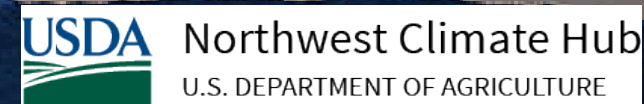


Weather, climate and adapting to changes

Holly R. Prendeville
Coordinator

USDA Northwest Climate Hub



A series of brief talks

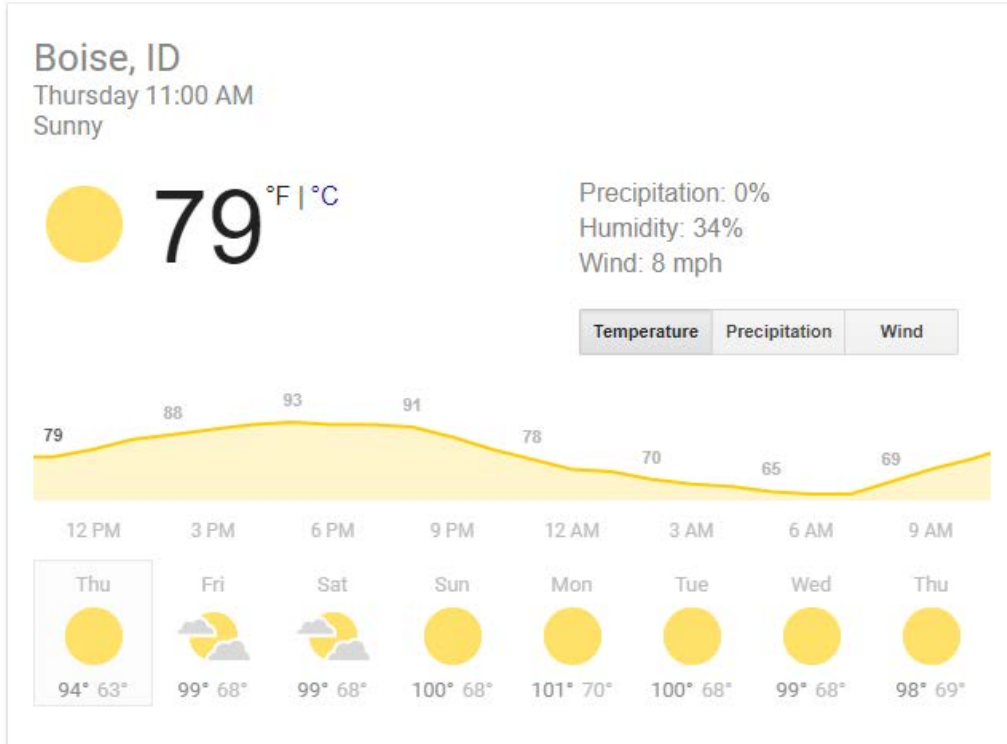
- Weather, climate, and climate change
- Seedlot Selection Tool
- Drought & CoCoRHaS
 - Community Collaborative Rain Hail Snow Network
- USDA Climate Hubs



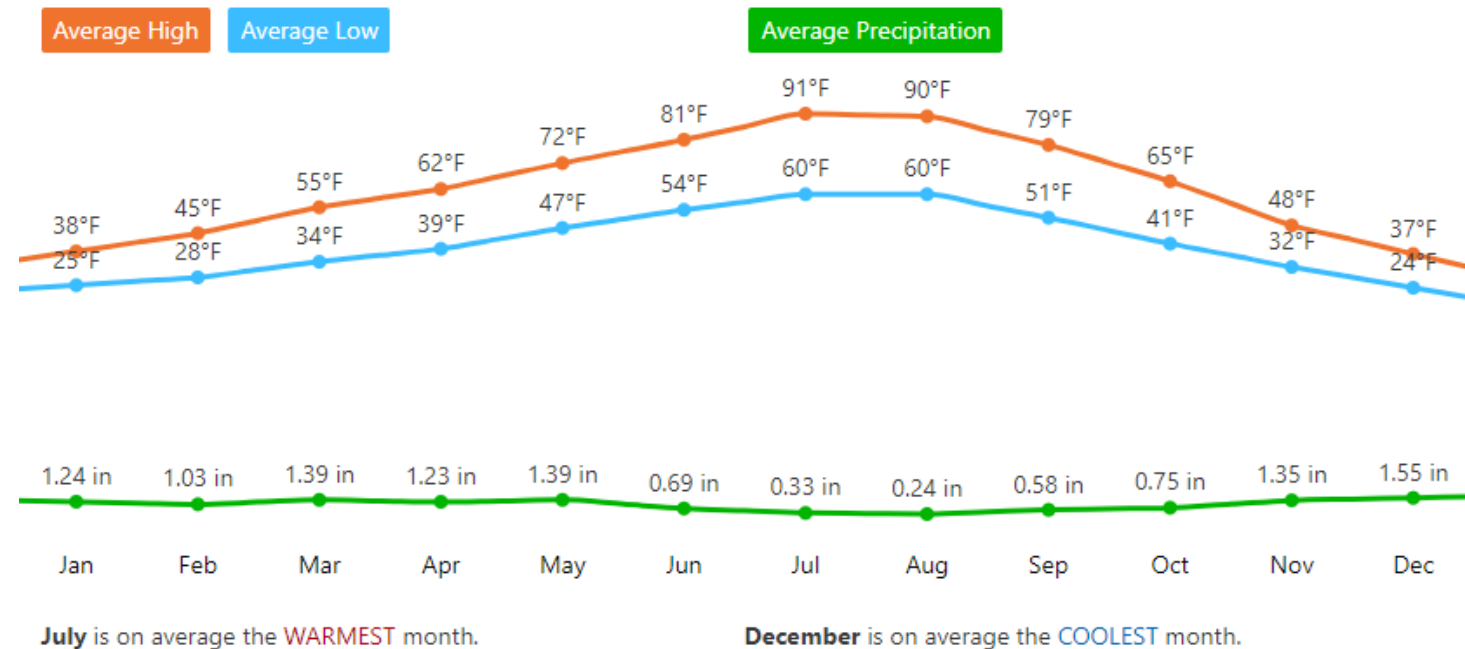
Weather, climate, and climate change



The difference between weather and climate is time



Weather: minutes to months

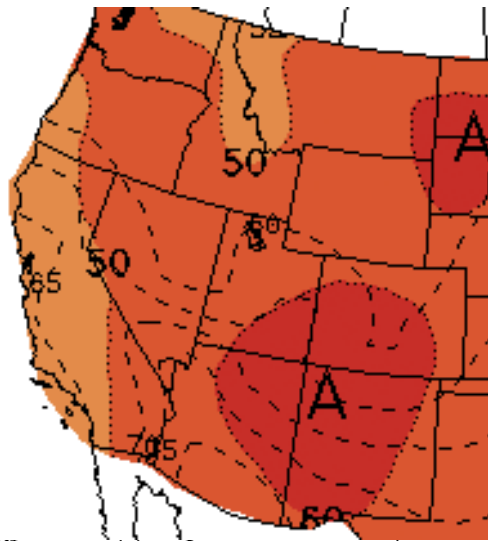


Climate: months, years+

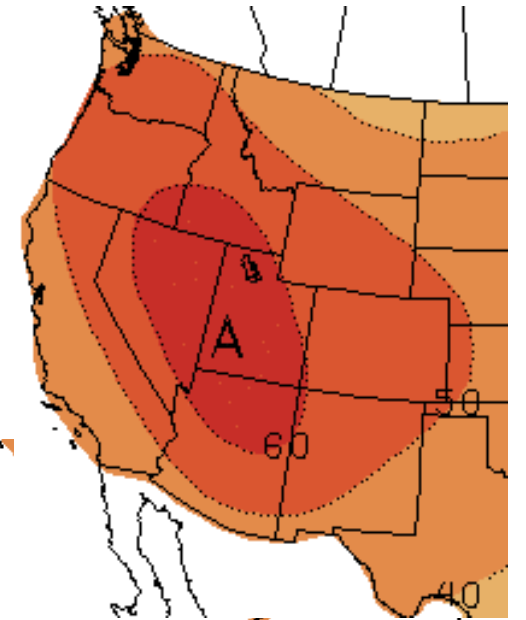
Short-term projections

8-10 day temperature probability outlook

1 month temperature probability outlook



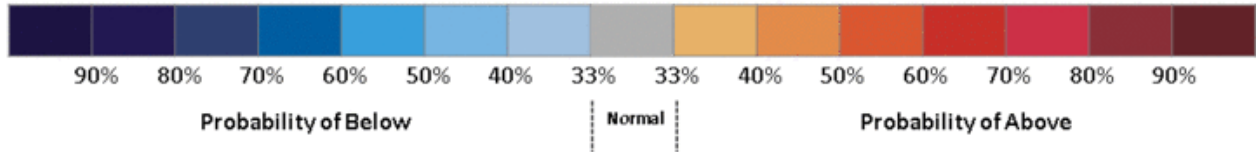
What's the probability it will be Normal, Above Normal, Below Normal?



NOAA
NATIONAL OCEANIC AND ATMOSPHERIC ADMINISTRATION
U.S. DEPARTMENT OF COMMERCE

6-10 DAY OUTLOOK
TEMPERATURE PROBABILITY
MADE 2 MAY 2018
VALID MAY 08 - 12, 2018

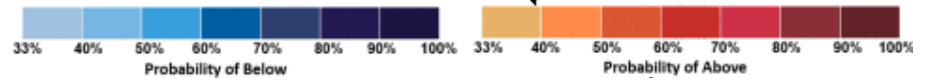
DASHED BLACK LINES ARE CLIMATOLOGY (DEG F) SHADED AREAS ARE FCST VALUES ABOVE (A) OR BELOW (B) NORMAL GRAY AREAS ARE NEAR-NORMAL



NOAA
NATIONAL OCEANIC AND ATMOSPHERIC ADMINISTRATION
U.S. DEPARTMENT OF COMMERCE

ONE-MONTH OUTLOOK
TEMPERATURE PROBABILITY
0.0 MONTH LEAD
VALID MAY 2018
MADE 30 APR 2018

EC MEANS EQUAL CHANCES FOR A, N, B
A MEANS ABOVE
N MEANS NORMAL
B MEANS BELOW



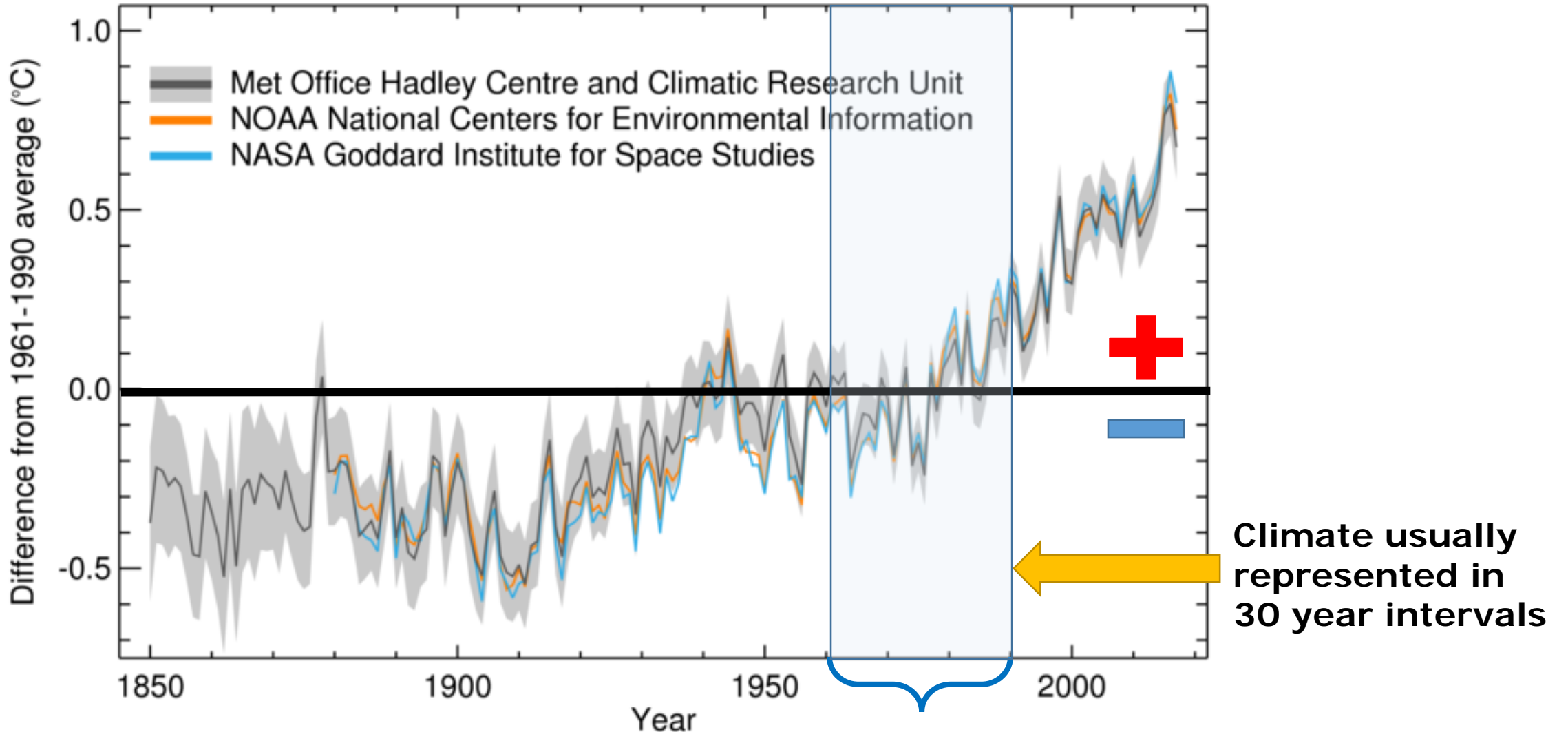
<http://www.cpc.ncep.noaa.gov/>

Observations in Global Climate



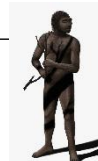
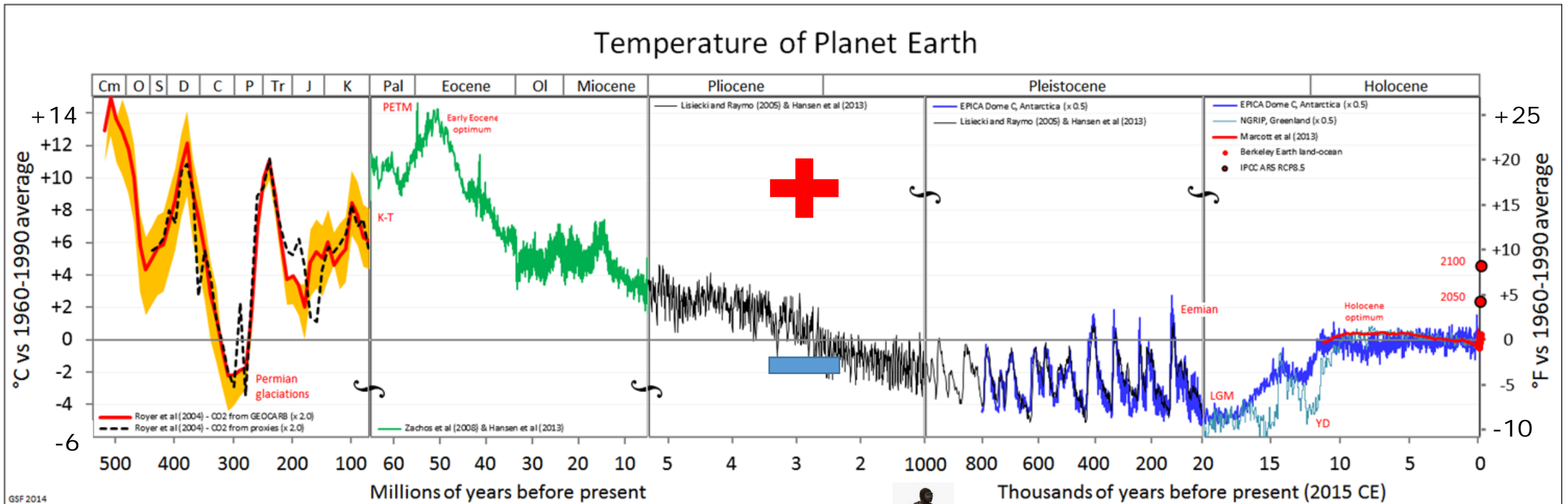
Global average temperature anomaly (1850-2017)

<http://www.metoffice.gov.uk/research/monitoring/climate/surface-temperature#how>



Global temperatures over geological time

“Normal” climate has varied throughout the history of the Earth.



Modeling the Climate System

To understand the climate of the Earth, here are some processes often included in models of the Earth's climate system.

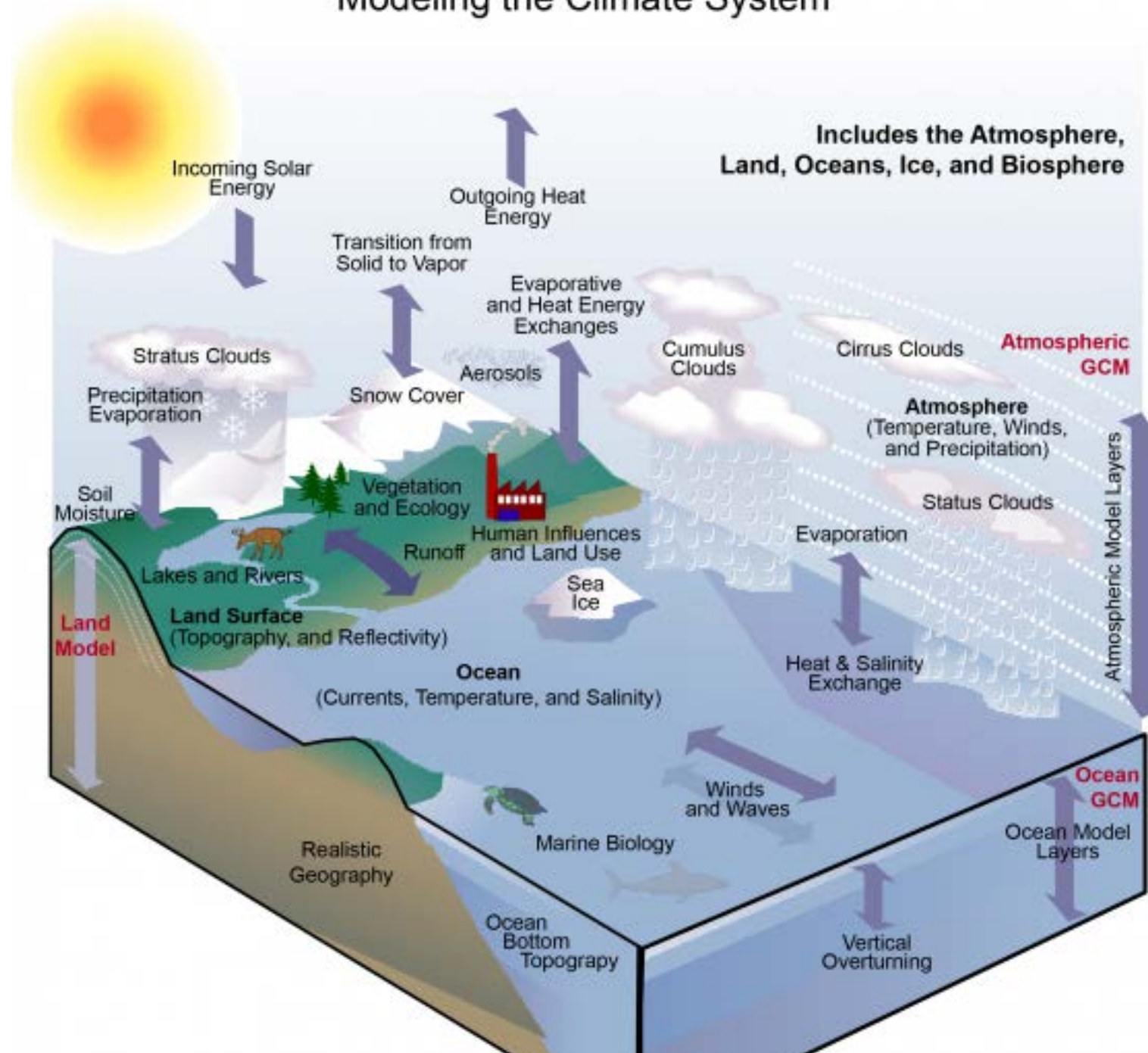
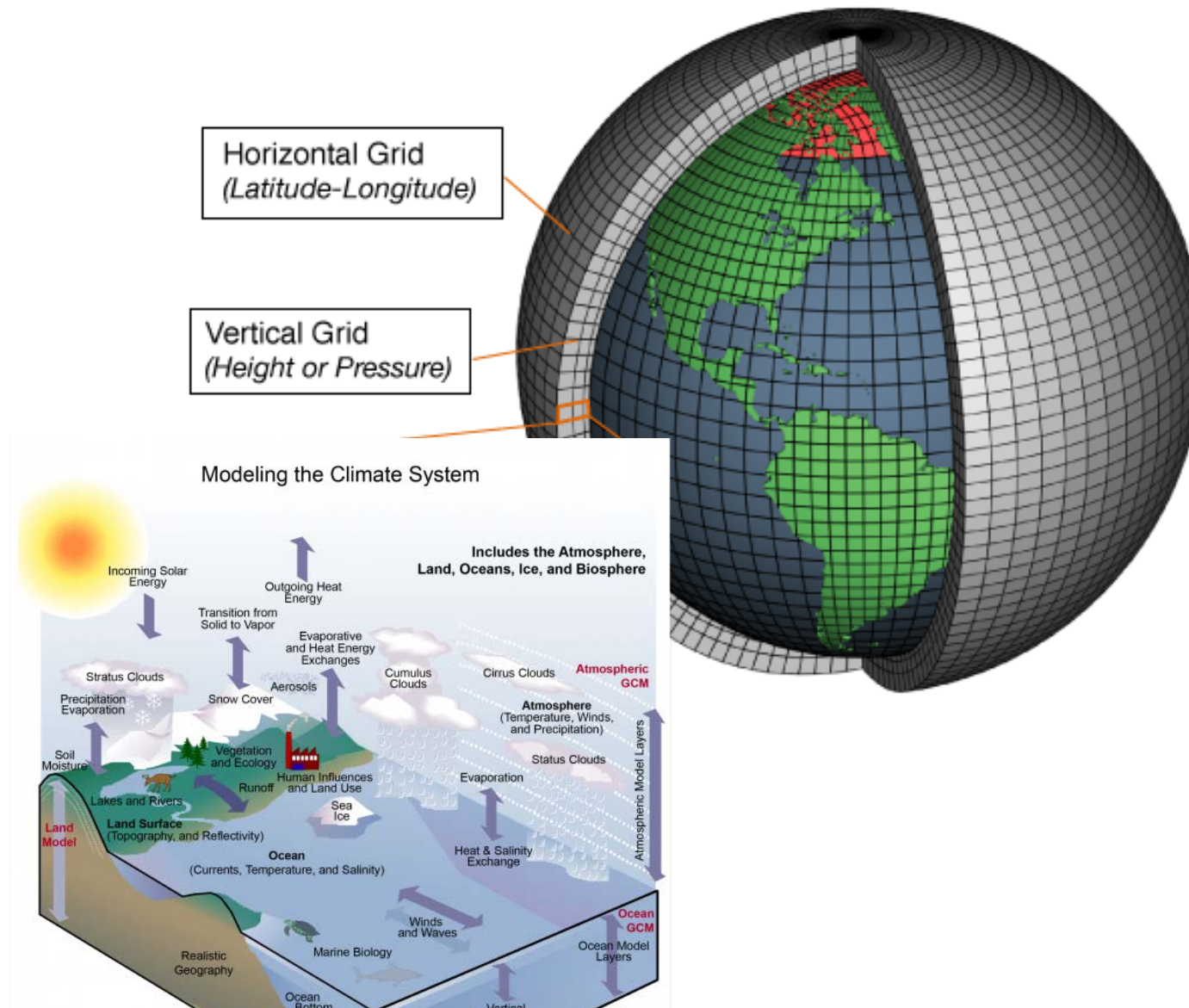


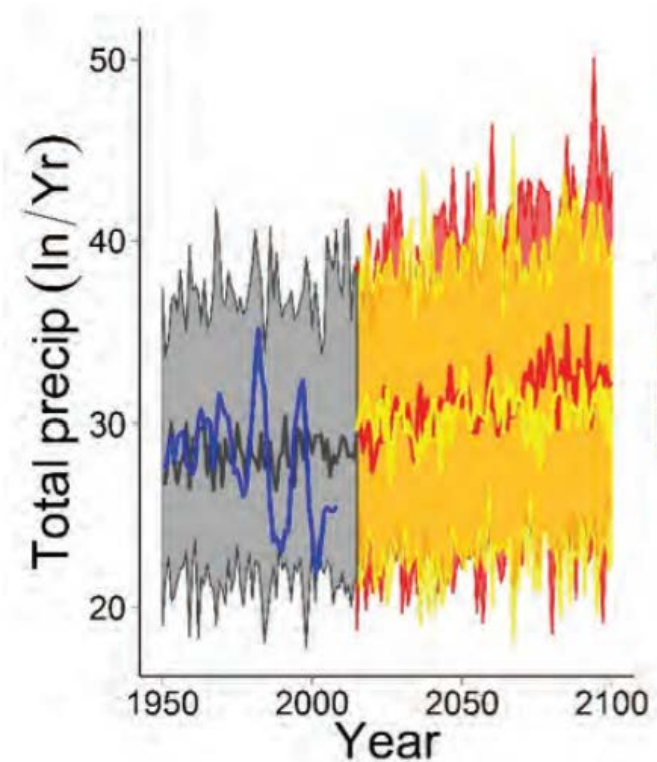
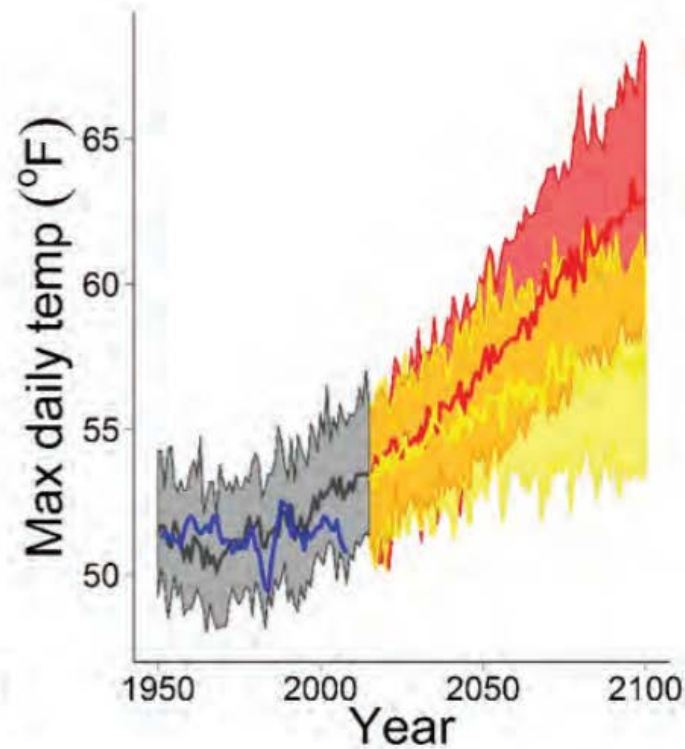
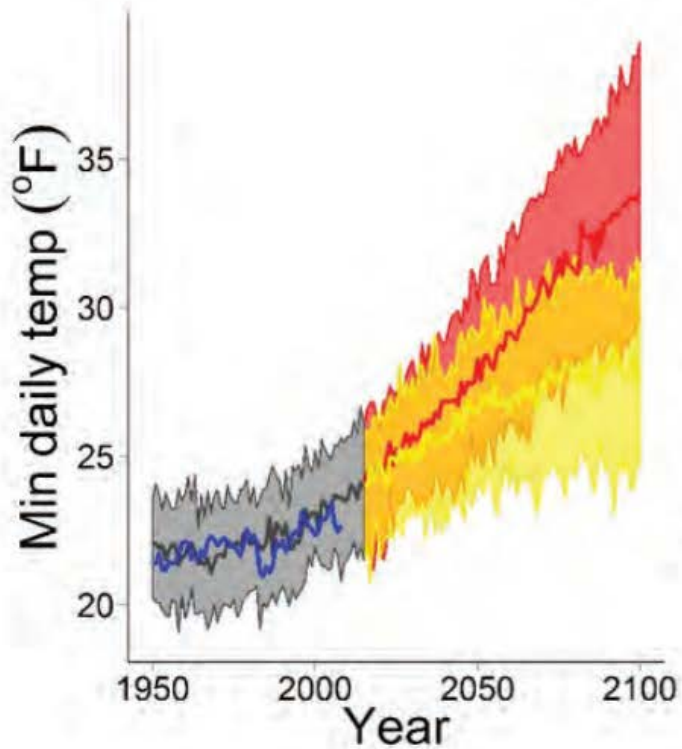
Figure source: Karl and Trenberth 2003

Global Climate Models



Projected climate changes = warmer temperatures, but uncertain changes in precipitation

Intermountain West Region (S ID, UT, NV, N AZ, N NM)



Emissions

- RCP 8.5
- RCP 4.5
- Modeled historical
- Maurer

Photo: Confederated Tribes of the Umatilla Indian Reservation
Tribal Native Plant Nursery



How will
this affect
your
nursery
operation?

Climate change impacts on nurseries

Warmer temperatures & longer periods without rain

Increase shading or move outdoor production to greenhouses/controlled environments

Water stress so will need to irrigate more & more efficient irrigation systems

Identify drought tolerant species

Identify species adapted to a warmer climate

Different plant hardiness zones

Require less chilling hours

Photo: Confederated Tribes of the Umatilla Indian Reservation
Tribal Native Plant Nursery



Climate change impacts on nurseries

More intense periods of rain / saturated soils

- May need to protect hoop houses

- May need to protect plants

- Enhance drainage

New / Increase in pest and disease pressure

- Modify integrated pest management practices

- Identify resistant species

Sea level rise

- Monitor salinity of irrigation water

- Move operations upland



Question?

Climate change impacts on nurseries

Warmer temperatures & longer periods without rain

Increasing shading or move outdoor production to hoop houses

Water stress so will need to irrigate more & more efficient irrigation systems

Identify drought tolerant species

Identify species adapted to a warmer climate

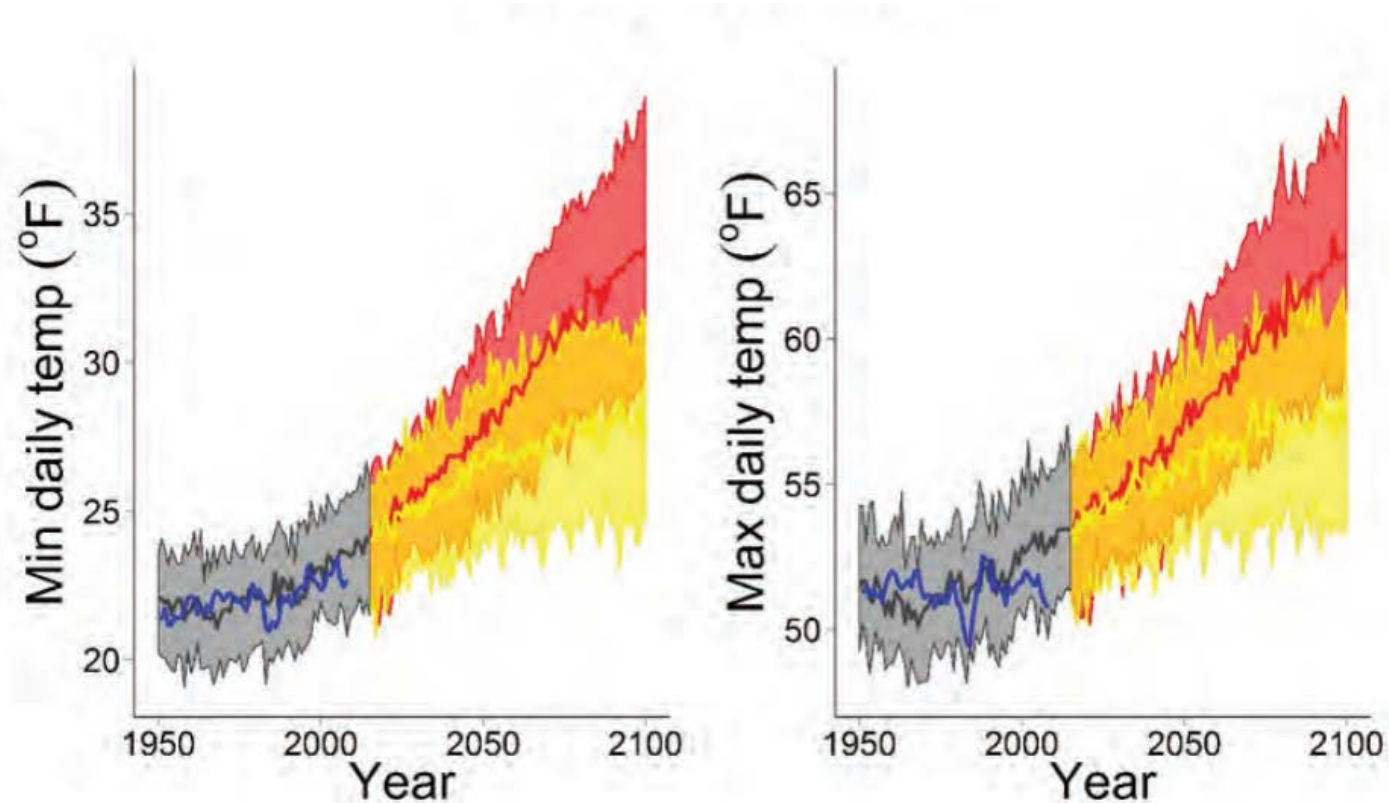
Different plant hardiness zones

Require less chilling hours

Photo: Confederated Tribes of the Umatilla Indian Reservation
Tribal Native Plant Nursery

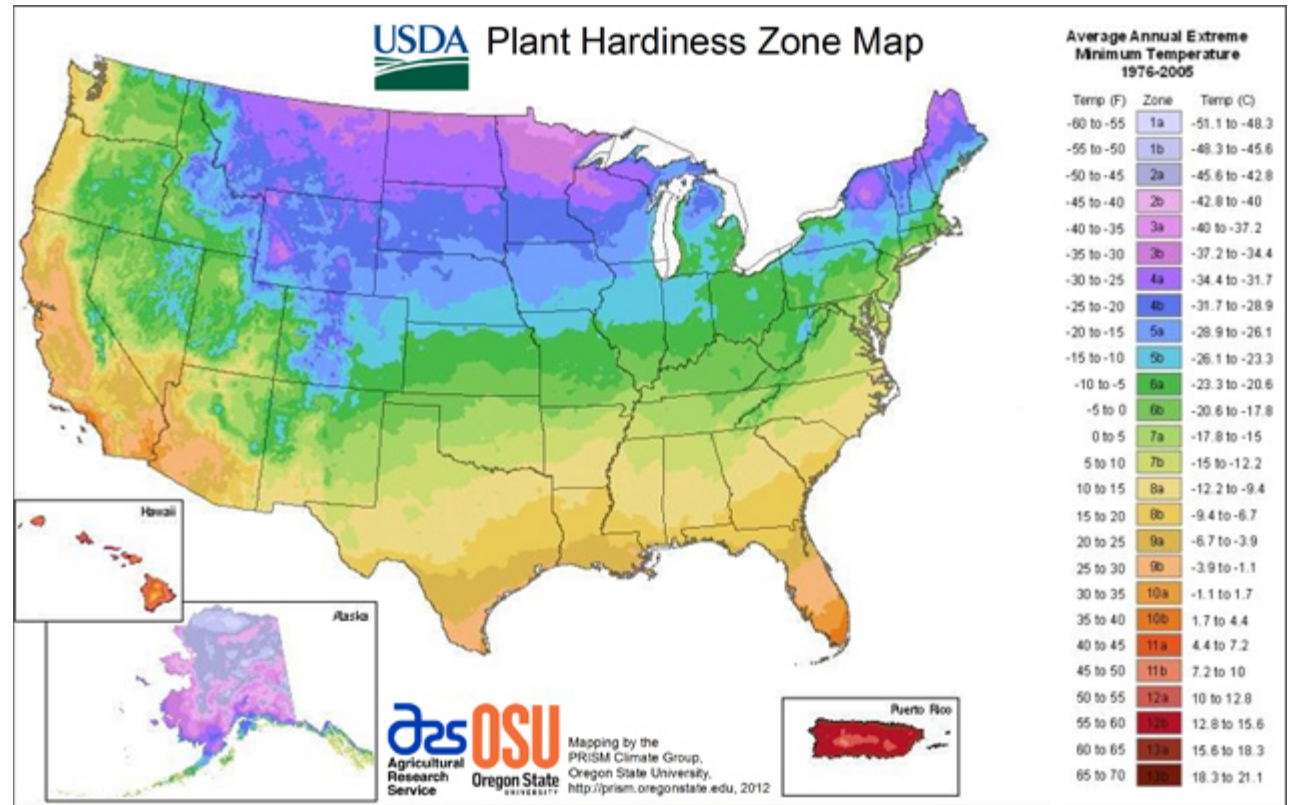
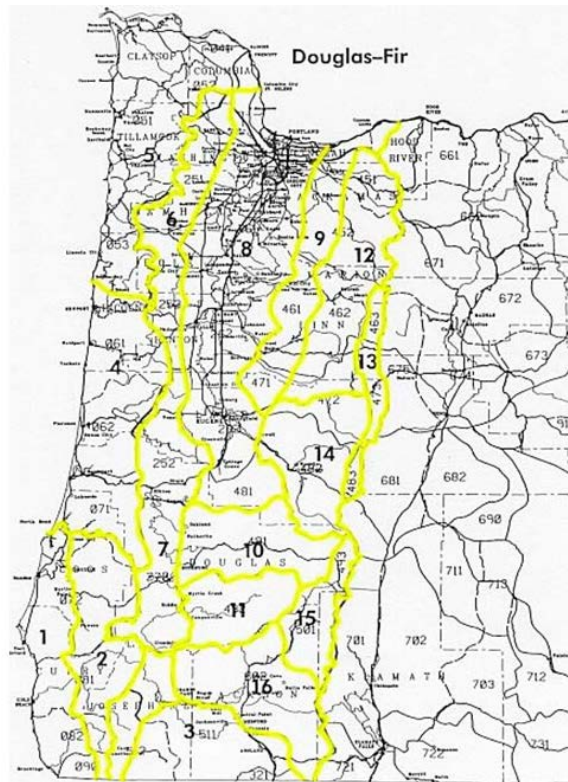


How will the climate change in areas to which I supply native plants?



Local adaptation

Within a species populations have evolved differently to be adapted to the local environment and/or biological factors



Seedlot Selection Tool

- Online <https://seedlotselectiontool.org/sst/>
- GIS (geographic information system) tool
- Designed to *help* forest managers match seedlots with planting sites based on climatic information.
 - To use along with your expertise and ecological knowledge
- Climates of the planting sites can be chosen to represent current climates, or future climates based on selected climate change scenarios.

Lat: 43.2932 Lon: -123.5566

Elevation: 2021 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**

Select a species

Western red cedar

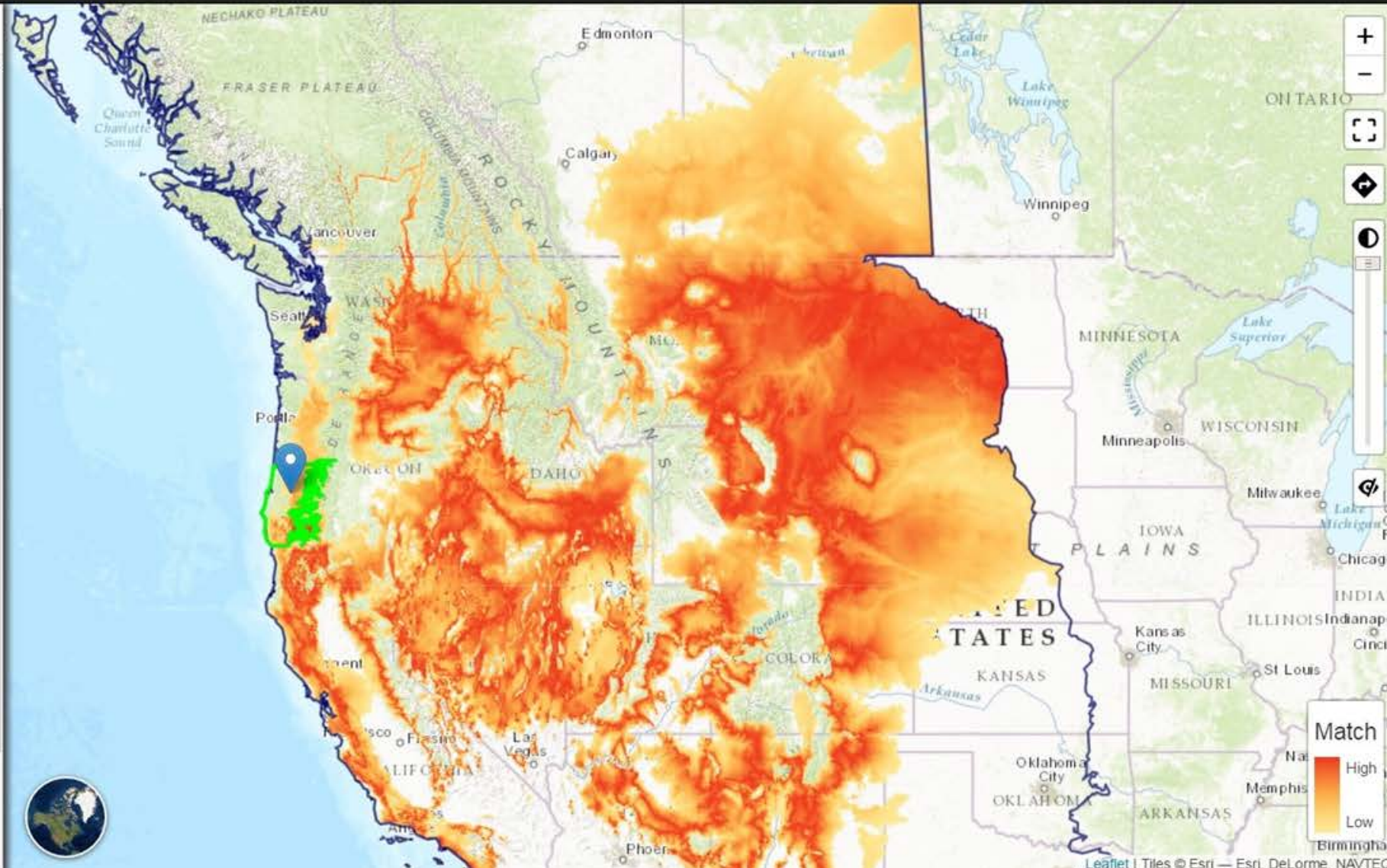
Select zone

Oregon (1996) western redcedar Zone 2, 0' - 99999

5 Select climate variables

Units: **Metric** Imperial







Name	Center	Transfer limit (+/-)
MWMT	21.3 °C	3.90 °C



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. 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 Region**
You can select the geographic region closest to your site or choose from a list of available regions.
-  **4. Select Climate Scenarios**
You can select historical, current, or future climates for your seedlots of planting sites
-  **5. Select Transfer Limit Method**
You can enter your own custom limit or use an existing zone to calculate a transfer limit
-  **6. Select Climate Variables**
You can use a variety of climate variables to match your seedlot and planting site



1. SELECT OBJECTIVE

1.1. FIND SEEDLOTS FOR MY PLANTING SITE **INVENTORY to acquire**

Click on the Find seedlots button if you have a planting site for which you want to find adapted seedlots.

1.2. FIND PLANTING SITES FOR MY SEEDLOT **INVENTORY in hand**

Click on the Find planting sites button if you have a seedlot and you want to know where you can plant it.



1 Select objective

2 Select planting site location

Locate your planting site
Use the map or enter coordinates

Lat: Lon:

3 Select region

Region: N/A

4 Select climate scenarios

Which climate are the seedlots adapted to?

1961 - 1990

When should trees be best adapted to the planting site?

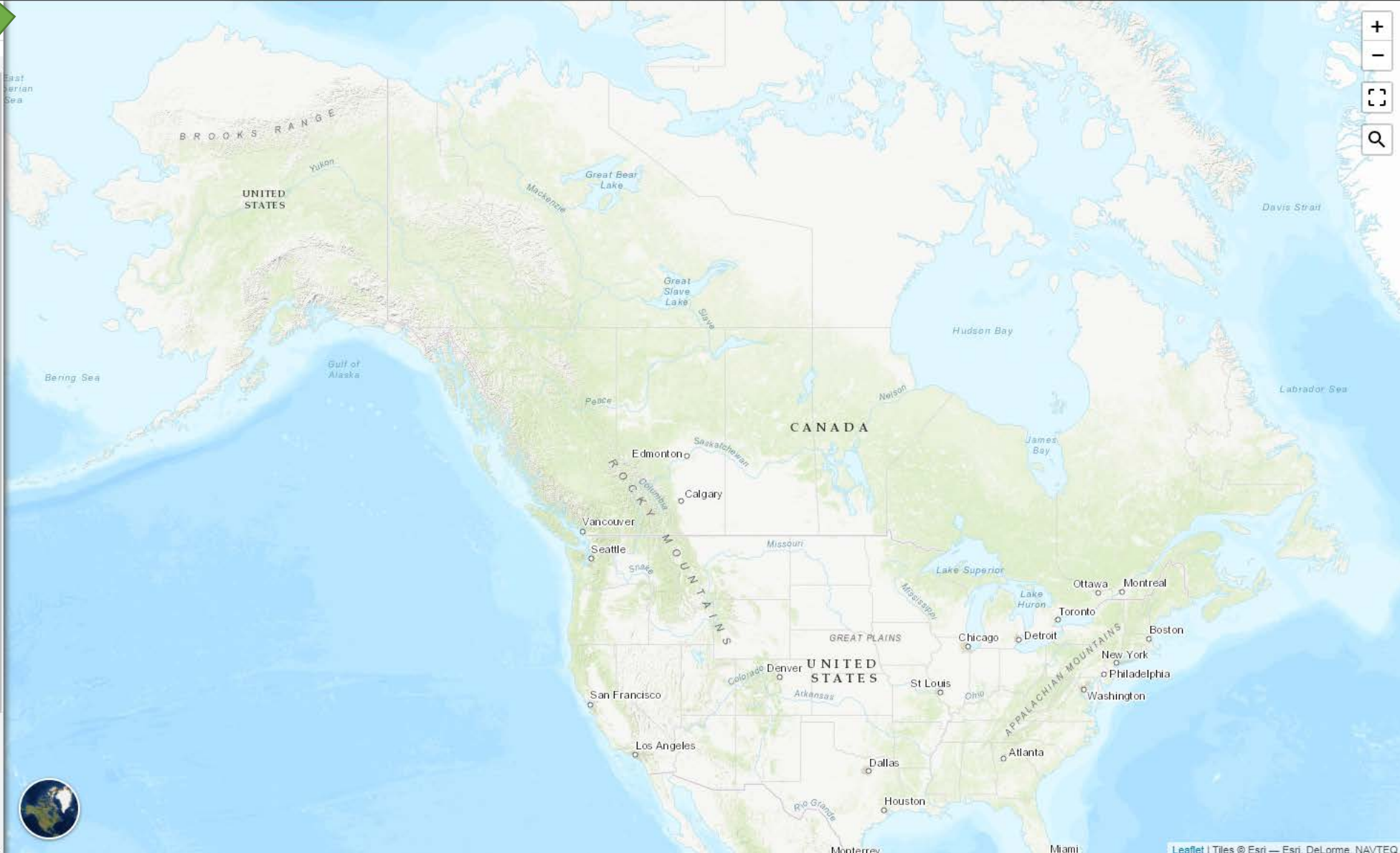
1961 - 1990

5 Select transfer limit method

6 Select climate variables

Units:

7 Apply constraints



- Select objective**
- Select planting site location**
Locate your planting site
Use the map or enter coordinates
Lat: Lon:
Elevation: 3478 ft (1060 m)
- Select region**

Region: Western US
- Select climate scenarios**
Which climate are the seedlots adapted to?

adapted to the planting site?
- Select transfer limit method**
- Select climate variables**
Units:
- Apply constraints**



About Tool Saved Runs

Elevation: 3478 ft (1060 m)

3 Select region
Automatic Custom
Region: Western US

4 Select climate scenarios
Which climate are the seedlots adapted to?
1961 - 1990
When should trees be best adapted to the planting site?
1961 - 1990
1981 - 2010
2011 - 2040
2041 - 2070
2071 - 2100
limit method

6 Select climate variables
Units: Metric Imperial
Add a variable...

7 Apply constraints
Add a constraint...

8 Map your Results
Run Tool
Save Last Run Export As...



About Tool Saved Runs

Elevation: 3478 ft (1060 m)

3 Select region

Automatic Custom

Region: Western US

Add a variable...

- MAT: Mean annual temperature
- MWMT: Mean warmest month temperature
- MCMT: Mean coldest month temperature
- TD: Temperature difference between MWMT and MCMT, or continentality
- MAP: Mean annual precipitation
- MSP: Mean summer precipitation, May to September
- AHM: Annual heat-moisture index
- SHM: Summer heat-moisture index

5

- DD_0: Degree-days below 0°C
- DD5: Degree-days above 5°C
- FFP: Frost-free period
- PAS: Precipitation as snow, August to July

6

- EMT: Extreme minimum temperature over 30 years
- EXT: Extreme maximum temperature over 30 years
- Eref: Hargreaves reference evaporation
- CMD: Hargreaves climatic moisture deficit

Add a variable... ▾

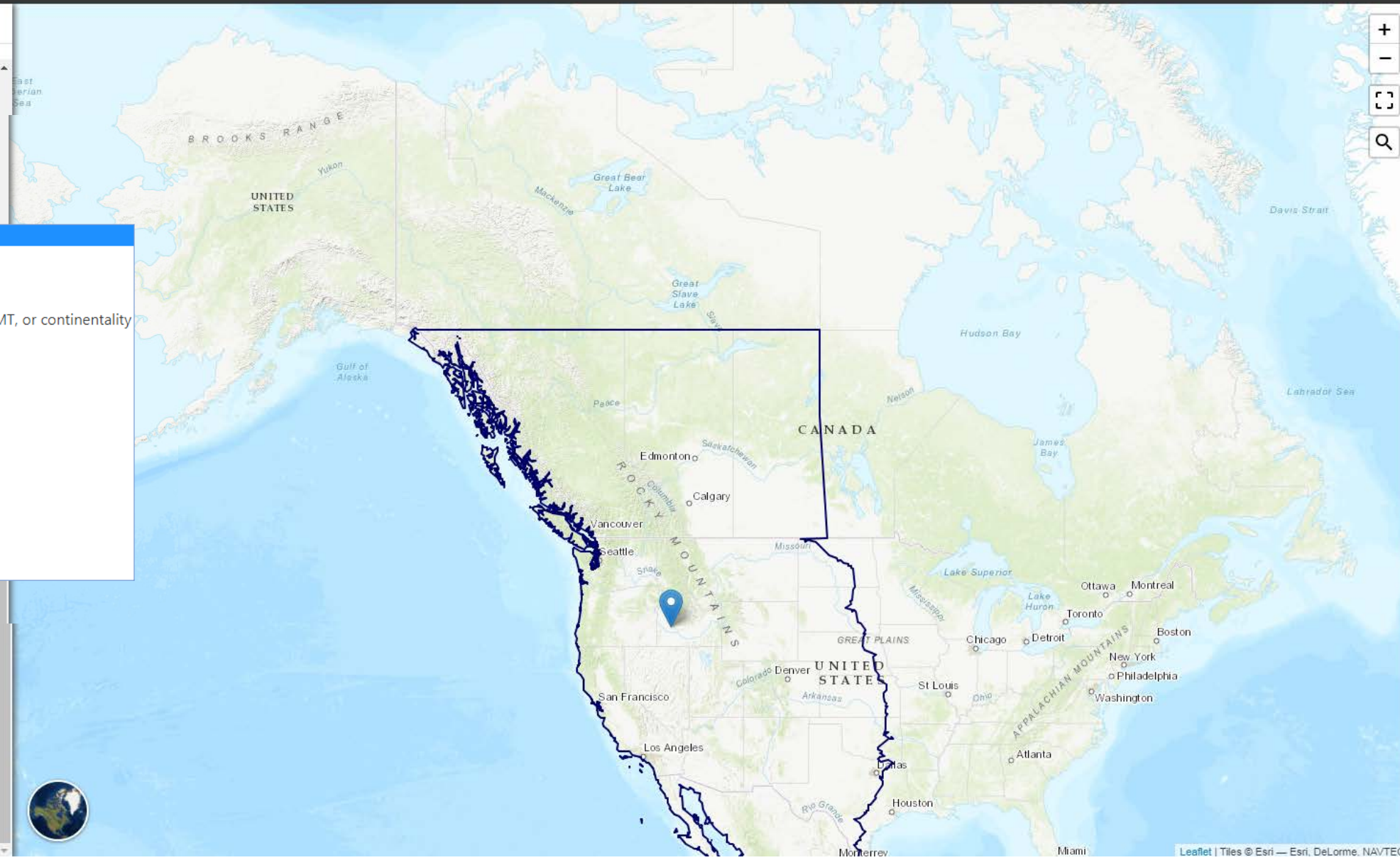
7 Apply constraints

Add a constraint... ▾

8 Map your Results

Run Tool

Save Last Run Export As... ⌵



About Tool Saved Runs

Automatic Custom

Region: Western US

4 Select climate scenarios

Which climate are the seedlots adapted to?

1961 - 1990

When should trees be best adapted to the planting site?

1961 - 1990

5 Select transfer limit method

Custom Zone

6 Select climate variables

Units: Metric Imperial

Name	Center	Transfer limit (+/-)
MCMT	-3.1 °C	2.00 °C

Add a variable...

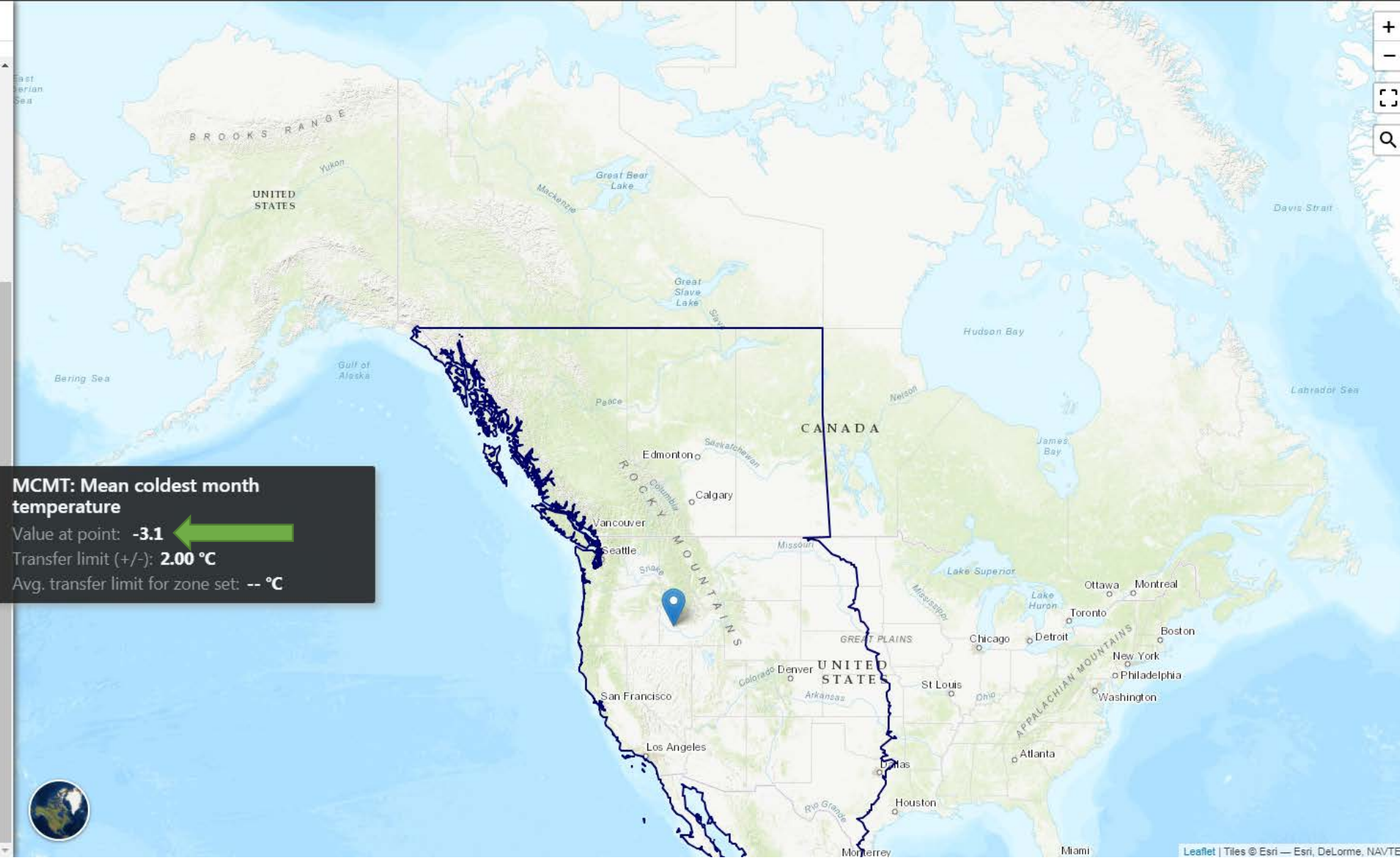
7 Apply constraints

Add a constraint...

Add a constraint...

- Elevation
- Photoperiod
- Latitude
- Longitude
- Distance

Save Last Run export AS...



MCMT: Mean coldest month temperature
Value at point: **-3.1**
Transfer limit (+/-): **2.00 °C**
Avg. transfer limit for zone set: -- °C



About Tool Saved Runs

Automatic Custom

Region: Western US

4 Select climate scenarios

Which climate are the seedlots adapted to?

1961 - 1990

When should trees be best adapted to the planting site?

2041 - 2070

5 Select transfer model

Custom Zone

6 Select climate variables

Units: Metric Imperial

Name	Center	Transfer limit (+/-)
MCMT	0.0 °C	2.00 °C

Add a variable...

7 Apply constraints

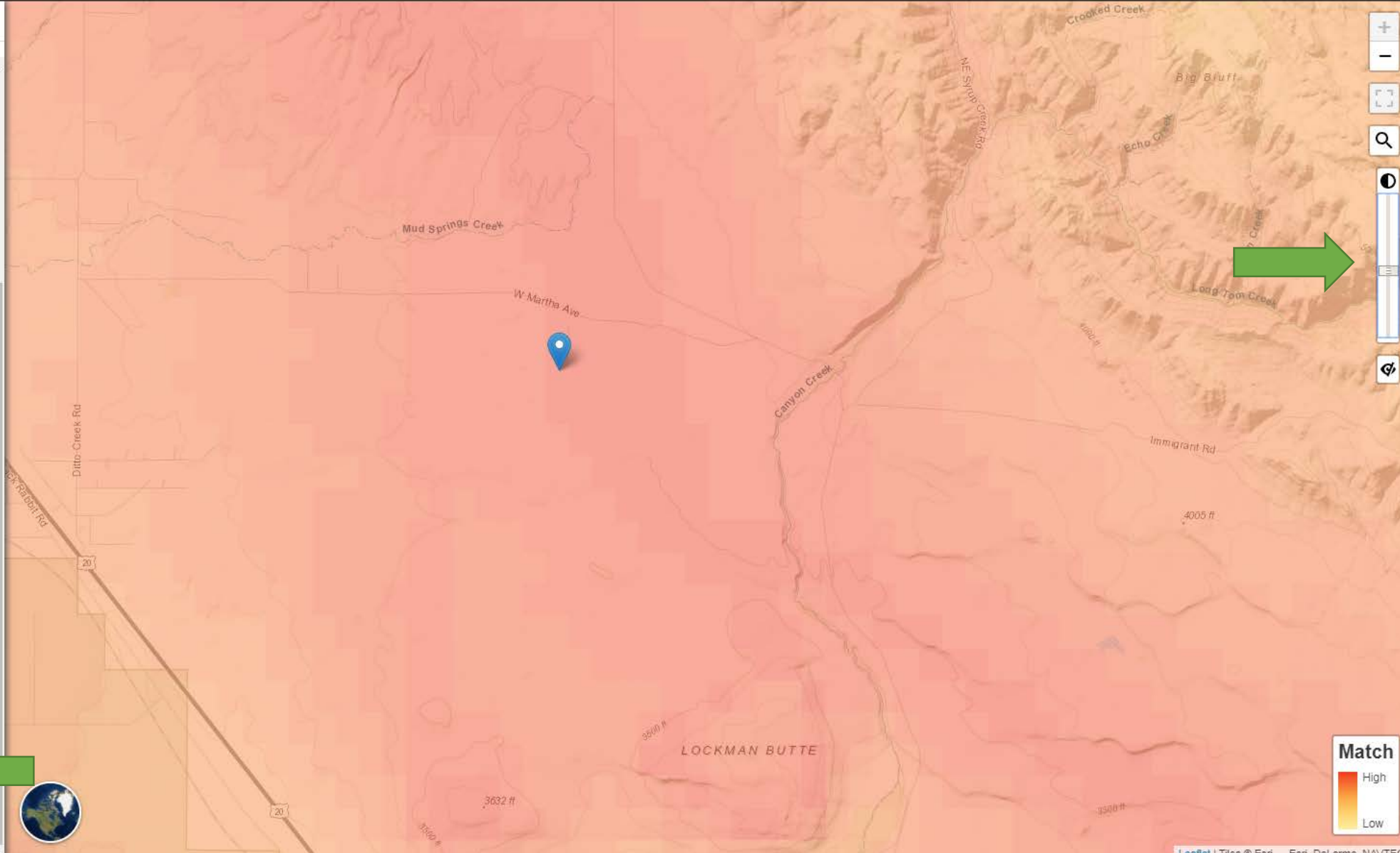
Add a constraint...

8 Map your Results

Run Tool

Save Last Run

Export As...



Seedlot Selection Tool

About Tool Saved Runs

Automatic Custom

Region: Western US

4 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

5 Select transfer limit method

Custom Zone

6 Select climate variables

Units: Metric Imperial

Name	Center	Transfer limit (+/-)
MCMT	0.0 °C	2.00 °C

Add a variable...

7 Apply constraints

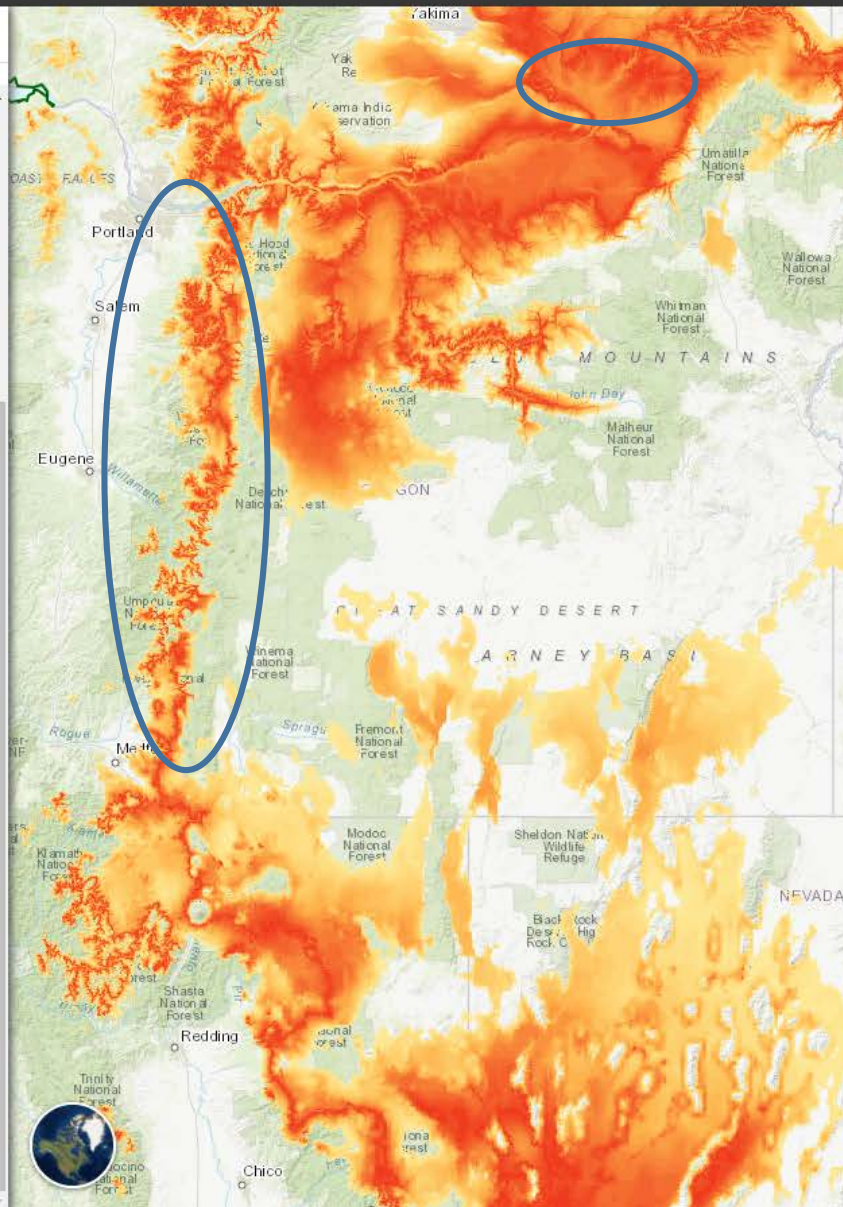
Add a constraint...

8 Map your Results

Run Tool

Save Last Run

Export As...



About Tool Saved Runs

Automatic Custom

Region: Western US

4 Select climate scenarios

Which climate are the seedlots adapted to?
1961 - 1990

When should trees be best adapted to the planting site?
1961 - 1990

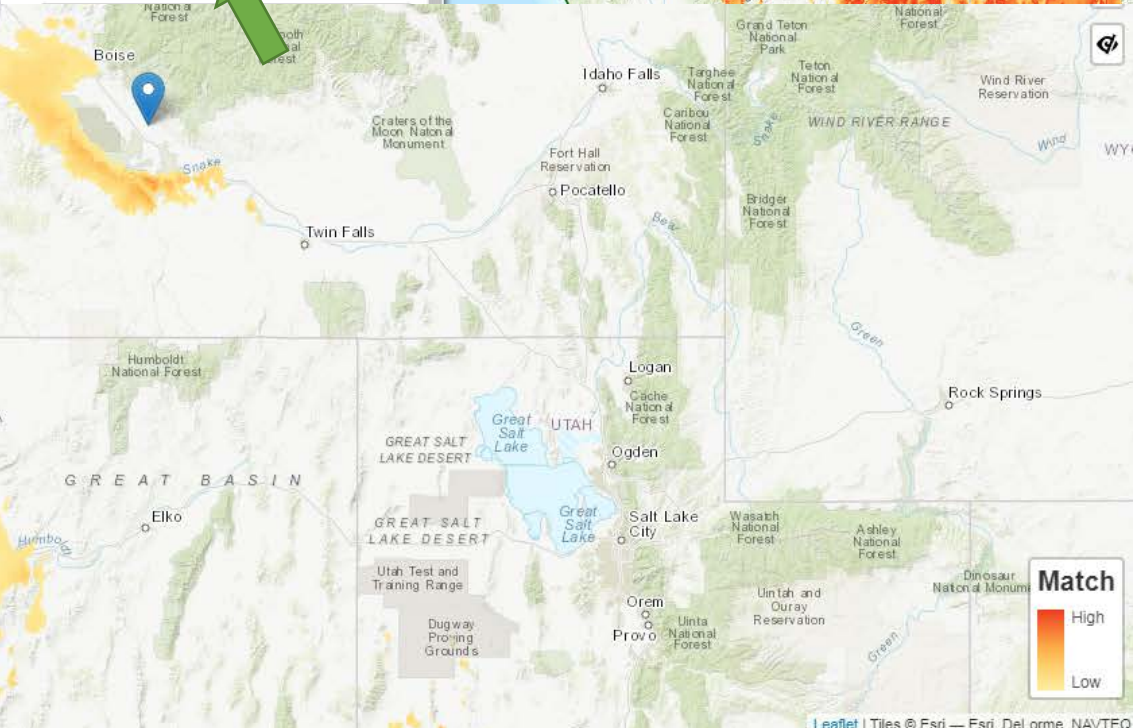
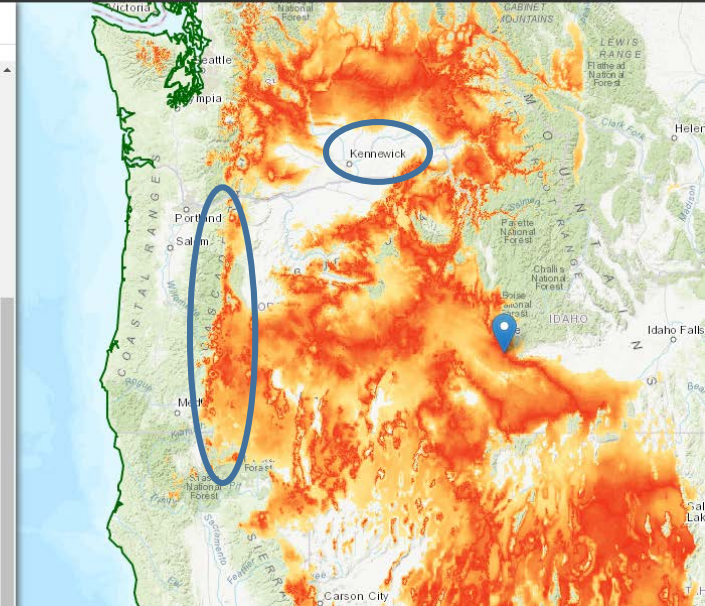
5 Select transfer limit method

Custom Zone

6 Select climate variables

Units: Metric Imperial

Name	Center	Transfer limit (+/-)
MCMT	-3.1 °C	2.00 °C



Questions?





Drought

Photo: Confederated Tribes of the Umatilla Indian Reservation
Tribal Native Plant Nursery



How will
drought
affect your
nursery
operation?

Drought impacts on nurseries

Warmer temperatures & longer periods without rain

Increasing shading or move outdoor production to hoop houses

Water stress so will need to irrigate more & more efficient irrigation systems

Identify drought tolerant species

Identify species adapted to a warmer climate

Different plant hardiness zones

Require less chilling hours

Photo: Confederated Tribes of the Umatilla Indian Reservation
Tribal Native Plant Nursery



Drought

Drought originates from a deficiency of precipitation over an extended period of time

Impacts result from the interplay between the natural event and the demand people place on water supply

Source: drought.gov



Insurance

- USDA Farm Service Agency
 - Disaster Assistance Program
 - Non-insured crop disaster assistance program (NAPD)
- USDA Risk Management Agency
 - Nursery Commodity Insurance
 - Whole Farm Insurance

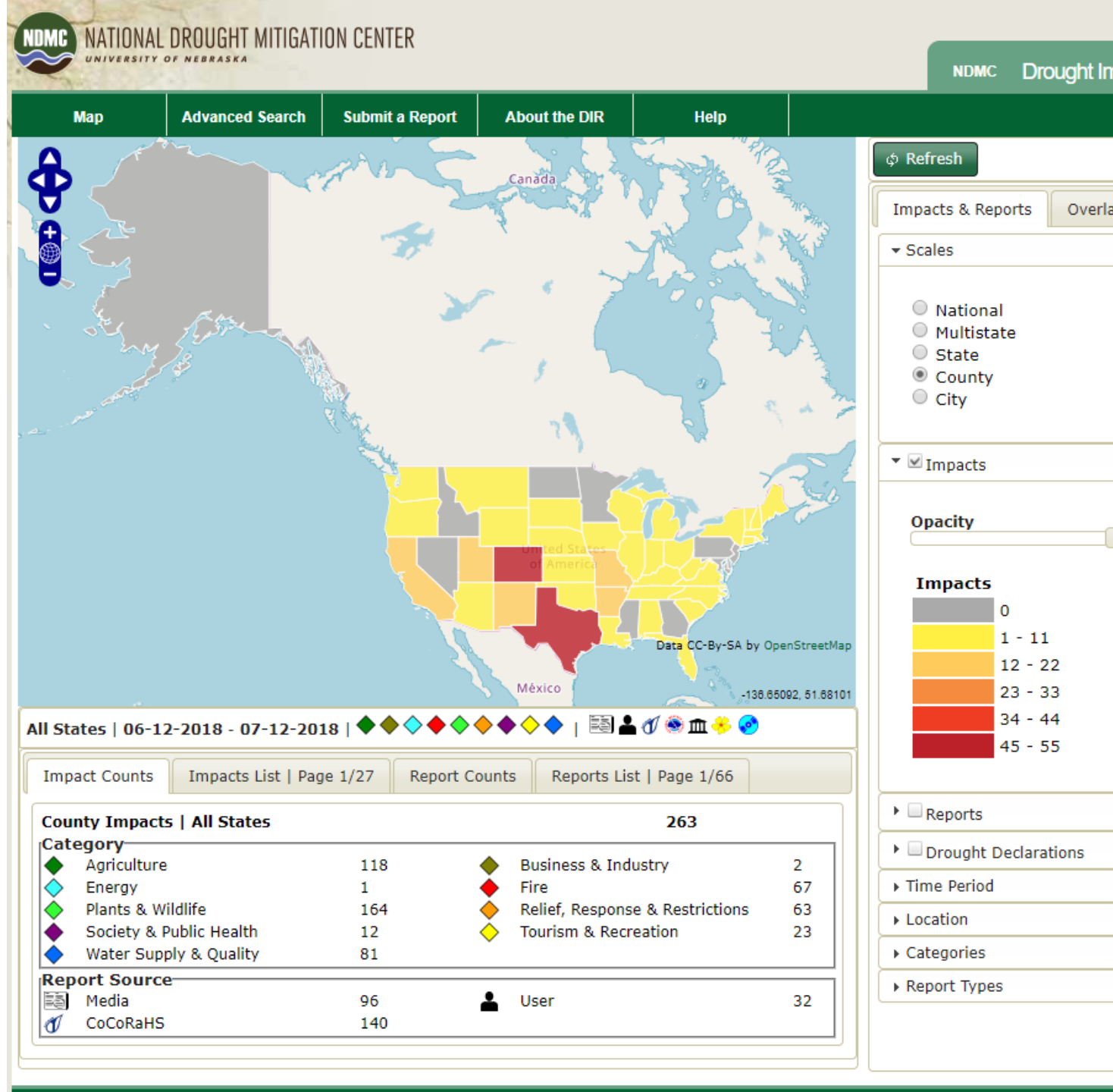
Information on

NIDIS drought.gov

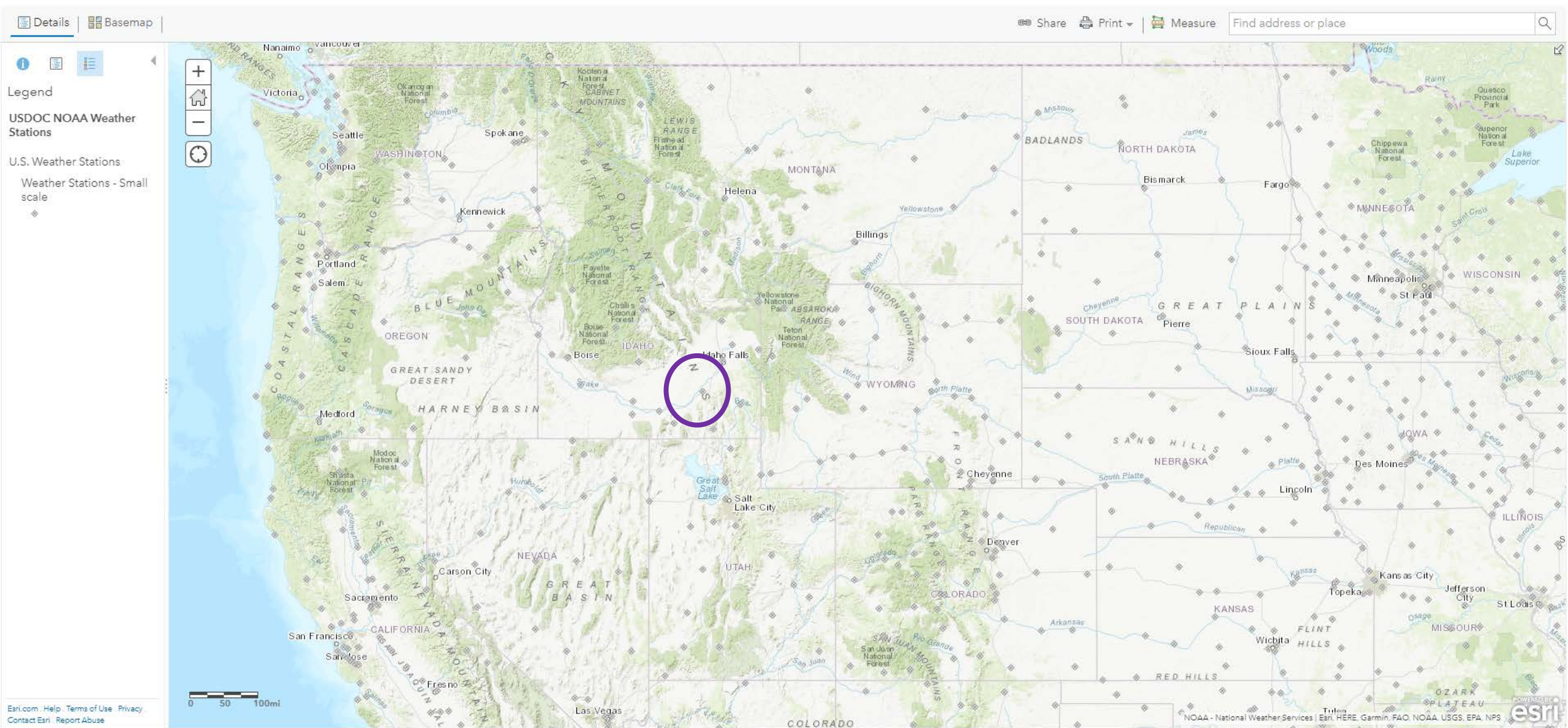
DEWS: Drought Early Warning System

National Drought Monitor

- Reporting: <http://droughtreporter.unl.edu/map/>



So few weather stations





CoCoRaHS: Community Collaborative Rain Hail Snow Network

Main focus is to provide quality precipitation data and educational opportunities to help the public better understand weather and climate

Volunteers report their DAILY observations on interactive website or using CoCoRaHS mobile app

- Data are immediately viewable

www.cocorahs.org

COCO
RAHS



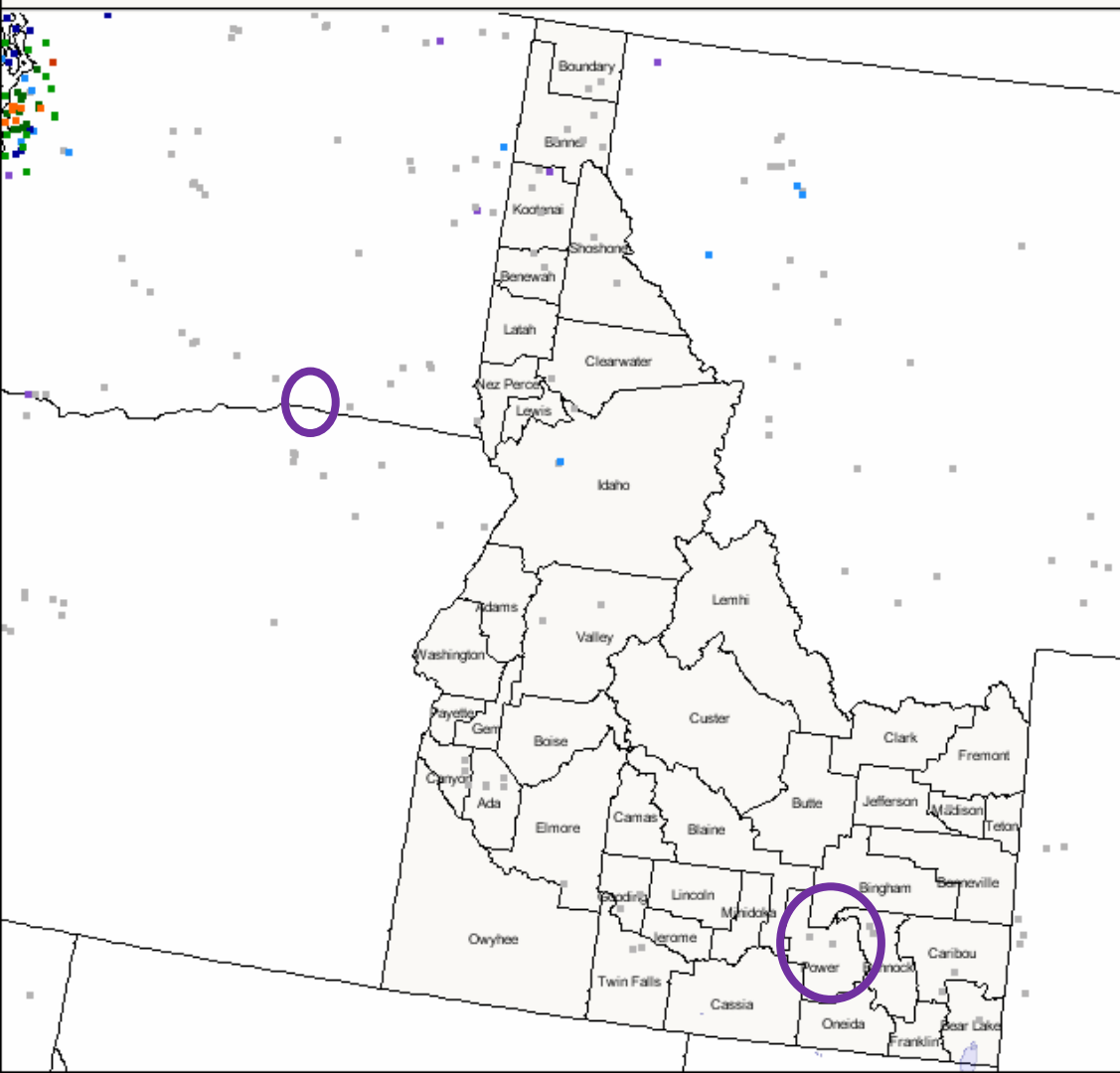
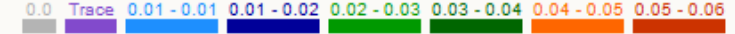
CoCoRaHS: Community Collaborative Rain Hail Snow Network

), for the 24 hour period ending ~7:00 am



Daily Precipitation (inches x.xx), for the 24 hour period ending ~7:00 am

Power County, Idaho 6/13/2018



Zeros are important especially for DROUGHT

Brief training in CoCoRHaS

Setting up your equipment and measuring precipitation

- Location is very important

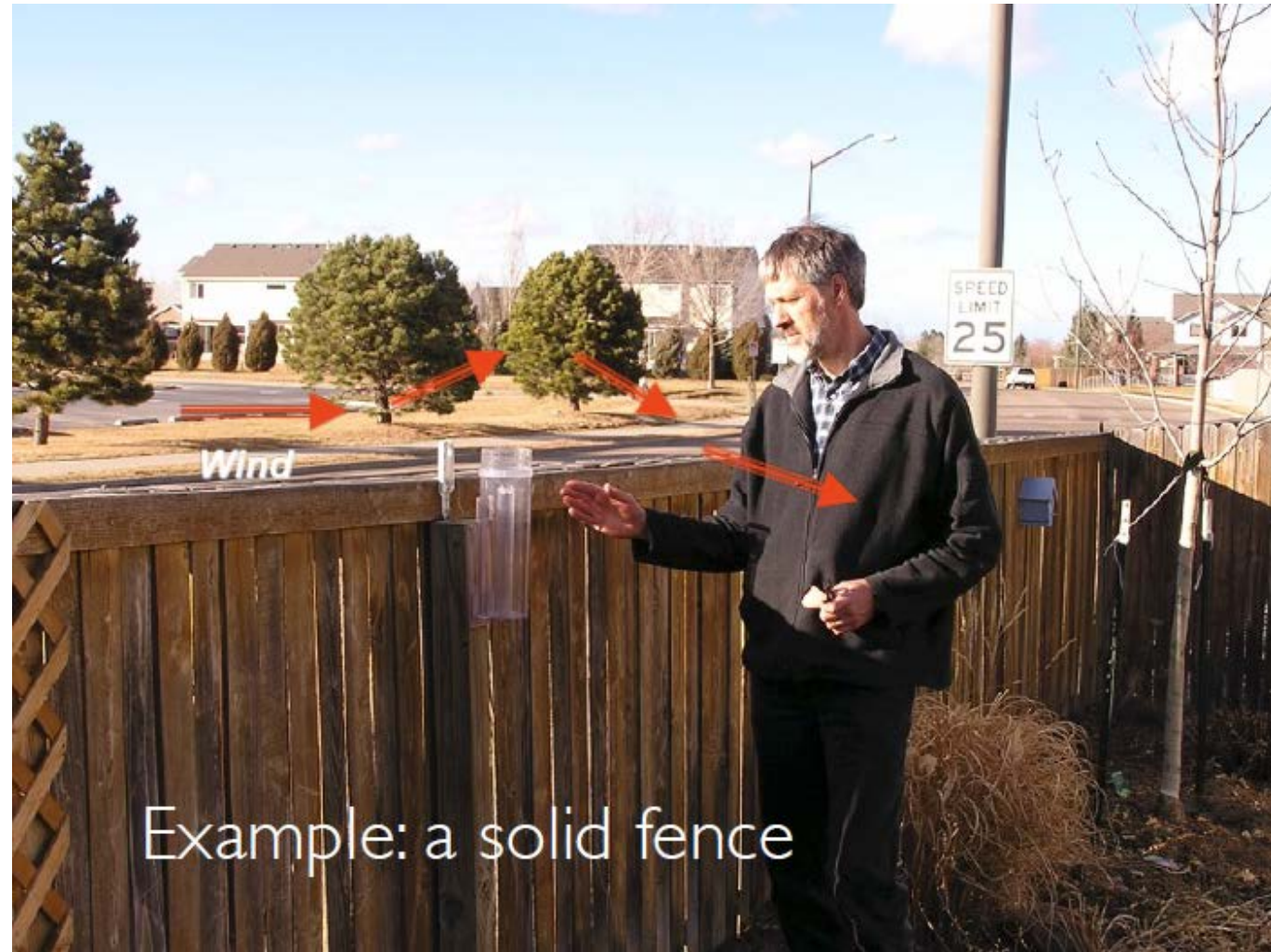


Where **NOT** to put your gauge



Avoid locations with structures that can affect rain collection into gauge

Solid fence can affect *wind movement* during strong wind events, which may *reduce rain* caught in the gauge.



Distances

- Open area
 - Twice as far from obstacles as they are high
 - Place gauge top about 2 feet off the ground
- Developed area
 - Strive to be as far from obstacles as they are high
 - Place gauge top about 5 feet off the ground
- Ideally be equidistant from the nearest trees

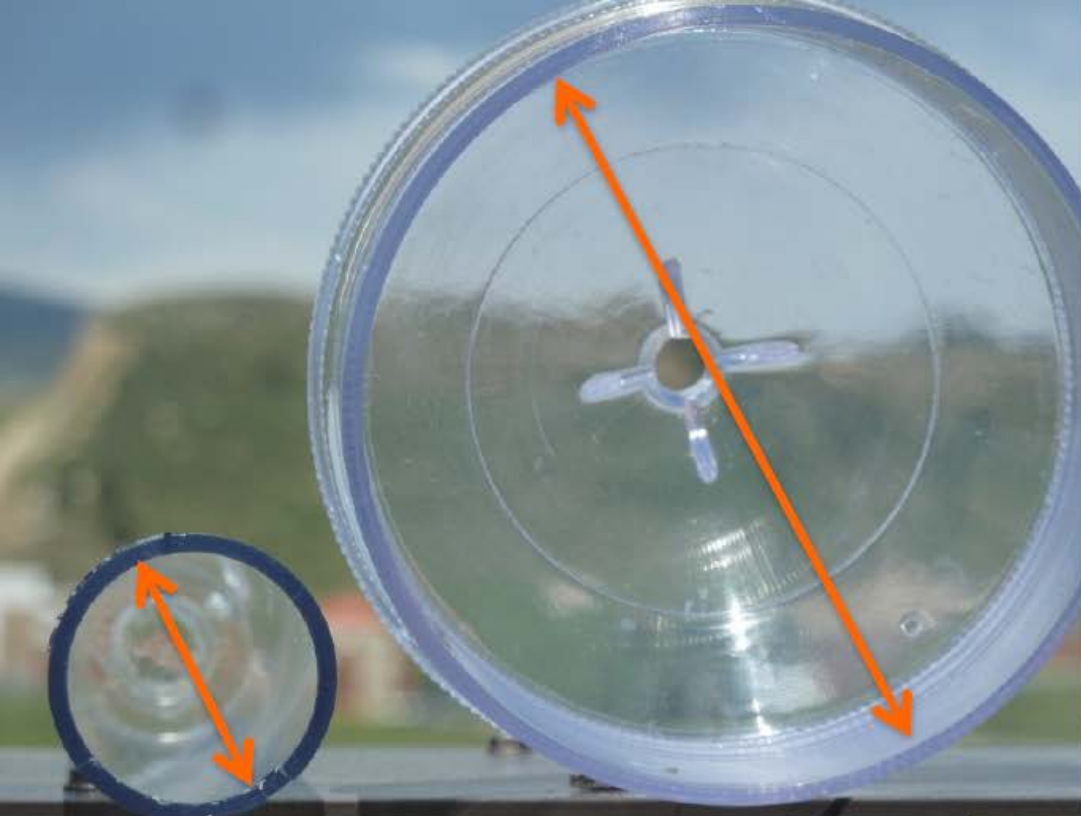


Gauge set up

- Make sure that your gauge is level
- Bevel the top of the post (cut at an angle away from the gauge) to limit rain splashing into your gauge



Measuring rainfall



One inch of rain in the inner tube looks different than one inch of rain in the outer tube

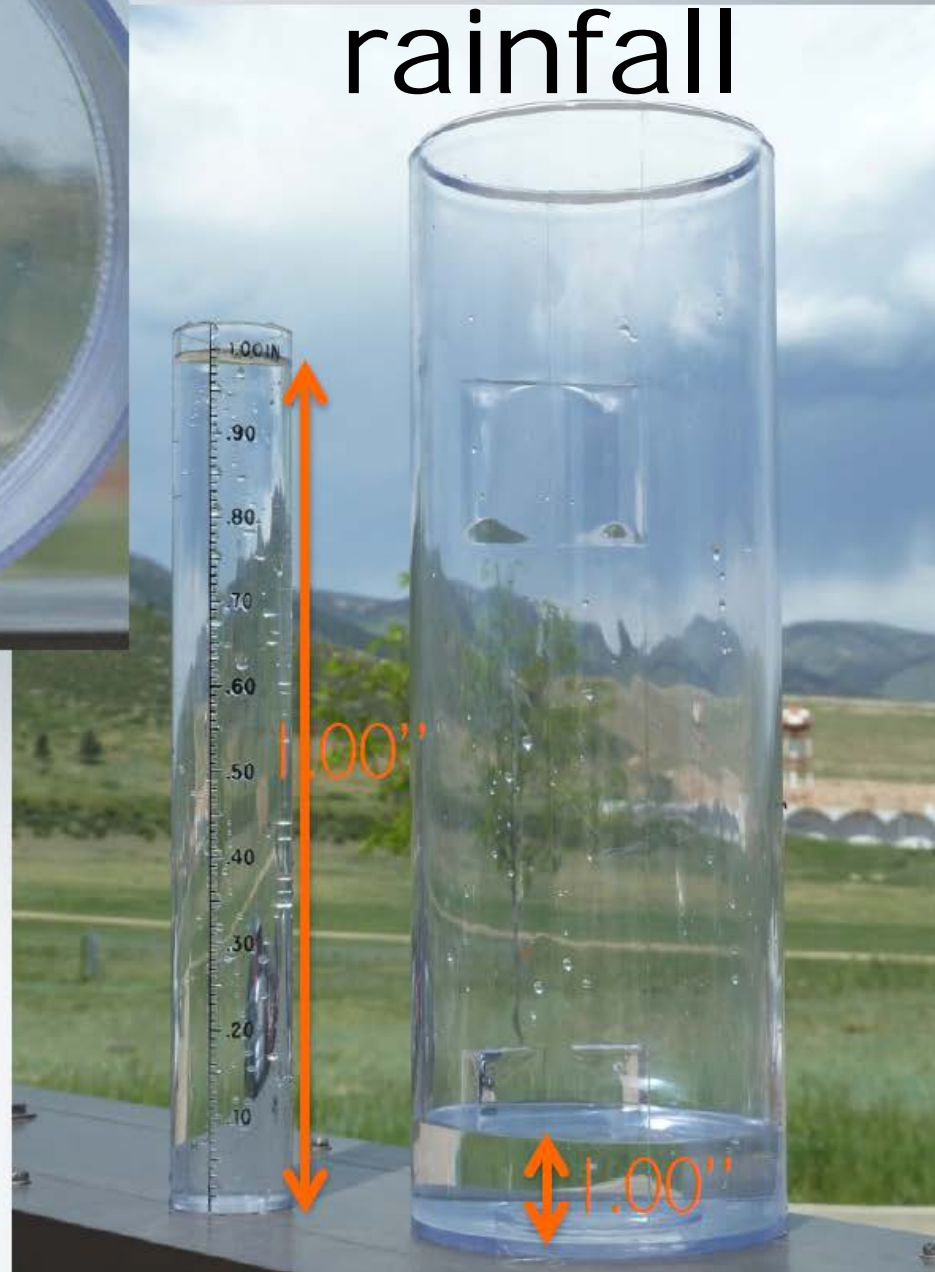
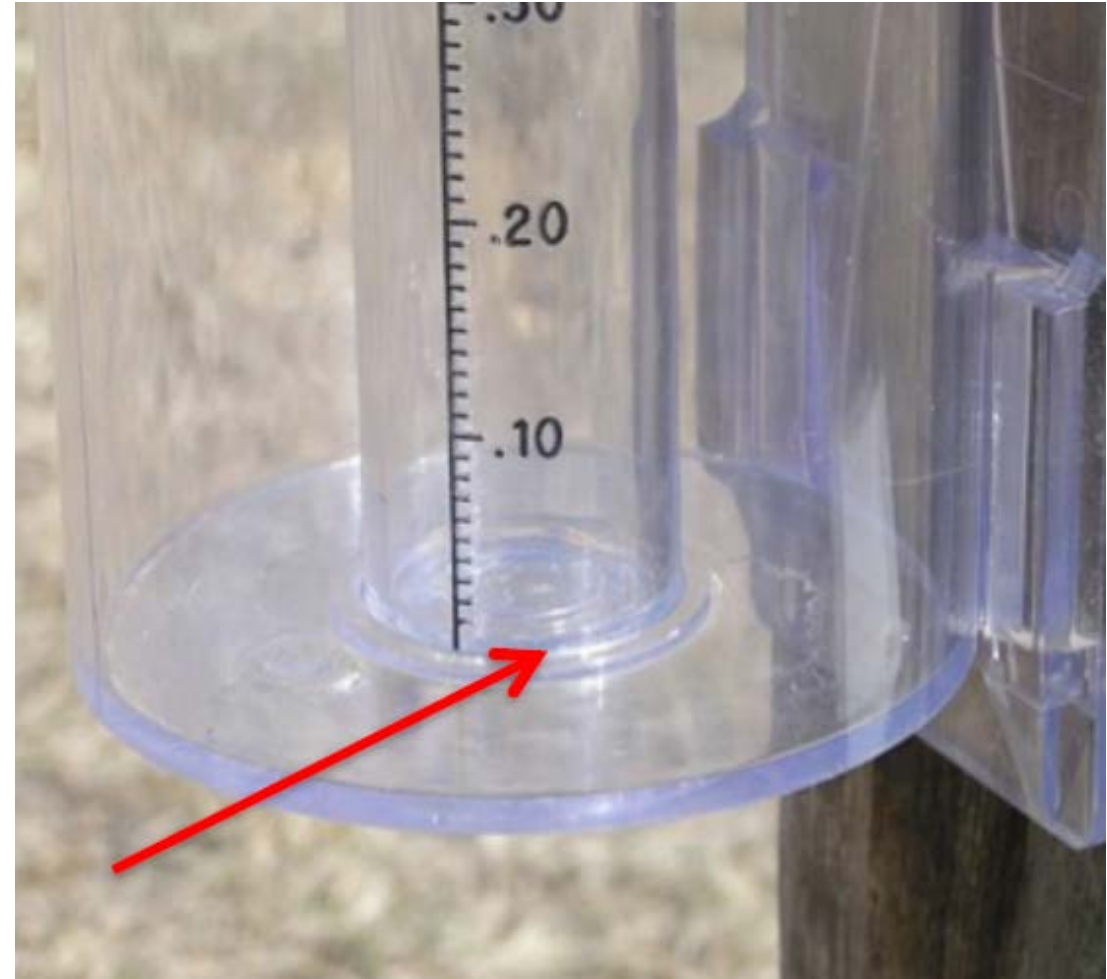


Photo: Steve Camp

Gauges hold up to 11" of rain!

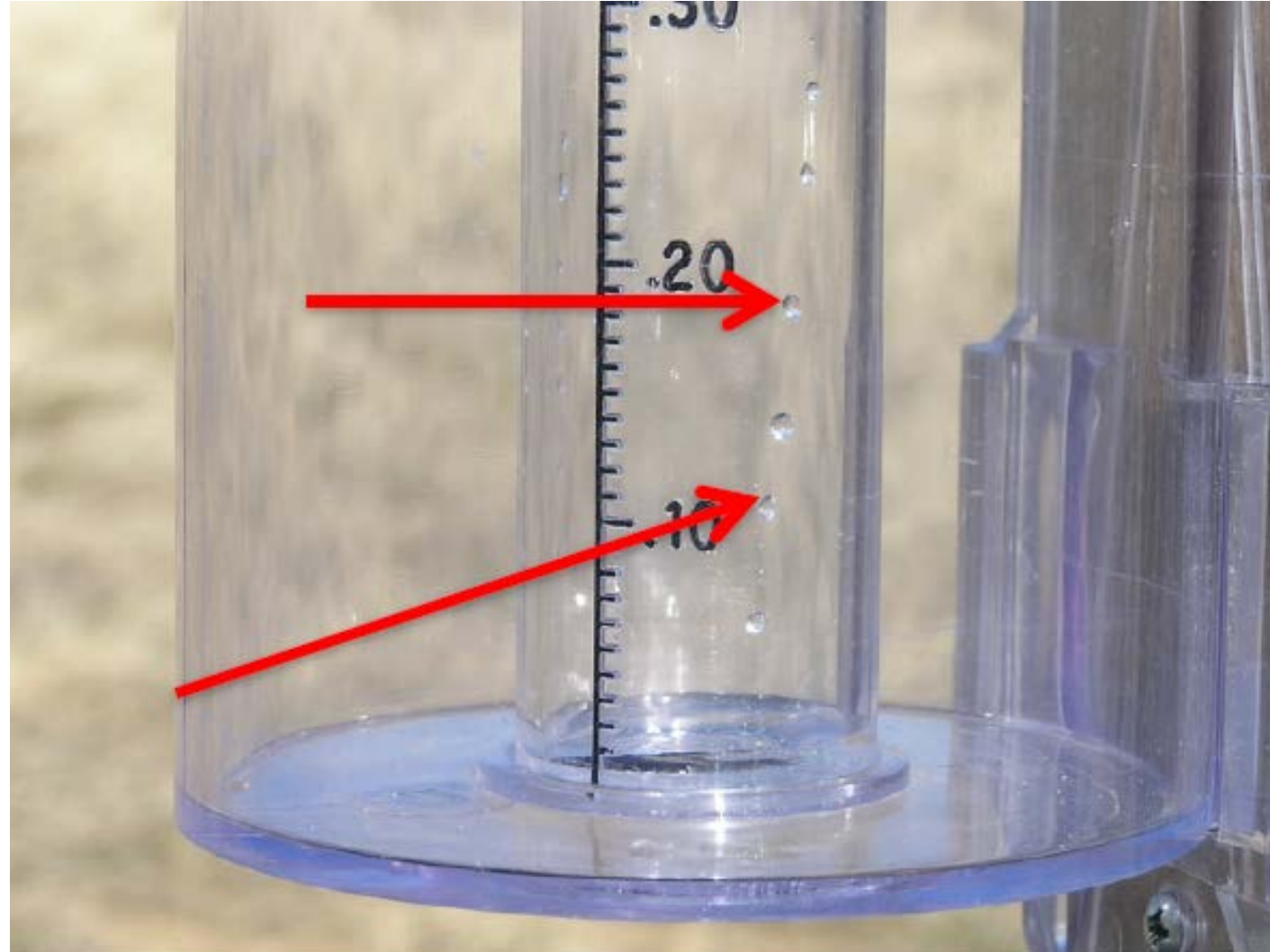
Reading the gauge: ZERO

- ZERO 0.00"
- Really important to know when it did not rain
 - Super important to understand for DROUGHT
- Record Zeros when observed and don't leave blank if you saw there was no rain



Reading the gauge: Trace "T"

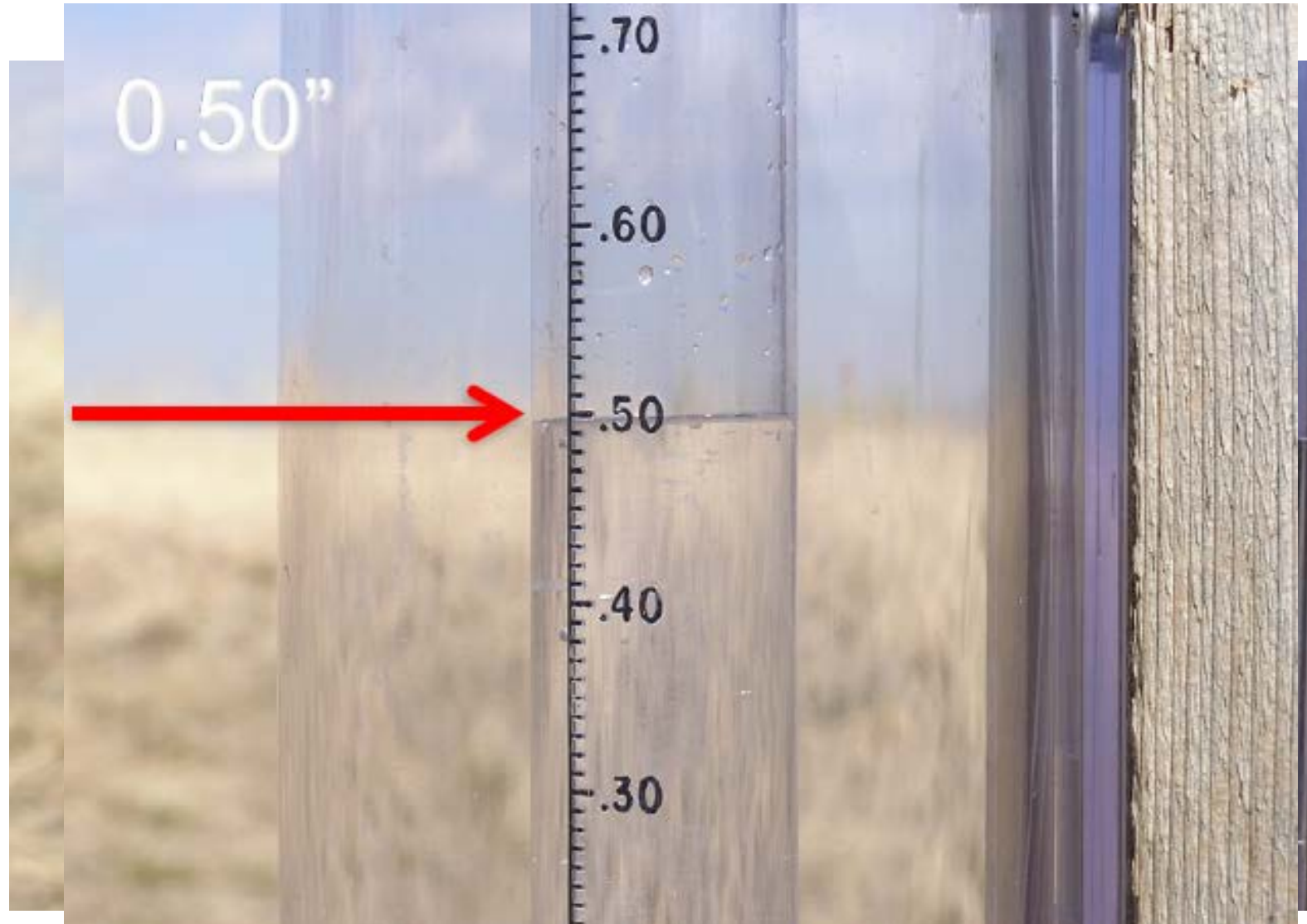
- Record trace if:
 - Sprinkle of rain
 - Few flakes of snow
 - as a Trace for your next observation, even if it does not fall in the rain gauge.
- A few drops in the gauge

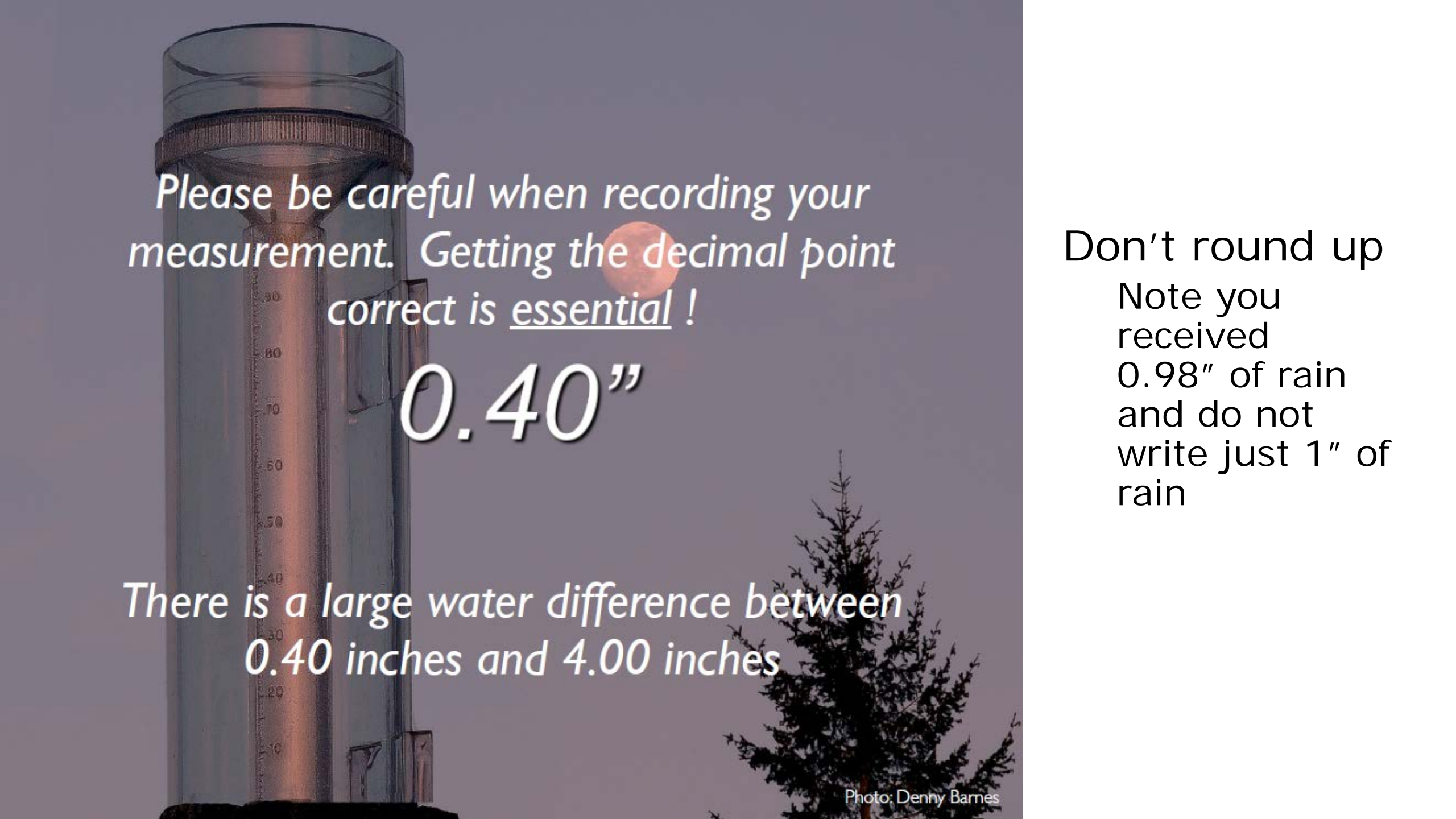


Reading the gauge

- Tenths
 - 0.50"

Record as accurately to the nearest hundredth of an inch





Please be careful when recording your measurement. Getting the decimal point correct is essential!

0.40"

There is a large water difference between 0.40 inches and 4.00 inches

Don't round up

Note you received 0.98" of rain and do not write just 1" of rain

1. Record first inch in inner tube
2. Empty inner tube
3. Pour remaining water in funnel into the tube
4. Record that measurement
5. Repeat until all rain in funnel is measured and recorded
6. Add up all measurements and enter data to CoCoRHaS



Other important information

Observations are preferred at 7am, but ok between 4:30-9:30 am. All other times accepted, but won't appear on CoCoRHaS maps.

Report when you are able. If gone for multiple days can report a multi-day total of rain upon your return.

Commitment is ideally one-season, but longer is better.



CoCoRaHS: Community Collaborative Rain Hail Snow Network

Other measurements

Snow

Hail

Significant weather events

Heavy rain or snow events

Condition monitoring

Drought impact reporter



Questions?

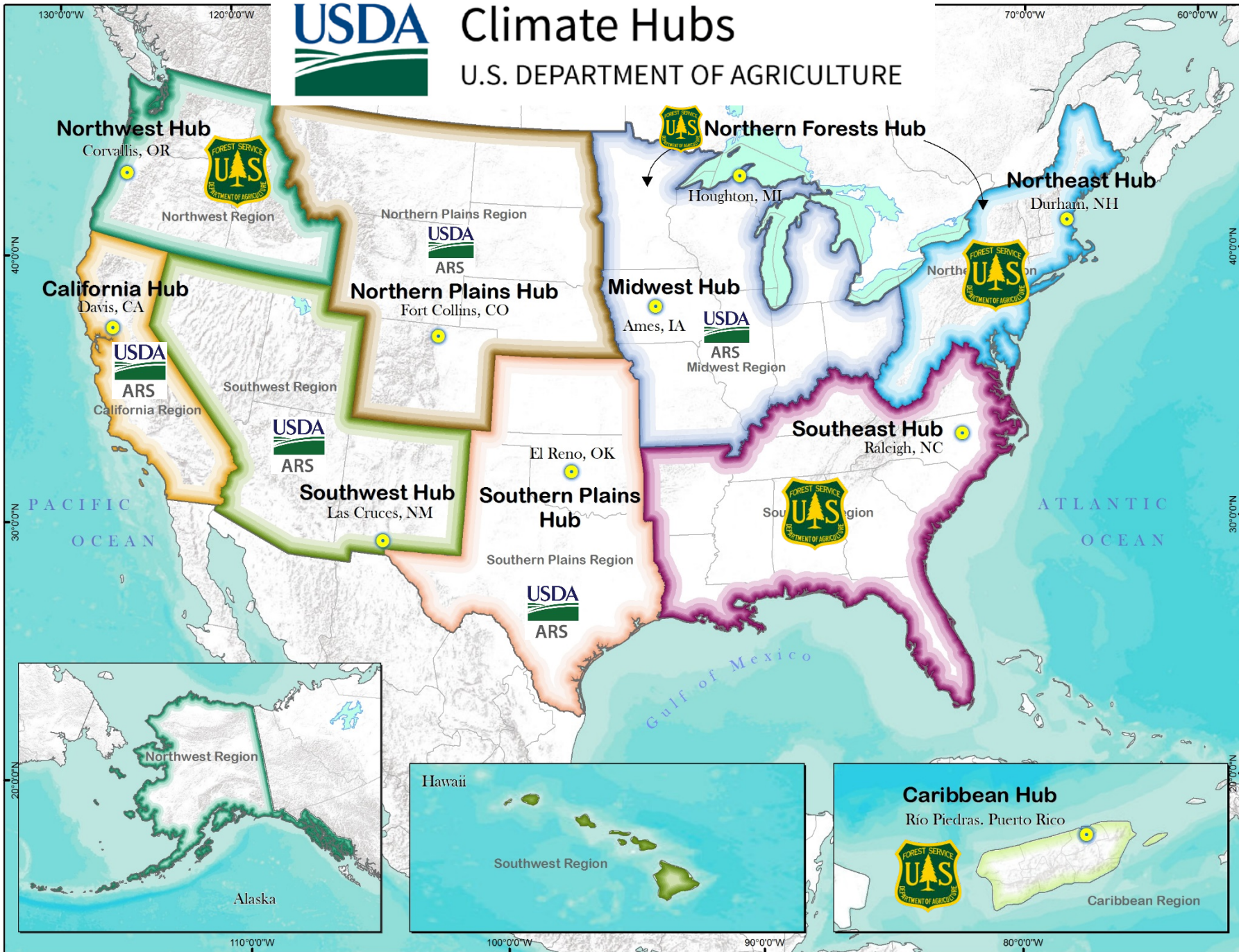
*Do you want to join
CoCoRHaS and take
home a gauge today?*





Climate Hubs

U.S. DEPARTMENT OF AGRICULTURE



USDA Climate Hubs

Collaboration across

- Forest Service (FS)
- Agricultural Research Service (ARS)
- Natural Resources Conservation Service (NRCS)

Contributions from

- Farm Service Agency (FSA)
- Risk Management Agency (RMA)
- Animal and Plant Health Inspection Service (APHIS)

USDA Climate Hub Mission

Develop and deliver science-based, region-specific information and technologies, with USDA agencies and partners, to agricultural and natural resource managers that enable climate-informed decision-making, and to provide access to assistance to implement those decisions.

<https://www.climatehubs.oce.usda.gov/>

Compilation of USDA Programs and Resources to Assist Tribes with Adapting to Climate Change

National product

Excel table (online soon)

150 Programs/Resources with descriptions & website links from 13 agencies

Grants and financial support

Insurance and loans

Informational resources

Services and training

Technical support

Filter by keywords, eligibility and geography

*Climate Change Component**

Examples resources / programs for nurseries

Agency	Title	Keywords	Programs / Resources	Description	Eligibility	Eligible	Climate change component	Category
Agricultural Marketing Service (AMS)	Grants & Opportunities	Commodity, Specialty crops	Specialty Crop Block Grant Program	The purpose of the Specialty Crop Block Grant Program (SCBGP) is to solely enhance the competitiveness of specialty crops. Specialty crops are defined as "fruits, vegetables, tree nuts, dried fruits, horticulture, and nursery crops (including floriculture)."	Applications for specialty crop projects must be submitted to the appropriate State Department of Agriculture to be considered for funding. <i>State Departments of Agriculture are encouraged to partner with specialty crop stakeholders, including socially disadvantaged and beginning farmers, in order to fulfill State specialty crop priorities. Individual or other non-</i>	Individuals, non-federal entity	This program enhances competitiveness of specialty crops and supports investing in specialty crop research, which includes conservation, environmental outcomes, sustainability, seed varieties / cultivars that will need to be resilient to changes in climate and	Grant: Block Grants
Farm Service Agency (FSA)	Disaster Assistance Programs	Emergency recovery	Tree Assistance Program	The Tree Assistance Program (TAP) provides financial assistance to qualifying orchardists and nursery tree growers to replant or, where applicable, rehabilitate eligible trees, bushes and vines lost by natural disasters. A qualifying mortality loss in excess of 15 percent (in excess of normal mortality) must be sustained to trigger assistance.	Open, contact your local FSA office.	Many	As extreme weather event impact farm productivity, FSA programs such as disaster assistance can help farms be more viable.	Financial Support
Risk Management Agency (RMA)	Whole-Farm Revenue Protection	Commodity	Whole-Farm Revenue Protection	Whole-Farm Revenue Protection (WFRP) provides a risk management safety net for all commodities on the farm under one insurance policy and is available in all counties nationwide. This insurance plan is tailored for any farm with up to \$8.5 million in insured revenue, including farms with specialty or organic commodities	Be eligible to receive Federal benefits; Be a U.S. citizen or resident; File either a Schedule F tax form or other farm tax form that can be converted to a Substitute Schedule F for a specified number of years; Have no more than \$8.5 million in insured revenue, which is the farm revenue allowed to be insured under the policy	Individuals	With climate change more extreme weather is expected. Crop insurance can help provide financial stability so that farmers and ranchers are better able to make the long-term investments needed to adapt to a changing climate.	Insurance
Farm Service Agency (FSA)	Disaster Assistance Programs	Conservation	Emergency Conservation Program	Farm Service Agency's ECP provides emergence financial and technical assistance to farmers and ranchers to rehabilitate farmland damaged by natural disasters and to implement emergency water conservation measures in periods of severe drought.	Open, contact your local FSA office.	Many	As extreme weather event impact farm productivity, FSA programs such as disaster assistance can help farms be more viable.	Financial and Technical Support
Farm Service Agency (FSA)	Conservation Programs	Emergency recovery	Emergency Forest Restoration Program	The Emergency Forest Restoration Program (EFRP) helps the owners of non-industrial private forests restore forest health damaged by natural disasters. The EFRP does this by authorizing payments to owners of private forests to restore disaster damaged forests. The local FSA County Committee implements EFRP for all disasters with the exceptions of drought and insect infestations. In the case of drought or an	Owners of non-industrial private forests. Contact your local FSA office.	Private forests	As extreme weather event impact farm productivity, FSA programs such as disaster assistance can help farms be more viable.	Financial Support
Farm Service Agency (FSA)	Farm Loan Programs	Emergency recovery	Emergency Loans	Emergency Loans (EL) help farmers and ranchers recover from production and physical losses due to drought, flooding, other natural disasters or quarantine. The Emergency loan program is triggered when a natural disaster is designated by the Secretary of Agriculture or a natural disaster or emergency is declared by the President under the Stafford Act.	For production losses, a 30% reduction in a primary crop in a designated or contiguous county is required. Losses to quality, such as receiving a reduced price for flood damaged crops, may be eligible for assistance. In addition to the general eligibility requirements all loan applicants must meet, there are some additional criteria unique to the Emergency Loan program see website.	Individuals, Business	More extreme weather events are expected to occur with changing climates. This program will provide farmers and ranchers with a loan to rebuild after sustained losses due to a disaster.	Loan

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Thank you

