suggests that weather in recent decades has been favorable to low levels of fire occurrence and spread. This is just a hint, but comparing Palmer Drought indexes, the pre-30s period included many dry years. Post 1990, fire seasons were very moist. Monthly and weekly data on winds and relative humidity would be need to thoroughly study this question.
5. Meteorologists say that every 50 yrs an extreme drought hits the region – this is what caused the peaks in fire occurrence in CT in the Great Drought of the early 60s.
6. Larger fires still cause most of the damage. In most high burn years, arson fires account for half (+/-) of area burned).
7. Ecologically, wildfire was a significant factor affecting vegetation up to the early 30's, but its annual impact has virtually vanished. Still, a significant number of patches 10 A + are affected by fire on a 30-year time scale.
8. History tells us that we should think of fire risk in terms of return periods of different levels of area burned, and not just in terms of the average of recent years. A return period analysis suggests a range of annual area burned levels to plan for based on perceptions of risk. Such levels are always far above the averages of recent area burned.
9. As the state is now almost entirely in the intermix and interface land use categories, from a value at risk standpoint, a 1,000 acre fire today could well be the equivalent of a 10,000 to 20,000 acre fire of the 1930.s

References.

Butler, Brett J., et al. 2011. The forests of southern New England, 2007. USDA FS Northern Res. Sta. Res. Bull, NRS-55.

Hawes, A. 1923. Forest fires in Connecticut, 1910-1922, inclusive. CT Office of State Forester. Hartford.

Hawes, A. 2011. History of forestry in Connecticut. MS in preparation for publication at CT AES.

Irland, L. C. and M. Cowart. 2012. A century of forest fire in Connecticut. Connecticut Woodlands Winter , p.14-17.

Hochholzer, Helene. Connecticut's Forest Resource Assessment and Strategy 2010. Forestry Unit, CT DEP. 2011. 282 pp.

NOAA. Website with historic monthly climate data to 1895.

http://www.ncdc.noaa.gov/temp-and-precip/time-series/index.php?

USDA Forest Service. Forest fire statistics, and Wildland Fire statistics, State and Private Forestry. Fire and Aviation Management. Var. yrs, including electronic supplements from Radnor PA.

Wallenius, T. 2011. Major decline in fires in coniferous forests – reconstructing the phenomenon and seeking for the cause. Silva Fennica 45(1): 139–155.

Wooden Nutmeg. Various issues.

Wooden Nutmeg, publication and website, various issues.

Appendix. Fire History Data, Southern New England. Note that Mass. Data are for fiscal years. Not also that Mass data for 1946 and 1948 are corrected for errors in some other tabulations –the largest fires were inadvertently omitted. But fire numbers have not been adjusted for those years.

	Connecticut		Massachusetts (FYs)		Rhode Island		**Total Southern**	
	Area Burned (acres)	No. Fires	Area Burned (acres)	No. Fires	Area Burned (acres)	No. Fires	Area Burned (acres)	No. Fires
1900								
1901								
1902								
1903								
1904								
1905	30,000	8,000						
1906	4036	125						
1907	4387	109						
1908	18430	283	39,672	1,289				
1909	14779	339	35,083	1,496				
1910	47,000	834	42,221	1,385				
1911	65,000	978	99,693	2,536				
1912	16,000	526	22,072	1,851				
1913	24,000	695	53,826	2,688				
1914	41,463	1,056	38,975	3,181				
1915	103,555	1,443	48,389	3,008				
1916	21,000	487	16,198	1,225				
1917	40,000	1,090	20,020	2,175				
1918	35,000	1,026	37,638	2,553				
1919	24,000	715	22,045	1,566				
1920	11,400	400	14,517	1,619				
1921	20,000	689	29,221	2,849				
1922	83,000	1,137	85,241	4,099				
1923	20,900	708	48,602	2,672				
1924	28,528	1,013	47,522	3,735				
1925	23,834	865	43,876	3,310				
1926	21,644	743	34,675	2,860				
1927	17,921	579	35,400	2,029				
1928	14,313	598	12,516	930				
1929	10,667	591	16,569	1,198				
1930	55,866	1,367	72,988	1,922				
1931	13,495	992	19,510	1,195				
1932	9,953	1,160	23,783	1,293				
1933	3,175	661	10,467	893				
1934	3,517	757	10,446	1,103				
1935	7,321	1,500	25,338	1,996				

1936	3,316	896	13,192	1,466				
1937	7,238	1,508	22,249	2,066				
1938	6,931	1,444	20,067	2,280				
1939	3,054	893	12,487	3,061				
1940	4,184	1,099	16,891	2,338				
1941	10,599	2,039	28,966	3,624				
1942	9,993	1,363	11,287	1,667				
1943	7,931	1,640	7,606	1,621	5208	328	20,745	3,589
1944	10,009	1,514	29,380	2,579	4414	577	43,803	4,670
1945	3,161	767	10,150	1,484	3513	228	16,824	2,479
1946	4,575	1,265	19,056	2,062	5481	396	29,112	3,723
1947	4,422	931	5,264	1,326	2846	345	12,532	2,602
1948	1,335	531	18,200	1,834	976	209	20,511	2,574
1949	1,630	501	5,000	1,844	1916	367	8,546	2,712
1950	1,997	575	9,382	2,032	4135	293	15,514	2,900
1951	2,214	468	7,053	2,091	10778	262	20,045	2,821
1952	4,408	801	4,849	964	5742	269	14,999	2,034
1953	1,857	547	6,909	2,790	585	168	9,351	3,505
1954	2,439	628	9,703	4,380	1142	192	13,284	5,200
1955	2,210	639	9,223	3,620	708	128	12,141	4,387
1956	1,443	347	5,311	3,565	642	124	7,396	4,036
1957	4,441	1,056	2,967	5,781	1145	244	8,553	7,081
1958	1,122	465	3,426	2,374	181	81	4,729	2,920
1959	1,974	452	8,432	3,951	216	93	10,622	4,496
1960	967	355	5,069	4,475	1008	124	7,044	4,954
1961	969	250	5,685	4,001	478	100	7,132	4,351
1962	2,818	577	9,092	5,709	2432	117	14,342	6,403
1963	3,708	873	19,114	12,727	1110	152	23,932	13,752
1964	3,570	943	17,881	8,579	1203	366	22,654	9,888
1965	2,236	716	14,138	8,397				
1966	1,966	615	9,490	8,397				
1967	1,139	308	7,166	8,214				
1968	2,361	582	6,075					
1969	1,462	399	9,139	7,745				
1970	2,476	555	6,473	4,879	1102	793	10,051	6,227
1971	1,382	593	3,015	na				

1971	1,382	593	3,015	na				
1972	673	328	4,344	4,127				
1973	1,044	462	6,069	5,338	521	747	7,634	6,547
1974	869	460	6,858	6,872	774	886	8,501	8,218
1975	2,652	889	9,424	7,749	902	999	12,978	9,637
1976	3,031	986	9,949	9,949				
1977	2,964	1,170	10,982	9,942	794	713	14,740	11,825
1978	2,453	1,402	7,861	7,065				
1979	2,338	1,455	11,950	10,396				
1980	1,781	1,494	9,009	8,753				
1981	3,918	2,683	15,430	11,413				
1982	1,843	1,386	10,487	4,887				
1983	833	1,100	2,618	3,690				
1984	3,858	1,541	5,168	5,302	407	149	9,433	6,992
1985	3,874	1,471	13,777	7,755	454	197	18,105	9,423
1986	3,481	1,117	9,110	6,162	376	110	12,967	7,389
1987	2,141	905	3,418	2,912	184	116	5,743	3,933
1988	*3,421*	*1,336*	8,164	5,721	569	246	12,154	7,303
1989	*2,782*	*1,006*	9,099	7,569	254	191	12,135	8,766
1990	1,297	512	3,507	4,593	173	142	4,977	5,247
1991	1,679	610	9,862	3,765	269	194	11,810	4,569
1992	489	262	5,210	4,515	81	102	5,780	4,879
1993	473	182	5,250	5,153	227	136	5,950	5,471
1994	1,048	318	7,631	4,783	482	127	9,161	5,228
1995	473	182	8,630	6,392	120	132	9,223	6,706
1996	94	34	2,225	2,254	136	85	2,455	2,373
1997	611	89	4,460	3,819	120	114	5,191	4,022
1998	135	33	3,158	3,020	192	104	3,485	3,157
1999	1,733	345	7,603	3,750	182	152	9,518	4,247
2000	616	89	2,572	1,915	81	99	3,269	2,103
2001	501	203	3,335	2,148	272	177	4,108	2,528
2002	*702*	*159*	2,615	3,036	317	181	3,634	3,376
2003	*132*	*90*	1,617	1,879	90	80	1,839	2,049
2004	*64*	*66*	1,524	1,766	81	70	1,669	1,902
2005	*255*	*302*	417	962	93	104	765	1,368
2006	*427*	*360*	1,186	1,536	123	114	1,736	2,010
2007	*266*	*344*	2,687	2,203	60	106	3,013	2,653
2008	*927*	*450*	2,941	1,938	145	142	4,013	2,530
2009	*287*	*361*	2,687	2,203	60	106	3,034	2,670
2010	*472*	*423*	2,150	2,023	63	94	2,685	2,540