WYOMING BUREAU OF LAND MANAGEMENT

2022 Air Resource Monitoring Report

(Data through 2021)

Sheridan BLM-WARMS Site

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1. Introduction

The Wyoming Bureau of Land Management (BLM) has prepared this air monitoring report to present existing environment conditions for use in environmental impact assessments. The BLM authorizes activities that can affect air resources by releasing pollutants into the atmosphere. The report assists the BLM in managing air resources by establishing current conditions and monitoring trends for National Environmental Policy Act (NEPA) analysis. Additionally, the report is used to promote education, awareness, and transparency of air resources on public lands. Air pollution does not stop at government or jurisdictional boundaries. Engaging the public, various levels of government, and tribes through cooperative airshed management is a key to protecting air quality.

2. Regulatory analysis

Congress gave the Environmental Protection Agency (EPA) regulatory authority for cleaning up air pollution. Under the Clean Air Act (CAA), EPA sets limits on certain air pollutants, including setting limits on how much can be in the air anywhere in the United States. The CAA also gives EPA the authority to limit emissions of air pollutants coming from sources like chemical plants, utilities, and steel mills (EPA 2007).

The Wyoming Department of Environmental Quality/Air Quality Division (WDEQ-AQD) is responsible for ensuring that air in Wyoming meets health and safety standards established under the CAA. To fulfil this responsibility, the WDEQ-AQD is required by the federal government to ensure compliance with the EPA's National Ambient Air Quality Standards (NAAQS) statewide. Additionally, the state ensures compliance with visibility standards through regional haze rules. The WDEQ-AQD enacts rules pertaining to air quality standards, develops plans to meet the federal standards, when necessary, issues preconstruction and operating permits to stationary sources, and ensures compliance with state and federal air quality rules (WDEQ 2022).

EPA's Tribal Authority Rule gives Tribes the ability to develop air quality management programs, write rules to reduce air pollution and implement, and enforce their rules in Indian Country. While state and local agencies are responsible for all CAA requirements, Tribes may develop and implement only those parts of the CAA that are appropriate for their lands (EPA 2007).

While the EPA, State, and Tribes have regulatory authority to control air pollution emissions, it is the mission of the BLM to sustain the health, diversity, and productivity of the public lands for the use and enjoyment of present and future generations. Section 2.1 lists the laws, policy, and guidance that directs BLM on how to achieve this mission with respect to air resources.

2.1. Regulations and Policy

Clean Air Act

The CAA of 1963 [42 U.S.C. § 1857 et seq.], as amended and recodified [42 U.S.C. § 7401 et seq.] is the primary Federal legislation and provides the framework for protecting and enhancing the quality of the Nation's air resources to promote the public health and welfare and the productive capacity of its population (Section 101(b)(1)). The Act focuses on reducing both criteria air pollutants and hazardous air pollutants. As required by the CAA, EPA has established National Ambient Air Quality Standards (NAAQS) for criteria pollutants (Section 109 (a)(1)(A)). Compliance and enforcement of these Federal requirements is delegated to applicable Tribal, State, and local regulatory agencies (Sections 107(a), 301(d), 302). The CAA also allows these agencies to establish regulations which are more, but not less, stringent than the Federal requirement (Section 116) (EPA 2007). The BLM has no authority to determine how air quality standards will be achieved nor to determine area designations.

Federal Land Policy and Management Act

Federal Land Policy and Management Act (FLPMA) of 1976 [43 U.S.C. §§ 1701-1785], often referred to as the BLM's "Organic Act," provides the majority of the BLM's legislated authority, direction policy, and basic management guidance. This Act outlines the BLM's role as a multiple use land management agency and provides for management of the public lands under principles of multiple use and sustained yield. The Act directs public lands to be managed "in a manner that will protect the quality of scientific, scenic, historical, ecological, environmental, air and atmospheric, water resource, and archeological values" (Sec. 102. [43 U.S.C. 1701] (a) (8)). To meet this responsibility, the BLM is to require "compliance with applicable pollution control laws, including State and Federal air, water, noise, or other pollution standards or implementation plans" (Sec. 202. [43 U.S.C. 1712] (a)(8)). This means that the BLM can reasonably rely on compliance with existing air pollution control regulations to ensure protection of regulatory air quality standards (e.g., NAAQS). In addition, BLM can reasonably rely on Federal or delegated State air pollution control agencies to determine compliance with these regulations, and to enforce these regulatory air quality standards. FLPMA also gives the BLM authority to halt any BLM-authorized activity that is found in violation of state of Federal air quality regulations, thus ensuring that the BLM can provide compliance with applicable air quality standards, regulations, and implementation plans (Sec. 302. [43 U.S.C. 1732] (a)(c)).

National Environmental Policy Act

The National Environmental Policy Act (NEPA) of 1969 [42 U.S.C. 4321 et seq.]: NEPA ensures that information on the potential environmental and human impact of Federal actions is available to public officials and citizens before decisions are made and before actions are taken. One of the purposes of the Act is to "promote efforts which will prevent or eliminate damage to the environment and biosphere," and to promote human health and welfare (Section 2). This Act requires that agencies prepare a detailed statement on the environmental impact of the proposed action for major Federal actions expected to significantly affect the quality of the human environment (Section 102 (C)). In addition, agencies are required, to the fullest extent possible, to use a "systematic, interdisciplinary approach" in planning and decision-making processes that may have an impact on the environment (Section 102(A)).

Additional Guidance

Other guidance and policy are useful for the BLM in managing air resources. While this guidance is not required by law it can be useful for managing and analyzing air resources. Such guidance includes but is not limited to: Council on Environmental Quality guidance on NEPA analysis, the Federal Land Managers' Air Quality Related Values Work Group (FLAG), and BLM Guidance for Conducting Air Quality General Conformity Determinations (BLM IM2013-025 2012) (BLM IB 2014-084 2014).

2.2. Regulated Values

2.2.1. Criteria Air Pollutants

The EPA has established NAAQS for six common air pollutants (also known as "criteria air pollutants"). These pollutants are found all over the U.S. Concentrations of air pollutants greater than the national standards represent a risk to human health and the environment. Criteria pollutants include carbon monoxide, nitrogen dioxide, ozone, particulate matter, sulfur dioxide, and lead, and are discussed below. Periodically, the EPA reviews the latest science to ensure that NAAQS appropriately protect human health and safety and to update the standards when necessary. Indicators for assessing environmental impacts from criteria air pollutants include emissions (mass per unit of time) and concentrations (mass per volume, or number of molecules over total molecules).

Carbon Monoxide

Carbon monoxide (CO) is a colorless, odorless gas emitted from combustion processes. The greatest sources of CO to outdoor air are cars, trucks and other vehicles or machinery that burn fossil fuels. CO can cause harmful health effects by reducing oxygen delivery to the body's organs (like the heart and brain) and tissues. At extremely high levels, CO can cause death (EPA 2018).

Nitrogen Oxides

Nitrogen oxides (NO_x) are a group of highly reactive gasses and include nitrogen dioxide (NO_2), nitrous acid, and nitric acid. While EPA's NAAQS cover this entire group of NO_x, NO_2 is the component of greatest interest and the indicator for the larger group of nitrogen oxides. NO_2 forms quickly from emissions from cars, trucks and buses, power plants, and off-road equipment. In addition to contributing to the formation of ground-level ozone, and fine particle pollution, NO_2 is linked with a number of adverse effects on the respiratory system (EPA 2018).

Ozone

Ground-level ozone (O_3) is a secondary pollutant. It is formed by a chemical reaction between NO_x and volatile organic compounds (VOCs) in the presence of sunlight (photochemical oxidation). Precursor sources of NO_x and VOCs include motor vehicle exhaust, industrial emissions, gasoline vapors, vegetation emissions (i.e., terpenes), wood burning, and chemical solvents. Abundant solar radiation drives the photochemical process and creates ground-level O_3. Primary health effects from O_3 exposure range from breathing difficulty to permanent lung damage. High concentrations of ground-level O_3 contributes to plant and ecosystem damage.

While ozone is generally considered a summertime air pollutant, in certain parts of the country it has become a wintertime issue due to highly concentrated precursor pollutants under low level temperature inversions and additional photochemical reaction from snow reflecting solar radiation back into the atmosphere.

Ozone and its precursors are a regional air quality issue due to possible transport hundreds of miles from origination, thus maximum O_3 levels can occur at locations many miles downwind from the sources.

Particulate Matter (PM_{10} AND $PM_{2.5}$)

Airborne particulate matter (PM) consists of tiny coarse-mode (PM_{10}) or fine-mode ($PM_{2.5}$) particles or aerosols combined with dust, dirt, smoke, and liquid droplets. $PM_{2.5}$ have diameters that are generally 2.5 micrometers or smaller and derive primarily from the incomplete combustion of fuel sources and secondarily formed aerosols. PM_{10} have diameters that are generally 10 micrometers or smaller and derive primarily from crushing, grinding, or abrasion of surfaces. Sources of particulate matter include industrial processes, power plants, vehicle exhaust, fugitive dust, construction activities, home heating, and fires. Many scientific studies have linked breathing PM to serious health problems, including aggravated asthma, increased respiratory symptoms, difficult or painful breathing, chronic bronchitis, decreased lung function, and premature death. Particulate matter is a major cause of reduced visibility. It can stain and damage stone and other materials, including culturally important objects, such as monuments and statues (EPA 2018).

Sulfur Dioxide

Sulfur dioxide (SO_2) is one of a group of highly reactive gasses known as “oxides of sulfur.” The largest sources of SO_2 emissions are from fossil fuel combustion at power plants (73%) and other industrial facilities (20%). Smaller sources of SO_2 emissions include industrial processes such as extracting metal from ore, and the burning of high sulfur containing fuels by locomotives, large ships, and non-road equipment. SO_2 is linked with a number of adverse effects on the respiratory system (EPA 2018).

Lead

Lead (Pb) is a metal found naturally in the environment as well as in manufactured products. The major sources of lead emissions have historically been from fuels in on-road motor vehicles (such as cars and trucks) and industrial sources. As a result of EPA's regulatory efforts to remove lead from gasoline, emissions of lead from the transportation sector declined by 95% between 1980 and 1999, and levels of lead in the air decreased by 94% during the same period. Major sources of lead emissions to the air today are ore and metals processing and piston-engine aircraft using leaded aviation gasoline (EPA 2018).

National Ambient Air Quality Standards (NAAQS)

NAAQS have been established for the six criteria air pollutants to protect human health and welfare. The WDEQ-AQD is responsible to for ensuring compliance with the NAAQS within the state of Wyoming. Table 1 shows current NAAQS for the EPA designated criteria pollutants (EPA 2018).

Table 1. Primary Criteria Pollutant NAAQS.

Pollutant	Primary/ Secondary	Averaging Time	Level*	Form
Carbon Monoxide (CO)	primary	8 hours	9 ppm	Not to be exceeded more than once per year
		1 hour	35 ppm	
Lead (Pb)	primary and secondary	Rolling 3-month average	0.15 μg/m^3	Not to be exceeded
Nitrogen Dioxide (NO_2)	primary	1 hour	100 ppb	98th percentile of 1-hour daily maximum concentrations, averaged over 3 years
	primary and secondary	1 year	53 ppb	Annual Mean
Ozone (O_3)	primary and secondary	8 hours	0.070 ppm	Annual fourth-highest daily maximum 8-hour concentration, averaged over 3 years
Fine Particulate Matter ($PM_{2.5}$)	primary	1 year	12.0 μg/m^3	Annual mean, averaged over 3 years
	secondary	1 year	15.0 μg/m^3	Annual mean, averaged over 3 years
	primary and secondary	24 hours	35 μg/m^3	98th percentile, averaged over 3 years
Coarse Particulate Matter (PM_{10})	primary and secondary	24 hours	150 μg/m^3	Not to be exceeded more than once per year on average over 3 years
Sulfur Dioxide (SO_2)	primary	1 hour	75 ppb	99th percentile of 1-hour daily maximum concentrations, averaged over 3 years
	Secondary	3 hours	0.5 ppm	Not to be exceeded more than once per year
* Units of measure for the standards are parts per million (ppm) by volume, parts per billion (ppb) by volume, and micrograms per cubic meter of air (μg/m^3).				

Volatile Organic Compounds

VOCs are any compound of carbon, excluding carbon monoxide, carbon dioxide, carbonic acid, metallic carbides or carbonates and ammonium carbonate, which participates in atmospheric photochemical reactions, except those designated by EPA as having negligible photochemical reactivity (EPA 2018). While there is no NAAQS for VOCs, these are regulated by the EPA to prevent the formation of O_3, a constituent of photochemical smog. VOCs in Wyoming originate mostly from biological sources such as vegetation and soils, chemical solvents, gasoline vapors, and oil and gas production. Many VOCs are also hazardous air pollutants.

2.2.2. Hazardous Air Pollutants (HAPs)

Hazardous air pollutants (HAP) are known or suspected to cause cancer or other serious health effects, such as birth defects, or adverse environmental impacts. The EPA has classified 187 air pollutants as HAPs. Examples of listed HAPs associated with the oil and gas industry include formaldehyde, benzene, toluene, ethyl benzene, isomers of xylene (BTEX) compounds, and normal-hexane (n-hexane). Indicators for assessing environmental impacts from HAPs include emissions (mass per unit of time) and concentrations (mass per volume).

The EPA National Toxics Assessment tool is used to evaluate impacts from existing HAP emissions in Wyoming (EPA, 2017 AirToxScreen: Assessment Results 2022). The EPA has determined that, for Wyoming counties with BLM managed lands, the total cancer risk is 10 to 20 in 1 million. This cancer risk is within the acceptable range of risk published by the EPA of 100 in 1 million as discussed in the National Contingency Plan, 40 CFR § 300.430. The highest cancer risks in Wyoming are found in counties of Laramie and Sweetwater. The noncancer respiratory hazard index for Wyoming counties with BLM managed lands is between 0.08 and 0.30. Hazard index values less than one mean it is unlikely that air toxics will cause adverse noncancer health effects over a lifetime of exposure. Oil and gas development and other foreseeable emission sources would contribute to HAP emissions and associated carcinogenic and noncancer risks.

The CAA requires the EPA to regulate emissions of toxic air pollutants from a published list of industrial sources referred to as "source categories." The EPA has developed a list of source categories that must meet control technology requirements for these toxic air pollutants. Under Section 112(d) of the CAA, the EPA is required to develop regulations establishing national emission standards for hazardous air pollutants (NESHAP) for all industries that emit one or more of the pollutants in major source quantities. These standards are established to reflect the maximum degree of reduction in HAP emissions through application of maximum achievable control technology (MACT). Source categories for which MACT standards have been implemented include oil and natural gas production and natural gas transmission and storage.

2.2.3. Air Quality Related Values

Air resources also encompass Air Quality Related Values (AQRVs). Air pollution can impact AQRVs through ambient exposure to elevated atmospheric concentrations, such as O_3 effects to vegetation, impairment of scenic views by PM in the atmosphere, and deposition of air pollutants, such as sulfur and nitrogen compounds on the earth's surface through dry and wet precipitation. AQRVs are identified and managed within the respective jurisdictions of several land management agencies in designated Class I areas. The requirement to assess impacts to AQRVs is established in the CAA Prevention of Significant Deterioration (PSD) rules. PSD is a permitting program for new and modified major sources of air pollution that are located in attainment areas. The Federal land managers have the responsibility to consider whether new emissions from proposed major facilities (or modifications to major facilities) would have an adverse impact on AQRVs areas they manage. Impact indicators for visibility include changes to color and contrast for an exhaust or dust plume, or changes to light extinction (deciview) for a cumulative assessment. Indicators for deposition include the Deposition Analysis Threshold (DAT), and critical load thresholds, both measured as mass over area and time.

2.2.4. Greenhouse Gases

Greenhouse gases (GHGs) became regulated pollutants on January 2, 2011, under the PSD and Title V Operating Permit Programs (EPA 2018) because of their contribution to global climate change effects. These gases absorb energy emitted from the earth's surface and re-emit a larger portion of the heat back to the earth, rather than allowing the heat to escape into space, than would be the case under more natural conditions. The EPA's GHG Tailoring Rule (40 CFR § 51, 52, 70, et al.) set initial emissions thresholds for PSD and Title V permitting based on carbon dioxide equivalent (CO_2e). These thresholds apply to stationary sources that emit greater than 100,000 tons CO_2e per year (e.g., power plant, or landfill, etc.) or modifications of major sources with resulting emissions increase greater than 75,000 tons CO_2e per year.

In addition to the Tailoring Rule, the EPA requires reporting of GHGs from facilities with stationary sources that emit 25,000 metric tons CO_2e per year or more in the United States. The Mandatory Reporting Rule (40 CFR § 98, Subpart C) does not require control of GHGs, it only requires that sources above the threshold levels monitor and report emissions. Facilities used for injecting carbon dioxide for geological sequestration must report net emissions regardless of quantity (40 CFR § 98, Subpart RR). This provides a basis for future EPA policy decisions and regulatory initiatives regarding GHGs. Additional regulations and policies for GHG's are incorporated by reference from the BLM Specialist Report on Annual GHG Emissions and Climate Trends (BLM 2021).

2.2.5. Criteria for Detailed Analysis of Air Quality Pollutants in NEPA

Generally, the criteria followed for the inclusion of a detailed analysis in NEPA documents for the air quality/greenhouse gas resources is based upon the emission limits in **Error! Reference source not found.**2. Exceptions to these criteria are possible based on specific project details. This could result in a project being analyzed in detail below the emission levels, and not being analyzed in detail above the emission levels in Table 2. In most scenarios, project related mobile sources are excluded from the emission limits in Table 2 since they are dispersed over large distances. The emission limits in Table 2 are specific to point source/stationary sources. Exceptions to the exclusion of project related mobile source are possible based on specific project details. The criteria in **Error! Reference source not found.**2 has been developed based on 40 CFR 52.21(b)(23)(i) and State of Wyoming/Department of Environmental Quality/Air Quality Division Wyoming Administrative Rules, Chapter 6, Section 13(b)(i) (WDEQ 2022).

Table 2. Emissions Criteria for Detailed Analysis of Air Quality in NEPA.

Pollutant	Emissions Limit
Sulfur Dioxide	40 tons per year
Nitrogen Oxides	40 tons per year
PM10 – Fugitive Emissions and Fugitive Dust*	5 tons per year
PM10 – Non-fugitive Emissions	15 tons per year
PM2.5	10 tons per year
Carbon Monoxide	100 tons per year
Lead	0.6 tons per year
Ozone	40 tons per year of volatile organic compounds or nitrogen oxides

*Fugitive emissions and fugitive dust from point/stationary sources.

2.3. Air Resource Management

The airshed concept is a means for evaluating the local and regional air quality effects of a pollutant source. An airshed is a volume of air that is generally homogeneous with respect to atmospheric properties and the dispersion of air pollutants. In Wyoming, geographical and meteorological constraints often define an airshed's boundaries and limit the dispersion of pollutants away from a source. The size of an airshed can vary from small valleys that are a few miles across to larger urban or regional areas that can be tens or hundreds of miles across.

Pollutants move through an airshed by two processes: transport and dispersion. Transport is movement caused by a time-averaged wind flow, with pollutants moving on scales of miles per hour. Dispersion is much smaller movement, primarily caused by localized turbulence on the scale of inches or feet. The transportation and dispersion extent of pollutants is the main factor for the area covered by an airshed.

2.4. Administrative Rules and Implementation Plans

To protect public health, the CAA (42 U.S.C Section 7401) requires that federal standards be set to limit the maximum levels of pollutants in the outdoor air. Each state is responsible for developing plans to demonstrate how those standards will be achieved, maintained, and enforced. The Wyoming Air Quality Board enacts rules pertaining to air quality activities and approve State Implementation Plans (SIP) to attain and maintain NAAQS. The plans and rules associated with them are enforced by the State, and, after federal approval, they are also federally enforceable. These plans are the framework for each state's program to protect the air. For NAAs outside of state air regulatory jurisdiction, a Federal Implementation Plan (FIP) or Tribal Implementation Plan (TIP) is developed.

2.5. Air Resource Developments

2.5.1. Guidance on Assessing GHG Emissions in NEPA

In 2019 the Council on Environmental Quality (CEQ) issued draft guidance on considering GHG emissions in NEPA documents (CEQ 2019). Executive Order 13990 directs CEQ to rescind the 2019 Draft GHG Guidance and review, revise, and update its 2016 GHG Guidance. On February 19th, 2020, the CEQ rescinded (86 FR 10252) the 2019 Draft GHG Guidance. The withdrawal of this guidance does not change any law, regulation, or other legally binding requirement. CEQ will address in a separate action its review of and any appropriate revisions and updates to the 2016 GHG Guidance. In the interim, agencies should consider all available tools and resources in assessing GHG emissions and climate change effects of their proposed actions, including, as appropriate and relevant, the 2016 GHG Guidance.

2.5.2. NEPA Guidance

In 2020, the CEQ issued a final rule to update its regulations for Federal agencies to implement the NEPA. This guidance became effective on September 14, 2020. Secretarial Order 3399, Department-Wide Approach to the Climate Crisis and Restoring Transparency and Integrity to the Decision-Making Process (April 16, 2021), directs Bureaus/Offices to not apply the 2020 Rule in a manner that would change the application or level of NEPA that would have been applied to a proposed action before the 2020 Rule went into effect on September 14, 2020. On April 20, 2022, CEQ issued a final rule to amend certain provisions of its regulations for implementing NEPA, addressing the purpose and need of a proposed action, agency NEPA procedures for implementing CEQ's NEPA regulations, and the definition of "effects." The amendments generally restore provisions that were in effect for decades before being modified in 2020. Bureaus/Offices will continue to follow the Department's NEPA regulations at 43 C.F.R. Part 46, Department Manual procedures (516 DM Ch. 1-15), and guidance and instruction from the Office of Environmental Policy and Compliance until updated direction is provided.

2.5.3. Nonattainment Area (NAA)

O_3

On April 30, 2012, the EPA formally recognized Wyoming's Upper Green River Basin (UGRB) as an ozone nonattainment area with a marginal classification. As a result of the nonattainment designation, the BLM must comply with General Conformity regulations in 40 CFR 93 Subpart B and Chapter 8, Section 3 of the Wyoming Air Quality Standards and Regulations (WAQSR). Per these regulations, the BLM must demonstrate that new actions occurring within the nonattainment area will conform with the Wyoming State Implementation Plan (SIP) by demonstrating that they will not: (1) cause or contribute to a new violation of the ozone standard; (2) interfere with provisions in the SIP for maintenance of any standard; (3) increase the frequency or severity of any existing violation; or (4) delay timely attainment of any standard or any required interim emissions reductions or other milestone. The BLM must first conduct an applicability analysis to determine if this Federal action will require a conformity determination. A conformity determination must be completed for a Federal action if the total of direct and indirect emissions from the proposed project exceeds the de minimis levels specified in 40 CFR 93.153(b) and WAQSR Chapter 8, Section 3. For a marginal nonattainment area, the de minimis threshold is 100 tons/year of NOx or VOCs (the precursor pollutants that form ozone in the atmosphere). Federal actions estimated to have an annual net emissions increase less than the de minimis levels are not required to demonstrate conformity under the General Conformity regulations.

In accordance with the Federal and State Conformity regulations, the General Conformity requirement does not apply to actions where the emissions are not reasonably foreseeable such as lease sales made on a broad scale followed by exploration and development plans. There are no direct effects from the proposed oil and gas lease sale because it is primarily an administrative action that only conveys the mineral rights to the potential lessee. Subsequent development proposals by lease holders will require to submittal of plans for any exploration or development that may occur, and a site-specific EA or EIS would be prepared to identify mitigation measures necessary to avoid undue degradation to the environment prior to approval any development activities. General Conformity is addressed at the proposal stage when emission generating activities are reasonably foreseeable and can be quantified. Six (6) parcels are located within this non-attainment area (parcels WY-204Q-0817, -0823, -0824, -0827, -6960 and -6961).

On August 27, 2015, the EPA published a Federal Register Notice finding that the Upper Green is attaining the ozone standard as of July 20, 2015, attainment date (see http://www.gpo.gov/fdsys/pkg/FR-2015-08-27/pdf/2015-21196.pdf). Formal re-designation of the area to attainment has not yet occurred.

3. Air Quality Conditions and Trends

3.1 Air Quality Index and Air Pollutant Concentrations

Air Quality Index

Air quality for Wyoming is examined using the EPA Air Quality Index Summary Report (EPA 2023). The Air Quality Index (AQI) is an indicator of overall air quality as it accounts for all criteria air pollutants in a county and is one way to quickly evaluate how clean or polluted the air is. The EPA calculates a daily AQI based on local air monitoring data. The terms "Good", "Moderate", and "Unhealthy" help to interpret the AQI. When the AQI value is in the good range, pollutant concentrations are well below the NAAQS and air pollution poses little or no risk. Moderate AQI values occur when pollution is below but near the NAAQS and voluntary emission reduction measures are encouraged. The AQI is considered unhealthy when the NAAQS is exceeded, and major pollution sources are often required to implement mandatory emission reduction measures. Counties without AQI data usually have fewer air pollutant sources and are assumed to have good air quality. Statistical AQI data from 2019 to 2021 is presented in Table 3. Proposed projects occurring in counties with more than 1% (approximate number of annual exceedances allowed for the O_3 NAAQS) of days with an unhealthy AQI, could merit further NEPA air quality impacts.

Table 3. 2019-2021 Wyoming AQI Index Summary Statistics by County.

		Number of Days When AQI was…			Percantage of Days Rated …		
County	**# Days with AQI**	**Good**	**Moderate**	**Unhealthy**	**Good**	**Moderate**	**Unhealthy**
Albany	1096	697	376	20	63.6	34.3	1.8
Big Horn	1079	1017	59	3	94.3	5.5	0.3
Campbell	1096	778	298	20	71.0	27.2	1.8
Carbon	1016	977	38	1	96.2	3.7	0.1
Converse	1096	895	192	9	81.7	17.5	0.8
Fremont	1096	850	231	14	77.6	21.1	1.3
Johnson	1093	986	100	7	90.2	9.1	0.6
Laramie	1095	892	187	14	81.5	17.1	1.3
Lincoln	1096	1021	69	6	93.2	6.3	0.5
Natrona	1095	936	149	10	85.5	13.6	0.9
Park	581	543	36	2	93.5	6.2	0.3
Platte	646	582	51	4	90.1	7.9	0.6
Sheridan	1095	977	111	7	89.2	10.1	0.6
Sublette	1096	818	255	19	74.6	23.3	1.7
Sweetwater	1096	743	328	19	67.8	29.9	1.7
Teton	1096	927	147	17	84.6	13.4	1.6
Uinta	1095	999	93	3	91.2	8.5	0.3
Weston	1056	940	115	1	89.0	10.9	0.1

Air Quality Design Values

Design values can be used to further evaluate the air quality for areas with poor air quality. A design value describes the air quality of a location with respect to the NAAQS and are typically used to classify NAA and evaluate progress towards meeting the NAAQS. The EPA annually publishes the most recently computed design values (EPA 2021). The $PM_{2.5}$, NO_2, and O_3 design values for Wyoming are presented in **Error! Reference source not found.**. Design values for PM_{10}, CO, SO_x, and lead are below the NAAQS and can be found on the EPA website (EPA, Air Quality Design Values 2021). The most recent design values show that O_3 is the only pollutant exceeding the NAAQS in Sublette County.

Table 4. County-level Design Value History for the PM2.5 Annual NAAQS (12 µg/m3).

County	2010-2012 µg/m³	2011-2013 µg/m³	2012-2014 µg/m³	2013-2015 µg/m³	2014-2016 µg/m³	2015-2017 µg/m³	2016-2018 µg/m³	2017-2019 µg/m³	2018-2020 µg/m³	2019-2021 µg/m³	Meets NAAQS
Albany	5.0	4.9	4.8	4.3	4.1	4.3	4.6	4.5	4.9	NA	Yes
Campbell	NA	NA	NA	4.2	4.7	4.8	4.5	3.3	NA	NA	Yes
Fremont	8.3	7.8	7.4	6.9	6.6	6.8	7.2	7.2	7.2	2.4	Yes
Laramie	4.7	4.8	4.7	4.1	4.2	4.2	4.4	4.3	3.4	4.1	Yes
Natrona	4.8	4.8	4.8	4.6	4.7	4.9	5.0	4.7	4.7	NA	Yes
Park	4.7	4.6	4.4	4.1	3.8	4.3	4.3	4.0	3.8	4.3	Yes
Sheridan	8.3	7.6	7.2	6.9	7.0	7.3	7.2	7.0	6.5	6.3	Yes
Sublette	NA	NA	NA	5.0	5.0	5.1	5.3	4.7	3.8	3.5	Yes
Sweetwater	6.0	5.7	5.5	4.8	4.7	5.1	5.3	5.1	NA	NA	Yes
Teton	5.1	5.3	5.2	4.7	4.5	4.6	4.8	4.5	4.5	4.4	Yes

Table 5. County-level Design Value History for the PM2.5 24-hour NAAQS (35 µg/m3).

County	2010-2012 µg/m³	2011-2013 µg/m³	2012-2014 µg/m³	2013-2015 µg/m³	2014-2016 µg/m³	2015-2017 µg/m³	2016-2018 µg/m³	2017-2019 µg/m³	2018-2020 µg/m³	2019-2021 µg/m³	Meets NAAQS
Albany	14	12	13	13	13	13	13	13	21	NA	Yes
Campbell	NA	NA	NA	16	14	19	19	15	NA	NA	Yes
Fremont	29	28	27	25	23	23	24	25	28	NA	Yes
Laramie	12	12	13	16	17	15	11	11	18	15	Yes
Natrona	14	14	15	14	13	16	17	16	20	23	Yes
Park	13	14	14	15	17	23	22	17	20	22	Yes
Sheridan	23	20	18	24	26	24	23	21	24	27	Yes
Sublette	NA	NA	NA	13	13	16	20	18	17	18	Yes
Sweetwater	17	17	16	13	15	19	20	19	NA	NA	Yes
Teton	15	16	16	13	13	15	18	19	24	30	Yes

Table 6. County-level Design Value History for the NO2 1-Hour NAAQS (100 ppb).

County	2010-2012 (ppb)	2011-2013 (ppb)	2012-2014 (ppb)	2013-2015 (ppb)	2014-2016 (ppb)	2015-2017 (ppb)	2016-2018 (ppb)	2017-2019 (ppb)	2018-2020 (ppb)	2019-2021 (ppb)	Meets NAAQS
Campbell	32	32	35	49	31	30	29	30	NA	NA	Yes
Carbon	NA	NA	NA	NA	NA	NA	29	29	29	30	Yes
Converse	NA	NA	NA	NA	35	4	31	31	13	15	Yes
Fremont	NA	5	5	5	5	35	4	4	4	4	Yes
Laramie	NA	35	NA	NA	40	40	34	33	31	29	Yes
Natrona	NA	NA	NA	NA	NA	NA	38	36	35	34	Yes
Sublette	8	30	22	19	20	24	24	24	19	18	Yes
Sweetwater	37	22	20	35	32	32	32	35	36	35	Yes
Uinta	13	12	12	12	12	13	13	14	NA	NA	Yes

Table 7. County-level Design Value History for the NO2 Annual NAAQS (53 ppb).

County	2010-2012 (ppb)	2011-2013 (ppb)	2012-2014 (ppb)	2013-2015 (ppb)	2014-2016 (ppb)	2015-2017 (ppb)	2016-2018 (ppb)	2017-2019 (ppb)	2018-2020 (ppb)	2019-2021 (ppb)	Meets NAAQS
Campbell	8	9	10	7	4	5	5	4	1	1	Yes
Carbon	1	1	6	7	5	6	5	3	4	4	Yes
Converse	NA	3	4	4	2	3	3	3	2	1	Yes
Fremont	1	1	2	1	1	0	1	1	1	1	Yes
Goshen	NA	NA	NA	NA	4	NA	NA	1	NA	NA	Yes
Johnson	NA	NA	NA	NA	NA	NA	NA	3	1	1	Yes
Laramie	4	4	4	4	4	4	4	4	3	3	Yes
Natrona	5	6	5	5	5	5	5	2	4	5	Yes
Sublette	3	2	2	1	3	5	6	3	2	2	Yes
Sweetwater	5	4	3	3	4	3	3	1	3	3	Yes
Uinta	2	2	2	2	2	2	2	2	NA	NA	Yes

Table 8. County-level Design Value History for the Ozone 8-hr NAAQS (0.070 ppm).

County	2010-2012 (ppm)	2011-2013 (ppm)	2012-2014 (ppm)	2013-2015 (ppm)	2014-2016 (ppm)	2015-2017 (ppm)	2016-2018 (ppm)	2017-2019 (ppm)	2018-2020 (ppm)	2019-2021 (ppm)	Meets NAAQS
Albany	NA	NA	0.068	0.066	0.064	0.064	0.066	0.067	0.067	0.067	Yes
Big Horn	NA	NA	NA	0.059	0.060	0.063	0.061	0.060	0.059	0.060	Yes
Campbell	0.065	0.064	0.063	0.060	0.060	0.060	0.062	0.061	0.060	0.064	Yes
Carbon	0.064	0.062	0.062	0.060	0.059	0.061	0.063	0.064	NA	NA	Yes
Converse	NA	NA	NA	NA	NA	NA	NA	0.063	0.064	NA	Yes
Fremont	0.067	0.066	0.064	0.063	0.063	0.062	0.063	0.064	0.065	0.068	Yes
Johnson	NA	NA	NA	NA	NA	NA	NA	NA	NA	0.066	Yes
Laramie	NA	0.068	0.067	0.065	0.063	0.063	0.064	0.064	0.062	0.064	Yes

County	2010-2012 (ppm)	2011-2013 (ppm)	2012-2014 (ppm)	2013-2015 (ppm)	2014-2016 (ppm)	2015-2017 (ppm)	2016-2018 (ppm)	2017-2019 (ppm)	2018-2020 (ppm)	2019-2021 (ppm)	Meets NAAQS
Natrona	NA	NA	NA	0.062	0.060	0.061	0.063	0.062	0.063	0.065	Yes
Sublette	0.080	0.076	0.064	0.062	0.063	0.063	0.065	0.072	0.070	0.074	No
Sweetwater	0.064	0.066	0.064	0.067	0.066	0.067	0.066	0.066	0.065	0.066	Yes
Teton	0.066	0.065	0.063	0.061	0.060	0.061	0.062	0.062	0.063	0.064	Yes
Uinta	0.065	0.065	0.063	0.063	0.061	0.062	0.062	0.065	0.067	NA	Yes
Weston	NA	NA	NA	0.062	0.060	0.061	NA	NA	0.062	0.064	Yes

Monitoring Data

State, Federal, and Tribal agencies operate several air pollutant monitoring stations across the State of Wyoming. Air pollutant data from these stations is available on the EPA Air Data website (EPA 2022). Most air monitors are situated to measure air quality in both neighborhoods and industrial areas. A few stations are in rural areas by various Federal agencies to monitor air quality conditions and trends at National Parks and other public lands, and to identify background concentrations away from major emission sources. The WDEQ 2022 Network Plan shows air pollutant trends for state run monitoring stations (WDEQ 2022). Air monitoring data from the current year is not analyzed as data is incomplete for the year, in the process of being quality assured, and considered preliminary until May 1 of the following year.

3.2 Air Quality Related Values (AQRV)

3.2.1 Visibility

Pollution in the atmosphere can impair scenic views by degrading the contrast, colors, and distance an observer is able to see. Visibility can be assessed in terms of the distance that a person can distinguish a large dark object on the horizon and is measured as the standard visual range in miles. Visibility is monitored using methodologies established by the Interagency Monitoring of Protected Visual Environments (IMPROVE) Program. The particulates that contribute to haze are collected on filters at each IMPROVE site. Samples are then measured to determine how visibility is impacted over time and by which pollutants.

A deciview (dv) is a unit of measurement to quantify human perception of visibility. It is derived from the natural logarithm of atmospheric light extinction coefficient. A one deciview change is roughly the smallest perceptible change in visibility. Because visibility at any one location is highly variable throughout the year, it is characterized by three groupings: the clearest 20% days, average 20% days, and haziest 20% days. Visibility degradation is primarily due to sulfate, nitrate, and particulate matter in the atmosphere, with contributions from both anthropogenic and natural sources. Measuring progress in air pollution control can be challenging because natural sources largely beyond human control such as dust storms and wildfire smoke can produce significant visibility impairment over large areas for days to weeks at a time. Under the auspices of the 2017 Regional Haze Rule revisions, the EPA proposed a new visibility tracking metric– most impaired days – to better characterize visibility conditions and trends. The most impaired days are those with the most impairment from anthropogenic sources while the haziest grouping now better represents days with haze from natural sources. Total haze on the most impaired days is used to track progress toward Regional Haze Rule goals. Comparing trends in the 20% haziest days with the 20% most impaired days provides a method to assess impacts from episodic events, like wildfires, which have greatly affected visibility throughout the western United States in recent years (Burke, et al. 2021). More information about the EPA's impairment framework can be found at:

http://vista.cira.colostate.edu/Improve/impairment/. Visibility information can be found at the Federal Land Managers Environmental Database (FLM 2019). Figures 2-5 illustrate visibility trends based on air monitoring data from three Wyoming sites and one South Dakota IMPROVE site for the clearest, haziest, and most impaired categories. The haziest days have shown little improvement due to many years with large wildfire smoke episodes. However, most impaired days and clearest days for all monitoring sites slowly improve over several years.

Figure 1. **National Parks, Wilderness Areas, and National Parks in and surrounding Wyoming.**

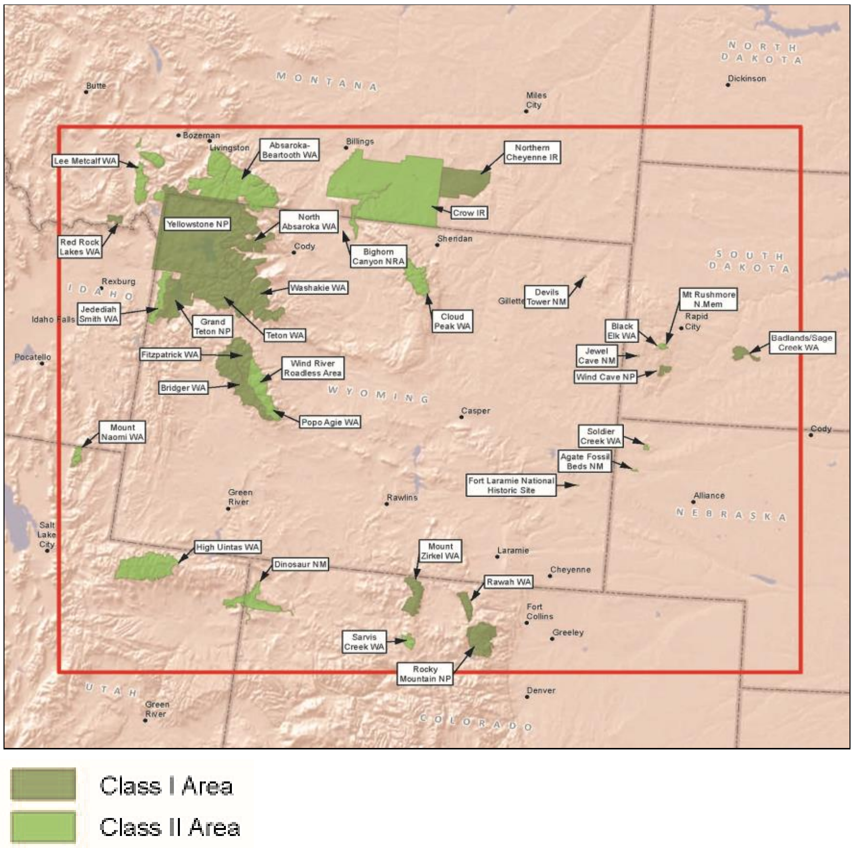


Figure 2. Visibility Trends at Yellowstone NP.

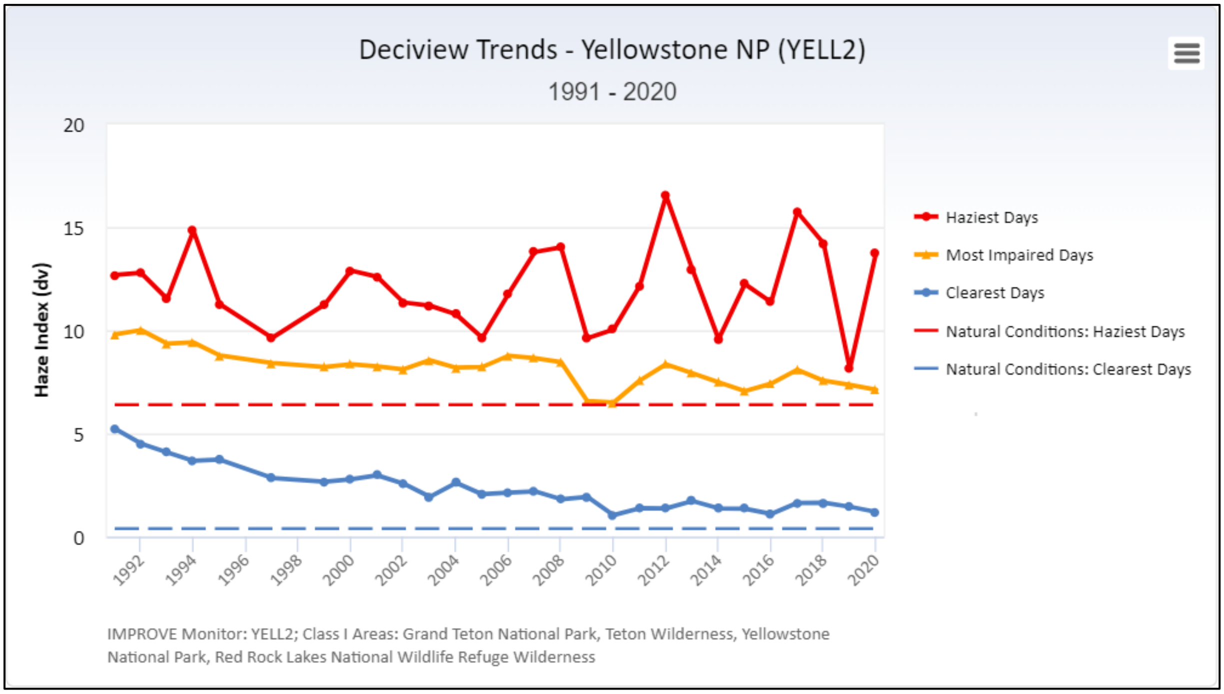


Figure 3. Visibility Trends at Bridger Wilderness.

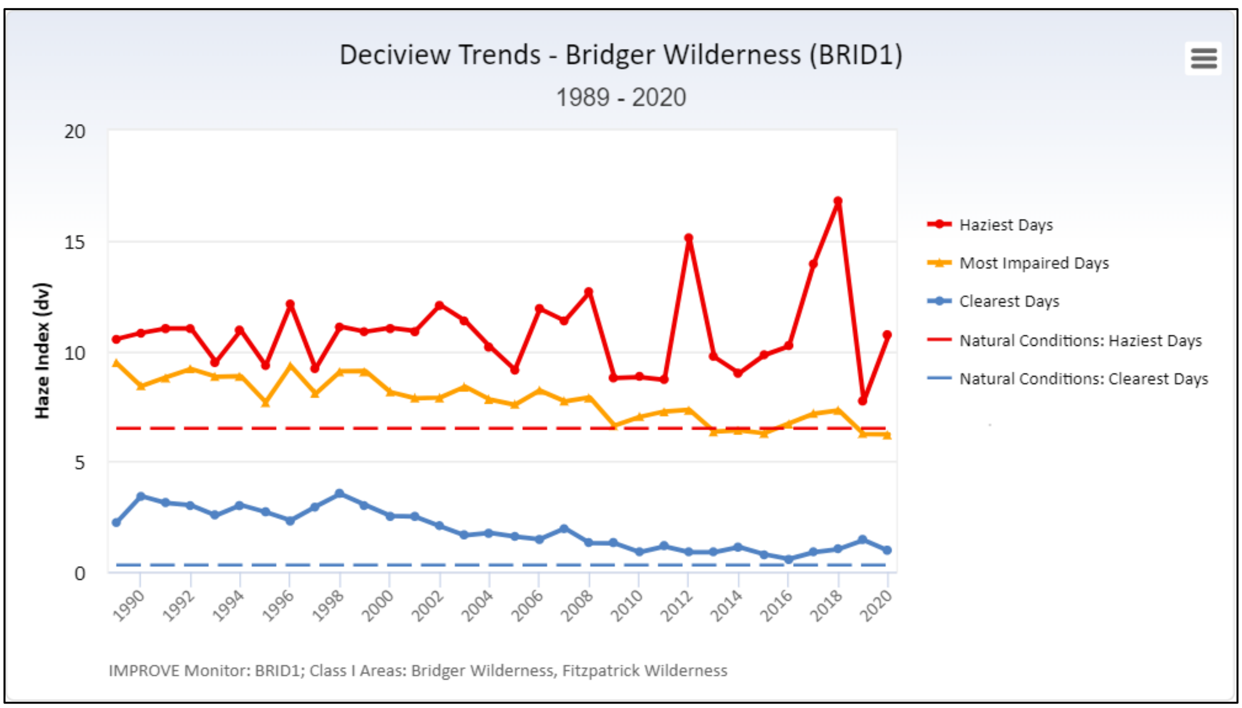


Figure 4. Visibility Trends at North Absaroka Wilderness Area.

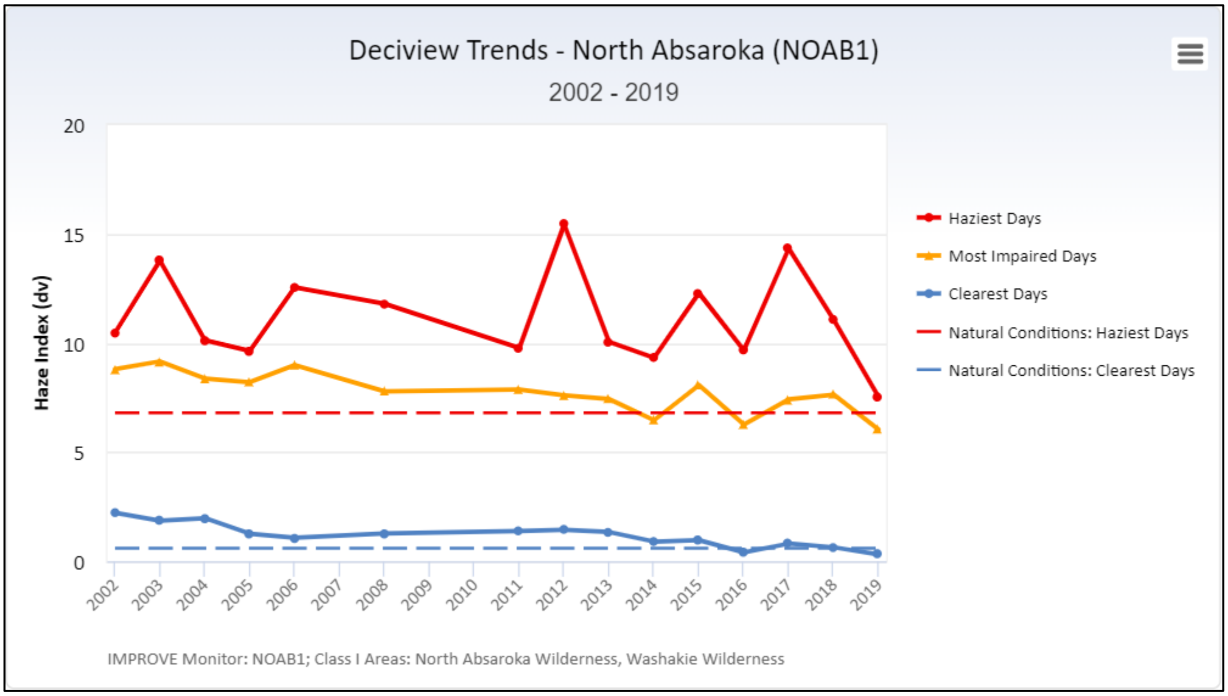
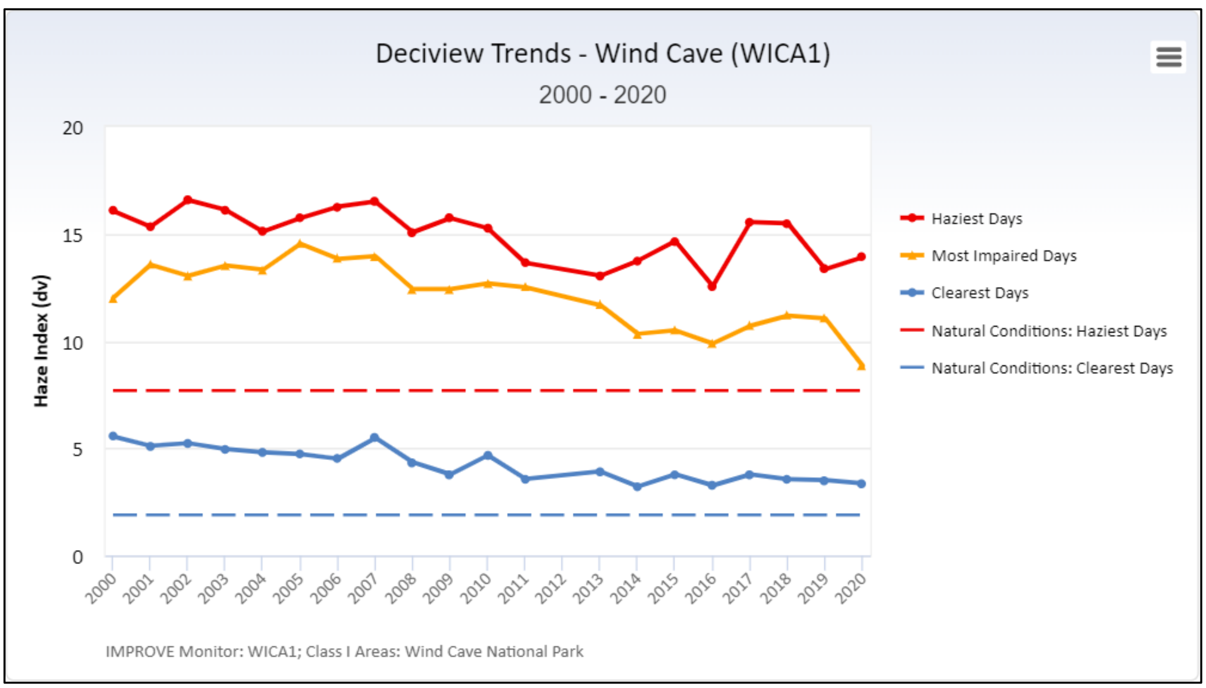


Figure 5. Visibility Trends at Wind Cave NP.



3.2.2 Atmospheric Deposition

Sulfur and nitrogen compounds that can be deposited on terrestrial and aquatic ecosystems include nitric acid (HNO_3), nitrate (NO_3^-), ammonium (NH_4^+), and sulfate (SO_4^{2--}). Nitric acid (HNO_3) and nitrate (NO_3^-) are not emitted directly into the air, but form in the atmosphere from industrial and automotive emissions of nitrogen oxides (NO_x); and SO_4^{2--} is formed in the atmosphere from industrial emission of sulfur dioxide (SO_2). Deposition of HNO_3, NO_3^-, and SO_4^{2-} can adversely affect plant growth, soil chemistry, lichens, aquatic environments, and petroglyphs (ancient carvings and/or engravings on rock surfaces). Ammonium (NH_4^+) is volatilized from animal feedlots and from soils following fertilization of crops.

Wet atmospheric deposition (precipitation that deposits the aforementioned chemical compounds) is measured at National Atmospheric Deposition Program (NADP) sites: Pinedale, Sink's Canyon, South Pass, Newcastle, and Wind Cave. Wet deposition is characterized by the concentration of nitrate ion (NO_3^-), sulfate ion ($SO_4^{\ -}$), and ammonium (NH_4^+) ions in precipitation samples.

The National Atmospheric Deposition Program (NADP) was established in 1977 under State Agricultural Experiment Station (SAES) leadership to address the problem of atmospheric deposition and its effects on agricultural crops, forests, rangelands, surface waters, and other natural and cultural resources. The NADP is a public, nonprofit, unincorporated, interstate association of parties interested in atmospheric deposition and its effects. It is structured as a cooperative program that represents coordinated efforts of many individuals in federal, state, academic, and private organizations to operate monitoring sites, report data, and oversee research activities related to atmospheric deposition. (NADP 2022).

Dry deposition (air that carries chemical compounds and deposits them on the earth's surface) is measured at three Clean Air Status and Trends Network (CASTNET) sites in Pinedale (Sublette County), Newcastle (Weston County), and Basin (Big Horn County). Information concerning dry deposition can be found at EPA's Clean Air Status and Trends Network monitoring program (EPA, CASTNET 2022)

Current data indicate a decrease in sulfate and nitrate ions for all Wyoming NADP sites in precipitation samples. However, concentrations for the ammonium ion are either steady or slowly increasing at sites.

For the three Wyoming CASTNET sites, concentration data indicate a decrease for all pollutant species at Pinedale and Newcastle. However, the Basin concentrations increase from 2016 to 2017.

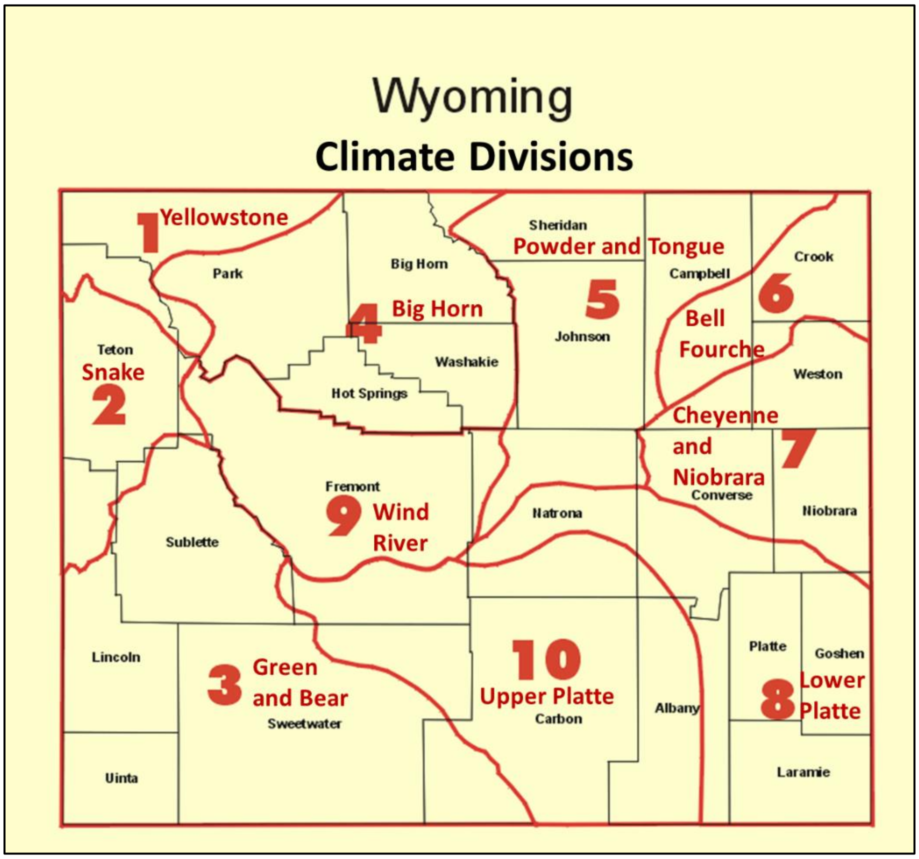
4. Climate and Climate Change

Climate is the composite of generally prevailing weather conditions, such as temperature and precipitation, of a particular region throughout the year, averaged over a series of years. Climate change is the long-term (several decades or longer) alteration of atmospheric weather patterns (temperature, precipitation, winds, etc.), but changes could also occur in other parts of the climate system such as the hydrosphere (water), cryosphere (ice), biosphere (living organisms, ecosystems), or lithosphere. One important way to track the causes and effects of climate change is through the use of indicators. Climate indicators show trends over time in key aspects of the environment. Many indicators are meteorological related. Other indicators include greenhouse gas emissions, sea level, growing season length, ecosystems, and others. Only climate indicators related to air resources are discussed in this document.

Wyoming climate is determined by its inland location, distance from the equator, elevation, wide range of topography, and location with respect to storm paths across the western United States. Elevations range from 3,100 feet in the southwest part of the state to 13,700 feet in the Wind River Range Mountains. Mountain ranges in western United States also influence climate in Wyoming. Pacific storms must cross these ranges before reaching Wyoming where much of the moisture in the storms falls as precipitation. Consequently, storms reaching Wyoming are relatively dryer and produce less precipitation (WRCC 2018).

The National Center for Environmental Information (NCEI) divides Wyoming into ten climate divisions: Yellowstone, Snake, Green and Bear, Big Horn, Powder and Tongue, Bell Fourche, Cheyenne and Niobrara, Lower Platte, Wind River, and Upper Platte as show by Figure 6. Wyoming Climate Divisions are organized based on areas with similar terrain and weather stations observing the same general climate conditions. All climate divisions in Wyoming have some general similarities such as winter having the highest amount of monthly precipitation.

Figure 6. NOAA National Centers for Environmental Information Climate Divisions.



4.1. Climate Normals

Climate normals are three-decade averages of climatological variables including temperature and precipitation, updated every 10 years, with the 1991–2020 U.S. Climate normals dataset serving as the latest release. It contains average daily and monthly temperature, precipitation, snowfall, heating and cooling degree days, frost/freeze dates, and growing degree days calculated from observations at approximately 9,800 stations (NCEI 2021). Climate normals representative for each field office are found in the climate normal section of Appendix A (Climate Data). Prevailing wind information is also presented in wind roses and monthly tables but are only available for airports with continuous measurements. Wind roses are a polar plot to visually present wind speed and direction.

4.2. Climate Trends

Trend analysis is a technique used to estimate future conditions based on historically observed trends. The main assumption behind trend analysis is that what happened in the past is expected to happen in the future. Average temperature and precipitation and trend information for each Wyoming climate division is compiled from the NCEI Climate at a Glance Website (NOAA/NCEI 2020) and is shown in Figures 7-26.

Figure 7. Wyoming Yellowstone Climate Division 1 Precipitation Trend.

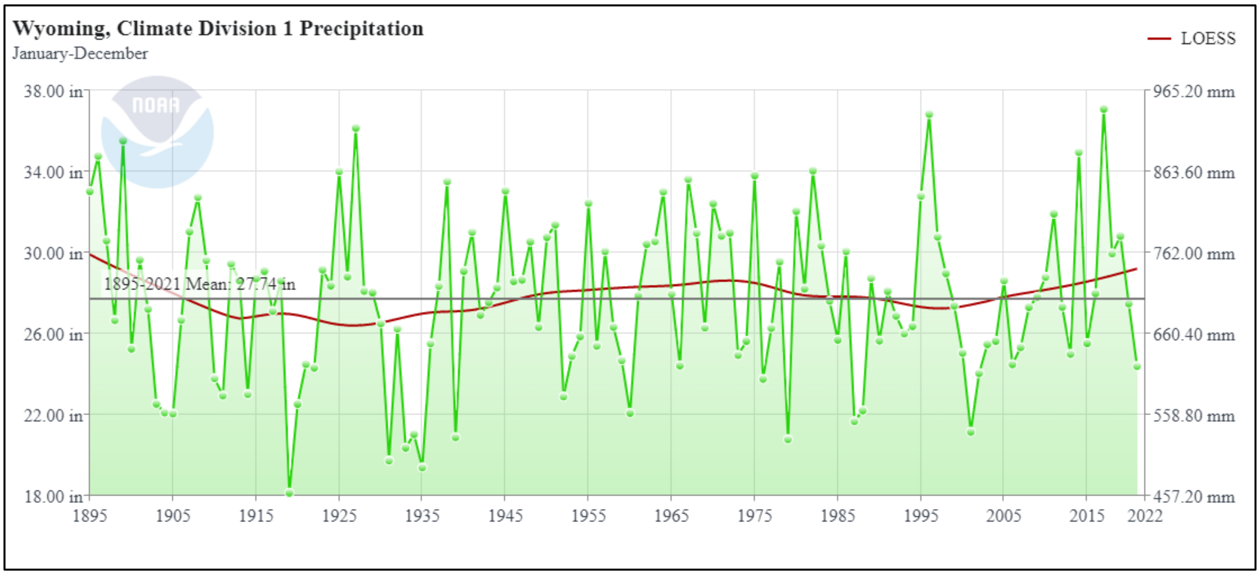


Figure 8. Wyoming Snake Climate Division 2 Precipitation Trend.

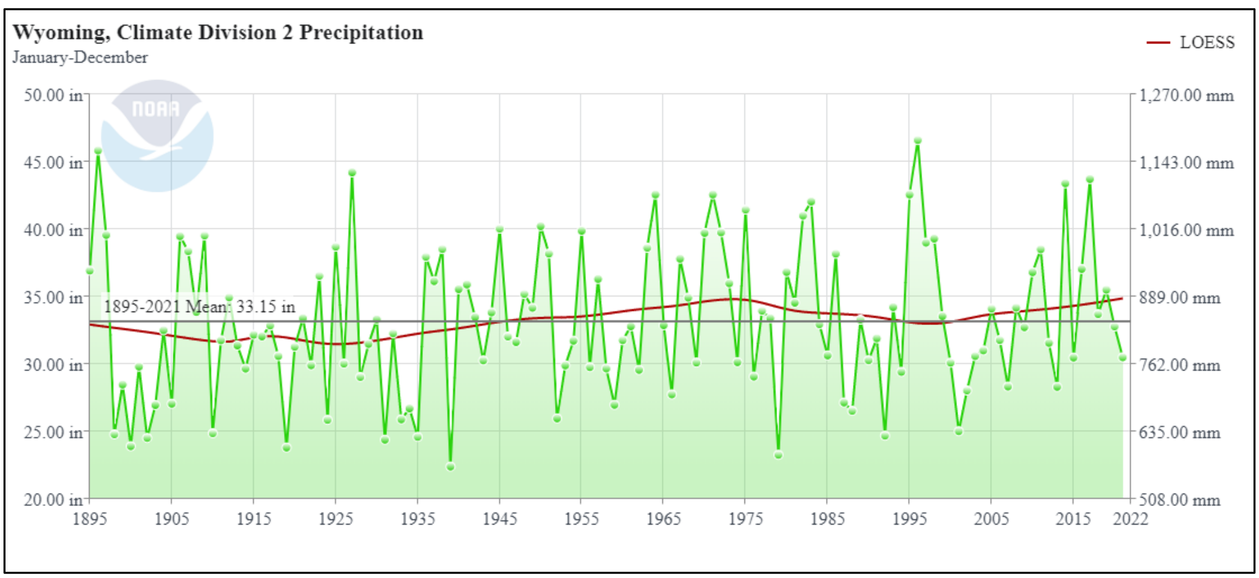


Figure 9. Wyoming Green and Bear Climate Division 3 Precipitation Trend.

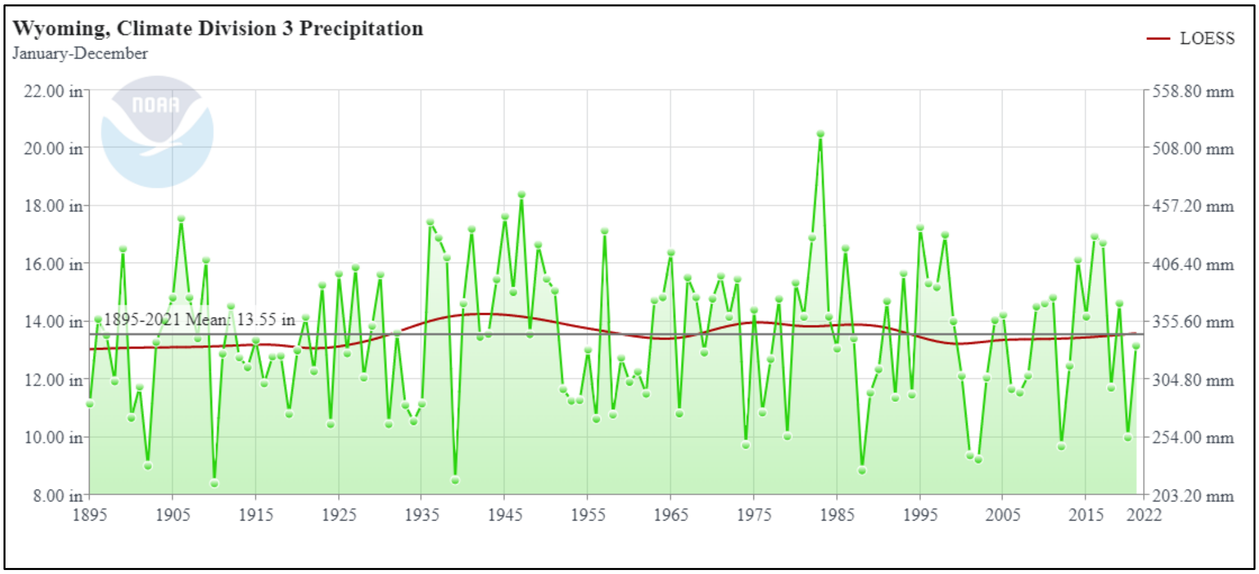


Figure 10. Wyoming Big Horn Climate Division 4 Precipitation Trend.

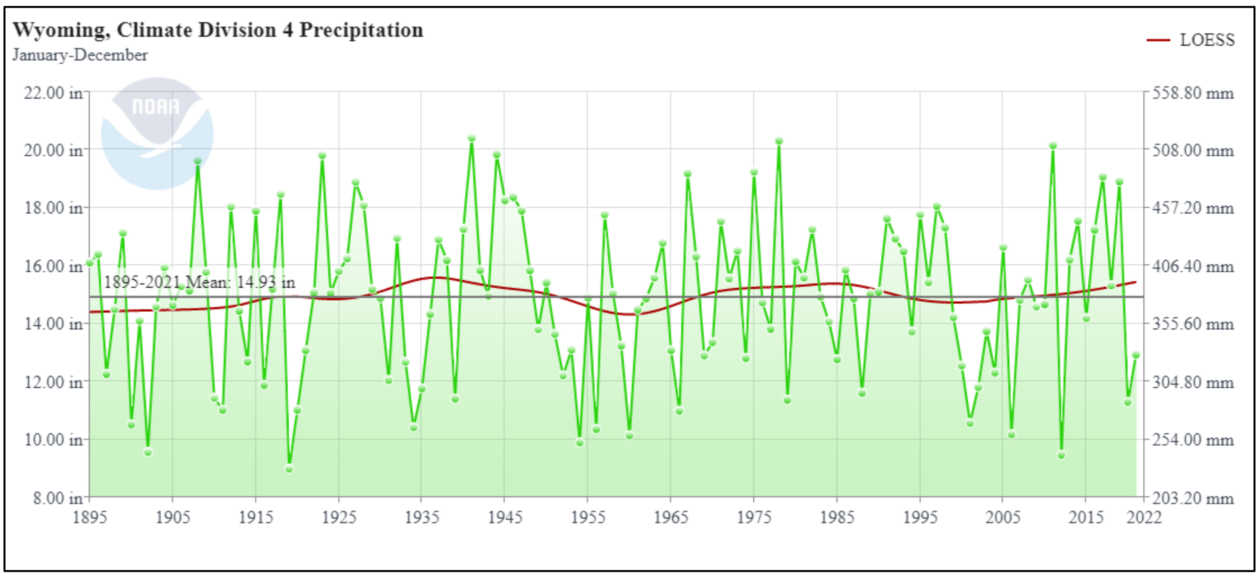


Figure 11. Wyoming Powder and Tongue Climate Division 5 Precipitation Trend.

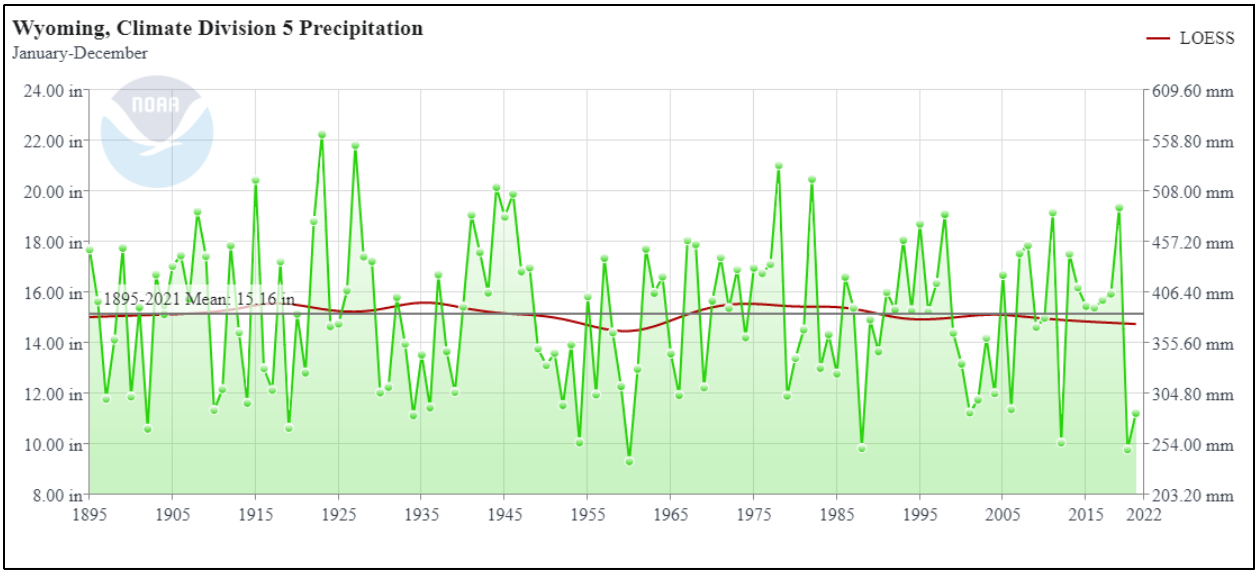


Figure 12. Wyoming Bell Fourche Climate Division 6 Precipitation Trend.

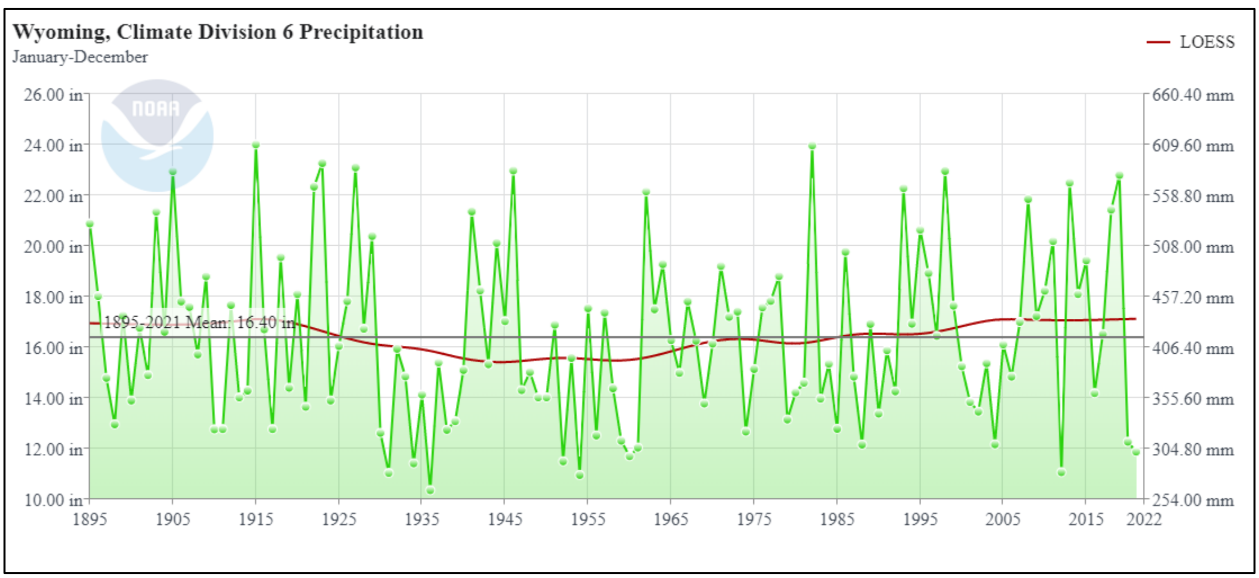


Figure 13. Wyoming Cheyenne and Niobrara Climate Division 7 Precipitation Trend.

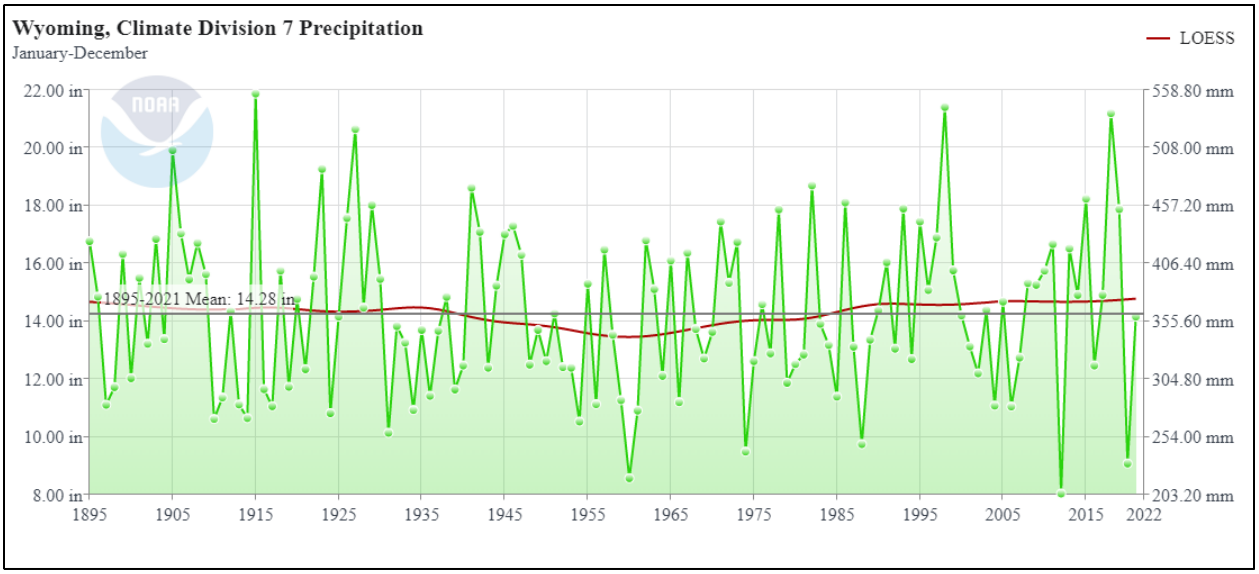


Figure 14. Wyoming Lower Platte Climate Division 8 Precipitation Trend.

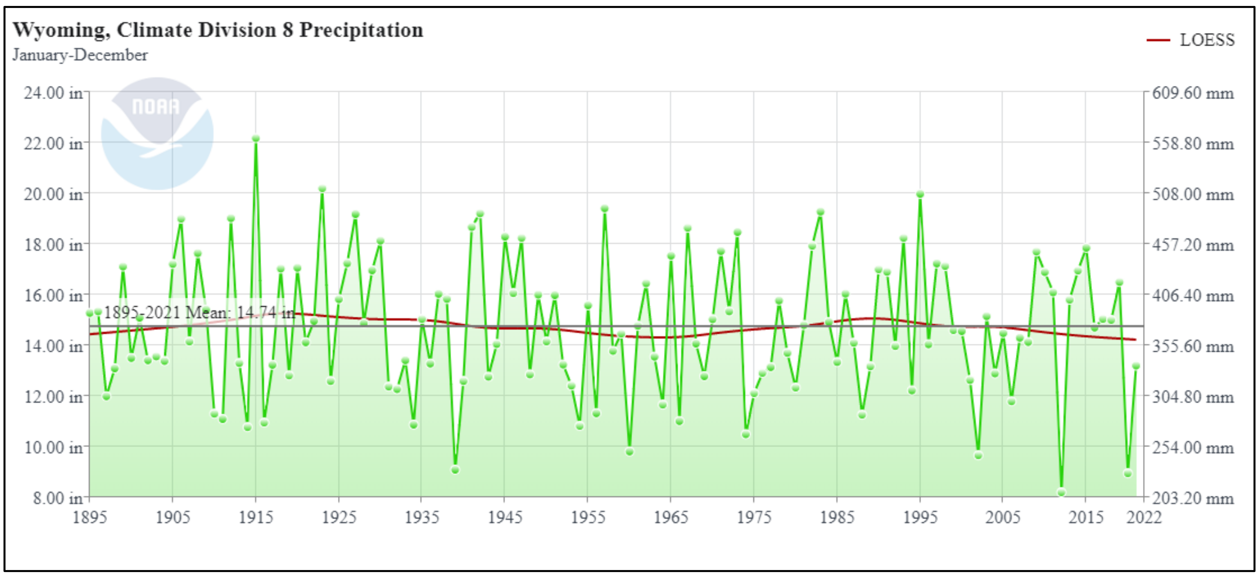


Figure 15. Wyoming Wind River Climate Division 9 Precipitation Trend.

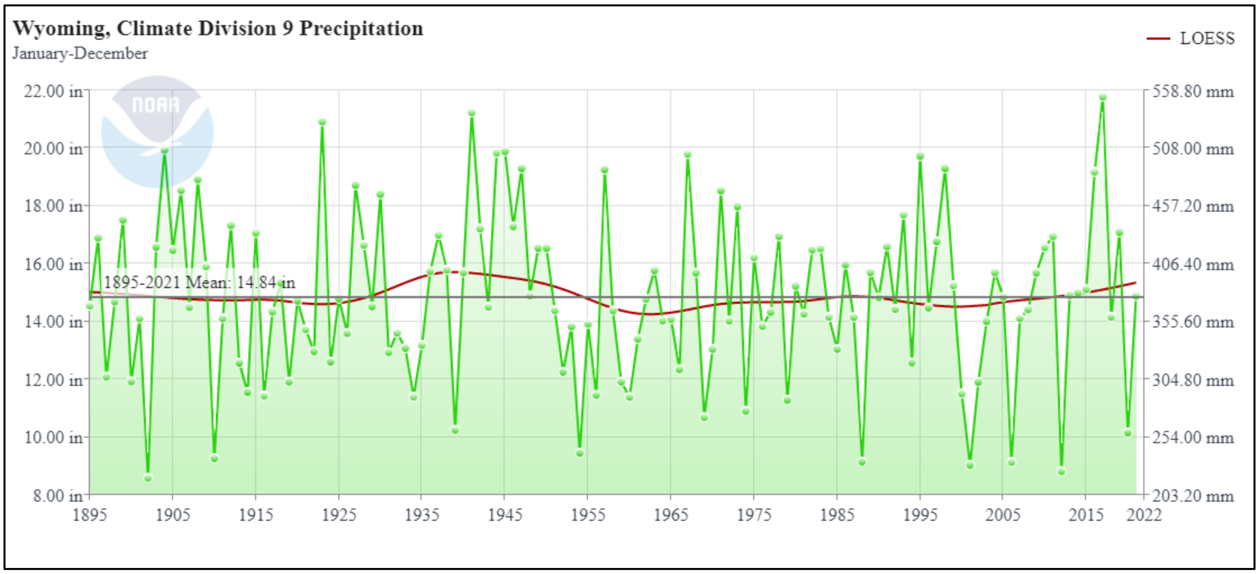


Figure 16. Wyoming Wind River Climate Division 10 Precipitation Trend.

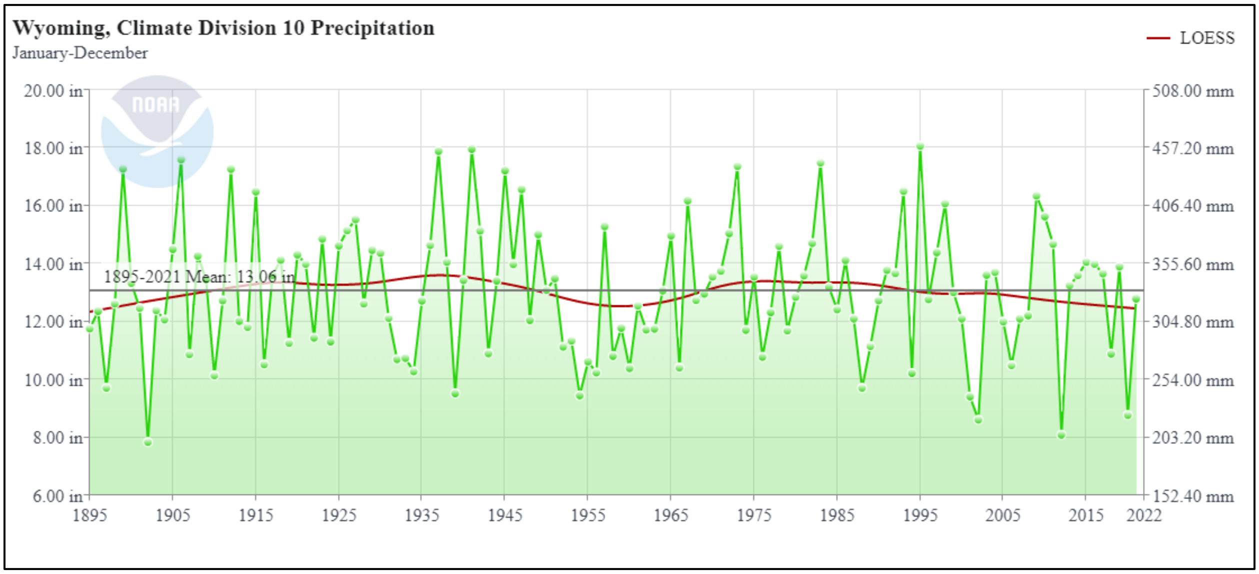


Figure 17. Wyoming Yellowstone Climate Division 1 Temperature Trend.

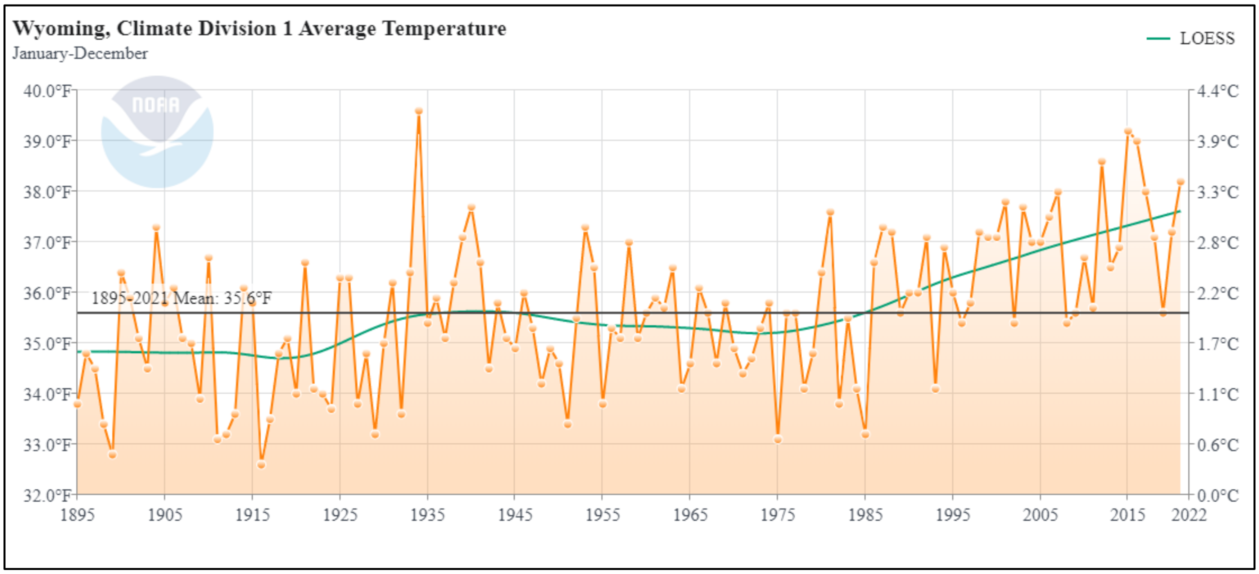


Figure 18. Wyoming Snake Climate Division 2 Temperature Trend.

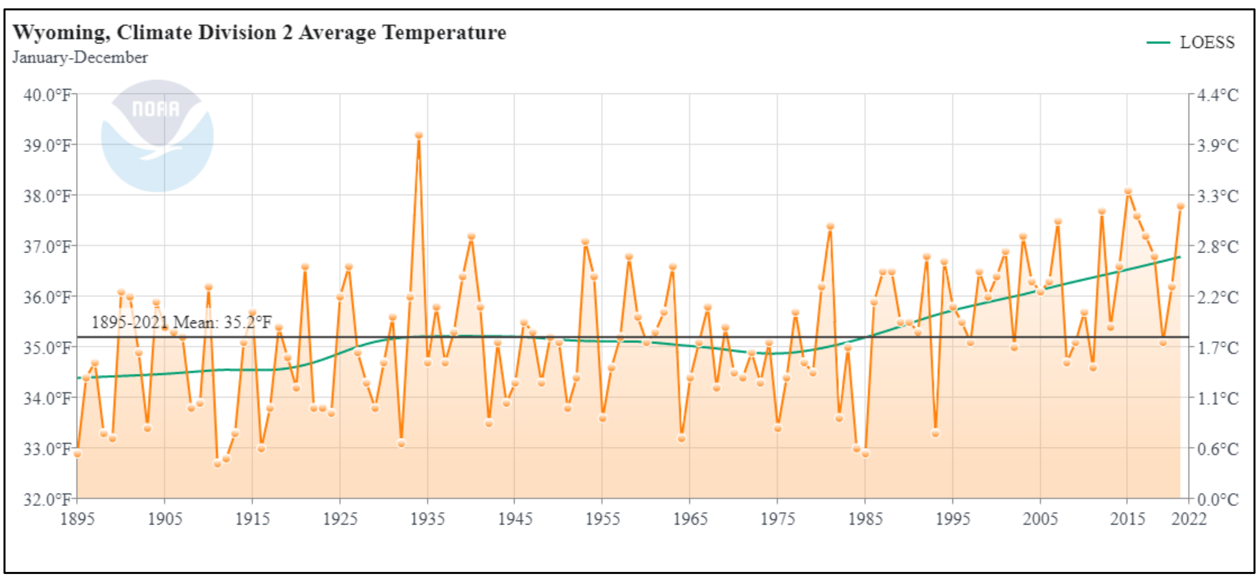


Figure 19. Wyoming Green and Bear Climate Division 3 Temperature Trend.

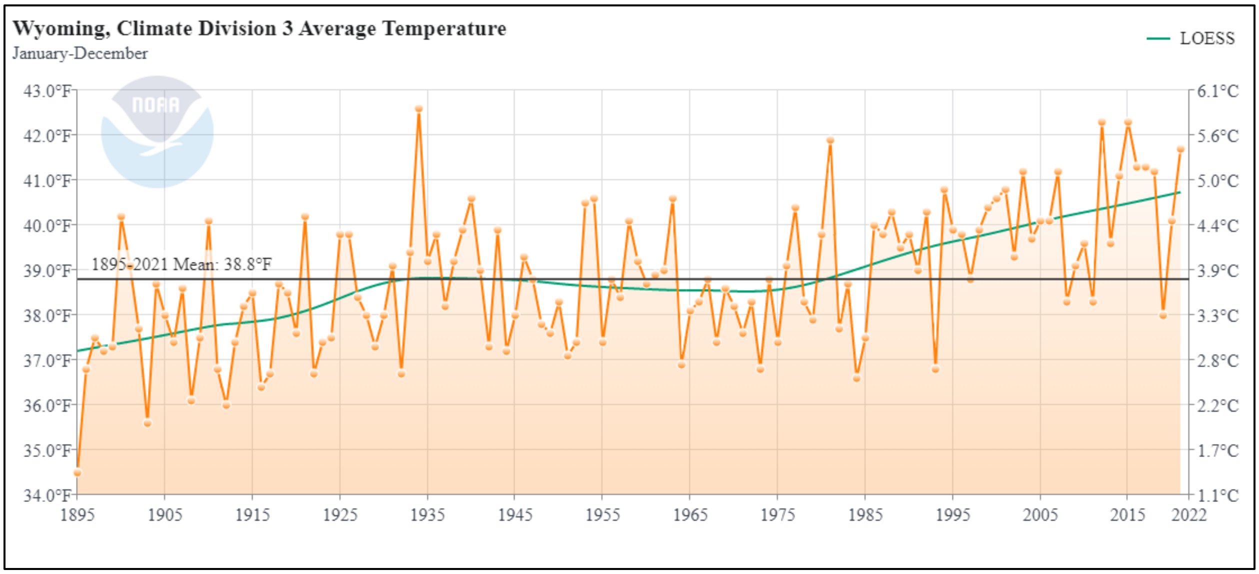


Figure 20. Wyoming Big Horn Climate Division 4 Temperature Trend.

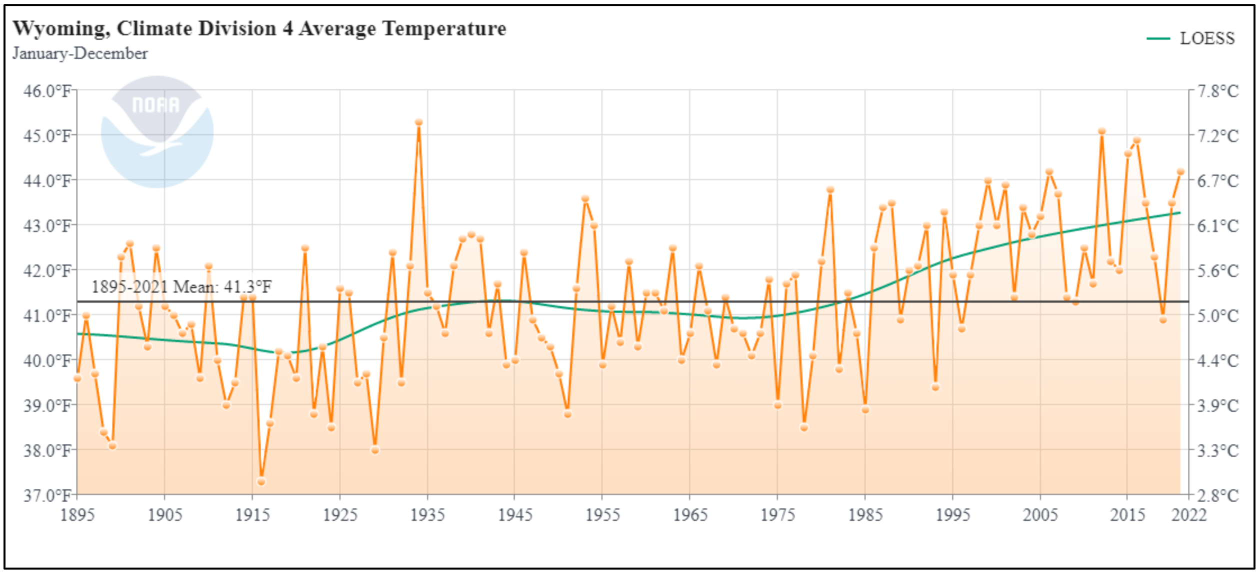


Figure 21. Wyoming Powder and Tongue Climate Division 5 Temperature Trend.

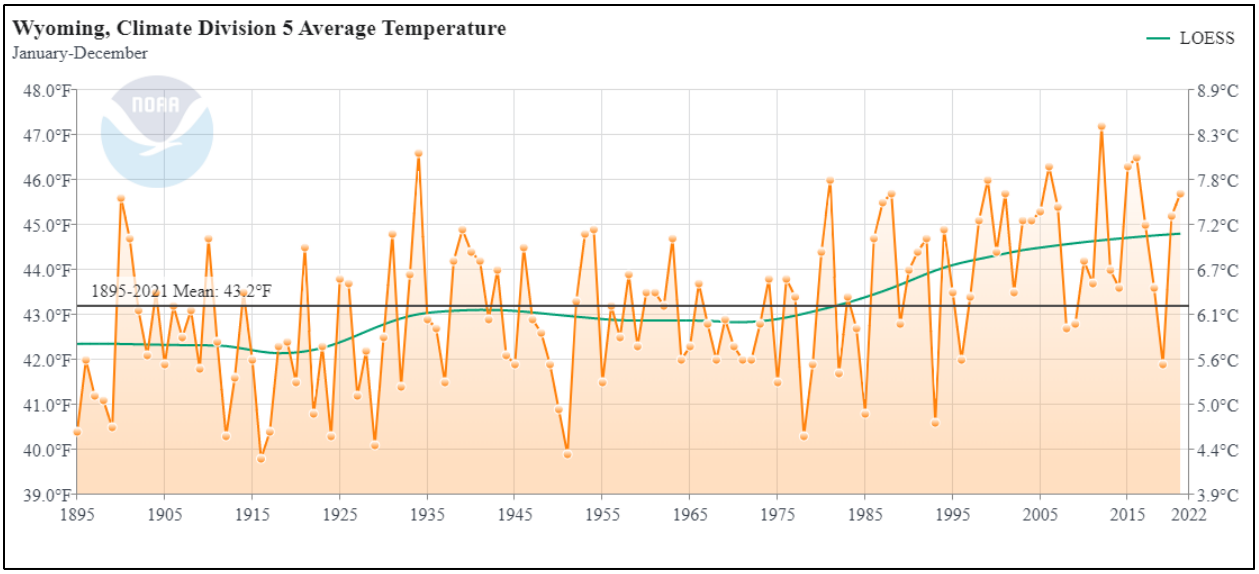


Figure 22. Wyoming Bell Fourche Climate Division 6 Temperature Trend.

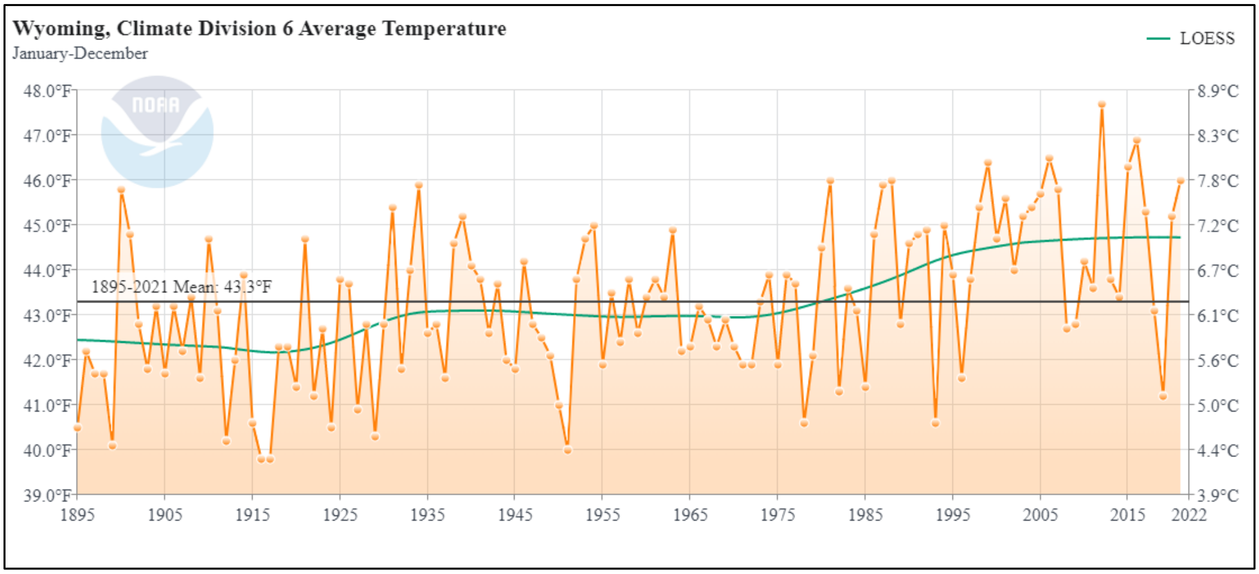


Figure 23. Wyoming Cheyenne and Niobrara Climate Division 7 Temperature Trend.

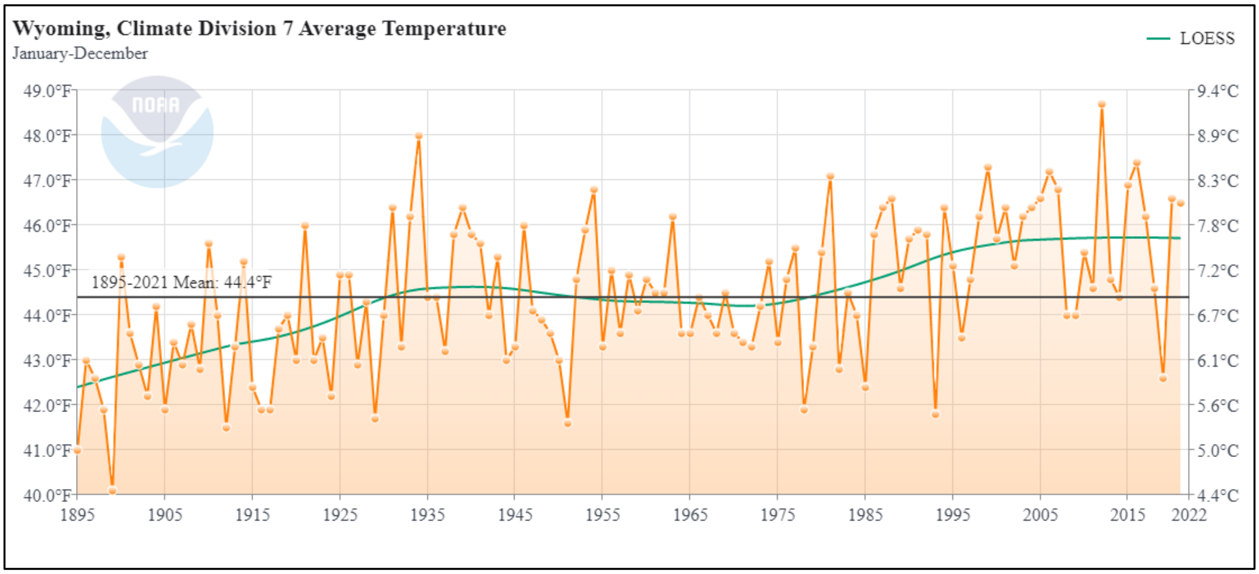


Figure 24. Wyoming Lower Platte Climate Division 8 Temperature Trend.

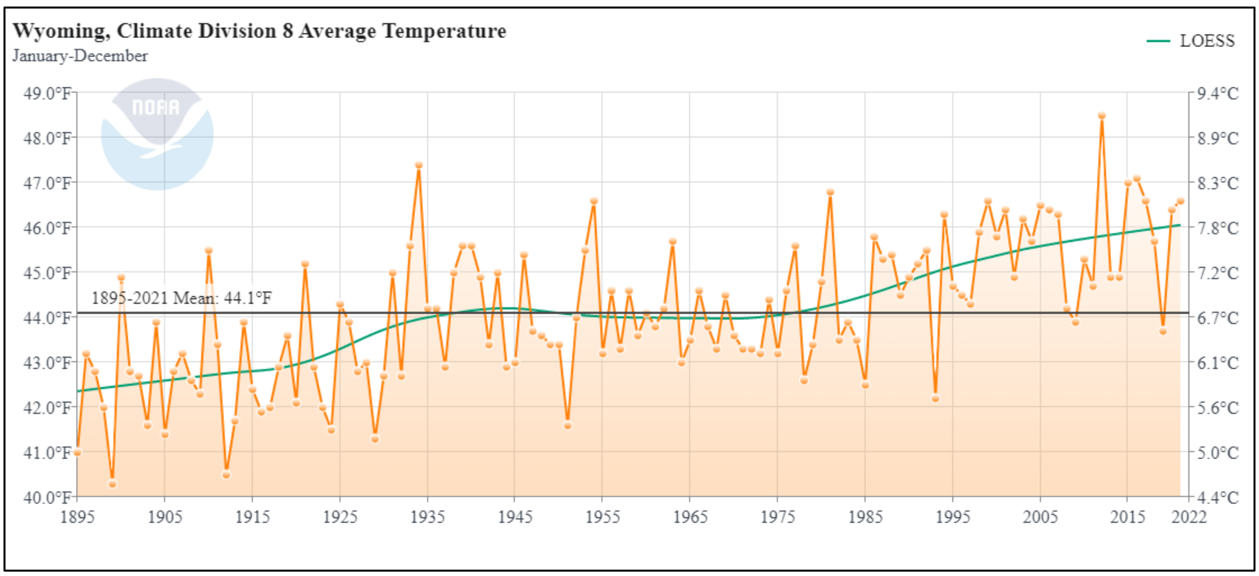


Figure 25. Wyoming Wind River Climate Division 9 Temperature Trend.

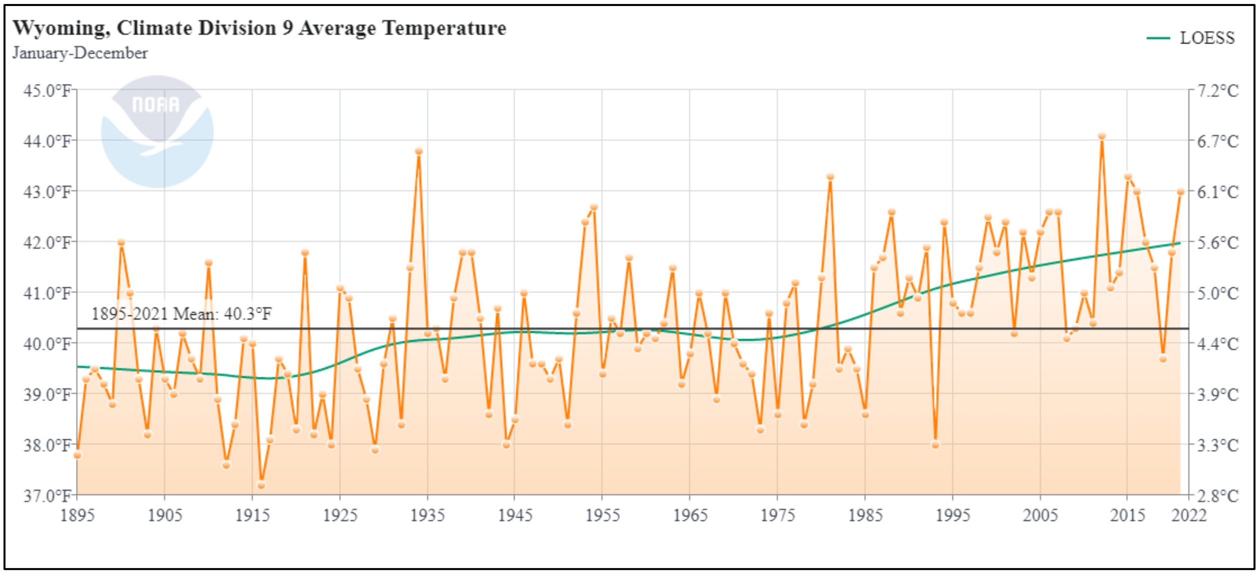
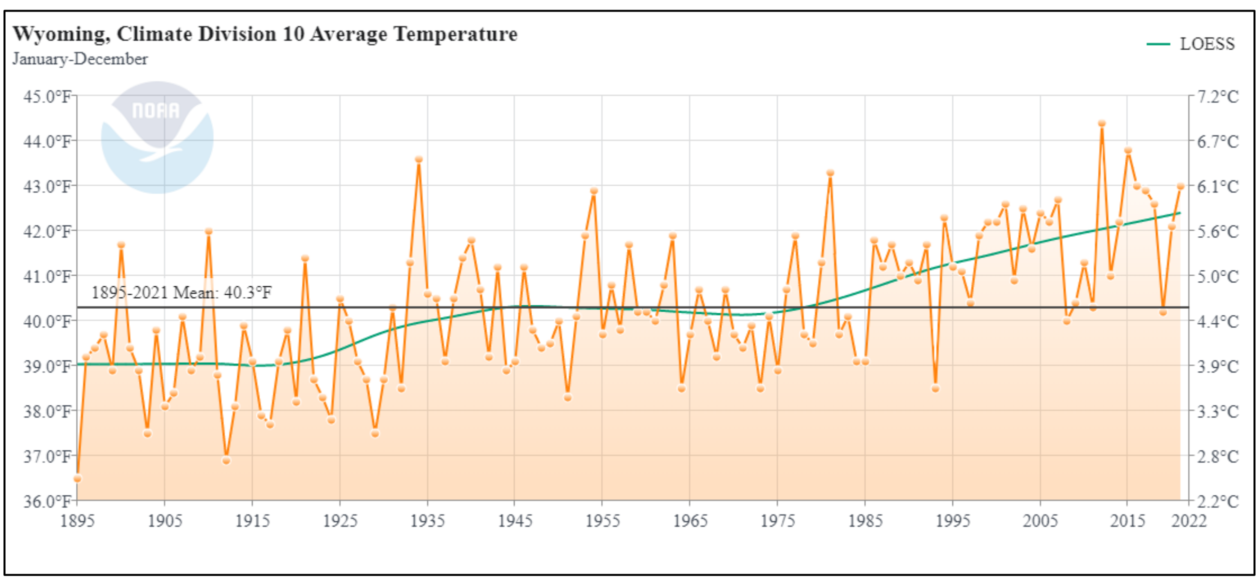


Figure 26. Wyoming Wind River Climate Division 10 Temperature Trend.



4.3. Climate Change and Climate Projections

The Annual GHG report contains general background information on climate change and specific climate model projections for the State of Wyoming. Climate projections under a higher emissions scenario (RCP8.5) indicate that Wyoming could warm by as much as 15ºF above current levels by the end of the century, though the mean RCP8.5 increase for the state is about 10ºF hotter than recent temperatures. Under a lower emissions scenario, warming is projected to be about 2ºF to 5ºF above the 1991-2020 mean. Increases in average temperatures will be accompanied by increases in heat wave intensity and decreases in cold wave intensity.

Climate models are not consistent in their projections of precipitation for Wyoming, including winter precipitation. However, projected rising temperatures will increase the average lowest elevation at which snow falls (the snow line). Continuing recent trends, this will increase the likelihood that precipitation will fall as rain instead of snow, reducing water storage in the snowpack, particularly at lower elevations that are currently on the margins of reliable snowpack accumulation. In addition, extreme precipitation is projected to increase, potentially increasing the frequency and intensity of floods.

Droughts, a natural part of Wyoming's climate, are expected to become more intense. Higher temperatures will amplify the effects of naturally occurring dry spells by increasing the rate of loss of soil moisture. Most of Wyoming's water is supplied by the snowpack, and changes to the snow/rain ratio could result in less water storage. Additionally, higher spring temperatures can cause early melting of the snowpack, decreasing water availability during the already dry summer months. The projected increase in the intensity of naturally occurring droughts will increase the occurrence and severity of wildfires.

Additional information on climate change projections for Wyoming can be found on NOAA's U.S. Climate Resilience Toolkit website (https:// https://statesummaries.ncics.org/chapter/wy/).

5. BLM Monitoring Activities

BLM Wyoming conducts air monitoring to evaluate on-the-ground air resource conditions to determine trends. Existing air monitoring networks do not always adequately cover areas managed by the. BLM does not conduct air monitoring to determine attainment status of an area under the requirements of the CAA, that being a function of the appropriate federal, state, or tribal regulatory agency.

The Wyoming Air Resource Monitoring System (WARMS) network is an air quality monitoring network maintained by Bureau of Land Management, Wyoming State Office (BLM-WSO). There are seven stations scattered throughout Wyoming, see Figure 27. The WARMS network began operation in 2000 to measure air quality parameters and particulate concentrations according to Clean Air Status and Trends Network (CASTNET) protocols. The WARMS sites formally became a part of the CASTNET network in 2012 and began participating in the National Atmospheric Deposition Program (NADP) Passive Ammonia Monitoring Network (AMON) in 2015. The WARMS network provides relevant air quality data to:

- Assess existing conditions.
- Evaluate long term trends in air quality conditions.
- Evaluate the effectiveness of prescribed mitigation measures and adaptive management strategies.
- Inform management decisions on public lands, particularly in wilderness study areas and areas of critical environmental concern.

- Provide readily available access to air quality data for BLM staff, other federal, state, and tribal agencies, BLM contractors, the scientific community, and the public.

Figure 27. WARMS Monitor Locations.

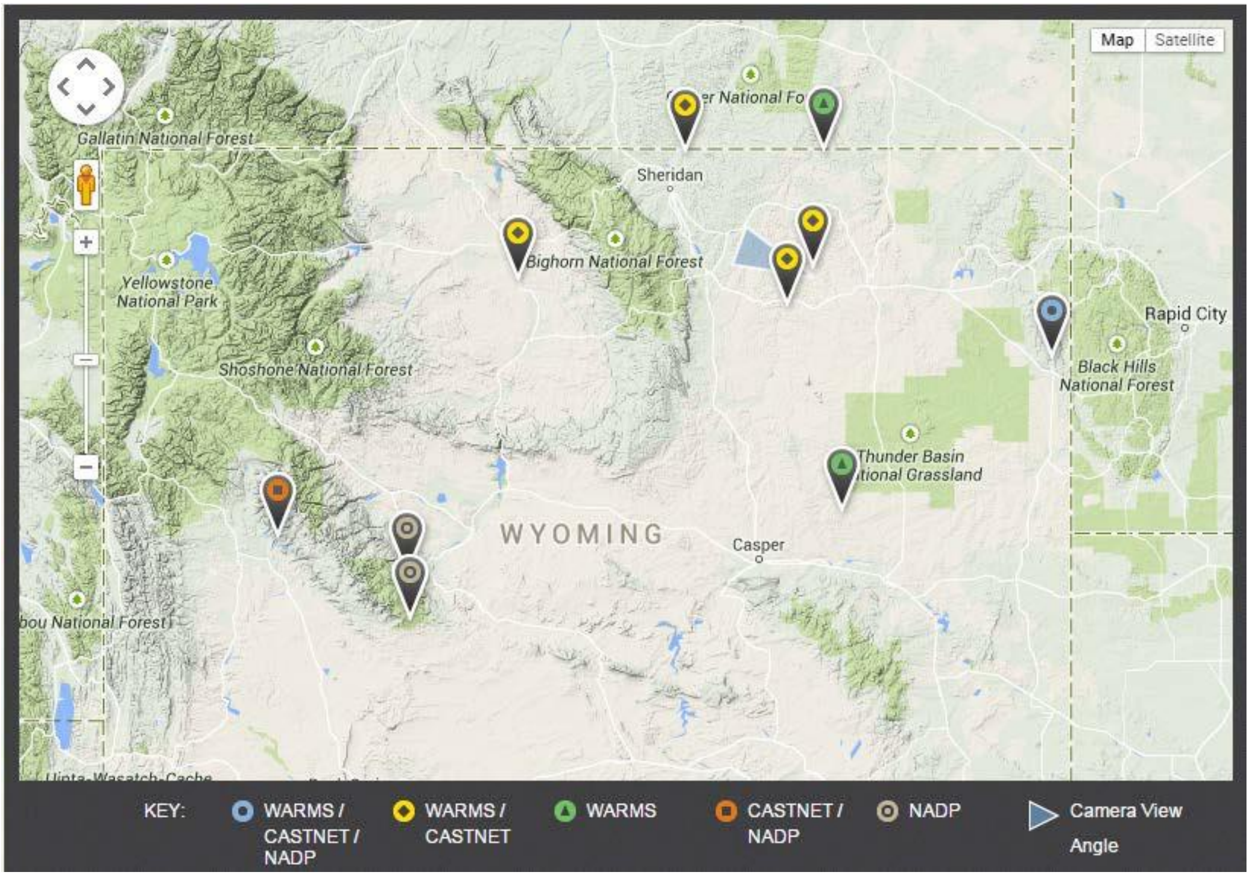
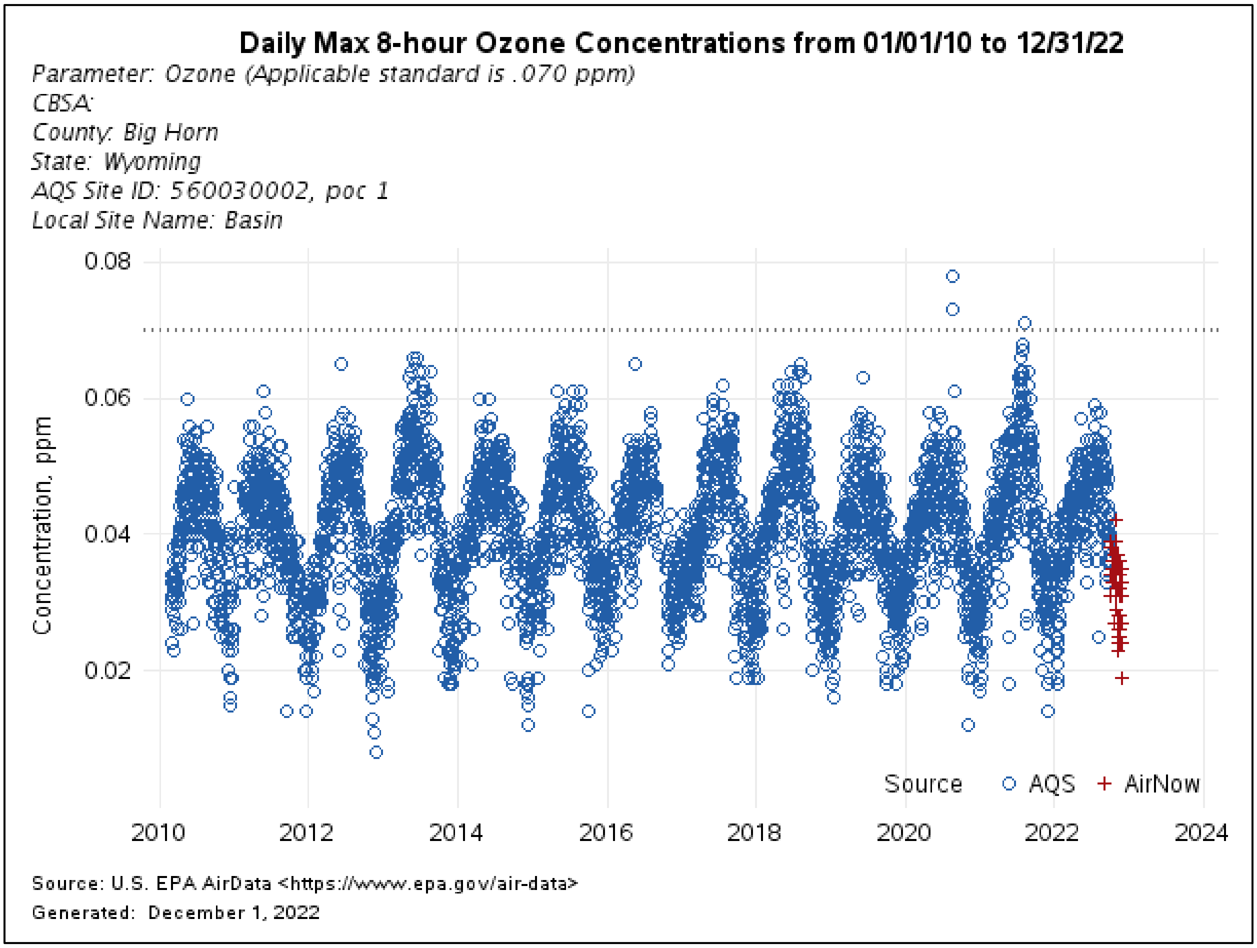


Figure 28 shows the maximum daily 8-hour Ozone concentrations for the Basin, Wyoming WARMS site. The 2010 to present data show no discernable trends.

Figure 28. Basin, Wyoming WARMS Daily Max 8-hour Ozone Concentrations.



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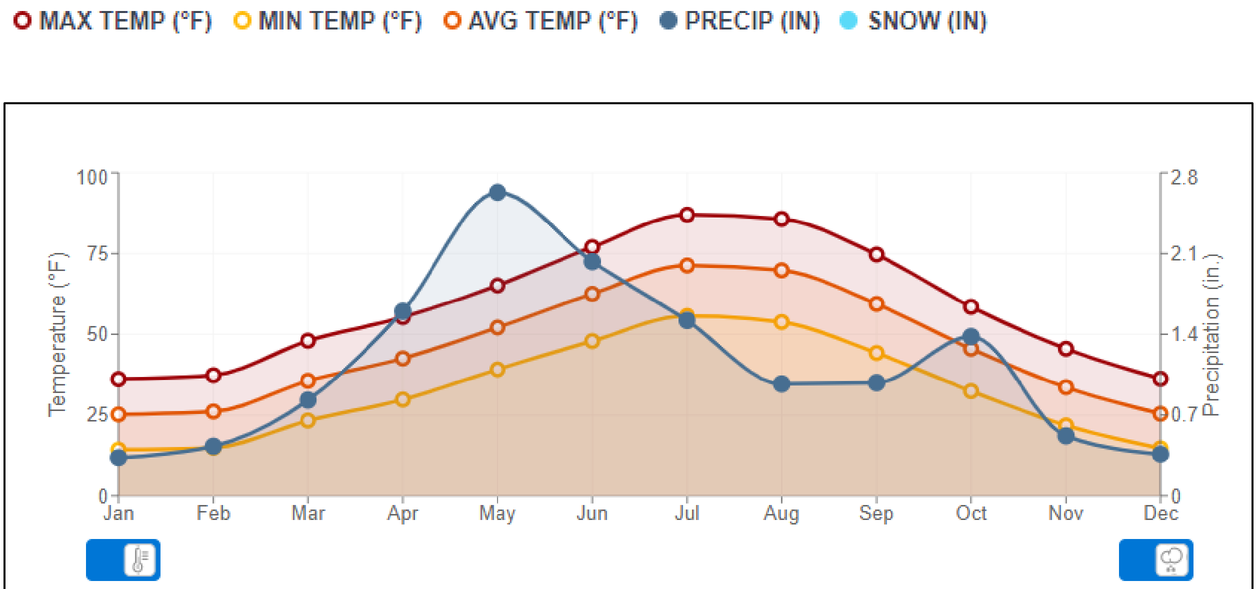
Appendix A (Climate Data)

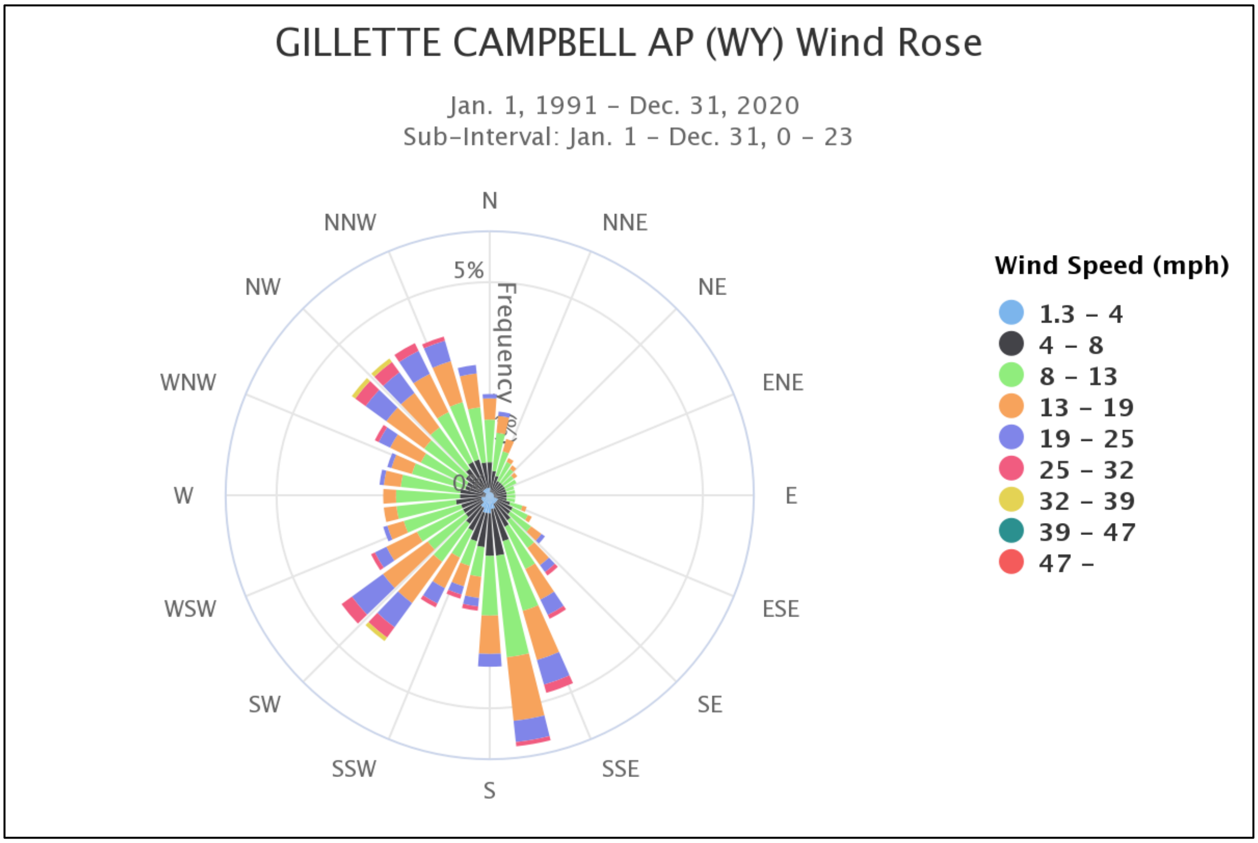
Buffalo Field Office

Figure 29. Climate Normals (1991-2020) for Gillette.



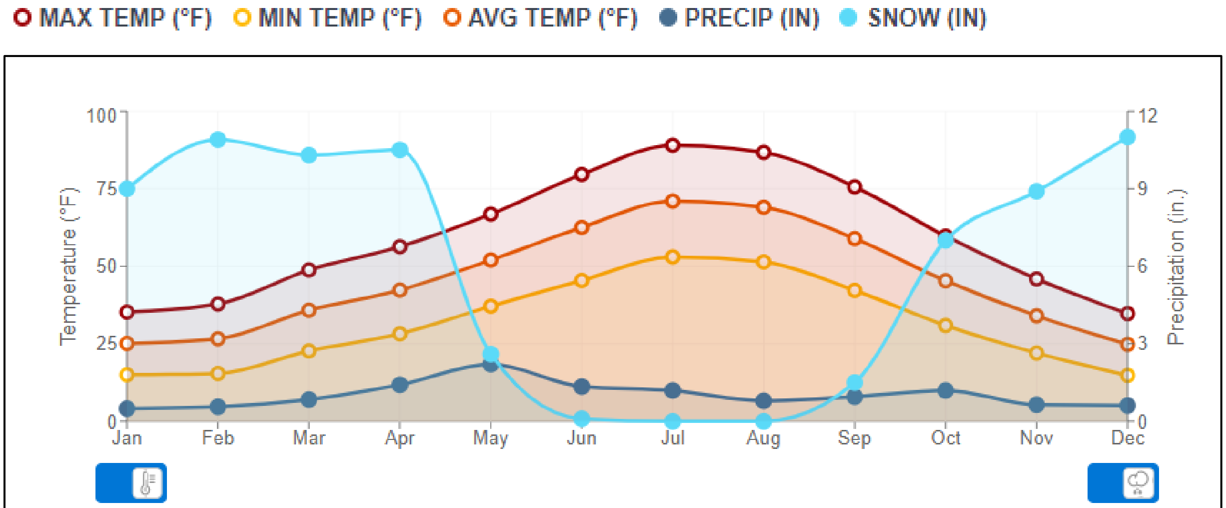
Month	MAX TEMP (°F)	MIN TEMP (°F)	AVG TEMP (°F)	PRECIP (IN)
Jan	36.1	14.3	25.2	0.33
Feb	37.3	14.9	26.1	0.43
Mar	48.0	23.3	35.6	0.83
Apr	55.3	29.8	42.5	1.60
May	65.1	39.1	52.1	2.63
Jun	77.0	47.9	62.5	2.03
Jul	87.0	55.7	71.3	1.52
Aug	85.7	53.8	69.8	0.97
Sep	74.7	44.2	59.4	0.98
Oct	58.5	32.4	45.5	1.38
Nov	45.5	21.8	33.6	0.52
Dec	36.2	14.7	25.4	0.36

Figure 30. Wind Rose for Gillette.



Casper Field Office

Figure 31. Climate Normals (1991-2020) for Casper.



Month	MAX TEMP (°F)	MIN TEMP (°F)	AVG TEMP (°F)	PRECIP (IN)	SNOW (IN)
Jan	35.2	15.0	25.1	0.49	9.0
Feb	37.8	15.4	26.6	0.56	10.9
Mar	48.8	22.7	35.8	0.84	10.3
Apr	56.3	28.2	42.3	1.41	10.5
May	66.8	37.1	52.0	2.21	2.6
Jun	79.6	45.4	62.5	1.34	0.1
Jul	89.0	53.0	71.0	1.19	0.0
Aug	86.7	51.4	69.0	0.79	0.0
Sep	75.6	42.2	58.9	0.95	1.5
Oct	59.7	30.9	45.3	1.19	7.0
Nov	45.9	22.0	34.0	0.64	8.9
Dec	34.7	14.8	24.8	0.61	11.0

Figure 32. Wind Rose for Casper.

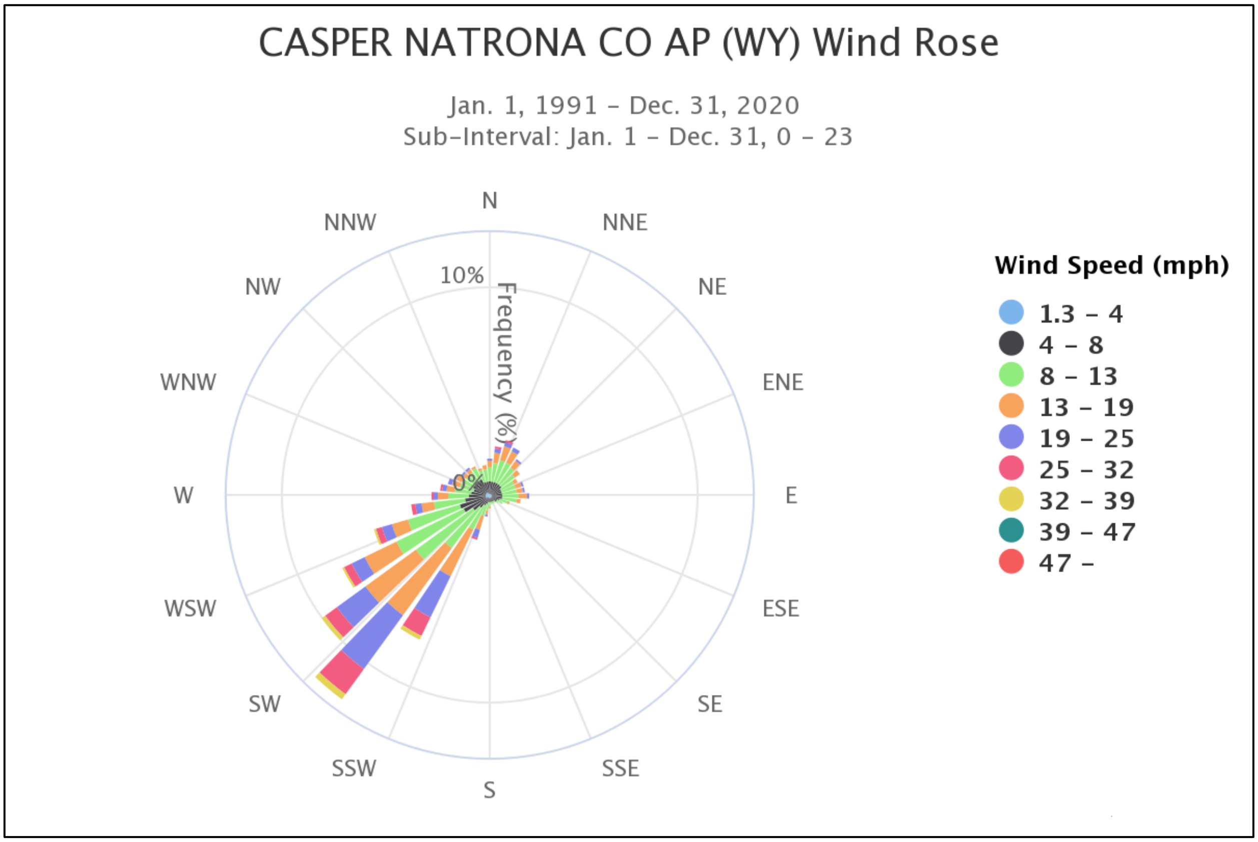
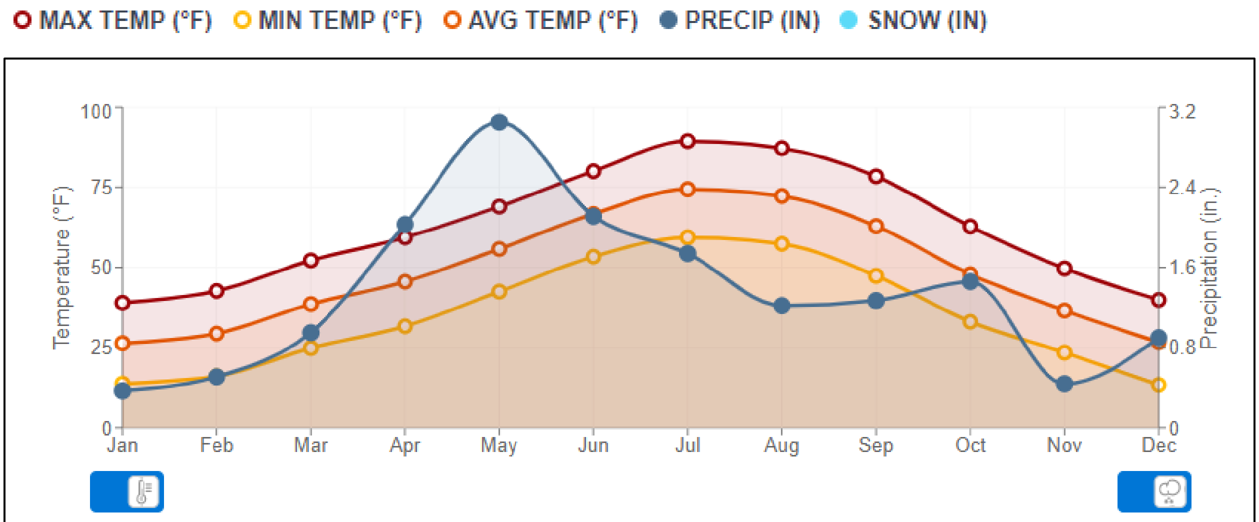


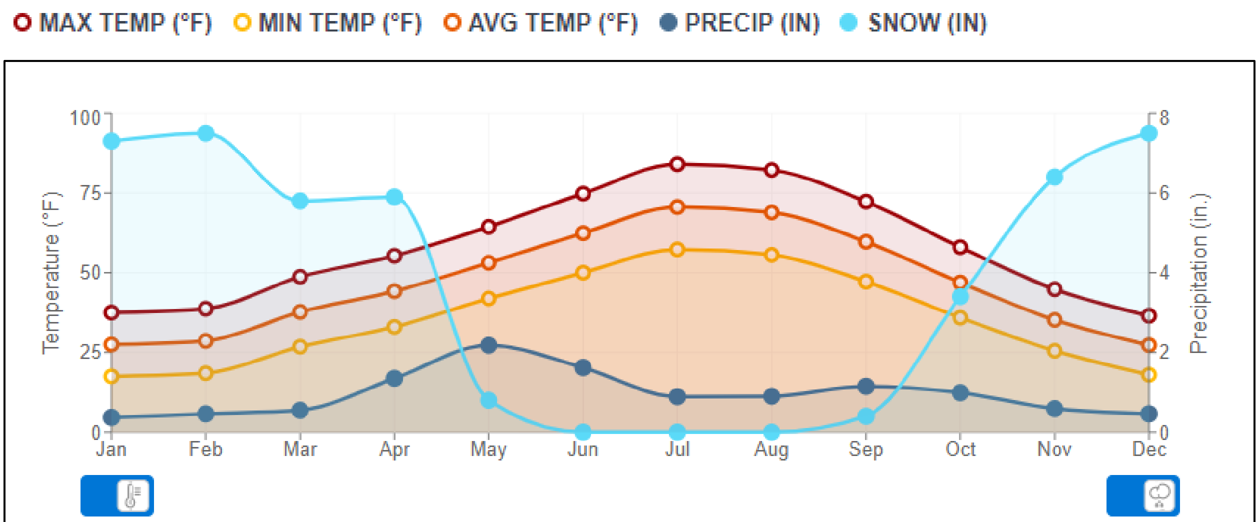
Figure 33. Climate Normals (1991-2020) for Guernsey.



Month	MAX TEMP (°F)	MIN TEMP (°F)	AVG TEMP (°F)	PRECIP (IN)
Jan	39.0	13.8	26.4	0.37
Feb	42.7	16.1	29.4	0.51
Mar	52.2	24.9	38.6	0.95
Apr	59.4	31.7	45.6	2.03
May	69.0	42.5	55.8	3.05
Jun	80.0	53.4	66.7	2.11
Jul	89.4	59.4	74.4	1.74
Aug	87.2	57.4	72.3	1.22
Sep	78.4	47.4	62.9	1.27
Oct	62.8	33.1	47.9	1.46
Nov	49.7	23.5	36.6	0.44
Dec	39.9	13.4	26.7	0.90

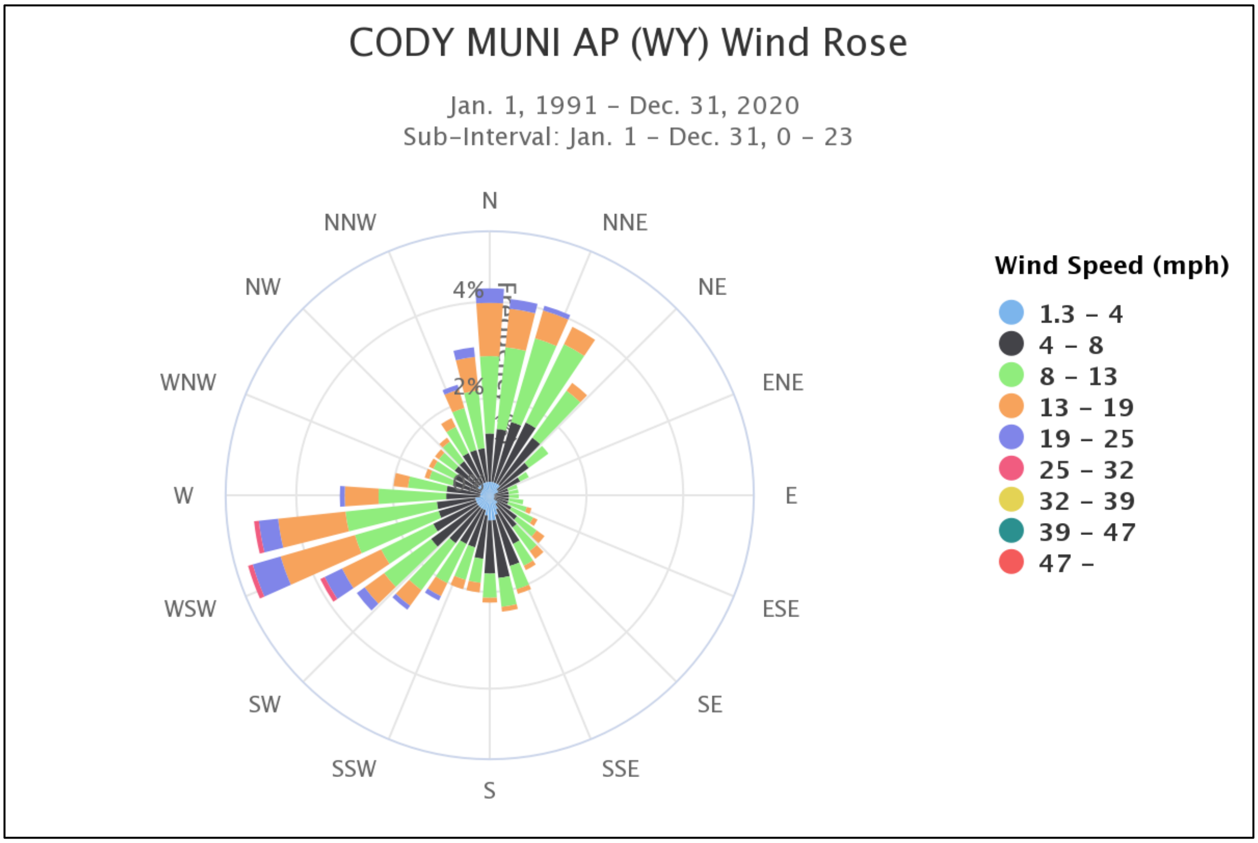
Cody Field Office

Figure 34. Climate Normals (1991-2020) for Cody.



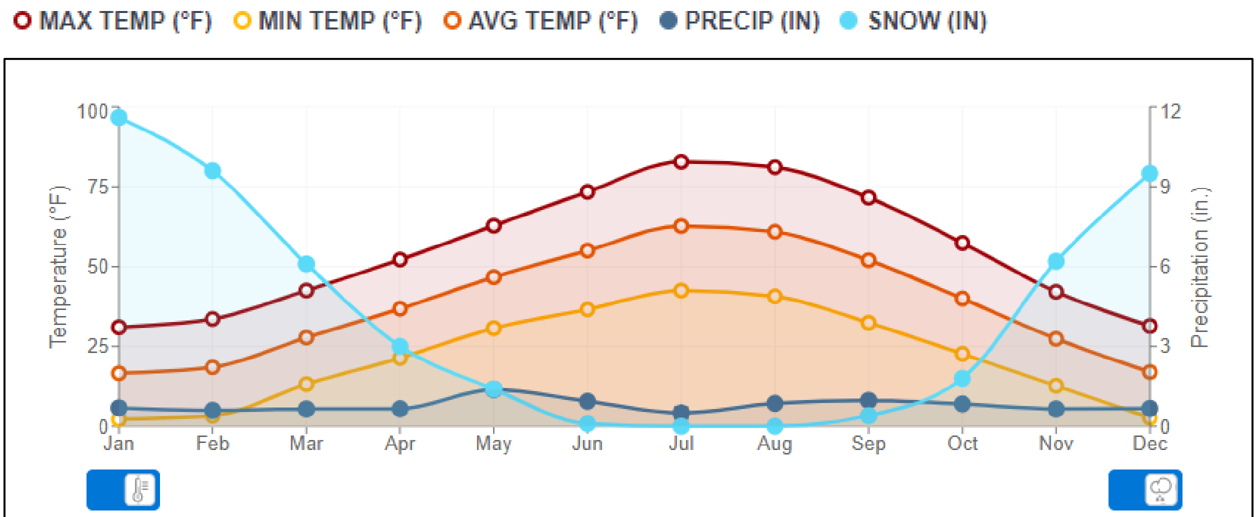
Month	MAX TEMP (°F)	MIN TEMP (°F)	AVG TEMP (°F)	PRECIP (IN)	SNOW (IN)
Jan	37.5	17.5	27.5	0.37	7.3
Feb	38.7	18.5	28.6	0.46	7.5
Mar	48.7	26.8	37.7	0.55	5.8
Apr	55.3	33.0	44.2	1.35	5.9
May	64.4	41.9	53.1	2.18	0.8
Jun	74.8	50.0	62.4	1.62	0.0
Jul	84.0	57.3	70.6	0.89	0.0
Aug	82.2	55.6	68.9	0.90	0.0
Sep	72.3	47.2	59.7	1.15	0.4
Oct	58.0	35.9	46.9	0.99	3.4
Nov	44.8	25.5	35.2	0.59	6.4
Dec	36.5	18.0	27.3	0.46	7.5

Figure 35. Wind Rose for Cody.



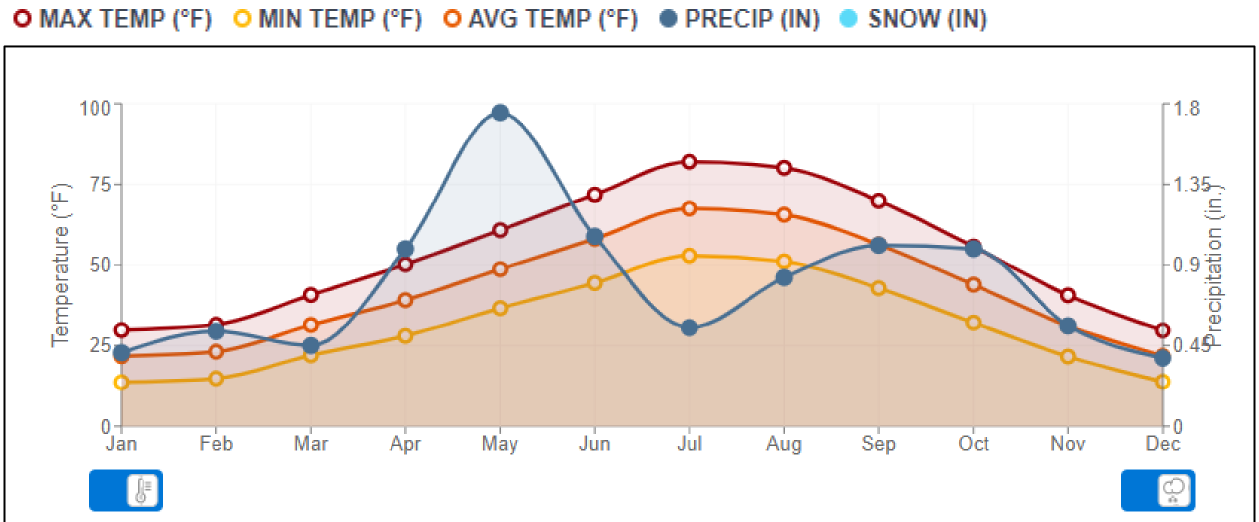
Kemmerer Field Office

Figure 36. Climate Normals (1991-2020) for Kemmerer.



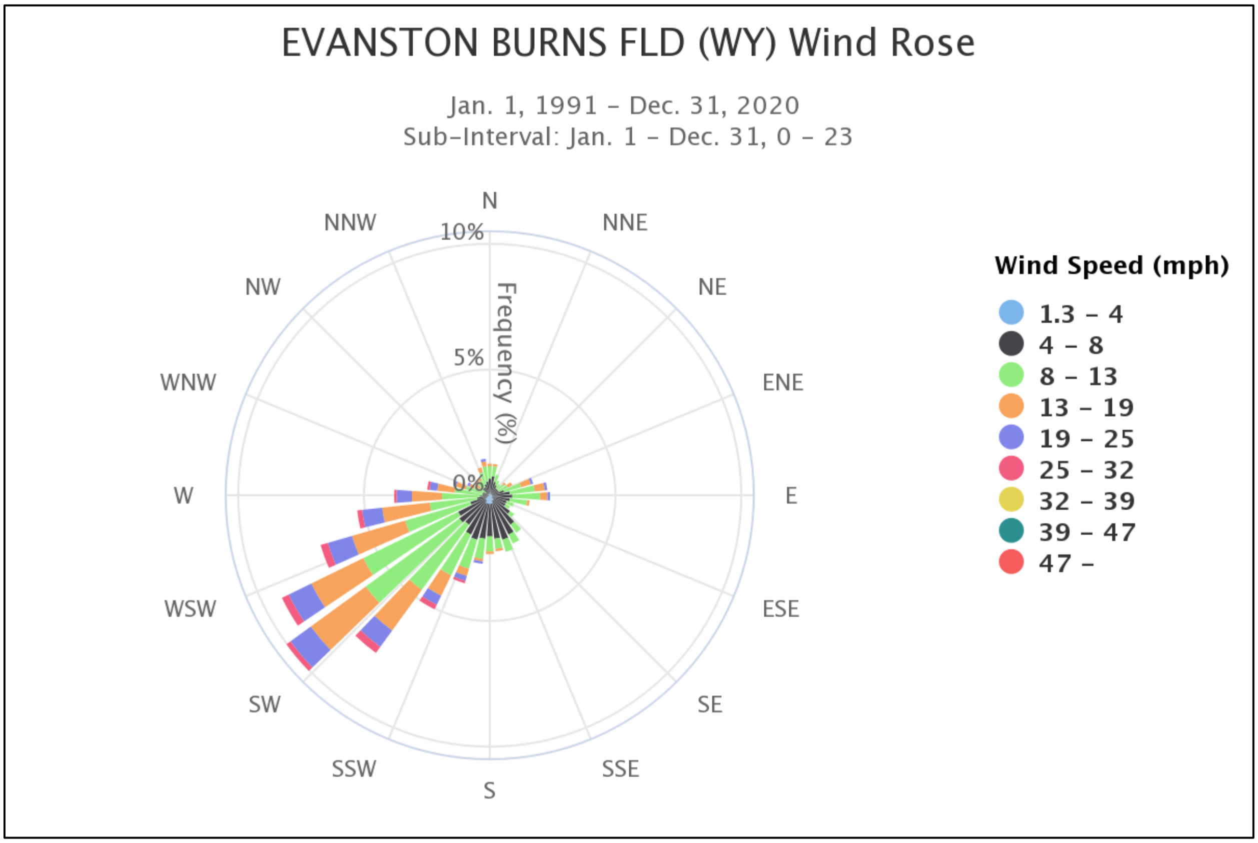
Month	MAX TEMP (°F)	MIN TEMP (°F)	AVG TEMP (°F)	PRECIP (IN)	SNOW (IN)
Jan	31.0	2.2	16.6	0.69	11.6
Feb	33.6	3.3	18.5	0.60	9.6
Mar	42.5	13.2	27.8	0.65	6.1
Apr	52.2	21.4	36.8	0.66	3.0
May	62.8	30.7	46.7	1.38	1.4
Jun	73.4	36.6	55.0	0.94	0.1
Jul	82.8	42.5	62.7	0.50	0.0
Aug	81.1	40.7	60.9	0.86	0.0
Sep	71.6	32.4	52.0	0.97	0.4
Oct	57.4	22.7	40.0	0.84	1.8
Nov	42.1	12.7	27.4	0.65	6.2
Dec	31.4	2.7	17.0	0.67	9.5

Figure 37. Climate Normals (1991-2020) for Evanston.



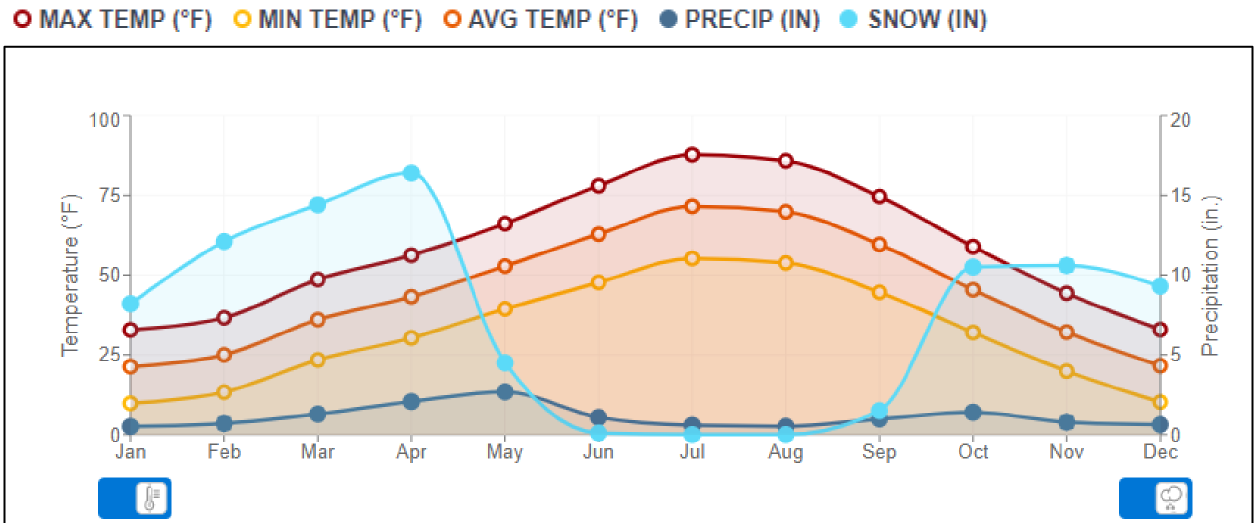
Month	MAX TEMP (°F)	MIN TEMP (°F)	AVG TEMP (°F)	PRECIP (IN)
Jan	29.8	13.6	21.7	0.41
Feb	31.5	14.8	23.1	0.53
Mar	40.7	22.0	31.4	0.45
Apr	50.2	28.0	39.1	0.99
May	60.8	36.6	48.7	1.75
Jun	71.8	44.4	58.1	1.06
Jul	82.0	52.9	67.5	0.55
Aug	80.1	51.1	65.6	0.83
Sep	69.9	42.8	56.3	1.01
Oct	55.7	32.1	43.9	0.99
Nov	40.6	21.6	31.1	0.56
Dec	29.7	13.8	21.8	0.38

Figure 38. Wind Rose for Evanston.



Lander Field Office

Figure 39. Climate Normals (1991-2020) for Lander.



Month	MAX TEMP (°F)	MIN TEMP (°F)	AVG TEMP (°F)	PRECIP (IN)	SNOW (IN)
Jan	32.8	9.8	21.3	0.51	8.2
Feb	36.6	13.3	25.0	0.70	12.1
Mar	48.6	23.4	36.0	1.29	14.4
Apr	56.2	30.3	43.2	2.07	16.4
May	66.1	39.4	52.8	2.68	4.5
Jun	78.0	47.7	62.8	1.08	0.1
Jul	87.7	55.2	71.5	0.59	0.0
Aug	85.8	53.8	69.8	0.52	0.0
Sep	74.6	44.6	59.6	0.98	1.5
Oct	58.9	32.0	45.4	1.40	10.5
Nov	44.3	19.9	32.1	0.78	10.6
Dec	32.9	10.2	21.6	0.63	9.3

Figure 40. Wind Rose for Lander.

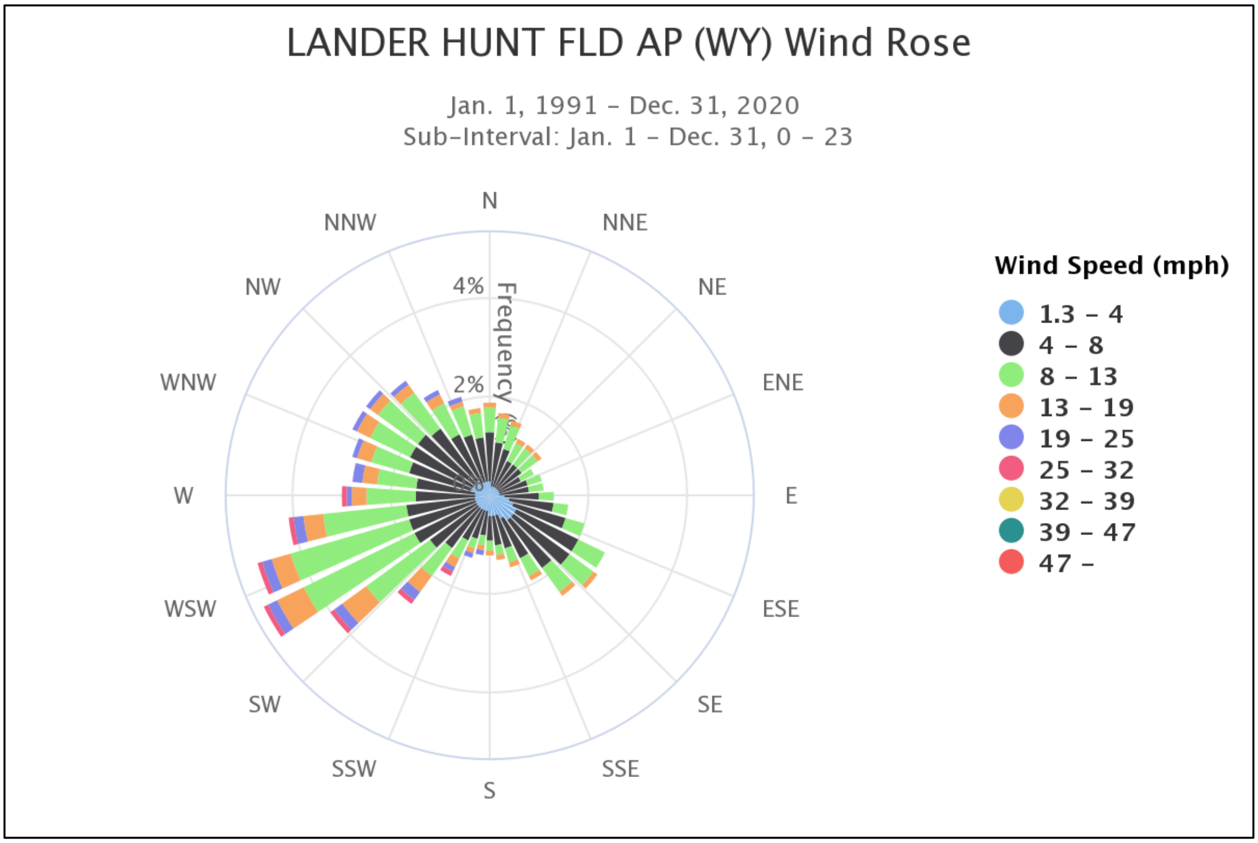
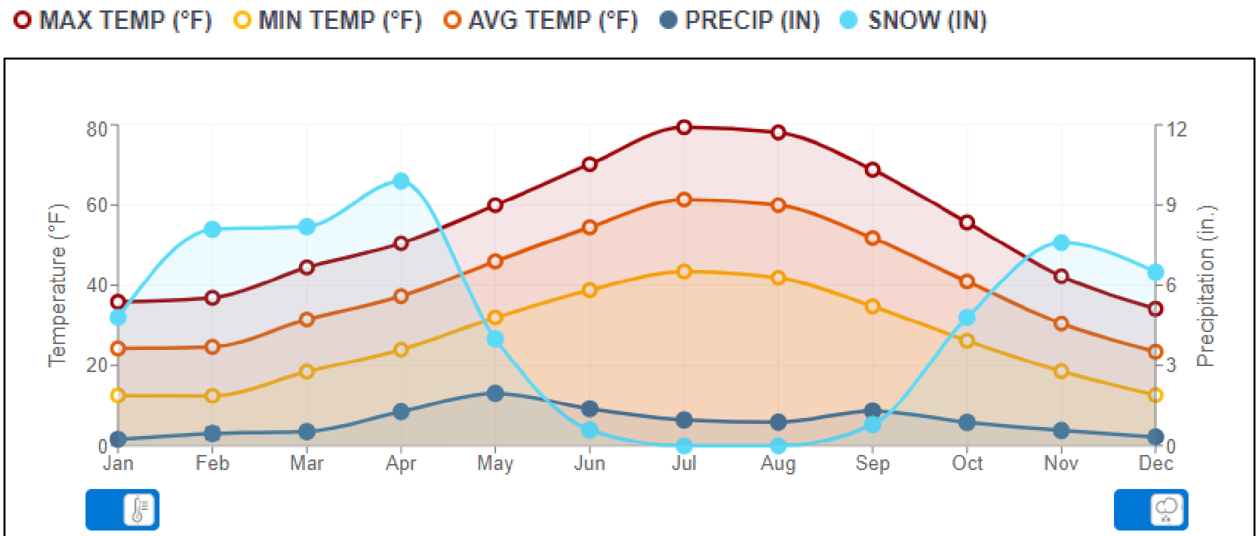


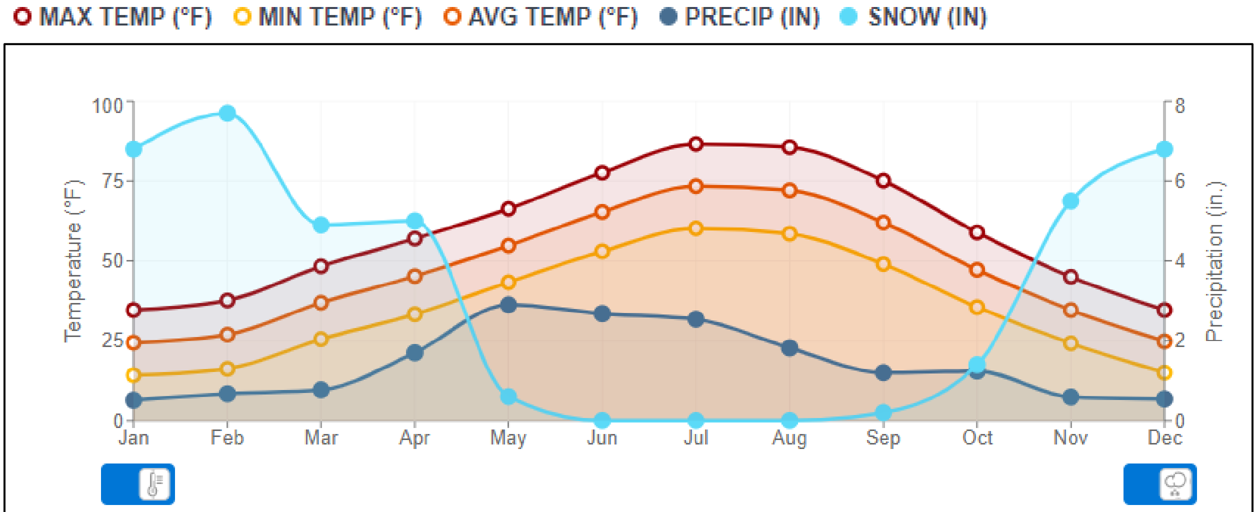
Figure 41. Climate Normals (1991-2020) for Dubois.



Month	MAX TEMP (°F)	MIN TEMP (°F)	AVG TEMP (°F)	PRECIP (IN)	SNOW (IN)
Jan	35.9	12.6	24.3	0.25	4.8
Feb	36.9	12.5	24.7	0.47	8.1
Mar	44.5	18.5	31.5	0.54	8.2
Apr	50.5	24.0	37.3	1.28	9.9
May	60.0	32.0	46.0	1.97	4.0
Jun	70.2	38.8	54.5	1.39	0.6
Jul	79.4	43.5	61.4	0.97	0.0
Aug	78.1	41.9	60.0	0.89	0.0
Sep	68.8	34.8	51.8	1.30	0.8
Oct	55.7	26.2	41.0	0.88	4.8
Nov	42.3	18.6	30.5	0.58	7.6
Dec	34.2	12.7	23.5	0.34	6.5

Newcastle Field Office

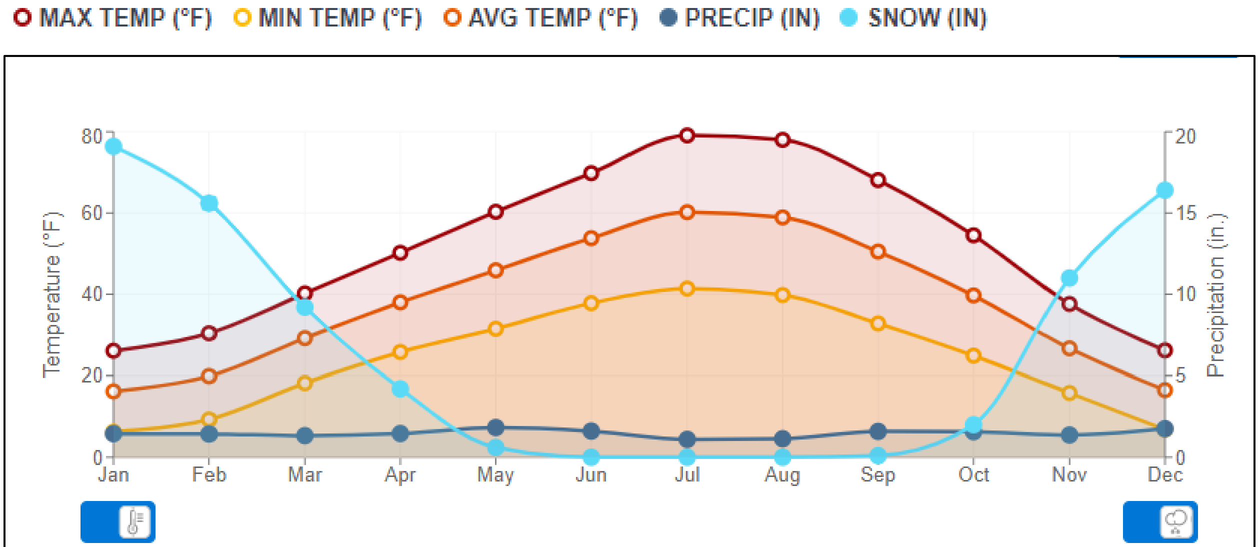
Figure 42. Climate Normals (1991-2020) for Newcastle.



Month	MAX TEMP (°F)	MIN TEMP (°F)	AVG TEMP (°F)	PRECIP (IN)	SNOW (IN)
Jan	34.6	14.2	24.4	0.51	6.8
Feb	37.6	16.2	26.9	0.67	7.7
Mar	48.3	25.5	36.9	0.77	4.9
Apr	57.0	33.3	45.2	1.70	5.0
May	66.3	43.3	54.8	2.90	0.6
Jun	77.6	53.0	65.3	2.68	0.0
Jul	86.6	60.2	73.4	2.54	0.0
Aug	85.6	58.5	72.1	1.82	0.0
Sep	75.1	49.0	62.0	1.20	0.2
Oct	58.9	35.5	47.2	1.24	1.4
Nov	45.0	24.2	34.6	0.59	5.5
Dec	34.6	15.0	24.8	0.54	6.8

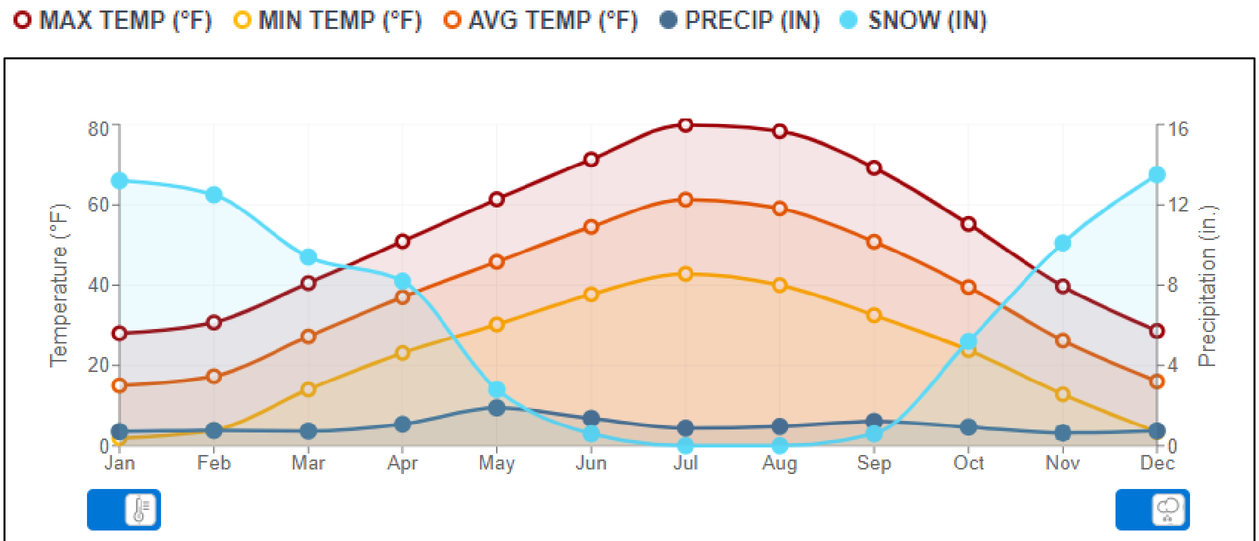
Pinedale Field Office

Figure 43. Climate Normals (1991-2020) for Jackson.



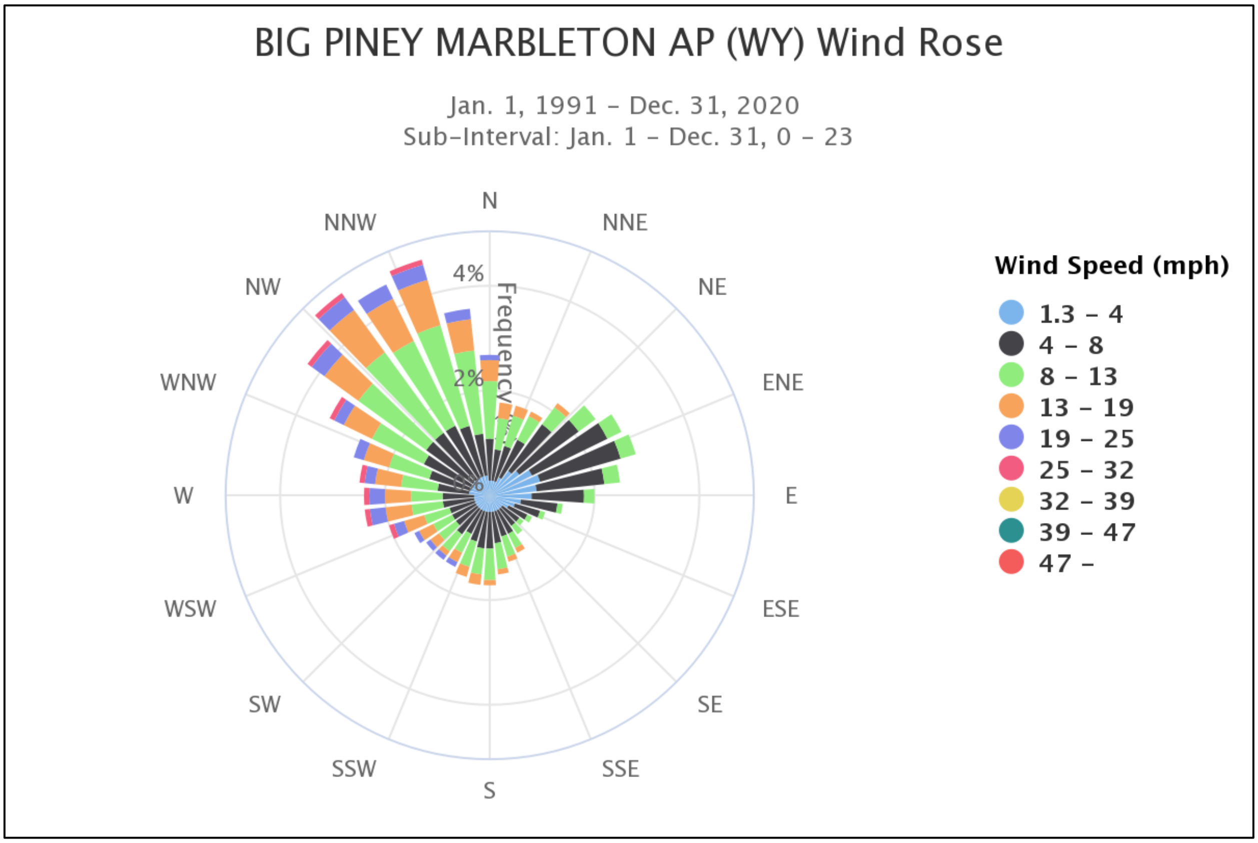
Month	MAX TEMP (°F)	MIN TEMP (°F)	AVG TEMP (°F)	PRECIP (IN)	SNOW (IN)
Jan	26.1	6.3	16.2	1.45	19.1
Feb	30.4	9.3	19.9	1.43	15.6
Mar	40.2	18.2	29.2	1.33	9.2
Apr	50.2	25.8	38.0	1.46	4.2
May	60.3	31.5	45.9	1.83	0.6
Jun	69.8	37.8	53.8	1.61	0.0
Jul	79.1	41.4	60.2	1.10	0.0
Aug	78.0	39.8	58.9	1.14	0.0
Sep	68.1	32.8	50.5	1.59	0.1
Oct	54.5	24.9	39.7	1.57	2.0
Nov	37.6	15.8	26.7	1.37	11.0
Dec	26.2	6.8	16.5	1.76	16.4

Figure 44. Climate Normals (1991-2020) for Pinedale.



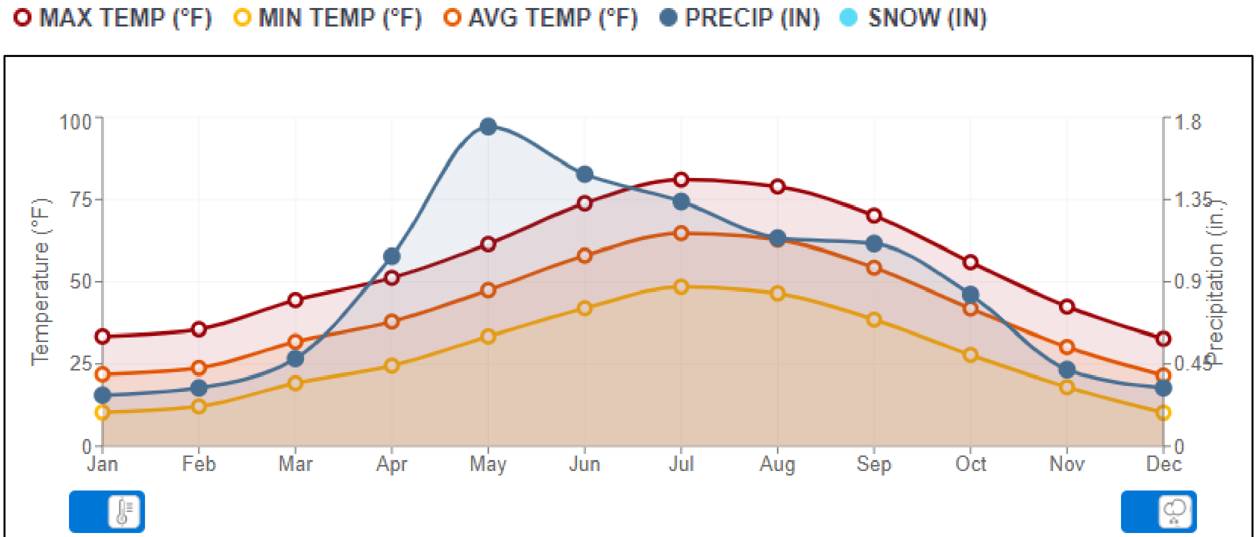
Month	MAX TEMP (°F)	MIN TEMP (°F)	AVG TEMP (°F)	PRECIP (IN)	SNOW (IN)
Jan	28.0	1.9	15.0	0.70	13.2
Feb	30.7	3.9	17.3	0.76	12.5
Mar	40.5	14.0	27.2	0.73	9.4
Apr	50.9	23.1	37.0	1.07	8.2
May	61.4	30.2	45.8	1.89	2.8
Jun	71.3	37.7	54.5	1.36	0.6
Jul	79.9	42.8	61.3	0.88	0.0
Aug	78.3	40.0	59.1	0.96	0.0
Sep	69.2	32.5	50.8	1.21	0.6
Oct	55.2	23.8	39.5	0.93	5.2
Nov	39.7	12.8	26.2	0.64	10.1
Dec	28.6	3.4	16.0	0.74	13.5

Figure 45. Wind Rose for Big Piney.



Rawlins Field Office

Figure 46. Climate Normals (1991-2020) for Laramie.



Month	MAX TEMP (°F)	MIN TEMP (°F)	AVG TEMP (°F)	PRECIP (IN)
Jan	33.4	10.3	21.9	0.28
Feb	35.6	12.1	23.8	0.32
Mar	44.5	19.2	31.8	0.48
Apr	51.2	24.5	37.9	1.04
May	61.5	33.4	47.5	1.75
Jun	73.9	42.0	58.0	1.49
Jul	81.1	48.5	64.8	1.34
Aug	79.0	46.5	62.8	1.14
Sep	70.2	38.5	54.3	1.11
Oct	56.0	27.8	41.9	0.83
Nov	42.5	18.0	30.2	0.42
Dec	32.7	10.2	21.5	0.32

Figure 47. Wind Rose for the Laramie.

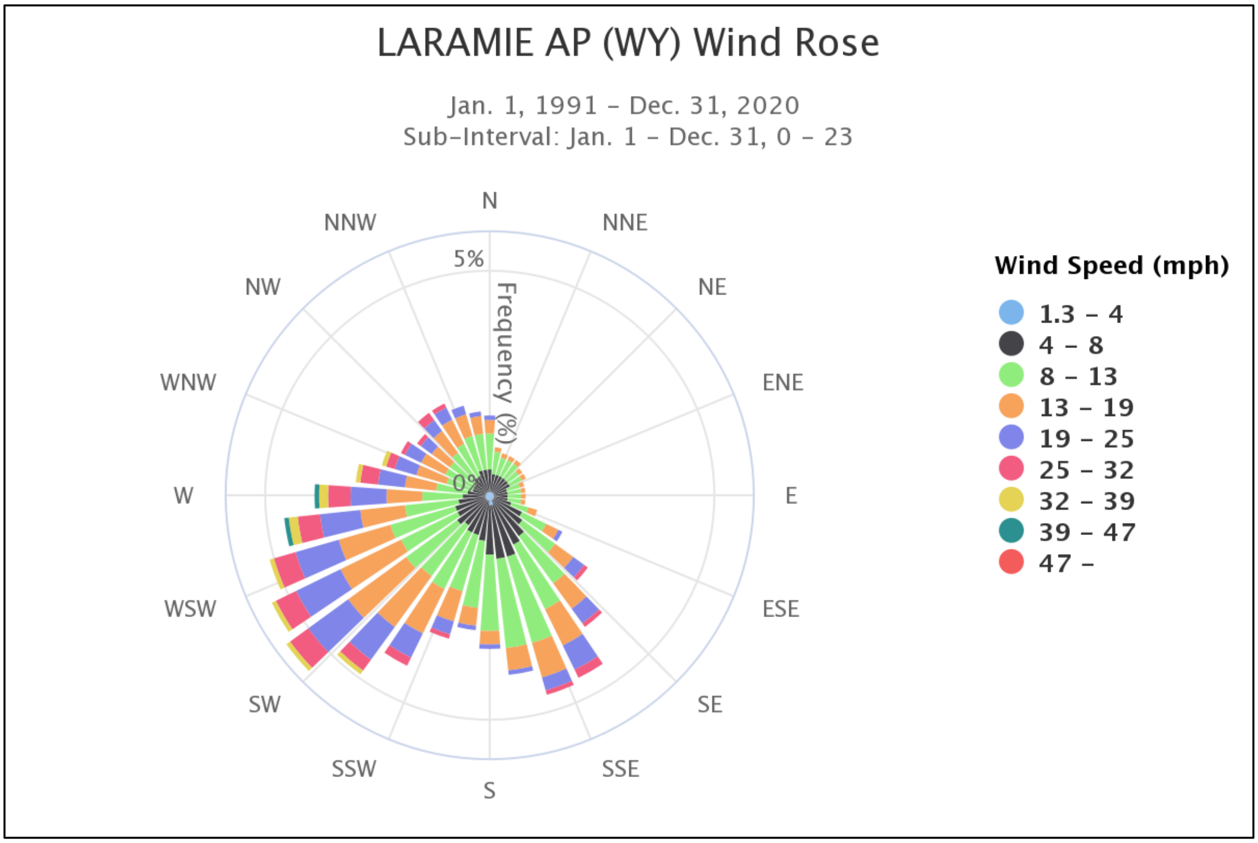
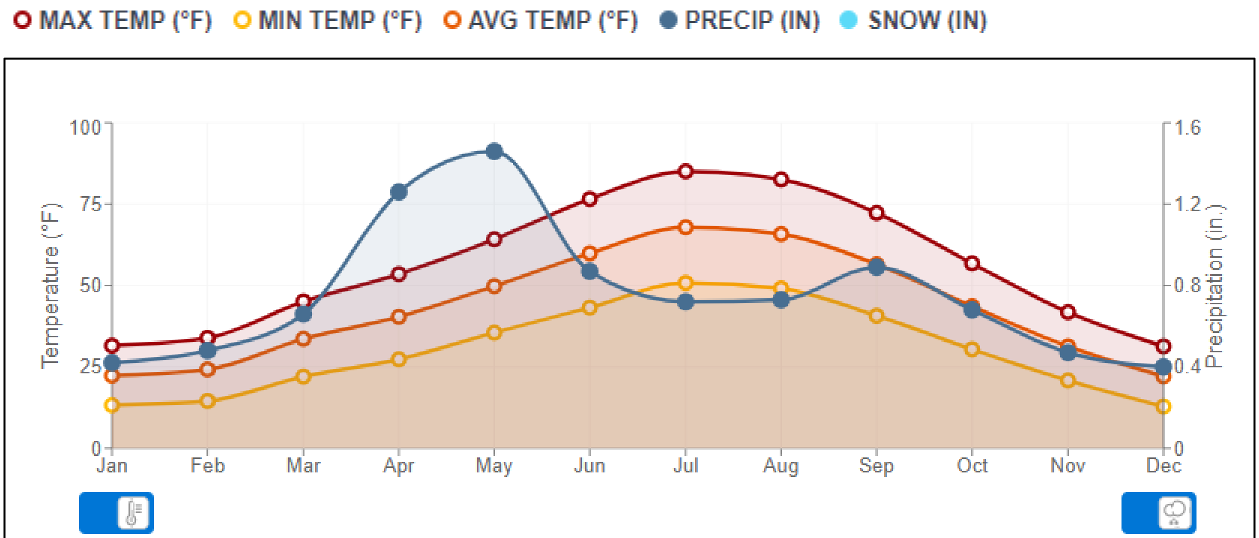


Figure 48. Climate Normals (1991-2020) for Rawlins.



Month	MAX TEMP (°F)	MIN TEMP (°F)	AVG TEMP (°F)	PRECIP (IN)
Jan	31.5	13.2	22.3	0.42
Feb	33.9	14.5	24.2	0.48
Mar	45.1	22.0	33.6	0.66
Apr	53.5	27.3	40.4	1.26
May	64.2	35.5	49.8	1.46
Jun	76.6	43.2	59.9	0.87
Jul	85.1	50.8	67.9	0.72
Aug	82.6	49.1	65.8	0.73
Sep	72.3	40.7	56.5	0.89
Oct	56.8	30.4	43.6	0.68
Nov	41.8	20.8	31.3	0.47
Dec	31.3	12.8	22.1	0.40

Figure 49. Wind Rose for Rawlins.

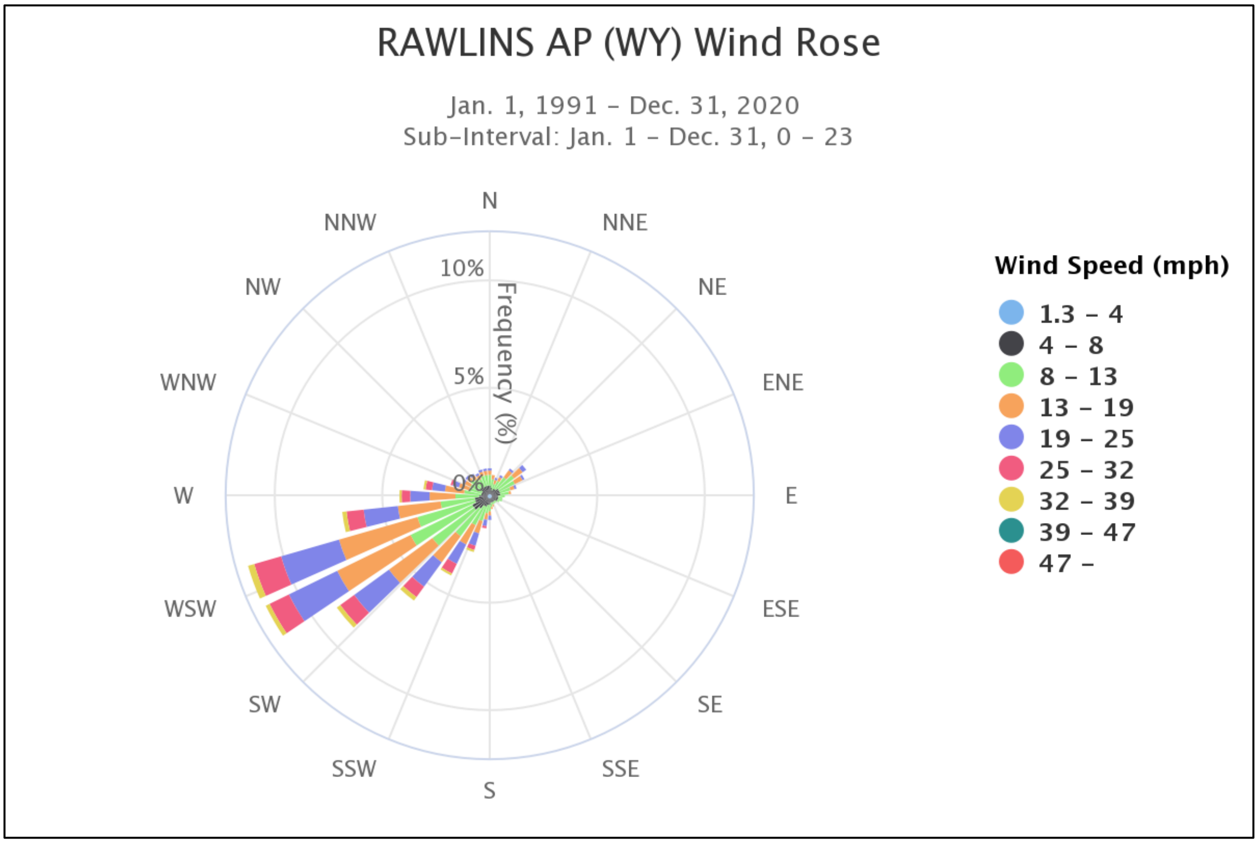
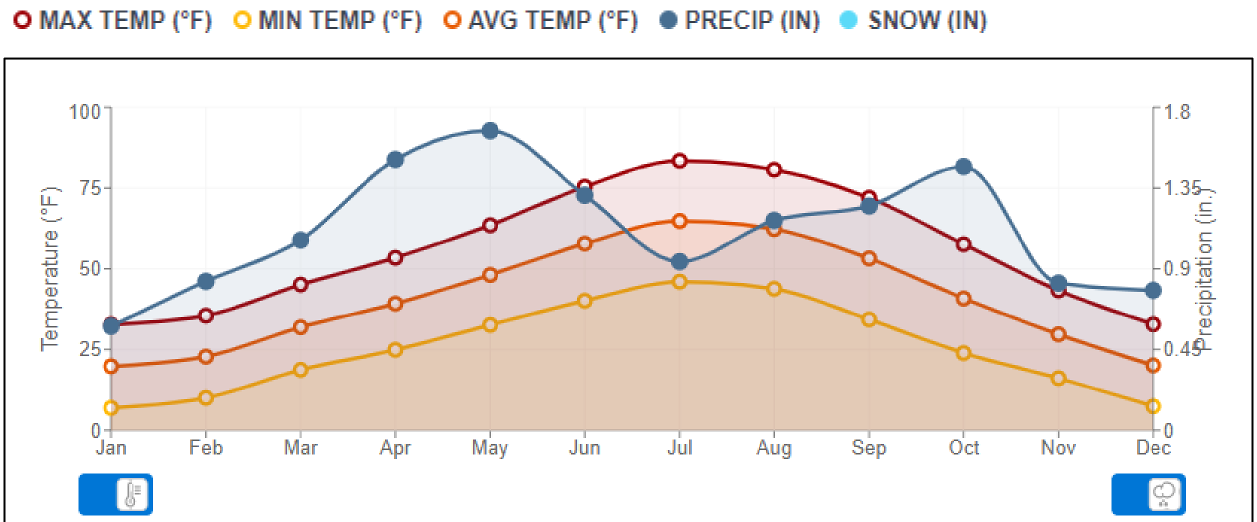


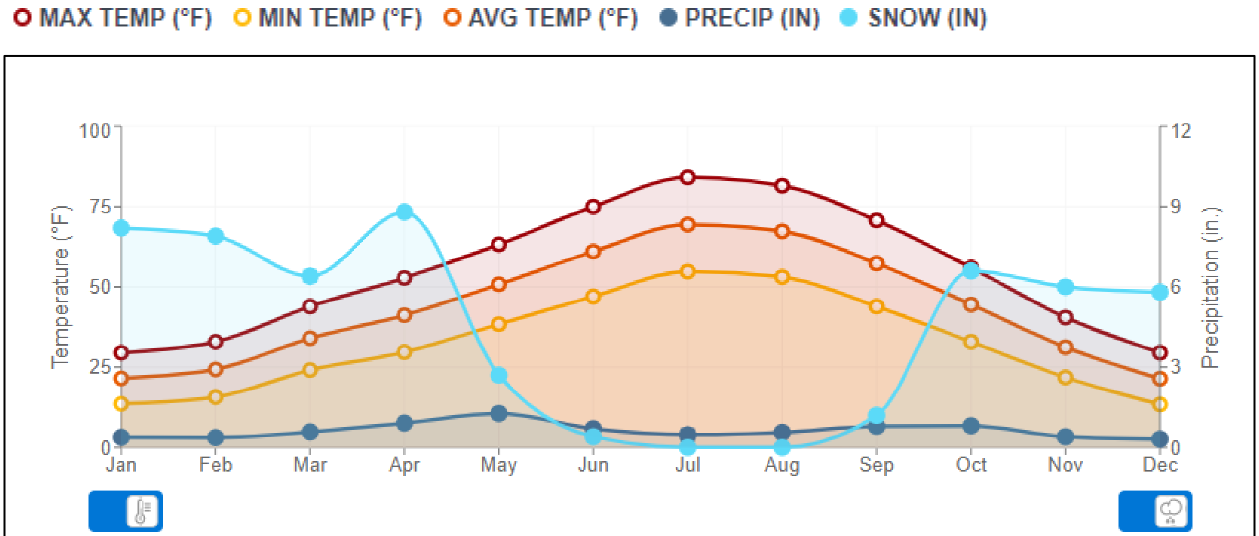
Figure 50. Climate Normals (1991-2020) for Saratoga.



Month	MAX TEMP (°F)	MIN TEMP (°F)	AVG TEMP (°F)	PRECIP (IN)
Jan	32.7	6.9	19.8	0.58
Feb	35.5	10.0	22.8	0.83
Mar	45.1	18.7	31.9	1.06
Apr	53.4	24.9	39.2	1.51
May	63.5	32.6	48.1	1.67
Jun	75.4	40.1	57.8	1.31
Jul	83.5	46.0	64.8	0.94
Aug	80.7	43.8	62.3	1.17
Sep	72.0	34.3	53.2	1.25
Oct	57.6	23.9	40.8	1.47
Nov	43.3	16.1	29.7	0.82
Dec	32.8	7.4	20.1	0.78

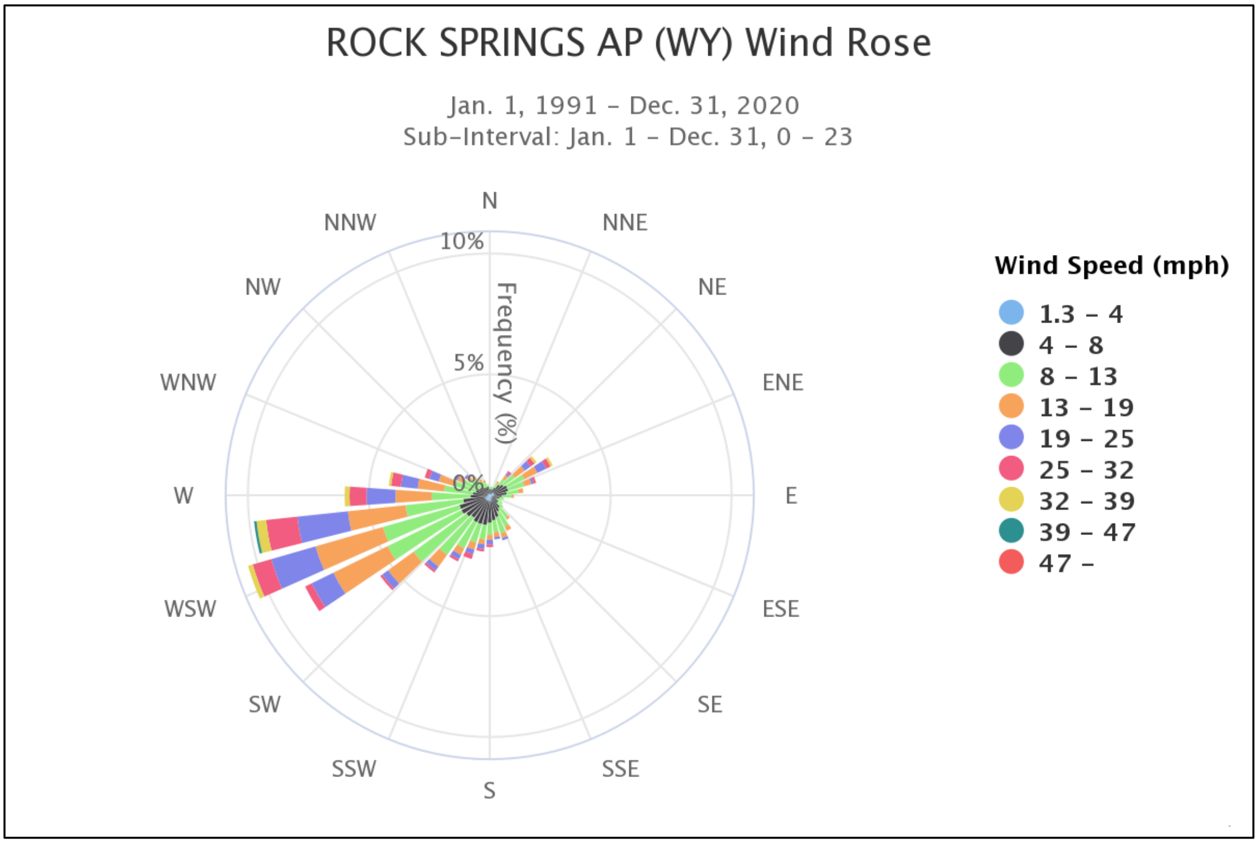
Rock Springs Field Office

Figure 51. Climate Normals (1991-2020) for Rock Springs.



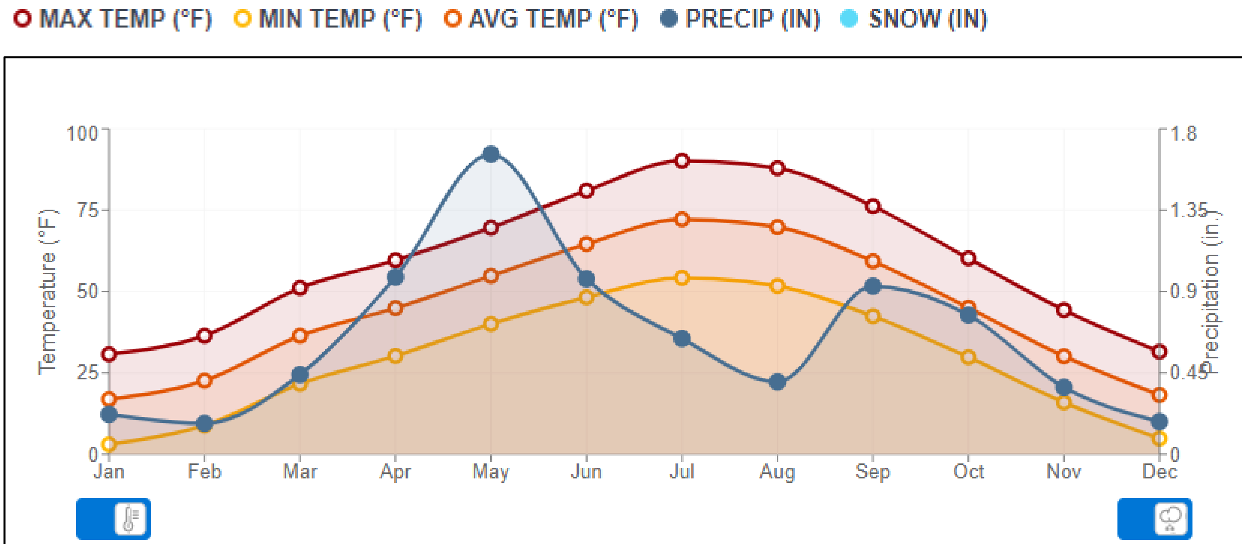
Month	MAX TEMP (°F)	MIN TEMP (°F)	AVG TEMP (°F)	PRECIP (IN)	SNOW (IN)
Jan	29.5	13.6	21.5	0.38	8.2
Feb	32.9	15.7	24.3	0.37	7.9
Mar	43.9	24.1	34.0	0.58	6.4
Apr	52.8	29.7	41.2	0.91	8.8
May	63.2	38.4	50.8	1.27	2.7
Jun	75.0	47.0	61.0	0.70	0.4
Jul	84.1	54.8	69.4	0.47	0.0
Aug	81.5	53.1	67.3	0.56	0.0
Sep	70.7	43.9	57.3	0.79	1.2
Oct	56.0	32.9	44.5	0.81	6.6
Nov	40.5	21.8	31.2	0.40	6.0
Dec	29.5	13.4	21.4	0.31	5.8

Figure 52. Wind Rose for Rock Springs.



Worland Field Office

Figure 53. Climate Normals (1991-2020) for Worland.



Month	MAX TEMP (°F)	MIN TEMP (°F)	AVG TEMP (°F)	PRECIP (IN)
Jan	30.7	3.0	16.9	0.22
Feb	36.4	8.8	22.6	0.17
Mar	51.1	21.6	36.4	0.44
Apr	59.6	30.2	44.9	0.98
May	69.6	40.0	54.8	1.66
Jun	81.0	48.2	64.6	0.97
Jul	90.2	54.2	72.2	0.64
Aug	87.9	51.7	69.8	0.40
Sep	76.2	42.4	59.3	0.93
Oct	60.2	29.8	45.0	0.77
Nov	44.3	15.9	30.1	0.37
Dec	31.5	4.8	18.2	0.18

Figure 54. Wind Rose for Worland.