

VULNERABILITY ASSESSMENT



A COMMUNITY WORKBOOK

*Understanding the local risk of
climate change*

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INTRODUCTION

The purpose of this vulnerability assessment is to provide city leaders and decision makers with information on the risk of climate change to city departmental **goals, objectives, focal resources, and populations**. Once vulnerabilities are identified and prioritized, the following adaptation strategy effort will result in a suite of actions to reduce the risk of climate change to the community.

City staff and other experts are tasked with completing this assessment based on their local knowledge and experience, with support and guidance from the Geos Institute and Brendle Group. Once the three components of vulnerability are documented, we will explore cross-sector implications and prioritize. These prioritized vulnerabilities will feed into a facilitated process to identify actions and strategies that will increase the resilience of the community to climate change and related stressors.

This vulnerability assessment is a compilation of existing information and should not replace detailed study of

specific issues and stressors facing the community. This assessment can help inform where additional information and study is needed. As better climate change projections and more detailed information becomes available, the vulnerability assessment should be revisited and updated.

Please work through the following pages of the workbook to document the different components of climate change and exacerbating stressors to the resources and populations of interest in your community. Provide as much detail as possible. We will use this as a starting point for developing a matrix of vulnerabilities for city departments. Please jot down any notes or thoughts along the way – this is not a final product, but rather an initial brainstorming effort.



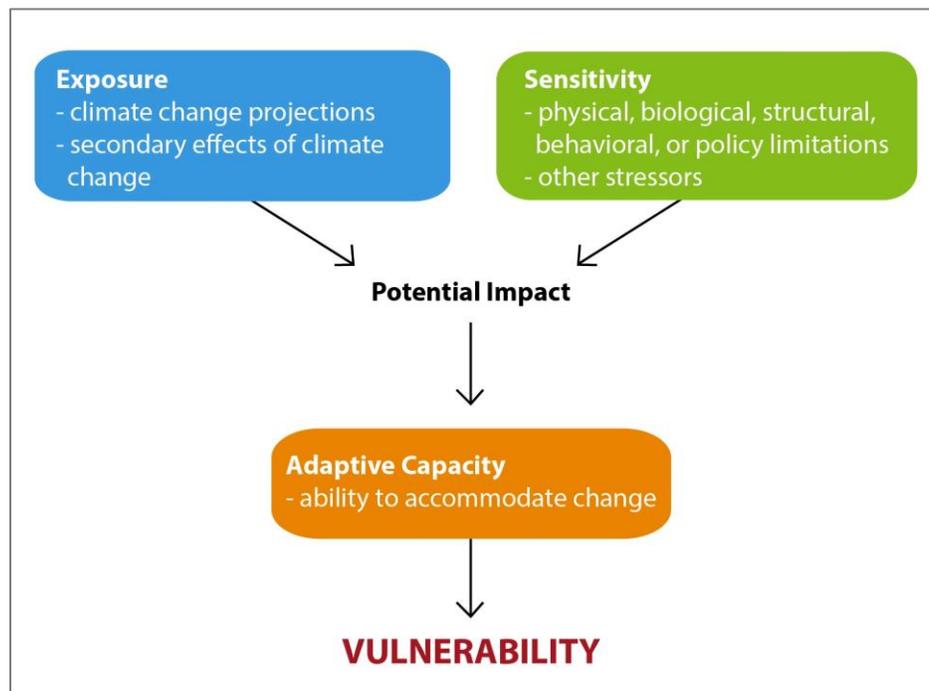
The Three Components of Vulnerability

For this assessment, vulnerability is broken down into 3 components: Exposure, Sensitivity, and Adaptive Capacity.

Exposure includes the changes that are expected from climate change specific to the resources or populations of interest. *Outdoor workers in Fort Collins, for example, might be exposed to severe heat but not sea level rise.* We have provided a review of the best available science on climate change specific to the local area to help participants assess exposure.

Sensitivity is the level of response of the resources or population of interest to climate change trends. *People with asthma, for example, might be very sensitive to the expected changes in temperature (and ozone) while people without asthma might be less sensitive.*

Adaptive Capacity is the ability of the focal resource or population to respond or adapt to the expected changes. *People with higher incomes, for example, have resources to spend on air conditioning while those with lower incomes might not.*



Focal Resources, Populations, and Services

Please describe the focus of your work or the specific sector or resources you are interested in assessing for this effort. To make this step easier, we have compiled a list of potential focal resources or populations to choose from. Please highlight which ones you are assessing and **PLEASE add to the list or edit** those that are on the list.



Department	Resource, population, or service (note who is being served)

Others that are part of this effort:	
Operations Services	Buildings for city operations (including Police, City Hall, Fire Stations, others?)
Operations Services	Vehicles for city staff
Operations Services	Facilities owned and run by the city for city residents
Parks and Cemeteries	Park system for local residents and tourists
Parks and Cemeteries	Trails for local residents and tourists
Natural Areas	Rivers and Streams
Natural Areas	Natural Areas
Natural Areas	Wildlife Habitat
Natural Areas	Ecosystems
Natural Areas	Collaboration with stormwater program
Natural Areas	Cattle (?)
Planning and Transportation	Land use planning (where to build/not build, etc.)
Planning and Transportation	Improve traffic flow

Planning and Transportation	Provide multiple transportation options (for low-income, bikers, walkers, etc.)
Planning and Transportation	Increase quality of transportation infrastructure
Planning and Transportation	Increase awareness of options and opportunities
Police Services	Safety
Police Services	Emergencies (homes in flood prone areas, homes in fire prone areas, university students, etc.)
Police Services	Ongoing stressors or local issues (please describe)
Police Services	Traffic
Economic Health	Support for business (including breweries, university, technology, tourism, etc.)
Economic Health	Enhance innovation for overall economic benefits (business community)
Economic Health	Develop talent, retention, and recruitment (potential employees for business)
Economic Health	Develop business infrastructure
Economic Health	Maintain and develop assets to support local business
Environmental Services	Improve air quality, including reducing greenhouse gases (focused on businesses, residents, and municipal inputs)
Environmental Services	Reduce waste and increase recycling
Environmental Services	Education and transparency of City's environmental programs and goals
Social Sustainability	Meet housing needs for low and moderate income citizens
Social Sustainability	Promote self-sufficiency and prevent homelessness among low-income residents
Social Sustainability	Provide alternative housing for residents of mobile home parks that close
Social Sustainability	Provide services to protect safety of vulnerable populations (low-income, elderly, non-English speaking, people in flood zones?, disables, etc.)
Social Sustainability	Provide services to protect health of vulnerable populations
Social Sustainability	Provide services to protect well-being of vulnerable populations
Utilities/Light and Power	Provide reliable and safe energy generation at sustainable rates for residents and businesses
Utilities/Light and Power	Provide reliable and safe energy distribution for residents and businesses
Utilities/Light and Power	Help electric customers (residents, businesses, municipal) save energy
Utilities/Water	Divert and store sufficient supply of water for residents, businesses, municipal use
Utilities/Water	Provide reliable water distribution for residents, businesses, municipal use
Utilities/Water	Maintain high quality water supply, meeting federal and state water quality standards
Utilities/Water	Help residents, businesses, and municipal customers conserve water to protect supply from potential shortages
Utilities/Wastewater	Collect and treat wastewater so its safely cleaned and returned to the environment
Utilities/Stormwater	Minimize potentially hazardous conditions associated with flooding
Utilities/Stormwater	Develop master plan for the watershed/drainage basin
Utilities/Stormwater	Minimize introduction of human caused pollutants into stormwater
Utilities/Stormwater	Protect and restore natural function of watershed to provide protection from flooding and water quality benefits
Larimer County – Emergency Response	
Larimer County – Public Health	

Component 1. Exposure

For this section, **please consult the Climate Change Primer for Fort Collins, Colorado** and consider which trends the focal resources or populations are most likely to be exposed to. Also consider secondary effects. For example, in an area where some models project declines in precipitation and/or snowpack, the trends that are recorded might be less water availability and/or lower late summer streamflow. Please provide notes and explanations for your answers. If you are unsure about your answer, jot it down anyway, with the questions you have about the projections or other information that is needed.

PLEASE NOTE that while we have started to put information specific to each department into the tables, **we need you to read it over, make edits, and supplement it** with a lot of additional information. You are far more familiar with your departmental responsibilities and challenges than we are. Thank you!!

Also PLEASE NOTE that the focal resources and populations in the following tables can (and should) be **subsets of those recorded in the previous table**. For instance, if you are responsible for city buildings, you might list specific buildings or types of buildings in the following exercises.

Focal resources or populations	Climate change trends or impacts that they likely will be exposed to (you can list many)
Example – A. Dam maintenance and flood control for downstream residents	More frequent and greater severity of large storms. More rain-on-snow events in spring, leading to potentially large runoff events.
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Component 2. Sensitivity

Continuing using the same numbering from the previous section, please provide information about how each of the focal resources listed might be impacted by climate change related trends. Also

consider how ongoing stressors or issues will be exacerbated by climate change (if erosion from overgrazing is already a problem, for example, will larger storms exacerbate its impacts?).

Focal resources or populations	How might the resources or populations be impacted by climate change related trends or other stressors?
Example – A. Dam maintenance and flood control for downstream residents	Local dam received poor marks on its last inspection, indicating a need for remediation. Downstream residences are highly vulnerable. Larger storms could cause a breach. Rain-on-snow events could result in early release of flood water, causing shortages later.
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Component 3. Adaptive Capacity

Continuing using the same numbering, please provide information about how flexible each of the focal resources listed are in their **response** to climate change. Also consider how different sectors of each population might respond differently. For example, farmers might plant different crops in response to

changes in temperature, but fruit growers with longer-lived trees would have less adaptive capacity for crop changes.

NOTE: Sometimes it's not clear whether a specific detail fits in the adaptive capacity or sensitivity category. Don't spend too much time on where to put it – just make sure its included in one of the boxes.

Focal resources or populations	How might the resources or populations adapt to climate change related trends or other exacerbated stressors?
Example – A. Dam maintenance and flood control for downstream residents	Dam remediation is already scheduled (but not for 5 years) and could be done to higher standards to withstand larger storms. If spring storage is compromised by rain-on-snow events, there is no secondary storage available so shortages are highly likely.
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Cross Sector Impacts

Many of the impacts of climate change are going to be indirect. One sector or population or region will respond in ways that affect other sectors, populations, and/or regions. This is one reason why a coordinated response is so important. Please write down any cross-sector responses or indirect effects of climate

change that you think affect the vulnerability of your focal resources or populations. An example might be the potential for climate refugees (people from other areas escaping drought and coastal flooding) to move to the area and increase population growth rates, thereby stressing city planning and resources.

Focal resources or populations	What are some potential factors coming from other sectors that might affect this resource or population?
Example – A. Dam maintenance and flood control for downstream residents	Larger storms could exacerbate upstream land use issues and sedimentation, making the local dam lose storage more quickly and increasing the cost to dredge. Zoning for city growth could lead to an increase in the number of people at risk if the dam were to be breached.
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Vulnerability Assessment Ranking

We will be collaboratively developing local strategies and solutions to address many of the issues that you have described here in this workbook. Yet some issues are more pressing or have potentially more severe outcomes than others. In this step, we would like you to help us rank the list of vulnerabilities.

To do this, you will need to go back through the 3 lists – Exposure, Sensitivity, and Adaptive Capacity and **rank each one on a scale of Low, Medium, or High** (write the letter L, M, or H in the margin next to each row).

For example, the exposure of outdoor workers to climate change impacts is high, but their sensitivity to the predicted change in temperature might be high, medium or low, depending on the time

frame (mid- or late-century) or predicted maximum temperatures. The adaptive capacity of outdoor workers might be low if there is a limited harvest window and no flexibility during extreme heat.

This step is different than the later prioritization step, which will help us identify which issues or resources should be addressed first. One component of that prioritization will be the vulnerability ranking outcome, but other factors, such as the potential cost of the impacts, social justice issues, political considerations, the cost of the solutions, and whether a solution has positive effects on other parts of the community (co-benefits) will all be considered in the prioritization step.

Thank You! And Next Steps

We appreciate the time you took to fill in this pre-assessment. The information will be compiled and used as a starting point for the first workshop. We will use this information to feed into the Vulnerability Assessment workshop, which will be held November 14th 2013. By coming to that workshop with many of the vulnerabilities already identified, we hope to move quickly through that step and on to developing solutions and strategies that create a more resilient community.

Appendix A. List of potential resources to consider

Below is a list of many resources or populations that are commonly at risk from climate change impacts, including floods, drought, water shortage, wildfire increase, severe heat, severe storms, and others. **This list is not comprehensive** – each community has a unique local mix of vulnerabilities. If you are responsible for any of these resources and have not addressed them in this document, please provide more information. Thank you!

Critical infrastructure:

- Wastewater treatment system
- Power grid
- Water purification system
- Transportation/evacuation routes

Critical Facilities:

- City Hall or other govt. buildings
- Police station or other enforcement buildings
- Fire station(s)
- Communications main office or substations
- Emergency operation center
- Evacuation shelter(s)
- Hospital(s)
- Critical record storage

Transportation:

- Bridges
- Culverts
- Roads prone to flooding
- Roads prone to buckling from heat

Commerce and economics:

- Transportation system for distribution
- Energy supply for manufacturing and other business
- Water supply for agriculture and business

Health and Safety:

- Elderly, infants, pregnant women, and people with compromised health (heat)
- People with asthma, allergies, and heart disease (smoke and ozone)
- Outdoor workers
- People in rural areas
- People living in floodplains
- People living in the Wildland Urban Interface (WUI)

Natural areas and parks:

- Fish, wildlife, and plants
- Trails
- Park facilities and infrastructure
- Public use during extreme weather (heat waves, smoke, fires, etc)
- Ice skating and ice fishing safety