Coeur d'Alene Climate Adaptation Project

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We gratefully acknowledge the comprehensive review and comments graciously provided by a panel of regional experts and university faculty. Their feedback has greatly improved this report. We also acknowledge the many members of our community who have provided support to this project. This would not be possible without their help.

Contents

1: Acronyms

CAP – Climate Action Plan

CCAP – Coeur d'Alene Climate Adaptation Project

cfs – Cubic Feet Per Second

CIRC – Pacific Northwest Climate Impacts Research Consortium

CO_2 – Carbon Dioxide

COPD – Chronic Obstructive Pulmonary Disorder

DOT – US Department of Transportation

FEMA – Federal Emergency Management Agency

GHG – Greenhouse Gases

HEPA – High Efficiency Particulate Air or High Efficiency Particulate Arrestance

HVAC – Heating, Ventilating and Air Conditioning

ITD - Idaho Transportation Department

IPCC – Intergovernmental Panel on Climate Change

NASA – National Aeronautics and Space Administration

NERC – North American Electric Reliability Corporation

NOAA – National Oceanic and Atmospheric Administration

PM – Particulate Matter

RISA – Required Integrated Sciences and Assessments

RCP – Representative Concentration Pathway

2: Executive Summary

This report was created by a volunteer group of Coeur d'Alene residents to quantify the impact that climate change is having and will continue to have on our communities. We also recommend ways in which we can reduce those impacts. With the help of the Pacific Northwest Climate Impacts Research Consortium (CIRC), our group used the Climate Toolbox[1], a suite of online climate science tools and related datasets to investigate the impacts of climate change on our region. Included are historic and future changes in temperature, rain and snow, drought, wildfire risk, and subsequent impacts on the health of Coeur d'Alene residents, Coeur d'Alene Lake, and the many other lakes, streams, forests, and croplands that are the cultural and economic heart of our region. We present these changes in a manner that will resonate with our community and spur action to mitigate the impact of these changes on our communities' health and wellbeing. Included are historical and current photographs of Coeur d'Alene, as well as observations from residents.

The CIRC is a team of climate and social science researchers that help local communities become more resilient to extreme climate and weather impacts. CIRC is publicly funded through the National Oceanic and Atmospheric Administration's (NOAA) Regional Integrated Sciences and Assessments (RISA) program. The RISA program supports research teams that help expand and build our nation's capacity to prepare for and adapt to climate variability and change. CIRC members are found at Oregon State University, the University of Idaho, the University of Washington, and the University of Oregon. All References used for this report are provided in Section 8 at the end of this document.

Key Findings

Temperature – Coeur d'Alene's average air temperature has risen 3°F since the 1890's and is expected to rise by as much as 8°F over the remainder of this century. By 2080, our temperature is predicted to be similar to what is currently seen in Lewiston, ID. Average daily high temperatures in the summer are projected to be above 90°F, and average daily low temperature in the winter to be above freezing.

Rain and Snow – Winters will have more precipitation, but it will come with more rain and less snow. We will have drier summers, reducing the amount of water available in the summer and degrading water quality. Drought will become more common, wildfire frequency and severity will increase, and higher temperatures and lower summer river flows will make it more difficult to protect human and lake health.

Wildfire – Due to hotter and drier summers, the number of extreme fire risk days is projected to double by mid-century.

Human Health – An increase in wildfire smoke from climate change will worsen heart conditions, asthma, allergies, and COPD. As heat waves increase (such as the 2021 Pacific Northwest heat dome), heat-related illnesses will also increase. Illnesses such as heat exhaustion and heat stroke can be deadly to the elderly and those working outside. In the U.S. and abroad, extreme heat kills more people than any other extreme weather event.

Lake Health - Climate change will increase water temperatures and cause lakes to be stratified for longer. This will lead to increased lake eutrophication, increased frequency and duration of harmful algae blooms, reduced oxygen levels, loss of cold water fish, and damage to our native fisheries.

3: What is Climate Change?

NASA describes climate as the average long-term weather pattern of a location or region[2]. This includes prevailing temperature, precipitation, humidity, wind, cloudiness, air pressure, and the frequency and severity of storms. Climate change is a long-term change in these patterns, for example global warming and cooling. These changes can occur both naturally and in response to human activities. Our climate has changed naturally over the Earth's many eons of history, prior to humanity's industrial age and widespread use of fossil fuels. These natural shifts were primarily driven by changes in the earth's energy balance: the amount of energy received from the sun compared to the amount re-emitted back to outer space.

A primary mechanism for controlling earth's temperature is how the concentration of greenhouse gases (GHGs) in our atmosphere trap and retain the sun's energy. These gases act like a "blanket," trapping the solar radiation that would otherwise be reflected by our planet's surface and lost back into to space (Figure 1). Large increases in the concentration of GHGs in our atmosphere disrupt the earth's energy balance. *This imbalance increases how much heat stays in our atmosphere and increases global temperatures*. These changes also have feedback loops that can exacerbate the atmospheric effects.

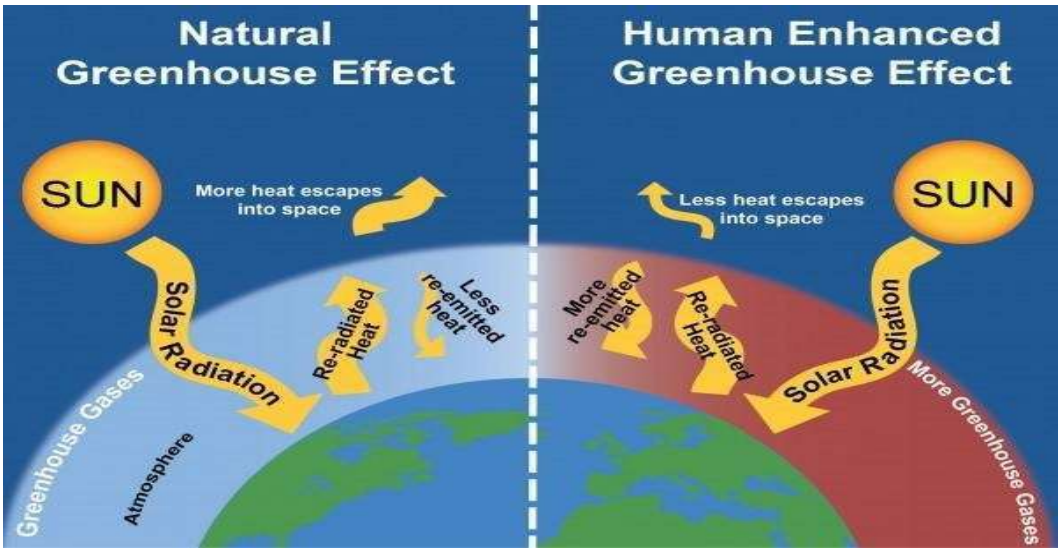


Figure 1. This diagram shows the difference in greenhouse gas emissions naturally versus human enhanced. With more GHGs in the atmosphere, more heat is trapped on Earth and less is lost to space. Source: University of Michigan Center for Sustainable Systems

Anthropogenic climate change is caused by human activities, especially those occurring since the mid-19th century. Human activities have fundamentally altered the way that carbon cycles on our planet. Prior to the modern age, plant material that was not decomposed was buried, where the Earth's heat and pressure transformed it into coal, oil, and gas. Today, we are rapidly harvesting that ancient reservoir, built over millions of years, and are sending billions of tons of carbon from deep in the ground up into the atmosphere. This accelerated use of fossil fuels started in the late 1700's and has led to a rapid and dangerous increase in our atmosphere's GHG concentrations, as shown in Figure 2. Data reported by NASA shows that our current GHG levels are higher than they've been throughout the entirety of human history (Figure 3). This is an unprecedented change.

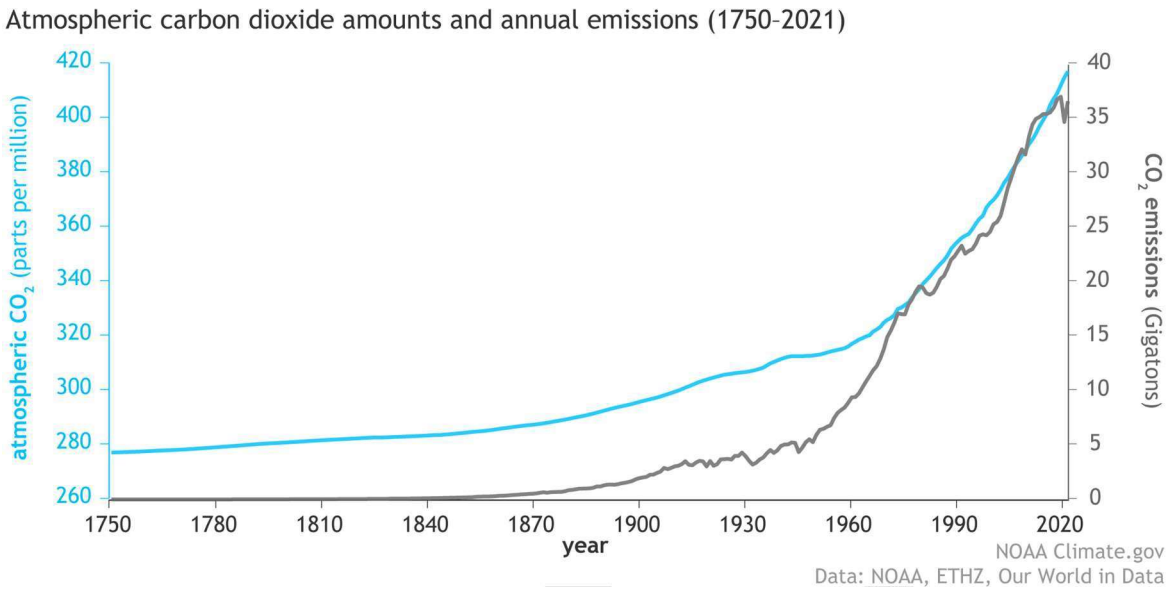


Figure 2. Atmospheric CO2 and annual emissions 1750–2021. Data is from the United States National Oceanic and Atmospheric Administration (NOAA.Climate.gov, Global Climate Dashboard).

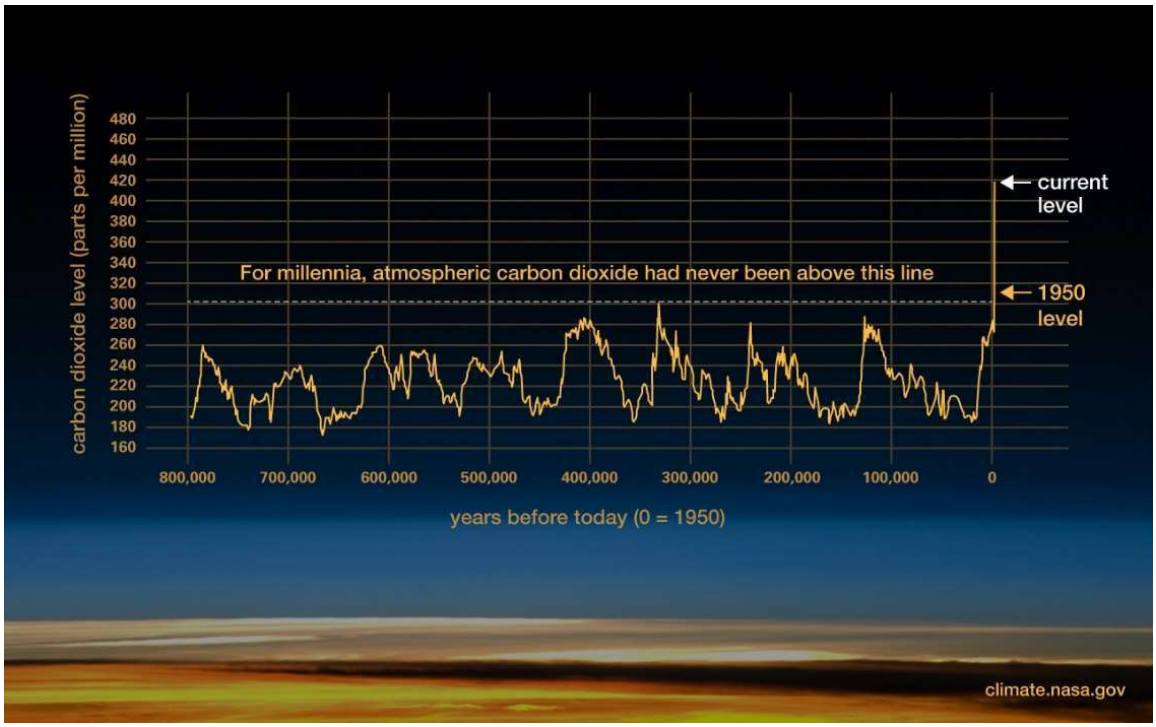


Figure 3 – Atmospheric CO_2 concentration over the last 800,000 years. The historical records were taken from ice core samples, and the modern levels were recorded with more direct measurements. Graph courtesy of NASA. https://climate.nasa.gov/climate_resources/24/graphic-the-relentless-rise-of-carbon-dioxide/

Carbon dioxide (CO_2) is the most common human derived GHG in the atmosphere. The increase in CO_2 concentration is due almost entirely to human activities[3]. The largest human contributions come from the production and use of fossil fuels and land conversion such as cutting down rainforests and replacing them with agriculture. Atmospheric CO_2 has risen and fallen for millennia via natural causes, within the range of ~180 – 280 ppm. In 2022 atmospheric CO_2 exceeded 417 ppm[4], higher than it has been in all human history.

Figures 2 and 3 show only CO_2 levels. Other gases, such as methane, fluorinated gases, nitrous oxide, and water vapor also influence the earth's temperature. These have also increased due to a combination of human activities and natural feedback loops (e.g., for methane and water vapor). Methane is particularly problematic, as it is approximately 25 times more potent than CO_2, and there are vast amounts that are currently held in melting permafrost, unstable frozen blocks beneath our warming coastal oceans, and leaking natural gas reservoirs. Therefore, the warming challenge is larger than what is caused by CO_2 alone.

These data show that our atmosphere is different than it has been throughout the entire evolution of humans and our society. The stability and well-being of human society is closely linked to what happens in our atmosphere. Atmospheric processes control what happens to our climate. Our climate determines what kind of crops we can grow, and when. Our climate controls our water supply and determines what our landscape can look like. Our climate controls the temperature of our oceans and our atmosphere controls how acidic our oceans are. Even minor shifts in ocean temperature and pH can have large consequences for marine life and the billions of people who depend on the oceans for food. Climate, water temperature, and the amount of glacial ice on our continents control sea levels and the amount of land we can live on. Our atmosphere is no longer within its historic boundaries. It is rapidly shifting into a new and imbalanced system with behavior that is very different from what we have experienced in the past. These atmospheric shifts are disrupting our climate system and threaten our security and livelihoods. We must adapt and respond to protect and sustain our communities.

Climate Models

Climate models are an important tool to help predict the effects of climate change on the environment and society. In this report we use two different scenarios to compare future outcomes, based on Representation Concentration Pathways (RCP) developed by the Intergovernmental Panel on Climate Change (IPCC).

These pathways represent increases in the amount of GHG's in the atmosphere relative to the pre-industrial period (i.e., since the period before 1750).

- *Higher GHG Emissions*: RCP 8.5 is the higher emissions scenario, representing a continual rise in GHG emissions through the end of this century.
- *Lower GHG Emissions*: RCP 4.5 is the lower emissions scenario, representing a peak in GHG emissions around 2040, then a general decline.[5]

Climate Change is hurting us today!

The Fourth National Climate Assessment documented how climate change is hurting our country. Heat waves are becoming more dangerous. Forest fires are more frequent and severe, foul our air and threaten our homes and communities. Spring snowpack has declined, reducing the amount of water in our rivers and causing more frequent and severe drought. In our neighboring states, farms and towns are losing access to water, making our food more expensive, and our communities less secure.

These two RCPs provide likely upper (RCP 8.5) and lower (RCP 4.5) bounds of our future emissions, depending upon humanity's choices. These predictions have many uncertainties, but they give us valuable information.

4: Impacts of Climate Change on Coeur d'Alene

4.1 : Air Temperature

Over the last few decades, Coeur d'Alene has become widely known as an outdoor recreation and resort area and the location for endurance races such as the Ironman, Coeur d'Alene Triathlon, and the Coeur d'Alene Marathon. The beauty of our lake and its proximity to hilly and challenging bike courses and scenic running routes make the city a desirable competition location. Coeur d'Alene has been one of Ironman's oldest locations and has typically been held the last weekend of June since 2003. The Coeur d'Alene Triathlon has been held continuously in August since 1984.

Remember the heatwave during the summer of 2021?

Cliff Harris, CdA's climatologist, said the six-week period from late June to mid-August was the "hottest and driest in recorded history" in the Lake City[6]

For the entire world, only five other heat waves were found to be more extreme since 1960.[7] *The 2021 western North America heat wave was among the most extreme events ever recorded globally.*[8]

Weather has played a key role in the success of these events. Ironman® advertises average race day temperatures here as 75°F and a water temperature of 68°F. While these average temperatures are pleasant, the trend has been an increase in average temperature. The highest temperature was in 2015, with a 105°F high.[9] Weather can make or break an event and elevated temperatures negatively impact participant and spectator safety.

Winter activities remain popular among year-round residents and visitors, including skiing, snowshoeing, snowmobiling, ice skating, and ice fishing. These activities require cold temperatures for ice to form and precipitation to fall as snow instead of rain. Warming temperatures have altered how much water is retained in Idaho's snowpack and the amount of winter ice we have on our lakes. These changes threaten winter sport activities and generate safety concerns for ice skating and ice fishing.

2023 the Warmest Year on Record!

"After seeing the 2023 climate analysis, I have to pause and say that the findings are astounding," said NOAA Chief Scientist Dr. Sarah Kapnick. "Not only was 2023 the warmest year in NOAA's 174-year climate record — it was the warmest by far.[10]

Historical and Projected Average Air Temperature

Coeur d'Alene's air temperature is rising. Figure 4 shows Coeur d'Alene's average annual air temperature has increased by approximately 3°F, from ~47°F to ~50°F over the last 127 years.[11] Projections from the Climate Toolbox, under both the lower and higher emission scenarios, show our average annual temperature is projected to rise an additional 2 to 3°F by 2050 and then another 2 to 5°F by the end of the century. To summarize, while our average temperature rose 3°F over 127 years, it is expected to rise as much as 8°F over the next 77 years, approximately double what we've already experienced.

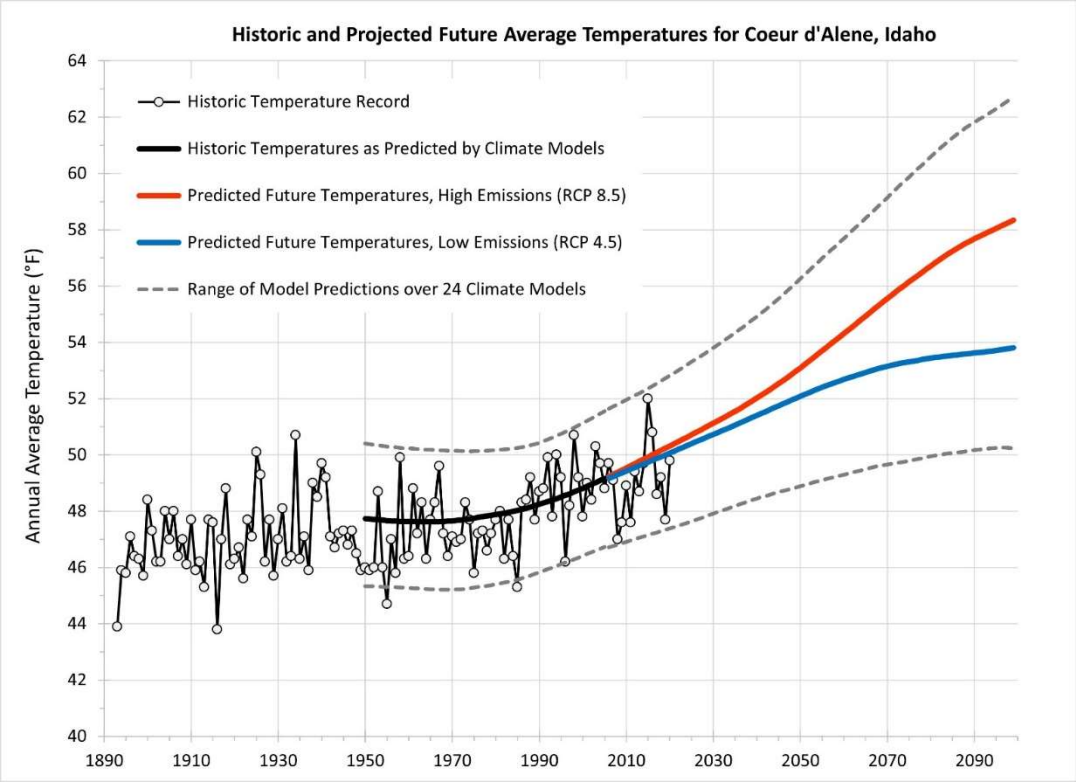


Figure 4 – Historic temperatures in the City of Coeur d'Alene[11] and modeled historic and projected future temperatures using the Climate Toolbox [1].

Projected Summer High and Winter Low Air Temperatures

The Future Climate Dashboard tool in the Climate Toolbox also includes projected seasonal average high and low temperatures for both lower and higher emission scenarios. Some key takeaways:

- Average summer high temperatures were approximately 87°F in the 1990's. They are projected to rise to between 93 and 95°F by mid-century and 94 and 99°F by the end of the century.
- Our hottest summer days were about 101°F in the 1990's. They are projected to rise to between to between 107 and 109°F by mid-century and between 108 and 114°F by the end of the century.
- Extreme heat days were approximately zero in the 1990's. They are projected to rise to between 2 and 6 days by mid-century and to as between 5 and 21 days by the end of this century. Extreme Heat Days are defined as days with a heat index (what the temperature feels like when combined with humidity) of 100°F or greater.
- Average winter low temperatures were approximately 24°F in the 1990's. They are projected to rise to between 29 and 31°F by mid-century and 30 and 35°F by the end of the century.

Consider the impact on our local economy and lifestyle if the average summer high temperature exceeds 90°F and our hottest days 110°F. Also, imagine our winters shifting from snow-cover to rainy mud, with average winter low temperatures at or above freezing. These would be profound changes.

4.2 : **Rain and Snow**

Probably the greatest impacts from climate change on the Coeur d'Alene region will arise from shifts in how and when we receive rain and snow. The total amount of precipitation (rain plus snow) we receive each year will likely not change much, though there may be larger seasonal shifts. However, warmer winters will cause more precipitation to fall as rain, rather than snow. This will have profound impacts on the future of our streams, lakes, forests, and farms. Figure 5 shows that Coeur d'Alene is expected to get as much total rain and snow in the coming years as we have over the past century, and maybe even a little more. This makes it seem as if climate change will not have a large impact. However, the total amount of precipitation that falls onto the land is only half the story. It is also very important to understand how that water is stored, and when it will be released into our streams and rivers. Snow and rain behave very differently.

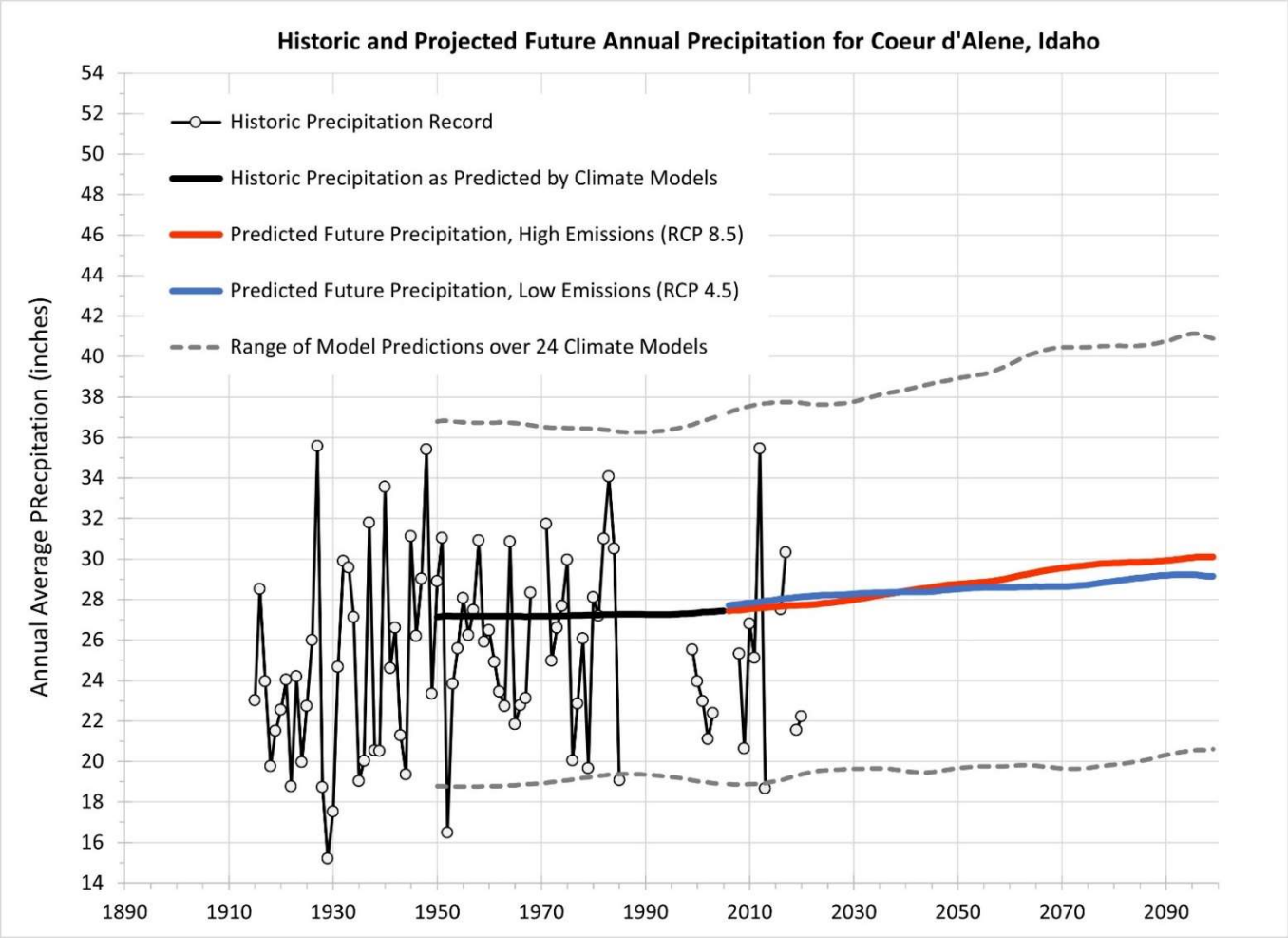


Figure 5 – Historic precipitation in the City of Coeur d'Alene[12] and modeled historic and projected future total precipitation using the Climate Toolbox[1]. Note that this figure is only for the City of Coeur d'Alene, not our overall watershed. The surrounding mountains will receive more precipitation, though the long-term trend is comparable.

To understand how the shift from snow to rain will impact us, it's first important to understand how these different types of precipitation move through our environment. Snow is like a giant water reservoir. It holds our water upstream for our cities, farms, and forests through spring and early summer, providing cold water for use when we need it most. This is not the case for rain. Rainwater is warmer. It runs off immediately and moves downstream, leaving us less water available for when we most need it. Thus, more rain and less snow mean that we will have less water available in summer – it will have already moved downstream. This loss of water will increase heat stress on plants, fish, and wildlife. It will also create water shortages and increase the risks of drought and wildfire. In addition, there may be a greater potential for flooding events from strong rainfalls and snowmelt events in winter and spring.

The graphs in Figure 6 summarize the changes we've already seen in our relative proportion of rain and snow (Figure 6A), and what we project for the future under a high emissions scenario (Figure 6B). We've already seen a ~10 –15% decline in the amount of precipitation that falls as snow, and that number could rise to be over 50% by the latter half of this century.

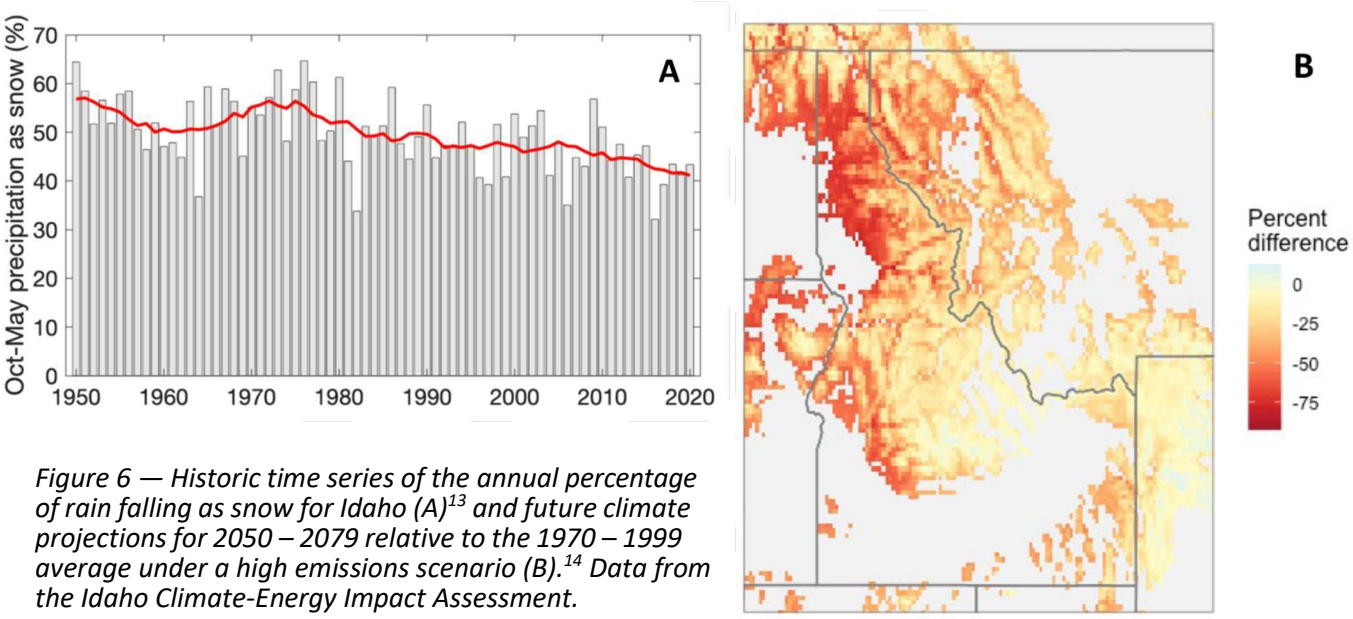


Figure 6 — Historic time series of the annual percentage of rain falling as snow for Idaho (A)[13] and future climate projections for 2050 – 2079 relative to the 1970 – 1999 average under a high emissions scenario (B).[14] Data from the Idaho Climate-Energy Impact Assessment.

Less snow has important implications for our future, beyond muddier winters and a browner Christmas. The loss of snow will lead to less water in our streams during summer, drier soils, and more drought. It may seem counterintuitive that we'll have more drought with the same amount of water. However, drought is not impacted by just water supply, it's also impacted by water demand. Warmer temperatures mean that plants lose more water, just as we sweat more when it's hotter. Less snow means that the water that used to be in our summer high-elevation snowpack, streams, and groundwater will have either moved downstream or been lost to the atmosphere. Extended years of fire and drought will tend to further reduce the land's ability to retain water through summer, exacerbating these impacts over time.

We have already seen a loss of water in our streams as temperatures have warmed and snow has been replaced by rain. Consider the map in Figure 7 (next page). It shows how stream flows have changed at the stream gauges in the Pacific Northwest where the longest dataset is available. This data shows a loss of

stream flow across many locations in the Pacific Northwest.

Data in Figure 7 show the following trends:

- Red and orange symbols represent measured declines in stream flows over the past 50+ years.
- Blue symbols show increased flows. White shows no change.
- Larger circles represent more certain changes, smaller squares show less certain changes.
- This figure is a simplified excerpt that shows only two of six different measures conducted by the University of Idaho. [15]

These data show that summer stream flows have declined at almost all sites where there is enough data to analyze, with the decline ranging from ~5 – 65%. Winter flows have decreased to a lesser extent but have declined in some locations.

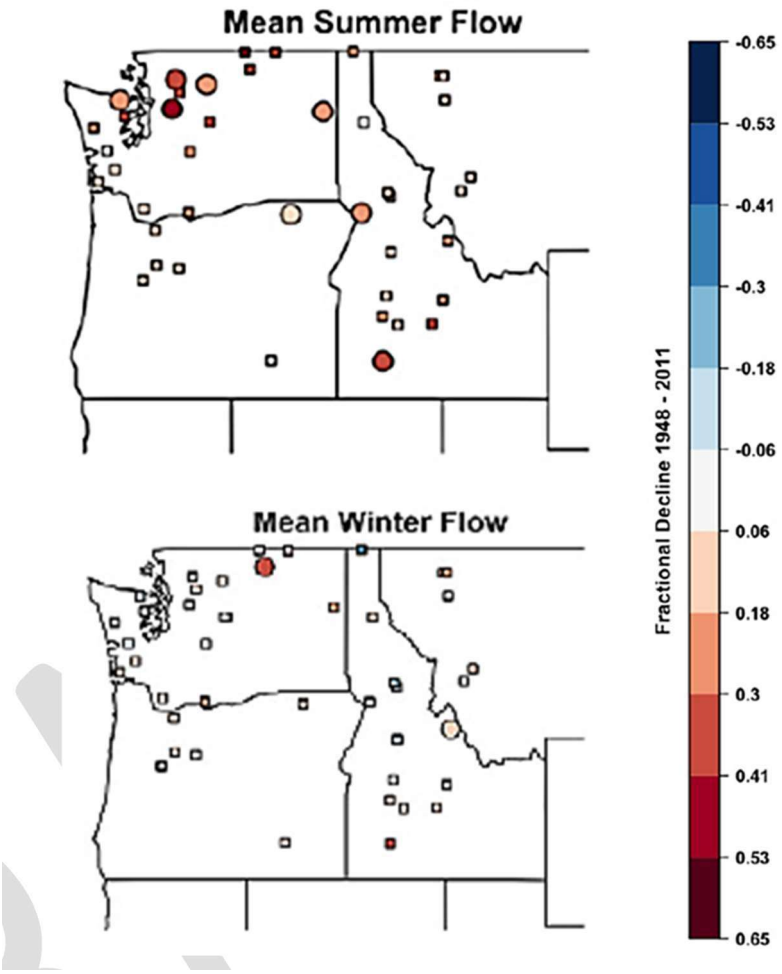
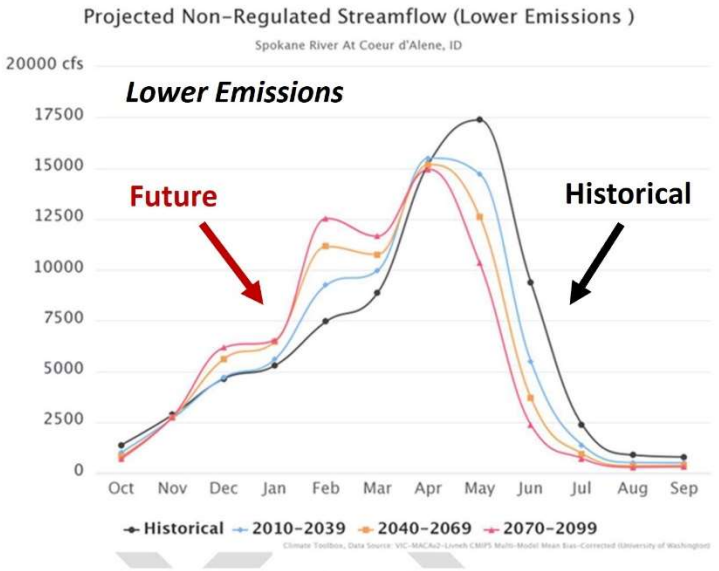


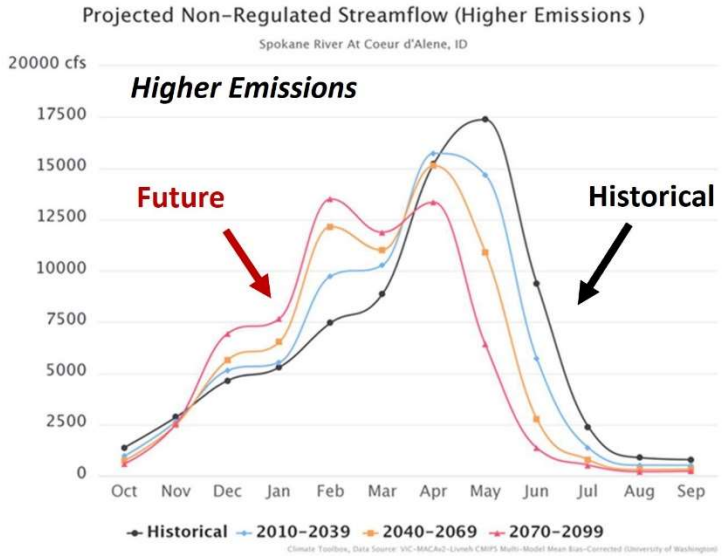
Figure 7— Historic Loss of Streamflow from 1948 to 2011, excerpt from Idaho Climate-Energy Impact Assessment, Water Report, Figure 11. Red colors indicate lower stream flows, circles are measurements with higher certainty than those with squares. [15]

Figure 7 shows the history of regional stream flows, demonstrating that climate change is already impacting our waters. Figure 8 (next page) provides a modeled projection of how the river flow in the Coeur d'Alene Basin is expected to change in the future under the two RCP scenarios. The charts are all model predictions that contrast historic climatic conditions with projected conditions in the coming decades.

The predictions in Figure 8 come from the Pacific Northwest Climate Toolbox and simulate the Spokane River, assuming no flow modifications due to the Post Falls dam. The actual historic flows for the Spokane River are influenced by the dam. Factoring in how future operations of the Post Falls dam might change would introduce an additional level of complexity that is not within the toolbox's analytical capabilities. However, the shape of the modeled historic curve is consistent with the historic record for gauges on the Coeur d'Alene and St. Joe Rivers that are not influenced by the Post Falls dam. Thus, these are reasonable predictions of what our future might look like. The model predictions in these figures show the following points.

- Two charts are provided here, one for each of the emissions scenarios.
- The lines in each chart represent average stream flows over the time-period that corresponds with that color.
- ***Historically,*** our long-term average has had a single peak flow event, with the highest average flows in May.
- ***During this century,*** we'll shift towards two peak flow events with lower and earlier flows. (April, February).
- ***A key finding***: our spring and summer flows will decline relative to what they've been historically. This will become worse as emissions increase over time.





Together, these models predict that we'll have less water when we most need it. This reduction in stream flow will reduce the amount of water that is available in summer. The combination of a lower water supply, higher temperatures, and greater evaporation and evapotranspiration will lead to more frequent and severe drought and a longer and more dangerous fire season. There will be additional damage to our traditional fisheries and hunting grounds as well.

In summary, we've already begun to see the impacts of historic climate change on our snowpack and in our streams. We have already seen more frequent and dangerous wildfires and more intense droughts. These changes will grow more noticeable as the warming climate melts our snow earlier – leading to earlier releases from this natural water storage system that is a crucial part of our environment and economy. Snow holds 50 – 75% of the water Idaho uses each year. Imagine what happens when that moves downstream by May instead of July. This is a major risk that must be addressed.

4.3 : **Drought**

The prior section described how changes in our rain and snow patterns will lead to greater impacts from drought, which is defined as a prolonged period of abnormally low rainfall and higher temperatures, leading to a shortage of water. Loss of snowpack can also lead to similar water shortages. We think of drought in terms of loss of farm and ranch production, which lead to food shortages and higher food prices. We also tend to think of drought in terms of more wildfire smoke and browner lawns. This seems to be more of an inconvenience than a threat, unless you are a famer/rancher or live in a fire-prone area where wildfire destroys lives and communities. We also tend to think of drought as a temporary thing that can be erased by a good period of winter rains. However, drought's roots and effects go much deeper than that.

> *"If you talk with most people, especially natives, they will say that the seasons have changed. There's only one thing you can attribute that to: that's global warming."*
>
> *Albert Neff, 68, long-time Kootenai County resident.*

Drought risks build over time. Much of our water here comes from groundwater aquifers rather than reservoirs and streams. The water in these aquifers is often replaced much more slowly than it is used – slowly "emptying the tub". Drier soils have different properties from wetter soils and some soil types tend to shed water rather than absorb water as they dry out. This can lead to a drying cycle that slows how fast our aquifers refill. Thus, repeated years of drought increases the risk of a truly devastating drought. As we've seen, climate change effects build on themselves and will tend to lead to longer and more severe droughts.

Figure 9- Lake Powell and Glen Canyon dam, April 2022. The white stone indicates where the water levels used to be. Drought and water over-use has caused water levels to drop by over 100 feet over the last 3 years. Power generating capacity has dropped by over 15%. Lose another 32 feet of water depth and electricity cannot be produced from this crucial dam.[16] *Regionally, Washington and Idaho have experienced a 10 – 15% reduction in flows through our hydropower dams. Our region is threatened as well.*

Coeur d'Alene has a moderate amount of agriculture, though our neighbors in the Palouse region to the south have a strong agricultural component of their economy. Our greatest drought impacts will likely be from food prices, wildfire and, interestingly, energy costs. Most of us think of energy in terms of the light

switches and electrical outlets in our homes, and occasionally our power bills. We don't usually think much about where energy comes from or how it is produced. *We often don't realize that water is essential to energy production*.

Consider hydropower, which provides approximately one-third of Coeur d'Alene's electricity. The lower spring and summer river flows predicted in the future (Figure 9) will reduce the amount of electricity dams can produce. At the same time, warmer temperatures will increase electricity demand for air conditioning. If we don't adapt, less supply and higher demand will likely lead to steadily higher energy prices. Our lakes and large reservoirs can buffer this effect. But, as we'll see in the analysis of how climate change impacts our lakes, drought will also reduce our lake and reservoir levels, as has recently been seen in more arid regions of the western U.S.

Drought also influences the production of electricity from fossil fuels, biomass, and nuclear energy, which currently combine to produce approximately 60% of the electricity provided to Coeur d'Alene. These power plants require water to turn heat into steam, which turns the turbines that make electricity. Reduced supply of water (from loss of snow) can lead to reduced energy production and even temporary shutdowns.[17] Higher air temperatures also reduce the power plant's efficiency while power demand increases. For example, in 2022 the combination of drought and high temperatures led the US Power grid regulator North American Electric Reliability Corporation (NERC) to warn of rolling summer blackouts across much of the nation.[18] Figure 10 shows a map of the number of U.S. power plants impacted by drought in the summer of 2022. These power disruptions were outside of Coeur d'Alene. But these and future disruptions can impact us through the integration of our energy markets.

Drought also impacts our fisheries. Less water in summer means lower stream flows and warmer water. Our native fish and the food they depend on need colder water. They suffer as water levels drop and temperatures rise. Our other wildlife, such as deer and elk suffer when temperatures rise, and water is less available. Increased drought will damage our summer recreational economy as well as our pocketbooks.

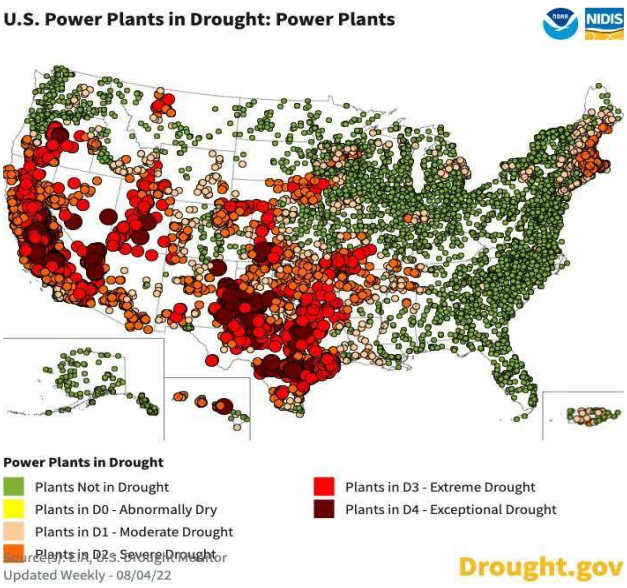


Figure 10 - Example of impacts of drought on electricity production. This map is from August 2022.

Climate change is making drought more frequent and more severe. The IPCC estimates that, globally, drought has already become 1.7 times more likely relative to the period from 1850 – 1900. It is likely to become 2 – 4 times more likely as warming progresses and our climate disruptions become more severe.[19] North Idaho's residents are lucky in that we live in a region with a climate that is less susceptible to drought than other parts of the U.S. and the world. This makes our job easier, but we will still face significant impacts that extend well beyond smokier summers and browner lawns.

4.2: Wildfire

Wildfire impacts Coeur d'Alene in many ways. Fires lead to hazardous air pollution, destroy wildlife habitat, and reduce recreational opportunities. They destroy homes, endanger firefighters and citizens, and are expensive to suppress. Wildfires can start anywhere. For example, at Tubbs Hill, a centerpiece of downtown Coeur d'Alene, with popular hiking trails and lake recreation opportunities.

Fire Danger Sign at the Tubbs Hill 3rd Street entrance (August 2021)

One way to quantify fire risk is to use general risk levels, like those displayed on the signs by the 3rd Street entrance to Tubbs Hill. Daily fire risk is defined by the National Fire Danger Rating System and warns of how likely a fire is to occur if the proper precautions are not taken. The Coeur d'Alene Fire Department receives the fire risk level from the Idaho Department of Lands and updates these signs to reflect the current fire risk. Fire risk levels are low, moderate, high, very high, and extreme.

What are the Fire Danger Ratings?[20]

Low - Fires may start from an intense source like lightning. Control is generally easy.

Moderate - Fires can start from most accidental causes. Control is often easy.

High - Fires start easily from most causes, small fuels ignite easily. *Control can be difficult, fires can become serious.*

Very High - Fires start easily from most causes and spread rapidly. Control can be difficult, fires can become much larger and longer-lasting.

Extreme - Fires of all types start quickly and burn intensely. Control can be very difficult, fires often last for several days.

Coeur d'Alene has begun experiencing more high-risk fire days. This change may seem small, but it is significant when that risk is multiplied by the millions of acres of forest that surround us and influence our air. Earlier springs, followed by drier and hotter summers have resulted in more frequent and severe wildfires across the western U.S., including northern Idaho. These fires have already begun to impact our communities, and the impacts of wildfire are expected to continue and become more pronounced.

To quantify this increase in wildfire risk we examined the Climate Toolbox's Fire Danger Days metric, under both emission scenarios. Results show that all projected Risk Fire Days increase compared to the past. The most notable increases are in Summer Extreme Risk Fire Days (Figure 11).

Key takeaways below compare the thirty-year period, 2040 - 2069, with historical norms. The lower emission result is the lower bound and the higher emission result is the upper bound.

- **Summer Extreme Risk Fire Days --** increase from 10 to between 16 and 20 days (60 to 100% increase).
- **Annual Extreme Risk Fire Days --** increase from 11 to between 18 and 21 days (64 to 90% increase).
- Over 90% of **Extreme Risk Fire Days** will occur in the summer months.

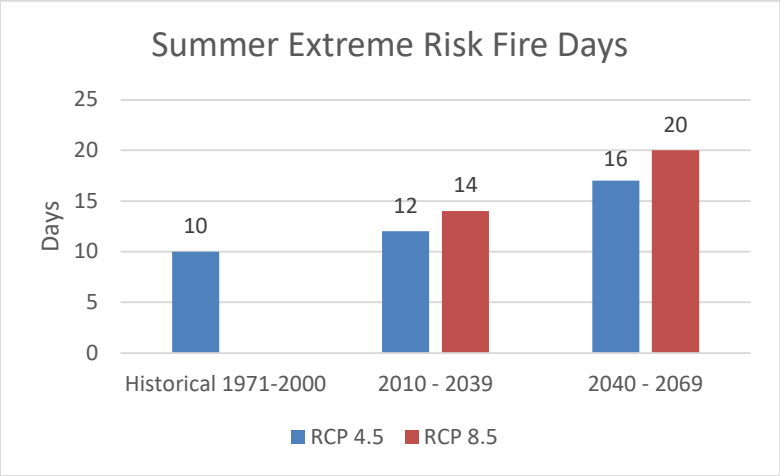


Figure 11. Predicted increases in summertime extreme risk days from the Climate Toolbox [1].

> *"So this is wildfire? Not at all what I thought.*
>
> *I wasn't in the forest, but in the middle of a town, with little patches of burning grass approaching my feet, little patches sneaking from house to house, sometimes flowing like little orange creeks through alleys and yards. In the middle of the day the sky was black as night. Next to me a woman with a car full of kids and pets pointed to an orange glow in the darkness. That's my house. That's everything I own."*
>
> Mike Bullard, CdA Resident and 10-year Disaster Volunteer for Red Cross, Federal Emergency Management Agency (FEMA), and Presbyterian Disaster Assistance

An example of the devastation that wildfires can bring to communities comes from August 2023, when the Gray Fire and Oregon Road fire razed over 350 homes and over 300 other structures in Medical Lake and other small settlements north of Spokane. These fires were fed by little rain, 100-degree days, and dry winds. The costs of these fires have not been calculated, but lives and homes were lost, and communities destroyed. The same month, the Ridge Creek fire in Kootenai County burned over 4,000 acres and prompted Level 1 evacuation warnings for residents in areas to the northeast of Hayden Lake, and closed Hayden Lake to boaters. The extent to which these fires are related to climate change is unknown. However, we can say that these types of fires will become more common as temperatures warm, and our summers become drier.

Gray Fire, Medical Lake, WA August 2023
COLIN MULVANEY/Idaho Spokesman

4.3: Human Health

The health of individuals and our community is affected by climate change in many ways. A partial list of anticipated negative impacts includes the following:

- increased heat related illness.
- reduced water supply and quality.
- Increased infectious diseases due to parasites, mosquitoes, and ticks.
- Increased air pollution.
- More frequent natural disasters such as wildfire.
- worsening of chronic medical conditions and mental illness due to natural disasters and displacement.

Coeur d'Alene, August 2015
MATT WEIGAND/Coeur d'Alene Press

In the Coeur d'Alene area, the most commonly occurring health effects are heat-related illnesses such as heatstroke and hyperthermia, and health impacts from exposure to wildfire smoke. These smoke effects include coughing, difficulty breathing, bronchitis, reduced lung function, worsening of asthma and COPD, and even increased risk of heart failure. Other effects include eye stinging, sinus irritation, headaches, general tiredness, and mental health impacts such as worsening anxiety and depression. If wildfires reach homes and communities, housefires emit toxic smoke from the burning of synthetic materials in homes.

Coeur d'Alene, August 2021

Wildfire Smoke and its Impact

One of the most common human health impacts from climate change in northern Idaho and the Pacific Northwest is from wildfire smoke. Unfortunately, we've all gotten to know wildfire smoke too well recently. Smoke has plagued every summer except two since 2015.

Wildfire smoke contains hundreds of chemical compounds, including carbon monoxide, nitrogen dioxide, nitric oxide, and ozone. Besides burning our eyes, smoke worsens heart conditions and other chronic medical problems, weakens the immune system, and exacerbates lung conditions such as asthma and allergies.

There are also increased emergency room and urgent care visits and hospitalizations due to respiratory infections. Most notably, long-term effects of wildfire smoke exposure led to development of decreased lung capacity in previously healthy individuals.[21]

A three-year case study following seven weeks of wildfire smoke in Seely Lake, MT in 2017 showed lung capacity declined in the first two years after the smoke cleared, with persistent reduction of lung capacity.[22] Smoke causes lung damage, even in people hundreds to thousands of miles from the flames. And direct exposure to fire results in burns, carbon monoxide poisoning and heat-related illness. Other risks include preterm birth, low birth weight, and increased risk of death from all causes.[21]

"My husband and I have lived in Coeur d'Alene since 2003. However, we're not sure how much longer we can stay here because of the wildfires making it so hard for me to breathe due to my asthma. If there are any wildfires, or if there's super heavy pollen in the air I can't go outside. I'm really stuck at home. I can't go camping, hiking, or swimming, which I love to do."

Tabitha Day, Licensed Masters in Social Work therapist and CdA Resident

"Avoidance of exposure to high levels of air pollution and air particles is paramount for individuals with chronic lung disease or those at risk for complications from air pollution. It is important during fire season and other times when the air quality is compromised to stay indoors and avoid exposure to poor air quality, particularly during the warmer middle parts of the day

Pulmonologist Todd Hoopman, MD at Kootenai Health-CdA

Some of the effects of wildfire smoke are from particulate matter, a component of air pollution. Tiny particles in the air, much thinner than a human hair (known as PM2.5 and PM10), gets lodged deep in the lungs. There they cause inflammation and multiple health problems, including increased risk of cardiovascular disease, heart attack, and stroke. In addition, PM2.5 in the lungs is associated with increased emergency room visits, chronic obstructive pulmonary disease (COPD), worsening asthma, development of respiratory disease, even premature death.[21,23] A 12-year study among more than 20,000 heart failure patients showed an increased risk of mortality among the patients due to particulate matter in wildfire smoke and other sources of air pollution. [24,25]

Heat-Related Illness

Heat waves have become more frequent and severe and are expected to worsen as climate change progresses. These cause heat related illnesses, from heat exhaustion to life threatening heat stroke. Body rashes form and muscles begin to cramp at core body temperatures above 104°F. These body temperatures cause heat exhaustion and worse, heat stroke, which is an inflammatory response that requires hospitalization.[26] These conditions were widespread during the heat waves we've already

experienced in Coeur d'Alene and the surrounding region; for example, late June to mid-July in 2021. These waves can be deadly, both to the elderly and those working outside in the heat. The 2021 heat wave killed 100's of people across the northwest and was shown to be a direct result of climate change, according to an analysis from an international group of researchers. This heat wave would have been a 1 in 1,000-year event under historical conditions. It was a virtually impossible occurrence without the environmental impacts from human-caused climate change.[27] Heat related illnesses will likely further increase as temperatures continue to rise. Extreme heat is also expected to further dimmish the productivity of outdoor workers in the manufacturing, service, agriculture, and construction sectors of the economy.[28,29] These factors suggest that heat events could even limit the number of tourists visiting and staying in the Coeur d'Alene area.

"Heat itself is not only a physiological but also a psychological stressor ...,"

Meighen Speiser,
ecoAmerica Executive Director

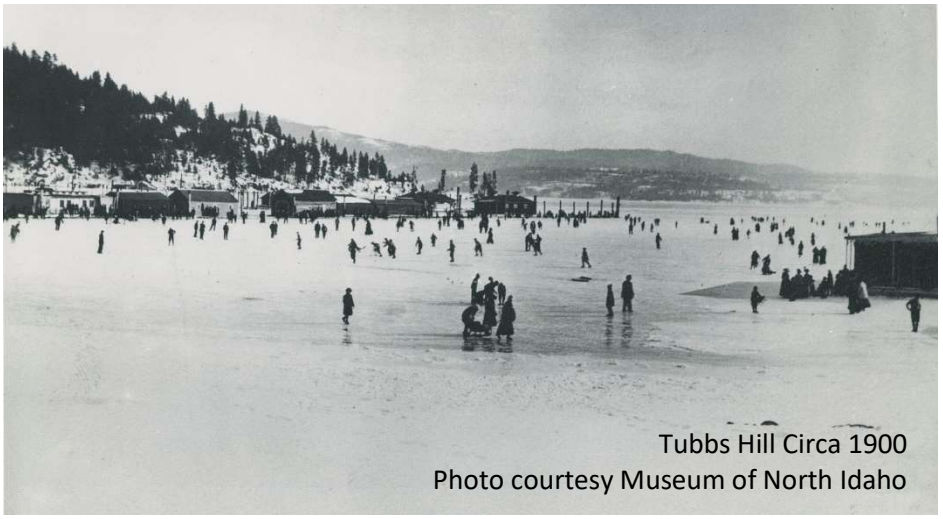
"At the community level, the rising temperatures are linked to not only interpersonal depression, including domestic violence, assault, rape and murder, but also intergroup violence, like political conflict and war."

Howard Kurtzman,
American Psychological Association
Senior Science Advisor [30]

Another heat related impact of climate change is increased plant growth and pollen production. Climate change has been found to lengthen the pollen season by 20 days across North America, from 1990 to 2018, in a 2021 study.[30] Increased carbon dioxide levels also increase the frequency of allergic reactions. Allergies worsen, in both adults and children, affecting work and school performance. Doctor and urgent care visits and associated costs increase.

Together, these examples of health impacts show that climate change can be expected to impact our communities on a personal level. Our children and elders will face increased health problems. Our outdoor workers and laborers will face increased occupational risks. There will be a higher demand for medical care, meaning that such care could become more expensive and difficult to attain. Our outdoor activities will become increasingly less pleasurable as summers become hotter and smokier. Our communities will need to respond and develop new strategies in order to continue our traditional activities, events, and way of life.

4.4 : Lake Health



Tubbs Hill Circa 1900
Photo courtesy Museum of North Idaho

North Idaho's clear mountain lakes follow an annual cycle that tracks with our climate and snow-fed streams. This cycle begins in winter, when our lakes are uniformly cold throughout their depth and were historically thickly ice covered before our climate began to warm. In spring, warming temperatures melt ice and snow, and we receive increasing amounts of rain. During this time, lake ice disappears, and the streams bring nutrient rich water into our lakes creating a spring plankton bloom. As spring progresses to summer, solar radiation warms the lakes' surface waters, creating a layer of less dense water that floats on top of the cooler, more dense waters deeper down. This stratification strengthens in summer and prevents oxygen in surface waters from mixing downwards. Algae grow and reproduce in the warm surface water. When they die and sink to the lake bottom, bacteria decompose them using oxygen in the process. Higher level predators that consume algae also defecate and produce organic matter for the bacteria to decompose. This bacterial decomposition can decrease oxygen concentrations in the deeper waters. In fall, the cooler air cools the lakes' surface waters and breaks down the stratification, leading again to the uniformly cold water in winter.[31]

Climate change has already begun to disrupt this cycle, and its impacts will grow as the planet continues to warm. According to the North American Lake Management Society, some of the key impacts we expect to see across all our lakes, both here in Idaho and elsewhere, are as follows.[32]

- Warmer winters and reduced snowfall will reduce ice cover, leading to loss of winter ice.
- We will also have less snow and more rain, snow will melt earlier, stream flows will begin to decrease earlier, and lakes will begin to warm earlier.
- Warmer waters and an earlier spring will lead to a longer period of lake stratification in summer.
- Warming temperatures will also increase the growth of algae and rooted plants – altering the ecology and thickening plant growth.
- Warmer summer and fall temperatures will further lengthen how long the lake remains stratified, driving oxygen levels even lower as the year progresses.
- Lower oxygen levels in the lakes' hypolimnion (bottom waters) will change the chemistry in the lakes' sediments in ways that release more nutrients into the lake from the sediments, as well as other contaminants. In Coeur d'Alene Lake, toxic metals like lead, arsenic, and cadmium can be mobilized. These metals are a legacy of 19th and 20th century mining activities.
- The combination of more nutrients and temperature shifts in the lakes' ecology will increase the frequency and duration of toxic algae blooms.
- Warmer lake waters will shift fisheries toward warmer water species, leading to a decline in native cold-water salmonids such as salmon and trout.

- Invasive species will become more difficult to manage, as warming waters will shift the lakes' ecological balance to be less suitable for native, cold-water species.
- Lower summer stream flows, combined with higher summer temperatures will increase the amount of evaporation and lead to lower lake levels.
- Larger rainfall events will enhance erosion and increase sediment loading to lakes.

Some of these changes have already begun to occur. The most obvious long-term change is the loss of ice-covered lakes during winter. There is not a thorough historic data record, but the anecdotal evidence is compelling. For example, consider Coeur d'Alene Lake. Throughout the early 1900's, the lake regularly froze over during winter. Ice skating near Tubbs Hill was a common winter activity. In some years, residents could drive across the frozen lake and regional steamboats had to use icebreakers during winter cold snaps. The northern lake now only has an occasional thin sheen of ice in enclosed areas during winter, and skating has not been possible since the 1980's.

The quality of our summer days on the lakes is being degraded by wildfire smoke, toxic algae blooms, and the spread of invasive species such as Eurasian Watermilfoil, which have all become a regular occurrence in many of our lakes over the past decade. It is becoming more difficult to manage algae blooms and invasive species, and our taxpayers are beginning to foot the cost of new infrastructure to maintain lake levels in accordance with our laws. A summary of the impacts of climate change on our lakes follows.

Eutrophication occurs when lakes are enriched with nutrients that over-stimulate plant growth. This overgrowth creates a chain reaction that can lead to toxic algae blooms, oxygen loss, fish kills, and habitat loss.

Harmful Algae Blooms

Harmful algae blooms (HABs) occur when colonies of toxin-producing algae grow out of control and produce toxic or otherwise harmful effects on people and wildlife. The blooms consist of cyanobacteria that produce a range of toxins, ranging from skin irritants to deadly neurotoxins. Health effects include gastrointestinal illness, headaches, skin irritation, joint and muscle pain, disorientation, short term memory loss, liver damage, seizures, paralysis, and even death. Even inhalation of fumes from a bloom can sicken people and impair breathing. People and wildlife can be exposed by swimming, drinking water, inhaling fumes, and consuming fish and shellfish that have ingested the cyanobacteria and toxins. Even when toxins are absent, the blooms are unsightly and can produce foul odors.[33,34]

Harmful algae bloom in Hayden Lake. This bloom prompted the issuance of a public health advisory.

Climate change has already begun to warm our waters and increase the frequency and severity of these dangerous blooms that are a regular summer occurrence on many of our lakes.[35] Climate change can influence the occurrence of harmful algae blooms and their toxicity. A key impact comes from earlier stream runoff and higher temperatures that can warm lake waters earlier, cool them later, and increase the length of time a lake remains stratified. This will influence the risk of toxic algae blooms in several ways. Warmer water temperatures favor the growth of the toxin producing cyanobacteria that comprise these blooms over other species of algae. Additionally, warmer waters and longer stratification leads to greater overall algae growth and less oxygen in a lake's hypolimnion. This oxygen loss releases nitrogen and phosphorus from the lake sediments into the overlying water, stimulating algae growth and often favoring the growth of cyanobacteria. This process can also generate a positive feedback loop that worsens the bloom.[36]

North Idaho has experienced in increased number of blooms in recent years, as the effects of climate change have become more visible. The limited data we have available suggests that blooms appear to be forming earlier and disappearing later. This increased incidence and severity of these blooms has led to more health advisories, less recreational opportunities, and economic loss. State of Idaho environmental and health agencies are having to direct significant resources to this problem, placing an increasing burden on the State's manpower and financial resources.

Lower Lake Levels

A lake's level depends on the balance between the amount of water flowing in, flowing out, and what is lost via evaporation. Climate change will both reduce the amount of water flowing into our lakes and increase the amount of water lost through evaporation. This will bring new legal, financial, and environmental challenges. Some of North Idaho's most important lakes, including Coeur d'Alene Lake, Priest Lake and Lake Pend Oreille have a requirement to maintain summer lake elevation at a set level. The rivers that flow out of these also must maintain a certain minimum flow to meet legal requirements and protect cold water fish. Lower lake levels will also require that docks and boat launches be modified to maintain access.

Consider Coeur d'Alene Lake, where there is a requirement to maintain a summer pool of 2,128 ft elevation and maintain minimum flows in the Spokane River (500 cfs at the Post Falls Dam). The chart below shows lake elevation for summer months (July – September) for Coeur d'Alene Lake, since 2007. Each spring, the lake level rises as Avista fills the lake to above summer pool in preparation for the summer season. During summer, the lake is held at the required summer pool while also providing hydropower generation and sustaining minimum stream flows in the Spokane River (to protect

downstream water quality). During summer, the lake level slowly drops as evaporation and lake outflows exceed lake inflows. Note the difference between 2015 and the other years. Lake levels had already begun to decline by July and then proceeded to reach their lowest level on record, approximately 6 inches below summer pool. Regional climatologists estimate that within our lifetimes, years like 2015 will become a more typical year.[37,38] We can expect lower lake levels in future years.

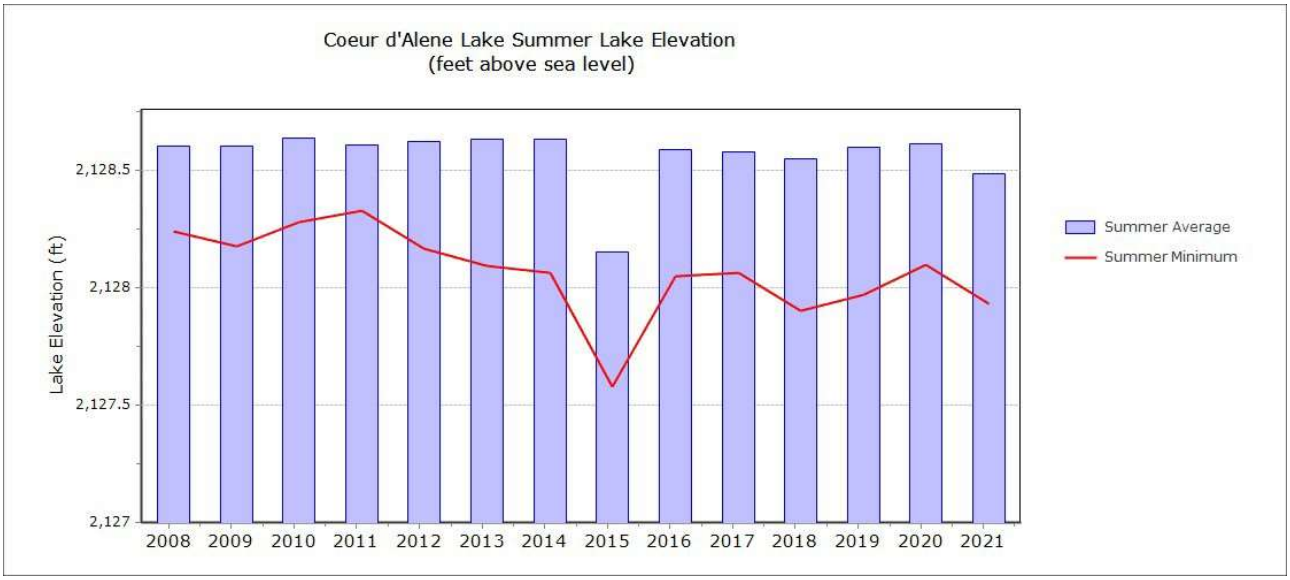


Figure 12. Historic record of summer lake level for Coeur d'Alene Lake. Note the much lower level in 2015, which is a year most regional climatologists describe as indicative of likely future climate conditions.

A lake decline of only 6 inches may not sound like a lot, but in 2020 the State of Idaho directed $5 million be spent to elevate the gates of the Priest Lake outlet dam by that much (6") and modify the Thorofare channel between Upper and Lower Priest Lake.[39] This is needed because the water balance in dry years reduces the lake level below its statutory level (2,437.7 ft) and makes the Thorofare channel too shallow to safely navigate in power boats.

Invasive Species and Loss of Traditional Fisheries

North Idaho's lakes host rich fisheries of salmon and trout. These fish species, technically referred to as cold-water salmonids are dependent on large volumes of cold water (~40 – 60 deg F) and abundant oxygen. Loss of cold, oxygen rich waters will hurt these iconic fish and lead to fish kills if water gets too warm. Warmer waters will also cause invasive species such as Quagga Mussels and Eurasian Watermilfoil to colonize and spread more aggressively.[40] These invasive species out-compete our native species and can cause millions of dollars in damage and control costs. For example, quagga mussels clog drains, drinking water systems, irrigation pipes, and dams, and infest beaches and docks. They can even coat a lake's crustaceans and damage fish spawning areas. Eurasian Watermilfoil can grow so thickly that it makes boating and fishing impossible and degrade property values. It easily spreads, and even a tiny sprig that settles into the lake's sediments can quickly sprout into a full-grown plant. These plants rapidly hybridize and become resistant to the pesticides used to control them.


Kokanee salmon


Cutthroat trout


Eurasian watermilfoil

The loss of cold-water habitat in lakes is often an invisible process. It occurs many feet below the surface, where the fish can experience an oxygen and temperature "pinch". Lower oxygen levels grow from the bottom-up and warmer water pushes from the top-down, leading to a shrinking zone of water that is both cold and high in oxygen. Climate change will deepen the warmer surface waters while also lowering oxygen in the deeper waters, shrinking the safe zone for these unique native fish while growing the zone for invading warm water fish. The combination of habitat loss and increased competition will degrade our cold-water fisheries and may eventually eliminate these fish from several of our

region's lakes.

The combined forces of temperature change and species competition will also make it more difficult and expensive to combat invasive species. Idaho currently operates a network of daylight-hours boat inspection stations that have inspected over 950,000 boats and quarantined several hundred from 2009 – 2021. It is estimated that if Idaho's waters were to become infested, managing the impacts of these mussels would cost over $100 million annually. This number may rise further in the future as Idaho grapples with the recent positive confirmation of quagga mussels in the Snake River in southern Idaho.

Dept. of Agriculture Boat Inspection

Quagga mussels

Idaho's dam operators and water management agencies already spend millions of dollars each year to manage milfoil and slow the rate of infestation. In some areas, such as the southern reaches of Coeur d'Alene Lake and the lateral lakes along the Coeur d'Alene and St. Joe Rivers, herbicide treatment is no longer effective and water managers are turning to mechanical means that will be an ongoing annual cost for the foreseeable future. Global warming, along with increased recreational use of our lakes is putting our lakes and streams at greater risk of damage from invasive species. This is an urgent and little recognized problem that needs greater attention and a more aggressive response.

5: Economic Impacts of Climate Change

Climate change is beginning to impact our lives and pocketbooks here in Coeur d'Alene. One of the greatest impacts is at the grocery store.

- Climate change is reducing agricultural productivity and disrupting supply chains.[41] Studies have indicated that the climate change we've already experienced may have reduced global agricultural productivity by approximately 20% since 1961.[42]
- Regionally, loss of snowpack is shifting our water supply to make droughts more frequent and severe. The droughts of 2021 and 2022 resulted in historic lows in America's agricultural production,[43] including Idaho where agriculture is almost 20% of our economy.[44]

There are many other impacts of climate change to the U.S. economy, including loss of housing and infrastructure, and general loss of economic productivity.[45] Beyond these systemic impacts, there are local impacts from wildfire, changing snow patterns, public health, and tourism.

Economic Impacts of Wildfire

One of the most visible impacts of climate change in Coeur d'Alene and our surrounding region is the increasing prevalence of wildfire. Wildfire has many impacts that are difficult to quantify. How does one put a price on our history of clean air and clear skies during summer outdoor work and play shifting to nasty wildfire smoke? How does one account for the cost of cultural loss in addition to the costs of people who don't visit or businesses that never locate here? That task is beyond our ability to tabulate. However, we can use the cost of fighting wildfire as one example of the economic impacts of wildfire. Climate change is estimated to have doubled the amount of acreage burned in the western U.S. over the past 20 years,[46] and this has greatly increased the costs of fire suppression.

Wildfire smoke represents . . .

"the most obvious and drastic change in our operations. Views are diminished for guests, breathing is less pleasant, few stars to view while camping"

Row Adventures has seen . . .

"diminished bookings in August due to guests being aware of wildfire smoke. More cancellations as well, some last minute due to the smokey conditions."

If my company . . .

"can't book a late August trip on the Middle Fork of the Salmon River because guests are worried about lower water and smoke, that's a loss of about $75,000 in potential revenue."

Jonah Grubb, VP & General Manager of Row Adventures - a Coeur d'Alene rafting trip outfitter

- ***Nationwide***— prior to 2000, fire suppression costs for the U.S. government rarely exceeded $500 million /yr. Since 2010, the average cost exceeds $2 billion/yr.[47]
- ***Idaho***— prior to 2010, fire suppression costs for the Idaho Department of Lands rarely exceeded $20 million /yr. Since 2012, costs have often exceeded $20 million and were over $75 million in both 2015 and 2021.[48]

Wildfire also has tremendous costs in property loss, healthcare costs, and loss of a community's economic base when people choose not to rebuild after multiple fires.

- U.S. property loss due to wildfire was less than $10 billion /yr. prior to 2000, but now exceeds $15 – 20 billion/yr.[49]
- Wildfire smoke also contains high levels of particulates that can damage our lungs and increase healthcare costs. One impact comes from fine particulates (PM 2.5), which penetrate the lungs and worsen respiratory illnesses.
- Prior to 2000, fewer than 0.5 million Americans were exposed to days with extremely unhealthy levels of PM 2.5, and now over 5 million Americans are exposed annually,[50] with most exposure happening in the western US. Locally, Spokane and Coeur d'Alene can have some of the nation's worst air quality when there are regional fires.
- Nationwide, short-term exposure costs are currently estimated to be $11 – 20 billion/yr., and long-term impacts of regular exposure are $76 – 130 billion/yr.[51] These costs are likely to increase as fires worsen.

There are not data on the property and health care costs specific to wildfire in Coeur d'Alene itself. But, summer days on the lake are often obscured by wildfire smoke and we are feeling the impacts on our health and recreation.

Economic Impacts of Warmer Temperatures, Reduced Snow, and Summer Drought

One of the impacts of rising temperatures is an increase in heat waves, where extreme heat can cause heat exhaustion, dehydration, and heatstroke that is particularly dangerous to young children and the elderly. One cannot put a price on the health and well-being of our children and elders! We also can't put a cost on all that we lose when our days shift from the mid-80's to lower 90's up to mid-upper 90's and hotter; or how our lives are lessened by losing wildlife. But we can evaluate the cost of cooling homes and providing health care when there is insufficient cooling available.

National studies have also shown an increased risk for extreme heat days.[52] These hot days kill people and are one of our deadliest weather hazards. For example,

- There are estimated 600 – 1,300 heat-related deaths per year as a long-term average.[53]
- By mid-century, U.S. heat-related deaths may be over 50% higher than prior to 2000.[54]
- Treating heat illness is expensive. One study of a 2-week heat wave in California in 2006 concluded there were 655 deaths, 1,620 hospitalizations, and over 16,000 emergency visits, costing ~$5.4 billion state-wide.[55]
- There is not similar data for Coeur d'Alene. However, regional news outlets have reported widespread heat-related illnesses and deaths, as well as a doubling of healthcare visits in Washington during the 2021 heat wave. There are also many homes that are not air-conditioned, and our region has insufficient cooling centers. There will be impacts from heat waves.

Another impact from warming temperatures will be less overall snow in winter and a shorter snow sport season. For example, consider the ski industry.

- Idaho has over 1.5 million ski visits per year and exceeded 2 million visits in 2020.[56]
- In 2020, skiers and snowboarders spent almost $310 million at our ski areas and local businesses, with an additional ~$310 million in indirect gross domestic product.
- A case study of projected climate change impacts on the skiing industry looked at 247 locations across the continental US. Virtually all locations see reductions in winter recreation season lengths, exceeding 50% by 2050 and 80% in 2090 for some locations.[57] Annual impact could result in millions to tens of millions of foregone recreational visits annually by 2050, with an annual monetized impact of hundreds of millions of dollars.[58]

This only includes snow skiing and does not account for other types of snow recreation. A shortening snow season will damage this economic engine that is important to Coeur d'Alene and the surrounding region. Skiing is a large U.S. industry that employs as many people as coal mining, and the loss of ski jobs will hurt North Idaho's winter economy.[59] Loss of skiing is only one small window into the larger cultural impacts of snow loss. It doesn't account for the cultural losses of ice fishing and ice skating with family and friends, or the loss of white snowy landscapes during otherwise darker, grayer days.

Summer drought will also have many impacts as water becomes scarcer and more expensive, impacting food production across Idaho and the western U.S. Unlike the rest of Idaho, agriculture is not a large part of the economy of Coeur d'Alene. However, drought will have direct economic impacts here, primarily in cooling costs. Locally, Avista Utilities gets approximately 50% of their power from hydropower and biomass. The remainder comes from fossil fuels (41%) and wind (9%)[60]. Droughts can reduce biomass availability and reduce the amount of water in our streams in summer – when higher temperatures and air conditioning will increase power demand. Less hydropower available and higher demand will lead to higher energy prices.

Economic Impacts to Tourism and Outdoor Recreation

Idaho is one of the nation's top tourism destinations. It contributes $3.5 billion to our state's economy each year, with ~$850 million coming from North Idaho. The Department of Commerce states that the top reason for people to visit here is to see friends and family; the second most important reason is our outdoor recreation. Four of the top six visitor activities involve the outdoors: hiking/backpacking, visiting landmarks/historic sites, swimming and visiting national/state parks. Eight of the top ten visits involve the water. Here in Kootenai County, where tourism is our largest employer with over 10,000 employees, Coeur d'Alene Lake and Lake Pend Oreille are the top two destinations.[61] Other aspects of tourism include:

- *Skiing & Snowmobiling* – due to increasing temperatures, the ski season is opening nearly a month later than the 1960s or '70s[62] and decreased snowpack is expected to shorten the snowmobiling season.[63]
- *Fishing* – stream habitat suitable for bull trout and cutthroat trout is expected to decline 46% and 11%, respectively, with a 2° C [3.6° F] warming, as streams exceed their tolerance.[64]
- *Hunting* – climate warming is impacting hunting through habitat loss, increased heat stress, and

increased mortality of important game species from disease.[65]

- *Boating* – increased wildfire smoke and reduced summer flows reduce opportunities for stream recreation. Idaho's rivers and lakes are a world-class destination for fishing, rafting, and general summer floating; with over $180 million/year in primary economic benefits.[66]
- *Harmful algae blooms* – toxic algae blooms have become a persistent problem on Idaho's lakes and many rivers, and they hurt our economy and lifestyle. While there are no direct measures of the impacts of these blooms in north Idaho, many of our lakes have health advisories that reduce recreational opportunities and tourism income.
- *Hiking, camping, cycling, general outdoor recreation* – the combined value of these activities to Idaho is over $500 million/year in primary spending.[66]
- *Next door in Montana* – A study commissioned by the Montana Wildlife Federation projects climate change could cost Montana $260 million by 2050 due to loss of jobs and labor earnings from outdoor industries like hunting, fishing, tourism, and recreation.[67]

There are additional outdoor recreation and tourism-based impacts of climate change. Outdoor recreation is more than a business for north Idaho; it is a way of life, and a large reason why businesses locate here. Loss of outdoor opportunities and its lifestyle will hurt our bottom line.

6: Mitigating Coeur d'Alene's Contribution to Climate Change

6.1 : Reduce Personal Greenhouse Gas Emissions

The most effective way to lessen the effect of climate change on our communities is to reduce humanity's GHG emissions. Achieving this global change requires everyone, everywhere to do their part, including here in Coeur d'Alene. Reducing GHG emissions will reduce the extent of the changes we'll see and help avoid the harsher impacts of the more dangerous scenarios. The lower emissions scenario assumes a peak in emissions around 2040 (less than 20 years from today), followed by a general decline. This decline would result in less energy absorbed by our atmosphere in the coming years. The actions in this section are intended to help our local communities contribute to the global effort to reduce global emissions starting in 2040.

Burning 1 gallon of gas produces 20 lbs. of CO_2!

It sounds impossible, but it's true!

Most of the weight of the CO_2 doesn't come from the gas itself, but from the oxygen in the air. That oxygen combines with the carbon in the gas to create 20 lbs. of CO_2.[68]

To address our emissions, we need to know how we in Idaho are emitting CO_2. Table 1 shows Idaho's CO_2 emissions for 2019, in millions of metric tons, based on fuel and sector type. Total Idaho CO_2 emissions were 20.1 million metric tons in 2019. Most emissions (55%) are from petroleum products burned in the transportation sector -- 11.1 million metric tons. Combined residential, commercial, and industrial uses of natural gas were 24% of Idaho's emissions in 2019.

Table 1: 2019 Idaho CO_2 emission in millions of metric tons by Fuel and Sector Types[69]

Sector	Fuels			Total
	Coal	Petroleum	Natural Gas	
Residential	0	0.4	1.7	2.1
Commercial	0	0.4	1.1	1.5
Industrial	0.2	1.0	2.0	3.2
Transportation	0	11.1	0.4	11.5
Power Generation	0	0	1.7	1.7
Total Emissions:	0.2	12.9	6.9	20.0
Overall Percentage	1.0 %	64.5%	34.5%	

While transportation is important in our lives, we can all lower our transportation-related emissions. Steps we can all take include,[70]

- Walk or bike for shorter trips. Biking and e-biking results in a much faster emission reduction than even electric vehicles (EVs)[71].
- Work from home one or more days per week if your job allows it.
- Carpool instead of driving alone.
- When you do need to drive, plan ahead to combine trips.

- Drive less aggressively to save money and reduce emissions. Speeding and rapid acceleration can lower your gas mileage by 15 to 30%.
- Avoid hauling cargo on your car roof. A roof-top cargo box can lower fuel economy by up to 8%.
- Remove excess weight in your vehicle. An extra 100 lbs. can reduce your fuel economy by 1%.
- Maintain your car by following the manufacturer's maintenance schedule.
- Consider saving money with a more fuel-efficient car, a hybrid, or EV.

Idaho's adoption of electric vehicles has been modest. There were 2,990 electric vehicles registered in Idaho in 2021, a tiny fraction of the total noncommercial vehicles registered in the state. EV registration is trending up, though; over 2,300 had already been registered as of late July 2022, with five months to go before the new year.[72] Barriers to the EV transition include EV and battery cost, range, and availability of charging stations. But the automobile industry and many regional governments (local, state, and federal) are tackling these challenges.

- Idaho will receive $28 million over the next five years to build charging stations every 50 miles along the interstate, according to Idaho Transportation Department (ITD) plans.[73]
- Idaho families are eligible for a $4,000 tax credit to purchase a used EV, and up to $7,500 to purchase a new EV.[74]
- Ford is on track to deliver more than 2 million electric vehicles annually by 2026, equal to about one-third of the company's global volume, on the way to 50% by 2030.[75]
- General Motors is targeting 1 million EV annual capacity by 2025 and plans to eliminate tailpipe emissions from all new light-duty vehicles by 2035.[76]

"I'm what's known as an early adopter. From 2012 to 2015 I had a Tesla Roadster which was Elon Musk's "proof of concept" car. In 2018 I bought a Chevrolet Bolt (with a B) pure electric car which I use today on a daily basis. This proved to be prophetic as the price of gas rose. I love my Bolt and charge it in my garage every 2 weeks or so.

I also built a "passive house" with rammed earth walls, triple pane windows, heat pumps for HVAC and hot water, and numerous other energy saving features."

Rob Rutherford, Coeur d'Alene resident

Additional steps we can all take as individuals to reduce our emissions include:

- Upgrade your gas furnace and water heater to high efficiency options such as a heat pump.
- Retire you gas can! Replace gas powered lawn tools (lawnmowers, leaf blowers) with their electric equivalents.
- Join the Avista My Clean Energy Program which allows customers to offset carbon emissions associated with their energy use.
- Reduce consumption, reuse what you can and recycle what you can't reuse.
- Support local farmers markets and grocery stores and restaurants that feature locally grown foods.

What's a heat pump?

A heat pump is an appliance that acts like a heater during cold weather and an air conditioner during hot months.

Benefits?

- Heat pumps have efficiency greater than 100% because they don't create heat like a gas furnace, but only move it from one space to another.
- Increased efficiency means cheaper Avista bills!
- Heat pumps are powered by electricity, not fossil fuels.
- Cold-Climate Heat Pumps operate with nearly 400% efficiency at 47°F, and 200% at temperatures to 0°F.[77]
- Rebates up to $8,000 are available, or a tax credit up to $2,000.[78]

6.2 : What can be done at a larger scale in Coeur d'Alene?

Two Idaho cities have developed plans to increase efficiency, reduce waste, GHG emissions, and save money. The City of Moscow has developed an aggressive Climate Action Plan (CAP)[79] that calls for the Moscow community to:

- Cut emissions in half by 2035.
- Be net-zero emissions by 2050.

Moscow's 2020 Municipal Operations' GHG emissions were 22% lower than 2008 levels due to city efforts to improve efficiency and limit emissions.[79]

Boise also has a CAP[80] that includes the following.

- All government facilities to have 100% clean electricity by 2030.
- All government facilities and operations to be carbon neutral, and all of Boise to have 100% clean electricity by 2035.
- To be carbon neutral by 2050.

"Climate action isn't just about the environment, it's about growing a strong, clean, and thriving climate economy."

Lauren McLean, Mayor of Boise[81]

What could Coeur d'Alene or Kootenai County do in its own Climate Action Plan? We could join both Moscow and Boise in taking action to address the highest emitting sectors: transportation, plus residential, commercial, and industrial use of natural gas. Below are actions Coeur d'Alene could take.

Action #1. *Replace School Buses with Clean School Buses* - Take advantage of the Environmental Protection Agency's (EPA) Clean School Bus program,[82] which provides $5 billion over fiscal years 2022 through 2026 to replace existing school buses with zero-emission and low-emission models. The program strives to save school districts money as they replace older diesel buses with new, clean school buses, freeing up resources for schools.

These buses eliminate or reduce:

- GHG emissions
- School bus exhaust and its health risks to children.
- Costs associated with diesel fuel.

Electric school busses charging[84]

Two Idaho school districts will receive more than $5 million in total grant funding for electric buses through this program. Genesee School District in North Idaho requested funding for three buses, totaling $1.185 million, and McCall-Donnelly Joint School District requested funding for 10 buses, totaling $3.95 million.[83]

Action #2. *Encourage bicycling by Improving its safety* **–**

Bicycling reduces our dependence on automobiles and their associated emissions. The Coeur d'Alene Pedestrian and Bicycle (Ped/Bike) Advisory Committee promotes non-automotive forms of travel, and the development of safe pedestrian and bicycle facilities into a well-designed, integrated transportation network for all Coeur d'Alene citizens.[86] Their accomplishments include:

- Bike lane installation
- Development of a Trails and Bikeways Plan
- Purchase and installation of bike racks in downtown Coeur d'Alene[87]

More than half of all daily trips in the U.S. are less than three miles long [85]

The Ped/Bike Advisory Committee and the City of Coeur d'Alene are considering several additional safety improvements including protected bike lanes and safer sidewalks.[88] In addition, the Ped/Bike Advisory Committee supports an annual Bike to Work/School Week.

Additional Ped/Bike Advisory Committee projects could be funded via the US Department of Transportation's (DOT) Safe Streets and Roads for All (SS4A) Grant Program. Like the Clean School Bus program, the SS4A Program provides $5 billion over fiscal years 2022 through 2026 to support city planners who have developed an action plan to prevent roadway related injuries and deaths. Included in the DOT's list of example activities is supporting the development of bikeway networks.[89]

Action #3. *Expand our Urban Canopy* - Urban Canopy, those trees planted in and around city streets and residential neighborhoods, deliver a range of energy, environmental, health, and social benefits that support both mitigating and adaptation efforts. Shaded surfaces can be anywhere from 25 to 45°F cooler than the peak temperatures of unshaded surfaces.[90] Benefits a robust Urban Canopy provide include:

Kootenai County is losing tree cover!

From 2001 to 2022, Kootenai County lost over 106,000 acres of tree cover. That's over 166 sq miles, equivalent to an 18% decrease in tree cover since 2000. Global Forest Watch estimates that much forest loss is equal to over 22 million tons of CO_2e emissions.[91]

What is Avista doing about Clean Energy?

"You may have heard about new legislation in Washington with the Clean Energy Transformation Act. This law sets more milestones to continue the clean energy journey and reduce carbon emissions. We have been doing this for quite some time with decades of innovation and adding clean energy sources like biomass, wind and solar.

We also set our own clean energy goals to serve our customers with 100% clean electricity by 2045 and to have a carbon-neutral supply of electricity by the end of 2027. On the natural gas side, our goal is to be carbon neutral by 2045, with a near-term goal of 30% reduction in greenhouse gas emissions by 2030."[92]

Dan Johnson
Avista's Director of Clean Energy Strategy.

- Reduce cooling costs and the adverse effects of extreme heat events.
- Mitigate the effect of roads and buildings in creating urban heat islands.
- Capture and remove air pollutants including CO_2.
- Strengthen local economies, contribute to property value, and improve recreation experiences for visitors.
- Improve social connection and quality of life for residents.
- Improve the quality of water entering rivers and streams.
- Reduce stormwater infrastructure costs.
- Provide habitat to support biodiversity.

The roads and buildings in urban areas absorb more heat than natural environments and create islands of elevated heat in urban areas. Combating this urban heat island effect is particularly important in vulnerable neighborhoods where communities may not have sufficient resources to cope with its negative impact. Shading provided by increased canopy can protect residents from heat stress and reduce building cooling demands during the summer months. Reducing the need for air conditioning not only decreases the urban heat island effect but also minimizes associated greenhouse gas emissions.[93]

Coeur d'Alene's Urban Forestry program seeks to preserve, protect, maintain, and enlarge the city's urban forest. To accomplish this goal the city has established care standards for public trees (park trees, street trees, and trees growing on other city-owned properties), licenses tree services, has a permit system for street trees, and provides a variety of tree planting and care information. Although our urban forestry ordinance primarily addresses public trees, much of the information available on its website is useful throughout the community.

While much of Coeur d'Alene has adequate tree cover, neighboring towns may not. Also, the extreme windstorm we all experienced in January of 2021 took down a considerable number of trees. That storm demonstrated that our Urban Canopy is not stagnant and requires upkeep of existing trees and planting new trees when required. Coeur d'Alene could more aggressively promote its Urban Forestry program to address parts of the city that do not have adequate tree cover, or had tree cover damaged, and encourage residents to plant new trees as well as properly maintain existing trees.

Action #4. *Generate Solar Energy in our Parking Lots* – The greater Coeur d'Alene region has a lot of space devoted to parking lots. These are hot, unpleasant areas that unnecessarily heat our town and could be put to more productive use. Covering these areas with energy-producing solar generation could cool the lots, help protect the public from heat waves, provide energy in summer when demand is high and hydropower is less reliable, and reduce the greenhouse gas emissions associated with fossil power production. They can also protect vehicles, help snow management in winter and power EV charging stations. Solar parking lots are widely used around the U.S. and have proven to be cost-effective innovations for local businesses.[95]

Solar parking lot at a Target store. Target plans to power the entire store with solar power.[94]

There are several ways Coeur d'Alene and Kootenai County could promote the adoption of solar parking lots. A first step would be for the City Council to direct the Natural Resource Advisory Committee to work with Avista Corporation and the Chamber of Commerce to conduct a study to investigate the economic and community benefits of expanded solar in our parking lots. The Kootenai County commissioners could join in the effort through their Natural Resource Advisory Board. This study could include a review that other local governments have employed to provide incentives to businesses to adopt this common-sense practice. Solar cells are widely available and inexpensive, and localities that invest in solar energy also spur the growth of local businesses that create high-paying local jobs. There are few win-win-win innovations that both reduce greenhouse gas emissions, help protect public health, and help businesses prosper. Solar parking lots are proving to be a winning innovation.

7: Protecting Coeur d'Alene through Climate Change Adaptations

7.1 : Public Health

Impacts to public health from climate change, primarily from high heat events and wildfire smoke, can be reduced through community initiatives to minimize their impacts, as well as enhance protections against wildfire. Specific examples include the following (this list is not comprehensive).

Local Residents

- Keep stores of food, water, protective masks and filters, and medications.
- Avoid exertion during the hottest part of the day.
- Maintain hydration, use cooling showers and fans, avoid restrictive clothing.
- Check in on high-risk populations during heat events.

Local Government

- Expand access to cooling centers.
- Expand access to affordable health care to deal with heat and smoke related illnesses and exposure to gaseous pollutants like ozone.
- Expand public service announcements for watches and warnings.
- Require plentiful cooling stations and watering stations during public events.
- Expand shaded areas in parks and public schools.
- Require increased shade in green spaces and parking areas in private developments.
- Integrate more trees and passive cooling into residential and commercial development.
- Invest in solar roofing in parking areas to increase shade and provide additional electricity generation.
- Expand programs to retrofit older homes with high efficiency cooling.

These adaptations provide examples of what Coeur d'Alene can do to adapt to some of the ways climate change will impact public health. There will be more impacts beyond what is listed here. For example, climate change is already expanding the range of many pests and diseases. In 2019, researchers from the University of Oxford, Harvard Medical School, and Boston Children's Hospital found that two disease bearing mosquitoes (*Aedes aegypti, Aedes albopictus*) are expanding their range in

How to stay safe during the 2021 Ironman Coeur d'Alene heat wave

In response to a forecast for triple digits during the 2021 Ironman, the Coeur d'Alene fire department brought in additional firefighters and EMS personnel including additional ambulances, fire engines and fire boats.

The athletes were not who the firefighters were most worried about, It was the spectators and the volunteers!

How do you stay safe in triple digit heat? Hydration is key. Double your water intake!

Other ways to stay safe are:

1. Wear loose fitting, lightweight clothing
2. Find shade
3. Apply a generous amount of sunscreen
4. Be careful with certain medications that may raise temperature
5. Sit down when feeling light-headed

KREM2 article by Morgan Trau published June 24, 2021

North America and Europe by 90 – 150 miles per year and are expected to threaten half the world's population within the next 30 years.[96] Disease-carrying insects from hotter parts of the world are expanding their range. Embracing public health adaptations to protect against heat and wildfire smoke today will help us get ahead of the even larger challenges yet to come.

7.2 : Wildfire

Wildfire has impacts that extend well beyond public health. Wildfire destroys property and leads to billions of dollars in property loss each year. Wildfires destroy homes, towns, rangelands, timber, and most importantly, peoples' lives. We cannot prevent all future wildfires, but we can adapt to make them less damaging and help our communities be more resilient.

Adaptations for wildfire impact can be broken into residential and local government actions, and forest management actions. This report considers forest management actions taken by State/federal authorities and timber companies to be outside the scope of this study that focuses on local and city actions. Note that adapting our forest management techniques to account for climate influences is extremely important for protecting against wildfire. Local wildfire adaptations that can be taken include the following:

Local Residents

- Keep stores of food, water, protective masks and filters, and medications.
- Avoid exertion during the hottest part of the day.
- Maintain hydration, use cooling showers and fans, avoid restrictive clothing.
- Use home furnace filters specifically designed for filtering wildfire smoke.
- Comply with fire-safe housing recommendations (clear space around homes and structures) especially in the wildland/urban interface.
- Maintain a stock of N95 masks and air filters for protection against smoke.
- Build simple in-home air filters using box fans and inexpensive air filters.
- Pay heed to public health warnings.
- Check in on high-risk populations during heat events.

Local government

- Invest in public health actions to protect against wildfire (see above).
- Incorporate the increasing risk of fire into city and county planning documents.
- Improve local communication of fire and smoke risks.
- Expand access to affordable health care to deal with heat and smoke related illnesses.
- Work with the business community to strengthen acceptance of limits on outdoor work or recreation.
- Invest in fire-safe public infrastructure.
- Develop sensible regulations to increase defensible areas around structures for businesses and homeowners, particularly in areas in the wildland/urban interface.
- Equip public cooling centers with high quality air filtration systems specifically designed for filtering wildfire smoke.
- Create stores of N95 or P100 masks that can be rapidly supplied during smoke events.
- Create similar stores of simple home air filtration systems (e.g., fans with filters).
- Work with HVAC companies to provide rebates and low-cost financing for improved home HVAC.
- Conduct public awareness campaigns.

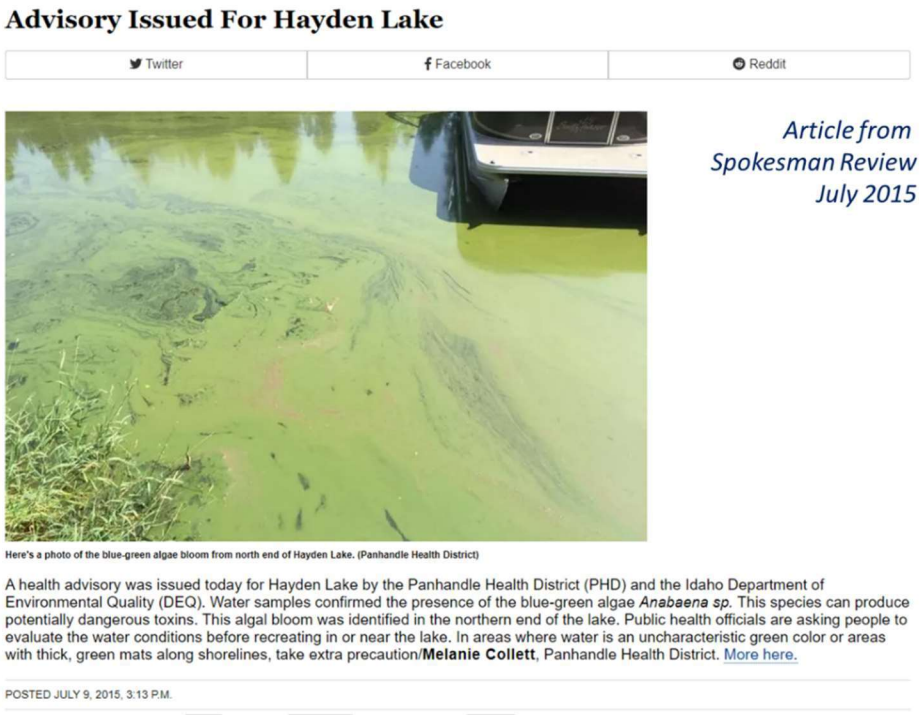
Local businesses

- Invest to improve worker safety during smoke events and provide N95 masks.
- Equip buildings with high quality air filtration systems using filters specifically designed for filtering wildfire smoke.
- Maintain filters and HVAC systems to better protect customers and workers.
- Help broadcast air quality alerts.
- Maintain defensible areas and fire-safe buildings.

This is a partial list, to spur public discussions. It is not exhaustive. Local governments also need to engage with the State and Federal land management agencies and large private sector landholders to advocate for pro-active actions to reduce the risk of wildfire. Wildfire is part of life in the Western U.S., but it's impacts on our health and economy are growing. Our response and adaptation planning needs to grow as well.

7.3 : Lakes and Streams

Our lakes and streams are large, complex systems that have many interwoven parts that are difficult to manage. The coming changes cannot be prevented if we continue to pollute the atmosphere with greenhouse gases that warm the planet. However, there are some actions that can be taken to better protect our lakes and mitigate some of the impacts of the coming changes.



Advisory Issued For Hayden Lake

Twitter | Facebook | Reddit

Article from Spokesman Review July 2015

Here's a photo of the blue-green algae bloom from north end of Hayden Lake. (Panhandle Health District)

A health advisory was issued today for Hayden Lake by the Panhandle Health District (PHD) and the Idaho Department of Environmental Quality (DEQ). Water samples confirmed the presence of the blue-green algae *Anabaena sp.* This species can produce potentially dangerous toxins. This algal bloom was identified in the northern end of the lake. Public health officials are asking people to evaluate the water conditions before recreating in or near the lake. In areas where water is an uncharacteristic green color or areas with thick, green mats along shorelines, take extra precaution/**Melanie Collett**, Panhandle Health District. More here.

POSTED JULY 9, 2015, 3:13 P.M.

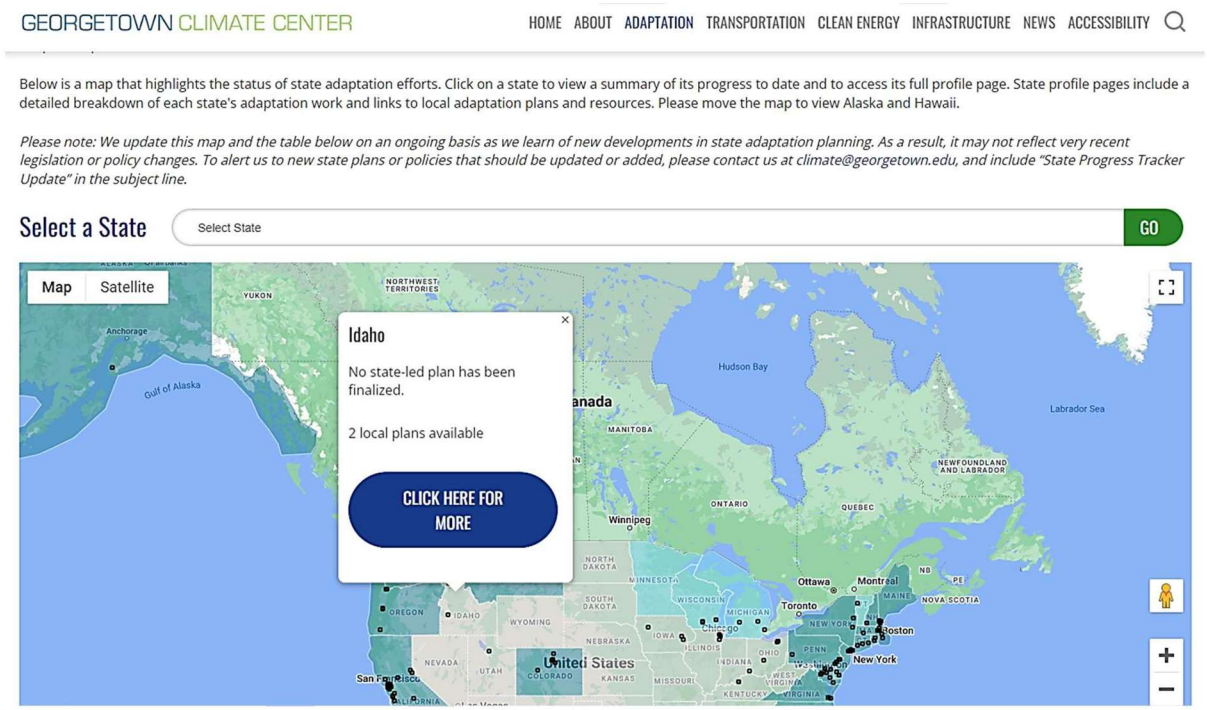
- *Sustain higher stream flows for longer*— many of our lakes' changes will come because we are losing snow as a water reservoir. There are ways to increase water storage in the streams, wetlands, and shallow groundwater in the watersheds that feed our lakes. These include reducing water withdrawals, increasing beaver populations (beaver ponds are great reservoirs), sustaining forests and shaping forest slopes to better capture water rather than eroding. Forests attract water into watersheds because trees absorb water from the atmosphere and build up a reservoir during winter to carry them through summer. More trees = more water in our streams.
- *Reduce nutrient input into our lakes*— strategies include improved wastewater and stormwater management, sustaining healthy forests, controlling water runoff from roads, and maintaining natural buffers along streams and lakes.
- *Set aside funding for new infrastructure and restoration efforts*— increased impacts will lead to increased management costs. For example, managing eutrophication and harmful algae blooms can require expensive, ongoing efforts to mitigate toxic algae blooms and/or reduce phosphorus levels via amendments or draining and excavation. Lower summer lake levels will also require that boat launches, and public access areas be modified. Warmer temperatures may require additional shaded areas.
- *Establish water quality protection districts*— these districts place additional fees and restrictions on people who live near a lake or sensitive watershed and have the greatest impacts and benefits. They work on the logic of "make development pay for itself" while not imposing new costs and environmental health risks on the larger community. New developments can do long-term damage to our lakes, damage that could be avoided or mitigated at reasonable costs. These districts can impose sustainable development restrictions on the minority of residents who live along lakes and sensitive watersheds and help provide funding to protect our waters.

- *Invest in water resource management and public education outreach*— fund health and environmental agencies to be more proactive about spotting and managing harmful algae blooms. There are emerging technologies to help control blooms, but our State and regional agencies don't have the funding to test and deploy them. These agencies also need greater capacity to inform and educate the public about the health risks and effective responses to the problems of eutrophication and toxic algae blooms.
- *Utilize lakes as clean energy resources*— toxic algae blooms tend to form in stagnant, warm waters. Shading near-shore waters with solar generation could potentially reduce the growth of toxic algae blooms in the shaded waters. These solar generators would provide a new source of clean energy to offset loss of hydropower from reduced summer stream flows and reduce our dependence on fossil fuels. Lake-based solar electric generation facilities are already being built elsewhere in the world.

Protecting our lakes and effectively adapting to climate change also requires that we change the way we live, work, and play in our upland streams and forests. What happens here not only impacts the local stream and forest, but also flows into our lakes. This report does not cover climate impacts on the mountains, streams, and forests surrounding Coeur d'Alene and the surrounding region. However, protecting these areas is essential to protecting our lakes and adaptation actions need to be taken throughout the many regional watersheds that sustain our communities.

7.4 : Resources for Adaptation Planning

Climate adaptation is a large and nebulous subject, and it is difficult to find information resources to help develop and implement adaptation plans. Many organizations from businesses to governmental agencies develop climate adaptation plans to help guide their future planning to build improved resiliency against the many threats and disruptions that climate change will bring. The U.S. military even has a climate strategy. Given the diversity of this problem and the lack of a centralized national resource to help communities respond, it may be helpful to simply see what others around the country are doing. One resource we've found is provided by the Georgetown Climate Center at Georgetown Law School.[97] This resource provides a State Adaptation Progress Tracker that provides a map interface to find other places in the country that are developing climate adaptation plans. Another resource is provided by the Climate Action Plans produced by Boise and Moscow. Screenshots of these websites are provided below. These provide an entry point to help find communities we can talk to, and perhaps learn from their experience as we tackle this problem in Coeur d'Alene.



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