



# ***Climate-Smart Seedlot Selection Tool: Restoration and Reforestation for the 21<sup>st</sup> Century***

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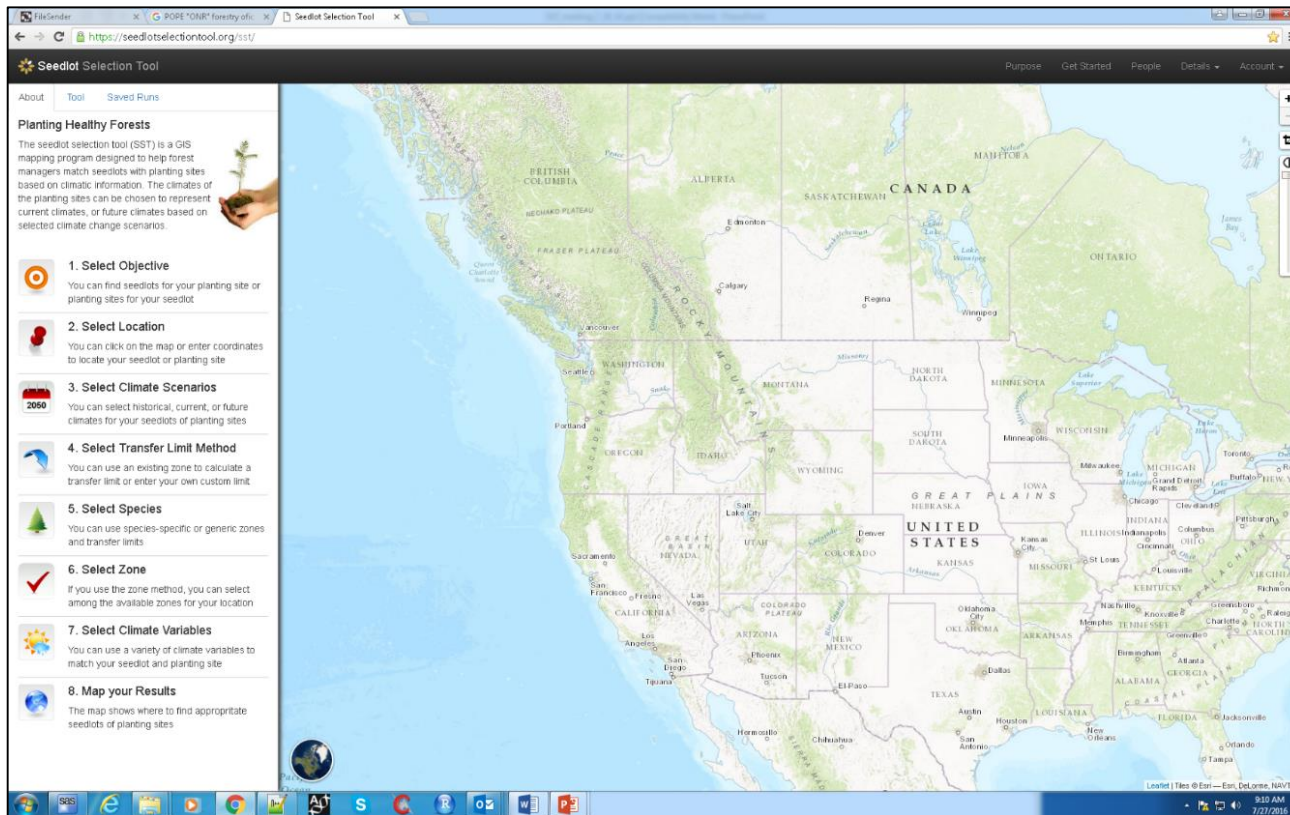


for the greatest good

***Presentation at the Washington Office, February 16, 2017***

# Objectives

1. *Introduce the Seedlot Selection Tool*
2. *Provide some examples*
3. *Discuss implications of climate change*



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# People and funding

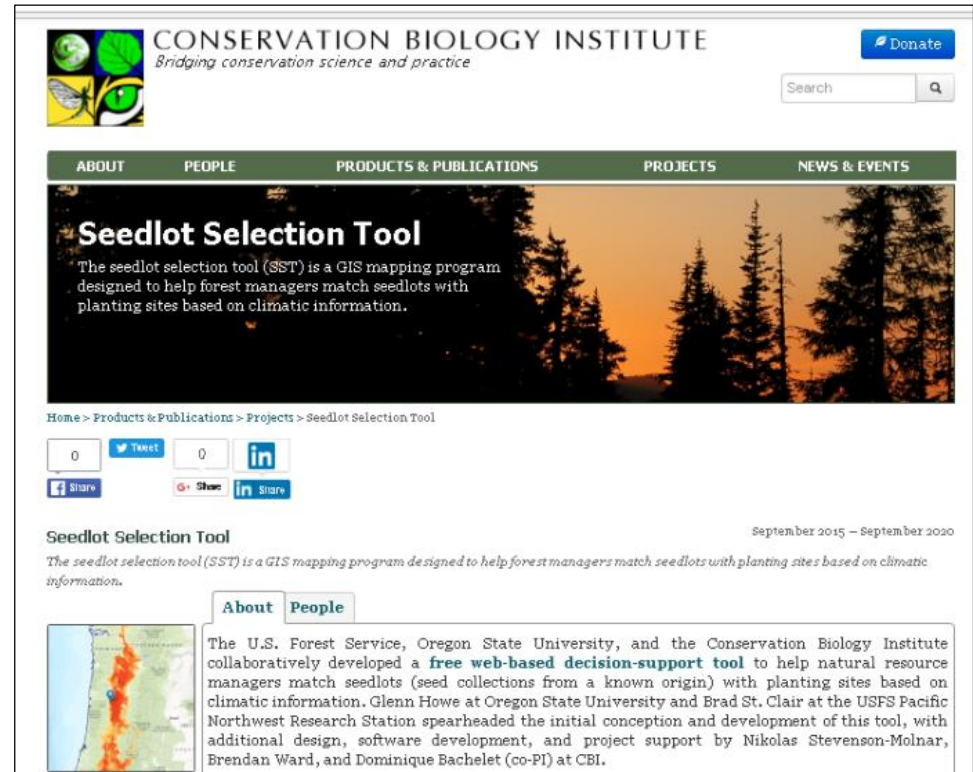
**Glenn Howe – Co-Principal Investigator**  
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Pacific Northwest Research Station  
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**Dominique Bachelet – Co-Principal Investigator**  
Conservation Biology Institute, Corvallis, Oregon  
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Conservation Biology Institute, Corvallis, Oregon  
[nik.molnar@consbio.org](mailto:nik.molnar@consbio.org)

**Brendan Ward – Project Manager**  
Conservation Biology Institute, Corvallis, Oregon  
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The screenshot shows the website for the Conservation Biology Institute (CBI). The header includes the CBI logo, the text "CONSERVATION BIOLOGY INSTITUTE Bridging conservation science and practice", a search bar, and a "Donate" button. A navigation menu contains "ABOUT", "PEOPLE", "PRODUCTS & PUBLICATIONS", "PROJECTS", and "NEWS & EVENTS". The main content area features a large image of a forest at sunset with the title "Seedlot Selection Tool". Below the image is a description: "The seedlot selection tool (SST) is a GIS mapping program designed to help forest managers match seedlots with planting sites based on climatic information." There are social media sharing buttons for Twitter, LinkedIn, Facebook, and YouTube. A breadcrumb trail reads "Home > Products & Publications > Projects > Seedlot Selection Tool". The date "September 2015 – September 2020" is displayed. Below the main text, there are tabs for "About" and "People". The "About" tab is active, showing a map of Oregon and text: "The U.S. Forest Service, Oregon State University, and the Conservation Biology Institute collaboratively developed a **free web-based decision-support tool** to help natural resource managers match seedlots (seed collections from a known origin) with planting sites based on climatic information. Glenn Howe at Oregon State University and Brad St. Clair at the USFS Pacific Northwest Research Station spearheaded the initial conception and development of this tool, with additional design, software development, and project support by Nikolas Stevenson-Molnar, Brendan Ward, and Dominique Bachelet (co-PI) at CBI."

[consbio.org/products/webinars/climate-smart-seedlot-selection-tool](https://consbio.org/products/webinars/climate-smart-seedlot-selection-tool)



United States Department of Agriculture  
Northwest Climate Hub



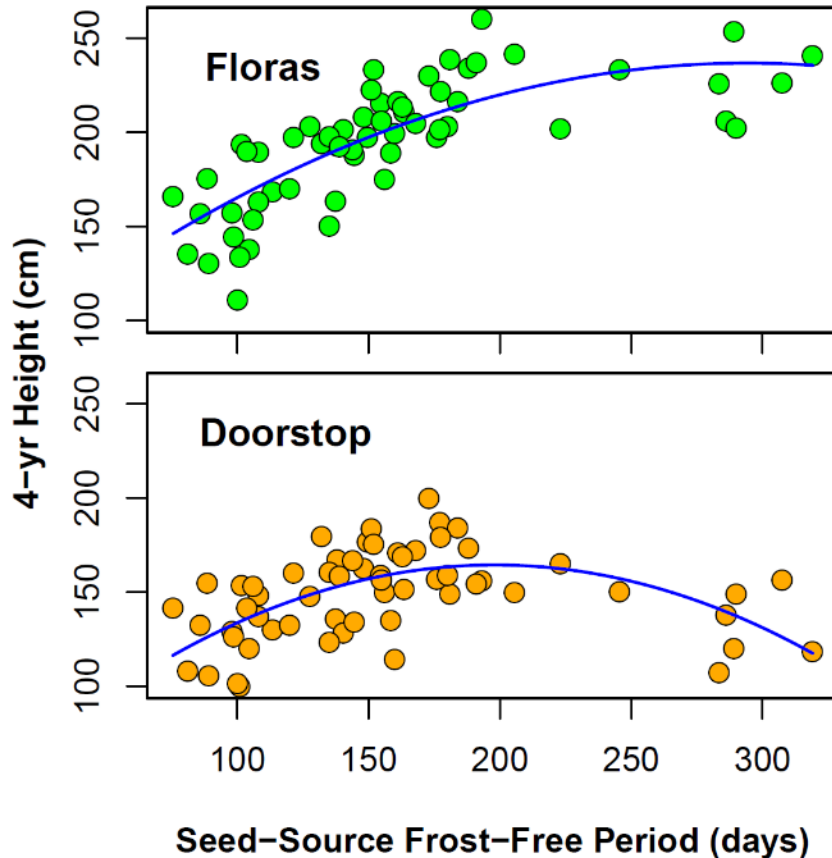


# Background



# 1. Plants are adapted to local climates

## *Douglas-Fir Seed Source Movement Trial*



### ***Floras – warm site***

Frost-free days = 308

### ***Doorstop – cool site***

Frost-free days = 190

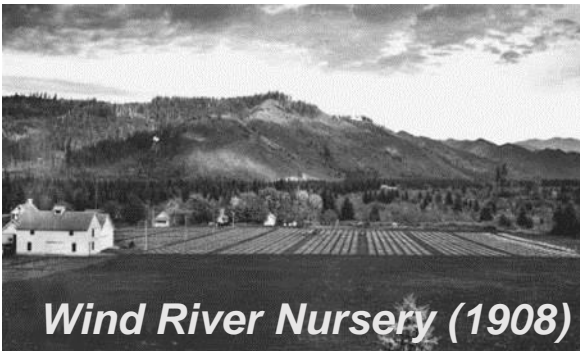
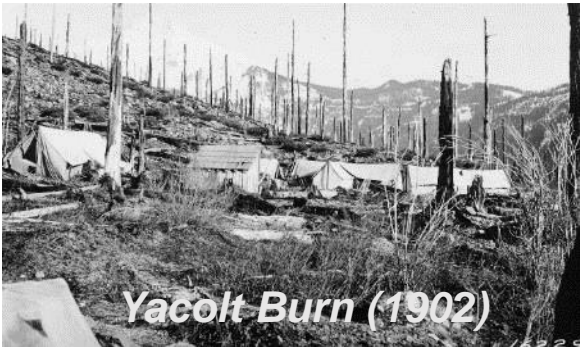
### ***Local adaptation***

Sources from climates similar to the planting site are among the tallest at each site



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# Lessons from Forestry



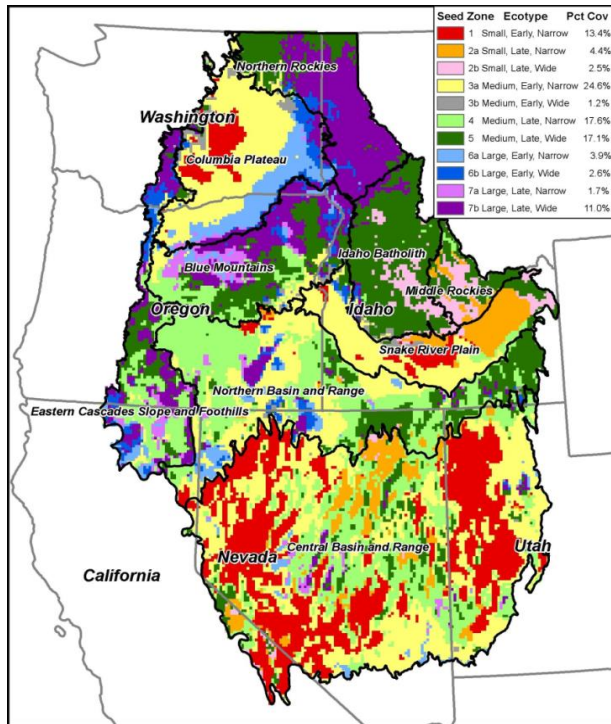
- *Early observations of poor growth and survival*
- *Maladaptation took time to develop*
- *Led to first seed movement guidelines in 1939*
  - *100 miles north or south*
  - *1,000 ft in elevation*
  - *Considerations for unusual climates, topography or soils*





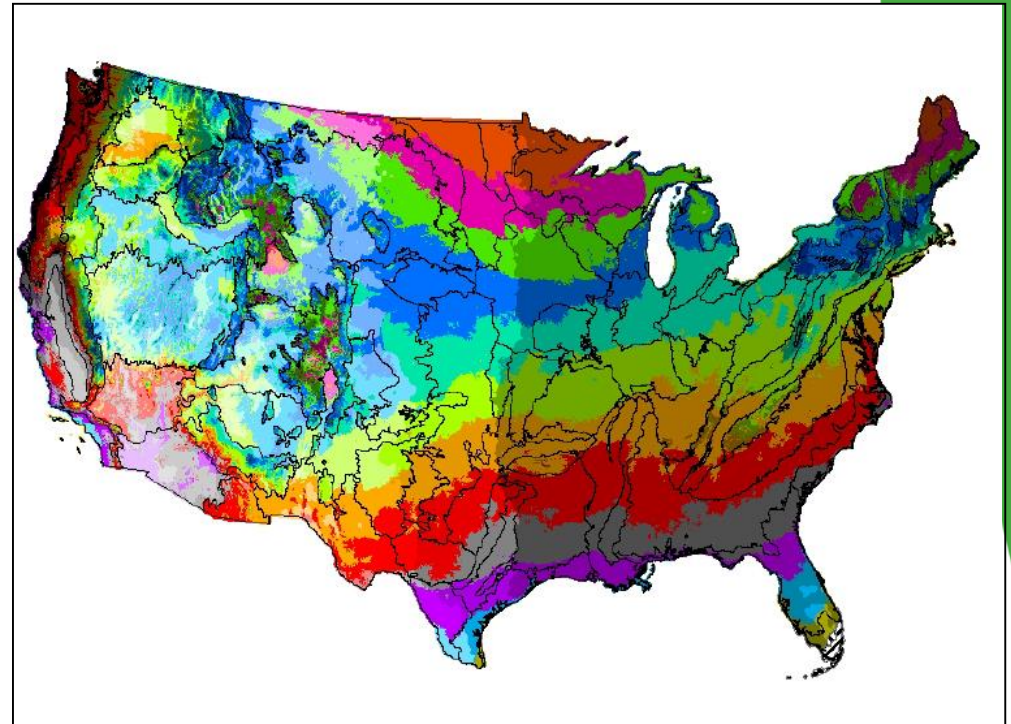
# 2. Seed zones and population movement guidelines developed to ensure adaptation

## Bluebunch Wheatgrass Seed Zones



St.Clair, Kilkenny, Johnson, Shaw, Weaver. 2013. Genetic variation in adaptive traits and seed transfer zones for *Pseudoroegneria spicata* (bluebunch wheatgrass) in the northwestern United States. *Evolutionary Applications* 6: 933-948

## Generalized Provisional Seed Zones



Bower, St.Clair, Erickson. 2014. Generalized provisional seed zones for native plants. *Ecological Applications* 24: 913-919

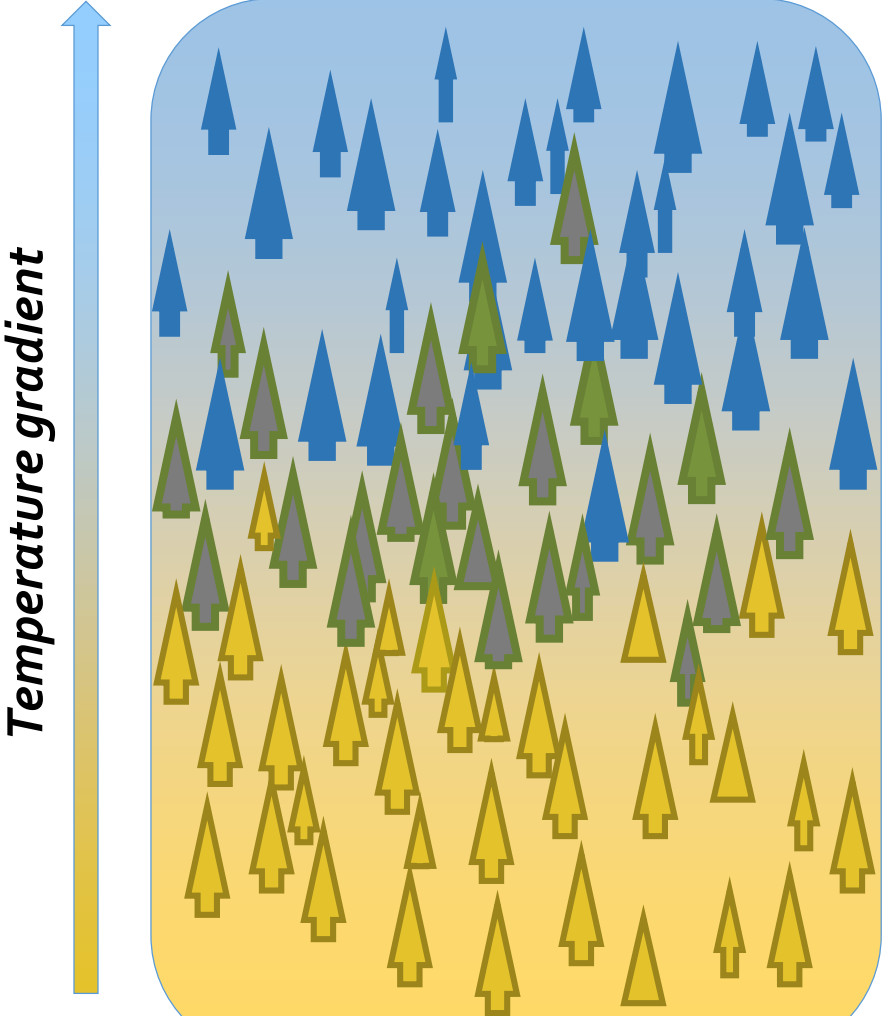


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# 3. But climates are changing, which affects adaptation

*Populations are genetically adapted to historic climate*

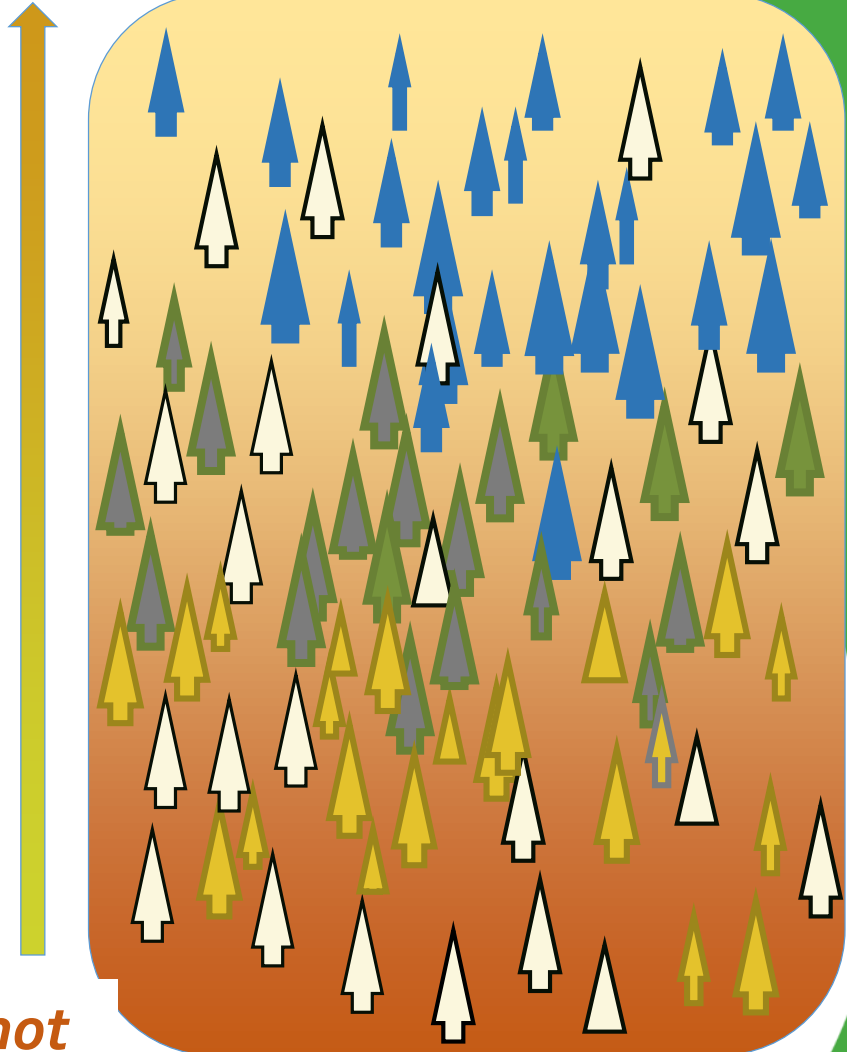
cool



warm

*And mismatched with future climate*

warm



hot

Figure courtesy of Sally Aitken, UBC



# 3. But climates are changing, which affects adaptation

*Populations are genetically adapted to historic climate*

*And mismatched with future climate*

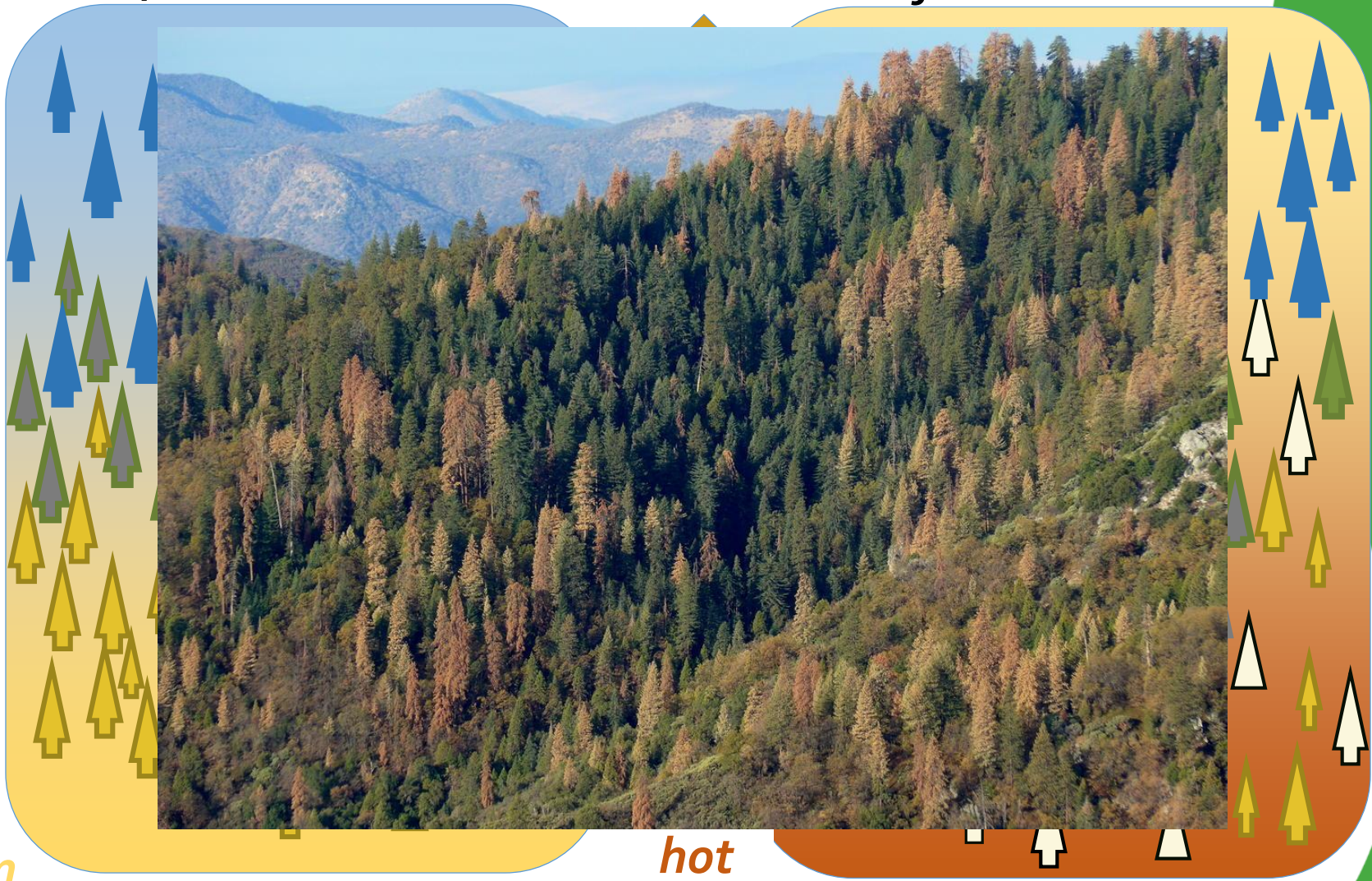
cool

warm

Temperature gradient

warm

hot





# 4. We can manage genetic variation to positively influence how plants respond and adapt to climate change











About Tool Saved Runs

### Planting Healthy Forests

The seedlot selection tool (SST) is a GIS mapping program designed to help forest managers match seedlots with planting sites based on climatic information. The climates of the planting sites can be chosen to represent current climates, or future climates based on selected climate change scenarios.



-  **1. Select Objective**  
You can find seedlots for your planting site or planting sites for your seedlot
-  **2. Select Location**  
You can click on the map or enter coordinates to locate your seedlot or planting site
-  **3. Select Climate Scenarios**  
You can select historical, current, or future climates for your seedlots or planting sites
-  **4. Select Transfer Limit Method**  
You can use an existing zone to calculate a transfer limit or enter your own custom limit
-  **5. Select Species**  
You can use species-specific or generic zones and transfer limits
-  **6. Select Zone**  
If you use the zone method, you can select among the available zones for your location
-  **7. Select Climate Variables**  
You can use a variety of climate variables to match your seedlot and planting site
-  **8. Map your Results**  
The map shows where to find appropriate seedlots of planting sites





# Can address two objectives:

*Given a planting site*

*Which seedlot is well adapted today...or in the future?*



*Find*  
→



*Given a seedlot*

*Where is it well adapted today...or in the future?*



*Find*  
→





# How the tool works

- *Select objective*
- *Select location*
- *Select climate scenarios*
- *Select transfer limit method*
- *Select species*
- *Select zone*
- *Select climate variables*
- *Map your results*



## 1. Select Objective

You can find seedlots for your planting site or planting sites for your seedlot



## 2. Select Location

You can click on the map or enter coordinates for the location of your seedlot or planting site



## 3. Select Climate Scenarios

You can select historical, current, or future climates for your seedlots or planting sites



## 4. Select Transfer Limit Method

You can use an existing zone to calculate a transfer limit or enter your own custom limit



## 5. Select Species

You can use species-specific or generic zones and transfer limits



## 6. Select Zone

If you use the zone method, you can select among the available zones for your location



## 7. Select Climate Variables

You can use a variety of climate variables to match your seedlot and planting site



## 8. Map Your Results

The map shows where to find appropriate seedlots or planting sites

# Adapted Sources for Soda Fire Restoration

## Seedlot Selection Tool

Purpose Instructions More Information People News & Updates Report an Issue Account

About Tool Saved Runs

### 1 Select objective

Find seedlots Find planting sites

### 2 Select planting site location

Locate your planting site  
Use the map or enter coordinates

Lat: 43.1230 Lon: -116.9570

Elevation: 4892 ft

### 3 Select climate scenarios

Which climate are the seedlots adapted to?

1961 - 1990

When should trees be best adapted to the planting site?

1961 - 1990

### 4 Select transfer limit method

Custom Zone

### 5 Select climate variables

Units: Metric Imperial

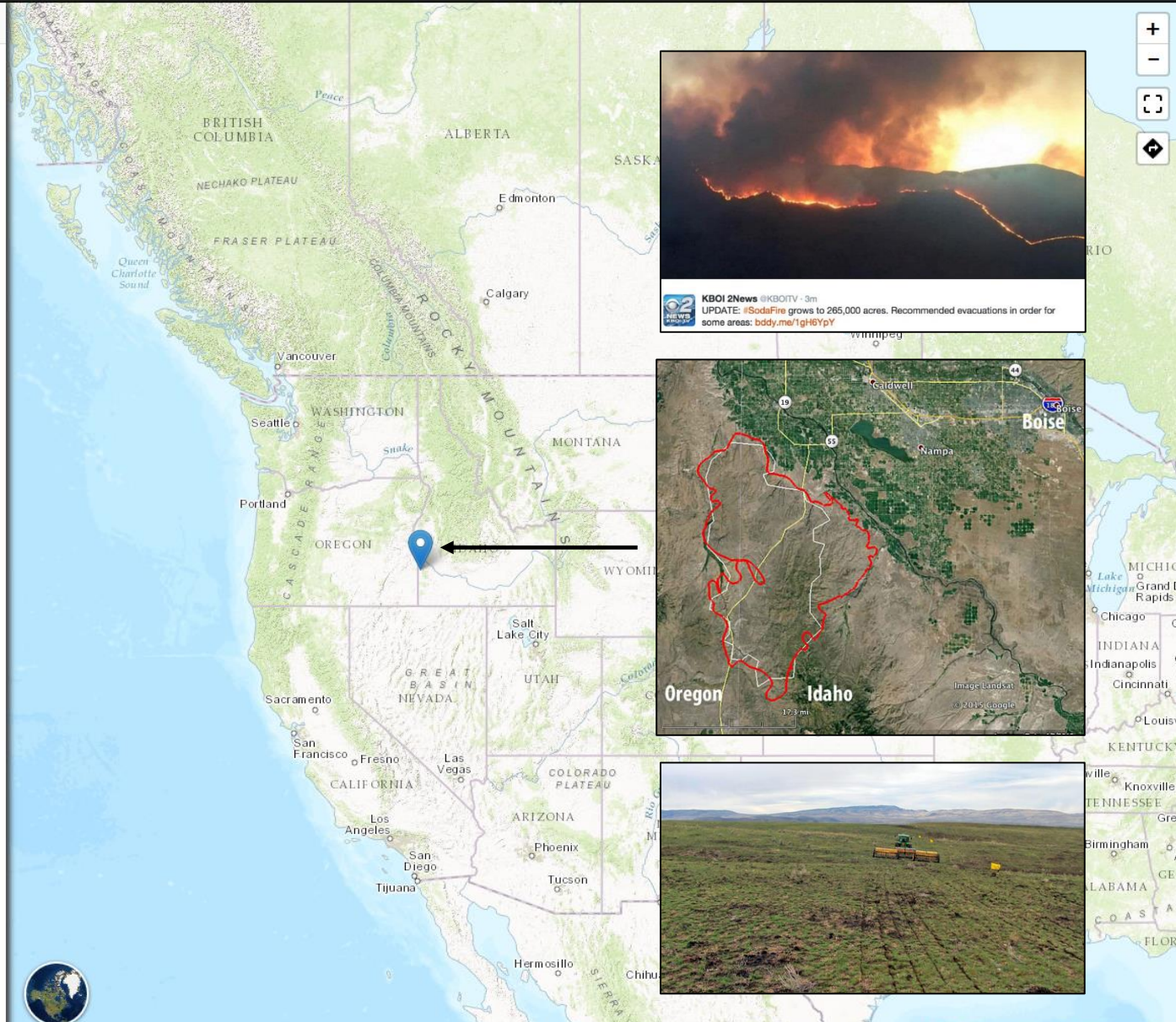
Add a variable...

### 6 Map your Results

Run Tool

Save Last Run

Export PDF





# Adapted Sources for Soda Fire Restoration

## Seedlot Selection Tool

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Find seedlots Find planting sites

### 2 Select planting site location

Locate your planting site  
Use the map or enter coordinates

Lat: 43.1230 Lon: -116.9570

Elevation: 4892 ft

### 3 Select climate scenarios

Which climate are the seedlots adapted to?

1961 - 1990

When should trees be best adapted to the planting site?

1981 - 2010

### 4 Select transfer limit method

Custom Zone

### 5 Select climate variables

Units: Metric Imperial

Name	Center	Transfer limit (+/-)
MCMT	-2.7 °C	2.00 °C
MAP	420 mm	250 mm

Add a variable...

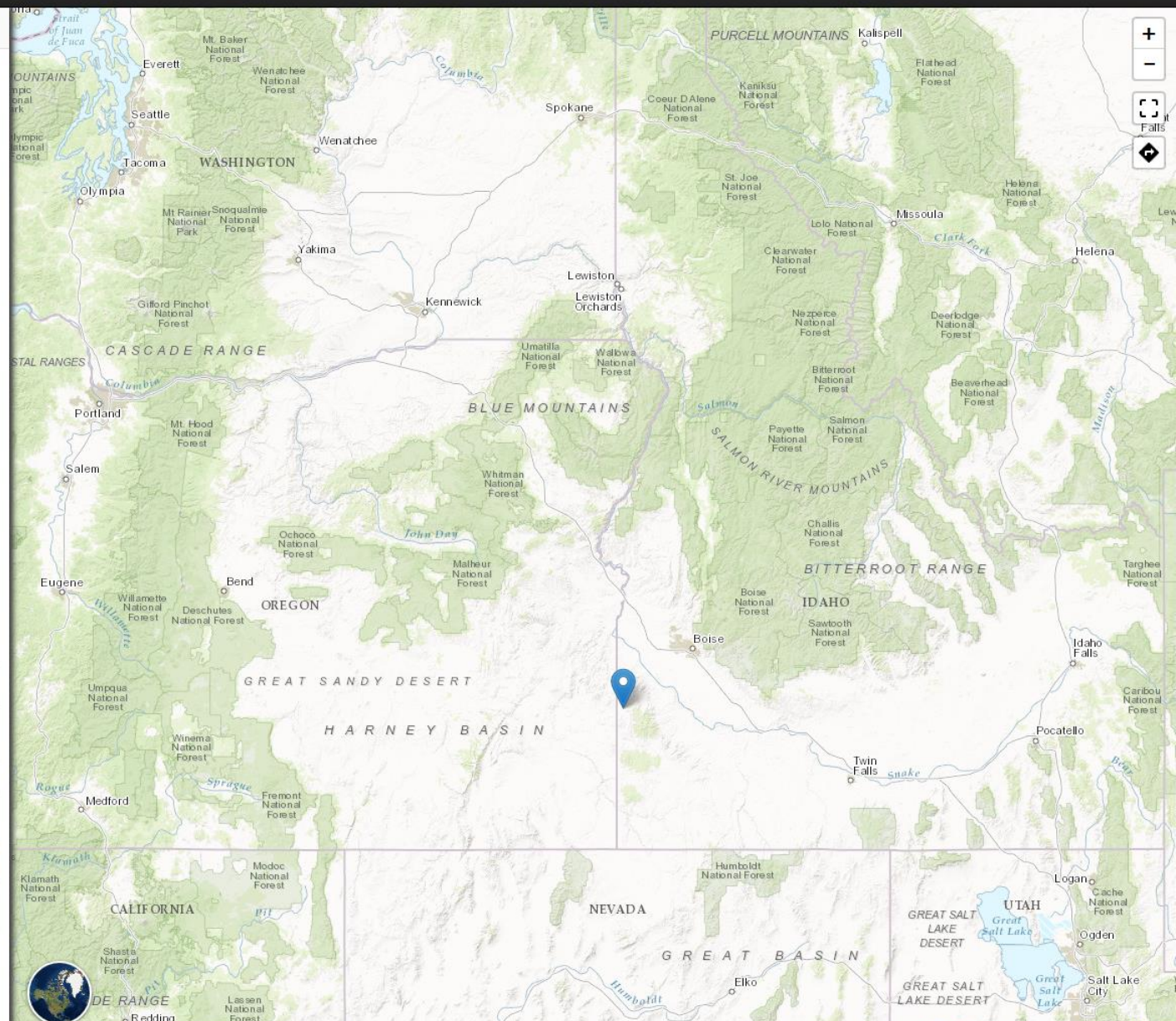
### 6 Map your Results

Run Tool

Save Last Run



Export PDF





# Adapted Sources for Soda Fire Restoration

## Seedlot Selection Tool

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Use the map or enter coordinates

Lat: 43.1230 Lon: -116.9570

Elevation: 4892 ft

### 3 Select climate scenarios

Which climate are the seedlots adapted to?

1961 - 1990

When should trees be best adapted to the planting site?

1981 - 2010

### 4 Select transfer limit method

Custom Zone

### 5 Select climate variables

Units: Metric Imperial

Name	Center	Transfer limit (+/-)	
MCMT	-2.7 °C	2.00 °C	
MAP	420 mm	250 mm	

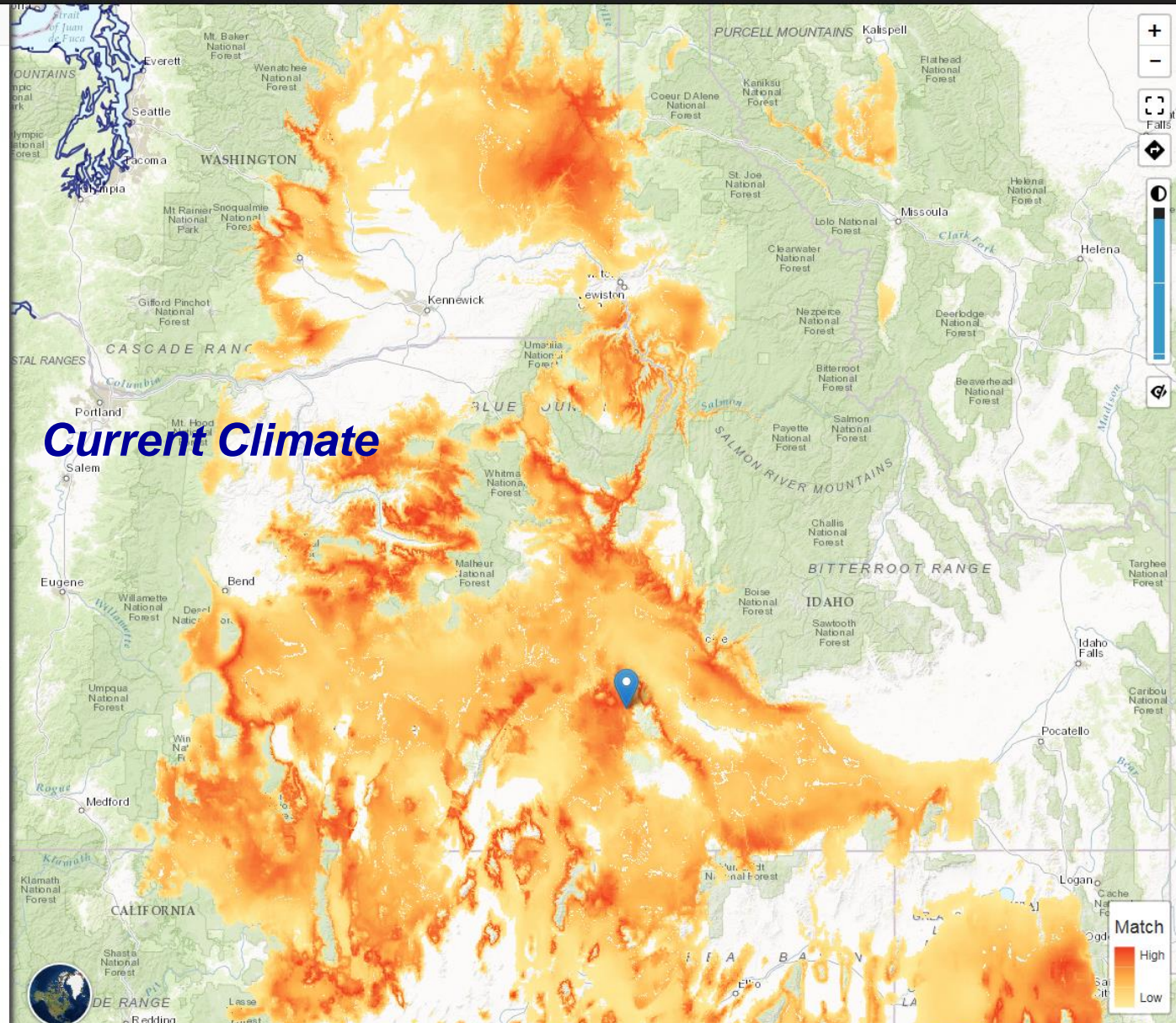
Add a variable...

### 6 Map your Results

Run Tool

Save Last Run

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# Wider transfer limits

## Seedlot Selection Tool

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About Tool Saved Runs

### 1 Select objective

Find seedlots Find planting sites

### 2 Select planting site location

Locate your planting site  
Use the map or enter coordinates

Lat: 43.1230 Lon: -116.9570

Elevation: 4892 ft

### 3 Select climate scenarios

Which climate are the seedlots adapted to?

1961 - 1990

When should trees be best adapted to the planting site?

1981 - 2010

### 4 Select transfer limit method

Custom Zone

### 5 Select climate variables

Units: Metric Imperial

Name	Center	Transfer limit (+/-)	
× MCMT	-2.7 °C	<u>2.50 °C</u>	⊙
× MAP	420 mm	<u>300 mm</u>	⊙

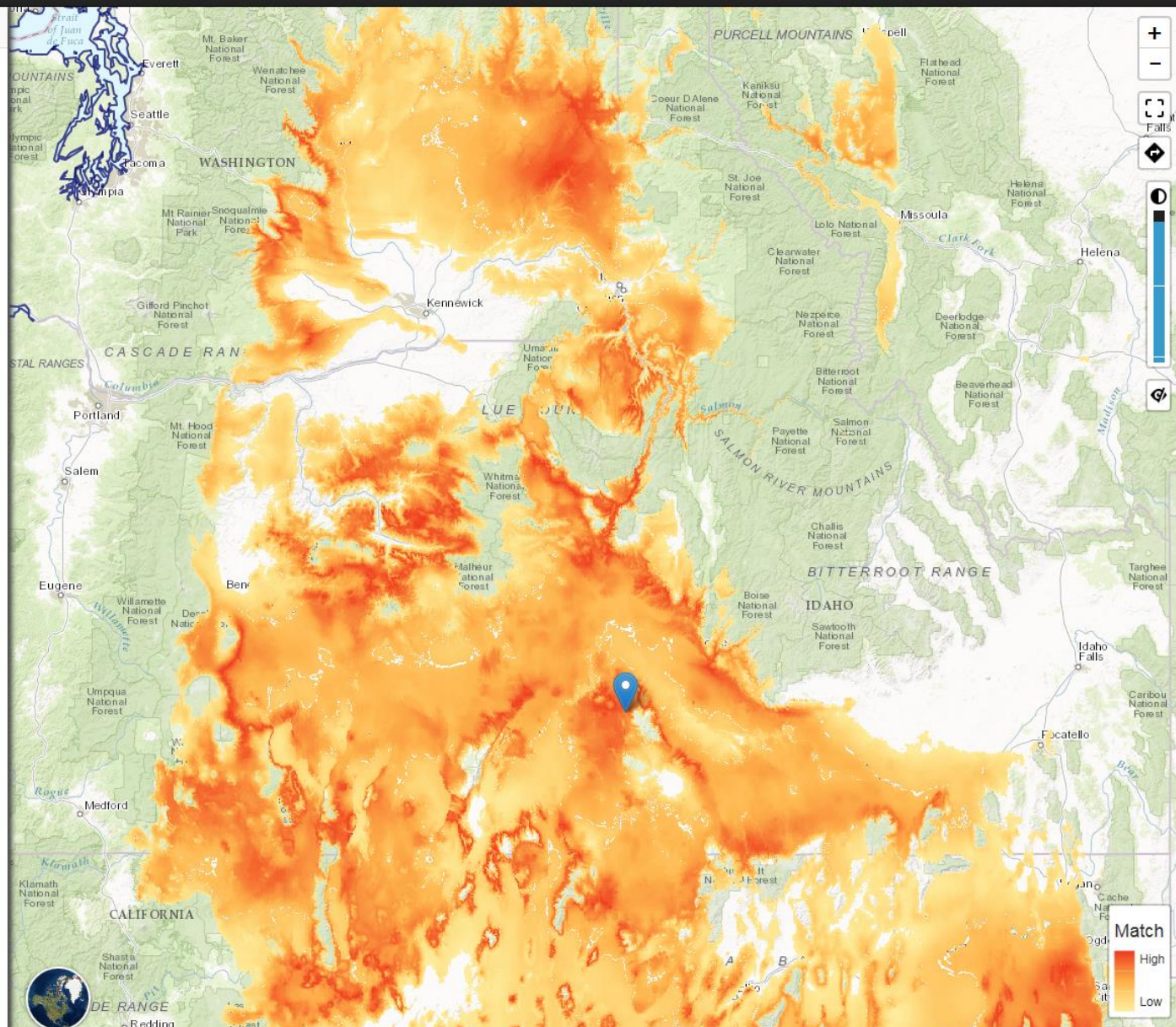
Add a variable...

### 6 Map your Results

Run Tool

Save Last Run

Export PDF





# Narrower transfer limits

## Seedlot Selection Tool

Purpose Instructions More Information People News & Updates Report an Issue Account

About Tool Saved Runs

### 1 Select objective

Find seedlots Find planting sites

### 2 Select planting site location

Locate your planting site  
Use the map or enter coordinates

Lat: 43.1230 Lon: -116.9570

Elevation: 4892 ft

### 3 Select climate scenarios

Which climate are the seedlots adapted to?

1961 - 1990

When should trees be best adapted to the planting site?

1981 - 2010

### 4 Select transfer limit method

Custom Zone

### 5 Select climate variables

Units: Metric Imperial

Name	Center	Transfer limit (+/-)	
× MCMT	-2.7 °C	1.50 °C	⊙
× MAP	420 mm	200 mm	⊙

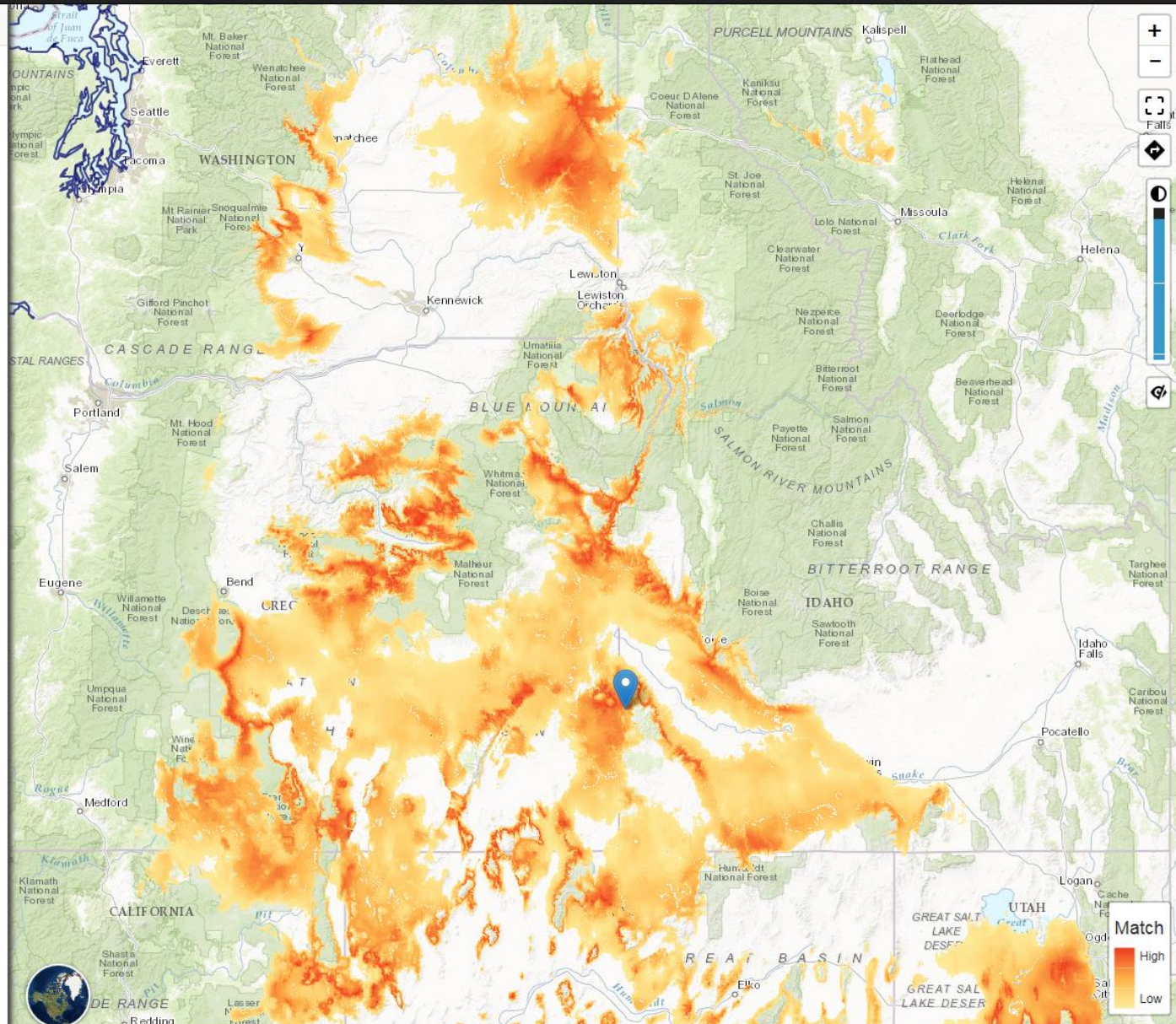
Add a variable...

### 6 Map your Results

Run Tool

Save Last Run

Export PDF







# Seed Needs Planning



# Bluebunch Wheatgrass - Anatone



## Seedlot Selection Tool

Purpose Instructions More Information People

About Tool Saved Runs

### 1 Select objective

Find seedlots Find planting sites

### 2 Select seedlot location

Locate your seedlot (its climatic center)  
Use the map or enter coordinates

Lat: 46.1558 Lon: -117.0923

Elevation: 3291 ft

### 3 Select climate scenarios

Which climate are the seedlots adapted to?

1961 - 1990

When should trees be best adapted to the planting site?

1981 - 2010

### 4 Select transfer limit method

Custom Zone

### 5 Select climate variables

Units: Metric Imperial

Name	Center	Transfer limit (+/-)
✕ MCMT	-1.9 °C	<u>2.00 °C</u>
✕ MAP	455 mm	<u>300 mm</u>

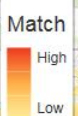
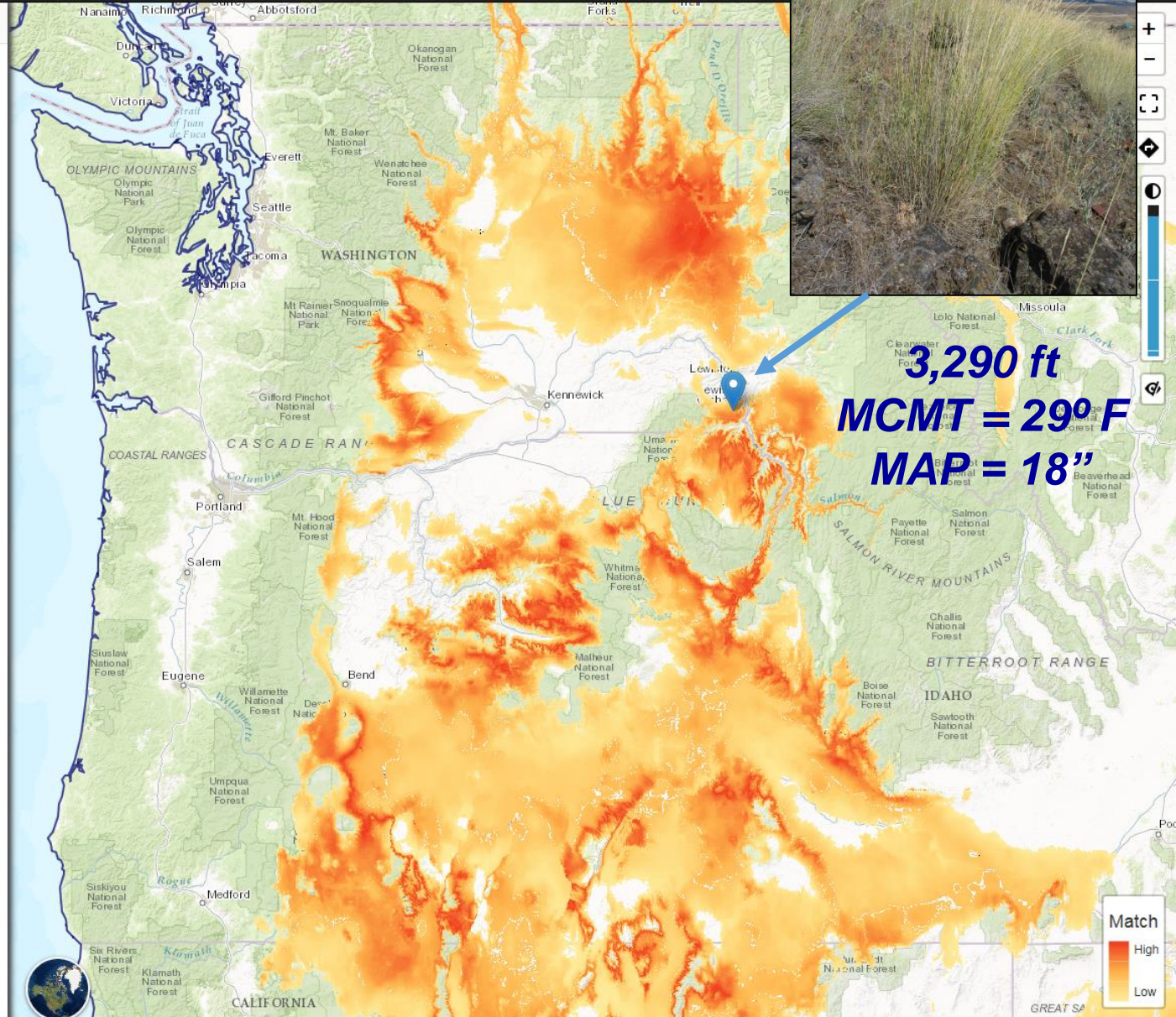
Add a variable...

### 6 Map your Results

Run Tool

Save Last Run

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# Wahluke source – hot, dry source

## Seedlot Selection Tool

Purpose Instructions More Information People News & Updates Report an Issue Account

About Tool Saved Runs

### 1 Select objective

Find seedlots Find planting sites

### 2 Select seedlot location

Locate your seedlot (its climatic center)  
Use the map or enter coordinates

Lat: 46.7355 Lon: -119.2932

Elevation: 971 ft

### 3 Select climate scenarios

Which climate are the seedlots adapted to?

1961 - 1990

When should trees be best adapted to the planting site?

1981 - 2010

### 4 Select transfer limit method

Custom Zone

### 5 Select climate variables

Units: Metric Imperial

Name	Center	Transfer limit (+/-)
MCMT	-1.0 °C	2.00 °C
MAP	208 mm	300 mm

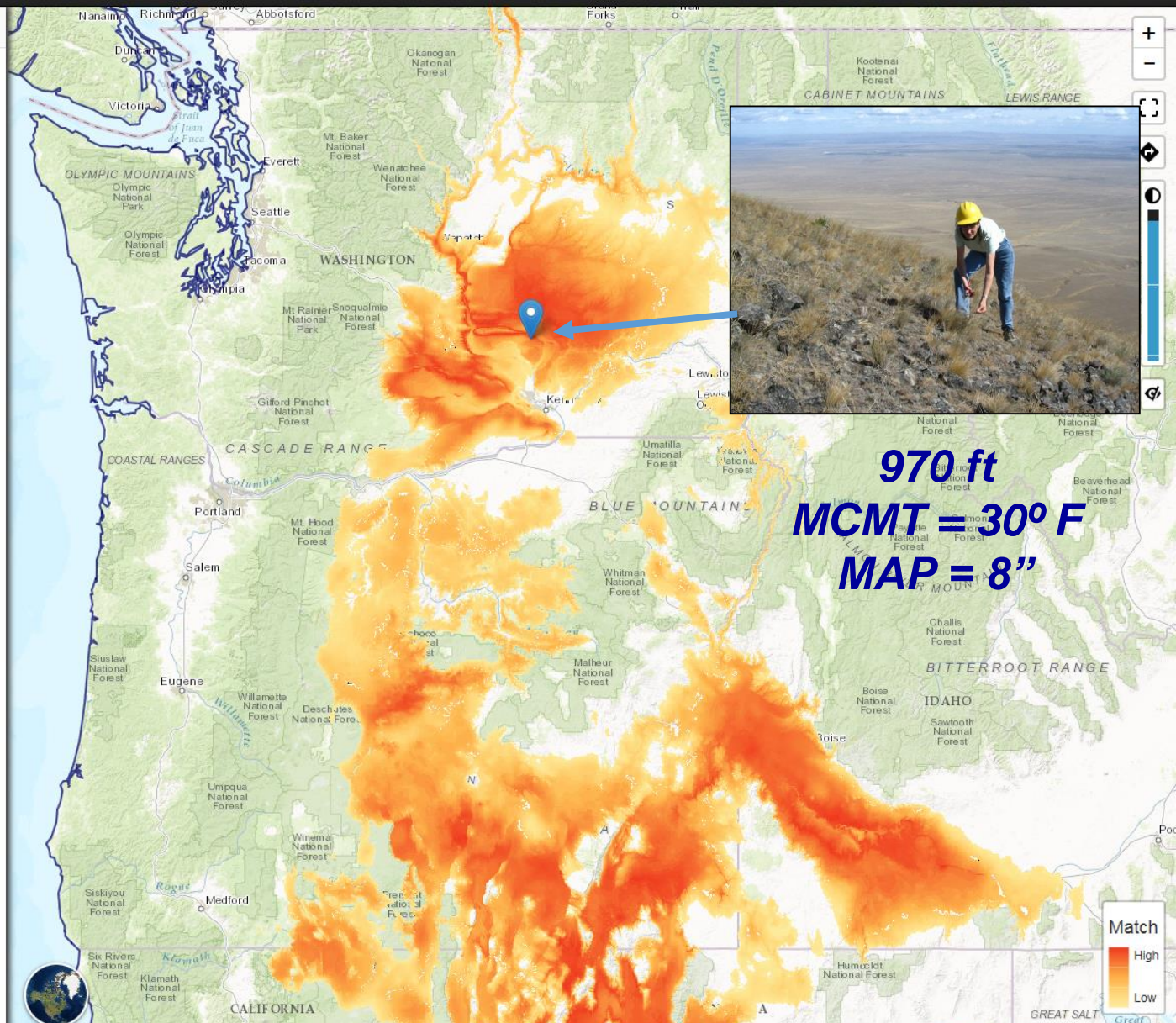
Add a variable...

### 6 Map your Results

Run Tool

Save Last Run

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# Blue Mountains source – cool, wet

## Seedlot Selection Tool

Purpose Instructions More Information People News & Updates Report an Issue Account

About Tool Saved Runs

### 1 Select objective

Find seedlots Find planting sites

### 2 Select seedlot location

Locate your seedlot (its climatic center)  
Use the map or enter coordinates

Lat: 45.2176 Lon: -118.6631

Elevation: 4633 ft

### 3 Select climate scenarios

Which climate are the seedlots adapted to?

1961 - 1990

When should trees be best adapted to the planting site?

1981 - 2010

### 4 Select transfer limit method

Custom Zone

### 5 Select climate variables

Units: Metric Imperial

Name	Center	Transfer limit (+/-)
MCMT	-3.8 °C	2.00 °C
MAP	638 mm	300 mm

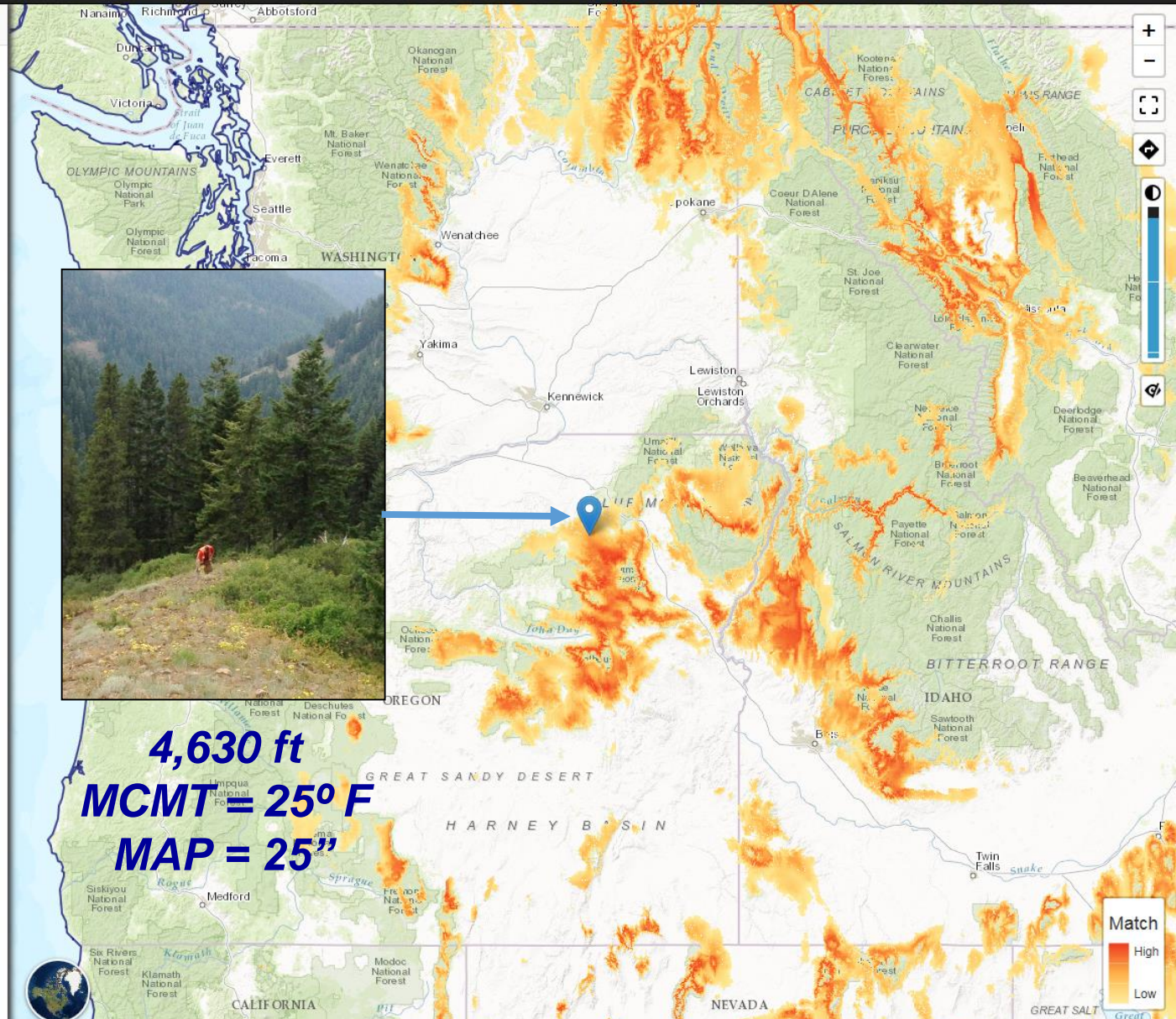
Add a variable...

### 6 Map your Results

Run Tool

Save Last Run

Export PDF





# Upper Snake River – cold, dry source

## Seedlot Selection Tool

Purpose Instructions More Information People News & Updates Report an Issue Account

About Tool Saved Runs

### 1 Select objective

Find seedlots Find planting sites

### 2 Select seedlot location

Locate your seedlot (its climatic center)  
Use the map or enter coordinates

Lat: 43.1740 Lon: -114.0340

Elevation: 4570 ft

### 3 Select climate scenarios

Which climate are the seedlots adapted to?

1961 - 1990

When should trees be best adapted to the planting site?

1981 - 2010

### 4 Select transfer limit method

Custom Zone

### 5 Select climate variables

Units: Metric Imperial

Name	Center	Transfer limit (+/-)
MCMT	-6.4 °C	2.00 °C
MAP	290 mm	300 mm

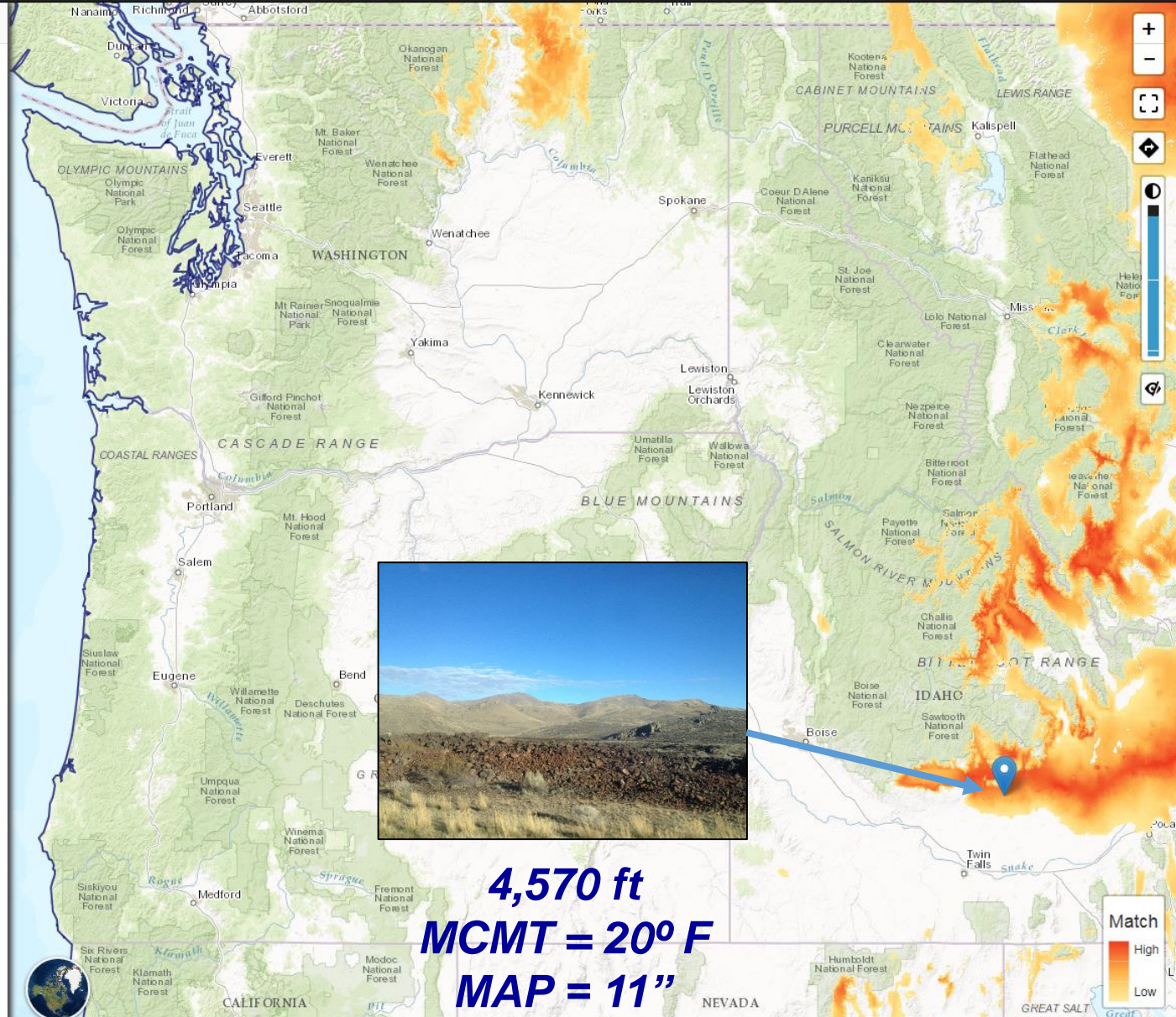
Add a variable...

### 6 Map your Results

Run Tool

Save Last Run

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A landscape photograph showing rolling green hills under a sky filled with large, white, fluffy clouds. The foreground is dominated by dense, green grasses. A dirt road or path is visible on the left side, leading into the distance. The overall scene is bright and natural, with a focus on the environment.

# Climate Change



# *Do we really need to worry about climate change?*

*Two questions:*

- 1. Are native populations adapted to current and future climates?*
- 2. If not, how far do we have to go to find populations adapted to a planting site (assisted migration)?*

# Adapted Sources for Soda Fire Restoration

## Seedlot Selection Tool

Purpose Instructions More Information People News & Updates Report an Issue Account

About Tool Saved Runs

### 1 Select objective

Find seedlots Find planting sites

### 2 Select planting site location

Locate your planting site  
Use the map or enter coordinates

Lat: 43.1230 Lon: -116.9570

Elevation: 4892 ft

### 3 Select climate scenarios

Which climate are the seedlots adapted to?

1961 - 1990

When should trees be best adapted to the planting site?

1981 - 2010

### 4 Select transfer limit method

Custom Zone

### 5 Select climate variables

Units: Metric Imperial

Name	Center	Transfer limit (+/-)	
MCMT	-2.7 °C	2.00 °C	
MAP	420 mm	250 mm	

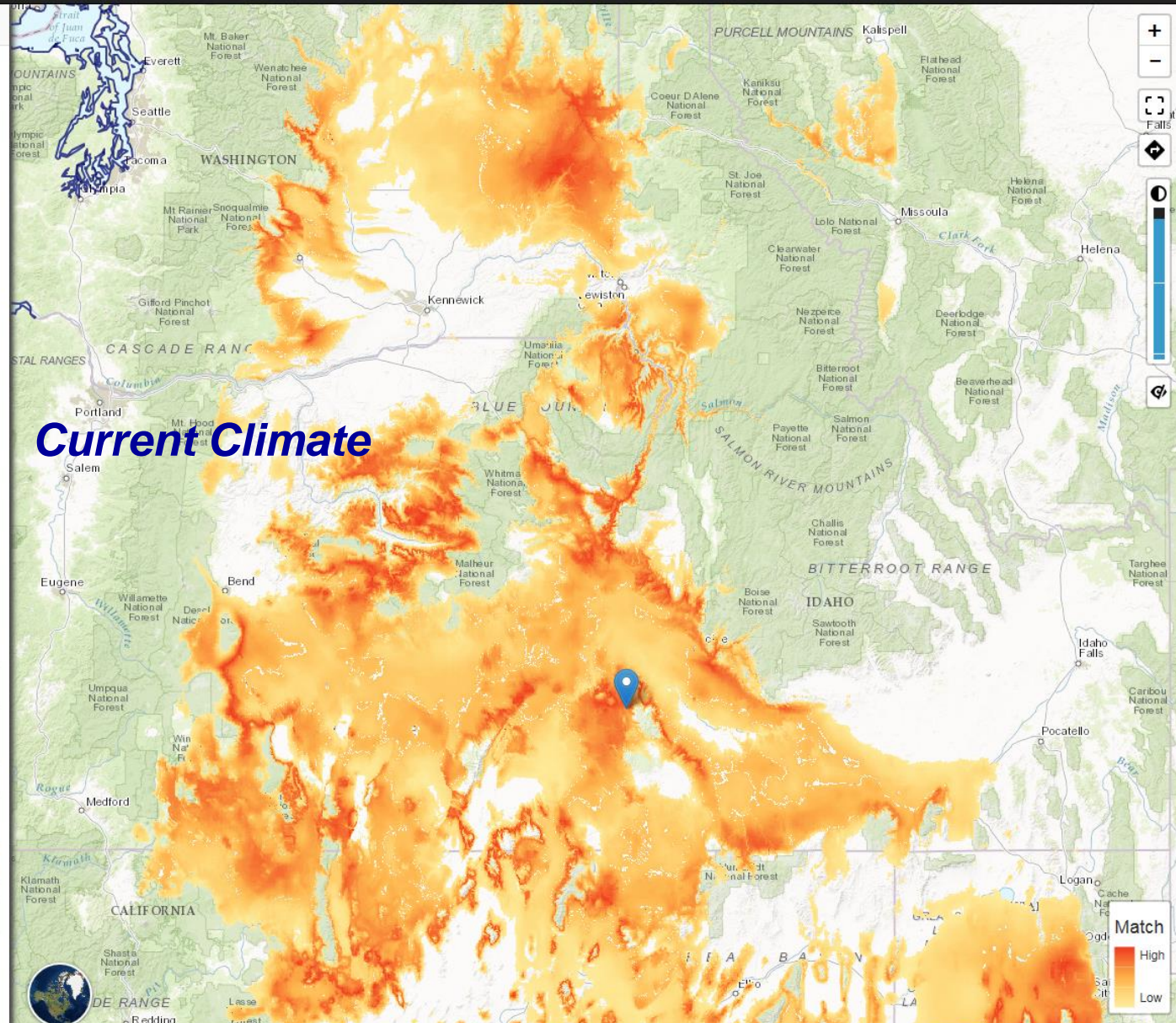
Add a variable...

### 6 Map your Results

Run Tool

Save Last Run

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# Seed sources adapted to 2025 climate RCP4.5

## Seedlot Selection Tool

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About Tool Saved Runs

### 1 Select objective

Find seedlots Find planting sites

### 2 Select planting site location

Locate your planting site  
Use the map or enter coordinates

Lat: 43.1230 Lon: -116.9570

Elevation: 4892 ft

### 3 Select climate scenarios

Which climate are the seedlots adapted to?

1961 - 1990

When should trees be best adapted to the planting site?

2011 - 2040 RCP4.5

### 4 Select transfer limit method

Custom Zone

### 5 Select climate variables

Units: Metric Imperial

Name	Center	Transfer limit (+/-)	
MCMT	-1.7 °C	2.00 °C	
MAP	447 mm	250 mm	

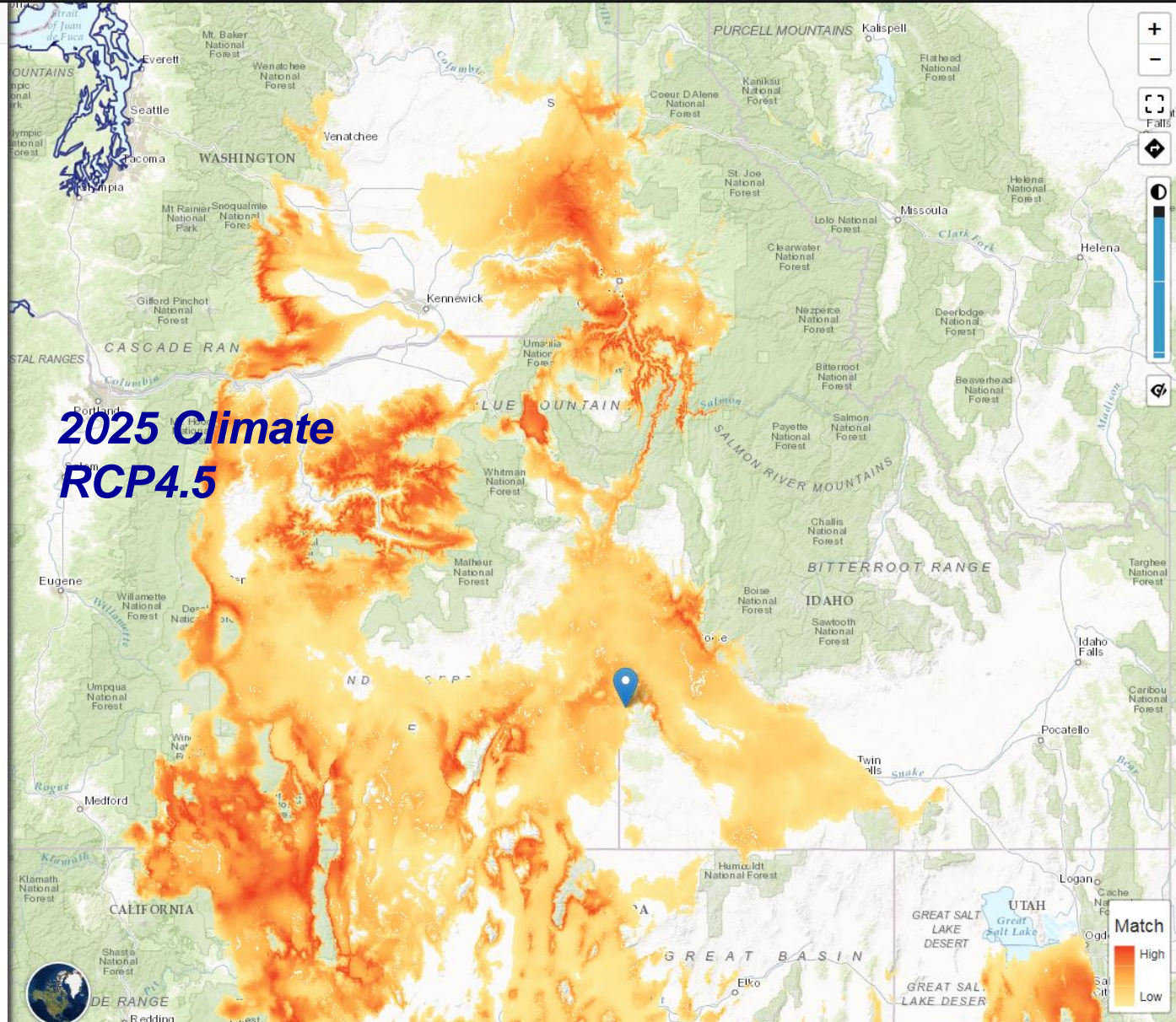
Add a variable...

### 6 Map your Results

Run Tool

Save Last Run

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# 2025 climate RCP8.5

## Seedlot Selection Tool

Purpose Instructions More Information People News & Updates Report an Issue Account

About Tool Saved Runs

### 1 Select objective

Find seedlots Find planting sites

### 2 Select planting site location

Locate your planting site  
Use the map or enter coordinates

Lat: 43.1230 Lon: -116.9570

Elevation: 4892 ft

### 3 Select climate scenarios

Which climate are the seedlots adapted to?

1961 - 1990

When should trees be best adapted to the planting site?

2011 - 2040 RCP8.5

### 4 Select transfer limit method

Custom Zone

### 5 Select climate variables

Units: Metric Imperial

Name	Center	Transfer limit (+/-)	
MCMT	-1.5 °C	2.00 °C	
MAP	444 mm	250 mm	

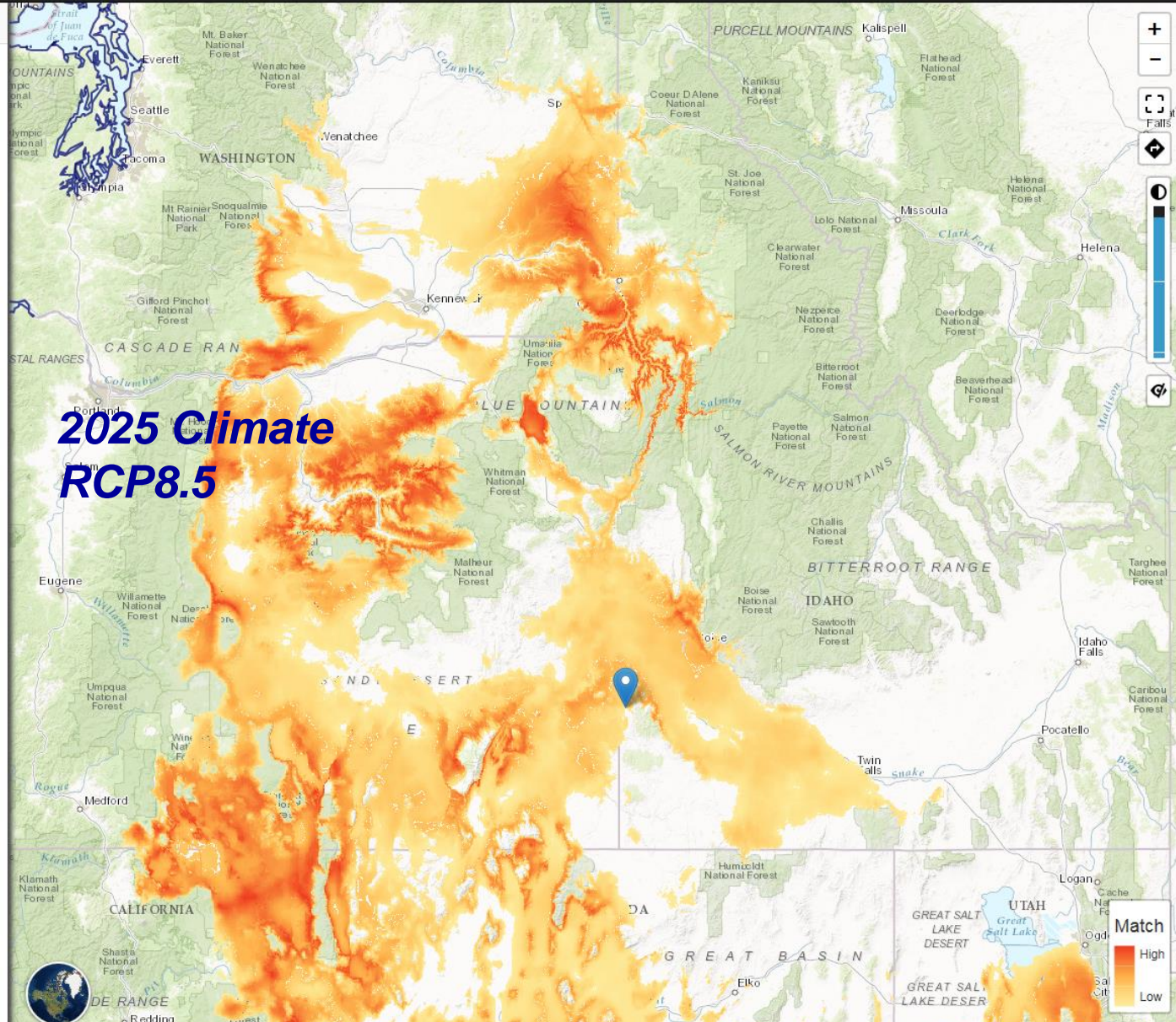
Add a variable...

### 6 Map your Results

Run Tool

Save Last Run

Export PDF





# 2055 climate RCP4.5

## Seedlot Selection Tool

Purpose Instructions More Information People News & Updates Report an Issue Account

About Tool Saved Runs

### 1 Select objective

Find seedlots Find planting sites

### 2 Select planting site location

Locate your planting site  
Use the map or enter coordinates

Lat: 43.1230 Lon: -116.9570

Elevation: 4892 ft

### 3 Select climate scenarios

Which climate are the seedlots adapted to?

1961 - 1990

When should trees be best adapted to the planting site?

2041 - 2070 RCP4.5

### 4 Select transfer limit method

Custom Zone

### 5 Select climate variables

Units: Metric Imperial

Name	Center	Transfer limit (+/-)
MCMT	-0.5 °C	2.00 °C
MAP	453 mm	250 mm

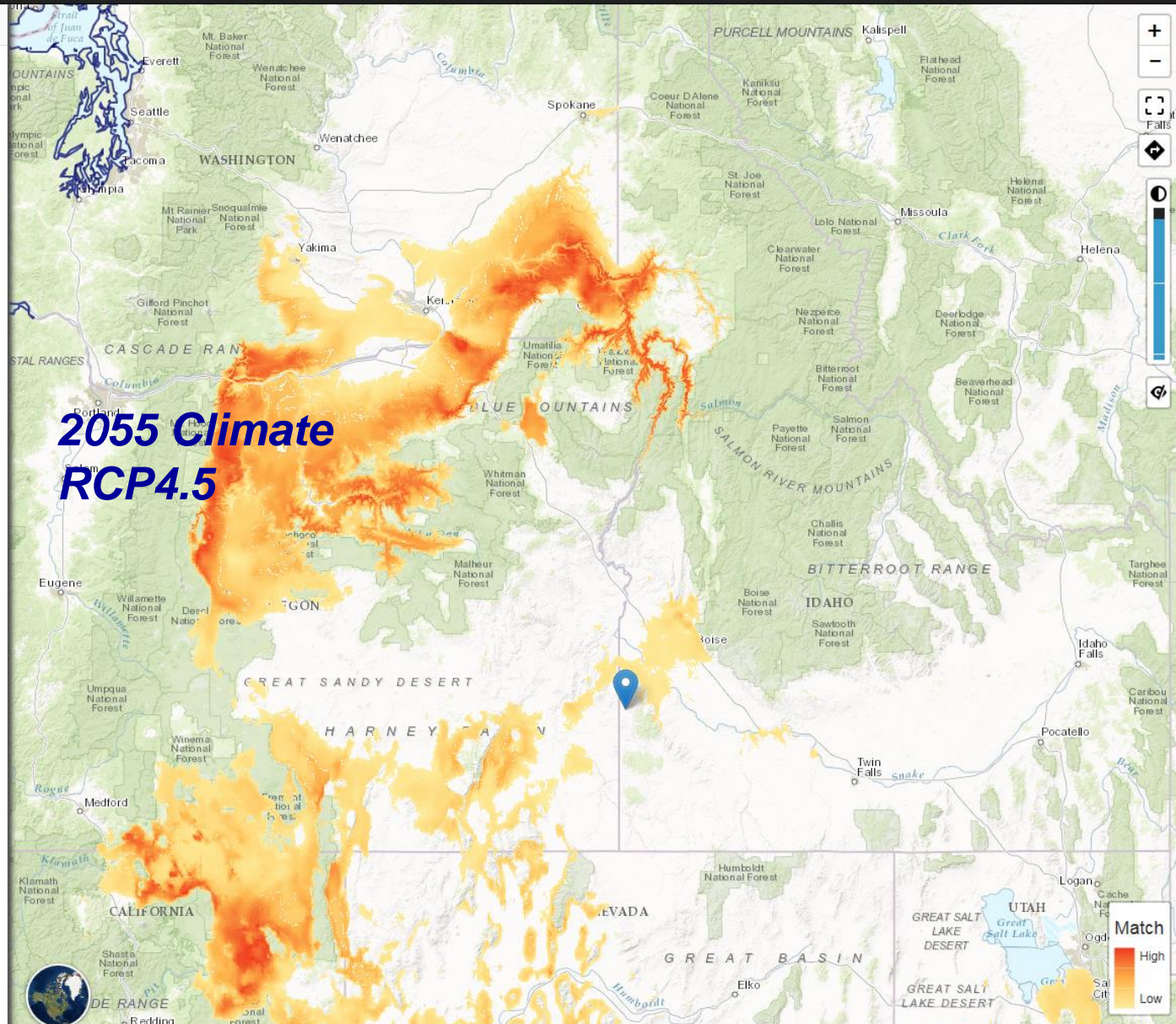
Add a variable...

### 6 Map your Results

Run Tool

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# 2085 climate RCP4.5

## Seedlot Selection Tool

Purpose Instructions More Information People News & Updates Report an Issue Account

About Tool Saved Runs

### 1 Select objective

Find seedlots Find planting sites

### 2 Select planting site location

Locate your planting site  
Use the map or enter coordinates

Lat: 43.1230 Lon: -116.9570

Elevation: 4892 ft

### 3 Select climate scenarios

Which climate are the seedlots adapted to?

1961 - 1990

When should trees be best adapted to the planting site?

2071 - 2100 RCP4.5

### 4 Select transfer limit method

Custom Zone

### 5 Select climate variables

Units: Metric Imperial

Name	Center	Transfer limit (+/-)
MCMT	0.1 °C	2.00 °C
MAP	462 mm	250 mm

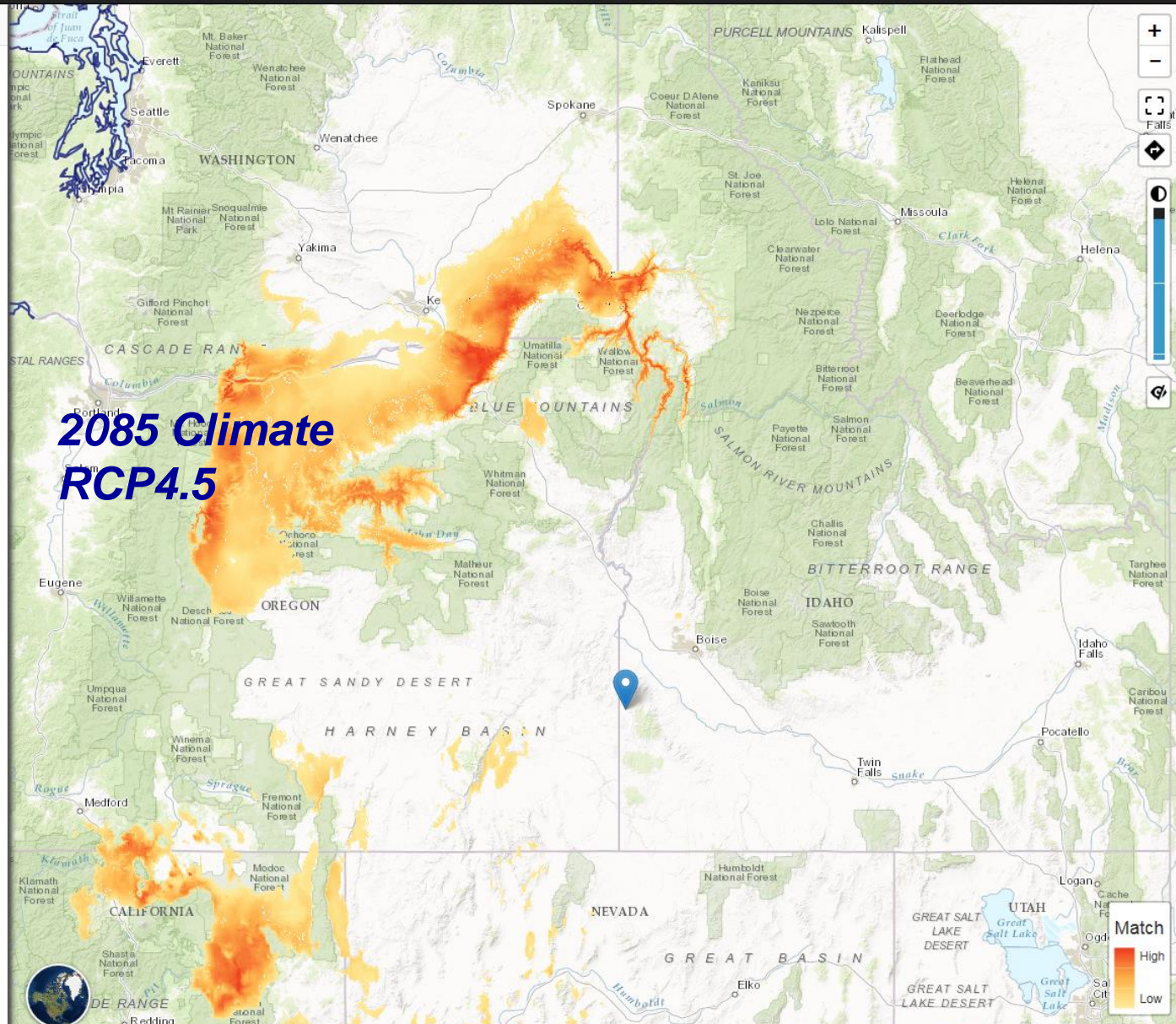
Add a variable...

### 6 Map your Results

Run Tool

Save Last Run

Export PDF





# 2085 climate RCP8.5

## Seedlot Selection Tool

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Find seedlots Find planting sites

### 2 Select planting site location

Locate your planting site  
Use the map or enter coordinates

Lat: 43.1230 Lon: -116.9570

Elevation: 4892 ft

### 3 Select climate scenarios

Which climate are the seedlots adapted to?

1961 - 1990

When should trees be best adapted to the planting site?

2071 - 2100

RCP8.5

### 4 Select transfer limit method

Custom Zone

### 5 Select climate variables

Units: Metric Imperial

	Name	Center	Transfer limit (+/-)	
X	MCMT	2.1 °C	2.00 °C	⊖
X	MAP	484 mm	250 mm	⊖

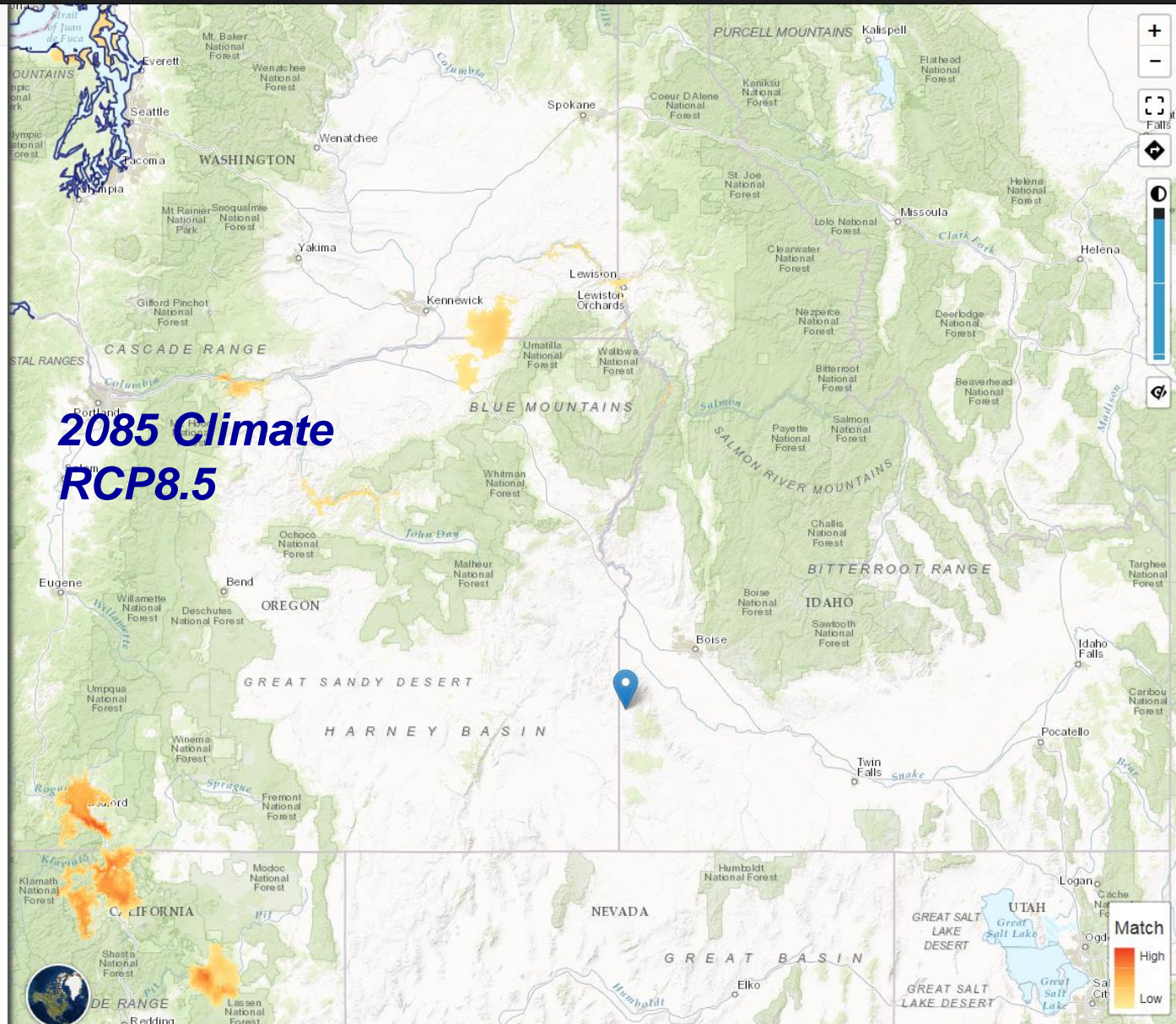
Add a variable...

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# Seed sources adapted to Wahluke planting site

## Seedlot Selection Tool

Purpose Instructions More Information People News & Updates Report an Issue Account

About Tool Saved Runs

### 1 Select objective

Find seedlots Find planting sites

### 2 Select planting site location

Locate your planting site  
Use the map or enter coordinates

Lat: 46.7355 Lon: -119.2932

Elevation: 971 ft

### 3 Select climate scenarios

Which climate are the seedlots adapted to?

1961 - 1990

When should trees be best adapted to the planting site?

1981 - 2010

### 4 Select transfer limit method

Custom Zone

### 5 Select climate variables

Units: Metric Imperial

Name	Center	Transfer limit (+/-)	
MCMT	-0.4 °C	2.00 °C	
MAP	221 mm	200 mm	

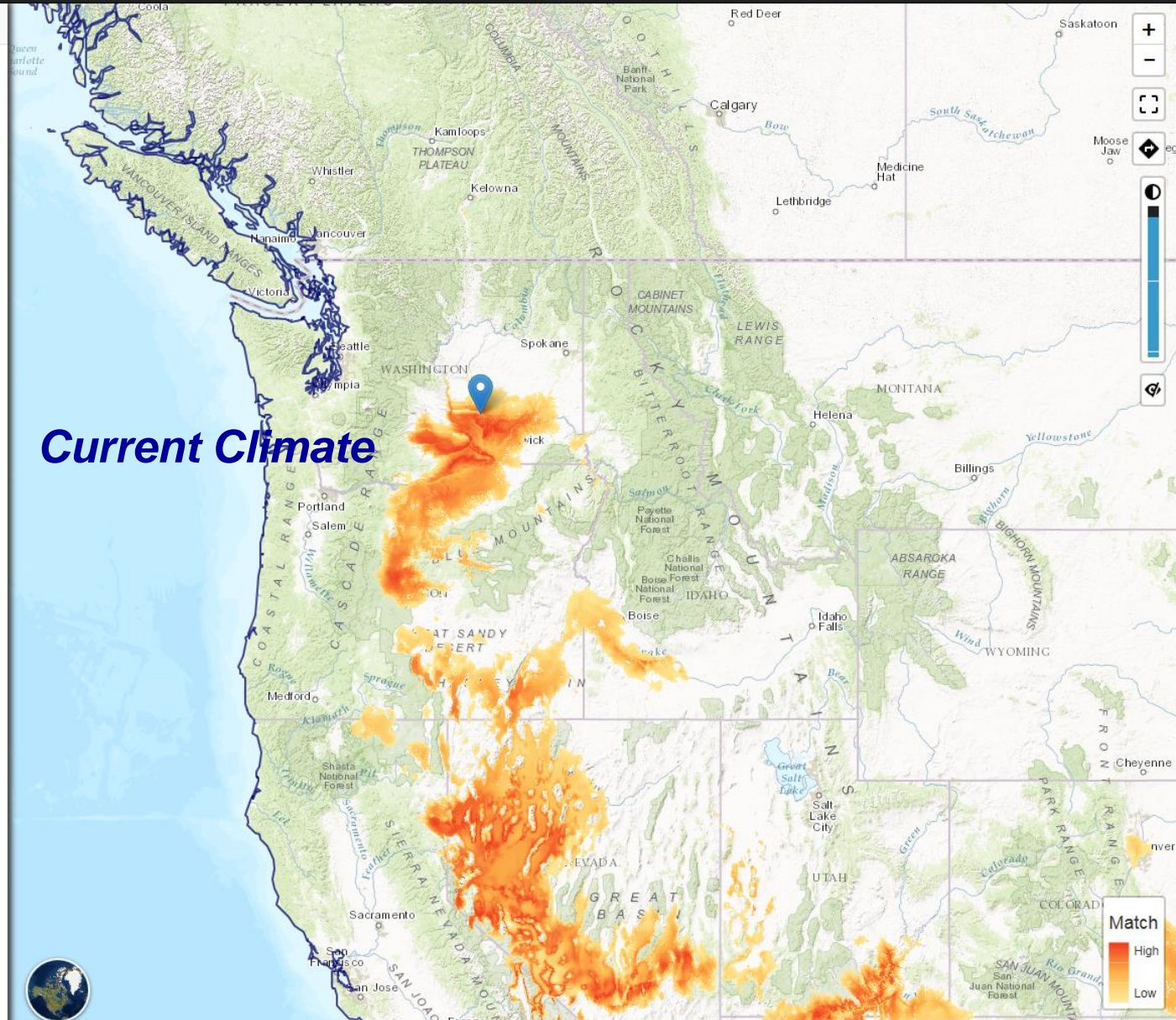
Add a variable...

### 6 Map your Results

Run Tool

Save Last Run

Export PDF



Match  
High  
Low



# 2025 climate RCP4.5

## Seedlot Selection Tool

Purpose Instructions More Information People News & Updates Report an Issue Account

About Tool Saved Runs

### 1 Select objective

Find seedlots Find planting sites

### 2 Select planting site location

Locate your planting site  
Use the map or enter coordinates

Lat: 46.7355 Lon: -119.2932

Elevation: 971 ft

### 3 Select climate scenarios

Which climate are the seedlots adapted to?

1961 - 1990

When should trees be best adapted to the planting site?

2011 - 2040

RCP4.5

### 4 Select transfer limit method

Custom Zone

### 5 Select climate variables

Units: Metric Imperial

Name	Center	Transfer limit (+/-)	
MCMT	0.5 °C	2.00 °C	
MAP	210 mm	200 mm	

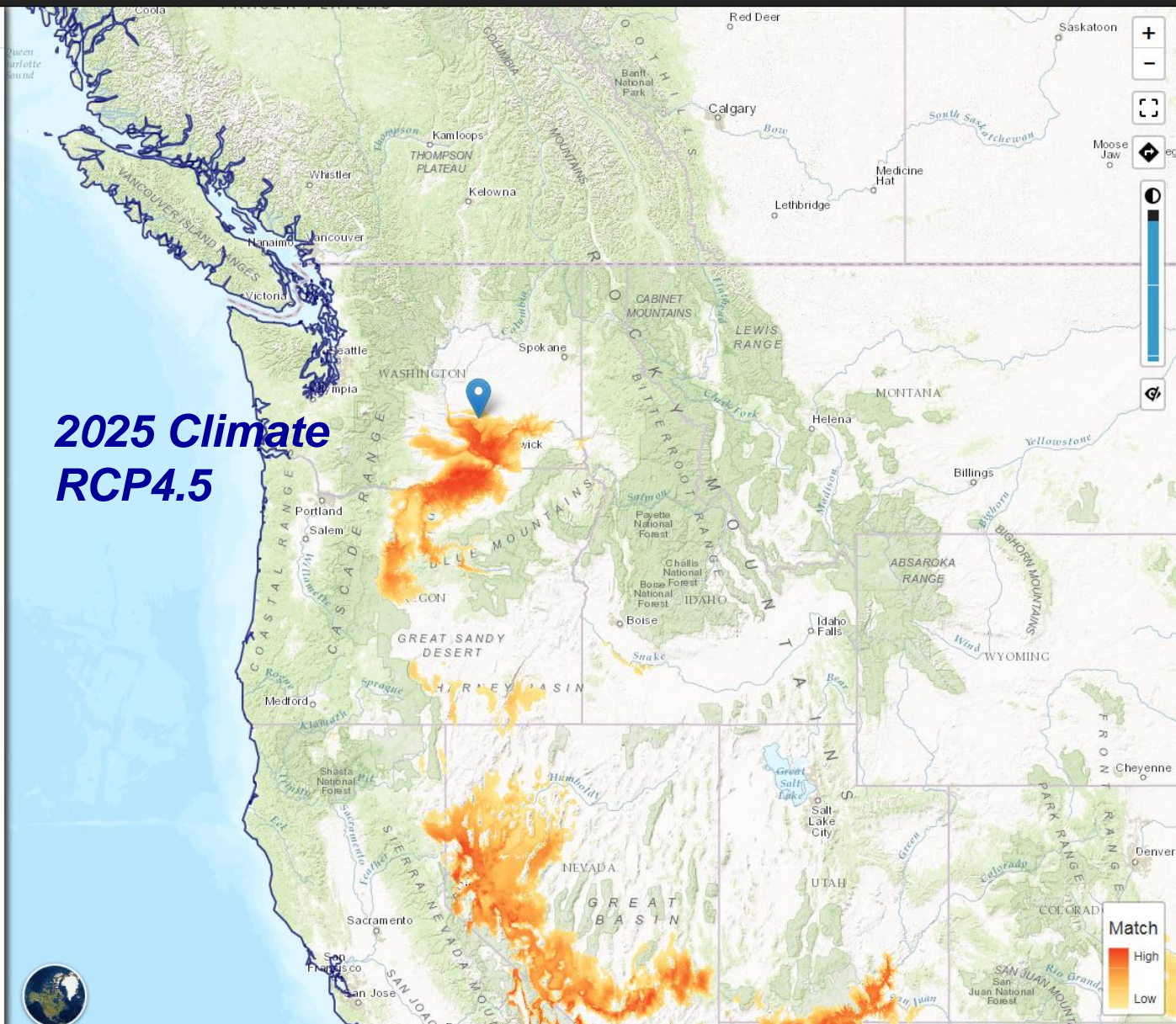
Add a variable...

### 6 Map your Results

Run Tool

Save Last Run

Export PDF



Map navigation controls including zoom in (+), zoom out (-), full screen, location pin, and a vertical color scale legend.

Match legend with a color scale from red (High) to yellow (Low).



# 2055 climate RCP4.5

## Seedlot Selection Tool

Purpose Instructions More Information People News & Updates Report an Issue Account

About Tool Saved Runs

### 1 Select objective

Find seedlots Find planting sites

### 2 Select planting site location

Locate your planting site  
Use the map or enter coordinates

Lat: 46.7355 Lon: -119.2932

Elevation: 971 ft

### 3 Select climate scenarios

Which climate are the seedlots adapted to?

1961 - 1990

When should trees be best adapted to the planting site?

2041 - 2070

RCP4.5

### 4 Select transfer limit method

Custom Zone

### 5 Select climate variables

Units: Metric Imperial

Name	Center	Transfer limit (+/-)	
✕ MCMT	1.6 °C	<u>2.00 °C</u>	⊖
✕ MAP	213 mm	<u>200 mm</u>	⊖

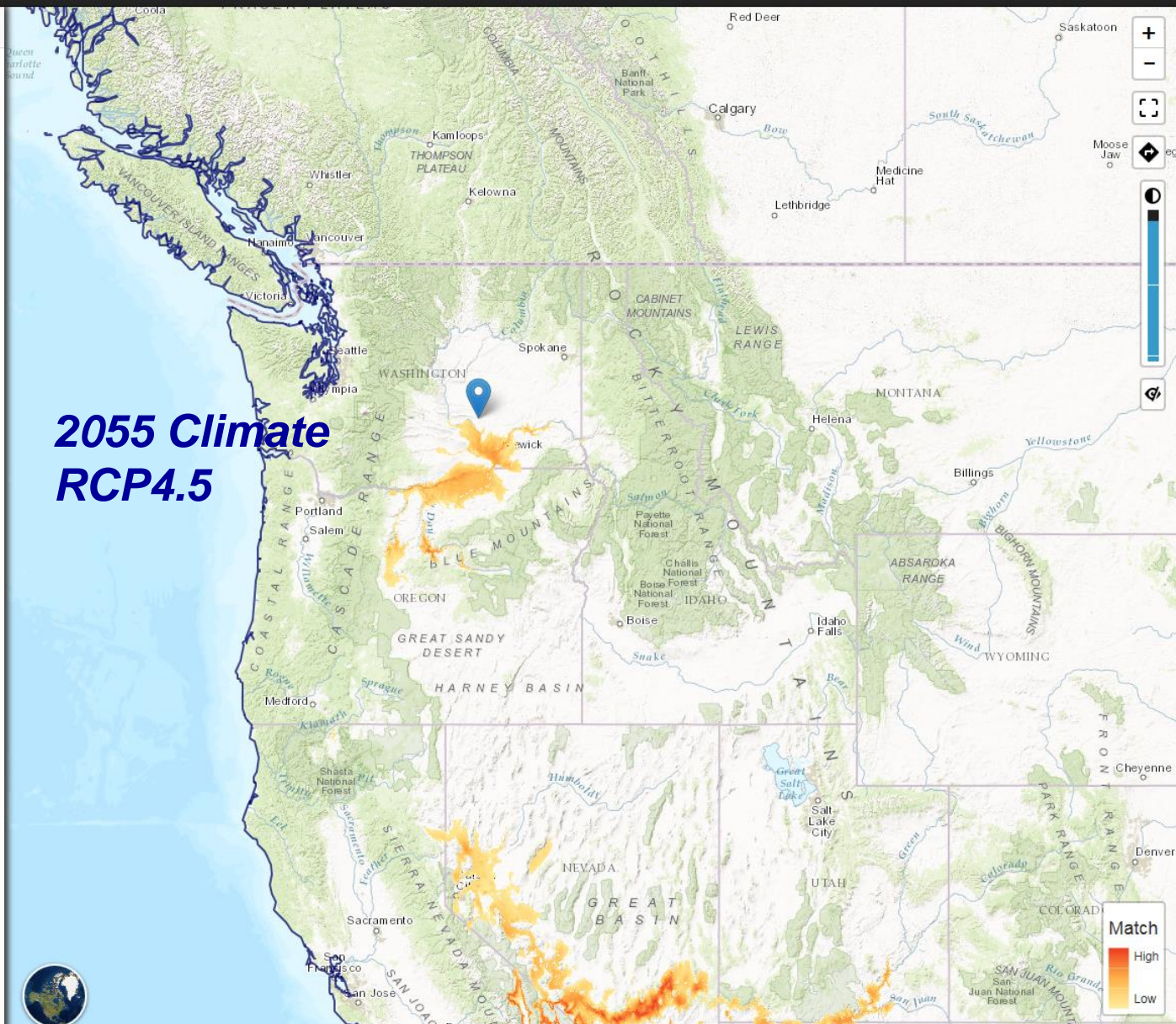
Add a variable...

### 6 Map your Results

Run Tool

Save Last Run

Export PDF





# 2085 climate RCP4.5

## Seedlot Selection Tool

Purpose Instructions More Information People News & Updates Report an Issue Account

About Tool Saved Runs

### 1 Select objective

Find seedlots Find planting sites

### 2 Select planting site location

Locate your planting site  
Use the map or enter coordinates

Lat: 46.7355 Lon: -119.2932

Elevation: 971 ft

### 3 Select climate scenarios

Which climate are the seedlots adapted to?

1961 - 1990

When should trees be best adapted to the planting site?

2071 - 2100

RCP4.5

### 4 Select transfer limit method

Custom Zone

### 5 Select climate variables

Units: Metric Imperial

Name	Center	Transfer limit (+/-)	
✕ MCMT	2.1 °C	<u>2.00 °C</u>	⊖
✕ MAP	216 mm	<u>200 mm</u>	⊖

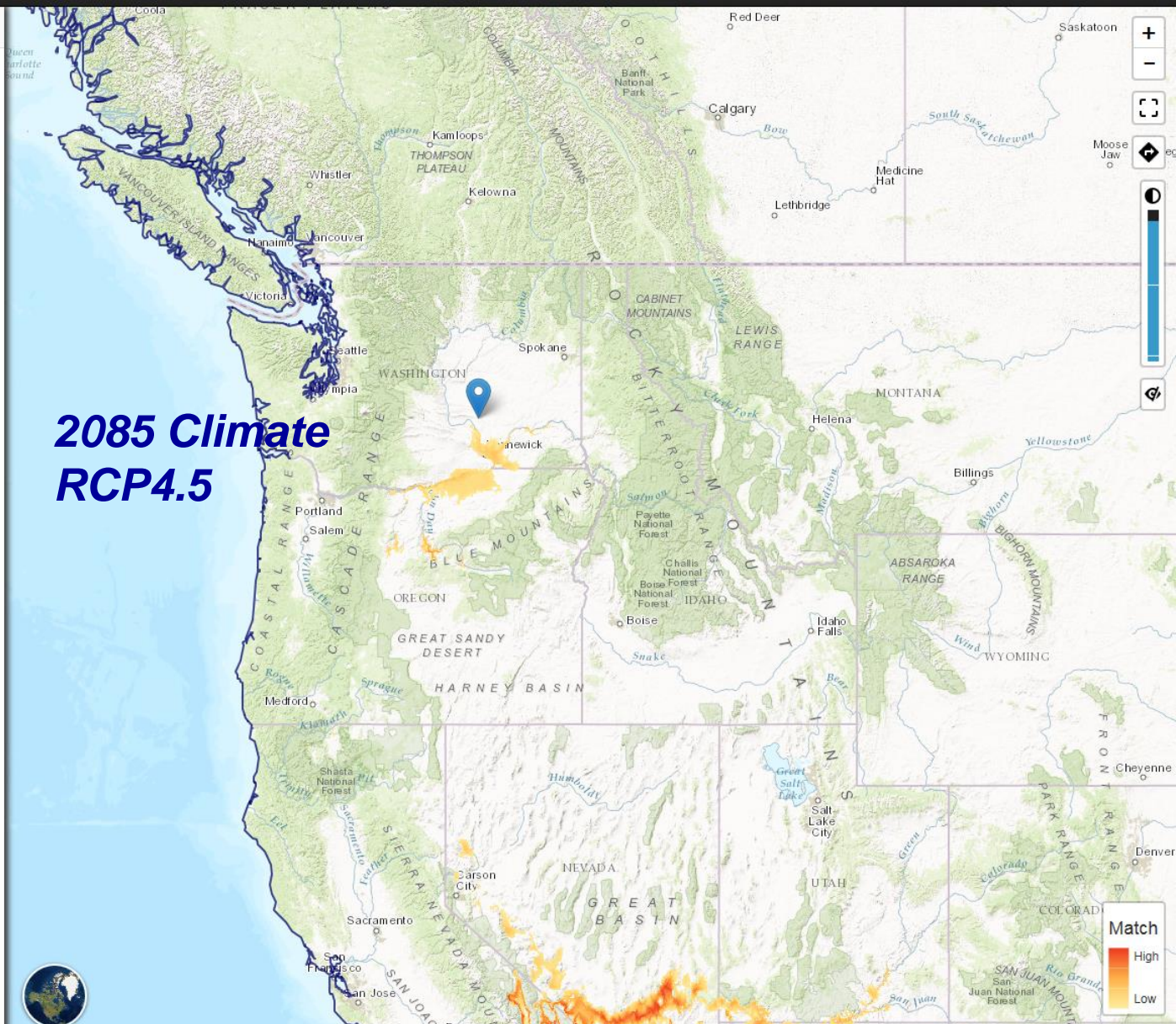
Add a variable...

### 6 Map your Results

Run Tool

Save Last Run

Export PDF



Map navigation controls including zoom in (+), zoom out (-), full screen, location pin, and a vertical color scale legend.

Match legend showing a color gradient from red (High) to yellow (Low).



# 2085 climate RCP8.5

## Seedlot Selection Tool

Purpose Instructions More Information People News & Updates Report an Issue Account

About Tool Saved Runs

### 1 Select objective

Find seedlots Find planting sites

### 2 Select planting site location

Locate your planting site  
Use the map or enter coordinates

Lat: 46.7355 Lon: -119.2932

Elevation: 971 ft

### 3 Select climate scenarios

Which climate are the seedlots adapted to?

1961 - 1990

When should trees be best adapted to the planting site?

2071 - 2100

RCP8.5

### 4 Select transfer limit method

Custom Zone

### 5 Select climate variables

Units: Metric Imperial

Name	Center	Transfer limit (+/-)	
<input type="checkbox"/> MCMT	3.9 °C	<u>2.00 °C</u>	<input type="radio"/>
<input type="checkbox"/> MAP	222 mm	<u>200 mm</u>	<input type="radio"/>

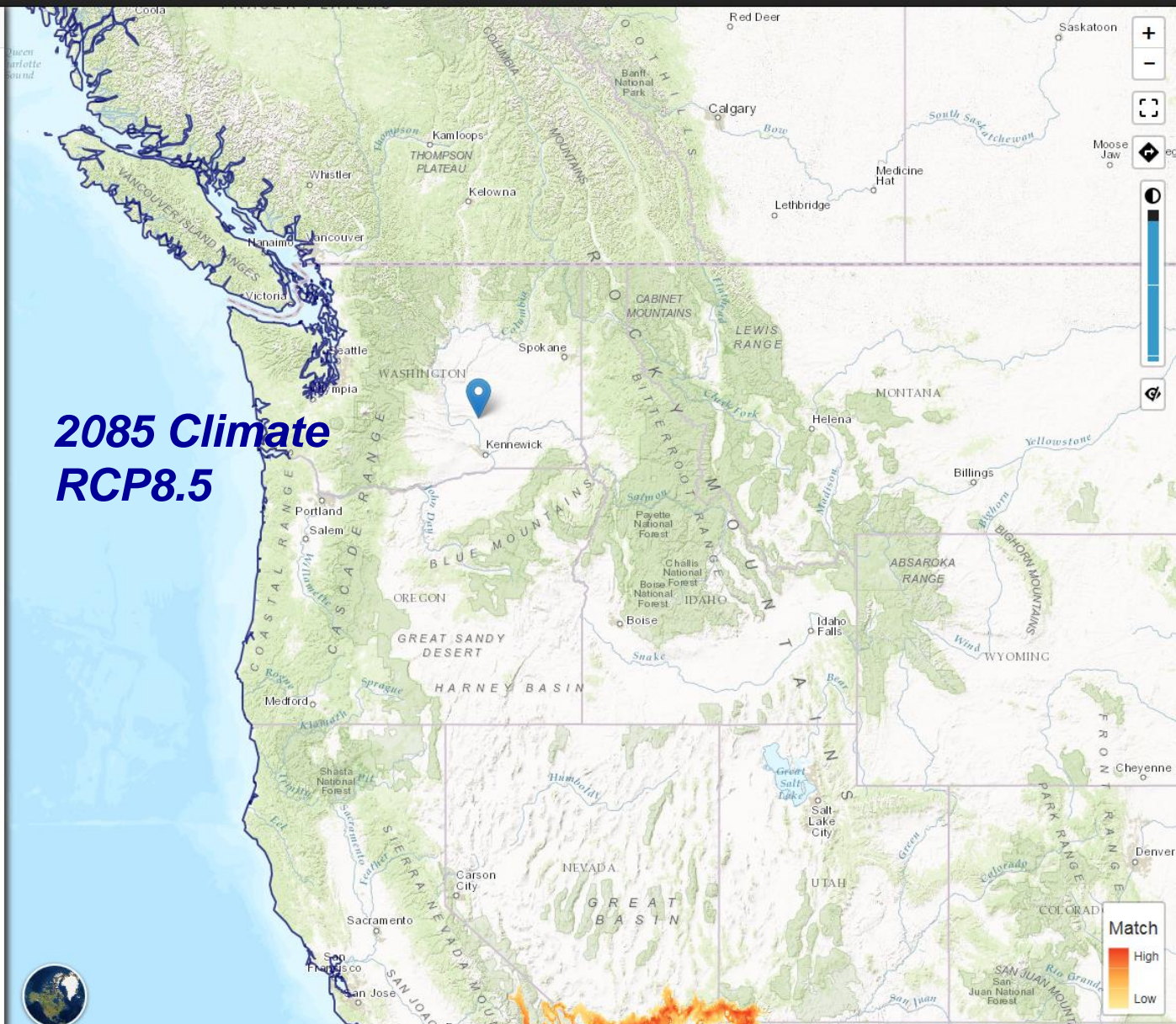
Add a variable...

### 6 Map your Results

Run Tool

Save Last Run

Export PDF



Map navigation controls: zoom in (+), zoom out (-), full screen, home, elevation scale, and refresh.

Match legend: High (red), Low (yellow).



# Planting sites for Anatone

## Seedlot Selection Tool

Purpose Instructions More Information People News & Updates Report an Issue Account

About Tool Saved Runs

### 1 Select objective

Find seedlots Find planting sites

### 2 Select seedlot location

Locate your seedlot (its climatic center)  
Use the map or enter coordinates

Lat: 46.1558 Lon: -117.0927

Elevation: 3291 ft

### 3 Select climate scenarios

Which climate are the seedlots adapted to?

1961 - 1990

When should trees be best adapted to the planting site?

1981 - 2010

### 4 Select transfer limit method

Custom Zone

### 5 Select climate variables

Units: Metric Imperial

Name	Center	Transfer limit (+/-)	
MCMT	-1.9 °C	2.00 °C	
MAP	455 mm	200 mm	

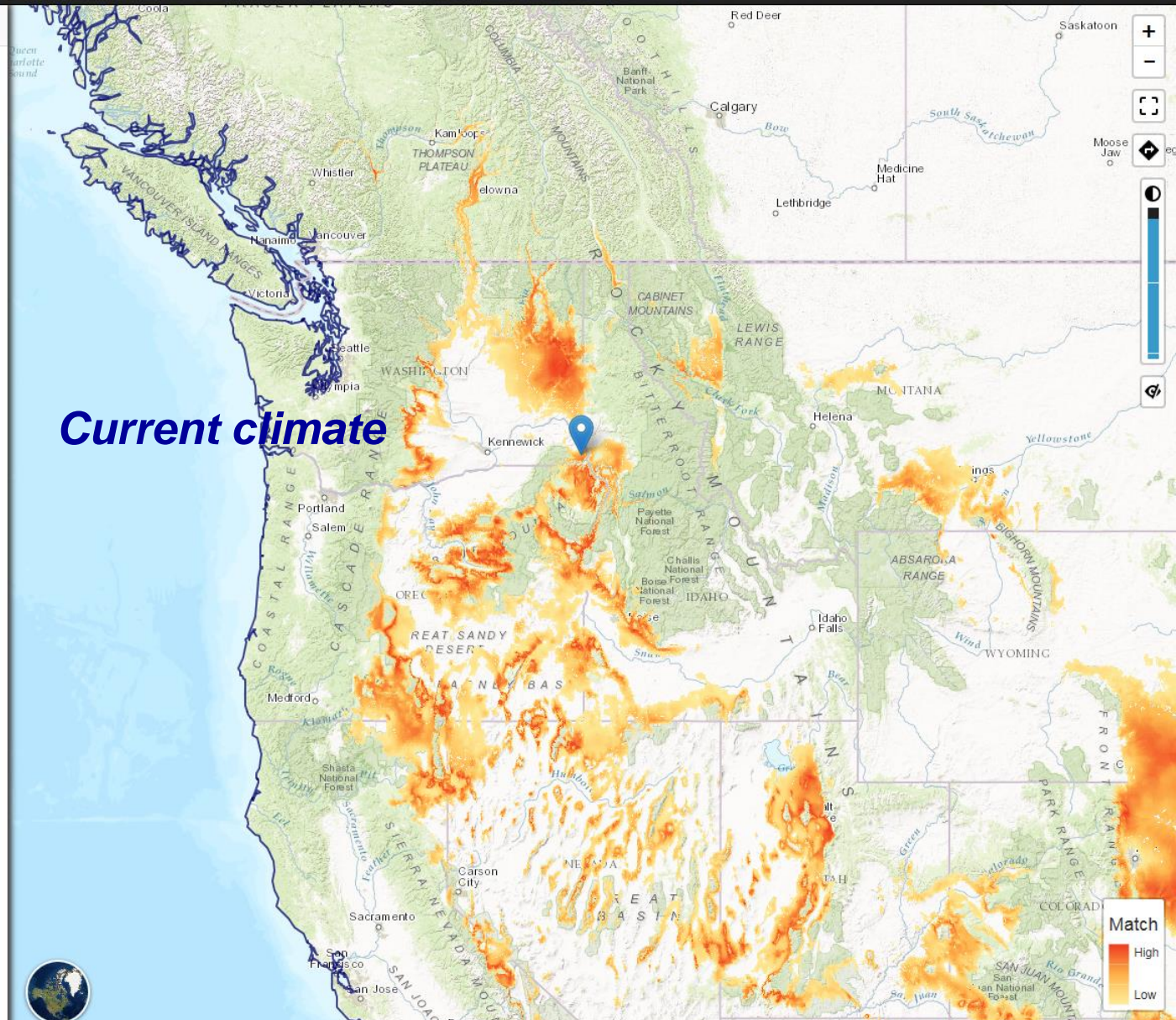
Add a variable...

### 6 Map your Results

Run Tool

Save Last Run

Export PDF





# Planting sites for Anatonne adapted to 2025

## Seedlot Selection Tool

Purpose Instructions More Information People News & Updates Report an Issue Account

About Tool Saved Runs

### 1 Select objective

Find seedlots Find planting sites

### 2 Select seedlot location

Locate your seedlot (its climatic center)  
Use the map or enter coordinates

Lat: 46.1558 Lon: -117.0927

Elevation: 3291 ft

### 3 Select climate scenarios

Which climate are the seedlots adapted to?

1961 - 1990

When should trees be best adapted to the planting site?

2011 - 2040 RCP4.5

### 4 Select transfer limit method

Custom Zone

### 5 Select climate variables

Units: Metric Imperial

Name	Center	Transfer limit (+/-)	
MCMT	-1.9 °C	2.00 °C	
MAP	455 mm	200 mm	

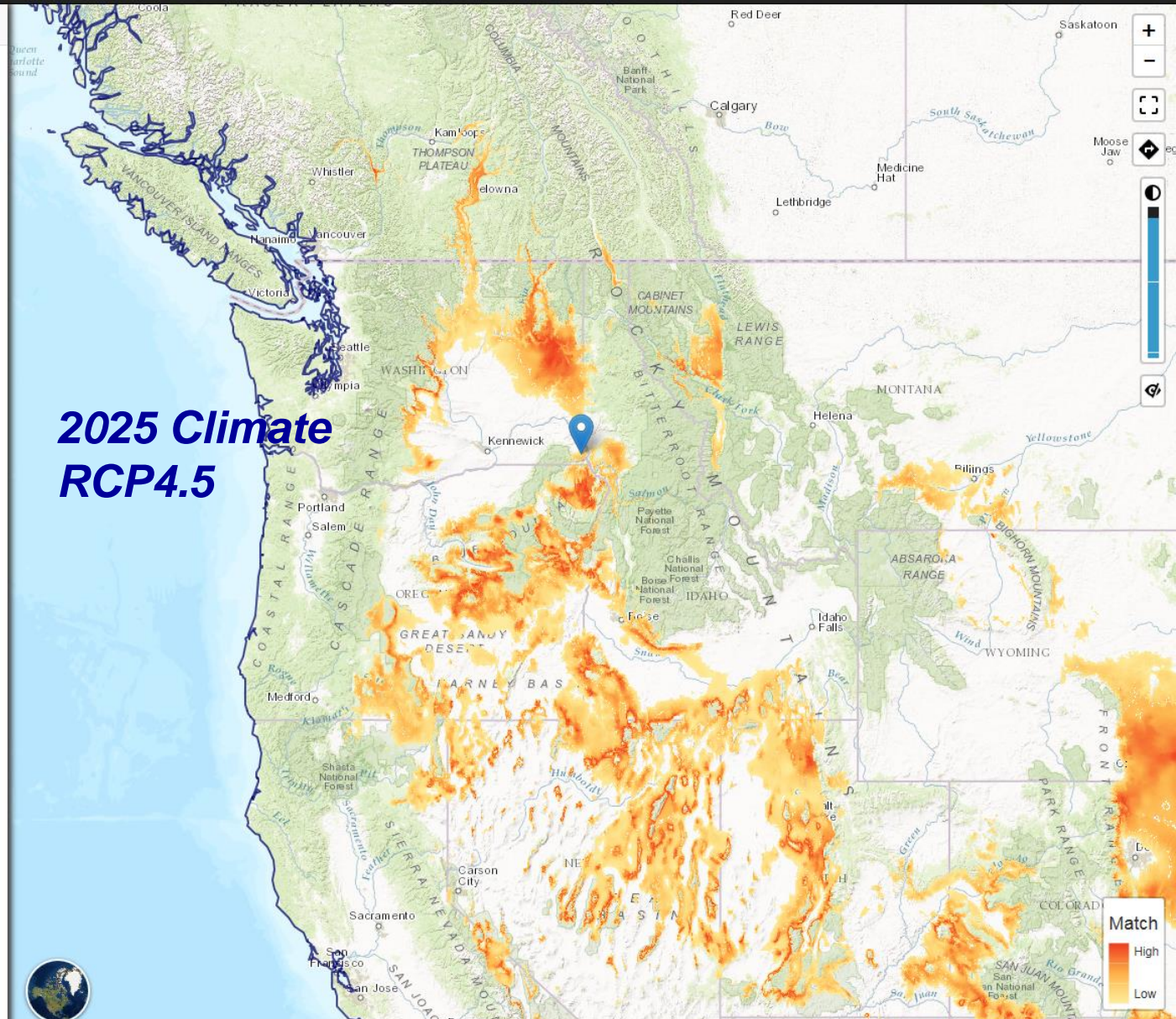
Add a variable...

### 6 Map your Results

Run Tool

Save Last Run

Export PDF



Map navigation controls: zoom in (+), zoom out (-), full screen, location, elevation scale, and refresh.

Match legend: High (red), Low (yellow).



# Planting sites for Anatonne adapted to 2055

## Seedlot Selection Tool

Purpose Instructions More Information People News & Updates Report an Issue Account

About Tool Saved Runs

### 1 Select objective

Find seedlots Find planting sites

### 2 Select seedlot location

Locate your seedlot (its climatic center)  
Use the map or enter coordinates

Lat: 46.1558 Lon: -117.0927

Elevation: 3291 ft

### 3 Select climate scenarios

Which climate are the seedlots adapted to?

1961 - 1990

When should trees be best adapted to the planting site?

2041 - 2070 RCP4.5

### 4 Select transfer limit method

Custom Zone

### 5 Select climate variables

Units: Metric Imperial

Name	Center	Transfer limit (+/-)	
MCMT	-1.9 °C	2.00 °C	⊖
MAP	455 mm	200 mm	⊖

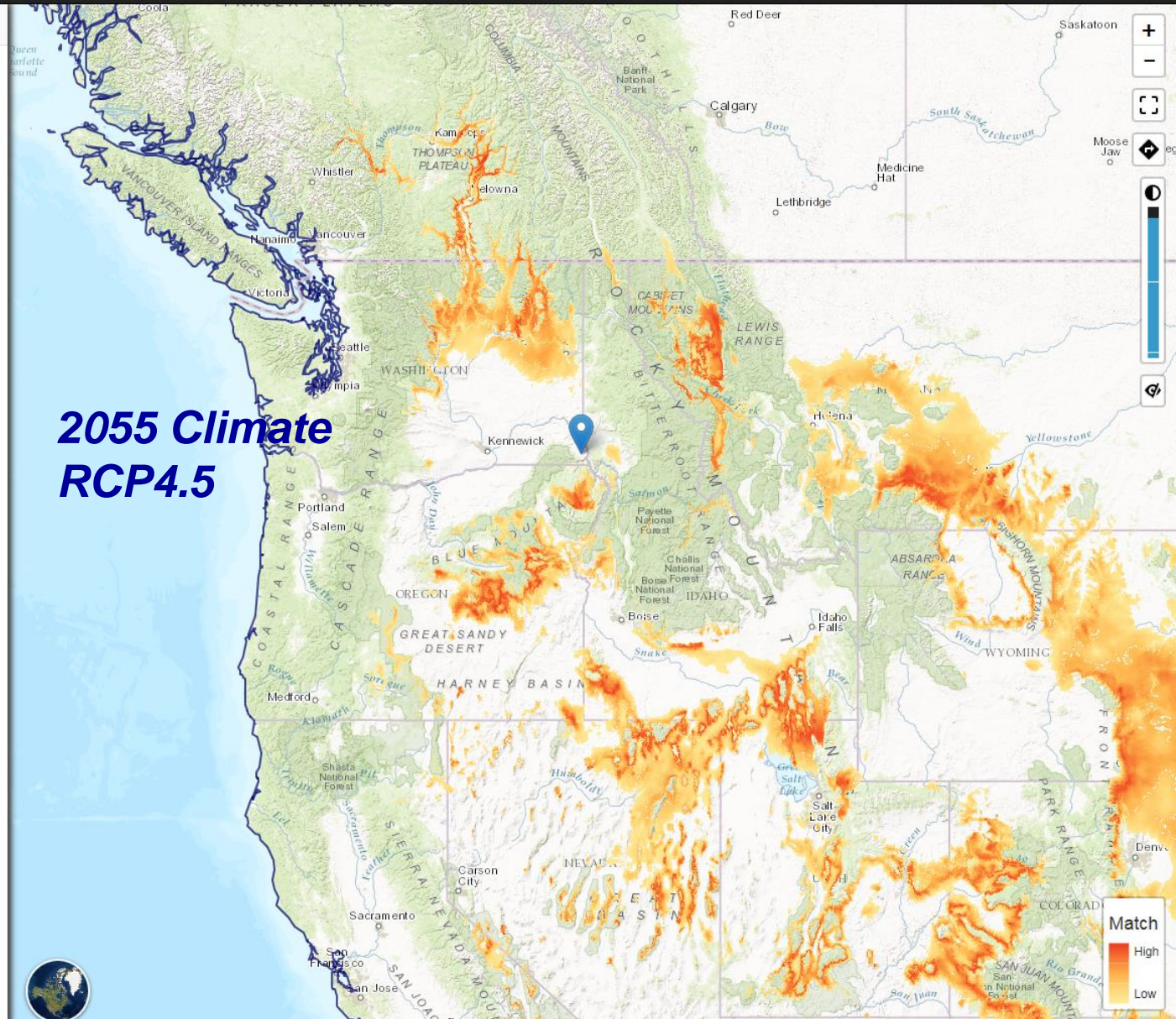
Add a variable...

### 6 Map your Results

Run Tool

Save Last Run

Export PDF



2055 Climate  
RCP4.5

Match  
High  
Low



# Planting sites for Anatone adapted to 2085

## Seedlot Selection Tool

Purpose Instructions More Information People News & Updates Report an Issue Account

About Tool Saved Runs

### 1 Select objective

Find seedlots Find planting sites

### 2 Select seedlot location

Locate your seedlot (its climatic center)  
Use the map or enter coordinates

Lat: 46.1558 Lon: -117.0927

Elevation: 3291 ft

### 3 Select climate scenarios

Which climate are the seedlots adapted to?

1961 - 1990

When should trees be best adapted to the planting site?

2071 - 2100 RCP4.5

### 4 Select transfer limit method

Custom Zone

### 5 Select climate variables

Units: Metric Imperial

Name	Center	Transfer limit (+/-)	
MCMT	-1.9 °C	2.00 °C	⊖
MAP	455 mm	200 mm	⊖

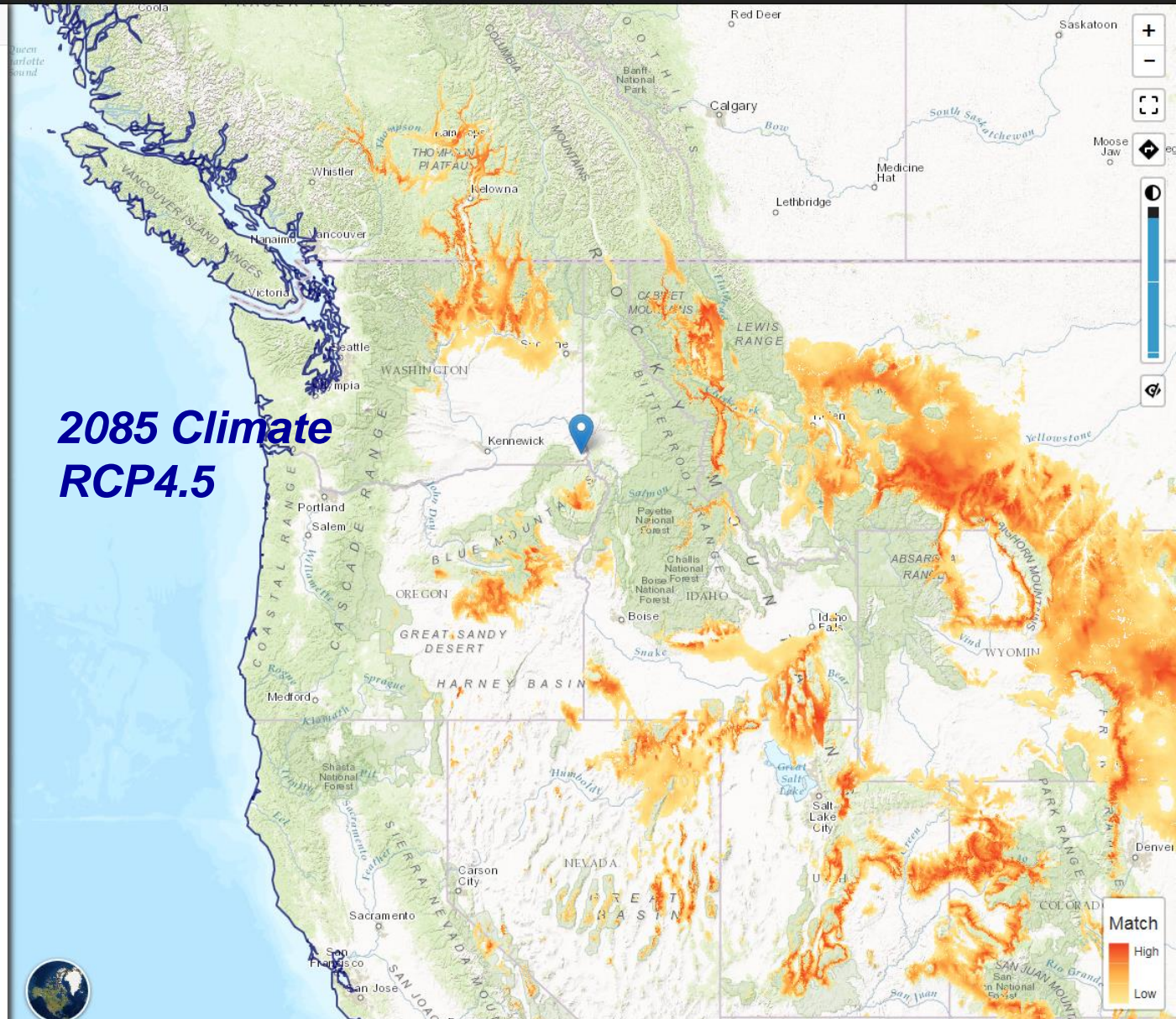
Add a variable...

### 6 Map your Results

Run Tool

Save Last Run

Export PDF



Map navigation controls including zoom in (+), zoom out (-), full screen, location pin, and a vertical color scale legend.

Match legend with a color gradient from red (High) to yellow (Low).



# Planting sites for Anatone adapted to 2085

## Seedlot Selection Tool

Purpose Instructions More Information People News & Updates Report an Issue Account

About Tool Saved Runs

### 1 Select objective

Find seedlots Find planting sites

### 2 Select seedlot location

Locate your seedlot (its climatic center)  
Use the map or enter coordinates

Lat: 46.1558 Lon: -117.0927

Elevation: 3291 ft

### 3 Select climate scenarios

Which climate are the seedlots adapted to?

1961 - 1990

When should trees be best adapted to the planting site?

2071 - 2100 RCP8.5

### 4 Select transfer limit method

Custom Zone

### 5 Select climate variables

Units: Metric Imperial

Name	Center	Transfer limit (+/-)	
MCMT	-1.9 °C	2.00 °C	⊖
MAP	455 mm	200 mm	⊖

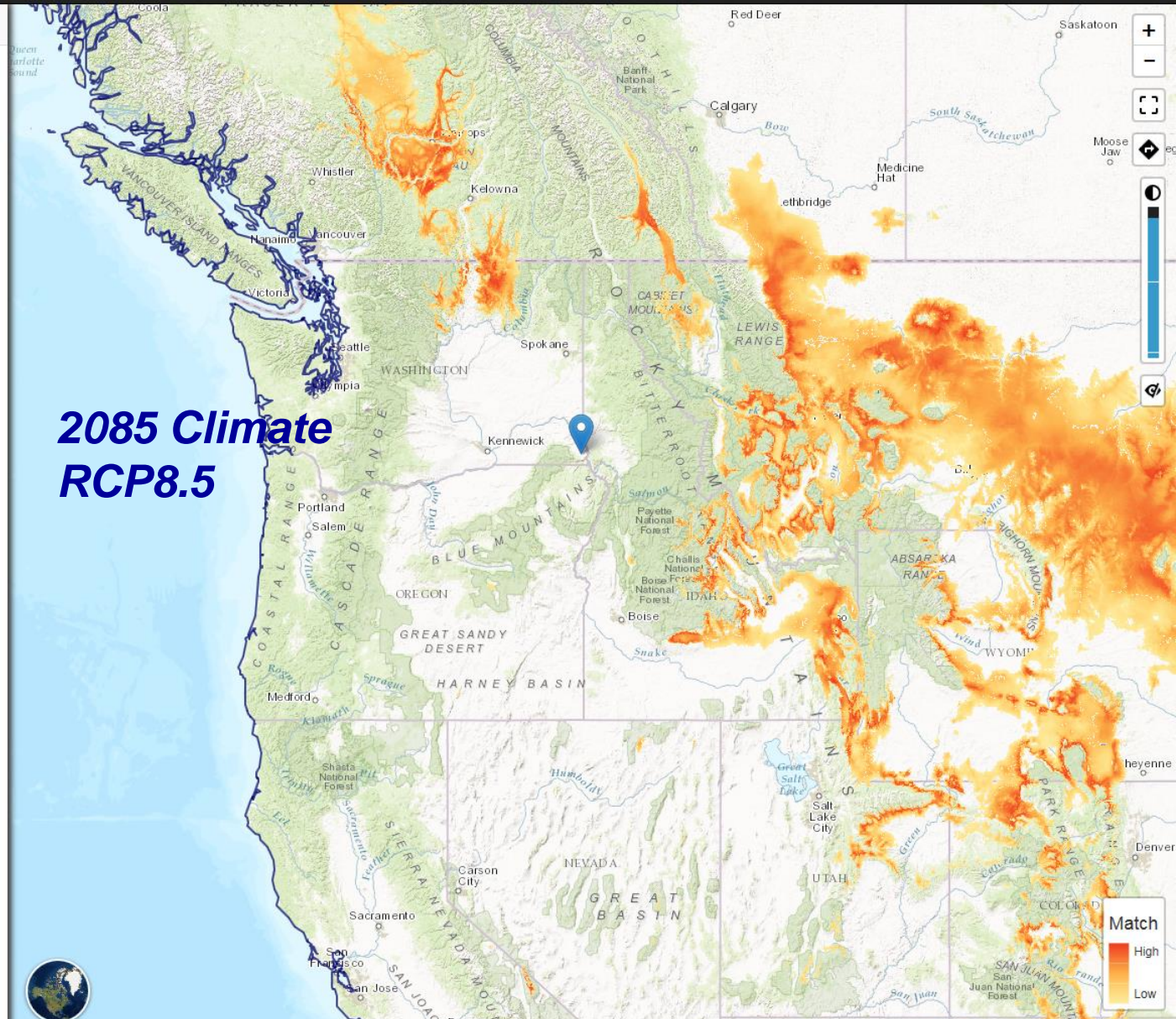
Add a variable...

### 6 Map your Results

Run Tool

Save Last Run

Export PDF





# *Do we really have to worry about climate change?*

- 1. Are native populations adapted to current and future climates?***
  - 2. If not, how far do we have to go to find populations adapted to a planting site (assisted migration)?***
- In the short-term (next decade, maybe two), local populations are adapted to the local climate*
  - Nevertheless, better-adapted populations may be found at lower elevations or further south*
  - In the long-term (by mid- to late-century), local populations are at high risk of maladaptation to projected climates*



# *Do we really have to worry about climate change?*

*Consider the potential for evolution: Can populations migrate or evolve through natural selection fast enough to keep up with climate change?*

*Depends upon:*

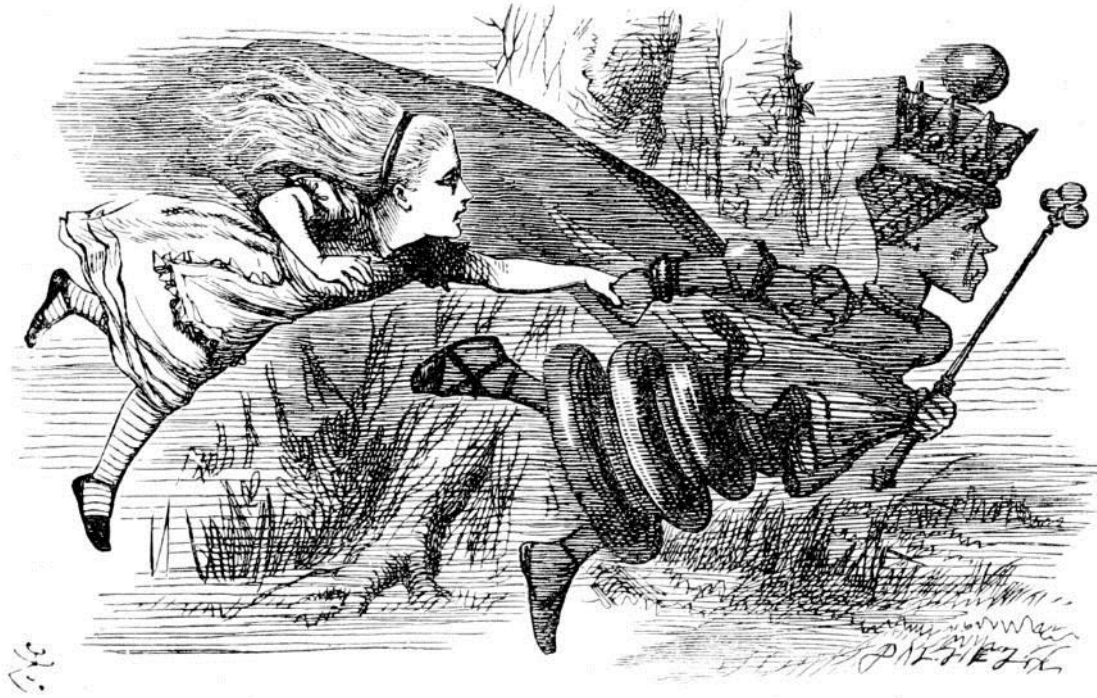
- *Generation turnover*
- *Migration rates*
  - *Seed dispersal*
  - *Fragmentation*
- *Genetic diversity*
  - *Outbreeding vs inbreeding*
  - *Population size*
  - *Gene flow*



*More concerned about species and populations that are long-lived, rare, inbreeding, fragmented*



# Answer:



***"Now, here, you see, it takes all the running you can do, to keep in the same place."***

The Red Queen from Lewis Carroll's *Through the Looking-Glass*



# Summary

- *Powerful tool to explore where climates occur now and how those change in the future*
- *Allows user to determine appropriate seedlots or populations for reforestation or restoration*
- *Allows users to explore different assumptions*
  - *Climate variables important for adaptation for species of interest*
  - *Appropriate transfer limits for species of interest -- as well as risk level of user*
  - *Time periods of concern for adaptation*
  - *Future emission pathways*
- *Tool is only as good as the knowledge behind it*
  - *Climate interpolation*
  - *Climate change scenarios*
  - *How species are adapted to their environments*



# Questions

<https://seedlotselectiontool.org/sst/>







The preceding presentation was delivered at the

## **2017 National Native Seed Conference**

Washington, D.C. February 13-16, 2017

This and additional presentations available at <http://nativeseed.info>

