The Waldo Canyon Fire: Fires on the Colorado Front Range and Home Destruction

A Report to the Pike and San Isabel National Forests

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Background

I was ordered to the fire as a long-term fire analyst (LTAN) to support Harvey's Great Basin National Incident Management Team. I arrived that fateful evening of June 26th. An LTAN uses field intelligence, infrared imagery, historical and forecasted weather, terrain and fuel data, and fire models to predict fire growth days or weeks ahead. It was surreal returning to Colorado Springs. It had been ten years since I spent several weeks documenting home destruction on the Hayman Fire as part of a review. [1]

As I looked at climatology, modeled fire growth, and saw the home destruction from the ground and air, my mind kept going back to images, experiences, and stories from the Hayman Fire as well as two other reviews (Fourmile Canyon Fire[2] [Boulder, CO] and Grass Valley Fire[3] [Lake Arrowhead, CA]). A question kept coming to my mind: Have any of these publications made a difference in our approach to fire in the wildland-urban interface (WUI)? Are local and federal agencies and homeowners better informed, policies and practices modified, and more effective actions taken at the ground level, or do these publications just serve as historical narratives?

Purpose

The purpose of this white paper is to discuss fires on the Colorado Front Range and to share initial observations of fire behavior and home destruction during the Waldo Canyon Fire. It is my hope that these lessons and observations will be beneficial to agencies and especially the public. I want to share this information early when our feelings and experiences are near the surface; when many are rethinking and others rebuilding.

Lesson 1: Fires on the Front Range are often Large, Fast-moving, and an Inevitable Part of the Landscape

I think it is important that we put the Waldo Canyon Fire in proper context. Yes, it is one of the largest, most expensive, and destructive fires in Colorado's history. Indeed, Colorado Springs has not seen an event like this in recent memory. It evacuated 32,000 people and cost human lives. However, if you look at the Colorado Front Range as a whole, it was not epic or unprecedented; it was just in a new location. It is an all too familiar phenomena occurring across the Foothills—big, fast-moving fires quickly overwhelm local suppression resources resulting in a WUI fire disaster. Consider Table 1 and Figure 1; parts of which appear in the Fourmile Canyon Fire Report. They were developed by a colleague of mine, Chuck McHugh of the Missoula Fire Sciences Laboratory (firelab.org).

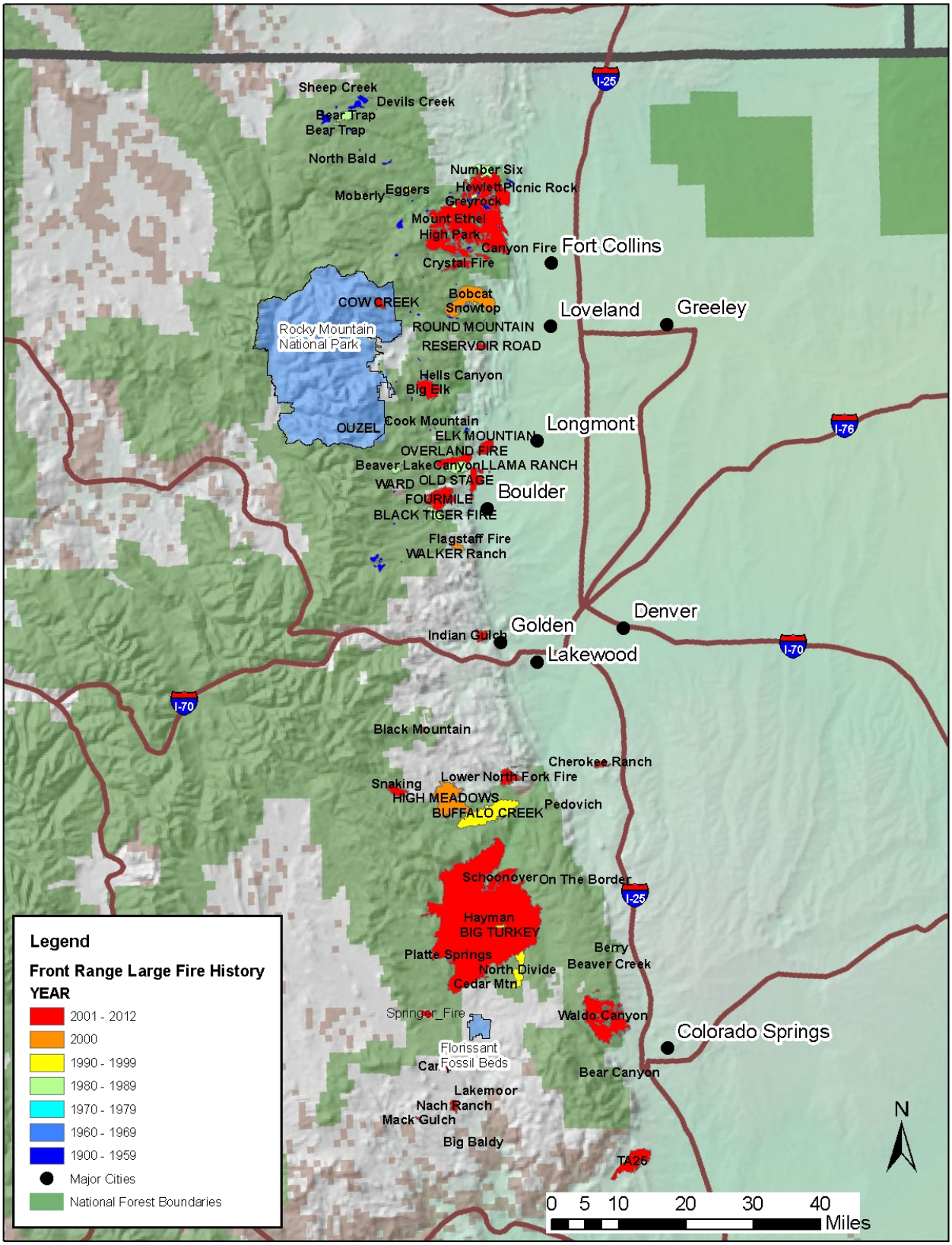
Table 1 (next page). Major wildfires that burned on federal, state and private lands throughout Colorado between 1976 and 2011. Original Source: http://csfs.colostate.edu/pdfs/fire_history.pdf. Additional fires were added by the Fourmile Canyon Fire review team.

Year	Month[a]	Fire Name	Cause	Size (Acres)	No. Homes Destroyed	Fatalities[b]
1976	July	Battlement Mesa	L	880	0	3
1978	September	Murphy Gulch	H	3,300	1 unoccupied home	0
1989	July	Black Tiger**	H	1,778	44 homes	0
1990	November	Olde Stage**	H	3,000	10 homes	0
1994	July	South Canyon	L	2,115	0	14
1994	July	Hourglass Fire	L	1,275	13 buildings	0
1996	May	Buffalo Creek*	H	12,000	10 homes	0
1999	June	Battlement Mesa	H	156	9 homes	0
2000	June	Hi Meadow*	H	10,800	51 homes	0
2000	June	Bobcat*	H	10,599	18 homes	0
2000	July	Bircher (Mesa Verde)	L	19,709	0	0
2001	October	Carter Lake/Armageddon	H	1,216	0	0
2002	April	Snaking*	H	2,590	0	0
2002	April	Cuerno Verde	H	388	2 homes	2
2002	May	Schoonover*	L	3,860	13 structures	0
2002	June	Trinidad Complex	L	32,896	0	0
2002	June	Iron Mountain	H	4,400	100+ cabins, etc	0
2002	June	Coal Seam	Coal Seam	12,209	29 homes	0
2002	June	Hayman*	H	137,760	133 homes	5
2002	June	Missionary Ridge	H	70,485	56 homes	1
2002	June	Miracle Complex	L	3,951	0	0
2002	June	Million	H	9,346	11 homes	0
2002	August	Mt. Zirkel Complex	L	31,016	0	0
2002	July	Big Elk*	H	4,413	0	3
2002	July	Big Fish	L	17,056	lodge & 7 cabins	0
2002	July	Long Mesa	L	2,601	3 homes	0
2002	July	Panorama	H	1,700	4 homes	0
2003	July	Brush Mountain	H	5,292	0	0
2003	October	Overland**	H	3,439	12 homes	0
2003	October	Cherokee Ranch	H	1,200	2 homes	0
2004	March	Picnic Rock*	H	8,908	1 home	0
2005	July	Mason	L	11,357	0	0
2006	January	Mauricio Canyon	H	3,825	0	0
2006	March	Yuma County	Power Lines	23,000	0	0
2006	June	Thomas	L	3,347	0	0
2006	June	Mato Vega	L	13,820	0	0
2009	January	Old Stage**	Power Lines	3,169	1 home	0
2010	September	Fourmile Canyon**	H	6,181	168 homes	0
2010	September	Reservoir Road*	H	754	2 homes	0
2011	April	Crystal*	H	2,940	13 homes	0

[a] Month of fire origin.
[b] All fatalities listed in this table are firefighters, air tanker, and helicopter pilots. Fatalities for the Hayman Fire are the result of an auto accident while en-route to the fire.
Cause: L (Lightning); H (Human).
* Fires located along the Front Range of Colorado 1976-2011.
** Fires located within Boulder County and along the Front Range of Colorado 1976-2011.

Now, add to the list significant fires from the 2012 season (includes civilian fatalities): Lower North Fork (human/4,140 ac/25 homes/3 fatalities); Hewlett (human, 7,685 ac/0 homes/0 fatalities); High Park (lightning/87,284 ac/259 homes/0 fatalities); Springer (human/1,145ac/0 homes/0 fatalities); Estes Park (Power Line/27 ac/22 homes/0 fatalities); Waldo Canyon (unknown/18,247 ac/346 homes/2 fatalities).

Figure 1. Colorado Front Range Fire History (1900 – 2012).



These fires are not only large and often destructive and deadly, but they exhibit rapid growth and can occur any time of the year, typically with high winds and low humidity. Table 2 outlines rates-of-spread on several large fires. After reading the tables and studying the figure, one should acknowledge a reality—large, fast-moving, fires are inevitable on the Colorado Front Range, especially in extreme weather and fuel conditions like 2002 and 2012.

Table 2. Large fires on the Colorado Front Range and their estimated speed and distance traveled.

Name	Date	Time (hrs)	Distance (mi)
High Park	June 2012	8	6
Buffalo Creek	May 1996	10	10
Black Tiger	July 1989	5.5	3
Waldo Canyon (Rampart Range Run)	June 2012	7	4
Hayman	June 2002	12	17
Fourmile Canyon	Sept 2010	10	4

Lesson 2: WUI Fire Disasters can be Avoided with an Understanding and Application of the HIZ

Although fires frequent the foothills of the Colorado Front Range, these fires do not have to become WUI fire disasters. Jack Cohen, a Research Physical Scientist with the Missoula Fire Lab, through laboratory and field experiments and destroyed home assessments, has shown that the home and its immediate surroundings (~100 ft.), constitute the home ignition zone[4/5] (HIZ). If we want to prevent these disasters, local and government agencies, organizations, and especially homeowners must recognize the WUI fire problem as a home ignition issue and understand how homes ignite in the HIZ. Through actions within the HIZ, homes can be made ignition resistant and withstand a high-intensity fire. Unfortunately, we tend to focus on the wildlands and less on the home—the reverse should be true.

Home destruction or survival ultimately comes down to combustion science—the availability of heat, fuel, and oxygen. “Homes ignite and burn during wildfires when the requirements for combustion…are sustained at one or more places on a home. If the requirements for combustion are not met, homes do not ignite and thus, do not burn. If homes do not burn during a wildfire then the WUI fire disaster does not occur. ” [2]

Forest fires do not move like Tsunamis—a wall(s) of water destroying everything in its path. As a fire moves into a subdivision homes are either fuel or a firebreak—the requirements for combustion determine the outcome. As you observe the burned area, focus on what remained, particularly the landscaping and wildland vegetation. You will see many cases where the vegetation was unburned, but the home was destroyed (i.e., the vegetation was more ignition resistant than the home and the tree canopies did not burn or ignite the homes).

Also keep in mind that homes are exposed multiple times in a wildfire (often in three phases). The HIZ must be designed with multiple exposures in mind—firebrands from the advancing flaming front, convective and radiant heat from the burning fuel, and post-frontal combustion (residual burning).

Lower Mountain Shadows

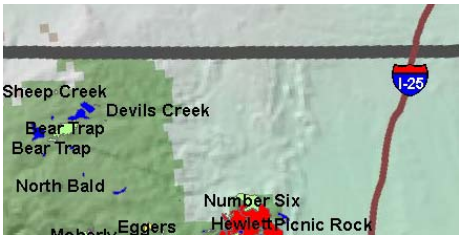
As I inspected home destruction in the lower portion of Mountain Shadows, several things were apparent. (1) Home destruction was largely house-to-house due to overlapping HIZs. Therefore, if a home was burning, the adjacent home had a shared HIZ and in turn was in jeopardy. Similar to dominos, the destruction sequence ceased only when the fuel was absent (e.g., a road or vacant lot) or suppression efforts were successful. This destruction sequence was channeled and intensified by the wind. (2) Homes with flammable wood roofs were a large target and receptive fuel for firebrands. In some cases these homes initiated the house-to-house destruction and extended the reach of the fire further into the subdivision through thermal exposure and the lofting of burning debris to adjacent homes and vegetation. (3) Firefighters were overwhelmed in their attempt to prevent the residential fire spread due to multiple homes burning simultaneously. However, more homes would have been burned without their intervention.

Upper Mountain Shadows

Homes farther up the hill are generally newer and spaced farther apart. Roofs are mostly tile or asphalt. Due to these two factors (non-ignitable roofs and separation distance), house-to-house destruction was lessened, but still evident (e.g., Brogans Bluff Dr.). One consistent way homes were ignited was from their decks that extended into the vegetated areas behind homes. These natural corridors ran parallel with the slope and acted as a fuse. Because the vegetation was part of the HIZ and the attached deck was part of the home, the fire made the transition to the home. Like lower Mountain Shadows, it was evident that firefighting efforts saved several homes.

Summary

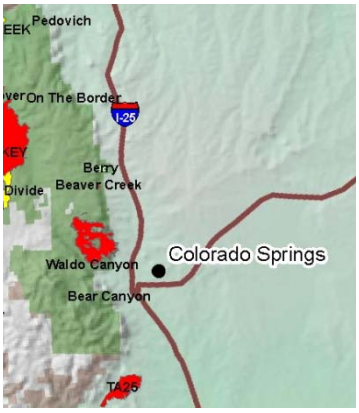
I hope this white paper and its resources will serve as a springboard for others to do more thorough study. Most importantly, I hope it will help individuals change the way we think about fire along the Foothills and home ignition from wildfires. Take another look at Figure 1 and ask yourself where the next large fire will occur. Fires on the Front Range are starting to fill the landscape, but there are still several areas where large fires could run unchecked for miles.



- North of Ft. Collins and the High Park Fire

- Between Loveland and Longmont

- North and south of Golden and Lakewood



- North and south of Colorado Springs and the Waldo Canyon Fire

Web Links

Below I have included a few links of photos and video. The first is a chronology of fire history on the Front Range by the Denver Post. Second, is a time lapse video of the Waldo Canyon Fire. Third, is raw video form Colorado Springs Fire Department on June 26th. Lastly, two videos describing the HIZ and home destruction associated with wildfires.

http://www.denverpost.com/ci_20753857/interactive-timeline-history-major-wildfires-colorado

http://youtu.be/ZBA7eHY022k

http://www.youtube.com/watch?v=joDHcJPqGws

http://www.fs.fed.us/rm/publications/titles/videos/wildfire.html

http://www.nfpa.org/catalog/search.asp?x=0&y=0&query=examining+home+destruction

References

(1) Cohen, J.D.; Stratton, R.D. 2003. Home destruction within the Hayman Fire perimeter. Hayman Fire Case Study. Gen. Tech. Rep. RMRS-GTR-114. Ogden, UT, U.S. Department of Agriculture, Forest Service, Rocky Mountain Research Station. 263-292. http://www.treesearch.fs.fed.us/pubs/28730

(2) Graham, R.; Finney, M.; McHugh, C.; Cohen, J.; Calkin, D.; Stratton, R.; Bradshaw, L.; Nikolov, N. 2012. Fourmile Canyon Fire Findings. Gen. Tech. Rep. RMRS-GTR-289. Ogden, UT, U.S. Department of Agriculture, Forest Service. http://www.fs.fed.us/rm/pubs/rmrs_gtr289.html

(3) Cohen, J. D.; Stratton, R. D. 2008. Home destruction examination: Grass Valley Fire. Technical Paper, R5-TP-026b, Vallejo, CA: USDA Forest Service, Region 5. 26 p. http://www.treesearch.fs.fed.us/pubs/31544

(4) Cohen, J.D. 2008. Wildfire: Preventing home ignitions. Video. U.S. Department of Agriculture, Forest Service, Rocky Mountain Research Station, Missoula Fire Sciences Laboratory, Missoula, MT. http://www.fs.fed.us/rm/publications/titles/videos/wildfire.html

(5) Cohen, Jack 2010. The wildland-urban interface fire problem. Fremontia. 38(2)-38(3): 16-22. http://www.fs.fed.us/rm/pubs_other/rmrs_2010_cohen_j002.pdF