Drought Forecast

This module provides seasonal forecasts of weather and soil water availability that can aid in the planning of treatments such as herbicide or seeding after wildfires. These forecasts may also be useful for understanding past treatment success, and/or evaluating climate and weather effects on treatments. These figures display soil moisture, temperature, and precipitation (30-day rolling average) for the selected site for the past 6 months and the modeled future 12 months. Figures also show the difference between forecasted conditions and the long-term average, which can be used to assess how the coming year is expected to differ from typical conditions at the site.

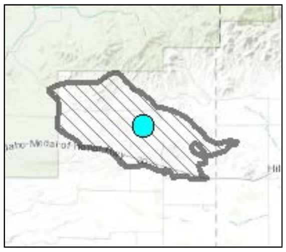
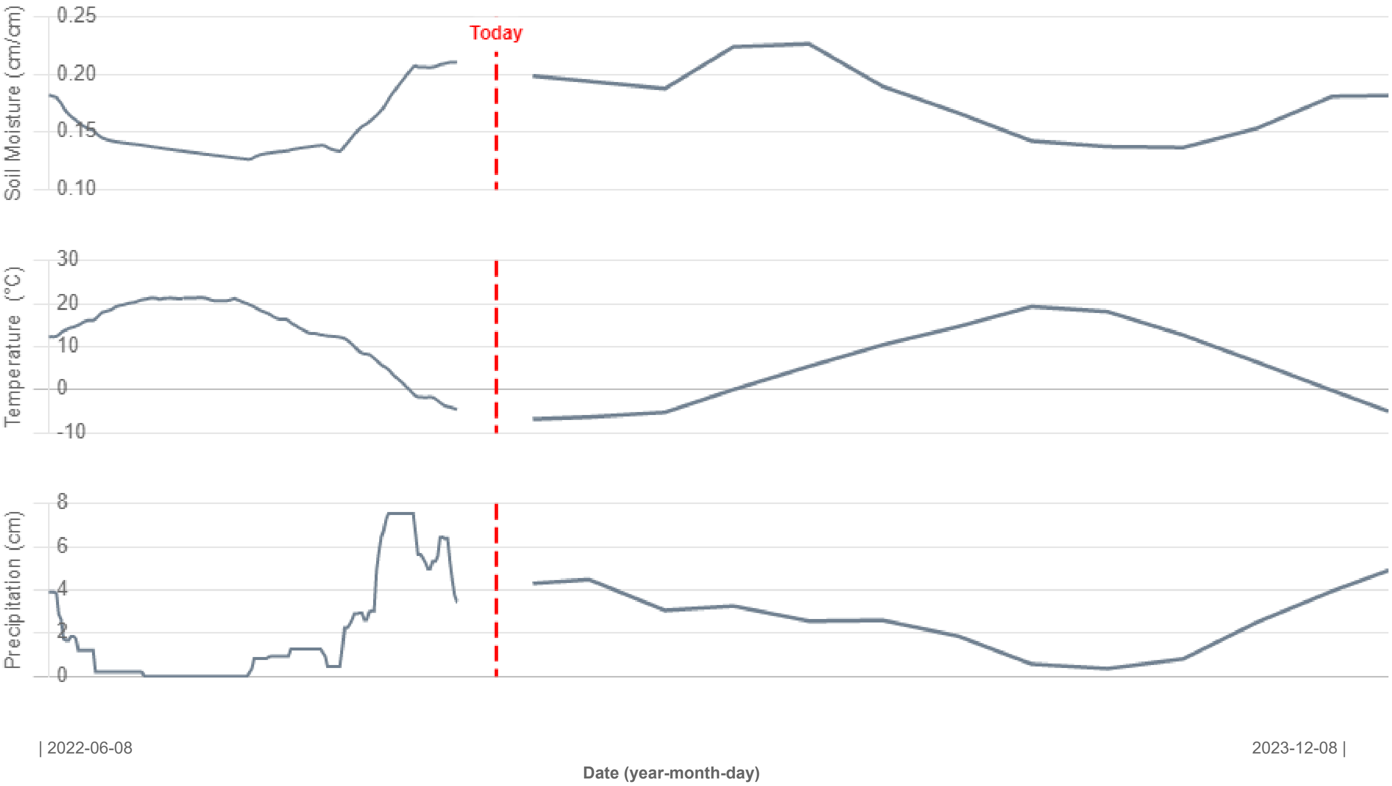


Figure 1. The location used for the drought forecast (blue circle).

Quick view

Past 6 months

Future 12 months



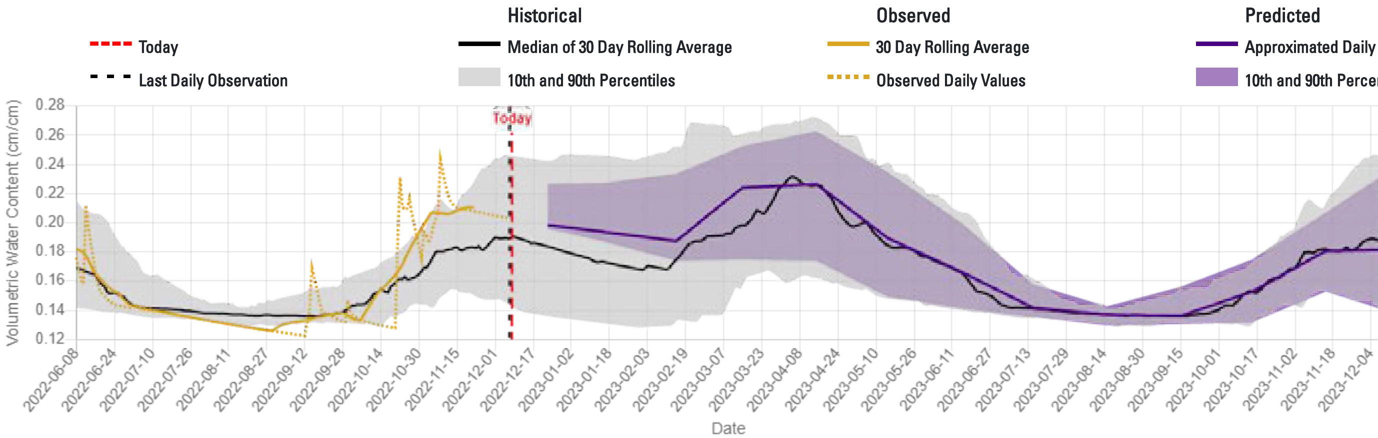
There are two figures each for soil moisture, temperature, and precipitation. For figure A in each section, the historical median of the 30-day rolling average (black line), and 10th and 90th quantile (gray shaded area) were calculated for the climatological normal period (1981 2011) and represent reference conditions for this site. The vertical, dashed red line on the figure is today's date and the vertical, dashed black line is the date of the most recent data from gridMet. To the left of the vertical red line are the observed dailys (dashed yellow line, data from gridMet, and a 30-day rolling average of observations (solid yellow line). To the right of the red line are the approximated daily means (thick purple line), and the 10th and 90th (shaded purple) values for the upcoming year.

For each figure B, The historical normal is calculated as the median of 30-day rolling average taken over 1981 - 2011. In this figure the normal is set to 0 (horizontal black line) and the 10th to 90th percentile of this period is shaded in gray. The vertical, dashed red line on the figure is today's date and the vertical, dashed black line is the date of the most recent weather data from gridMet. The difference between the historical normal and the recent past/upcoming year are represented in green or red (greater than historical normal) and brown or blue (less than historical normal) shaded areas. The differences between the 10th and 90th percentiles of the future and the historical normal are represented as dashed purple lines.

Future forecasts show variation at the monthly timescale (that are interpolated to daily) because that is the timescale of the National Weather Service forecasts. More about the development of these forecasts can be found at https://github.com/DrylandEcology/ShortTermDroughtForecaster.

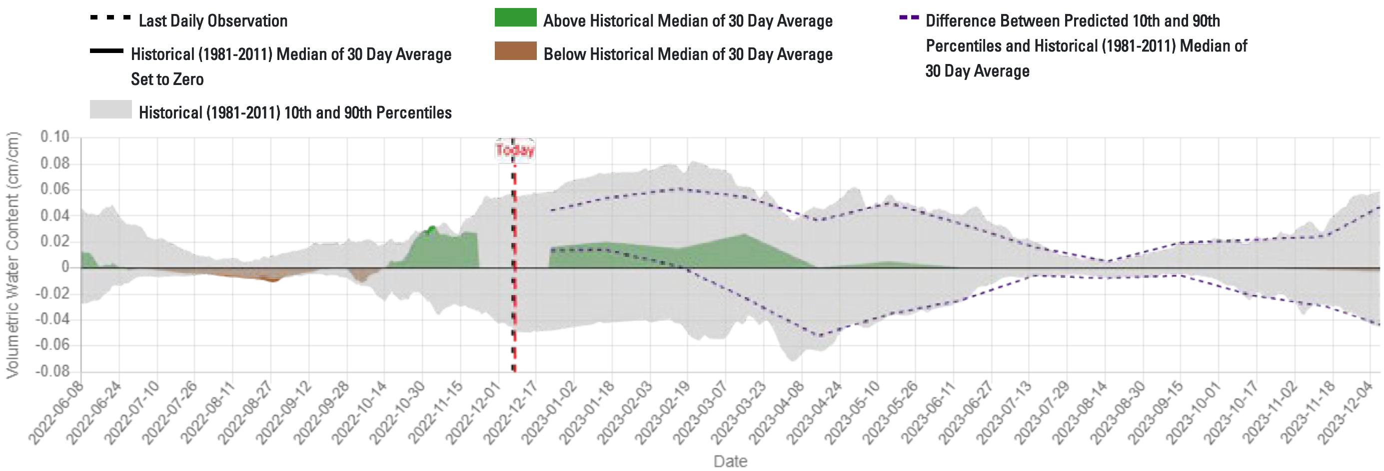
Soil Moisture

A



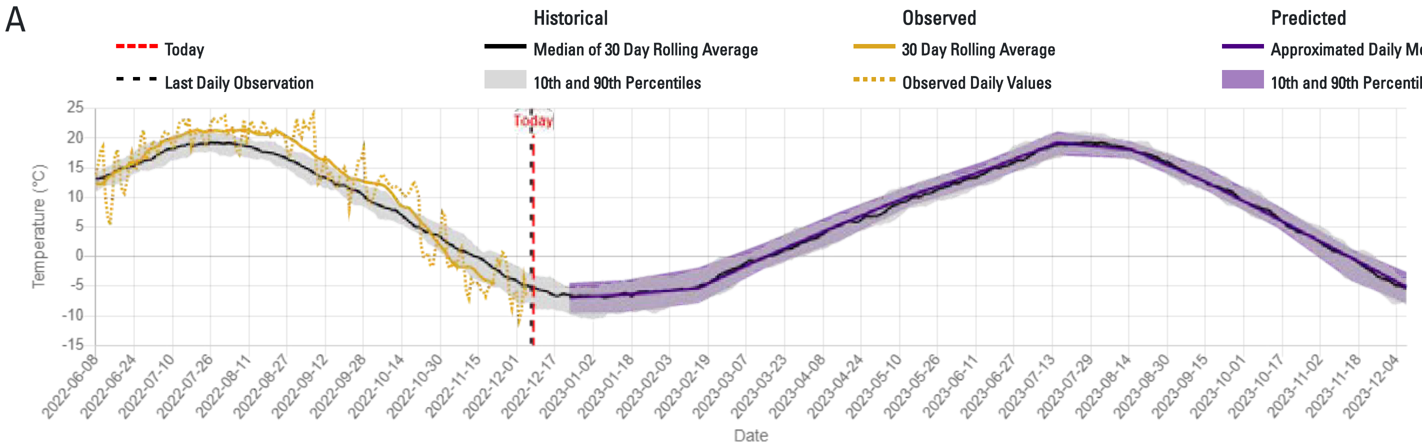
The figure above shows an 18-month time series of soil moisture (volumetric water content) values in Shallow (0-15cm) soils. The time series includes recent (the last 6 months) observations on the left and forecasted values (the next 12 months) on the right. Variability in forecasted values is a result of uncertainty in the seasonal outlooks for temperature and precipitation.

B

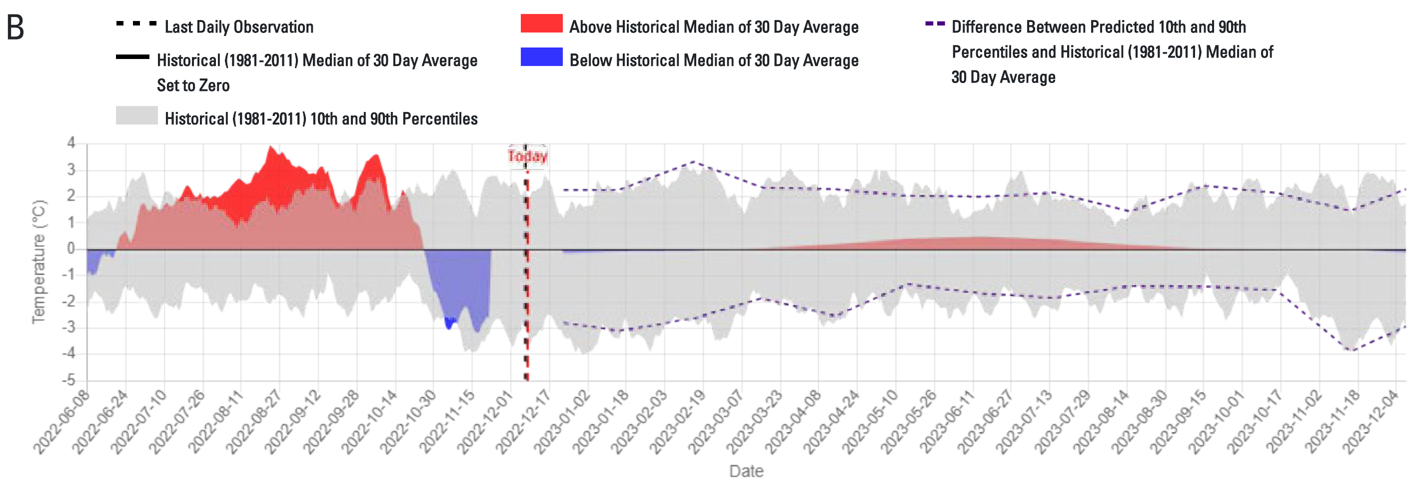


The figure above shows an 18-month time series of soil moisture (volumetric water content) deviations from the long-term site median of the 30-day rolling average in Shallow (0-15cm) soils. The vertical, dashed red line on the figure is today's date and the vertical, dashed black line is the date of the most recent data from gridMet. The time series includes recent (the last 6 months) observations on the left and forecasted values (the next 12 months) on the right. The long-term historical normal for each day is plotted in the background to help compare the recent past and future to reference conditions. This figure helps users determine if soils are expected to be wetter or drier than normal.

Temperature



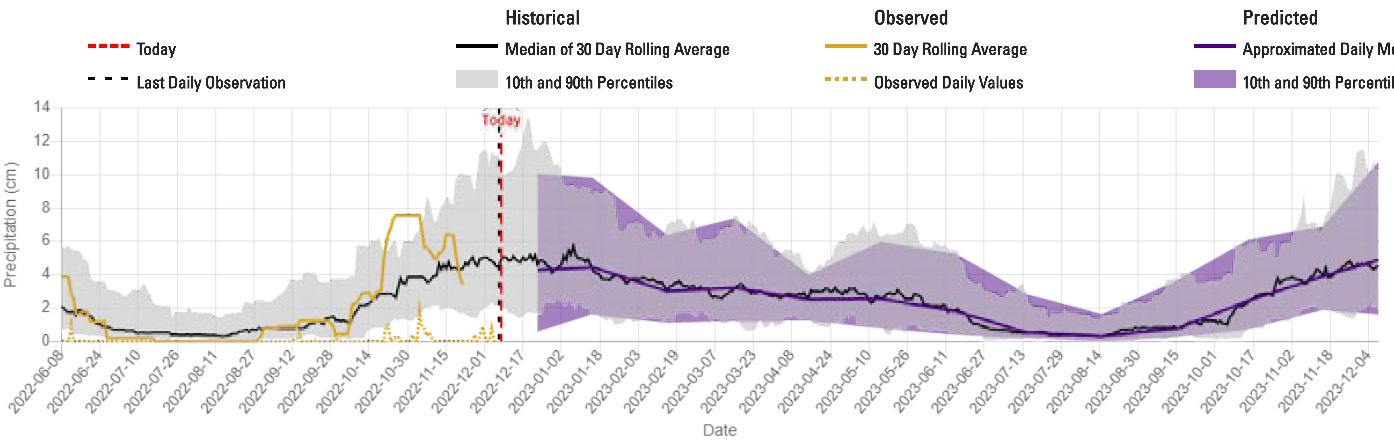
The figure above shows an 18-month time series of air temperature. The time series includes recent (the last 6 months) observations on the left and forecasted values (the next 12 months) on the right. Variability in the forecasted values is a direct result of variability in the seasonal temperature outlooks.



The figure above shows an 18-month time series of air temperature deviations from the long-term climatological normal for your site. The time series includes recent (the last 6 months) observations on the left and forecasted values (the next 12 months) on the right. The long-term historical normal for each day is plotted in the background to help compare the recent past and future to reference conditions. This figure helps users determine if the temperature is expected to be warmer or cooler than normal.

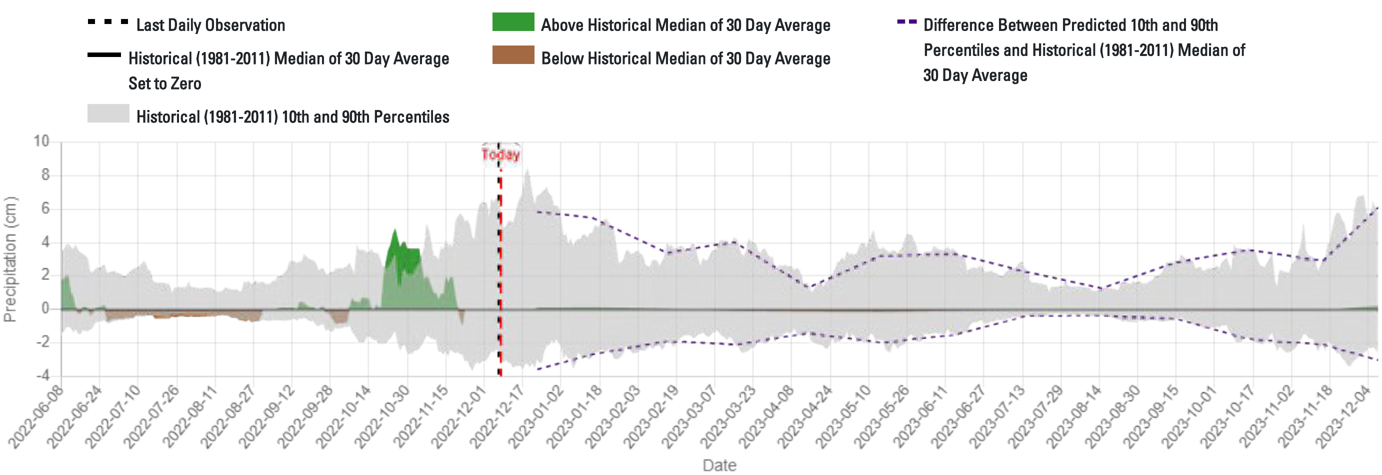
Precipitation

A



The figure above shows an 18-month time series of precipitation. The time series includes recent (the last 6 months) observations on the left and forecasted values (the next 12 months) on the right. Variability in the forecasted values is a direct result of variability in the seasonal precipitation outlooks.

B



The figure above shows an 18-month time series of precipitation deviations from the long-term climatological normal for your site. The time series includes recent (the last 6 months) observations on the left and forecasted values (the next 12 months) on the right. The long-term historical normal for each day is plotted in the background to help compare the recent past and future to reference conditions. This figure helps users determine if precipitation is expected to be less than or greater than normal.

Sagebrush Seeding Success

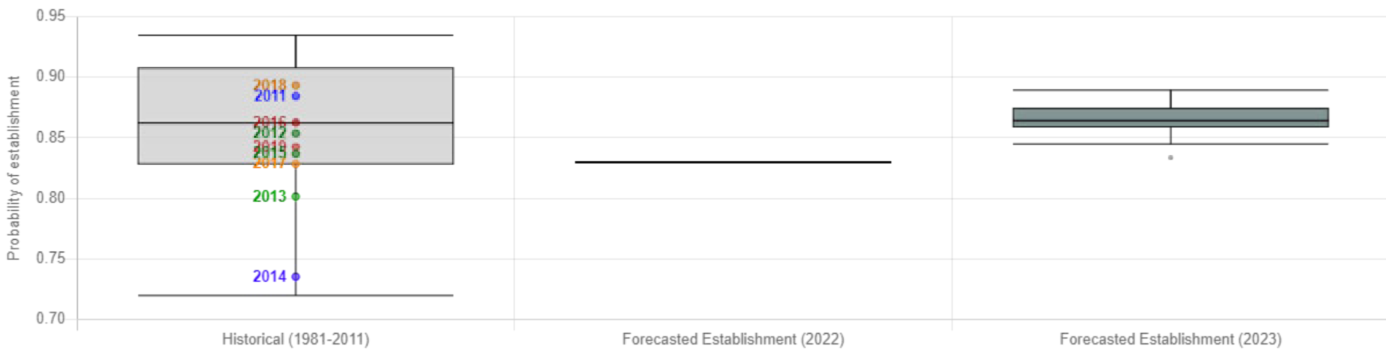
Estimates of future seeding success can be made from the findings of historic relationships of post-fire sagebrush seeding success to soil-moisture and temperature conditions in and around the Great Basin. Below are estimates of big sagebrush seeding outcomes for the coming season derived from two recent publications. The first study (Shriver et al. 2018) identified that seeding success is greater where and when spring moisture is greater. The second study (O'Connor et al. 2020) further discovered that successful seedings had seven additional days of soil water available to seeds and seedlings based on soil physical properties(e.g., texture) when soils were above freezing, compared to unsuccessful sites.

Study 1 (Shriver et al. 2018)

These metrics were developed under the SageSuccess Project, which is a joint effort between USGS, BLM, and FWS. This study related soil water content in early spring and site air temperature the first half of the year to post-wildfire sagebrush seeding success. The results indicated big sagebrush occurrence is most strongly associated with relatively cool temperatures and wet soils in the first spring after seeding. The resulting forecasts help identity where and when seedings might be more or less successful.

In 2022, there is a 0.00% chance that probability of establishment is above historical median

In 2023, there is a 53.33% chance that probability of establishment is above historical median



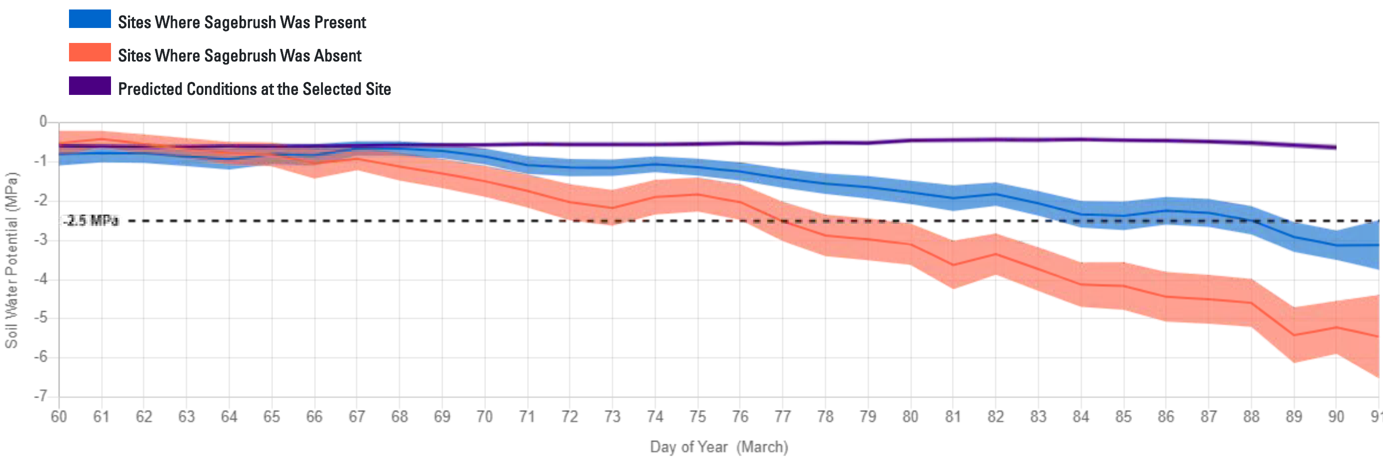
The boxplot on the left represent the median and the range of sagebrush establishment in the climatic normal period (1981 - 2011). Individual points of probability of success in more recent years are marked. The center and right-most boxplot are predictions for probability of success for 2022 and 2023. The boxplots represent the range across potential realizations of the future. Data for 2023 will not be displayed until at least 6 months of forecast data are available for that year.

Study 2 (O'Connor et al. 2020)

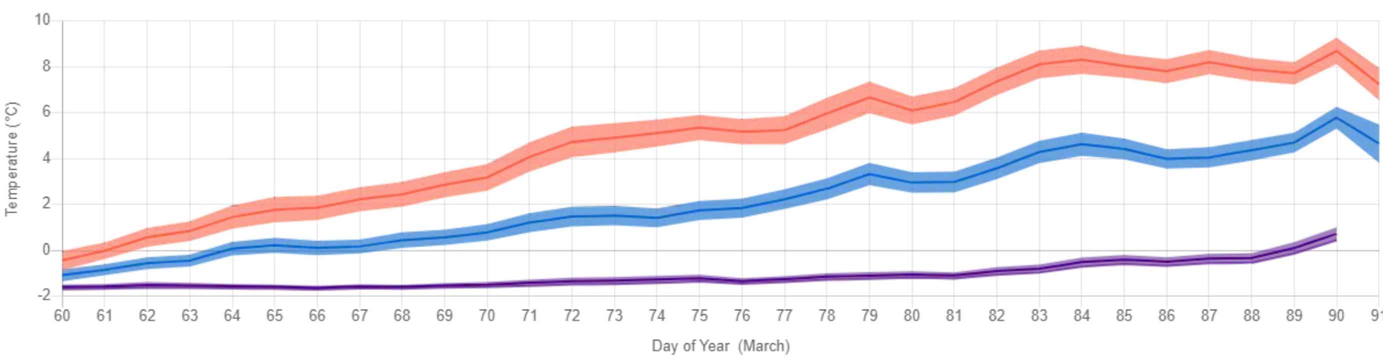
These metrics were developed by the USGS under the Climate Adaptation Science Center (CASC) Ecological Drought Index study. This study used the SageSuccess data and included additional post-wildfire seeding areas for statistical validation, and considered whether the modeled soil-water contents were in the plant-available range during sagebrush germination and emergence (March). Soil-water availability relates to how strongly bound soil water is to soil. Values 0 to -1.5 MPa (megapascals) are typically easily extracted by most wildland plants while values below -2.5 MPa cannot be extracted by most plants, including sagebrush seedlings. This study found that successful seedings had seven additional days of soil water available to seeds and seedlings based on soil physical properties (e.g. texture) when soils were above freezing, compared to unsuccessful sites. These figures allow for the comparison between the user selected location and sites where sagebrush was or was not present.

For each figure below, sites where sagebrush was present (blue) and absent (orange), with a 95% confidence interval in shaded band. The predicted conditions for the selected site and 95% confidence interval are shown in purple. If 'Today's' date falls in March, days in March before 'Today' are observed values (yellow) and days in March after 'Today' are the predicted values (purple) for the remainder of the month.

If the purple and blue lines are similar, then the selected site is predicted to have a similar soil water potential or Temperature in March as did sites where sagebrush was present post wildfire seeding. Note that predicted values are more accurate for values in the near future than those in the more distant future.



Mean daily soil water potential (top layer of soil/0-5cm only) in March across all sites used in O'Connor et al. 2020 study, where sagebrush was present (blue) and absent (orange), with a 95% confidence interval in shaded band. The predicted conditions for the selected site and 95% confidence interval are shown in purple. If 'Today's' date falls in March, days in March before 'Today' are observed values (yellow) and days in March after 'Today' are the predicted values (purple) for the remainder of the month. If the purple and blue lines are similar, then the selected site is predicted to have a similar soil water potential in March as did sites where sagebrush was present post wildfire seeding. Note that predicted values are more accurate for values in the near future than those in the more distant future.



Mean daily soil temperature (top layer of soil/0-5cm only) in March across all sites used in O'Connor et al. 2020 study, where sagebrush was present (blue) and absent (orange), with a 95% confidence interval in shaded band. The predicted conditions for the selected site and 95% confidence interval are shown in purple. If 'Today's' date falls in March, days in March before 'Today' are observed values (yellow) and days in March after 'Today' are the predicted values (purple) for the remainder of the month. If the purple and blue lines are similar, then the selected site is predicted to have a similar soil temperature in March as did sites where sagebrush was present post wildfire seeding. Note that predicted values are more accurate for values in the near future than those in the more distant future.

Potential Natural Sagebrush Seedling Survival

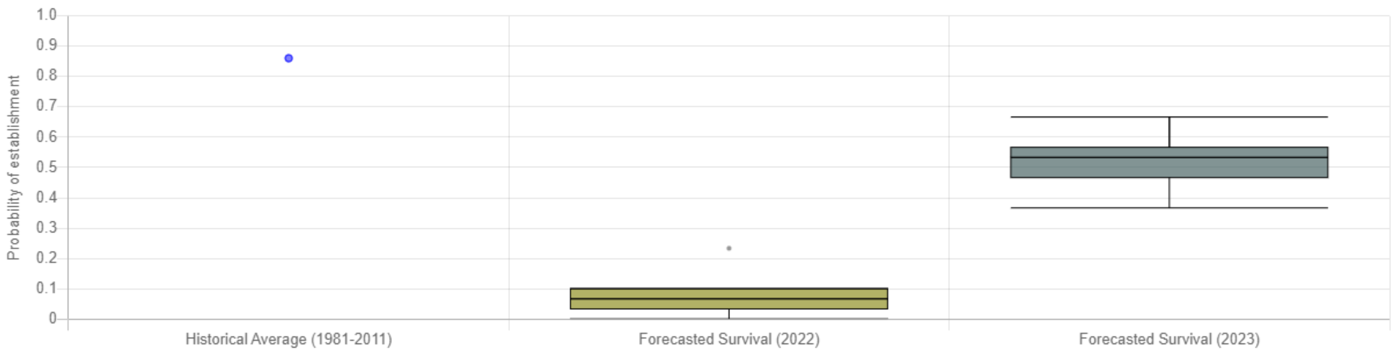
Previous research (Schlaepfer et al. 2014a) has evaluated how natural sagebrush regeneration (e.g. germination and survival from seed produced by established big sagebrush plants) is influenced by soil moisture, temperature, snowpack, and other conditions. Natural regeneration is a very different process from seeding establishment during restoration. Below is the forecasted probability of conditions supporting sagebrush seedling survival for natural regeneration in an unburned, intact sagebrush plant community.

Study 1 (Schlaepfer et al. 2014a)

This study reviewed the literature to identify important drivers of big sagebrush regeneration (Schlaepfer et al. 2014b) and built a model based on those drivers that estimates big sagebrush regeneration potential on an annual basis, parameterized with field observations (Schlaepfer et al. 2014a). These regeneration patterns and forecasts relate to unburned, intact sagebrush plant communities.

In 2022, there is a 0.00% chance that probability of survival is above historical mean.

In 2023, there is a 0.00% chance that probability of survival is above historical mean.



The point on the left is the mean of conditions supporting sagebrush in the climatic normal period (1981 - 2010). The center and right-most boxplot are predictions for sagebrush survival in 2022 and 2023. The boxplots represent the range across potential realizations of the future. Data for 2023 will not be displayed until at least 6 months of forecast data are available for that year.

About the Land Treatment Exploration Tool

The Exploration Tool is designed for use by resource managers during the land treatment planning stage. This tool summarizes environmental characteristics of planned treatment areas and facilitates adaptive management practices by comparing those characteristics to similar legacy treatments.

How to cite ❓:

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