Vulnerability Assessment Results

Natural Lands Climate Adaptation Project
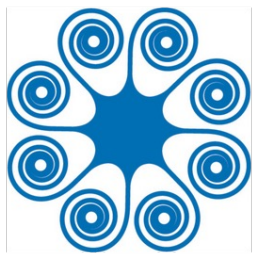
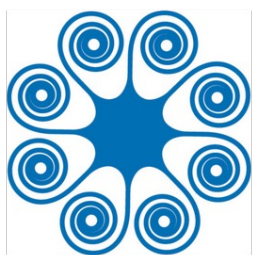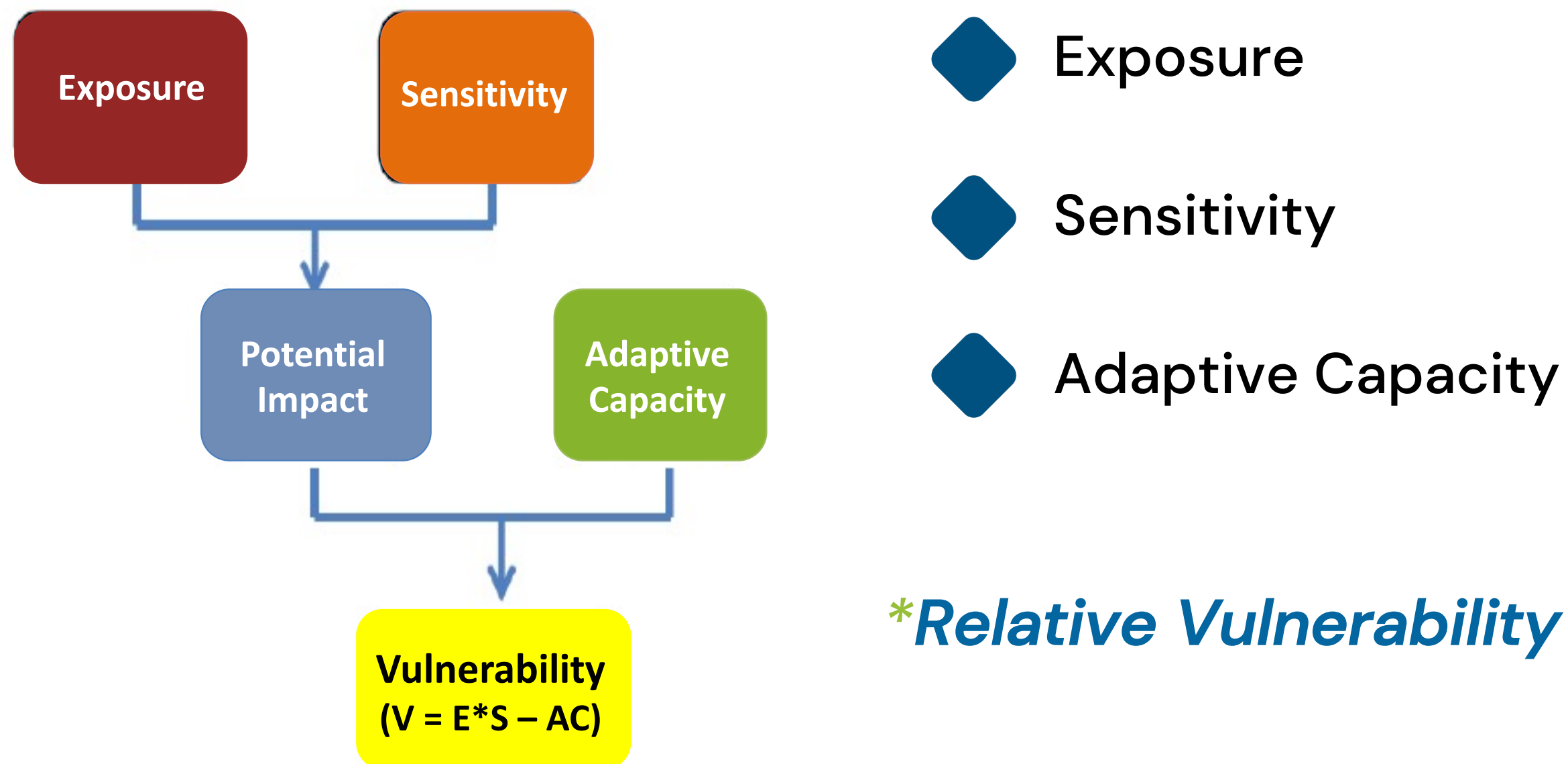Images courtesy of : Natural Lands

Defining Vulnerability

Climate change vulnerability

refers to the degree to which a resource is susceptible to and/or unable to cope with the adverse impacts of climate change

Image courtesy of : Sean Quinn

Vulnerability Assessment

Purpose of a vulnerability assessment:

Identify *which* resources are most vulnerable and *why*

Exposure

Sensitivity

Adaptive Capacity

Relative Vulnerability

Exposure

Sensitivity

Potential Impact

Adaptive Capacity

Vulnerability
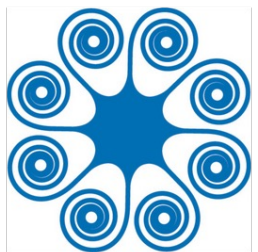(V = E*S − AC)

Figure adapted from Glick et al. 2011

Assessing Exposure

Exposure is a measure of how much change in climate that resource is likely to experience

Factors affecting exposure

◆ Direction and magnitude of change in climate stressors and disturbance regimes
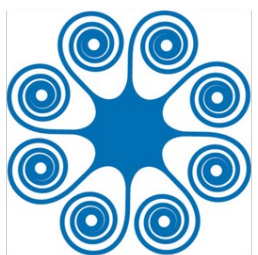
◆ Degree of uncertainty associated with projected changes

Image courtesy of : Natural Lands

Assessing Sensitivity

Sensitivity is a measure of whether and how a resource is likely to be affected by a given change in climate factors

Factors affecting sensitivity

◆ Climate stressors

◆ Disturbance regimes

◆ Non-climate stressors

Assessing Adaptive Capacity

Adaptive Capacity is a measure of a resource's ability to accommodate or cope with climate change impacts with minimal disruption

Factors affecting adaptive capacity

◆ Extent and integrity

◆ Connectivity

◆ Resistance and recovery

❖ *Plasticity*

◆ Diversity

◆ Public, societal, and cultural value

◆ Management potential

Image courtesy of : Natural Lands
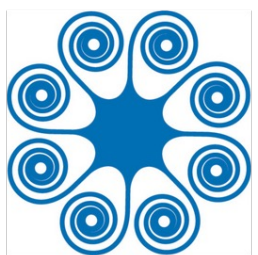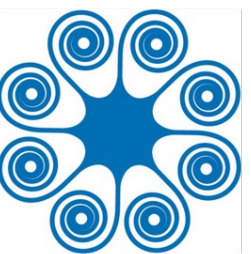
Why Assess Vulnerability?

Vulnerability assessments can...

Prioritize the focus of management actions

Develop strategies to address climate change

Efficiently allocate resources

Image courtesy of : Natural Lands

Why Assess Vulnerability?

Vulnerability assessments cannot...

Make a management decision for you
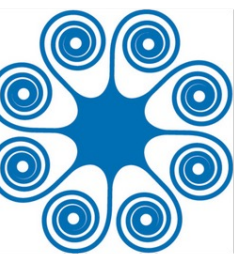
Vulnerability Results: *Early- successional forests*

Exposure

Moderate Exposure

Moderate Confidence

- ⬆ Air temperature
- ⬆ Heat waves
- ⬆ Precipitation amount/timing
- ⬆ Drought
- ⬆ Soil moisture
- ⬆ Extreme storms and flooding
- ⬆ Wildfire

Sensitivity

Moderate Sensitivity

High Confidence

Adaptive Capacity

High Adaptive Capacity

High Confidence

Vulnerability Results: *Early- successional forests*

Low **High**

Exposure

Moderate Exposure

Moderate Confidence

↑ • Air temperature

↑ • Heat waves

↑ • Precipitation amount/timing

↑ • Drought

↑ • Soil moisture

↑ • Extreme storms and flooding

↑ • Wildfire

Sensitivity
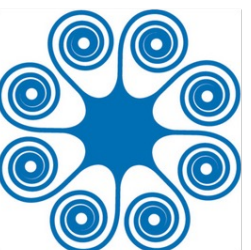
Moderate Sensitivity

High Confidence

- Reduced reliability of spring growth cues
- Disruption in seed establishment
- Shifts in species composition
- Altered forest structure
- *Non-climate stressors:* invasive and problematic species, fire exclusion/suppression

Adaptive Capacity

High Adaptive Capacity

High Confidence

Vulnerability Results: *Early- successional forests*

Low ——————— **High**

Exposure

Moderate Exposure

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- Air temperature
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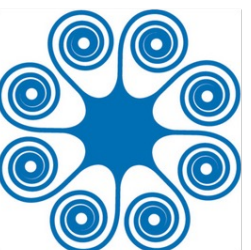
Adaptive Capacity
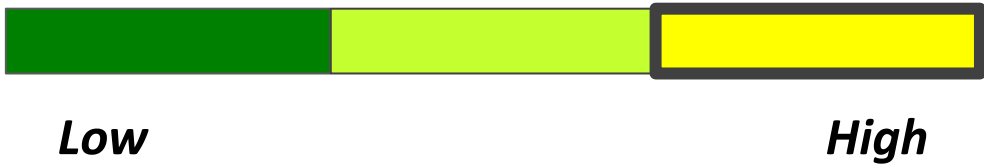
High Adaptive Capacity

High Confidence

- ▲ Relatively diverse species composition and habitat structure
- ▲ Public agencies support the management of this habitat
- ▲ May benefit from disturbances

- ▼ Current limited extent and continuity within the preserve

Vulnerability Results: *Water Resources*

Exposure

Moderate Exposure

Moderate Confidence

- ⬆ Freshwater temperature
- ⬆ Air temperature
- ⬆ Precipitation amount/timing
- ⬆⬇ Altered streamflow
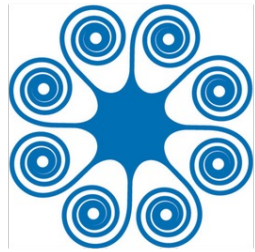- ⬆ Extreme flooding and storm events

Sensitivity

High Sensitivity
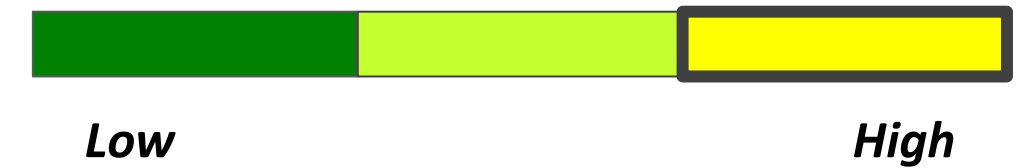
High Confidence

Adaptive Capacity

Moderate Adaptive Capacity

High Confidence

Vulnerability Results: *Water Resources*

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Moderate Exposure
Moderate Confidence

- ⬆ Freshwater temperature
- ⬆ Air temperature
- ⬆ Precipitation amount/timing
- ⬆⬇ Altered streamflow
- ⬆ Extreme flooding and storm events

Sensitivity

High Sensitivity
High Confidence

- Aquatic species growth, reproduction, survival, and distribution
- Changes to species composition and survival
- Transport of excess nutrients, sediments, or pollutants
- Reduced growth and establishment of new seedlings
- *Non-climate stressors:* dams and roads, nearby development and agricultural areas, invasive or problematic species

Adaptive Capacity

Moderate Adaptive Capacity
High Confidence

Vulnerability Results: *Water Resources*

Low   High

Exposure

Moderate Exposure
Moderate Confidence

- ⬆ Freshwater temperature
- ⬆ Air temperature
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- ⬆⬇ Altered streamflow
- ⬆ Extreme flooding and storm events

Sensitivity

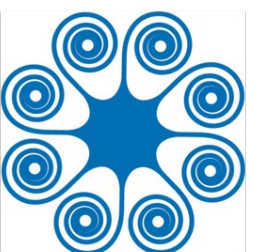### High Sensitivity
High Confidence

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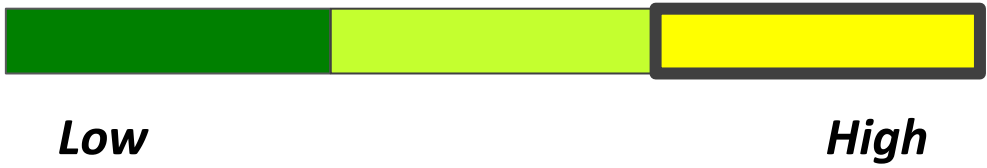
Adaptive Capacity

Moderate Adaptive Capacity
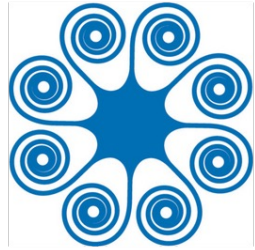*High Confidence*

- ▲ Good water quality contributing to the health of downstream ecosystems
- ▲ Low deer grazing impacts and invasive species
- ▲ Increased likelihood of management support due to the value of water resources and strong public support
- ▼ Discontinuous waterways within the preserve
- ▼ Little control over influx of contaminants from areas outside of the preserve
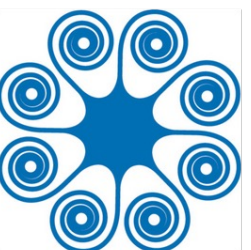
Relative Vulnerability

Low   High

Habitat	Vulnerability Score	Confidence Score
ChesLen Preserve		
Unionville Barrens	Moderate	Moderate
Afforestation Areas	Moderate	Moderate
Water Resources	Moderate	Moderate
Agriculture	Moderate	High
Meadows	Moderate	High
Bear Creek		
Spruce Swamp	Moderate	Moderate
Early-Successional Forests	Moderate	High
Mature Forests	Moderate	High
Cranberry Bog	Moderate	High
Water Resources	High	High

Relative Vulnerability

Low ——————————————— High

Adaptive Capacity (vertical axis, High to Low)

Sensitivity & Exposure (horizontal axis, Low to High)

- Low Vulnerability
- High Vulnerability

- Early-Successional Forests
- Water Resources – ChesLen
- Cranberry Bog
- Unionville Barrens
- Afforestation Areas
- Spruce Swamp
- Mature Forest
- Meadows
- Agriculture
- Water Resources – Bear Creek
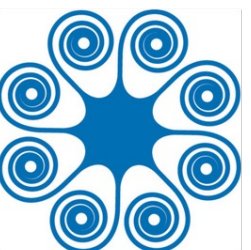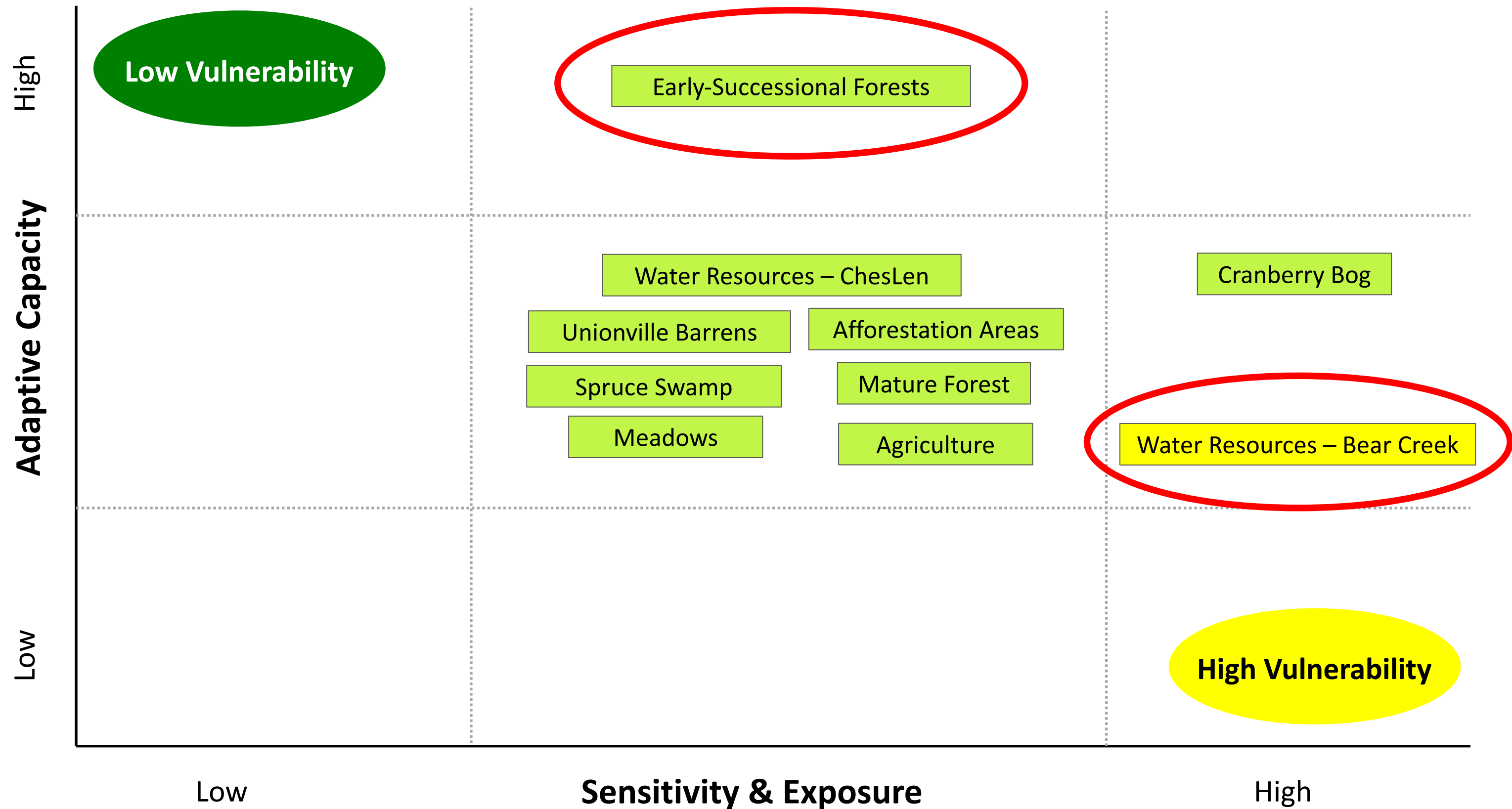
Vulnerability Assessment Trends

Climate Stressors

- Precipitation
- Soil moisture
- Air temperature
- Freshwater temperature

Disturbance Regimes

- Insects and disease
- Extreme storms and flooding
- Wildfire

Non–Climate Stressors

- Invasive and problematic species
- Roads, highways, and trails
- Pollution and poisons

Adaptive Capacity Factors

▲ Large amount of public value and societal support

▲ Ability and capacity of managers to manage/cope with climate impacts

▲ Critical habitat for many species

Adaptive Capacity Factors

▼ The inability of some species to tolerate insect pests and diseases and/or invasive and problematic species

▼ Natural and manmade barriers to dispersal

▼ Inability to control the influx and dispersal of pollutants entering from outside of the preserve
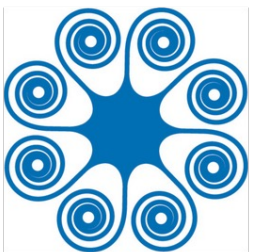
Vulnerability Assessment Products

Expert Assessment

Downscaled Climate Projections

Review of scientific literature

Spruce Swamp, Bear Creek Preserve
Climate Change Vulnerability Assessment for the Natural Lands Climate Adaptation Project

Unionville Barrens, ChesLen Preserve
Climate Change Vulnerability Assessment for the Natural Lands Climate Adaptation Project

Meadows Habitat, ChesLen Preserve
Brief Climate Change Vulnerability Assessment for the Natural Lands Climate Adaptation Project

Mature Forest, Bear Creek Preserve
Climate Change Vulnerability Assessment for the Natural Lands Climate Adaptation Project

Water Resources, Bear Creek Preserve
Brief Climate Change Vulnerability Assessment for the Natural Lands Climate Adaptation Project

Afforestation Areas, ChesLen Preserve
Climate Change Vulnerability Assessment for the Natural Lands Climate Adaptation Project

Water Resources, ChesLen Preserve
Climate Change Vulnerability Assessment for the Natural Lands Climate Adaptation Project

Early-Successional Forests, Bear Creek Preserve
Climate Change Vulnerability Assessment for the Natural Lands Climate Adaptation Project

Agriculture Habitat, ChesLen Preserve
Brief Climate Change Vulnerability Assessment for the Natural Lands Climate Adaptation Project

Cranberry Bog Habitat, Bear Creek Preserve
Brief Climate Change Vulnerability Assessment for the Natural Lands Climate Adaptation Project

Products:

- **Full vulnerability assessments for 6 focal habitats**

- **Vulnerability briefs for 4 focal habitats**

Images courtesy of : Natural Lands

Vulnerability Assessment Products

https://ecoadapt.org/workshops/natural-lands-workshop
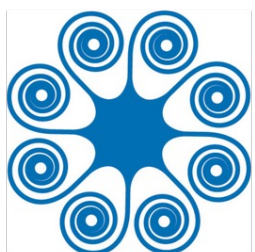
Natural Lands Climate Adaptation Workshop

Overview

The goal of this two-part virtual workshop is to develop concrete, actionable adaptation strategies and actions that can be implemented within ChesLen and Bear Creek Preserves, while also building the capacity of Natural Lands staff to understand and incorporate information about expected climate change impacts and ecosystem vulnerability into climate-informed planning and management.
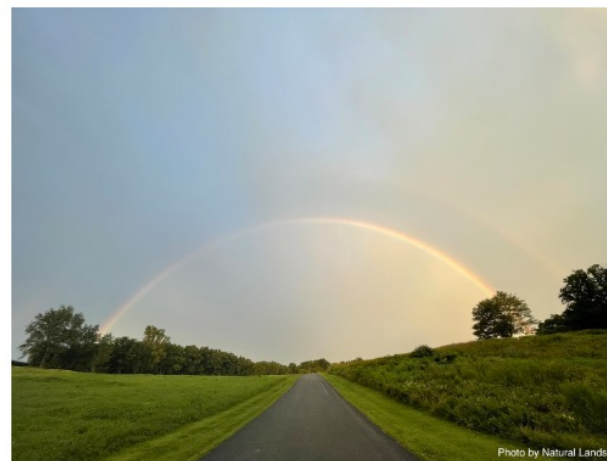
Agenda & Speakers

Workshop agenda

Presentations

Will be posted here upon the conclusion of each workshop day

Reading & Resources

Summary of climate trends/projections and vulnerability assessments *(near the bottom of the page)*

Products

Overview of Climate Trends and Projections for Natural Lands Preserves

Vulnerability Assessments

ChesLen Preserve

- Afforestation areas
- Unionville barrens
- Water resources
- Agriculture *(brief summary)*
- Meadows *(brief summary)*

Bear Creek Preserve

- Early-successional forests
- Mature forests
- Spruce swamp
- Cranberry bog *(brief summary)*
- Water resources *(brief summary)*
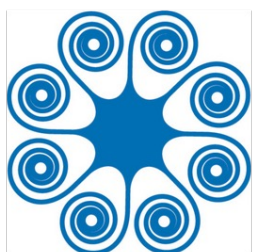
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Images courtesy of : Natural Lands