2014 Annual Fire Weather Report
WFO Riverton, WY

Kelly Allen, Fire Weather Program Manager

December 2014

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From: Kelly Allen, NWS Riverton
Fire Weather Program Manager

Subject: 2014 NWS Riverton Fire Weather Program Summary

Please find attached the 2014 NWS Riverton Fire Weather Program Summary which also includes Red Flag Warning Verification and Statistics, the number of Fire Weather Watches issued, Spot Forecast Statistics, and information on IMET Dispatches

WFO Riverton Fire Weather Program Summary - 2014

Month to Month Climate and Operations:

January, February, March

Climate:

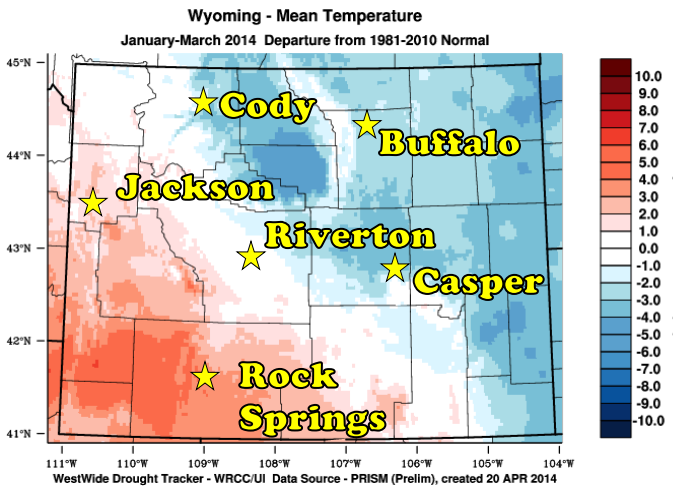


Fig. 1

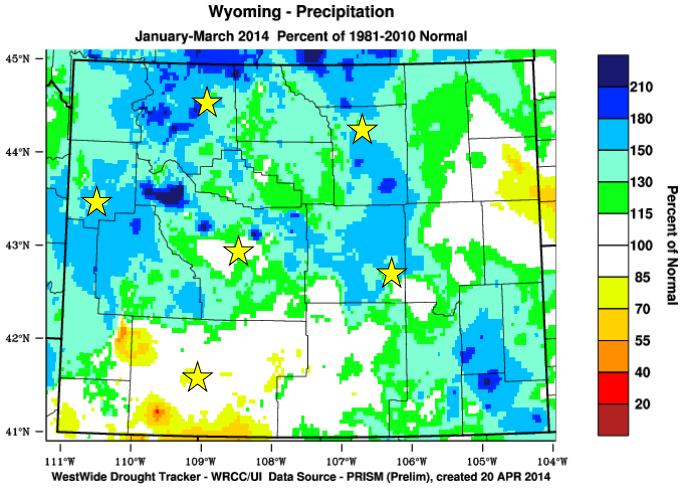


Fig. 2

Fig. 3 – Several Northwest Flow Events Hammered Cody

Fig. 4 – Several Waves of Snow Created Hazardous Avalanche Conditions in the Western Mountains

Overall, the year began colder than normal east of the Continental Divide with warmer than normal temperatures across the southwest (Fig.1). Several snow storms touched both sides of the Divide during what is historically a dry time of year. This resulted in above normal precipitation just about everywhere (Fig. 2). Persistent, unstable northwest flow, generally not handled well by forecast models, continued to deliver a few curveballs with surprisingly efficient snow bands dropping record snowfall several locations including Cody (Fig. 3) and Casper. In between those tricky northwest flow storms, there were some more predictable but impressive westerly flow storms that delivered over 400 inches of snow to Jackson Hole Mountain Resort between September 2013 and March 2014! This loaded snowpack created an avalanche hazard across the west resulting in three fatalities during the season. The cooler temperatures east of the Divide prolonged the spring thaw, leading to some ice jam flooding problems in the Bighorn Basin and some ponding and flooding of low lying areas across the west. Going into April, there was anywhere from 1 to 4 feet of snow still on the ground in the Upper Green River Basin.

Operations:

- Normal off-season Fire Weather AOP discussion and coordination, and Regional Focal Point Meetings took place between surrounding WFO Fire Weather Program Leaders and GACC Meteorologists
- Kelly Allen (Team Lead) met with Dave Lipson and Chuck Baker (Fire Weather Team) on February 20th to discuss upcoming partner meetings and program changes
- Dave Lipson taught an S-290 course February 4th & 5th, and an S-390 course February 25th – 28th
- Kelly Allen and ASA Kathleen O'Leary completed materials for a "Safe Spring Burning Campaign" raising awareness about wildfires caused by agricultural burning through pamphlets, posters, and a local radio interview urging property owners to call the NWS to obtain weather conditions before burning. Pamphlets were tailored to meet the needs of each county and were distributed to county Fire Wardens and Chiefs. The Spring Burning Campaign Week kicked off on March 16th
- There were 0 spots completed in January, 3 in February, and 8 in March. Seven of these spots were for Hazmat or Search and Rescue, the rest were for prescribed burns

April

Climate:

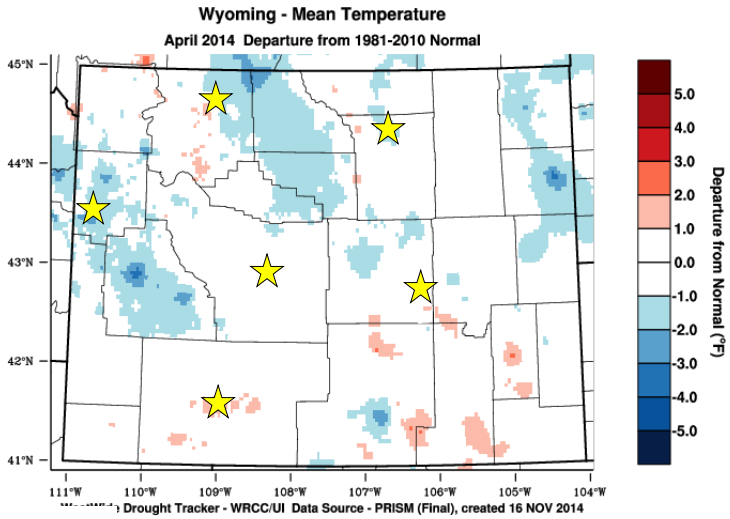


Fig. 5

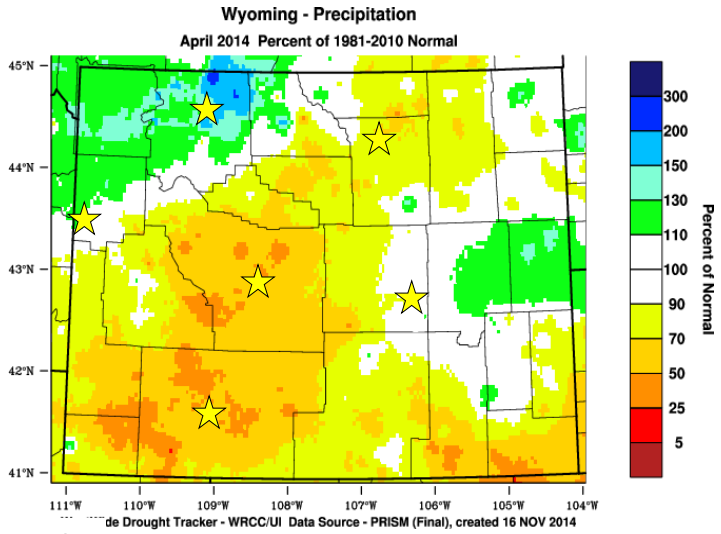


Fig. 6

Winter started to lose its grip in April with several warm, dry, and windy days toward the beginning of the month (Fig. 7) but winter still fought the good fight with several snow storms continuing to make an impact across the region (Fig. 8). As a result, temperatures worked out to be about average (Fig. 5) as we swung back and forth between extremes. Precipitation overall was on the low side even though we did see a couple of storms move through (Fig. 6). Snowpack remained above normal for this time of year, which kept fuels moist even though we were coming into pre-greenup in some of the lower elevations. Fine fuel growth was vigorous in the low elevations, especially east of the Divide in April.

Operations:

- Kelly Allen hosted three partner meetings in April: Casper, Kaycee, and Rock Springs. Dan Borsum, the Fire Weather Program Manager from the Billings NWS office attended the Casper and Kaycee meetings.
- Kelly Allen and Chris Jones attended the Wyoming Bureau of Land Management Leadership Meeting on April 16th in Lander. At this meeting, Kelly and Chris were presented with the 2013 State Fire Management Leadership Award, and Kelly presented the 2014 seasonal outlook.
- Dave Lipson and Chuck Baker attended the virtual IMET training April 14th – 18th

- Brett McDonald changed a few items within the Fire Weather Planning Forecast Formatter:
  - A "Chance of Rain/Snow XX Percent" phrase was added at the end of the Sky/Weather portion of the forecast. This was done based on feedback from our partners as coverage of precipitation is better understood when expressed as a percentage as opposed to a vague descriptor term (e.g. Scattered)
  - Mountain Zone boundaries were reset to exclude any elevations that were above tree line. This was done in hopes of better representing the burnable areas of the zone.
- Participated in talks with the Northern Rockies GACC and neighboring offices about grid consistency and naming conventions. This issue continues to cause formatter difficulties for offices that have Fire Weather Zones that cross the Public Zones of another office.
- 26 Spots were issued in April, 4 of which were for either Hazmat or Search & Rescue, 22 were for Prescribed Burns

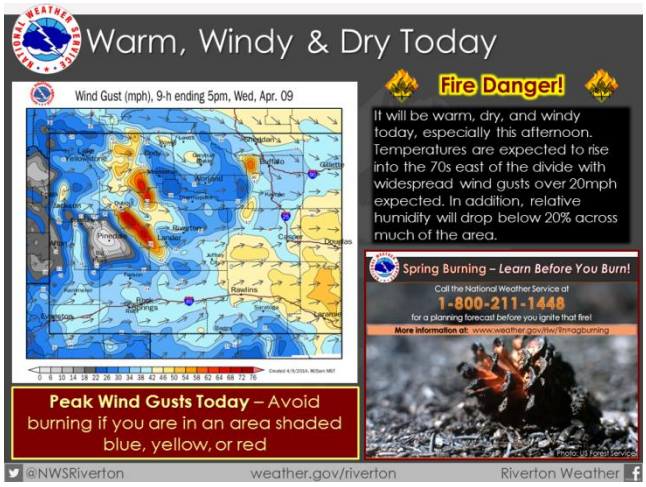


Fig. 7 – Several warm, dry, & windy days in April

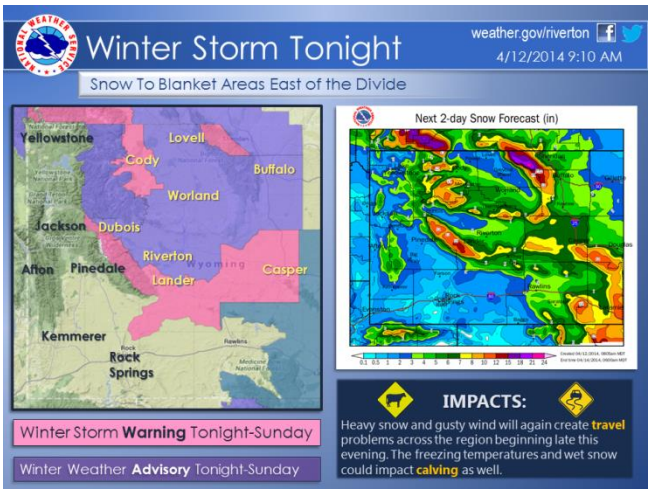


Fig. 8 – But the snow didn't want to let up either…

May

Climate:

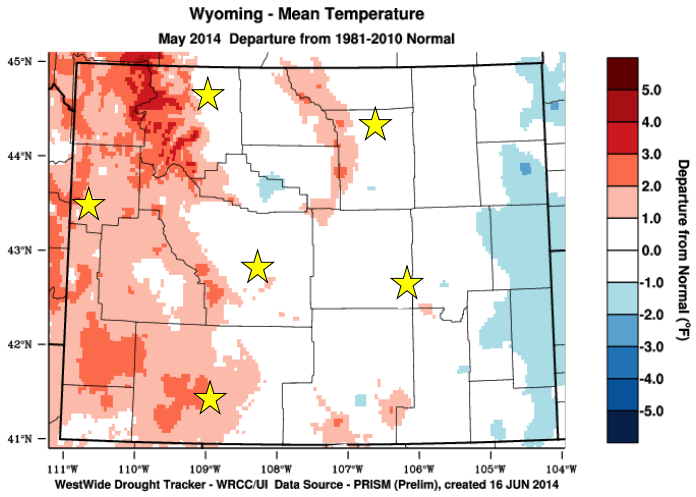


Fig. 9

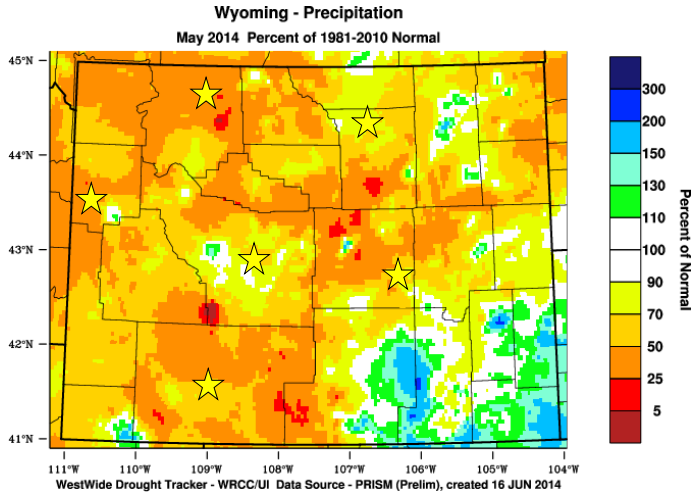


Fig. 10

May was warmer than normal across the west and in the mountains, with seasonal temperatures in the low elevations east of the Divide (Fig. 9) and on the dry side across the board (Fig. 10). There were a couple of decent storms early in the month that dropped over an inch of rain in the Bighorn and Absaroka mountains. Another storm dropped two feet of snow on Casper Mountain on Mother's Day. By mid month, we moved to a warmer, more convective regime with several severe thunderstorm days complete with tornadoes (Fig. 12) and large hail. The warming temperatures also brought the snow out of the mountains and the melted the last of the low elevation snow. River flooding (Fig. 13) occurred in some of the more vulnerable spots like Ten Sleep Creek and the Wind River near Dubois. There were concerns about more areas flooding due to the abnormally high snowpack that remained; however, the warm-up late in the month was rather gentile, and the large rain-on-snowpack events that were feared ended up not being as widespread as expected. Even with all of the storms and the flooding, most climate sites were slightly to well below normal for precipitation. Some climate locations found May 2014 ranked within their top10 driest Mays on record. The dry conditions finally began to have an impact on the finer fuels and grasses with some Cheatgrass curing (Fig. 11) in the low elevations by the end of the month.

Fig. 11 – Cheatgrass turning purple

Operations:

- The Fire Weather Planning Forecast, NFDRS Point Forecasts, and the Dispatch Area Forecast began on May 1st
- 62 Routine Narrative Planning Forecasts were issued during the month
- 31 NFDRS Point Forecasts issued
- 27 Spots issued; 5 of which were for wildfires, 17 for prescribed burns
- Three more partner meetings were held, one in Lander (joined by Dave Lipson), one in Jackson, and one in Lander
- Wyoming Flood Awareness Week began on May 5th – One new wildfire burn scar flood map was introduced to the public for the Fairfield Hill Scar (above Lander)
- Chuck Baker attended WYOFIRE at Camp Guernsey from May 16th – 18th

Fig. 12 – Two tornadoes formed north of Riverton on May 6th. One of them snapped several power poles and was rated an EF1, the other was rated an EF0. Photo: Josh Allen

Fig. 13 – River flooding developed in some more vulnerable areas like Ten Sleep Creek (above). Photo: Judy Morrison

June

Climate:

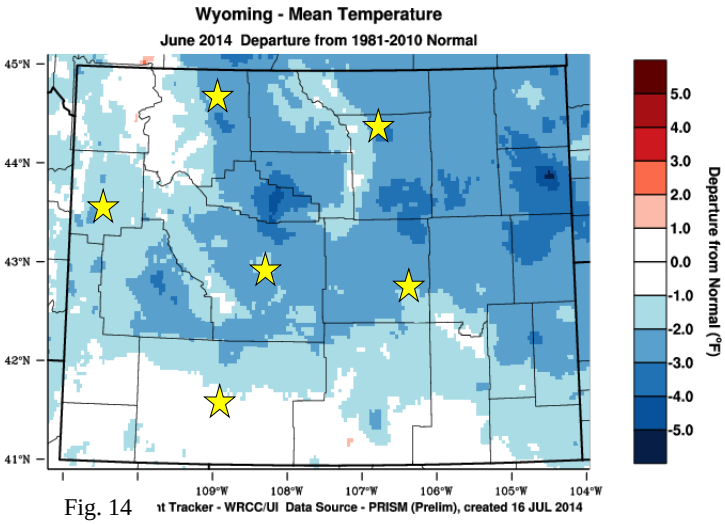


Fig. 14

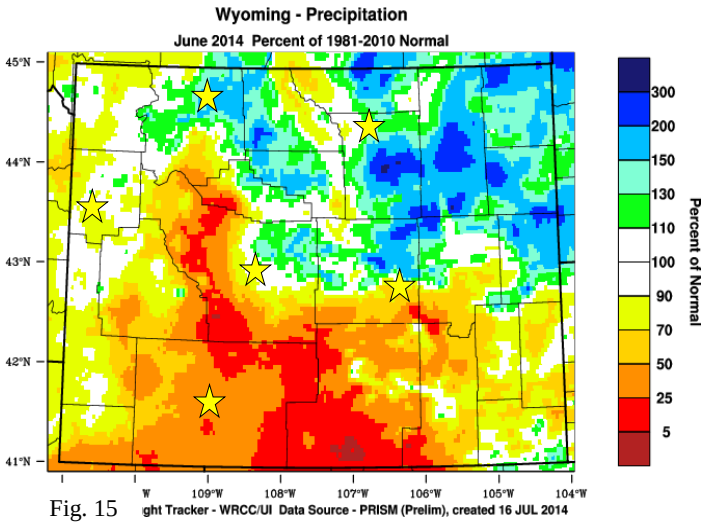


Fig. 15

Spring (and winter) continued into June with a late-season snow storm (Fig. 16) and more severe wet thunderstorms in what is normally the start of fire season. Temperatures remained well below normal along and east of the Divide with temperatures slightly below normal to near normal across the south and west (Fig. 14). Green River and Rock Springs actually had measurable snow on June 16th-18th but that wasn't enough to put them into the normal to above normal precipitation category for the month. It was hit or miss in most areas, but the seemingly endless parade of cold fronts dropping in from the north. This most benefited the low elevations east of the Divide where above normal precipitation fell during the month. There were a few records broken during June. The last week of the month set rainfall records and cold temperatures in Buffalo, Lake Yellowstone, Riverton, Casper, Greybull, and Worland. Also, there was a tornado that dropped down briefly on Dollar Lake, high up in the Wind River Mountain range at 7,782 ft. above sea level, breaking the world record for the highest water spout ever recorded! The late-season snow, rain, and record cold temperatures prevented fuels from going critical in any zone during the month and fine fuels continued to grow.

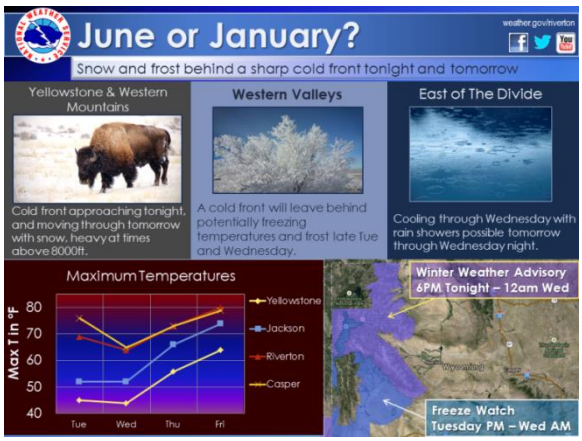


Fig. 16 – Snow flew well into June

Operations:

- 60 Routine Narrative Planning Forecasts, 30 NFDRS Point Forecasts issued
- 32 Spot forecasts were issued, 21 of which were for wildfires, 11 were for prescribed burns
- Kelly Allen and Kevin Lynott participated in an investigation regarding the Pole Creek Prescribed Burn June 7th transition to a wildfire on June 10th. Investigation found that our forecasts were correct but there was some confusion regarding the valid time of the spot. Kelly Allen issued corrective action instructions to the staff, they can be found in the Fire Weather Program Manual and Quick Reference Guide.
- Teton area fuels collaboration calls began on June 17th and were held every Tuesday through September
- Weekly Eastern Great Basin coordination calls began on June 18th and were held every Wednesday through August
- Kelly Allen taught two "Save Your Bacon – Practical Weather Application for the Field" courses June 10th in Jackson

July

Climate:

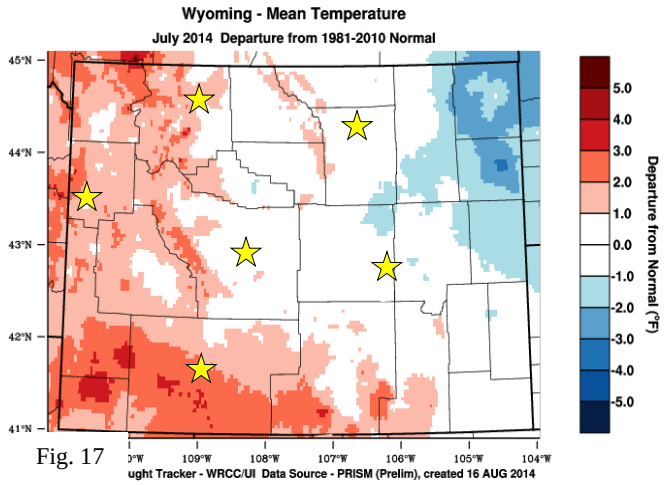


Fig. 17

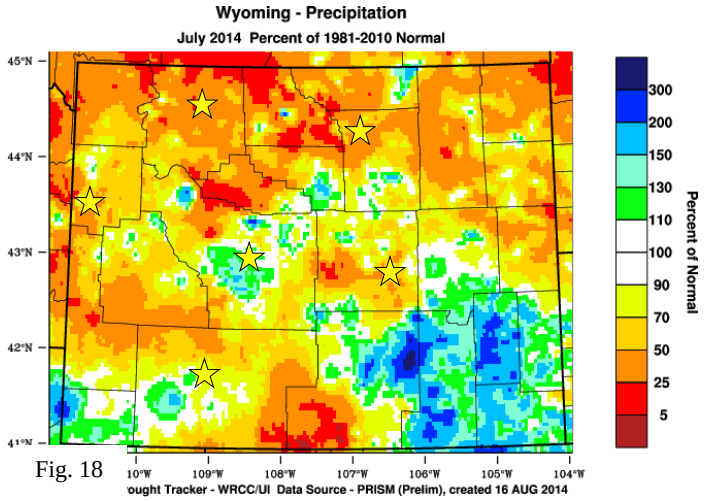


Fig. 18

July started off pretty smoky, but none of it was from any close fires; the smoke was actually from fires in northern Alberta, as fire season got off to a strong start to our north. Later in the month, the flow shifted more westerly, bringing in smoke from fires in Washington and Oregon. Closer to home, temperatures were near normal to slightly above normal across the west and south (Fig. 17). The month began rather warm with temperatures reaching the century mark early, with a roller coaster of temperatures thereafter as cold fronts and pushes of monsoonal moisture moved through the region. Some of these fronts brought periods of strong wind and Red Flag conditions, others brought heavy rain and periods of severe thunderstorms (Fig. 19), but it was not enough to push much of the state to above average precipitation (Fig. 18). Thunderstorms trended drier as we headed toward the end of July. Fuels began to dry out this month in most areas, first across the grasslands in Natrona and southern Johnson counties (Fig. 20), and then across most low elevation zones by the end of the month. The mountain zones remained non-critical through the summer.

Operations:

- 62 Routine Narrative Planning Forecasts issued
- 31 NFDRS Point Forecasts issued
- 32 Spot forecasts were issued, 21 of which were for wildfires, 11 were for prescribed burns
- 34 Red Flag Warnings were issued, there were 4 missed events (busiest month of the year)
- Southern FWZ 281 and Zone 280 were critical by July 4th, while almost all of the other low elevation zones (275, 276, 277, 279, 282, 283, 285, 287, and the low elevations of Zone 300) were critical by the end of the month.
- The largest wildfire of the season started on July 23rd, the Swede Fire (Fig. 21), in the Elk Fork drainage of the Shoshone National Forest west of Cody. It eventually burned 1,529 acres, most of which were burned on July 25th.
- Weekly conference calls with the Bridger-Teton National Forest continued each Tuesday
- Weekly conference calls with the Eastern Great Basin continued each Wednesday

Fig. 19 – Heavy Rain Over Casper

Fig. 20 – First Red Flag Warnings on July 4th

Fig. 21 – Swede Fire started on July 23rd

August

Climate:

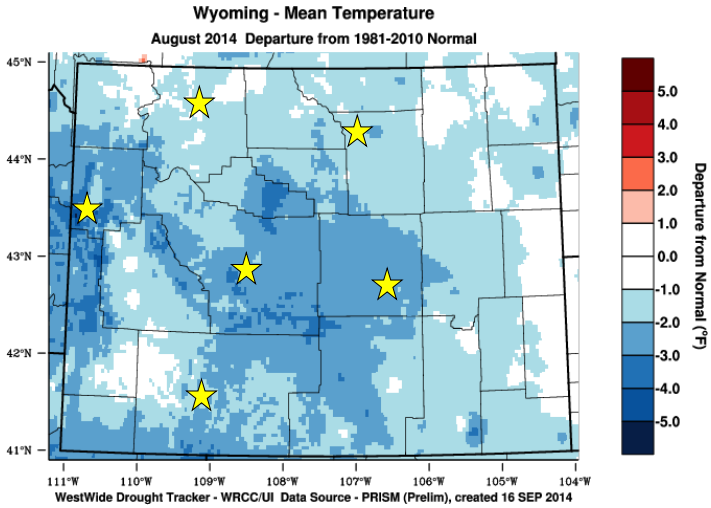


Fig. 22

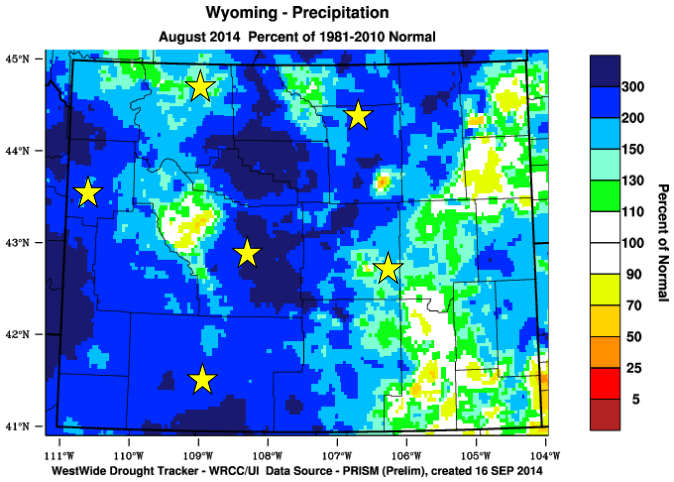


Fig. 23

The fire season pretty much ended before it had a chance to start. August was very cool and wet. In fact, there was snow in the forecast by August 22nd (Fig. 24)! Otherwise, there was wave after wave of low level moisture that kept the rain and thunder coming off-and-on through the month (Fig. 25). Many of our climate locations had their wettest August on record with most locations seeing more than 200% of their normal rainfall for the month. Needless to say, fire activity was rather quiet in the month of August but we did still manage to have two Red Flag days in the middle of the month during a warm, dry, and windy spell.

Operations:

- 62 Routine Narrative Planning Forecasts issued.
- 31 NFDRS Point Forecasts issued.
- 22 Spot Forecasts were issued, 11 for wildfires, 1 was for a prescribed burn
- 5 Red Flag Warnings were issued, 1 of which did not verify, there were 0 missed events
- Bridger-Teton and Eastern Great Basin coordination calls continued weekly through the month

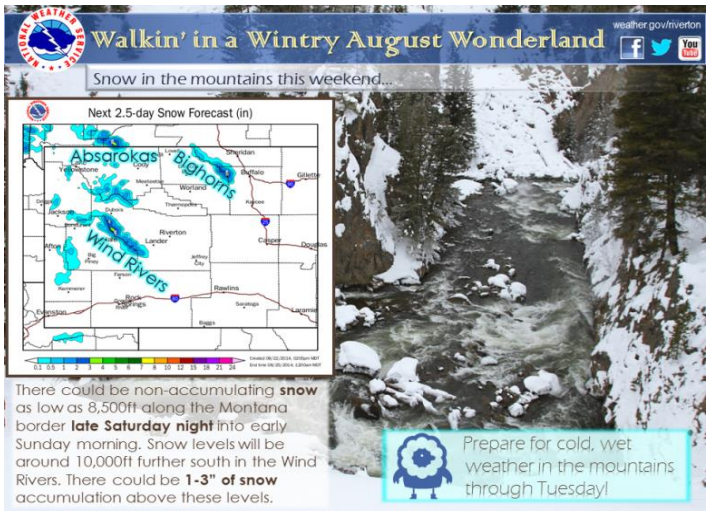


Fig. 24 – How cold was it? Cold enough to snow by the end of the month

Fig. 25 – Showers and Thunderstorms pummeled the region with rain

September

Climate:

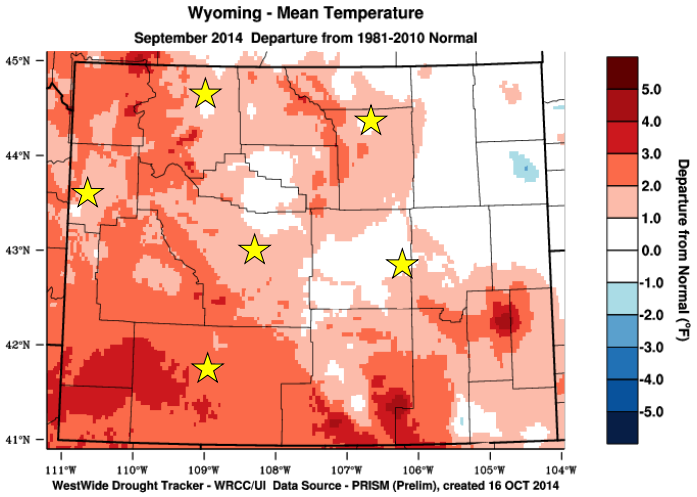


Fig. 26

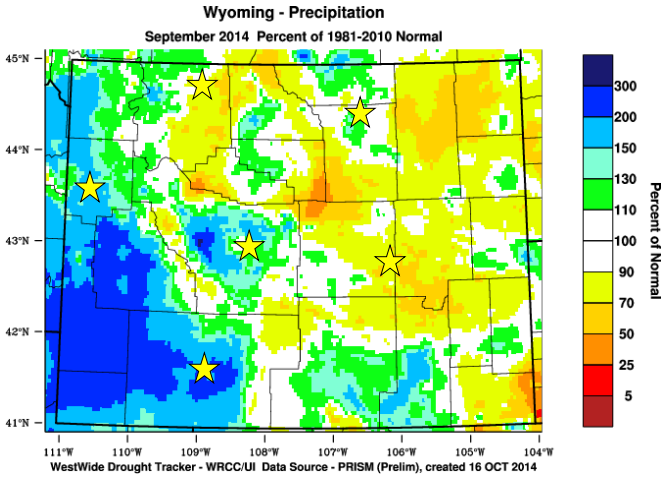


Fig. 27

September started off warm and breezy with a few Red Flag Warnings issued for areas east of the Divide. In fact, September came in second for the most Red Flag warnings and days behind July. The low humidity and the lowering sun angle also led to some freezing conditions across the western valleys, with many areas around Jackson and the Upper Green River Valley experiencing a hard freeze by September 3rd. There were also a few rounds of thunderstorms early in the month with some reaching severe limits, dropping large hail, and sending out gusty outflows. The first major snow storm of the year occurred on September 10th-11th as 7 to 10 inches of snow fell around Buffalo, snapping trees and causing widespread power outages (Fig. 28). Cody also received a significant amount of snow, making it the earliest snowfall for Cody since 1970. Not long after this storm hit, we transitioned to record warmth (Fig. 26) with high temperatures soaring back into the 90s east of the Divide, and into the 70s and 80s across the west; even Yellowstone had high temperatures in the 70s. The record heat was then followed by record rainfall amounts as a very wet storm moved in from the Pacific, bringing precipitation for the month to well above normal across the southwest and portions of Fremont County (Fig. 27 & 29).

Operations:

- 60 Routine Narrative Planning Forecasts issued
- 30 NFDRS Point Forecasts issued
- 16 Spot Forecasts issued, 0 were for wildfires, 10 for prescribed burns
- 21 Red Flag Warnings were issued and 2 were not verified, there were 0 missed events
- The last Red Flag Warning of the season was issued on September 25th
- Only 2 of the 12 fire weather zones with critical fuels went back to non-critical by the end of the month – Zones 277, and 279

Fig. 28 – Early snow causes damage in Buffalo

Fig. 29 – Heavy rain pounds Afton & the Southwest

October, November, December

Climate:

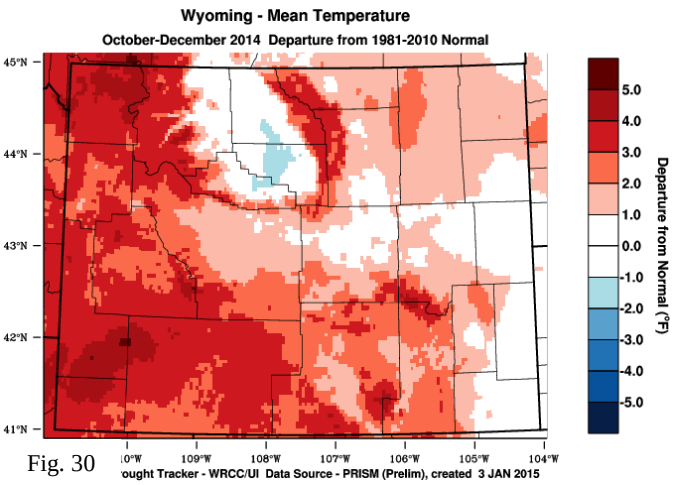


Fig. 30

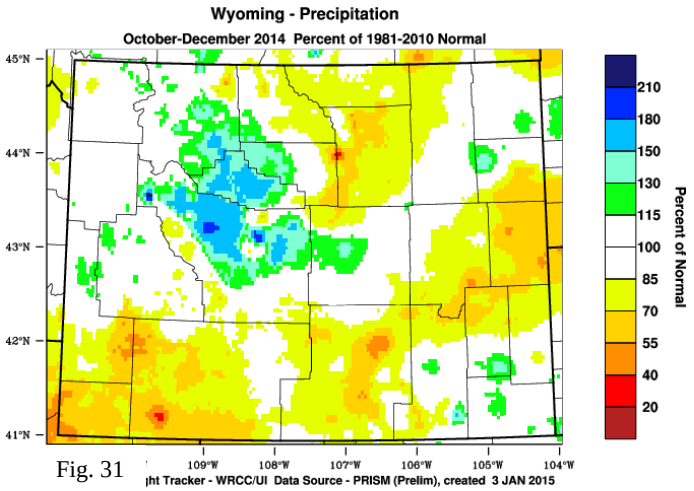
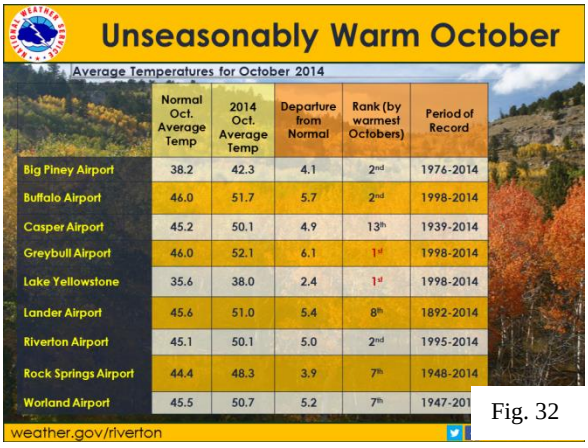


Fig. 31

The autumn and early winter months were pretty warm on the whole (Fig. 30) with the recent rainfall and warmth causing vibrant autumn colors early in the period (Fig. 32). There were a few storms that moved through, bringing periods of rain and snow, with the latest storms in December bringing the Wind River Basin and the southern Big Horn Basin above average for the period as the rest of the state was near to below normal (Fig. 31). There were a couple of wind events in mid October, and again in November, but by this time, the fuels were no longer critical.



	Normal Oct. Average Temp	2014 Oct. Average Temp	Departure from Normal	Rank (by warmest Octobers)	Period of Record
Big Piney Airport	38.2	42.3	4.1	2nd	1976-2014
Buffalo Airport	46.0	51.7	5.7	2nd	1998-2014
Casper Airport	45.2	50.1	4.9	13th	1939-2014
Greybull Airport	46.0	52.1	6.1	1st	1998-2014
Lake Yellowstone	35.6	38.0	2.4	1st	1998-2014
Lander Airport	45.6	51.0	5.4	8th	1892-2014
Riverton Airport	45.1	50.1	5.0	2nd	1995-2014
Rock Springs Airport	44.4	48.3	3.9	7th	1948-2014
Worland Airport	45.5	50.7	5.2	7th	1947-201

Fig. 32

The below normal temperature anomaly in the Bighorn Basin (Fig. 30) was caused largely by a singular snow storm on November 10th that dropped a foot of snow in some portions of the basin; but, the snow didn't stop there as this storm also blanketed much of the state with measurable snow. The low sun angle and calm winds led to sharp temperature inversions that ended up trapping many basins in abnormally cold arctic air that accompanied the snow. Overnight low temperatures were well below zero in many basins. In fact, Casper dropped to -27ºF on November 12th setting their new record low for the month of November, and breaking the old record of -21 ºF set back on November 23, 1985. Temperatures eventually returned to normal after this outbreak, ending fears that winter came and was never going to leave. However, winter eventually did come back in the form of snow in most places, and in the form of Category 3 Hurricane force wind (gusts) along the Cody foothills. The wind gusted to 117 mph west of Clark and to 82mph in Cody. These winds toppled trees and caused power outages around Cody at the end of November (Fig. 33). That storm at the end of November was also characterized by an impressive arctic front that dropped temperatures over 30°F in a matter of minutes as it passed.

Fig. 33 – Strong winds topple trees at the Cody Chamber of Commerce

December also began unseasonably warm and mild, with a couple of snow storms dropping widespread measurable snow around the middle of the month and also around Christmas day.

There was some talk of a potential moderate El Niño this winter as early as the spring of 2014, but it never seemed to materialize. A weak El Niño remains possible. A typical El Niño winter brings very dry and warm

conditions to the state (Fig. 34). This could have made for a disastrous early fire season for 2015 as the past two wet years have made a lot of fine fuels available for burning. While the actual 2014-2015 Winter Outlook from NOAA does hint at some El Niño-type signatures, it is not expected to be as pronounced. This is likely to result in a slightly warmer than average winter with average precipitation for the state of Wyoming (Fig. 35).

Operations:

- Routine Fire Weather Planning Forecasts (FWF) dropped down to one per day on October 1st, the FWF and NDFRS Point Forecasts stopped for the season on October 31st , 31 FWF forecasts were issued in October and 31 NDFRS Forecasts were issued
- 36 Spot Forecasts were issued during the period, 7 were for wildfires, and 27 were for prescribed burns
- The second largest wildfire of the season, the West Range Fire, started on November 8th just outside of Buffalo, WY. It grew to 1,170 acres and staffed roughly 110 people before it was put out by a snow storm on November 10th. The fire came within 50 feet of a subdivision.
- A Smoke Dispersion Forecast decision support page was created for the web and a Winter Fire Weather Grid procedure in D2D were developed in November in support of fall/winter prescribed burning activities.
- Dave Lipson (IMET) attended the Wildland Fire Weather IMET User Workshop on November 20th at the National Center for Atmospheric Research (NCAR) in Boulder, CO
- Trevor Lavoie joined the Fire Weather Team

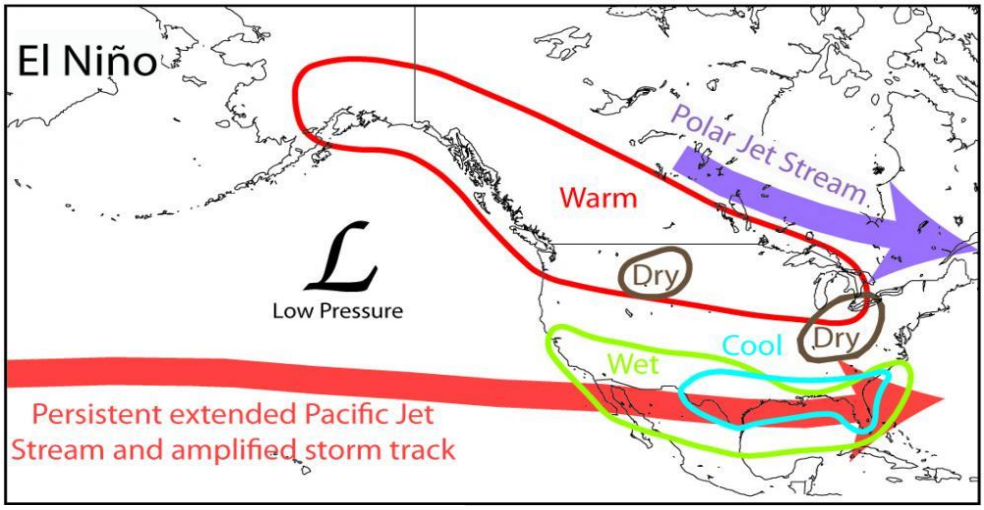


Fig. 34 – Typical El Niño Winter

Fig. 35 – 2014-2015 Winter Season Outlook from the Climate Prediction Center

☼ NWS Riverton 2014 Red Flag Warning Events and Verification:

- **Summary**:

A total of 61 RFW events occurred this season, much fewer than the 487 warnings issued during the 2012 season, but a few more than the 42 issued in 2013. The zones with the most Red Flags issued were Zones 279 and 280, Sweetwater and Natrona Counties, with 13 Red Flags each; the least warned zones are all the mountain zones and Sublette County where 0 Red Flags were issued for the season (140, 278, 286, 288, 414, 415, 416). Of the 61 warnings, 58 of them were verified. There were a total of 4 missed events. The following represents our performance for these events:

POD:	94%
FAR:	5%
CSI:	89%

The average lead time for the Red Flag Warning was 23 hours.

There were a total of 22 Fire Weather Watches, 22 of which were followed by a successful Red Flag Warning. There were 0 watches not followed by a successful warning. The number of Red Flag Warnings not preceded by a watch totaled 43.

☼ NWS Riverton 2014 Fire Weather Spot Forecast Archive:

Spot forecasts issued for Wildfires:	93
Spot forecasts issued for prescribed burns:	74
Spot forecasts issued for other purposes:	36
Total Number of Spot Forecasts issued:	203

This year ranks 7th for total number of spots. Last year, 263 spots were issued, which ranked the 2013 season 7th for number of spots. Our top two years, 2006 and 2012, each had over 450 spots issued. National Weather Service-wide, the Riverton office ranked 36th for number of spots this year, and #7 in the Central Region. WFO Riverton tied with WFO Seattle for 3rd overall for number of Search and Rescue spots with 29 for the year.

☼ NWS Riverton IMET Dispatch Days:

There were zero IMET dispatch days in 2014.