Review Draft

To: Compact Ops Committee 7/12/2011

From: LCI

Subject: **Breaking the Bank: Montana Fire Season 2006-2007**

At our Campton meeting you urged me to look into bad fire seasons in several locations. I have taken a quick look at Montana. I uncovered somewhat less detail than I had expected, but learned some things and thought I'd share a quick summary. I have shared this draft with some people out there to ground-truth it and see if I shake loose some additional info[1].

## Background

Montana contains some 22 million acres of forest land, of which about 15 MM qualify as "timberland" by federal definitions. Far less than this is actually available for active management under federal management plans. Much of the forest is extremely rugged, unroaded and in wilderness and similar designations. Contention over fire, land allocations, and forest policy is a minor local industry.

Montana was one of the scenes of the famous 1910 Fires, which burned an estimated 2.6 million acres of federal land. Those fires are said to have been the stimulus for the aggressive fire suppression campaign of following years. Montana is used to big fires (next page). But in years 2006 and 2007, new records were set for total area burned, though the historic peak area burned of recent years was still 2003. Looking just down the list of the top 25 fires in Montana, in these 2 yrs alone 72% of the period total of 1.5 millon acres burned, accounting for 59% of the estimated cost. Total firefighting costs for the 25 reached reached $290 million. Eight of the top 10 major fires since 2001 occurred in these 2 years. Still, the 2003 Wedge Canyon fire, ranked at No. 16 in this table, kept its lead as the most costly.

The big fire years of 2006-2007 were part of a period of elevated fire occurrence and volatility. (charts, succeeding pages)

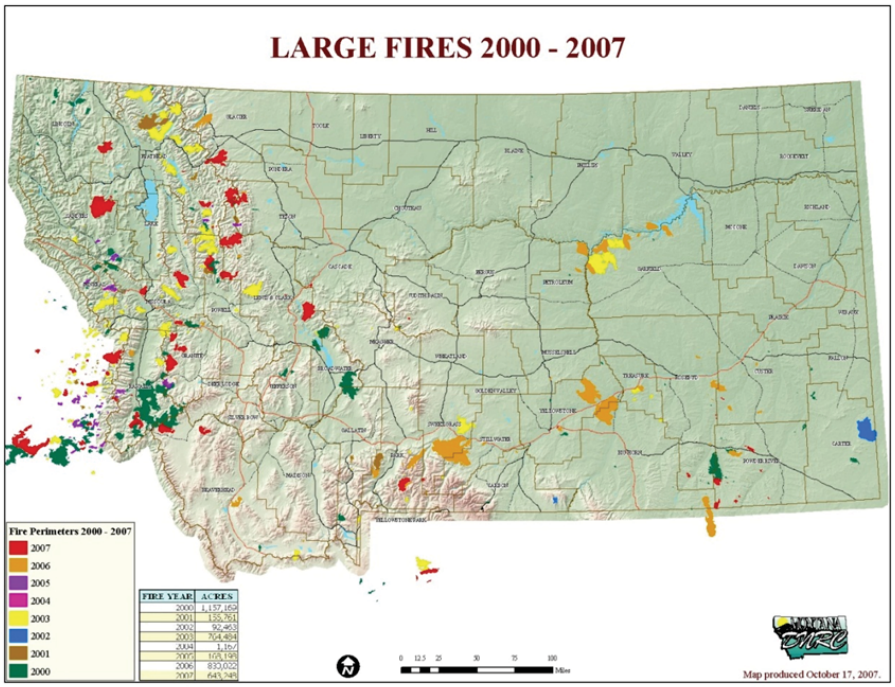
[1] Thanks especially to Ted Mead, Leanne Kurtz, and Cathy Scofield of USFS Region One.

| | **Montana Big Fires:** | | | |
|---|---|---|---|---|
| | | | Acres | Est. Costs |
| Rank | Year | Fire | M acres | $ MM |
| 1 | 2006 | Derby | 200 | 20 |
| 2 | 2003 | Mo. Breaks | 131 | 3 |
| 3 | 2006 | Black Pulaski | 125 | 3 |
| 4 | 2006 | Pine Ridge Complex | 121 | 2 |
| 7 | 2007 | Chippy Crk | 99 | 20 |
| 8 | 2006 | Bundy RR | 92 | 3 |
| 12 | 2007 | Sawmill Complex | 68 | 21 |
| 13 | 2007 | Fool Crk | 60 | 4 |
| 16 | 2003 | Wedge Canyon | 53 | 34 |
| 17 | 2007 | Ahorn | 52 | 15 |
| 22 | 2007 | Skyland | 46 | 18 |
| 23 | 2007 | Meriwether | 43 | 0.4 |
| 26 | 2003 | Lincoln Complex | 40 | 16 |
| 27 | 2003 | Hobble | 38 | 3 |
| 28 | 2003 | Fish Crk | 37 | 27 |
| 29 | 2007 | Jocko Lakes | 36 | 31 |
| 30 | 2005 | Selway-Salmon Complex | 36 | 1 |
| 31 | 2006 | Red Eagle | 32 | 7 |
| 33 | 2003 | Windmill Complex | 30 | 5 |
| 34 | 2007 | Brush Crk | 30 | 15 |
| 37 | 2007 | Rombo Mtn | 29 | 7 |
| 38 | 2007 | Powder R Complex | 28 | 0.2 |
| 39 | 2001 | Fridley | 26 | 11 |
| 40 | 2003 | Cooney Ridge | 26 | 19 |
| 41 | 2007 | Rat Crk | 25 | 6 |

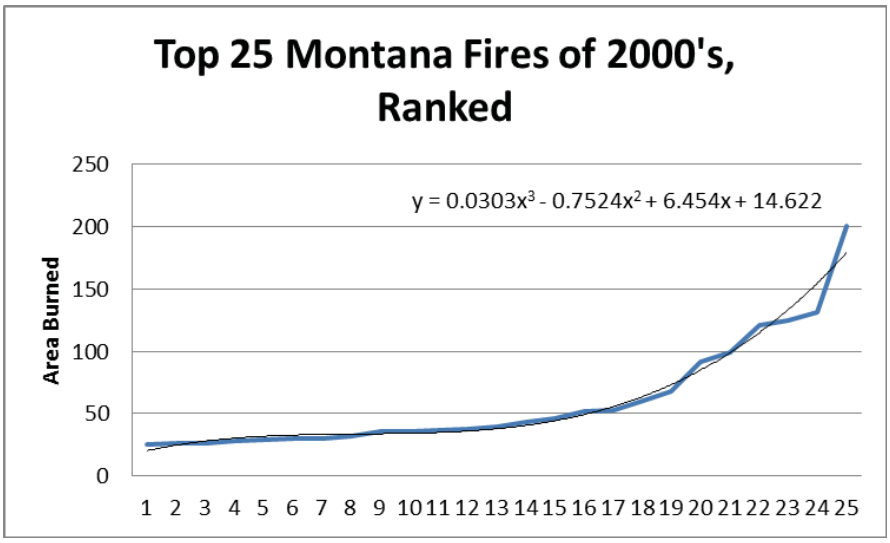
Source: USFS , Northern RCC website.

Notes: above numbers are rounded. Ranks are applicable to entire Region not just MT.

A considerable part of the variation in cost is due to different management prescriptions applied. (and some were rangeland fires)

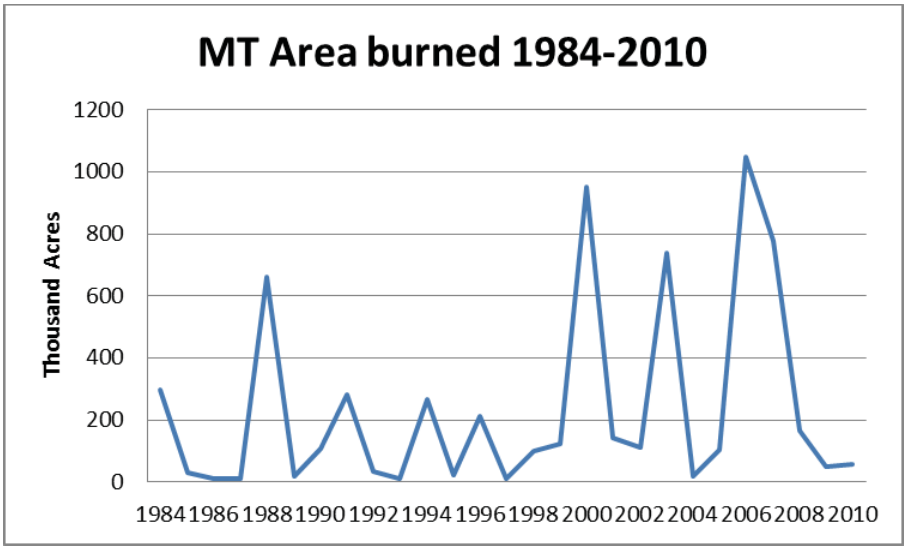


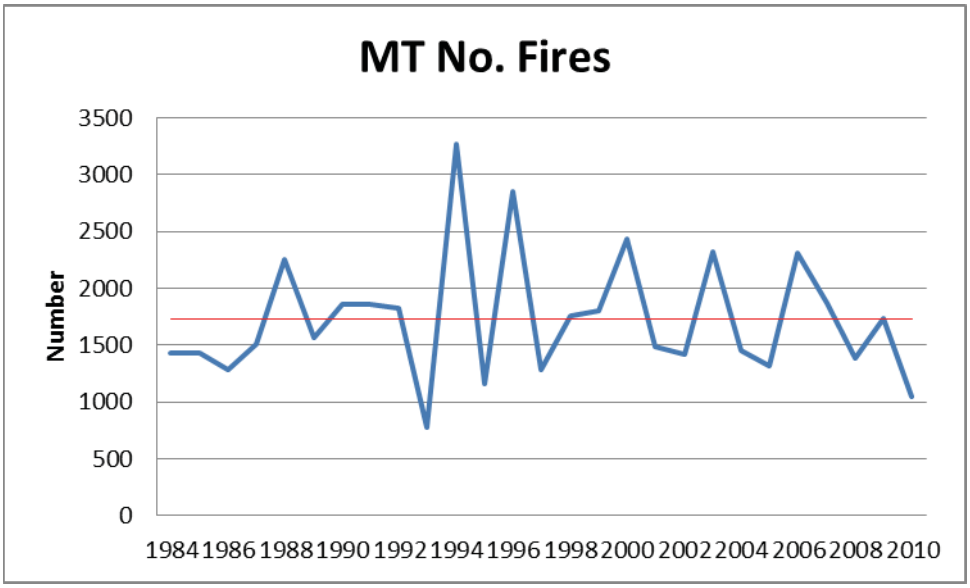

The top 25 fires follow a pattern similar to the annual data that we see elsewhere: beyond a range in which fires of adjacent rank are similar in size, the biggest ones become much larger than the next-ranking ones. The Derby Fire was 53% larger than the second largest. This follows the pattern seen for "fat-tailed " distributions. In extreme value parlance, the largest fire, the Derby, was a "4.6 standard deviation event" meaning it was 4.6 times the standard deviation for the period considered. This is just a fancy way of saying it was a rare event. The fifth largest fire, the Chippy Creek, was a 2.3 standard deviation event.



The 3d degree polynomial is just an empirical fit;  its mathematical form has no particular significance other than just to illustrate that the distribution of fire sizes does not follow any simple relationship.

With barely a break, from 2000 to 2007,  area firefighters and resource managers, as well as the public, had to deal with 4 separate years of fire outbreaks -- all of them more intense than the previous 1988 peak.



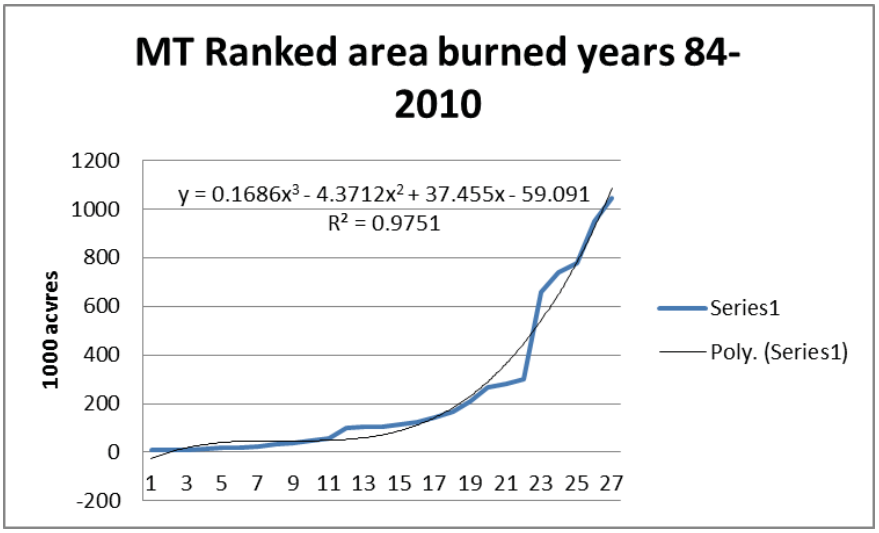



The 2000's were not unique for number of fires, as the chart above illustrates. Instead, they just had very big ones. As the above table indicates, many were also very costly ones. The volatility from year to year was extraordinary. The averages in the next table obscure this, but they illustrate the step change that occurred in area burned after 1999.

| **1984-2010** | **No.** | | **Area burned** | **Ave size** |
|---|---|---|---|---|
| Ave | 1,731 | | 236 | 116 |
| Median | 1,561 | | 106 | 68 |
| | | | | |
| **1984-1999** | | | | |
| Ave | 1,747 | | **137** | 69 |
| Median | 1,661 | | 69 | 39 |
| | | | | |
| **2000-2010** | | | | |
| Ave | 1,708 | | **378** | 186 |
| Median | 1,488 | 149 | 144 | 97 |

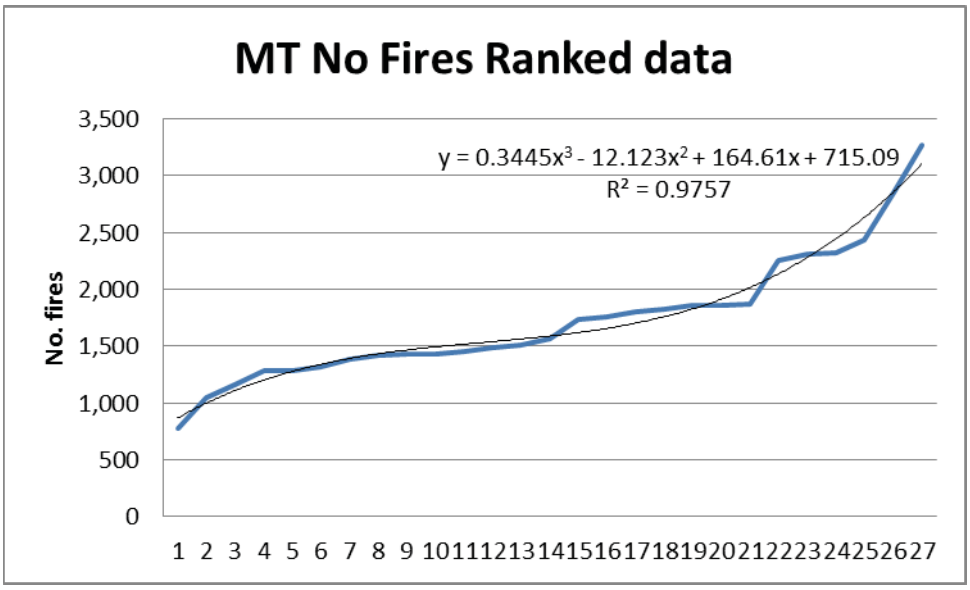
## Analysis

Looking at this data through the lens of extreme value analysis suggests looking at ranked data. This is of no predictive significance, but does bring out some important points.



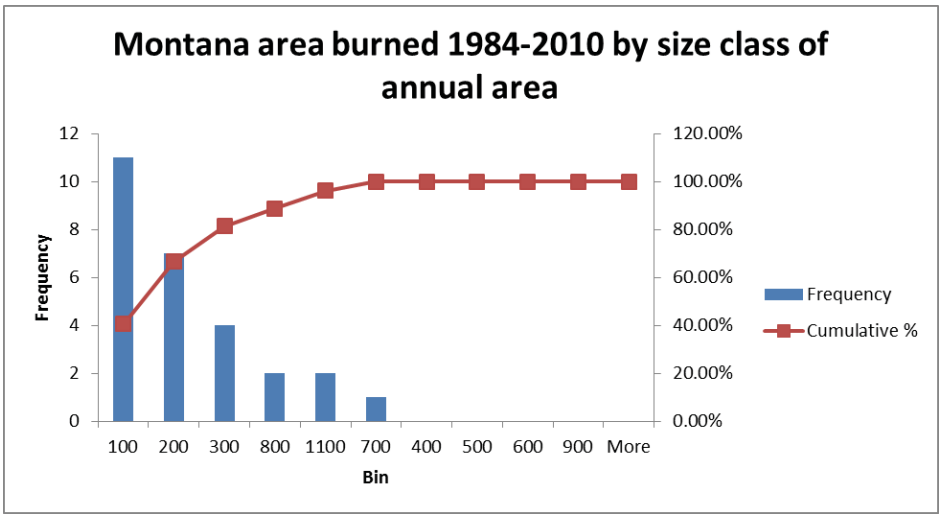

In making charts like these for different time periods and areas, and for fire years as well as individual fires, I have found so far that no simple function fits the data well. Most often, there is a break in the pattern at the point where really big fires start to appear. The chart above happens (arbitrarily) to use a third degree polynomial to fit the data, courtesy of Excel. This functional form probably does not mean anything; it only illustrates that simple functional forms do not fit well. The ranked chart illustrates a key point of extreme value theory – that for certain kinds of natural events, the next bigger event will probably NOT be just 1% bigger than the last biggest – it could be MUCH bigger.

**T**he chart for the number of fires by year is not as steep as that for total area burned, but it is not a simple pattern and it steepens as higher numbers are reached.

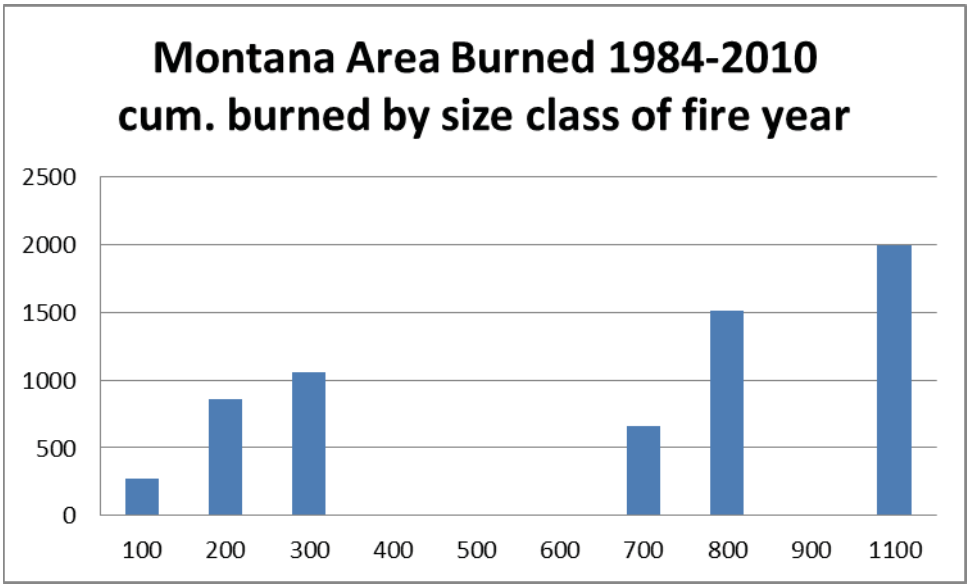



It is useful to analyze the total area burned over the period by categories of area burned by

year. This is just another way of illustrating that in most years, area burned is less than 200,00 acres. The skewness in the relationship indicates that relying on simple averages to estimate protection costs is unreliable, as Montana decisionmakers have recognized.




It is also useful to track total area burned by the same classes of years by area burned. This indicates the overall impact on the resource instead of focusing on individual years. When this is done, it is seen that the years of moderate levels of area burned contribute significantly to cumulative total area affected over a period of years:



## Aftermath

The fire years of 2006-07 in Montana did not break the Forest, nor did they break the state-federal-local firefighting organizations. But they did break the bank. Because of the multiple agencies involved, firefighting, policy, and funding are especially complex there.

In late 2007, even as fires burned, the Legislature had to meet to boost supplemental funding. The Legislature then created a Fire Suppression Interim Committee, which held many meetings and hearings, reviewed many detailed issues, and reported in Sept. 2008. There was considerable second-guessing and bitterness over policy (USFS "Appropriate Management Response"), as would be expected when unusually large losses to homes and structures occur[2]. There were undoubtedly situations where fires had could not be attacked or managed as they might have been in a year with fewer huge fires burning at once.

The volatility in firefighting costs is illustrated by this excerpt from the Commission Report:

[2] A short document, Montana DCNR, 2008, offers the State's view on these matters, and provides a good listing of the issues. Whether some of the issues are relevant to our situation in the Northeast, perhaps we ought to discuss later in the project.

| Average Cost of Fire Suppression | | | | |
|---|---|---|---|---|
| Fiscal Year | Total Cost | Reimbursements | Net Cost to State | |
| 2003 | 6,710,688 | 4,684,927 | 2,025,761 | 30% |
| 2004 | 79,579,965 | 44,582,841 | 34,997,124 | 44% |
| 2005 | 3,969,096 | 989,945 | 2,979,151 | 75% |
| 2006 | 8,302,312 | 3,240,042 | 5,062,270 | 61% |
| 2007 | 61,000,318 | 21,290,928 | 39,709,390 | 65% |
| 2008 | 81,544,805 | 31,544,805 | 50,000,000 | 61% |
| 2009 | *8,474,127* | *2,489,460* | *5,984,667* | 71% |
| 7 year average | 34,443,883 | 15,190,498 | 19,253,385 | 56% |
| 5 year adjusted average | $ 32,813,482 | $ 12,650,032 | $ 17,746,520 | 54% |

FSC, p. 39

Suppression costs are the tip of a very big iceberg. A later review for the Western Governors Association (2010) argued that the true total costs of fires can exceed suppression costs by 2 to 10 times (see also Morton et al. 2003).

There were changes in policy during and after the '07 season that do not concern us here, but are mentioned in the attached references. Also, the Montana Commission took the WUI issue seriously. One of its recommendations was to map the state's SWUI, a task that is soon to be completed.

The FSC report delivered page after page of specific recommendations to all agencies concerned. They expected that not all would be popular. Moderate fire years following 2007 removed some of the pressure for action.

Most importantly, the Commission delivered a grim message:

1. With limited resources and fuel and climactic conditions, it is likely that communities will burn, firefighters will be seriously injured or killed, and hundreds of members of the public will be seriously injured or killed.

2. Stress associated with longer wildland fire seasons will continue to rise, affecting landowners, firefighters, business owners, and local, state, and federal agency staff, as well as other members of the public.

3. With limited resources to fight fires, the costs of fire suppression and the damage to property and natural resources will continue to grow.

4. The state and local governments cannot conduct evacuations on a scale that would be necessary in the event of a fire year similar to 1910.

5. There will be another fire year similar to 1910 and the state is not prepared for fires of that scale.

7. FSC anticipates a $200 million fire year liability for the state budget sooner or later. Costs incurred by the state may be reduced if there are fast-moving, large fires that simply burn through thousands of acres before resources are available. Other than that limitation, costs will continue to grow.

Note: all costs mentioned in these quotes above are state budget costs only.

"As far as any additional actions that have occurred since the FSC completed their report, we were given additional fire suppression staffing (~ 25 FTE in Montana DNRC) and appropriated additional funds (~ $500k/ yr.) to develop new fire engines for our county cooperators. I feel these moves have increased our suppression capability in Montana. Additionally, the legislature continued the Fire Suppression Account to have appropriated funds available for state fire costs.

Lastly, I would advise you to explore what work is being done nationally (federal, state, tribal, & local) in the *National Cohesive Wildland Fire Strategy* which is an outcome of the federal F.L.A.M.E. Act which was recently passed".

--Ted Mead, pers. Comm. July 2011.

In Montana, the fire season is definitely increasing in length and becoming somewhat drier (Hadlow and Seielstad, 2010). The Commission noted this trend in its analysis.

In Sept 2009, The Western Governor's Association initiated a Westwide Fire Risk Assessment project, which is to report results in late 2011. The Western governors have also been active advocates for programs to reduce fuel loads in the region's forests.

In 2008, 09, and 10, area burned in Montana was well below the 1984-2010 average. This led, we are told, to a joke:

If you want to make fires go away, set up a Legislative Commission"

## Some (tentative) Take-Aways…

In our region, we may not expect sustained droughts as in the West (but see 1961-65) , nor do we have to grapple with extensive, contiguous areas of elevated fuel loadings.

In most of the Compact's area, the institutional structure for fire suppression and for fire policy and funding is considerably simpler than in Montana.

Yet, there are similarities:

Many parts of our region have significant and growing WUI issues, with very similar weaknesses in how they face fire risks

We have local areas of highly flammable forest types

Montana's fire experience shows that the averages of recent years, or even fairly long periods, tell you nothing about the probability of extreme fire occurrence next year. Their record fire was a 4.6 standard deviation event.

We we see here, Legislative and public attention to the issues fades rapidly after a bad fire year.

Fire size, intensity, suppression cost, and damages can jump dramatically even with no change in the number of fires. Size of fires, for the major recent ones, bore no relationship to cost.

**Most importantly, in contrast to Montana, no jurisdiction in the Northeastern Compact has experienced an extreme fire year since 1999. For most, area burned remained around a level trend or even declined.**

## References

M. Hadlow and C. A. Seielstad. 2010. Changes in Idaho and Montana fires season precipitation. Bulletin Amer. Met. Soc. June . p. 720-721.

Headwaters Economics. 2009. Solutions to the rising costs of fighting fires in the Wildland-Urban Interface. Bozeman, MT. www.headwaterseconomics.org/wildfire.php

Montana Fire Suppression Interim Committee. 2008. The Price of Flame. Helena: State Legislature.

Montana Dept of Nat Res and Cons. 2008. Appropriate Management Response (AMR) policies: a state perspective. DCNR website.

Morton, D.C. et al. 2003. Assessing the environmental, social, and economics impacts of wildfire. Yale School of F&ES, Global Institute of Sustainable Forestry Res Paper 001.

Western Governors Association. True cost of Wildfire in the Western US.

www. wflc.org

Westwide Wildfire Risk Assessment. 2009.

*For more information visit the WWA project web site at www.westwideriskassessment.com*

*Note from Ms. Leanne Kurtz, legislative staff:*

there is a chart describing development of WUI policy in MT over the last several years. I couldn't isolate the document to send to you, but you can view it as Appendix C-1 in this report:

http://leg.mt.gov/content/Publications/Committees/interim/2009_2010/2010-community-service.pdf

A memo by Ms Kurtz to the Committee, May 12, 2010, indicates the complexities of dealing with the a WUI issues. Copy in Irland Group files.

Bills passed 2009:

| BILL NUMBER | CHAPTER NUMBER | SHORT TITLE |
|---|---|---|
| HB 42 | 330 | Forest management program for FWP land |
| HB 44 | 58 | Revise DNRC participation in federal forest management planning |
| HB 139 | 115 | DNRC intervention authority in federal forest management projects |
| HB 140 | 116 | Increase excess sustained yield authority for forest health |
| SB 98 | 38 | Authorize local taxing jurisdiction for wildland fuel reduction projects |
| SB 111 | 172 | Clarifying DNRC initial wildland fire attack authority |
| SB 113 | 289 | State land fuel reduction pilot program |
| SB 131 | 397 | Require DNRC to designate wildland-urban interface |
| SB 143 | 173 | Revise condominium fire protection assessments |

**ATTACHMENTS**

**Montana Fire Data**

Source: USFS annual fire data compendia, complied by TIG

| Year | No Fires | *No fires div by 10* | M Acres Burned | Acres/fire | Acres above Average |
|---|---|---|---|---|---|
| 1984 | 1432 | *143* | 299 | 209 | 63 |
| 1985 | 1432 | *143* | 31 | 22 | -205 |
| 1986 | 1286 | *129* | 10 | 8 | -226 |
| 1987 | 1508 | *151* | 9 | 6 | -227 |
| 1988 | 2257 | *226* | 659 | 292 | 423 |
| 1989 | 1561 | *156* | 20 | 13 | -216 |
| 1990 | 1858 | *186* | 106 | 57 | -130 |
| 1991 | 1864 | *186* | 282 | 151 | 46 |
| 1992 | 1829 | *183* | 36 | 20 | -200 |
| 1993 | 780 | *78* | 12 | 15 | -224 |
| 1994 | 3269 | *327* | 265 | 81 | 29 |
| 1995 | 1161 | *116* | 23 | 20 | -213 |
| 1996 | 2856 | *286* | 212 | 74 | -24 |
| 1997 | 1283 | *128* | 10 | 8 | -226 |
| 1998 | 1,760 | *176* | 101 | 57 | -135 |
| 1999 | 1,809 | *181* | 123 | 68 | -113 |
| 2000 | 2,437 | *244* | 950 | 390 | 714 |
| 2001 | 1,488 | *149* | 144 | 97 | -92 |
| 2002 | 1,415 | *142* | 112 | 79 | -124 |
| 2003 | 2,326 | *233* | 737 | 317 | 501 |
| 2004 | 1,455 | *146* | 18 | 12 | -218 |
| 2005 | 1,316 | *132* | 103 | 78 | -133 |
| 2006 | 2,311 | *231* | 1,047 | 453 | 811 |
| 2007 | 1,875 | *188* | 778 | 415 | 542 |
| 2008 | 1,388 | *139* | 167 | 120 | -69 |
| 2009 | 1,731 | *173* | 49 | 28 | -187 |
| 2010 | 1,050 | *105* | 57 | 54 | -179 |

A typo???

An idea we should look at?

# *THE LEARNING CURVE*

## FIVE LESSONS LEARNED AND EFFECTIVE PRACTICES
## WESTERN STATE FIRE MANAGERS
## AUGUST 2006 – 9 TH EDITION

***Insurance Policies and Suppression***

In Oregon, state law mandates that private landowners of forestland maintain responsibility for providing fire protection. These landowners pay the costs of basic fire protection on a local district budget basis to the Oregon Department of Forestry (ODF). This district assessment, charged per acre, covers prevention, detection, readiness and fire suppression through the extended attack stage.

***Lessons Learned:***

To cover the costs of fires that exceed the capacity of regularly budgeted resources, the landowners contribute funds to a statewide emergency fire fund which is further supplemented by State of Oregon general funds and a commercial insurance policy that currently adds another $25 million to the capacity of the emergency fire fund. Buying commercial insurance for emergency fire costs represents a practice unique to Oregon. The insurance, obtained through a broker, is provided by various companies from the world insurance market, with Lloyd's of London underwriting the largest share of the policy. The insurance premium is funded in a 50/50 partnership between forest landowners and the State of Oregon General Fund.

Once large fires occur, Oregon's citizens effectively receive immediate access to $50 million to fund fire suppression operations. Forest Landowners pay the first $15 million expended from the State's large fire suppression account, funded from a combination of acreage assessments, harvest tax, improved lot surcharges, interest earnings and fire cost reimbursements collected from parties responsible for prior fires. The State then pays the next $10 million of suppression costs. Together, these obligations represent the annual deductible portion of the State of Oregon's insurance policy. Once the deductible is met, $25 million in insurance becomes available through the insurance pool. If the $50 million fund is expended, the burden then falls back to Oregon's General Fund. Recently, the ODF increased the deductible to drive down the premium costs. The savings were used to reinvest in initial attack resources. ODF funded five helicopters and two heavy air tankers on a severity basis, and the costs to preposition crews and engines.