

Building an Enhanced Drought Climatology Decision Support Tool: The Drought Risk Atlas

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Western States Drought Coordinators and Emergency Managers Meeting
Seattle, WA July 21-22, 2015

Photo credit: CoCoRaHS observer near Lamar, Colorado

Drought Risk Atlas (DRA):

➤ **OPEN for business!**
➤ **Droughtatlas.unl.edu**

- Launched March 2014
- **~3000** stations archived
 - 139 clusters/regions developed and analyzed
 - SPI, SPEI, PDSI, sc-PDSI and Deciles through 2010
 - 1 billion indice records
 - Weekly/monthly gridded maps for all parameters back to early 1900s (over 500,000 maps)
- Created to answer questions about the **characteristics of drought:**
 - Frequency/return periods
 - Duration
 - Trends
 - Intensity
 - Spatial extent

Friday, February 01, 2013

Drought Risk Atlas

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Welcome to the Drought Risk Atlas

Introduction

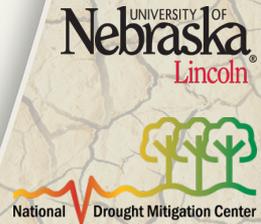
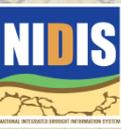
The idea of updating and expanding a national drought atlas was developed from the original Drought Atlas that was done in conjunction with United States Army Corps of Engineers by Hoskings, Wallis and Guttman in the early 1990s. The original Drought Atlas consisted of those stations in the Historical Climate Network (HCN), numbering approximately 1,000 stations. The period of record at the time was limited, as many stations only had records from the 1940s to present, and these data points were put into their respective climate divisions. A monthly time step was used to calculate the Palmer Drought Severity Index (PDSI). With the new Drought Atlas, bringing precise data down to spatial scales that would allow decision makers to use this tool to better understand drought in their respective region and to make a better decision.

For the new National Drought Atlas, the idea was to expand the data both in the number of stations analyzed and the period of record to include the most complete long-term stations, some of which are not part of the HCN. Using a weekly time-step to calculate multiple drought indices at each station location, not on a climate division scale, allows for a more precise representation of drought histories. The Standardized Precipitation Index (SPI), Palmer Drought Severity Index (PDSI), Deciles, the United States Drought Monitor and other Climatological data are included in the new drought atlas. Along with the Climatological data, gridded maps created on a weekly time-step are available for the entire United States.

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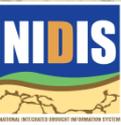
UNIVERSITY OF Nebraska Lincoln

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What Questions Will the Drought Risk Atlas Help Answer?

- ▶ How does the drought ***compare historically?***
- ▶ How often does a drought of this magnitude happen? (***frequency/return periods***)
- ▶ When was the last time a drought like this happened? (***analog***)
- ▶ What did the ***spatial footprint*** of the last drought look like? (areal extent via maps)
- ▶ Expand drought planning ***horizons?***
 - Would like to add ***paleo*** (tree rings) data in the future

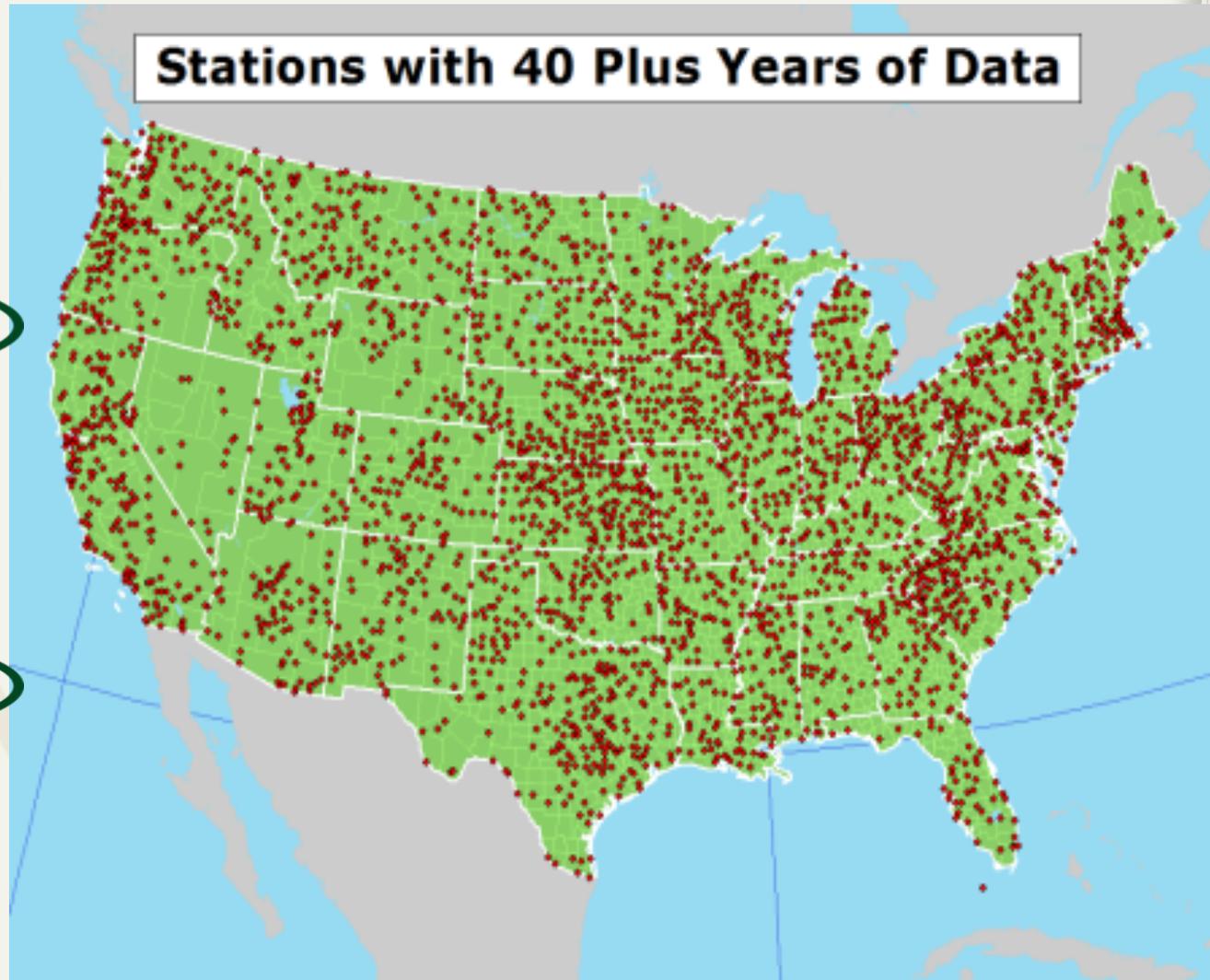


Drought Risk Atlas Stations:

Here is the final breakdown of stations used in the DRA meeting all our criteria:

- **3059** stations with **40+** years of data
- 2462 stations with 50+ years of data (81.04%)
- **1733** stations with **60+** years of data (**57.04%**)
- 1170 stations with 70+ years of data (38.51%)
- **827** stations with **80+** years of data (**27.22%**)
- 537 stations with 90+ years of data (17.68%)
- **349** stations with **100+** years of data (**11.50%**)

Stations with 40 Plus Years of Data



Climate Data

Select Atlas Station: 457473 (SEATTLE TACOMA INTL AP)

Select New Station

Station Climate Deciles SPI SPEI PDSI SC-PDSI Drought Monitor Drought Periods Compare Indices Frequencies



457473: SEATTLE TACOMA INTL AP

Latitude

47.444

Longitude

-122.314

Elevation (ft)

370

State

Washington

County

King

Climate Division

3

Time Period

1/1/1948 - 12/31/2012

Years on Record

64

Precipitation Only

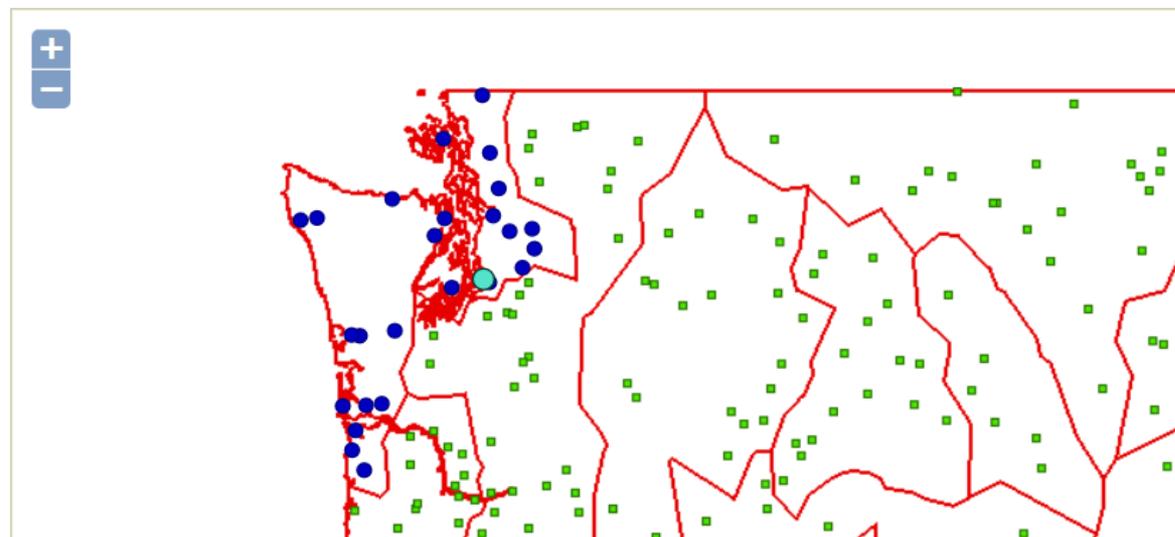
No

[Download Metadata](#)

The Atlas period of record can and will vary from the ACIS period of record. Stations may

Similar Stations

Atlas Region



Related Stations:

(Click to select)

350328: ASTORIA RGNL AP

355971: NEHALEM 9 NE



Results for **SEATTLE TACOMA INTL AP (457473)** between 1/1/1948 and 12/31/2012, aggregated by year.



Date

1/1/1948 to 12/31/2012
 Period of Record
 Station start date: 1/1/1948

Aggregate

Annual

Precipitation

Driest

Wettest

Rank	Date	Total (in.)
1	1952	23.72
2	1985	25.14
3	1976	26.78
4	1993	28.51
5	2000	28.51
6	1987	29.98
7	2008	31.17
8	2004	31.20
9	2002	31.46
10	1979	32.10

Rank	Date	Total (in.)
1	1950	55.40
2	1996	50.00
3	1953	49.50
4	2006	49.33
5	1968	49.14
6	1972	48.39
7	2012	48.27
8	2010	47.31
9	1955	47.15
10	1959	46.53

Temperature - Warmest

TMax

TMin

Rank	Date	Average (°F)
1	1992	62.51
2	1997	62.14

Rank	Date	Average (°F)
1	1995	46.75
2	2004	46.33

Climate Data

Selected Atlas Station: 457473 (SEATTLE TACOMA INTL AP)

Select New Station

Station Climate Deciles SPI SPEI PDSI SC-PDSI Drought Monitor Drought Periods Compare Indices Frequencies



Results for SEATTLE TACOMA INTL AP (457473) between 1/1/1948 and 12/31/2012, aggregated by year.



Date

1/1/1948 to 12/31/2012

Period of Record

Station start date: 1/1/1948

Aggregate

Annual

Show 25 entries

Search:

Date	Precipitation (in.)	Contains NoData	TMax (°F)	Contains NoData	TMin (°F)	Contains NoData
1952	23.72	No	58.74	No	41.47	No
1985	25.14	No	57.63	No	42.27	No
1976	26.78	No	59.87	No	45.12	No
1993	28.51	No	60.04	No	44.43	No
2000	28.51	No	58.68	No	44.28	No
1987	29.98	No	62.14	No	45.14	No
2008	31.17	No	58.50	No	44.38	No
2004	31.20	No	60.62	No	46.22	No
2002	31.46	No	58.89	No	44.44	No
1979	32.10	No	60.86	No	45.25	No
1992	32.78	No	62.51	No	46.09	No
1977	32.84	No	60.53	No	45.40	No
1949	33.16	No	59.15	No	41.40	No
1988	33.40	No	60.25	No	44.57	No
1965	33.62	No	60.32	No	44.83	No

Climate Data

Selected Atlas Station: 457473 (SEATTLE TACOMA INTL AP)

Select New Station

- Station
- Climate
- Deciles
- SPI**
- SPEI
- PDSI
- SC-PDSI
- Drought Monitor
- Drought Periods
- Compare Indices
- Frequencies

- ?
- ?
- ?
- ?
- ?
- ?

Results for **SEATTLE TACOMA INTL AP (457473)** for the 12 Month timestep(s) between 1/1/1948 and 12/31/2012 and aggregated by month.

Date

1/1/1948 to 12/31/2012

Period of Record

Station start date: 1/1/1948

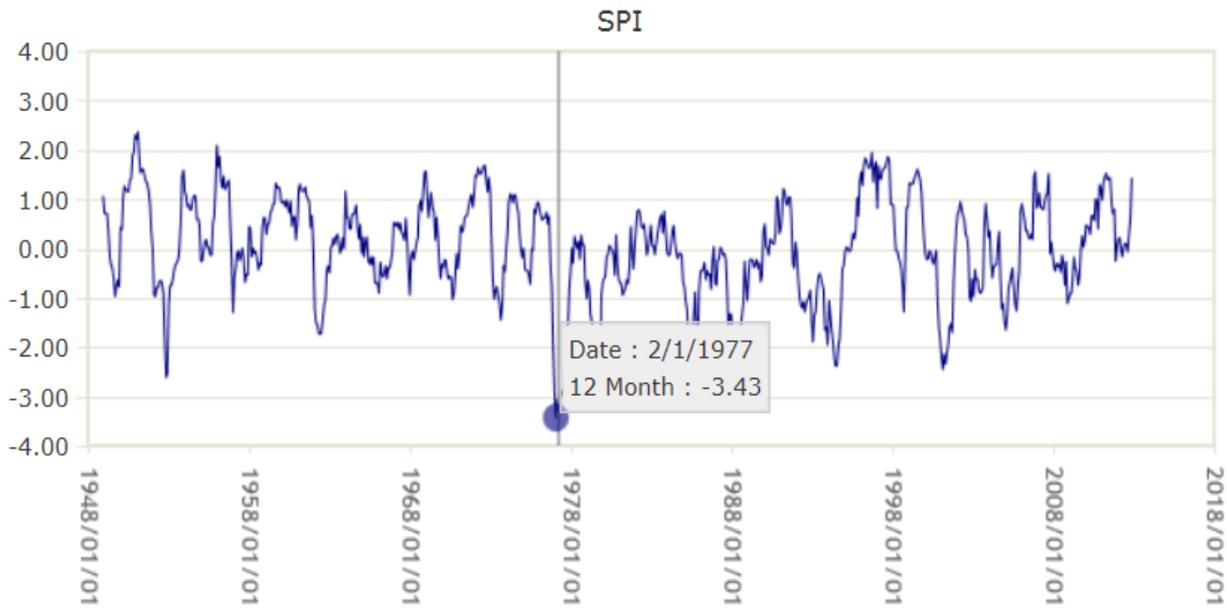
Aggregate

Month

Timestep

Select one or more timesteps to compare.

- 1 month
- 2 month
- 3 month
- 4 month
- 5 month
- 6 month
- 7 month
- 8 month
- 9 month
- 10 month
- 11 month
- 12 month**
- 18 month
- 24 month



- 1 Month
- 2 Month
- 3 Month
- 4 Month
- 5 Month
- 6 Month
- 7 Month
- 8 Month
- 9 Month
- 10 Month
- 11 Month
- 12 Month
- 18 Month
- 24 Month
- 36 Month
- 48 Month
- 60 Month
- 72 Month
- 84 Month
- 96 Month

To zoom in on the chart, click and drag across the chart area. To return to the complete chart, double-click in the chart area.

Climate Data

Selected Atlas Station: 457473 (SEATTLE TACOMA INTL AP)

Select New Station

Station Climate Deciles **SPI** SPEI PDSI SC-PDSI Drought Monitor Drought Periods Compare Indices Frequencies



Results for **SEATTLE TACOMA INTL AP (457473)** for the 12 Month timestep(s) between 1/1/1948 and 12/31/2012 and aggregated by month.

Date

1/1/1948 to 12/31/2012

Period of Record

Station start date: 1/1/1948

Aggregate

Month

Timestep

Select one or more timesteps to compare.

- 1 month
- 2 month
- 3 month
- 4 month
- 5 month
- 6 month
- 7 month
- 8 month
- 9 month
- 10 month
- 11 month
- 12 month
- 18 month
- 24 month

Show 25 entries

Search:

Month	12 Month
2/1/1977	-3.43
4/1/1977	-3.3
3/1/1977	-3.07
7/1/1977	-2.99
5/1/1977	-2.97
1/1/1977	-2.92
6/1/1977	-2.88
8/1/1977	-2.83
11/1/1979	-2.75
11/1/1952	-2.62
12/1/1952	-2.54
9/1/1977	-2.45
3/1/2001	-2.45
7/1/1994	-2.39
8/1/1994	-2.38
9/1/1979	-2.35
5/1/2001	-2.35



Date

1/1/1948 to 12/31/2012

Period of Record

Station start date: 1/1/1948

Aggregate

Month

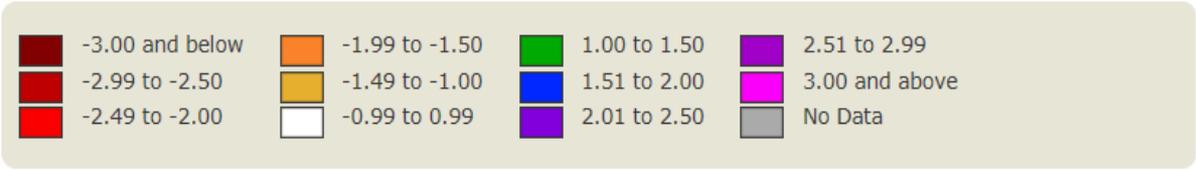
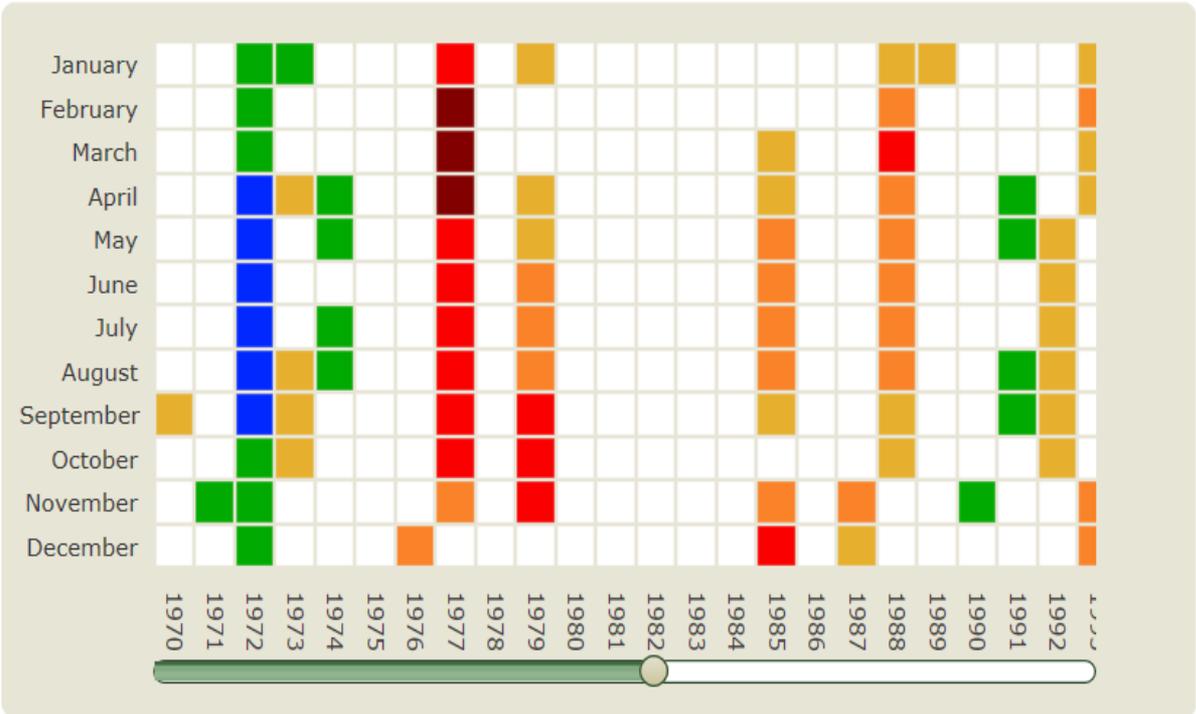
Timestep

Select one or more timesteps to compare.

- 1 month
- 2 month
- 3 month
- 4 month
- 5 month
- 6 month
- 7 month
- 8 month
- 9 month
- 10 month
- 11 month
- 12 month
- 18 month
- 24 month
- 36 month
- 48 month
- 60 month
- 72 month
- 84 month
- 96 month

Results for **SEATTLE TACOMA INTL AP (457473)** for the 12 Month timestep(s) between 1/1/1948 and 12/31/2012 and aggregated by month.

Note: Only the shortest duration timestep that is selected will be displayed below. ✕










Results for **SEATTLE TACOMA INTL AP (457473)** for the 12, 24 Month timestep(s) between 1/1/1948 and 12/31/2012 and aggregated by month. 

Date

 to 
 Period of Record
 Station start date: 1/1/1948

Aggregate

Month

Timestep

Select one or more timesteps to compare.

- 1 month
- 2 month
- 3 month
- 4 month
- 5 month
- 6 month
- 7 month
- 8 month
- 9 month
- 10 month
- 11 month
- 12 month
- 18 month
- 24 month
- 36 month
- 48 month
- 60 month
- 72 month
- 84 month
- 96 month

September

12 Month			24 Month		
Rank	Year	SPI	Rank	Year	SPI
1	1977	-2.45	1	1994	-2.05
2	1979	-2.35	2	1980	-1.78
3	1994	-1.97	3	1986	-1.52
4	2001	-1.53	4	1978	-1.50
5	1973	-1.45	5	1979	-1.44
6	1985	-1.45	6	1993	-1.44
7	1988	-1.39	7	1989	-1.39
8	1962	-1.15	8	2001	-1.31
9	2005	-1.13	9	1995	-1.28
10	1992	-1.10	10	1985	-1.27

Climate Data

 Selected Atlas Station: **457473 (SEATTLE TACOMA INTL AP)**
[Select New Station](#)

 Station Climate Deciles SPI SPEI PDSI SC-PDSI **Drought Monitor** **Drought Periods** Compare Indices Frequencies

 Results for **SEATTLE TACOMA INTL AP (457473)** at the 12 Month timestep with a minimum drought class of -2 between 1/1/1948 and 12/31/2012.

Date

 to

 Period of Record

Station start date: 1/1/1948

Note: the drought period ends when the index returns to zero.

Index

Select an index

Drought Classification

Timestep

Number of Droughts: 4

Longest Drought: 22 months

Average Duration: 17 months

Time in Drought: 8.72%

 Show entries

 Search:

Drought Start	Drought End	Duration (months)
7/1/1994	11/1/1995	16
3/1/1988	1/1/1990	22
9/1/1979	7/1/1980	10
1/1/1977	9/1/1978	20

Showing 1 to 4 of 4 entries



Climate Data

Selected Atlas Station: 457473 (SEATTLE TACOMA INTL AP)

[Select New Station](#)[Station](#)[Climate](#)[Deciles](#)[SPEI](#)[SPEI](#)[PDSI](#)[SC-PDSI](#)[Drought Monitor](#)[Drought Periods](#)[Compare Indices](#)[Frequencies](#)

Index

SPEI

Aggregate

Month

Timestep

12 Month

Results for **SEATTLE TACOMA INTL AP (457473)** for the 12 Month timestep and aggregated by month.

Show 10 entries

Search:

Threshold	Frequency	Return Period
2.5	1	64.92
2.3	1	64.92
2.2	5	12.92
2	2	32.42
1.9	2	32.42
1.8	2	32.42
1.7	16	4
1.6	18	3.58
1.5	17	3.75
1.4	15	4.25

Showing 1 to 10 of 49 entries



Climate Data

Selected Atlas Station: 457473 (SEATTLE TACOMA INTL AP)

Select New Station

Station Climate Deciles SPI SPEI PDSI SC-PDSI Drought Monitor Drought Periods Compare Indices Frequencies



Year

1977

Station start date: 1/1/1948

Index

SPI
SPEI
PDSI
Self-calibrated PDSI
Deciles

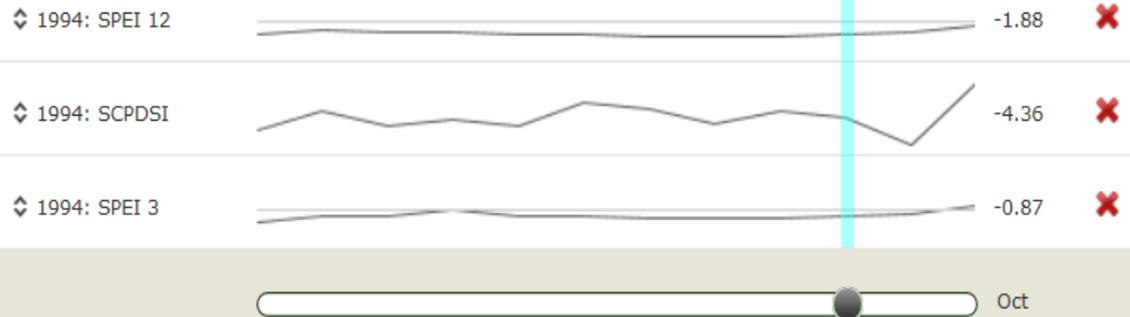
Timestep

3 Month

Add Index

Clear All

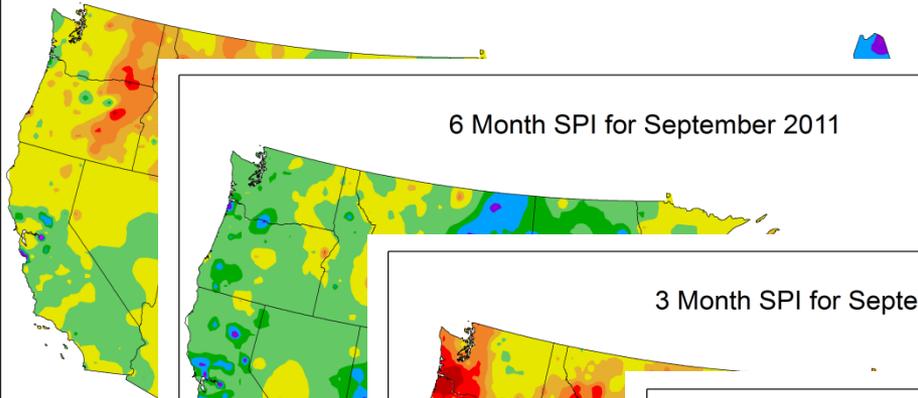
Drought Index Comparisons for 457473 (SEATTLE TACOMA INTL AP).



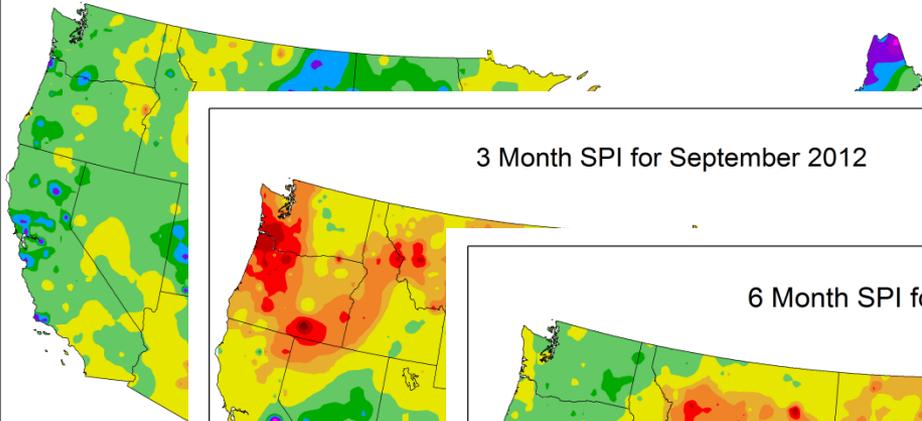
Select up to six datasets for comparison. To remove a dataset from the comparison, click the Remove Dataset button. To clear all datasets from the comparison, click the Clear All button. The datasets can be reordered at any time by dragging the rows.

All data for the comparisons is aggregated by week. Drought Monitor data represents the county-level data for the selected station.

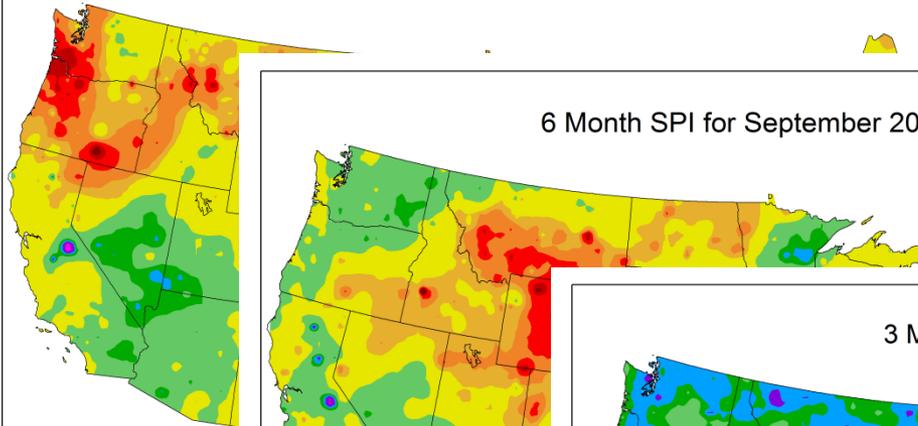
3 Month SPI for September 2011



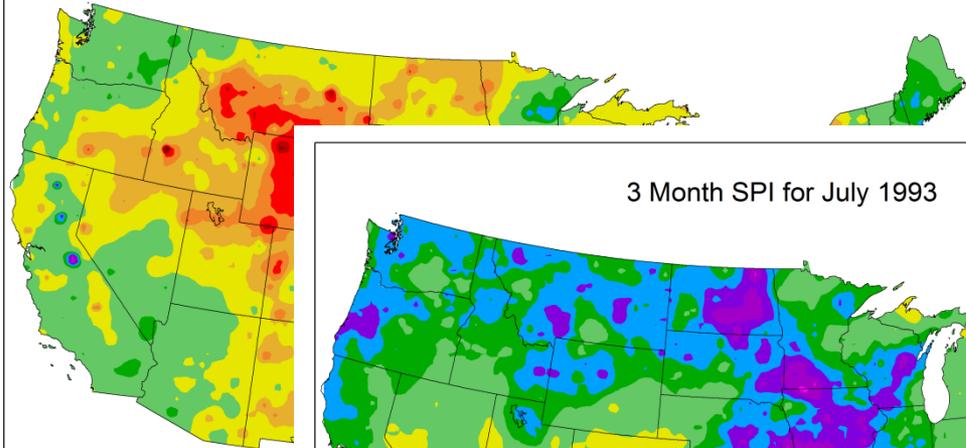
6 Month SPI for September 2011



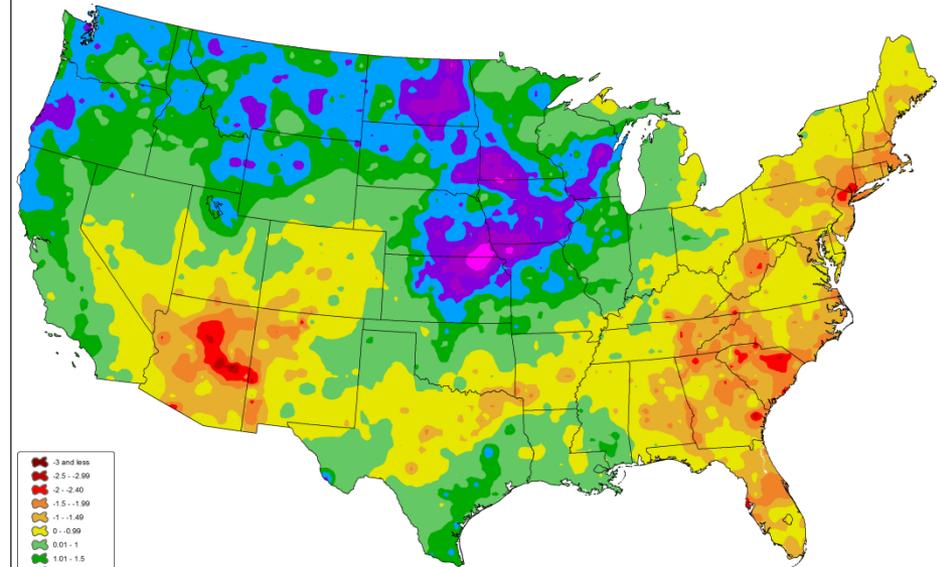
3 Month SPI for September 2012



6 Month SPI for September 2012



3 Month SPI for July 1993



- 3 and less
- 2.5 - 2.99
- 2 - 2.40
- 1.5 - 1.99
- 1 - 1.49
- 0 - -0.99
- 0.01 - 1
- 1.01 - 1.5
- 1.51 - 2
- 2.01 - 2.5
- 2.51 - 3
- 3.01 and greater

Interpolation - IDW
1/4 Degree/25km
Drought Risk Atlas

- 3 and less
- 2.5 - 2.99
- 2 - 2.40
- 1.5 - 1.99
- 1 - 1.49
- 0 - -0.99
- 0.01 - 1
- 1.01 - 1.5
- 1.51 - 2
- 2.01 - 2.5
- 2.51 - 3
- 3.01 and greater

Interpolation - IDW
1/4 Degree/25km
Drought Risk Atlas raw data

- 3 and less
- 2.5 - 2.99
- 2 - 2.40
- 1.5 - 1.99
- 1 - 1.49
- 0 - -0.99
- 0.01 - 1
- 1.01 - 1.5
- 1.51 - 2
- 2.01 - 2.5
- 2.51 - 3
- 3.01 and greater

Interpolation - IDW
1/4 Degree/25km resolution, 12 Neighbors
Drought Risk Atlas raw data

- 3 and less
- 2.5 - 2.99
- 2 - 2.40
- 1.5 - 1.99
- 1 - 1.49
- 0 - -0.99
- 0.01 - 1
- 1.01 - 1.5
- 1.51 - 2
- 2.01 - 2.5
- 2.51 - 3
- 3.01 and greater

Interpolation - IDW
1/4 Degree/25km resolution, 12 Neighbors
Drought Risk Atlas raw data

- 3 and less
- 2.5 - 2.99
- 2 - 2.40
- 1.5 - 1.99
- 1 - 1.49
- 0 - -0.99
- 0.01 - 1
- 1.01 - 1.5
- 1.51 - 2
- 2.01 - 2.5
- 2.51 - 3
- 3.01 and greater

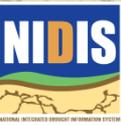
Interpolation - IDW
1/4 Degree/25km resolution, 12 Neighbors
Drought Risk Atlas raw data

Next Steps



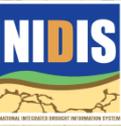
- ▶ **Hydrology** work is underway
- ▶ Update climate stations **through 2015**
- ▶ **Seamlessly integrate** with near real-time ACIS indices, US Drought Monitor and Drought Impact Reporter
- ▶ Tie to drought **impacts and triggers**
- ▶ Add a **Paleo** perspective?
- ▶ **Trend/Frequency/Magnitude analyses** and other drought characteristics

****Acknowledgements: Project supported by USDA's Risk Management Agency, NOAA's--SARP and NIDIS**



Final Thoughts

- ▶ Developing ***usable*** information and services is critical (trust/ownership)
- ▶ ***Tools help bridge*** the gap between monitoring/early warning, prediction and preparedness (triggers for decision support)
- ▶ Goal is to ***link scientific data and knowledge w/ the information and actions*** needed to reduce impacts and future risk



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