Climate Change Vulnerability of Washington Rare Plants: A Preliminary Assessment

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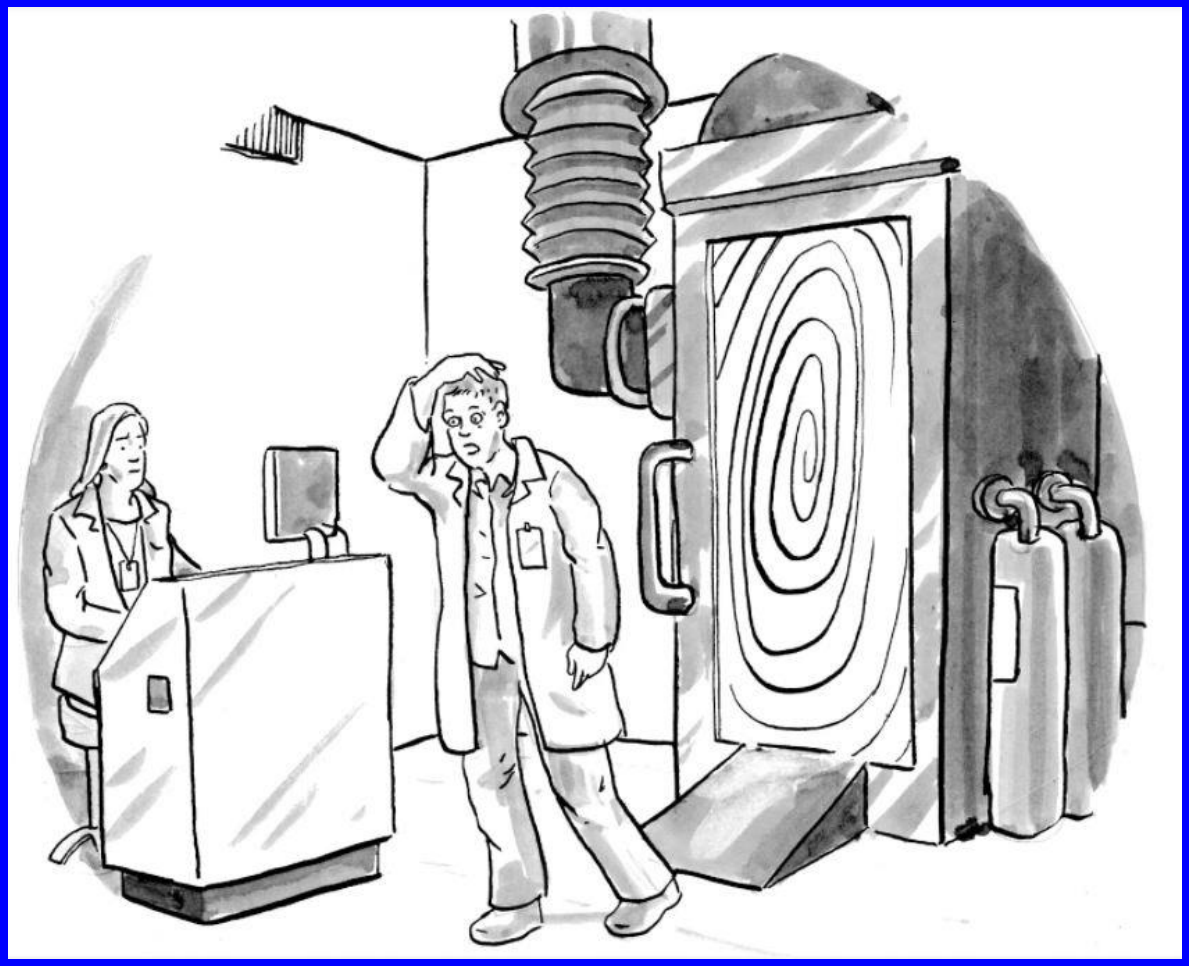
Sticky sky-pilot (*Polemonium viscosum*)

Talking About Climate Change



Brendan Loper,
The New Yorker,
January 27, 2022

"I went back to warn them, but they already knew and didn't seem to care."

Climate Change in Pacific Northwest

Over next 80-100 years:

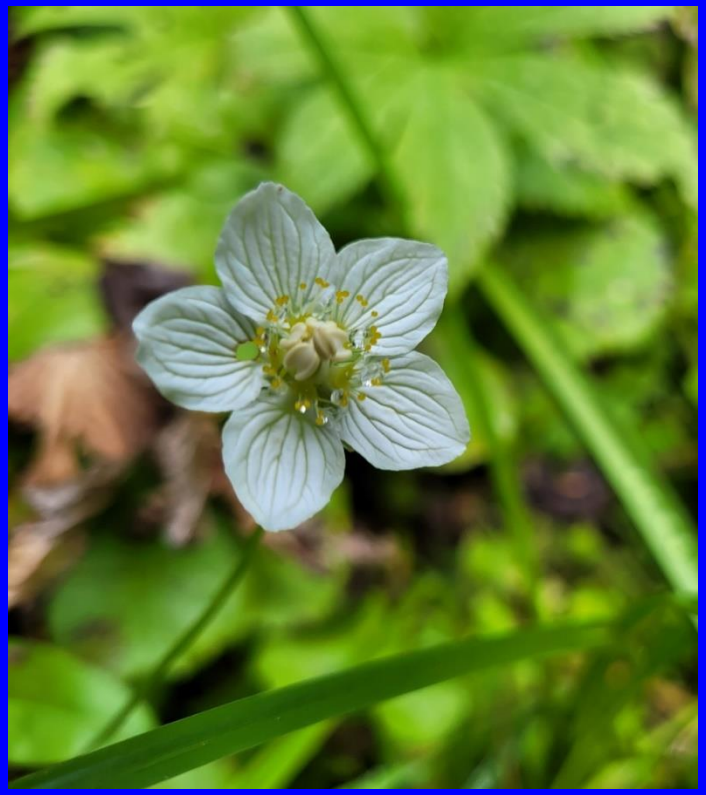
- **Higher temperatures**
- **Changes in snowpack**
- **Lower precipitation**
- **Lower stream flows**
- **Shift from snow to rain**
- **Higher fire frequency**
- **High stochasticity**

Alaska yellow-cedar (*Callitropsis nootkatensis*)

Abatzoglou et al. 2014, Halofsky et al. 2018, Mote 2006, Peterson & Halofsky 2019

How will Plant Species Respond?

- Changes in timing of flowering & emergence
- Asynchrony with pollinators
- Ranges shift/contract
- Loss of habitat
- More competition
- Responses often species-specific based on life history



Marsh grass-of-Parnassus (*Parnassia palustris*)

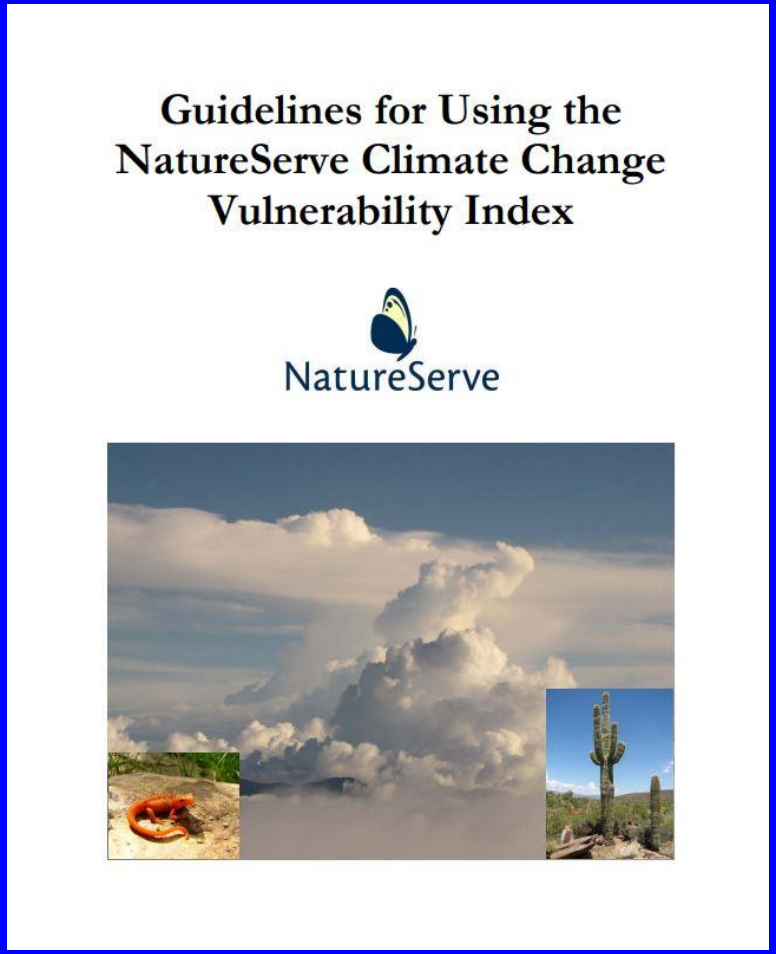
How will Rare Plant Species Respond?

- Relatively few studies of rare plant spp in NW
- Case et al. 2015: 195 NW species (27 plants)
- Alpine/subalpine & grassland plants vulnerable
- **Rare species are more vulnerable** than common species

Spalding's catchfly (*Silene spaldingii*)

Climate Change Vulnerability Index (CCVI)

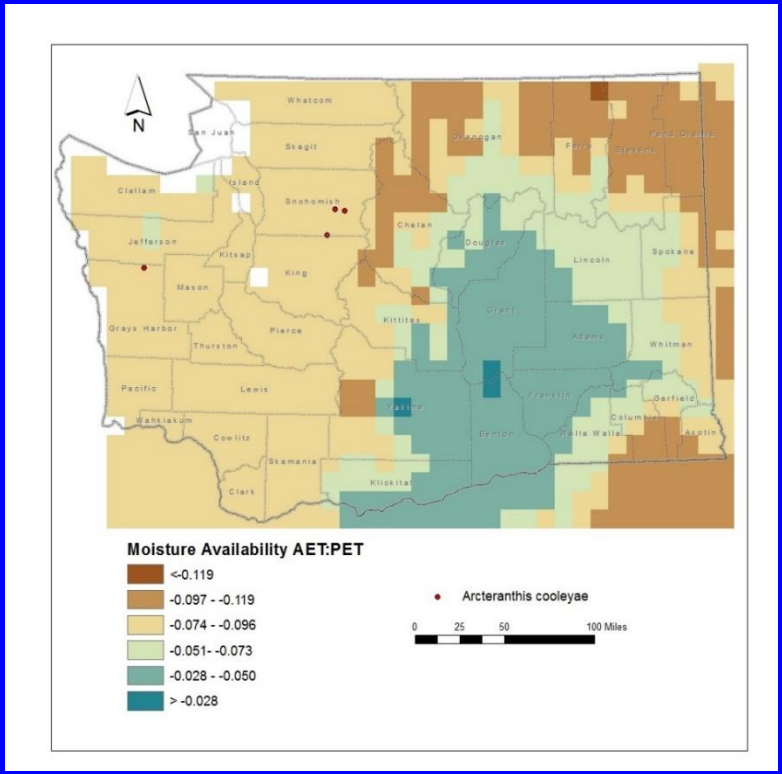
- **Funding from USFWS, BLM, & USFS (ISSSSP)**
- **CCVI protocol developed by NatureServe to assess vulnerability of plant & animal species and plant communities to climate change**



Young et al. 2016

Climate Change Vulnerability Index (CCVI)

- 29 environmental & biological variables
- Includes historical and projected temperature & precipitation change
- Habitat: snowpack, uncommon geology/landform, barriers



Quantitative values derived from location data
Qualtitative scores from literature review (GI, I, SI, N, Unknown)

Climate Change Vulnerability Index (CCVI)

Life history traits:

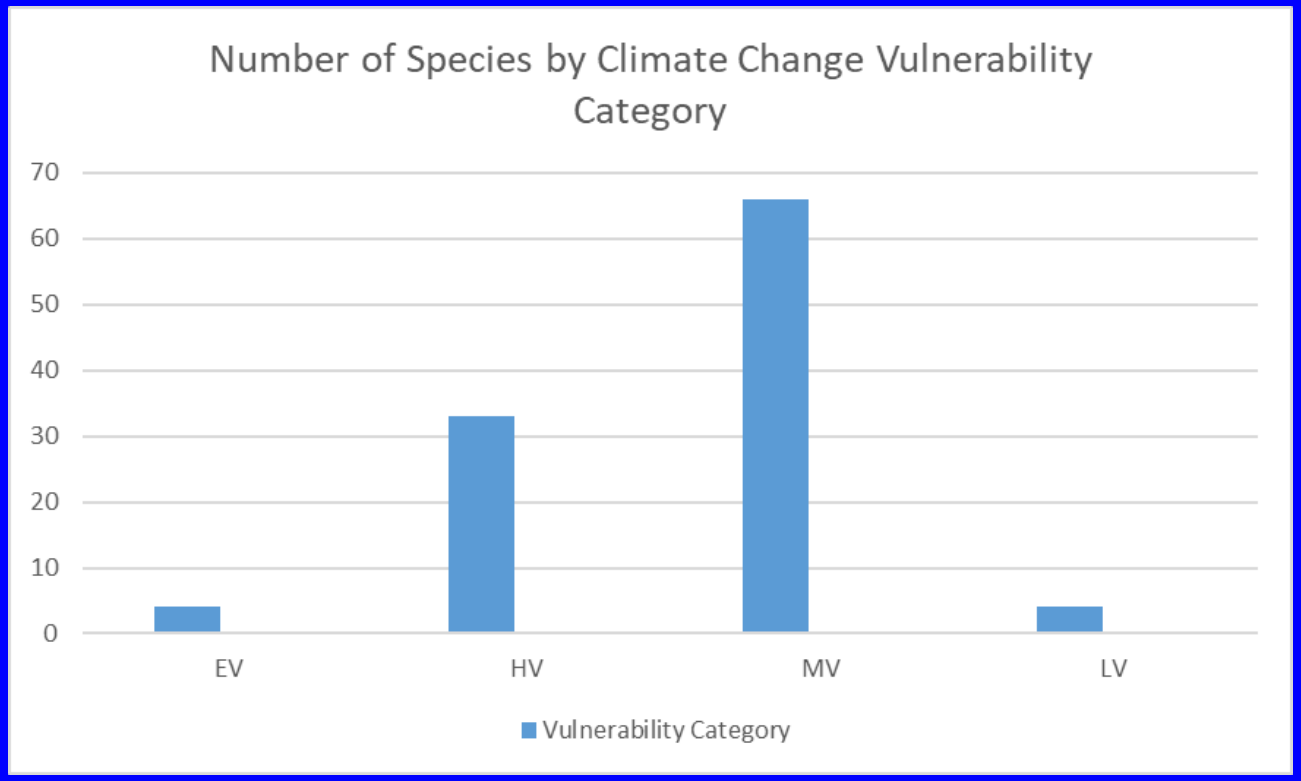
- **Dispersal ability**
- **Pollinators**
- **Genetic variability & breeding system**
- **Competition**

Response to climate change

- **Observed & Modeled**

Cotton's milkvetch (*Astragalus australis* var. *cottonii*)

Climate Change Vulnerability Index (CCVI): Results



Completed CCVIs for 107/371 WA rare plants (28%)

- **Four Summary Scores: Extremely Vulnerable, Highly Vulnerable, Moderately Vulnerable, Less Vulnerable**

Climate Change Vulnerability Index (CCVI): Results

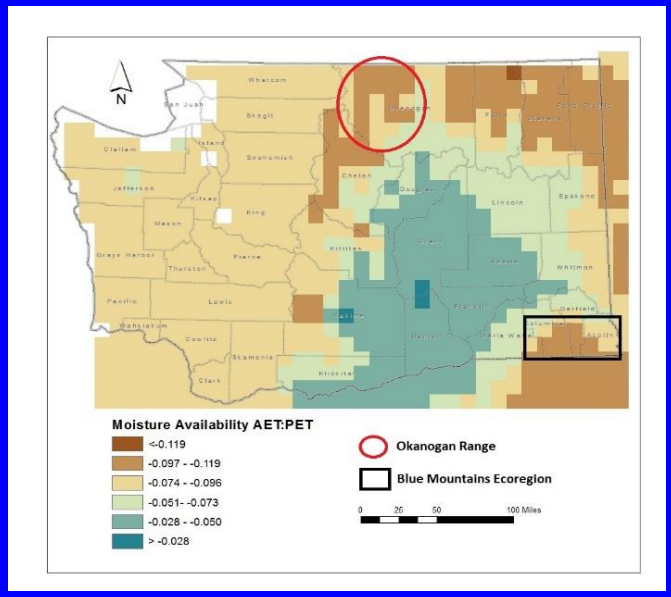
Extremely & Highly Vulnerable species:

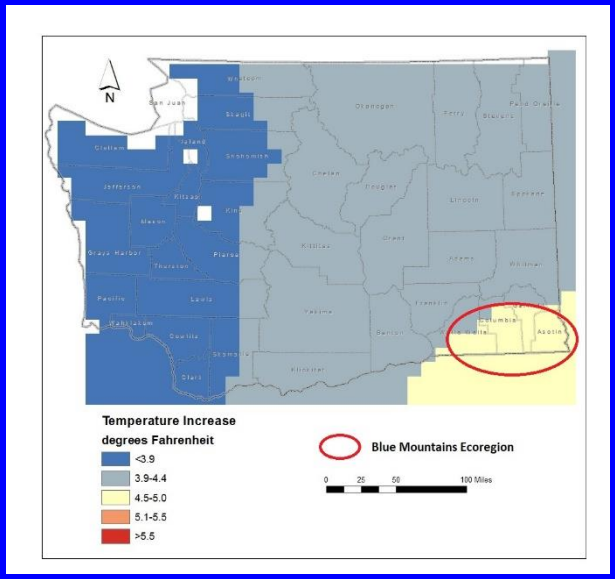
1. **Wetter habitats likely to become less predictable**
2. **Dependent on winter snow/ice**
3. **Stable temperatures and cool microhabitats that are likely to change**
4. **Uncommon geologic features, poor dispersal, few pollinators, low genetic variability**
5. **Alpine, peatland, or groundwater-dependent wetland species**

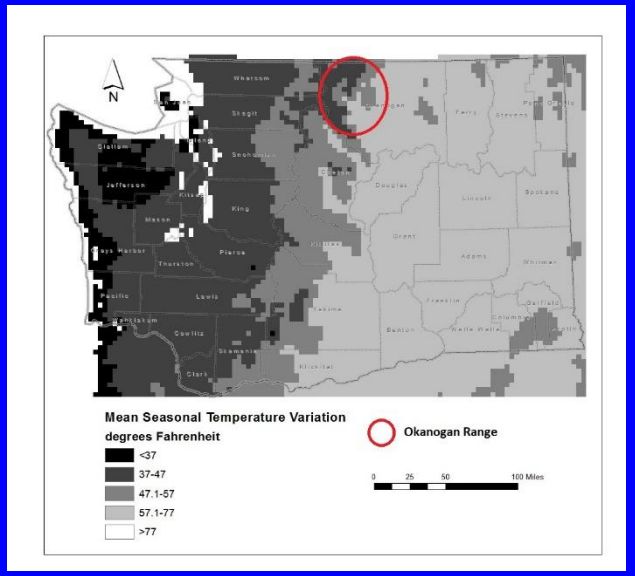
Climate Change Vulnerability Index (CCVI): Results

Surprise: Extremely & Highly Vulnerable species associated with Okanogan & Blue Mountains

Lance-leaved draba (*Draba cana*) by B. Legler







Climate Change Vulnerability Index (CCVI): Results

Less Vulnerable species

- **Often found in successional habitats (native "weeds")**
- **May actually benefit from anthropogenic changes**

Coyote tobacco (*Nicotiana attenuata*)

Climate Change Vulnerability Index (CCVI): Results

Moderately Vulnerable Spp

- **More likely to be from sites with more stable temperatures (often already warm, like Columbia Basin)**
- **Less associated with snow, uncommon geology**
- **Less limited by dispersal, pollinators, genetic variability**

Snake River cryptanth (*Cryptantha spiculifera*)

Climate Change Vulnerability Index (CCVI): Results

Endemic & disjunct species tend to rank Extremely or Highly Vulnerable

- **Often restricted to unusual geology, have specialized pollinators, low genetic diversity**
- **Some score Moderately Vulnerable when data are lacking on modeled change**

Umtanum desert buckwheat (*Eriogonum codium*)

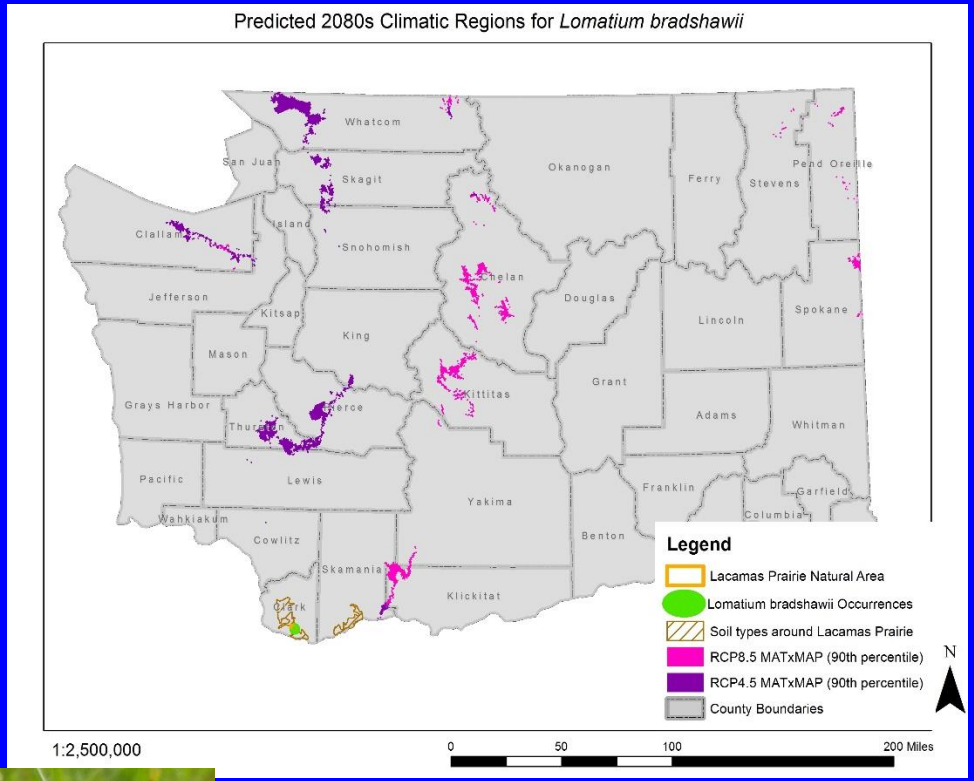
Climate Change Vulnerability Index (CCVI): Future Directions

- Complete CCVIs for all 371 state listed vascular plant species
- Conduct CCVIs for a cross section of more widespread & common native plant species

Intermediate sedge (*Carex media*)

Climate Change Vulnerability Index (CCVI): Future Directions

- Need **better data on genetic diversity** of rare plant species
- **Model response to climate change** for rare species & ecological systems



Bradshaw's lomatium (*Lomatium bradshawii*)

Climate Change Vulnerability Index (CCVI) Results

- CCVI reports are a summary of current information
- Include brief rationale for each score & references
- Transparent
- Acknowledge data gaps
- Meant to be revised with new data

Climate Change Vulnerability Index Report

Hackelia taylorii (Taylor's stickseed)

Date: 11 February 2020

Assessor: Walter Fertig, WA Natural Heritage Program

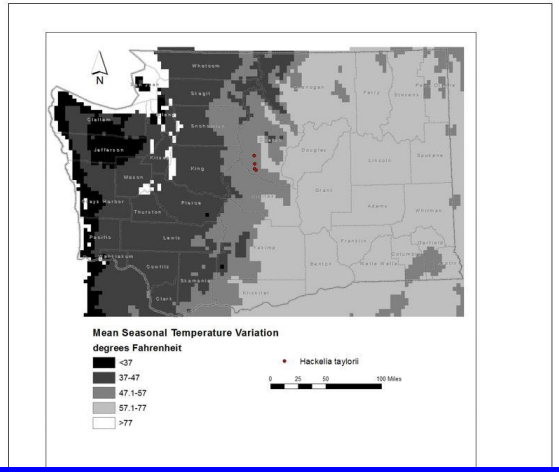
Geographic Area: Washington — Heritage Rank: G2/S2

Index Result: Highly Vulnerable — Confidence: Very High

Climate Change Vulnerability Index Scores

Section A	Severity	Scope (% of range)
1. Temperature Severity	>6.0° F (3.3°C) warmer	0
	5.6-6.0° F (3.2-3.3°C) warmer	0
	5.0-5.5° F (2.8-3.1°C) warmer	0
	4.5-5.0° F (2.5-2.7°C) warmer	0
	3.9-4.4° F (2.2-2.4°C) warmer	100
	<3.9° F (2.2°C) warmer	0
2. Hamon AET:PET moisture	< -0.119	0
	-0.097 to -0.119	50
	-0.074 to - 0.096	50
	-0.051 to - 0.073	0
	-0.028 to -0.050	0
	>-0.028	0
Section B		**Effect on Vulnerability**
1. Sea level rise		Neutral
2a. Distribution relative to natural barriers		Somewhat Increase
2b. Distribution relative to anthropogenic barriers		Neutral
3. Impacts from climate change mitigation		Neutral
Section C		
1. Dispersal and movements		Somewhat Increase
2ai Change in historical thermal niche		Somewhat Increase
2aii. Change in physiological thermal niche		Increase
2bi. Changes in historical hydrological niche		Neutral
2bii. Changes in physiological hydrological niche		Neutral
2c. Dependence on specific disturbance regime		Somewhat Increase
2d. Dependence on ice or snow-covered		
3. Restricted to uncommon landscape/g		

C2ai. Historical thermal niche: Somewhat Increase.
Figure 3 depicts the distribution of *Hackelia taylorii* in Washington relative to mean seasonal temperature variation for the period from 1951-2006 ("historical thermal niche"). All of the known occurrences (100%) are found in areas that have experienced slightly lower than average (47.1-57°F/26.3-31.8°C) temperature variation during the past 50 years and are considered at Somewhat Increased vulnerability to climate change.



Hackelia taylorii
by Matt Below

Climate Change Vulnerability Index (CCVI) Results

- 107 CCVI reports and summary report posed on WNHP website: https://www.dnr.wa.gov/NHPclimatespecies
- Or google "Washington Natural Heritage Program Assessing Species Vulnerability"