

Climate Vulnerability Assessment & Resiliency Strategy



Project Overview

- Background & Objectives
- Local Climate Impacts
- Resilience Vision, Terms & Definitions
- Vulnerability Assessment Results
- Resiliency Implementation Strategies



Background and Objectives

Project Objectives

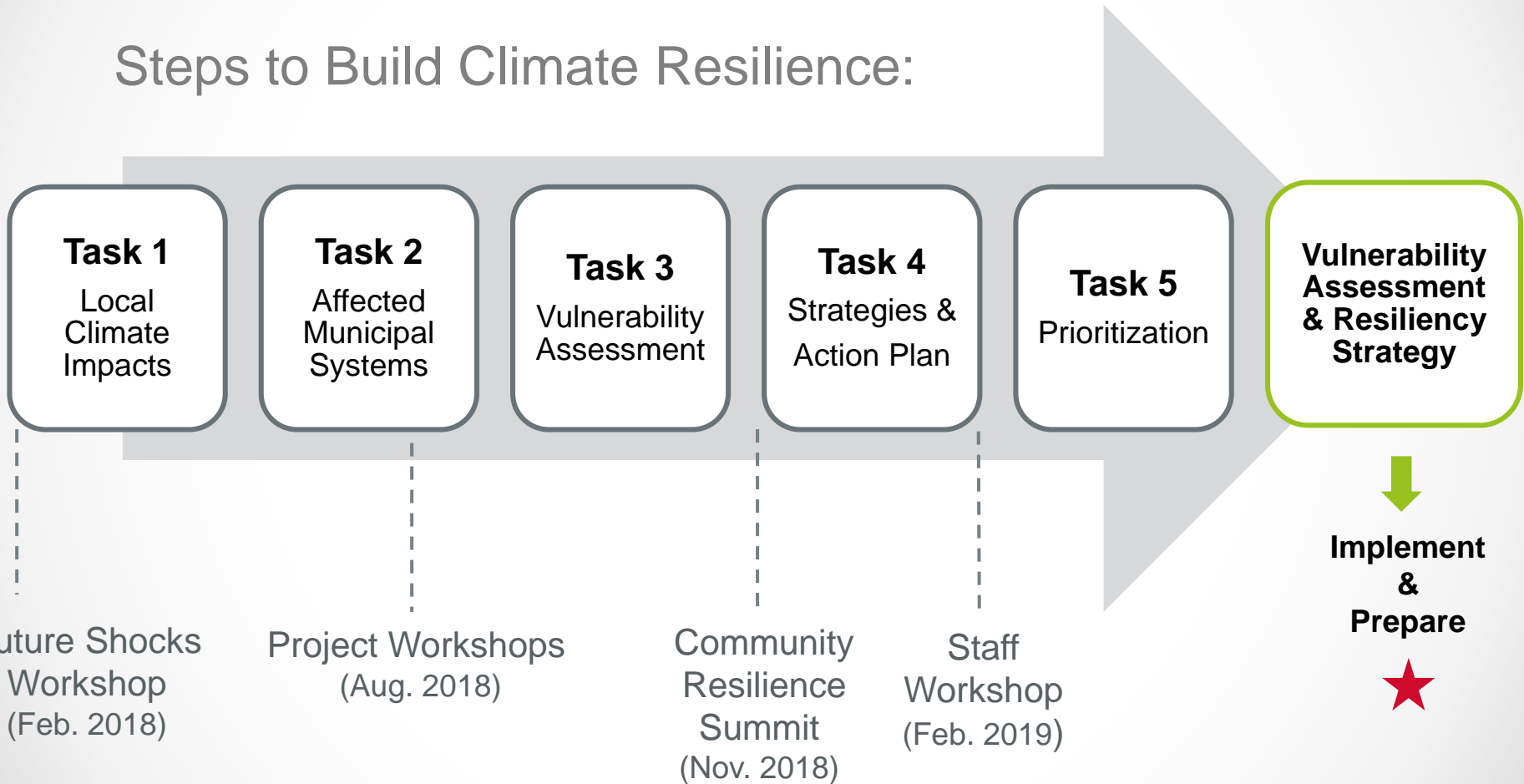
- Enhance City preparedness for climate change
- Analyze vulnerabilities
- Prioritize needs and opportunities
- Build awareness

Approach







- Utilize available tools and frameworks
- Leverage subject matter expertise
- Tie into existing and upcoming planning efforts

Project Process

Steps to Build Climate Resilience:



Local Climate Impacts Summary

 Extreme Heat	More frequent and intense
 Floods	More severe
 Drought	More frequent and intense
 Mountain Snowpack	Decline in volume
 Wildfire	More extensive, frequent, and intense
 Winter Storms	More severe

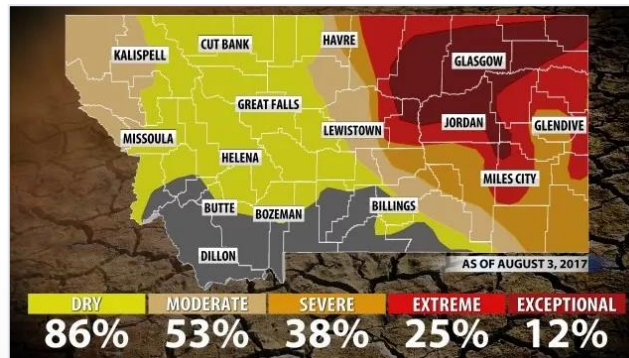
2017 Montana Climate Assessment:
www.montanaclimate.org

Local Climate Impacts

Business-as-usual Mid-century Projections for Southwest Montana

Average annual temperature	+6.0°F
Average number of days above 90° F	+33 days
Average number of freeze free days above 32° F	+41 days
Average annual precipitation	+1.2 inch/year
Change in summer precipitation	-0.1 inch/month

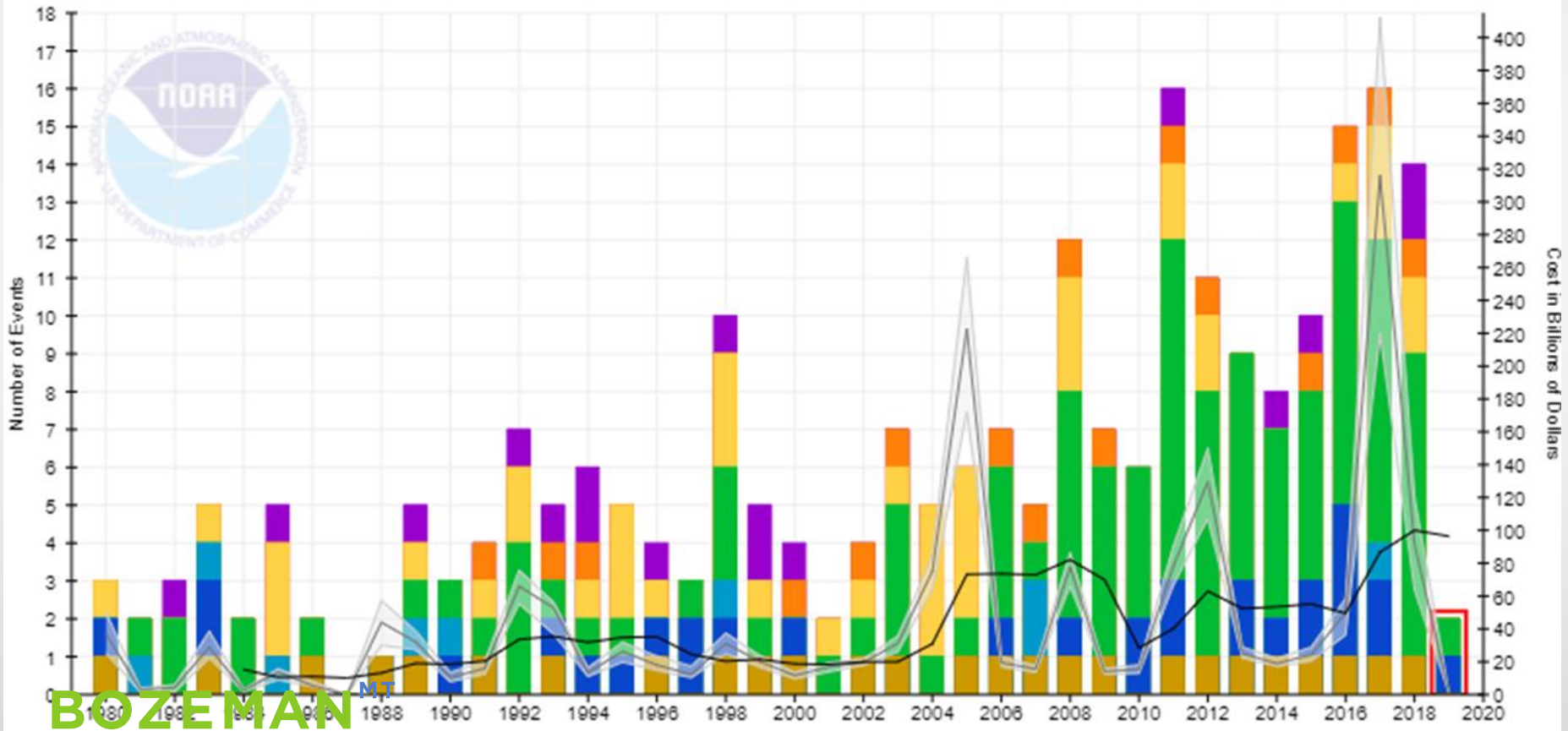
2017 Montana Climate Assessment



Disaster Losses & Trends

Billion-Dollar Disaster Event Types by Year (CPI-Adjusted)

- Winter Storm
- Wildfire
- Trop Cycl
- Severe Storm
- Freeze
- Flooding
- Drought
- Cost w/ 95% CI
- 5-Year Mean



BOZEMAN

City Sustainability

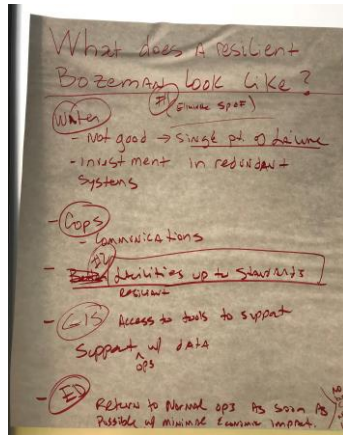
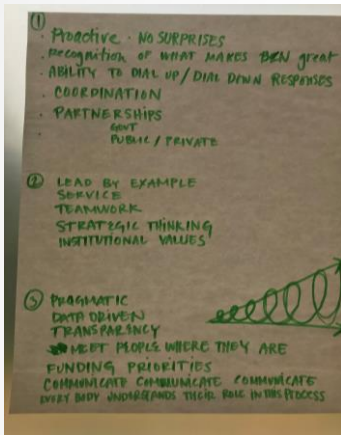
Resilience & Financial Impacts

- Moody's incorporation of climate change into rating assessment
- AT&T building infrastructure based on 30-year local climate change models.
- Cost savings



Source: National Institute of Building Science, 2016

Resilience Vision Concepts



THE MOST LIVABLE PLACE.

Terminology

What is resilience?

The ability to prepare and plan for, absorb, respond, recover from, and more successfully adapt to adverse events.

Source: National Academies of Science definition



THE MOST LIVABLE PLACE.

Terms & Definitions

- ***Sensitivity***: The degree to which a building or facility is affected (adversely or beneficially) by exposure to a climate hazard.
- ***Adaptive Capacity***: The degree to which a building or facility can currently cope with and accommodate change caused by an exposure to a climate hazard within existing resources and constraints.
- ***Vulnerability***: The degree to which a building or facility is susceptible to or unable to cope with a climate hazard.

Sensitivity + Adaptive Capacity = Vulnerability

Vulnerability Assessment



Critical City Facilities

Critical City facilities generally provide or support operations and services for common public benefit.



Community Centers

Community centers are meeting places for social, educational, or recreational activities for all in the community.

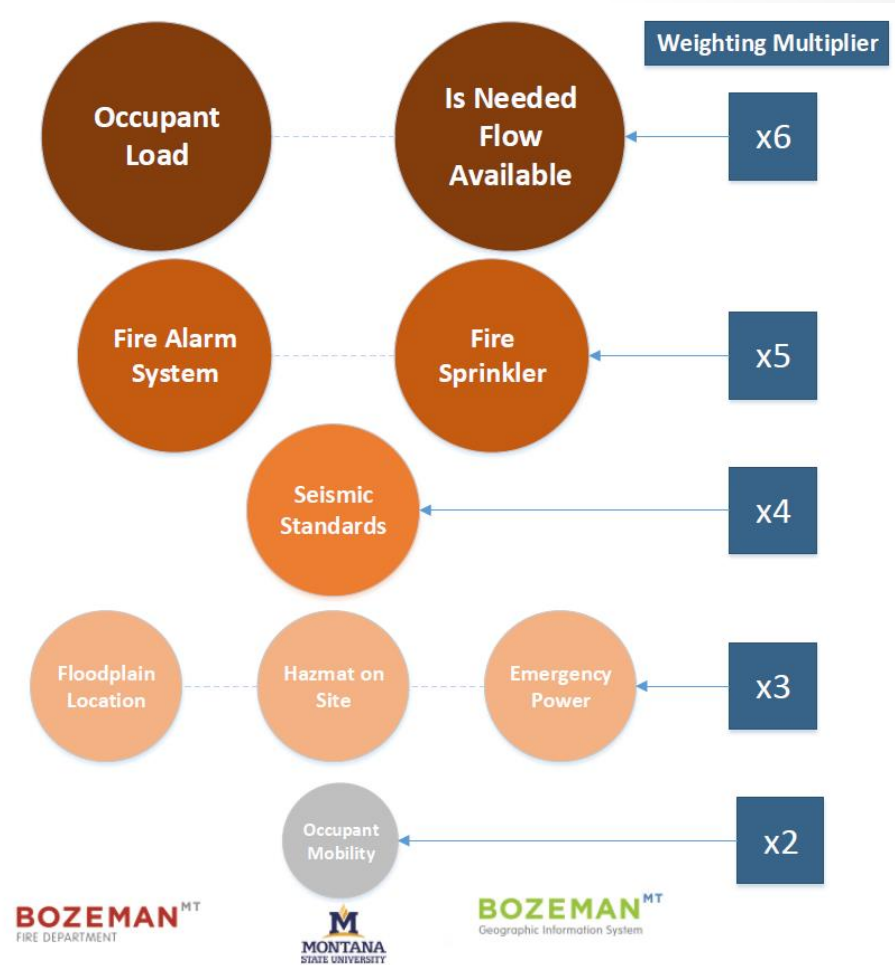


Critical Infrastructure

Critical infrastructure delivers resources that make the community livable and underlies economic function.

Vulnerability Assessment

- Fire Department and GIS Occupancy Vulnerability Assessment Profile (OVAP)
 - Structures Inventory



Sensitivity + Adaptive Capacity = Vulnerability

	Occupant Load	Goal to Recovery	Floodplain	Basement	Wildland Urban Interface	Emergency Power	Demographics
Extreme Heat	Green	Green					Green
Flood		Green	Green	Green			Green
Drought	Green	Green					Green
Reduced Snowpack	Green	Green					Green
Wildfire		Green			Green		Green
Winter Storms		Green				Green	Green

Sensitivity + Adaptive Capacity = Vulnerability

Adaptive Capacity: The degree to which a system is able to cope currently and adapt to changes in climate within existing resources and operational and organizational constraints.

Low – There is little to no operational and/or operational adjustments you can do to affect outcomes with current resources.






Medium – There are operational and/or organizational adjustments available to lessen the impact(s), but still will be adversely impacted.

High – There is enough operational flexibility to withstand an event without overly adverse impacts.

Sensitivity + Adaptive Capacity = Vulnerability

Building/Facility	Extreme Heat	Drought	Flood	Reduced Snowpack	Winter Storms	Wildfire
Shops Complex	High - Medium	High - High	Low - High	High - High	Medium - Medium	High - Medium
Bozeman Public Safety Center (Proposed)	High - High	High - High	Medium - Medium	High - High	Medium - High	High - High
Law & Justice Center	High - Medium	High - High	High - High	High - High	Medium - Medium	High - Medium
Cemetery Building	Low - Medium	Low - Medium	Low - High	Low - Medium	Low - Medium	Low - Medium
Alfred Stiff Professional Bldg.	High - High	High - High	Medium - Medium	High - High	Medium - High	High - Medium
Bozeman Fire Department Station #1	Medium - Medium	Medium - Medium	High - Low	Medium - Medium	Medium - Low	Medium - Medium
Bozeman City Hall	High - High	High - High	High - Low	High - High	Medium - High	High - Medium
Gallatin County Coordination Center	Medium - High	Medium - High	High - High	Medium - High	Medium - High	Medium - Medium
Bozeman Fire Department Station #3	Medium - High	Medium - Medium	High - High	Medium - Medium	Medium - High	Medium - Medium
Bozeman Fire Department Station #2	Medium - High	Low - Medium	Low - High	Low - Medium	Medium - High	Low - Medium
Logan Landfill	Medium - High	Low - High	Low - Low	Low - High	Medium - High	Low - Medium
Story Mill Landfill/Convenience Site/HHW	Low - High	Low - High	Low - Low	Low - High	Medium - Medium	High - Low
Vehicle Maintenance Building	Low - High	Low - High	Low - High	Low - High	Medium - Medium	Low - Medium
Parking Garage	Low - High	Low - High	Low - Medium	Low - High	Medium - Low	Low - High
Laurel Glen Shops	Low - Medium	Low - High	Low - High	Low - High	Low - High	Low - High
Beall Rec Center	Medium - High	Medium - High	Low - Medium	Medium - High	Medium - Low	Medium - Medium
Bozeman Senior Center	High - Medium	High - High	Low - High	High - High	High - Medium	High - Medium
Lindley Center	Medium - Low	Medium - High	Low - High	Medium - High	Medium - Medium	High - Low
Bozeman Public Library	Medium - High	Medium - High	Low - Medium	Medium - High	Medium - High	Medium - Medium
Story Mill Community Center	High - Low	High - High	High - Medium	High - High	Medium - Medium	High - Medium
Swim Center	Medium - Medium	Medium - Low	Low - High	Medium - Low	Medium - Low	Medium - Medium
Story Mansion	Medium - Medium	Medium - High	Low - High	Medium - High	Medium - Medium	Medium - Medium
Water Reclamation Facility (WRF)	Low - High	Low - High	Low - High	Low - High	Medium - High	Low - High
Water Treatment Plant (WTP)	Low - High	Medium - Low	Low - High	Medium - Low	Medium - High	High - Medium

Vulnerability Summary

Climate Hazard	Service Category	Primary Issues
 Extreme Heat	Community Centers	Vulnerable populations
 Flooding	Critical City Facilities	Building damage, transportation network to deliver services
 Drought/Snowpack	Critical Infrastructure	Water supply
 Wildfire	Critical Infrastructure, City Facilities, Community Centers	Smoke and human health, Water supply and treatment
 Winter Storms	Critical City Facilities	Emergency response time, power outages



Resiliency Strategy

Strategy Summary

1

Infrastructure & Capital Planning

The City will plan for critical facility infrastructure hardening and capital projects to limit damage community-wide and improve its operational resilience during and after hazard events.

2

Hazard Event Protocols & Training

The City will continue to develop its internal training and operational protocols to improve response capability in the face of hazard events.

3

Public Policies & Programs

The City will pursue policies and standards that build individual, organizational, and community resilience.

4

Climate Resilience Planning & Integration

The City will integrate climate resilience within all policy and planning efforts to build resilience from the inside out.

Strategy Summary

5

Inter-agency Community Partnerships

The City will play an important role in building resilience by partnering and coordinating with community organizations.

6

Awareness & Education

The City will prioritize proactive education within City operations to build individual, organizational, and community resilience.

7

Ongoing Climate Monitoring & Risk Assessment

The City will adapt its operations to weather by conducting an evidence-based assessment of the City's vulnerability and risk to climate variability.

Strategy Alignment & Prioritization

Strategy 1: Infrastructure and Capital Planning (ICP) *Plan for critical facility infrastructure hardening and capital projects that limit damage to property, protect human health, and improve operational resiliency.*

Actions	Department / Partner	Plan Alignment	FY20 Budget	Cost	Effort	Benefit	Priority
1. Continue to build out back-up power, mobile back-up power, fuel storage, and communications redundancies for buildings and infrastructure.	IT, Facilities, Fire, Police, Gallatin County Emergency Management	Gallatin County Hazard Mitigation Plan (2019)	Partial	\$\$	H	H	H

Implement & Monitor

- Climate Action & Resiliency Plan
- Continuity of Operations Planning with MSU
 - HEPT 1, 2
- Bozeman Public Safety Center
 - ICP 1, 2, 3, 8
- Administrative Order for formalize commitment to resiliency
 - PPP 1
- Tracking and Reporting Tool
- Vulnerability Assessment Mapping Tool



Climate Vulnerability Assessment & Resiliency Strategy

www.Bozeman.net > Sustainability >
Climate Action Plans & Policies

Thank You!

