Watershed Management Plan

Protecting Our Drinking Water Supply

Public Utilities

Keep It Pure

DON'T POLLUTE THE WATERSHED

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 end
- Want your input,
- We appreciate your time, knowledge, and views
- We will prepare a meeting report

Keeping Our Drinking Water Pure

Is The Purpose Of The Watershed Management Plan

Keep It Pure

DON'T POLLUTE THE WATERSHED

Overview Video

Please see video at: https://vimeo.com/670045290

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

Jurisdictional Roles

Water Quality
- U.S. Environmental Protection Agency
- Utah Division of Drinking Water
- Utah Division of Water Quality
- Salt Lake County Health Department
- Salt Lake County Watershed Restoration and Planning
- Salt Lake City Department of Public Utilities

Wetlands
- U.S. Army Corps of Engineers
- Uinta-Wasatch-Cache National Forest
- Salt Lake County Health Department
- Salt Lake City Department of Public Utilities
- Sandy City

Stream Alteration & Flood Control
- Utah Division of Water Rights
- Salt Lake County Flood Control
- Salt Lake City

Land Use
- Uinta-Wasatch-Cache National Forest
- Salt Lake County
- Salt Lake County Health Department
- Salt Lake County Metropolitan Service District
- Salt Lake City
- Town of Alta
- Town of Brighton
- Emigration Township
- Sandy

Law Enforcement
- U.S. Forest Service
- Unified Police Department
- Salt Lake City Police
- Town of Alta Marshals
- University of Utah Police

Wildfire Response & Fuels Reduction
- U.S. Forest Service
- Utah Division of Forestry, Fire & State Lands
- Unified Fire Authority
- Salt Lake City Fire Department

A lot of entities involved but there are still gaps and having enough funding for what is needed is an issue

Existing Plans

The Purpose Of The Watershed Management Plan

Public Utilities is required and has the authority to protect its source waters and to demonstrate they are appropriately protected. One way we do this is by having in place the Watershed Management Plan. It helps guide the City's and Public Utilities watershed polices, programs and ordinances.

- Wasatch Cache National Forest Plan 2003
- Salt Lake County Canyons Master Plan
- Salt Lake County Water Quality Stewardship Plan 2009, 2015 update
- Salt Lake City Watershed Management Plan 1999
- City Creek Canyon Master Plan 1988
- Emigration Township General Plan
- Town of Brighton General Plan (Underway)
- Mountain Accord
- Central Wasatch Commission Mountain Transportation System
- UDOT Little Cottonwood Canyon Transportation EIS
- U.S. Forest Service & Salt Lake County Trails Master Plan (Starting)
- Town of Brighton Trails Plan (Starting)
- Salt Lake City Trails & Natural Lands – Foothill Trails Master Plan
- Salt Lake City Trails & Natural Lands – Master Plan
- Division of Wildlife Resources Little Dell Fishery Plan (Draft, On Hold)
- City Creek Water Treatment Plan Rebuild (Public Outreach)
- Big Cottonwood Canyon Water Treatment Plant Rebuild (Public Outreach)

Why Update The Plan?

- Plan is updated every 6 years as required per DEQ/DDW. Time for a more in-depth review
- Changes in the existing condition as compared to 1999
- Change in environmental stressors
- Identification of new trends
- Adaptive and proactive management

High quality water + ongoing stewardship = Pure water for the future

High quality water at the source = Reliability of the supply & a benefit to public health

Strategies to protect water quality have been working, . . .

Entering the water treatment plants

Water quality has been consistently high, requiring minimal treatment

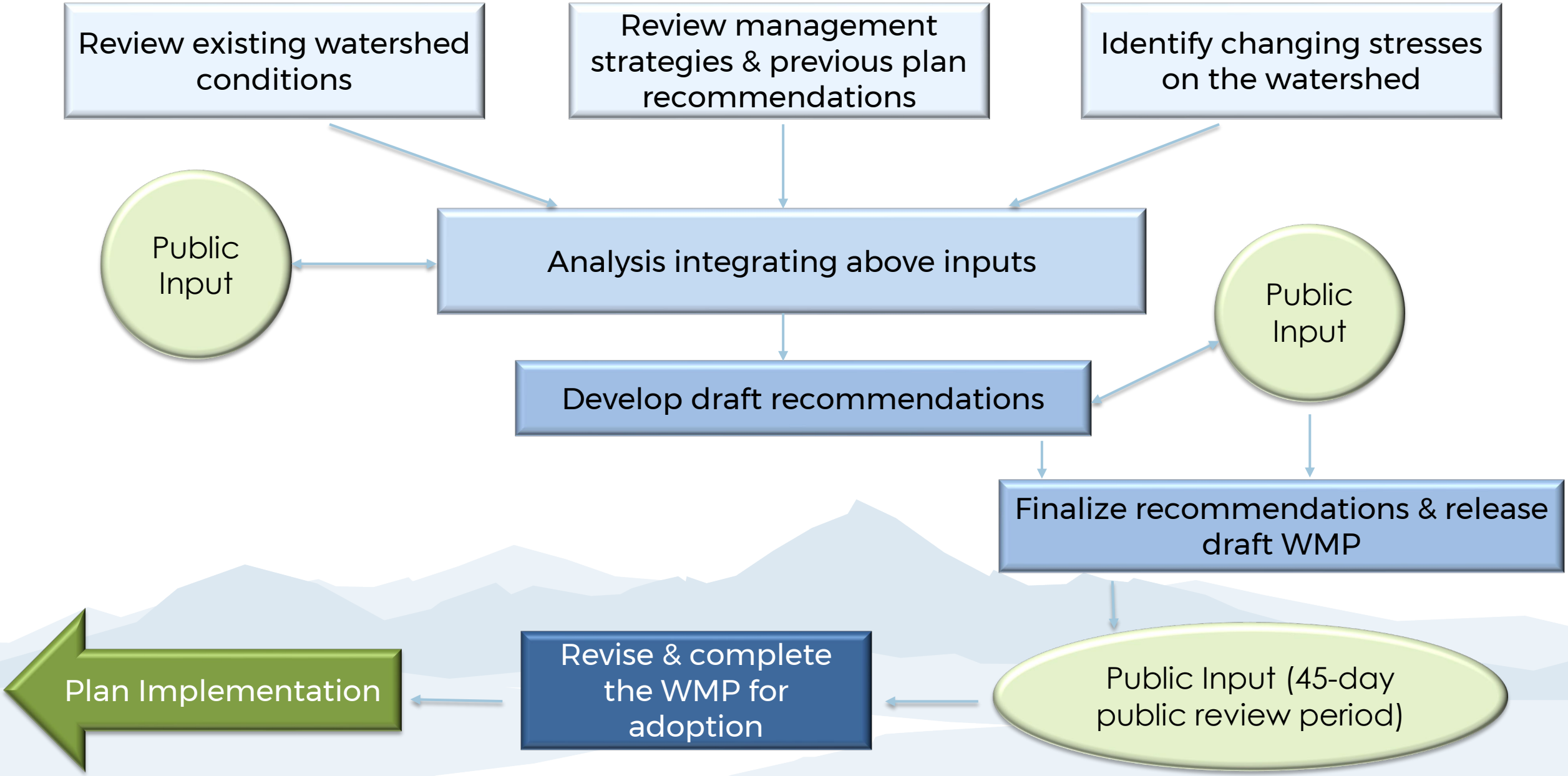
Leaving the water treatment plants

Treated water exceeds all US EPA requirements (SLCDPU Water Quality Report, 2021)

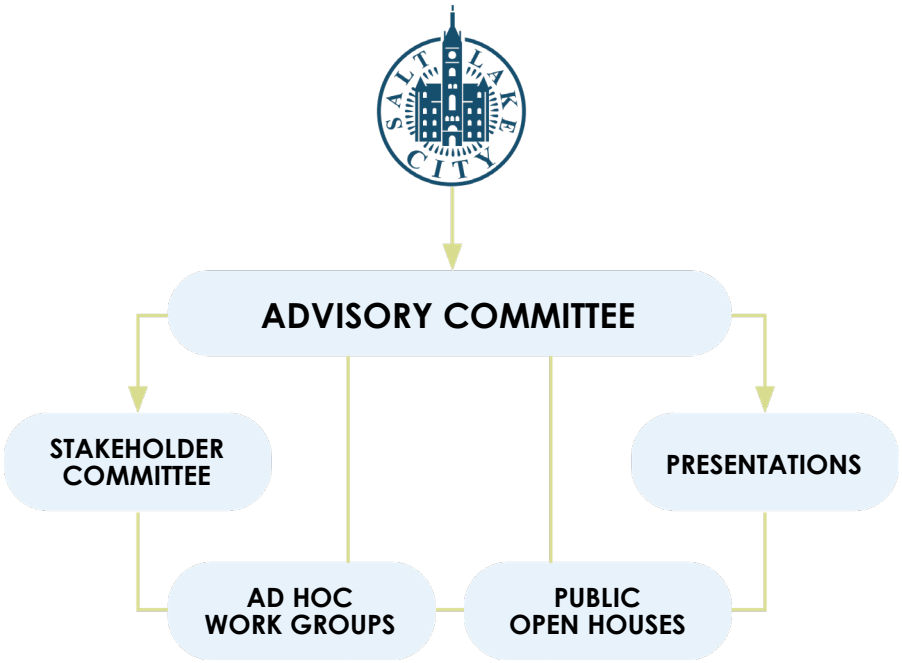
- Increasing population
- Pressure for more recreational opportunities
- Continued development
- New threats from climate change
- Existing & amplified wildfire threat

. . . But . . . We need to proactively protect our water from new and increasing threats.

Plan Development Framework



Engagement Framework



Advisory Committee Meetings (3 total)

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

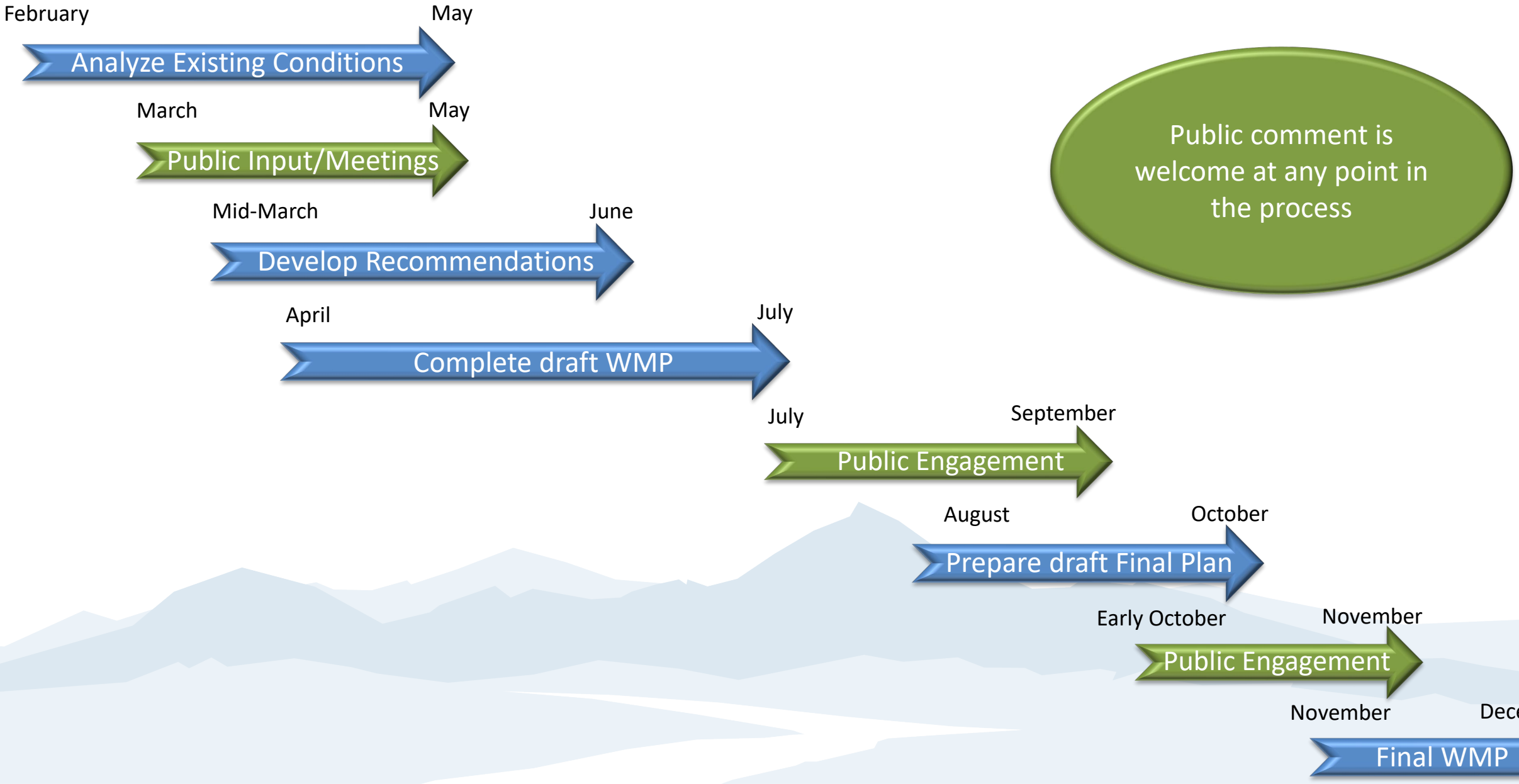
Stakeholder Committee Meetings (8 total)

- **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

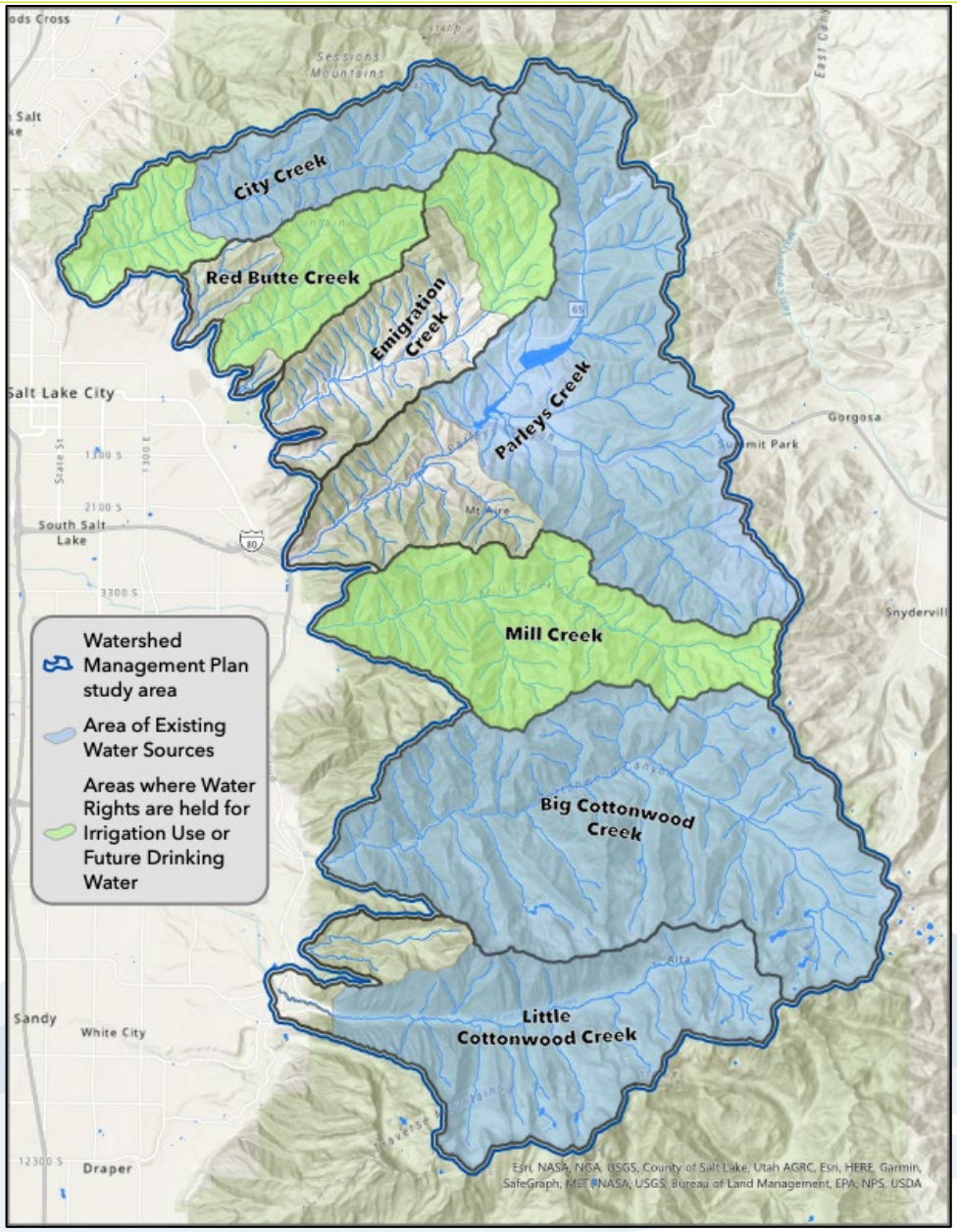
Public Open Houses (4 total)

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

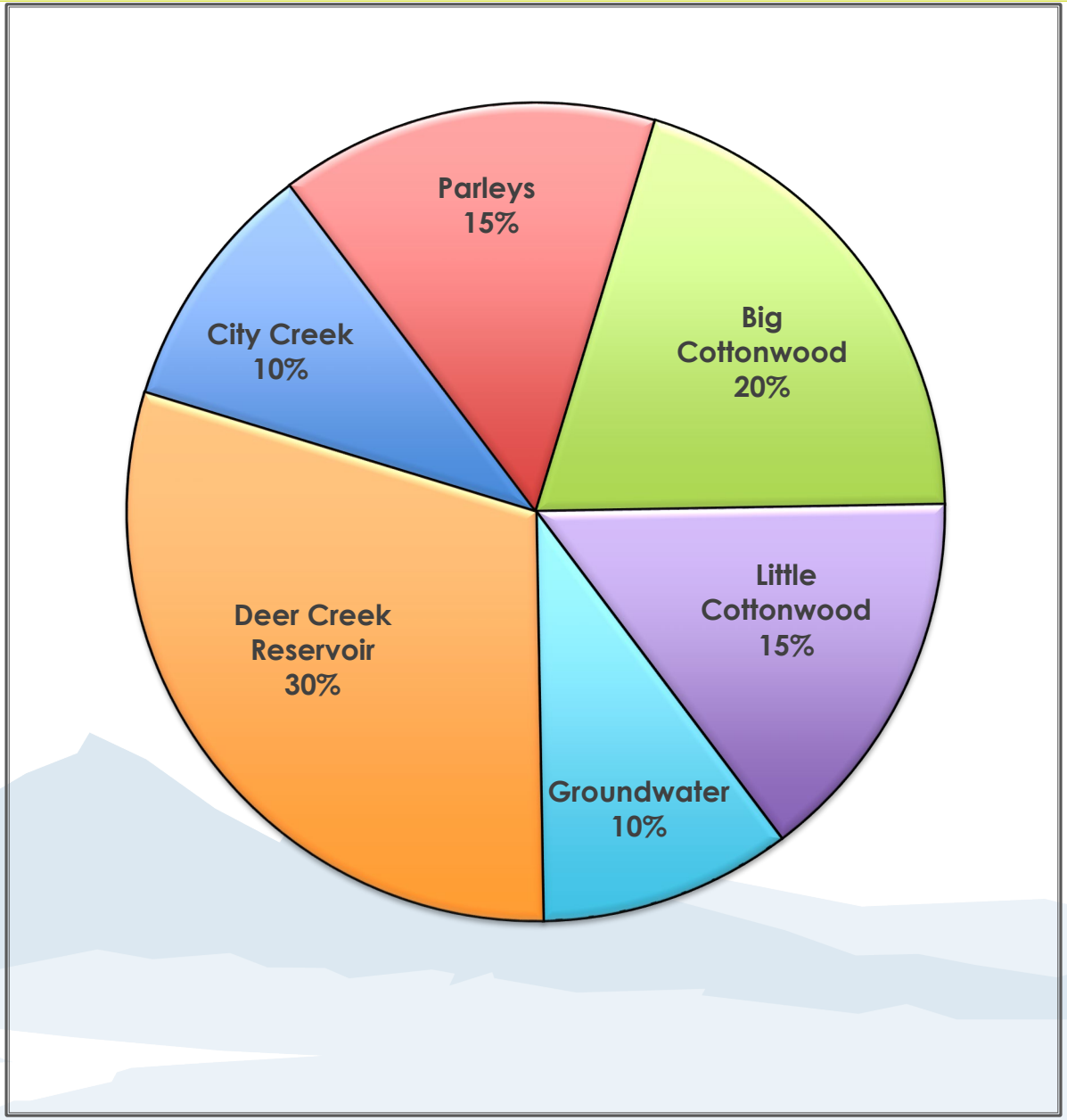
Anticipated Timeline



Study Area



Salt Lake City Drinking Water Supply



View from Brighton Ski Area

Photo: JW Associates – Jessica Wald

The unique watersheds of the Wasatch Front

Critical for water, valued by the community

Unique Attributes of Salt Lake City and the Wasatch Watersheds

- **Proximity to urban core**
  - Approximately 60% of the service area's drinking water comes from these canyons.
- **Short distance from source to tap**
  - Time for a drop of water to go from the top of Big Cottonwood Canyon and into the tap is about 24 hours.
- **Major recreational areas concentrated in small canyons**
- **Rapid population growth**

View of Wasatch from Sugar House Park

Photo: JW Associates – Jessica Wald

Also in the Watersheds

- **4 world-famous ski resorts** less than 30 miles from downtown Salt Lake City
- **3 Wilderness Areas** with trailheads a few miles from Salt Lake City
- **Major Freeway**, highways up canyons
- **Extensive trail network** for hiking and biking: some walking distance from the edge of town
- Rapidly growing **mountain bike, skiing and other recreational opportunities** that are gaining national attention

Management - watersheds are open to most recreation with minimal restrictions on traffic in City Creek and domestic animals in the protected watershed areas

BRIGHTON SKI AREA

Brighton Ski Area

Photo: JW Associates - Jessica Wald

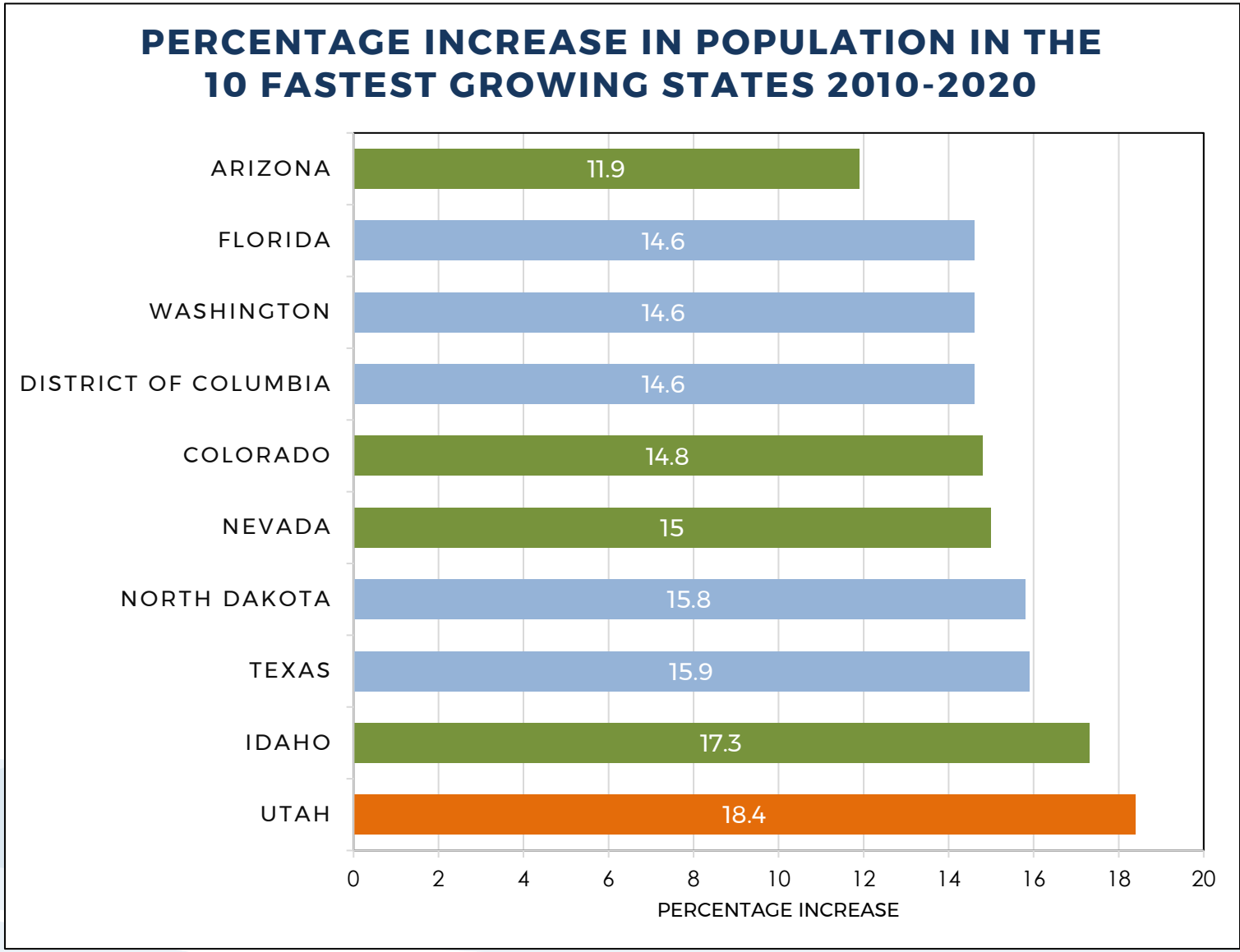
Unique Watershed Attributes – Rapid Population Growth

Utah is the fastest growing state in the US

The **Uinta-Wasatch-Cache National Forest** is among the top five most visited in the nation

More visitors annually than Yellowstone NP (average of 4.2 million past 5 years)

Source: Best Practices for Watersheds and Recreation: 2018 Research Paper by Headwaters Economics



Source: Census Bureau

Watershed management in other communities around the west

City/ Watershed	Approx Service Pop.	Primary Water Source	Distance from Source	Watershed Area/ % of supply	Other details	Characterization of Watershed
Portland, OR/ Bull Run	645,000	Rainfall temperate rainforest	<30 miles	89,000 ac (65,000 ac protected) Augmented by groundwater	2 reservoirs 30,700 ac-ft	Since late 1800s, 2/3 of watershed has been mostly closed to all activities
The watershed was opened to logging for a brief period (1958-1977). Closed again after evidence of contamination and public opposition. Only access to the watershed now is guided educational tours.						

City/ Watershed	Approx Service Pop.	Primary Water Source	Distance from Source	Watershed Area/ % of supply	Other details	Characterization of Watershed
City of Tacoma Upper Green River	320,000	Snowmelt/ Rainfall	<30 miles	147,000 acres (2/3 closed to recreation) Almost 100% small amount of groundwater	1 reservoir 20,000 ac-ft	Lower portion closed to nearly all recreation. Limited hunting and timber harvest. Dispersed recreation in upper watershed.
City owns 11% of watershed and has been strategic in land acquisition. Access tightly controlled using locked gates, staffed entry points video surveillance. Has agreements with USFS whereas public use rights were relinquished and Tacoma assumed road maintenance. Other agreements in place with landowners to control access allow water quality monitoring						

Watershed Condition – Vulnerability to Stress

"Watershed condition changes over time due to natural processes and anthropogenic influences. The most pervasive impacts to watershed condition are expected to come from population increases . . . and climate change"

US EPA, Healthy Watersheds Protection: Developing a Watershed Vulnerability Index, EPA.gov.

Mountain Dell and Little Dell Reservoirs, Parleys Canyon

Photo: Patrick Nelson

Driving Concept – Watershed Resiliency

Watershed Resiliency Definition

The ability of a watershed to withstand, or recover quickly, from a severe event such as fires, floods or extreme weather.

Cornell Cooperative Extension

A healthy riparian zone in Big Cottonwood Canyon

Photo: Sharon Turner

Characteristics of Watershed Resiliency

- Healthy riparian areas
- Intact wetlands
- Natural stream flows
- Functional flood plains

- Healthy, diverse upland vegetation
- Mix of openings/meadows
- Good ground cover
- Wildfires in natural disturbance regime

- Minimal impervious or compacted cover
- Lower road density
- Well designed stream/road crossings

Watershed Resilience – Importance to Water Supply

POST-FIRE ASPEN SPROUTING

East Troublesome Fire, Grand County, CO Photo: JW Associates - Brad Piehl

1. **Ability to withstand disturbance** = Reduction in risk to infrastructure and service disruptions

2. **Rapid recovery from disturbance** = Reduction in long-term water treatment costs

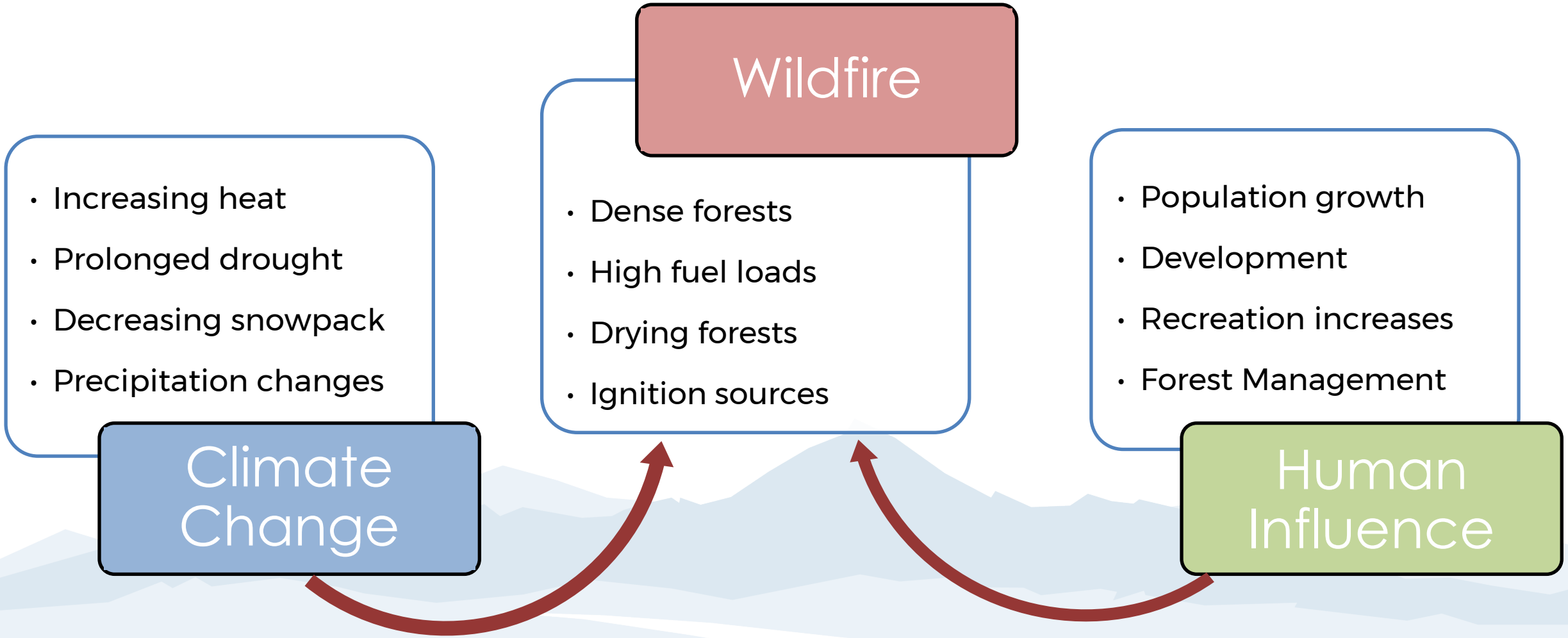
Focusing Management Planning

How do we balance the stress of climate change, the desire for recreation and need for infrastructure, with the long-term protection of our watersheds and water supply?

Lake Blanche, Big Cottonwood Canyon

Photo: Sharon Turner

Critical Concerns for watershed health and the quality and reliability of the water supply



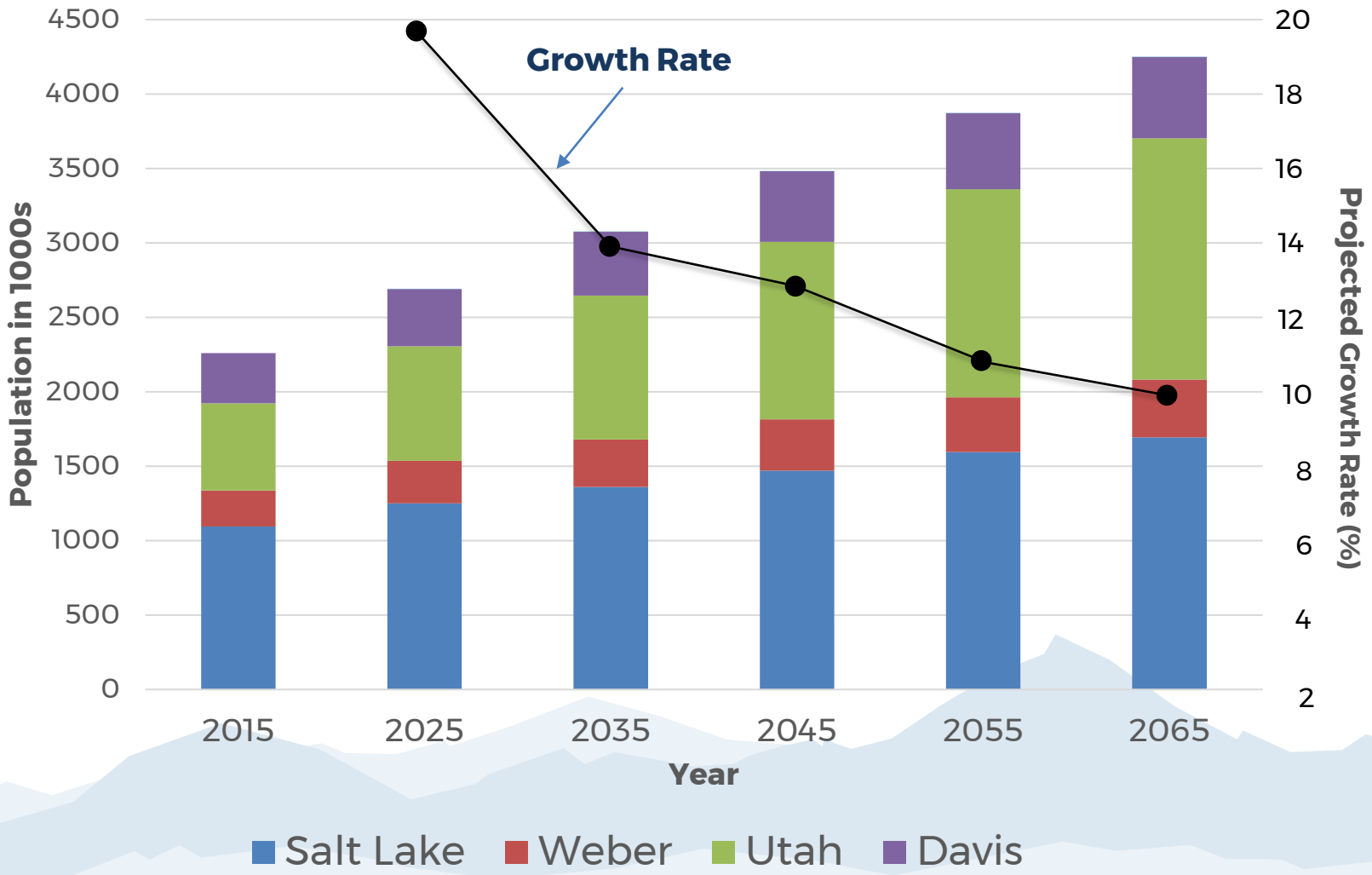
Little Dell Reservoir

Photo: JW Associates – Jessica Wald

Critical concerns for watershed health

- Human Influence
- Climate Change
- Wildfire

Population growth by County along Wasatch Front



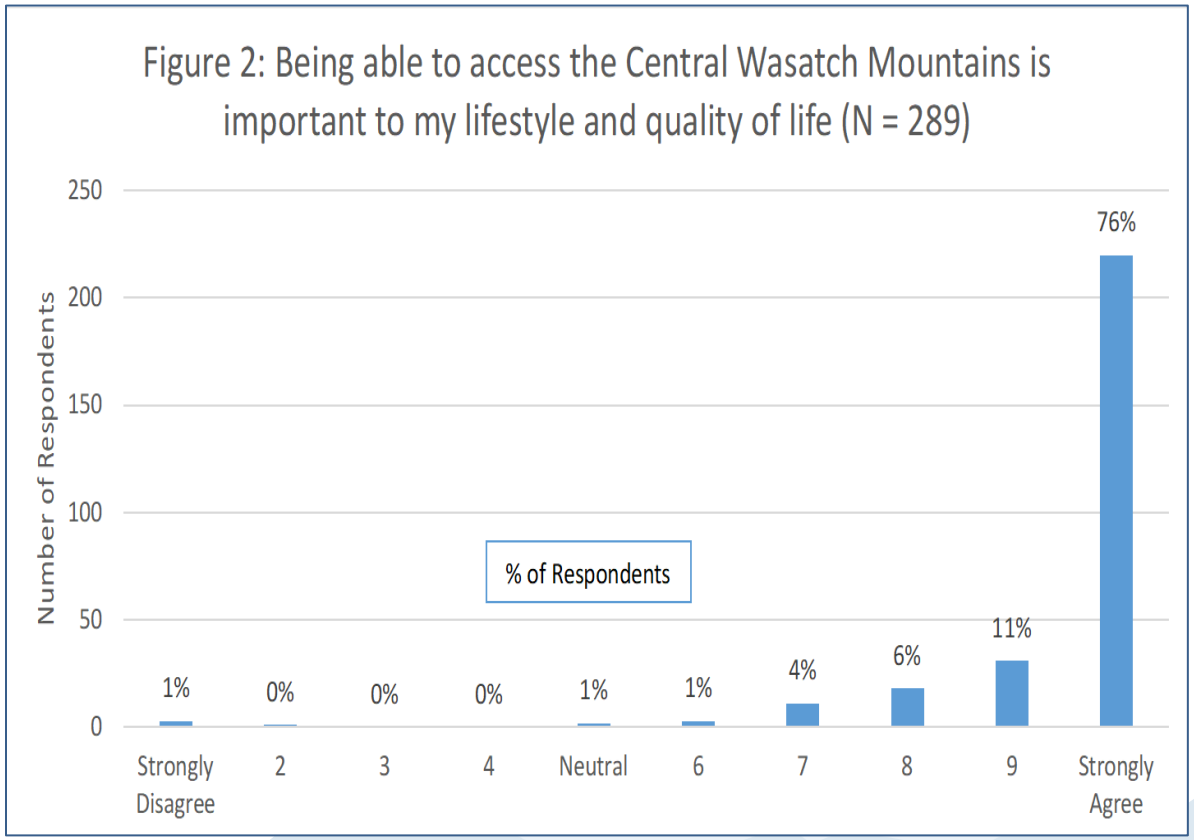
Wasatch Front

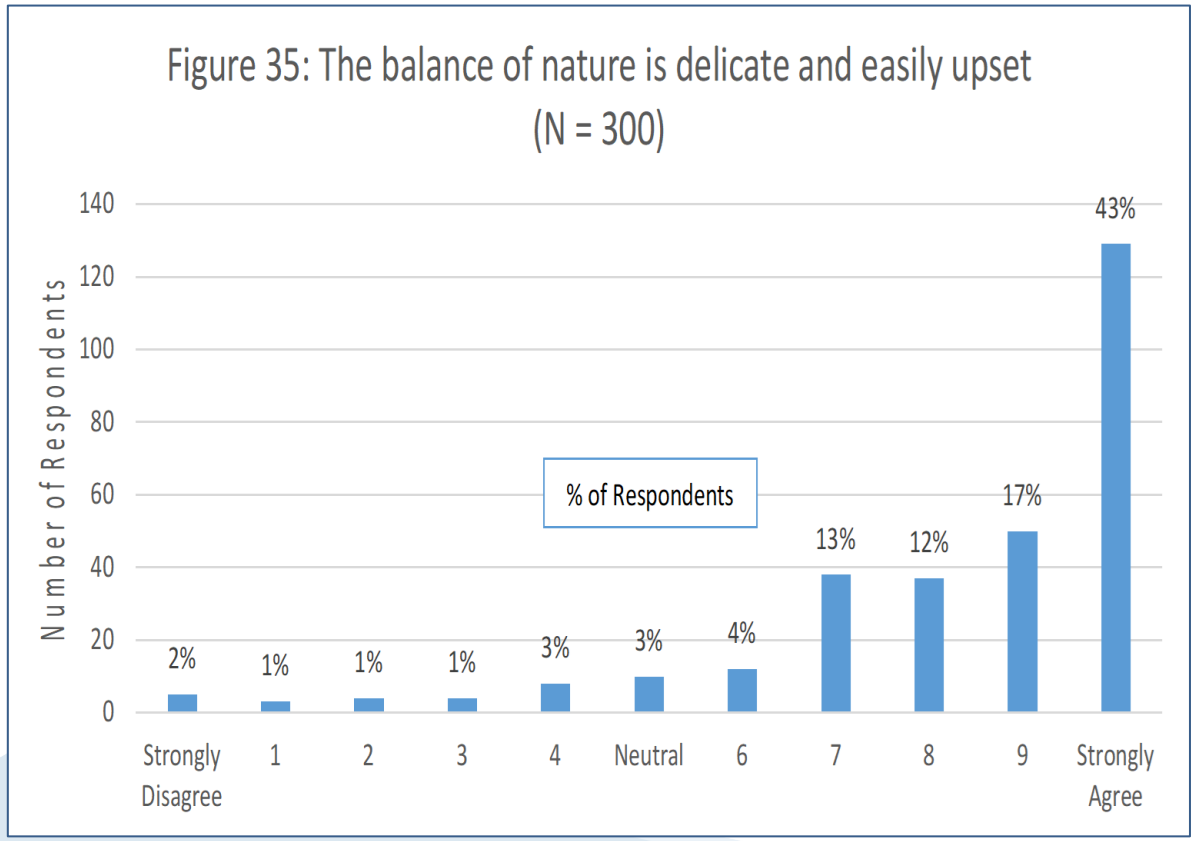
Population Increase from 2015-2065 = 1,988,879
Percentage Change = 88%

State of Utah

Population Increase from 2015-2065 = 2,997,404
Percentage Change = 94%

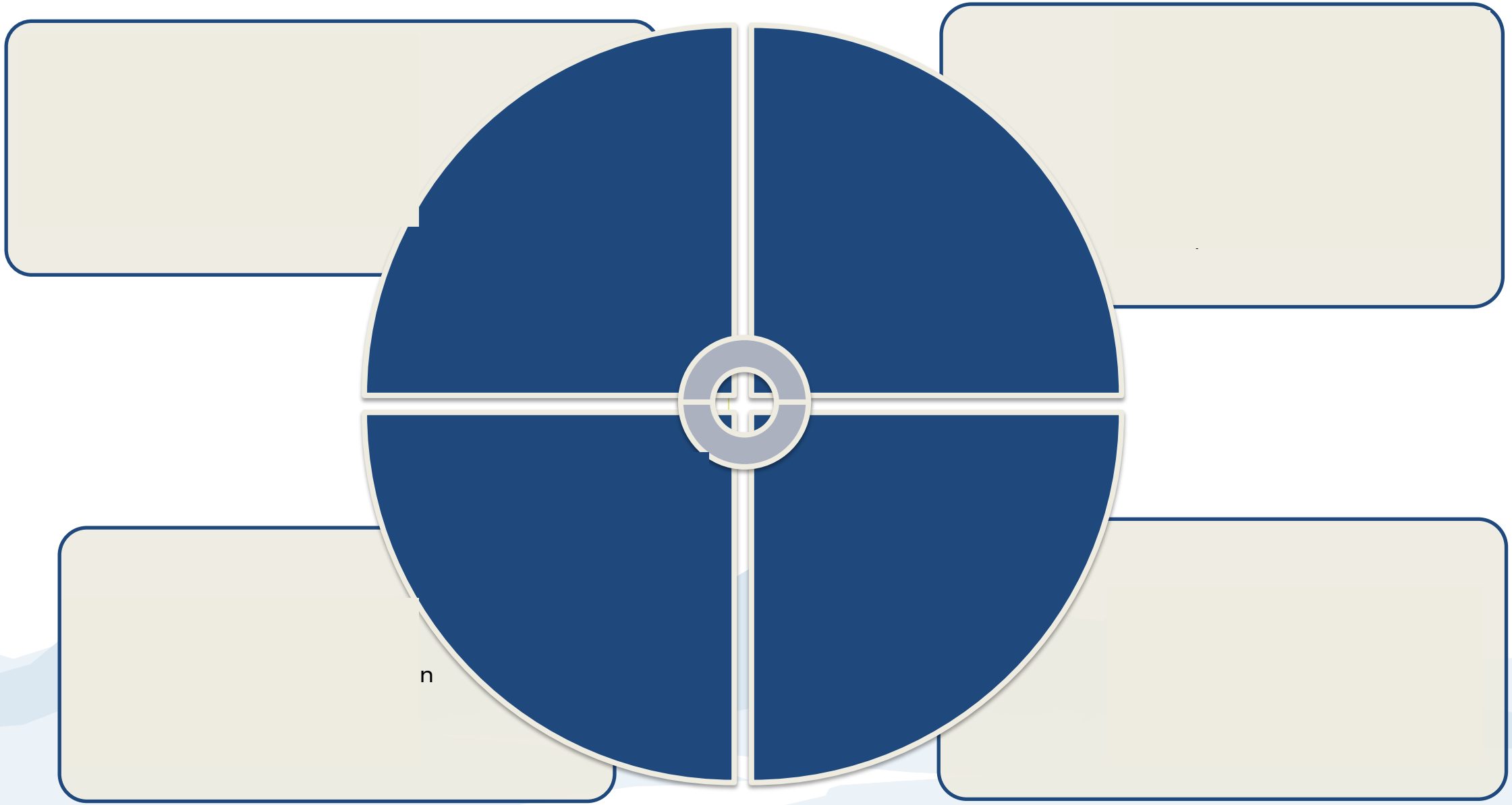
Why people want to be here - The Wasatch Mountains and the outdoor recreation they provide





Source: 2014-2015 Central Wasatch Visitor Use Study: Follow-Up E-Survey (Institute for Outdoor Recreation and Tourism, Utah State University, 2015)

Human Influence & Potential Impacts



Potential for Direct Contamination

CHALLENGES

- Automobiles in river
- Atmospheric deposition from traffic
- Litter & trash
- Human & animal waste
- Mining discharges
- Runoff from roads & parking areas
- Non-native fauna
- Septic Systems

CBS Denver – Car Crash in Poudre River

Potential for Direct Contamination

Installing a restroom in the canyons Photo: Patrick Nelson

WHAT CAN BE DONE?

- Guardrails and warning signs at key locations
- Traffic reduction to minimize emissions
- Informational signs, education, clean up crews
- Appropriate facilities and enforcement of regulations
- Monitoring and BMP implementation in collaboration with responsible parties and agencies
- Improve drainage and settling basins
- Move houses from septic to sewer systems

Potential for Disruption to Hydrologic Function

CHALLENGES

- Riparian area damage
- Filling/damage to wetlands
- Interruption of natural stream flows
- Channelization of streams
- Disconnection of floodplains or wetlands from streams
- Invasive species

Trampled riparian area Photo: Brad Piehl

Wetland fragmented by development
Photo: Utah Geologic Survey

Purple loosestrife in a riparian zone

Potential for Disruption to Hydrologic Function

Riparian Restoration
Photos: Beschta et. al, 2012. *Environmental management.*

Invasive weed control
Photos: Patrick Nelson

WHAT CAN BE DONE?

- Policy for review of building plans to ensure connections are maintained
  - ✓ Establish new connections where lost
- Riparian restoration and/or fencing
- Invasive weed control program
- Wetland restoration & source control
- Stream restoration

Potential for Erosion and Transport of Sediments to Water Sources

CHALLENGES

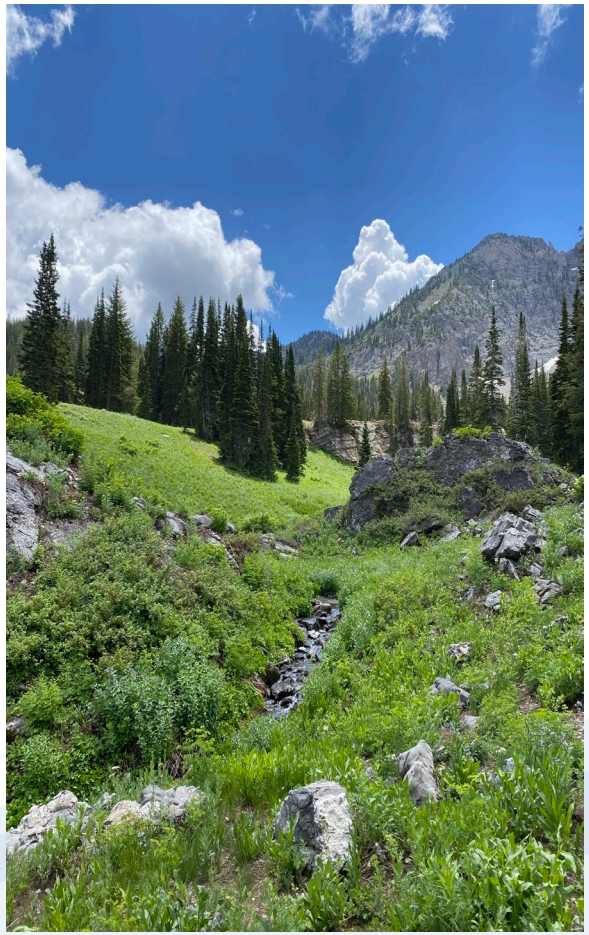
- Wildfire/Post-fire
- Stream/trail & road crossings
- Trail & road erosion
- Development in Wildland Urban Interface (WUI)

Post-fire sediments after Parleys Canyon Fire Photo: Patrick Nelson

Trail erosion in the Caribou-Targhee National Forest Photo: USDA

Erodiing trail near wetlands Photo: Patrick Nelson

Potential for Erosion and Transport of Sediments to Water Sources



Healthy riparian zone. Photo Sharon Turner

Bottomless culvert above Turquoise Lake
Photo: JW Associates Brad Piehl

WHAT CAN BE DONE?

- Appropriately designed crossings
- Appropriately designed roads & trails
- Inventory of riparian areas, signage in heavily used areas, fencing in damaged areas
- Education, review of ground disturbing projects
- Pre- and post-fire planning, quick actions after fires

Loss of Healthy Resilient Forests and Potential for Human Influenced Wildfire

CHALLENGES

- Forest structure
- Non-native invasive species
- Development in Wildland Urban Interface (WUI)
- Wildfire ignitions

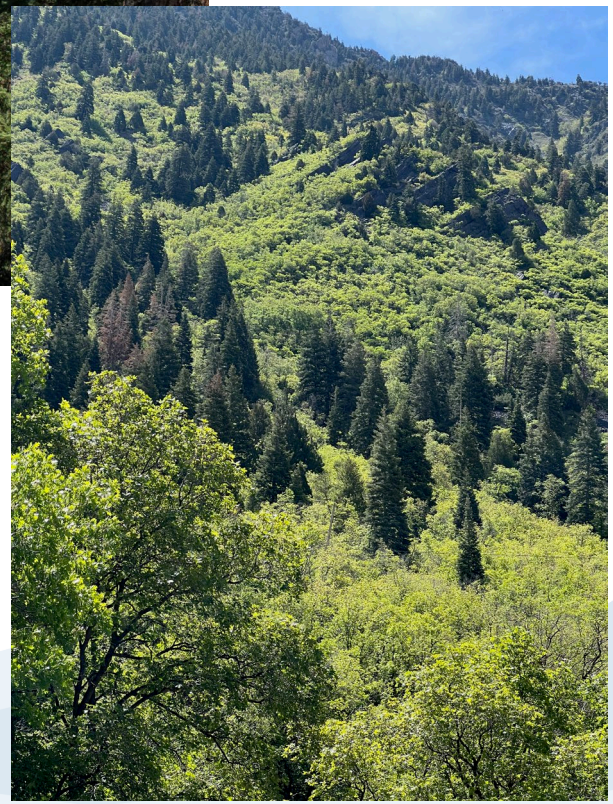
Cheatgrass in Parleys Canyon Photo: JW Associates Jessica Wald

Yellow star-thistle

Area of dense forest in Big Cottonwood Canyon
Photo: JW Associates Brad Piehl

Loss of Healthy Resilient Forests and Potential for Human Influenced Wildfire

Thinning an overly dense forest. Photo: Brad Piehl



Area of structural and vegetative Diversity in Big Cottonwood Canyon Photo JW Associates – Jessica Wald

WHAT CAN BE DONE?

- Collaborative design of forest management projects to improve resiliency
- Non-native, invasive weed control program
- Ban/limit open fires, including from picnic areas and backcountry, especially during times of high fire risk
- Education about wildfire and impact on watershed
- Fuel breaks to protect critical infrastructure and vulnerable waters
- Cell phone alert and reporting system
- Defensible space program in WUI

Critical to Successful Management – Funding and Partnerships

- Watershed management solutions cross ownership & jurisdiction boundaries
- Consistent communication from multiple agencies, municipalities, non-profits, and others is important for public understanding and support
- Consistent recurring funding is critical for multi-year projects
- Funding from multiple sources builds support and ownership of projects

Little Dell Reservoir

Photo: JW Associates – Jessica Wald

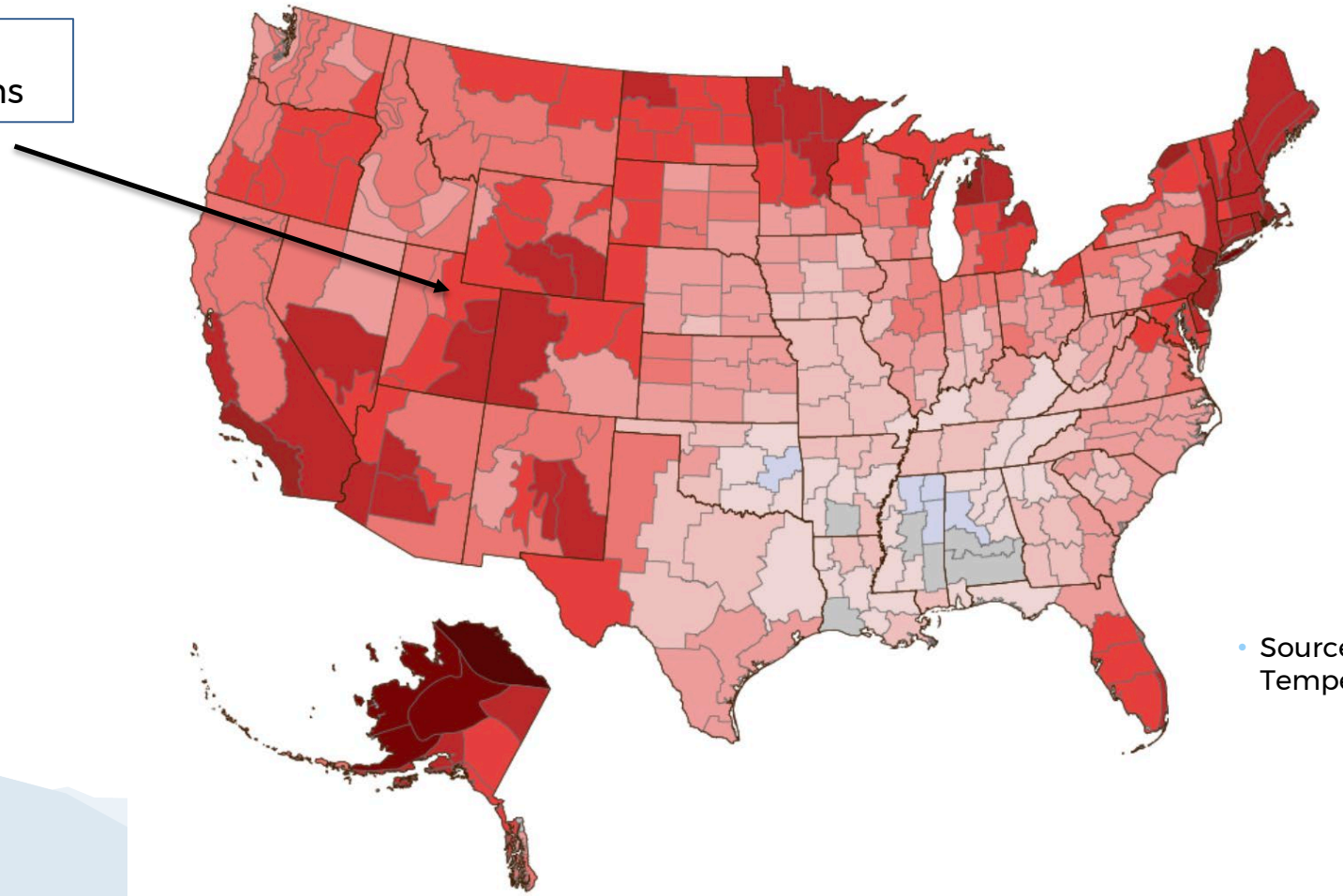
Critical concerns for watershed health

- Human Influence
- Climate Change
- Wildfire

Rising Temperatures - Average Annual Temperature Deviations from long-term averages (1901- 2020)*

Figure 3. Rate of Temperature Change in the United States, 1901–2020

Salt Lake City and Wasatch Mountains



The last decade was the warmest on record throughout the west.

- Source: US EPA, Climate Change Indicators, US Temperature Change, EPA.gov

Temperatures in Northern Utah have risen 1.5 to 2.5 °F from historical averages

Temperatures in high elevations worldwide are warming faster than sea level.

Utah ski resorts are warming faster than global averages.

Minimum winter temps (Dec-Mar) are expected to rise 10°F by 2100.

Pace of change in temperature is increasing.

1900-2014 Pace = 0.2 °F per decade • 1970-2014 Pace = 0.5 °F per decade

Sources: Utah Department of Public Safety: Utah Hazard Mitigation: Climate Change https://hazards.utah.gov/wp-content/uploads/Utah-SHMP-Ch12-Climate-Change-1.pdf. Accessed March 4, 2022;
Utah State University, Utah State Today, Climate Change in Utah will Require Ski Resort Adaptations. July 29, 2021.

In the Wasatch and Uinta Mountain Ranges

Between 1950 and 2010, amount of precipitation falling as snow has decreased by 9%.

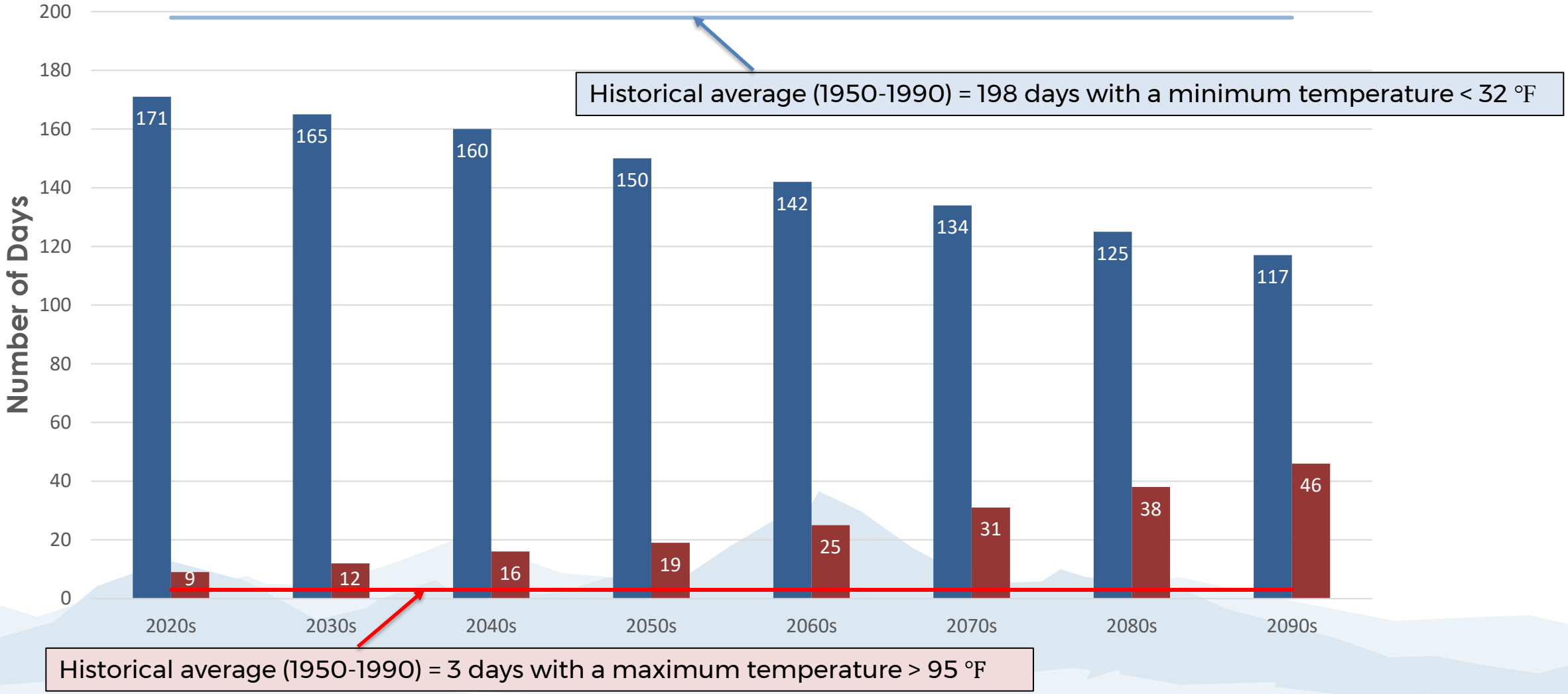
By 2080s , maximum median temps are outside historical range for all seasons.

By mid-century, > 50% of precipitation will fall as rain between December and February.

By 2100 – The increase in median maximum temperature is expected to range from 5-11 °F (low-high emission scenarios).

Sources: USDA FS RMRS-GTR-375, Klos et al 2014 as cited in USDA FS RMRS-GTR-362 2017)

Wasatch Front - More days above 95 °F -- Fewer below 32 °F



Source: USDA Forest Service, Office of Sustainability and Climate, Climate by Forest: A tool for exploring climate change information on National Forest System Lands. February 23, 2022. Website accessed April, 2022.

Potential Climate Related Impacts to Watersheds and Water Supply

Increased insects and disease

→ ***Higher wildfire risk, earlier snow melt, more nutrient export***

Increased size and higher intensity wildfires

→ ***Increased sediment & nutrient yield, debris flows, stream bank erosion, damage to riparian areas***

Increased populations of invasive species

→ ***Increased erosion, altered nutrient cycling, increased fire risk***

Degradation of riparian zones

→ ***Reduction in filtering, altered nutrient cycling, increased stream bank erosion***

Potential Climate Related Impacts to Watersheds and Water Supply

Altered timing & quantity of runoff

→ *Changed patterns for water supply, increased erosion*

Increased instream & reservoir water temperatures

→ *Increased algal growth, increase in TDS, reduced water quality*

Increased intensity of rainfall, rain-on-snow events

→ *Increased sediment delivery to streams, larger peak flows & altering timing*

Increased evaporation from reservoirs

→ *Reduction in water supply, potentially higher TDS*

Analyzing the Climate Change Vulnerability Within the Watersheds

Areas most at risk from climate change have a **High Vulnerability** to Climate Change

1. **High Exposure**
   - Defined as areas that will experience the most severe changes in temperature and precipitation.
   - All of the Wasatch has a high exposure.
   - This is a common factor throughout the study area (does not differentiate between sub-watersheds)

2. **Low Resilience**
   - Defined as a limited capacity to absorb or adapt to changes
   - Can be evaluated by analyzing vegetation diversity and topographic variability

3. **High Sensitivity**
   - Defined as areas that are ecologically sensitive to climate related changes
   - Evaluated by analyzing landscape condition, insects and disease, fire regime departure

Ecosystem Resilience

Part 1 of 2

Vegetative Diversity

Diverse vegetative diversity Photo: JW Associates

Ecosystem Resilience

Part 2 of 2

Topographic and microclimate variability

Topographic variability in Utah Photo: JW Associates

Ecosystem Sensitivity

Part 1 of 3

Landscape condition as measured by presence of roads

Arial photo of Emigration Canyon Photo: USA Forest Service

Ecosystem Sensitivity

Part 2 of 3

Risk of Insects and Disease

Area of beetle infestation and tree mortality Photo: JW Associates - Brad Piehl

Ecosystem Sensitivity

Part 3 of 3

Change from historic fire regime

Low intensity ground fire Photo: Open source

High intensity crown fire Photo: JWA – Brad Piehl

Additional Consideration for Ecosystem Sensitivity – Invasive Plants

- Reduce diversity
- Out-compete natives
- Change disturbance regimes
- Reduce habitat values

Yellow Star-thistle

Garlic Mustard

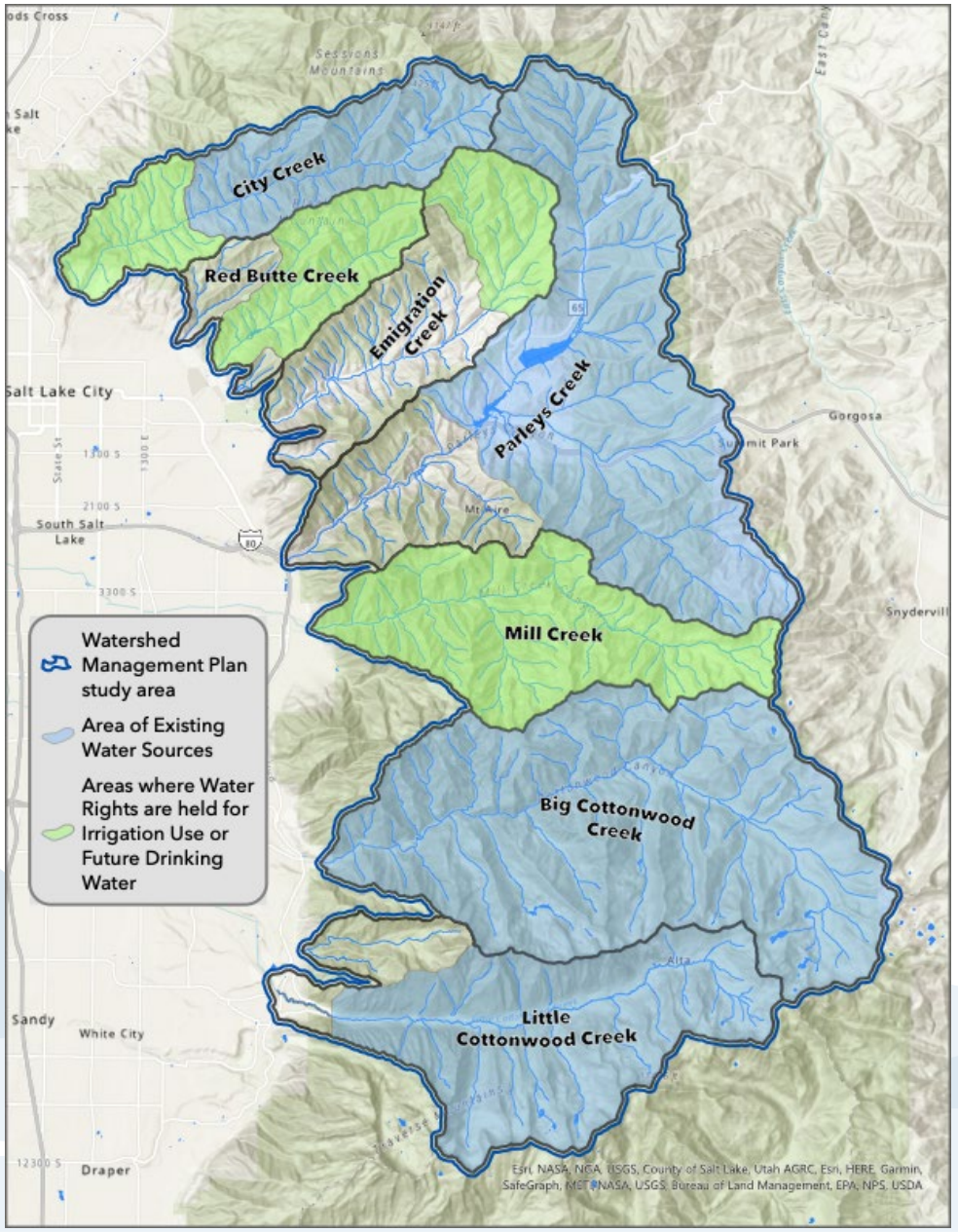
How did we apply this research to analyze the watersheds?

Foundational Concept

Analysis provides a scientific basis for management to prioritize actions & optimize resources.

Analyze the Components

1. Start with the watersheds as shown in map
2. Subdivide each watershed into smaller 7th level watersheds
3. Analyze components within those smaller watersheds including:
   - Ecosystem Resilience
   - Ecosystem Sensitivity



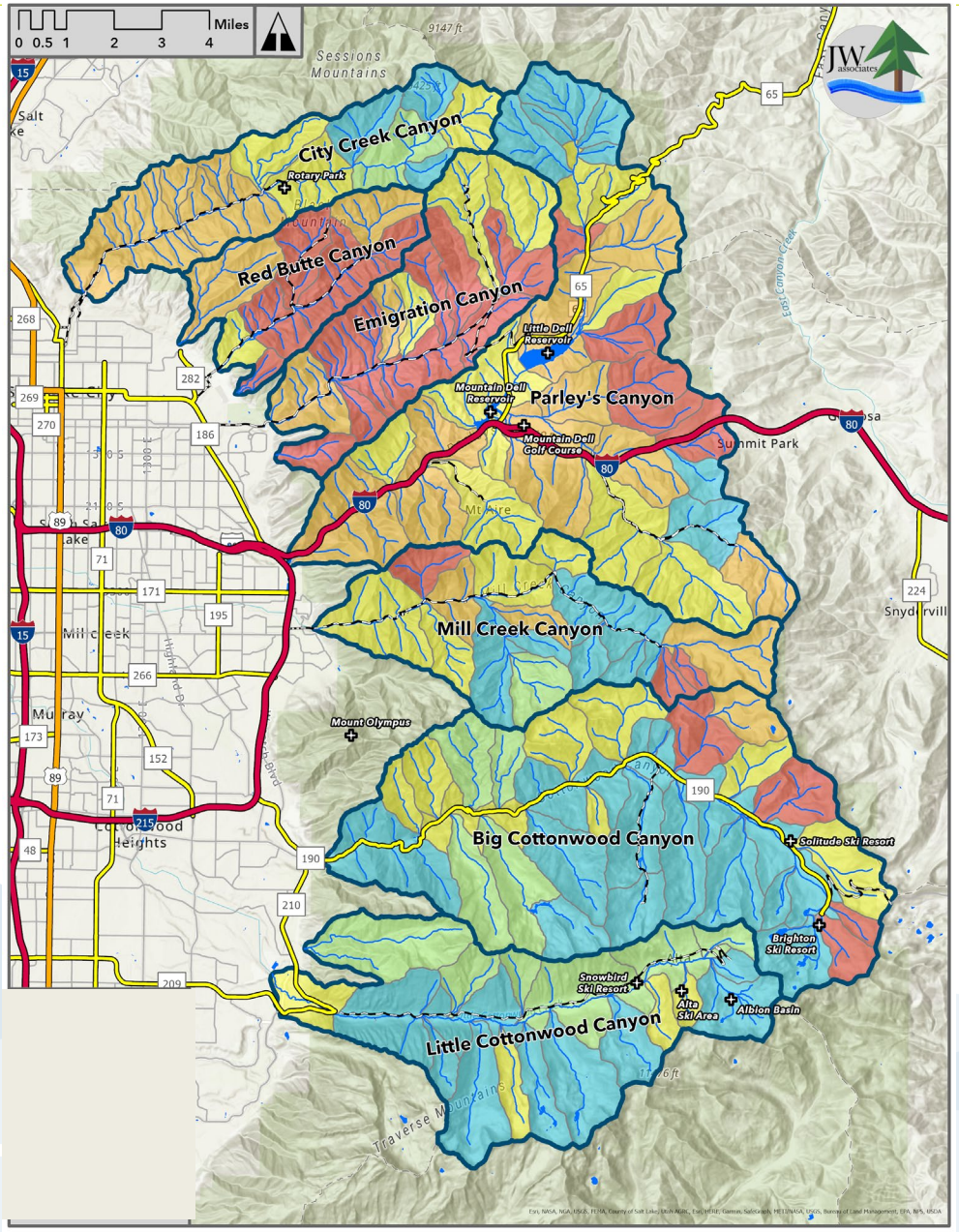
How did we apply this research to analyze the Climate Change Vulnerability of the watersheds?

Second – Rank the Individual Components

1. Comparatively rank all the smaller watersheds across the WMP Study Area (map) for each analyzed component (sensitivity and resiliency)
2. Group watersheds of similar magnitude into five roughly equal categories
3. Categories range from Lowest (green and blue) to Highest (orange and red) reflecting potential for increasingly adverse impacts from climate change

Third – Combine all factors into one metric the Climate Change Vulnerability Index

1. In all maps, including the final composite map, areas in orange and red are at most risk from climate change.
2. Provides localized detail for management decisions.



Important Points

1. This is a tool to help prioritize management actions and optimize resources.

2. This is a comparative analysis.

3. Wasatch Mountains has a whole has high vulnerability. This analysis helps us see the differences on a smaller scale.

4. Blue or green watersheds are ranked lower but that does not mean those areas will not see the effects of climate change or are not at risk.

View from top of Little Cottonwood Canyon Photo: JW Associates – Jessica Wald

Can We Increase Watershed Resilience?

- **Topo-Climatic Variability – No**
- **Vegetation Diversity – Yes, In some places**

How to increase vegetation diversity

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

Can We Reduce Watershed Sensitivity?

- **Landscape Condition – Maybe**
- **Fire Regime Departure – In some places**
- **Forest Insect & Disease Risk – In some places**

Actions to Reduce Watershed Sensitivity

- Reduce road impacts
- Forest restoration
- Reduce forest density
- Enhance aspen
- Enhance function of riparian areas

Little Dell Reservoir

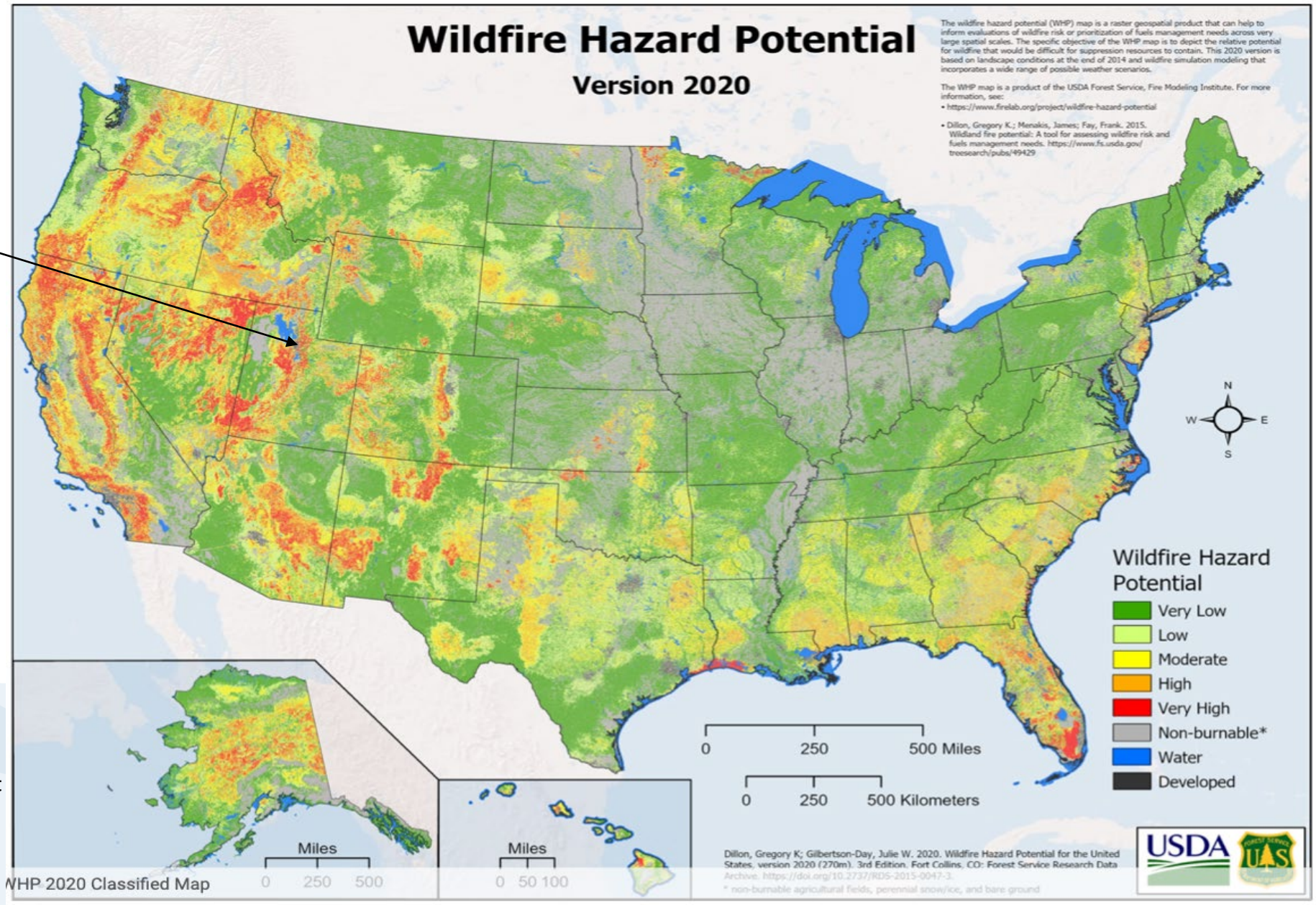
Photo: JW Associates – Jessica Wald

Critical concerns for watershed health

- Human Influence
- Climate Change
- Wildfire

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.
2. **Increased Fuels -** Heat stress and drought increase forest fuels.
3. **Increased Ignitions -** Increasing air temperatures increase lightning strikes.

HOW DOES CLIMATE CHANGE IMPACT FUEL MOISTURE?

- Increasing vapor pressure deficits (VPD) – the weight between how much water air can hold and how much it does hold. Large deficits result in drier vegetation.
- Predicted 12% increase in lightning strikes for every degree C of temperature increase (Romps et al 2014). But long-term some places may see a decrease in fuels (trees don't grow back).
- 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.

Primary Causes of 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

All photos – JW Associates

Analyzing the Wildfire Hazard Within Watersheds

Our analysis identifies & maps **areas of highest concern** by sub-watershed by combining:

1. **Modeled wildfire severity**
   - Flame length
   - Crown fire activity
2. **Potential for post-wildfire impacts to the watershed**
   - Debris flows
   - Roads
   - Soil Erodibility

JW Associates: Cameron Peak Fire (2020)

JW Associates: Dollar Ridge Fire – Cow Hollow

Wildfire Severity

Flame Length

Crown Fire Activity

JW Associates: East Troublesome Fire

Potential post-wildfire Impacts

Part 1 of 3

Debris flow hazard

JW Associates: Big Cottonwood Creek

JW Associates: Cow Hollow post-fire debris flow Dollar Ridge Fire

Potential post-wildfire Impacts

Part 2 of 3

Road 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)

JW Associates: Post-fire road conditions East Troublesome Fire, Colorado

Potential post-wildfire Impacts

Part 3 of 3

Soil Erodibility Hazard

JW Associates: Post-fire soil conditions Cameron Peak Fire, Colorado

JW Associates: Black water from post fire erosion Cameron Peak Fire, Colorado

Combined Wildfire Hazard Ranking

Wildfire Severity Hazard

+

Debris Flow Hazard

+

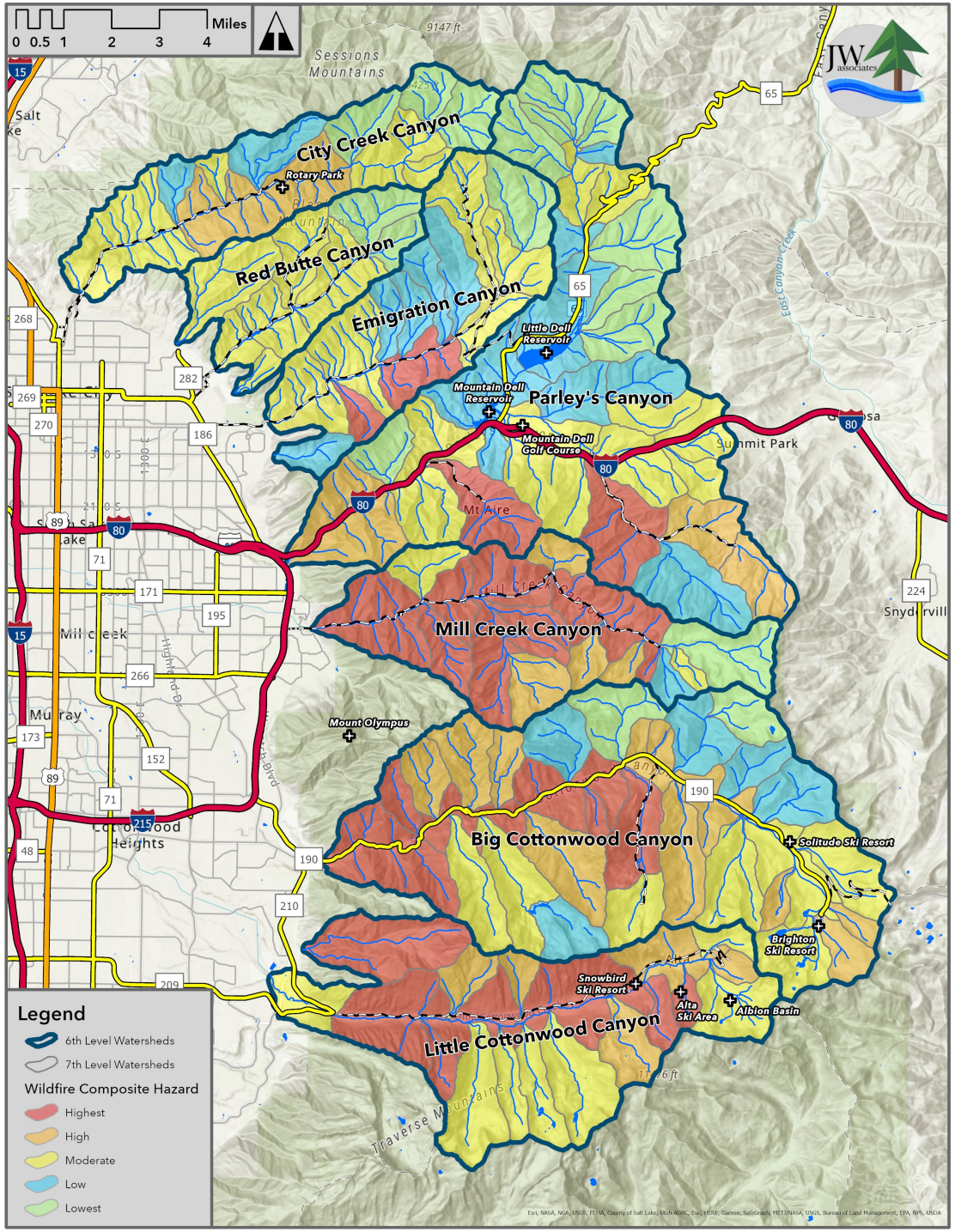
Roads Hazard

+

Soil Erodibility Hazard

=

Watershed/Wildfire Composite Hazard



Planning for Wildfire - Management Strategies

Three-part Strategy

1. Identify, plan and implement pre-fire actions to reduce wildfire intensity and post-fire impacts
2. Work with Suppression teams during fires
3. Plan post-fire actions and get ready

Pre-fire Actions

In strategic locations:

- Thin overly dense forests
- Create fuel breaks and openings
- Reduce ladder fuels
- Enhance aspen

JW Associates: Post-fire evidence of effectiveness of structural diversity in slowing fire. East Troublesome Fire, Colorado

Pre-fire Actions

Manage for forest and watershed resilience

- Protect riparian areas – including removal of conifer encroachment
- Enhance aspen and forest diversity
- Create patchiness
- Control non-native, invasive species

JW Associates: Post-fire vegetative recovery in East Troublesome Fire, Colorado

Pre-fire Actions

Work with landowners in WUI

- Education
- Buffer zones on property
- Fuel reduction around property

JW Associates: WUI buffer zone, Buffalo Fire, Colorado

During Fire

Work with suppression teams and emergency agencies

- Be prepared to provide information on pre-fire actions

JW Associates: East Troublesom Fire, Colorado

Post-fire Actions

Have a plan

- Have areas at risk identified for potential post-fire protection
- Develop a manual of potential post-fire actions
- Include identification of partners and funding sources

JW Associate: Post-fire wood mulch application in High Park Fire burn area

Keep In Mind

Keeping Our Drinking Water Pure
Is The Purpose Of The Watershed Management Plan

Keep It Pure

DON'T POLLUTE THE WATERSHED

We Want Your Input

www.slcwatershedmanagementplan.com

Thank You

Public Utilities

Keep It Pure

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