Boulder County Community Wildfire Protection Plan
Appendices



Wildfire + *Unprepared* = *Disaster*



Management + *Community* = *Protection*

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Community Wildfire Protection Plan

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Boulder County

Community Wildfire Protection Plan

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Acknowledgements

In addition to all the Core Team, Citizen Advisory Team, and work group members listed in the report, we would like to thank the following individuals for their work to produce the plan:

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Appendix A: The Fourmile Fire

The September 2010 Fourmile Fire burned 6,181 acres and destroyed 169 homes. The following maps (Soil Burn Severity, Fire Progression, and Building Status) provide a visual representation of the Fourmile Fire burn area. These maps are one way to evaluate the damage caused by the fire.

Maps and numbers help us compare the relative size and damage caused by different fires. Number, however, can hide the numerous impacts associated with wildfire. These impacts are often profoundly personal. As a result, they are best communicated by stories and personal accounts rather than through statistics. To help everyone understand how the Fourmile Fire impacted this community, we have gathered a small sampling of writing from some of the individuals most affected by the fire and directed you to blogs, websites, and additional material where you can read about people and the fire in greater depth.

One of the best ways to begin to understand the impact the fire had on our community is to read the blogs of individuals who write about the fire. Andi O'Conor's blog, Burning Down the House: Essays on the Poetry of Loss, is an award winning site that provides rare insights on the true impacts of a catastrophic wildfire. The link is www.burningdownthehouseblog.com.

Several videos about the fire, highlighted throughout this plan, are available at www.bouldercountycwwp.org. The best way to learn about what it is like to live through a wildfire is to watch the stories of those of have experience it firsthand.

Four Mile on Fire, September 2010: A Tragic Loss, but for Hundreds a Miraculous Save is a publication produced by the Four Mile Fire Department. It is a scrapbook filled with photos, stories, and remembrances written by community members so their experiences may help others.

Both Marisha and Andi read their works at the University of Colorado Center for the American West's event, Words to Stir the Soul and Reckon with Reality: The Six Month Anniversary of the Fourmile Canyon Fire. All ten readings from this event are available on the Center's website, www.centerwest.org/fourmilefire.

The 2010 Fourmile Fire dramatically changed the lives of thousands of Boulder County residents. For these individuals and communities, wildfire protection is not just a task to put on their "To Do Lists;" it is now an integral part of their everyday routines. Everyone can learn from these profoundly personal experiences and take action outlined in this plan to help protect themselves and their community from future wildfires.

Home

By Marisha Evans

It is impossible to convey the true impacts of the Fourmile Fire, but the poem, Home, by 15-year-old Marisha Evans gives you a sense of the pain and agony it caused.

Home was
Peacefulness,
Happiness,
Patience.
Home was the comfort
of my mother's arms,
The sonorous resonance
of my father's voice,
The vibrant melodies
of my brother's cello as I fell asleep.
Home was the familiar smell
of home cooking.
Home was my mother's
Baking,
Roasting
Frying.
The glorious result
of her hard work.
Home was my father's
Fresh greens that filled the stomach
of our happiness.
Home was the laughter and family at all the holidays.
Home was old traditions shared with new friends.
Sharing,
Giving,
Receiving.
Our greatest reward was seeing a thankful face.
Home was souvenirs
and old family heirlooms
The rows on rows
of much loved books.
Home was the first flowers of spring.
The sweet smell filling our house.
The elderberry bush
whose first fruit was taken by the birds.
Home was the prickly pine needles
beneath my bare feet.
Running wild through the tall tress
of the mountain.
Freedom like the wind.

Home was the smell
of sticky pinesap on my fingers.
The feel of the garden dirt
between my toes.
Home was digging tunnels
through the deep snow.
Sipping hot cocoa by the fire
on cold winter nights.
Reading by candlelight
when the electricity failed.
Home was
Comfort,
Family,
Freedom.
The wind changed.
The fire burned.
I watched the smoke rise into the sky
Like a giant tree.
No familiar smell
of pine filled my nose.
The air reeked of smoke.
White ash fell from the sky
like the snow
from my memories.
There was no escape
from the smoke
that followed me like a dark cloud.
Fear gripped my heart.
Home was gone without a second glance.
Old memories coating my shoe
in white ash.
Pictures of my youth
Taken by the wind.

Appendix B: List of Online Recommendations for Boulder County's Community Wildfire Protection Plan

Number	Title	Committee
09-01	Community Wildfire Partnership	Collaboration
13-01	Land Use Coordination with Fire Districts	Collaboration
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06-02	Improved Communications	Preparedness and Prevention
06-03	Evacuation and Access Coordination	Preparedness and Prevention
07-01	Professional Fire Fighters	Preparedness and Prevention
09-02	Communication Reliability	Preparedness and Prevention
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01-02	Funding for Project Maintenance	Funding
01-03	Forest Improvement District	Funding
01-04	One Stop Shopping	Funding
02-01	Slash and Debris Pick Up Program	Homeowner Mitigation
04-06	Private Property Mitigation Support	Homeowner Mitigation
04-07	AmeriCorps for Wildfire Mitigation	Homeowner Mitigation
11-01	A Third Sort Yard Location	Homeowner Mitigation
04-01	Transportation and Firebreaks	Land Management
04-03	Protecting Rural Communities from Fire	Land Management
04-04	Protection of Critical Water Supplies	Land Management
04-05	Right-of-Way Mitigation Efforts	Land Management
14-01	USFS Policy of Fire Break Construction	Land Management
15-01	Fire Bans	Preparedness and Prevention
15-02	CDOT Sign	Education
15-03	Patrolling Public Lands	Preparedness and Prevention
15-04	Evacuation of Animals of Neighbors	Preparedness and Prevention
15-05	Preventing Tall Grass	Homeowner Mitigation
15-06	Insurance Limits	Preparedness and Prevention
15-07	Cell Service	Preparedness and Prevention
15-08	Number for Emergency Information	Preparedness and Prevention
15-09	Interagency Crew	Land Management
15-10	Facility for Interagency Crew	Land Management

Number	Title	Committee
15-12	Consolidation of Districts	Collaboration
15-13	Helicopter Program	Preparedness and Prevention
15-14	Equipment for Interagency Crew	Funding
15-15	Evaluation of Forestry Practices	Land Management
15-16	Utilization of Forest Products	Land Management

Appendix C: Complete Online Recommendations

Number: 09-01

Title: The Boulder County Community Wildfire Partnership

Issue Area: 09 Collaboration and Coordination

Audience: 28 Multiple agencies or groups

People Impacted: 300,000

Proposal Summary

Once the Boulder County Community Wildfire Protection Plan is complete, there needs to be a group that is responsible for coordination and implementation of the recommendations. There are a large number of organizations and individuals involved in community wildfire protection. This partnership would bring these organizations and individuals together to improve communications and coordination as well as support and momentum for wildfire protection activities.

Problem Addressed

There are a large number of government agencies (federal, state, and local) and non-governmental interests (community groups, non-profits, and individual residents)invovled in wildfire protection. If these groups don't coordinate their efforts, they will not be efficient or effective. The community wildfire protection plan will contain a large number of recommendations. Many of these recommendations will not be implemented unless there is some entity that is responsible for follow up. If government agencies don't engage community partners in their work, they will struggle.

Costs

The members of the partnerships would be required to make a time commitment (time is money). Assembling, staffing, supporting, and/or facilitating the partnership would require resources.

Advantages

There would be a permanent, highly visible, credible group that would bring all the key players together to implement the CWPP and perform other tasks. Communication, coordination, and collaboration would improve. More work would get done and more recommendations would be implemented. Relationships between participating organizations would also improve.

Disadvantages

Everyone is busy. Some may not have time to participate. The group may hit some rough patches--internal conflicts, disagreements on what to do. The group may have difficult sustaining itself if a stable funding source is not found.

Number: 13-01

Title: Land Use Coordination with Fire Protection Districts (FPDs)

Issue Area: 13 Land Use Planning, Growth and Management

Audience: 28 Multiple agencies or groups

People Impacted:

Proposal Summary:

Modify current practice to increase coordination of Land Use process with local FPDs in a systematic way. New practice will include ensuring all agencies are aware of the decision-making milestones in the Land Use process. It will involve FPDs earlier in the process. Finally, to the extent possible, Land Use mechanisms, such as creating requirements through the Land Use review to ensure maintenance of approved driveway designs, will be put in place to support the FPD efforts.

Problem Addressed:

1. Ensure FPD input is received in a timely manner and incorporated into Land Use determinations.
2. Ensure FPDs are aware that their referrals are granted equal weight in the Land Use process.
3. Support FPD efforts to the extent possible in the Land Use process.

Costs:

The costs would consist of salaries for the staff involved in research and development of the new policies.

Advantages:

1. FPD input improves the decisions made through the Land Use docket review process.
2. The Land Use process can assist in furthering FPD goals.

Disadvantages:

1. The impact of this policy is limited to new construction and major remodels.
2. The effectiveness of this policy is limited by legal constraints on Land Use Dept. authority.

Number: 09-03

Title: Fire Protection District (FPD) Ombudsman

Issue Area: 09 Collaboration and Coordination

Audience: 28 Multiple agencies or groups

People Impacted:

Proposal Summary:

Create an ombudsman position at the county to act as an intermediary between the county and the various FPDs. Tasks would include identifying ways in which the county can support FPD goals, facilitating the implementation of FPD plans, and forwarding local CWPP recommendations. This person would also ensure communications between the various FPDs and between the county and the FPDs were appropriately coordinated. Individual CWPPs would also be coordinated.

Problem Addressed:

Having a person work in this capacity would facilitate the relationship between the county and the various FPDs and provide a mechanism to move FPD goals forward. An official point of contact would ensure consistent communication between parties internal and external to the county. An example of internal communication would be to ensure that the Transportation Department would be aware of, and concurred with, transportation-related recommendations in local CWPPs.

Costs:

The costs would include the salary for a new position. Possibly, all the FPDs could contribute to the funding of the position so that the entire financial burden did not fall to the county.

Advantages:

1. Provides potential for partnership to achieve FPD goals.
2. Ensures consistent communication between parties internal and external to the county.
3. Strengthen relationship between county and FPDs.

Disadvantages:

1. County financial resources are limited and the county may not be able to fulfill frequent and/or large requests for financial support.

Number: 09-04

Title: GIS/GPS Data Support to Fire Protection Districts (FPDs)

Issue Area: 09 Collaboration and Coordination

Audience: 28 Multiple agencies or groups

People Impacted:

Proposal Summary:

Develop a process where county can share GIS/GPS datasets and related mountain addressing information with mountain FPDs. The Boulder County GIS Strategy Team will review the proposal and identify and draw on the appropriate county resources.

Problem Addressed:

1. In the name of collaboration, it makes sense to share information with relevant agencies whenever possible.

Costs:

There would be salary costs to the county for staff to assemble datasets. There could also be capital and training costs to the FPDs for the hardware and software required to use the information from the county.

Advantages:

1. Commercial GIS datasets can be costly as can acquisition of GPS data and its consequent conversion to GIS data.
2. GIS data is helpful to FPDs when revising local CWPPs and.
3. Provision of information from a common data source guarantees consistency in data and methodology to all FPDs.
4. Fewer interagency mistakes and miscommunications occur when all agencies are using the same data. It is a near certainty that data from multiple sources will be inconsistent.
5. County GIS data can be shared under a data sharing agreement.

Disadvantages:

1. FPDs may not have the ArcGIS software and expertise to work with this data.
2. This project would be an additional burden to the county GIS workforce which is already strained.

Number: 12-01

Title: Boulder County Wildfire Protection Day

Issue Area: 12 Public Education and Outreach

Audience: 20 Boulder County Board of County Commissioners

People Impacted: 1,000

Proposal Summary

Declare Labor Day Boulder County Wildfire Protection Day. Organize community-oriented mitigation events and activities on this day. Make it an annual event.

Problem Addressed

People can quickly forget and easily ignore the risk wildfire poses in this community. An annual event will help bring attention and awareness to this issue. Volunteer programs can complete substantial amounts of work and help reduce wildfire risk.

Costs

Marketing, advertising, organizing, and coordinating would require time and efforts by a large number of people. The bigger the budget such an event could secure, the greater impact it could have.

Advantages

Raising awareness is key. Giving people an easy and meaningful way to volunteer their time is also helpful. Linking the event of the day the Fourmile Fire started would increase its impact.

Disadvantages

Events like this take a great deal of time to organize.

Number 12-02

Title: Public Education Outreach

Issue Area: 12 Public Education and Outreach

Audience: 16 County Resident

People Impacted: Half the county

Proposal Summary

Trained presenters will prioritize and target already-constituted groups (such as residents in the Volunteer Fire Dept. Protection Districts, businesses, whatever organizations are most appropriate in a given area of the county or county-wide, eg. realtors associations, Chamber of Commerce, BVSD, etc.), give presentations and/or educational workshops focused on garnering public support for prescribed burns and fire mitigation. The material will be presented in terms of the needs and interests of the specific audience, assessed beforehand, during the talk if need be, and in the question and answer period (eg. property values, safety and security, community, meaning, irrigation, larger questions of climate and beetles, etc.). Q and A should be as long as needed. The presentation will likely draw upon the work of all or most of the CWPP committees and fire history. Further, the CWPP presentation reps. will detail (via adapted FireWise and other recommendations) exactly how individuals and neighborhoods can work together to mitigate, self-lead, and share best practices with other neighborhoods and how they can initiate and sustain this yearly process. (We will have worked the details out in our committee meetings.) Media (local newspapers, social media, video/CD, internet should be used to advantage and both grassroots and leader-targeting approaches used.)

Problem Addressed

The imminence of wildland fire is not on the public's radar. The general public does not understand that fire is a part of the ecosystem. This idea seeks to put fire on the public radar and keep it there, to garner strong public support (which requires, first, understanding)for prescribed burns in the WUI and even possibly on Boulder County Ag-leased land (to be discussed in our meetings), and competent public action in terms of home and business mitigation (eg. for those in the WUI). It seeks to educate the public on our place here and now in fire history and how critical our conscious participation is in this process.

Costs

Depends on the scope of the outreach. Ideally, we would pay presenters. Experienced firefighters are often fantastic presenters, have given countless volunteer hours, and need to be paid. We could have a mix of volunteer and paid. Costs need to be discussed in committee meetings.

Advantages

A fire-educated public is a necessity for resident buy-in for public policy with respect to prescribed burns, homeowner mitigation, fire mgmt., and reducing the crushing public debt of fighting wildland fires.

Disadvantages

Reaching a critical mass of residents will entail much time and therefore necessarily expense at a time when budgets are very lean and volunteers less available because of economically strained times.

Number: 12-03

Title: Wildfire Danger Signs

Issue Area: 12 Public Education and Outreach

Audience: 16 County Resident

People Impacted: Hundreds in each community

Proposal Summary

Installation of new Wildfire Danger signs. Installation of information signs about various wildfires.

Problem Addressed

Existing wildfire danger signs in many areas of Boulder County are old and faded and need to be replaced. Some areas don't even have wildfire danger signs. Additional wildfire information signs should be installed that describe various wildfire events (such as the recent fourmile fire). This would help increase public knowledge, especailly in the future when the burn area begins to heal. People new to the area should be made aware of past wildfire events to prepare for future ones.

Costs

New signs could cost $250 - $500 or more to purchase and install. Some time also needs to be spent obtaining permission to install the signs in key areas in the community, especially if private property is involved.

Advantages

New information signs and fire danger signs are more likely to get peoples attention and show that there is interest in the subject than the old faded ones. Information kiosks could also present information about forest management projects, pine beetles, and other items of community interest.

Disadvantages

More signs are likely to be ignored if not put in key locations where people can stop and read. More signs don't necessarily mean people will get the information, especailly road signs people drive past. Wildfire Danger signs must also be continually updated to stay current. A sign whose rating never changes doesn't encourage people to pay attention to it, and in fact encourages them to ignore it.

Number: 12-04

Title: Electronic Fire Danger Signs

Issue Area: 12 Public Education and Outreach

Audience: 16 County Resident

People Impacted:

Proposal Summary

Develop electronic access to daily local fire weather/danger information. This information can be distributed electronically on web pages, new fire danger signs and by links to appropriate web sites from agencies that post current fire weather/danger information (from Allenspark CWPP; more information is available from this document).

Problem Addressed

Current fire danger signs must be changed manually. On some occasions, these signs are not updated regularly.

Costs

Unknown

Advantages

Information would be made available on a more timely basis.

Disadvantages

Cost

Number: 14-02

Title: Sale of Local Firewood

Issue Area: 14 Public Land Management

Audience: 26 Private, for-profit corporations

People Impacted:

Proposal Summary

Launch a campaign to persuade all businesses in Boulder County that sell firewood to use local sources.

Problem Addressed

To reduce treatment costs and generate revenue, it is important to develop local markets for forest products. The sale of firewood is one of these uses. For example, the firewood Home Depot currently sells does not come from Boulder County. We need a citizen's campaign to get Home Depot and others to sell only Boulder County firewood.

Costs

The main cost would be the time and effort of volunteer activists.

Advantages

The campaign could help educate people on the need to develop local markets for wood products.

Disadvantages

Getting larger corporations to switch practices may be difficult.

Number: 06-01

Title: Early Warning System

Issue Area: 06 Evacuation Procedures and Planning

Audience: 29 Multiple agencies or groups

People Impacted: I believe more people would have gotten out with some belongings.

Proposal Summary

In the September fire, I did not receive notification (either by reverse 911 NOR county door to door NOR any other official means). At about 11:30 the morning of September 6, the power went out meaning communications were severed. At that time there was NO information on the internet about a wildfire threatening 4 mile canyon. After that time, communications were cut off. I believe there need to be many ways for word to spread in the event that any one, or several (as in this specific case) channels fail. For instance, a simple phone tree, bell or other alarm system might be effective were other channels are not.

Problem Addressed

Letting people know that there is an actual emergency when normal channels fail.

Costs

I believe there are low cost solutions. I think the failure of the reverse 911 system on the day of September 6 should be researched and answers for the future produced.

Advantages

In these cases, with the total chaos unfolding, it would be wise to have multiple channels of communication open...this could be a fire truck with a loudspeaker, person to person networks and phone trees... I am sure research into other fire prone areas will give us further ideas.

Disadvantages

Can you have too much communication? Having backup channels is common sense.

Number: 06-02

Title: Improved Communications

Issue Area: 06 Evacuation Procedures and Planning

Audience: 28 Multiple agencies or groups

People Impacted: There are hundreds of households without cell service in the foothills.

Proposal Summary

Mountain residents need cell phone service for emergencies, reverse 911 calls, etc. And they need a better source for up-to-the-moment information during emergencies.

Problem Addressed

Many foothill residents do not have cell service. When power is disrupted (as it was twice this fall during the Four Mile and Dome fires) wireless land lines do not work. And when the phone lines are down (as during the Dome fire), even old land line phones are not operational. This leaves us with no form of sending or receiving communication, including reverse 911 calls or the ability to connect with emergency websites. Also, local emergency services should provide radio information on the current status of emergencies -- a frequency that could be reached by standard battery-operated commercial radios. We should not have to depend on infrequent reports from Denver or Boulder radio stations.

Costs

This is obviously a phone provider (AT&T, Verizon, etc.) issue. Local officials -- sheriff, county, fire departments, etc. -- need to put pressure on the cell phone providers to provide service. Thus, cost should be minimal. I have no idea what the cost would be for radio information.

Advantages

Good communication is essential during emergencies and many of us lacked access to current, reliable information during the recent fires.

Disadvantages

I see no disadvantages to cell service in the mountains. Perhaps there would be better ways to obtain information than through radios. I don't know. But if we had cell service, at least we could phone for information from local officials.

Number: 06-03

Title: Evacuation Route and Fire Access Road Coordination

Issue Area: 06 Evacuation Procedures and Planning

Audience: 29 Multiple agencies or groups

People Impacted:

Proposal Summary:

Develop a process in which the county coordinates with the various FPDs to evaluate and identify viable evacuation routes and fire access roads throughout the county. Additionally, the county would work with the FPDs to install appropriate signage on county roads that are part of an evacuation route.

Problem Addressed:

4. Currently, there is not agreement about the location and viability of evacuation routes and fire access roads.
5. During a fire, motorists could use roads that carries them into an area of danger rather than away.
6. Responsibility for maintenance of evacuation routes and fire access roads would be determined.

Costs:

Salary costs would include research to determine rights-of-way ownership. Other costs may include improvements to, maintenance of, and signing of evacuation routes.

Advantages:

1. Develop common agreement as to the location and viability of evacuation routes and fire access roads.
2. Placing route information on county roads would assist residents in evacuating an area during a fire.

Disadvantages:

3. Agreement may be difficult.

Number: 07-01

Title: A Safer Mountain Supported by Professional Fire Fighters

Issue Area: 07 Emergency Preparedness and Firefighting Capabilities

Audience: 24 Fire Protection Districts

People Impacted: the entire mountain community

Proposal Summary

It is simple. I am very interested and prepared to help lead the way as an advisor to make change that relates to a safer mountain. As noted in my comments to the press and interest for all.

Problem Addressed

We need to have a professional fire fighting team and not rely on a volunteer fire department. They should be the second line of action. In addition, the prehistoric equipment needs to be replaced if we are ever to have a fighting chance against the next perfect storm. Yes my house was lost because the pre WWII bombers could not fly in over 30mph winds. A sorry joke.

Costs

To be analyzed and with source support. I have a list of companies and ideas on where the funding should come from.

Advantages

I am not only a victim but have years of experience on how to develop cause-related campaigns. Most of all I am a big advocate of the Boulder Mountain community who wants a safe environment to live in.

Disadvantages

The only weakness is if my passion and interest goes to deaf ears. We have an extraordinary opportunity to make change. Now let’s do it.

Number: 09-02

Title: Communication Reliability During Wildfires

Issue Area: 09 Collaboration and Coordination

Audience: 16 County Resident

People Impacted: About 35 homes in Spring Valley lost communication during the Fourmile fire.

Proposal Summary

Provide county residents in fire areas, a way to obtain fire status info on demand, when commercial wired communication channels are broken. I don't think it's reasonable for people to be relying on devices which use commercial power and/or commercial communication links over overhead wires strung in fire areas, for their emergency communication needs. Cell phones seem like the easiest approach and most people have one; you should advise residents in fire-danger areas to have a cell-phone that is kept charged, for emergency reasons. Yes, I know you can sign up on boulder OEM to get phone calls pushed to your phone number, but I'd like to see you implement a system that would allow cell-phone users to get emergency information on demand. I think it would be very useful for you to offer a dial-in information service. Cell phone users could dial a number, and hear the messages that are posted on boulderoem.org, spoken in reverse order, or maybe even a menu of choices for the messages issued in the past 24 hours. Of course, I also realize that there are parts of fire-danger areas that do not have cell service. However, I don't see that the county can afford to solve this problem some other way. Perhaps you should advise people who live deeply in fire areas, to have battery powered communication devices that support satellite links. Expensive, of course, but it seems to me that people who wish to live out of cell-phone coverage areas, should figure the expense of emergency communication into their living expense. (The only other possible alternative is to use a local radio station to broadcast continuous status, but radio has the same coverage problem as cell-phones in mountain areas.)

Problem Addressed

There was a communication problem that occurred in Spring Valley during the Fourmile fire. Many of my neighbors had signed up with Comcast for internet/TV, and some had also put their phone service on Comcast IP. Unfortunately Comcast had decided to put their feed point for Spring Valley up the hill in Pinebrook, which went dead when Xcel turned off power to Pinebrook. So obviously, nobody should be depending on corporations for emergency information, as reliability in emergency situations is their last priority.

Costs

The cost of implementation would be (1) providing a rotary of a few lines where cell-phone users could call to pull current information, and (2) providing a computer system behind this rotary that could turn the content of boulderoem.org into spoken audio. I have no idea what that would cost.

Advantages

When residents of fire areas lose their twisted-pair DSL or internet cable service, they have no way to get information from boulderoem.org on demand, as they need it.

Disadvantages

It has a cost. The only other way to do this is to put the cost on residents of fire areas, by notifying them that they are responsible for having battery-powered satellite access that could get them on the internet to boulderoem.org, even when they are outside cell-phone signal coverage.

Number: 01-01

Title: Reduce subsidies to owners of high-risk properties

Issue Area: 01 Funding for Wildfire Protection

Audience: 20 Boulder County Board of County Commissioners

People Impacted: 300000 people (as well as the whole US)

Proposal Summary

People living in high-risk areas for fire should pay their own way for fire suppression efforts that are directed at property and would not be done otherwise. Perhaps something like requiring flood insurance for high-risk properties.

Problem Addressed

Patty Limerick is right in her "fire alarm" article: "Of all the people who did not have to pay up front for the full cost of producing the goods they wanted, the owners of exurban residences may well lead the pack." In Aug 2008, U.S. Forest Service Chief Abigail Kimbell declared that “spending on fires could reach $1.6 billion this year, about half the agency’s budget."

Costs

This saves money for the general public.

Advantages

This would reduce the subsidy to owners of high-risk properties and allow the funds to be used for more appropriate needs (like improving ecosystem health), or to reduce taxes.

Disadvantages

A rapid change in expectations could cause unnecessary disruptions, so it might make sense to phase the requirement in over time.

Number: 01-02

Title: Funding for Project Maintenance

Issue Area: 01 Funding for Wildfire Protection

Audience: 28 Multiple agencies or groups

People Impacted: Everyone

Proposal Summary

Every 10th year, all project funds in the county should be used to conduct maintenance of past projects. No new projects would be implemented. (Also could somehow create a maintenance fund for this work.)

Problem Addressed

Funding is focused on new projects. Funders want to support new projects; they do not want to fund the maintenance of past projects. There are other incentives that direct organizations to new projects rather than maintenance.

Costs

No new costs--just a change of priorities.

Advantages

Treatments lose their effectiveness over time. Priorty should be give to maintaining past projects so that past investments are protected. It is often cheaper to maintain existing projects than undertake new ones. Although maintenance may not be as exciting as starting something new; it is a practical, common sense approach.

Disadvantages

Funders set their priorities internally; they may be very difficult to change or influence.

Number: 01-03

Title: Forest Improvement District

Issue Area: 01 Funding for Wildfire Protection

Audience: 20 Boulder County Board of County Commissioners

People Impacted: entire county

Proposal Summary

The Board of County Commissioners should enact a resolution, and submit the question to voters, creating a Forest Improvement District in Boulder County. If approved, the district would levy a sales tax and the funds generated would be used to support wildfire mitigation efforts identified by the Advisory Team.

Problem Addressed

There are many projects and initiatives required to reduce the risk of wildfire in the county. Lack of funding is a major obstacle to undertaking these efforts. Another local funding source is needed to complement resources from individuals and federal and state government sources.

Costs

A campaign to support the ballot initiative would require both human and financial resources. The more resources devoted to this effort, the greater the proposals chance of success would be. Staff support from the Commissioners' Office would be required.

Advantages

If passed, the District would provide funding for a number of important efforts.

Disadvantages

If the ballot initiative failed, the funding would not materialize.

Number: 01-04

Title: One Stop Shopping

Issue Area: 01 Funding for Wildfire Protection

Audience: 28 Multiple agencies or groups

People Impacted: entire mountain community

Proposal Summary

Create a central place for all grant funded wildfire activity. All funders and all applicants would make use of this service. House the central, one-stop shopping location at the CSFS. Hire a grant writer/coordinator to staff it.

Problem Addressed

There are a number of different funding sources for mitigation work with different deadlines, requirements, and needs. It is hard for all the different players to know what funding is available. All the different deadlines add to everyone's workload. One stop shopping would increase efficiency and effectiveness.

Costs

Need to fund someone to do this work.

Advantages

If everyone had to submit their project proposals one time a year, there would be increased coordination and communications and there would be less stress and running around at the last minute trying to put proposals together.

Disadvantages

Having a common grant application date may make some proposals out-of-date by the end of the year.

Number: 02-01

Title: Slash and Debris Pick Up Program

Issue Area: 02 Defensible Space for Individual Homes

Audience: 26 Private, for-profit organizations

People Impacted: 1000

Proposal Summary

Create a slash and debris pickup program for high wildfire hazard areas in the county. The program could charge a reasonable fee and be subsidized with government grants. The program could be awarded to a private tree care and/or waste management company through a contract.

Problem Addressed

Some homeowners need an additional incentive to create defensible space. Providing inexpensive pickup services would be one of the most effective and efficient ways to promote defensible space work.

Costs

Government grant funding or some other funding sources would be needed to subsidize this program.

Advantages

Creating defensible space is one of the most important mitigation activities. The more people that do it, the more homes that will be saved. Paying for all the costs of defensible space work would be extremely expensive and in not necessarily appropriate. Providing some subsidy for one of the key aspects of this work would limit costs and potenitally encourage a large number of people to act.

Disadvantages

Finding funding to support this effort would require some work.

Number: 04-06

Title: Private Property Mitigation Support

Issue Area: 04 Community Mitigation Efforts

Audience: 28 Multiple agencies or groups

People Impacted:

Proposal Summary:

Support and expand FPD programs to assist property owners in fire mitigation efforts on private property. Support and expansion of existing programs may include facilitating education efforts regarding the need for fire mitigation, how to proceed with mitigation and the importance of maintaining emergency accesses. It may also include the pursuit of grants to fund mitigation on private property, the maintenance of sort yards and the development of additional programs.

Problem Addressed:

7. Local FPDs spend time and money to support property owners in mitigating wildfire risks on private property, however, funds are limited and there is always more to do with fire mitigation efforts than there are resources to support it.

Costs:

This program would require ongoing commitment and annual funding to be effective.

Advantages:

3. The county has many opportunities to provide information to the public throughout the year, i.e., when license plates are renewed, when property assessments are mailed, when a building or septic system permit is applied for, etc. These are opportunities to disseminate information and to educate.
4. The county can assist in the pursuit of grants.
5. The county can provide sort yards.

Disadvantages:

4. An ongoing program could be expensive.

Number: 04-07

Title: AmeriCorp Volunteers to Support Wildfire Mitigation

Issue Area: 04 Community Mitigation Efforts

Audience: 16 County Resident

People Impacted: 1,000

Proposal Summary

Establish a program to use AmeriCorps volunteer to support community mitigation efforts and other wildfire-related projects in Boulder County.

Problem Addressed

In order to conduct community mitigation projects, someone needs to do the leg work--help organize the community, coordinate activities, and follow up on various tasks. Individuals from fire protection districts and homeowners associations often do this work. However, sometimes these organizations lack the volunteers, or capacity to do all the work that is needed. AmeriCorps Volunteers work in community doing these types of tasks. They could supplement the existing capacity in a community so that more projects (activities) could be completed on the ground.

Costs

Supporting volunteers would require some resources.

Advantages

This would be a relatively low cost way to get people to perform this work.

Disadvantages

Training and experience of these individuals would be limited. The individuals may come from outside the community.

Number: 11-01

Title: A Third Sort Yard Location

Issue Area: 11 Forest Health, Management, and Pine Beetles

Audience: 22 Boulder County Parks and Open Space Department

People Impacted: 2,000

Proposal Summary

The county currently operates two sort yards--alternating between Nederland and Meeker Park. These sort yards are a critical, effective, and popular component of wildfire mitigation efforts. A third sort yard is needed to support landowner efforts in lower elevations.

Problem Addressed

Landowners who perform mitigation work need a place to take their slash. An additional sort yard strategically placed would address this problem.

Costs

Sort yards are expensive to locate, equip, and operate. Funding for this idea would need to be identified.

Advantages

Instead of providing funding to work on a relatively small number of properties, public funding should be used on programs that benefit a large number of residents and meet a clearly identified need. The biggest advantage of another sort yard is that it will help encourage people who want to do work to follow through and get it done.

Disadvantages

The cost of the yard is substantial. Finding an appropriate site is also a huge challenge. This may be a service that the private sector should provide.

Number: 04-01

Title: Transportation and Firebreaks

Issue Area: 04 Community Mitigation Efforts

Audience: 28 Multiple agencies or groups

People Impacted: everyone that lives in, drives in, or looks at the mountains

Proposal Summary

The wildland urban interface in Boulder County (and anywhere) needs to be planned with an eye to 1) safe travel routes for evacuation and firefighting access, 2) vegetative variation to effect firebreaks which will tend to limit wildfire spread.

Problem Addressed

Public roads are not designed to provide alternate escape routes and non-unique firefighting access. Public lands maintenance is not targeted to provide and coordinate with other efforts to locate firebreaks where they will do the most good.

Costs

Substantial ... both road and forest maintenance, public and private, are ongoing costs that need to be borne for the ongoing health of the community and the local ecology.

Advantages

To keep the fire risk reduction effort in the public eye, it needs to be an ongoing program, with public and private lands involved, and efforts required from everyone affected. A continuous forest canopy is as much an invitation to disaster as a long narrow dead-end access road. There need to be standards and clear goals.

Disadvantages

It's huge, ongoing, unending. This is no magic bullet.

Number: 04-03

Title: Protecting Rural County Communities from Fire

Issue Area: 04 Community Mitigation Efforts

Audience: 20 Boulder County Board of County Commissioners

People Impacted: 50K?

Proposal Summary

Fighting fires in older County neighborhoods will continue to be difficult, because structures are old and flammable, water sources are limited, access and "space-between" less than ideal, and much of the existing community landscape in built areas is considered "critical screening" to be preserved. Therefore, undeveloped lands around rural communities should be improved to optimally fight fires so these threats don't reach into developed communities. This would involve several changes for undeveloped public and private lands, including improved emergency access, regarding and establishing water sources as appropriate, and thinning of natural vegetation. Public open space should lead the way in necessary land improvements, widening trails to allow emergency access, for example.

Problem Addressed

Successful firefighting is difficult or impossible within older, compact, rural County communities. Better to prepare the surrounding landscape and to fight fires in undeveloped areas outside of these communities.

Costs

Initial and ongoing costs involved. Should become a priority in current open space and fire district operating budgets. Will require consulting assist to mediate between competing open space interests and capitol-maintenance priorities. Could be partially funded by new development fees.

Advantages

The wildfire mitigation investment in landscapes surrounding old communities will ultimately save personal property and infrastructure assets, limit the impacts of future fire events, and enhance quality of life in the County.

Disadvantages

Requires a unified effort between County-City departments with separate agendas (Open Space, etc), Fire Districts, and Local-State-Fed land jurisdictions.

Number: 04-04

Title: Identification and protection of critical water supplies

Issue Area: 04 Community Mitigation Efforts

Audience: 28 Multiple agencies or groups

People Impacted: Populations of the cities of Boulder, Louisville, Lafayette, Longmont, and Lyons that rely on Boulder County source water areas; populations in Denver that use water stored in Gross Reservoir.

Proposal Summary

I strongly suggest that the Boulder County CWPP include a process by which critical water supplies are identified and protected from the consequences of high severity wildfire. A method to help prioritize watersheds that provide or convey water for communities and municipalities was developed by a multi-agency group. This prioritization will enhance existing schemes for ranking fuel reduction projects and help identify where pre-fire measures can help protect water supplies. A description of this method can be found on the Colorado Department of Public Health and Environment website, "Wildfire and Watershed assessment", http://www.cdphe.state.co.us/wq/sw/swap/wildfire_protection.htm Furthermore, we should adopt the principles described in a Watershed Wildfire Protection Plan (also called a Critical Community Watershed Wildfire Protection Plan). Please contact Joseph Duda, Colorado State Forest Service, t. (970) 491-6303, joseph.duda@colostate.edu, for additional information about this approach.

Problem Addressed

In Colorado we have experienced significant downstream effects on water supplies after major wildfires like the 1996 Buffalo Creek Fire and 2002 Hayman Fire. These effects included increased sediment transport, leading to the diminishment of reservoir capacity, and a variety of chemical effects in both the dissolved and particulate phase. For example, after the Buffalo Creek Fire Strontia Springs Reservoir experienced elevated levels of manganese that increased treatment costs. Research has shown that the conditions created by higher severity wildfires are most likely to lead to post-fire flooding and erosion. The first step in protecting water supplies from the threats of severe wildfire is to identify which watersheds are essential to the operation of public water supplies and are most susceptible to post-fire erosion. Even in cases where fuel management options are limited (for example in wilderness areas), knowing the susceptibility of a watershed to post-fire erosion and its water use ranking can help us plan water protection measures before fires burn through our watersheds. This approach has already being used in Grand County, which as a result of trans-basin diversions of water from the Western Slope, contributes to our water supply here in Boulder County.

Costs

Water providers in Boulder County may have already completed an assessment of critical water supply watersheds. Therefore, I think the additional cost to include the identification of critical water source areas and conveyances in Boulder County's CWPP should be minimal, perhaps $10000 or less. This first step is the identification of the most critical water resources, and a method for ranking the importance of those resources to small communities and municipalities.

Advantages

Water is one of our most scarce resources and we should do all that we can to protect our water supplies.

Disadvantages

There have been cases where, despite our best efforts, water supplies are severely impacted by post-fire consequences. Yet our best defense is to identify ahead of time what the range of potential impacts might be on our watersheds and water supplies. This includes understanding the magnitude, duration, and form of the expected impact. I would further advocate that we need to be thinking ahead to understand the potential impacts of climate change on wildfires and the post-fire response.

Number: 04-05

Title: Right-of-Way Mitigation Efforts

Issue Area: 04 Community Mitigation Efforts

Audience: 20 Boulder County Board of County Commissioners

Proposal Summary:

Boulder County would conduct an assessment to identify fire risk hazards in the county rights-of-way and develop a plan to address them. The assessment would include specific recommendations to reduce the risk of ignition, reduce the spread of fire, and address impediments to prompt emergency response, such as substandard bridges. Recommendations may include projects such as tree thinning in the right-of-way and developing an inventory of substandard bridges and minor structures.

Problem Addressed:

When mitigation efforts are not conducted on county rights-of-way and infrastructure, opportunities to contain fires are lost and the rights-of-way and infrastructure may become barriers to fire suppression efforts.

Costs:

This program would require ongoing commitment and annual funding to be effective.

Advantages:

6. The geometry of county rights-of-way exist in such a manner as to create the opportunity to easily plan and create fire breaks since they are owned by one entity.
7. Advance information regarding substandard infrastructure gives FPDs the opportunity to develop contingency plans and helps the county identify structures to include in its bridge and minor structures rehabilitation program.

Disadvantages:

5. An ongoing program could be expensive and would divert funds from other projects.
6. There are instances where right-of-way ownership, width and alignment are uncertain and considerable survey work may be necessary.

Number: **14-01**

Title: USFS Policy on Fire Break Construction where County/USFS overlap.

Issue Area: 14 Public Land Management

Audience: 17 Boulder Ranger District, Arapahoe and Roosevelt National Forest, USFS

People Impacted: 3000

Proposal Summary:

Fire Breaks: It should be made significantly easier to obtain approval from USFS to construct Fire Breaks on USFS land.

Problem Addressed:

It is exceedingly difficult, if not impossible, to obtain approval for Fire Break construction on USFS land.

Costs:

This is a permissions issue, not request for hand-outs. USFS and County would incur administrative costs for managing requests, approvals, and follow-through.

Advantages:

Fire Breaks are a keystone of successful wildfire suppression, as they not only reduce available fuels, but also provide highly visible and profitable targets for air support. The Fourmile fire and the Dome Fire demonstrated that air support is the PRIMARY means of stopping wildfire, not ground crews. The only reason Fourmile's northern burn area boundary is where it is is because of Fire Break construction in the District and air support's profitable use of it.

Disadvantages:

There are no material disadvantages. Nevertheless, possible objections include loss of habitat and aesthetic alteration of the landscape, but both of these are manageable.

Additional Recommendations Received

15-01

Please, please put the County Fire Bans in place much, much sooner. Before the Four Mile Fire it had been dry and windy for weeks if not months. A fire ban does little good after the fact.

15-02

Please use the huge CDOT sign at the bottom of Boulder Canyon to advise of high fire conditions. Such notification might have helped to prevent the fire last December in the Canyon. People do not think of high fire conditions in December and people from out of state who come from wetter environments do not think of how dangerous our conditions are here.

15-03

Please have better patrolling of Open Space and other public lands from campfires and illegal camping!!!! I have friends on Magnolia who have come across abandon camp fires on public lands and put them out with their camel packs while mountain biking. There just has to be better management of public lands, i.e. the Dome Fire on Open Space Land.

15-04

Please please establish a way for residents to assist others in evacuating horse, dogs, and cats belonging to their neighbors. I could have come back to get my neighbors horses and donkeys after I evacuated my own horses, but I was not allowed back up. Could there be a certification of residents so they could be allowed back to rescue animals?????

15-05

Please do not forget the flatlands east of the foothills. At least in these areas, regulations preventing 4 or 5 foot tall grass and weedy unmowed lots, and enforcement of those regulations, could prevent destruction. Right now that does not seem to be the code, and we are in danger due to a batch of developer owned unkept residential lots adjacent to us. Traditionally, for the last 150 years, these areas have been mowed or grazed, so these dangers are new.

15-06

I am a qualified insurance expert and thought my services might be utilized as an outreach to homeowners and others who suffer fire damage losses. Please note I do not sell insurance. For my qualifications please visit www.rmaexperts.com. Problem addressed: how to ensure that insurance limits are sufficient.

15-07

Cell service MUST be available to all mountain areas. When electricity and/or land lines are down there is no way to contact anyone for information or receive reverse 911 calls to evacuate! There is no cell service in Four Mile Canyon -- you must be near Gold Hill to receive any service.

15-08

Residents need a phone number to call (even a recording) to find updated information during emergencies. The web page was not always informative during the Four Mile fire and depending on it to communicate is not possible for those of us who were evacuated and had no computer access. This was especially important after the press conferences were moved from the Justice Center to the Rez and closed to all but the media.

15-09

A full-time interagency fire fuels crew (40 personnel total) – A formal merger between City of Boulder Wildland Fire Crew and Boulder County Sheriff's Office crew along with a significant increase in personnel. These numbers will allow us to send a full 20 person handcrew to fires across the country to gain valuable training and experience while maintaining an appropriate level of coverage on the home front.

15-10

A facility that would easily accommodate the above described crew. Would likely require housing for 20 seasonal employees, a training facility/room, offices, workout facility, saw shop, and 6 double deep apparatus bays, for example.

15-11

An identified plan to retain well-qualified and highly trained personnel. Thoughts would be to provide higher pay, commensurate with other agencies and/or with structural firefighters in the same agency, full benefits, identified career progression tracks, etc.

15-12

An effort to investigate the consolidation of fire protection districts within the county, streamlining response, increasing efficiencies, taking advantage of the exponential increase in work completed as a result of an increase in a coordinated workforce.

15-13

Reinstatement of the proven helicopter program which was disbanded several years ago due to lack of funding, with an exclusive use helicopter on contract for the county for some designated time frame each season, if not year-round

15-14

Equipment needs/wants (based on 40 person work force, see Recommendation 15-9):

- 2 type 3 engines (larger 4x4 engines w/500 gal. of water)
- 2 type 6 engines (smaller 4x4 chassis – Fore F-550 for example, w/200 gal. water)
- 2 crew cab 4x4 trucks (supervisor vehicles)
- Transportation for the crews – Hotshot Buggies for example (carry 10 personnel + gear)
- 2 UTVs w/trailer
- 2 ATVs w/trailer

15-15

Evaluation of current forestry and thinning practices to increase efficiencies (increase use of equipment designed for logging)

15-16

Increase utilization of by-products of thinning (chips, logs, etc.). Establish a mechanism to recoup costs of the program by selling these by-products as opposed to just giving them away for free, as we do now. A portable mill, for example, would allow us to produce a merchantable product on site.

Appendix D: Final Citizen Advisory Team Recommendations

Description of 13 Priority Recommendations Made by the Citizen Advisory Team and Submitted to the Boulder County Board of County Commissioners and the Core Team for Further Consideration

Number: 01-03

Title: Forest Improvement District

Committee: Funding

Responsible Organization: Boulder County

Summary

The Board of County Commissioners should enact a resolution and submit the question to voters to create a Forest Improvement District (FID) in Boulder County. If approved, the district would levy a sales tax and the funds generated would be used to support wildfire mitigation and fund agencies to make necessary improvements.

Problem Addressed

There are many projects and initiatives required to reduce the risk of wildfire and maintain optimal fire fighting efforts in the county. Lack of funding is a major obstacle to undertaking these efforts. Another local funding source is needed to complement resources from individuals, the private sector, and federal and state government sources.

Description

The Forest Improvement District Act from 2007 offers Boulder County a way to fund projects regarding mitigation, emergency preparedness, agency staffing, equipment, communications, and homeowner reimbursements.

Identification of projects is not included in this recommendation and could be conducted in conjunction with formulation of a FID resolution.

The funding team is comprised of members from other teams, i.e. Emergency Preparedness, Homeowner Mitigation and Public Lands Management. Other item numbers could be incorporated in the FID initiative, but further research needs to be done in order to determine which items numbers will be incorporated.

We recommend a team be formed to spearhead this initiative. A project identification team could be comprised of CWPP Team Members and County Staff.

Costs

A campaign to support a ballot initiative would require staff and financial resources. Estimates to support this effort need to be evaluated.

Advantages

Would provide much needed funding for a number of important projects in risk reduction, staffing, equipment, and emergency communications.

Disadvantages

Challenge to implement

Number: 12-08
Title: Assign or Hire a CWPP Education/Outreach Coordinator for Wildfire Education
Committee: Education and Outreach
Responsible Organization: County

Summary: Assign a current county employee to be the CWPP Education/Outreach Coordinator for the County or hire for this position.

Problem Addressed: We live in a wildfire prone and wildfire-dependent, highly populated area. The occurrence of devastating wildland fires has increased substantially in the last fifty years and is projected to increase further. The public is only vaguely aware of this and what we need to do to be prepared. Many homeowners/renters rely on fire-fighting forces to save them without taking prior responsibility themselves. The attitude of dependence shifting to one of taking responsibility for community and self is crucial in fire preparedness. Fire education can help create a fire-savvy, responsible, and prepared public. Research (much from USFS) substantiates this. For education and outreach to be implemented effectively, an overall education and outreach coordinator must be assigned or hired.

Description

The E/O coordinator will coordinate:

1. October Wildfire Mitigation month (Oct. is national fire prevention month) . The E&O will set up and maintain a website that includes articles, ideas for programs, a list of possible speakers, and a calendar. Each FPD will be encouraged to carry out its own activities during October, supported by the E&O. Volunteer groups, BCMPOS and schools (to name a few) will be encouraged to plan events/activities. The Coordinator will help facilitate these activities, plus market all community activities relevant to Wildfire Mitigation Month by submitting articles to the local media on wildfire restoration, mitigation, awareness, and preparedness.

2. Recommendation 12-02

3. Develop and coordinate fire education outreach to already existing programs within the county and ideally the city and the private sector to create a wildland fire-knowledgeable, fire-prepared workforce, whether paid or volunteer, who can share this information with colleagues, staff, personnel, clients, and networks, creating a fire-prepared populace.
   Implementation:
   Identify every existing program, conference, training, or course of study in the county in which fire preparedness education can be inserted and incorporated with what the group is already doing. In this way, County and local fire-fighting/mitigation training programs can be publicized and a larger, better prepared fire-mitigation force can grow. And the county will come to identify community groups that can help in other ways with fire mitigation. (The amount of time spent on fire ed per program will vary per the group.)

   Some examples: education can be part of the training for BCPOS volunteers: crew leaders, trail leaders, cultural history tour guides at the Ag Heritage Center and Walker Ranch, resource monitors, and naturalists. (Some of these programs are already starting to do this at the suggestion of the community.) A gardening group can suggest their members grow gardens around the perimeter of their homes, thus making the house and land more fire-wise. And these gardeners can then be resources for other community members interested in doing the same.

   All county staff during new hire training, inservices, and ongoing professional education should be fire-educated. For instance: all clerks must be fire-educated so when a customer is renewing a license, for instance, they can hand a

customer a brochure on fire preparedness and knowledgeably say a few words about it (eg. “we live in a fire-prone, fire-dependent area. This is important to read.”) Research shows that the more places a resident hears about CWPP fire ed, the more s/he will come to understand it is important and take appropriate measures (eg. doing home mitigation and land restoration, approving a prescribed burn, preparing a personal disaster plan kit.)

Other organizations to which this can apply: real-estate agents, insurance agents, all city employees, all teachers being licensed in CO planning to work in Boulder County, tourist industry, appropriate not-for-profit organizations, businesses: brown bag lunches or professional training, gardening and farming organizations, individual town events, newsletters, ongoing operations, etc. etc.

4. The E&O Coordinator will work collaboratively and cooperatively with e&o coordinators at other agencies, organizations, departments, and centers of fire education in and outside the county.

5. The E&O Coordinator will take applications and choose home mitigation and land restoration demonstration sites in critical neighborhoods. S/he will arrange the mitigation/restoration events as public demonstrations (with which neighbors can help the homeowner and forester) and certify the homes with a plaque so people driving by can see living examples of home mitigation/land restoration.

6. The E& O Coordinator will be responsible for disseminating the day’s Forest Fire Danger Index to all emails and every possible venue so residents and tourists will be aware of it.

7. The E&O Coordinator will be responsible for preparing and disseminating all materials to the public and for coordinating the fire education trainers. If there are not enough paid staff to fill the need, the E&O Coordinator will train volunteer fire education trainers.

Costs

Likely one salary or some portion thereof. May cost at least part of a regular salary even if an existing employee is assigned to do this full time, as some of their duties will need to be re-assigned unless these duties are eliminated. To reduce expenses, the Coordinator could oversee a group of committed fire education e&o volunteers.

Advantages

Boulder needs a fire-ready, self-reliant community to prevent catastrophes in the worst fire weather. The prepared homeowner, renter, and employee are crucial strategic assets in preventing costly catastrophes. One person (or job-share) is needed to implement, coordinate, oversee and effectively grow the necessary education program to create this kind of resilience. Without anyone developing overall coordination and growth, implementation is likely to be sporadic, uncoordinated, neglected, and generally less effective on a system-wide basis. Other advantages: reach diverse audiences. Reach audiences that perhaps could not be reached any other way. Cost-effective because working with and within structures that exist already. Saves more money, time, and energy in the long run than that which would have been spent in the short, medium, or long term on a county fire and its after-effects.

Disadvantages

Costs money up front. Position needs to be at a rank equivalent to that of the Wildfire Mitigation Coordinator for there to be sufficient supervisory time available for this position or some of the WMC’s responsibilities must be transferred so s/he has time to supervise this position.

Number: 12-02

Title: CWPP Outreach and Ongoing Education to Communities

Committee: Education and Outreach

Responsible Organizations: Boulder County CWPP Implementers

Summary

Putting fire on the public's radar – and keeping it there - will require reaching out to Boulder County residents and providing opportunities for education and information sharing. By using varied approaches to interest, involve and educate residents, the CWPP can increase public support for fire mitigation, promote the value of self-reliance, and strengthen existing fire-related networks and efforts within communities.

Problem Addressed

To increase fire mitigation, prevention and safety within Boulder County, the CWPP will need to be explained to communities as to what it is, and why it matters. For many living within the WUI, there is limited and/or confusing information regarding policies and techniques for property mitigation. Awareness of the CWPP and its components combined with education addressing what the CWPP is, and how individuals can learn from it, will increase self-reliance and be central to the success of the plan.

Description

CWPP representatives should bring the plan into communities via public presentations given by fire-educated speakers. The "communities" can be: 1) an entire fire protection district, 2) communities within a fire protection district, 3) geographically coherent organizations within a community, such as subdivisions and neighborhoods. The CWPP implementer can bring in additional educators from local FPD's and trained volunteer organizations as needed. Meetings can focus on the prevailing mitigation issues and needs within a particular area, along with local fire history and practical advice. Another goal of the meetings will be to get property owners to buy-in to the CWPP plan, which will help in the sharing of information, and foster neighbors to work together.

Presentations can include a variety of mediums to reach their audience:

1) Power point or video examples of home mitigation that has worked.
2) Local firefighter stories on how fighting would have been more effective and less hazardous had more homeowners mitigated and/or had prescribed burns.

3) Include the area's fire history, as this links all the property owners to their land, and to each other.
4) Offer sign-up sheets for one-on-one consultations with experts that can go to homeowner's property and give advice on mitigation.
5) Encourage neighbors to attend each other's consultations to reinforce knowledge and offer mutual help.
6) Offer cost sharing of equipment and debris removal to help homeowners mitigate, and assist with accessing resources for grants or funds for those who cannot, or do not wish to, do their own work.

Research shows that extensive and ongoing education, training and consultation opportunities are necessary for most homeowners to understand the concept of defensible space for hazard mitigation. Educational opportunities can also expand to other levels:

1) Communities could find a homeowner willing to let their home serve as a "model" of a fire-proof home in exchange for mitigation, and agreeing to hold meetings and allow visitors on the property to get ideas and see concrete examples.
2) Training for people who live within the WUI on what to do if you are the first person to find/respond to a fire. Taking the right actions in the first minutes before help arrives could be crucial in preventing a small grass fire from turning into a large wildfire.
3) Finally, a "Fire Safety Council" could be established with representatives from each community/neighborhood to share best practices and what worked, brainstorm solutions, share information and coordinate efforts (for ongoing education, grants, tool rental etc.).

Costs

Ideally funded through the government (federal through county), and supplemented by volunteers.

Advantages

If property owners mitigate, all levels of government stand to save significantly over the cost of fighting a wildfire, and homeowners would reduce property loss.

Disadvantages

Time intensive for landowners. Need extra measures to communicate with absentee/seasonal landowners and tourists. Will need a coordinator to oversee and develop.

Number: 12-06

Title: Disseminating Fire Education Event Information

Committee: Public Education and Outreach

Responsible Organization: Fire Series/Fire Net

Summary

Include (a) "The Fire Series" and (b) “Fire Net” in CWPP

Problem Addressed

A central place for ongoing public fire education has been needed (Both A and B). A central inter-agency, inter-governmental, inter-organizational county umbrella for all CWPP-approved county-wide fire education (B) is needed so we can help each other do outreach, have each organization do what it's best at and mandated for, and help each other in other ways.

Description

Include (a) "The Fire Series" and (b) “Fire Net” in CWPP

(a) The Fire Series is a series of ongoing, monthly community educational presentations on all aspects of wildland fire. Its purpose is to help create a wildfire-literate and thus wildfire-prepared community that makes informed lifestyle decisions that (1) prevent or minimize loss of human life and property to wildfire and its aftereffects (flood, debris flows), while (2) also maximizing wildfire’s value to the ecosystem, thus retaining or enhancing essential ecosystem services and minimizing wildfire-fighting cost to the county. These seemingly opposite needs in the WUI require an informed community.

The Fire Series is currently loosely sponsored by the CO Native Plant Society, Boulder County Nature Association, and City of Boulder Open Space and Mt. Parks. It is free.

The Fire Series takes place the first Monday evening of every month at 6:30 at REI Boulder. Presentation topics include fire history, behavior, ecology, science, management, safety, research, relation to climate, the performing and fine arts, stress management, soil, debris flows, children, and schools. Presenters are experts in their respective fields.

(b) Fire Net arose from the desire of multiple agencies to publicize their own fire education events, including field trips and workshops, with The Fire Series. **Fire Net** is envisioned to be a county-wide, inter-agency, inter-organizational umbrella calendar/blog/group which serves as a "one-stop shop"

central source for all the fire education going on in the county. Those organizations which are permitted to list their events agree as a condition of listing to publicize to their own private lists most of the events of the other organizations listing on **Fire Net**. **Or** it can be a Google/Yahoo group like Nature Net where anyone can subscribe and everyone gets all the emails, which are vetted by a moderator. **Fire Net** has not been implemented, but some of their upcoming events are currently being publicized with the monthly Fire Series emails. Wild Bear Center for Mountain Ecology has agreed to be the sponsoring organization for **Fire Net** and has offered a blogspot on its WordPress website.

Costs

If Fire Series and Fire Net have a big enough volunteer base, this can be a volunteer activity in perpetuity. It depends how it develops.

Advantages

The public can benefit greatly by having an ongoing central, reliable place for monthly fire education (A), which can be a central contact point for getting in touch with (B). Every member of the public can benefit from being able to see at a glance where and where fire education is going on in a given month in the entire county. Both A and B will help put CWPP and fire preparedness education "on the map," and "on our radar" in Boulder County. The synergy of so much fire ed going on with so many organizations can help build credence for fire ed and momentum in delivering it.

Cooperating in this way can help facilitate interagency collaboration in other areas. Every fire educator can profit from knowing what every other one is doing.

Disadvantages

Some agencies may not want to promote fire ed in other parts of the county or with other organizations for fear of detracting from their own upcoming events that they are mandated to do by their home agency. (However, maybe we can all move together to “advanced” public training levels, with specialization! And there will always be a need for entry-level education geared to a specific agency’s client profile.)

Number: 02-01

Title: Rural Community Slash and Debris Removal Program

Committee: Homeowner Mitigation Committee

Responsible Organizations: Boulder County Land Use or other staffing entity. Resource providers should include local Fire Districts, Forest Improvement District, State Forester, adjacent State Parks or open space jurisdictions, local companies, and the County Chipping Program.

Summary

To improve defensible space within forested County Townsites and other compact rural communities, and to remove combustible fuels, a seasonal slash and debris removal program is proposed. Goal is to have County staff facilitate community cleanup initiatives, and secure the necessary resources not available in each community, including wood sawing and chipping, and hauling of end products to some reuse site.

Problem Addressed

Dense forest fuels have accumulated within older rural communities, creating difficult firefighting environments. In compact communities, County Wildfire Mitigation criteria results in woody materials remaining as "critical screening". Rural communities would commit to seasonal cleanups if they had assistance with chipping, and hauling of reuseable product.

Description

Staff would contact interested communities for Spring and Fall scheduling of community cleanups, and help promote the event. The model is the Eldorado Springs cleanup program of recent years. Each community will provide volunteer workers to bring trash, debris, logs and slash to a central location. Dumpsters will be provided for trash and debris, logs will be chain-sawed into useable firewood size, and slash will be chipped. Wood logs and chips not reused locally would be transported to either a wildfire mitigation site, to a biomass plant, or for landscaping materials.

Costs

Staff time.

Advantages

Motivates rural communities to organize. Puts County staff and local Fire Districts in rural communities, and collaborating with property owners. Improves county wildfire preparedness. More efficiently utilizes available resources and programs. Helps to protect County building, infrastructure and human assets. Contributes wood logs and chips to an emerging wood reuse industry. Could replace County sort yards.

Disadvantages

Requires staff time.

Number: 09-05

Title: Permanent CWPP Steering Committee & Implementation Team

Committee: Collaboration and Coordination

Responsible Organizations: Board of County Commissioners

Summary

Implementing and overseeing the projects outlined in the CWPP requires the appointment of two groups:

1. An all-volunteer Steering Committee that will function as a "board of directors" and
2. A paid Implementation Team charged with administering and completing the projects identified by the Steering Committee.

Problem Addressed

The creation of a Steering Committee and its subordinate, the Implementation Team, addresses the issue of how to prioritize, manage and carry out the action items in the CWPP.

Description

The Steering Committee will:

- Prioritize CWPP projects
- Make necessary adjustments and updates to the CWPP
- Provide direction to the Implementation Team
- Be comprised of volunteer stakeholders.

The Implementation Team will:

- Take direction from and be the administrative arm of the Steering Committee
- Act as the facilitator between the Steering Committee, the CWPP agencies and outside groups involved in completing CWPP projects
- This recommendation does not give guidance as to how the Implementation Team is comprised
- This committee strongly recommends that the Implementation Team be headed by at least one paid employee or a paid team

Costs

The resources and funding required to support the Steering Committee and the Implementation Team will be identified by the Core Group.

Advantages

In order for the recommendations contained in the CWPP to be completed, an entity must take ownership of the document. The Steering Committee will prioritize projects and lobby for the necessary resources and funds required to implement those projects.

The Implementation Team will coordinate and implement projects, and assure the follow-through that cannot be expected of an all-volunteer team.

Disadvantages

Carrying out the CWPP over the long term may require substantial resources and funding.

Number: 14-03

Title: Landscape Scale Forest Restoration

Committee: Public Lands

Responsible Organizations: All agencies planning, specifying and implementing wildfire protection treatments

Summary

Prioritize projects that
1. Address wildfire protection at the landscape scale and
2. Comply with forest restoration best practices.

Problem Addressed

High-intensity wildfires that develop in over-grown forests, far from the WUI, cannot be stopped when they reach developed communities. Too often, current fuels reduction treatments are inconsistent with sound forest restoration science and therefore are ineffective and result in long-term damage to the forest.

Description

Most development within Boulder County forests is within forest types where low intensity fire has been the historic norm—predominately Ponderosa Pine Woodland. Fires in pre-settlement times were frequent and served to clear the forest understory of ladder-fuels while favoring the survival of older naturally fire resistant trees. Post-settlement fire suppression has dramatically increased the risk of extreme fire events in these forests and created the problem we face today.

Communities adjacent to these fuel-loaded forests cannot be protected from extreme fire events through wildfire mitigation treatments that are limited to the forest immediately adjacent to the community. But, the risk of extreme wildfire can be dramatically reduced by restoring broad regions of forest landscape to pre-settlement conditions. Restoring the forest landscape is the most effective way to mitigate the risk of future extreme fire events before fire reaches our communities.

Development within vegetation cover types where stand-clearing fires are the historic norm, Lodgepole Pine and Mixed Conifer, is more problematic than within Ponderosa Pine Woodland. But, the risk of extreme fire events in these forest types can still be reduced. Interrupting fuel continuity and managing size and fuel arrangement will serve to check a fire's behavior early in its development.

Best practices for forest restoration vary by forest type and are generally well understood by foresters and forest scientists alike. However, forest treatment decision makers are frequently confronted with other, more immediate pressures that too often trump the science. Then, “Forest Restoration” becomes merely a slogan that is applied to whatever treatment is applied—often, with disastrous long-term results.

The CWPP Core Team should draw upon the resources of foresters and forestry scientists to document the best-practices for science-based forest restoration as it applies to the forest conditions that occur within Boulder County forests.

The goal of these best-practices should be the restoration of landscape scale forest conditions that closely approximate the historic natural range of variability within vegetation cover types that are naturally fire tolerant and to create a more fire-resistant mosaic within vegetation cover types that are less fire tolerant. In addition to established forest health values, these best-practices should recognize and prioritize cultural and community values including the importance of preserving stands and even individual trees of outstanding age, size or historical importance.

These best-practices should be published as a component of this CWPP and made a requirement for all treatment projects authorized by this plan.

Costs

Initial and ongoing costs involved, but these costs are dwarfed by the costs of the big fires that are the inevitable alternative.

Advantages

The investment in wildfire protection on a landscape scale will ultimately save personal property and infrastructure assets, limit the impacts of future fire events, and enhance quality of life in the County.

Disadvantages

Requires a unified effort between agencies and departments with differing agendas.

Number: 04-05

Title: Right-of-way Mitigation

Committee: Public Lands

Responsible Organizations: Fire Protection Districts, Colorado State Forest Service, United States Forest Service, Boulder County Land Use Department, Boulder County Parks and Open Space, Boulder County Transportation Department, Colorado Department of Transportation

Summary

The rights-of-way along public and private roads throughout the County need to be mitigated to reduce fire hazards, to provide safe evacuation routes, to increase safety during fire suppression efforts, and to utilize opportunity to create fuel breaks along existing barriers.

Problem Addressed

When mitigation is not implemented on both public and private rights-of-way, opportunities to contain wildfires can be lost. Given the difficulty of determining ownership of many rights-of-way, and the resistance of some private landowners, a public/private cooperative effort would ensure that all parties agree on the necessity and involvement to mitigate these areas. Large scale efforts along existing natural barriers such as rights-of-way are more likely to receive funding and community buy-in.

Description

A minimum standard for right-of-way mitigation should be established to ensure safer access for fire fighters. The Boulder County Community Wildfire Protection Plan's Foresters Work Group is already completing work to identify areas for fuel breaks. Their work already includes many of the responsible organizations that will implement the mitigation to areas of right-of-way. The type of eco-systems, as well as the adjacent landowners along the right-of-way, need to be identified. This will inform what educational approach is required before right-of-way mitigation and fuel break construction can receive authorization. This strategic approach strengthens the credibility of projects, the message for residents, and eligibility for funding.

Costs

Research is already underway. The large-scale approach of this project will qualify the project for federal funding that, when appropriated to the projects, will provide for collaboration across many organizations throughout Boulder County. Additionally the collaborative approach will initiate both funding and volunteer involvement to areas of the County otherwise low on the spectrum.

Advantages

Appropriately mitigated roads can serve as fire breaks, as well as increasing safety and facilitating evacuations during fire suppression efforts. Boulder County's CWPP Foresters Work Group is already investing time to identify areas for fuel breaks. Their efforts are often stone-walled by residents resistant to having trees removed on their property. Approaching fuel-breaks by utilizing rights-of-way helps educate communities as to why fuel breaks are important and necessary. This large-scale approach offers higher chance for project funding and community buy-in. The more all responsible parties collaborate on projects, the better our County will respond to emergency situations.

Disadvantages

Inevitably a private landowner will disagree with the project and be resistant. Multiple agencies collaborating can be problematic, on-going coordination will be necessary.

Number: 09-04

Title: Boulder County and Fire Protection Districts (FPDs) Data-Sharing / Mapping Project

Committee: Collaboration and Coordination

Responsible Organizations: Fire Protection Districts, County GIS Group, Boulder Office of Emergency Management (OEM)

Summary

The proposal would facilitate a data-sharing and mapping project between Boulder County and FPDs within the county. Completion of this project would allow FPDs, Incident Management Teams (IMTs) as well as other fire personnel to more easily access fire-related GIS data-sets to support the management of wildfire events throughout Boulder County. In addition, the project would be beneficial to FPDs (or groups they have contracted with) for pre-fire planning.

Problems Addressed

1. Access by FPDs and IMTs to up-to-date mountain addressing information has been problematic, in addition there have been discrepancies between the mountain addressing information and the Assessor's Office data. During a recent wildfire event misinformation was distributed resulting in confusion for evacuees.
2. Currently there is no single location where county-wide fire-related GIS data-sets can be accessed by FPDs to support pre-fire planning or wildfire events.
3. Fire district data (which includes valuable “inside knowledge”) are only available at the FPD level, making it difficult for local or incoming IMTs to obtain the necessary information during a wildfire event.
4. Many FPDs do not have the ability (expertise or software) to produce district-wide maps for pre-fire planning or use during initial attack on wildfires.

Description

This data-sharing and mapping project can be started at a somewhat modest level and then expanded as time, money and data become available. The following list of project elements (in priority order) would be valuable:

1. Designate one person from the county GIS group to be the point of contact for which FPDs can obtain information and data.
2. Develop a single location where all fire-related county-wide data (see* at end) can be easily accessed by FPDs as well as Incident Management Teams arriving to manage wildfires.
3. Provide a mechanism where FPDs can supply their local data (see** at end) so it can then be digitized (if necessary) and put into a seamless format with other county data.
4. A copy of the assimilated data-sets should be made available (24/7) for use by local or incoming incident management teams during a wildfire event.
5. After the data have been acquired, maps (paper and/or digital) should be made for each FPD for pre-fire planning work.

6. FPDs should provide regular corrections/updates to their data (including mountain addresses) so the data-sets can then be revised and re-posted by the county GIS group.
    - Explore the development of a website that would enable FPDs to directly update dynamic GIS data (such as homes with disabled residents, locations of large animals to be evacuated, etc.).
    - OR - Allow FPD personnel to use free Google Earth to create/update .kmz files of district-specific data that would be sent to the county (as .kmz files) for inclusion on the county-wide data site or converted to shapefiles and made part of the seamless county-wide data-set.

Costs

There would be salary costs to the county for staff to assemble data-sets. Some of these data-sets currently do not exist, therefore the creation of some missing data-sets could require hundreds of hours of work. Perhaps the county could contract with CU to hire GIS student interns once a year to compile/update data prior to each fire season. (OEM currently has a CU GIS intern working for them and possibly OEM could expand this program.) Once the County CWPP is complete, there may be opportunities to apply for grants to provide money for this project.

Advantages

1. Geographic Information System (GIS) data are extremely useful for FPD pre-fire planning activities, such as for revising local CWPPs. Some data-sets are available on various File Transfer Protocol (FTP) sites, however, it would be extremely valuable to have a single location where all county-wide fire-related GIS data-sets can be accessed by FPDs to support pre-fire planning as well as during wildfires.
2. Information from a common data source helps to guarantee consistency in data and methodology to all FPDs and would result in fewer interagency mistakes and miscommunications.
3. The ability to provide a digital county-wide fire-related GIS package to an Incident Management Team during an emerging large scale wildfire could be quite beneficial to the team as they develop fire suppression strategies as well as help provide for the safety and well-being of firefighters and the general public.
4. Completion of this project could allow FPDs to access common county GIS data to develop their own GIS maps (if they have the software and expertise).

Disadvantages

1. FPDs are primarily made up of volunteers thus obtaining/developing local fire district data is likely to be difficult and time-consuming for some departments. (Time costs for FPDs could possibly be offset by using community volunteers, Eagle Scouts, etc. for collecting and ground-truthing data.)
2. This project would be an additional workload to the county GIS workforce. (Monetary costs for the county could possibly be offset if student interns were used to prepare and/or update data-sets)

* Examples of county-wide data include: roads, trails, structures, administrative boundaries (FPDs, USFS, county & city open space, etc), mountain addresses, power lines, Incident Command Post (ICP) locations, staging areas, water sources, landing zones and other values-at-risk (historical, watershed, etc.)

** Examples of possible FPD district-specific data include: locations of disabled residents, evacuation routes, FPD cisterns, potential safety zones, hazardous areas, locations of large animals needing evacuation or release, helicopter landing zones, helicopter dip-sites, aircraft hazards, ICP locations, staging areas, and other values-at-risk (historical, watershed, etc.).

Number: 15-04

Title: Animal Evacuation Resources and Plan

Committee: Emergency Preparedness

Responsible Organizations: Any animal special interest groups, Boulder County Sheriff's Office, local fire districts

Summary

There needs to be an animal evacuation plan in place to assist with coordinating rescues, evacuations, and helping residences plan ahead for emergencies.

Problem Addressed

Several families lost pets in the four mile fire, due in part to the lack of an organized plan and avenue of communication between the residents affected by the fire and Boulder County officials.

Description

Boulder County needs an evacuation plan for pets and farm animals to address the issues that contributed to animal loss in the recent fires. The plan must be easily accessible to both residents and Boulder County officials and include specific guidelines for residents to follow for evacuating animals and for communicating with officials. A web page could suffice. The plan should give residents a list of procedures to follow in an emergency, a central location to look for animals during and after the emergency, and identify the agency responsible for facilitating actions to rescue animals from the evacuation zone.

Costs

Volunteers could be trained to either perform the rescue or accompany owners and help with the rescues. These volunteers could communicate with the relevant fire officials to ensure the safety of the rescue efforts. Evacuation locations (Boulder County Fair Grounds, Humane Societies, etc..) already exist. Website maintenance is a potential cost unless volunteers can be enlisted. There are training costs for these volunteers as well as the need for a contact person (perhaps from the sheriff's office) to interface with residents during an emergency.

Advantages

Such a system would allow animals in danger to be rescued. It could also reduce tensions between residents and officials during an emergency.

Disadvantages

May require substantial resources and funding.

Number: 04-08

Title: Low-Interest Loan Program (for Private Property Mitigation Efforts)

Committee: Homeowner Mitigation

Responsible Organizations: The responsible organization would depend on how the program was ultimately structured. The list includes: County Land Use, County Commissioners' staff, and private financial institutions.

Summary

This program would provide a resource to complement efforts to educate landowners about the individual and community-wide benefits of making fire safety improvements to their property. Landowners would be able to avail themselves of low-interest loans to fund improvements. The program is could be modeled on the existing Energy Smart program that is being administered by the County.

Problem Addressed

This program is designed to support homeowners who would like to make fire safety improvements to their property and might prefer this program to other options that would either be more costly or more difficult to apply for or receive.

Description

The goal of this program is to provide a resource for landowners who would like to initiate fire safety improvements to their property. Landowners would propose a project/s from a list of acceptable fire safety improvements. Some examples include: re-roofing with non-combustible materials; converting wood siding to non-combustible siding; rebuilding a deck with non-combustible materials; performing landscape mitigation in zones 1-3. The landowner would get a bid (or several) from a licensed Boulder County contractor. That bid would form the basis of the loan amount, plus whatever fees might be necessary to administer the loan. This program could be developed in a variety of ways, depending on the available funding streams. The lending agency would probably be a financial institution. The structure and period of the loans would need to be determined.

Costs

The program would require administration. These costs may or may not be covered by loan origination fees, depending on how the program is structured and whether it can be supported by grants or other revenue streams.

Advantages

- This program would provide a cost-effective way for landowners to tackle necessary but relatively expensive improvements.

- Improvements that reduce the likelihood of individual homes catching fire also reduce the likelihood of that fire spreading to neighboring homes and structures.

- The more resistant homes and properties are to wildfire, the more likely firefighting efforts will be successful.

- Any mitigation efforts that are visible within a community serve to incentivize and educate neighbors.
- Publicity surrounding the launch of this program could provide a platform for general fire safety education.

- Mandating that landowners use local contractors helps the local economy.

- The county already administers a similar program, Energy Smart. There may be an opportunity to share administrative personnel, providing an economy of efficiency.

- Once the County CWPP is complete, there may be opportunities to apply for grants to provide seed money for this program

Disadvantages

The details and costs are unclear since the program hasn't been developed yet.

Number: 06-02

Title: Improved Communications

Committee: Emergency Preparedness and Wildfire Prevention

Responsible Organizations: Multiple agencies

Proposal Summary

The original proposal focused on mobile / cell service. We decided to revise the proposal to include all communications. This recommendation will cover items 06-02, 09-02, 15-07, 15-08, and 06-01.

Problem Addressed

Many foothill / mountain residents do not have cell service. When the power and phone lines are down, communications via mobile / cell and land-lines are non-existent. Therefore residents need to get information and make contact via another reliable source. And agency communications devices appear to need upgrading.

Description

Cell Service: What we have in the mountain area now is about the best we can expect. Both Verizon and AT&T have added a tower in Nederland.

Land Lines: We suggest all residents have one Land Line phone that doesn't require 110 AC. A simple $15.00 corded phone will work even if the AC power is out. The phone company provides 48 VDC from the central office that appears at the jack in each home. But obviously if the phone lines are down this option will not work.

Satellite Phones: For individuals what require service 24/7/365, We suggest Satellite Phones. One company that provides this service is GMPCS (www.gmpcs-us.com/portable-satellite-phones.htm). The cost is $650.00 for the phone, $150.00 / year for service that give you 60 minutes of talk time. Then $1.39/minute for calls to land lines, and $1.54 / minute to cell phones.

Agency Communications: Police - Fire - Emergency Services - EOC:

- VHF is used for all agencies
- Coverage is 95% in the mountains
- 12 repeaters and 5 frequencies
- Mobile and Portable units deployed
- Some training, and procedural issues need to be addressed for Volunteer Groups. Mainly addressing portable to mobile communication
- 3-CP (Communication – Command – Control) processes need to be reviewed and revised is necessary.
- Overall agency communications has mixed reviews

Team Recommendations: Emergency Preparedness/Wildfire Protection team members are also active on other CWPP teams, they are Funding, Collaboration, and the Education and Outreach teams.

Residents:

- Have one phone to connect to a land line that doesn't require 110 VAC.
- If able purchase Satellite Phones.
- Own a battery powered emergency radio.
- Have maps available for emergency evacuation routes.

Agencies:

Agencies need to supply After Action Reports that depict communication problems to justify the need for upgrades.

- Upgrade from the VHF radio system to an 800 Mhz system.
- Supply enough repeaters and frequencies for the 800 Mhz system based on input from agencies.
- Equip radio system with balloon antennas.
- Develop a emergency radio frequency the public can access for information during wildfires and other emergency situations.
- Review / Develop a Communication / Command / Control (3-CP) process which includes a public interface. This should be owned by the EOC
- Develop an early warning system that communicates a high risk situation. This issue needs staff, agencies, and the CWPP research.

Boulder County:

- Install fire alert sirens
- Establish an AM or FM emergency radio channel that residents can access to get information pertaining to wildfires, flooding, or other hazardous conditions.

Costs

The cost of improved communications needs to be determined by the funding team based on valid data through resident input and agency After Action Reports.

Advantages

The advantages are obviously, the safety for the public, emergency workers, and preservation of public and private land.

Disadvantages

None

Number: 01-04

Title: Centralized Grant Processing

Committee: Funding

Responsible Organizations: Boulder County, CSFS, and possibly a Forest Improvement District Board if one is approved by voters.

Summary

Create a central clearinghouse for private landowners and community groups, such as FPDs, neighborhoods, and homeowners' associations, to access funding for mitigation and forest restoration projects. Both funders and applicants would make use of this service.

Problem Addressed

There are numerous grants and cost-sharing programs available to help fund fire mitigation and forest restoration projects, but it is often difficult to identify and apply for this assistance since it comes from so many different sources.

Description

A number of fire mitigation projects involving fuels reduction, forest restoration, watershed improvements, firebreaks, etc. are currently being planned or carried out on public lands in Boulder County. In order to achieve a consistent level of treatment throughout the county, encouraging participation by private landowners and community groups is necessary. Treatment projects are invariably costly to carry out, sometimes beyond the means of property owners. The FRFTP Roundtable, in *Living with Fire: Protecting Communities and Restoring Forests,* states that “subsidizing private treatments benefits the public since wildfires, watersheds, habitats, and airsheds cross ownership boundaries”.

There are grants and cost-sharing programs for mitigation projects available from the Federal, State, and Local Governments, as well as from private foundations. A centralized location to coordinate funding opportunities would simplify the process of accessing available funding, and thus increase the rate of treatment on private land. There should be a facilitator to research and write grants, as well as to assist private landowners and community groups in identifying and applying for appropriate financial assistance. Similar services have in the past been offered by the CSFS, although it might have been limited to government grants. The current status of this service should be determined and then a decision made on the appropriate agency to offer this more comprehensive service.

Costs

Creating a staff position (if one is not already funded by the CSFS).

Advantages

- Available grants and cost-sharing programs would be more fully utilized.
- Additional grants could be obtained.
- More forest treatments would be completed because the cost to individuals would be minimized.

Disadvantages

Potential cost of hiring an additional staff person.

Appendix E: Defensible Space Scoring Pilot Project

RIVERSIDE

global science solutions

BOULDER COUNTY LAND USE DEPARTMENT

FINAL REPORT

Wildfire Defensible Space Scoring System Pilot Study

PREPARED BY RIVERSIDE TECHNOLOGY, INC.

JUNE 13, 2011

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1.0 Introduction

Wildfire is a destructive force in the western United States. Colorado has suffered many destructive wildfires in recent years. Many agencies across the west map wildfire hazard to better understand the risk in the wildland urban interface. Romme, et al. (2006) created a wildfire hazard map for La Plata County. The final hazard map is a composite map that is composed of a vegetation map, a heat release map, a flame length map, and a spread rate map. Many wildfire hazard maps are created with a regional approach and often display the Wildfire Susceptibility Index (WFSI) such as the map produced by Sanborn through the Colorado Wildfire Risk Assessment System (Sanborn, 2008). Other hazard mapping methods use risk inputs such as housing density in the wild land urban interface as input, such as the model built by Edel (2002). Parcel based hazard maps typically show the wildfire hazard for each individual parcel in the wildland urban interface. Boulder County, Colorado State Forest Service, and Colorado Springs Fire Department have created parcel based wildfire hazard. They typically include a rating system of low, medium, high, and extreme. Creating these maps typically involves visiting the parcels in the field to determine their hazard rating. The hazard rating is determined by several input parameters including access to the property, home construction and roof materials, slope of the property, and the amount and type of vegetation in the structure's defensible space. Creating these hazard maps is typically done once and is difficult to update. Some projects beginning to take hold are looking at ways to support local government and develop wildfire hazard mitigation plans (Muller, et al., 2009) Boulder County is implementing this pilot study to research a method of using remote sensing and GIS analysis to create a score for each property's defensible space. Once developed, Boulder County will investigate different ways to use the score to encourage homeowners to perform the mitigation work. Potential uses for the scores range from online public defensible space maps, reports for potential home buyers to see the defensible space score, and financial incentives (or disincentives) for wildfire hazard mitigation work.

The Colorado State Forest Service defines defensible space as "an area around a structure where fuels and vegetation are treated, cleared or reduced to slow the spread of wildfire towards the structure. It also reduces the chance of a structure fire moving from the building to the surrounding forest. Defensible space provides *room for firefighters to do their jobs."*

The Colorado State Forest Service defines 3 Zones of Defensible space. These zones will be used in the defensible space mapping pilot project. The zones are defined as follows:

- Zone 1 –15' from house and deck
  - ◊ Maximum Fuel Reduction
  - ◊ No Vegetation 0 – 5'
  - ◊ Remove trees 5' – 15'
- Zone 2 – Zone 1 to 100' from house and deck
  - ◊ Fuel Reduction
  - ◊ Thin Trees

- ◊ Add space between crowns or clumps
- Zone 3 – Zone 2 to edge of property
  - ◊ Follow forest management plan

Figure 1 shows an example graphic of the zones surrounding a structure on a parcel.

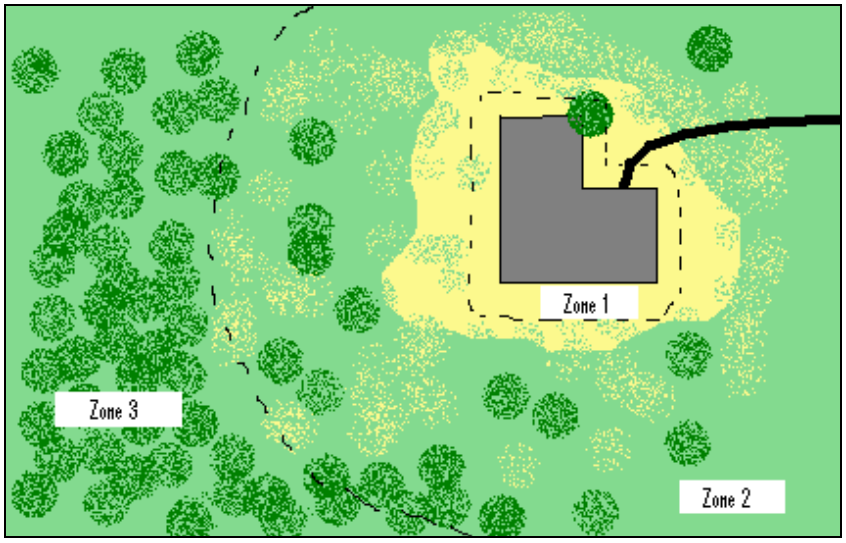


Figure 1. Defensible space zones surrounding a structure on a parcel

2.0 Approach

Boulder County hired Riverside Technology, inc. to conduct this pilot study to test the methodology of using Remote Sensing Imagery to develop a parcel based defensible space score. Several pilot parcels were identified. The selected parcels had mitigation work performed on the property between 2008 and 2010. In this study Digital Globe Quickbird satellite imagery was acquired for 2008 and 2010. This imagery already existed in the archive maintained by Digital Globe. A 0 – 100 based scoring system was developed from the imagery. Each parcel was scored to determine if the score was reduced by the mitigation efforts. The score itself was developed by buffering each structure to create the defensible space zones. A land cover classification was developed with satellite imagery. The percent area of each cover type was tabulated by zone and input into a formula with a cover type dispersion indicator to determine defensible space scores. Different cover types have more influence on the score (e.g. tree canopy in zone 1). The scores from 2008 and 2010 were compared to determine if mitigation efforts had an effect on the score. **Figure 2.** Project procedure flow diagram displays a flow chart of the project approach.

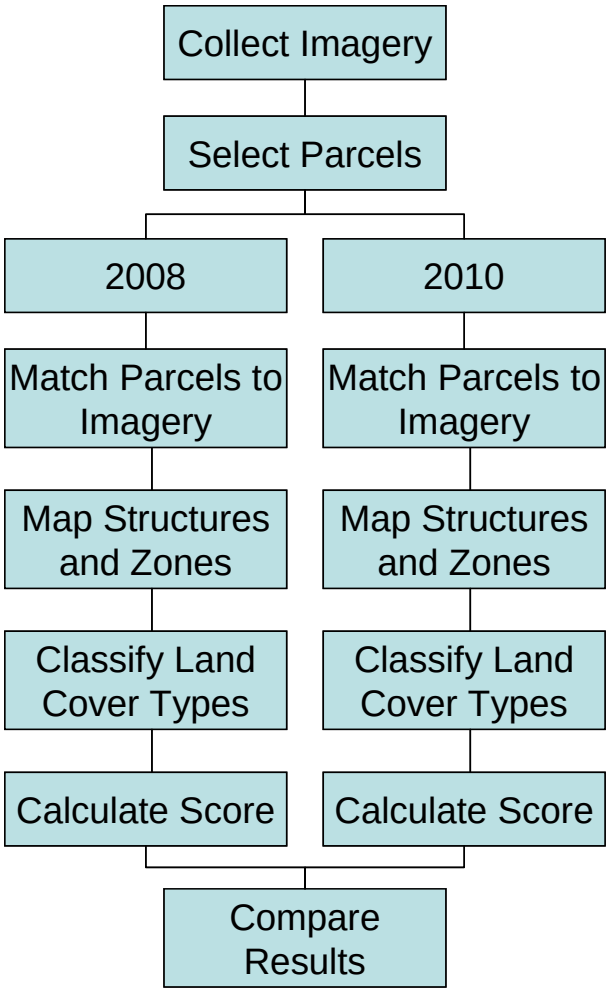


Figure 2. Project procedure flow diagram

2.1 Preparing Data

2.1.1 Selecting Imagery

The first step in the project was to select digital imagery available in 2008 and 2010 for an area in Boulder County where property owners have performed some mitigation work. Requirements for the imagery include:

- High spatial resolution (< 1 meter)
- Multi-spectral data (blue, green, red, and near-infrared spectral bands)
- Leaf-on (imagery acquired during the growing season)

At the start of the project Boulder County had planned on using the DrCOG digital aerial imagery. This data is high resolution (1 foot ground resolution) and contains four multi-spectral bands of data (blue, green, red, and near-infrared). It is collected as part of a joint collaboration with Front Range government agencies. This imagery was flown in 2008 and 2010. Boulder County has the 2008 images in house. However, as of the spring of 2011 the 2010 images were still being processed and not available for this project. Thus, other imagery sources were searched.

Riverside searched the Digital Globe archive for suitable Quickbird satellite imagery. The Quickbird satellite from Digital Globe provides high resolution (0.6 meter pan-sharpened) multi-resolution (blue, green, red, near-infrared) imagery. Riverside found two suitable images available from the archive. These images were acquired on May 11th, 2008 and September 10th, 2010. **Figure 3** displays the study area for which the images were obtained.

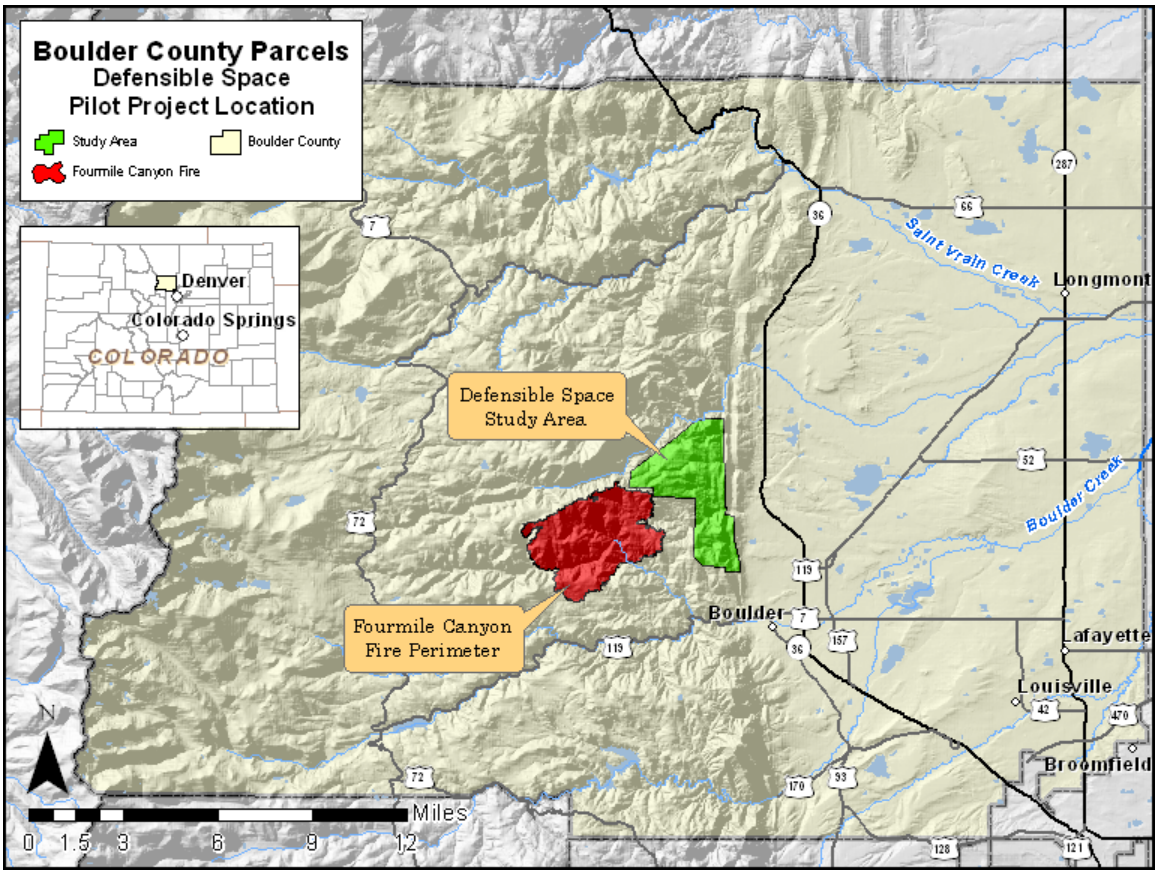


Figure 3. Defensible space mapping pilot project study area

The imagery was ordered through i-cubed, a Digital Globe imagery reseller and image processing company. The imagery was orthorectified by i-cubed and projected to UTM Zone 14 NAD 83.

2.1.2 Selecting and Preparing Parcels for Pilot Study

The next step in the pilot study was to select appropriate test parcels that have had varying levels of mitigation work performed. Riverside worked with Jim Webster at the Boulder County Land Use Department to select appropriate parcels. Mr. Webster provided several lists of parcels to Riverside. The parcels in these lists were part of several wildfire mitigation programs and local chipping programs. A final list of 58 parcels was selected. The parcels are located around the study area. The parcels range in the amount of mitigation work performed on them from no mitigation work to vegetation removal. This list of parcels was chosen to determine how sensitive the scoring system is in measuring the amount of mitigation work performed.

After the parcels were selected they were edited spatially to match both the 2008 and 2010 satellite imagery. The parcel boundaries obtained from Boulder County do not precisely match roads and other features on the imagery. Editing the parcel boundaries was necessary to accurately map the vegetation cover on each parcel. Two parcel datasets were created and edited to match the 2008 and 2010 imagery. **Figure 4** displays a sample of parcels on the 2008 imagery before and after editing.

Figure 4. Parcel boundaries editing

2.2 Mapping Structures and Zones

2.2.1 Mapping Structures

After parcels were selected and edited to match image features the structures within each parcel was mapped. The structures were mapped manually by heads-up digitizing each feature on the satellite imagery in ArcMap 10.0. Parcels were identified through manual photo-interpretation. The 2008 DrCOG aerial imagery, with its higher spatial resolution, was used in conjunction with the satellite imagery to aid in interpretation. Each structure identified on the imagery was digitized. This included houses, garages, and out buildings. Structures were digitized from the 2008 imagery and the 2010 imagery. **Figure 5** shows an example of structures mapped on the 2008 imagery.

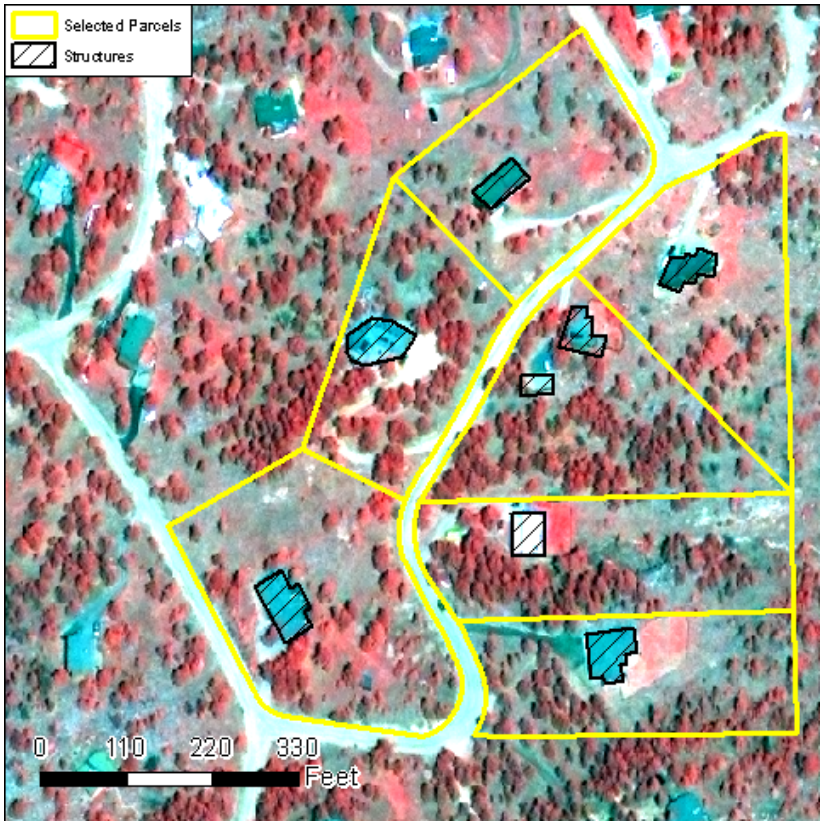


Figure 5. Mapped structures shown on the 2008 imagery

2.2.2 Mapping Defensible Space Zones

After the structures in each parcel were mapped the defensible space zones were created. The zones were created by following the Colorado State Forest Service (CSFS) definition for defensible space. The CSFS defines defensible space as follows[1]:

- Zone 1
  - ◊ 0-5 feet from structures

[1] Dennis, F.C. Creating Wildfire-Defensible Zones. "Fact Sheet 6.302: Natural Resources Series." Colorado State University Cooperative Extension. January 2006.

- ◊ No vegetation
- Zone 1
  - ◊ 5-15 feet from structures
  - ◊ No trees
  - ◊ Prune all vegetation
  - ◊ Keep grasses green and short
- Zone 2
  - ◊ 15-100 or 125 feet from structures
  - ◊ Thin trees and shrubs
  - ◊ 10 feet or more space between crowns
  - ◊ Mow grasses or remove them
- Zone 3
  - ◊ 100 or 125 feet from structures out to property line
  - ◊ Follow forest management practices outlined in property's forest management plan.

Since the CSFS defines two different mitigation recommendations for Zone 1 Riverside created separate zones for each (5 feet from the structure and 15 feet from the structure). **Table 1** lists the zones and distance from structures that were mapped.

Table 1. Pilot project defensible space zones sizes

Zone Name	Distance from Structure (feet)
1a	5
1b	15
2	100
3	Property boundary

Figure 6 displays the defensible space zones mapped on the 2008 imagery. These zone boundaries end at the property line for each parcel. This feature was requested by Boulder County Land Use staff in order to develop a score for each property that is independent of neighboring parcels. Riverside wrote an ArcGIS geoprocessing script to develop the zones feature class. The script creates the defensible space zones by buffering the structures on each parcel with the distances listed in **Table 1**. The buffers are intersected with the parcel boundaries to create the final zone feature class. The script is run from a script tool in an ArcGIS toolbox.

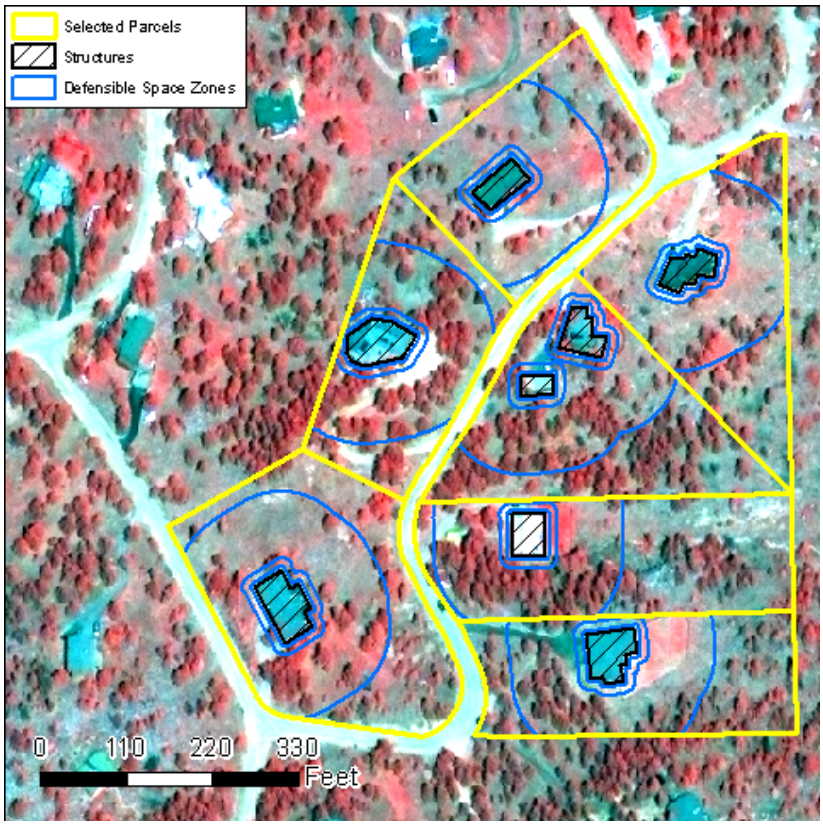


Figure 6. Defensible Space Zones

2.3 Mapping Land Cover Types

The most critical part of developing the defensible space score is mapping the vegetation cover. The different cover types will contribute differently to the final score depending on their unique hazardous fuels properties. Mapping the vegetation cover was accomplished using the ArcGIS 10.0 image classification tools. Each multispectral image (2008 and 2010) was evaluated for classes that were spectrally separable and significant for contributing to the final score. The final classes delineated were as follows:

- Irrigated Lawn
- Grasses
- Tree Canopy
- Bare Ground (rock, soil, sparse grass)
- Gravel/Rock
- Bare Soil
- Water

In order to delineate these classes a supervised Maximum Likelihood classification was performed in ArcGIS 10. Training polygons were first delineated in order to capture the spectral characteristics of each class. The training polygons are used to 'train' the computer to separate the pixels of the imagery into the different classes. **Figure 7** displays the Image

Classification tools in ArcGIS 10.0 and some representative training polygons for the separate classes.

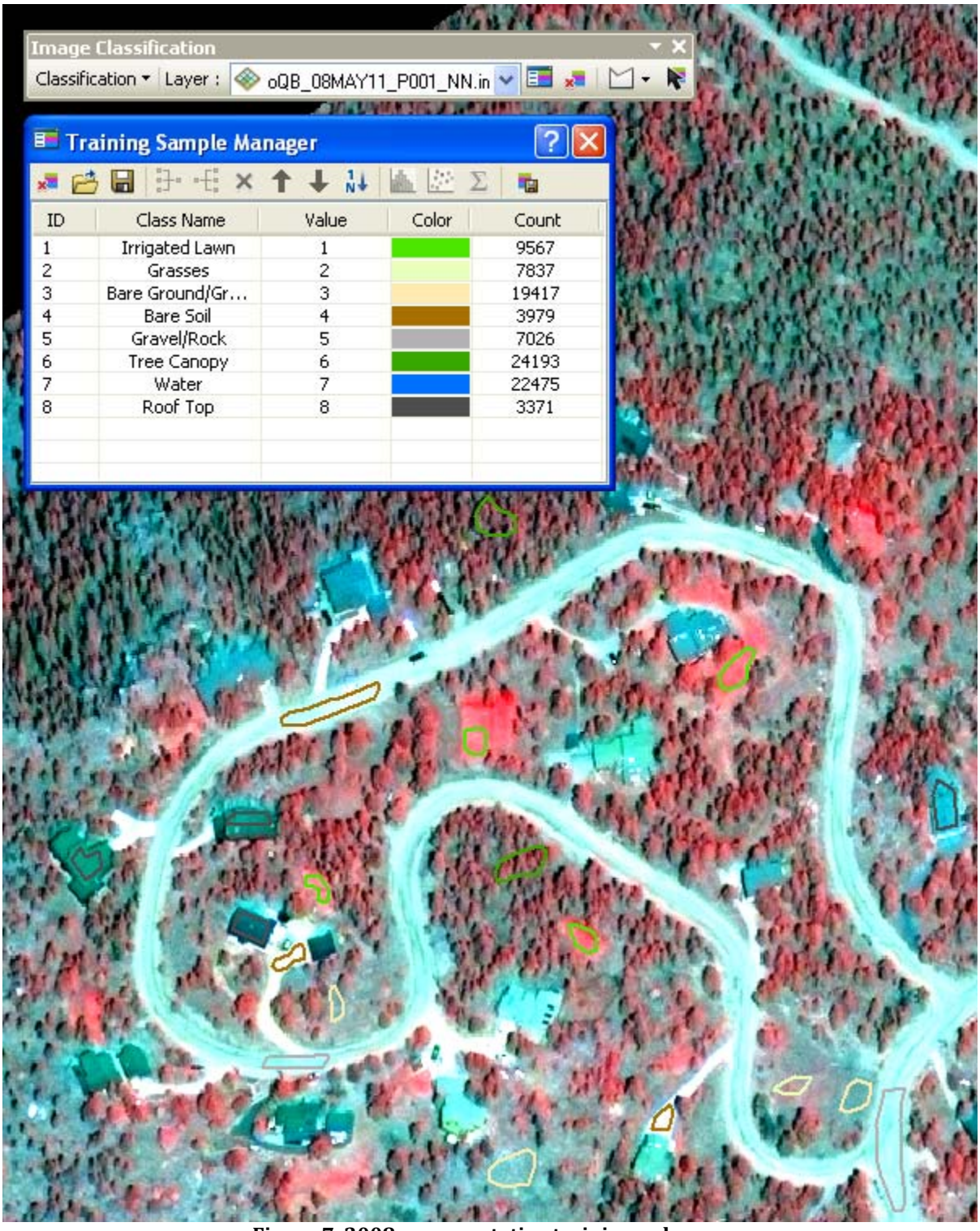


Figure 7. 2008 representative training polygons

A signature file was created with these training polygons and an initial supervised classification was run. After running the classification, test polygons were created from the classification. 39 polygons were given to Boulder County Land Use staff to review in the field. The test polygons were reviewed in the field by Boulder County staff to ensure that the cover type class accurately captured the vegetation on the ground and that the cover types were distinct and would logically contribute to a defensible space score. Comments on the test polygons were returned to Riverside. Using the comments and image classification tools the training polygons were further refined to create the final signature files for the 2008 and 2010 classifications. **Table 2** displays the final land cover classes and the number of pixels that make up each training class.

Table 2. Training samples

Class Name	Class Value	Pixel Count 2008	Pixel Count 2010
Irrigated Lawn	1	9567	8903
Grasses	2	7837	23815
Bare Ground	3	19417	23002
Bare Soil	4	3979	2748
Gravel/Rock	5	7026	3761
Tree Canopy	6	24193	140483
Water	7	22475	13881
Roof Top	8	3371	4755

Further classification refinements were performed to eliminate noise from the classification. The ArcGIS Spatial Analyst Boundary Clean[2] function was run on both classifications (2008 and 2010). This function eliminates noise in the classification and consolidates classes to represent a more realistic land cover classification. The 2010 classification required further refinements to edit the tree canopy class. The 2010 image was acquired on September 10th 2010. Beginning in September the sun angle begins to move lower on the horizon creating longer shadows in the satellite imagery. This shadow is sometimes misclassified as tree canopy. An ArcGIS Model was created to help eliminate this error. The model uses the Normalized Difference Vegetation Index to identify shadows that are mistakenly classified as tree canopy. Those pixels identified as mistaken tree canopy are reclassified to the class of their neighboring pixel. **Appendix A** displays the models. The models will be delivered at the completion of this project. The final classifications for 2008 and 2010 were used to calculate defensible space zone scores and final parcel scores. **Figure 8** shows an example of the final 2008 land cover classification displayed next to the color infra-red 2008 image.

[2] http://help.arcgis.com/en/arcgisdesktop/10.0/help/index.html#//009z00000035000000.htm

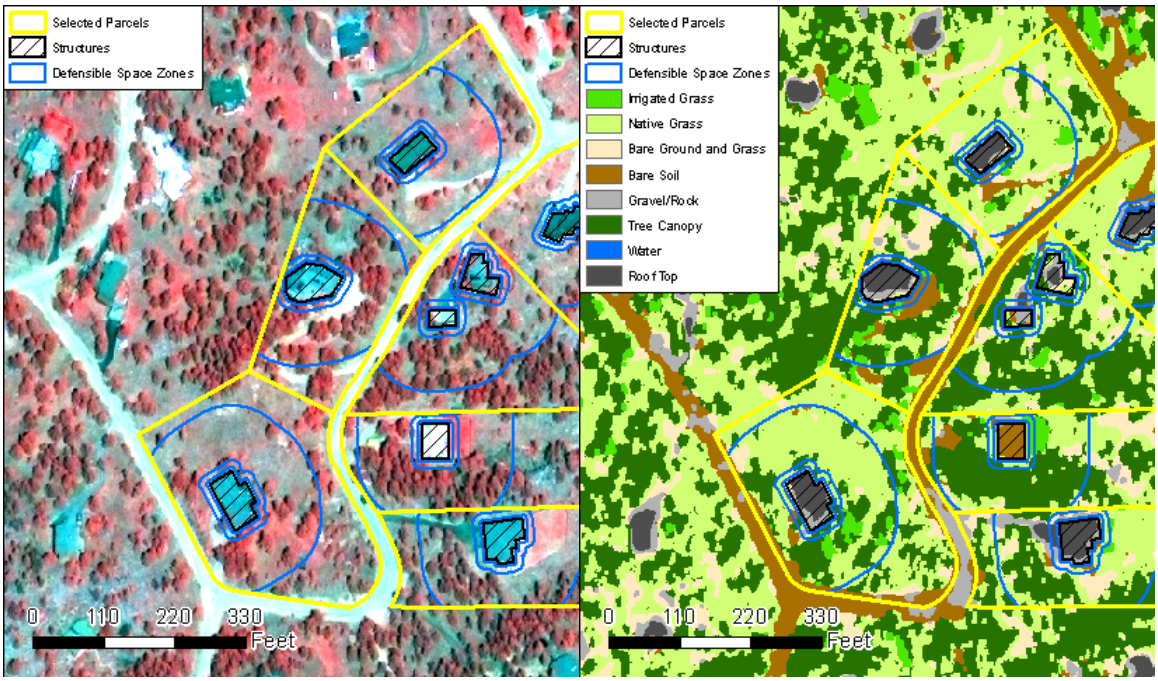


Figure 8. 2008 final image classification

2.4 Calculating the Defensible Space Scores

The CSFS defensible space zone definitions listed in **Section 2.2.2** were used by Riverside to develop a formula for calculating the defensible space score. The score is based on the varying amount of different cover types in each zone. The ArcGIS Spatial Analyst Tabulate Area[3] function is used to calculate the percent area of each cover type within each zone. These percentages are then used to calculate the score.

2.4.1 Calculating a Defensible Space Zone Score

The first step in calculating the defensible space score for each parcel is calculating the score for each zone. Using the tabulate area function the area of each class within each zone is calculated. The area of the class and the total area of the zone are used to calculate the percent area of the zone that the class occupies. The percentages are then used to calculate the score for each zone. Zone 1a and Zone 1b are calculated with the following formulas:

Zone 1a = TC + IL + G
Zone 1b = TC + G

Where:

TC = Tree Canopy % Area
IL = Irrigated Lawn % Area
G = Grass % Area

This formula follows the CSFS definition: zone 1a should not have any vegetation and zone 1b should not have any tree vegetation and grasses should be kept short and green. Zone 2

[3] http://help.arcgis.com/en/arcgisdesktop/10.0/help/index.html#//009z000000w2000000.htm

is described by the CSFS as a transition zone[4]. Tree canopy and forest stands should be thinned. Tree crowns should be spaced apart with no large clusters of trees. Grasses should be kept short or removed. Cover types, especially tree canopy should be dispersed and not clustered. To capture the dispersion of cover types in zone 2 the Moran's I spatial auto-correlation[5] function is used in the score calculation. Zone 2 is calculated with the following formula:

Zone 2 = (TC + G) – (BS + GR) + I

Where:

TC = Tree Canopy % Area
G = Grass % Area
BS = Bare Soil % Area
GR = Gravel/Rock % Area
I = Moran's I Index

Using this formula, zones with a majority of tree canopy and grasses will have a higher score than zones with more diverse distribution of cover types. The Moran's I index in this formula acts a dispersion factor. The Moran's I index that is returned from the spatial auto-correlation function is a number between -1 and +1. Features that are more clustered are positive and features that are dispersed are negative. Therefore, properties with highly clustered cover types will have a higher score and properties with more dispersed cover types will have a lower score. **Figure 9** shows an example of how the amount of dispersion or clustering affects the index.

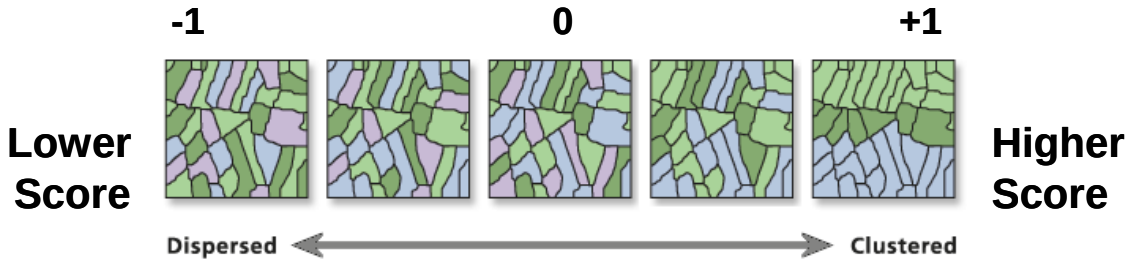


Figure 9. Moran's I Dispersion Factor

2.4.2 Calculating a Defensible Space Parcel Score

After scores are calculated for each zone a score is calculated for each parcel. The scores for zones 1a, 1b, and 2 for each parcel are used in the final parcel score. The formula for the final parcel score is as follows:

Parcel Score = (Zone1a Score * **40%**) + (Zone1b Score * **35%**) + (Zone 2 Score * **25%**)

[4] Boulder County will review CSFS guidelines and make changes to this formula based on lessons from the Fourmile Fire.
[5] http://help.arcgis.com/en/arcgisdesktop/10.0/help/index.html#//005p0000000n000000.htm

In this formula the individual score for each zone is weighted heavier the closer to the structures it is. This rewards property owners for performing more mitigation work closer to the house. This can have a positive effect in motivating property owners that have limited resources to perform mitigation work.

2.5 Automating the Defensible Space Scoring System

Calculating the parcel zone scores and final parcel scores was first accomplished on an individual parcel basis with ArcGIS Model Builder. ArcGIS models were created to calculate the cover type percent area for each zone, the Moran's I index for zone 2, the zone scores, and the final parcel score. After the scoring system was developed the entire process was automated using Python and the ArcPy module for ArcGIS 10.0. The Python script tool calculates zone scores and parcel scores for all of the parcels at once. The script tool also allows the user to customize the weight percentages for the zone scores as well as the neighborhood distance to evaluate the zone 2 dispersion factor. **Figure 10** displays the interface for the Calculate Scores Script Tool.

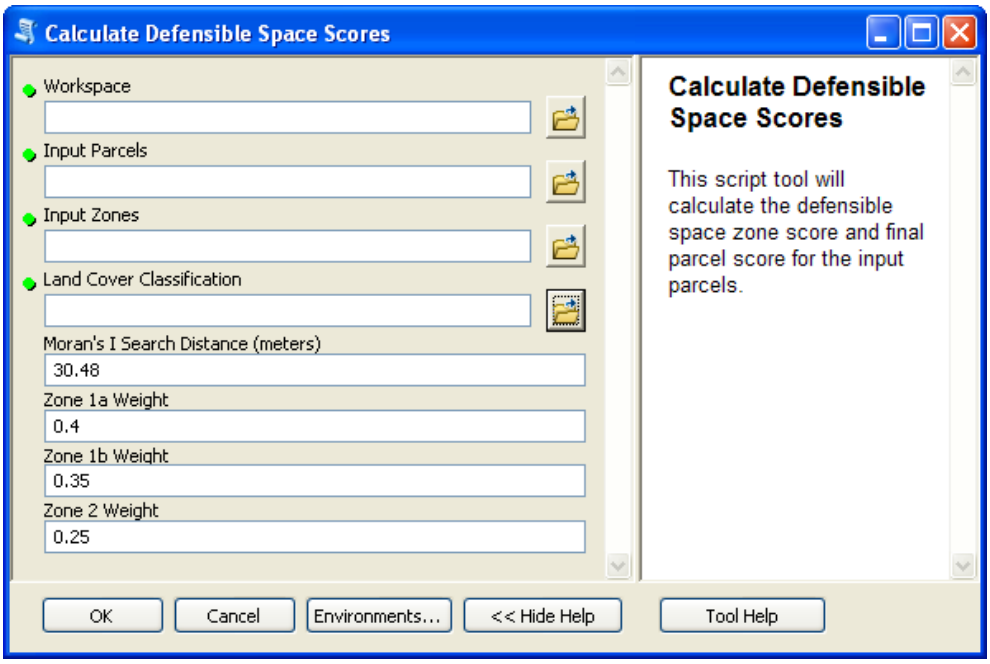


Figure 10. Calculate defensible space scores scrip tool

3.0 Results

The results show that the scoring system does accurately score the parcels based on the different land cover amounts in each zone. Vegetation in zone 1 has the most influence on the score. This is by design as mitigation work in zone 1 yields the most benefit. Between the two years the score does decrease for certain parcels. However, for other parcels the score does not decrease and in fact increases for some parcels. In the following section a review of the parcels describes the score in more detail.

3.1 Individual Parcel Score Review

Reviewing a group of parcels in the Boulder Heights subdivision shows mixed results. The score for some parcels does go down; however, other scores go up or are unchanged. **Figure 11** and **Figure 12** show the parcel scores for 2008 and 2010, respectively.

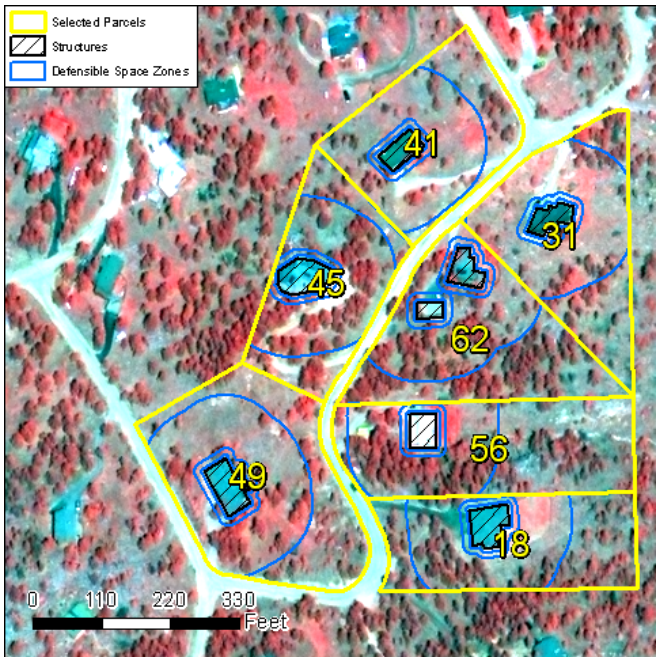


Figure 11. Final parcel scores 2008

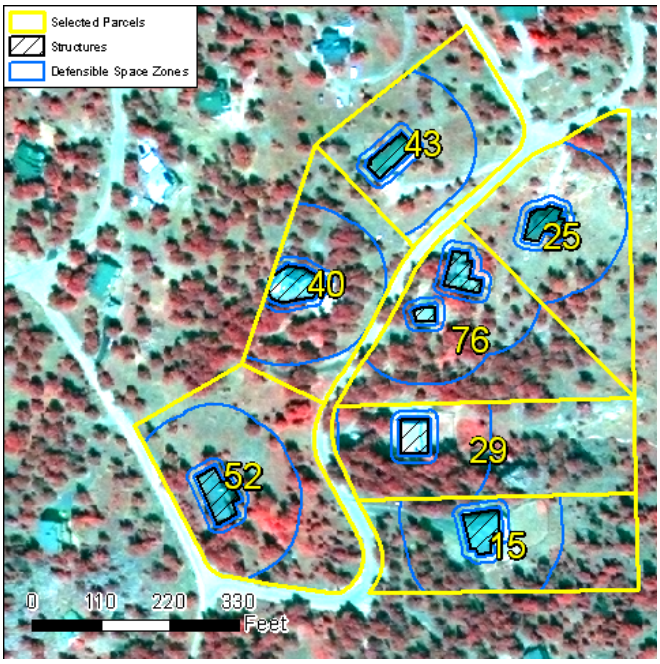


Figure 12. Final parcel scores 2010

Most differences in the score appear to be the result of differences in grass vegetation, which can vary between seasons. However, it also appears that there has not been much

major mitigation work performed in these parcels. The major stands of trees appear to be present in 2008 and 2010.

Another group of parcels in the Pine Brook Hills subdivision appear to have more mitigation work done and the score does reflect this work. **Figures 13**, **14**, **15**, and **16** show a selection of these parcels. Parcels to the left of the blue line appear to have performed some mitigation work. Parcels to the right do not appear to have done any mitigation work. The parcel in the lower left of the graphics has a score of 81 in 2008 and a score of 66 in 2010.

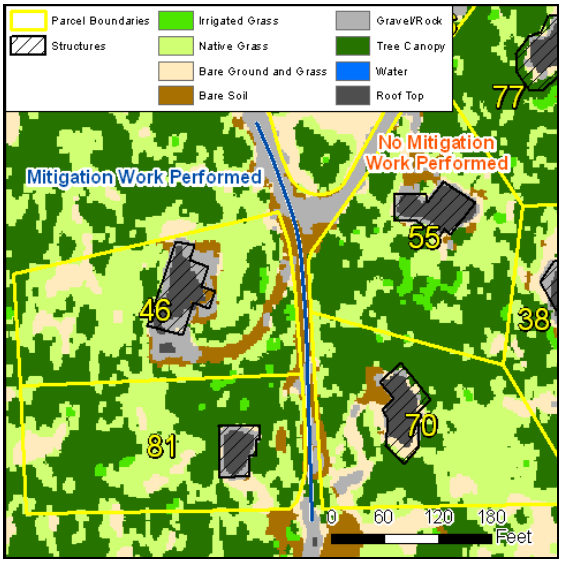


Figure 13. 2008 Final parcel scores (land cover)

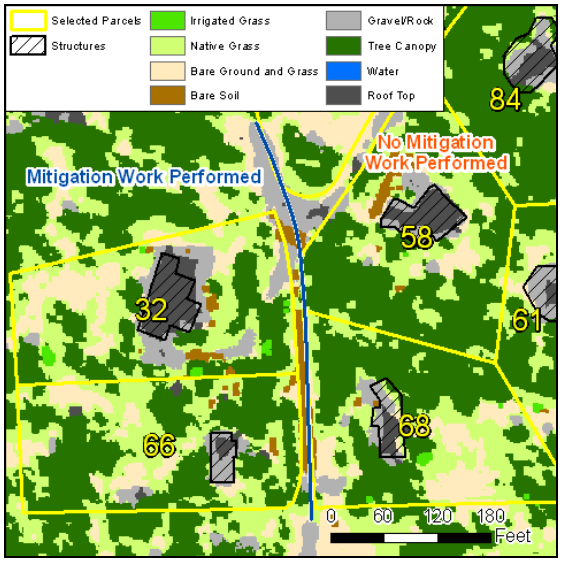


Figure 14. 2010 Final parcel scores (land cover)

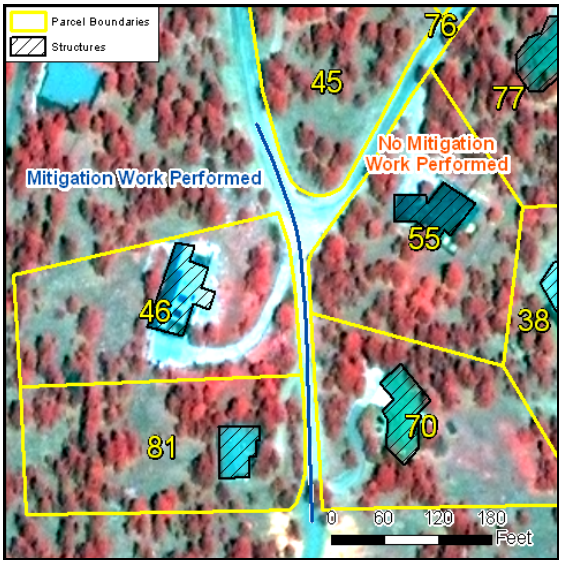


Figure 15. 2008 Final parcel scores (image)

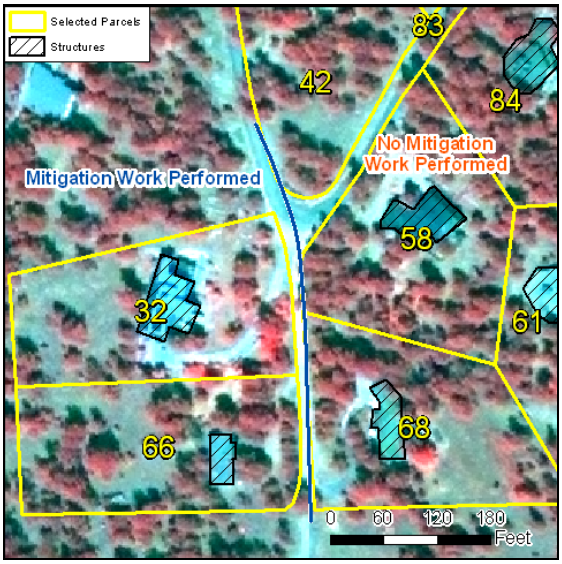


Figure 16. 2010 Final parcel scores (image)

By inspecting the land cover classifications and the imagery, it appears that some mitigation work is evident. Some tree canopy and grass surrounding the structure and further away from the structure in zone 2 has been removed. This parcel is in the list of parcels provided by Boulder County Staff as having performed mitigation work between 2008 and 2010. The parcels immediately to the right of the blue line show scores of 55 and 70 in 2008 and 58 and 68 in 2010. An inspection of these parcels shows that mitigation work is not evident.

4.0 Comments and Recommendations

4.1 Comments

The defensible space scoring system developed in this project produces measurable, repeatable, and customizable scores for parcels in the wildland urban interface. The score adjusts appropriately with differences in vegetation cover within the different zones. The scores range from the 20s to the 80s and 90s. Appendix B lists the parcels used in the study with their 2008 score and 2010 score.

Scores within the selected parcels that increase from 2008 to 2010 can be attributed mostly to the differences in satellite image parameters. By obtaining imagery from the Digital Globe archive it was impossible to specify exact image parameters. Thus, the imagery from 2008 and 2010 are acquired in different months and at different satellite incidence angles. Satellite incidence angle is the angle that the satellite is pointing while the image is acquired. A smaller incidence angle means the satellite was directly overhead while acquiring the imagery resulting in the least amount of displacement and distortion. A larger incidence angle means the satellite was not directly above the study area while acquiring the imagery. This results in some displacement and distortion. The 2008 image has a satellite incidence angle of 19 degrees while the 2010 image has an incidence angle of 33 degrees. This results in some displacement of tall objects such as trees, possibly having an effect on the percent area covered by tree canopy.

The different dates among the imagery can have an effect on grass class in the classification as well. The 2008 imagery was obtained in late spring when grasses are typically green and tall. The 2010 imagery was obtained in late summer when grasses are drier. Ideally, the images would be taken in the same month. However, grass vegetation can be affected by differences in precipitation within the season as well as differences among different seasons.

4.2 Recommendations

4.2.1 Pilot Study Recommendations

Included with this pilot study are the GIS data and tools that produced the results. Boulder County should investigate the scores of various parcels to understand how they are affected by different land cover types. The tools that are provided with this project make it possible to rerun the analysis with different parameters and achieve a different score.

Parameters that can be adjusted are the search distance for the Moran's I dispersion factor and the weights that each zone's score contributes to the final score.

The tools themselves are written in Python and can be easily modified. The Defensible Space Scores script tool uses the land cover classification and the land cover class values identified in **Table 2** to calculate the scores. If these land cover class values are changed the script will need to be updated in order to calculate the score correctly.

Further investigation on the effect of mitigation work could be performed by editing one of the classification files for 2008 or 2010. The edited file would simulate mitigation work performed. The tools could then be run with original classification and edited classification to determine what affect the virtual mitigation work had on the score.

4.2.2 County-wide Defensible Space Scoring System Implementation

In order to implement an annual county-wide defensible space scoring system accurate, consistent imagery will need to be obtained annually. Aerial imagery or satellite imagery is adequate; however, consistency is most important. The imagery must be multi-spectral (with a near-infrared band) and should have a high spatial resolution (<1m). Images should be acquired within one month of each other, preferably in July. A small satellite incidence angle should also be specified when acquiring imagery. Some vendors may offer orthorectified products that minimize displacement in the imagery.

The land cover classification should be performed consistently from year to year. Improvements to the classification accuracy will likely occur over time. However, it should be recognized that any major improvements or changes to the classification procedure will likely affect the defensible space score. Scores developed from a new classification process should be reconciled with the previous year's score.

References

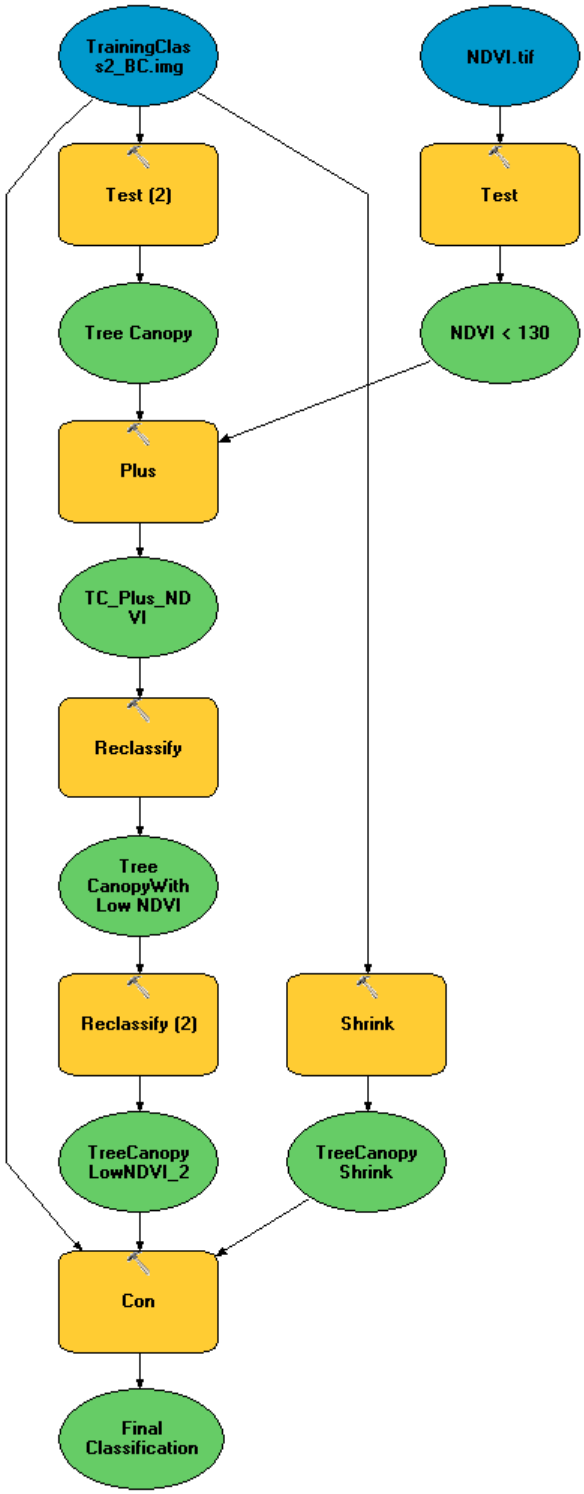
Edel, S., 2002. Colorado Wildland Urban Interface Hazard Assessment Methodology [online]. Available from: http://csfs.colostate.edu /pages/documents/ColoradoWUIHazardAssessmentFinal.pdf

Muller, B., and Yin, L., Regional governance and hazard information: the role of co-ordinated risk assessment and regional spatial accounting in wildfire hazard mitigation. *Journal of Environmental Planning and Management*, Vol. 53, No. 1, 1-6.

Romme, W., Barry, P., Hanna, D., Floyd, M., and White, S., 2006. A Wildfire Hazard Assessment and Map For La Plata County, Colorado, USA. *Fire Ecology*, Vol. 2, No.1, 18-21.

Sanborn, 2008, [online]. Available from: http://gis.sanborn.com/Portals/2/CFRAS%209.2%20-%20FAQ.pdf

Appendix A – ArcGIS Classification Refinement Model



Appendix B – Pilot Parcel Scores

PIN	House	Vegetation	Acres	Subdivision	In Mitigation List	Score 2008	Score 2010
146115002002	yes	moderate	0.9	Pine Brook Hills	Yes	78.1	96.0
146114007005	yes	moderate	1.5	Pine Brook Hills	No	72.5	68.4
146114003001	yes	moderate	1.1	Pine Brook Hills	No	55.8	43.0
146114003002	yes	moderate	0.9	Pine Brook Hills	No	69.7	93.4
131934003013	yes	moderate	2.1	Boulder Heights	Yes	83.5	92.0
146124201003	yes	light	2.0	Pine Brook Hills	No	46.3	43.7
146114030001	yes	dense	3.2	Pine Brook Hills	No	69.2	50.9
146115003004	yes	moderate	1.0	Pine Brook Hills	No	38.0	61.1
146114007002	yes	dense	1.2	Pine Brook Hills	No	31.8	59.6
146115002001	yes	light	1.0	Pine Brook Hills	No	45.1	42.4
146104007006	yes	light	3.0	Boulder Heights	Yes	74.8	63.2
146115002003	yes	dense	0.9	Pine Brook Hills	No	82.9	95.7
146115003003	yes	moderate	1.0	Pine Brook Hills	Yes	69.9	67.8
146123014002	yes	dense	8.2	Pine Brook Hills	No	36.4	34.7
146114003003	yes	light	1.0	Pine Brook Hills	No	76.5	80.0
146123011015	yes	dense	3.2	Pine Brook Hills	No	66.3	66.4
146104007009	yes	moderate	1.8	Boulder Heights	No	59.5	57.3
146104007002	yes	light	1.5	Boulder Heights	No	33.5	16.7
146104007007	yes	moderate	1.9	Boulder Heights	No	55.3	57.1
146104007010	yes	moderate	4.9	Boulder Heights	No	58.1	73.4
131935000012	yes	moderate	36.5	-	Yes	51.3	56.1
146123011016	yes	dense	3.1	Pine Brook Hills	Yes	50.0	51.4
131935000032	yes	moderate	5.9	-	Yes	35.1	47.0
131935000007	yes	dense	16.8	-	Yes	25.2	48.3
146123009010	yes	moderate	1.2	Pine Brook Hills	No	84.6	76.2
146104007001	yes	moderate	3.0	Boulder Heights	Yes	67.5	68.1
146114007001	yes	dense	1.1	Pine Brook Hills	Yes	71.2	56.4
146115001011	yes	moderate	1.0	Pine Brook Hills	Yes	81.1	65.5
146115003001	yes	dense	1.1	Pine Brook Hills	No	77.4	83.7
146115002004	yes	moderate	0.9	Pine Brook Hills	No	76.3	83.0
146115003002	yes	moderate	0.9	Pine Brook Hills	No	55.4	58.0
146105002002	yes	moderate	1.2	Boulder Heights	No	44.0	62.5
146104007008	yes	moderate	4.6	Boulder Heights	No	58.1	57.0
146104021012	yes	light	1.7	Boulder Heights	No	65.2	72.7
146104021008	yes	light	1.2	Boulder Heights	No	62.1	37.8
146105003001	yes	moderate	1.2	Boulder Heights	No	48.5	57.6
146104017008	yes	light	1.2	Boulder Heights	No	68.1	70.3
146104023009	yes	light	1.4	Boulder Heights	No	41.5	35.2
146104021009	yes	moderate	1.2	Boulder Heights	No	51.6	61.7
146123009009	yes	light	6.1	Pine Brook Hills	No	41.3	50.4
146104018006	yes	light	30.5	Boulder Heights	No	31.1	31.3
146115001010	yes	light	1.0	Pine Brook Hills	No	46.5	31.9
146105003003	yes	moderate	1.0	Boulder Heights	No	69.5	84.0
146104026002	yes	light	1.4	Boulder Heights	No	44.6	68.8
146104026001	yes	moderate	1.6	Boulder Heights	No	32.2	40.9
146104017006	yes	light	1.4	Boulder Heights	No	70.5	65.5
146104023008	yes	medium	1.4	Boulder Heights	Yes	76.2	70.3
146104023006	yes	light	1.3	Boulder Heights	No	27.9	18.4
146114024002	yes	light	1.5	Pine Brook Hills	No	64.4	68.4
146105003004	yes	light	1.0	Boulder Heights	Yes	33.9	38.6
146104023007	yes	moderate	1.5	Boulder Heights	No	69.0	30.9
146114024001	yes	light	1.5	Pine Brook Hills	Yes	69.4	65.3
146123009008	yes	Moderate	14.8	Pine Brook Hills	No	35.1	31.4
146105003002	yes	moderate	0.9	Boulder Heights	No	65.2	74.7
146104018002	yes	light	3.1	Boulder Heights	Yes	39.1	54.8
131934000010	yes	moderate	1.9	-	Yes	59.8	76.2

Appendix F: Fuel Mapping and Wildfire Simulation Methods

One tool increasingly used for wildfire mitigation and planning is computerized wildfire simulation to pinpoint areas projected to experience the most extreme wildfire behavior and effects. These projected fire maps can then be combined with maps of "values" at risk to identify areas at the highest risk of being damaged by extreme wildfires. Limited resources for fire mitigation can then be used strategically to alter forest vegetation (fuel) in these prioritized areas to reduce the intensity of future wildfires in order to protect life, property, and other values at risk in fire prone environments.

Fire modeling is a data intensive endeavor, requiring detailed maps of surface, ladder, and canopy fuels. Certain assumptions must also be made about the environmental conditions under which simulated fires occur (wind, weather, and fuel moistures). The description below briefly details the mapping and wildfire simulation methods employed by the Boulder County Community Wildfire Protection Plan.

Fire Simulation Background

The Boulder County Community Wildfire Protection Plan employed FlamMap to simulate wildfire in Boulder County (Finney 2006). This software is a fire behavior mapping and analysis program that uses information on fuels, topography, and weather to compute potential fire behavior characteristics (flame length, crown fire potential, conditional burn probability, among others). Fuel inputs for FlamMap include surface fuel model, canopy base height, canopy cover, canopy bulk density, and tree height (fuel inputs described below). Topographic inputs to FlamMap include aspect, slope, and elevation. Environmental inputs to FlamMap include: wind speed, wind direction, and fuel moistures. For conditional burn probability modeling, required inputs also include a number of random ignitions and a burn period.

Fuel Mapping Methods

Accurate fuel maps are essential for wildfire modeling. The Assessment Work Group is committed to using the most accurate fuel maps available for fire simulation and chose to use fuel maps recently created at the University of Colorado, Boulder, which were derived from 196 field plots and pre-existing vegetation maps (Krasnow et al. 2009). At each plot, measurements were made of surface fuels, ladder fuels, canopy characteristics, and a complete tree census was taken. Through detailed comparisons of modeled fire behavior and effects of two past wildfires (Overland Fire of 2003 and Walker Ranch Fire of 2000) these fuel maps were shown to outperform national LANDFIRE fuel maps for wildfire simulation accuracy (Krasnow et al. 2009). The fuel maps used in this assessment are a significant improvement over previously existing maps and have helped produced more reliable fire behavior outputs. However, forests are constantly changing and future refinements to these maps will likely be necessary to incorporate natural or human caused changes to forest fuels.

Maps developed by Krasnow and others (2009) only covered the montane zone of Boulder County (elevations between 5,900 – 9,850 feet in elevation), so the first challenge was to extend their mapping methods across the entire county (including a 10 km buffer). The area east of Highway 36 (and Braodway) is represented by unaltered LANDFIRE fuel maps as these are mostly grass fuels that were not mapped earlier by Krasnow et al. 2009. The area to the west of Highway 36, not covered by

Krasnow et al. 2009, was mapped according the models developed by Krasnow to crosswalk LANDFIRE data to a product that is analogous to Krasnow et al. 2009 fuel maps. Fuel strata and mapping models are described below in more detail.

Surface fuel model – Gridded map representing a categorical surface fuel model from Scott and Burgan 2005. This layer also contains one model from Anderson 1982 (fuel model 2, Timber grass and understory), and a custom fuel model for aspen forests.

Mapping method - A cross-tab confusion matrix was created from 1000 points placed randomly in Boulder County. The resulting matrix identified how LANDFIRE fuel model assignments correlated with Krasnow et al. 2009 fuel model assignments. The resulting matrix was used to create the following surface fuel model crosswalk (all number refer to the numeric code for surface fuel models in Scott and Burgan 2005, except "Anderson 2" and "171"):

LANDFIRE Fuel Model Assignment	Most likely Krasnow et al. 2009 analogue
91	Anderson 2
93	171
98	98
102	102
121	Anderson 2
122	188
141	102
147	Anderson 2
161	Anderson 2
165	188
181	181
183	183
188	188

Canopy cover (cc) - Gridded map representing percent forest canopy cover (units = percent canopy cover).

Mapping method – Linear regression was employed on the same 1000 random points to create a model to predict Krasnow et al. 2009 canopy cover value from LANDFIRE canopy cover values. The resultant equation was: (LANDFIRE canopy cover value)*.54829 + 13.1132 = new canopy cover value.

Canopy Bulk Density (cbd) – Gridded map representing the canopy bulk density (units = kg/m^3 x 100).

Mapping method - Linear regression was employed on the same 1000 random points to create a model to predict Krasnow et al. 2009 canopy bulk density value from LANDFIRE canopy bulk density values. The resultant equation was: (LANDFIRE canopy bulk density value)*.35706 + 10.14941 = new canopy bulk density value.

Canopy Base Height (cbh) – Gridded map representing the average canopy base height in each pixel (units = feet x 10).

Mapping method – Classification and Regression Tree (CART) analysis was used to create a model to map this variable. The resultant CART model had 14 terminal nodes (leaves) and used the following variables: Vegetation type (from Southwest Regap Vegetation Map), LANDFIRE cbh, LANDFIRE surface fuel model, National Land Cover Dataset (NLCD) canopy cover, and LANDFIRE canopy cover.

Canopy Height (ht) – Gridded map representing the average height of the dominant tree canopy in each pixel (units = feet).

Mapping method – Classification and Regression Tree (CART) analysis was used to create a model to map this variable

Fire Simulation Methods

The first step in wildfire simulation for county planning and fire mitigation is to define the "problem fire." For Boulder County, this was not hard as, coincidentally, the Fourmile Fire erupted soon after the Community Wildfire Protection Planning began. The Fourmile Fire was chosen as the 'problem fire' for the county because it occurred during extremely dry environmental conditions, was fanned by warm Chinook winds from the west, defied fire suppression efforts, and damaged or destroyed homes and other human values in the wildland urban interface. Prior to the Fourmile fire, there were other damaging fires that occurred under similar environmental conditions and there will likely be similar fires in the future – which this assessment intends to protect against.

The environmental conditions under which wildfires were simulated in this assessment were modeled after the Fourmile Fire and are detailed below (1, 10, and 100 hour fuels are woody fuels of increasing diameter, the time indicates how fast they gain or lose moisture):

- 1 hour fuel moisture = 4%
- 10 hour fuel moisture = 5%
- 100 hour fuel moisture = 6%
- Live Herbaceous fuel moisture = 35%
- Live Woody fuel moisture = 70%
- Wind speed = 19 mph
- Wind direction = 270 Degrees (coming out of the west)

Basic Fire Behavior Modeling

For the basic fire behavior (flame length, crown fire potential, fire intensity), FlamMap assumes constant environmental conditions for the entire landscape (see above), assumes the entire landscape burns, and calculates fire behavior in each map cell.

Conditional Burn Probability

In this module in FlamMap (minimum travel time), the software will randomly locate a set number of ignitions across the landscape and simulate a wildfire (for each ignition) that burns for a pre-determined time period (the "burn period"). In this module, as in the basic fire behavior module, environmental conditions are held constant so the calculations can generate fire growth in the absence of time-varying winds or moisture content which enables analysis only of the effects of spatial patterns of fuels and topography (Finney 2006). When a large number of random ignitions are allowed to burn across the landscape, a conditional burn probability map can be generated. This map shows the likelihood of specific areas burning, given there was a fire in the study area. For this assessment the conditional burn probability parameters were set as:

- Burn period = 10 hours
- Number of random ignitions = 10,000

References

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Southwest Regional Gap vegetation map: http://www.gap.uidaho.edu/landcoverviewer.html (downloaded on 9/18/10)

Appendix G: Fuel Treatments-Opportunities and Constraints

A Discussion about the General Opportunities and Constraints involved in Wildfire Hazard Mitigation Projects

Ownership

Major land ownership classifications are Federal, State, Local Government and Private. Federal Lands include the NFS Lands, Bureau of Land Management (BLM), National Park Service, Department of Defense, and potentially other agencies and departments. State lands are typically those owned or managed by the State Land Board, the Colorado Division of Wildlife, or State Parks. However, there are other agencies or institutions, such as state universities, that also may own significant acreage. Local Government lands typically include county, city or town-owned properties. County-owned lands are often managed as open space or park lands. City-owned lands are also often owned and managed for open space or parks, but also for watershed protection or other purposes.

The final category, Private Lands, is a catch-all that can include a myriad of other types of ownerships including special district lands, company or corporate-owned lands, privately-owned properties and more. These, too, can be of all sizes. Privately-owned parcels can be extremely complex, particularly where they are comprised of old mining claims.

Access

Access to and within any particular area is a key factor in determining opportunities for mitigating wildfire hazards or the ability to install, operate and maintain erosion and sediment control structures following wildfires. The initial analysis of an area is often limited by the data available in determining what roads exist within any given area. Normally, data layers available for these analysis show major roads and access routes, but often fail to include small, local roads and trails, particularly on non-federal lands. Such roads are very important for accessing backcountry areas for conducting mitigation activities. Experience has shown that old roads used for mining or logging that can be temporarily re-opened to conduct project work may not be shown on any maps. Another option is temporary roads that can be constructed and closed following treatment, but they add costs to projects and current policies on many federal lands make even use of temporary roads difficult.

When conducting traditional logging and thinning operations where products are removed from the forest, areas within ¼ to as much as ½ mile of roads can be addressed. Specialized logging equipment commonly referred to as “forwarders” can be used to move logs and other products to the road from as far away as 2 miles or more if terrain allows. If products do not have to be removed to meet fuel loading requirements and alternate treatment methods such as “mastication” or mulching can be used, equipment can be “walked” to treatment units as far from roads as terrain allows and it is practical to maintain and support the equipment.

Slopes

Land slope can be a major constraint when considering where and what treatments may be conducted to reduce wildfire hazards. Slope constraints are related directly to the typical harvesting or treatment systems and equipment employed and available within Colorado. Land management agency policies may also constrain the slopes upon which treatments may be conducted.

Slopes of 30 percent or less are the easiest to treat and the most traditional threshold for treatment given typical harvesting systems and equipment availability. Technological, power and other improvements now allow equipment to operate on slopes of 40 percent or perhaps even steeper ground. Experimental work conducted by the Colorado State Forest Service on Denver Water's lands in the Upper South Platte showed that tracked mastication equipment could work on slopes of up to 55 percent without causing erosion.

Quite recently in Colorado there have been several cable logging and even a few helicopter logging operations conducted. Slope is typically not an absolute constraint with these types of operations, but other factors such as the shape of the hillside (convex vs. concave), whether the project can be treated from above or below, and others determine actual project feasibility. For helicopter logging factors such as elevation, the type of helicopter, flight distance to suitable landing areas, average log size and weight, and even the maximum daily temperatures are of concern.

Vegetation

Vegetation is what fuels a wildfire. The vegetation type and its arrangement, size, density, and moisture content; the slope of ground and the aspect it is found on; whether it is dead or alive; the weather and season of the year, and more all dictate if and how intensely that fuel will burn. Major forest types are discussed below:

- Ponderosa pine – In Boulder County ponderosa pine is one of the first forest species encountered as one moves westward and upslope from the plains grasslands. Historically ponderosa pine burned relatively frequently. At lower elevations it likely burned quite frequently and this created very open stands of timber. Fires were usually of low intensities and likely caused little damage. At the higher elevations where ponderosa pine is found, fires occurred less frequently and likely burned with mixed severities. Some areas burned similar to the lower elevations with relatively low intensities while other areas burned with higher intensities, often torching pockets of trees and occasionally crowning and burning most trees in areas. This created a highly diverse landscape, very much different than the ponderosa pines stands we see today in much of Boulder County.
- Douglas-fir – This species is often found mixed in varying degrees with ponderosa pine. Historically it was most often found on the shady and moist north-facing slopes. Its spread outside these areas was kept in check by natural fires. Since the early 1900s fires have been suppressed with increasing efficiency. This has allowed Douglas-fir to greatly expand beyond the areas it historically occupied. Because of its growth habit and the increasingly dense forests,

fires in these Douglas-fir and ponderosa pine/Douglas-fir mixed stands are burning much more intensively and over much greater areas than was ever experienced historically.

- Aspen is an aggressive invader to disturbed areas. It quickly populates areas damaged by fire, rockslides or mass soil movement, avalanche paths and run-out areas, large areas of windthrow, and other areas where conifers have been killed. It is normally a successional species in that as it matures, more shade tolerant conifer species begin to grow and alter the forest type. In some areas, however, aspen can actually be a climax species.

Aspen is somewhat "resistant" to fire as crown fires will seldom carry through this forest type except under extreme drought combined with windy conditions. Its susceptibility to fire is normally seasonal: normally only burning during dry fall periods, often after their leaves have fallen; and, occasionally, in the spring, prior to green-up if conditions are dry. Because of these characteristics, it is a good species to maintain or promote within the landscape. This can be done using a variety of silvicultural and prescribed fire techniques.

- In Colorado, lodgepole pine is also found in dense, continuous stands. Lodgepole pine normally comes in after a fire. It often can be considered the climax species under normal fire intervals. In the absence of fire lodgepole stands will transition to more shade tolerant species. Lodgepole pine has a natural fire interval that may begin at about 150 years of age up to perhaps 300 years. Mature stands begin to "fall apart" due to insect, disease, rot and other factors. As trees fall, they add significant heavy fuel to the forest floor, and helping to create conditions that make the species susceptible to hot, fast-moving crown fires. It, like the spruce/fir, is difficult within a short time period, to thin lodgepole pine sufficiently to develop diversity significant enough to reduce wildfire hazards. This much needed diversity must be developed by creating diversity at the stand and landscape levels by clearcutting, patch cutting, creating permanent openings, or converting areas to aspen. Once management has begun for home, town or watershed protection, in some situations it may be advisable to utilize less traditional management techniques for long-term management (*Lodgepole Pine Management Guidelines for Land Managers in the Wildland -Urban Interface,* Colorado State Forest Service, 2009).

- Spruce/fir is a component of the Boulder County's forest vegetation that is found at the highest elevations. This forest type is comprised of mixtures of Engelmann and Colorado blue spruce, subalpine fir and other minor species. It is a forest type that, under natural conditions, has a very long fire interval – perhaps as long as 500 to 700 years. When it does burn, it burns very intensely and can cause severe erosion and sedimentation problems. Human-caused fires are a wildcard that can occur anytime weather conditions allow, introducing an unnatural fire event into that normal historic fire interval.

Spruce/fir is difficult, within a short time period, to thin it sufficiently to develop diversity significant enough to reduce wildfire hazards. This much needed diversity must be developed by creating varied conditions at the stand and landscape levels by group selection, small patch cutting, creating permanent openings, converting areas to aspen, and by other techniques. Once management has begun for

watershed protection, in some situations it, too, may be advisable to utilize less traditional management techniques for long-term management.

Mountain pine beetles have and are impacting to varying degrees the lodgepole pine forests in portions of Boulder County. Those forests that have not yet been impacted by the current MPB epidemic continue to be at risk for attack and the extensive mortality seen elsewhere in Colorado.

Potential Effects of Fire in Mountain Pine Beetle-Infested Areas

The lodgepole forest is a disturbance-driven and fire-dependent forest type. The risk of fire is present through much of this forest's life cycle. The degree of increased risk due to the epidemic has been a matter of academic debate. Regardless of this debate over the probability of such fire, it is important for watershed stakeholders to understand how such fires might burn and what the impacts to forest soils and watersheds might be. Recent reports from Canada about fire behavior in beetle impacted stands, and experience with several small-scale fires in Colorado, provide insight into what we might experience in Colorado:

The Red Needle Stage (within three years of infestation):

- Relatively benign ground fires may transition into independent crown fires without a torching phase. In Canada, thresholds for such fires were 80 degrees and 30 percent relative humidity. Both red and yellow tree crowns readily carried fire with little wind or slope. Initial attack efforts fail even under milder fire danger indices.
    - ✓ Good anchor points, escape routes and safety zones are essential.
    - ✓ During fire incidents, constantly monitor escape route conditions.
- For the three years following the epidemic, each fire season started earlier than the last. Major project fires might occur within weeks of snow-free ground.
    - ✓ Spotting from tree crown to tree crown without any supporting ground fire may occur.
    - ✓ Multiple-mile runs may be common even with relatively mild winds.
    - ✓ Fire spread direction may become fickle, changing with very subtle wind shifts. These shifts are difficult for firefighters to detect at ground level inside timber stands.
- Think on a landscape scale when developing suppression tactics for individual fires and when planning for fuels treatments and wildfire hazard mitigation.

- ✓ Multiple lightning starts may burn into one another by the end of the first or second burning periods.
- ✓ Deciding where to make a stand can become a complicated exercise in predicting fire dynamics and time frames.
- ✓ Fire activity as described above may occur in areas with continuous crowns of red or yellow needles. Fires may behave like an elevated grass Fuel Model 1, often as an independent crown fire.
- ✓ Fire behavior may force firefighters to back off and give up country to find more secure fire control features. Plan multiple fuelbreaks and other "defensive" treatments across the planning area.
- ✓ Clearcuts (with or without slash disposal), meadows, and open fuelbreaks likely will be the preferable location for fire control activities because in such areas the fire is more likely to stay on the ground where firefighters can deal with it.

The Grey Stage (after most needles drop in the infested stands):

- Once needles drop from trees, fire behavior is expected to become much more subdued and predictable. The increase in the amount of available dead fuels will result in slower moving but more intense fires that resist control and are more likely to damage forest soils.
- Snag hazards to firefighters, forest visitors and landowners greatly increases over time during the grey stage. In Canada, mechanized equipment and access are available for much of its initial fire attack and suppression work. Understand that in many parts of Colorado, we may not have this option.

The Down-and-Dead Stage (as trees fall over time):

- As trees rot and fall or are blown over, heavy fuels accumulate on the ground. Anticipate hot surface fires with high resistance to control that will damage forest soils.
- Fuel profiles will become increasingly complex as new lodgepole seedlings and saplings become established in this dead fall. It is not difficult to visualize a fuel profile of continuous heavy dead-down material with large patches of interlaced crowns twelve to fifteen feet tall.

Summary:

The British Columbia experience with fire behavior reminds us that we need to become vigilant observers in our own insect damaged stands. While we may not be exposed to exactly the same behavior they are experiencing, we most certainly will see things out of the "norm" for Colorado. The red needle stage is obviously hazardous and of relatively short duration. The standing dead trees present special hazards for falling snags. The accumulating dead-down has high fire intensity during the early stages and creates special challenges for fire line construction and firefighter access. Future dense

lodgepole stands with heavy dead-down material on the ground may become the most problematic from both a soil erosion and fire suppression perspective.

Talking Points & Implications:

1. The current mountain pine beetle infestation is unprecedented in Colorado's recorded history. Our expectations of what will happen when fire occurs in these areas are based on information from beetle outbreaks in other areas, the science of fire ecology, and on fire behavior predictions.

2. During the "red needle stage" when red/brown-colored pine needles are still attached to the trees, the needles contain volatile chemicals that increase flammability. The red-needle stage generally lasts between three and five years.

3. We believe that the beetle epidemic will increase fire danger, though not as dramatically as some experts are predicting. In beetle-infested areas, fire hazard will become elevated more quickly during shorter time periods when conditions are dry than it will where pre-epidemic conditions exist.

4. Although the proper alignment of environmental factors (fuels, topography, winds, temperature and relative humidity) are still necessary to create conditions that will drive fire in lodgepole pine, experience indicates that such an alignment can occur within a shorter timeframe because of the epidemic.

5. When significant quantities of trees begin to fall, the jackstraw effect will suspend logs above the surface of the ground. On average, these logs will be drier than logs that are in direct contact with the ground surface and may more-easily ignite.

6. The lack of forest shading resulting from downed trees will cause an increase in surface temperature. The combined increase in temperatures and decreased moisture content may increase the probability of ignitions from both human and natural causes.

7. Fires that burn in jackstraw logs will occur as slow-moving, high-intensity fires that will be difficult to control. These fires will kill lodgepole pine seedlings and saplings, and cause major damage to forest soils. Erosion, sedimentation, and mudslides or debris flows may be major consequences after these fires. If the trees are too young to produce cones or have non-serotinous cones when burned, such areas likely will not regenerate and will remain as openings for long periods of time.

8. The greatest threat to firefighter safety will likely be from falling dead trees (snags) that will occur during fire events, rather than from fire spread.

9. Over time, the numbers of dead trees that will have fallen will greatly increase. In addition, as fires burn through decomposing root systems, the number of snags that fall will substantially increase

during the fire. These jackstraw logs will make walking difficult in and around fires, which will make it even more challenging to escape falling snags.

10. To improve firefighter safety, it may be advisable to increase the use of heavy equipment, such as bulldozers, whenever and wherever possible. Understand however, that use of such equipment will likely require additional post-fire rehabilitation to avoid adding to the erosion and sedimentation potential.

11. The potentially damaging effects to communities, watersheds and infrastructure (power lines, recreation sites, roads, reservoirs, etc.) from larger wildfires in beetle-infested stands of lodgepole pine will increase and remain high even after some regeneration has occurred. (Such behavior was observed in the 1980 Emerald Lake Fire, which burned in jackstraw that resulted from the 1950s spruce beetle epidemic.)

12. Individuals and groups need to be proactive in their efforts to reduce hazards from falling snags and wildfire around homes, businesses, utilities, infrastructure, and other high-value assets. Such work must occur prior to wildfire incidents.

Appendix H: Fuel Treatment Planning Procedures

Large, collaborative, landscape-scale projects require a different approach than traditional single-component projects. Every project is different; however, collaborative projects should consider the following planning procedures.

1. Convene a Community Working Group
    a. This will be a stakeholder group of participants, landowners, and community leaders. It is imperative that such a group be formed early in the process.
    b. Seek general input from the group
2. Convene a Media/Outreach Team or process
    a. Draft a Communications Plan
    b. Utilize public information officers and outreach specialists from all agencies involved
    c. Initiate project with a newsletter and try and keep residents updated using appropriate media and outreach tools
    d. Initiate a process for communication to project leaders from communities
3. Hold community meetings
    a. Review goals, objectives, prescriptions, and timelines
    b. Conduct field tours
    c. Conduct update meetings and tours on a regular basis
4. Assign person or team to seek funding
    a. Tie into ongoing efforts; seek additional funding from all public land management involved
    b. Utilize the Good Neighbor Agreement as appropriate
    c. Seek funding from both traditional and non-traditional sources
5. Assign a person, small core team or private entity to manage the overall project
    a. Draft an organizational structure and revise it as process moves forward
6. Convene a local Monitoring and Evaluation Team
    a. Recruit interested local residents
    b. Train team as needed
    c. Establish permanent photo points
    d. Use existing monitoring and evaluation procedures and protocols as much as possible
7. Initiate individual components as soon as possible. Don't wait until a "full blown" project can be initiated
    a. Organize implementation based on funding, individual agency work ongoing, planned and then add to these planning and funding processes as needed
8. While some efficiencies can be brought to bear with this strategy, there will be agency policies, protocols and fiscal requirements that must be considered and followed
    a. Explore opportunities to manage the project from a single entity. A private sector business or non-profit may work to implement such a project in a more efficient manner
9. Use local crews, contractors and fire protection district personnel as much as possible
10. Develop a utilization strategy to use material generated form treatments
    a. Boulder County Community Forestry Sort Yards
    b. Peak to Peak Wood
    c. Local markets

Appendix I: Community Wildfire Protection Programs: The Colorado State Forest Service and Boulder County

Colorado State Forest Service

The Colorado State Forest Service is committed to helping homeowners and landowners promote healthy and sustainable forest conditions. It emphasizes action on state, private and other non-federal lands, and provides technical and financial assistance to those that have demonstrated a willingness and/or commitment to effectively manage their property.

Example Programs:

Forestry Ag

> Landowners in Colorado are eligible to sell their timber through the Forest Ag Program, which offers similar tax valuation as that of traditional agricultural lands. This voluntary program promotes forest health and stewardship, wood products utilization, sustainable forest management and reduced fragmentation of forested lands.

Home Assessments

> CSFS foresters are available to assist homeowners and landowners with how to best manage and care for trees on their property. A forester will visit the property and examine trees for disease, wildland fire defensible space and overall health. They can make recommendations for disposing of diseased trees, safeguarding trees, keeping trees healthy and reducing their risk of disease, and mitigating the risk of catastrophic wildfire.

Grants:

The Colorado State Forest Service helps individuals, landowners, fire departments, community groups and others secure grant assistance for projects that promote healthy forests in Colorado, whenever opportunities arise. One such grant, the Wildland-urban interface competitive grants, supports forest stand improvement for hazardous fuels reduction, including defensible space, thinning, slash disposal, fuelbreaks, assessments, planning, monitoring and prescribed fire.

Publications

The Colorado State Forest Service website is a great resource for education on forestry. The site provides many publications on a wide range of topics including wildfire protection, insects and disease, forestry health, forestry management, tree selection and care, and community planning.

For more information visit the Colorado State Forest Service website: http://csfs.colostate.edu/index.shtml

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Boulder County

Boulder County has seven departments and offices that play a direct role in community wildfire protection. For the purposes of this entire plan, including this appendix, community wildfire protection includes wildfire mitigation, preparedness, and recovery. It does not include the response to and suppression of wildfires. The county, and its partners, have a large number of programs and staff working in these areas. They are discussed in the Fire Management Plan and other documents.

The county departments and offices that work in the area of community wildfire protection include:

- Board of County Commissioners
- Land Use Department
- Office of Emergency Management
- Parks and Open Space Department
- Public Health Department
- Sheriff's Office
- Transportation Department

The County has 10 primary "program areas" and several additional initiatives and tasks related to community wildfire protection.

1. Forest Restoration and Fuels Treatments on County Parks and Open Space Property
2. Building, Fire and Land Use Codes
3. Fourmile Fire Recovery
4. Community Forestry Sort Yards
5. Boulder County Community Wildfire Protection Plan
6. Support for Local Community Wildfire Protection Plans and Local Mitigation Projects
7. Wildfire Education, Outreach, and Training
8. Sheriff's Office Fire Management Program
9. Community Preparedness
10. Wildfire Mitigation along Roadways

Additional initiatives and functions include:

- The Boulder County Forest Health Task Force
- Participation in the Front Range Roundtable
- Issuing Fire Bans
- Issuing Air Quality Permits for Open Burning
- GIS and mapping support
- Boulder County Fire Management Plan

Strengths, Weaknesses, Opportunities, and Threats

At an April 2011 workshop with key county staff involved with wildfire protection, participants discussed and analyzed the strengths, weaknesses, opportunities, and threats associated with each program area. This information was compiled, analyzed, and prioritized. Four themes—that cut across all programs—are outlined here: 1) Accountability, 2) Communication and Coordination, 3) Capacity, and 4) Opportunities

1) Accountability

The strongest programs have clear lines of authority and staff who are accountable to county residents.

- The Sheriff is responsible for the safe and efficient implementation of fire management activities with other agencies or landowners in accordance with delegation of authorities
- The Director of Parks and Open Space is responsible for management of county property
- The Director of Land Use is responsible for enforcement of the building, fire and land use codes
- The Director of the Office of Emergency Management is responsible for coordinating emergency planning efforts
- The Fourmile Fire Recovery Manager serves as a single point of contact and is responsible for coordinating recovery efforts

For example, in 2011 the Sheriff was pro-active in issuing fire bans across the county. Following the Fourmile Fire, the most common recommendation residents made for improve wildfire protection efforts was to more pro-actively implement fire bans in the county. This recommended was not prioritized by the Advisory Team because the Sheriff was already acting to implement this idea.

Forest restoration and fuels treatment projects on county property are the responsibility of the Parks and Open Space Department. In addition to county staff, the Parks and Opens Space Advisory Council is an official body that helps make sure the department is accountable for its actions.

With the increased risk of flooding following the Fourmile Fire, the Office of Emergency Management took the lead in organizing an extensive emergency preparedness effort.

For other programs, the lines of authority, responsibility, and accountability are not as clear. These programs—such as implementing the Boulder County Community Wildfire Protection Plan; supporting local Community Wildfire Protection Plans and local mitigation projects; and conducting wildfire training, education, and outreach activities—are shared across departments and among staff members.

To improve its chances of success, a single leader or department within Boulder County government should be held responsible for helping to implement this plan. This county representative should serve on the Boulder County Community Wildfire Protection Council and lead the county's contribution to this initiative.

2) Communication, Coordination and Collaboration

The county is a leader in a number of regional wildfire-related groups:

- The Front Range Fuels Treatment Partnership
- The Front Range Fuels Treatment Partnership Roundtable

- The Northern Front Range Mountain Pine Beetle Working Group

As a result, county staff members have the chance to communicate, coordinate, and collaborate with individuals and groups outside of the county.

There are also countywide groups related to wildfire protections, including:

- The Core Team of the Boulder County Community Wildfire Protection Plan[1]
- The Boulder County Fire Fighters Association
- The Boulder County Wildland Fire Cooperators
- The Fire Code Review Committee

The Boulder County Wildfire Mitigation Group met from 1989 to 2007. It played a key role in improving communication, coordination, and collaboration among all parties working in this area.

As far as internal groups that are limited to Boulder County staff, quarterly meetings of the Boulder County Forest Health Task Force facilitates communications and promotes coordination and collaboration across departments.

This quick review shows there are already a number of organizations in place to facilitate communications and help coordinate efforts. We don't need to create additional efforts with these objectives in mind, rather we should work to make sure existing initiatives are effective.

3) Capacity

The county has 1 full-time, permanent position devoted exclusively to wildfire mitigation: The Wildfire Mitigation Coordinator in the Land Use Department. The county has 6.5 full-time, permanent positions devoted to forest health and wildfire mitigation in the Parks and Open Space and Land Use Departments. The county has 3 full-time positions devoted to both wildfire protection and suppression in the Sheriff's Office. (This plan does not cover suppression and response issues and so these programs are not listed here.)

An additional 69 county staff members assist with wildfire protection programs as a portion of the job responsibilities or work in a seasonal or temporary capacity. (Many more county staff worked on the immediate response to the Fourmile Fire.) In-depth information on each program is located on its website identified in the descriptions.

The 77 staff members included here come from the following departments and offices:

- Board of County Commissioners (7)
- Land Use Department (21)
- Office of Emergency Management (4)
- Parks and Open Space Department (17)

[1] The Core Team included 11 members from Boulder County, the City of Boulder, Sunshine Fire Protection Districts, U.S. Forest Service, and Colorado Forest Service. The Core Team will disband with the adoption of this plan and should form the basis for a permanent community wildfire protection structure.

- Public Health Department (2)
- Sheriff's Office (17)
- Transportation Department (5)
- Other Departments (4)

It is clear that a large number of county staff are involved in wildfire protection programs. In addition, the county's response to the Fourmile Fire and the subsequent recovery efforts demonstrated that the county has the ability to mobilize a large number staff in a short amount of time to respond to a crisis and address immediate needs.

However, until it received an American Recovery and Reinvestment Act grant, the county lacked the capacity to develop a Community Wildfire Protection Plan. There was no individual with the time needed to coordinate the effort. Grant funding supported the position responsible for producing the plan through September 2011.

The county has a large number of staff who are able to devote a portion of their time to wildfire issues, or are seasonal, or short-term employees. With the exception of the area of forest health, the county lacks full-time, permanent employees dedicated to wildfire mitigation. The county's Wildfire Mitigation Coordinator is responsible for mitigation efforts. However, he is fully consumed with administering the day-to-day operations of wildfire mitigations components of the Land Use and Building Codes and does not have time to coordinate countywide collaborative programs. The Fire Management Officer works within the county assisting with wildland fire mitigation planning and implementation but is also responsible for suppression efforts.

The county is already heavily involved in wildfire mitigation efforts. However, in order to implement the recommendations contained in this plan and reduce the negative impacts of future catastrophic fires, it needs to add additional capacity.

4) Opportunities

The Fourmile Fire has attracted national attention to Boulder County. The opportunity to obtain outside funding to support wildfire mitigation programs and staff in the county is high. The county has produced a number of innovative programs with the support of federal grants. Grants to support the recommendations contained in this plan should be aggressively pursued (see Chapter 13 on Funding).

Program Descriptions

This section includes a description of Boulder County's 10 primary community wildfire protection program areas and a website where additional information is located.

1. Forest Restoration and Fuels Treatments on County Parks and Open Space Property
2. Building, Fire and Land Use Codes
3. Fourmile Fire Recovery
4. Community Forestry Sort Yards
5. Boulder County Community Wildfire Protection Plan
6. Support for Local Community Wildfire Protection Plans and Local Mitigation Projects

7. Wildfire Education, Outreach, and Training
8. Sheriff's Office Fire Management Program
9. Community Preparedness
10. Wildfire Mitigation along Roadways

Program:	Forest Restoration and Fuels Treatment on County Lands
FTEs:	5 FTEs, 2 seasonals, 2 Boulder County Youth Corps Teams, assistance from other staff including: grant writer, wildlife, plant ecology, weed, GIS and trails staff
Departments:	Parks and Open Space
Partners:	Colorado State Forest Service, US Forest Service, City of Boulder, Fire Protection Districts, University of Colorado, Colorado State University
Activities:	• Resource inventories • Forest management policy • Management plans for individual properties • Forestry plans and prescriptions for individual properties • Impact assessments • Implementation plans • Revegatation and weed management • Grant writing and management
Coordination & Communication:	Community meetings; coordination with fire protection districts and local Community Wildfire Protection Plans; Coordination with grant funders like CSFS
Strategic Planning Documents:	• Boulder County Comprehensive Plan • Boulder County Forest Policy • Individual Property Management Plans • Five-Year Forestry Plan • Individual Forestry Prescriptions
Issues:	• Lack of staff and resources to complete work • Support from adjacent property owners can be problematic • 30,000 acres of forest to manage • Mountain Pine Beetle epidemic

Website: http://www.bouldercounty.org/government/dept/pages/pos.aspx

Program: Building, Fire, and Land Use Codes

FTEs: 1 full-time FTE plus 13 part-time FTEs

Departments: Land Use, Transportation, Board of County Commissioners, County Attorney's Office

Partners: Fire Protection Districts

Activities:

- Building Permits
- Wildfire Mitigation Plans
- Plan Review
- Docket Review
- Fire Code Review
- Inspections

Coordination & Communication: Building Division and Land Use Department meetings, Fire Code Review Committee

Strategic Planning Documents:

- Boulder County Comprehensive Plan
- Land Use Code
- Building Code
- Fire Code

Issues:

- Mitigation plans are for new construction and remodels only
- Cannot enforce code unless associated with a Building Permit
- Mitigation plan not developed by the Colorado State Forest Service can present additional challenges
- Driveway access can be problematic
- Emergency water supply for firefighting is a common concern
- Wildfire Hazard Identification and Mitigation System not completed or updated

Website: http://www.bouldercounty.org/government/dept/pages/landusemain.aspx

Program:	Fourmile Canyon Fire Recovery
FTEs:	2 full- time, temporary positions (through Fall 2012) and at least 16 county staff on a part-time basis
Departments:	Board of County Commissioners, Land Use, Public Health, Office of Emergency Management, Transportation, Sheriff, Parks and Open Space, Administrative Services
Partners:	Fire Districts: Gold Hill, Sunshine, Sugar Loaf, Four Mile; US Forest Service; Colorado State Forest Service; Urban Drainage and Flood Control District; Foothills United Way; Community Foundation; City of Boulder; National Weather Service; US Geological Survey; Natural Resources Conservation Service; Federal Emergency Management Administration; State of Colorado; United Policy Holders
Activities:	• Single point of contact for fire survivors and internal and external agencies • Coordinate all recovery activities
Coordination & Communication:	Coordinating group weekly meetings; periodic meetings with four fire protection districts and communities
Strategic Planning Documents:	Emergency preparedness plan
Issues:	• No formal recovery plan • Limited funding

Website: http://www.bouldercounty.org/live/environment/land/pages/fourmilefire.aspx

Program:	Community Forestry Sort Yards
FTEs:	.5 FTE (1 full-time staff from March-November), 1 seasonal (April-October), several staff on a part-time basis
County Departments:	Parks and Open Space; Land Use
Partners:	Peak to Peak Wood

Activities:

- Drop-off sites for logs and slash for private landowners and small contractors (material is used for biomass, firewood, and other uses; material that is not utilized is consumed in an air curtain burner)
- Education and Outreach

Coordination & Communication: Weekly Parks and Open Space Forestry-Fire staff meeting, quarterly Boulder County Forest Health Task Force Meeting s

Strategic Planning Documents: Parks and Open Space 5-year work annual work plans

Issues:

- Budget for running and staffing sort yards is limited
- Only one (of the two) sort yards is open at a time
- Sort yards are not open in November – March
- There is no sort yard at lower elevation

Websites: http://www.bouldercounty.org/live/environment/land/pages/fhsortyards.aspx

Program or Project:	Developing Boulder County Community Wildfire Protection Plan
Total FTEs:	1 full-time, temporary position (through September 2011), 6 county staff served on Core Team, 12 additional county staff assisted with the plan and participate on work groups
Departments:	Land Use, Parks and Open Space, Sheriff's Office, Transportation, Board of County Commissioners, Office of Emergency Management
Partners:	US Forest Service, Colorado State Forest Service, City of Boulder, Fire Protection Districts
Activities:	• Risk Assessment • Identification and Prioritization of Fuel Treatment Projects • Citizen Advisory Team • Educational Videos and Interactive Maps • Defensible Space Scoring Pilot Project • FEMA Grant Development
Coordination & Communication:	Core Team meetings every other month; Work Groups meet as necessary
Strategic Planning Documents:	Project planning documents have been incorporated into final plan
Issues:	• Grant funding for plan development ends in September 2011 • Seeking champion within the county to spearhead implementation
Website:	www.bouldercountycwpp.org

Program:	Support for Local Community Wildfire Protection Plans and Local Mitigation Projects
Total FTEs:	No full-time FTEs; at least 12 staff work part-time on these tasks
Departments:	Parks and Open Space, Land Use, Sheriff's Office, Transportation, Board of County Commissioners
Partners:	Residents, Fire Protection Districts, Fire Protection Districts, US Forest Service, Colorado State Forest Service

Activities:

- Technical assistance and consultation
- Assisting with Local Community Wildfire Protection Plans
- Making and printing maps
- Chipping Grant Program
- Supporting community fuels treatment projects
- Boulder County Fire management Plan

Coordination & Communication:	Done on a case by case basis
Strategic Planning Documents:	Individual staff and departments respond to requests for assistance

Issues:

- Difficult to plan for requests for assistance
- Amount of assistance dependent on timing and staff availability
- Staff must juggle requests with formal job responsibilities

Website: http://www.bouldercounty.org/live/environment/land/pages/chippingreimbursement.aspx

Program:	Wildfire Education, Outreach, and Training
FTEs:	1 full-time FTE, 6 staff work part-time seasonal on these issues
County Departments:	Land Use, Parks and Open Space, Sheriff's Office, Transportation, Board of County Commissioners, Office of Emergency Management
Partners:	Colorado State University Extension, Fire Protection Districts, Boulder County Wildland Fire Cooperators, Colorado State Forest Service, Colorado Tree Farmers, US Forest Service, Natural Resources Conservation Service, local municipalities, homeowner associations, and community based homeowner groups
Activities:	• Conduct wildfire education training • Provide speakers for public events • Host community wildfire protection related websites • Support Boulder County Wildland Fire Cooperators training program • Answer questions by phone, email, or site visit • Forest ecology field trips with Parks and Opens Space Volunteer Naturalists • volunteer opportunities with Parks and Opens Space
Coordination & Communication:	Quarterly Boulder County Forest Health Task Force Meetings
Strategic Planning Documents:	None
Issues:	• Advisory Team has recommended creation of Wildfire Education Coordinator position (either a new position or assign a current staff member to take on this role) • Coordination of Sheriff's Office, Land Use, and Parks and Open Space Staff • Collaboration between county staff and fire protection districts • Lack of a wildfire education strategy • Educational component of Boulder County's Wildfire Hazard Identification and Mitigation System is no longer fully utilized • Expanding wildfire and volunteer programs
Website:	http://www.bouldercounty.org/live/environment/land/pages/foresthealth.aspx

Program:	Sheriff's Office Fire Management Program
FTEs:	3 full-time, permanent positions, 13 seasonal employees, and 10 volunteers
Departments:	Sheriff's Office, Parks and Open Space
Partners:	Fire protection districts, US Forest Service, Bureau of Land Management, Rocky Mountain National Park, and Colorado State Forest Service
Program Activities:	• Response and suppression (not included in this plan) • Prescribed fire activities • Hazard fuel reduction and ecosystem restoration projects • Coordination with other fire entities • Media relations • Fire prevention programs • Fire Management Plan • Wildland Fire Annual Operating Plan
Coordination & Communication:	Regular meetings with local, state and Federal wildland fire cooperators
Strategic Planning Documents:	Fire Management Plan, Annual Operating Plan, Colorado Revised Statutes Title 29, Section 22.5-104
Issues:	Need additional full-time staff to help ensure sustainability and continuity of operations

Website: http://www.bouldercounty.org/live/safety/law/pages/emerserv.aspx

Program:	Community Preparedness
FTEs:	No full-time FTE, 4 Office of Emergency Management staff spend part of their time on community wildfire preparedness
Departments:	Office of Emergency Management, Sheriff's Office
Partners:	Fire Protection Districts, City of Boulder, Red Cross, United Way, 211, Salvation Army, Mental Health Center of Boulder County, Ready Colorado, Colorado Department of Emergency Management, Colorado Department of Public Health and Environment, Hospitals
Activities:	• Coordinate emergency planning efforts, include fire mitigation information in preparedness outreach publications • Coordinate and support response to wildfires • Coordinate recovery efforts for community • Provide preparedness training to residents (limited) • Update county multi-hazard mitigation plan
Coordination & Communication:	Monthly Multi-Agency Coordination group meetings, Emergency Operations Center activation, Fourmile Fire recovery meetings, Fire Chiefs meetings
Strategic Planning Documents:	County Emergency Operations Plan, Boulder County Multi-Hazard Plan, Emergency Operations Center Operational Guidelines
Issues:	• Boulder Community Preparedness Council recently dissolved • Planning efforts will be led by Community Services and Public Health
Website:	http://www.boulderoem.com/

Program:	Wildfire Mitigation along Roadways
FTEs:	4 staff members contribute part of their time to the primary wildfire mitigation activities; a large number of staff contributes time to secondary activities
County Departments:	Transportation, Land Use, Board of County Commissioner, Risk Management, Sheriff's Office
Partners:	Colorado Department of Transportation, municipalities
Activities:	Primary: • Tree removal in right-of-way for safety, forest health and wildfire mitigation • Draft policy for emergency access/evacuation roads for Fire Protection Districts Secondary - other transportation activities that contribute to wildfire protection: • Maintain and improve condition of rights-of-way with shoulder widening, overlays and reconstruction • Bridge replacements • Road design for safety and emergency access • Facilitate neighborhood mitigation efforts
Coordination & Communication:	BOCC business meetings and public hearings, staff meetings
Strategic Planning Documents:	Transportation Standards, Boulder County Comprehensive Plan
Issues:	• Location of right-of-way is not always clearly defined • No funding in place for the primary activities • Ownership of some rights-or-way in mountains in dispute
Website:	http://www.bouldercounty.org/government/dept/pages/transportation.aspx

Appendix J: Community Wildfire Protection Resource Guide

Funding

Headwaters News: Curbing Wildfires' Cost
http://www.headwatersnews.org/p.HeadwatersEconomics010610.html

Headwaters: Solutions to the Rising Costs of Fighting Fires in the Wildland-Urban Interface
http://www.headwaterseconomics.org/wildfire/HeadwatersFireCosts.pdf

The True Cost of Wildfire in the Western U.S.
http://www.wflccenter.org/news_pdf/324_pdf.pdf

Forest Improvement Districts (Session Laws of Colorado 2007 First Regular Session, 66th General Assembly)
http://www.state.co.us/gov_dir/leg_dir/olls/sl2007a/sl_111.htm

Senate Bill 10-046
http://www.statebillinfo.com/bills/bills/10/046_enr.pdf

Four Mile Fire Protection District CWPP (Appendix E)
http://csfs.colostate.edu/pages/documents/4MileCWPP_FINALwappendices.pdf

Gold Hill Fire Protection District CWPP (Pg. 61-65)
http://csfs.colostate.edu/pages/documents/GoldHillCWPP06final.pdf

Rocky Mountain Fire CWPP (Pg. E-3 to E-4)
http://csfs.colostate.edu/pages/documents/RockyMountainFPDCWPP_2010.pdf

Sugar Loaf Fire Protection District CWPP (Pg. E-4)
http://csfs.colostate.edu/pages/documents/SugarLoaf_FPD_CWPP_CompleteFinal.pdf

Defensible Space

CSFS-Defensible Space
http://csfs.colostate.edu/pages/defensible-space.html

FireWise-Safer from the Start: A Guide to Firewise-Friendly Developments
http://www.firewise.org/Information/Who-is-this-for/~/media/Firewise/Files/Pdfs/Booklets%20and%20Brochures/BookletSaferFromtheStart.pdf
(13-17)

Wildfire & Insurance
http://www.rmiia.org/downloads/RMIIA_CO_Wildfire_web.pdf

Defensible Space Diagram
http://dnr.wi.gov/forestry/fire/images/prepared.gif

Defensible Space (Douglas County website)
http://www.douglas.co.us/building/wildfire/documents/Defensible_Space.pdf

Ignition Resistant Construction

CSFS-Construction, Design & Materials
http://csfs.colostate.edu/pages/construction-design-materials.html

FireWise Home virtual Tour
http://interactive.firewise.org/vrhome/index.htm

FireWise guide to Landscape and Construction
http://www.firewise.org/~/media/Firewise/Files/Pdfs/landscaping.pdf

Article on California requirements
http://www.californiagreensolutions.com/cgi-bin/gt/tpl.h,content=1261

Boulder County Building with Ignition Resistant Materials
http://www.bouldercounty.org/find/library/environment/w06ignitionresistmats.pdf

Community Mitigation Efforts

FireWise Communities/USA Recognition Program
http://www.firewise.org/Communities/USA-Recognition-Program.aspx

FireWise-Safer from the Start: A Guide to Firewise-Friendly Developments
http://www.firewise.org/Information/Who-is-this-for/~/media/Firewise/Files/Pdfs/Booklets%20and%20Brochures/BookletSaferFromtheStart.pdf
(pg. 9-12)

CSFS Publications for Communities
http://csfs.colostate.edu/pages/pub-communities.html

How Prepared is your community for living with wildfire?
http://southwestcoloradofires.org/WildfireMitigationPractionerSeries.pdf

Building Code/Wildfire Mitigation Plans

Boulder County Wildfire Mitigation Plan
http://www.bouldercounty.org/find/library/environment/w02wildfiremitigationplan.pdf

California codes
http://firecenter.berkeley.edu/bwmg/codes-standards-1.html

Getting Public Involvement in Wildfire Hazard Mitigation
http://www.firescience.gov/projects/briefs/05-3-2-05_FSBrief111.pdf

Douglas County Wildfire Hazard Regulation for Building and Development
http://www.douglas.co.us/building/wildfire/Wildfire_Hazard_Regulation_for_Building_and_Development.html
http://www.douglas.co.us/building/wildfire/Permitting_Process.html

Boulder County Building Code
http://www.bouldercounty.org/live/property/build/pages/buildingamends.aspx

Wildfire Mitigation Timeline
http://www.bouldercounty.org/find/library/environment/w01wildfiremittimeline.pdf

WHIMS
http://www.bouldercounty.org/live/environment/land/pages/whims.aspx

Evacuation Procedures and Planning

Evacuation and Sheltering, and Post-disaster safety
http://www.firewise.org/Information/Who-is-this-for/Firefighters/Evacuation-Planning/~/media/Firewise/Files/Pdfs/Research/EvacandSheltering.pdf

Anchorage Fire Dept-Wildfire: Making the Decision Guidelines for safe Evacuation & for Sheltering in Place
http://www.firewise.org/Information/Who-is-this-for/Firefighters/Evacuation-Planning/~/media/Firewise/Files/Pdfs/Research/WildfireMakingDecisions.pdf

FireWise-What to do when wildfire approaches
http://csfs.colostate.edu/pdfs/what-to-do-when.pdf

FEMA- Wildfire: Are you prepared?
http://www.usfa.dhs.gov/citizens/home_fire_prev/wildfire/

Community Preparedness
http://www.serve.gov/toolkits/disaster/index.asp

Douglas County Emergency Management
http://www.dcsheriff.net/emergencymanagement/index.html

Boulder County Emergency Management
http://www.bouldercounty.org/government/offices/pages/sheriff.aspx

Deschutes County Evacuation Guide
http://www.projectwildfire.org/images/uploads/Evacuation%20Guide.pdf

Boulder County: Driveway Access for Emergency Vehicles
http://www.bouldercounty.org/find/library/environment/w04emergencyvehiclesaccess.pdf

Emergency Preparedness and Firefighting Capabilities

See links under Evacuation Procedures and Planning

Emergency Water Supply for Firefighting
http://www.bouldercounty.org/find/library/environment/w05emerwatersupply.pdf

Community Action

FireWise-Safer from the Start: A Guide to Firewise-Friendly Developments
http://www.firewise.org/Information/Who-is-this-for/~/media/Firewise/Files/Pdfs/Booklets%20and%20Brochures/BookletSaferFromtheStart.pdf
(17-28)

Community Preparedness
http://www.serve.gov/toolkits/disaster/index.asp

How Prepared is your community for living with wildfire?
http://southwestcoloradofires.org/WildfireMitigationPractionerSeries.pdf

Collaboration and Coordination

Community Preparedness Principles
http://www.citizencorps.gov/about/principles.shtm

Social Science to Improve Fuels Management: A synthesis of research relevant to communicating with homeowners about fuels management
http://nrs.fs.fed.us/pubs/gtr/gtr_nc267.pdf

BOOK: Collaborative Leadership: How citizens and civic leaders can make a difference. By David D. Chrislip & Carl E. Larson.

How Prepared is your community for living with wildfire?
http://southwestcoloradofires.org/WildfireMitigationPractionerSeries.pdf

Getting Public Involvement in Wildfire Hazard Mitigation
http://www.firescience.gov/projects/briefs/05-3-2-05_FSBrief111.pdf

Collaboration and leadership for effective emergency management
http://faculty.maxwell.syr.edu/rdenever/NatlSecurity2008_docs/Waugh_CollaborationLeadership.pdf

Sustainability: Keeping Actions Going in the Long Run

Social Science to Improve Fuels Management: A synthesis of research relevant to communicating with homeowners about fuels management
http://nrs.fs.fed.us/pubs/gtr/gtr_nc267.pdf

BOOK: Fostering sustainable behavior. By Doug McKenzie-Mohr and William Smith
http://www.cbsm.com/pages/guide/preface

Forest Health Management and Pine Beetles

Boulder County Forest Health Initiative
http://www.bouldercounty.org/live/environment/land/pages/foresthealth.aspx

Northern Front Range Mountain Pine Beetle Working Group
http://www.frontrangepinebeetle.org/

Common Forest Insects & Disease
http://csfs.colostate.edu/pages/common-insects.html

Front Range Fuels Treatment Partnership Roundtable
http://www.frftp.org/docs/roundtable_report_brochure.pdf

Public Education and Outreach

Oneida County Fire Prevention Programs-Public Education
http://www.idl.idaho.gov/nat_fire_plan/county_wui_plans/oneida/p45-49_sec10.pdf

Social Science to Improve Fuels Management: A synthesis of research relevant to communicating with homeowners about fuels management
http://nrs.fs.fed.us/pubs/gtr/gtr_nc267.pdf

Douglas County
http://www.douglas.co.us/building/wildfire/Defensible_Space.html

BOOK: Fostering sustainable behavior. By Doug McKenzie-Mohr and William Smith
http://www.cbsm.com/pages/guide/preface

BOOK: Social Marketing: Influencing Behaviors for Good. By Phillip Kotler and Nancy R. Lee
http://www.cbsm.com/pages/guide/preface

Land Use Planning Growth & Development

FireWise-Safer from the Start: A Guide to Firewise-Friendly Developments
http://www.firewise.org/Information/Who-is-this-for/~/media/Firewise/Files/Pdfs/Booklets%20and%20Brochures/BookletSaferFromtheStart.pdf

Getting Public Involvement in Wildfire Hazard Mitigation
http://www.firescience.gov/projects/briefs/05-3-2-05_FSBrief111.pdf

Public Land Management

USFS Wildfire Policy
http://www.fs.fed.us/fire/management/policy.html

Videos

Protecting Your Home From Wildfire
http://www.fs.fed.us/rm/publications/titles/videos/protecting.html

Boulder Wildfire Videos
http://www.youtube.com/user/BoulderCounty#g/c/466B051AC3E3C8BE

General CWPP Info

Boulder County Wildfire mitigation Glossary
http://www.bouldercounty.org/find/glossary/pages/wfmitglos.aspx

CSFS-Community Wildfire Protection Planning
http://csfs.colostate.edu/pages/community-wf-protection-planning.html

FireWise Communities/USA Recognition Program
http://www.firewise.org/Communities/USA-Recognition-Program.aspx

The community wildfire protection plan process: Lessons learned in Colorado (hard-copy)

Extra Resources

50 firewise things you can do
http://www.co.summit.co.us/wildfiremitigation/documents/50things1.pdf

http://csfs.colostate.edu/pdfs/what-to-do-when.pdf

Four Mile on Fire September 2010: A tragic loss, but for hundreds a miraculous save (Hard-Copy)

The Role of Community Policies in Defensible Space Compliance
http://www.efi.int/files/attachments/associate_affiliate_members/winter_2009_forest-policy-and-economics.pdf