

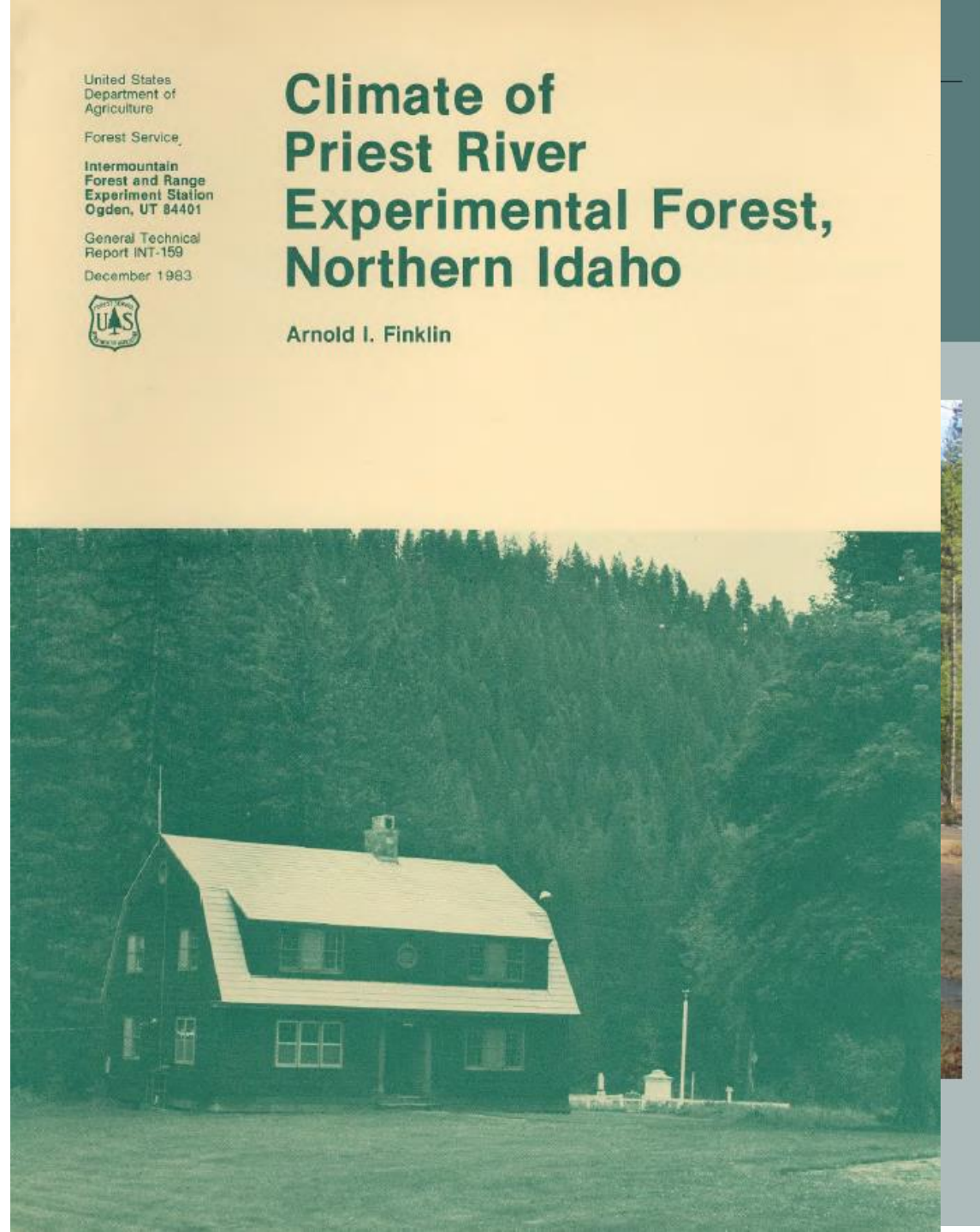
# 100 Year Climate Review

## Priest River Experimental Forest

Brandon Glaza – USFS Hydrologist

# Excerpts from...

Climate last summarized by Finklin in 1983. Climate of Priest River Experimental Forest, northern Idaho. GTR-INT-159



# Priest River Experimental Forest

Established in 1911.

- 34 Miles Southwest of Bonners Ferry
- Weather collected for 109 years from same location. Temperature, Precipitation, Humidity, Wind.
- Streamflow data collected for 81 years on Benton Creek since 1939.
- Snowpack measurements at low and high elevation continuously for 83 years.
- Other data collected intermittently.





# Weather Station



The main weather station where daily measurements have been made since 1912. A summary of these records for 1912 to 1931, inclusive, is available upon request.



# Weather Station





# Weather Sta

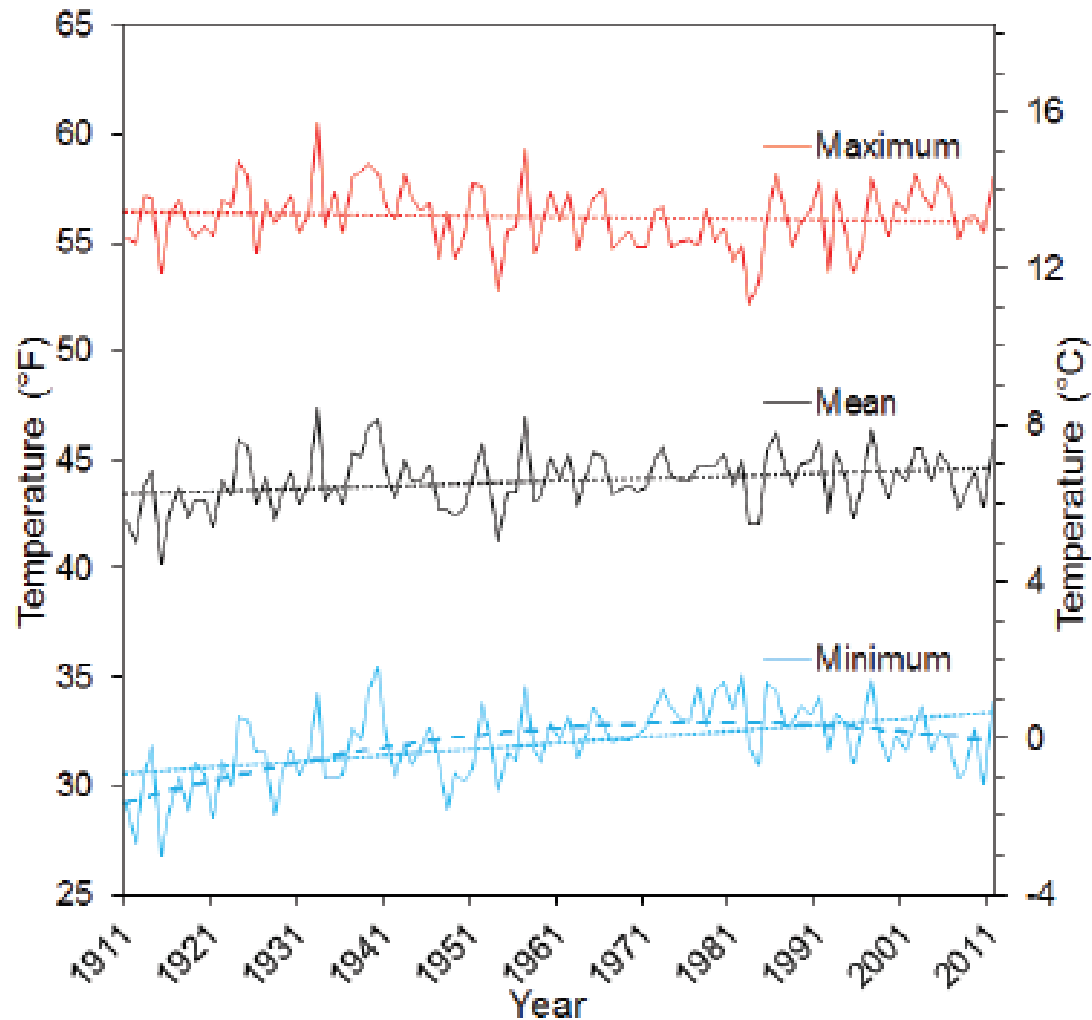


# Climate Data Summary-Temperature

Table 1—Monthly average and daily extreme temperatures (°F) at the PREF control weather station from 1911 to 2013.

Month	Averages			Extremes			
	Daily maximum	Daily minimum	Monthly	Highest	Year	Lowest	Year
Jan.	30.5	18.3	24.4	50	2003	-33	1950
Feb.	37.0	20.3	28.7	57	1947	-35	1933
Mar.	45.6	24.7	35.2	71	2004	-18	1945
Apr.	57.0	30.2	43.6	88	1934	-1	1936
May	66.8	37.3	52.1	97	1936	18	1954
June	73.6	43.4	58.5	97	1912	24	1918
July	82.8	46.2	64.6	102	1924	29	1917
Aug.	81.9	44.6	63.3	103	1961	26	1914
Sept.	71.3	38.3	54.8	97	1988	16	1926/1934
Oct.	55.8	32.1	44	83	1935/1943	-5	1935
Nov.	38.9	26.7	32.8	64	1965	-16	1955
Dec.	31.6	21.3	26.5	55	1933	-36	1968
Year	56.1	32	44.1	103	Aug. 1961	-36	Dec. 1968

# Climate Data Summary-Temperature Trends

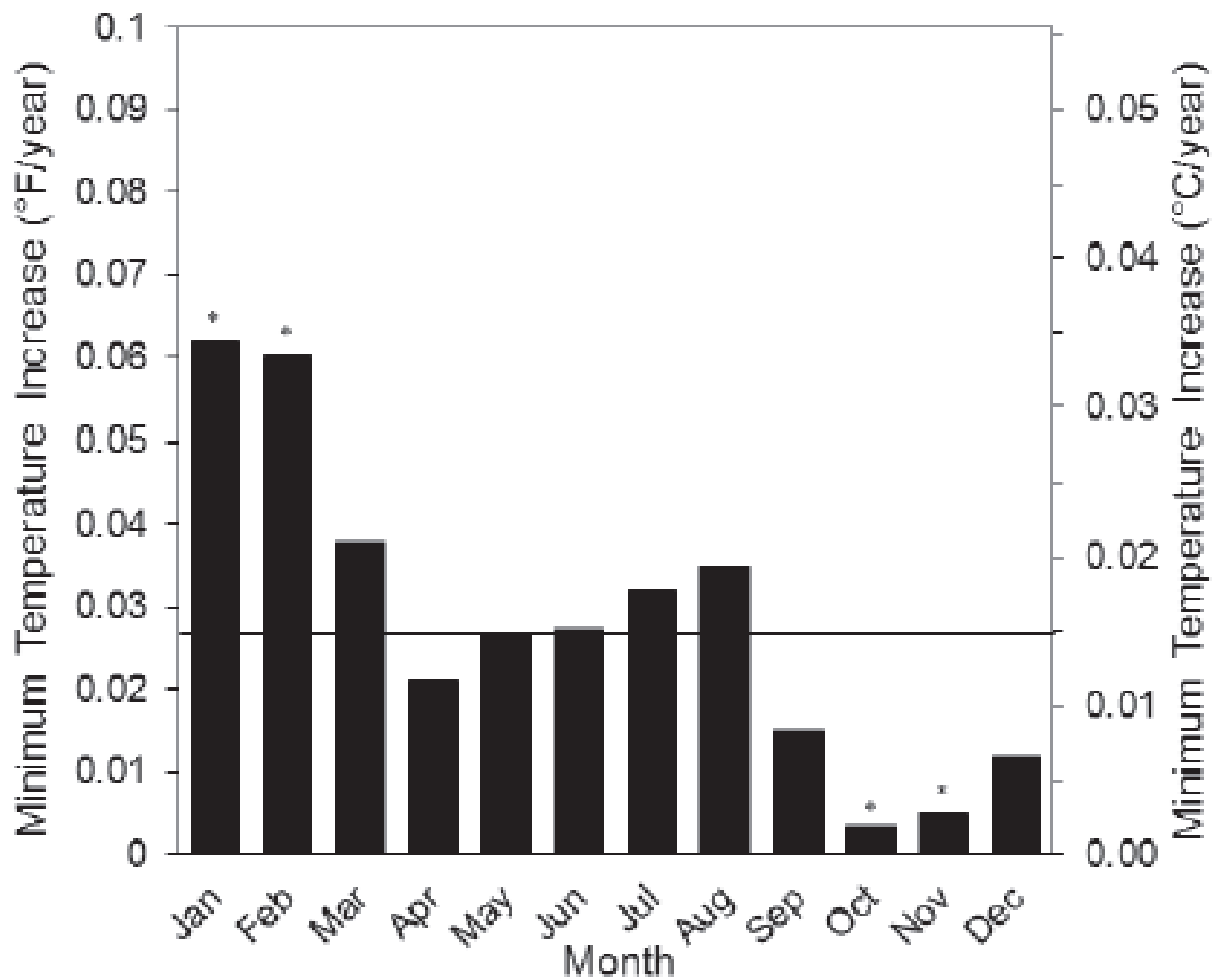


- No change in daily maximum or daily mean temperatures over last century.
- Daily minimums have increased 2.8 degrees F since 1911.
- All months show increase in minimums but the coldest months, January and February have warmed more rapidly than the mean(6 degrees per century).
- 8.6 less days with 1 inch of snow since 1911.
- Found a daytime lapse rate of 4 degrees F per 1000 feet elev.

Figure 29—Annual average daily maximum, mean, and minimum temperatures for 1912 to 2012 at the control weather station in PREF, with lines of linear (dotted) and polynomial (dashed) regression overlaid. Analyses show no change in the maximum and mean daily temperatures, while annual daily average minimum temperatures have increasing by 2.8 °F over the last century.



Tem|



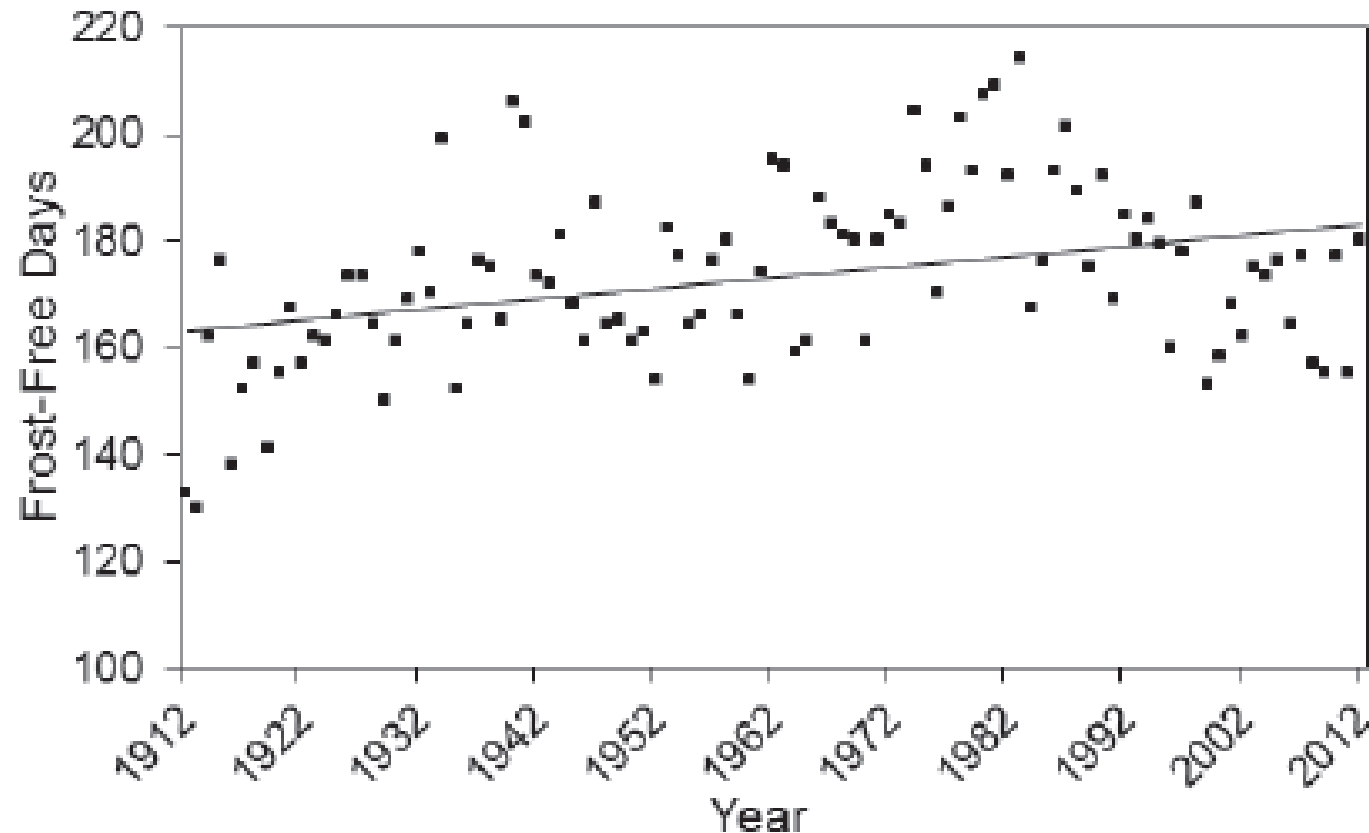
# Temperature - Extremes

New Record High For Month of August  
in 2018 - 105°

Month	Extremes			
	Highest	Year	Lowest	Year
Jan.	50	2003	-33	1950
Feb.	57	1947	-35	1933
Mar.	71	2004	-18	1945
Apr.	88	1934	-1	1936
May	97	1936	18	1954
June	97	1912	24	1918
July	102	1924	29	1917
Aug.	105	2018	26	1914
Sept.	97	1988	16	1926/1934
Oct.	83	1935/1943	-5	1935
Nov.	64	1965	-16	1955
Dec.	55	1933	-36	1968
Year	103	Aug. 1961	-36	Dec. 1968

# Temperature – Frost Free Days

20 more frost-free days since 1911 (Most in Apr and May).



**Figure 31**—Number of frost-free days per year from 1912-2012; a day was counted if the minimum temperature did not go below 32 °F (0 °C). The line denotes a linear regression and shows that over the last century the growing season length has increased by approximately 20 days.



# Precipitation

- Control receives an average of 31.4" per year with SD 5.6"
- 40% comes in November, December, and January
- 13% comes in July, August and September
- Benton Spring (4800 feet elev) averages 4.5 inches greater per year than control station (2400 feet elev)
- No statistically significant trend in precipitation in the last century

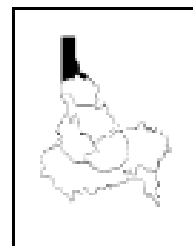
New Precip Record for January 2020 with 8.70"  
Beat previous record of 8.38" in 1954.

# Snowpack

- 2 manual snow courses- Benton Meadow at the control weather station at 2300' elevation and Benton Spring on Gisborne Mountain at 4800' elevation
- Established in 1937 measured once per month
- Benton Spring March 1<sup>st</sup> snowpack depth averages 51.5" while Benton Meadow averages 18.6"
- Cooperative with NRCS.

Figure 1: Monthly Precipitation  
January 2020

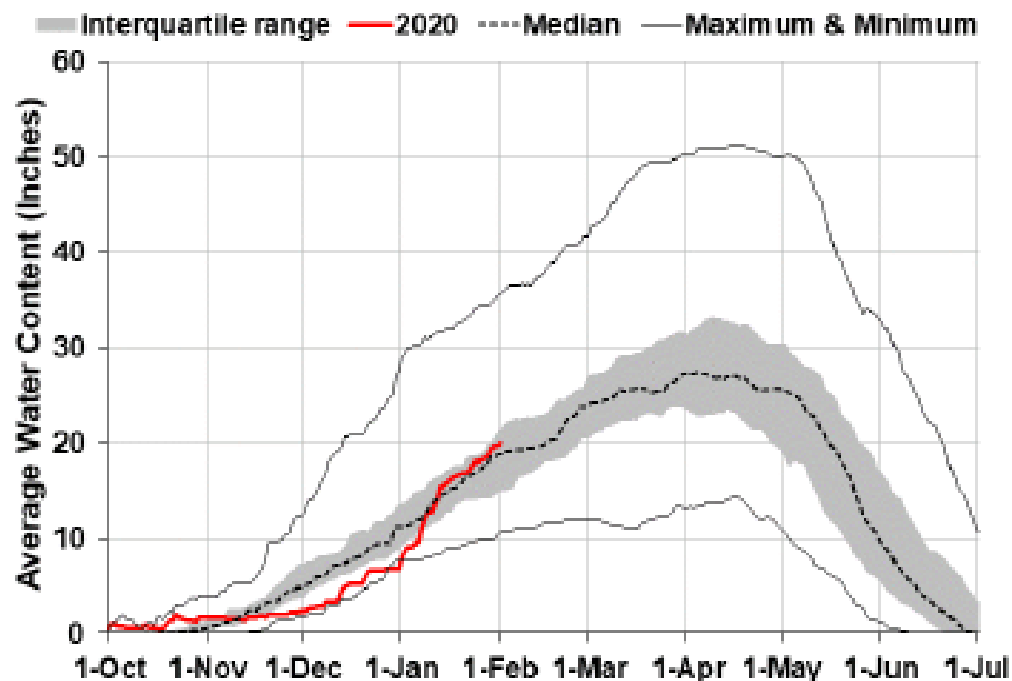
Figure 3: Percent of Median  
February 1, 2020



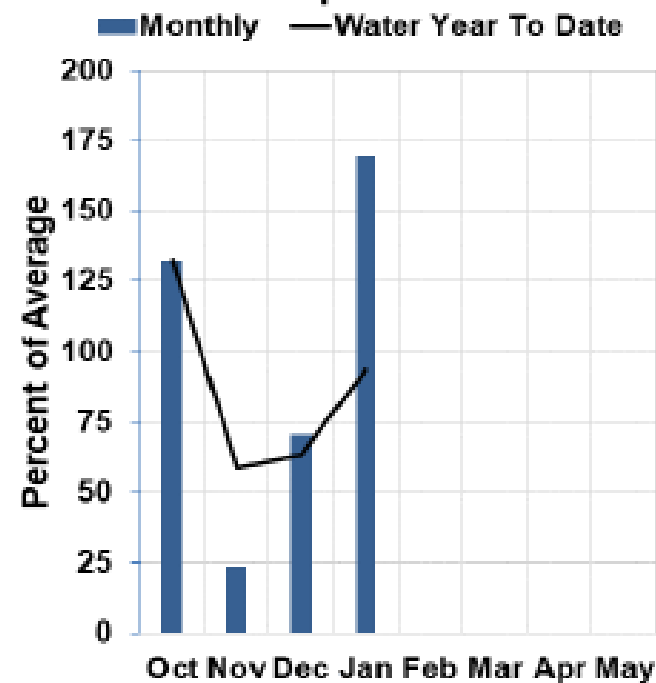
## Panhandle Region

February 1, 2020

### Current Snowpack and Historic Range



### Precipitation



SOUTHSIDE SNAKE  
RIVER BASINS

0 25 50 100 150 200 Miles

This map is prepared by the USDA-NRCS Idaho Snow Survey Office.  
<http://www.nrcs.usda.gov/wps/portal/nrcs/main/id/snow/>



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# Snowpack- Snowcourse

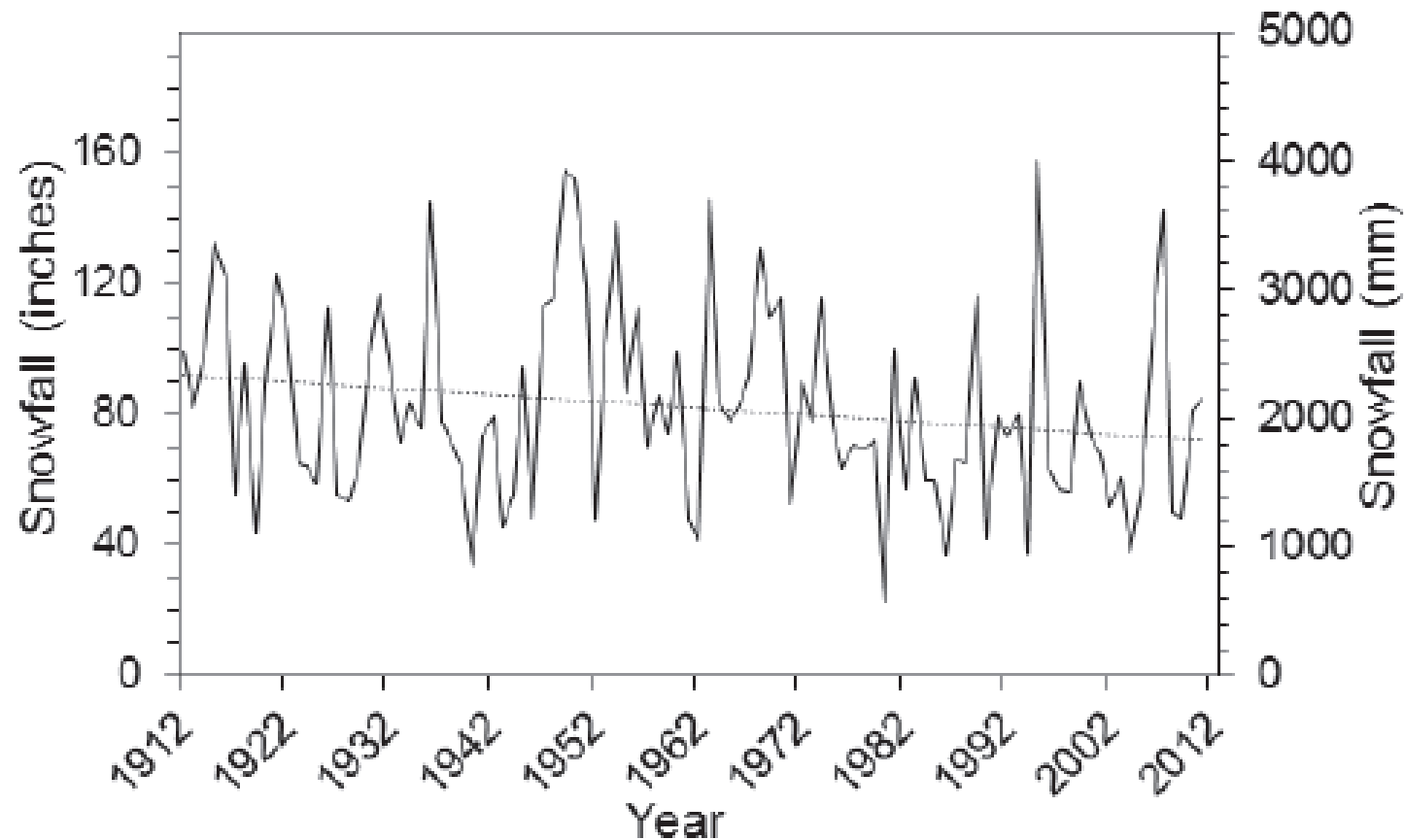






# Snowpack-Snowfall

Low Elevation snowfall has declined by 20 inches.



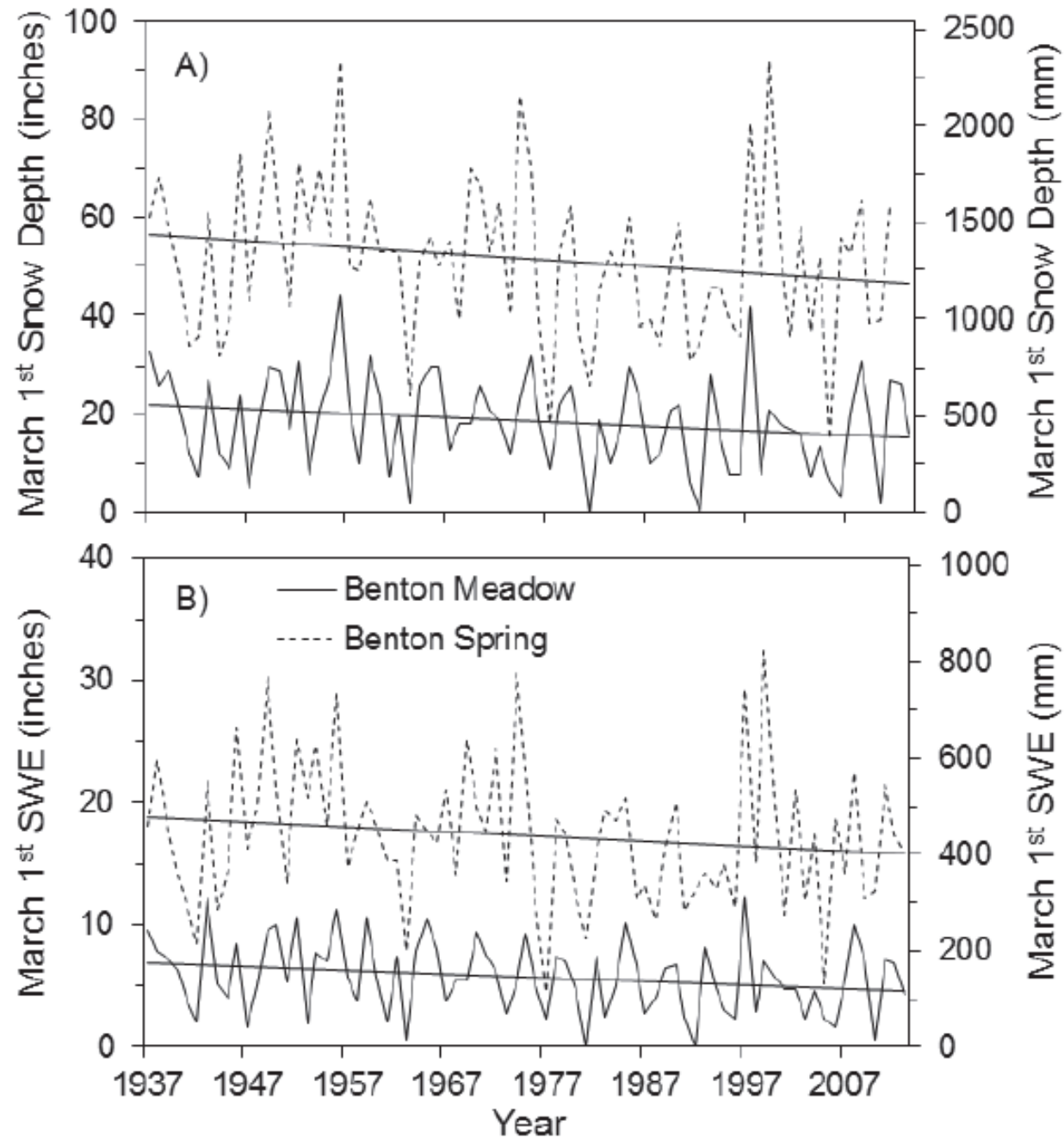
**Figure 21**—Cumulative annual snowfall at the low-elevation control station for 1912 to 2012, with a linear regression line plotted through the data. Over the last century cumulative snowfall at the lower elevations of the watershed has declined by approximately 20 inches.



# Snowpack

- Benton Meadow (2300' elev.): Snow depth and SWE at March 1<sup>st</sup> declining 0.11 inch per year since 1930s. This is 30% reduction or 1/3 less water than the 1930s.
- Benton Spring (4800' elev.): March 1<sup>st</sup> Snowpack regression shows a negative slope but no significant decline.

# Snowpack



**Figure 22**—Comparison of the low elevation Benton Meadow (solid line) and high elevation Benton Spring (dashed line) snow courses from 1937 to 2013. The comparisons show the March 1<sup>st</sup> (A) snowpack depth and (B) snow water equivalent (SWE), where the line through each dataset represents a linear regression.



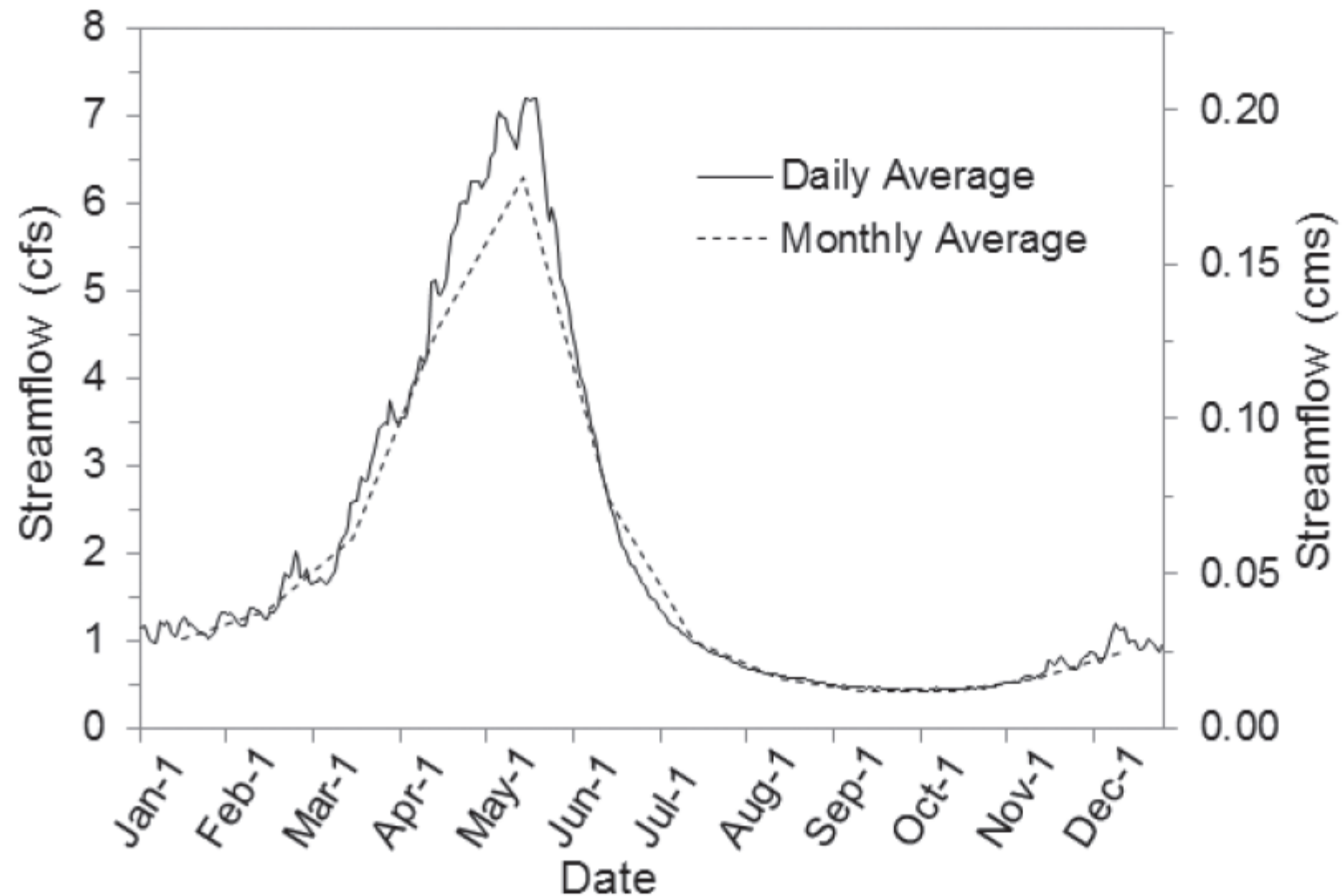
# Str

- Str
- 95
- ~2
- Av
- His
- Ev



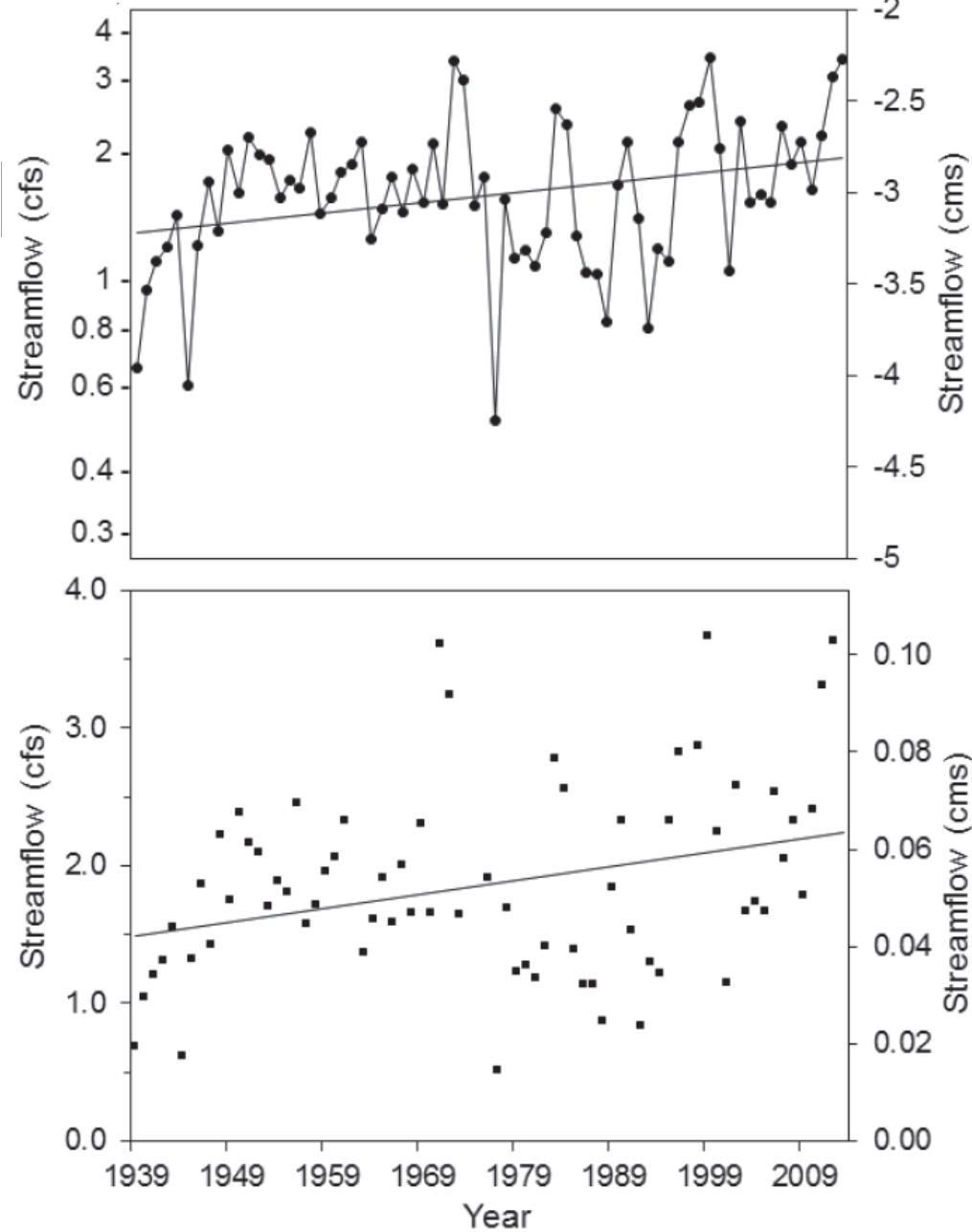


# Streamflow



**Figure 23**—Seasonal distribution of streamflow in both cubic feet per second (cfs) and cubic meters per second (cms) averaged monthly since 1939 and daily since 1955 until early 2012 at the Benton Dam gauging station.

# Streamf

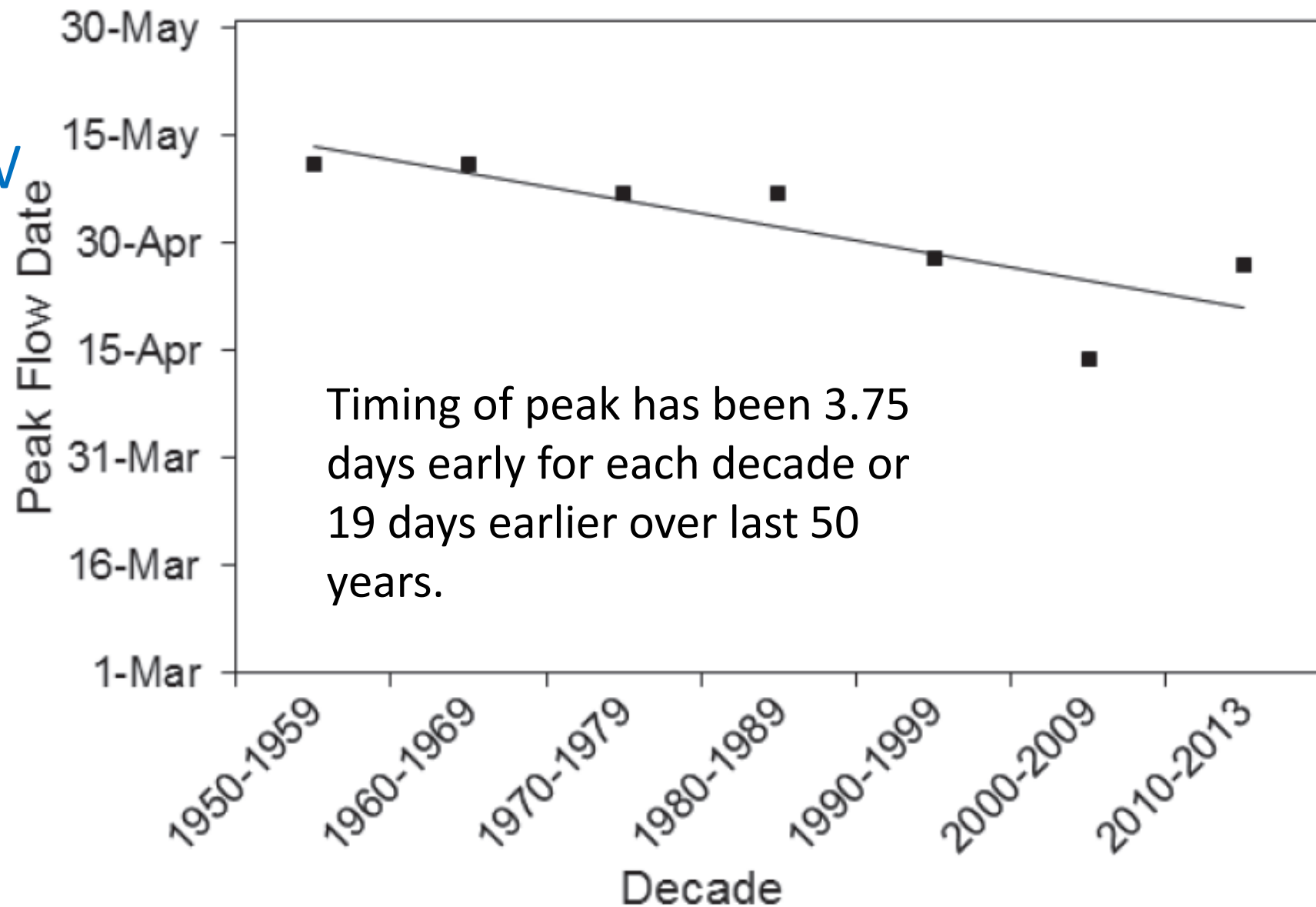


Variability has increased;  
1983 max min =25.3" and 6"  
2015 max min =33.5" and 4.6"

33% increase in streamflow in 73 years

**Figure 25**—Average annual stream flow from 1939 through 2012, log transformed on top and presented as the raw data on bottom. Both graphs are plotted with a linear regression through the data, showing an approximate 33% increase in streamflow over the 73 years of observation.

# Streamflow



**Figure 27**—Timing of peak decadal streamflow over the last 60 years, with a linear regression plotted through the data. The regression shows that peak streamflow has shifted 3.75 days early each decade.



# Streamflow Discussion

- Streamflow increased with no measureable increase in precipitation.
- Luce and Holden (2009) & Clark (2010) found decreasing streamflow in large basins.
- Birsan et al. (2005) and Jones (2011) found similar results to Benton Cr.
- Canopy and deep drainage likely haven't changed much.
- Change due to tree species composition? White Pine to Douglas Fir/ Western Red Cedar dominated.
- ?

# Thank you. Questions?

- Answers?

Copies of these publications available.  
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Historic photographs of PREF available at...  
[www.lib.uidaho.edu/digital/expforest/](http://www.lib.uidaho.edu/digital/expforest/)

