"You're On Your Own"

White Paper for Northeast Compact Stress Test Project

Report to Northeastern Forest Fire Protection Compact

By

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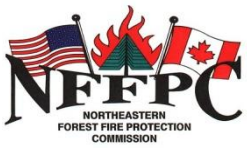

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In early 2011, the Compact Commission decided that it was necessary to develop a longrun threat scenario for assessing its capabilities for responding to extreme events. In addition, it sought a review of any issues affecting its ability to respond to future extreme events. The Compact does not have staff for applied research of this kind, and so hired The Irland Group of Wayne, Maine to assess the situation and prepare this report. Irland is an experienced forest economist and policy analyst with ten years experience in Maine state government including 5 years with the Department of Conservation.

The Compact thinks of this as a process of "stress-testing" its capabilities against plausible future threat scenarios. The study process was thorough, including preparation of state and Province working papers summarizing fire histories, extensive interviewing, and development of informal case studies of other places where extreme wildfire events had recently occurred. Personal reports were presented and discussed at several Compact meetings. This report was accepted by the Compact Commission at its August 2013 meeting in Lake George NY.

This is a report by The Irland Group to the Northeast Compact. It is not an officially adopted position of the Compact. It is intended to supply a sound basis for discussion by the Compact and its jurisdictions of the practical issues to be confronted in the future. The Compact is the instrument developed by 7 northeastern states and 4 provinces of Eastern Canada to share resources for controlling fires when they exceed local capabilities. It supplies dispatching services for fire control on roughly 280 million acres of forest land, 80% of which is in Canada. In addition, agency capabilities are often mobilized in response to natural disasters such as hurricanes, under the emerging all-hazard concept.

(signed)

Chair, NFPPC

1. Highlights

1. The forest fire situation over most of the Compact region has been one of declining number of fires and area burned. This has been due to a combination of factors, including improved fire control techniques and weather forecasting capabilities, and improved regulation of open burning. This record of control has been achieved with declining staff and budgets.

2. In most places aside from Quebec, the Compact has been more likely to make the news when sending equipment and crews to other states experiencing megafires than by fighting fire with its own borders.

3. Scientific certainty is difficult to attain, but there is more than a hint in the data that favorable weather patterns, compared to previous decades, have played a part in this success story.

4. Fire control services are part of a larger Emergency Response system. Often fire control resources assist in nonfire disasters; as well, extreme fire situations call for other Emergency Response assets. In recent tropical storms and tornadoes fire control resources were called upon to aid in recovery.

5. Extreme fire events have not only occurred in the semiarid and mountain West, but also with increasing frequency east of the Mississippi as well. Past history, particularly the 1947 fires and the Great Drought of 1961-65, shows that regional weather systems can cause elevated fire experience regionwide.

6. Developing a plausible threat scenario for the future cannot be based on recent averages. From 1991-2010, the peak fire year in the US Compact states saw 6.5 times as much area burned as the average; in Canada the ratio was 4.1.

7. A 20 year return period for annual area burned and for the largest fire would be a sensible planning benchmark, for individual jurisdictions and the entire Compact.

8. For planning compact wide, plans should be prepared to deal with one regional emergency such as a hurricane, concurrent with at least one peak fire situation somewhere in the Compact, as well as extreme fire danger elsewhere.

9. Response capabilities are declining, though data to measure this trend at a regional level are lacking. But we know anecdotally that increasingly requests for aid are being declined or partially filled.

10. Barriers to Mutual Aid are tightening, especially in recent years. More states are not allowing export of crews/equipment; other unnecessary barriers to meeting requests for aid exist. Briefly, the "mutual" is disappearing from "mutual aid.

11. Because of recent mild weather and innovations in control practice, the system has not been severely tested by a true extreme regional weather event. Because of this, it is impossible to assure the public that a truly explosive fire event threatening life and property could be effectively handled.

12. Given the fiscal realities, the primary response to the extreme fires that will challenge shrinking response capacity will have to be through

better policy, coordination, and organization for quick response. There is, however, no single button to push to bring this about.

13. Increasingly, jurisdictions are acting as if someone else will come to their aid when the next extreme event strikes. The realities noted in this report suggest that one day, the answer from the other end of the phone will be, “You’re on your own.”

14. Specific recommendations to the member jurisdictions and the Compact as whole are listed at the end of this report.

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2. NFFPC Membership

Who is the NFFPC?

The mandate of the Northeastern Forest Fire Protection Commission (NFFPC) is to provide the means for its member states and provinces to cope with fires that might be beyond the capabilities of a single member through information, technology, training, regional coordination and resource sharing (mutual aid) activities.

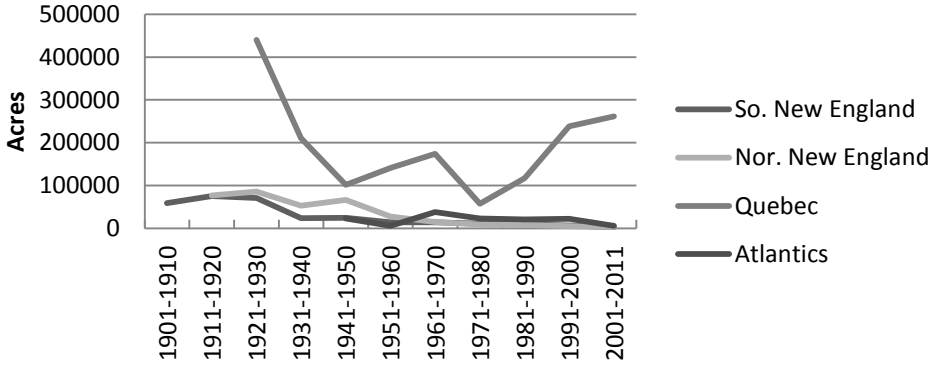
Participating members:

- Provide resource sharing (mutual aid) among members and establish procedures to facilitate this aid. The sharing of resources may include fire crews, fire management (overhead) staff, fire equipment and fire aircraft;
- Provide fire related information and technology sharing among members;
- Support the development of integrated forest fire plans and the maintenance of appropriate forest fire fighting services by its members; and
- Maintain a central agency (the Compact) to coordinate the services needed by member states and provinces.
- Members are: Quebec, Newfoundland and Labrador, Nova Scotia, New Brunswick, Maine, New Hampshire, Vermont, New York, Massachusetts, Connecticut, and Rhode Island.
- Associate members are: USDA Forest Service, National Park Service, and US Fish and Wildlife Service

3. History and Current Situation

Recently, average annual burn rates in this region have been at historic lows, leading to the description of "asbestos forest" being widely used (Fig. 1, Table 1). Exceptions are the boreal and subboreal regions in Quebec and Newfoundland and Labrador, and localized fireprone types, mostly in coastal New York and New England[1].

Figure 1. Decadal Average Areas Burned, Compact Subregions 1901-2011



Average annual rates of burning have been extremely low since 1950 -- a small fraction of one percent of forest area. For the US states, the annual average was only two one-hundredths of one percent; for Quebec it was 14 hundredths of a percent, and in Newfoundland and Labrador it was four tenths of a percent annually. The annual

[1] Gaps and imperfections in the reported data on fire occurrence are discussed in the individual working papers (see list at end of report). While they may render detailed statistical analysis of little use, we believe the overall picture supports our conclusions. In Table 1, for example, we believe Massachusetts is high due to more thorough reporting. For New York, only fires handled by the state (Ranger fires) are included.

burning level of almost 300,000 acres per year seems very large. But because of the huge forest area involved, it is very low on a percentage basis.

Table 1. Average Annual Burn Percent 1950-2011	
Connecticut	0.10%
Maine	0.02%
Massachusetts	0.23%
New Hampshire	0.02%
Rhode Island	0.24%
Vermont	0.01%
New York	0.03%
NS	0.04%
NB	0.05%
Quebec	0.14%
Nfld & Labrador	0.40%

Because of this prolonged period of mild fire experience, there has been little awareness among homeowners, forest owners, and many senior elected and appointed officials of the importance of being prepared for extreme events. Ongoing improvements in training, weather support, regulation of open burning, and communications have made it possible for shrinking fire control programs to meet the challenge. Overall, the data strongly suggest that in most locations, suppression programs have succeeded in keeping most small fires small, so that they do not have the chance to become large fires.

Yet, even during these years, extreme fire years have occurred. Since 1984, the average area burned Compact-wide was 334,000 acres. In two years, however, the area burned exceeded one million acres. The average number of fires was about 7,800 per year, yet in several of those years the number of fires exceeded 10,000. Fire occurrence data for a more recent period – 1984-2010—show recent trends. Over this period, total burned area in the Compact region was dominated by Quebec, which also had the most volatile experience.

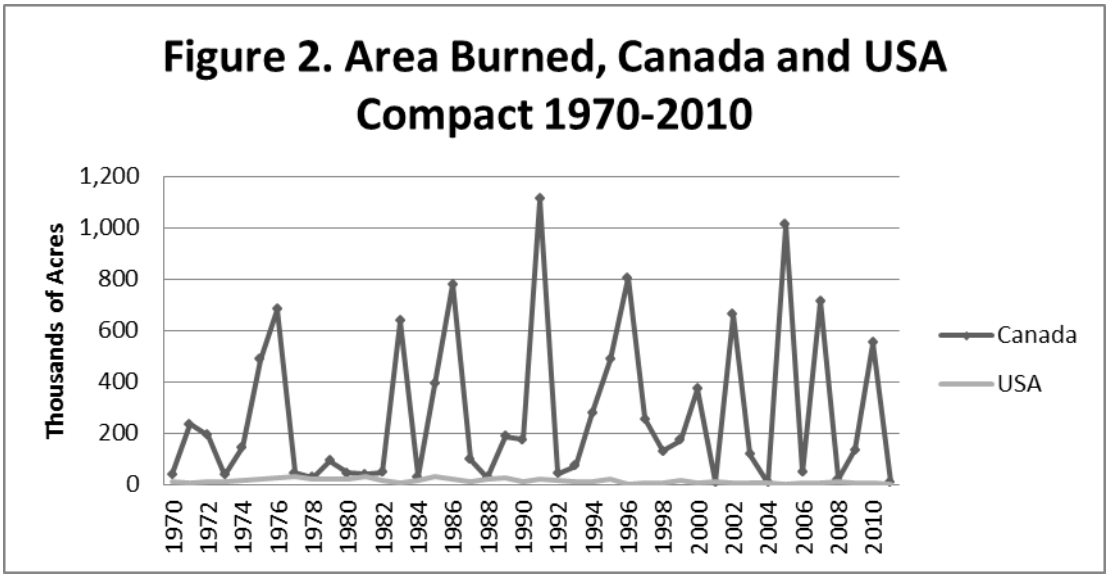


Figure 2. Area Burned, Canada and USA Compact 1970-2010
Thousands of Acres
1,200
1,000
800
600
400
200
0
1970
1972
1974
1976
1978
1980
1982
1984
1986
1988
1990
1992
1994
1996
1998
2000
2002
2004
2006
2008
2010
Canada
USA

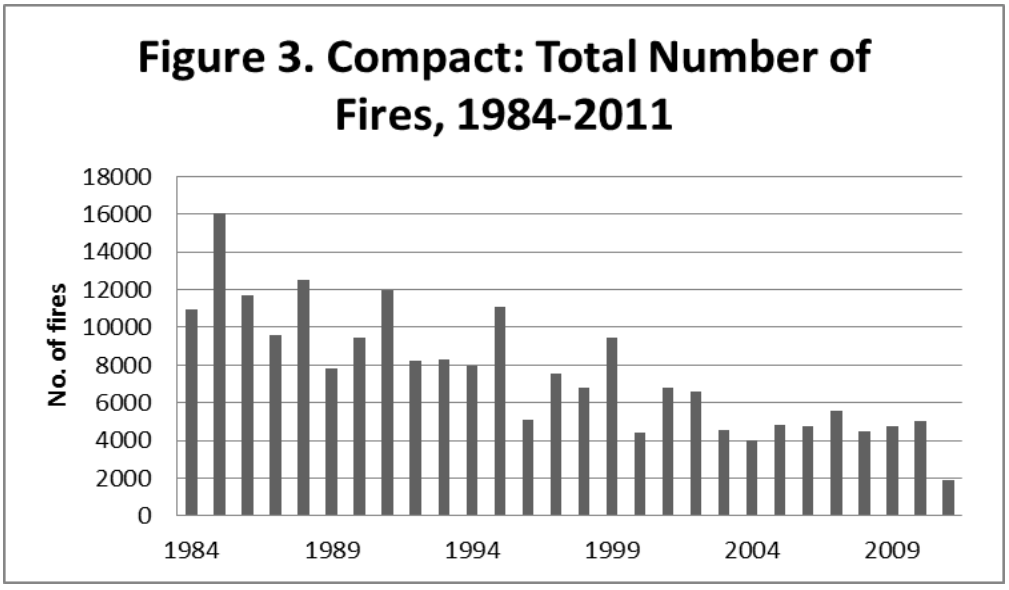
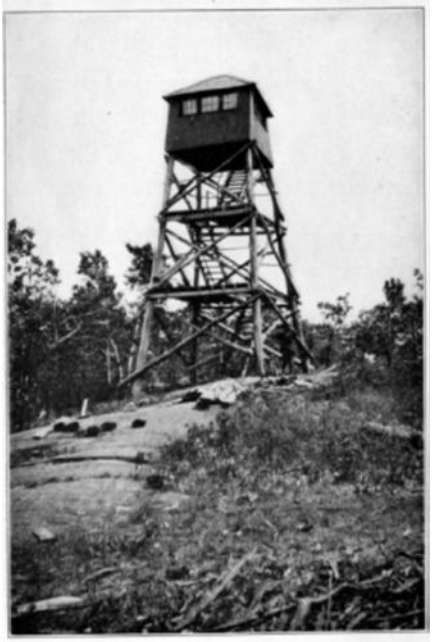


Figure 3. Compact: Total Number of Fires, 1984-2011
No. of fires
18000
16000
14000
12000
10000
8000
6000
4000
2000
0
1984
1989
1994
1999
2004
2009

The Compact averages, for 1984-2010 are:

	Area Burned (A.)	**No. Fires**
US- 7 States	11,200	6,000
Canada 4 Jurisdictions	323,600	1,760
Compact	334,600	7,760



Fire Lookout Tower on State Forest, Mohawk Mountain, Cornwall.

Fire tower, CT DEP Forestry Unit.

Stylized facts about Wildfires in the Northeast

Most are, in one way or another, human-caused. Some of the largest are believed to be arson fires. The exception is the sub-boreal and boreal regions of Quebec and Newfoundland and Labrador.

They can occur just about anywhere.

Most fires are tiny. But since 1985, the top 7 fires burned 47% of all the area burned by fires larger than 100 acres.

Many small fires are extinguished before they become large fires. Some are extinguished by rain. Some by circumstances burn themselves out. Many are extinguished be emergency personnel.

It only takes a few days of windy, dry weather to reduce fine fuel moisture to hazardous levels. If such fuels are extensive, fires can run very rapidly and quickly overwhelm firefighters. When conditions are at their worst, firebreaks are useless as are water drops from aircraft.

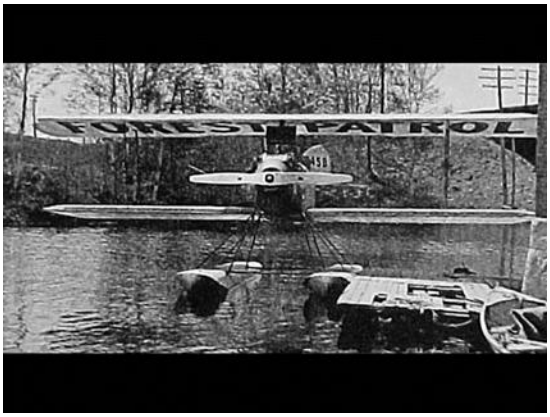
Most fire years are routine. A few are not.

The Northeast has not been challenged for decades by widespread and extreme fire weather conditions. Recent extreme tropical storms, hurricanes, and tornadoes would raise the question of whether the kinds of weather systems that support widespread fire outbreaks can recur. The answer is Yes.

Why then, would we be concerned about forest fires when such tiny areas are affected each year? There are 3 reasons.

First, though fire frequency has recently been low, this has very likely been caused at least in part by favorable weather conditions. Fire services have been able to reach and extinguish most fires. But weather conditions conducive to extreme forest fires are certain to recur (National Climate Assessment, 2013) .

Second, in recent decades, the homes, communities, and populations exposed to risk by forest fires have dramatically increased (Stein, et al. 2013). For example, in the footprint of the 1947 fires in southern Maine, 27 towns experienced 500 acres or more of fire in October 1947. In this local area alone there were more than 500 separate fires in just a few weeks. These towns are now home to 118,000 residents. In the New Hampshire towns that experienced 100 or more acres of fire in October 1947, 110,000 people now reside (Irland, 2013). Further examples across the region could easily be cited.

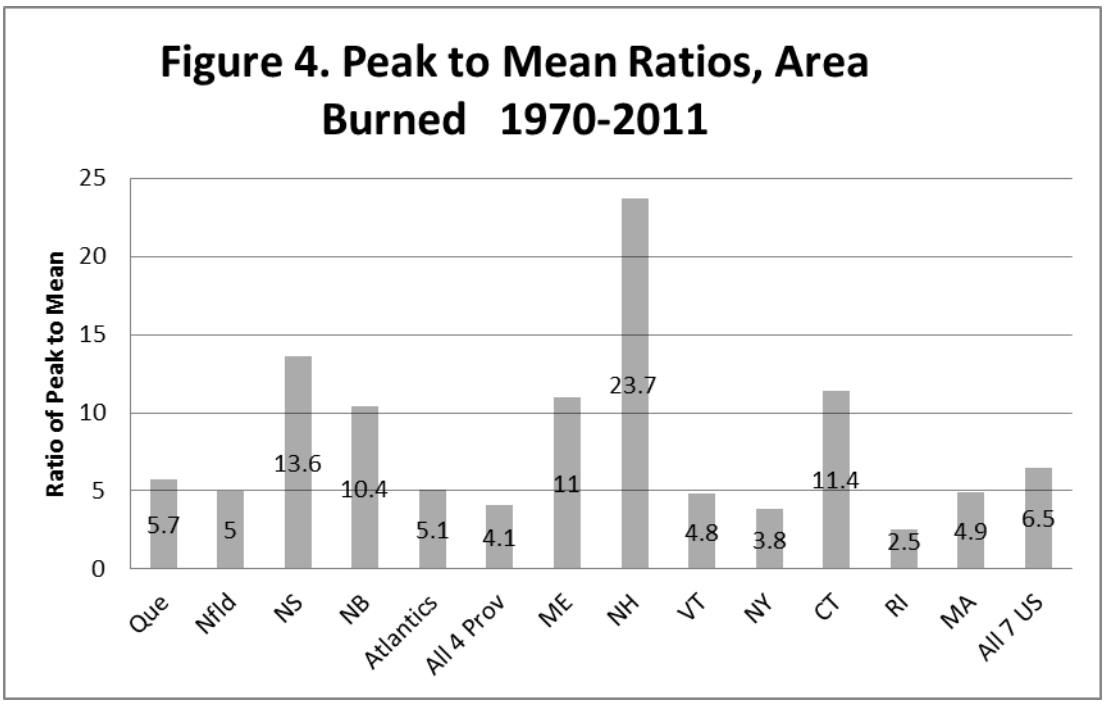


From the 50s to the 70s, aircraft largely replaced towers for detection; satellite lightning detection and citizens with cellphones have in turn steadily reduced the use of air patrols. Citizens with cellphones are the newest form of fire detection.

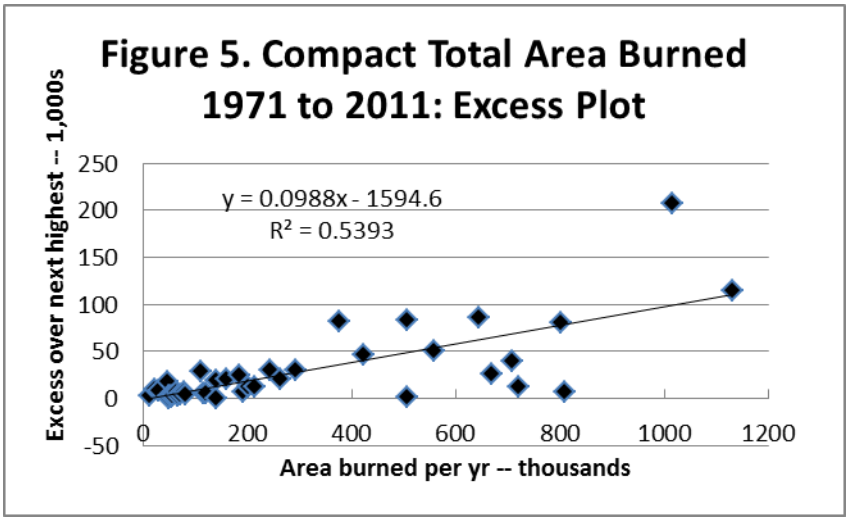
Third, the capacity to control serious fire outbreaks has diminished, as outlined below. Because response capacity is difficult to measure, and capacity has not recently been challenged, this has passed largely unnoticed outside the fire agencies themselves. To depict the occurrence of extreme events is the purpose of the next section.

4. Defining a Threat Scenario

Forest fires, being largely weather driven, are one of a class of events that display extreme behavior. That is, they are not well-behaved statistically and their occurrence is not normally distributed. For example, Compact-wide, 37% of the total area burned during 1970-2010 occurred in only 5 years. The mission of the emergency response system is to be prepared for these 5 years, not the average of the entire period. To understand the occurrence of extreme fire years, we assembled a longterm dataset on fire within the Compact. A series of basic diagnostics for extreme behavior were computed (Figure 4). The peaks are strikingly higher than the averages. Further, the percentage of area burned in the very worst years ranges from 22% to 41%. Additional measures of variability are in the attachments.



Extreme weather events are not just a bit more severe than the last record event. Often, they are much more severe, as illustrated by this plot (Fig. 5) of the Compact total area burned. This is termed an "excess plot" as it shows the amount by which each successively large event exceeded the next highest in rank. Relationships of this kind often hold true for floods, hurricanes, and tornadoes, as well as forest fires.



This depicts the true challenge the Compact was designed to meet-- being able to deal with these extreme events, without regard to where they occur in the region.

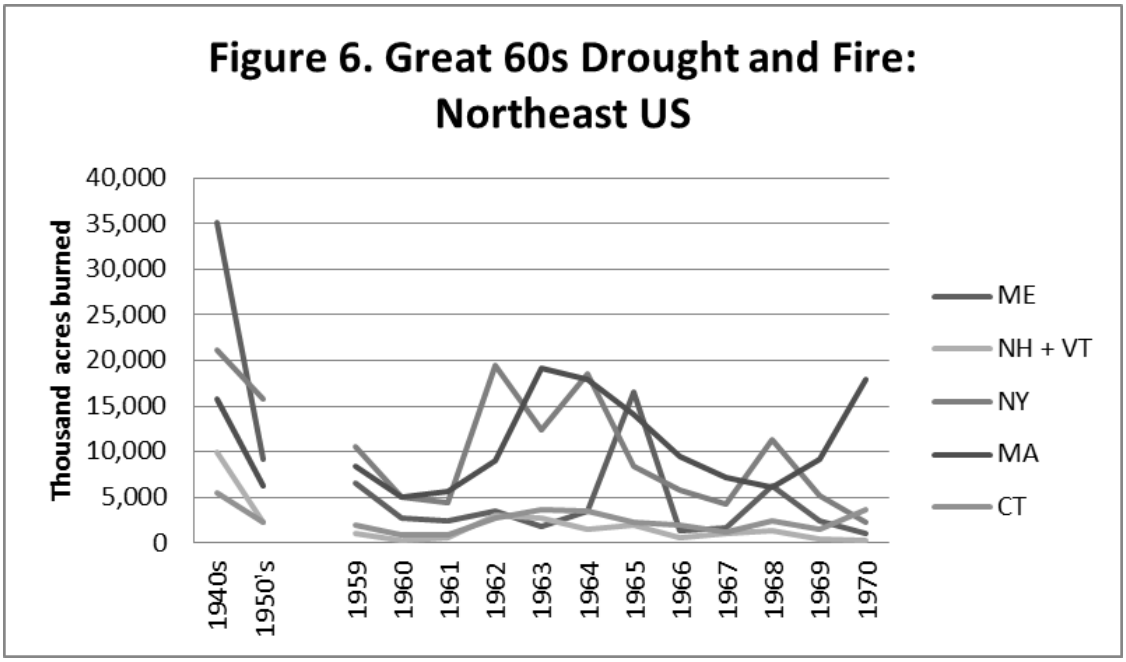
The key to understanding extreme events is that they are not "outliers", they are not "freak" occurrences -- they are normal. *They are just infrequent.* Their return periods may exceed the length of accurate data we have for measuring their past behavior. Changing circumstances may increase or reduce their probability of occurrence, or our ability to foresee them coming[2].

How Often do Severe Fire Years Coincide?

Fire control officials' worst fear is that multiple extreme fires could occur concurrently. The Great 60s Drought was the last time roughly coincident bad fire years occurred in the Northeast (Fig. 6) . These coincided with a severe, prolonged regional drought – the like of which has not recurred since. A similar regional drought, much more concentrated in time, occurred in the fall of 1947 and resulted in large and costly fires

[2] Further discussion on analyzing extreme behavior of forest fires can be found in Irland (2013) with extensive citations to technical literature.

across most of the region. It must be assumed that such regional droughts could happen again.

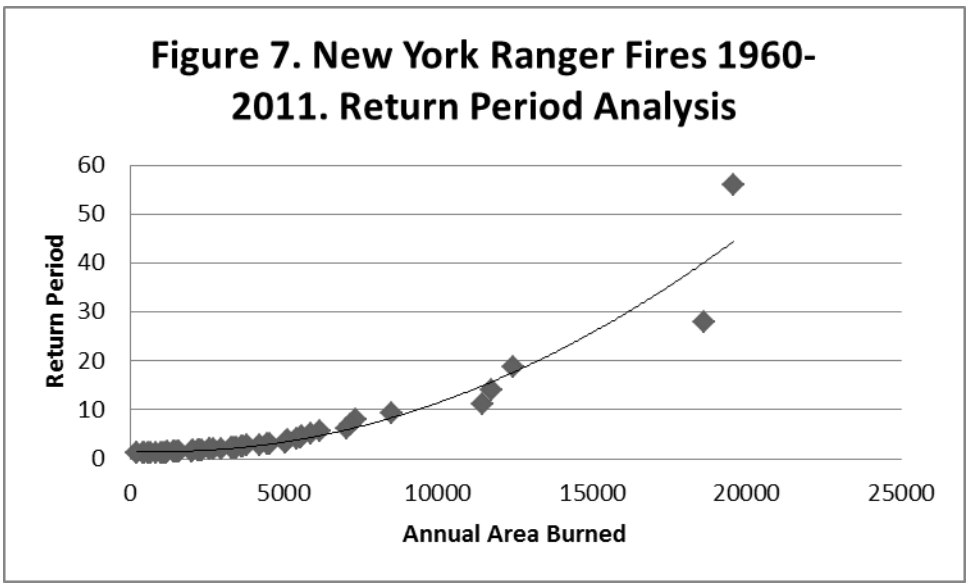


Coincidences of extreme wildfire events occurring in different jurisdictions at once have been rare in the Compact region since 1961-65. And even during that historic drought, different areas experienced peak fire activity at different times.

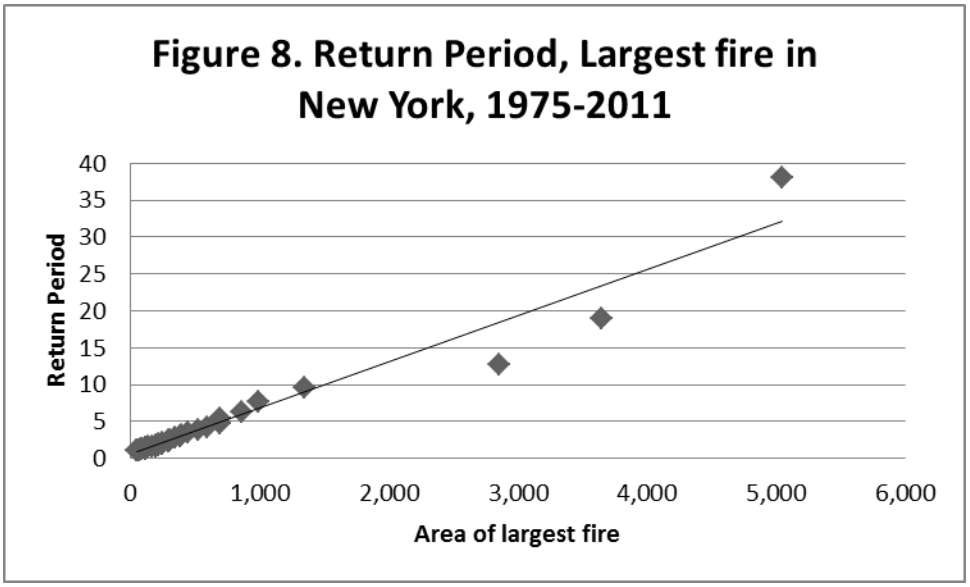
Quebec, which dominates regional annual area burned, typically experiences its severe fire months in mid-summer. But its extreme months can occur earlier or later. In New England, New York, Nova Scotia, and New Brunswick, spring fire seasons are typical. Extreme drought conditions often upset the normal seasonal patterns – the regional 1947 fire outbreak occurred in late October.

Few citizens would want their local fire department to be prepared only for the average fire. Few coastal residents would want levees or emergency services to be prepared only for the average hurricane surge. *Emergency services, rather, are expected to prepare for extreme events.* This is why the planning standard for floods and other disasters is usually the 100-year event. It is curious but true that this concept is only recently being introduced to analysis of forest fire risks. We can think of risks in terms of total area burned per year, or of the largest fire each year. In each case, the averages are misleading.

Take the example of New York State. The figure shows the return period curve for annual area burned from 1960-2010 (Fig. 7). It shows that on average, in any 20-year period, one year can be expected with wildfires burning about 14,000 acres. This is far larger than the annual average for this period, which is 4,332 acres.



A return period analysis can also be applied to the largest fire of each year (Fig. 8). This shows that once in a 20 year period, a fire as large as 3,200 aces can occur somewhere in New York.



Fire seasons are not of uniform duration. In New York, seasons can be as brief as 250 days, or as long as 350 days. Obviously this cannot be predicted in advance. Further, a great deal of the burning is concentrated in the worst days or weeks. In half the years, New York's largest fire occurred during April, but the largest fire of a year can occur in almost any month. Similar analyses have been conducted for all Compact jurisdictions and are available in the Working Papers listed in the Attachments. Results are roughly similar, differing only in details. But recent experience in the East shows that large fires are no longer exclusively seen west of the Mississippi River (Box)

Recent Examples of Extreme Fires: Eastern North America

In recent years, the placid fire experience of the Northeast was unusual. Firefighters, fire managers, and equipment were sent to assist with epic fires, including:

The 2010 Smoky Lake fire in Quebec. 264,000 acres.

July 2013, several fires in northern Quebec burned an estimated 800,000 + acres, causing evacuations, a mine shutdown and power failures in Montreal. Smoke observed in Scandinavia.

The second worst fire in the history of **Georgia :** Honey Prairie complex, (309,000 acres)

The most damaging fire season in **Texas** history, with 3.9 million acres burned, and several thousand homes lost in the Austin area.

The Largest Fire in **Ontario** in 50 yrs: Sioux Lookout 70 fire. Almost 350,000 acres; more than 4,000 people evacuated.

The Pagami Creek fire (100,000 acres), the largest forest fire in **Minnesota** in 80 years

The Largest fire in entire history of Mark Twain NF in **Missouri, the**

Minningham Fire, 5,000 A.

Crescent Bow (Manorville) fire, **Long Island**, 992 acres. April 2012. 300 homes evacuated.

Duck Lake Fire, Upper **Michigan**, 22,000 acres May 2012. Its major run ended when the fire reached Lake Superior.

Germann Road Fire, NW **Wisconsin**, 8,000 acres, largest since 1980.

The challenges in providing assistance for these fires emphasized the approaching limits to the Compact's capabilities. In a number of recent instances, the Compact was unable to fully fill requests for aid. Further, they raised the question: could such fires happen here?

Proposed Threat Scenario for Compact

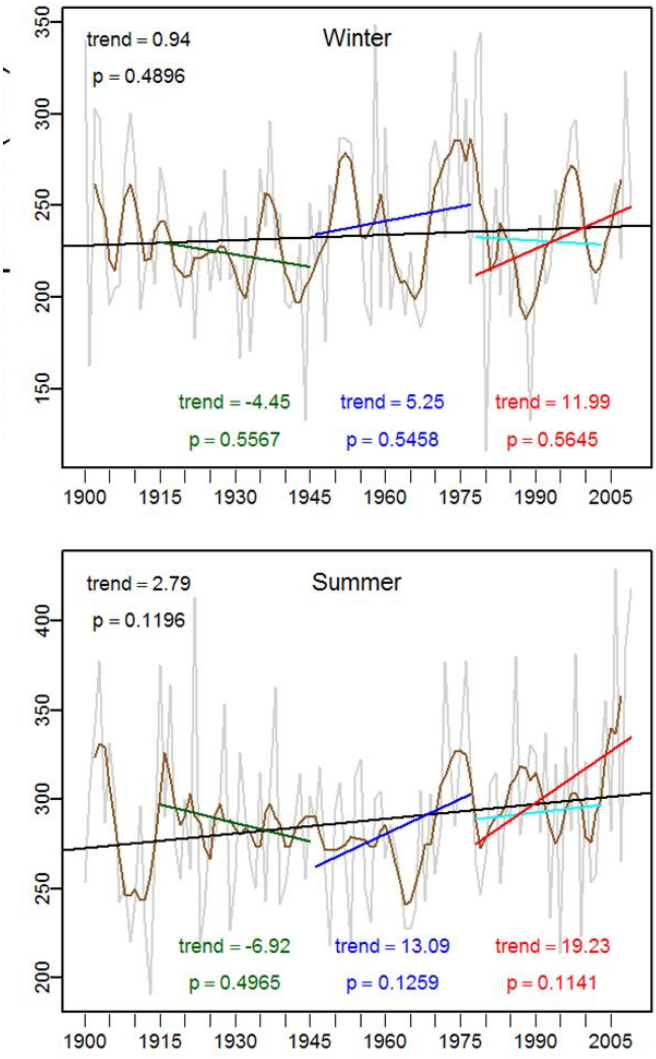
Each jurisdiction should assess its capabilities and ensure that its own resources could promptly handle a 20-year event, based on its own past experience The Compact as a whole should assess its ability to respond to a scenario in which fire danger is high regionally, at last one major jurisdiction is becoming fully engaged, and one regional emergency such as a hurricane appears imminent. This would be an occasion when heavy demands would have to be made on outside resources, as well as calling for extensive within-Compact movements.

Capacity to respond should be assessed by multiple methods, including war-game type simulations, practical field exercises, and audits of equipment and capabilities. Third-party auditing methods should be used to the maximum feasible degree. Analyses provided for this report can be improved, and brought up to date over time, by more thorough probing of local data and relationships.

Future Climate Change

In our working papers, we review many different aspects of weather as it affects fire occurrence from year to year and over time. In those papers, we review evidence suggesting that in the Northeast, recent decades have experienced fairly mild weather during fire seasons compared to previous decades. But our stress-test must be forward-looking. It is clear that some aspects of climate have changed significantly, depending on the portion of the Compact region being considered. As just one example, the growing season increased in recent decades by as much as ten days, with significant implications for fire seasons (National Climate Assessment, 2013). At the same time, though, extreme droughts have been fairly rare compared to the past. An index of precipitation trends for the entire North shows strong cycles (Fig. 9) and high variability. Looking only at summer, the season totals show the effects of the Great 60's drought clearly, but not of local multiweek droughts that were associated with severe fires. The chart shows that in the last few years regional precipitation totals have been well above longterm trend.

Figure 9. Cycles in summer and winter precipitation (mm), Northern US. 1900-2010.



Source: presentation by Dillon and Lane, Compact meeting, Nov 2012, Augusta, ME.

The outlook, as described in the working papers for the new National Climate Assessment of 2013, now out for review, is that the Northeast US will experience generally warmer but wetter conditions, with more weather extremes. Drought is not characterized in detail. In Quebec, abundant research suggests climate shifts favorable to elevated fire occurrence (see Working paper on Quebec which cites scientific literature). Vegetation projections suggest that the most fire resistant forest type, the northern hardwoods, could substantially shrink in area in the Northeast US by 2100 (for details, see Terrier, et al. 2013; Rustad et al. 2013; Tang and Beckage, 2010).

How future climate change will affect fire occurrence and behavior is something that we will all have to learn gradually. But it does not change the core challenges depicted by this report.

5. CAPACITY TO RESPOND

This section reviews trends in capacity to respond to wildfire in the region.

First some Good News

Over recent decades significant improvements in fire control methods and equipment have been made. Training and certification of personnel and incident management teams have been upgraded and standardized, enabling rapid assembly of large fire organizations. Improved weather monitoring and forecasting have enabled a transition from tower-based to air and land based detection, supplemented by satellite-based lightning detection. Over the years, communication capabilities have been significantly improved at all levels.

The regular dispatch of fire managers, crews and equipment to other regions has upgraded skills by providing on the ground experience on large –long-duration fires. This is an important and under-recognized benefit of the mutual aid program. Further, on assignment to such fires, fire managers from within the Compact saw firsthand the consequences when unprecedented events hit organizations that had never experienced such massive challenges before.

Improved regulation of open burning has been a major factor in many jurisdictions. In New Brunswick, an improved fire permit system is credited with a significant reduction in ignitions. The same has been true in New York:

> "When New York changed its open burning laws in 2009 to prohibit the burning of garbage and leaves at any time and the burning of brush from Mid-March through Mid-May, wildfires were reduced in 2010, 2011 and 2012 by 33-50% statistically and anecdotally. 2012 was a very dry and warm early spring. And yet the overall occurrence (number) of wildfire was below the 25-year average and debris-caused wildfires only accounted for 5% of the wildfires as compared to the 25-year history of 55% for the same dates and locations". (A. Jacob, pers. comm.)

Further, in local areas, fire chiefs are taking their own initiatives to improve coordination, shared training exercises, and shared dispatch to adapt to declining funds and levels of volunteers. These efforts improve response times. Examples include the Lakes Region Mutual Aid group, consisting of 6 towns in Central Maine, and the nearby Franklin County Mutual Aid system.

A 1920's forest fire risk education poster,

Connecticut.

Regional/National Response Capabilities

The Compact has two general types of wildfire response systems. In the more remote regions, such as the Adirondacks, northern Maine, much of Quebec and eastern Canada, State or Province level organizations manage pre-suppression, initial attack, and extended containment on wildfires. These areas are generally thinly settled. In the southern New England states, and settled portions of New York, Quebec, Maine, New Hampshire, and Vermont, initial attack is the responsibility of local fire departments. When needed, state and regional dispatch systems can supply aircraft, equipment, or additional crews when needed. When homes and settlements are threatened, local and

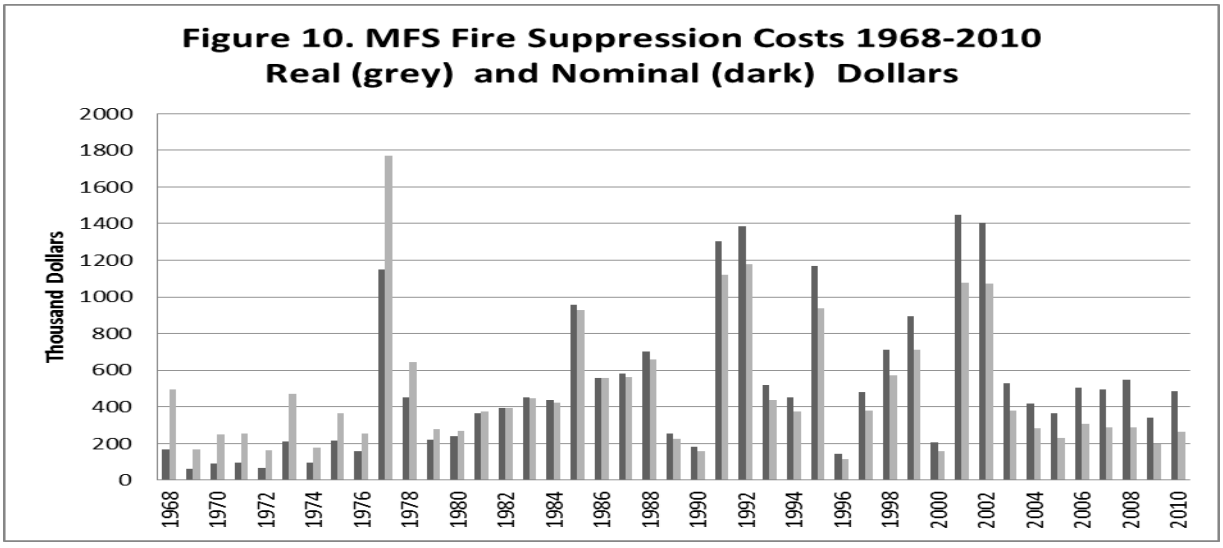
regional emergency management agencies can become involved to assist with evacuation, cleanup, restoration of power, and recovery .

The fire services depend on several levels of reinforcement when extreme events occur:

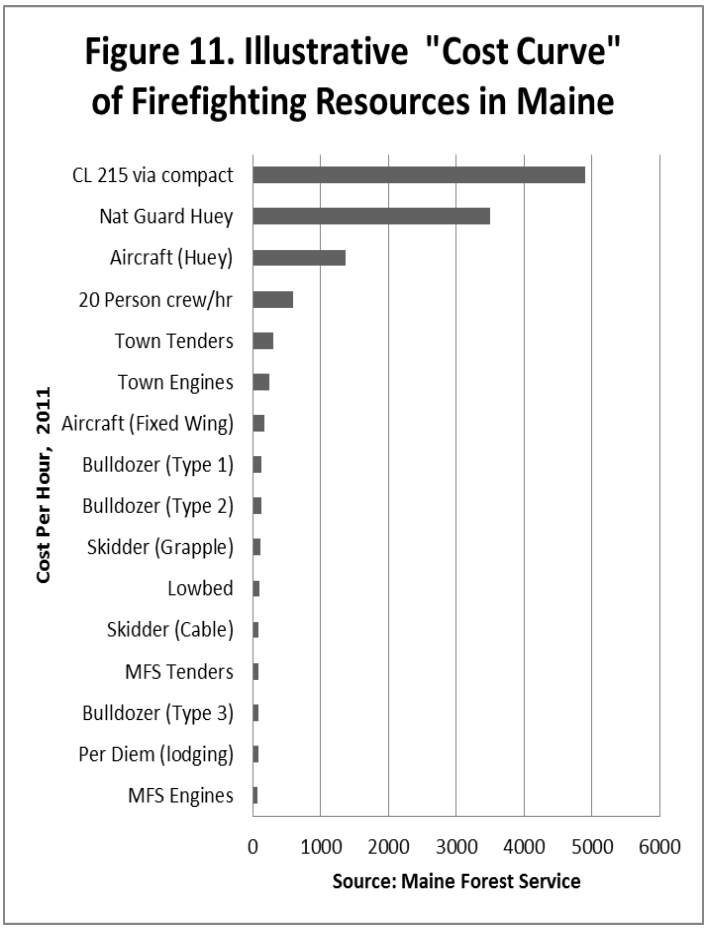
- Internal resources within their own organization
- Assistance from nearby towns or states, within - compact
- Mutual aid from outside the Compact
- Assistance from federal resources
- Assistance from military organizations

When communities and human lives are threatened, and events become very large, the general emergency management system may come into play. In most of the Compact region, those organizations have had little experience with extreme wildfire outbreaks

Every jurisdiction has its own system of funding for wildfire response. These are individually complex and in the aggregate quite diverse. For this project it has not been possible to assemble a Compact-wide view of the resources available for wildfire response. One of the most significant challenges is providing budgeting and financial systems that are adapted to the extreme variability of firefighting costs from year to year. For example, Maine's experience shows how widely fire control costs can fluctuate even when overall fire experience is mild (Fig. 10). This chart shows only costs attributed to suppression; ongoing program fixed costs are not included. In real dollars, suppression costs in Maine remained on a constant trend line over this period. Maine's total fire control budget, however, declined 19% from 2001 to 2010 in real dollars (Attachment 3). We have not been able to compile a region wide set of such data, but would venture the impression that the results would be similar.



The volatility of fire experience, both in the wildlands and in cities and settled areas, means that no one organization can maintain capacity to deal with extreme emergencies. They must rely on mutual aid. Yet this has a cost. As a fire grows larger, threatens buildings or lives, and runs faster, the means needed to confront it quickly become more costly. Recent Maine Forest Service information, shows how steeply the hourly costs of resources increase from a 20 person crew up to a CL-215 airtanker (Fig. 11). Even in the resource agencies and among landowners and legislators, there is little awareness of this, as the kinds of fires requiring extensive reinforcement over long periods have not been occurring in most of the region.



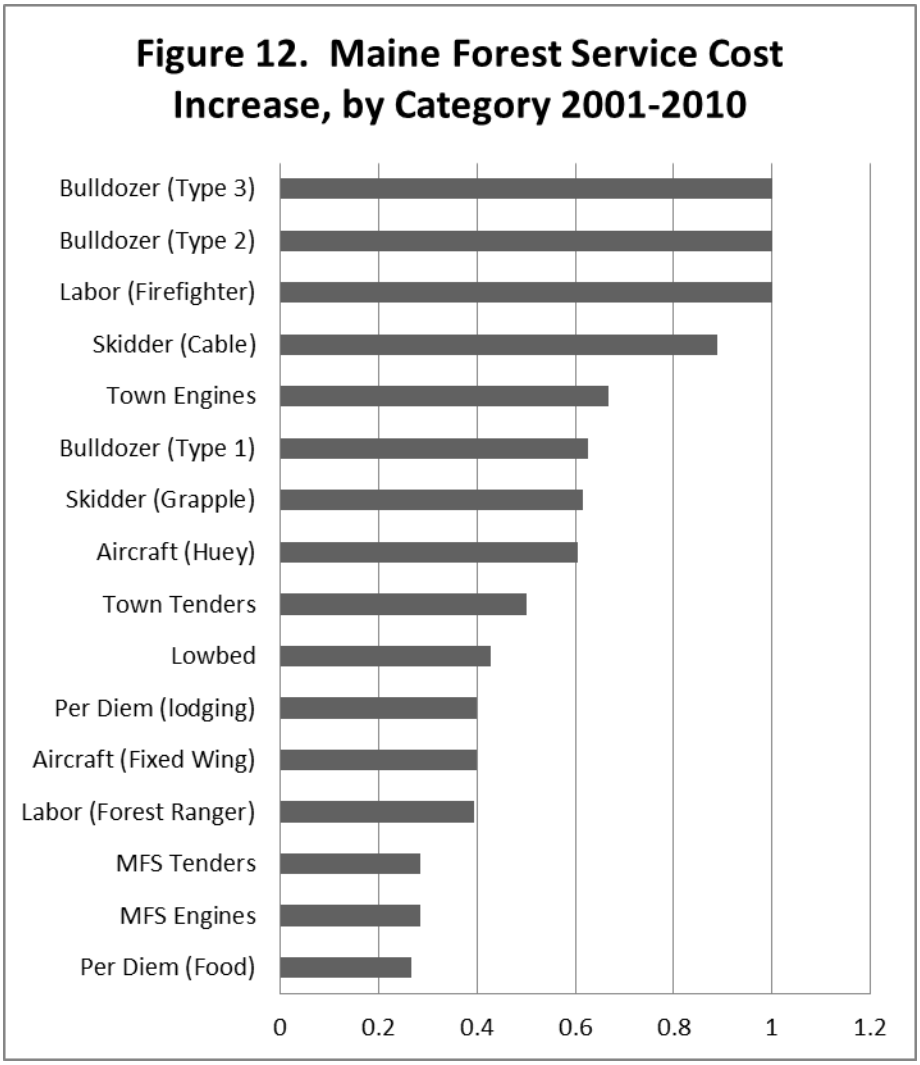
Helicopters: costly on an hourly basis but they can achieve fast response and quick knockdown of fires when well positioned and dispatched. Nova Scotia DNR.

Fire organizations must maintain readiness on an ongoing basis. They are aided in this by impressive weather prediction and monitoring systems. Their ability to supply resources on request will be based on judgments about near term risk in their own boundaries first. The fact that an organization declines to export resources may not mean that it is fully engaged on fires at the moment, but is based instead on judgments concerning near-term fire danger conditions.

Costs are Rising

Significant cost inflation has occurred in costs over time. MFS analysts compiled a set of 13 "benchmark fires" that occurred from 1984 to 2008. Only 3 of these exceeded 1000 acres in size, and few structures were affected. Three were smaller than 60 acres. It was estimated that the state budgetary cost to fight those 13 fires today would be roughly double what it was at the time. Ten of the fires occurred in organized towns, where towns share the costs. For those fires, the Town share would be three times as high if those fires occurred in 2011. So, most towns and cities that might be affected by a wildfire in the future have no idea what even a small fire could cost them. State and local budget planners have little idea of these realities.

Using Maine as an example, individual cost elements have risen especially rapidly for equipment that must be obtained from contractors (Fig. 12). A major increase in firefighter compensation occurred in the mid 00's. Replacement costs for aircraft, whether for waterbombing or reconnaissance, have risen dramatically. Data for Nova Scotia for the same period shows similar increases in unit costs.



Capacity is Slowly Eroding[3]

Except in the remote regions managed by state/province wide entities, the first line of defense against wildfire is the local fire department. In most rural areas, this means a volunteer department. Nationally, from 2004-2008, local fire departments responded to 32,000 forest, brush and grass fires on average every year (Ahrens, 2010). In both the US and Canada, volunteer departments (VFD's) have seen their enrollment levels shrinking. There are several interlinked causes. A principal one is the disappearance of agricultural and related rural livelihoods, which has occurred across the

[3] See, for context, National Fire Administration, 2007, and Thomas and Butry, 2012.

region. The number of local residents who would have been available in the past are simply no longer there, as populations continue to decline in outlying rural areas. Further, VFD members are aging and many are not as fit for demanding fireline duty as was true in the past. In fact, the leading cause of death among volunteer firefighters is heart attacks, a concern now receiving national level attention. The local fire forces are primarily trained, equipped and organized for their principal mission - to fight structure fires. Without extensive familiarization and cross training, integrating them into fireline work on an emergency basis can be difficult.

Obtaining state level data on volunteer fire departments is difficult; there is no central source. Yet a few indicators are available. Maine's VFD force has shrunk from 11,000 to about 8,000 over the last few decades. Nationally, for communities of up to 5,000 population, more than 96% of the firefighters are volunteers. The total recorded number of firefighters nationally has declined slightly since 1990, but the number of calls per firefighter jumped from 18 to 37. In communities of 2500 or smaller, in 1990, 36.8% of the firefighters were 40 years or older; by 2010, it was 52%. (NCVF fact sheet, Aug 9, 2012). Many settled areas in eastern Canada rely on volunteers as well; we have not sought data on those.

So for the volunteer force, workloads have been increasing, the recruitment pool has shrunk, and many states report lower enrollments in the fire departments. Other barriers to participation have increased. The training requirements have become more demanding; that time has to be volunteered as well. Also, as employment options have shrunk, people must drive farther to work. Increased commuting time cuts into time and energy. When on fires for the State, volunteer firefighters are paid, but the amounts are modest. Finally, leaders report that burdens of paperwork of various kinds have increased, dampening motivation and cutting into training time.

The logging industry has mechanized everywhere. Where once a forest ranger could call on dozens of loggers already in the woods, this is no longer true. Further, those loggers are equipment operators, not chainsaw hands -- they are older, and many are less physically fit for fireline duty. Further, in some areas, industry restructuring has reduced the ready availability of equipment such as bgulldozers.

At one time military units – National Guard and Reserves -- were often called on for assistance with aircraft, bulldozers, and fireline crews. Today, the US and Canadian military establishments have been stressed by 20 years of overseas deployments. When the time comes to "call in the cavalry", it turns out that they are in Afghanistan, Iraq or other parts of the world. Civil missions have been cut back. Units available locally are often supply and service elements that are below authorized strength, have never been

trained for fireline duty, and are much older than was typical true decades ago. Also, as we saw above, the billing rates for personnel and equipment by the military agencies are extremely high.

State and federal agencies have seen staff cutbacks, which are understandable in view of the continually declining level of fire activity in the Northeast. Existing positions have not been filled due to budget difficulties. Further, aircraft, pumpers, and dozers are aging and some in need of replacement. Equipment provided from military surplus helped keep state programs afloat for many years; this source has been drying up.

Despite all the progress in achieving uniform training and dispatch systems, the system's success has brought with it rigidities, especially in the federal system, by increasing response times when rapid response is needed. In this project it has not been possible to develop a full inventory of data on staffing, equipment, and training programs and trends. They are nonetheless real.

Barriers to Mutual Aid are Rising

The dispatch system is under stress. Last season, an effort to mobilize 8 crews from the Northeast could only be filled with three. A brief period occurred in Canada when the National Dispatch center (CIFFC) would have been unable to respond to any additional requests for assistance. The problem was not that all assets were engaged, but rather that weather conditions and fire levels made it unwise for any fire mangers to export resources.

An important barrier is the lack of understanding of the importance of mutual aid, and the benefits to supplying partners as well as to receiving partners. Fire control seems to be compartmentalized in a parallel universe—states that consider themselves entitled to massive inflows of aid following major disasters are often restricted by state travel policies from sending fire control crews to help others.

A serious concern is that for many of the jurisdictions, crews must be already on public payrolls to be eligible for mobilization to meet needs elsewhere. This severely constrains opportunities to build surge capacity when it is needed. This situation can be readily addressed, with suitable provisions for checking all the boxes as to health, fitness, and training. This will come home to roost one day when the fires are here and not in Arizona. In winter 2013, Compact members compiled a listing of the significant barriers they are encountering (Box)

Barriers That Limit Sharing of Resources Between Compact Members

- Restricted hiring of seasonal or temporary firefighters in some states and provinces which does not give the compact access to trained firefighters.
- US Forest Service requires employees to use federal passport for out-of-country travel when these are not required by Customs and Border Protection
- Limited availability of leadership for crews as states have reduced staffing
- Limited availability of firefighters for personal reasons
- Limited French-speaking translators on fire incidents
- Limited authority by some members to travel out of state by their agency, state or province which is counter to the compact legislation signed by each agency
- Agencies limit availability due to internal non fire program priorities
- Liability language absent in some compacts for inter compact sharing
- Conflicts with scheduled training or other events during known busy fire periods
- Lack of availability of aircraft or busses used for transportation during spring season

Source: Compact members, Feb 2013.

This description of shrinking capacity has necessarily been general and anecdotal, given the absence of detailed and accessible databases that would supply a basis for regional totals. But information on regional mutual aid activity provides important indications of the trends.

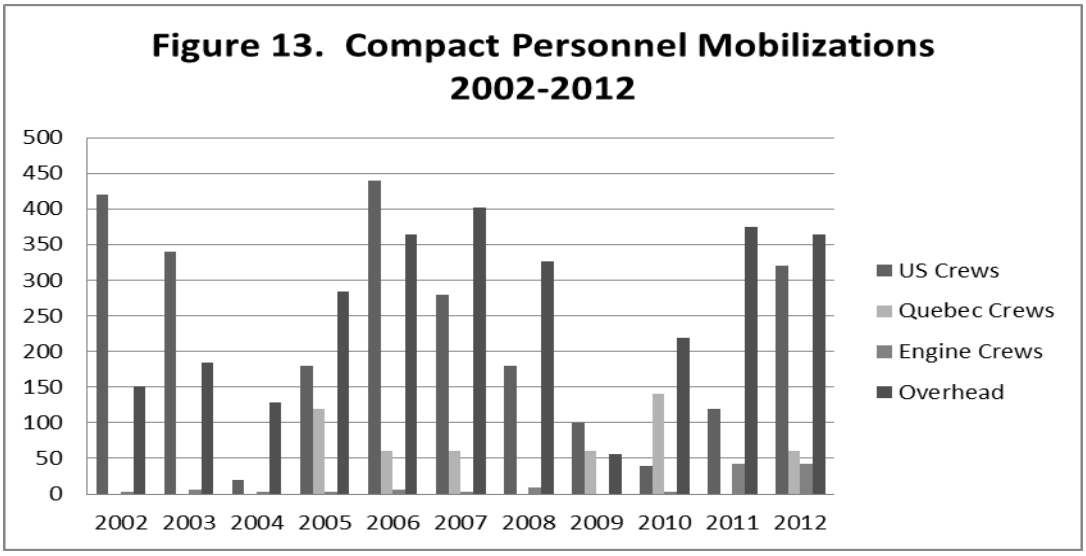
6. Trends in Mobilizations Under the Compact, 2002-2012

This section reviews experience over the last decade in Compact activity. Activity by the Canadian Interagency Fire Center, and SOPFEU, the Quebec fire control organization. The Compact covers the 7 northeastern states plus four provinces, and associate membership by the National Forests, National Parks and U.S. Fish & Wildlife, including units in adjacent Pennsylvania and New Jersey. Activity under this system varies widely from year to year.

Variations in Mobilization Experience

Overhead teams are often mobilized; the peak was 2007, with 2011/12 close behind. For total people mobilized, the peak year was 2006, when 25 crews and 365 overhead people were mobilized. In six years, Quebec has supplied crews to other jurisdictions. The variations from year to year respond to the variable fire experience. Total number of people mobilized was lowest in 2004, at 152, and highest in 2006 and 2012 (Fig 13). There has been a rough trend toward more mobilizations of overhead teams. This indicates the important role of the Compact in providing operational experience on very large fires for staff of the member agencies. Mobilizations of engines have been few until recently. This is indicates the increasing interregional reach for resources due to unusual fire activity.

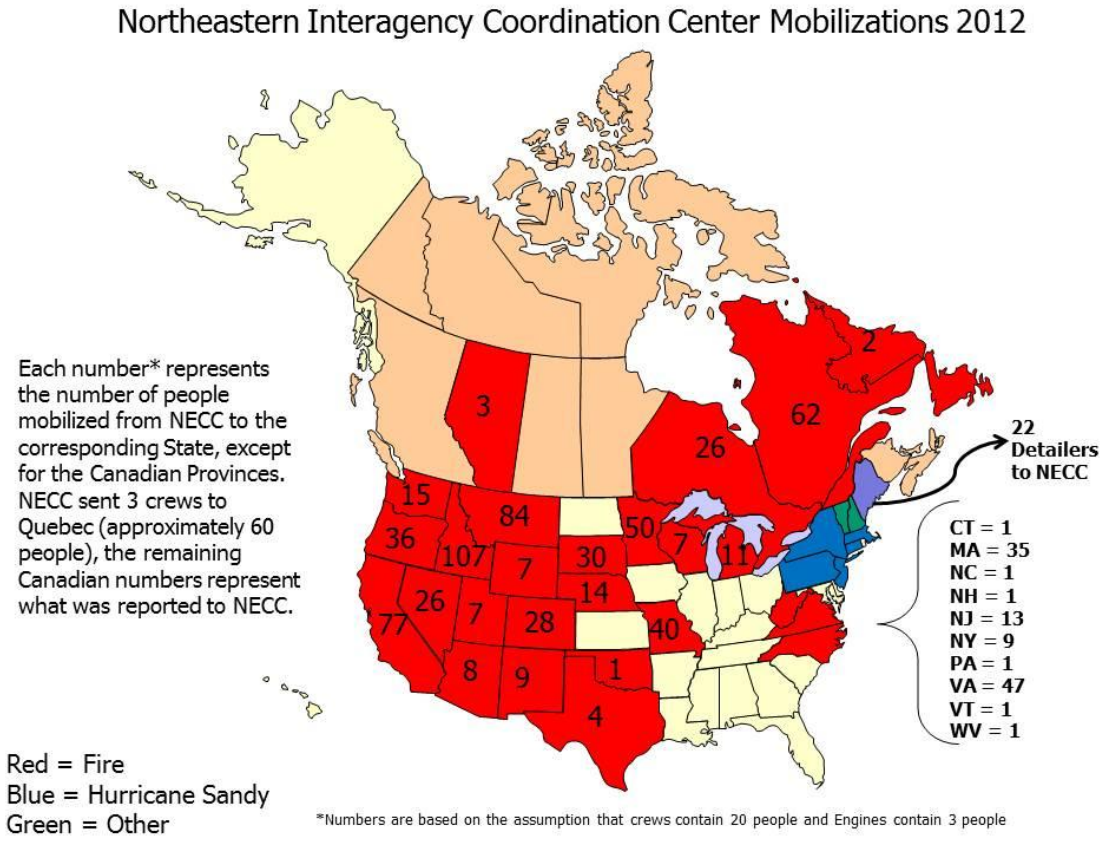
In recent years, however, it has been more difficult to fill requests for assistance, though records do not permit a statistical trendline. In the past, agencies made informal inquiries as to availability of resources, and did not file formal requests if they learned that availability was tight. This makes it difficult to tell how often resource limits were reached in the past. There are other mobilization agreements , such as Emergency Response pathways that are not covered in this data, so without further research we cannot measure the total workload being borne by the system.



Source: Tom Parent and NECC.

The mobilizations in 2012 from this region covered a wide portion of the US. Plus 4 Canadian provinces (Fig. 14) .

Figure 14.



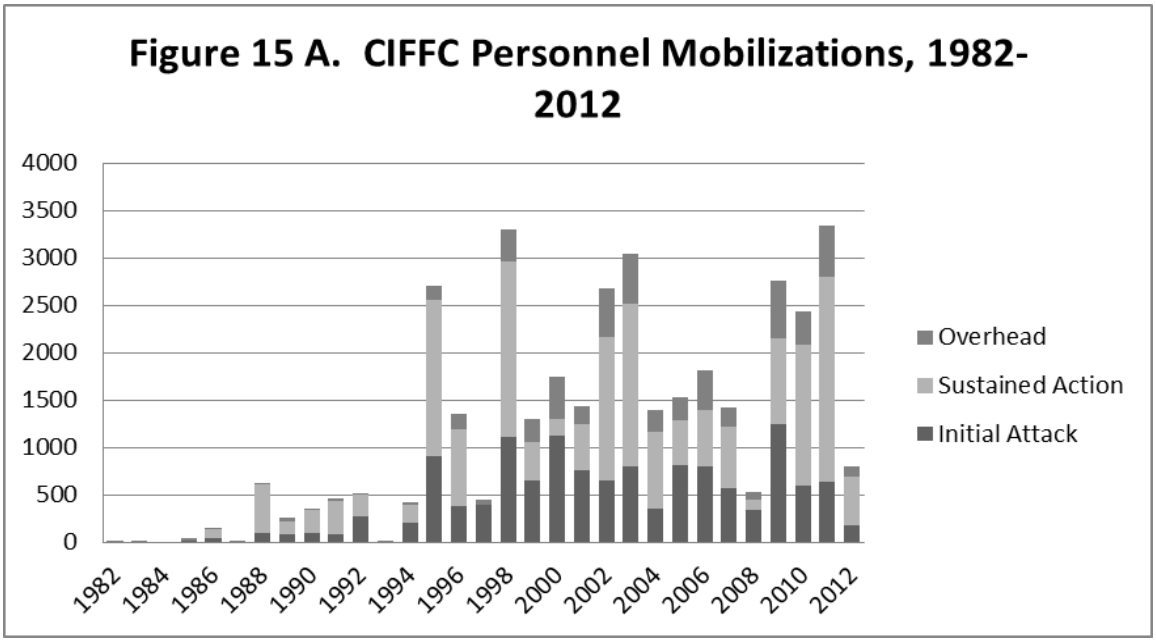
This shows that it is still possible to conduct substantial mobilizations under the Compact when needed.

Limits are Reached: Canada July 2012.

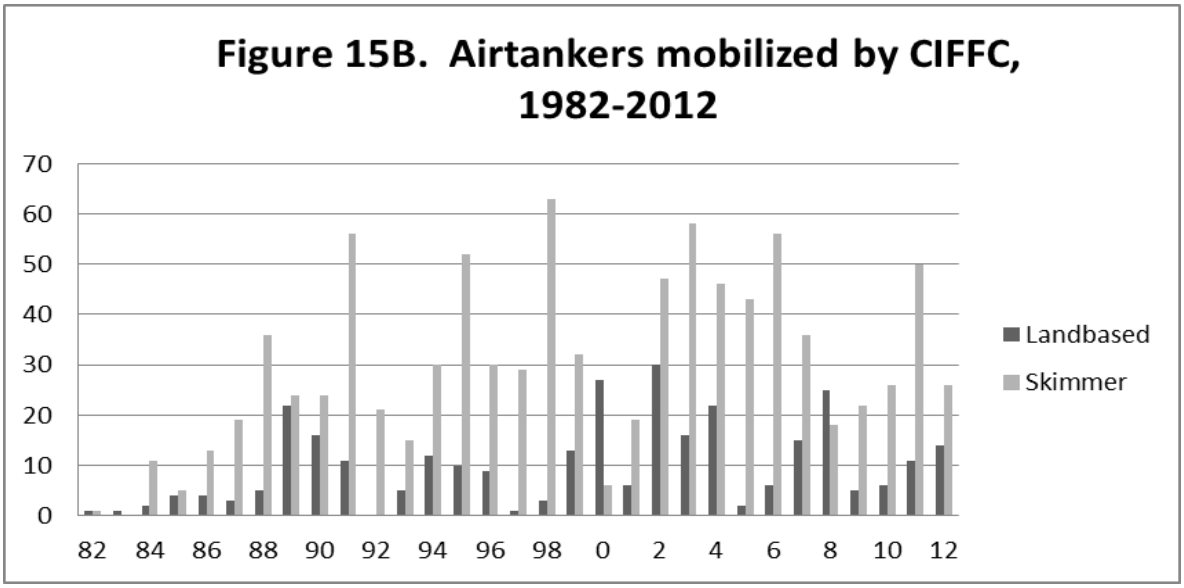
In July 2012, the Canadian Interagency Forest Fire Centre experienced its first-ever point at which it would have been unable to respond to any further calls for assistance. In fact, for contingency purposes, a liaison officer from Australia came to Canada to discuss options under previous agreements. Initial contacts were also made with New Zealand. Quebec had to bring in firefighting crews from Mexico. Their system is well supplied with aircraft but not with crews.

As of Sept 4, 2012, total area burned nationwide was below 2011, but the number of fires was significantly larger[4]. CIFFC uses 100 fires a day nationally as an indicator of a busy time. This occurred on 5 days in July 2012, compared to 7 days in the entire 2011 season. The problem was not the level of fire activity, although activity was high. It was the fact that across the nation, fire danger conditions were very high, so that the various jurisdictions could not send resources elsewhere . In July, there were 7 days at National Preparedness level 3, and 5 days at level 4. For those 5 days, crew availability nationwide was zero. During the month, orders classed as UTF (unable to fill) included 20 - 4-person Initial Attack crews, 8 - 20 person Sustained Action crews, 2 overhead teams, and 1 skimmer group.

For perspective, 2012 was not an active year for mobilizations within CIFFC (Fig. 15 A and B). Partly this was due to the inability to release resources. Still, Newfoundland was able to release CL 415's on several occasions when they were not needed. The mobilization data by CIFFC distinguish between initial attack, sustained action, and overhead. Because of the large, long-burning fires in much of Canada, the sustained action component is very large. This is a strong contrast to the Northeast US where fires burning more than a few days are rare.



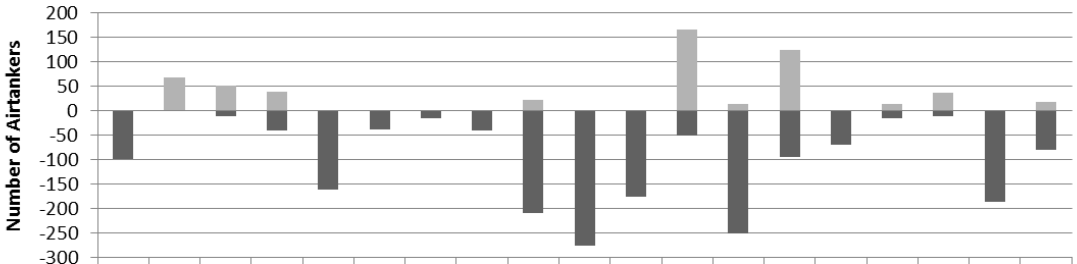
[4] Serge Poulin, CIFFC, pers. comm. Sept 26, 2012.



Quebec: 2012

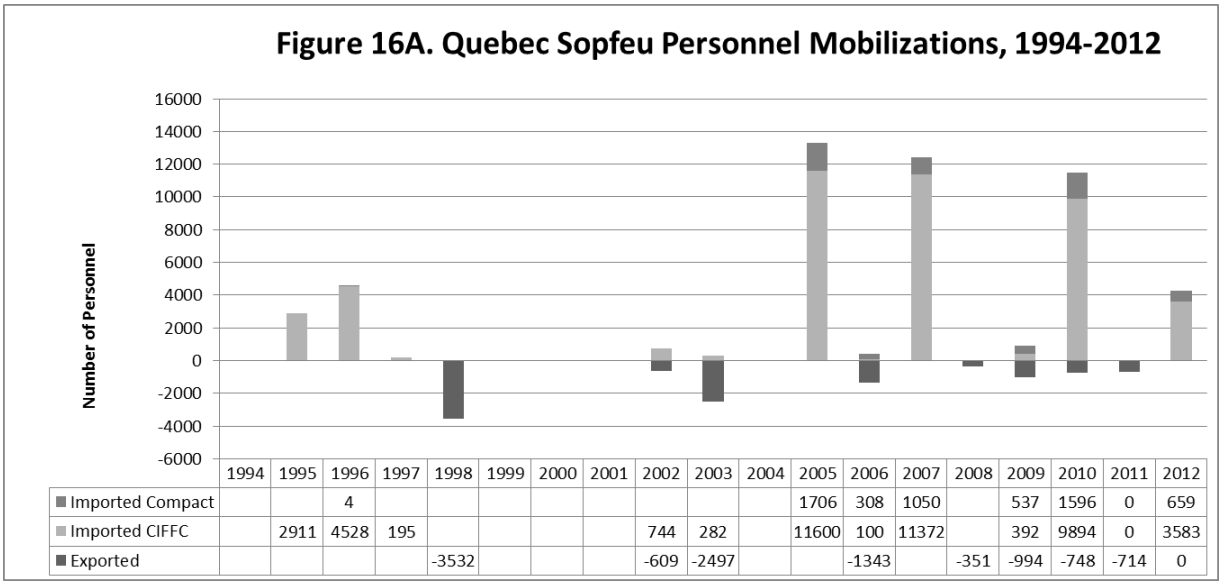
Over the period 1994-2012, Quebec "imported" a total of 51,000 person days for service from other jurisdictions, mostly within Canada, while exporting almost 11,000 days. The highest years for CIFFC imports were 2005, 2007, and 2010, while the highest for the Compact was 2010. On the aviation side, Quebec exported a total of 1800 aircraft-days, while importing 556 aircraft-days. These differing balances reflect Quebec's resource position as mentioned above (Figs 16 A and B). Quebec can be a major provider of airtankers when its own needs are low. (Source: present. by G. Lemaire, fall 2012). Since the year 2000, Quebec has been a net importer of fire control personnel on a large scale in 4 years – 2005, 2007, 2010, and 2012.

Figure 16 A. Quebec: Sopfeu Airtanker Mobilizations 1994-2012
Light: imports, Dark: exports



	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012
import	0	68	51	40	0	0	0	0	22	0	0	166	15	124	0	14	38	0	18
export	-98	0	-10	-40	-162	-38	-14	-40	-210	-275	-175	-51	-250	-94	-70	-15	-10	-186	-80

Airtanker -- Sopfeu photo



	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012
Imported Compact			4									1706	308	1050		537	1596	0	659
Imported CIFFC		2911	4528	195					744	282		11600	100	11372		392	9894	0	3583
Exported					-3532				-609	-2497			-1343		-351	-994	-748	-714	0

7. Observations on Policy and Politics

In gathering information and ideas for this project, it was suggested to look into recent extreme fire situations in a number of other regions. This was to seek useful lessons for the Compact's primary mission of mutual aid, and for individual jurisdictions with limited experience in extreme fires. This effort stretched over most of the duration of the project, relying on interviews and literature searching. Some of the results are in Working Papers listed in Attachments.

Some Lessons on Responses to Extreme Fires

Western fire managers will see nothing new or noteworthy in this section. But in the Northeast, apart from individual managers with experience in major fire campaigns elsewhere, few organizations, other than Quebec, have experienced the rigors of prolonged fire outbreaks and what they can do to quickly improvised organizations relying on multiple levels of cooperation and communication. A few observations emerge from studying epic fires elsewhere:

- Predictive services are critical in foreseeing when a routine fire situation promises to run out of control.
- It is essential to staff up before this point is reached. Shrinkage in staffing has made it more difficult in this region to follow this advice.

- Extreme events often elicit the remark: "We saw fire behavior never seen before". Because of the long return period of such events in the East, within a career of one person this could be true. But fire professionals say that as a general matter it is NOT true. Somewhere, that fire behavior has been seen. The issue is to be certain, through information sharing and training, that crews and incident commanders are not ambushed by fire behavior outside their own immediate experience. (The various Staff Rides exemplify efforts to address this issue)
- The ramp-up from small local fire to major regional disaster fire with imported overhead teams is rarely easy. It can involve politics, egos, and uncertainties as to the best allocations of resources. Events here and elsewhere attest that fire escapes can occur with dazzling speed. In extreme fire weather, it is usually impossible to recover from early errors, unexpected accidents, or delays. As an example:

  "Southern NY saw an arson-caused 50-acre fire burn 8 dwellings and 40 buildings, a smoker-caused 480-acre remote fire in a state park and an arson-caused 1,000 acre wildland urban interface fire in one afternoon on Long Island. All three of these fires had access to significant and (arguably) sufficient firefighting resources to have kept the fires smaller and less destructive. Tactics were the reasons these fires became as large and destructive as they were". (A. Jacob, pers comm)

  Lest this be seen as an isolated set of examples, the same observation has been made to the author by officials in two other Compact jurisdictions.

- "The focus on federal standards for a response of certified personnel and fire asset modules (crews, task forces, etc.) may be **the cause** of large fires. These resources are only available and engaged after the fire has become large. The time between a failed initial attack and the deployment of federally-typed firefighting resources to an incident may take days in which the fire grows to unusual size, with corresponding loss and damage." (A. Jacob, pers. comm)
- Major outbreaks consisting of numerous fires will require reserving some headquarters capacity for addressing the strategic decisions. This is often realized too late, because extreme outbreaks can escalate so rapidly.
- Local officials must be prepared for the fact that difficult decisions may be necessary in light of the regional situation. They won't like it.
- Local control during an escalating fire emergency can lead to over-turnout of nearby fire departments, diverting them from where they really need to be, and can even result in traffic jams and resources standing idle. This may render them unavailable when needed later.

- Fatigue on the fireline is a well understood issue. Fatigue and stress among mid-level and senior managers is often not recognized until it becomes a major problem. Organizations need to be prepared in advance for this.
- Evacuation is a key issue -- how and when to order it. Where evacuations have been infrequent in the past, as in the Northeast, there may be difficulties in reaching decisions and in achieving compliance.
- It is necessary to reckon with the possibility of arson around the perimeter of major fires. This may have a variety of motivations and effects. It increases stress on law enforcement at the worst possible time.
- Lack of inter-operable communication equipment continues to be a barrier to prompt and effective application of military resources to fires. The radio equipment needed is extremely costly. Most jurisdictions have developed partial work-arounds.
- Recent experience in other states has reportedly opened many minds to the need for Firewise activities by individual property owners. But in the Northeast, efforts to involve individual property owners in such programs are far short of meeting the need. This activity has been heavily dependent on federal funding, which has little prospect of increasing.

Training programs for incident management teams in the Compact fully recognize these issues. But it is necessary to ensure that the implications are fully understood throughout their respective organizations and cooperating Emergency Management organizations. Further, agencies need to ensure over time that senior elected and appointed officials are prepared for the decisions they may face.

Effective learning from experience is one major benefit of a Compact jurisdiction sending crews, equipment, and fire managers to major fires as mutual aid. Especially considering the mild fire experience in most of the Compact region in the past 3 decades, this has been a critical investment in human capital. As the figures above show, this has involved hundreds of mid-level and senior managers over the past decade. Except for those benefitting from these experiences, there are senior fire managers as well as equipment operators and fire crew bosses who have never experienced a severe, fast running project fire in the midst of an exhausting fire outbreak.

Maine Forest Service personnel -- response to Superstorm Sandy, New York City, early November 2012.

Defining Success

In the end, wildfires end. They hit firelines, are declared under control, and gradually burn out. They burn into a lake, or it rains. Structures are saved, often in dramatic actions. Yet, defining success of a fire program as "the fire is out" is not enough. In fact, metrics for effectiveness are highly elusive given the many uncertainties involved in fighting wildfires, and the judgments that must be made on the spot in the mist of smoke and confusion. Still, questions must be asked that can supply the basis for improved practice in the future. What caused the fire to escape notice and control? Were tactics effective? Did dispatch and interagency communication function as expected? Was weather support timely and accurate? And many more. The questions need to be aimed at identifying improvements and lessons, not at trying to pin blame.

The "Lessons Learned" System is Ineffective for Policy and Program Structure

In the opinion of this writer, the system for after action review and lessons learned on major policy and structural issues is ineffective[5]. Fire professionals report that in the West, the tough lessons get learned and communicated because there is a core of experienced managers who communicate and who work together on extreme fires all over the region. This extensive oral tradition and archive of learned experience is not readily available to managers in the East who need it. The written record, to put it bluntly, fails us. In reports reviewed for this project, serious structural issues are regularly omitted or danced around. The writers bend over to the breaking point to avoid hinting that some move or other was a mistake. Instead, the reports often list trifling improvements to forms and procedures – even when the people on the ground can see serious structural defects in the system. A variety of cultural and political factors contribute to this.

The fact that a fire was extinguished is portrayed as a great victory. But fires never burn forever. What might have been done better is rarely discussed. Could we learn to contain fires more quickly? To what extent did we spend more than was needed? Did flaws in organization or tactics arise that affected the results? Was there waste due to political interference? Pursuing such questions in the written record produces very little.

The multilayered US wildfire system has been described by some critics as a "Fire Industrial Complex." They say it is extremely conservative and highly resistant to change, especially on fundamental issues of power and influence. This is felt by many to be true at the federal level and it is certainly true in important states. Generally speaking, the public officials are hardworking, experienced and sincere. But they are inhibited from commenting on or even mentioning fundamental problems as they know from experience that it can harm their careers. Even people close to events who are immune from political retaliation have a get – along mindset: in many inquiries for this project, the first thing a respondent wanted to do was to refer questions to someone else.

Even the US Congress has difficulty getting straight answers on difficult issues. It is surprising and disconcerting to read prepared testimony by senior state, federal, and military officials that is essentially hot air – soothing saccharine statements of good will,

[5] A strong and valuable lessons learned capability does exist, it addresses more the "on the fireline" kinds of issues. The Lessons Learned Center in Tucson, Arizona is a principal feature. After action reports on major fires are becoming increasingly multidisciplinary and detailed. The existing system is not tasked with addressing the policy and program problems discussed here.

bland generalizations, and fluff that completely dodge questions being asked. This cannot be described as a healthy atmosphere for learning and improvement.

Nobody could expect everything to run like a Swiss watch in extreme events such as experienced in the East in the past 5 years. We are entitled to expect, however, that the lessons -- including decisions that look in retrospect like mistakes -- be frankly faced and communicated in ways that can aid other jurisdictions to avoid encountering the same problems. Reports filled with sugary language that refuse to face serious problems are worse than useless – they breed complacency and allow tough problems to fester.

Why does this matter for the Northeast? *Because we need to learn in order to be ready.* On this, the national system is failing us. Until this system and its methods can receive regular scrutiny from some well-informed, independent entity, this will continue.

Regional and National Issues

Nationally, participants say that "mutual aid is evaporating". Details are noted above. This is a serious issue for the Compact, whose entire reason for existence is mutual aid. Individual jurisdictions have experienced such tightening of staff and resources that some are no longer willing to send resources out of state on any terms. Others have tightened "rules of engagement" for when they will export people or resources. The fire community nationally struggled with a major shortage of airtanker capacity over 2012 at the same time as several extreme wildfires burned consuming forests, rangelands and structures (USDA FS 2012). Debates occurred over the right size and mix of aircraft needed for the airtanker force. The only agreement was that the federal government should pay for it. From a northeastern viewpoint, this debate has distracted attention from deeper structural problem that cannot be solved just by buying a few airplanes.

A situation in which occasional events inflict extreme losses to property and to suppression budgets would bring to mind whether an insurance mechanism would be applicable, as it is for residential fires insurance coverage. Surprisingly little systematic attention has been paid to this in the forest fire field[6]. The state of Oregon maintains insurance coverage to protect against extreme fire control budgets; that system reportedly works well. The Province of Alberta attempted an insurance program but it

[6] A partial exception has been the interest in legal and insurance issues in the Interface out West, where insurance firms are beginning to shake loose their past passivity concerning property owner duties to minimize risks. See, e.g., relevant papers in Bradshaw and Lueck, 2012.

was not continued. The true insurer of last resort in the US has been the federal government – so long as the federal checkbook is open to cover extreme years, states and localities have no incentive to reserve for or insure against predictable extreme events. Yet, in parts of the world, insurance coverage has been arranged for forests. As part of this project, a detailed analysis of annual fire occurrence data was conducted, but further policy analysis was not possible. The work, by Forest Re of London, is documented in one of the Working Papers listed in the attachments.

Traditionally USFS fire budgets have been managed with the option to return to Congress for appropriations to cover overages during extreme years. This has become more difficult. The agency has had to transfer funds from other accounts to keep firefighting operations funded (National Association of State Foresters, 2012). Limits on the federal dispatch system are growing tighter. From a state and local perspective in the Northeast, the federal safety net for responding to extreme wildfire events is full of holes. If ever a system were ripe for a serious outside review, this would be the occasion. It's not happening.

Politicians seeking TV news sound bites have become a regular feature of major fires. Interventions by the wrong politicians at the wrong times, based on the wrong advice, can result in what fire professionals cynically term "perception runs" where costly aircraft dump brightly colored swaths of retardant, solely for the benefit of TV cameras. This supposedly proves "we are doing everything we can". Only the occasional journalist calls them out on this behavior. The waste is significant. The incentives for politicians are irresistible and will not change.

At one time, State of the Art. MFS photo.

8. Principal Findings and Recommendations

The present task is to stress-test the current system, based on what we can learn from agency and Compact data and interviews with officials.

> *Could the existing system within the Compact, buttressed by federal dispatch, with continuing shrinkage of capability described above, weather the sort of storm that engulfed Texas, Georgia, and other states in the last few years?*
>
> *The truth is, we do not know.*

The Compact's system has not been severely tested in recent decades. But another bout of extreme fire outbreaks could well occur. There is no reason to suppose that we have seen the last prolonged regional drought.

All the facts point to the conclusion that response capabilities are shrinking, in mutually reinforcing ways that are real -- despite the lack of good data to measure them. The emerging constraints on the federal dispatch system pose a serious challenge, since so many jurisdictions now rely to a greater and greater extent on reinforcements from elsewhere. It is difficult to define program needs effectively, much less make the case to leaders who are making difficult fiscal choices every year.

With frequent turnover of senior appointed officials and legislators, keeping them well informed about the risks, the options and the realities is an unceasing task. Usually these people are overloaded with *current* problems; there is little chance of getting them to focus on potential *future* problems.

A key observation, by experienced fire professionals, as well as regional cooperators on the National Cohesive Strategy, is that the first enemy is complacency. The second report of the Cohesive Strategy's Phase II National Report offers this strong observation:

> *The second primary issue is **complacency on several levels**. The Northeast can be described in risk management terms as low occurrence but high risk. Unlike the West, which has large, significant fires on an annual basis, or the Southeast, which has a history and culture of fire (both wildfire and prescribed), the Northeast neither has large fires on a regular basis nor does prescribed fire play a significant role. Long*

intervals between large wildfire events create challenges in investment strategies in preparedness, whether by governments or homeowners. Wildfire preparedness at the local fire department level can be overshadowed or downplayed because of the responsibility for more frequent all-hazard and medical emergency response.

- *National Wildland Fire Leadership Council, 2012, Cohesive Strategy, Phase II report, p. 22. Emphasis supplied.*

In an interview, a fire professional from another state noted to this author – " in the Northeast, they are in denial". Another fire professional noted:

> "The Northeast denies its wildfire potential because all but one member (New York) has its state wildfire agency embedded in its state forester organization. State foresters in the northeast have stated openly that they are more concerned for the wood fiber industry and invasive species and every other part of their program other than fire". (pers. comm, anonymous fire professional)

The Compact system depends heavily on the aircraft and experienced crews available in Canada. Yet in terms of surge capacity for national high fire danger situations, all is not well there. The imminent resource crunch of 2012 has been described. A recent MS Thesis based on intensive research argued that the system has made major progress but significant improvements are needed (Gereghty, 2012).

The problems identified in this report cannot be solved at the operational level. Solving them will require support at senior levels, and cooperation by multiple levels of government and the private sector. But they will not even be addressed unless the issue is first recognized.

Somehow – and it will not be easy – a cultural change is needed. This has to come from senior levels. As an experienced fire professional put it :

> "Agencies need to foster an environment that does not penalize constructive input, even if it is not good news. The point is that politicians are looking for scapegoats when things don't go well and fire managers don't always feel free to state their true opinions and observations."

As a first listing of recommendations emerging from all of this work, we present the following.

Recommendations

This report attempts to diagnose the problem of forest fire risk in the Compact area. It reflects an effort to learn lessons from places recently stressed by catastrophic and unexpected extreme fires. It is not principally concerned with prescribing action steps in detail. Some suggestions, however, did emerge from the research and conversations on this project. They must be implemented at various levels of government and the private sector. An effort has been made to focus on key points; many other topics emerged during the research.

(a) To the Individual Jurisdictions

1. Prepare cost updates on largest fires of last 10-20 yr to show what they would cost if they were to occur today.
2. Audit all local mutual aid arrangements to test their robustness to unexpected strain on resources.
3. Improve networking and training academies for local mutual aid response groups, and where they are absent or weak, develop a program of improvement. It is recognized, though, that current time demands for training are an issue for the volunteer fire departments.
4. Conduct thorough outreach to the emergency services community within each jurisdiction on the implications of a 20 year return period threat assessment.
5. Meet in depth with local military authorities to assess likely future trends in their ability to respond to fire control needs.
6. Continue to seek improvements to cost – effectiveness of all programs.
7. Seek ways and means of assuring that policies, administrative structures, or informal understandings do not impede prompt application of needed force and tactics in Initial Attack situations.
8. Improve management of internal data to better characterize and record situations when resource limits are reached.
9. Focused efforts will be needed to increase application of Firewise practices in priority situations.

(b) To the Compact as a Whole

1. Develop a short list of key needed upgrades to the US federal dispatch system, with full justification, and pursue these aggressively through multiple channels.
2. Develop options for improving the lessons learned capabilities of the system, especially concerning larger structural and policy issues which are not currently addressed by existing lessons learned activity.
3. War-game several hypothetical extreme fire events under plausible assumptions about occurrence, location, rate of spread, and occurrence of concurrent demands on emergency response resources.
4. Consult with leaders at forestry educational and research institutions on the adequacy of their teaching and research in this field[7]. Apparently a full course in forest fire control is no longer required to earn a BS degree in forestry in this region in most US forestry schools; this is not true in Canada.
5. Following suitable preparation, pursue options for developing a realistic Quality Assurance system for volunteer FD's respecting their forest fire fighting capabilities.
6. Consider in detail whether some form of insurance against extreme losses would be practical in the Northeastern Compact context. The state of Oregon maintains an insurance policy against extreme firefighting expenses; informal reports are that it has worked well
7. Assess, on a regional basis, the implications of the aging fleet of firefighting aircraft, in light of available alternatives and new technologies.
8. Improve management of Compact mobilization and resource data to better characterize and record situations when resource limits are reached. An analysis such as that conducted by Magnussen and Taylor (2012) would be difficult to conduct at present given the state of the information.
9. Initiate a process whereby selected incidents and programs are subjected to true third-party audit by informed but outside parties not subject to political retribution if they report unwelcome views or information.

[7] Most of the Compact region is not covered by a regional compact in the Joint Fire Science Program, reflecting the perception that research needs are minimal here. See map at http://www.firescience.gov/JFSP_consortia.cfm. See also Kocher et al. 2012. As an example, the Northeast is minimally mentioned in Prestemon et al's recent review on ignitions, as there is so little research being done.

9. Closing Note

The Bar Harbor fire of October 1947 burned 9,000 acres in a single day. This is an extreme case and to predict it will soon happen again, in an identical manner, would not be responsible. But this fire was a historical fact, not a hypothesis. What should foster thought however, is this: had this fire been authoritatively predicted 2 or 3 weeks in advance – how many people and agencies would have believed it and acted accordingly?

In 1947, firefighters near Machias realized the fires in their area were running out of control. When they called Civil Defense in Bangor for help, they were told that none was available, due to the other fires: "you're on your own"[8]. In the end the fires near Machias burned some 20,000 acres. In the future, unless steps are taken, more and more fire managers will be getting this response to appeals for help. Hence the title of this report.

[8] Interview with Chief "Peanut" Gardiner of E. Machias, Jan 2012.

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11. Attachments

Attachment 1.

Forest Data – Compact Region

		Acres	
	Total Land Area	**Total Forest Area**	**Protected Area**
Maine	19,752	17,673	
New Hampshire	5,740	4,850	
Vermont	5,920	4,618	
Massachusetts	5,018	3,171	
Connecticut	3,101	1,794	
Rhode Island	669	356	
New York	30,217	18,669	
USA Compact states	**70,417**	**51,131**	
Quebec	380874	181,199	123,500
New Brunswick	18031	15,045	
Nova Scotia	13585	10,473	
Nfld and Labrador	100035	26,503	
Canada jurisd.	**512,525**	**233,220**	
Total Compact	**582,942**	**284,351**	

Sources: USA: USF FIA -- RPA tables for 2007.
Canada: various websites

Attachment 2

Table	Measures of extreme behavior in annual forest fire area burned.							
Jurisdiction			Annual Area Burned					
			1	2	3	4	5	6
			20 year average 1000s	20 Year Return Period 1,000s	No. of 1 SD events 1991-2010	Ratio of Peak to mean	Percent of area burned in top 5 yr	Data period for Ret Per.
Quebec		ha	106.3	340.0	6	5.7	54	1970-2010
Newfoundland			33.9	160.0	2	5	41	"
Nova Scotia			0.8	3.0	0	13.6	51	"
New Brunswick			0.8	3.0	0	10.4	27	"
Subtotal E. Canada						4.1		"
Maine		acres	1.3	8.0	0	11	34	1960-2010
New Hampshire			0.2	1.7	0	23.7	34	1960-2010
Vermont			0.3	1.0	0	4.8	22	1960-2010
New York			2.1	14.0	0	3.8	33	1960-2010
Connecticut			0.6	3.8	0	11.4	23	1961-2010
Rhode Island			0.2	0.6	na	2.5	41	1984-2010
Massachusetts			3.9	16.0	na	4.9	23	1961-2010
Subtotal USA						6.5		
Notes	1. Most recent 20 yr averages, 1991-2010.							
to columns	2. Based on years shown in col (6), differnces due to data availability and comparability issues.							
	3. Events during 1991-2010 relative to standard deviation for 1944-2010.							
	4. Ratio of peak to Mean 1970-2011 for Canada, 2010 for US.							
	5. Sum of area burned in top five years as percent of cum. Total 1970-2010 in Canada, 1960-2010 for US.							
	6. Data yrs for return period calculations.							

Attachment 3.

Table MFS 0232 Div For Protection -- General Fund						
Category	**2001**	**%**	**2010**	**%**	**% Ch 01 to 10**
Personal svcs					
Salaries & and wages	3,574	45%	4,463	51%	25%
retirement	868	11%	1,631	19%	88%
health	632	8%	982	11%	55%
Other fringe	171	2%	266	3%	56%
UE reimb.	8	0%	6	0%	-25%
Total PS	5,252	67%	7,347	84%	40%
All Other	2,498	32%	1,419	16%	-43%
Capital Exp.	138	2%	0	0%	-100%
Total	**7,888**	100%	**8,767**	100%	11%
memo: total fringes	1,679	21%	2,885	33%	72%
divisor for PPI	1.342		1.847		38%
Total in $82	5,878		4,747		-19%

Budget sheet from Peter Beringer MFS Feb 2012.

Attachment 4.

Maine Forest Service			
Last Decade, Change in Cost (2001 - 2011)			
	2001	**2011**	**% 2011/2000**
Labor (Firefighter)	$8.70	$17.40	200%
Labor (Forest Ranger)	$15.29	$21.32	139%
Aircraft (Huey)	$850.00	$1,365.00	161%
Aircraft (Fixed Wing)	$125.00	$175.00	140%
MFS Tenders	$65.00	$83.44	128%
MFS Engines	$50.00	$64.18	128%
Town Tenders	$200.00	$300.00	150%
Town Engines	$150.00	$250.00	167%
Skidder (Cable)	$45.00	$85.00	189%
Skidder (Grapple)	$65.00	$105.00	162%
Bulldozer (Type 1)	$80.00	$130.00	163%
Bulldozer (Type 2)	$60.00	$120.00	200%
Bulldozer (Type 3)	$40.00	$80.00	200%
Lowbed	$70.00	$100.00	143%
Per Diem (Food)	$30.00	$38.00	127%
Per Diem (lodging)	$55.00	$77.00	140%

Attachment 5.

Northeast Compact Mobilization History 2002-2012.

	Crew	Engine	Overhead	Other	Total people	% Ovhd
2002	21	1	151		574	26%
2003	17	2	185		531	35%
2004	1	1	129		152	85%
2005	15 (9us + 6qc)	1	284	3	587	48%
2006	25 (22us+3qc)	2	365		871	42%
2007	17 (14us+3qc)	1	402		745	54%
2008	9	3	326	7	515	63%
2009	8 (5us+3qc)	0	56		216	26%
2010	9 (2us + 7qc)	1	220	2	403	55%
2011	6	14	375	7	537	70%
2012	19 (16us+3qc)	14	365	15	787	46%
Year	Crew US	Crew QC	Engine Crew	Total		
2002	420	0	3	574		
2003	340	0	6	531		
2004	20	0	3	152		
2005	180	120	3	587		
2006	440	60	6	871		
2007	280	60	3	745		
2008	180	0	9	515		
2009	100	60	0	216		
2010	40	140	3	403		
2011	120	0	42	537		
2012	320	60	42	787		

Source: T. Parent, pers. comm. Mar 2012.

Attachment 6. Northeast Forest Fire Protection Compact Stress-Testing Project

Irland Group: Documents Prepared and Planned

Area Considered	Document title	Date	Time period	Remarks
Region				
Forest RE Risk Assessment	Report and Analysis of Risk scenarios	31-5-2012	1903 to 2010	Insurance perspective on extreme risks
Regional Forest Data	Spreadsheet	Ongoing	Current	Current forest area etc.
Compact Regional Fire history	Spreadsheet	Ongoing	Entire record	Includes averages and variability measures
1947 Fires	Northeast Regional Fire Outbreak… 1947	June 2012	1947	
Great 60s Drought	The Northeast's Great Sixties Drought…	June 2012	1960-70	
Extreme value analysis – portion of region	Extreme Value analysis of forest fires from NY to NS: 1950-2010	Oct 2012	1950-2010	Published in Forest Ecology & Management, 294 (2013): 150-157. Doi: 10.1016/j.foreco.2012.09.004
White Paper	"You're on your Own"	Aug 2013		To summarize all work and recommendations
Canada				

Atlantic Provinces	Atlantic Canada Fire History	4/19/2012	1919-2010	Data periods vary by Province; some indiv fire data.
Quebec	Quebec Fire history and implications	6/14/2012	1920-2010	Indiv fires 1994-2010
US Compact States				
PDSI data	PDSI Analysis all Compact states	Spreadsheets	1895-2010	PDSI and other monthly weather history, w. some analysis
Compact States	1984-2010 fire data by USFS, with analysis and charts	ongoing	1984-2010	Spreadsheet; valuable for states lacking indiv fire data
Maine	Fire History 1903-2010	6/2012	1903-2010	
	Individual Fire Analysis		1967-2010	
	Cost Analysis		1967-2010	W budget information since 2000.
New Hampshire	Fire History	5/2012	1903-2011	
New Hampshire	Expanding Interface…	Fall 2013	1947-present	Reviews interface and fire in NH.
Vermont	Fire History and individual fires	5/2012	1905-2011	Condensation in prep for technical journal
Massachusetts	Fire History	5/2012		
	Individual Fire Analysis 2000-2011	5/2012	2000-2011	
Rhode Island	Fire History	June 2012		Efforts under way to fill in data gaps

Connecticut	Fire History	5/2012		Condens. pub in Conn. Woodlands Winter 2012
New York	Fire History 1891-2011	6/6/2012	1891-2011	
	Analysis of Individual Fires		1975-2011	
Northern Forest states	Short article on fire histories	1900-to date		In preparation.
US Outside of Compact				Short memos on focused topics.
	Montana			Review of major fires in late 00's & response
	Oregon forest insurance	May 2012		Reviews Oregon's insurance for extreme fire costs
	Georgia Megafires 2007, 2011		Data 1955-present	Major data archive compiled; no formal writeup likely.
	Texas	9/26/2012		complete
	Mack Lake Fire, Michigan	6/3/2011		complete
	Arizona: Greater Flagstaff Partnership	5/25/2012		complete

Professional meetings

Poster at Megafires Conference, Tallahasssee, FL, Nov 2011.

Poster at New England SAF, Amherst, Mass March 2012.

Presentation at Harvard Forest, Oct 26, 2012

Presentation and poster at ECANUSA conference, Durham NH, Nov 2-3, 2012.

Presentation at University of Maine School of Forest Resources, Jan. 2013. (with Jeff Currier of MFS and Andy Mitchell of NPS)

Attachment 7. Outreach Ideas on Fire Management

Information developed for this project, for the Coherent Strategy, and ongoing efforts in the jurisdictions will be of no use unless communicated effectively to key audiences. This will be a demanding task as the audiences are several and their information needs differ. It cannot all be accomplished quickly. As part of this project, detailed Working Papers and articles have been prepared that outline the issues. These supply potential tools. But they only suit limited audiences. There will be no substitute for personal briefings with brief, factual hard hitting, and locally specific background documents. Audiences should include:

Newspaper editorial boards in key locations

Stories/interviews/field visits for local weeklies (w. photos)

US & Canadian regional governor/Premier groups

Senior Departmental appointed officials. This will be especially important in the "superagencies" whose top officials are necessarily quite distant from operations, and other difficult and contentious issues occupy their time, and also may turn over frequently.

Newly appointed staff in Governor's/Premier's offices

Trade and environmental groups

Fire chiefs and firefighter's groups

The real estate development, banking, and insurance community

Local government officials, through their state/province associations

Messages/formats could take a variety of formats. As an example, it has been customary for officials returning form tours of duty on major out of compact fires to make a summary briefing to the Compact meetings on their return. The Compact's work is what politicians and journalists see as "inside baseball" – i.e. of no reader/voter interest. We need to show the news "hook".

Especially important could be short case studies of benefits achieved from local Firewise implementation.