# Watershed Management Plan

*Protecting Our Drinking Water Supply*

Salt Lake City Public Utilities

Keep It Pure

DON'T POLLUTE THE WATERSHED

# Introductions

Mentimeter Word Cloud

# Introductions

**Agenda**

- Introductions – SLCDPU & Stakeholder Committee
- Meeting Agenda, Meeting Courtesies – Cindy Gubler
- Plan's purpose – Laura Briefer
- Climate Conditions Facilitated Discussion – The Langdon Group & Stakeholder Committee
- Wildfire Conditions – JW Associates
- Wildfire Facilitated Discussion – The Langdon Group & Stakeholder Committee

# Meeting Courtesies

- Mute your microphone
- Leave your camera on
- Use the comment tool or the raise your hand tool
- Our ground rules:

  - Want everyone to participate

  - There are no right or wrong answers – every opinion counts

  - Be respectful; no one interrupts or talks over another person

  - Keep an open mind, listen carefully, and try to understand other people's view

  - Respond to others how you want to be responded to

What To Expect:

- Ask if there are slide questions during presentation
- Facilitated discussion at the start and at the end
- Want your input, ideas and recommendations
- We appreciate your time, knowledge, and views
- We will prepare a meeting report

# Plan Need & Historical Context

## GOAL

Protect the high-quality source of drinking water supply that originates from our watershed areas.

## NEED

Salt Lake City Department of Public Utilities is required by the Safe Drinking Water Act to create and implement a plan that documents how our source waters are protected. The conditions in our watershed areas have changed and they are under pressure on multiple fronts. It's time to update the plan.

## VISION

Develop sound policy that can be executed methodically by Salt Lake City Department of Public Utilities through collaborative management with trusted partners.

**"The eyes of the future are looking back at us, and they are praying for us to see beyond our time"**

*– Local author and naturalist Terry Tempest Williams*

# Plan Need & Historical Context

## Keeping Our Drinking Water Pure

### Is The Purpose Of The Watershed Management Plan

Keep It Pure

DON'T POLLUTE THE WATERSHED

# Climate Change Conditions Facilitated Discussion

The Langdon Group

# Wildfire Conditions

JW Associates

# Source Water Protection

# and

# Managing for Resilient Watersheds

# in 2022

*Protecting Our Drinking Water Supply – 2022 Watershed Management Plan Update*

Salt Lake City Public Utilities

# Critical concerns for watershed health

- Climate Change
- Wildfire
- Human Influence

Little Dell Reservoir

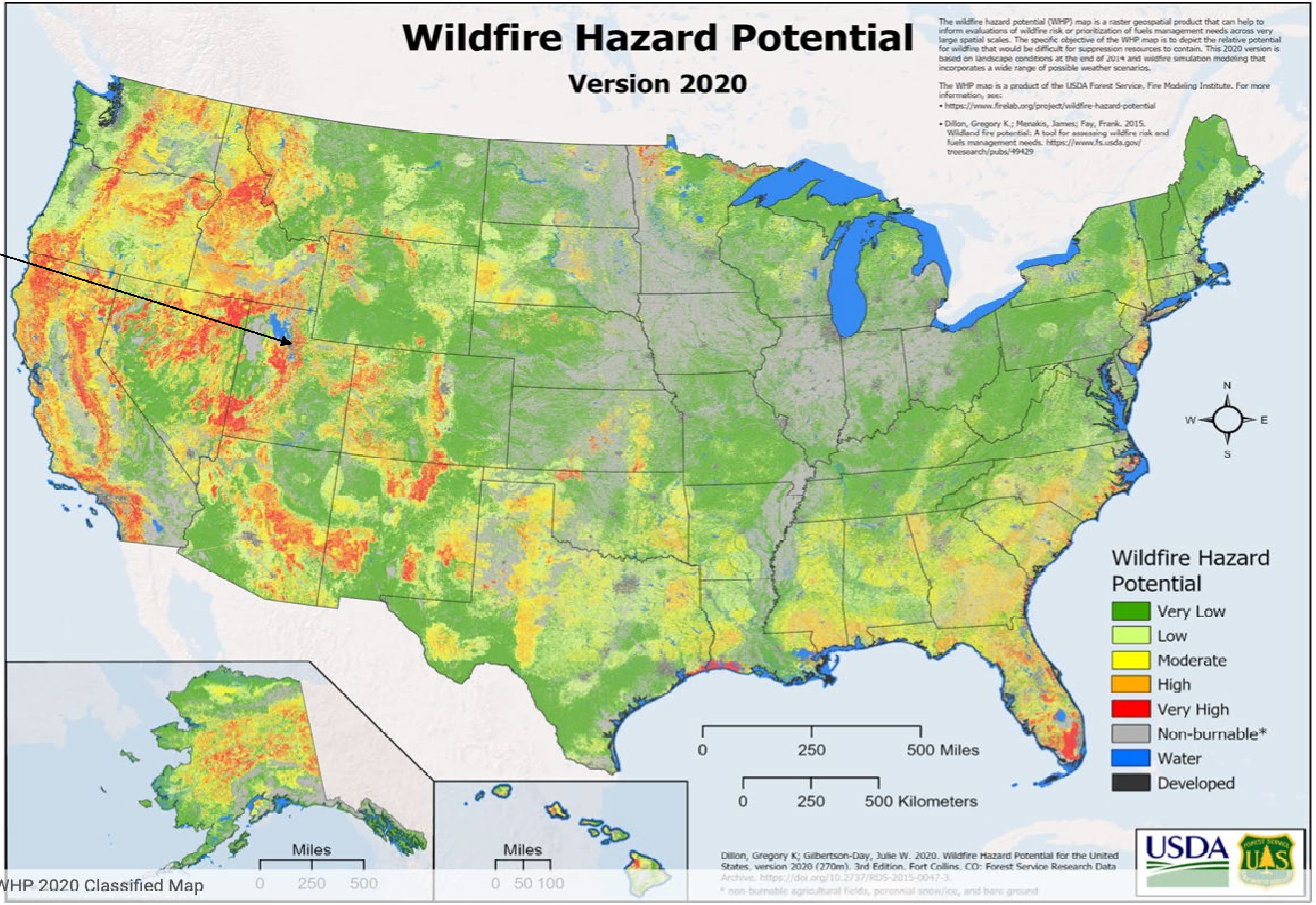
Photo: JW Associates – Jessica Wald

# What are we going to talk about/agenda

1. Wildfire in a changing climate
2. Causes of wildfire
3. Threats to the reliability and quality of water supply
4. Wildfire hazard analysis
5. Strategies to protect the watersheds & mitigate impacts

# Wildfire Hazard Across the United States

Wasatch Mountains




Source: Dillon, Gregory K; Gilbertson-Day, Julie W. 2020. Wildfire Hazard Potential for the United States, version 2020 (270m). 3rd Edition, Fort Collins, CO; Forest Service Research Data Archive. https/doi.org10.2737/RDS-2015-0047-3.

# Factors Influencing Wildfire – Climate Change & Forest Management

Wildfire is **NATURAL** and **HEALTHY** for ecosystems, HOWEVER:

- Past forest management practices including fire suppression

  Increased forest density — Larger wildfires of higher intensity and severity

- Between 1992 and 2012

  ⬆ ~6 weeks: Fire Season Length

  ⬆ 3x more megafires burning more than 100,000 acres

  *(Utah Hazard Mitigation, https://hazards.utah.gov/wildfire/)*

- **No End in Sight**

  Increasing temperatures, drought, drier soils and vegetation, spread of noxious weeds

  ➡ All likely to increase the length and intensity of fire season ⬅

# Wildfire in a changing climate

## CLIMATE CHANGE INCREASES FAVORABLE CONDITIONS FOR WILDFIRE

1. **Drier Fuel Conditions -** Drought and higher temperatures decrease fuel moisture. .

## HOW DOES CLIMATE CHANGE IMPACT FUEL MOISTURE?

- Increasing Vapor Pressure Deficits (VPD) = Difference between how much water air can hold and how much it does hold. Large deficits result in drier vegetation.
- Longer snow-free period = earlier exposure to heat, longer time for fuels to dry out.
- Feedback loop – As moisture is sucked out, sun's energy goes into baking the soils = increased drying.

Mueller, Stephanie E., et al. 2020. Climate Relationships with increasing wildfire in the southwestern US from 1984 to 2015. Forest Ecology and Management. 460 (2020) 117861

Romps, David M. et al. 2014. Projected increase in lightning strikes in the United States due to global warming. Science Vol. 346, No. 6211.

# Wildfire in a changing climate

## CLIMATE CHANGE INCREASES FAVORABLE CONDITIONS FOR WILDFIRE

1. **Drier Fuel Conditions -** Drought and higher temperatures decrease fuel moisture.

2. **Increased Fuels -** Heat stress and drought increase forest fuels.

## HOW DOES CLIMATE CHANGE IMPACT FOREST FUELS

- Increased fuels from mortality due to drought, and reduced ability to withstand insect and disease outbreaks.

- May be increased fuels in the short-term (tree mortality) but long-term some places may see a decrease in fuels (trees don't grow back).

Mueller, Stephanie E., et al. 2020. Climate Relationships with increasing wildfire in the southwestern US from 1984 to 2015. Forest Ecology and Management. 460 (2020) 117861

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# Wildfire in a changing climate

## CLIMATE CHANGE INCREASES FAVORABLE CONDITIONS FOR WILDFIRE

1. **Drier Fuel Conditions -** Drought and higher temperatures decrease fuel moisture.
2. **Increased Fuels -** Heat stress and drought increase forest fuels.
3. **Increased Ignitions -** Increasing air temperatures increase lightning strikes.

## HOW DOES CLIMATE CHANGE IMPACT WILDFIRE IGNITIONS

- Lightning strikes are more frequent when air temperature is hotter.
- Predicted 12% increase in lightening strikes for every 1 degree C of temperature increase (Romps et al 2014).
- Over the next century, potential for a 50% increase in lightning strikes.

Mueller, Stephanie E., et al. 2020. Climate Relationships with increasing wildfire in the southwestern US from 1984 to 2015. Forest Ecology and Management. 460 (2020) 117861

Romps, David M. et al. 2014. Projected increase in lightning strikes in the United States due to global warming. Science Vol. 346, No. 6211.

# What causes wildfires

## HUMAN ACTIVITY

- Across the US ~ 85% started by humans (WFMI)
- Unattended campfires - back-country & established fire grates
- Downed powerlines
- Sparks from machinery
- Backfiring automobiles
- Overheated brakes
- Discarded cigarettes

## LIGHTNING

- Between 1992 – 2015, 44 percent of the wildfires in the west were caused by lightning (USDA FS Data Archive)
- However, these fires burned 71 percent of the total burned area.
- Often harder to control

The WUI is of concern both due to the risk to structures and human lives but also because there is an increased risk of fire starts in these areas.

Short, Karen C. 2021. Spatial wildfire occurrence data for the United States, 1992-2018 [FPA_FOD_20210617]. 5th Edition. Fort Collins, CO: Forest Service Research Data Archive. https://doi.org/10.2737/RDS-2013-0009.5

WFMI *2000-2017 data based on Wildland Fire Management Information (WFMI)*

# Wildfire Threats to the Reliability and Quality of the Water Supply

Infrastructure damage

Debris Flows - risk to property, human life, water quality

Water quality impacts due to erosion and transport of sediments

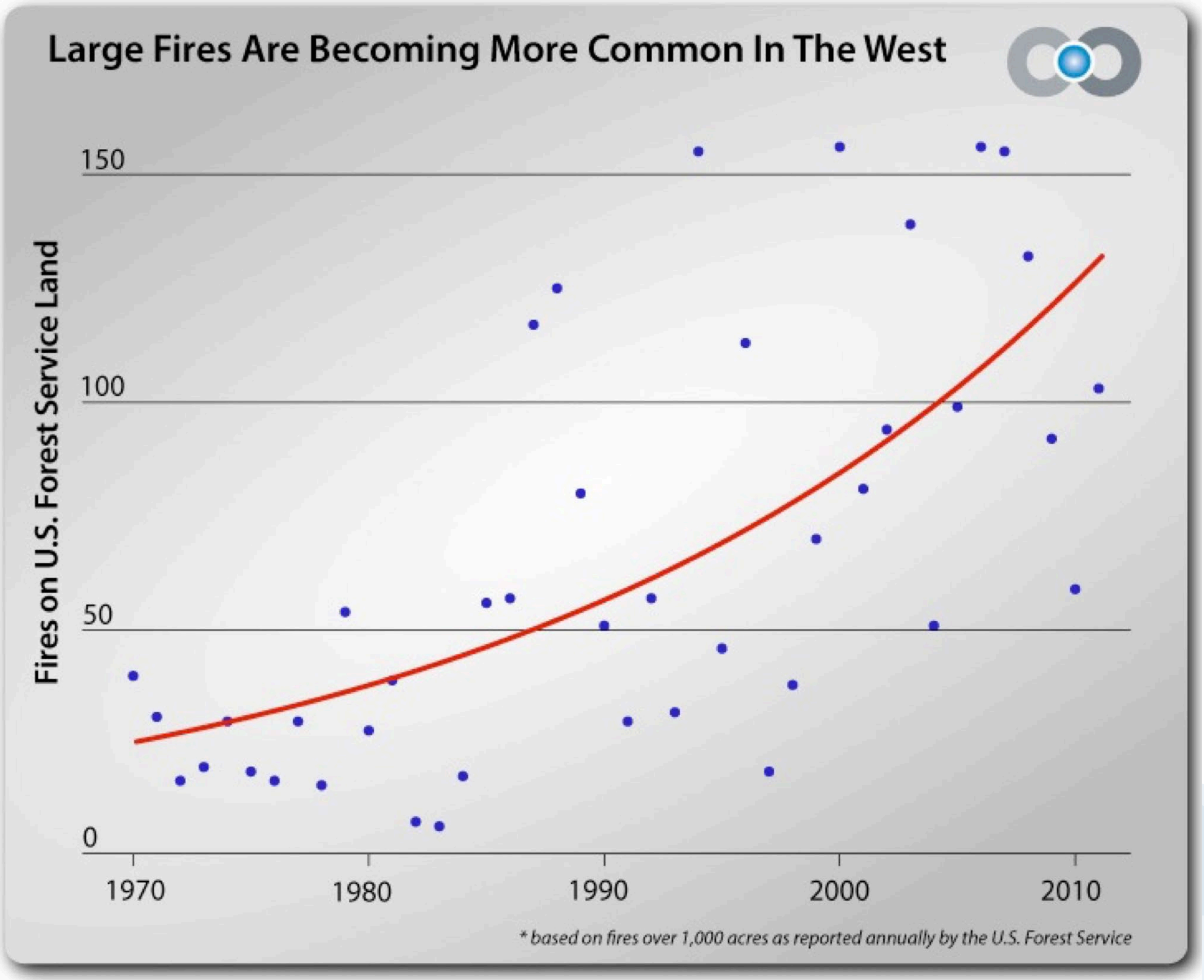
Soil damage – delay of revegetation

Debris or peak flow damage to roads bridges, culverts

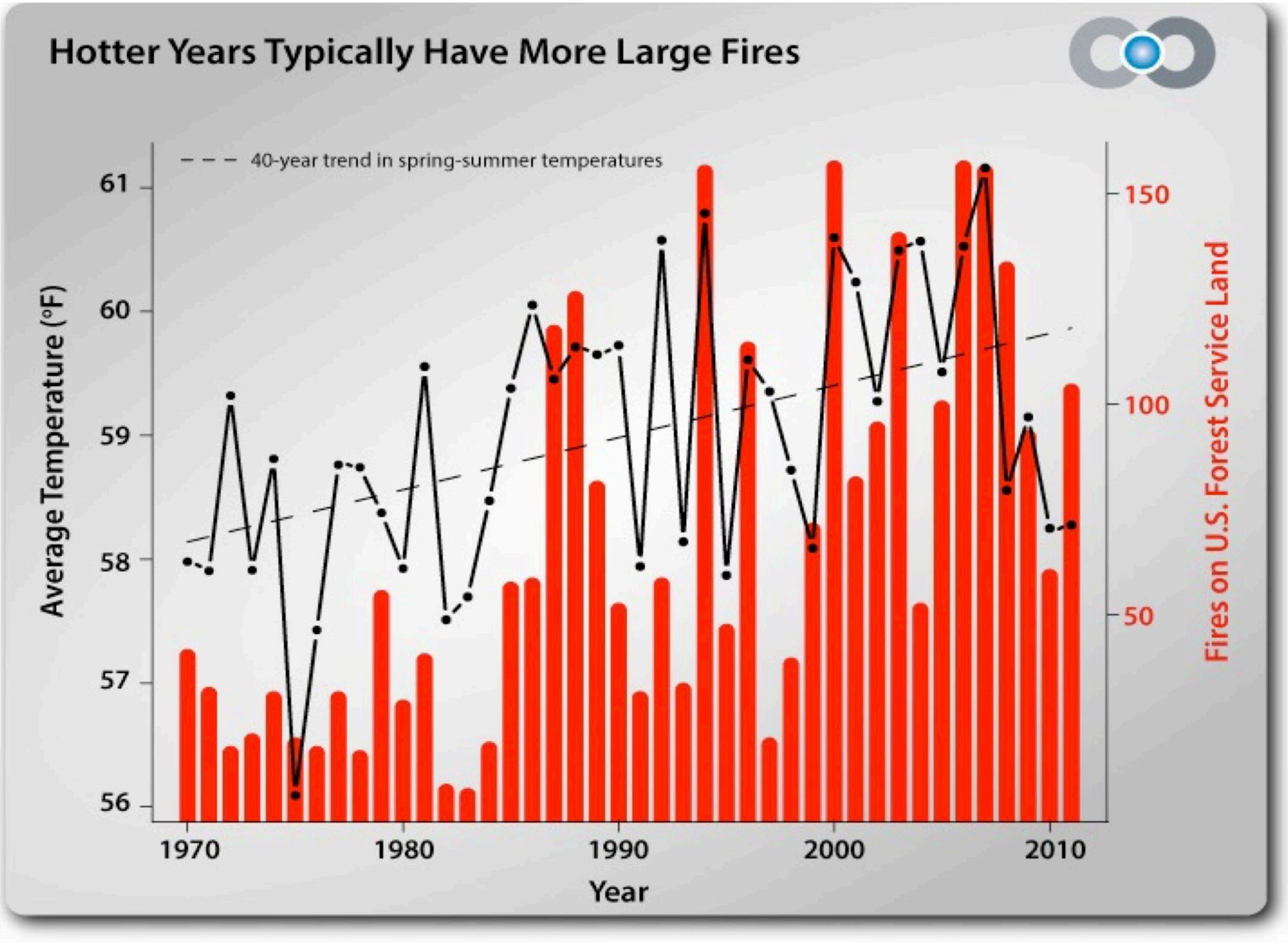
Riparian ecosystem damage

# Mentimeter or other questions/discussion

# Wildfire size, frequency, and timing has changed



# Wildfire size, frequency, and timing has changed



# Wildfire size, frequency, and timing has changed

# Wildfire size, frequency, and timing has changed

CSIRO PUBLISHING

*International Journal of Wildland Fire* **2015**, *24*, 892–899
http://dx.doi.org/10.1071/WF15083

## Climate change presents increased potential for very large fires in the contiguous United States

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**Abstract.** Very large fires (VLFs) have important implications for communities, ecosystems, air quality and fire suppression expenditures. VLFs over the contiguous US have been strongly linked with meteorological and climatological variability. Building on prior modelling of VLFs (>5000 ha), an ensemble of 17 global climate models were statistically downscaled over the US for climate experiments covering the historic and mid-21st-century periods to estimate potential changes in VLF occurrence arising from anthropogenic climate change. Increased VLF potential was projected across most historically fire-prone regions, with the largest absolute increase in the intermountain West and Northern California. Complementary to modelled increases in VLF potential were changes in the seasonality of atmospheric conditions conducive to VLFs, including an earlier onset across the southern US and more symmetric seasonal extension in the northern regions. These projections provide insights into regional and seasonal distribution of VLF potential under a changing climate, and serve as a basis for future strategic and tactical fire management options.

**Additional keywords:** climate-fire models, climate variability, fire risks, megafires.

Received 9 January 2015, accepted 4 June 2015, published online 16 July 2015

### Introduction

Very large fires (VLFs; often defined as the top 5 or 10% of the largest fires) account for a majority of burned area in many regions of the US (e.g. Strauss *et al.* 1989), increasingly threaten and affect homes and communities, have unique ecological effects on ecosystems, contribute to widespread degradation in air quality (e.g. Schultz *et al.* 2008) and lead to numerous indirect effects including those on human health (e.g. Johnston *et al.* 2012) and water quality (e.g. Rhoades *et al.* 2011). An increase in the number of VLFs has been observed in recent decades across the US (Dennison *et al.* 2014). Although difficult to apportion causation, both the legacy of fire suppression allowing for increased fuel accumulation (Marlon *et al.* 2012) and a more favourable climate (Barbero *et al.* 2014*a*) have likely enabled more frequent VLFs. According to the National Interagency Fire Center, direct federal expenditures on fire suppression in the US have more than doubled in recent decades, exceeding US$1 billion per year since the year 2000, the vast majority of which is spent on large incidents. Collectively, such changes have taxed fire suppression resources and prompted the need for fire agencies to reallocate funding from a broader set of land management objectives to specifically fighting fire.

Most VLFs in the US occur coincident with favourable fuel and fire spread conditions facilitated by antecedent climate and current extreme fire weather conditions respectively (e.g. Riley *et al.* 2013; Stavros *et al.* 2014*a*; Barbero *et al.* 2014*b*). These relationships are similar to the broader body of climate–fire studies linking interannual climate variability and spatially aggregated burned area (e.g. Westerling *et al.* 2003; Littell *et al.* 2009). Observed changes in climate may have already influenced wildfire potential over parts of the globe (e.g. Stocks *et al.* 1998; Gillett *et al.* 2004; Westerling *et al.* 2006), and projected changes in climate over the next century are hypothesised to significantly alter global wildfire regimes (e.g. Flannigan *et al.* 2009), including across parts of the US, via changes in fire danger (e.g. Brown *et al.* 2004; Abatzoglou and Kolden 2011; Liu *et al.* 2012), moisture deficits (Westerling *et al.* 2011*a*; Westerling *et al.* 2011*b*) and vegetation composition (Bradley 2009). Prior studies reported increased annual (sometimes monthly) burned area for parts of the US with climate change (e.g. Spracklen *et al.* 2009; Westerling *et al.* 2011*a*, 2011*b*; Yue *et al.* 2013); however, such studies have been limited to the western US and did not provide insights on future VLF occurrence (see Table 1). In the only known study to date on climate change and VLF, Stavros *et al.* (2014*b*) projected substantial increases in VLFs across the western US. However, their projections and modelling efforts focused on very coarse-scale management units that did not discriminate

 

# Wildfire size, frequency, and timing has changed

PHILOSOPHICAL
TRANSACTIONS B

rstb.royalsocietypublishing.org

Research

# Wildfire size, frequency, and timing has changed

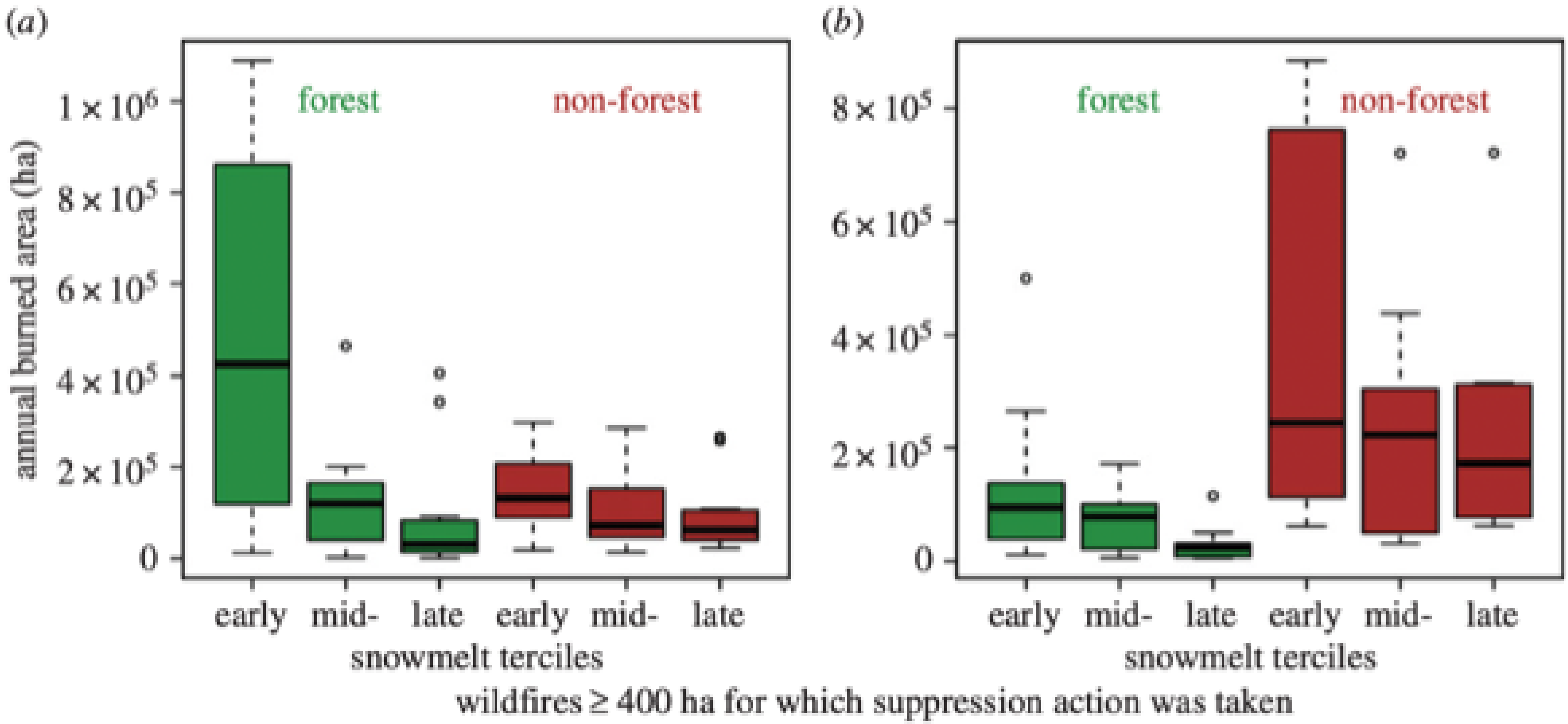


**Figure 4.** Annual burned area by coarse vegetation type and snowmelt tercile for USFS, NPS and BIA wildfires (1973–2012) (*a*), and BLM wildfires (1980–2012) (*b*).

# Wildfire size, frequency, and timing has changed

## Warming enabled upslope advance in western US forest fires

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Edited by James T. Randerson, University of California, Irvine, CA, and approved March 31, 2021 (received for review May 18, 2020)

**Increases in burned area and large fire occurrence are widely documented over the western United States over the past half century. Here, we focus on the elevational distribution of forest fires in mountainous ecoregions of the western United States and show the largest increase rates in burned area above 2,500 m during 1984 to 2017. Furthermore, we show that high-elevation fires advanced upslope with a median cumulative change of 252 m (−107 to 656 m; 95% CI) in 34 y across studied ecoregions. We also document a strong interannual relationship between high-elevation fires and warm season vapor pressure deficit (VPD). The upslope advance of fires is consistent with observed warming reflected by a median upslope drift of VPD isolines of 295 m (59 to 704 m; 95% CI) during 1984 to 2017. These findings allow us to estimate that recent climate trends reduced the high-elevation flammability barrier and enabled fires in an additional 11% of western forests. Limited influences of fire management practices and longer fire-return intervals in these montane mesic systems suggest these changes are largely a byproduct of climate warming. Further weakening in the high-elevation flammability barrier with continued warming has the potential to transform montane fire regimes with numerous implications for ecosystems and watersheds.**

wildfire | fire elevation | climate change | climate velocity | montane forests

Fire is an integral component of most forested lands and provides significant ecological services (1). However, burned area, fire size, the number of large fires, and the length of fire season have increased in the western United States in recent decades (2, 3). Increasing fire activity and the expansion of wildland urban interface (4) collectively amplified direct and indirect fire-related loss of life and property (5, 6) and contributed to escalating fire suppression costs (7). While increased biomass due to a century of fire exclusion efforts is hypothesized to have partially contributed to this trend (8), climate change is also implicated in the rise of fire activity in the western United States (9–11).

Although increases in forest fire activity are evident in all major forested lands in the western United States (2, 12, 13), an abundance of moisture—due to snowpack persistence, cooler temperatures, and delayed summer soil and fuel drying—provides a strong buffer of fire activity (13) and longer fire-return intervals (14) at high elevations. Recent studies, however, point to changing fire characteristics across many ecoregions of the western United States (15), including high-elevation areas of the Sierra Nevada (16), Pacific Northwest, and Northern Rockies (12, 17). These studies complement documented changes in montane environments including amplified warming with elevation (18), widespread upward elevational shift in species (19), and increased productivity in energy-limited high-elevation regions that enhance fuel growth and connectivity (20). These changes have been accompanied by longer snow-free periods (21), increased evaporative demand (9), and regional declines in fire season precipitation frequency (11) across the western United States promoting increased fuel ignitability and flammability that have well-founded links to forest burned area. A warmer climate is also conducive to a higher number of convective storms and more frequent lightning strikes (22).

In this study, we explore changes in the elevational distribution of burned forest across the western United States and how changes in climate have affected the mesic barrier for high-elevation fire activity. We focus on changes in high-elevation forests that have endured fewer direct anthropogenic modifications compared to drier low-elevation forests that had frequent low-severity fires prior to European colonization and have been more subject to changes in settlement patterns as well as fire suppression and harvest (23, 24); we also pose the following questions: 1) Has the elevational distribution of fire in the western US forests systematically changed? and 2) What changes in biophysical factors have enabled such changes in high-elevation fire activity? We explore these questions across 15 mountainous ecoregions of the western United States using records from large fires (>405 ha) between 1984 and 2017 [Monitoring Trends in Burn Severity (MTBS) (25)], a 10-m–resolution digital elevation model, and daily high-spatial–resolution surface meteorological data [gridMET (26)].

We focus on the trends in $Z_{90}$—defined as the 90th percentile of normalized annual elevational distribution of burned forest in each ecoregion. Here, the term "normalized" essentially refers to the fraction of forest area burned by elevation. We complement this analysis by examining trends in burned area by elevational bands and using quantile regression of normalized annual forest fire elevation. We then assess the interannual relationships between $Z_{90}$ and vapor pressure deficit (VPD) and compare the upslope advance

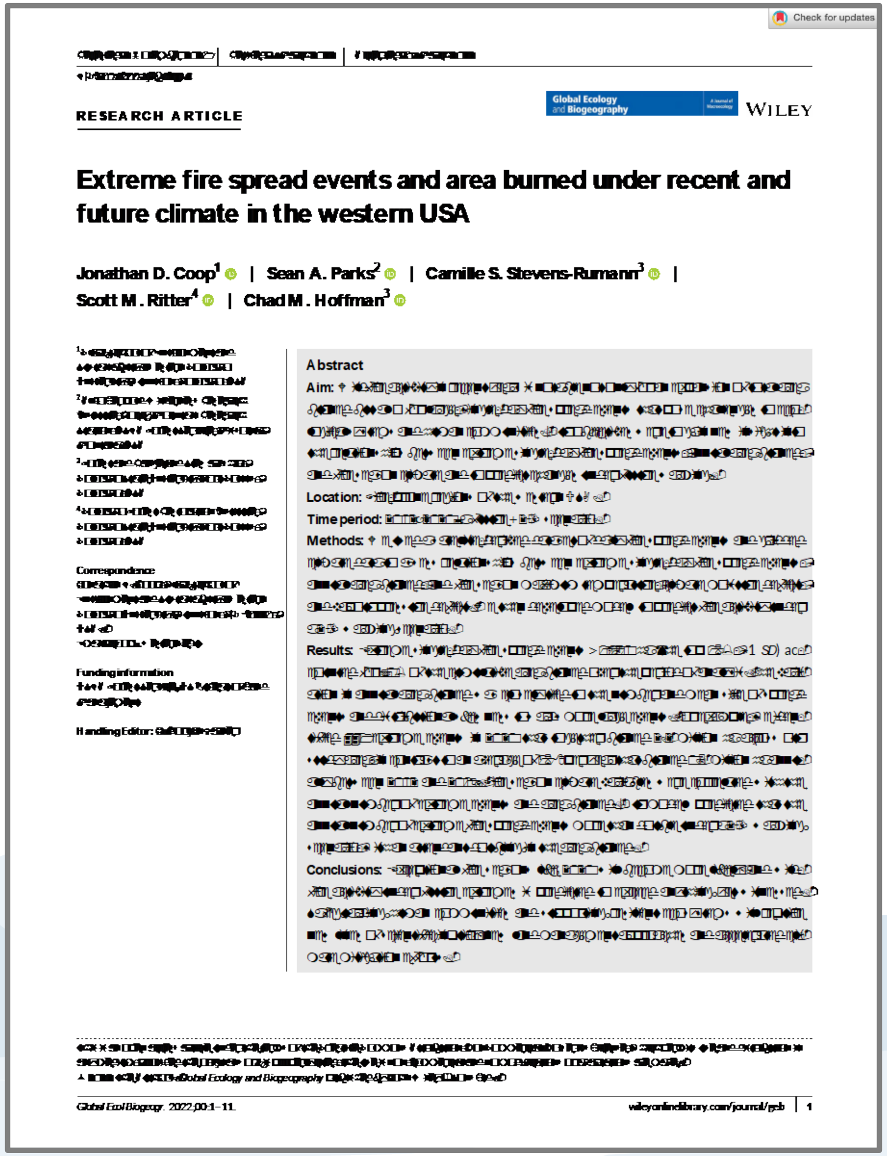
EARTH, ATMOSPHERIC, AND PLANETARY SCIENCES

ed May 24, 2021.

# Wildfire size, frequency, and timing has changed

**We estimate that increased aridity between 1984 and 2017 exposed an additional 81,500 km2 of western US montane forests to fires. These changes have significant implications for terrestrial carbon storage, snowpack, and water quantity and quality.**

# Wildfire size, frequency, and timing has changed



Check for updates

RESEARCH ARTICLE

Global Ecology and Biogeography — WILEY

**Extreme fire spread events and area burned under recent and future climate in the western USA**

Jonathan D. Coop[1] | Sean A. Parks[2] | Camille S. Stevens-Rumann[3] | Scott M. Ritter[4] | Chad M. Hoffman[3]

Correspondence

Funding information

Handling Editor:

Abstract

Aim:

Location:

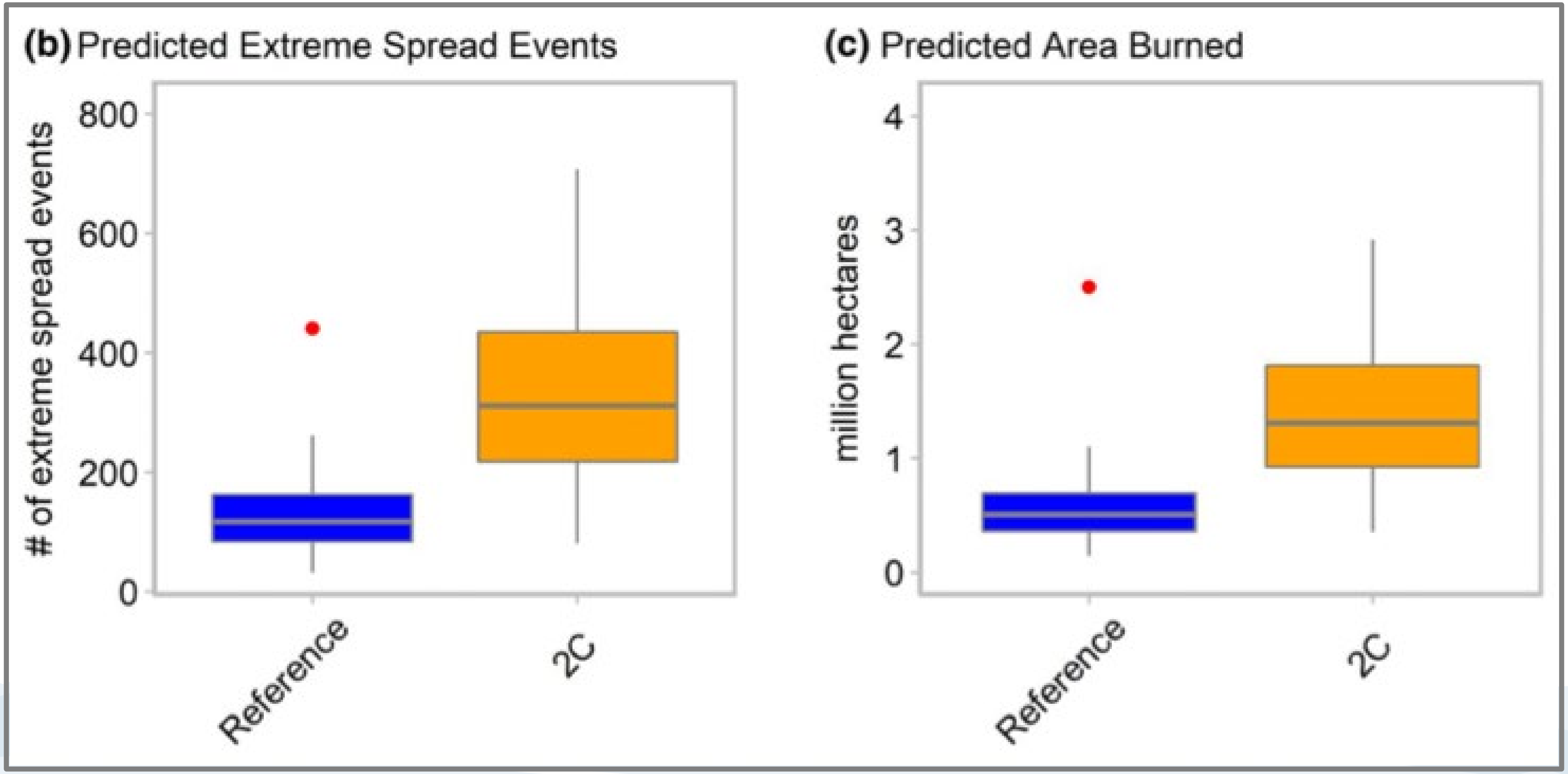
Time period:

Methods:

Results:

Conclusions:

# Wildfire size, frequency, and timing has changed



# Wildfire Hazard in Watershed Management

- Challenge is identifying & mapping areas of highest concern by watershed

  **> Watershed/Wildfire Hazard Ranking <**

- Analysis combines:

Modeled **wildfire severity**

➕

Potential for **post-wildfire impacts to the watershed**

Photos from Cameron Peak Fire (2020)

# Wildfire Hazard

# Wildfire Hazard

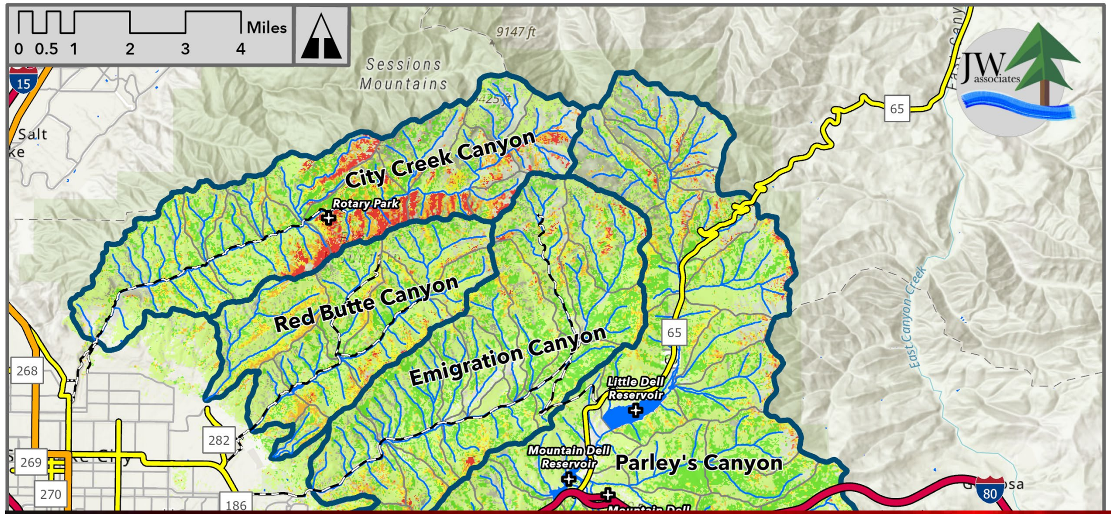
Wildfire Modeling:

- Interagency Fuel Treatment Decision Support System (IFTDSS)
- Online implementation of FlamMap


# Wildfire Hazard: Flame Length

Flame Length - output from IFTDSS

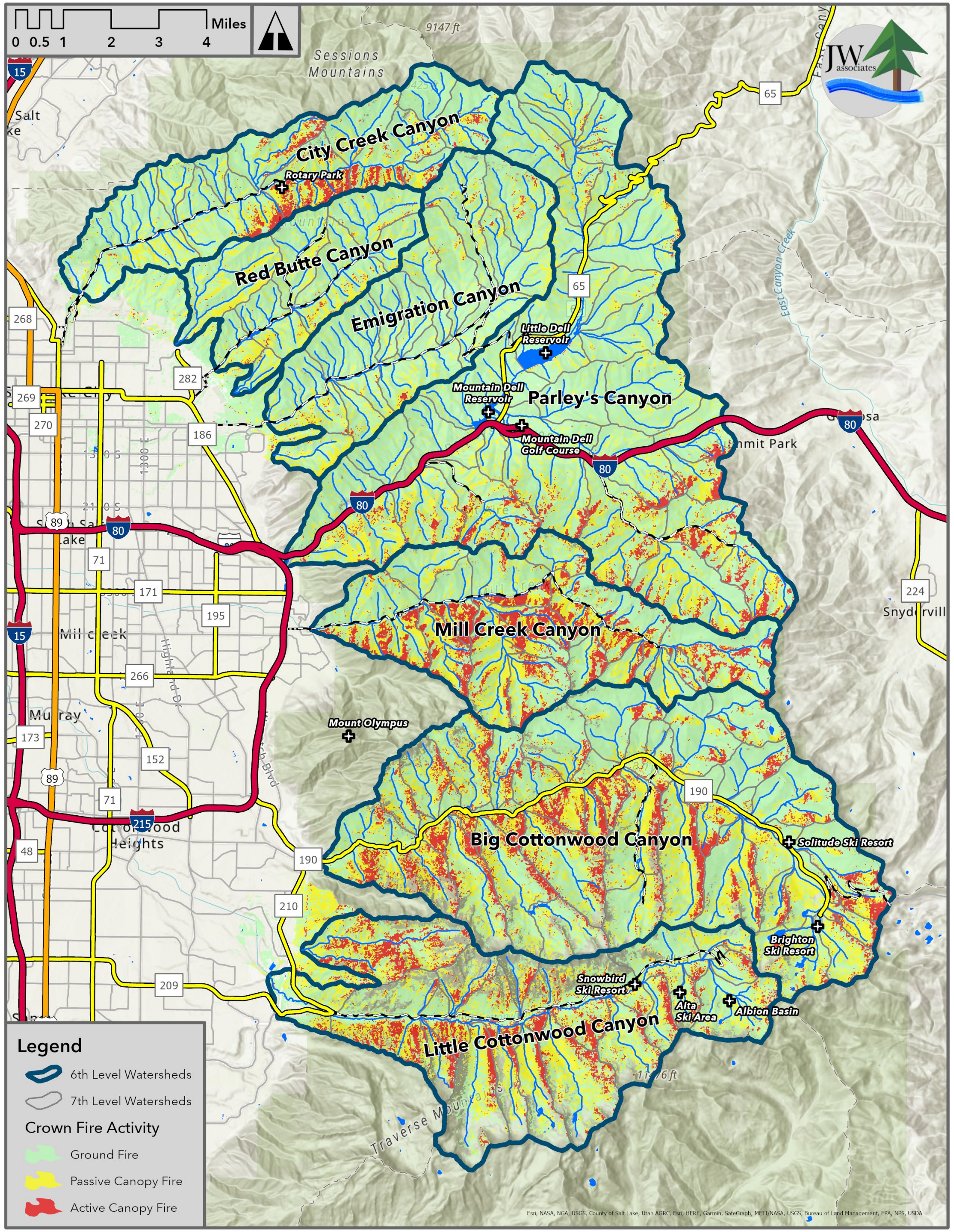
- Categorized into groups based on length of the flames above the canopy
  - Category 0: <1 feet
  - Category 1: 2 to 4 feet
  - Category 2: 5 to 8 feet
  - Category 3: 9 to 11 feet
  - Category 4: 12 to 25 feet
  - Category 5: >25 feet




# Wildfire Hazard: Crown Fire Activity

Crown Fire Activity - output IFTDSS

- Categorized into groups based on the characteristic intensity
  - Category 0: Non-burnable
  - Category 1: Surface Fire
  - Category 2: Passive Crown Fire
  - Category 3: Active Crown Fire



# Wildfire Hazard

Shorter Flame Lengths & Lower Crown Fire Activity

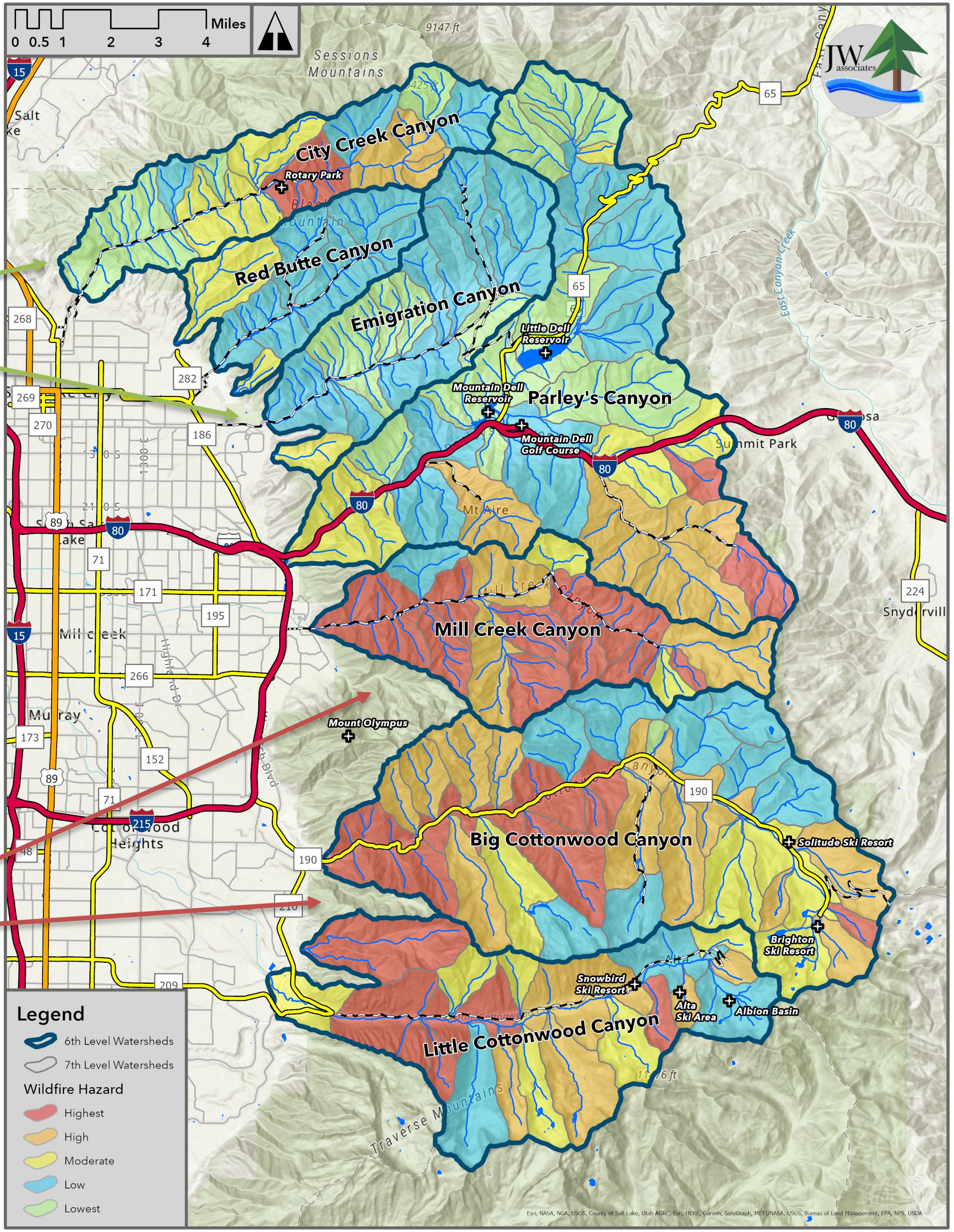
Combined Wildfire Hazard Rank:

Flame Length Hazard Rank

+

Crown Fire Activity Hazard Rank

Longer Flame Lengths & Higher Crown Fire Activity



# Debris Flow Hazard

Photo: Black Hollow post-fire debris flow, July 2021

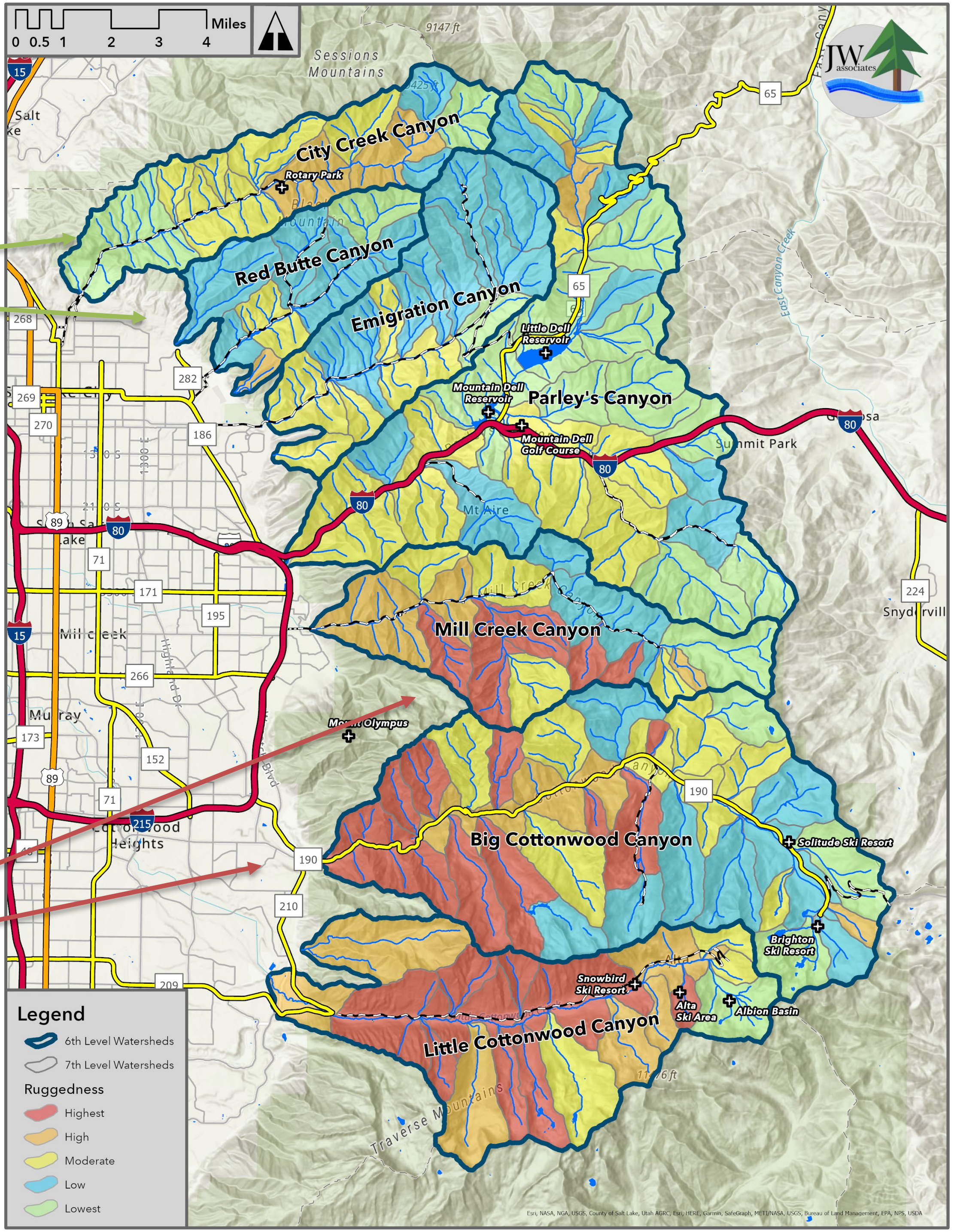
# Debris Flow Hazard - Ruggedness

Lower Ruggedness, less sensitive to debris flows

Watershed **steepness** or ruggedness is an indicator of the relative **sensitivity to debris flows**

- Ruggedness from Melton (1957)

Higher Ruggedness, more sensitive to debris flows

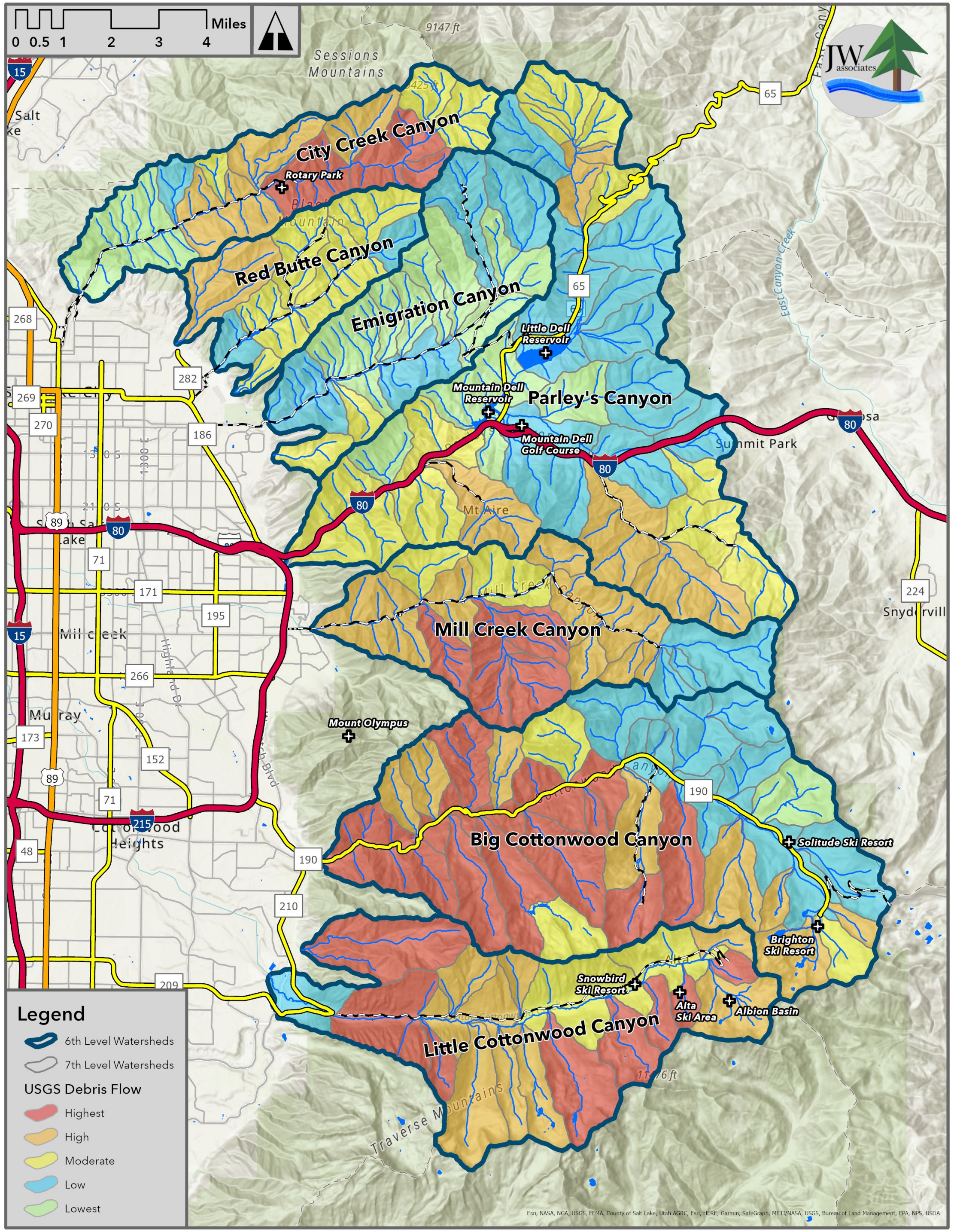



Melton, M.A. 1957. An analysis of the relations among elements of climate, surface properties, and geomorphology. Technical Report 11. Department of Geology, Columbia University. New York, NY. p. 102.

# Debris Flow Hazard – USGS Model

United States Geological Survey (USGS) method for post-fire debris flow hazards

- Predicts post-fire debris flow hazard in response to a triggering rainfall event




Staley, D.M., A.C. Tillery, J.W. Kean, L.A. McGuire, H.E. Pauling, F.K. Rengers, J.B. Smith. 2018. Estimating post-fire debris-flow hazards prior to wildfire using a statistical analysis of historical distributions of fire severity from remote sensing data. International Journal of Wildland Fire 27, 595-608. Available at: https://doi.org/10.1071/WF17122

# Debris Flow Composite Hazard

Lower Debris Flow Hazard

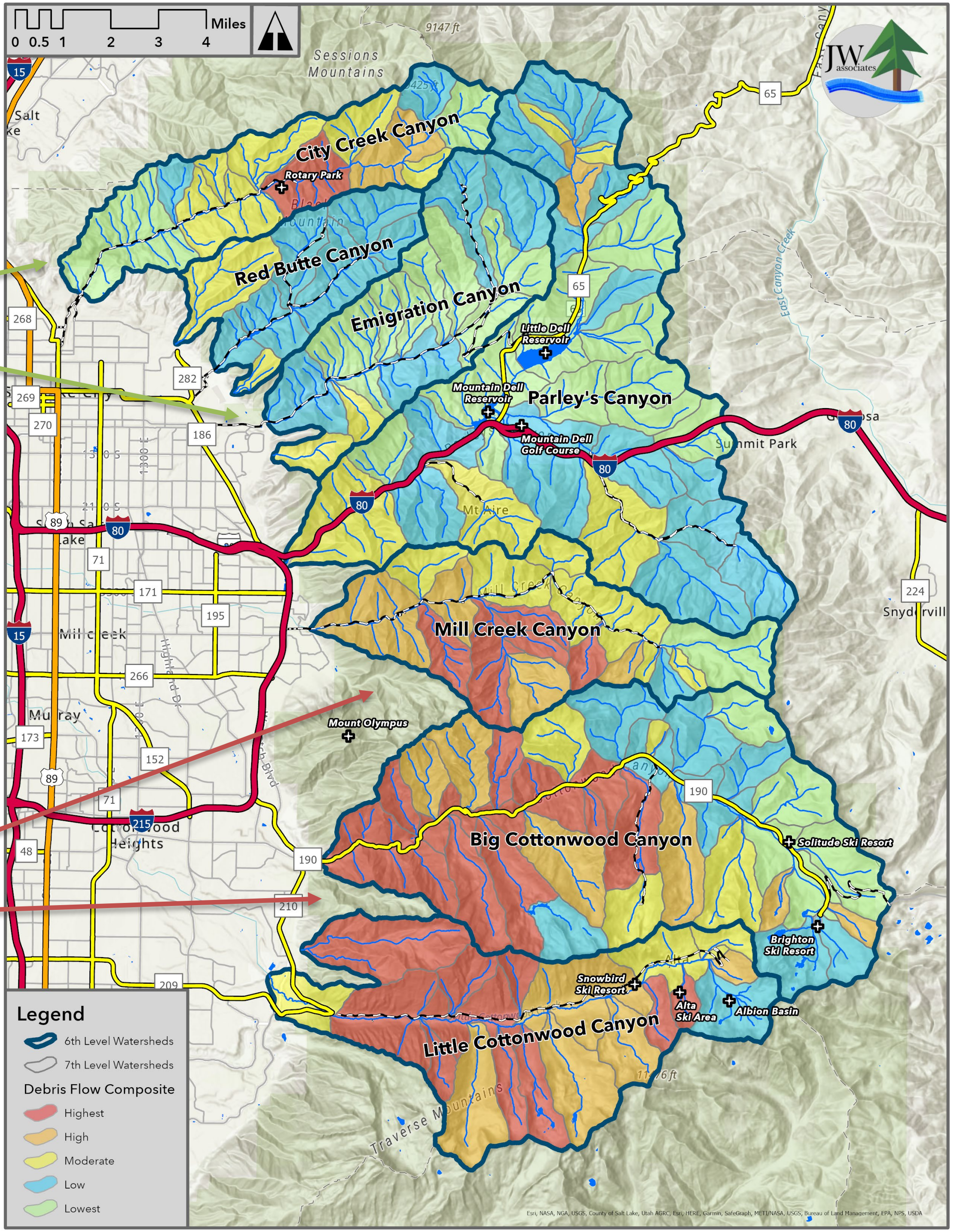
Combined Debris Flow Hazard Rank:

Ruggedness Hazard Rank

+

USGS Debris Flow Hazard Rank

Higher Debris Flow Hazard



## Roads Hazard

Even if culverts are adequately sized, road erosion and the subsequent transport of sediments during high flow events can be a significant contributor to in-stream sediments. Forest roads are usually the largest source of long-term sediment in forested watersheds.

(Elliott 2000, MacDonald and Stednick 2003)

# Roads Composite Hazard

- Amplification of post-fire or flooding impacts.
- Can convert subsurface runoff to surface runoff and route the surface runoff in a ditch or on the road surface to stream channels, increasing peak flows
  (Megan and Kidd 1972, Ice 1985, and Swanson et al. 1987)
- Culverts that are not adequately sized for post-fire peak flows.
  - ✓ Over-topping of the road
  - ✓ Increased erosion
  - ✓ Risk of debris flows stemming from road failure

# Roads Composite Hazard

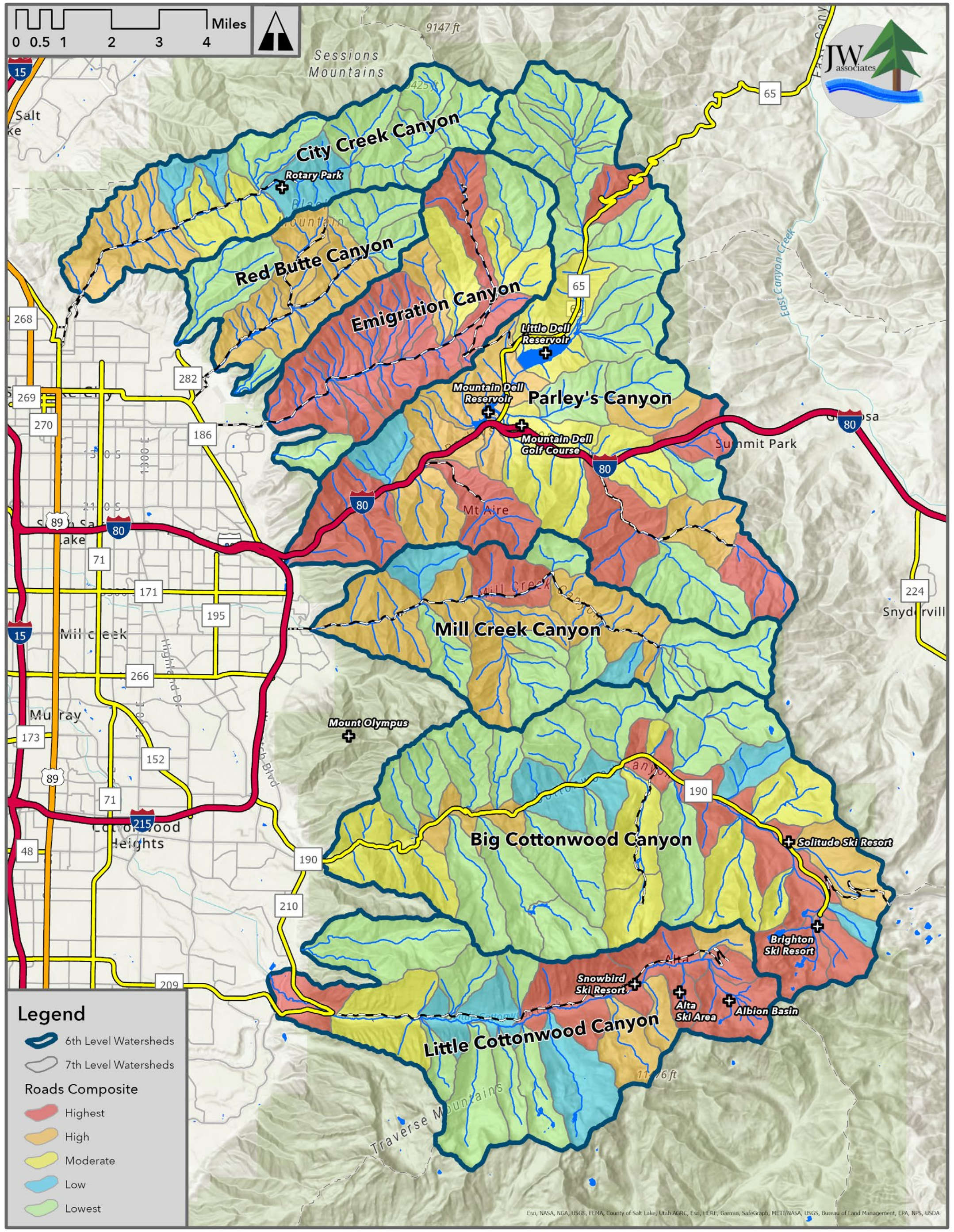
Overall Road Density

+

Roads Close to Streams (within 100m)

+

Road/Stream Crossings



## Soil Erodibility Hazard


# Soil Erodibility – Post-fire Hazards

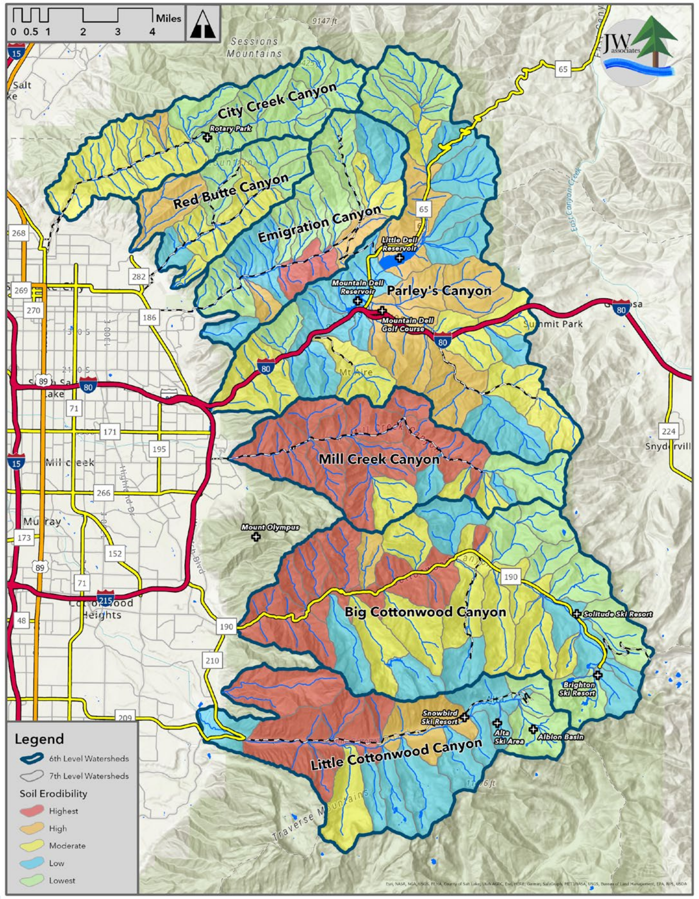
- Sediment yields increase
- Hyrdophobic soil layers
- Sediments increase nutrients export

(Johansen et al. 2001, Gannon et al. 2017, Hungerford et al. 1991)

# Soil Erodibility Hazard

Combination of two indicators:

- Inherent susceptibility of soil to erosion (K-factor)
  - Natural Resources Conservation Service (NRCS)
- Slope
  - USGS 30m DEM




## Classification Grid

| Percent Slope | K Factor <0.1 | K Factor 0.1 to 0.19 | K Factor 0.2 to 0.32 | K Factor >0.32 |
|---|---|---|---|---|
| 0-14 | Slight | Slight | Slight | Moderate |
| 15-34 | Slight | Slight | Moderate | Severe |
| 35-50 | Slight | Moderate | Severe | Very Severe |
| >50 | Moderate | Severe | Very Severe | Very Severe |


USDA Natural Resource Conservation Service. 1997. National Forestry Manual, title 190. Washington, D.C., Government Printing Office, June 1997.

# Watershed/Wildfire Composite Hazard

Wildfire Hazard

\+

Debris Flow Composite Hazard

\+

Roads Composite Hazard

\+

Soil Erodibility Hazard

# Combined Wildfire Hazard Ranking

Wildfire Hazard

+

Debris Flow Composite Hazard

+

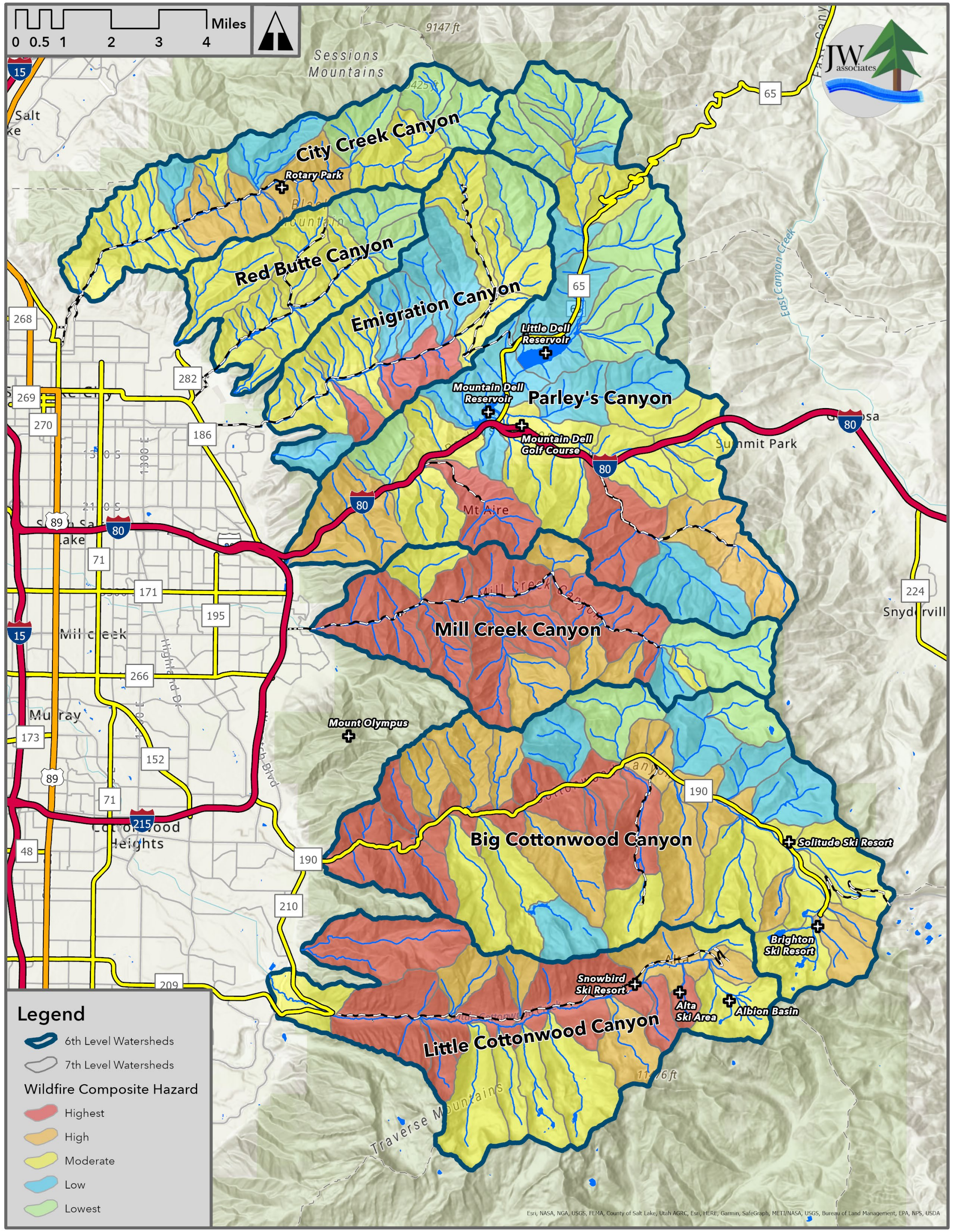
Roads Composite Hazard

+

Soil Erodibility Hazard

=

Watershed/Wildfire Composite Hazard



# Management Strategies

What CAN we do?

Three part strategy

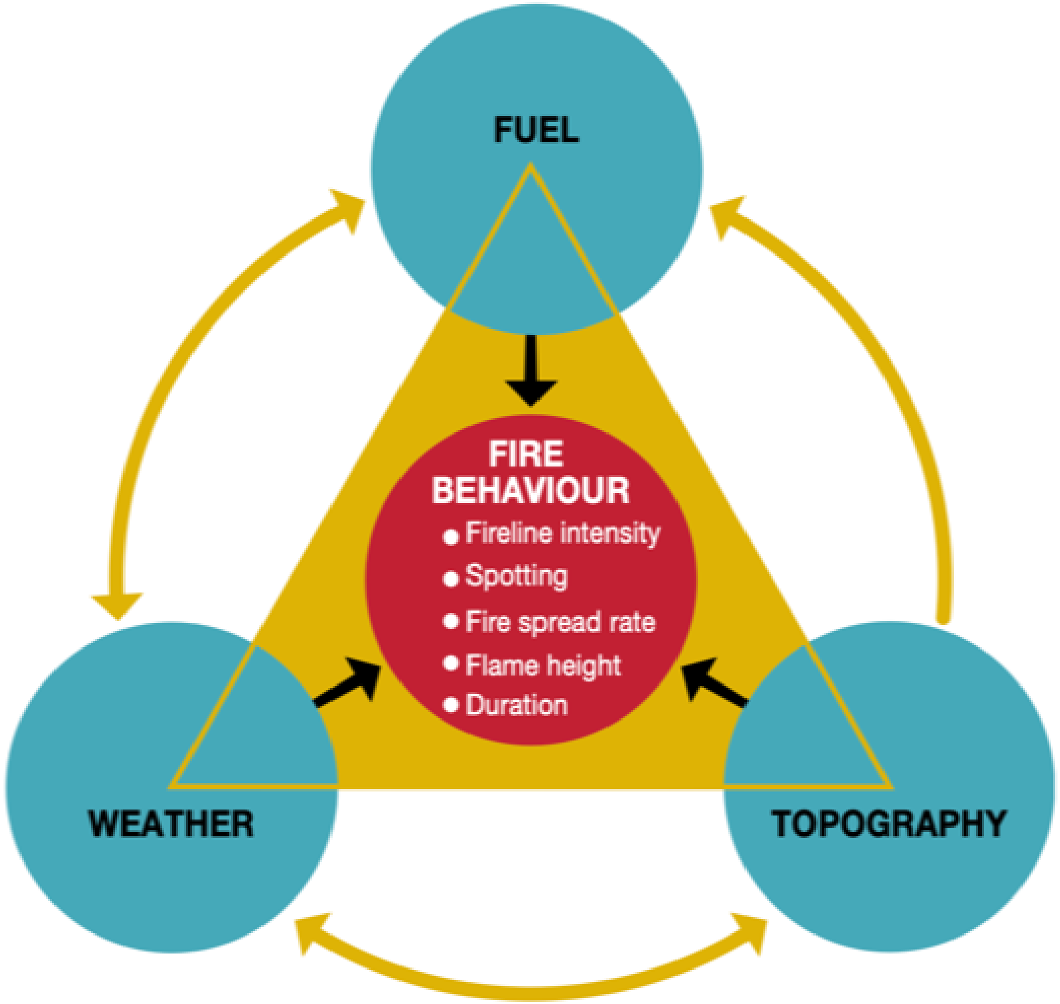
1. Identify, plan, implement pre-fire actions
2. Work with suppression team during fires
3. Be ready for post-fire actions

# Pre-fire Actions

## Can we reduce the size and intensity of wildfires?

## Manage Fuels

Fire behaviour triangle




Source: Countryman, 1966.

GRID-Arendal/Studio Atlantis, 2021

# Fuel Breaks

# Forest Management

# Resilient Watersheds

# Can We Reduce Negative Impacts of Wildfires?

- Stop Wildfires – Probably not
- Reduce Fire Intensity – Yes, In some places
- Reduce Post-fire Impacts – Yes, but it is challenging

***How to Reduce Wildfire Intensity and Reduce Post-fire Impacts***

- Thin over dense forest
- Enhance aspen
- Create openings
- Remove conifer encroachment in riparian areas
- Increase patchiness
- Increase age class diversity
- Need to be strategic

# Planning for wildfires

## Increasing watershed resilience

One of the most effective strategies to increase watershed resilience is to increase vegetation diversity.

## Planning & Preparing for Disturbances

- *Analysis of wildfire & post-fire hazards*
- *Prioritize watersheds*
- *Identify, plan & implement pre-fire actions*
- *Identify & plan post-fire actions*
- *Revise analysis & planning with new information*

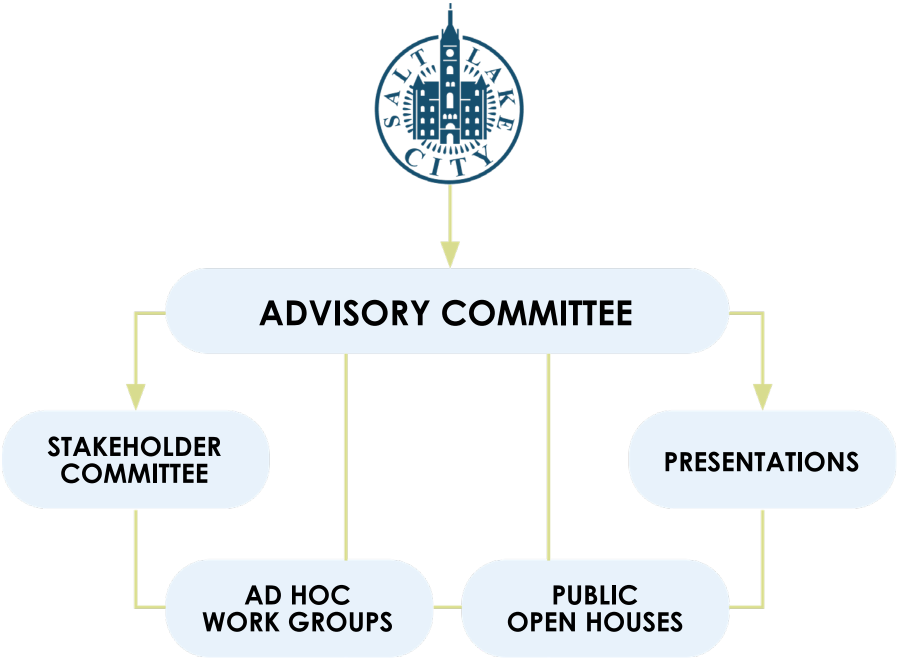
# Wildfire Facilitated Discussion

The Langdon Group

## Website

slcwatershedmanagementplan.com

# Wrap Up




## Advisory Committee Meetings (3 total)

- **Meeting 1 – Process Framework**
  March 14, 3:00 – 4:00 pm

## Stakeholder Committee Meetings (8 total)

- **Meeting 1 – Need, Characteristics & Framework**
  March 24, 1:00 – 3:00 pm
- **Meeting 2 – Climate Change**
  April 11, 3:00 – 5:00 pm
- **Meeting 3 – Wildfire**
  April 21, 10:00 – 12:00
- **Meeting 4 – Human Impacts**
  May 6, 10:00 – 12:00
- Meeting 5 – Elements To Be Explored
  TBD
- Meeting 6 – Draft Guidelines/Practices/Tools
  TBD
- Meeting 7 – Draft Plan
  TBD
- Meeting 8 – Updated Draft Plan
  TBD

## Public Open Houses (4 total)

- **Meeting 1 – Need, Characteristics, Framework, Areas Of Focus**
  May 25, 5:00 – 7:00 pm

# Thank You

Public Utilities

Keep It Pure

DON'T POLLUTE THE WATERSHED