



Drought in Alaska – Indicators, Impacts, & Definitions

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* with contributions from Alaska NWS offices

Overview

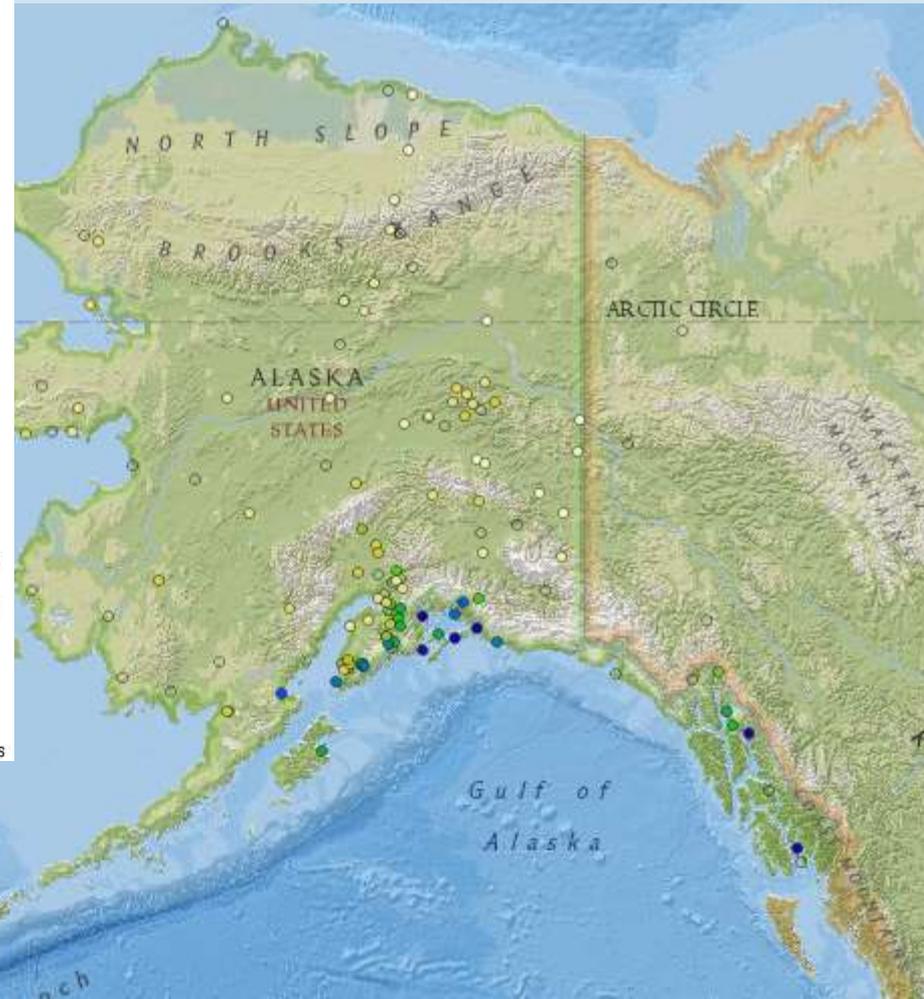
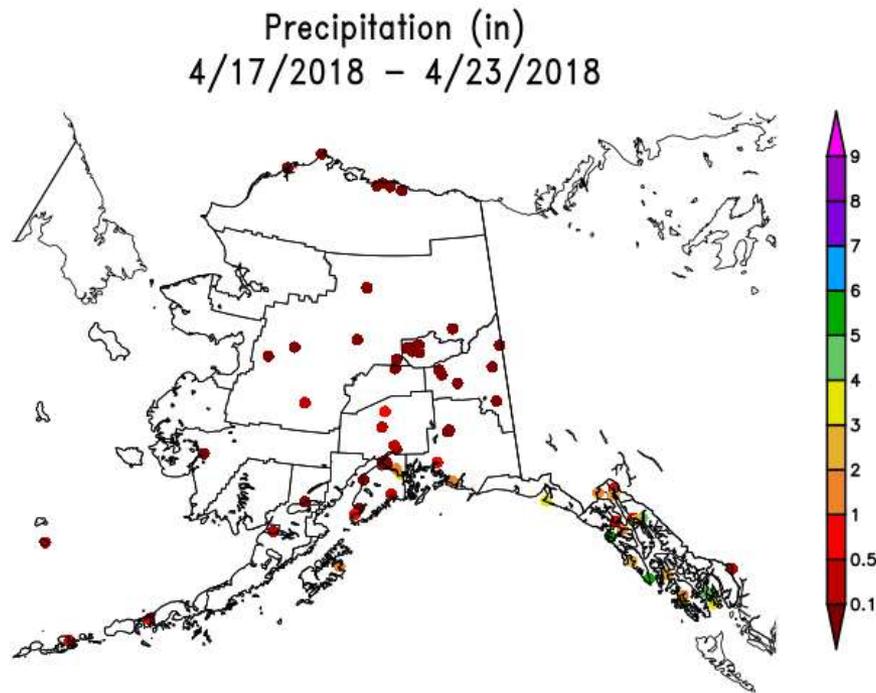
- What is drought in Alaska?
- What tools can we use to monitor drought in Alaska?
- What are the drought impacts in Alaska?
- How can we best monitor drought in Alaska?

What Is Drought In Alaska?

- Cold climate → different approach compared to CONUS
- Is drought even defined the same way in Alaska?
 - Meteorological Drought: low precipitation – relative to climatology (relative to normal or to history/percentile)
 - Hydrological Drought: low streamflows, but can other processes result in low streamflows? And groundwater is complicated by permafrost.
 - Agricultural Drought: soil moisture issues – how affected by permafrost?
- Alaska is a large state with many diverse climates and, therefore, many ways needed to view drought in different parts of the state. Seasonality also important.
- Should we consider a different way to define drought in Alaska?

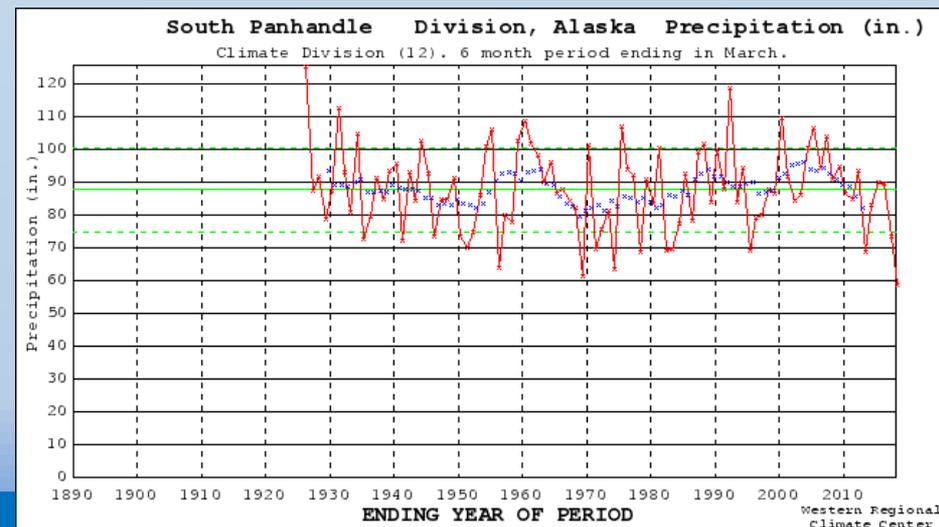
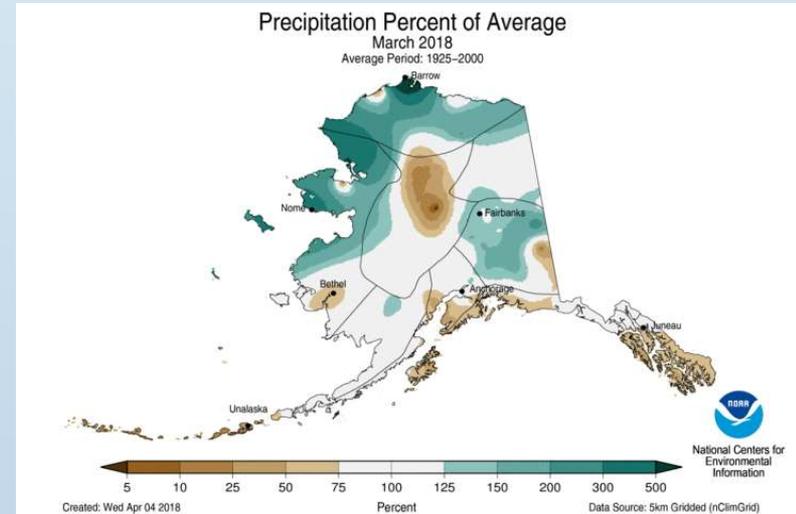
Drought Monitoring Tools In Alaska

- Precipitation data are available from a couple sources (NOAA & SNOTEL) ...



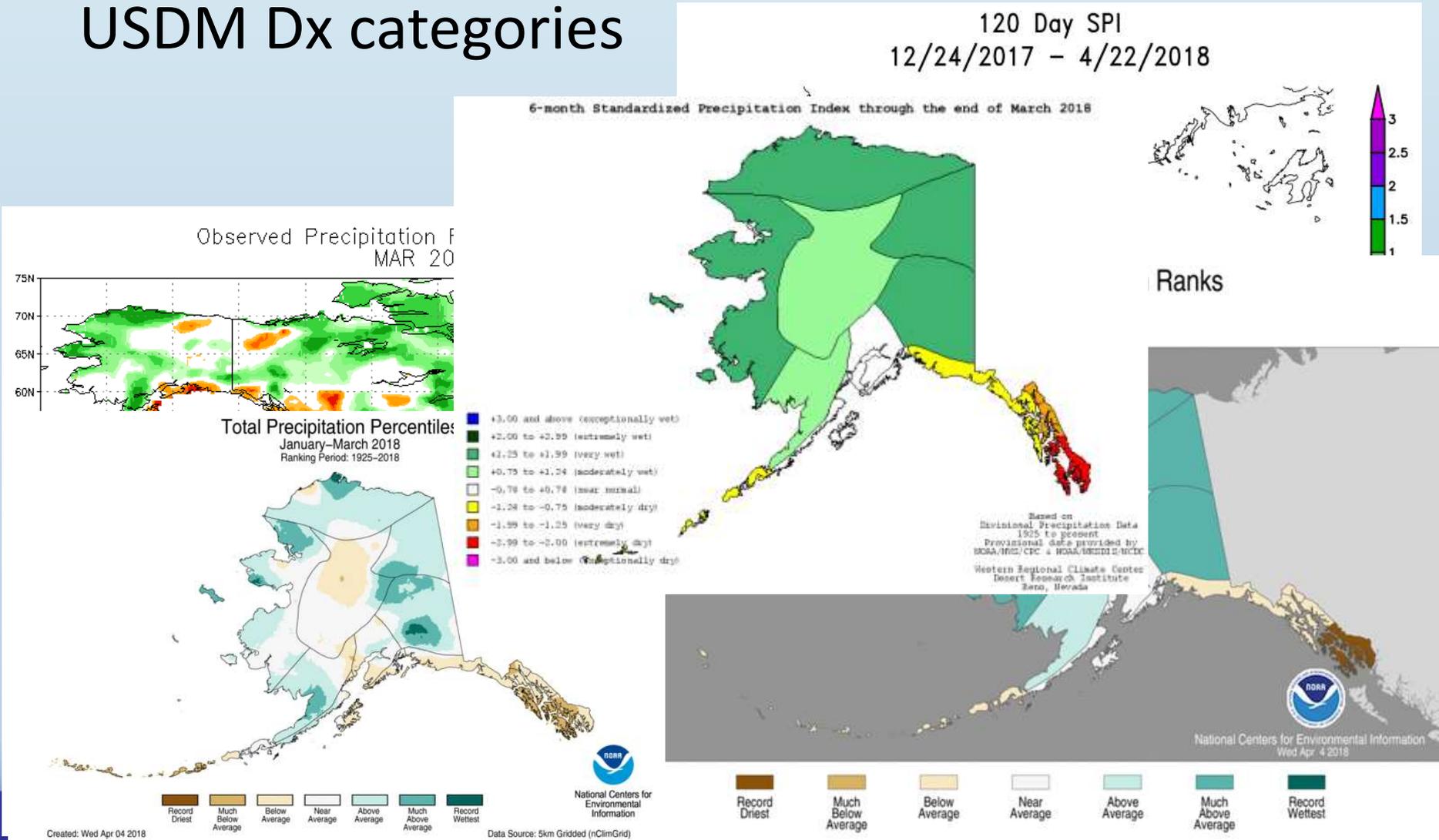
Precipitation – Factors to Consider

- Precipitation amounts vary by season and location, so consider climatology when using percent of normal precipitation.
- Bullseyes on maps are ASOS artifacts – ASOS turned off in cold season in northern AK.
- Should look at all sources to see general patterns of precipitation anomalies.
- Anomalies in different parts of the state may have different significance (departures and percent of normal should be used with percentiles – percentiles best).



Precipitation

- SPI and percentiles are directly comparable to USDM Dx categories



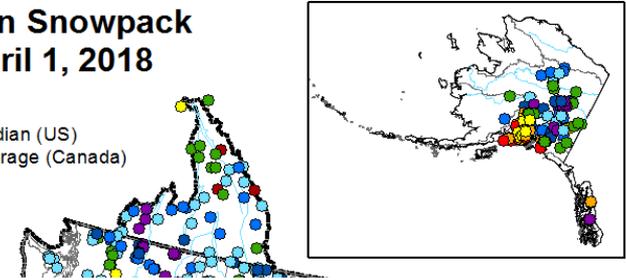
Snowpack

- Sources: 1) SNOTEL snow depth and SWE, & 2) USDA snow course data
- Snow drought can occur with above-normal precip & warm temps, impacting summer streamflow.

Mountain Snowpack as of April 1, 2018

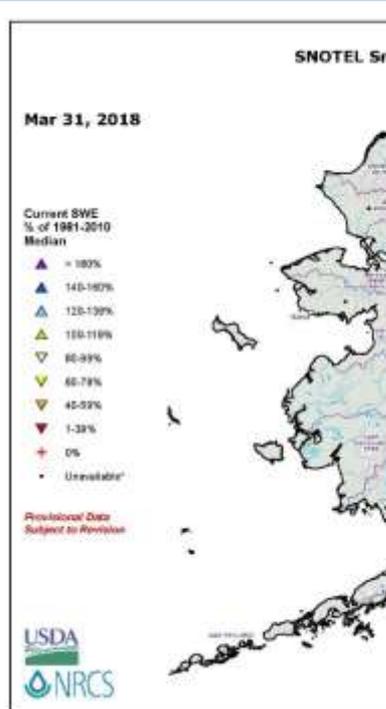
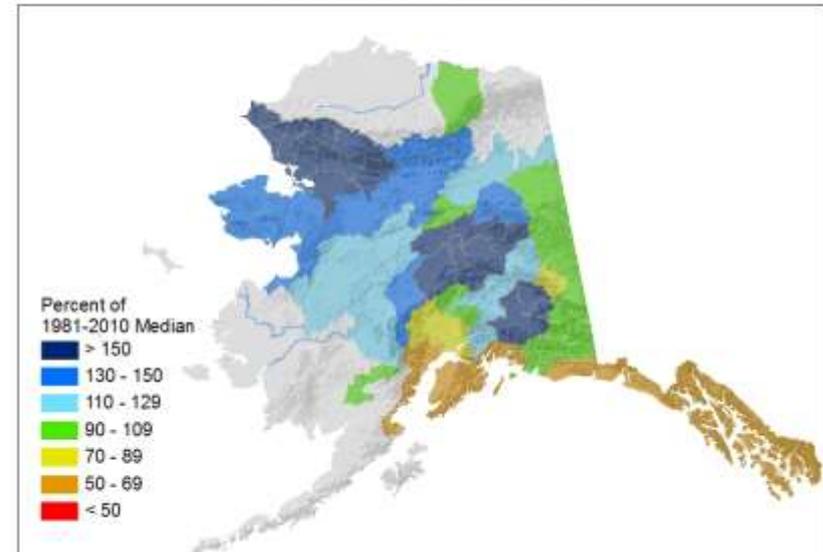
Percent of
1981-2010 Median (US)
1981-2010 Average (Canada)

- > 180
- 150 - 180
- 130 - 149
- 110 - 129



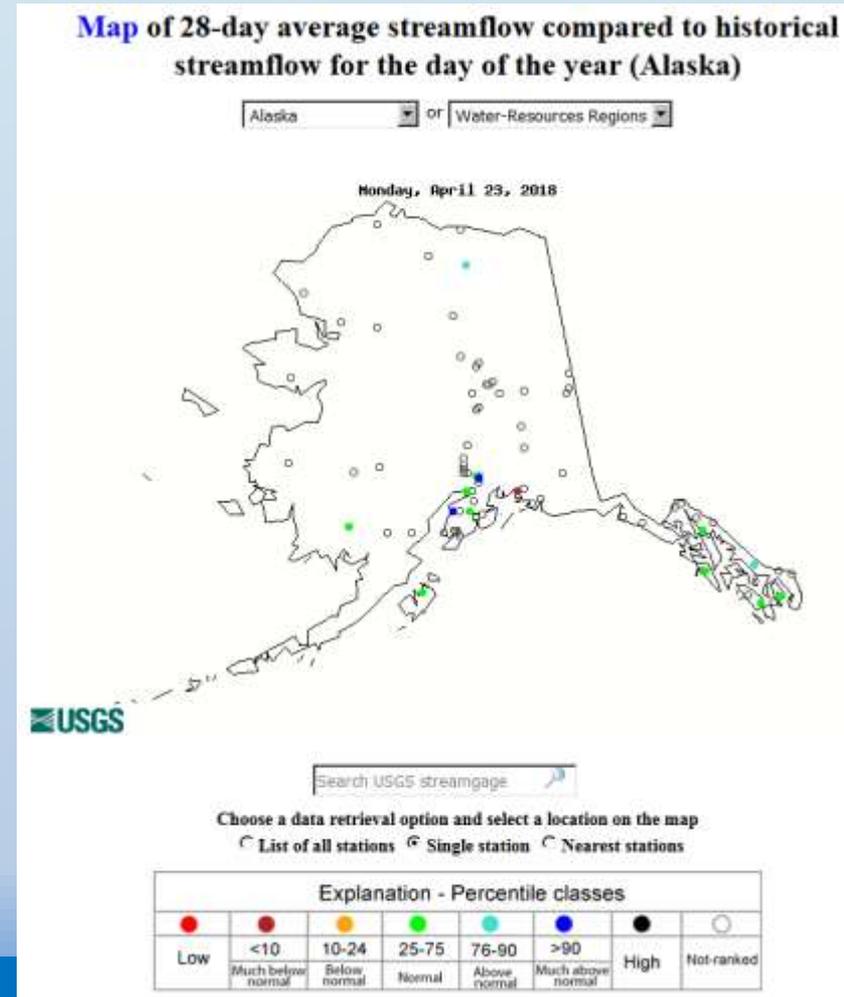
Alaska Snowpack as of April 1, 2018

Based on Snow Course and SNOTEL site Snow Water Content



Streamflow

- Low streamflow usually indicates drought, but this is regionally & seasonally dependent.
- Glacier-fed streams vs. clear-water streams (which are fed by snowmelt, rainfall, groundwater).
 - Summer warm/dry spell → above-normal glacier-fed streamflow; but with no snowpack, clear-water streams may be below normal. This can impact fisheries.
 - A wet/cool spell → above-normal clear-water streamflow but glacier-fed streams will be below normal.
- In an Arctic climate, rivers are frozen much of the year.



Soil Moisture

- USDA observations, modeled data (CPC Leaky Bucket)
- A few instrumented soil moisture sites.



United States Department of Agriculture
National Agricultural Statistics Service

Alaska Crop Weather

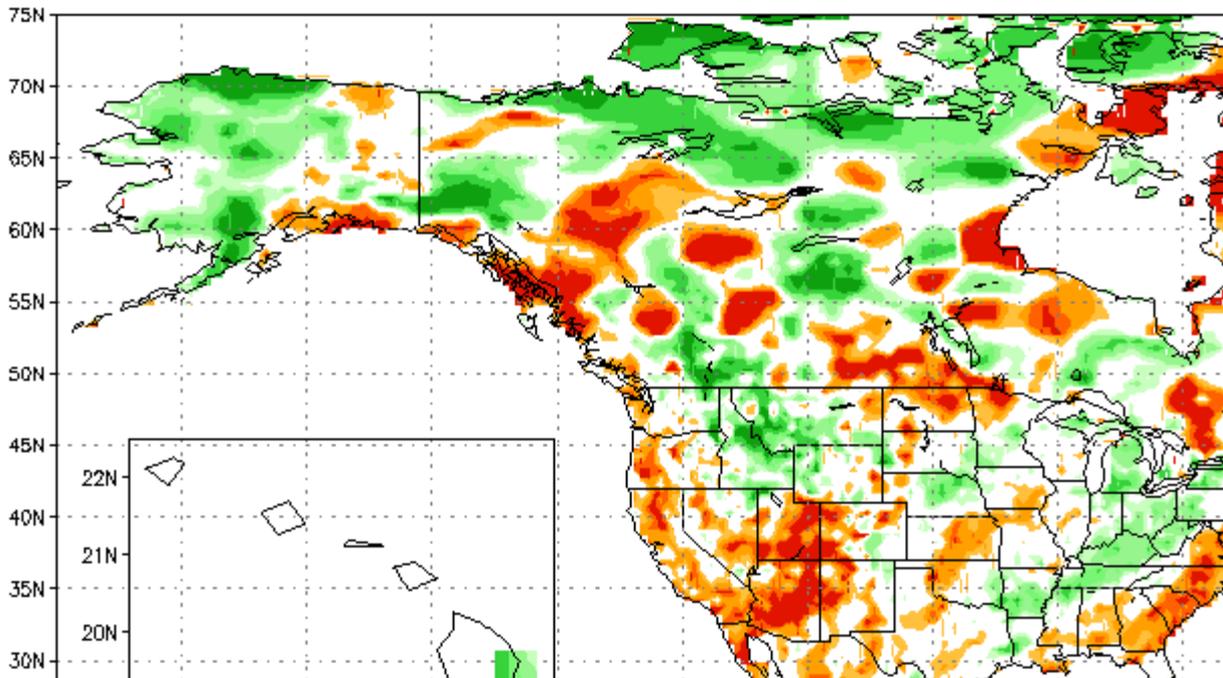


Calculated Soil Moisture Ranking Percentile
MAR 2018

AK 99645

www.nass.usda.gov/ak

Released: August 5, 2013



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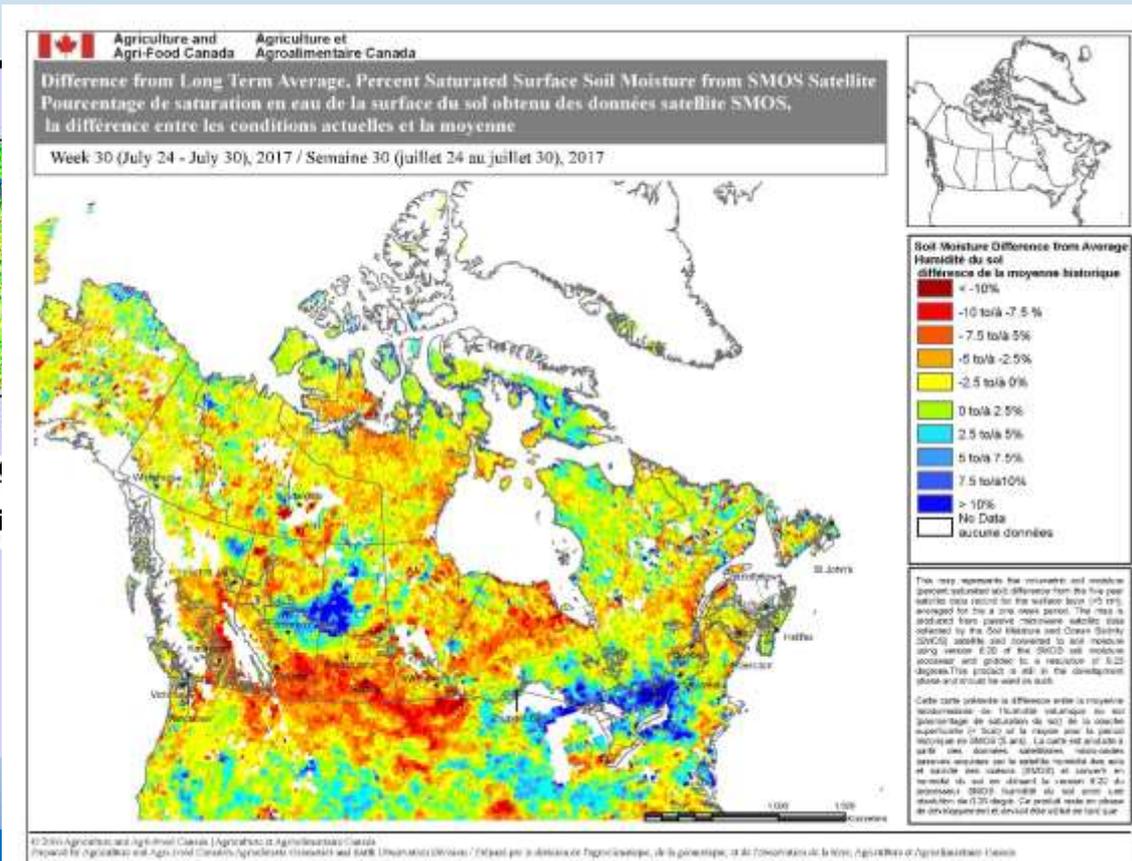
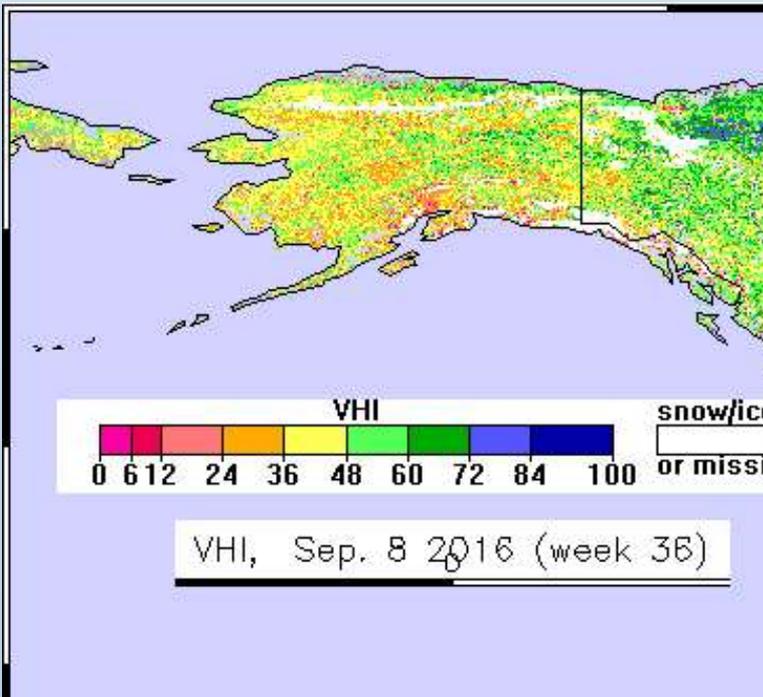
CROP WEATHER SUMMARY		
July 29 – August 4, 2013		
Days Suitable for Fieldwork: 7.0		
Crop	Topsoil Moisture	Subsoil Moisture
Very Short	15%	20%
Short	45%	40%
Adequate	40%	40%
Surplus	0%	0%
Pan Evaporation ¹ , UAF- AFES, Trunk Rd		1.65

Soil Moisture

- But what role does permafrost play in soil moisture?
 - Active layer is important (the region where the ground thaws out above the permanent permafrost layer)
- As the soil thaws, even if it doesn't rain, the active layer will be wet (especially early in the warm season and in southern areas).
- But the active layer can dry out later in the warm season, particularly in the interior where summer temps & evaporation are highest.

Satellite-based Products

- NOAA's Vegetative Health Index (VHI)
- AAFC's SMOS (Percent Saturated Surface Soil Moisture Difference from Long-term Average)



Drought Impacts in Alaska

- Impacts on forest growth – impacts delayed, cumulative.
 - Snow drought → no root protection from cold temps.
- Wildfires – flash drought impactful for fire weather.
- Fisheries – low streamflows (precip/snow pack) affect hatcheries and fish migration



Drought Impacts in Alaska

- Water supply:
 - Well-below-normal precipitation can result in low reservoirs and water rationing.
 - Especially important in southeast Alaska where reservoirs are crucial for electrical production.
 - Water transportation along rivers to resupply communities (low flows= delayed barged traffic)



Drought Impacts in Alaska

- Agriculture:
 - Most in Matanuska Valley (N.E. of Anchorage); some interior.
 - Short but intense growing season (24-hr sunlight but low sun angle).
 - short growing season magnifies impacts on crops
 - Drought can be an issue if low precipitation during the growing season.
 - Snowmelt moistens ground early in growing season
 - Low precip in June-July-Aug more important
 - Wet conditions at the wrong time (reduce yields/loss of crops)
 - No significant irrigation for agriculture, so precipitation crucial for crops.

* Alaska's top five agricultural products are greenhouse and nursery products, hay, dairy products, potatoes, and cattle and calves.



Summary

- Best indicators to use:
 - precip (SPI and percentiles), taking into account region and time of year
 - snowpack (NRCS percent of normal SWE), indication of potential drought problems (esp. for warm season)
 - USDA NASS soil moisture observations
 - “convergence of evidence” – for the other indicators (agree with above)
- Regional and seasonal variability important for agricultural impacts
- Some indicators are complicated, may reflect drought or may not (esp streamflow) ... (see “convergence of evidence” above)
- Yes, need to think of & define drought differently in Alaska due to size of the state, variety of climates (interior to arctic to south central to panhandle), & different types of impacts which vary by region, and mixed messages by some indicators (fires & streams).

Thank You!

- Acknowledgements – This work would not be possible without input from Rick Thoman and Aaron Jacobs (Alaska NWS offices) & colleagues.

