Coping With Climate:

How our changing environment is affecting native plants and habitat restoration in the Pacific Northwest and beyond

Institute for Applied Ecology

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Executive Director

Mission

Conserve native species and habitats through restoration, research, and education

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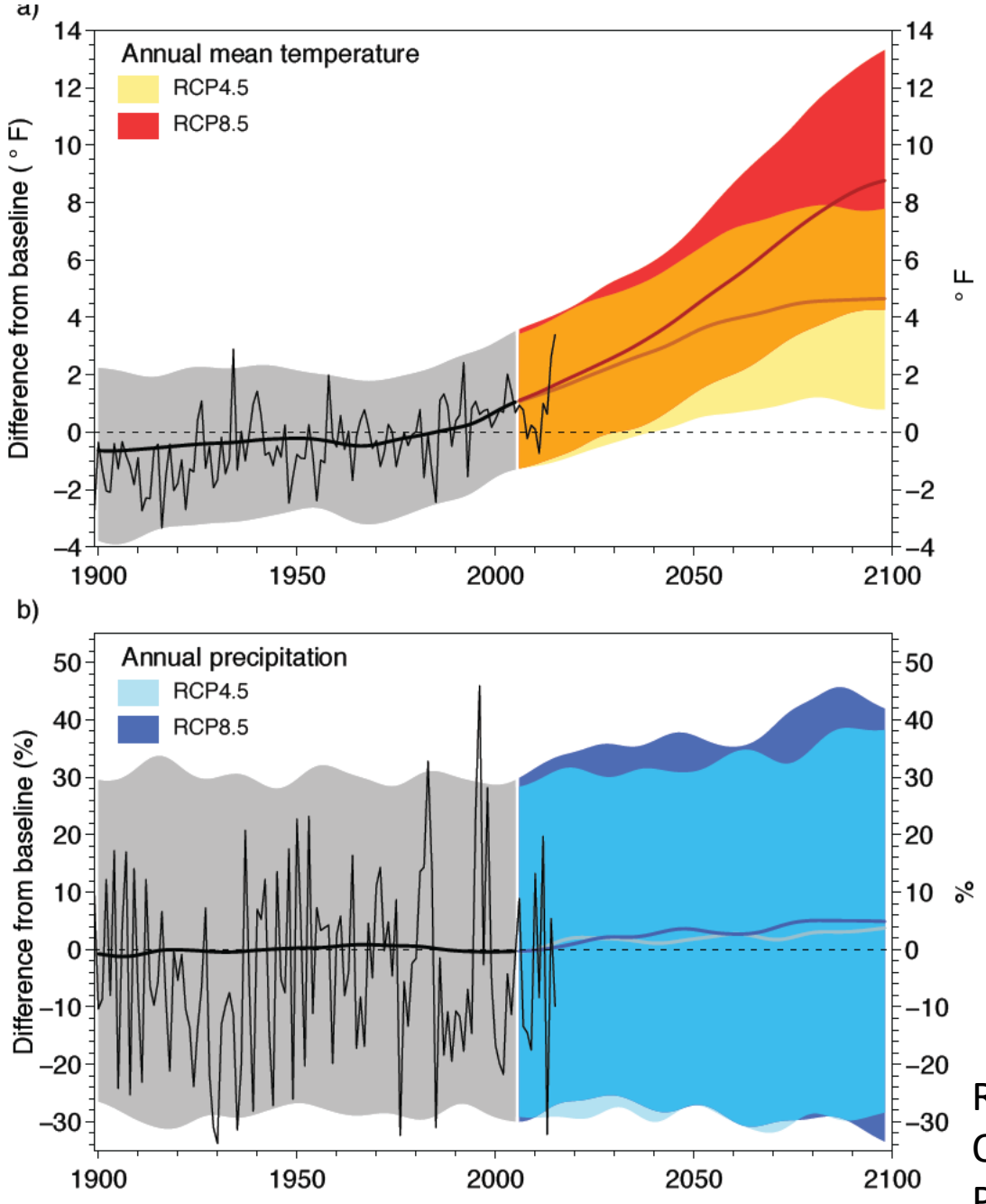
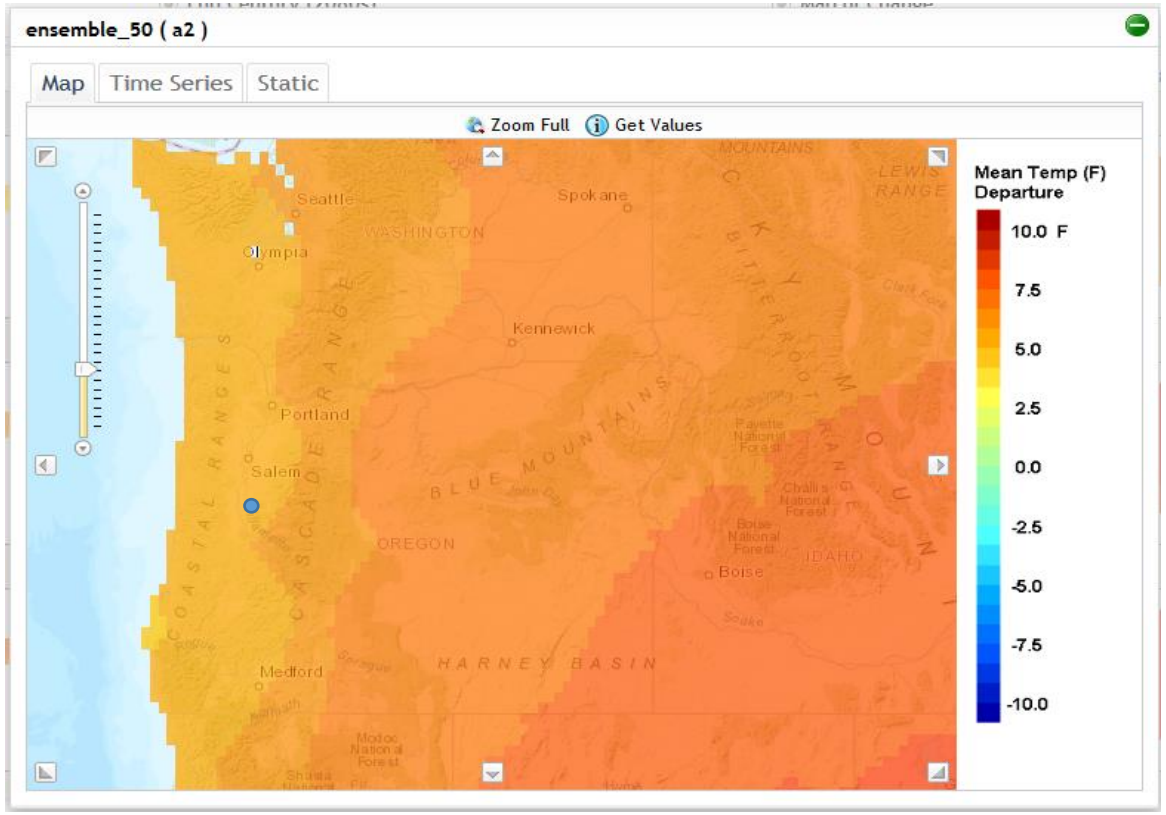
Welcome to the Anthropocene





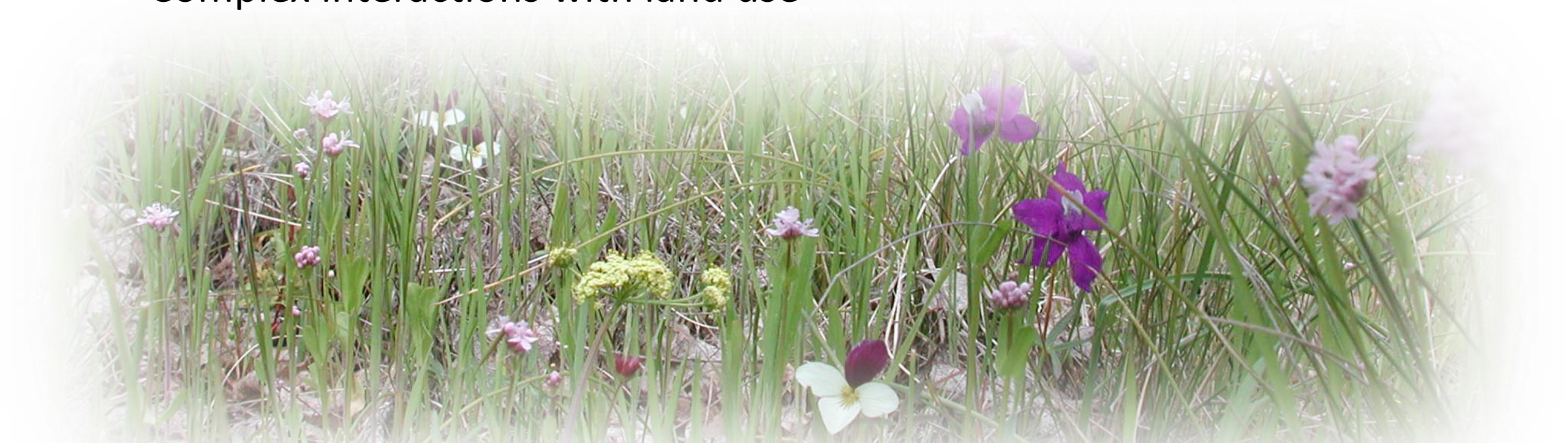
Climatewizard.org, average annual temperature change by 2080s

Rupp et al., 2016. Adapted for Oregon, Integrated Scenarios Project, Kathie Dello

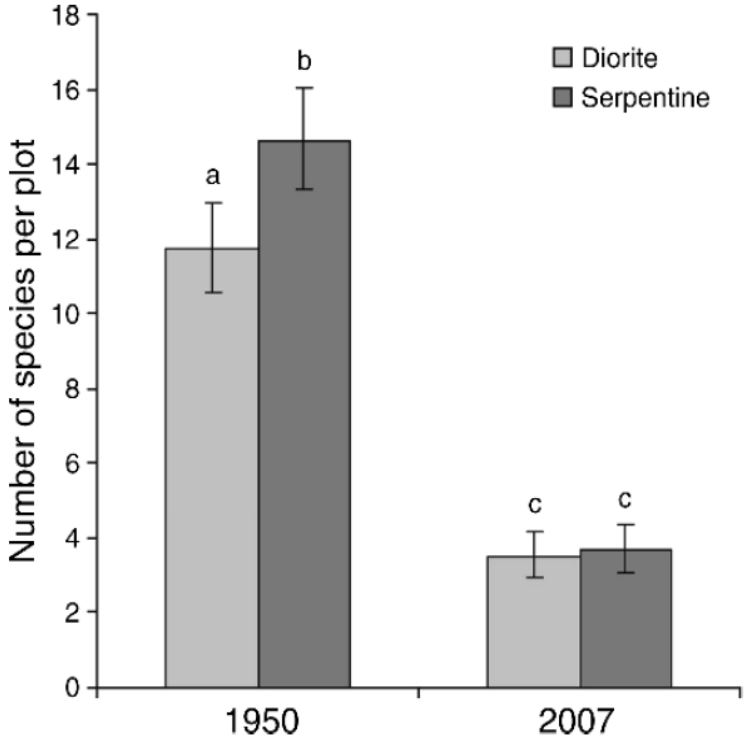

Solastalgia

Some effects of climate change on plants

- Loss of diversity
- Changes in phenology
- Range shifts
- Species extinctions
- Complex interactions with land use



Diversity is in decline because of climate change

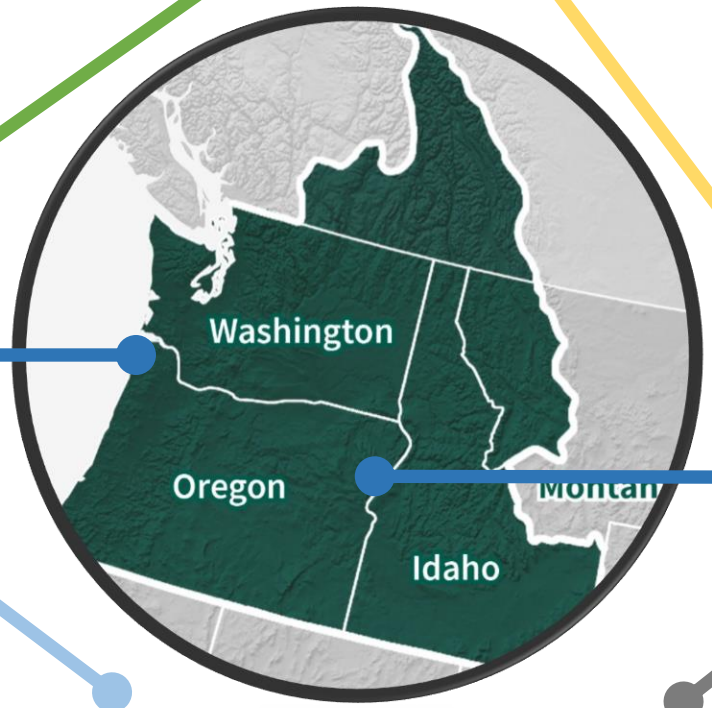


Damschen, Harrison, and Grace, 2010. *Ecology*.

Strong declines in northern and endemic species, shift to southern-type and south-facing communities

Shifting phenology in the PNW

season



Early bloomers shifting earlier
Low elevation, maritime shifting earlier

Late bloomers shifting less
High elevation, arid shifting less

elevation

4.4 days shift per 1˚C

Kopp et al., 2020. *International Journal of Biometeorology*

1901 to 2015

Ranges may need to shift with climate change


Festuca roemeri


Microseris laciniata

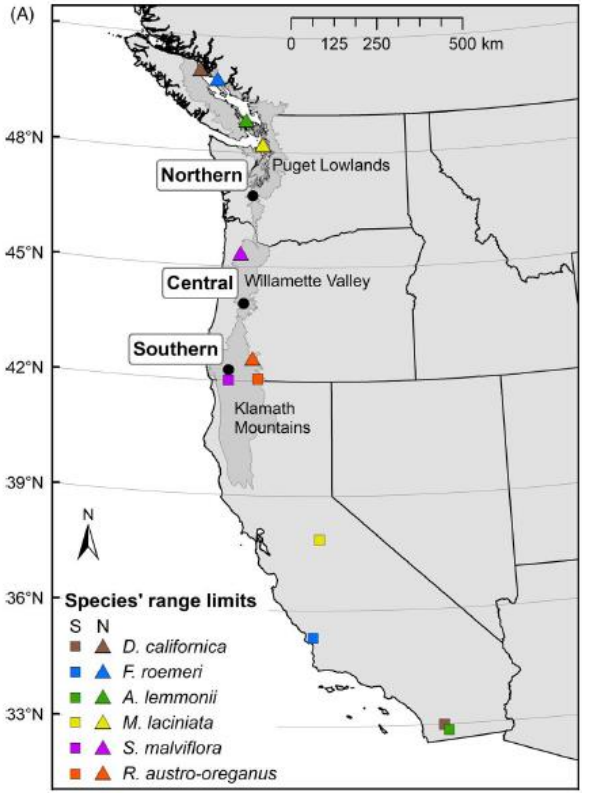

Danthonia californica

Declined with heating and drought.


Ranunculus austro-oreganus (CalPhotos)


Sidalcea malviflora virgata

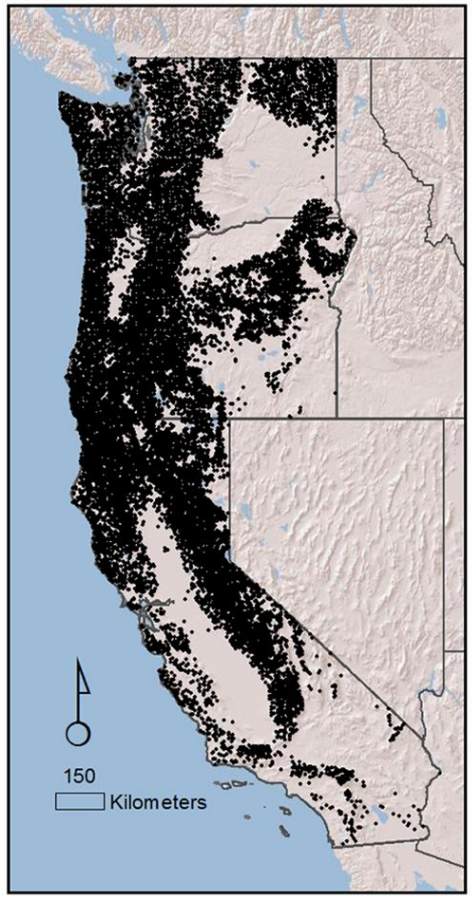
Improved with heating and drought <u>beyond northern range limit</u>

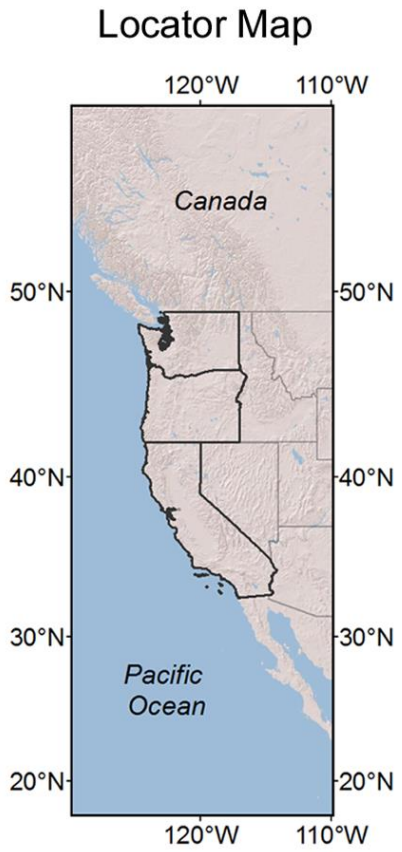


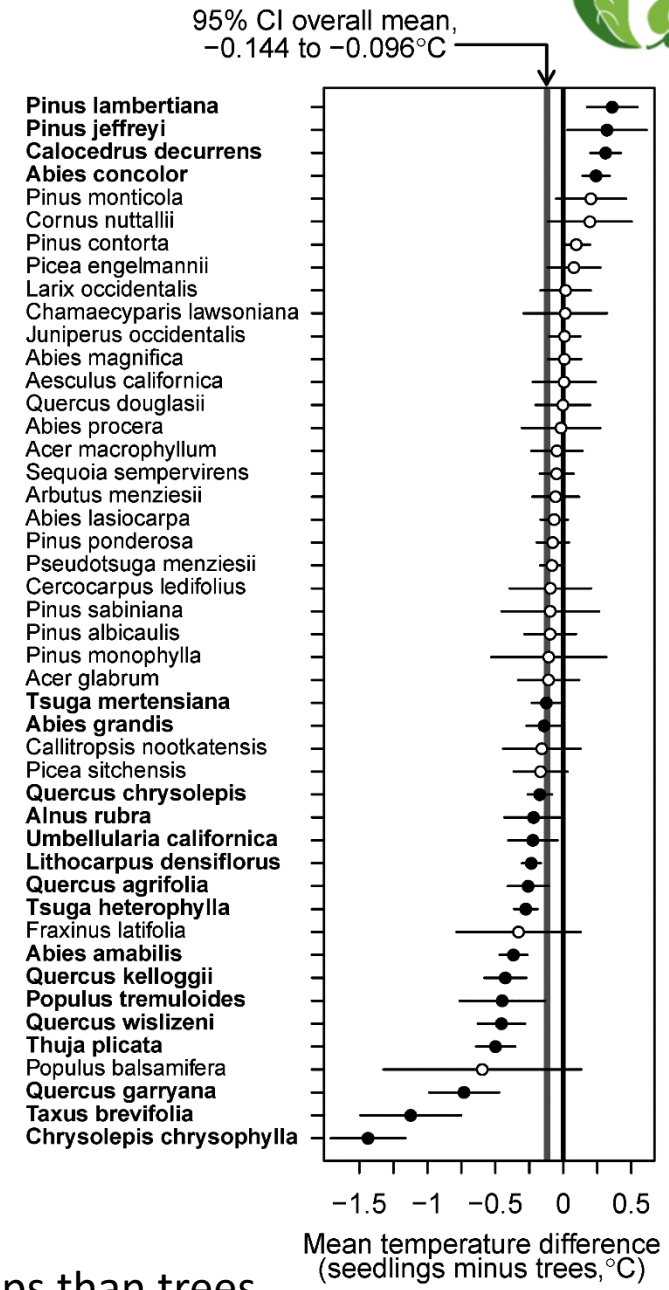
Reed et al., 2020. Journal of Ecology.

Trees may need to shift to survive and reproduce

Monleon and Lintz, 2015. Plos One.





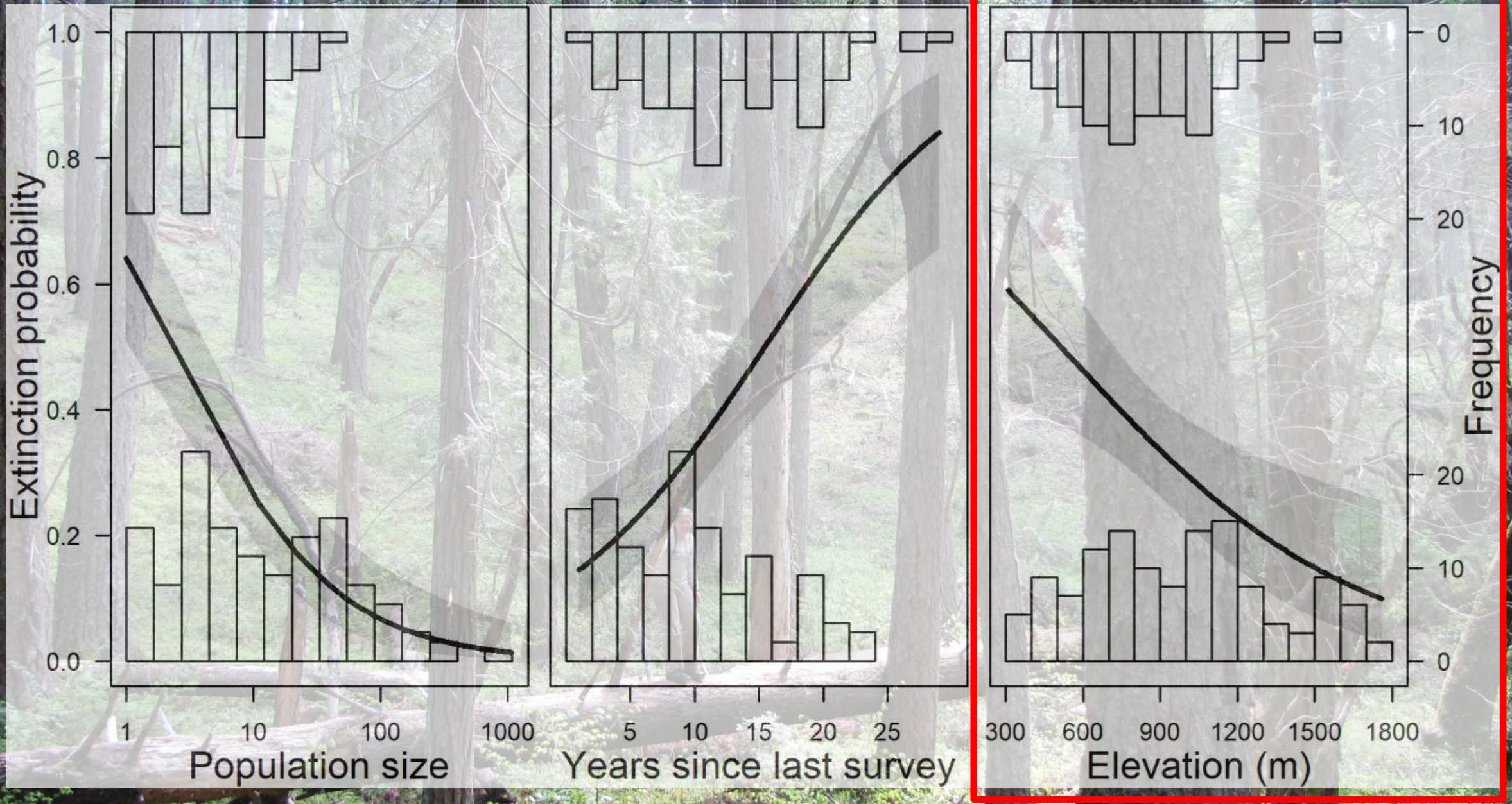


Seedlings of 33 species prefer cooler temps than trees

Population extinctions are being driven by climate change, population size, and time

Site revisits: *Cypripedium fasciculatum*

Kaye et al, 2019.
Plos One


Extinction probability
1.0
0.8
0.6
0.4
0.2
0.0
1
10
100
1000
Population size
5
10
15
20
25
Years since last survey
300
600
900
1200
1500
1800
Elevation (m)
Frequency
0
10
20
20
10
0

Greene's mariposa lily (*Calochortus greenei*)

Greene's mariposa lily (*Calochortus greenei*)

survival → growth → reproduction → dormancy } Population growth

spring → summer → fall → winter } Climate

Top driver: Minimum temperature in spring

a.

log population size

herbivores present -- control

year

b.

log population size

fenced

year

Climate change

Past climate

Sourcing plants for habitat restoration in a changing climate

- Local adaptation
- Future climate analogs

Local adaptation: Nonlocal types may fail in restorations

95% — Variation among populations

305 studies

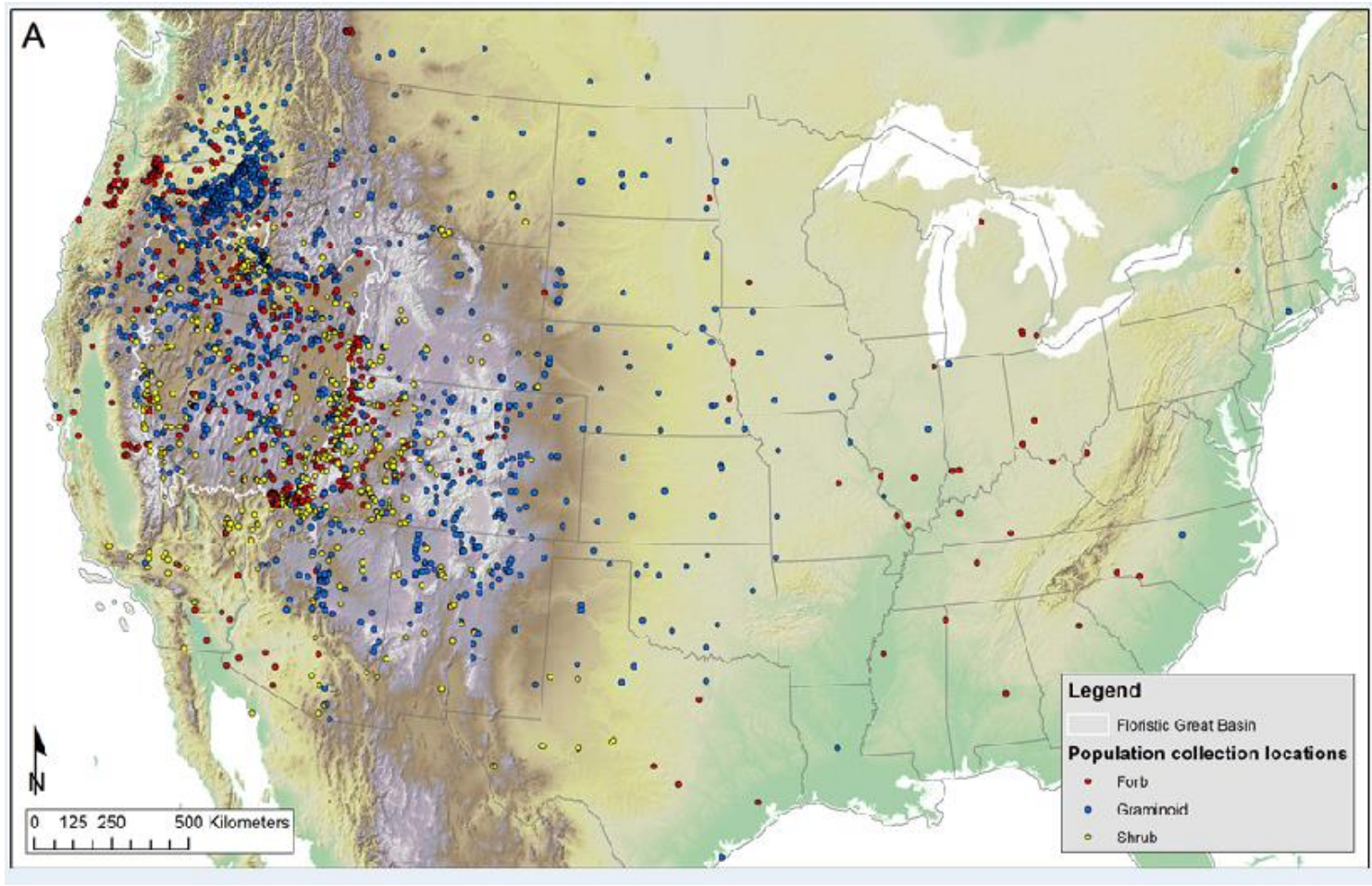
86% — Trait by environment variation

161 studies

75% — Climate

67% survival, 90% flowering — Local advantage

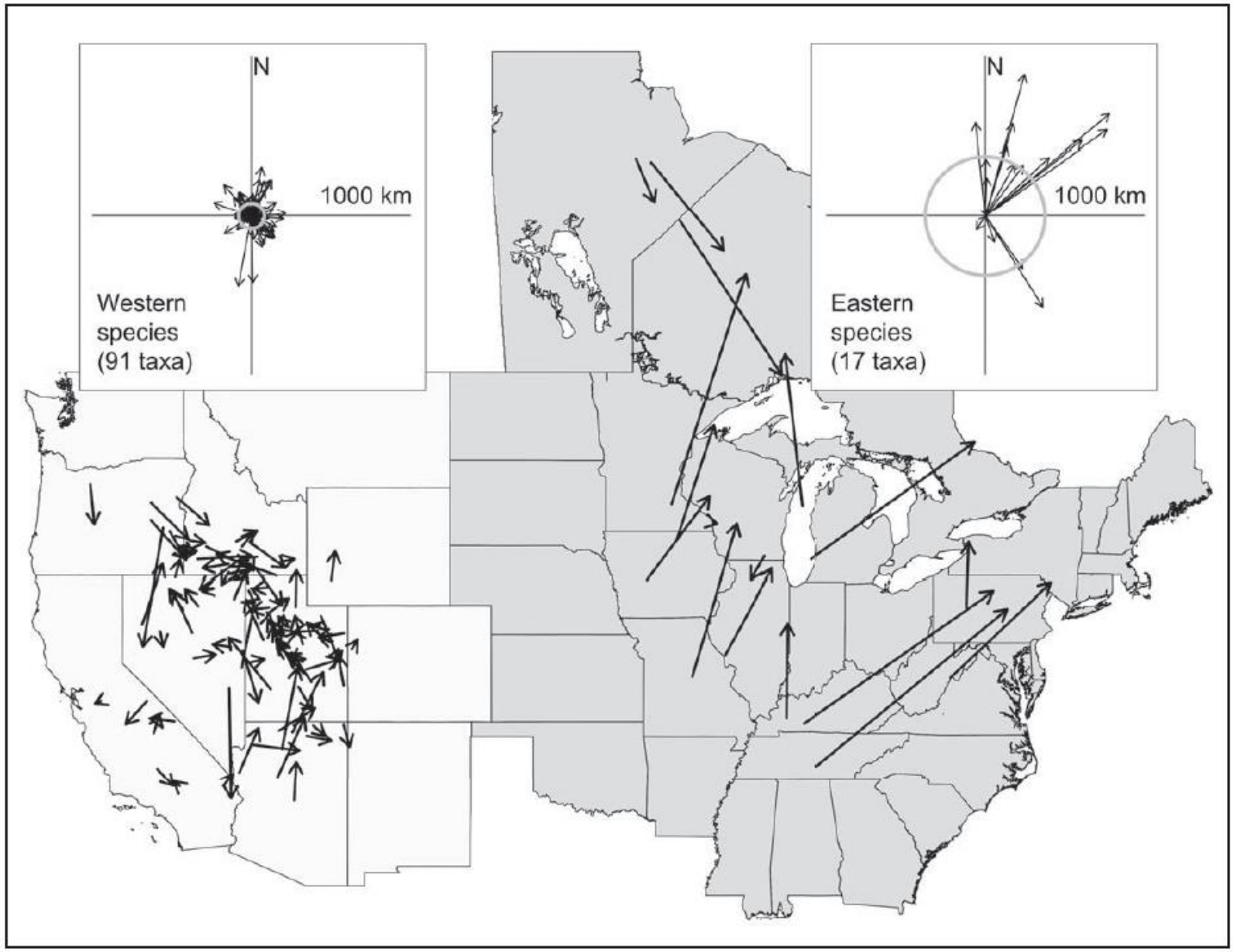
24 and 10 studies



Baughman et al. 2019, *Ecology and Evolution*

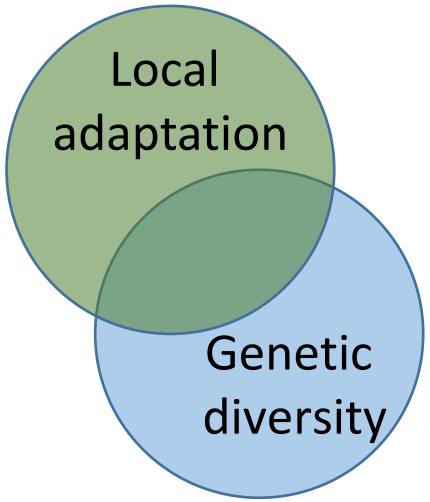
Planning for climate change

- Changing climate means optimal environments for species may shift
- Strategies for obtaining seeds:
  - Strict local
  - Relaxed (mixed) local
  - Composite mix
  - Admixture (range-wide mix)
  - Predictive (matching to future climate)

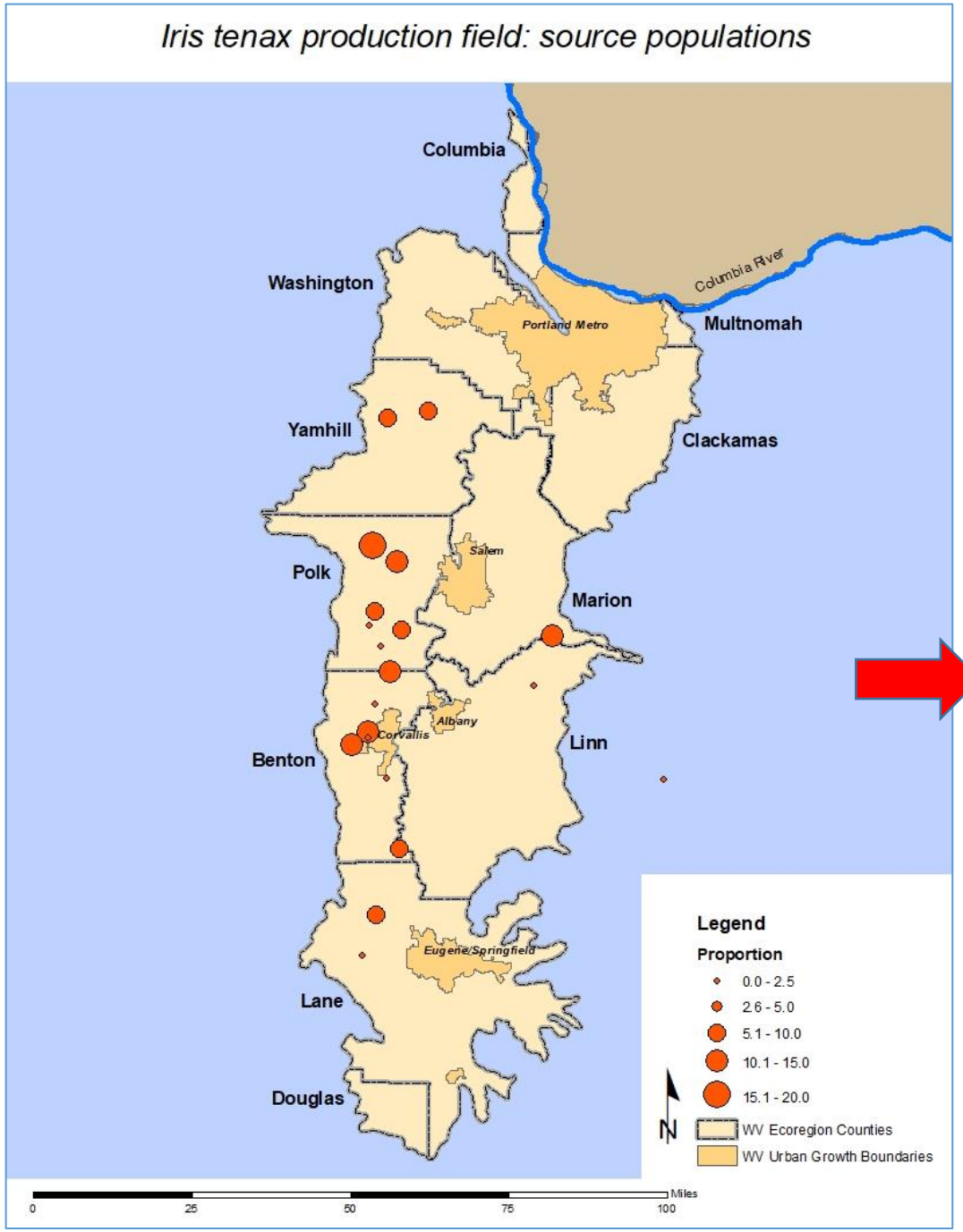


Havens et al., 2015. *Natural Areas Journal*
Breed et al., 2013. *Conservation Genetics*

Composite mix

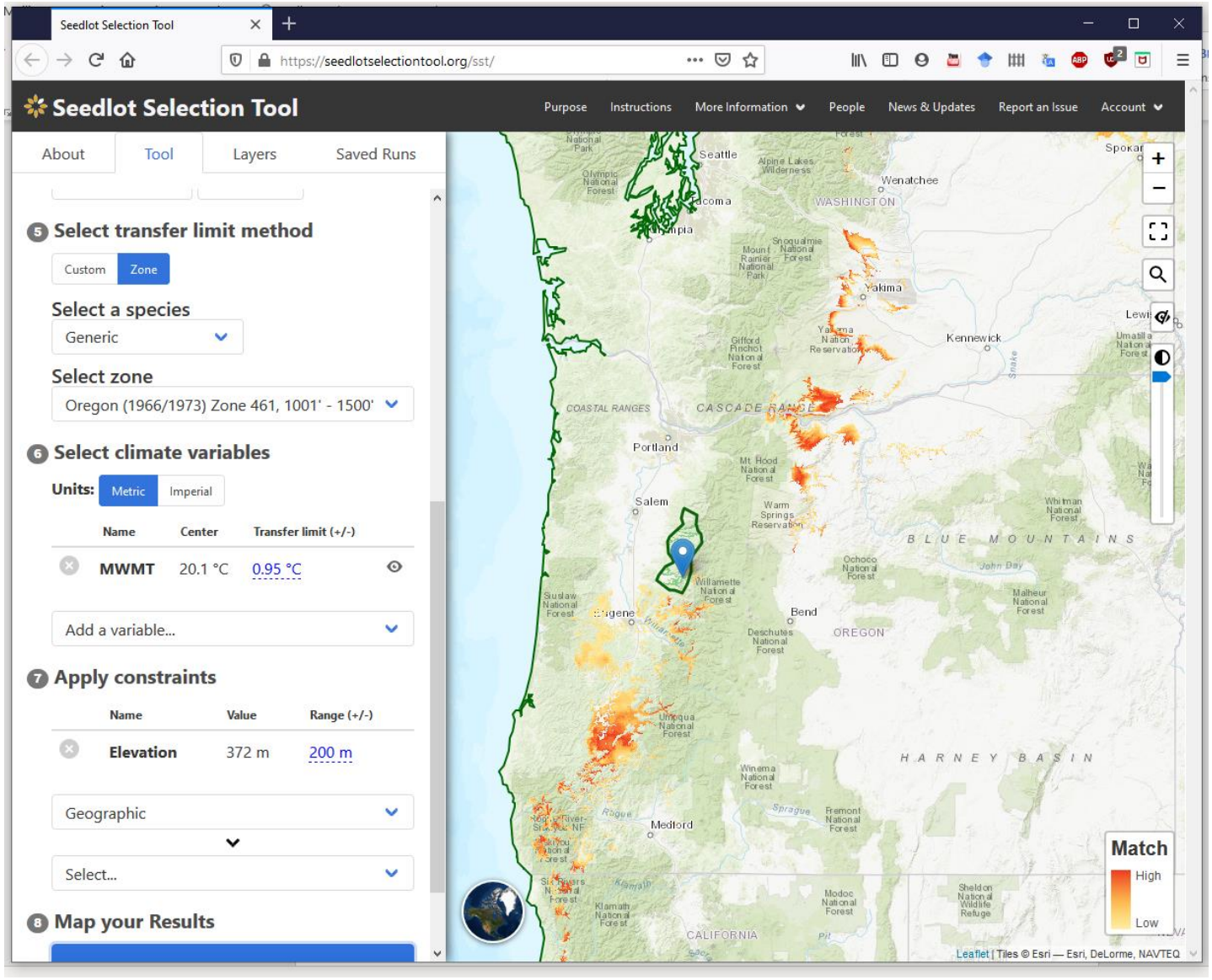


Example: *Iris tenax*
Multiple collections from throughout an ecoregion



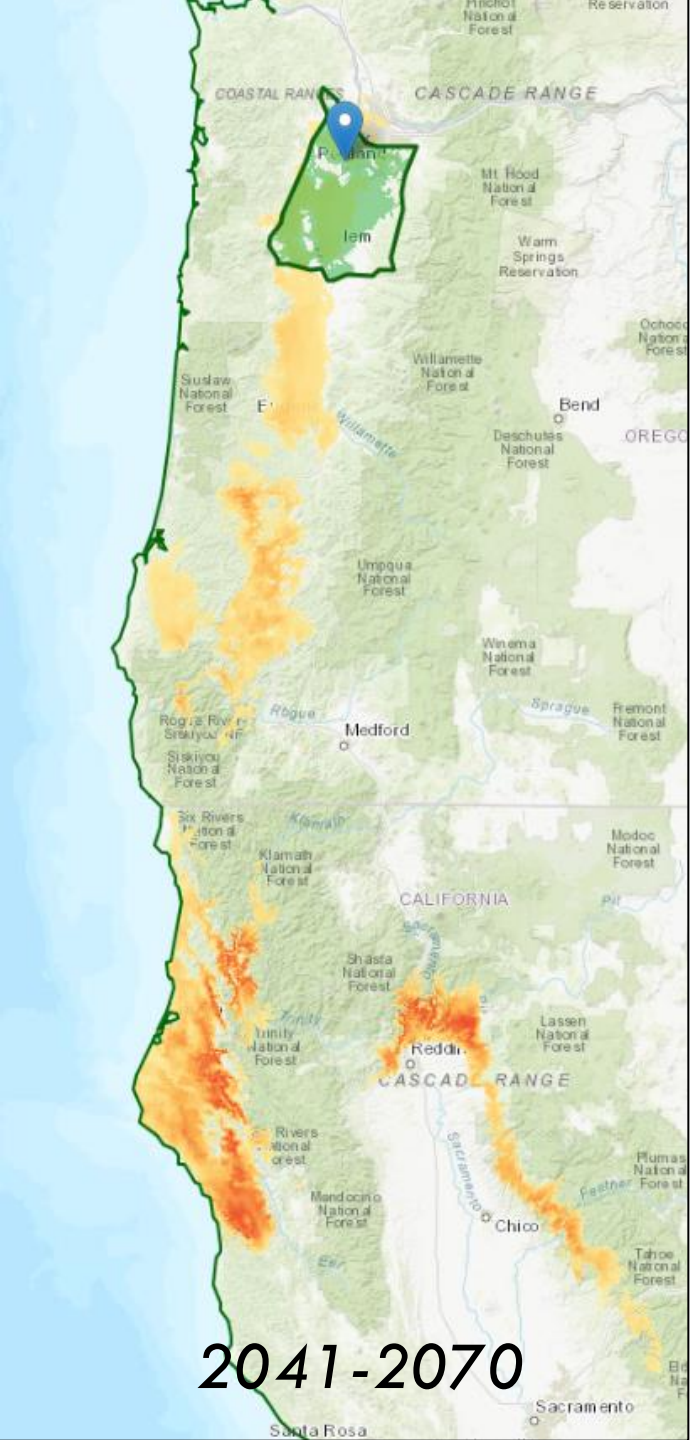
“Climate-Smart” Seedlot Selection Tool (SST)

- seedlotselectiontool.org
- US Forest Service, Conservation Biology Institute
- Identifies locations from which seeds may be moved to new site to match climate
- User specified past or future climate scenario

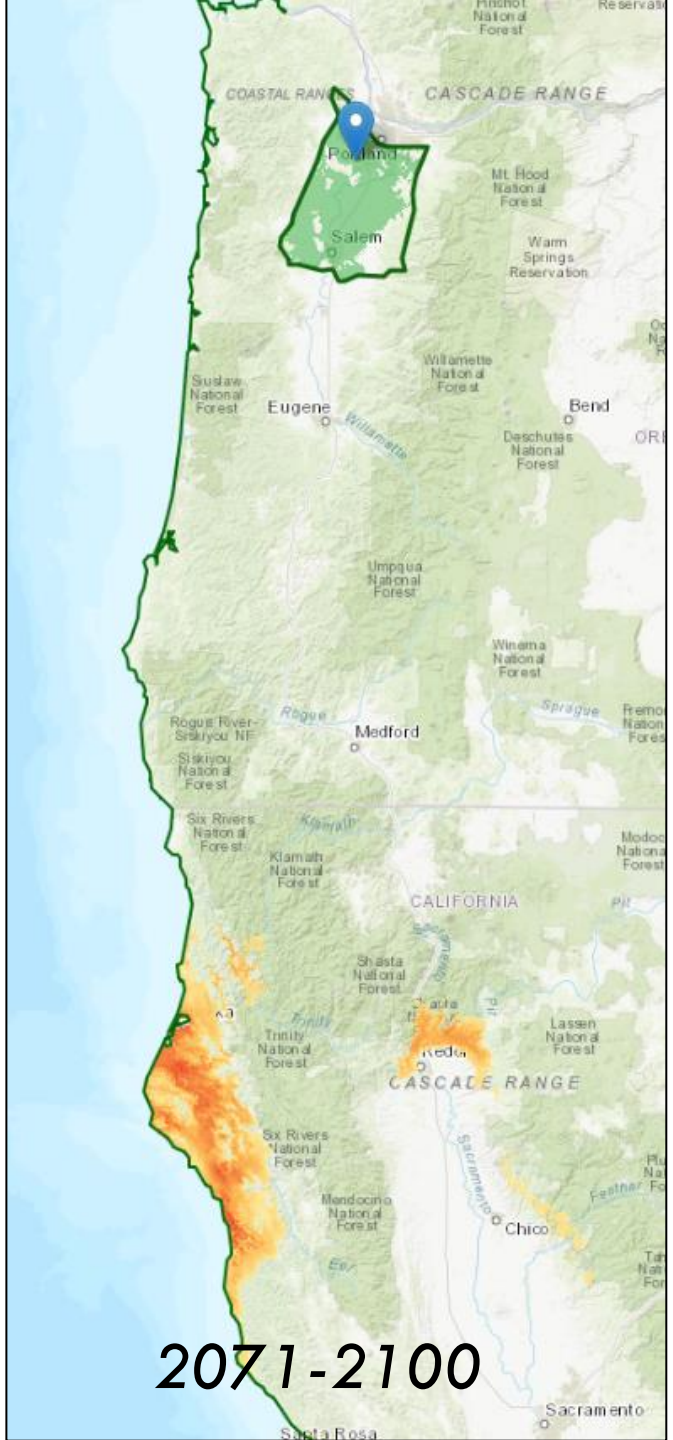


Seedlot selection tool

Climate admixtures of plant sources
Assisted migration trials



2041-2070

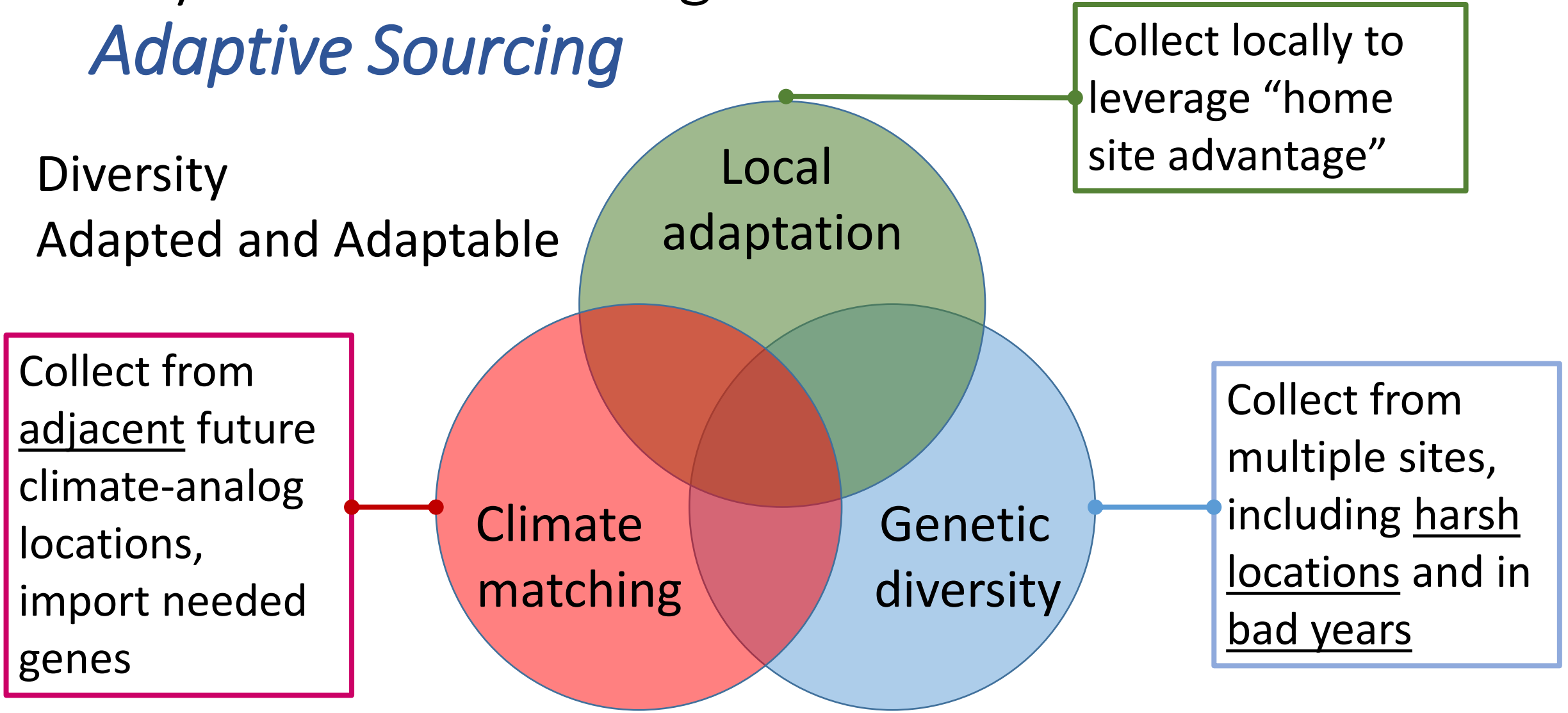


2071-2100


White alder (*Alnus rhombifolia*)

Beyond Assisted Migration:
Adaptive Sourcing

- Diversity
- Adapted and Adaptable



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