USRT Priority Climate Action Plan:

Burns Paiute Tribe
Fort McDermitt Paiute Shoshone Tribe
Shoshone-Paiute Tribe of the Duck Valley Reservation
Shoshone-Bannock Tribes of the Fort Hall Reservation

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Key Definitions and Acronyms

Adaptation International (AI): Adaptation International is an independent contractor who has assisted the Upper Snake River Tribes Foundation and member tribes develop climate change vulnerability assessments, adaptation planning, and collaborated on the emissions inventory in this document.

Environmental Protection Agency (EPA): The federal agency tasked with oversight of numerous environmental laws such as the Clean Water Act, Clean Air Act, etc. The EPA is tasked with oversight for the Climate Pollution Reduction Grant.

Bureau of Indian Affairs (BIA): The federal agency within the Department of Interior primarily tasked with assisting federally recognized tribes manage their trust resources and offering technical assistance to tribal communities at a regional/national level.

Greenhouse Gas (GHG): for the purposes of this PCAP, refers to quantifiable emissions of Carbon Dioxide, Methane, Nitrous Oxide, and Fluorinated gases; this plan focuses primarily on anthropogenic emissions. GHG absorb infrared radiation and trap its heat in the atmosphere, creating a greenhouse effect that results in global climate change.

Priority Climate Action Plan (PCAP): The narrative report for the USRT member tribes' list of near-term, high-priority, and implementation-ready measures to reduce GHG pollution; as well as an estimate/analysis of GHG emissions reductions from those actions.

Comprehensive Climate Action Plan (CCAP): A narrative report developed in the two years following the submittal of the USRT PCAP that provides a long-term resiliency strategy that is tailored to their specific context. The CCAP will feature comprehensive strategies to reduce and/or eliminate emissions of GHG from their communities to the maximum extent feasible by 2035. The CCAP will clearly delineate each member tribes' significant GHG sources/sinks for each sector, establish near-term and long-term GHG emission reduction goals, and provide policy guidance to address emissions by sector.

Tribal Greenhouse Gas Inventory Tool (TGIT): a list of emission sources and sinks and the associated emissions quantified using standard methods in a public tool created for communities planning for reducing climate pollutants. The PCAP utilized a "simplified" inventory with the TGIT, using primarily Scope 1 emissions to develop priority actions. The CCAP will include a comprehensive inventory of emissions and sinks for the following sectors: industry, electricity generation/use, transportation, commercial and residential buildings, agriculture, natural and working lands, and waste and materials management.

Upper Snake River Tribes Foundation (USRT): refers to the non-profit, inter-tribal consortium of the Burns Paiute Tribe, Fort McDermitt Paiute Shoshone Tribe, Shoshone-Paiute Tribes of the Duck Valley Reservation, and Shoshone-Bannock Tribes.

Burns Paiute Tribe (BPT): refers to the federally recognized tribe located in eastern Oregon in the Snake River Basin. The governing body for the BPT is the Burns Paiute Business Council, who oversees and manages the tribe's lands and policies.

Fort McDermitt Paiute Shoshone Tribes (FMPST): refers to the federally recognized tribe located on the border of Nevada and Oregon in the Snake River Basin. The governing body for the FMPST is the Fort McDermitt Paiute Shoshone Business Council, who oversees and manages the tribe's lands and policies.

Shoshone-Bannock Tribes of the Fort Hall Reservation (SBT): refers to the federally recognized tribe located in Southeastern Idaho in the Snake River Basin. The governing body for the SBT is the Fort Hall Business Council, who oversees and manages the tribe's lands and policies.

Shoshone-Paiute Tribes of the Duck Valley Reservation (SPT): refers to the federally recognized tribe located on the border of Idaho and Nevada in the Snake River Basin. The governing body for the SPT is the Shoshone-Paiute Tribal Business Council, who oversees and manages the tribe's lands and policies.

Overview of Priority Climate Action Plan

This document is intended to provide short-term, priority guidance to support member tribes of the Upper Snake River Tribes Foundation (USRT) in developing actions that increase their community's resilience to the worst effects of climatic shifts in our region. Each of the member tribes comprising the USRT are federally-recognized and exercise jurisdiction over most of the actions necessary to promote a thoughtful and community-level response to the exigency of the climate crisis.[1] The USRT developed this Priority Climate Action Plan (PCAP) under the U.S. Environmental Protection Agency's (EPA) Climate Pollution Reduction Grant (CPRG) Planning Grant Program for each of the four member tribes; each set in their own unique context. The PCAP was developed based on data gathered from publicly available resources, such as the National Emissions Inventory (NEI), and analyzed using newly developed tools from the EPA like the Tribal Greenhouse Inventory Toolkit (TGIT).

The USRT technical staff developed this PCAP process to assist our member Tribes develop climate action plans based on the three goals below:

1. **Goal 1** - Improve tribal understanding of current greenhouse gas (GHG) emissions and long-term effects of climate change to those tribal communities; and,
2. **Goal 2** - Identify priority actions to reduce GHG emissions in the near-term and develop comprehensive, long-term solutions to maximize the potential benefits of climate resiliency actions; and,
3. **Goal 3** - Implement those durable solutions in tribal communities so future generations of tribal members thrive in resilient and carbon-negative communities in their permanent homelands.

The information evaluated during the PCAP phase will be used to develop a Comprehensive Climate Action Plan (CCAP) for each of our member tribes to address long-term emissions reduction actions. USRT anticipates a significantly greater effort to develop the CCAP during the final three years of the planning program. It is critical to note the condensed timeline for developing the PCAP did not allow for a comprehensive collaboration with other entities (states, municipalities, etc.); engaging in additional stakeholder discussions will be a cornerstone of the outreach efforts completed during the CCAP development. Our collective goal during the CCAP is to ensure collaborative solutions with neighboring communities and improving our ability to leverage federal funding opportunities to create sustainable GHG reduction measures in our tribal communities.

[1] The Upper Snake River Tribes Foundation is a non-profit organization comprised of the Burns Paiute Tribe, Fort McDermitt Paiute-Shoshone, Shoshone-Paiute Tribes of the Duck Valley Reservation, Shoshone-Bannock Tribes of the Fort Hall Reservation. Each tribe administers their own programs directly and USRT staff play a support role offering technical assistance in developing the PCAP/CCAP through this EPA CPRG program.

Indigenous communities are often at a higher risk adverse climate impacts than other communities due to a number of critical factors that include economic and environmental pressures.[2] The EPA notes that the lack of adequate infrastructure, medical conditions with higher prevalence in tribal communities, institutional and policy barriers to managing their homelands, and, their connection to their ancestral homelands and the resources thereon.[3] It would be an inadequate federal response to rely on tribal communities to fully fund the mitigation efforts for the effects of global climate change at a regional or national level. The purpose of isolating native communities through colonization was to engage in anthropogenic modification at a national level, it was the function of government policy during the westward expansion phase. It can be fairly stated that the end-state of colonization was 'climate change' and tribal communities don't bear responsibility for our contemporary issues at a global or national level. Despite this traumatic history, tribal communities take lead roles in advocating for conservation, clean water, and defending their homelands from the worst effects of climate change; this deep connection to their homelands is a testament to the strength of tribal partnerships and the potential for CPRG projects to help in reducing GHG emissions in tribal communities across the nation.

Organization of the PCAP

This document was developed by USRT staff to evaluate emissions on four reservations, in three states, across the Upper Snake River Basin in Regions 9 and 10 of the EPA[4]. The scope of the evaluation and the unique challenges faced by each of our member tribes necessitated dividing each tribe into their own section; based on their own unique emission profile. The PCAP is designed to layout the priority actions for each tribe, providing additional opportunities to pursue meaningful climate resilience measures through pollution reduction measures in their own communities. Although each tribe has its own priorities for implementing measures to combat climate change, the emissions profile, and options for reducing climate pollutants clearly demonstrate shared challenges based on our shared geography in the Snake River Basin. It should also be noted that while each tribe did select some specific PCAP measures for their reservation, all of the measures noted in this document or the relevant State PCAP should be considered as available for implementation based on the specific needs of the tribe.

The Executive Summary section summarizes the priority actions identified by each tribe and a high-level narrative for each of actions identified. The initial section will describe the current status of climate planning for our member tribes, potential risks associated with climate change, and any identified concerns for community resilience that pose an immediate risk to the region. The following sections are dedicated to each of the tribes and their reservations, with discussion of the initial GHG inventory completed for each reservation and discussion of long-term and short-term options for reducing climate pollutants. Only short-term, 'shovel-ready' options are presented in the PCAP as priority actions, while long-term actions will be presented in the CCAP phase of the project due to the complexity of evaluating those measures. The shorter sections in the PCAP for each member tribe will serve as the foundation for comprehensive climate planning in the CCAP; as well as the foundation for funding requests or applications to implement those noted priority measures. The USRT technical staff summarized information available in previous climate assessments and adaptation plans; those documents are

[2] See, https://www.epa.gov/climateimpacts/climate-change-and-health-indigenous-populations for additional information and tools for tribal communities planning for climate impacts.
[3] *Id.*
[4] EPA Region 9 is the primary point of contact for the USRT CPRG planning grant; it is assumed that any awarded funds as a result of the Phase II Implementation Grant will be directed to each tribe individually within their respective region.

included as appendices and should be considered background information and are critical for establishing the planning context for the USRT member tribes.

Executive Summary

The Upper Snake River Basin has been home to Shoshone, Bannock and Paiute peoples from time immemorial; the rich homelands provided for physical subsistence, spiritual sustenance, and continued existence as *Newe* people. Throughout the epochs of human history in our homelands, *Newe* people lived through massive shifts in climate across tens of thousands of years; continuing to exist in relative harmony with the landscape. The advent of colonial settlement rapidly changed the structure of resource management in an exceptionally short period of time. Mining, railroad, agriculture, timber and hydro developments have all led to irretrievable losses for many resources, such as the anadromous fisheries in the Upper Snake River basin.

The Upper Snake River Tribes Foundation (USRT) is a non-profit consortium comprised of four federally recognized tribes: Burns Paiute Tribe (BPT), Fort McDermitt Paiute Shoshone Tribe (FMPS), Shoshone-Paiute Tribe of the Duck Valley Reservation (SPT), and the Shoshone-Bannock Tribes of the Fort Hall Reservation (SBT) (collectively referred to as USRT member tribes). Among the principal reasons for founding the organization was the intent to form a common voice for anadromous fisheries restoration in the Upper Snake River basin and to protect our shared traditional cultural practices. Over the past decade, USRT has played a critical role in bringing our member tribes together to address a collaborative response to global climate change, including the development of Climate Vulnerability Assessments and Climate Adaptation Planning with funding from the Bureau of Indian Affairs. The award of funding under the Climate Pollution Reduction Grant (CPRG) provided resources for USRT to engage in detailed emissions reduction planning at the community level over the next several years.

CPRG funds were allocated to planning processes for States, Metropolitan Service Areas, and Tribes or Intertribal Consortium; provided the relevant entity accepted those funds and completed the deliverable there would be a competition for awardees to receive funding for the implementation of emissions reduction measures. The Environmental Protection Agency (EPA) was directed to administer the funds in an equitable manner that emphasized the delivery of services and funding to necessary projects in a short period of time. As such, the EPA directed recipients to prepare a bifurcated planning process that allowed for the USRT member tribes to prioritize a suite of actions that will serve to reduce Greenhouse Gas (GHG) emissions in the near term, as well as engage in comprehensive planning at the community scale over the next several years. This allows for the rapid deployment of emissions reduction actions across these four tribal communities while larger, landscape level resiliency and sequestration actions are planned and evaluated.

This Priority Climate Action Plan (PCAP) is intended to: provide an overview of the planning process through the completion of the Comprehensive Climate Action Plan (CCAP); provide an introduction to each of the USRT member tribes; present a high-level GHG emissions inventory that is downscaled to each reservation for our member tribes; and, present priority GHG reduction measures that each community should take in the near-term. In line with presenting priority actions for implementation by our member tribes, the PCAP will also discuss the challenges and/or limitations of specific measures, the workforce needed to implement those actions, and funding options to ensure the actions contribute to the national goal of immediately reducing GHG emissions to combat global climate change.

Previous USRT Climate Vulnerability Assessment and Climate Adaptation Planning

The Upper Snake River Tribes Foundation and the Shoshone-Bannock Tribes were awarded funding through the Bureau of Indian Affairs to engage in regional climate planning to ensure our communities were aware of the challenges a shift in climate might pose. Beginning in 2016, continuing through early summer 2017, the USRT and SBT initiated a planning process that accomplished the critical task of working with academia and professional climate planners to develop downscaled climate projections for a number of different climate scenarios.[5] Within the USRT tribal communities it was important to understand the potential ecological effect of shifts in physical processes within the upper and mid-Snake River watershed; assessments were also included for central Idaho's Salmon River basin due to the importance of salmon and that landscape to the Shoshone, Paiute, and Bannock peoples. It was clear there were some relatively consistent challenges that our region will face in the coming century in the form of changing precipitation patterns, extended frost-free days, and increasing surface air temperatures (affecting both water bodies and terrestrial communities).

The Snake River region USRT and SBT studied is exceptionally diverse, ranging from low-gradient river valleys to high-mountains that hold the year's snowpack. These communities are connected by transitional sage steppe habitats moving to the nearby agricultural communities; with extensive riverine modification for irrigation, hydroelectric facilities, and community development. The way the precipitation arrives to the Snake River has significant effects on the ecological and economic processes in the Snake River, with fewer feet of snowpack in the higher elevations comes a corresponding reduction in reservoir function and impacts to the communities that rely on the spring run-off. A changing thermal regime might also provide for more diverse agricultural opportunities, increasing the demand for water resources for a longer irrigation season. The contemporary assessment performed by the USRT and SBT technical staff demonstrate that there are vulnerable systems in our tribal communities and across the region that would benefit from proactive conservation measures to protect agricultural resources and tribal lifeways, promote sustainable ecosystem function for fish and wildlife, and prepare systems for increasingly frequent stochastic events (i.e. catastrophic wildfire, heatwaves, drought, violent storms, etc.).

The Snake River watershed will face diverse climate challenges under the best-case scenarios, relative to the concentration of atmospheric carbon (or GHG equivalents) at the mid-century mark. Under other scenarios where emissions are not reduced globally, and we increase our carbon output those impacts become significantly more extreme. The purpose of the climate planning is to maximize opportunities to develop tools and implement proactive conservation measures that will be effective in creating community resilience from the effects of the change. The CPRG program has the potential to bring immediate emissions reduction benefits and improve community resilience in tribal communities, and if funded, the tribes would like to continue developing as stewards of the Snake River basin, the tribes will continue to advance efforts that improve the resilience of their communities, provide opportunities for ecological restoration, and ensure future generations of tribal members can thrive.

[5] Both the USRT and SBT plan in the Appendices and are critical reading for this document, the full citation for each is: *Petersen, S., Bell, J., Hauser, S., Morgan, H., Krosby, M., Rudd, D., Sharp, D., Dello, K., and Whitley Binder, L., 2017. Upper Snake River Climate Change Vulnerability Assessment. Upper Snake River Tribes Foundation and Member Tribes.* and *Petersen, S., Nasser, E., Stone, D., Krosby, M., Morgan, H., Rupp, D.,Sharp, D., Dello, K., and Whitley Binder, L., 2017. Shoshone-Bannock Tribes Climate Change Vulnerability Assessment and Adaptation Plan. Shoshone-Bannock Tribes.*

Burns Paiute Tribe

The Burns Paiute Tribe, located in Eastern Oregon, has been actively participating in measures to make their community more aware of the potential impacts of the coming change. Working with USRT to develop a vulnerability assessment for their region and taking those first steps to adaptive resource planning has been a critical component of the plan to actively engage in implementation projects through the CPRG process. Essentially the Burns Paiute Tribe is already aware of numerous 'solution-based' projects that would improve the resilience in their community. The table below is a high-level summary of the priority climate pollution reduction measures that could be implemented with Phase II CPRG or other sources of funding in the near-term. These measures are specifically focused on directing any potential emissions reduction programs to their membership directly.

Measure Description	Measure Benefits	*Estimated Cost
Measure 1: Residential Service Panel Installation	Certified smart panels have an estimated range of 10-15% improvement in efficiency; but more critically they are the crux of installing level 2 charging stations in a home for plug-in vehicles, adding new electrical appliances, solar panels, or battery systems. A 10% reduction in GHG emissions associated with residential electricity for the 50 households would constitute ~12 m/tons GHG emissions per year.	$7,500 per panel (includes installation); $375,000 for BPT would provide services to 50 households. The actual program cost would be determined by project interest in the community, timeline for installation of service panel upgrades, and availability of contract services.
Measure 2: Install 10KW Solar Array for Tribal Households	A 10kwh solar system is estimated to save 6.1 tons of GHG annually; the full program is expected to reduce up to 305 tons of GHG emissions per year. This would represent approximately a 100% reduction in total emissions associated with residential electricity on the Burns Paiute Reservation and mitigating some additional stationary emissions from institutional sources.	$45,000 per household; 50 households based on need (elder, low-income, medical need, etc.) - $2,250,000 total estimated cost. Actual costs would be determined by project interest in the community, timeline for installation of solar services, and availability of contract services.
Measure 3: Install replacement wood stoves or electric furnaces	Using the EPA calculator, it is estimated that this program will reduce GHG emissions by ~6 m/tons annually, while also improving indoor air quality for tribal member households. Exchanging a wood burning	$375,000 for total project costs; includes administration of project and up to 50 homes with complete replacement of wood burning stoves with new stoves or electric furnaces. Actual project costs would be

	stove for electrical furnace would reduce the emissions even further.	determined by project interest in the community and contractor availability to install replacement equipment.
Measure 4: Develop GHG sequestration Studies for the Burns Paiute Reservation and Tribal Lands	Provides consistent conservation planning and adaptive management for the Burns Paiute Reservation. Dedicated climate program coordinator will be directly tasked with developing site plans, grant applications, and coordinating permitting for conservation programs in wetland/riparian habitat on the Burns Paiute Reservation (1 acre of wetland can store 80-200 tons of carbon).	$500,000 annually through the end of the CPRG grant period ($1,500,000). Employed directly by USRT and stationed remotely on the Burns Paiute Reservation.

Table 1. BPT summary table of PCAP measures.

The Burns Paiute Tribe has determined that pursuing the following actions in the near-term (3-5 years) through a mix of federal resources, including the CPRG program, will have positive effects on the tribal community. While the transition to carbon neutrality needs to be accelerated, the exigency of the circumstance also warrants careful planning by the tribal staff; a portion of the climate crisis can be squarely assigned to a failure to consider the long-term effects of energy consumption as a society. The Burns Paiute Tribe would like to be a collaborative partner with other entities engaging in climate resilience measures, such as the State of Oregon and other federal agencies, throughout the implementation process. As critical as the pace of the energy transition will be the long-term continuity of funding resources for tribal communities to meet the goals of being carbon-neutral or carbon negative economies by the mid-century.

Fort McDermitt Paiute Shoshone Tribe

The Fort McDermitt Paiute Shoshone Tribe, located on the border of Oregon and Nevada, has been actively participating in measures to make their community more aware of the potential impacts climate change and the rush to develop lithium resources adjacent to their reservation. Working with USRT to develop an emissions inventory for their region and engaging in adaptive resource planning has been a critical component of the plan to actively engage in selecting implementation projects through the CPRG process. The Fort McDermitt Paiute Shoshone Tribe is already aware of numerous 'solution-based' projects that would improve the resilience in their community but lack funding to directly implement those solutions in the near-term. The table below is a high-level summary of the FMPST priority climate pollution reduction measures that would be implemented with Phase II CPRG or other sources of funding in the near-term.

Measure Description	Measure Benefits	*Estimated Cost
Measure 1: Install Residential Smart Panel	Certified smart panels have an estimated range of 10-15% improvement in efficiency; but	$7,500 per panel (includes installation); $1,012,500 for FMPS would provide services to

	more critically they are the crux of installing level 2 charging stations in a home for plug-in vehicles, adding new electrical appliances, solar panels, or battery systems. A 10% reduction in GHG emissions associated with residential electricity for the 135 households would constitute ~30.6 m/tons GHG emissions per year.	135 households. The actual program cost would be determined by project interest in the community, timeline for installation of service panel upgrades, and availability of contract services.
Measure 2: Install 10KW Solar Array for Tribal Households	A 10kwh solar system is estimated to save 6.1 tons of GHG annually; the full program is expected to reduce up to 610 tons of GHG emissions per year. This would represent approximately a 100% reduction in total emissions associated with residential electricity on the Fort McDermitt Reservation and mitigating some additional stationary emissions from institutional sources.	$45,000 per household; 100 households based on need (elder, low-income, medical need, etc.) - $4,500,000 total estimated cost. Actual costs would be determined by project interest in the community, timeline for installation of solar services, and availability of contract services.
Measure 3: Install replacement wood stoves or electric furnaces	Using the EPA calculator, it is estimated that this program will reduce GHG emissions by ~6 m/tons annually, while also improving indoor air quality for tribal member households. Exchanging a wood burning stove for electrical furnace would reduce the emissions even further.	$375,000 for total project costs; includes administration of project and up to 50 homes with complete replacement of wood burning stoves with new stoves or electric furnaces. Actual project costs would be determined by project interest in the community and contractor availability to install replacement equipment.
Measure 4: Develop GHG sequestration Studies for the Fort McDermitt Reservation and Tribal Land	Provides consistent conservation planning and adaptive management for the Fort McDermitt Reservation. Dedicated climate program coordinator will be directly tasked with developing site plans, grant applications, and coordinating permitting for conservation programs in wetland/riparian habitat on the	$500,000 annually through the end of the CPRG grant period ($1,500,000). Employed directly by USRT and stationed remotely on the Fort McDermitt Reservation. Additional funding for new climate project pilot funding may be requested within next three-years from other agencies.

	Fort McDermitt Reservation (1 acre of wetland can store 80-200 tons of carbon).	

Table 2. FMPS summary table of PCAP measures.

The Fort McDermitt Paiute Shoshone Tribe has determined that pursuing the following actions in the near-term (3-5 years) through a mix of federal resources, including the CPRG program, will have positive effects on the tribal community. While the transition to carbon neutrality needs to be accelerated, the exigency of the circumstance also warrants careful planning by the tribal staff; a portion of the climate crisis can be squarely assigned to a failure to consider the long-term effects of energy consumption as a society. The rush to develop 'green energy' resources can be clearly seen in the McDermitt Caldera, where proposed lithium mines are slated to begin production at massive scales, with potentially severe environmental consequences for the tribal community. Emissions per person are already significantly higher than their tribal counterparts due to this type of activity, so it is appropriate to focus mitigation measures specifically in this community.

The Fort McDermitt Paiute Shoshone Tribe would like to be a collaborative partner with other entities engaging in climate resilience measures, such as the State of Oregon, State of Nevada and other federal agencies, throughout the implementation process. As critical as the pace of the energy transition will be the long-term continuity of funding resources for tribal communities to meet the goals of being carbon-neutral or carbon negative economies by the mid-century. As an indigenous community in the McDermitt Caldera, mitigation measures need to be implemented to ensure tribal people don't bear the burden of a broader, societal need for lithium and other 'green energy' materials. The aspects of mineral development impacts will be specifically addressed in the development of the CCAP for the tribe.

Shoshone Paiute Tribes of the Duck Valley Reservation

The Shoshone Paiute Tribe, located on the Idaho and Nevada border, has been actively participating in measures to make their community more aware of the potential impacts of the coming change. The SPT manage approximately 300,000 acres of reservation lands that are a blend of residential, commercial/institutional, agricultural and open-space landscapes. Working with USRT to develop a vulnerability assessment for their region in 2017 helped identify some of the long-term climate risks to the various sectors in their local tribal economy. The SPT began taking steps to adaptively manage critical resources on the Duck Valley Reservation prior to the development of the CPRG planning process. The tribes perspective on climate change will be a critical component of the proposal to actively engage in implementation projects through the CPRG process. Essentially the Shoshone Paiute Tribe is already aware of numerous 'solution-based' projects that would improve the resilience in their community. The table below is a high-level summary of the Shoshone Paiute Tribal proposal for priority climate pollution reduction measures that would be implemented with Phase II CPRG or other sources of funding in the near-term.

Measure Description	Measure Benefits	*Estimated Cost
Measure 1: Wood Stove Replacement Program	Using the EPA calculator, it is estimated that this program will reduce GHG emissions by ~24 m/tons annually, while also	$1,500,000 for total project costs; includes administration of project and up to 200 homes with complete replacement of

	improving indoor air quality for tribal member households.	wood burning stoves with new stoves or electric furnaces.
Measure 2: Install 1 MW Solar Array for Tribal School and Government Campus	A 1 MW solar system is estimated to save 190 tons of GHG annually; the full program is expected to provide renewable energy to government buildings and the tribal school system. This would represent approximately a 25% reduction in total emissions associated with stationary electricity (commercial/institutional) on the Duck Valley Reservation.	$1,750,000 total; including design and installation is the project estimate. Actual costs would require sufficient time to design the project, complete necessary environmental review, and find a qualified contractor to complete the interconnection and installation
Measure 3: Develop GHG sequestration Studies for the Duck Valley Reservation	The Duck Valley Reservation has ~300,000 acres owned by the Tribes and its members. There is a broad range of habitat types from alpine meadows, non-commercial forests, shrub-steppe, and freshwater riparian areas present on the Reservation. Natural landscapes can be carbon 'sinks' and this program would develop recommendations to maximize the landscapes ability to absorb atmospheric carbon.	$1,000,000 for a 5-year pilot project for stewardship program managed by the SPT on the Duck Valley Reservation. This project would be focused on implementing best management practice education for agricultural operators, natural resource managers, and water users. The focus would be on measuring the efficacy of those BMPs and any associated implementation projects for carbon sequestration.
Measure 4: Duck Valley Climate Stewardship Program (USRT Technical Assistance)	Provides consistent conservation planning and adaptive management for the Duck Valley Reservation. Dedicated climate program coordinator will be directly tasked with developing site plans, grant applications, and coordinating permitting for conservation programs in wetland/riparian habitat on the Duck Valley Reservation (1 acre of wetland can store 80-200 tons of carbon).	$500,000 annually through the end of the CPRG grant period ($1,500,000). Employed directly by USRT and stationed remotely on the Duck Valley Reservation.

Table 3. SPT summary table of PCAP measures.

The Shoshone Paiute Tribe has determined that pursuing the following actions in the near-term (3-5 years) through a mix of federal resources, including the CPRG program, will have positive effects on the

tribal community. While the transition to carbon neutrality needs to be accelerated, the exigency of the circumstance also warrants careful planning by the tribal staff; a portion of the climate crisis can be squarely assigned to a failure to consider the long-term effects of energy consumption as a society. Currently there is a rush to implement renewable energy projects throughout adjacent federal lands in the Owyhee Watershed, like the rush to build hydroelectric projects that drove the Owyhee River salmon population into extinction. It is critical that the Tribes be provided a seat at the table and cooperative management over some aspects of the energy planning process in their homelands, with focus on sustainable resource development and adaptive resource planning.

The Shoshone Paiute Tribe would like to be a collaborative partner with other entities engaging in climate resilience measures, such as the State of Idaho, State of Nevada, and other federal agencies, throughout the implementation process. As critical as the pace of the energy transition will be the long-term continuity of funding resources for tribal communities to meet the goals of being carbon-neutral or carbon negative economies by the mid-century. The ecological, wind and solar resources of the ~300,000 acre Duck Valley Reservation are aspects of the tribal community that must be managed sustainably in perpetuity; with the appropriate levels of support the Shoshone-Paiute Tribes will not likely have an issue reaching carbon neutrality by the mid-century.

Shoshone-Bannock Tribes

The Shoshone-Bannock Tribes, located in Southeastern Idaho, has been actively participating in measures to make their community more aware of the potential impacts of the coming change. Working with USRT to develop a vulnerability assessment for their region and completing their own regional climate adaptation plan for the Upper Snake River basin primed this tribe to implement significant measures to reduce climate pollution. Essentially the Shoshone-Bannock Tribe is already aware of numerous 'solution-based' projects that would improve the resilience in their community due to the management of approximately 540,000 acres of reservation lands in Southeastern Idaho. The table below is a high-level summary of the Shoshone-Bannock Tribal proposal for priority climate pollution reduction measures that would be implemented with Phase II CPRG or other sources of funding in the near-term.

Measure Description	Measure Benefits	*Estimated Cost
Measure 1: SBT Revolving Loan Program	Provides access to capital for tribal members installing renewable energy on households. On average a 10kwh solar system removes ~4 tons of carbon annually, at full lending capacity this program will remove a minimum of 200 tons of carbon per year.	$2.25 million fund capitalization; managed by SBT CDFI.
Measure 2: SBT Service Panel Upgrade	Provides access to upgraded residential service panels for eligible tribal households.	$1.5 million; goal is to install panels on up to 200 tribal homes on the Fort Hall Reservation.
Measure 3: SBT Electric Vehicle Charging Stations	Provide 'fee-free' electric vehicle charging at each of the three central commercial locations on the Fort Hall Reservation. This measure includes constructing and maintaining	$2.5 million (construction), $500,000 (maintenance); goal is to install up to 10 charging ports at each location to provide public

	adequate solar array and battery storage to power the system annually.	benefits for travelers on Interstates 15 and 86.
Measure 4: SBT Renewable Energy and Mobile Incentive	Provides a one-time adult tribal member benefit of $1,000 for qualifying purchases of renewable energy, battery storage, electric/hybrid vehicle, electric non-road equipment or vehicles.	$3.5 million; goal is to provide an incentive to each adult tribal member (~3500) for qualifying purchase.
Measure 5: Fort Hall Climate Stewardship Program	Provides consistent conservation planning and adaptive management for the Fort Hall Reservation. Dedicated climate program coordinator will be directly tasked with developing site plans, grant applications, and coordinating permitting for conservation programs in wetland/riparian habitat on the Fort Hall Reservation (1 acre of wetland can store 80-200 tons of carbon).	$500,000 annually through the end of the CPRG grant period ($1,500,000). Employed directly by USRT and stationed remotely on the Fort Hall Reservation.
Measure 6: Wood Stove Replacement Program	Using the EPA calculator, it is estimated that this program will reduce GHG emissions by ~6 m/tons annually, while also improving indoor/outdoor air quality for tribal member households.	$750,000 for total project costs; up to 100 homes with complete replacement of wood burning stoves with new stoves or electric furnaces.

Table 4. SBT summary table of PCAP measures.

The Shoshone-Bannock Tribes determined that pursuing the following actions in the near-term (3-5 years) through a mix of federal resources, including the CPRG program, will have positive effects on the tribal community. While the transition to carbon neutrality needs to be accelerated, the exigency of the circumstance also warrants careful planning by the tribal staff; a portion of the climate crisis can be squarely assigned to a failure to consider the long-term effects of energy consumption as a society. The Fort Hall Reservation was once a leading producer of phosphate ore, mining disturbed thousands of acres of lands to provide essential nutrients in the industrial agricultural process; allowing for tens of thousands of acres to be converted into irrigable farmland over the past century. The extraction and industrial scale development of phosphate resources left two distinct superfund areas within the Fort Hall Reservation and now influence every development decision made on behalf of the tribes. The advent of industrial scale agriculture is also one of the tribes and Idaho's major sources of GHG emissions; this issue will be a significant component to the CCAP.

The Shoshone-Bannock Tribes would like to be a collaborative partner with other entities engaging in climate resilience measures, such as the State of Idaho, regional tribes, and other federal agencies, throughout the implementation process. As critical as the pace of the energy transition will be the long-term continuity of funding resources for tribal communities to meet the goals of being carbon-neutral or carbon negative economies by the mid-century. The Shoshone-Bannock Tribes manage sufficient resources to be carbon negative by the mid-century; providing sustainable agricultural products, renewable energy resources, and innovative transportation solutions; all that is needed is the requisite investments to help this tribal community emerge as a regional leader in this space. The SBT have the capacity to manage every aspect of emissions reduction actions on the Fort Hall Reservation.

Next Steps in the CPRG Planning Process

The Upper Snake River Tribes Foundation would also like to play a role in providing additional technical assistance to our member tribes through direct staffing on each reservation with a USRT employee. The USRT Climate Steward Program measure is designed to meet the demands of highlighting emissions reduction measures within the community that are 'low-hanging fruits', developing grant/funding proposals to address those issues, and, developing detailed reports for each of the member tribes to include in the CCAP. USRT's proposed measures associated with this PCAP are as follows:

Measure Description	Measure Benefits	*Estimated Cost
Measure 1: Upper Snake River Tribes Climate Stewardship Program (cross-listed with each member tribe as a priority technical assistance measure)	USRT will hire, manage, and coordinate activities for 4 Climate Coordinators; one full-time employee per reservation. The Climate Coordinators will be assigned to work remotely on each reservation and actively pursue grant funding, track implementation projects, and coordinate permitting issues for any conservation project with climate benefits.	$1.5 for three years (each employee will have a budget of approximately $125,000/annually for program management)
Measure 2: USRT Remote/Hybrid Work Policies and Reimbursement Incentives	USRT will develop and implement remote/hybrid work policies and reimbursement incentives for employees to reduce GHG emissions from commuting.	$20,000 for three years (up to $2,500 per employee requesting remote work for up to 8 FTEs). Actual expenditures will match the number of active USRT employees currently employed during the fiscal year.

Table 5. USRT summary table of PCAP measures.

At the conclusion of this document there will be a discussion regarding the next climate planning steps that will occur during the CCAP phase of the CPRG process. The tables presented above are the immediate reaction to the emissions inventory and 'shovel-ready' projects that could occur within the next several years. It is critical to note that each of measures prioritized for implementation should be in some phase of development during the CCAP planning process. As such, it is likely that new or emerging issues will be identified during the CCAP process and that each of our member tribes will continue developing new actions to make their communities more resilient to the effects of global climate change.

2 Emissions and Climate Assessments in the Upper Snake

The Upper Snake River Basin, essentially the portion of the watershed above the Hells Canyon Complex and the Salmon River watershed, is linked together by the many river systems that make up our member tribes' homelands. Each of our member tribes share common heritage and/or ancestry, with the riverscapes helping define their own specific geographic context. It is critical to note that the contemporary reservation landscape of our tribes is not reflective of the vast area they call home or their cultural connection to lands outside of their reservations. While the PCAP is directly focused on taking immediate actions to reduce climate pollutants for tribal members and their reservations directly, the CCAP will include multiple actions focused on promoting resilient conditions across their respective traditional homelands with the appropriate partners.

The member tribes from the USRT began engaging in climate vulnerability assessments and adaptation planning in 2016 for the entire Upper Snake River Basin, along with the Salmon River basin due to its cultural tie to some of the last wild populations of anadromous fishes remaining in our watershed and the presence of the terminated Lemhi Shoshone and Mixed-Bands Bannock Reservation.[6] These vulnerability assessments are included as appendices to this PCAP and form a significant portion of the local, tribal understanding of potential impacts from climatic shifts in our region and measures that can be employed to increase community and ecological resiliency. This background information was developed through the Bureau of Indian Affairs (BIA) through the regional climate adaptation process and should be considered foundational background while reviewing this document. Due to the presence of the approved climate assessments, the USRT PCAP planning phase was focused solely on evaluating coarse-scale data available from publicly available and vetted resources like the National Emissions Inventory (NEI) and other federal databases; a discussion of how the data was 'downscaled' for planning purposes is included in the following sections below.

All the States that our member tribes are located or co-located within completed Priority Climate Action Plans funded through the Climate Pollution Reduction Grant program.[7] This document is intended to accentuate those broader State-based plans with local, tribal issues; nothing in this document conflicts with the direction or any of the measures included in those plans. Each of the tribes in the relevant jurisdiction are included as communities in those State-based plans and are shown consideration throughout those planning processes. To the extent that any of the measures or proposed policies in the State plans of Nevada, Oregon, or Idaho will benefit our member tribes' communities, those measures are incorporated by reference throughout this document. The summaries for each of the State-based PCAPs are intended to be illustrative and not comprehensive to provide focus for the tribal specific measures proposed for implementation in the near-term.

2.1 CPRG Overview

The Climate Pollution Reduction Grant (CPRG) program, administered by the Environmental Protection Agency (EPA), was developed through the Inflation Reduction Act to provide meaningful planning and implementation of pollution reduction measures across the nation. The CPRG program is a two-phase process that provided $250 million for noncompetitive planning grants for states, local municipalities,

[6] Both plans are attached as appendices to this document and are considered supplemental materials to this PCAP that the reader should consider in context of reducing GHG emissions.

[7] The States of Idaho, Nevada, and Oregon CPRG PCAPs can be easily found on EPA's CPRG website at https://www.epa.gov/inflation-reduction-act/priority-climate-action-plans-states-msas-tribes-and-territories (last searched on March 14, 2024). Each of the state-based plans are relevant to our member tribes and nothing in this document is intended to conflict with those adopted plans by our member tribes.

tribes and inter-tribal consortium. The Upper Snake River Tribes Foundation (USRT) applied for and received Phase 1 planning funding to support our member tribes' efforts to promote climate resiliency on their homelands. This Priority Climate Action Plan (PCAP) represents the coarse-scale data collection and evaluation of near-term actions that can be implemented to provide immediate climate pollutant reduction within our member tribes' communities. These PCAP actions will be used to apply for additional funding through the CPRG program, where approximately $4.6 billion is available for competitive implementation grants; provided the tribes have an approved PCAP in place.

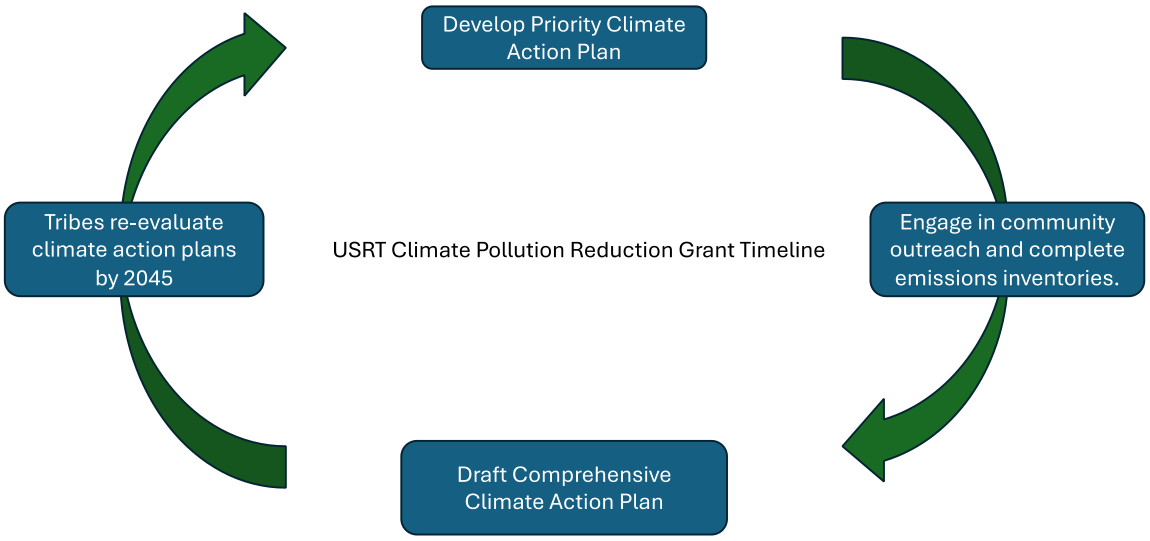


Figure 1. Process-flow diagram for re-evaluating CPRG climate action planning documents.

Following the submittal of the PCAP and Phase 2 Implementation applications on behalf of our member tribes, USRT will begin the second planning phase to complete a Comprehensive Climate Action Plan (CCAP). While it is critical to begin the process of implementing near-term reduction actions, it is equally important to recognize that actions taken to build climate resiliency will occur on a much longer timeline and require thoughtful adaptive management assessments by tribal professionals. The purpose of the CCAP is to take the coarse data gathered during the PCAP and the preliminary results of implementation measures, evaluate that data in a localized or 'downscaled' view specific to each of our member tribes' unique geographic context. Following the planning process, each member tribe will have a comprehensive roadmap to achieve carbon-neutral or carbon-negative goals while improving the ecological, community, and economic health of their respective homelands.

2.2 USRT Climate Assessments (Snake River Basin)[8]

As noted above, USRT member tribes participated in a collaborative effort to develop a climate vulnerability assessment for the Snake River Basin above Hells Canyon Dam; the SBT further developed information for the area surrounding their reservation into a Climate Adaptation Plan. Understanding potential impacts from global climate change at a downscaled level can provide decision makers with critical information to develop policies that match the nature and scope of the issues their communities may face in the coming decades. The Upper Snake River Basin will experience dramatic shifts in climate that will see a decline in snowpack, increase in ambient air temperatures, increases in the number of frost-free days in lower elevations, and an uncertain water quantity future for much of the Snake River Basin; in particular with those communities dependent on the current reservoir configuration.

During the planning process for the USRT and SBT Climate Assessment and Adaptation Planning, the Project Team for USRT selected the large boundary shown below for the project based on watershed boundaries that encompass the four USRT member tribes. The 97,060 square miles (62,118,234 acres) included in the assessment covers large sections of southern Idaho and eastern Oregon, and small portions of northern Nevada, northern Utah, and western Wyoming.

Figure 2. USRT Climate Change Vulnerability Assessment Study area, includes areas documented by the Shoshone-Bannock Tribes Climate Change Assessment and Adaptation Plan (*yellow - South, and green –East, polygons used for climate analysis).*

This larger domain was divided into three smaller subdomains, each with somewhat distinct elevations, climates, and ecosystems. These subdomains are hereby referred to as the North (shown outlined in red), South (outlined in yellow), and East (outlined in green). Downscaled climate projections for the

[8] **Recommended Citation:** Petersen, S., Bell, J., Hauser, S., Morgan, H., Krosby, M., Rudd, D., Sharp, D., Dello, K., and Whitley Binder, L., 2017. Upper Snake River Climate Change Vulnerability Assessment. Upper Snake River Tribes Foundation and Member Tribes. Available: http://www.uppersnakerivertribes.org/climate/

Upper Snake River regions were from 20 global climate models run with two emissions scenarios by the Oregon Climate Change Research Institute (OCCRI) and the University of Washington Climate Impacts Groups (CIG), with technical assistance from the tribes' technical staff and Adaptation International. The outputs from the models were used to calculate potential future changes in temperature and precipitation for the tribal lands being evaluated. Since climate is considered the long-term[9] average of weather for a specific location, it is important that changes be compared between multi-decadal periods. These projections were analyzed in reference to a baseline period (1950-2005) for three future time periods: the 2030s (which represents the years 2020-2049), the 2050s (which represents the years 2040-2069), and the 2080s (which represents the years 2070-2099). All the information summarized in this section is included as an appendix to this PCAP, USRT strongly encourages the reader to review these documents in detail as they form the foundation for much of this work presented in the PCAP. The USRT member tribes have spent the past decade developing assessments for various species and habitat types, for precipitation and surface temperatures, across their homelands and the information remains more pressing with each passing year.

The Upper Snake River Basin evolved around the seasonal pulse of melting snow from higher elevations during the spring months. The higher elevation tributaries would store water equivalent stream flows in mountain snowpack until the early summer, keeping high mountain springs and streams flowing with cold, clear water that supported the ecological health of the watershed. The decline in snowpack is both a feature of the shift from snow to rain in the higher elevations in the late fall and early spring, as well as extended periods of drought based on Pacific Ocean cycles. The natural cycle built an ecosystem that formed the basis of cultural practices for our member tribes and the disruption of the snow cycle is just one example of climate challenges. Fortunately, the Upper Snake River Basin is not projected to see significant declines in the total amount of precipitation in the coming decades, with some models projecting slight increases; however, the timing of that precipitation will affect the ecological processes for our homelands and important subsistence foods.

Perhaps one of the more striking themes of the climate models was to visualize the change in 'frost-free' days in the Snake River basin. The potential impact on agricultural processes that are already stretching water resources and infrastructure from an additional 60 days of frost-free weather is significant. In a changing climate it is not beyond reason to assume that new and more water intensive crops will be planted across the Snake River plain; potentially contributing to a rise in agricultural emissions and chemicals. The potential for stochastic events, even with relatively stable water resources, will also continue to stress this industry and the tribes who rely on these products as a foundational component of their economic health. In addition, fuels that drive the significant wildfire risk on the Snake River plain will dry out more quickly and the risk of wildfire will remain present over the landscape for longer periods of time.

A common feature of most climate assessments is the development of projections for the increase in ambient air temperatures that is expected to dominate the next century based on the relative concentrations of GHG in our atmosphere. There are several ways to express the planet's warming potential, with one being an aspirational goal of rapid actions designed to alleviate some of the worst effects and the other being a 'business as usual' scenario where actions are not implemented in a timely

[9] The PCAP will use the phrase "long-term" to reference a temporal distance of greater than 25 years. The term short-term and/or near-term will be used to reference less than 5 years.

manner, and we are experiencing significant effects from a changing climate. The figure below highlights the range of projections for precipitation and temperatures for the mid-century mark.

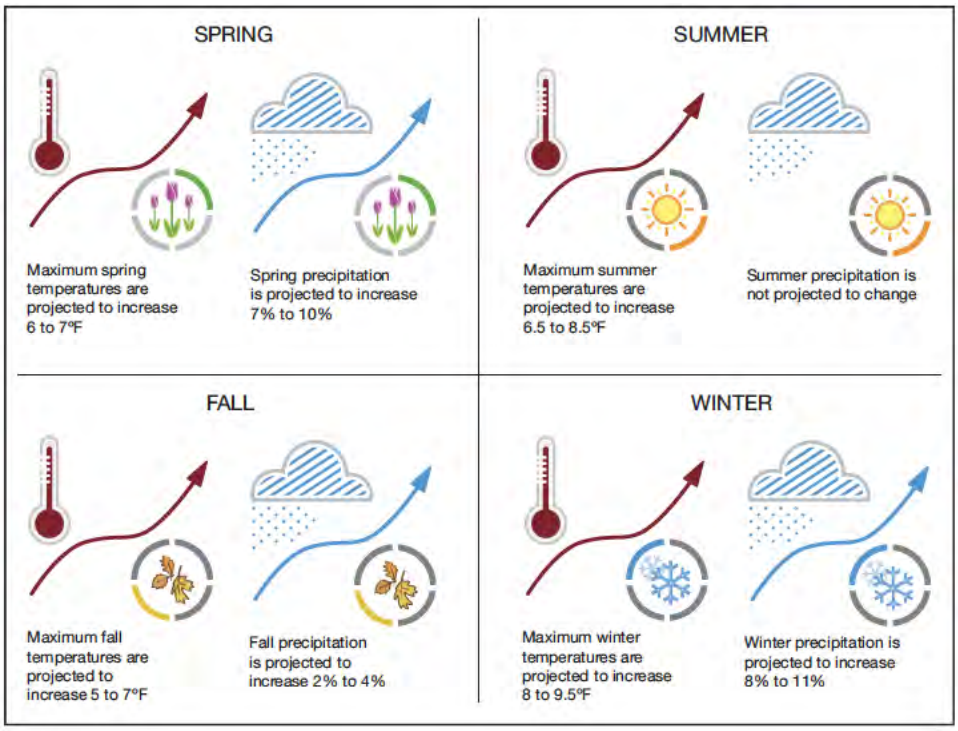


Figure 3. Seasonal climate change projections for the Upper Snake River Study Area in the 2050's.

Maintaining a cultural tradition on a landscape over the course of more than 10,000 years is fundamentally an exercise in effective climate adaptation and building resilient communities. In the Upper Snake River Watershed, this time-period included: a transition out of an ice age; mass emergence and migration of plants and animals; and the collision of societies, materials and goods, and disease from the opposite side of the world. USRT member tribes now face similar environmental, societal, and cultural effects of human-driven global climate change and will look both to their proven cultural strengths and the adoption of innovative scientific techniques to continue to successfully adapt and thrive on the landscape. Tribal communities are still experiencing the effects of colonization, structural violence, and lack of control over their own resources, the intersection of climate change and funding opportunities like the CPRG program will serve our member tribes by helping them plan and implement specific measures to take advantage of new information and technology.

USRT has participated in numerous climate resilience and adaptation forums, as well as playing a key role in developing a Tribal Resilience Action Database that will be functional later this year. The Tribal Resilience Action Database project brings together a group of project partners and advisors representing more than two dozen Tribes across North America to create a culturally sensitive, easily accessible, and useful database of climate adaptation strategies and community examples already published by Tribes that can be used to inform ongoing and new climate adaptation and resilience work in Tribal communities. In addition to participating in database development, USRT also participated in helping develop the Tribal Climate Adaptation Guidebook in collaboration with multiple partners. The intent of

this project was to ensure that regional tribes have access to examples of planning documents, processes, and contact information for regional climate professionals.[10]

Strengthened collaboration between the four tribes and assessment of their shared concerns under regional climate change was, perhaps, the most important outcome of the climate assessments. The tribal perspectives and scientific climate projections of the assessments help establish a common foundation for future adaptation efforts among and between the USRT member tribes that address specific vulnerabilities. The species-specific vulnerability information in the climate reports can assist in the development of truly localized adaptation strategies and actions that minimize the negative effects of climate change and take advantage of emerging opportunities. Continued collaboration and action to address these vulnerabilities and prepare for the future will help ensure that the tribes who have lived and subsisted in the Upper Snake River Watershed for thousands of years will continue to thrive for generations to come.

2.3 PCAP Overview of Topics Evaluated

The USRT PCAP is formatted to include the following elements for each of the four member tribes; all the required elements are present for each of the tribes' GHG inventory and prioritized climate pollutant reduction actions. While not required the USRT PCAP also contains a brief description about the need to build long-term tribal capacity to implement the resiliency measures and to develop sustainable reduction measures that focus on community health in the coming century. The following bulleted list of topics are addressed in each of the Tribal Chapters for our members. It should be noted that while this PCAP does not address the "Optional" criteria, each of the required elements for the CCAP will be addressed in the coming years following in-depth discussions with our member tribes. The USRT Foundation remains focused on developing near-term measures to help our member tribes prepare for climate change and to ensure future generations have the opportunity to thrive in a healthy and resilient environment.

- *GHG inventory **(Required)***
- *Quantified GHG reduction measures (priority measures only are **Required**)*
- *A benefits analysis **(Required)***
- *A review of authority to implement **(Required)***

As noted above, it is critical that the reader of this document consider background information contained in the previous USRT/SBT Climate Vulnerability Assessment and Adaptation Plans. The efforts to characterize the range of potential physical changes in current climate helps lay the foundation for the approach to building climate resilience in our tribal communities. The approach to developing the Comprehensive Climate Action Plan relies heavily on leveraging previous assessments, coupled with current emissions inventories, to develop long-term strategic plans for both project implementation and policy frameworks for managing critical resources and infrastructure. The figure below is a summary of the shared concerns from the previous climate assessments for the Upper and Mountain Snake River basins, these concerns have been the foundation of natural resource actions from 2017 and the USRT member tribes will continue to implement programs associated with these concerns.

[10] The Tribal Climate Adaptation Guidebook can be accessed at https://tribalclimateadaptationguidebook.org/tribal-examples/

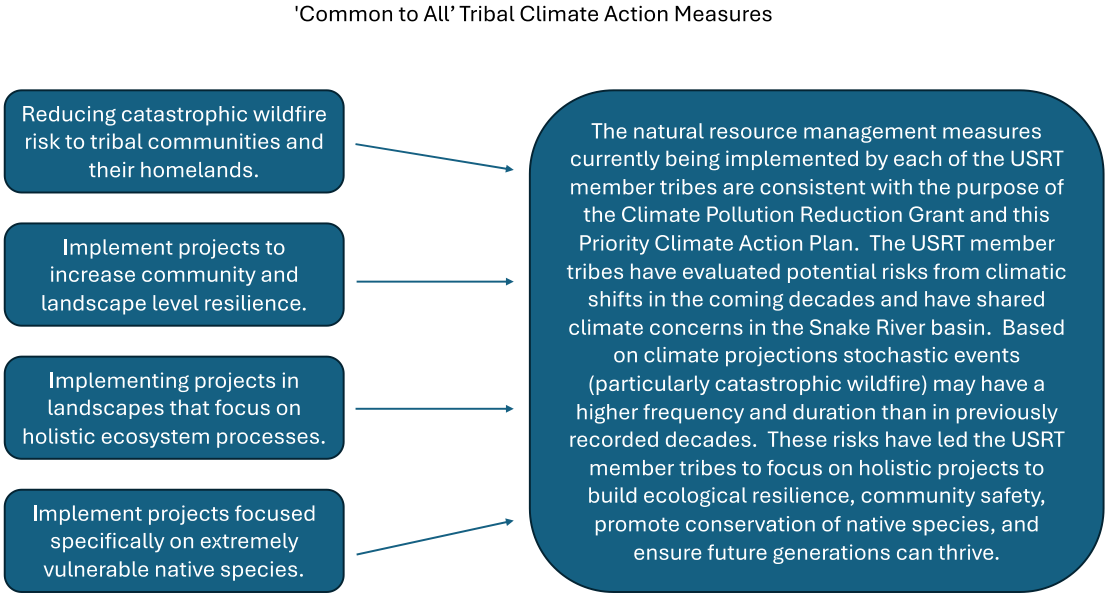


Figure 4. Climate adaptation measures previously described in planning documents and considered common measures for all four member tribes.

Each of the USRT member tribes engage in extensive natural resource management both on and off-reservation to promote the protection and stewardship of important tribal resources, sensitive and listed species, medicinal plants, and water resources. The tribal natural resource programs are all mature and pre-date the development of the CPRG program and will continue long after the grant funding has been expended for priority projects. While the impact of these programs is not evaluated as a specific priority measure, each of the tribal projects will need to be included in the CCAP to estimate the total GHG 'value' of these conservation measures. Investing in technical assistance for each of our member tribes to engage in long-term conservation on tribal lands has the potential to gain long-term GHG reduction benefits from existing projects implemented by tribal programs.

2.4 Approach to Developing the PCAP

USRT technical staff determined that the most effective way to approach developing the PCAP was to partition the tasks as follows: perform a high-level scan of publicly available and vetted emissions data resources; compile that information in a spreadsheet format using the TGIT worksheets from the EPA; review draft measures with tribal technical staff; and, completing the PCAP by prioritizing and selecting GHG reduction measures for implementation on tribal lands. The PCAP will also estimate the potential reductions from those actions and lay out a clear path for those actions to be implemented by each respective tribe. USRT is a support organization for our member tribes and will continue to fill that role through the development of the CCAP over the course of the next three years.

Technical staff from USRT reviewed available data from previous planning efforts and determined that new emissions inventory would need to be conducted to provide a better resolution for each tribal community. The States of Idaho, Nevada, and Oregon did conduct similar emissions estimates based on their previous emissions inventory; those PCAPs cover the tribes within their jurisdiction and should be

considered as companion documents for the USRT PCAP insofar as they do not conflict with or assert jurisdiction over tribal actions within their respective reservations. The USRT PCAP direction was determined to be most effective at advocating for those measures with the potential to be implemented immediately and to have significant benefits for the tribal communities while the comprehensive planning efforts take place on a parallel track.

2.5 The Tribal PCAP Management and Development Team

The development of the USRT PCAP was composed of USRT staff: Daniel Stone, Environmental Program Director (CPRG 'Task Leader'); Dennis Daw, Fish and Wildlife Program Director (QA/QC); and, Scott Hauser, Executive Director (Project Oversight). Adaptation International, specifically Sarah Fleckenstein, was integral in gathering and evaluating data for this project during the drafting of this PCAP. Utilizing specialized contractor expertise for the emissions inventory allowed for tribal collaboration, emissions inventory/data analysis, and initial plan drafting to occur simultaneously.

- Working with Trey Wall, Rebecca Fritz, Jason Fenton, and Calla Hagle from the Burns Paiute Tribe, USRT staff was able to answer several of the initial inventory questions and to review the initial draft of the PCAP. The draft PCAP was reviewed with the Burns Tribal Council on March 27, 2024 to select tribal priorities for near-term implementation, pending tribal funding availability or receipt of Phase II Implementation funds.
- USRT staff worked with Duane Masters from the Fort McDermitt Paiute Shoshone Tribe to answer the initial inventory questions and during the plan drafting. The PCAP was reviewed the FMPS Tribal Council to select priorities for near-term implementation; pending funding availability or receipt of Phase II Implementation funds. The Fort McDermitt Tribal Council met on March 12, 2024, and passed a resolution of support for the Upper Snake River Tribes Foundation to submit this PCAP to the EPA.
- USRT staff worked with Marissa Snapp, Environmental Director from the Shoshone-Paiute Tribes, during the initial inventory phase of the planning process and during the initial draft of the PCAP. The PCAP was reviewed with the SPT Tribal Council on March 19, 2024, to select priorities for near-term implementation; pending funding availability or receipt of Phase II implementation funds.
- Working with Chad Colter, Wyatt Peterson, Lori Howell, and other technical staff from the Shoshone-Bannock Tribes, USRT staff was able to identify several priorities for inclusion in the PCAP. The PCAP was reviewed with the SBT Tribal Council on March 26, 2024, to select priorities for near-term implementation, pending future availability or receipt of Phase II implementation funds.

USRT staff would like to acknowledge the role each of the tribal leaders and their staff play in developing goals for sustainable and climate resilient communities, this recognition extends to our USRT Commission who take on the additional duty of representing our Intertribal Consortium while also maintaining their elected seats on their respective councils.[11] The continued leadership and dedication by our member tribes to the goal of protecting their homelands is evident in their commitment to reducing their respective tribal emissions. While USRT plays a coordinating role each of these tribal leaders are working on the ground in their communities for future generations of tribal members.

[11] The Upper Snake River Tribes Foundation Commission membership is located at https://uppersnakerivertribes.org/ (last searched March 21, 2024).

Intertribal consortium, in general, help fill a critical need to take on regional coordination for issues of common concern for their members, with climate change being a very good fit for those organizations to offer technical assistance and fill in gaps for tribal capacity.

2.6 Data Collection

The PCAP utilized high-level, publicly available data for the purposes of setting near-term climate pollutant reduction measures; with planning data primarily derived from the National Emissions Inventory (NEI), US Census "My Tribal Area" portal, and the SLOPE tool from the National Renewable Energy Laboratory (NREL). In contrast, the CCAP is intended to utilize down-scaled, localized data to set generational climate pollutant reduction targets for each tribe. Given the difference in scope for each planning process, USRT staff determined that an initial survey of emissions, demographic, vehicle, and utility data would provide a broad understanding of the local challenges each of our member tribes will face in the coming decade, while remaining cognizant of the missing information necessary to make nuanced decisions on specific topics.

USRT staff collaborated with staff from Adaptation International (AI, *see Acknowledgements*) to evaluate data from: the NEI[12], 2020 US Census[13], State and Local Planning for Energy (SLOPE) data viewer from the National Renewable Energy Laboratory (NREL) Department of Energy[14], Alternative Fuels Data Center (AFDC)[15], and locally available data specific to each tribe from their respective counties, states and/or tribal governments. Data was logged by staff in the Tribal Greenhouse Gas Inventory Tool (TGIT) data collection spreadsheet, checked for consistency with other sources of information, and ultimately curated as figures for use in the PCAP.[16] The data was collected for each Tribe within the EPA GHG Collection Templates (Collection Templates). The Collection Templates include the equations for unit conversions and the data sources and are available in Appendix A. The data was collected for the year 2020, because it included the most up to date information available, although there may be emissions differences due to the impacts of the COVID-19 pandemic they are expected to be relatively minimal.

The majority of the NEI data was collected at the county level. However, three of the four USRT member tribes' reservations are in multiple counties, with two of our member tribes sharing a border within two states.[17] The USRT team used the following equation to calculate the per capita data and the Tribal total data.

- (County level data/total county population) * Reservation population = Total Tribal data

[12] The USRT team decided to use the NEI 2020 emissions data, recognizing that there would be some impacts to emissions from the COVID pandemic. (*last accessed 2/15/24*), https://www.epa.gov/air-emissions-inventories/2020-national-emissions-inventory-nei-data

[13] The USRT team decided to use the "My Tribal Area" portal to evaluate each of the member tribes reservations, this data has some limitations but is relatively reliable. (*last accessed 2/15/24*) https://www.census.gov/tribal/

[14] This tool is primarily used to develop benefits evaluations and future planning. (*last accessed 2/15/24*) https://maps.nrel.gov/slope

[15] This tool was simply used to compare results for the purposes of this PCAP, it may be featured more heavily in future iterations like the CCAP. (*last accessed 2/15/24*) https://afdc.energy.gov/

[16] USRT staff utilized this tool to prepare the high-level PCAP inventory and will be utilizing this tool over the next several years to complete the CCAP for the member tribes. (*last accessed 2/15/24*) https://www.epa.gov/statelocalenergy/tribal-greenhouse-gas-inventory-tool

[17] The Burns Paiute Tribe is located entirely within Oregon, Harney County. The Fort McDermitt Paiute Shoshone Tribe is co-located in Oregon and Nevada, within Malheur and Humboldt Counties respectively. The Shoshone-Paiute Tribes are co-located in Idaho and Nevada, within Owyhee and Elko Counties respectively. The Shoshone-Bannock Tribes are located entirely within Idaho, including Bannock, Bingham, Caribou, and Power Counties.

For reservations that are within multiple counties the calculator is:

- ((county A data + county B data … + county N data)/(county A total population + county B total population … + county N data))* reservation population = total Tribal data

This information was put into the TGIT by staff from AI and USRT in November and December 2023, delivering the final spreadsheets for use in this PCAP prior to the update in February 2024.[18] The TGIT calculates the data by source and inventories the greenhouse gas emissions by sector and scope. Within this research process and the time allotted for the Priority Climate Action Plan, our data only includes high-level data within scopes 1 and 2; the CCAP will contain the entire inventory for each of the member tribes.

The NEI Data Retrieval Tool was used to incorporate the mobile and facility data emissions. However, this data only included the GHG emissions released. The TGIT did not allow this GHG to be input directly into the source locations (ie. stationary, mobile, and electricity). Therefore, the mobile and facility emissions were logged on the "Additional Emissions" tab of the TGIT. This process did not allow all the total emissions to be calculated by the correct source location, although this issue will be resolved in the CCAP.

Following the development of data in the TGIT, the research team edited the Inventory Tool outputs by adding these emissions to their correct source locations. These edited outputs provided better representation of the total emissions, emissions by gas, and emissions by sector. The research team created additional figures to represent the emissions by source and the sectors that are currently creating them (ie. Mobile Emissions by residential, commercial/institutional, and industrial). These figures are shown in this PCAP for each of the member tribes in their section along with a brief narration of the results.

For the purposes of the PCAP, the use of the categories found in the TGIT were deemed acceptable to USRT staff and the data was largely available for each of the categories. Each of the participating tribes provided critical feedback during the process to USRT staff about existing information for each of the planning categories. It is notable that while each of the categories were evaluated, tribal PCAP actions focused on near-term, implementation-focused projects to immediately reduce the effects of GHG pollutants in their communities. For example, three of the USRT member tribes do not utilize wastewater treatment facilities, but the Shoshone-Bannock Tribes operate a wastewater system that would benefit significantly from adaptive measures to reduce climate pollutants during the wastewater treatment process. Each of the USRT member tribes are unique in their governance, culture, geography, and tribal needs; but they are bound together through their tribal heritage and the common climatic issues facing the Upper Snake River basin.

2.7 Coarse Downscaling of State and County Data for USRT Tribes

The most obvious issue with developing a PCAP involving four tribes in three states is sacrificing precision for expediency during the accelerated planning and implementation grant process for the Climate Pollution Reduction Grant (CPRG) process. Data sets are often built around states and their

[18] USRT recognizes that there was a 'last minute' update in February 2024 to the TGIT but declined to re-develop previous work given the advanced stage of development for the PCAP. It is anticipated that in future iterations of the CCAP this updated tool will be used in place of the previous tool.

associated counties, without including specific references to tribal lands within those states/counties. The Shoshone-Bannock Tribes of the Fort Hall Reservation (SBT), located in Southeastern Idaho, is approximately 540,000 acres spread across four counties. The Shoshone-Paiute Tribe of the Duck Valley Reservation is approximately 290,000 acres and is located in Owyhee County, Idaho and Elko County, Nevada. The Fort McDermitt Paiute Shoshone Tribe has approximately 35,000 acres located in Malheur County, Oregon and Humboldt County, Nevada. The Burns Paiute Tribe is located entirely within Harney County, Oregon and manages approximately 14,000 acres of tribal lands. The issue of how to appropriately downscale existing data in a meaningful way for each of the tribal decision makers to set priorities was the first order of planning.[19]

USRT and AI staff determined that for the purposes of the PCAP, a proportion of the county level estimates, based on demographic information from the 2020 Census, would be sufficiently precise enough to provide meaningful information to tribal decision makers, while still allowing for localized data to refine estimates and climate pollution reduction targets during the CCAP planning phase. The purpose of the PCAP is to highlight and identify critical reduction measures that can be implemented expeditiously by the tribes to reduce their climate pollution footprint and make a meaningful contribution to the goal of becoming carbon neutral in the coming decades. There will likely be some minor differences between the information evaluated in this initial PCAP and the final CCAP, although those difference are likely to be negligible and based on site specific indicators that are not clear at the state or county level; essentially, those differences will be specific to each tribe and their reservations.

This coarse method of proportional emissions can lead to some anomalies in the data based on the communities we are evaluating. It might be assumed that everyone uses approximately the same amount of electricity per capita, but rural users who rely on electricity for pumping groundwater for household use will utilize significantly higher rates of power than their urban counterparts who use 'city' water systems. Likewise, rural communities may travel further than their urban counterparts, have less access to public transit, and have fewer options for transitioning to electric vehicles based on the lack of charging station infrastructure. It may also show, like in the FMPST emissions inventory, that per capita emissions are exceptionally high for a tribal member due to emissions in the county that are outside of the immediate jurisdiction of the council to address. The PCAP is acknowledges these data gaps and/or potential issues and is focused on developing immediate climate reduction measures for these communities, rather than wait for detailed data analysis at the localized level.

2.8 Scope of the PCAP vs. Scope of the CCAP

A challenging component of any planning process is to determine the scope of the evaluation, particularly when the subject of the planning process is a combination of related tribes with vast areas of traditional homelands and the catalyst for the planning process is a global phenomenon. To accomplish the primary deliverable for the CPRG, essentially a downscaled inventory and collaborative selection of measures to reduce GHG emissions in the near-term, USRT staff focused on working directly with our member tribes' relevant information for climate change, strategic planning, etc. The CCAP is intended to set a trajectory for each of these tribes to develop a carbon-neutral or carbon-negative economy by the mid-century mark. This ambitious goal is supported by USRT and our member tribes

[19] For example, the Shoshone-Bannock Tribes have a portion of their reservation in Caribou County, Idaho but don't have any tribal members residing in that portion of the reservation; it is primarily rangeland.

because it will ensure future generations of tribal members are living in climate resilient and ecologically sustainable communities.

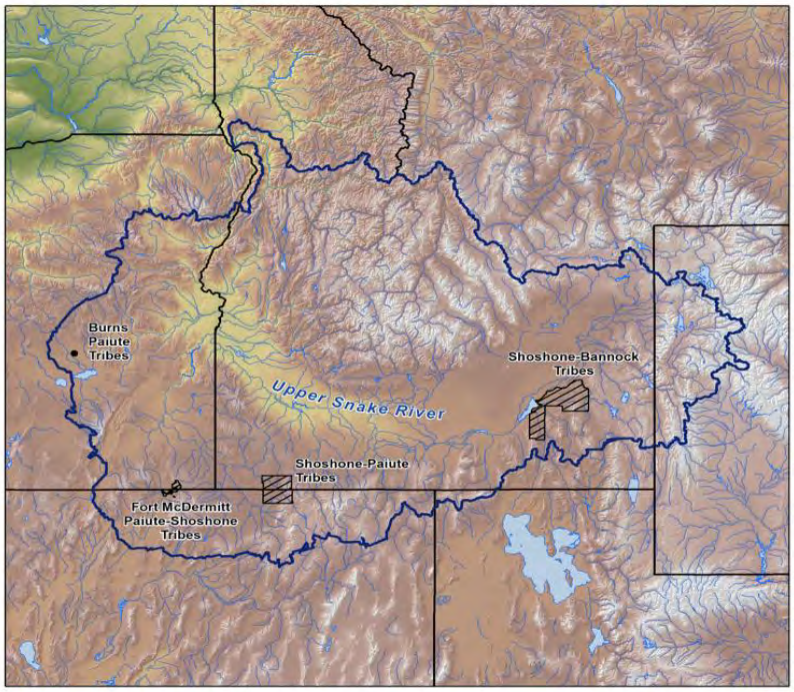


Figure 5. The Upper Snake River Basin covers an area of ~97,000 square miles, member tribes' reservations are noted in hashed portions of Idaho, Nevada, and Oregon.[20]

The USRT staff limited the scope of the evaluation to the counties in which member tribes' reservations were located and tied the implementation actions to those that could be implemented by the tribes under their jurisdiction. This determination was made to effectively deliver the required elements of the CPRG Phase 1 PCAP, make a meaningful impact in the immediate tribal communities, and reserve capacity for adaptive planning in the CCAP. While the scope of the PCAP is intended to be limited, the CCAP will include a broader evaluation of related actions that could be included. Further, the publication of State level PCAPs for Idaho, Nevada, and Oregon help establish the overall emissions inventory for the region. While the publicly available resources were more than adequate to establish an emissions baseline for each of the USRT member tribes there are some limitations of the research outputs due to the high-level data that was collected.

Commercial and Industrial Emissions:

The SLOPE and NEI data appeared to be the best representative of the electricity, natural gas use, mobile emissions, and facility emissions for the area. This data provided information for residential, commercial, and industrial sectors. This data was likely an overestimate within the commercial and industrial sectors. It is known that there is some commercial, institutional, and industrial activity on the reservations; however, the majority of industrial and commercial activity happens off reservation.[21] This

[20] This area corresponds to the USRT and SBT Climate Assessments and Adaptation Plans found in Appendices B and C of this document.
[21] This issue is a specific limitation of the coarse downscaling by county for emissions data, for the CCAP the anomalies will be isolated and corrected to get a better view of each tribes' emissions.

would be an area for further research to identify more accurate ways to identify commercial and industrial activity levels for scope 1 and 2 emissions.

NEI Large Facility Emissions:

The NEI facility emissions were included if they were within the geopolitical boundaries of the reservations. For the Fort Hall Reservation, this included Eastern Michaud Flats Superfund Site and the Pocatello Regional Airport. For the Duck Valley Reservation this included the Owyhee Airport. Though these facilities' emissions were included, they are not necessarily linked to the Tribe's activities. Future researchers should discuss if this should be included or excluded from the emissions inventories, because they may not be supported by the Tribes' activities.

Electricity Emissions and Household Heating:

The electricity emissions were estimated for the NWPP region as a whole but this may be an overestimate because Oregon and Idaho have a lower carbon intensity compared to the surrounding states within the NWPP region. Additionally, a high proportion of the households of the Upper Snake River Tribes heat their homes and occasionally cook with wood burning stoves. This means that the total Tribal emissions for the residential electricity and natural gas use may be lower than the surrounding communities. Future research could include conducting surveys of the number of households with wood stoves and wood stove usage. Future research could also include surveys for utility bills and local utilities to identify more accurate representations of residential electrical use.

Nitrogen Use in Agriculture:

The Shoshone-Bannock Tribe GHG Inventory included agriculture and land management emissions, because the Fort Hall Reservation has high intensity agriculture within its geopolitical boundaries. There was no exact data available for the nitrogen use, so staff used the most conservative application of 2.5 lbs. per acre of synthetic nitrogen as an input for the TGIT.[22] There is a total of 110,000 acres of irrigable farmland in Fort Hall, so these numbers were multiplied for an estimated number. Future research could include a more in-depth survey of the agricultural industry for Fort Hall and measures to reduce the GHG emissions from that sector.

Solid Waste, Agriculture and Land Management, and Urban Forestry:

Solid waste, water use, and urban forestry data was unavailable at the time the GHG Inventory was conducted for this PCAP. Solid waste data was not collected because there were no landfills located nor operated by any of the Upper Snake River Tribes. Agriculture and land management data was only estimated for the Fort Hall Reservation, and only for nitrogen application on croplands. Future research could include this data by surveying for waste collection data for scope 3 emissions. Water use data could be included by surveying households using municipal or commercial water lines and the utility use. Agriculture and land management data could be located by surveying for fertilizer application methods, as well as the carbon sequestration potential of tribal rangelands or non-commercial forests.

[22] Wheat requires ~2.5 lbs of nitrogen per acre in southern Idaho (https://www.webpages.uidaho.edu/ce431/Handouts/Winter%20Wheat%20Fertilize%20Guide.pdf), Potatoes can require up to 220lbs/acre, this topic will be addressed in more detail through the CCAP process due to the wide variation in emissions.

Expected Changes in Average Temperature and Average Precipitation

Previous work developing climate vulnerability assessments under funding through the BIA has allowed the USRT member tribes to understand specific risks to their communities. A large component of the climate planning process is to adapt contemporary management systems and strategies to expected conditions. This can be exceptionally difficult when there are risks to infrastructure, particularly electrical and transportation, that are supposed to be generational investments. The Upper Snake River Basin was modelled using a 'business as usual' scenario and one that hews closely to the U.N. climate targets for global carbon concentrations.

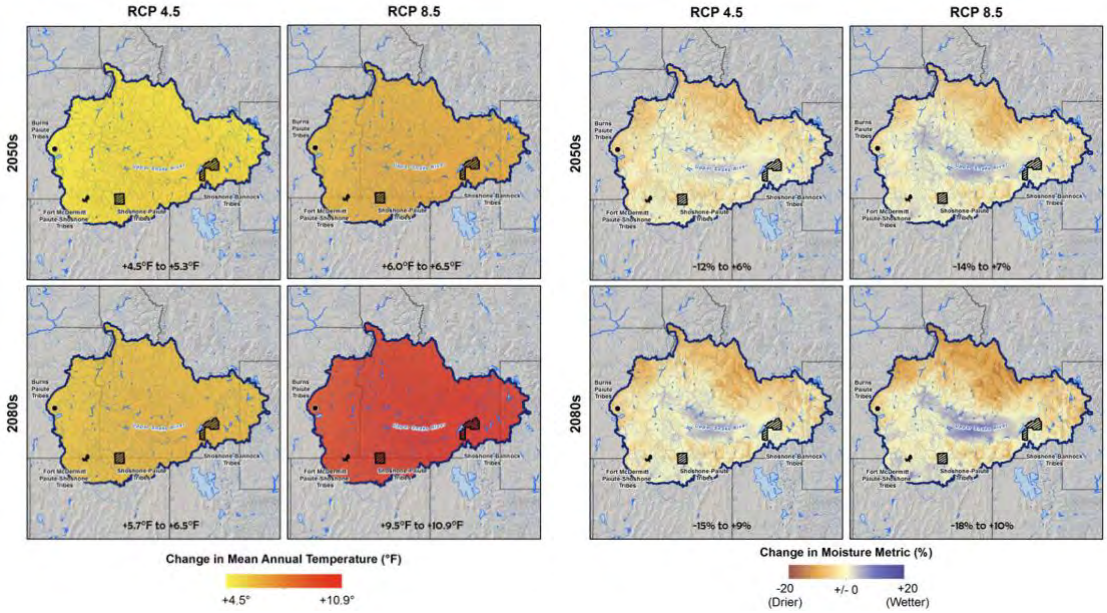


Figure 6. The figure above shows a shift in temperature and precipitation anticipated through 2080 that will dramatically re-shape tribal priorities in coming decades.

Famous Statistician George Box was credited with a 1976 quote, "All models are wrong, but some models are useful." Climate change vulnerability assessments, adaptative planning, and even emissions inventories have fundamental flaws that can lead to numerous conclusions that may turn out to be less accurate in hindsight. The USRT is treating this particular PCAP with the mentality to prepare for climate change pragmatically and in clear step with planned measures that do not contribute inadvertently to the crisis. The previous climate planning efforts and contemporary 'high-level' emissions estimate both provide context for potential policy measures to combat climate change. While policy development can have some expenses for a Tribal government it can play a key role in making our communities more resilient; this PCAP recommends a handful of policy measures that could be implemented to reduce GHG emissions.

A critical component of climate research is to note that the consensus is that a warming planet will have significant consequences, and that the current body of science is pointing to a trend that will continue for the next century. Increases in average temperature can decrease the number of 'frost-free' days in

agricultural zones and allow for new crops to proliferate, in turn this may increase water demand and inorganic fertilizer applications in the Upper Snake River Basin. Change in precipitation from snow-pack to rainfall could drastically impact the current water delivery system from current reservoirs, the output of hydroelectric operations, and the reliance on advanced water delivery systems or groundwater pumping systems. Finally, the nature of extreme weather, heat, or cold events may stress existing housing and community infrastructure beyond its breaking point. USRT staff recognizes that even the best-intentioned models are likely 'wrong' but we cannot underscore how useful they are to plan for a future in tribal communities that will be dominated by change.

2.9 Summary Information from States of Idaho, Nevada, Oregon PCAPs

All three States where our member tribes are located, or co-located, completed PCAPs for their jurisdiction and assigned focus areas for emissions reductions that are relevant for each of our member tribes.[23] The following information is intended to be a high-level summary of those documents and the reader is encouraged to review relevant portions of those plans as background information for the following tribes within their jurisdiction. The following State plans will be relevant for the member tribes as follows:

- State of Idaho – Gem State Air Quality Initiative, Priority Plan, State of Idaho, Department of Environmental Quality March 2024.
    - This plan covers some of the homelands of the Shoshone-Bannock Tribes of the Fort Hall Reservation (located entirely within the State of Idaho), and the Shoshone-Paiute Tribes of the Duck Valley Reservation (co-located within the States of Idaho and Nevada).
- State of Nevada - State of Nevada Priority Climate Action Plan, February 2024 (prepared by: Nevada Division of Environmental Protection, Governor's Office of Energy, Sustainability Solutions Group (SSG), Ericka Aviles Consulting, CIVIX).
    - This plan covers some of the homelands of the Shoshone-Paiute Tribes of the Duck Valley Reservation (co-located within the States of Idaho and Nevada) and the Fort McDermitt Paiute Shoshone Tribes (co-located within the States of Nevada and Oregon).
- State of Oregon - Oregon Priority Climate Action Plan, State of Oregon Department of Environmental Quality, March 2024.
    - This plan covers some of the homelands of the Burns Paiute Tribe (located entirely within the State of Oregon) and the Fort McDermitt Paiute Shoshone Tribes (co-locate within the States of Nevada and Oregon).

These plans cover the areas adjacent to and have considered impacts on tribal communities in their State PCAP boundaries. The USRT PCAP is intended to supplement this more generic information about statewide emissions with community specific information and tribal priorities for measures to reduce GHG emissions. The Tribes are necessary partners in any efforts to collaborate with any of the State initiatives or measures and USRT looks forward to playing a coordinating role throughout the climate planning process. It is important to note that Tribal governments are sovereign entities, with specific jurisdiction over their respective tribes and tribal resources; one critical component of tribal sovereignty

[23] All submitted CPRG PCAPs can be found at https://www.epa.gov/inflation-reduction-act/priority-climate-action-plans-states-msas-tribes-and-territories including Idaho, Nevada, and Oregon.

is the ability make your own tribal laws and effectively govern your own community based on those tribal laws.

Each of the States participating in the CPRG program approached the issue of developing a priority plan in a slightly different manner, much like the USRT approach, each State is unique in their issues and perspective on reducing GHG emissions in both the long and short-term. The common threads binding all these documents together are the focus on reducing 'tailpipe' emissions, focusing on conservation efforts to maximize ecological sequestration, increasing the availability of renewable energy technology, and developing these programs in a manner that helps tribal communities become more climate resilient.

For example, the State of Nevada is home to the richest renewable energy potential of any State in the entire union, with the capacity to generate many times what they consume through a blend of solar, wind, hydroelectric, and geothermal.[24] In the State of Oregon, they have ambitious plans to dramatically reduce all GHG emissions by 2035 in key focus areas like transportation, waste, and residential/commercial buildings.[25] In Idaho Agriculture accounts for approximately 40% of all GHG emissions and the landscapes associated with the Gem State are trending to becoming a source of carbon rather than a sink; these data points speak strongly in favor of conservation measures on those working landscapes.[26] Each of these focal areas mirror issues that the USRT member tribes have discussed both in previous planning efforts and during the preparation of this PCAP. The figures below are intended to highlight PCAP measures from each of these State-based PCAPs that are relevant to tribal interests in the CPRG program.[27]

State of Idaho Summary Emissions

Idaho greenhouse gas emissions in MMT CO2e by economic sector	**2000**	**2010**	**2021**
Agriculture	11.6	13.8	16.2
Commercial	1.7	1.8	2.4
Industry	5.7	3.6	3.7
Power	0.5	1.0	2.3
Residential	1.6	1.7	2.3
Transportation	9.2	9.4	11.1
Total Emissions (Sources)	**30.2**	**31.4**	**37.8**
Land-Use, Land-Use Change, and Forestry (LULUCF) Sector Net Total	0.8	(2.3)	2.7
Net Emissions (Sources and Sinks)	**31.0**	**29.1**	**40.5**

Idaho's Priority Plan (2024) summarizes their GHG emissions as follows: "The GHG emissions inventory by economic sector, presented in Table 1, is from EPA's Inventory of U.S. Greenhouse Gas Emissions and Sinks by State and shows the economic sectors and includes all GHGs. Idaho's GHG emissions

[24] State of Nevada, PCAP, Executive Summary, page 7; citing NREL SLOPE data, "The technical potential for commercial, residential, and utility solar PVs is 6.27 billion MWh; for wind, it is 1.13 billion MWh; for geothermal, it is 54 million MWh; and for hydropower, it is nearly two million MWh.3 This dwarfs annual electricity consumption, which was approximately 39 million MWh in 2021."

[25] State of Oregon, PCAP, Executive Summary, "In March 2020, Governor Brown signed Executive Order 20-04, directing state agencies to take action to reduce and regulate greenhouse gas emissions toward meeting reduction goals of at least 45% below 1990 emissions levels by 2035."

[26] State of Idaho, PCAP, pages 2 and 3, "Idaho's GHG emissions have had a net increase of 9.5 million metric tons (MMT) since 2000. Agriculture is the largest contributor of GHG emissions in Idaho, accounting for 40% of the total emissions, followed by the transportation sector (30%)" and "Figure 2 shows that since 2015, Idaho's lands have been trending toward a source of GHG emissions rather than a sink (EPA's Inventory of U.S. Greenhouse Gas Emissions and Sinks by State). Enhancing carbon sequestration through healthy lands could be a tool for mitigating GHG emissions in the state."

[27] These figures are based on technical review of the available PCAPs from Idaho, Nevada, and Oregon and were not developed by the States, these figures are intended for illustrative purposes only.

have had a net increase of 9.5 million metric tons (MMT) since 2000. Agriculture is the largest contributor of GHG emissions in Idaho, accounting for 40% of the total emissions, followed by the transportation sector (30%)."[28]

State of Idaho Priority Measures

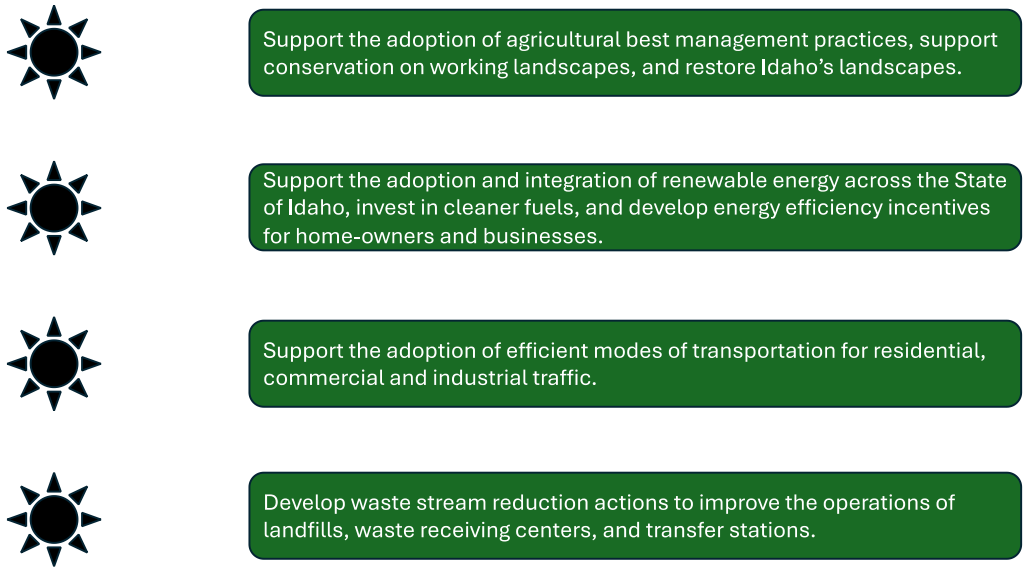


Figure 7. Measures from Idaho's Priority Action Plan that are relevant for tribal communities and lands within the State of Idaho.

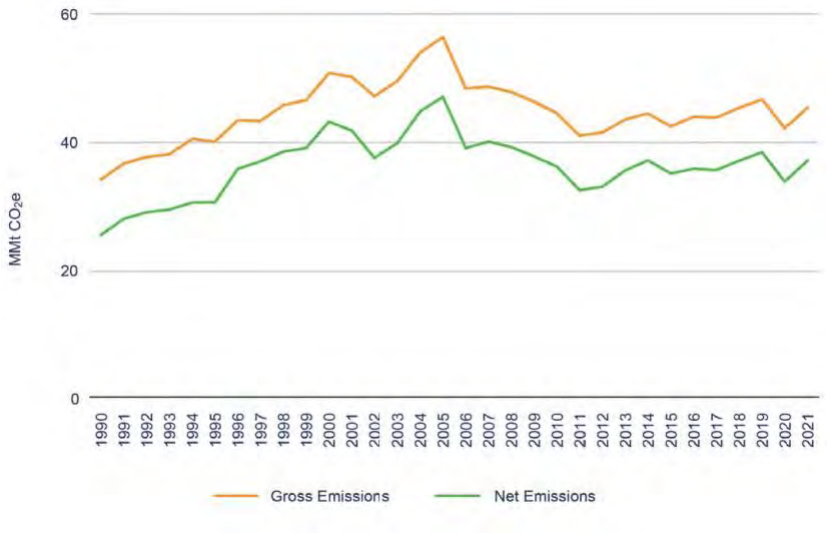
The Shoshone-Bannock Tribes of the Fort Hall Reservation are located entirely within the State of Idaho, and the Shoshone-Paiute Tribes of the Duck Valley Reservation are co-located in the States of Idaho and Nevada. Idaho's priority measures related to agricultural practices and conservation of working landscapes closely aligns with priorities for both the SBT and SPT on their respective reservations, with tribal leadership and previous climate planning identifying risks associated with agriculture and conservation areas. As with the specific measures proposed by the tribes, incorporating renewable energy into the tribal community is a critical aspect of the transition to a carbon-neutral economy; specifically for sectors that consume significant amounts of energy (i.e. gaming, transportation, agriculture). Finally, both the SPT and SBT did not specifically address the management of waste in the PCAP but it will be a focal component of the CCAP, along with agriculture.

State of Nevada Summary Emissions

The State of Nevada summarizes their emissions as follows: "Gross total GHG emissions for the state were 45.4 $MMtCO_2e$ in 2021, with sequestration reducing the total by 8.2 $MMtCO_2e$, for a net total of 37.2 $MMtCO_2e$. In the last decade, net GHG emissions have been climbing slowly after declining from a

[28] Idaho Priority Plan (2024), pages 2 and 3.

peak in 2005, oscillating around 37 $MMtCO_2e$. The COVID-19 pandemic resulted in a drop of 4-5 $MMtCO_2e$ in 2020, but GHG emissions in 2021 have bounced back to pre-pandemic levels."[29]



State of Nevada Priority Measures

In the transportation focus area, measures aim to increase active travel, public transit, and zero emissions vehicle (ZEV) adoption in Nevada.

Measures in the buildings focus area aim to reduce energy use and emissions in both residential and commercial buildings. This includes expanding programs that support pre-weatherization, weatherization, electric upgrades, and retrofits.

Measures in the energy systems focus area aim to reduce GHG emissions from producing energy and electricity. These measures support skillbuilding and knowledge sharing and encourage the use of renewable energy and energy storage.

Key "Industry" measures include turning industrial sites and brownfields into clean energy hubs, encouraging renewable energy and green hydrogen production near industry, reducing methane leaks, and promoting technological innovation.

Measures in the waste reduction focus area incentivize waste diversion, composting, and developing a circular economy. These measures aim to significantly reduce the amount of organic waste and recyclable material that goes to landfills.

Priority conservation measures include tree planting, ecological restoration, and adaptive reuse of industrial/mining sites. Support ongoing research on how land use, land use change, and the agricultural sector contribute to and potentially reduce GHG emissions.

Figure 8. The six focal areas that form the foundation of the Nevada PCAP, each of the focal areas align with goals for tribal communities in Nevada.

The Shoshone-Paiute Tribes of the Duck Valley Reservation and the Fort McDermitt Paiute Shoshone Tribes are both co-located within the State of Nevada; the SPT are also co-located in Idaho, while the

[29] Nevada PCAP (2024), pages 84 and 85. The complete inventory and all figures are found in this section and are derived from Nevada Department of Environmental Quality data.

FMPST are co-located in Oregon. The State of Nevada focused their PCAP on six areas, including renewable energy, residential building upgrades, reducing waste, and adaptive measures for restoring old industrial areas or mining sites. Both the SPT and FMPST have expressed interest in developing renewable energy resources and focusing efforts on engaging in additional conservation efforts to reduce GHG emissions in their communities. It is also clear that additional mining interests, specifically for lithium in the McDermitt Caldera have the potential to impact both tribal communities if they are not adequately planned through reclamation; it is critical that emissions from mining are accurately characterized during the development of the CCAP for both of these tribes.

State of Oregon Summary Emissions

The State of Oregon summarized their emissions data for the state as follows (position modified by technical staff to fit this document format): "Oregon's two GHG inventories depict points of overlap as well as unique contributions and areas that need the most focused reductions: *Transportation is the single-largest contributing sector under both inventories, producing 35% of the state's emissions under the sector-based inventory, and 25% under the consumption-based inventory which includes emissions from "vehicles and parts" and "transportation services" categories. *Residential and commercial buildings contribute 34% of the state's emissions in the sector-based inventory. These emissions are primarily associated with electricity and fuels used to heat, cool, and power buildings. There is considerable overlap in building emissions between the sector-based and consumption-based inventories, such as operating residential, commercial, and government buildings, including appliances and lighting. Emissions associated with construction itself – including both construction activities as well as "embodied carbon" in construction materials – contribute 8% of emissions in the consumption-based inventory. *Food and beverage is the second-largest category in the consumption-based inventory, producing 13% of emissions. The parallel categories in the sector-based inventory include emissions from in-state farms, ranching and food manufacturing."[30]

Oregon Greenhouse Gas Emissions in MMT CO2e by Economic Sector

Sector Totals	**1990**	**2021**
Transportation	21	22
Electric Power Consumption	17	18
Residential and Commercial	6	8
Industry	8	7
Agriculture	7	7
Total Emissions (Sources)	**57**	**61**

[30] Oregon PCAP 2024, pages 13 and 14.

State of Oregon Priority Measures

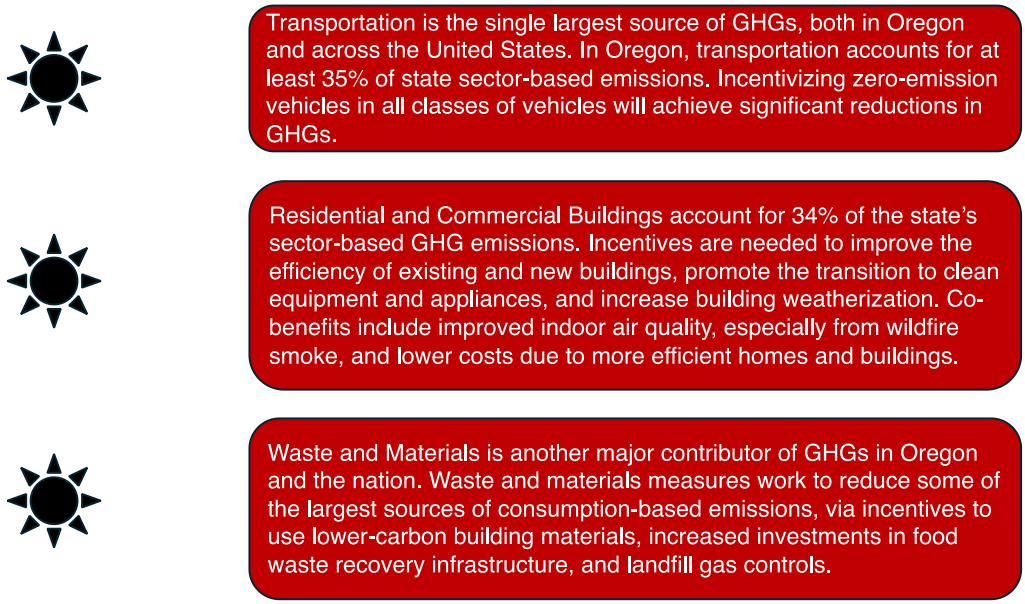


Figure 9. The three focal areas from Oregon's Priority Climate Action Plan are consistent with the direction for tribal lands and communities in the State.

The Burns Paiute Tribes is located entirely within the State of Oregon and the Fort McDermitt Paiute Shoshone Tribe is co-located within Oregon and Nevada. The State of Oregon has proposed focusing their States efforts in three main categories: Transportation, Residential/Commercial buildings, and Waste Management. The BPT and FMPST have both expressed interest in developing programs to improve the efficiency of their tribal communities through the installation of renewable energy projects and electrical service upgrades for tribal homes. While waste management was not directly covered through the PCAP, primarily based on the deliverable deadline for the PCAP, the development of waste management facilities would improve tribal operations and reduce overall GHG emissions associated with the current tribal programs. Finally, measures to address emissions from transportation are relevant to members of both tribes but were not specifically addressed as a priority measure for this PCAP.

3 Burns Paiute Tribe

The Burns Paiute Reservation is composed of 781 acres north of Burns, Oregon, in the arid region of the Great Basin, with a total of 966 acres held in trust by the Tribe and other tribal lands managed for the benefit of fish and wildlife in perpetuity.[31] There are approximately 412 people who hold membership

[31] Burns Paiute Strategic Plan 2022-2026, https://burnspaiute-nsn.gov/wp-content/uploads/2022/10/Burns-Paiute-Tribe_Strategic-Plan-FINAL-Approved-by-Council-9.28.2022.pdf (accessed from Burns Paiute Tribe website, last searched March 27, 2024).

with the Burns-Paiute Tribe with approximately one hundred members living on the reservation.[32] They consist primarily of descendants of the *Wadatika* (Wada Root eaters) Band of Northern Paiute Indians, along with surviving peoples of six other eastern Oregon Northern Paiute bands.[33] The Malheur Reservation was established in 1872 but terminated only 7 years later in 1879 following the Bannock War; the loss of this 1.5 million acre reservation opened much of Eastern Oregon to settlement and deprived the tribes of control over their permanent home. At the time there were still rich salmon fisheries throughout the Malheur, Powder, Burnt and Owyhee Rivers.

The Tribe's homelands and traditional use areas include portions of the Cascade Mountains, the Columbia River, the western Great Basin, and the High Plains/Plateau of western Idaho. Major campsites were historically along lakes, streams, and rivers, where water sources as well as food could be harvested. The Northern Paiutes used willow, tule plant, and sagebrush to make baskets, sandals, fishing nets, and traps. The resources found within this ancestral territory were visited seasonally, stewarded carefully, and sustained the *Wadatika*, providing for their material, spiritual, and medicinal needs.[34] The natural resources of the Upper Snake River Watershed continue to sustain the dietary, cultural, spiritual, and economic needs of the Burns Paiute Tribe.

The data utilized for demographic information in the development of the high-level emissions estimates for the Burns Paiute Tribe and associated tribal lands was derived from the 2020 Census "My Tribal Area" data retrieval tool (https://www.census.gov/tribal/?st=41&aianihh=0400). Demographic data is critical to estimating emissions data for the Burns Paiute Tribe because data inputs for the Tribal Greenhouse Inventory Tool (TGIT) are developed at the State and/or County level; those estimates are not downscaled specifically for each member's reservation associated with the Upper Snake River Tribes Foundation. The primary purpose for using this information from the census is to generically apportion emissions based on a percentage of the total population in the county for which data is available. The methodology associated with this assumption is in line with the presumption that the PCAP is a high-level document to engage Tribal communities in near-term priority actions to reduce climate pollution; the Comprehensive Climate Action Plan will revisit this assumption and attempt to refine data in a manner tailored specifically to each reservation and emission sector.

The total population of the Burns Paiute Tribal lands is presented in the 2020 Census as 104, with 71 people identified as Native American alone. The data indicates that there are 60 total housing units, with 54 of those units occupied in 2020. Further, 46 individuals are commuting for work with approximately 90% of those utilizing light duty vehicles for their 'daily' drive to work. The 2020 Census indicates that 26 individuals are enrolled in school pre-Kindergarten through High School; it is assumed for purposes of estimating emissions that these individuals are utilizing bus transportation to and from school. Given the Census is already four years old, it is likely there will be differences from year to year, but the range estimates provided by the My Tribal Area portal are helpful for evaluating high-level emissions for the BPT.

For purposes of estimating emissions at the County level, all of the Burns Paiute Tribal lands are located within the exterior boundaries of Harney County, Oregon. Harney County has a total population of

[32] Oregon Secretary of State, 2016. Oregon Blue Book: Burns Paiute Tribe. Available: http://bluebook.state.or.us/national/tribal/burns.htm

[33] Teeman, Diane L. 2013. Impacts for Consideration in the Columbia River Treaty 2014/2024 Review. *Submission from the Burns Paiute Tribe*. 16 pgs.

[34] Id.

7,495 individuals with 180 of those individuals reporting status as American Indian, or approximately 2.4% of the total county population will be used for the emissions estimate. It should be noted that there is a difference between the reported figure for the Reservation and those living in Harney County. While this may pose a slight problem in data interpretation USRT staff understand that every tribal member will not reside on their tribal lands for a variety of reasons; as such, the USRT will utilize the total county population of American Indian for emissions estimate. The rationale for this inclusive method of estimation is to ensure that Tribal leadership have adequate data to support growth models and/or planning efforts for future generations of tribal members who may return to tribal lands.

3.1 Special Considerations for the Burns Paiute Tribe

The BPT are located in rural Harney County in Eastern Oregon and have a unique land-base to manage with some parcels being located miles away from each other. The overall acreage provides adequate resources to generate income and/or energy resources for their community. For the purposes of this PCAP, the Burns Paiute Tribe has two issues that increase the complexity of a comprehensive evaluation of emissions and offer opportunities to improve management of this tribal community.

Wastewater Treatment Facilities

The Burns Paiute Tribe does not operate the local wastewater facility in Burns, Oregon. While wastewater facilities can be a source of GHG emissions in any community, the lack of control over the instrumentality of the facility requires that this emission source be disregarded for the purposes of the PCAP. Further options will be explored during the CCAP (Comprehensive Climate Action Plan) for improving the operations of that facility and seeking collaborative solutions with the local utility manager.

Solid Waste Facilities

The BPT does not own or operate a landfill facility, the solid waste produced from tribal lands is removed to a local landfill facility operated outside of the Tribe's direct control. The movement of solid waste from transfer stations does create significant emission sources, but for the purposes of this initial planning process, priority emission reduction actions will focus on other sources. It is anticipated that during the comprehensive planning process the Tribes will allocate multiple emission reduction actions to this category.

3.2 Collaborations

USRT staff focused our collaborative efforts entirely on our member tribes due to the short period of time to develop a high-level GHG emissions inventory, PCAP, and an implementation grant application based on tribal priority actions. Following the release of funding in mid-September 2023 USRT staff developed and received approval for a Quality Assurance Project Plan (QAPP) in late October 2023. With an approved QAPP to work from, USRT staff immediately engaged with our partners through the USRT Technical Work to initiate dialogue with tribal staff to get additional background information relevant to the emissions inventory.

It should be noted that the collaboration occurring during the PCAP development phase through the Technical Assistance Forums, hosted by EPA and Endyna, were excellent opportunities to engage in peer-learning and document development. The opportunity to learn from professionals across the nation, all engaged in the same type of climate action planning, afforded tribal professionals a rare

'inside' look at how Metropolitan Service Areas (MSA) and States utilize data to prioritize actions that support GHG reductions. USRT staff would also like to acknowledge our EPA project officer for hosting regular 'Office Hours' to discuss issues directly with other professionals throughout the planning process.

3. Burns Paiute PCAP Elements

The USRT technical staff engaged with USRT member tribes in beginning early 2024 through the USRT Commission, providing a relatively narrow window to address priority actions to reduce climate pollutants in the near-term with each of the member tribes. Fortunately, the USRT member tribes have already begun the process of climate adaptation and resiliency planning through Bureau of Indian Affairs funding and provided technical contacts to develop tribal priorities with USRT. While neither the USRT or SBT climate adaptation plans were funded through EPA, and are primarily focused on natural resource management, both documents have significant relevance to the PCAP.[35] The Burns Paiute Tribe has already experienced impacts from extreme weather events and a shift in climate has the potential to significantly affect this community.

CPRG planning for this community has the potential, with the requisite capacity, to ensure the Burns Paiute Tribe are carbon-neutral in the coming decade. Reducing GHG emissions in the near-term requires a careful evaluation of the benefits of actions relative to their overall costs and significance relative to a community's GHG emissions. Each USRT member tribe is geographically unique, and each has its own governance structure that is responsible for the health and welfare of their membership. For the Burns Paiute, supporting the tribal member households directly and investments for infrastructure have the highest potential to reduce GHG emissions in the near-term. The following sections contain the GHG Inventory, Emissions Reduction Measures, and Benefits analysis for the Burns Paiute Tribe.

4.1 Burns Paiute Greenhouse Gas (GHG) Inventory

The development of an accurate GHG inventory is critical to understand the specific needs of each of USRT's member tribes. Given the limitations of funding, time, and planning objectives to reduce climate pollutants in the near-term USRT staff utilized coarse, downscaled information to develop the high-level estimates represented in the figures below. There are limitations to the scale of research that can be accomplished during the PCAP process, so additional topics of investigation are noted and USRT requests continued support for member tribes seeking to increase their own understanding of these topics. For detailed information on how the following data was collected and evaluated please refer to Section(s) 1.6-1.8 of this document. The TGIT workbook and associated data collection spreadsheets for the BPT are included as Appendix A, those Excel files were used to develop the following figures.

[35] Both documents are appended to this PCAP as reference material for previous climate planning processes and refined information about each of the tribes and their specific climate goals.

Total Burns Paiute Emissions (MT CO2e)								
	CO_2	CH_4	N_2O	HFCs	PFCs	SF_6	Total MT CO_2e	Percent of Total
Scope 1	1,499.68	0.77	0.01	-	-	-	1,500.46	83%
Scope 2 - Location Based	307.66	0.80	1.09	-	-	-	309.55	
Scope 2 - Market Based (for informational purposes only)	307.66	0.80	1.09				309.55	17%
Scope 3	-	-	-	-	-	-	-	0%
Total Gross Emissions	**1,807.34**	**1.58**	**1.10**	**-**	**-**	**-**	**1,810.01**	**100%**
Total Net Emissions	**1,807.34**	**1.58**	**1.10**	**-**	**-**	**-**	**1,810.01**	**100%**

Emissions by Source (MT CO_2e)								
Source	CO_2	CH_4	N_2O	HFCs	PFCs	SF_6	Total	Percent of Total
Stationary Combustion	16.13	0.04	0.01	-	-	-	16.18	1%
Mobile Combustion	487.33	-	-	-	-	-	487.33	27%
Solid Waste	-	-	-	-	-	-	-	0%
Wastewater Treatment	-	0.55	-	-	-	-	0.55	0%
Electricity - Location Based	307.66	0.80	1.09	-	-	-	309.55	
Electricity - Market Based (for informational purposes only)	307.66	0.80	1.09				309.55	17%
Water	-	-	-	-	-	-	-	0%
Ag & Land Management	-	-	-				-	0%
Urban Forestry	-	-	-				-	0%
Waste Generation	-	-	-				-	0%
Other	996.22	0.18	0.00	-	-	-	996.41	55%
Total (Gross Emissions)	**1,807.34**	**1.58**	**1.10**	**-**	**-**	**-**	**1,810.01**	**100%**
Total (Net Emissions)	**1,807.34**	**1.58**	**1.10**	**-**	**-**	**-**	**1,810.01**	**100%**

Figure 10. Required Sector emissions estimates for BPT PCAP.

As noted above, the USRT PCAP developed emissions inventory estimates for the 'required' parameters and will be developing the complete inventory during the CCAP process. While it would be preferred to have the entire inventory available for the PCAP, particularly for setting priority measures to reduce GHG emissions, the accelerated timeline did not permit adequate consultation for each of the individual tribes. In the coming three years, USRT staff will work directly with representatives from our member tribes to complete this project for the CCAP.

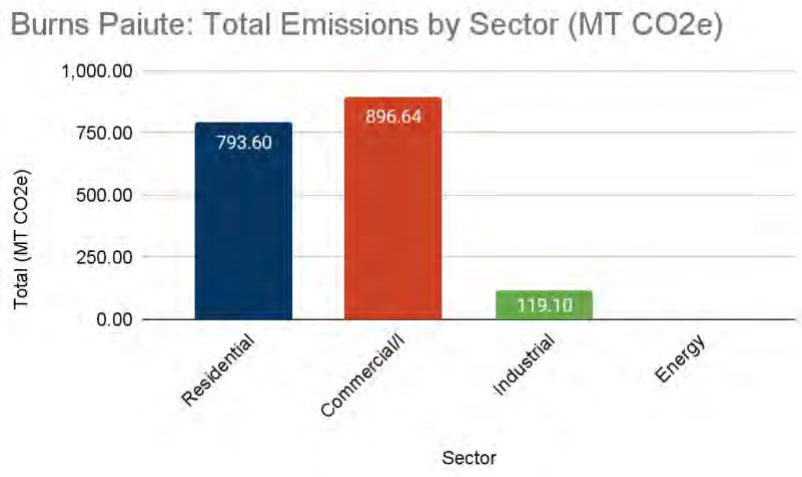


Figure 11. Bar chart showing total emissions by sector for BPT.

The BPT sector emissions inventory hews relatively close to the national per capita emissions of GHG, with an estimate of **17.4 Per capita Emissions (MT CO2e/person)** for people living on the Burns Paiute Reservation in Eastern Oregon. For the purposes of the PCAP USRT and the BPT focused on areas of emissions that could be addressed by the Tribal Council in the near-term that are directly within their scope of influence. As with the national emissions for GHG, transportation is the driving force behind most emissions for the BPT community and is a focus of near-term PCAP measures proposed for implementation.

The figures below shows a simple breakdown of total emissions by source for the BPT. Understanding the source of the emission is critical because the evaluation of implementation measures requires each applicant to identify specific actions that will address an issue within their community. While the information by sector provides a high-level overview, the detailed information developed through the TGIT will help the BPT engage in meaningful reduction measures in the spaces where those actions will be most meaningful.

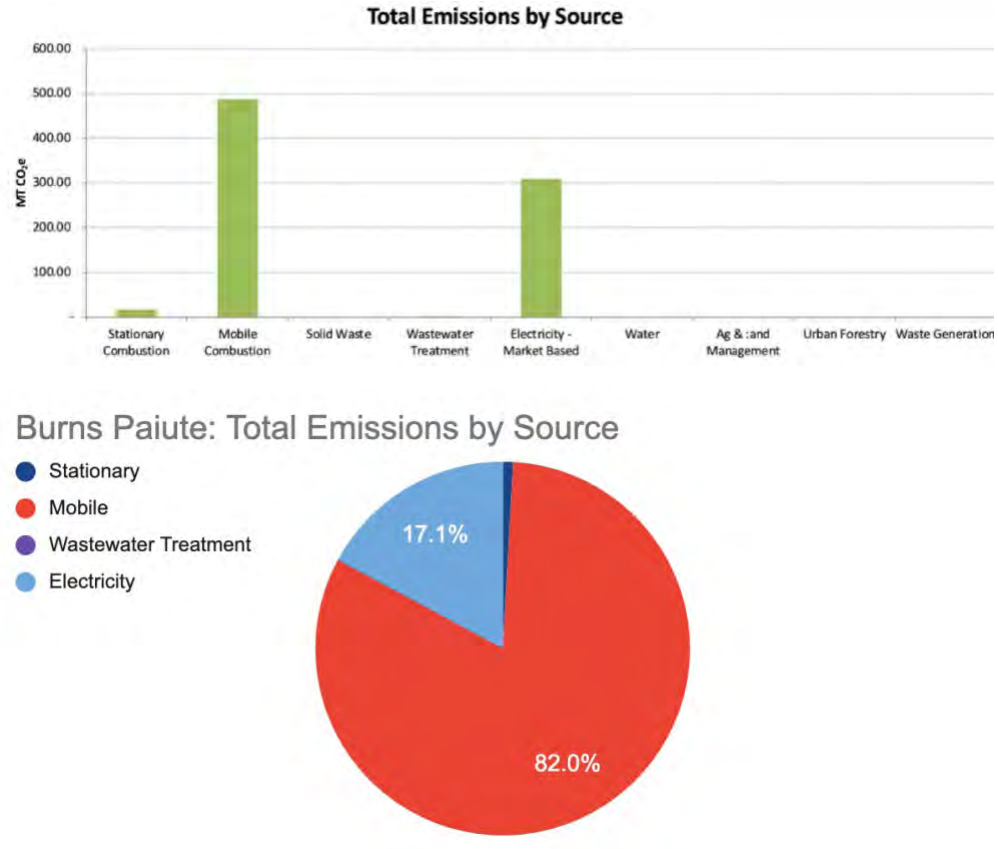


Figure 12. BPT charts (graph and pie-chart) showing total emissions by source estimated during the PCAP process.

The following figure breaks down the chart above for a better description of one of the challenges with downscaling emissions directly to a Reservation utilizing the publicly available datasets for GHG emissions like the NEI. A large portion of emissions within Harney County can be attributed to larger trucking and shipping centers that are not directly located on tribal lands or under tribal jurisdiction for implementing GHG reduction measures directly at the source of those emissions. It should be noted

that regardless of source, the BPT are committed to being an active participant in ameliorating the worst effects of climate change by building more resilient communities.

Figure 13. Further breakdown of source emission data for BPT.

While the development of this high-level GHG emissions inventory was relatively straightforward, given the assumptions made during the coarse downscaling for a per capita emissions estimate, there were still challenges that will need to be addressed during the development of the CCAP. The first assumption that will need to be updated when the 2023 NEI is released, the most current version of that dataset is from 2020 and emissions data might be significantly skewed based on the Covid pandemic during that year. Another critical note is that there will need to be an evaluation of the contributions of fire emissions and agricultural emissions during the CCAP development. The mobile data is still relatively elevated due to the presence of commercial/institutional mobile emissions across Harney County, so a more detailed evaluation of that category is likely warranted. Finally, there seem to be some anomalies in the Industrial sector (stationary emissions) that might be related to a facility within Harney County that the BPT don't directly control for GHG emissions reduction measures.

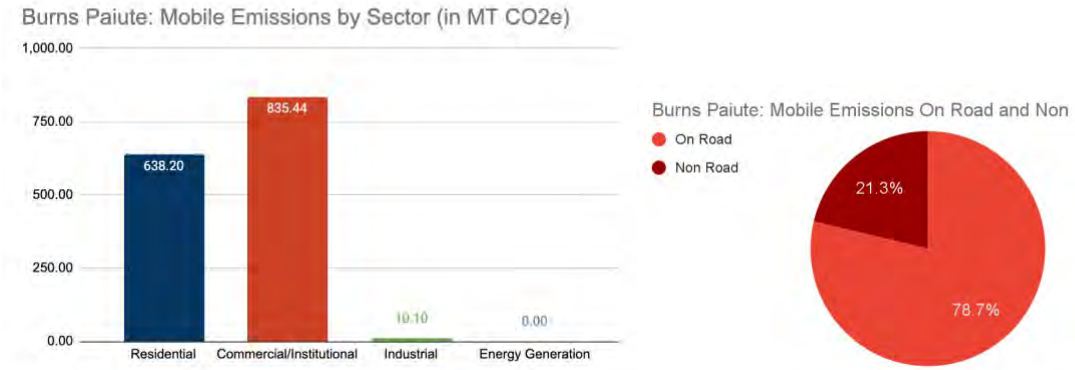


Figure 14. BPT Mobile Emissions by Sector

Essentially mobile emissions by sector in the BPT inventory are split between commercial and residential, with a significant portion of the emissions being from on-road sources. Maintaining these levels of emissions from the mobile source wouldn't allow for the tribes to easily meet GHG emissions goals in the near-term. Given the relative abundance of electric options for vehicles (both on and off-road) this does seem like a specific focus area where immediate emissions reduction can occur with clear investments on this issue. All of the USRT member tribes set priority measures associated with near-term reductions in the mobile category for their communities.

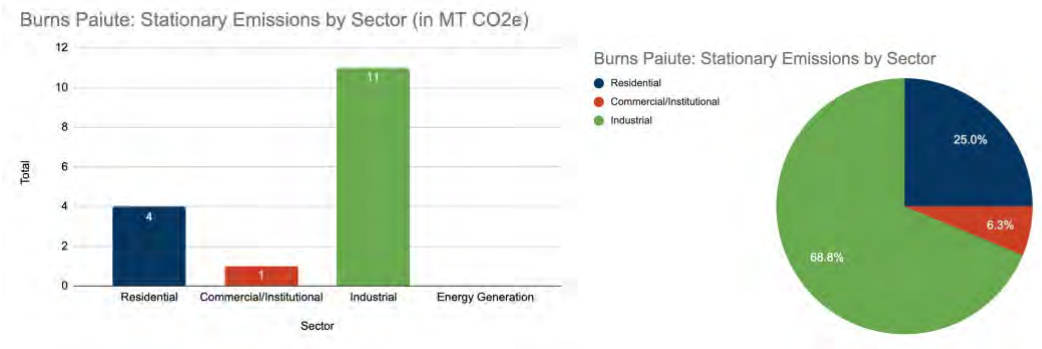


Figure 15. BPT Stationary Emissions by Sector

The BPT stationary emissions are significantly skewed toward the industrial sources, with 68.8% of stationary sources being industrial on this first pass emissions inventory USRT staff will be refining this specific estimate. It should be noted that residential structures are the next highest category for stationary emissions and there are ample opportunities for mitigation measures on those tribal member homes. Stationary emissions are relatively simple to mitigate, and the tribe has prioritized maximizing the efficiency of structures, ensuring they are updated enough to change to electrical infrastructure, and when commercial facilities are generating solid/organic waste it is diverted into adequate mitigation structures. All the USRT tribes prioritized offering direct assistance to their membership to the maximum extent possible; recognizing that community structures are also used to benefit the members there are measures associated with upgrading those facilities.

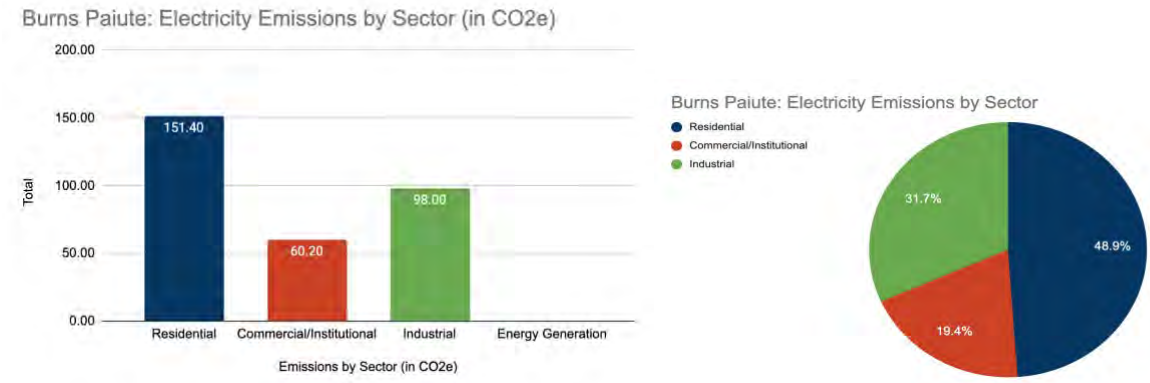


Figure 16. BPT electricity emissions by sector.

The emissions associated with electricity use for the BPT skew heavily toward residential emissions although each of the categories have meaningful opportunities for GHG reduction measures. As with other sectors the tribes are prioritizing delivering meaningful services to the membership so there is resiliency built into tribal communities. It should be noted that developing additional electrical infrastructure is a critical component to modernizing our grid and making our projects valuable for the reservation as a whole.

4.2 Burns Paiute GHG Reduction Targets

This PCAP does not set formal reduction targets for our member tribes, in part due to the complex nature of preparing a GHG inventory in a short amount of time and the focus on developing near-term

priorities for implementation. During the development of the CCAP this section will include both an emissions reduction target, conceptual measures to meet those targets, and an associated feasibility analysis to meet those targets. It is worth noting that the national targets vary widely based on the State/Country/Global Region but the consensus from the International Community[36] is to reduce GHG emissions are as follows:

- (United States) Reduce GHG emissions by ~28% to meet 1990 levels of emissions by 2025.
- (United States) Reduce GHG emissions by 45% by 2030.
- (United States) Fully transition to a carbon negative economy by 2050

The State of Oregon, through Governor Kate Brown's administration issued Executive Order 20-04 to set a goal of reducing GHG emissions to 45% of 1990 emissions levels by 2035; clearly ambitious and largely in line with the goals set by the United Nations.[37] While this order is not binding on the Burns Paiute Tribe it lays out a series of measures and directives to State agencies that might impact the tribal community. In order to fully participate in GHG emissions reduction measures with their non-tribal communities across Oregon, the BPT will need federal assistance to keep pace with this ambitious goal. One of the focal areas in the Oregon PCAP is to develop programs and incentives to make residential and commercial spaces more energy efficient and powered by renewable energy when possible.[38] This goal clearly aligns with the BPT's focus on developing measures specifically designed to eliminate GHG emissions to the maximum extent possible within their reservation.

The measures proposed in this PCAP are intended to provide a significant shift in GHG emissions in the next three years for our member tribes, although each will vary based on the availability of funding to implement the measures. For example, the average per capita GHG emissions for a member of the Burns Paiute Tribe is 17.4 MT/CO2 annually and the bulk of those emissions inventoried are mobile or electrical emissions. To make progress to a 'net-zero' transition in the coming two decades the infrastructure for renewable electricity (residential and commercial) and electrical transportation must be completed in the near-term or you will not see a meaningful declines in GHG emissions. The USRT member tribes are committed to developing and implementing projects to be net-zero or carbon negative by 2050.

4.3 Burns Paiute GHG Reduction Measures

The BPT has reviewed the available material and has selected the following priority measures for the Phase II implementation funding grant, it should be noted that the BPT also incorporates by reference the PCAP measures proposed by the State of Oregon noted above. Each of the items are severable in the event there is a limit on available funding and the construction is contingent on funding for near-term implementation due to current constraints in tribal budgets. The BPT is committed to implement the projects selected for implementation within the next three years and to work collaboratively with USRT staff on each reservation to complete the CCAP. Each table with the priority measure contains a brief narrative, simple budget, and workplan; as well as a description of emissions reduction for that specific measure. The following PCAP measures are intended to be severable in the event one or more

[36] United Nations Net Zero Coalition Homepage; searched and located on January 12, 2024.

[37] State of Oregon, Executive Order 20-04, March 2020, https://www.oregon.gov/gov/eo/eo_20-04.pdf (last searched March 14, 2024)

[38] State of Oregon PCAP, Executive Summary, "Residential and Commercial Buildings account for 34% of the state's sector-based GHG emissions. Incentives are needed to improve the efficiency of existing and new buildings, promote the transition to clean equipment and appliances, and increase building weatherization."

are not funded for implementation; it should be noted that the tribes view the order of priorities to focus on infrastructure and the immediate deployment of ubiquitous renewable energy systems for tribal members living on the reservation.

Measure 1: Residential Service Panel Installation

Burns Paiute Tribe: Residential Service Panel Installation Program	
Implementing agency	Burns Paiute Tribe
Implementation milestones	Develop open solicitation period for interested Tribal members, develop a priority list to ensure a minimum of 40% of program benefits flow to Low-Income or Elder households.
Geographic location	Burns Paiute Reservation
Funding sources	EPA CPRG Phase II grant; IRA Renewable Energy Tax Credits (Community Outreach)
Metrics tracking	Implementation status reports, certified installer report
Cost	$7,500 per panel (includes installation); $375,000 for BPT would provide services to 50 households.
Annual estimated GHG and criteria air pollutant emission reductions	Certified smart panels have an estimated range of 10-15% improvement in efficiency; but more critically they are the crux of installing level 2 charging stations in a home for plug-in vehicles, adding new electrical appliances, solar panels, or battery systems. A 10% reduction in GHG emissions associated with residential electricity for the 150 households would constitute ~30.6 m/tons GHG emissions per year.
Implementation authority milestones	Burns Paiute Tribe, Tribal Council approves receipt of implementation funds

Table 6. Residential Service Panel upgrade narrative.

The installation of 'renewable-ready' service panels in residential homes serves as a barrier to transitioning tribal homes away from non-renewable sources and/or grid based electrical services. One of the purposes of the coming energy transition is to prepare for shifts in infrastructure and utilities, with a specific focus on electrification through renewable energy. Interested tribal members are currently reviewing the industry potential, especially because of the high utility bills on reservation, but are finding that in order to implement an energy project on their land it will require upgrades on their residential service panel. This initial point of engagement with residential electricity can be the determining factor between installing feasible renewable energy and/or electric-vehicle charging capacity; costs for this upgrade service are currently cost-prohibitive for many tribal households, with additional burdens falling on elders and households on fixed income. This program is meaningful, straightforward and a necessary step before developing additional GHG emissions projects.

The intent of this program is to subsidize the installation of upgraded electrical service panels that mitigate the use of electricity in up 50 households (or ~100% of the total households on the Burns Paiute Reservation). The service panel upgrades will also include evaluations for solar and wind potential, and a certified energy audit to describe efficiency recommendations the home-owner can implement to maximize the energy savings from this installation. The Tribes are not endorsing a specific type of panel at this time and will allow for responsive bids and landowner consent to determine the precise panel

type installed at each home. While this program would service the majority of households with this upgrade, the program will also engage in outreach and education about the current tax incentives available to working households on the reservation.

Measure 2: Install 10KW Solar Array for Tribal Households

Burns Paiute Tribe: Residential Solar Installation Program	
Implementing agency	Burns Paiute Tribe
Implementation milestones	Develop residential solar plan, develop utility agreement for grid interconnections on tribal lands, install PV arrays on households on reservation
Geographic location	Burns Paiute Tribe
Funding sources	EPA CPRG Phase II Implementation funds
Metrics tracking	Electrical generation data, captured via surveillance video and electrical consumption report
Cost	$45,000 per household; up to 50 households based on need (tribal member, elder, low-income, medical need, etc.) - $2,250,000 total
Annual estimated GHG and criteria air pollutant emission reductions	A 10kwh solar system is estimated to save 6.1 tons of GHG annually; the full program is expected to reduce up to 305 tons of GHG emissions per year. This would represent approximately a 100%+ reduction in total emissions associated with residential electricity on the Burns Paiute Reservation with a likely impact on stationary emissions as well.
Implementation authority milestones	Burns Paiute Tribe, Tribal Council accepts implementation grant funding, site contractor is selected and project is implemented

Table 7. Residential solar installation.

The Burns Paiute Tribe is in a relatively unique situation where the installation of 50 residential solar systems, along with the other measures listed in this section, could essentially eliminate the carbon contribution from this community. The installation of photovoltaic arrays is often associated with off-reservation communities due to the expense of lending, local expertise in installation and long-term maintenance; with expenses to upgrade residential services and the complexity of rural intertie applications with local utilities. The tribes would utilize federal, state, and tribal funds to support a project to install and maintain solar systems with battery back-up capacity on eligible homes for tribal members. The focus of this program would be to assist low-income or fixed-income households with the installation of this technology and to pair this installation with the application process for lending through the revolving loan fund.

Measure 3: Install replacement wood stoves or electric furnaces

Burns Paiute Tribe: Electric/Pellet/Wood Stove Replacement Program	
Implementing agency	Burns Paiute Tribe
Implementation milestones	Burns Paiute Tribe accepts CPRG implementation grant funds, develops agreements with willing participants, approves contractor(s) for installation
Geographic location	Burns Paiute Reservation, up to 20 homes.

Funding sources	EPA CPRG Phase II Implementation Grant funds
Metrics tracking	Published project outreach materials, quarterly status reports, and final project report
Cost	$375,000 for total project costs; includes administration of project and up to 50 homes with complete replacement of wood burning stoves with new stoves or installing new high-efficiency electric furnaces.
Annual estimated GHG and criteria air pollutant emission reductions	Using the EPA calculator, it is estimated that this program will reduce GHG emissions by ~6 m/tons annually, while also improving indoor air quality for tribal member households. It should also be noted that there are co-benefits to indoor air pollution that are associated with replacing and/or updating wood burning stoves. Coupled with solar panel installation, an electric furnace would increase the GHG emissions reduction potential significantly.
Implementation authority milestones	Burns Paiute Tribe, Tribal Council approval of contractor(s) and homeowner agreement.

Table 8. Wood burning stove replacement.

This measure is specifically designed to accomplish the goal of providing tribal households with access to reliable and sustainable winter heating on the reservations, with a specific focus on those households that are utilizing wood as a heating source. While wood stoves can be considered a sustainable energy source for heating, antiquated systems have the potential to increase indoor air pollution, increase soot production that can cause dangerous house fires, and result in an inefficient fire per mass ignited. The purpose is to provide multiple options, including a complete system change-out, for eligible tribal households for their heating needs. The Tribe will complete an evaluation of eligible households and distribute the benefits to qualifying tribal members on a rolling basis as applications are received. Each annual report, for the three proposed funding cycles, will describe the nature of the stove replacement and have a specific estimate on the reduction of GHG associated with that year's program accomplishments.

Measure 4: Develop GHG sequestration Studies for the Burns Paiute Reservation and Tribal Lands

Burns Paiute Tribes: Burns Paiute Climate Stewardship Program	
Implementing agency	Burns Paiute Tribes
Implementation milestones	Develop study design with local academic institutions and/or agency staff, develop pilot conservation measures in situ, select contractor, implement conservation measures
Geographic location	Burns Paiute Reservation and adjacent lands.
Funding sources	EPA CPRG Phase II Implementation funds, Tribal Competition; conservation funds (USDA, FSA, NRCS); Tribal cost-share
Metrics tracking	Published outreach materials, status reports, project completion report
Cost	$1,000,000 (5-year pilot project for stewardship program managed by the BPT)
Annual estimated GHG and criteria air pollutant emission reductions	The Burns Paiute Reservation does have limited acreage owned by the Tribes and its members where conservation efforts can have a positive effect. There is a broad range of habitat types from alpine

	meadows, non-commercial forests, shrub-steppe, and freshwater riparian areas present on the Reservation.
Implementation authority milestones	Burns Paiute Tribal Council accepts implementation grant funding, site contractor is selected, and project is implemented

Table 9. Climate stewardship measures.

The Tribes will work with qualified contractors, staff, and regional Universities to develop appropriate studies that can measure the effect of implementation actions to increase the surface area of existing wetlands or riparian areas. The most significant co-benefit of engaging in conservation work include the primary goal of leaving intact and functional wetlands and riparian areas intact and undisturbed, these areas contain significant carbon and methane stores that are released when disturbed. Another opportunity that conservation programs have is to utilize areas that could be new wetlands or enhanced riparian areas to store 'new' atmospheric carbon in the soil. The final component of the conservation program is directly related to the ecological health of the wetland or riparian system, including benefits to water, soils, plants, animals, and aquatic organisms.

4.4 BPT Reduction Measures Benefits Analysis

The benefits of GHG reduction measures can be roughly placed into three topic spaces; infrastructure transition to sustainable renewable energy for tribal communities, deployment and installation of adequate renewable energy projects on tribal lands to support those communities, and policy measures to increase community support for climate resiliency and carbon neutrality goals. Each of those broad topics are addressed in the USRT member tribes' individual PCAP measures to achieve goals of carbon neutrality, but there is a need for sustained technical and financial support for tribal communities. The unique relationship between the federal government and the tribes should be viewed as a natural partnership to implement renewable energy projects and to pilot programs for carbon neutrality across the Upper Snake River basin. While every development has the potential to have deleterious effects on the environment, the projects selected by the tribes for implementation are carefully designed to increase climate resilience and support transitioning existing developments with sustainable technology.

The benefit assessment for each measure was developed by using the emissions inventory developed for each of the member tribes, relying on NEI source data for each of the counties as inputs in the Tribal Greenhouse Gas Inventory Tool (TGIT). The measures proposed above were then individually evaluated to ensure there wouldn't be any significant negative effects to the tribal community or the reservation environment. It is reasonably foreseeable that a complete transition to renewable energy will necessitate dramatic changes and potentially negative consequences for the environment if projects aren't adequately developed. By focusing the PCAP measures on immediate 'tailpipe' emissions, electrical service infrastructure, and near-term policies, the tribes can effect positive change while developing sound projects to service reservation residents that don't impact the character of their homelands.

Measure 1 – Residential Electrical Service Panel Upgrade

A key component to engaging the tribal membership in the electrical transition, particularly for home energy use and electric vehicle transportation, is to ensure that the entry point for those electrical components is appropriate for the residence. The electrical service panel on many tribal homes will require upgrades prior to the installation of solar systems, battery powered backups, level 1 and 2 EV

charging stations, and other electrical appliances. The benefits of engaging in upgrades to electrical service panels with new service panels are both direct and indirect.

The Tribes won't endorse a particular brand of service panel, preferring to allow an open solicitation process to select the appropriate equipment for their geography. The range of estimates for upgrading this component in the household range from 5% - 10% improvements in electrical efficiency, providing an immediate benefit to the household in terms of GHG emissions.[39] The most important benefit is indirect, primarily because this component provides the household with options to install EV chargers, renewable energy and battery storage systems, and transition from fossil fuel heat sources into electrical heat sources.

Measure 2 – Installation of Residential Solar

The Burns Paiute community is similarly situated to their sister tribe to the south, the Fort McDermitt Paiute Shoshone Tribes, in both total households on the reservation and energy potential. While developing options it should be noted that the projects with the greatest impact for the community are those that directly help tribal members engage in the transition to an electric economy sooner than later. With a keen focus on deploying commonly available equipment to this community we can completely eliminate the GHG emissions associated with residential electricity in a couple of construction seasons. This reduction in GHG emissions will also be maximized by including upgraded service panels for tribal members interested in making an EV transition as well because the panels will provide 'fuel' for those vehicles at their residence with safe and effective charging mechanisms. A single 10kwh system deployed on a home in Burns, Oregon will offset ~6 tons of GHG annually and will be a generational investment lasting up to 25 years.

Measure 3 – Wood Stove Replacement Program

Some of the tribal membership on the Burns Paiute Reservation rely on wood burning stoves as a primary heat source during the winter months. The tribes will investigate programs to support for tribal elders and low-income households with 4-6 cords of firewood each winter to support their heating needs and have received funding in the past to help replace aging wood stoves with new, EPA-certified, stoves in elder households. The direct impacts of replacing a wood burning stove depend heavily on the type of fuel burned in the household and the age of the stove used as the heat source, but generically the program is anticipated to reduce approximately 6 m/tons of GHG per year.

It is relatively clear that this program will have an immediate impact on GHG emissions from wood burning stoves during the winter months and similar programs have found noticeable improvements occurring for indoor air quality. The Burns Paiute are also optimistic that this project will have associated co-benefits noted in other similar projects that have been implemented on tribal lands. The BPT expect to see reductions in indoor air pollutants following the replacement and will work directly with willing program participants to conduct post-replacement measurements of indoor air pollutants. This should also help reduce outdoor air pollution on the reservation during winter months, specifically when there are high-pressure inversions present across Eastern Oregon.

[39] See https://www.span.io/panel for an example of a commercially available "Smart Panel" option; this plan and the tribes do not endorse any particular project for installation. Another common example might be the Tesla 'Power Wall' or the Leviton 'Load Center'. The installation of residential smart panels is to prepare dated homes with new technology and allow for those homes to be powered with renewable energy resources.

Measure 4: Addressing the Ecological Health of the Burns Paiute Reservation

The Burns Paiute Reservation is home to numerous resources that are critical to the function of the Malheur River basin, including tribal lands at the headwaters that support sensitive populations of fish, wildlife, and botanical resources. The Burns Paiute Tribes did not retain acreage like the Shoshone-Bannock or the Shoshone-Paiute, but are careful stewards of their tribal lands where every acre is significant. The tribes will evaluate the effectiveness of conservation efforts on significant landscapes within or adjacent to their reservation and develop implementable programs to engage in conservation efforts that sequester atmospheric carbon in wetland and riparian habitats they control. The retentive capacity would be determined through collaboration with local academic institutions and implemented through federal programs to promote riparian and wetland health.

4.5 Burns Paiute Tribe Authority to Implement GHG Reduction Measures

Federally recognized tribes in the United States, including the USRT member tribes, have a relatively high degree of sovereignty and self-governance over their own reservation lands. This authority is rooted in the recognition that tribes, like any other sovereign entity, possessed authority to govern their own constituents and handle their own affairs within their land base; this authority pre-dated any limitations on that authority imposed by the U.S. Constitution, treaties, statutes, and court decisions. It is critical to note that the inherent rights associated with self-governance are not grants of rights to tribes, rather they are a component of their inherent sovereignty that has always existed.

While there are a number of nuanced issues within the subject matter of tribal jurisdiction, the primary legal frameworks governing the implementation of PCAP recommended measures will include the following:

- U.S. Constitution: The Constitution recognizes tribes as separate sovereigns, and the Commerce Clause grants Congress the authority to regulate commerce with Indian tribes. This early relationship formed the basis for tribal relations that impact our member tribes through present.
- Treaties and Executive Order: While some tribes have treaties with the U.S. government that outline the tenets of their 'nation to nation' relationship, some tribes were established with other mechanisms during the eighteenth and nineteenth centuries. Common features of both mechanisms for developing relationships with tribes include setting boundaries of reservations, establishing a fiduciary relationship, and defining the scope of their self-governance. The Shoshone-Bannock Tribes and the Fort Hall Reservation was formed under the Fort Bridger Treaty of 1868 (ratified), and while the other three USRT member tribes were present and negotiated direct treaties they were never ratified by Congress. Each of the remaining USRT member tribes (BPT, SPT, and FMPS) were established through Executive Order or a formal act of Congress and each has an intact land base and active, engaged tribal community-based government. All four of the tribes possess the inherent authority to manage their own internal affairs and maintain the capacity to contract services or manage the scope of programs described in this PCAP.
- Indian Reorganization Act (IRA) of 1934: The IRA marked a shift in federal Indian policy towards supporting tribal self-governance after a scathing review of federal Indian policy around the turn of the century. Tribes who adopted IRA constitutions operate under a constitution, with a tribal council who manages the daily affairs of the tribes. Not all tribes adopted an IRA constitution and continue

to manage their government affairs based on the direction of their general membership; both systems will be present across our USRT member tribes.

- Indian Self-Determination and Education Assistance Act of 1975 (PL 93-638): This legislation reinforced tribal self-governance by giving tribes greater control over their own affairs, including the management of their lands and resources. In its contemporary iteration, 93-638 contracts and/or cooperative agreements can be developed directly with eligible tribes seeking to utilize federal funding on their lands with their own staff. In some instances USRT member tribes may still need to consult with the BIA to determine the applicability of an environmental review process prior to ground disturbance.
- Federal Trust Responsibility: The U.S. government has a trust responsibility to protect tribal lands, resources, and treaty rights. This principle has been interpreted by tribes to imply a fiduciary duty to assist tribes in managing their lands and resources for the benefit of tribal members.
- Tribal Sovereign Immunity: Tribal governments generally possess sovereign immunity, protecting them from lawsuits without their consent. This immunity extends to actions related to land management.

All four of the USRT member tribes are aware of their obligations to manage federal funds to accomplish the intended purpose and have reviewed the proposed climate pollutant reduction measures associated with this PCAP. Each of the measures associated with this PCAP are directly intended to alleviate a current burden on their respective communities and help make each of their homes more resilient to the worst impacts from global climate change. There aren't any measures contemplated for the PCAP that will exceed the limits of tribal sovereignty and if there are any perceived inconsistencies for future project recommendations during the CCAP process, they will be noted accordingly.

4.6 Identification of Other Funding Mechanisms

Although this section is optional for the PCAP, USRT staff have noted that the Biden/Harris Administration, in concert with the release of federal funding through the Bipartisan Infrastructure Law and Inflation Reduction Act, has developed an online tool to help Tribes access funding opportunities. The intent of the Access to Capital web portal, hosted by the Bureau of Indian Affairs, is to provide tribal professionals a 'one-stop' portal to access federal programs to engage in meaningful community change.[40] The website is functional, as of December 6, 2023, and will be utilized to help the USRT member tribes access specific funding mechanisms to implement meaningful measures that reduce GHG emissions on tribal lands.

Specific funding sources for the PCAP measures identified above may include working with a number of program(s) within the federal administration to accomplish specific tribal climate goals. Given the nature of the 2024 funding environment, USRT staff has noted that a number of funding opportunities are related to one-time grants for projects or competitive grant notices. USRT technical staff have chosen to work directly with Tribal staff to identify opportunities to accomplish near-term PCAP measures, while acknowledging that accomplishing meaningful GHG emissions reduction will require long-term funding opportunities rather than single projects. The Tribes would like to focus climate change resilience actions on more consistent, programmatic funding resources within the federal government for tribes.

[40] https://www.bia.gov/atc

4.7 Workforce Planning CCAP Recommendation

Transitioning a workforce to accomplish new tasks can be a generational task in small Tribal communities, where dedicated tribal members are often working diligently for their tribe already. Developing a climate ready workforce is a priority for the USRT member tribes, although the PCAP measures detailed in the preceding sections are not intended to build that workforce. Achieving near-term climate goals and allowing the PCAP measures to be a catalyst for generating community support and 'buy-in' are critical components of each of those measures.

The workforce planning analysis was an optional section and due to the complex nature of the evaluation by USRT technical staff, we have opted to work with our member tribes on this issue for the CCAP. Tribal members from each of our member tribes have dedicated their entire careers to working for their people and are already working to protect natural and cultural resources on their reservations. USRT is committed to helping our tribal communities engage in climate stewardship activities and helping instill traditional values of resilience, accountability, and reciprocity in all of our GHG emissions reduction measures. For the CCAP, USRT staff will work directly with each of the tribes to develop the appropriate workforce planning measures to help maximize emissions reductions and to ensure that tribal communities have locally available labor to meet the demands of an uncertain future.

5 Fort McDermitt Paiute and Shoshone Tribe

The Fort McDermitt Paiute-Shoshone Tribe's Reservation spans the Nevada–Oregon border, in Humboldt County, Nevada, and Malheur County, Oregon, near the Quinn River, which runs through the Tribe's Nevada lands, east to west. The reservation includes 16,354 acres in Nevada and 19,000 acres in Oregon. There are 1,016 enrolled members of the Fort McDermitt Paiute-Shoshone Tribe.[41] The valley of the Quinn River was the location of winter homelands utilized by the Northern Paiutes and Western Shoshonean peoples. This area was later occupied by the cavalry for a military fort in the 1860's and then that fort was eventually closed in the 1890's. The Fort McDermitt Paiute Shoshone Tribe remains in their homelands and are being challenged by climate change on two fronts.

The Northern Paiute and Western Shoshone in this area are related culturally and linguistically to the Shoshone, Bannock, and other tribes of the region. Our people had traditional homelands ranging from the southwest into Nevada, Oregon, and southwestern Idaho. Paiute and Shoshone bands in the Great Basin had a sustainable subsistence diet that typically contained roots, seeds, fish (resident and anadromous), small mammals, birds, waterfowl, as well as larger animals like antelope, deer, and bighorn sheep. The natural resources of the Upper Snake River Watershed continue to sustain the dietary, cultural, spiritual, and economic needs of the Fort McDermitt Paiute-Shoshone Tribe but there are threats.

The McDermitt Caldera is one of the world's richest lithium deposits[42] and is rapidly undergoing a watershed level transformation as one of the potential epicenters of the 'green revolution'. Virtually every PCAP (nationally) will contain measures to electrify sectors of our economy and one of the

[41] Duane Masters Sr., Environmental Director of Fort McDermitt Paiute-Shoshone Tribe. Personal Communication. 01/06/2017.

[42] **Lithium-Rich Claystone in the McDermitt Caldera, Nevada, USA: Geologic, Mineralogical, and Geochemical Characteristics and Possible Origin** by Stephen B. Castor and Christopher D. Henry * Nevada Bureau of Mines and Geology, University of Nevada, Reno, NV 89557, USA *Minerals* **2020**, *10*(1), 68; https://doi.org/10.3390/min10010068 Submission received: 23 November 2019 / Revised: 23 December 2019 / Accepted: 9 January 2020 / Published: 15 January 2020 (This article belongs to the Special Issue Evolution of Li-rich Brines)

fundamental components of contemporary battery technology is lithium. Lithium mining has the potential to cause irreversible consequences for the Fort McDermitt Paiute Shoshone Tribe, creating a situation where the Tribes could once again bear the burden of development in their homelands. The planning process shows that there is a high GHG emissions rate per-capita among our member tribes and there should be a focus on reducing tribal emissions to carbon-neutral in the near-term. It is possible to plan ahead for these impacts and to increase the resilience of this tribal community through significant investments before mining impacts reach their peak in the coming decades.

The data utilized for demographic information in the development of the high-level emissions estimates for the Fort McDermitt Paiute-Shoshone Tribe and associated tribal lands was derived from the 2020 Census "My Tribal Area" data retrieval tool (https://www.census.gov/tribal/?st=32&aianihh=1210). Demographic data is critical to estimating emissions data for the Fort McDermitt Paiute-Shoshone Tribe because data inputs for the Tribal Greenhouse Inventory Tool (TGIT) are developed at the State and/or County level; those estimates are not downscaled specifically for each member's reservation associated with the Upper Snake River Tribes Foundation. The primary purpose for using this information from the census is to generically apportion emissions based on a percentage of the total population in the county for which data is available. The methodology associated with this assumption is in line with the presumption that the PCAP is a high-level document to engage Tribal communities in near-term priority actions to reduce climate pollution; the Comprehensive Climate Action Plan will revisit this assumption and attempt to refine data in a manner tailored specifically to each reservation and emission sector.

The total population of the Fort McDermitt Paiute Shoshone Tribal lands is presented in the 2020 Census as 283, with 247 people identified as Native American alone. The data indicates that there are 166 total housing units, with 135 of those units occupied in 2020. Further, 75 individuals are commuting for work with approximately 85% of those utilizing light duty vehicles for their 'daily' drive to work. The 2020 Census indicates that 46 individuals are enrolled in school pre-Kindergarten through High School; it is assumed for purposes of estimating emissions that all of these individuals are utilizing bus transportation to and from school.

For purposes of estimating emissions at the County level, all of the ~35,354 acres of the Fort McDermitt Tribal lands are located within the exterior boundaries of Malheur County, Oregon and Humboldt County, Nevada. Malheur County has a total population of 31,571 individuals with 448 of those individuals reporting status as American Indian, or approximately 1.4% of the total county population will be used for the emissions estimate. Humboldt County has a total population of 17,285 individuals with 312 of those individuals reporting status as American Indian, or approximately 1.8% of the total county population. It should be noted that there is a difference between the reported figure for the Reservation and those living in Malheur and Humboldt Counties. While this may pose a slight problem in data interpretation, the USRT staff understand that every tribal member will not reside on their tribal lands for a variety of reasons; as such, the USRT will utilize the total county population of American Indian for emissions estimate. The rationale for this inclusive method of estimation is to ensure that Tribal leadership have adequate data to support growth models and/or planning efforts for future generations of tribal members who may return to tribal lands.

5.1 Special Considerations for Tribal/Territorial Entities

The Fort McDermitt Reservation is located in a rural area on the border of Oregon and Nevada. The Reservation is located in an area that has ample opportunities for renewable energy project and is also

located in an area where rich lithium deposits have been located, sparking a green energy mining rush in the McDermitt Caldera. As noted in the inventory, per capita emissions in this area are already well above the national average and additional emissions from extractive industries will not alleviate that concern locally. For the purposes of this PCAP, USRT staff have chosen to reserve discussion about mineral extraction activities for the next portion of the planning process. Likewise, discussions about solid waste and wastewater management will be reserved for the CCAP process.

The Fort McDermitt Paiute Shoshone Tribe does not operate a local wastewater facility in their community, with the primary mechanism to deal with wastewater being septic based systems. While wastewater facilities can be source of GHG emissions in any community, the lack of a facility requires that this emission source be disregarded for the purposes of the PCAP. According to technical staff from the tribes there are approximately 162 homes with septic systems on tribal lands, and about 102 of those homes are currently in use. Further options will be explored during the CCAP for developing and/or improving the operations of wastewater operations and seeking collaborative solutions for the tribe.

The Fort McDermitt Paiute-Shoshone Tribe does not own or operate a landfill facility, the solid waste produced from tribal lands is removed to a local landfill facility operated outside of the Tribes' direct control. The movement of solid waste from transfer stations does create significant emission sources, but for the purposes of this initial planning process, priority emission reduction actions will focus on other sources. It is anticipated that during the comprehensive planning process the Tribes will allocate multiple emission reduction actions to this category.

5.2 Collaborations

USRT staff focused our collaborative efforts entirely on our member tribes due to the short period of time to develop a high-level GHG emissions inventory, PCAP, and an implementation grant application based on tribal priority actions. Following the release of funding in mid-September 2023 USRT staff developed and received approval for a Quality Assurance Project Plan (QAPP) in late October 2023. With an approved QAPP to work from, USRT staff immediately engaged with our partners through the USRT Technical Work Group and direct contacts from the Environmental Director to tribal staff to get additional background information relevant to the emissions inventory. The PCAP was presented to the Fort McDermitt Tribal Council on March 12, 2024 and they endorsed the submittal of the document to the EPA in support of their efforts to combat the effects of climate change in their tribal community.

It should be noted that a beneficial collaboration during the PCAP development phase was the Technical Assistance Forums hosted by EPA and Endyna. The opportunity to learn from professionals across the nation, all engaged in the same type of climate action planning, afforded tribal professionals a rare 'inside' look at how Metropolitan Service Areas (MSA) and States utilize data to prioritize actions that support GHG reductions. USRT staff would also like to acknowledge our EPA project officer for hosting regular 'Office Hours' to discuss issues directly with other professionals throughout the planning process.

6 Fort McDermitt Paiute Shoshone PCAP Elements

As noted in the preceding section, both mineral development and climate change have the potential to impact the Tribes in a significant way in the coming decades. USRT technical staff engaged with USRT member tribes following the completion of a draft PCAP and GHG inventory in early January 2024,

providing a relatively narrow window to address priority actions to reduce climate pollutants in the near-term. Fortunately, the USRT member tribes have already begun the process of climate adaptation and resiliency planning through Bureau of Indian Affairs funding. While neither the USRT or SBT climate adaptation plans were funded through EPA, and are primarily focused on natural resource management, both documents have significant relevance to the PCAP. It is critical for the reader to consider the attached materials as a component of this document, with particular recognition that the USRT climate vulnerability assessment provides a foundation for understanding the regional climate impacts most relevant to the tribes.

The Fort McDermitt Reservation is located in a region with excellent solar and wind potential, particularly for residential energy generation. However, the Fort McDermitt region is also home to one of the world's largest lithium deposits with numerous proposed mining activities slated to irreversibly changing the character of the area and dramatically increase localized effects on emissions. Reducing GHG emissions in the near-term requires a careful evaluation of the benefits of actions relative to their overall costs and significance relative to a community's GHG emissions; with the FMPS experiencing significantly higher per-capita emissions estimates than their similarly situated USRT counterparts. Each USRT member tribe is geographically unique, and each has its own governance structure that is responsible for the health and welfare of their membership. Given the available information, it is feasible to assume this community could be carbon-neutral in the near-term with the implementation of the PCAP measures and appropriate federal investments.

6.1 Fort McDermitt Paiute Shoshone Tribe Greenhouse Gas (GHG) Inventory

The development of an accurate GHG inventory is critical to understand the specific needs of each of USRT's member tribes. Given the limitations of funding, time, and planning objectives to reduce climate pollutants in the near-term USRT staff utilized coarse, downscaled information to develop the high-level estimates represented in the figures below. The focus of this PCAP was to identify emissions reductions measures that could be accomplished in the near-term, additional topics will be evaluated in the CCAP. For detailed information on how the following data was collected and evaluated please refer to Section(s) 1.6-1.8 of this document. The TGIT workbook and associated data collection spreadsheets for the FMPS are included as Appendix A, those Excel files were used to develop the following figures.

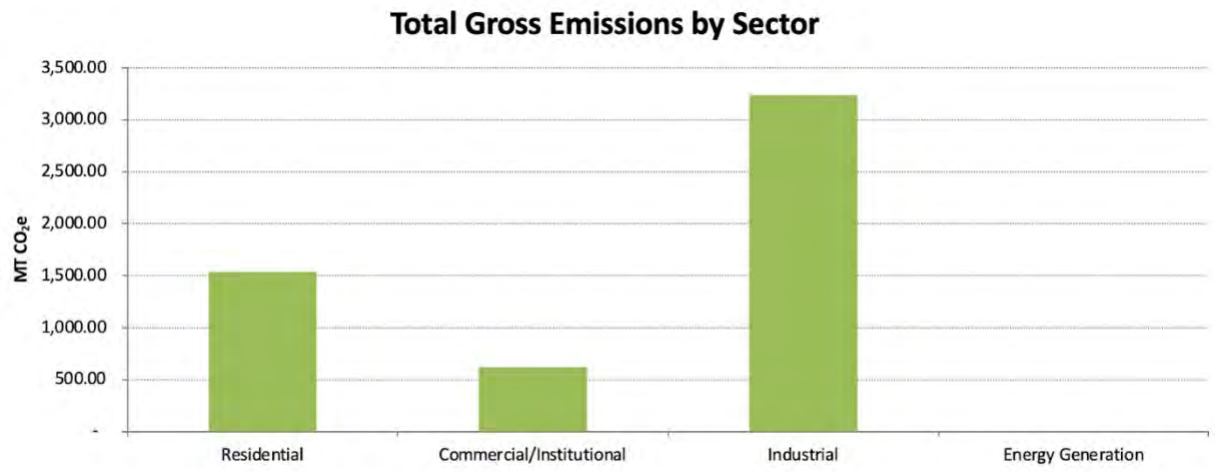
Total Fort McDermitt Emissions (MT CO2e)								
	CO_2	CH_4	N_2O	HFCs	PFCs	SF_6	Total MT CO_2e	Percent of Total
Scope 1	4,748.69	93.07	0.61	-	-	-	4,842.37	62%
Scope 2 - Location Based	3,003.87	7.85	10.61	-	-	-	3,022.34	
Scope 2 - Market Based (for informational purposes only)	3,003.87	7.85	10.61				3,022.34	38%
Scope 3	-	-	-	-	-	-	-	0%
Total Gross Emissions	**7,752.56**	**100.92**	**11.23**	**-**	**-**	**-**	**7,864.71**	**100%**
Total Net Emissions	**7,752.56**	**100.92**	**11.23**	**-**	**-**	**-**	**7,864.71**	**100%**

Emissions by Source (MT CO_2e)								
Source	CO_2	CH_4	N_2O	HFCs	PFCs	SF_6	Total	Percent of Total
Stationary Combustion	1,206.54	3.00	0.60	-	-	-	1,210.14	15%
Mobile Combustion	1,068.03	-	-	-	-	-	1,068.03	14%
Solid Waste	-	-	-	-	-	-	-	0%
Wastewater Treatment	-	89.92	-	-	-	-	89.92	1%
Electricity - Location Based	3,003.87	7.85	10.61	-	-	-	3,022.34	
Electricity - Market Based (for informational purposes only)	3,003.87	7.85	10.61				3,022.34	38%
Water	-	-	-	-	-	-	-	0%
Ag & Land Management	-	-	-				-	0%
Urban Forestry	-	-	-				-	0%
Waste Generation	-	-	-				-	0%
Other	2,474.13	0.14	0.01	-	-	-	2,474.28	31%
Total (Gross Emissions)	**7,752.56**	**100.92**	**11.23**	**-**	**-**	**-**	**7,864.71**	**100%**
Total (Net Emissions)	**7,752.56**	**100.92**	**11.23**	**-**	**-**	**-**	**7,864.71**	**100%**

Figure 17. Bar chart showing FMPS total emissions by sector.

As noted above, the USRT PCAP developed emissions inventory estimates for the 'required' parameters and will be developing the complete inventory during the CCAP process. While it would be preferred to have the entire inventory available for the PCAP, particularly for setting priority measures to reduce GHG emissions, the accelerated timeline did not permit adequate consultation for each of the individual tribes. In the coming three years, USRT staff will work directly with representatives from our member tribes to complete this project for the CCAP.

The FMPS sector emissions inventory is close to double the national per capita emissions of GHG, with an estimate of **27.8 (MT CO2e/person)** for people living on the Fort McDermitt Reservation on the southern border of Oregon and the northern border of Nevada. For the purposes of the PCAP USRT and the BPT focused on areas of emissions that could be addressed by the Tribal Council in the near-term that are directly within their scope of influence. As with the national emissions for GHG, transportation is the driving force behind the majority of emissions for the FMPS community and is a focus of near-term PCAP measures proposed for implementation.



The figures below show a simple breakdown of total emissions by source for the FMPS. Understanding the source of the emission is critical because the evaluation of implementation measures requires each applicant to identify specific actions that will address an issue within their community. While the information by sector provides a high-level overview, the detailed inventory developed through the TGIT will help the FMPS engage in meaningful reduction measures in the spaces where those actions will be most meaningful. It is apparent that there are industrial sector emissions within the counties in Oregon and Nevada that are not likely directly attributable to the FMPS and a more refined estimate will be recommended for the tribe specifically to assess the quantity of emissions directly from their tribal lands.

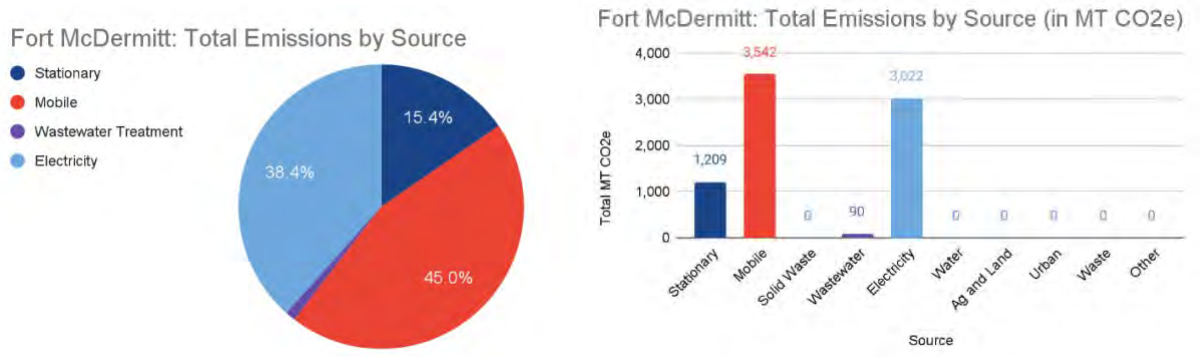


Figure 18. FMPS charts showing total emissions by source.

The challenges with downscaling emissions directly to a Reservation utilizing the publicly available datasets for GHG emissions like the NEI. A large portion of emissions within the two counties, in two different states can be attributed to larger trucking and shipping centers that are not directly located on tribal lands or under tribal jurisdiction for implementing GHG reduction measures directly at the source of those emissions. There are also significant mining operations within the FMPS area of evaluation that are also contributing to a higher-than-average emissions per capita; with additional mining operations for lithium anticipated in the McDermitt Caldera following recent discoveries. It should be noted that regardless of source, the FMPS are committed to being an active participant in ameliorating the worst effects of climate change by building more resilient communities.

While the development of this high-level GHG emissions inventory was relatively straightforward, given the assumptions made during the coarse downscaling for a per capita emissions estimate, there were still challenges that will need to be addressed during the development of the CCAP. The first assumption that will need to be updated when the 2023 NEI is released, the most current version of that dataset is from 2020 and emissions data might be significantly skewed based on the Covid pandemic during that year. Another critical note is that there will need to be an evaluation of the contributions of fire emissions and agricultural emissions during the CCAP development. The mobile data is still relatively elevated due to the presence of commercial/institutional mobile emissions across both Humboldt and Malheur Counties, so a more detailed evaluation of that category is likely warranted. Finally, there seem to be some anomalies in the Industrial sector (stationary emissions) that might be related to facilities within Humboldt and Malheur Counties that the FMPS don't directly control for GHG emissions reduction measures.

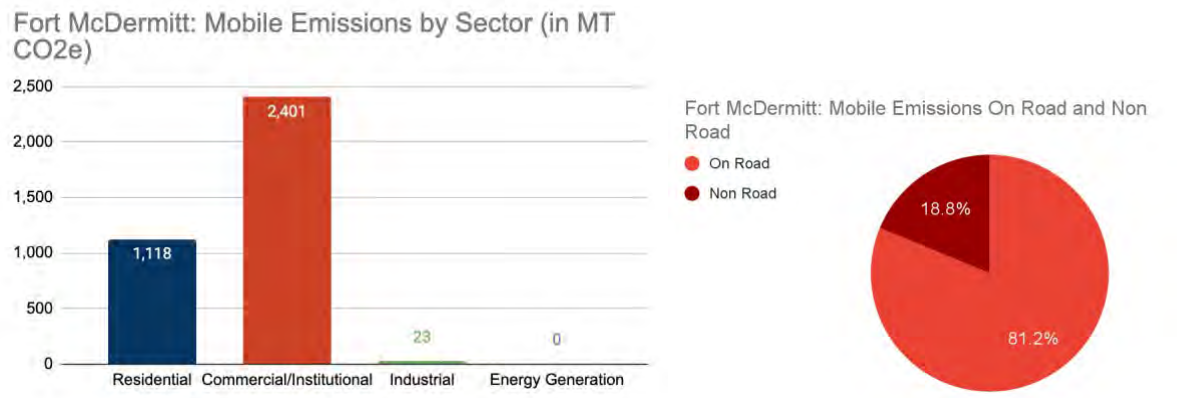


Figure 19. FMPS mobile emissions by sector.

Essentially mobile emissions by sector in the FMPS inventory are split between commercial and residential, with a significant portion of the emissions being from on-road sources. Maintaining these levels of emissions from the mobile source wouldn't allow for the tribes to easily meet GHG emissions goals in the near-term. Given the relative abundance of electric options for vehicles (both on and off-road) this does seem like a specific focus area where immediate emissions reduction can occur with clear investments on this issue. All of the USRT member tribes set priority measures associated with near-term reductions in the mobile category for their communities.

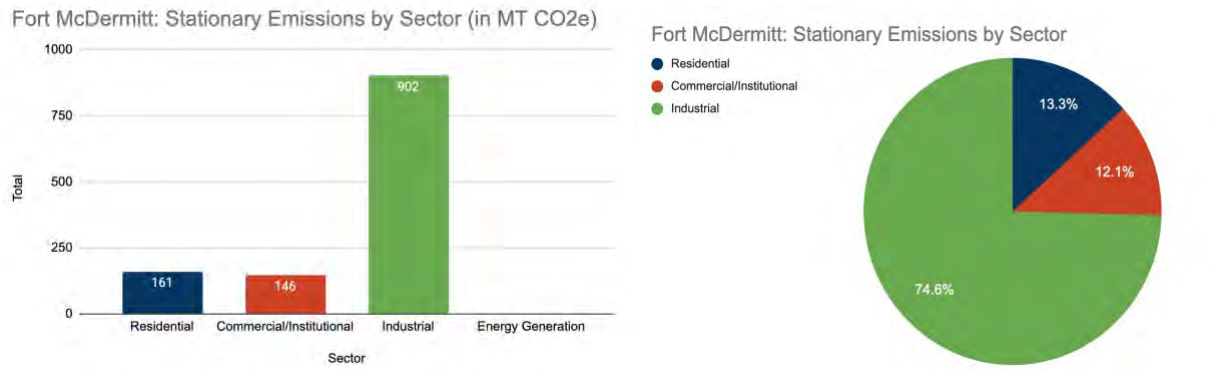


Figure 20. FMPS stationary emissions by sector.

The FMPS stationary emissions are significantly skewed toward the industrial sources, with 74.6% of stationary sources being industrial on this first pass emissions inventory USRT staff will be refining this specific estimate. It should be noted that commercial and residential structures are a near even split. Stationary emissions are relatively simple to mitigate, and the tribe has prioritized maximizing the efficiency of structures, ensuring they are updated enough to change to electrical infrastructure, and also that when commercial facilities are generating solid/organic waste it is diverted into adequate mitigation structures. All of the USRT tribes prioritized offering direct assistance to their membership to the maximum extent possible; recognizing that community structures are also used to benefit the members there are measures associated with upgrading those facilities.

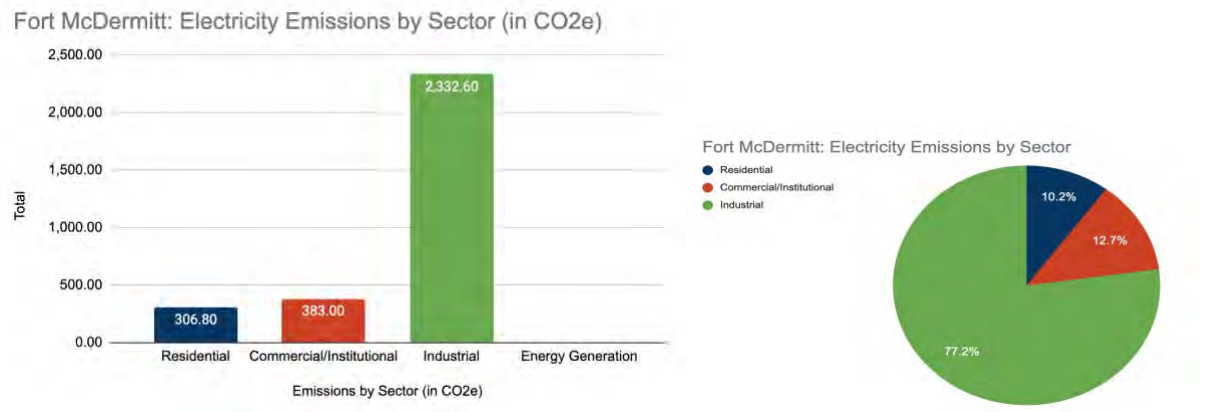


Figure 21. FMPS electricity emissions by sector.

The emissions associated with electricity use for the FMPS skew heavily toward industrial emissions although each of the categories have meaningful opportunities for GHG reduction measures. This is likely related to the FMPS emissions inventory issues that do assign a high per capita emission of GHG for the tribes but are directly related to those industrial emissions. As with other sectors the tribes are prioritizing delivering meaningful services to the membership so there is resiliency built into tribal communities. It should be noted that developing additional electrical infrastructure is a critical component to modernizing our grid and making our projects valuable for the reservation.

6.2 FMPS GHG Reduction Targets

This PCAP does not set formal reduction targets for our member tribes, in part due to the complex nature of preparing a GHG inventory in a short amount of time and the focus on developing near-term priorities for implementation. During the development of the CCAP this section will include both an emissions reduction target, conceptual measures to meet those targets, and an associated feasibility analysis to meet those targets. It is worth noting that the national targets vary widely based on the State/Country/Global Region but the consensus from the International Community[43] is to reduce GHG emissions are as follows:

- (United States) Reduce GHG emissions by ~28% to meet 1990 levels of emissions by 2025.
- (United States) Reduce GHG emissions by 45% by 2030.
- (United States) Fully transition to a carbon negative economy by 2050

The State of Oregon, through Governor Kate Brown's administration issued Executive Order 20-04 to set a goal of reducing GHG emissions to 45% of 1990 emissions levels by 2035; clearly ambitious and largely in line with the goals set by the United Nations.[44] In Nevada, the PCAP indicates, "The State has ambitious targets to reduce GHG emissions. In the 2019 Senate Bill (SB) 254, the State adopted goals to reduce GHG emissions from 2005 levels by 28% by 2025 and 45% by 2030, and to achieve zero or near-zero emissions by 2050. In addition to GHG reduction targets, the State has had a Renewable Portfolio Standard since 1997. By 2030, at least 50% of electricity sold to retail customers by Nevada utilities must come from renewable sources."[45] In order to fully participate in GHG emissions reduction measures with their non-tribal communities across Oregon and Nevada, the FMPST will need federal assistance to keep pace with these ambitious reduction goals. Both States include focal areas to develop programs and incentives to make residential and commercial spaces more energy efficient and powered by renewable energy when possible. This goal clearly aligns with the FMPST's focus on developing measures specifically designed to eliminate GHG emissions to the maximum extent possible within their reservation for tribal members both individually and as a community.

The measures proposed in this PCAP are intended to provide a significant shift in GHG emissions in the next three years for our member tribes, although each will vary based on the availability of funding to implement the measures. For example, the average per capita GHG emissions for a member of the Fort McDermitt Shoshone Paiute Tribe is 27.8 MT/CO2 annually and the bulk of those emissions inventoried are industrial emissions related to activities outside of the direct control of the tribal community. In order to make progress to a 'net-zero' transition in the coming two decades the infrastructure for renewable electricity (residential and commercial) and electrical transportation must be completed in the near-term or you will not see a meaningful declines in GHG emissions. The USRT member tribes are committed to developing and implementing projects on their respective reservations to be net-zero or carbon negative by 2050.

6.3 FMPS GHG Priority Reduction Measures

The Fort McDermitt Tribe has reviewed the available material and has determined it is most appropriate to submit an individual application for the following priority items for the Phase II implementation

[43] United Nations Net Zero Coalition Homepage; searched and located on January 12, 2024 (Daniel Stone).

[44] State of Oregon, Executive Order 20-04, March 2020, https://www.oregon.gov/gov/eo/eo_20-04.pdf (last searched March 14, 2024)

[45] State of Nevada PCAP, Executive Summary page 6.

funding grant. Each of the items are severable in the event there is a limit on available funding and the construction is contingent on funding for near-term implementation due to current constraints in tribal budgets. The FMPS is committed to implement the projects selected for implementation within the next three years and to work collaboratively with USRT staff on each reservation to complete the CCAP. Each table with the priority measure is followed with brief narrative about the proposed measure; the description of emissions reduction for that specific measure are found in the following section. PCAP measures for the Fort McDermitt Reservation are intended to be severable in the event one or more are not funded for implementation under this program; it should be noted that the tribes view the order of priorities to focus on infrastructure and the immediate deployment of readily available renewable energy systems for tribal members living on the reservation.

Measure 1: Install Residential Smart Panel

Fort McDermitt Paiute Shoshone Tribes: Residential Smart Panel Program	
Implementing agency	Fort McDermitt Paiute Shoshone Tribes
Implementation milestones	Develop open solicitation period for interested Tribal members, develop a priority list to ensure a minimum of 40% of program benefits flow to Low-Income or Elder households.
Geographic location	Fort McDermitt Reservation
Funding sources	EPA CPRG Phase II grant; IRA Renewable Energy Tax Credits (Community Outreach)
Metrics tracking	Implementation/status reports, certified installer report
Cost	$7,500 per panel (includes installation); $1,012,500 for FMPS would provide services to 135 households.
Annual estimated GHG and criteria air pollutant emission reductions	Certified smart panels have an estimated range of 10-15% improvement in efficiency; but more critically they are the crux of installing level 2 charging stations in a home for plug-in vehicles, adding new electrical appliances, solar panels, or battery systems. A 10% reduction in GHG emissions associated with residential electricity for the 135 households would constitute ~30.6 m/tons GHG emissions per year.
Implementation authority milestones	Fort McDermitt Paiute Shoshone Tribes, Tribal Council approves receipt of implementation funds

Table 10. Residential service panel upgrade.

The installation of 'renewable-ready' service panels in residential homes serves as a barrier to transitioning tribal homes away from non-renewable sources and/or grid based electrical services. One of the purposes of the coming energy transition is to prepare for shifts in infrastructure and utilities, with a specific focus on electrification through renewable energy. Interested tribal members are currently reviewing the industry potential, especially because of the high utility bills on reservation, but are finding that in order to implement an energy project on their land it will require upgrades on their residential service panel. This initial point of engagement with residential electricity can be the determining factor between installing feasible renewable energy and/or electric-vehicle charging capacity; costs for this upgrade service are currently cost-prohibitive for many tribal households, with additional burdens falling on elders and households on fixed income. This program is meaningful, straightforward and a necessary step before developing additional GHG emissions projects.

The intent of this program is to subsidize the installation of upgraded electrical service panels that mitigate the use of electricity in up 135 households (or ~100% of the total households on the Fort McDermitt Reservation). The service panel upgrades will also include evaluations for solar and wind potential, and a certified energy audit to describe efficiency recommendations the home-owner can implement to maximize the energy savings from this installation. The Tribes are not endorsing a specific type of panel at this time and will allow for responsive bids and landowner consent to determine the precise panel type installed at each home. While this program will service the majority of households with this upgrade, the program will also engage in outreach and education about the current tax incentives available to working households on the reservation.

Measure 2: Install 10KW Solar Array for Tribal Households

*Fort McDermitt Paiute Shoshone Tribes: **Residential Solar Installation Program***	
Implementing agency	Fort McDermitt Paiute Shoshone Tribes
Implementation milestones	Develop residential solar plan, develop utility agreement for grid interconnections on tribal lands, install PV arrays on households on reservation
Geographic location	Fort McDermitt Reservation
Funding sources	EPA CPRG Phase II Implementation funds
Metrics tracking	Electrical generation data, captured via surveillance video and electrical consumption report
Cost	$45,000 per household; 100 households based on need (elder, low-income, medical need, etc.) - $4,500,000 total
Annual estimated GHG and criteria air pollutant emission reductions	A 10kwh solar system is estimated to save 6.1 tons of GHG annually; the full program is expected to reduce up to 610 tons of GHG emissions per year. This would represent approximately a 100% reduction in total emissions associated with residential electricity on the Fort McDermitt Reservation and mitigating some additional stationary emissions from institutional sources.
Implementation authority milestones	Fort McDermitt Paiute Shoshone Tribes, Tribal Council accepts implementation grant funding, site contractor is selected and project is implemented

Table 11. Residential solar installation.

The Fort McDermitt Paiute Shoshone Tribe is in a relatively similar situation to the Burns Paiute Tribe, where the installation of 100 residential solar systems, along with the other measures listed in this section, could essentially eliminate the carbon contribution from this community. The installation of photovoltaic arrays is often associated with off-reservation communities due to the expense of lending, local expertise in installation and long-term maintenance; with expenses to upgrade residential services and the complexity of rural intertie applications with local utilities. The tribes would utilize federal, state and tribal funds to support a project to install and maintain solar systems with battery back-up capacity on eligible homes for tribal members. The focus of this program would be to assist low-income or fixed-income households with the installation of this technology and to pair this installation with the application process for lending through the revolving loan fund.

Measure 3: Install replacement wood stoves or electric furnaces

Fort McDermitt Paiute Shoshone Tribes: Wood Stove Replacement Program	
Implementing agency	Fort McDermitt Paiute Shoshone Tribes
Implementation milestones	Fort McDermitt Paiute Shoshone Tribes accepts CPRG implementation grant funds, develops agreements with willing participants, approves contractor(s) for installation
Geographic location	Fort McDermitt Reservation, up to 20 homes.
Funding sources	EPA CPRG Phase II Implementation Grant funds
Metrics tracking	Published project outreach materials, quarterly status reports, and final project report
Cost	$375,000 for total project costs; includes administration of project and up to 50 homes with complete replacement of wood burning stoves with new stoves or electric furnaces.
Annual estimated GHG and criteria air pollutant emission reductions	Using the EPA calculator, it is estimated that this program will reduce GHG emissions by ~6 m/tons annually, while also improving indoor air quality for tribal member households. Exchanging a wood burning stove for electrical furnace would reduce the emissions even further.
Implementation authority milestones	Fort McDermitt Paiute Shoshone Tribes, Tribal Council approval of contractor(s) and homeowner agreement.

Table 12. Wood burning stove replacement.

This measure is specifically designed to accomplish the goal of providing tribal households with access to reliable and sustainable winter heating on the reservations, with a specific focus on those households that are utilizing wood as a heating source. While wood stoves can be considered a sustainable energy source for heating, antiquated systems have the potential to increase indoor air pollution, increase soot production that can cause dangerous house fires, and result in an inefficient fire per mass ignited. The purpose is to provide multiple options, including a complete system change-out, for eligible tribal households for their heating needs. The Tribe will complete an evaluation of eligible households and distribute the benefits to qualifying tribal members on a rolling basis as applications are received. Each annual report, for the three proposed funding cycles, will describe the nature of the stove replacement and have a specific estimate on the reduction of GHG associated with that year's program accomplishments.

Measure 4: Develop GHG sequestration Studies for the Fort McDermitt Reservation and Tribal Lands

Burns Paiute Tribes: Burns Paiute Climate Stewardship Program	
Implementing agency	Fort McDermitt Paiute Shoshone Tribes
Implementation milestones	Develop study design with local academic institutions and/or agency staff, develop pilot conservation measures in situ, select contractor, implement conservation measures
Geographic location	Fort McDermitt Reservation and adjacent lands.
Funding sources	EPA CPRG Phase II Implementation funds, Tribal Competition; conservation funds (USDA, FSA, NRCS); Tribal cost-share
Metrics tracking	Published outreach materials, status reports, project completion report

Cost	$1,000,000 (5-year pilot project for stewardship program managed by the FMPST)
Annual estimated GHG and criteria air pollutant emission reductions	The Fort McDermitt Reservation does have limited acreage owned by the Tribes and its members where conservation efforts can have a positive effect. There is a broad range of habitat types from alpine meadows, non-commercial forests, shrub-steppe, and freshwater riparian areas present on the Reservation.
Implementation authority milestones	Fort McDermitt Paiute Shoshone Tribal Council accepts implementation grant funding, site contractor is selected, and project is implemented

Table 13. Climate stewardship program.

The Tribes will work with qualified contractors, staff, and regional Universities to develop appropriate studies that can measure the effect of implementation actions to increase the surface area of existing wetlands or riparian areas. The most significant co-benefit of engaging in conservation work include the primary goal of leaving intact and functional wetlands and riparian areas intact and undisturbed, these areas contain significant carbon and methane stores that are released when disturbed. Another opportunity that conservation programs have is to utilize areas that could be new wetlands or enhanced riparian areas to store 'new' atmospheric carbon in the soil. The final component of the conservation program is directly related to the ecological health of the wetland or riparian system, including benefits to water, soils, plants, animals, and aquatic organisms.

6.4 FMPS Priority Measures Benefits Analysis

The benefits of GHG reduction measures can be roughly placed into three topic spaces; infrastructure transition to sustainable renewable energy for tribal communities, deployment and installation of adequate renewable energy projects on tribal lands to support those communities, and policy measures to increase community support for climate resiliency and carbon neutrality goals. Each of those broad topics are addressed in the USRT member tribes' individual PCAP measures to achieve goals of carbon neutrality, but there is a need for sustained technical and financial support for tribal communities. The unique relationship between the federal government and the tribes should be viewed as a natural partnership to implement renewable energy projects and to pilot programs for carbon neutrality across the Upper Snake River basin. While every development has the potential to have deleterious effects on the environment, the projects selected by the tribes for implementation are carefully designed to increase climate resilience and support transitioning existing developments with sustainable technology.

The benefit assessment for each measure was developed by using the emissions inventory developed for each of the member tribes, relying on NEI source data for each of the counties as inputs in the Tribal Greenhouse Gas Inventory Tool (TGIT). The measures proposed above were then individually evaluated to ensure there wouldn't be any significant negative effects to the tribal community or the reservation environment. It is reasonably foreseeable that a complete transition to renewable energy will necessitate dramatic changes and potentially negative consequences for the environment if projects aren't adequately developed. By focusing the PCAP measures on immediate 'tailpipe' emissions, electrical service infrastructure, and near-term policies, the tribes can effect positive change while developing sound projects to service reservation residents that don't impact the character of their homelands.

Measure 1 – Residential Electrical Service Panel Upgrade

A key component to engaging the tribal membership in the electrical transition, particularly for home energy use and electric vehicle transportation, is to ensure that the entry point for those electrical components is appropriate for the residence. The electrical service panel on many tribal homes will require upgrades prior to the installation of solar systems, battery powered backups, level 1 and 2 EV charging stations, and other electrical appliances. The benefits of engaging in upgrades to electrical service panels with new service panels are both direct and indirect.

The Tribes won't endorse a particular brand of service panel, preferring to allow an open solicitation process to select the appropriate equipment for their geography. The range of estimates for upgrading this component in the household range from 5% - 10% improvements in electrical efficiency, providing an immediate benefit to the household in terms of GHG emissions.[46] The most important benefit is indirect, primarily because this component provides the household with options to install EV chargers, renewable energy and battery storage systems, and transition from fossil fuel heat sources into electrical heat sources.

Measure 2 – Installation of Residential Solar

The Fort McDermitt community is similarly situated to their sister tribe to the north, the Burns Paiute Tribe, in both total households on the reservation and energy potential. While developing options it should be noted that the projects with the greatest impact for the community are those that directly help tribal members engage in the transition to an electric economy sooner than later. With a keen focus on deploying commonly available equipment to this community we can completely eliminate the GHG emissions associated with residential electricity in a couple of construction seasons. This reduction in GHG emissions will also be maximized by including upgraded service panels for tribal members interested in making an EV transition as well because the panels will provide 'fuel' for those vehicles at their residence with safe and effective charging mechanisms. A 10kwh system deployed on a home in Fort McDermitt will offset ~6 tons of GHG annually and will be a generational investment lasting up to 25 years.

Measure 3 – Wood Stove Replacement Program

Some of the tribal membership on the Fort McDermitt Reservation rely on wood burning stoves as a primary heat source during the winter months. The tribes will investigate programs to support for tribal elders and low-income households with 4-6 cords of firewood each winter to support their heating needs and have received funding in the past to help replace aging wood stoves with new, EPA-certified, stoves in elder households. The direct impacts of replacing a wood burning stove depend heavily on the type of fuel burned in the household and the age of the stove used as the heat source, but generically the program is anticipated to reduce approximately 6 m/tons of GHG per year.

It is relatively clear that this program will have an immediate impact on GHG emissions from wood burning stoves during the winter months. The FMPS are also optimistic that this project will have associated co-benefits noted in other similar projects that have been implemented on tribal lands. The FMPS expect to see reductions in indoor air pollutants following the replacement and will work directly with willing program participants to conduct post-replacement measurements of indoor air pollutants.

[46] As with other USRT tribes, the recommendation to install a electrical service panel upgrade is based both on the immediate efficiency gains for the homeowner and the potential to install batteries and renewable energy on that household.

This should also help reduce outdoor air pollution on the reservation during winter months, specifically when there are high-pressure inversions present across the McDermitt Caldera.

Measure 4: Addressing the Ecological Health of the Fort McDermitt Reservation

The Fort McDermitt Reservation is home to numerous resources that are critical to the function of this high elevation desert landscape, including surface water resources that are relatively rare in the area. The advent of industrial scale development in surrounding areas due to lithium exploration, extraction, and refining will likely place significant ecological pressures on water and biological resources adjacent to the Fort McDermitt Reservation. The tribes will evaluate the effectiveness of conservation efforts on significant landscapes within their reservation and develop implementable programs to engage in conservation efforts that sequester atmospheric carbon in wetland and riparian habitats. The retentive capacity would be determined through collaboration with local academic institutions and implemented through federal programs to promote riparian and wetland health.

6.5 FMPS Authority to Implement Priority GHG Measures

Federally recognized tribes in the United States, including the USRT member tribes, have a relatively high degree of sovereignty and self-governance over their own reservation lands. This authority is rooted in the recognition that tribes, like any other sovereign entity, possessed authority to govern their own constituents and handle their own affairs within their land base; this authority pre-dated any limitations on that authority imposed by the U.S. Constitution, treaties, statutes, and court decisions. It is critical to note that the inherent rights associated with self-governance are not grants of rights to tribes, rather they are a component of their inherent sovereignty that has always existed.

While there are a number of nuanced issues within the subject matter of tribal jurisdiction, the primary legal frameworks governing the implementation of PCAP recommended measures will include the following:

- U.S. Constitution: The Constitution recognizes tribes as separate sovereigns, and the Commerce Clause grants Congress the authority to regulate commerce with Indian tribes. This early relationship formed the basis for tribal relations that impact our member tribes through present.
- Treaties and Executive Order: While some tribes have treaties with the U.S. government that outline the tenets of their 'nation to nation' relationship, some tribes were established with other mechanisms during the eighteenth and nineteenth centuries. Common features of both mechanisms for developing relationships with tribes include setting boundaries of reservations, establishing a fiduciary relationship, and defining the scope of their self-governance. The Shoshone-Bannock Tribes and the Fort Hall Reservation was formed under the Fort Bridger Treaty of 1868 (ratified), and while the other three USRT member tribes were present and negotiated direct treaties they were never ratified by Congress. Each of the remaining USRT member tribes (BPT, SPT, and FMPS) were established through Executive Order or a formal act of Congress and each has an intact land base and active, engaged tribal community-based government. All four of the tribes possess the inherent authority to manage their own internal affairs and maintain the capacity to contract services or manage the scope of programs described in this PCAP.
- Indian Reorganization Act (IRA) of 1934: The IRA marked a shift in federal Indian policy towards supporting tribal self-governance after a scathing review of federal Indian policy around the turn of the century. Tribes who adopted IRA constitutions operate under a constitution, with a tribal council

who manages the daily affairs of the tribes. Not all tribes adopted an IRA constitution and continue to manage their government affairs based on the direction of their general membership; both systems will be present across our USRT member tribes.

- ❖ Indian Self-Determination and Education Assistance Act of 1975 (PL 93-638): This legislation reinforced tribal self-governance by giving tribes greater control over their own affairs, including the management of their lands and resources. In its contemporary iteration, 93-638 contracts and/or cooperative agreements can be developed directly with eligible tribes seeking to utilize federal funding on their lands with their own staff. In some instances USRT member tribes may still need to consult with the BIA to determine the applicability of an environmental review process prior to ground disturbance.
- ❖ Federal Trust Responsibility: The U.S. government has a trust responsibility to protect tribal lands, resources, and treaty rights. This principle has been interpreted by tribes to imply a fiduciary duty to assist tribes in managing their lands and resources for the benefit of tribal members.
- ❖ Tribal Sovereign Immunity: Tribal governments generally possess sovereign immunity, protecting them from lawsuits without their consent. This immunity extends to actions related to land management.

All four of the USRT member tribes are aware of their obligations to manage federal funds to accomplish the intended purpose and have reviewed the proposed climate pollutant reduction measures associated with this PCAP. Each of the measures associated with this PCAP are directly intended to alleviate a current burden on their respective communities and help make each of their homes more resilient to the worst impacts from global climate change. There aren't any measures contemplated for the PCAP that will exceed the limits of tribal sovereignty and if there are any perceived inconsistencies for future project recommendations during the CCAP process, they will be noted accordingly.

6.6 Identification of Other Funding Mechanisms

Although this section is optional for the PCAP, USRT staff have noted that the Biden/Harris Administration, in concert with the release of federal funding through the Bipartisan Infrastructure Law and Inflation Reduction Act, has developed an online tool to help Tribes access funding opportunities. The intent of the Access to Capital web portal, hosted by the Bureau of Indian Affairs, is to provide tribal professionals a 'one-stop' portal to access federal programs to engage in meaningful community change.[47] The website is functional, as of December 6, 2023, and will be utilized to help the USRT member tribes access specific funding mechanisms to implement meaningful measures that reduce GHG emissions on tribal lands. A similar web-based portal is available for tribal professionals seeking funds to engage in clean energy projects from the Department of Energy, Office of Indian Energy Policy and Programs.[48]

Specific funding sources for the PCAP measures identified above may include working with a number of program(s) within the federal administration to accomplish specific tribal climate goals. Given the nature of the 2024 funding environment, USRT staff has noted that a number of funding opportunities are related to one-time grants for projects or competitive grant notices. USRT technical staff have chosen to work directly with Tribal staff to identify opportunities to accomplish near-term PCAP

[47]See generally, https://www.bia.gov/atc
[48]See generally, https://www.energy.gov/indianenergy/current-funding-opportunities#:~:text=Clean%20Energy%20Technology%20Deployment%20on,technology%20deployment%20on%20Tribal%20lands.

measures, while acknowledging that accomplishing meaningful GHG emissions reduction will require long-term funding opportunities rather than single projects. Rather than focus on one-time funding opportunities the FMPS is focused on more consistent, programmatic funding resources within the federal government for tribes.

6.7 Workforce Planning Analysis

Transitioning a workforce to accomplish new tasks can be a generational task in small Tribal communities, where dedicated tribal members are often working diligently for their tribe already. Developing a climate ready workforce is a priority for the USRT member tribes, although the PCAP measures detailed in the preceding sections are not intended to build that workforce. Achieving near-term climate goals and allowing the PCAP measures to be a catalyst for generating community support and 'buy-in' are critical components of each of those measures.

The workforce planning analysis was an optional section and due to the complex nature of the evaluation by USRT technical staff, we have opted to work with our member tribes on this issue for the CCAP. Tribal members from each of our member tribes have dedicated their entire careers to working for their people and are already working to protect natural and cultural resources on their reservations. USRT is committed to helping our tribal communities engage in climate stewardship activities and helping instill traditional values of resilience, accountability, and reciprocity in all of our GHG emissions reduction measures. For the CCAP, USRT staff will work directly with each of the tribes to develop the appropriate workforce planning measures to help maximize emissions reductions and to ensure that tribal communities have locally available labor to meet the demands of an uncertain future.

7 Shoshone-Paiute Tribe of the Duck Valley Reservation

Descendants of the Western Shoshone and the Northern Paiute occupy the Duck Valley Reservation on the border of southwestern Idaho and northeastern Nevada along the East Fork of the Owyhee River.[49] The reservation is 289,819 acres, including 22,231 acres of wetlands. There are approximately 2,200 people who hold membership with the Shoshone-Paiute Tribes.[50] The Tribes have homelands throughout the Western United States with a primary focus on lands within the tristate area of Idaho, Nevada, and Oregon. The Reservation was established in 1886 for the Western Shoshone and was later expanded in 1910 for the Northern Paiute through respective executive orders.

The Tribes' lifestyle was well adapted to the desert environment in which they lived. Each band or tribe generally centered on a lake or wetland, which supplied fish and waterfowl for subsistence. Surrounding areas provided salmon, steelhead, rabbits, pronghorns, pinyon nuts, grass seeds, and roots as important parts of their diet. The natural resources of the Upper Snake River Watershed continue to sustain the dietary, cultural, spiritual, and economic needs of the Shoshone-Paiute Tribes of the Duck Valley Reservation. Under the careful stewardship of the SPT, the Duck Valley Reservation maintains abundant species of fish and wildlife, as well as thousands of acres of intact shrub-steppe habitat. Maintaining a thriving community in the next century will require adaptive planning and investments in infrastructure.

The data utilized for demographic information in the development of the high-level emissions estimates for the Shoshone-Paiute Tribes of the Duck Valley Reservation and associated tribal lands was derived

[49] Shoshone Paiute Tribes, 2016. Shoshone Paiute History. Available: http://www.shopaitribes.org/culture/.
[50] Shoshone Paiute Tribes, 2016. Where is Duck Valley?. Available: http://shopaitribes.org/spt-15/component/content/article/30-what-languages-are-supported-by-joomla-15.html

from the 2020 Census "My Tribal Area" data retrieval tool found at (https://www.census.gov/tribal/?st=32&aianihh=0965). Demographic data is critical to estimating emissions data for the Shoshone-Paiute Tribes because data inputs for the Tribal Greenhouse Inventory Tool (TGIT) are developed at the State and/or County level; those estimates are not downscaled specifically for each member's reservation associated with the Upper Snake River Tribes Foundation. The primary purpose for using this information from the census is to generically apportion emissions based on a percentage of the total population in the county for which data is available. The methodology associated with this assumption is in line with the presumption that the PCAP is a high-level document to engage Tribal communities in near-term priority actions to reduce climate pollution; the Comprehensive Climate Action Plan will revisit this assumption and attempt to refine data in a manner tailored specifically to each reservation and emission sector.

The total population of the Shoshone-Paiute Tribal lands is presented in the 2020 Census as 1,125, with 1,002 people identified as Native American alone. The data indicates that there are 488 total housing units, with 384 of those units occupied in 2020. Further, 370 individuals are commuting for work with approximately 75% of those utilizing light duty vehicles for their 'daily' drive to work. The 2020 Census indicates that 258 individuals are enrolled in school pre-Kindergarten through High School; it is assumed for purposes of estimating emissions that all of these individuals are utilizing bus transportation to and from school.

For purposes of estimating emissions at the County level, all of the ~289,819 acres of the Duck Valley Reservation are located within the exterior boundaries of Owyhee County, Idaho and Elko County, Nevada. Owyhee County has a total population of 11,913 individuals with 203 of those individuals reporting status as American Indian, or approximately 1.7% of the total county population will be used for the emissions estimate. Elko County has a total population of 53,702 individuals with 1,002 of those individuals reporting status as American Indian, or approximately 1.8% of the total county population. It should be noted that there is a difference between the reported figure for the Reservation and those living in Elko and Owyhee Counties. While this may pose a slight problem in data interpretation. The USRT staff understand that every tribal member will not reside on their tribal lands for a variety of reasons; as such, the USRT will utilize the total county population of American Indian for emissions estimate. The rationale for this inclusive method of estimation is to ensure that Tribal leadership have adequate data to support growth models and/or planning efforts for future generations of tribal members who may return to tribal lands.

7.1 Special Considerations for Tribal/Territorial Entities

The large land base and rural setting for the Duck Valley Reservation comes with a number of unique considerations that will be further developed during the CCAP planning process. While it is critical to ensure that emissions are accurately characterized, it is equally important to develop mechanisms to reduce emissions in the near-term. This is particularly true for relatively straightforward emissions in the mobile or electricity category; essentially this requires policy shifts and rapid deployment of existing technologies. With the exceptionally large land-base held in trust, the tribes have opportunities to engage in landscape level conservation to sequester carbon, develop large-scale renewable energy projects, and offer innovative agricultural solutions to tribal producers.

Solid Waste

The Shoshone-Paiute Tribe does not own or operate a landfill facility, the solid waste produced from tribal lands is removed to a local landfill facility operated outside of the Tribe's direct control. The movement of solid waste from transfer stations does create significant emission sources, but for the purposes of this initial planning process, priority emission reduction actions will focus on other sources. It is anticipated that during the comprehensive planning process the Tribes will allocate multiple emission reduction actions to this category.

Wastewater

The SPT does not operate a local wastewater facility in their community, with the primary mechanism to deal with wastewater being septic based systems. While wastewater facilities can be source of GHG emissions in any community, the lack of a facility requires that this emission source be disregarded for the purposes of the priority actions proposed in this PCAP. Further options will be explored during the CCAP (Comprehensive Climate Action Plan) for developing and/or improving the operations of wastewater operations and seeking collaborative solutions for the tribe.

7.2 Collaborations

USRT staff focused our collaborative efforts entirely on our member tribes due to the short period of time to develop a high-level GHG emissions inventory, PCAP, and an implementation grant application based on tribal priority actions. Following the release of funding in mid-September 2023 USRT staff developed and received approval for a Quality Assurance Project Plan (QAPP) in late October 2023. With an approved QAPP to work from, USRT staff immediately engaged with our partners through the USRT Technical Work Group and direct contacts from the Environmental Director to tribal staff to get additional background information relevant to the emissions inventory.

It should be noted the collaboration that occurred during the PCAP development phase was the Technical Assistance Forums hosted by EPA and Endyna. The opportunity to learn from professionals across the nation, all engaged in the same type of climate action planning, afforded tribal professionals a rare 'inside' look at how Metropolitan Service Areas (MSA) and States utilize data to prioritize actions that support GHG reductions. USRT staff would also like to acknowledge our EPA project officer for hosting regular 'Office Hours' to discuss issues directly with other professionals throughout the planning process. The Shoshone-Paiute Tribal staff, particularly Marissa Snapp, helped throughout the process by identifying tribal measures and confirming information with USRT staff.

8 SPT PCAP elements

The SPT emissions inventory, emission reduction measures, and benefits analysis show that it will take longer to reach community level carbon neutrality without significant investments in infrastructure and energy partnerships at a commercial scale. The USRT technical staff engaged with USRT member tribes in early 2024, providing a relatively narrow window to address priority actions to reduce climate pollutants in the near-term. Fortunately, the USRT member tribes have already begun the process of climate adaptation and resiliency planning through Bureau of Indian Affairs funding, with the Shoshone-Paiute Tribes participating in throughout those planning processes to guide tribal priorities. While neither the USRT or SBT climate adaptation plans were funded through EPA, and are primarily focused on natural resource management, both documents have significant relevance to the PCAP.

The SPT also produced an internal climate plan to adopt strategies that encourage economic and ecological resilience on the Duck Valley Reservation with numerous actions specifically related to the support of the tribal membership through technical assistance and project implementation. This PCAP addresses several of these issues specifically addressed in the proposed measures developed by the Shoshone-Paiute Tribal community and are commonly shared across the USRT member tribes. As a large land manager, similar to the Shoshone-Bannock Tribes, there are potentially community and landscape level impacts to the Duck Valley Reservation from stochastic events like wildfires or floods. This requires the SPT to manage both landscape level infrastructure and ecological integrity, while also preparing contemporary communities for electrical infrastructure needs and an eventual transition to a carbon neutral community.

The Duck Valley Reservation is significantly larger than the BPT or FMPS reservations, at ~300,000 acres there are resources present to develop community projects that support it membership; although this would require significant investments to implement. Reducing GHG emissions in the near-term requires a careful evaluation of the benefits of actions relative to their overall costs and significance relative to a community's GHG emissions. Each USRT member tribe is geographically unique, and each has its own governance structure that is responsible for the health and welfare of their membership. The number of households and spatial distribution of communities will require additional planning in the CCAP, but priority measures focused on the underlying infrastructure to encourage electrification on the reservation will pay dividends in the coming decade.

8.1 SPT Greenhouse Gas (GHG) Inventory

The development of an accurate GHG inventory is critical to understand the specific needs of each of USRT's member tribes. Given the limitations of funding, time, and planning objectives to reduce climate pollutants in the near-term USRT staff utilized coarse, downscaled information to develop the high-level estimates represented in the figures below. There are limitations to the scale of research that can be accomplished during the PCAP process, so additional topics of investigation are noted and USRT requests continued support for member tribes seeking to increase their own understanding of these topics. For detailed information on how the following data was collected and evaluated please refer to Section(s) 1.6-1.8 of this document.

Total Shoshone-Paiute Emissions (MT CO2e)								
	CO_2	CH_4	N_2O	HFCs	PFCs	SF_6	Total MT CO_2e	Percent of Total
Scope 1	14,570.70	317.38	1.29	-	-	-	14,889.38	67%
Scope 2 - Location Based	7,451.30	19.47	26.33	-	-	-	7,497.10	
Scope 2 - Market Based (for informational purposes only)	7,451.30	19.47	26.33				7,497.10	33%
Scope 3	-	-	-	-	-	-	-	0%
Total Gross Emissions	**22,022.00**	**336.85**	**27.62**	-	-	-	**22,386.48**	**100%**
Total Net Emissions	**22,022.00**	**336.85**	**27.62**	-	-	-	**22,386.48**	**100%**

Emissions by Source (MT CO_2e)								
Source	CO_2	CH_4	N_2O	HFCs	PFCs	SF_6	**Total**	**Percent of Total**
Stationary Combustion	2,533.12	6.30	1.27	-	-	-	2,540.69	11%
Mobile Combustion	4,817.19	-	-	-	-	-	4,817.19	22%
Solid Waste	-	-	-	-	-	-	-	0%
Wastewater Treatment	-	310.65	-	-	-	-	310.65	1%
Electricity - Location Based	7,451.30	19.47	26.33	-	-	-	7,497.10	
Electricity - Market Based (for informational purposes only)	7,451.30	19.47	26.33				7,497.10	33%
Water	-	-	-	-	-	-	-	0%
Ag & Land Management	-	-	-				-	0%
Urban Forestry	-	-	-				-	0%
Waste Generation	-	-	-				-	0%
Other	7,220.39	0.43	0.03	-	-	-	7,220.85	32%
Total (Gross Emissions)	**22,022.00**	**336.85**	**27.62**	-	-	-	**22,386.48**	**100%**
Total (Net Emissions)	**22,022.00**	**336.85**	**27.62**	-	-	-	**22,386.48**	**100%**

Figure 22. Total emissions for Shoshone-Paiute Tribes

As noted above, the USRT PCAP developed emissions inventory estimates for the 'required' parameters and will be developing the complete inventory during the CCAP process. While it would be preferred to have the entire inventory available for the PCAP, particularly for setting priority measures to reduce GHG emissions, the accelerated timeline did not permit adequate consultation for each of the individual tribes. In the coming three years, USRT staff will work directly with representatives from our member tribes to complete this project for the CCAP.

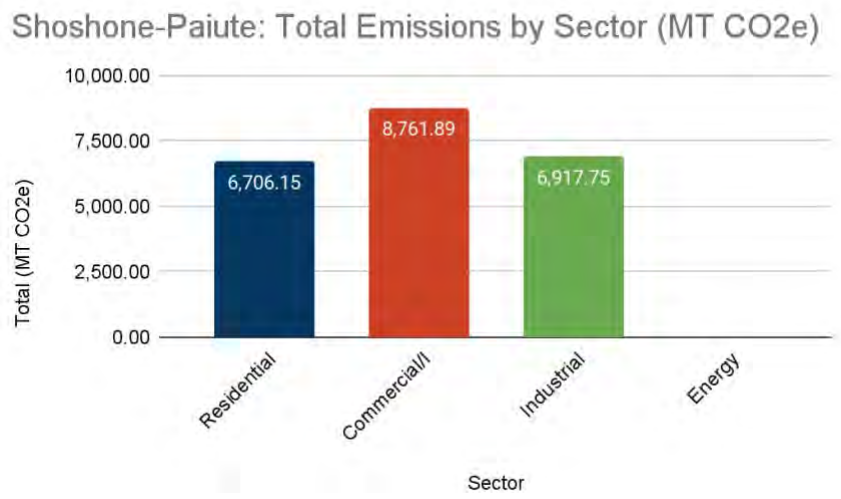


Figure 23. SPT total emissions by Sector.

The SPT sector emissions inventory is relatively close to the national per capita emissions of GHG, with an estimate of **19.9 (MT CO2e/person)** for people living on the Duck Valley Reservation on the southern border of Idaho and the northern border of Nevada. For the purposes of the PCAP, USRT and the SPT

focused on areas of emissions that could be addressed by the Tribal Council in the near-term that are directly within their scope of influence. As with the national emissions for GHG, transportation is the driving force behind the majority of emissions for the SPT community and is a focus of near-term PCAP measures proposed for implementation.

The figures below show a simple breakdown of total emissions by source for the SPT. Understanding the source of the emission is critical because the evaluation of implementation measures requires each applicant to identify specific actions that will address an issue within their community. While the information by sector provides a high-level overview, the detailed inventory developed through the TGIT will help the SPT engage in meaningful reduction measures in the spaces where those actions will be most meaningful. It is apparent that there are commercial sector emissions within the counties in Idaho and Nevada that are not likely directly attributable to the SPT and a more refined estimate will be recommended for the tribe specifically to assess the quantity of emissions directly from their tribal lands. The figure below shows that by source, it is almost the same conclusion as the other USRT member tribes; tribal communities need near-term support to retrofit existing homes, deploy available renewable energy systems, and provide infrastructure to support a transition to electrical transportation.

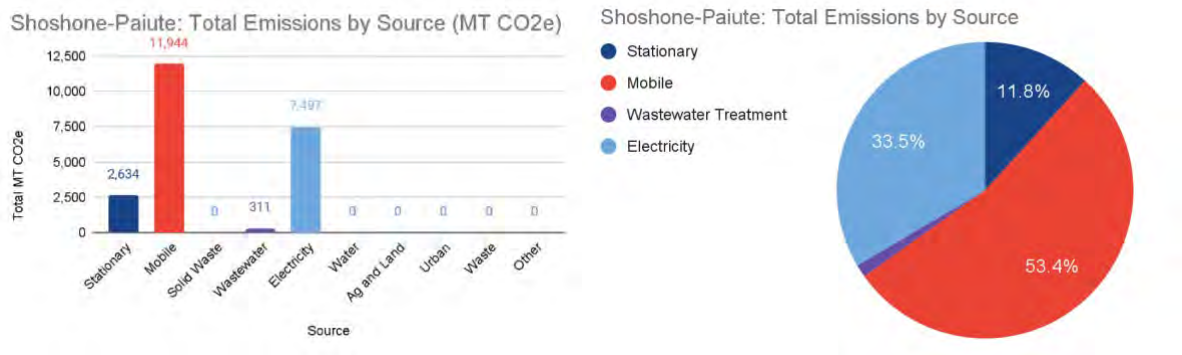


Figure 24. SPT charts showing total emissions by source.

The challenges with downscaling emissions directly to a Reservation utilizing the publicly available datasets for GHG emissions like the NEI can be significant and can vary widely based on the assumptions modelled in the preliminary assessment phase. A large portion of emissions within the two counties, in two different states can be attributed to facilities that are not directly located on tribal lands or under tribal jurisdiction for implementing GHG reduction measures directly at the source of those emissions. It should be noted that regardless of source, the SPT are committed to being an active participant in ameliorating the worst effects of climate change by building more resilient communities.

While the development of this high-level GHG emissions inventory was relatively straightforward, given the assumptions made during the coarse downscaling for a per capita emissions estimate, there were still challenges that will need to be addressed during the development of the CCAP. The first assumption that will need to be updated when the 2023 NEI is released, the most current version of that dataset is from 2020 and emissions data might be significantly skewed based on the Covid pandemic during that year. Another critical note is that there will need to be an evaluation of the contributions of fire emissions and agricultural emissions during the CCAP development. The mobile data is still relatively elevated due to the presence of commercial/institutional mobile emissions across both

Owyhee and Elko Counties, so a more detailed evaluation of that category is likely warranted. Finally, there seem to be some anomalies in the Commercial sector that might be related to facilities within Owyhee and Elko Counties that the SPT don't directly control for GHG emissions reduction measures.

Figure 25. SPT mobile emissions by sector.

Essentially mobile emissions by sector in the SPT inventory are split between commercial and residential, with a significant portion of the emissions being from on-road sources. Maintaining these levels of emissions from the mobile source wouldn't allow for the tribes to easily meet GHG emissions goals in the near-term. Given the relative abundance of electric options for vehicles (both on and off-road) this does seem like a specific focus area where immediate emissions reduction can occur with clear investments on this issue. All of the USRT member tribes set priority measures associated with near-term reductions in the mobile category for their communities.

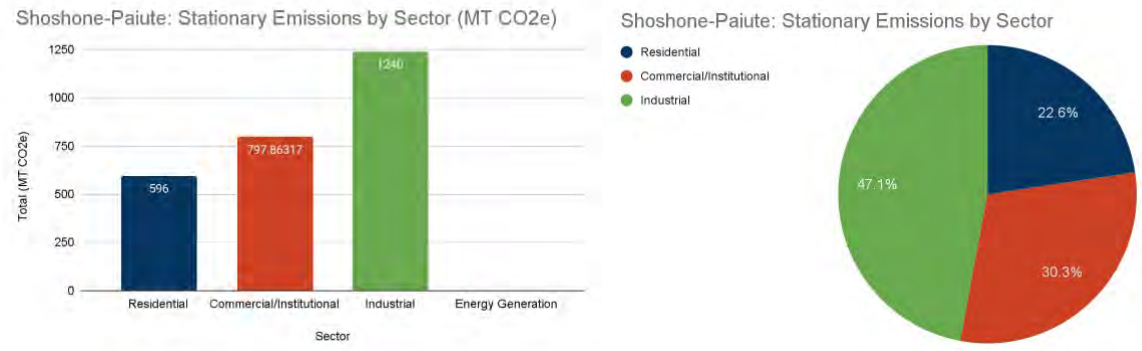


Figure 26. SPT Stationary emissions by Sector.

The SPT stationary emissions are relatively skewed toward the industrial and commercial, although a large proportion (22.6%) is assigned to residential structures. Stationary emissions are relatively simple to mitigate and the tribe has prioritized maximizing the efficiency of structures, ensuring they are updated enough to change to electrical infrastructure, and also that when commercial facilities are generating solid/organic waste it is diverted into adequate mitigation structures. All of the USRT tribes prioritized offering direct assistance to their membership to the maximum extent possible; recognizing that community structures are also used to benefit the members there are measures associated with upgrading those facilities.

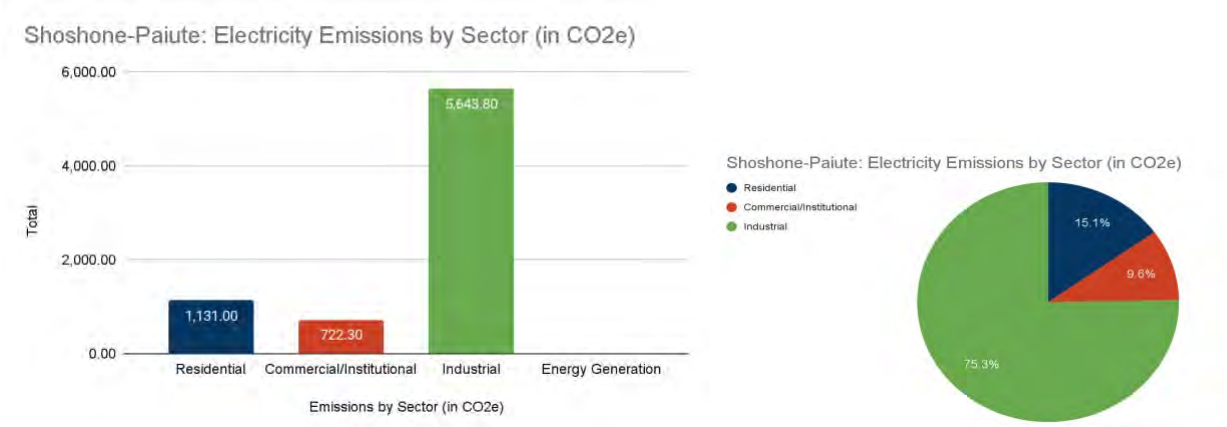


Figure 27. SPT electricity emissions by sector.

The emissions associated with electricity use for the SPT skew heavily toward industrial emissions although each of the categories have meaningful opportunities for GHG reduction measures. This is likely related to the SPT emissions inventory issues that do assign a high per capita emission of GHG for the tribes but are directly related to those industrial emissions that are outside of the tribes' direct line of authority. As with other sectors the tribes are prioritizing delivering meaningful services to the membership so there is resiliency built into tribal communities. It should be noted that developing additional electrical infrastructure is a critical component to modernizing the grid and making those projects valuable for the reservation as a whole.

8.2 SPT GHG Reduction Targets

This PCAP does not set formal reduction targets for our member tribes, in part due to the complex nature of preparing a GHG inventory in a short amount of time and the focus on developing near-term priorities for implementation. During the development of the CCAP this section will include both an emissions reduction target, conceptual measures to meet those targets, and an associated feasibility analysis to meet those targets. It is worth noting that the national targets vary widely based on the State/Country/Global Region but the consensus from the International Community[51] is to reduce GHG emissions are as follows:

- (United States) Reduce GHG emissions by ~28% to meet 1990 levels of emissions by 2025.
- (United States) Reduce GHG emissions by 45% by 2030.
- (United States) Fully transition to a carbon negative economy by 2050

The State of Nevada, as discussed above, has set GHG emissions reduction targets and goals to ensure that a majority of their energy is produced by renewable sources. The State of Idaho did not opt to set emissions reduction targets through their PCAP and have not acted legislatively or administratively to set those reduction targets at the time of this writing. However, the focal areas for engaging in meaningful reductions in emissions reductions are in line with the tribal priorities for assisting the community through meaningful measures that improve the reliability of electricity in institutional buildings, renewable heating resources for tribal households, and increasing the resiliency and sequestration of working landscapes through best management practices. In an effort to reduce

[51] United Nations Net Zero Coalition Homepage; searched and located on January 12, 2024 (Daniel Stone).

redundancy, only those specific tribal measures appear below and each relevant State measure is incorporated by reference.

The measures proposed in this PCAP are intended to provide a significant shift in GHG emissions in the next three years for our member tribes, although each will vary based on the availability of funding to implement the measures. For example, the average per capita GHG emissions for a member of the Shoshone Paiute Tribe is 17.4 MT/CO2 annually and the bulk of those emissions inventoried are mobile or electrical emissions. In order to make progress to a 'net-zero' transition in the coming two decades the infrastructure for renewable electricity (residential and commercial) and electrical transportation must be completed in the near-term or you will not see a meaningful declines in GHG emissions. The USRT member tribes are committed to developing and implementing projects to be net-zero or carbon negative by 2050.

8.3 SPT Priority GHG Reduction Measures

The SPT has reviewed the available material and has selected the following priority items for the Phase II implementation funding grant. Each of the items are severable in the event there is a limit on available funding and the construction is contingent on funding for near-term implementation due to current constraints in tribal budgets. The SPT is committed to implement the projects selected for implementation within the next three years and to work collaboratively with USRT staff on each reservation to complete the CCAP. Each table with the priority measure is followed with brief narrative, simple budget, and workplan; as well as a description of emissions reduction for that specific measure. The following PCAP measures are intended to be severable in the event one or more are not funded for implementation; it should be noted that the tribes view the order of priorities to focus on infrastructure and the immediate deployment of ubiquitous renewable energy systems for tribal members living on the reservation.

Measure 1: Wood Stove Replacement Program

Shoshone Paiute Tribes: Wood Stove Replacement Program	
Implementing agency	Shoshone Paiute Tribes
Implementation milestones	Shoshone Paiute Tribes accepts CPRG implementation grant funds, develops agreements with willing participants, approves contractor(s) for installation
Geographic location	Duck Valley Reservation, up to 200 homes.
Funding sources	EPA CPRG Phase II Implementation Grant funds
Metrics tracking	Published project outreach materials, quarterly status reports, and final project report
Cost	$1,500,000 for total project costs; includes administration of project and up to 200 homes with complete replacement of wood burning stoves with new stoves or electric furnaces.
Annual estimated GHG and criteria air pollutant emission reductions	Using the EPA calculator, it is estimated that this program will reduce GHG emissions by ~24 m/tons annually, while also improving indoor air quality for tribal member households.
Implementation authority milestones	Shoshone Paiute Tribal Council approval of contractor(s) and homeowner agreement.

Table 14. Wood burning stove replacement program.

This measure is specifically designed to accomplish the goal of providing tribal households with access to reliable and sustainable winter heating on the reservations, with a specific focus on those households that are utilizing wood as a heating source. While wood stoves can be considered a sustainable energy source for heating, antiquated systems have the potential to increase indoor air pollution, increase soot production that can cause dangerous house fires, and, result in an inefficient fire per mass ignited. The purpose is to provide multiple options, including a complete system change-out, for eligible tribal households for their heating needs. The Tribe will complete an evaluation of eligible households and distribute the benefits to qualifying tribal members on a rolling basis as applications are received. Each annual report, for the three proposed funding cycles, will describe the nature of the stove replacement and have a specific estimate on the reduction of GHG associated with that year's program accomplishments.

Measure 2: Install 1 MW Solar Array for Tribal School and Government Campus

Table 15. Educational solar installation at Duck Valley schools.

The Shoshone Paiute Tribe is in a similar situation to the Shoshone-Paiute Tribes where the installation of a larger solar installation that would significantly reduce, but not eliminate, the carbon contribution from this community. The size of the community would necessitate a much larger investment than is likely available for a single tribe through the CPRG Phase 2 program. The installation of photovoltaic arrays is often associated with off-reservation communities due to the expense of lending, local expertise in installation and long-term maintenance; with expenses to upgrade residential services and the complexity of rural intertie applications with local utilities. The tribes would utilize federal, state and tribal funds to support a project to install and maintain solar systems with battery back-up capacity at government and school system buildings that the community can use.

Measure 3: Develop GHG sequestration Studies for the Duck Valley Reservation

Shoshone Paiute Tribes: Duck Valley Reservation Climate Stewardship Program

Implementing agency	Shoshone-Paiute Tribes
Implementation milestones	Develop study design with local academic institutions and/or agency staff, develop pilot conservation measures in situ, select contractor, implement conservation measures
Geographic location	Duck Valley Reservation and adjacent lands.
Funding sources	EPA CPRG Phase II Implementation funds, Tribal Competition; conservation funds (USDA, FSA, NRCS); Tribal cost-share
Metrics tracking	Published outreach materials, status reports, project completion report
Cost	$1,000,000 (5-year pilot project for stewardship program managed by the SPT)
Annual estimated GHG and criteria air pollutant emission reductions	The Duck Valley Reservation has ~300,000 acres owned by the Tribes and its members. There is a broad range of habitat types from alpine meadows, non-commercial forests, shrub-steppe, and freshwater riparian areas present on the Reservation.
Implementation authority milestones	Shoshone-Paiute Tribal Council accepts implementation grant funding, site contractor is selected, and project is implemented

Table 16. Climate stewardship program.

The Tribes will work with qualified contractors, staff, and regional Universities to develop appropriate studies that can measure the effect of implementation actions to increase the surface area of existing wetlands or riparian areas. The most significant co-benefit of engaging in conservation work include the primary goal of leaving intact and functional wetlands and riparian areas intact and undisturbed, these areas contain significant carbon and methane stores that are released when disturbed. Another opportunity that conservation programs have is to utilize areas that could be new wetlands or enhanced riparian areas to store 'new' atmospheric carbon in the soil. The final component of the conservation program is directly related to the ecological health of the wetland or riparian system, including benefits to water, soils, plants, animals, and aquatic organisms.

8.4 SPT Priority Reduction Measures Benefits Analysis

The benefits of GHG reduction measures can be roughly placed into three topic spaces; infrastructure transition to sustainable renewable energy for tribal communities, deployment and installation of adequate renewable energy projects on tribal lands to support those communities, and policy measures to increase community support for climate resiliency and carbon neutrality goals. Each of those broad topics are addressed in the USRT member tribes' individual PCAP measures to achieve goals of carbon neutrality, but there is a need for sustained technical and financial support for tribal communities. The unique relationship between the federal government and the tribes should be viewed as a natural partnership to implement renewable energy projects and to pilot programs for carbon neutrality across the Upper Snake River basin. While every development has the potential to have deleterious effects on the environment, the projects selected by the tribes for implementation are carefully designed to increase climate resilience and support transitioning existing developments with sustainable technology.

The benefit assessment for each measure was developed by using the emissions inventory developed for each of the member tribes, relying on NEI source data for each of the counties as inputs in the Tribal Greenhouse Gas Inventory Tool (TGIT). The measures proposed above were then individually evaluated to ensure there wouldn't be any significant negative effects to the tribal community or the reservation

environment. It is reasonably foreseeable that a complete transition to renewable energy will necessitate dramatic changes and potentially negative consequences for the environment if projects aren't adequately developed. By focusing the PCAP measures on immediate 'tailpipe' emissions, electrical service infrastructure, and near-term policies, the tribes can effect positive change while developing sound projects to service reservation residents that don't impact the character of their homelands.

Measures Addressing Conservation on the Duck Valley Reservation

Carbon sequestration in freshwater wetlands is a critical part of the carbon cycle and anthropogenic modifications of this habitat type have inhibited parts of this cycle; but wetland restoration remains a promising avenue for mitigating climate impacts.[52] Direct carbon sequestration in specific soils will need to be determined as a component of the project, but analogous re-forestation and wetland conservation efforts have yielded a wide range of sequestration estimates.[53] The presence of large and intact wetlands are an opportunity for this project to engage in meaningful conservation work for numerous sensitive species of wildlife, continue to regulate surface temperatures locally, regulate water quality, and reduce the effect of GHG emissions. The goal of the project will be to return affected systems to normative conditions associated with a riverine or riparian habitat type; and, to conserve existing, functional wetlands in their current condition.

An acre of wetland can store a range of 80-200 tons of carbon in its soil, while the range is determined by the type of wetland habitat the Duck Valley Reservation contains hundreds of miles of streams and significant wetland resources that are prime candidates for additional studies and conservation work. It is rare to find an opportunity with a willing partner to engage in landscape level conservation across thousands of riparian and wetland acreage; based on the most conservative benefits analysis there is an opportunity to contribute to climate resilience locally and continue to provide sequestration benefits nationally. Working with qualified contractors and local university specialists, the Tribes would develop a series of measures across the landscape and develop real-time estimates of current carbon storage, carbon storage potential from conservation practices, and low-tech projects to increase the surface area of existing wetlands where feasible. Following the study period, series of pilot projects would be implemented annually to increase riparian and wetland habitat where appropriate on the Duck Valley Reservation.

Measures Addressing Deployment of Clean Energy and Energy Resilience on Reservation

These measures are prioritized to help meet tribal goals for providing tribal households with access to reliable and sustainable winter heating on the reservations, with a specific focus on those households that are utilizing wood as a heating source. While wood stoves can be considered a sustainable energy source for heating, antiquated systems have the potential to increase indoor air pollution, increase soot production that can cause dangerous house fires, and result in an inefficient fire per mass ignited. The purpose is to provide multiple options, including a complete system change-out, for eligible tribal households for their heating needs. The Tribe will complete an evaluation of eligible households and distribute the benefits to qualifying tribal members on a rolling basis as applications are received. Each

[52] M.S. Fennessy, D.H. Wardrop, J.B. Moon, S. Wilson, C. Craft, Soil carbon sequestration in freshwater wetlands varies across a gradient of ecological condition and by ecoregion, Ecological Engineering, Volume 114, 2018, Pages 129-136, ISSN 0925-8574, https://doi.org/10.1016/j.ecoleng.2017.09.013. (https://www.sciencedirect.com/science/article/pii/S0925857417305335)
[53] See https://www.nature.com/articles/ncomms13835 for additional information on variation for habitat types and the need to specifically study potential benefits from wetland conservation.

annual report, for the three proposed funding cycles, will describe the nature of the stove replacement and have a specific estimate on the reduction of GHG associated with that year's program accomplishments. The Shoshone-Paiute Tribe is currently delivering wood to 265 households annually who rely on that heat source each winter.[54]

The SPT are interested in ensuring that the government buildings are trending toward being completely energy-neutral through the implementation of solar, wind and battery technology; this includes the new tribal school that will be constructed in the near-term. Government buildings provide the membership with significant assets throughout the year and are a focal point in the tribal community. The proposed measure would install up to 1 MW of solar and appropriate battery storage at the Tribal school to serve as an energy supplement and to reduce up to 25% of GHG emissions related to institutional sources from the SPT inventory. Following award, the SPT would work collaboratively with the funding agency to design and construct the facility; as well as implement an educational curriculum associated with renewable energy for the community.

Measures Addressing Policies to Support Carbon Neutrality in Tribal Community

The Duck Valley Reservation straddles the border of Idaho and Nevada, sitting in different regions for multiple funding agencies and with completely different challenges associated with interfacing effectively on climate programs from different regions. The proposed USRT position assigned directly to the SPT would provide a valuable asset to engage in technical writing, seeking grant funding, coordinating with federal agencies, and conducting community outreach for applicable programs. As a part of the community, with a remote work-station assigned to the Duck Valley Reservation, this technical assistance will be accessible to tribal members and tribal government staff throughout the year without requiring significant travel funding to participate in community events.

8.5 SPT Authority to Implement Priority Reduction Measures

Federally recognized tribes in the United States, including the USRT member tribes, have a relatively high degree of sovereignty and self-governance over their own reservation lands. This authority is rooted in the recognition that tribes, like any other sovereign entity, possessed authority to govern their own constituents and handle their own affairs within their land base; this authority pre-dated any limitations on that authority imposed by the U.S. Constitution, treaties, statutes, and court decisions. It is critical to note that the inherent rights associated with self-governance are not grants of rights to tribes, rather they are a component of their inherent sovereignty that has always existed.

While there are a number of nuanced issues within the subject matter of tribal jurisdiction, the primary legal frameworks governing the implementation of PCAP recommended measures will include the following:

- U.S. Constitution: The Constitution recognizes tribes as separate sovereigns, and the Commerce Clause grants Congress the authority to regulate commerce with Indian tribes. This early relationship formed the basis for tribal relations that impact our member tribes through present.
- Treaties and Executive Order: While some tribes have treaties with the U.S. government that outline the tenets of their 'nation to nation' relationship, some tribes were established with other mechanisms during the eighteenth and nineteenth centuries. Common features of both mechanisms for developing relationships with tribes include setting boundaries of reservations,

[54] Personal communication – Shoshone-Paiute Tribal Council Member Arnold Thomas.

establishing a fiduciary relationship, and defining the scope of their self-governance. The Shoshone-Bannock Tribes and the Fort Hall Reservation was formed under the Fort Bridger Treaty of 1868 (ratified), and while the other three USRT member tribes were present and negotiated direct treaties they were never ratified by Congress. Each of the remaining USRT member tribes (BPT, SPT, and FMPS) were established through Executive Order or a formal act of Congress and each has an intact land base and active, engaged tribal community-based government. All four of the tribes possess the inherent authority to manage their own internal affairs and maintain the capacity to contract services or manage the scope of programs described in this PCAP.

- Indian Reorganization Act (IRA) of 1934: The IRA marked a shift in federal Indian policy towards supporting tribal self-governance after a scathing review of federal Indian policy around the turn of the century. Tribes who adopted IRA constitutions operate under a constitution, with a tribal council who manages the daily affairs of the tribes. Not all tribes adopted an IRA constitution and continue to manage their government affairs based on the direction of their general membership; both systems will be present across our USRT member tribes.
- Indian Self-Determination and Education Assistance Act of 1975 (PL 93-638): This legislation reinforced tribal self-governance by giving tribes greater control over their own affairs, including the management of their lands and resources. In its contemporary iteration, 93-638 contracts and/or cooperative agreements can be developed directly with eligible tribes seeking to utilize federal funding on their lands with their own staff. In some instances USRT member tribes may still need to consult with the BIA to determine the applicability of an environmental review process prior to ground disturbance.
- Federal Trust Responsibility: The U.S. government has a trust responsibility to protect tribal lands, resources, and treaty rights. This principle has been interpreted by tribes to imply a fiduciary duty to assist tribes in managing their lands and resources for the benefit of tribal members.
- Tribal Sovereign Immunity: Tribal governments generally possess sovereign immunity, protecting them from lawsuits without their consent. This immunity extends to actions related to land management.

All four of the USRT member tribes are aware of their obligations to manage federal funds to accomplish the intended purpose and have reviewed the proposed climate pollutant reduction measures associated with this PCAP. Each of the measures associated with this PCAP are directly intended to alleviate a current burden on their respective communities and help make each of their homes more resilient to the worst impacts from global climate change. There aren't any measures contemplated for the PCAP that will exceed the limits of tribal sovereignty and if there are any perceived inconsistencies for future project recommendations during the CCAP process, they will be noted accordingly.

8.6 Identification of Other Funding Mechanisms

Although this section is optional for the PCAP, USRT staff have noted that the Biden/Harris Administration, in concert with the release of federal funding through the Bipartisan Infrastructure Law and Inflation Reduction Act, has developed an online tool to help Tribes access funding opportunities. The intent of the Access to Capital web portal, hosted by the Bureau of Indian Affairs, is to provide tribal professionals a 'one-stop' portal to access federal programs to engage in meaningful community change.[55] The website is functional, as of December 6, 2023, and will be utilized to help the USRT

[55] https://www.bia.gov/atc

member tribes access specific funding mechanisms to implement meaningful measures that reduce GHG emissions on tribal lands.

Specific funding sources for the PCAP measures identified above may include working with a number of program(s) within the federal administration to accomplish specific tribal climate goals. Given the nature of the 2024 funding environment, USRT staff has noted that a number of funding opportunities are related to one-time grants for projects or competitive grant notices. USRT technical staff have chosen to work directly with Tribal staff to identify opportunities to accomplish near-term PCAP measures, while acknowledging that accomplishing meaningful GHG emissions reduction will require long-term funding opportunities rather than single projects. Rather than focus on one-time funding opportunities the tribes would like to develop more consistent, programmatic funding resources within the federal government for tribes.

8.7 Workforce Planning Analysis

Transitioning a workforce to accomplish new tasks can be a generational task in small Tribal communities, where dedicated tribal members are often working diligently for their tribe already. Developing a climate ready workforce is a priority for the USRT member tribes, although the PCAP measures detailed in the preceding sections are not intended to build that workforce. Achieving near-term climate goals and allowing the PCAP measures to be a catalyst for generating community support and 'buy-in' are critical components of each of those measures.

The workforce planning analysis was an optional section and due to the complex nature of the evaluation by USRT technical staff, we have opted to work with our member tribes on this issue for the CCAP. Tribal members from each of our member tribes have dedicated their entire careers to working for their people and are already working to protect natural and cultural resources on their reservations. USRT is committed to helping our tribal communities engage in climate stewardship activities and helping instill traditional values of resilience, accountability, and reciprocity in all of our GHG emissions reduction measures. For the CCAP, USRT staff will work directly with each of the tribes to develop the appropriate workforce planning measures to help maximize emissions reductions and to ensure that tribal communities have locally available labor to meet the demands of an uncertain future.

9 Shoshone-Bannock Tribes of the Fort Hall Reservation

The Fort Hall Reservation is in the eastern Snake River Plain of southeastern Idaho, north and west of the town of Pocatello. Initially the Reservation was 1.8 million acres, an amount that was reduced to 1.2 million acres in 1872, the result of a survey error. The Reservation was further reduced to its present size (546,500 acres) through subsequent legislation and the allotment process.[56] There are more than 5,800 people who hold membership with the Shoshone-Bannock Tribes.[57] The Shoshone and Bannock peoples lived in close connection with the pulse of riverine resources across their homelands. The Treaty with the Eastern Shoshone and Bannocks, July 3, 1868 was the only treaty ratified by Congress between

[56] Shoshone Bannock Tribes, 2015. "History of the Shoshone-Bannock Tribes". Available: http://www.shoshonebannocktribes.com/shoshone-bannock-history.html

[57] Randy L' Teton. Public Affairs Manager for the Shoshone Bannock Tribes. Personal Communication. 11/18/2016

the Shoshone and Bannock peoples and continues to be the foundation of the tribal system of governance.[58]

The Tribes generally subsisted on the plentiful resources of the river systems across their homelands, traveling during the spring and summer seasons, collecting foods for use during the winter months. They hunted wild game, fished the region's abundant and bountiful streams and rivers (resident and anadromous), and collected native plants and roots such as the camas bulb. The natural resources of the Upper Snake River Watershed continue to sustain the dietary, cultural, spiritual, and economic needs of the Shoshone-Bannock Tribes of the Fort Hall Reservation. The Fort Hall Reservation is also home to a large agricultural sector, with over 80,000 acres of irrigable farmland that produces wheat and potatoes.

The Snake and Blackfoot rivers and the American Falls Reservoir border the Reservation on the north and northwest. In addition to abundant populations of resident fish, there are migratory waterfowl, moose, deer, wild horses, and buffalo in the area. The reservation faces ongoing environmental challenges, such as loss of vegetation, erosion of stream banks and soil, warmer water temperatures and changing seasons, and wildfires. In spite of the challenges, there are significant wind resources for commercial development, as well as potential photovoltaic systems. In addition, the Tribes also work directly with the Bureau of Indian Affairs to manage the Fort Hall Irrigation Project that contains two reservoirs that are currently not outfitted with hydroelectric power. The Fort Hall Reservation could be a carbon-negative economy with the appropriate planning and investment in infrastructure, as such the PCAP measures are focused on developing capacity and infrastructure for tribal members locally.

The data utilized for demographic information in the development of the high-level emissions estimates for the Shoshone-Bannock Tribes and associated tribal lands was derived from the 2020 Census "My Tribal Area" data retrieval tool (https://www.census.gov/tribal/?st=41&aianihh=0400). Demographic data is critical to estimating emissions data for the Shoshone-Bannock Tribes because data inputs for the Tribal Greenhouse Inventory Tool (TGIT) are developed at the State and/or County level; those estimates are not downscaled specifically for each member's reservation associated with the Upper Snake River Tribes Foundation. The primary purpose for using this information from the census is to generically apportion emissions based on a percentage of the total population in the county for which data is available. The methodology associated with this assumption is in line with the presumption that the PCAP is a high-level document to engage Tribal communities in near-term priority actions to reduce climate pollution; the Comprehensive Climate Action Plan will revisit this assumption and attempt to refine data in a manner tailored specifically to each reservation and emission sector.

The total population of the Shoshone-Bannock Tribal lands is presented in the 2020 Census as 5,168, with 3,093 people identified as Native American alone. The data indicates that there are 2,111 total housing units, with 1,856 of those units occupied in 2020. Further, 1,984 individuals are commuting for work with approximately 75% of those utilizing light duty vehicles for their 'daily' drive to work. The 2020 Census indicates that 1,297 individuals are enrolled in school pre-Kindergarten through High School; it is assumed for purposes of estimating emissions that all of these individuals are utilizing bus transportation to and from school.

[58] *Treaty with the Eastern Shoshone and Bannock 1868*, 15 Stat. 673, (Ratified 1869). The Fort Bridger Treaty was the only ratified treaty between the US government and member tribes of the Upper Snake River Tribes; in spite of the many attempts to forge those agreements across the watershed.

For purposes of estimating emissions at the County level, all of the ~540,000 acres of the Fort Hall Reservation and associated tribal lands are located within the exterior boundaries of Bannock, Bingham, Power Counties, Idaho; a portion of tribal lands are located in Caribou County but there aren't permanent homes on that portion of the reservation. Bannock County has a total population 87,018 individuals with 3,104 of those individuals reporting status as American Indian, or approximately 3.5% of the total county population will be used for the emissions estimate. Bingham County has a total population of 47,992 individuals with 2,892 of those individuals reporting status as American Indian, or approximately 6% of the total county population. Power County has a total population 7,878 individuals with 172 of those individuals reporting status as American Indian, or approximately 2.1% of the total county population will be used for the emissions estimate. It should be noted that there is a difference between the reported figure for the Reservation and those living in Bannock, Bingham, and Power Counties. While this may pose a slight problem in data interpretation, the USRT staff understand that every tribal member will not reside on their tribal lands for a variety of reasons; as such, the USRT will utilize the total county population of American Indian for emissions estimate. The rationale for this inclusive method of estimation is to ensure that Tribal leadership have adequate data to support growth models and/or planning efforts for future generations of tribal members who may return to tribal lands.

9.1 Special Considerations for Tribal/Territorial Entities

The major sources of emissions that are not considered for the purposes of this PCAP are listed below. While the majority of priority GHG emissions reduction measures are directly related to mobile and electrical emissions, the topics below remain critical considerations for the Shoshone-Bannock Tribes. It should be noted that there are existing programs under the Tribes' jurisdiction or are a component of an ongoing remediation effort that this program will not interfere with.

Eastern Michaud Flats Superfund Site

The Fort Hall Reservation is impacted by two phosphorous plants, Don Simplot Plant (operational) and FMC (closed), that resulted in a large superfund site with a portion within the exterior boundaries. The Tribes have been active participants in the effort to cleanup the site for several decades prior to this PCAP. The Tribes have not proposed any measures associated directly with the facility's emissions because the operable portion is not within the Reservation boundaries. The Tribes recommend EPA divert a significant portion of regional funding to improving emissions at the Don Simplot Plant and associated emissions within the Eastern Michaud Flats Superfund Site.

Agriculture

The Fort Hall Reservation has numerous intensive agricultural operations that produce wheat, barley, potatoes, alfalfa and myriad other agricultural products. The agricultural industry plays a significant role in the Tribes' economy but also contributes to user and resource related conflicts. While there are minimal measures associated with this PCAP directed at direct GHG emissions from agricultural products, it is anticipated this issue will be further refined in the CCAP planning phase. The State of Idaho has also set goals to reduce the GHG emissions associated with intensive agriculture and the SBT are optimistic these improvements in the industry will reduce emissions associated with agriculture on the Fort Hall Reservation.

Wastewater Treatment

The Shoshone-Bannock Tribes operate a facultative lagoon system without any mechanical mixing or aeration. The effluent is land applied near the Fort Hall townsite and Solid Waste Transfer Station. The system has 344 addresses connected to the system with 274 of those connected to residential addresses and there are 70 commercial/government connections. The SBT completed a wastewater facility planning study in 2023 that may be available on request to the Tribes. The current system receives and processes waste from the central government offices, Fort Hall district, the Exit 80 commercial and gaming area, and housing projects; making it difficult to put a precise estimate on the total number of people using the system. The Shoshone-Bannock Tribes have already developed specific measures to improve the operations of the facility and reduce its emissions consistent with the purposes of the PCAP.

The SBT have estimated that a range of 1,500 to 1,900 septic systems are in operation, based on the active wells attached to those systems. As noted above it is difficult to ascertain a precise amount of people using the septic systems that exist on the reservation; as such we are assuming 4 people per household connection are utilizing that septic system. The tribes currently administer a septic program for the Fort Hall Reservation, as such measures were not included in this PCAP to address this issue.

Solid Waste

The Shoshone-Bannock Tribe does not own or operate a landfill facility, the solid waste produced from tribal lands is removed to a local landfill facility operated outside of the Tribes' direct control. The movement of solid waste from transfer stations does create significant emission sources, but for the purposes of this initial planning process, most priority emission reduction actions will focus on other sources (electrical and mobile emissions). The exception is the biomass composting facility at the central collection facility in Fort Hall. It is anticipated that during the comprehensive planning process the Tribes will allocate multiple emission reduction actions to this category.

9.2 Collaborations

USRT staff focused our collaborative efforts entirely on our member tribes due to the short period of time to develop a high-level GHG emissions inventory, PCAP, and an implementation grant application based on tribal priority actions. Following the release of funding in mid-September 2023 USRT staff developed and received approval for a Quality Assurance Project Plan (QAPP) in late October 2023. With an approved QAPP to work from, USRT staff immediately engaged with our partners through the USRT Technical Work Group and direct contacts from the Environmental Director to tribal staff to get additional background information relevant to the emissions inventory.

It should be noted that the most critical collaboration that occurred during the PCAP development phase was the Technical Assistance Forums hosted by EPA and Endyna. The opportunity to learn from professionals across the nation, all engaged in the same type of climate action planning, afforded tribal professionals a rare 'inside' look at how Metropolitan Service Areas (MSA) and States utilize data to prioritize actions that support GHG reductions. USRT staff would also like to acknowledge our EPA project officer for hosting regular 'Office Hours' to discuss issues directly with other professionals throughout the planning process. The Shoshone-Bannock Tribes' technical staff's commitment to climate change research, natural resource stewardship, and solution-based landscape conservation is an example of their commitment to the resources of the Snake River basin.

10 SBT PCAP Elements

The USRT technical staff engaged with USRT member tribes in early 2024, providing a relatively narrow window to address priority actions to reduce climate pollutants in the near-term. Fortunately, the USRT member tribes have already begun the process of climate adaptation and resiliency planning through Bureau of Indian Affairs funding. While neither the USRT or SBT climate adaptation plans were funded through EPA, and are primarily focused on natural resource management, both documents have significant relevance to the PCAP.

Reducing GHG emissions in the near-term requires a careful evaluation of the benefits of actions relative to their overall costs and significance relative to a community's GHG emissions. Each USRT member tribe is geographically unique, and each has its own governance structure that is responsible for the health and welfare of their membership. The USRT PCAP has a specific section for each member Tribe to prioritize actions relevant to their community that specifically address the emissions from their own unique inventory.

10.1 SBT Greenhouse Gas (GHG) Inventory

The development of an accurate GHG inventory is critical to understand the specific needs of each of USRT's member tribes. Given the limitations of funding, time, and planning objectives to reduce climate pollutants in the near-term USRT staff utilized coarse, downscaled information to develop the high-level estimates represented in the figures below. There are limitations to the scale of research that can be accomplished during the PCAP process, so additional topics of investigation are noted and USRT requests continued support for member tribes seeking to increase their own understanding of these topics. For detailed information on how the following data was collected and evaluated please refer to Section(s) 1.6-1.8 of this document.

Total Shoshone-Bannock Emissions (MT CO2e)								
	CO_2	CH_4	N_2O	HFCs	PFCs	SF_6	Total MT CO_2e	Percent of Total
Scope 1	65,067.54	1,682.90	8.68	-	-	-	66,759.12	76%
Scope 2 - Location Based	20,521.78	53.63	72.51	-	-	-	20,647.93	
Scope 2 - Market Based (for informational purposes only)	20,521.78	53.63	72.51				20,647.93	23%
Scope 3	-	-	-	-	-	-	-	0%
Total Gross Emissions	**85,589.32**	**1,736.53**	**1,068.14**	**-**	**-**	**-**	**88,393.99**	**99%**
Total Net Emissions	**85,589.32**	**1,736.53**	**1,068.14**	**-**	**-**	**-**	**88,393.99**	**99%**

Emissions by Source (MT CO_2e)								
Source	CO_2	CH_4	N_2O	HFCs	PFCs	SF_6	Total	Percent of Total
Stationary Combustion	17,107.09	42.55	8.57	-	-	-	17,158.21	19%
Mobile Combustion	18,462.98	-	-	-	-	-	18,462.98	21%
Solid Waste	-	-	-	-	-	-	-	0%
Wastewater Treatment	-	1,638.02	-	-	-	-	1,638.02	2%
Electricity - Location Based	20,521.78	53.63	72.51	-	-	-	20,647.93	
Electricity - Market Based (for informational purposes only)	20,521.78	53.63	72.51				20,647.93	23%
Water	-	-	-	-	-	-	-	0%
Ag & Land Management	-	-	986.94				986.94	1%
Urban Forestry	-	-	-				-	0%
Waste Generation	-	-	-				-	0%
Other	29,497.47	2.33	0.11	-	-	-	29,499.91	33%
Total (Gross Emissions)	**85,589.32**	**1,736.53**	**1,068.14**	**-**	**-**	**-**	**88,393.99**	**100%**
Total (Net Emissions)	**85,589.32**	**1,736.53**	**1,068.14**	**-**	**-**	**-**	**88,393.99**	**100%**

Figure 28. Total emissions for the Shoshone-Bannock Tribes.

As noted above, the USRT PCAP developed emissions inventory estimates for the 'required' parameters and will be developing the complete inventory during the CCAP process. While it would be preferred to have the entire inventory available for the PCAP, particularly for setting priority measures to reduce GHG emissions, the accelerated timeline did not permit adequate consultation for each of the individual tribes. In the coming three years, USRT staff will work directly with representatives from our member tribes to complete this project for the CCAP.

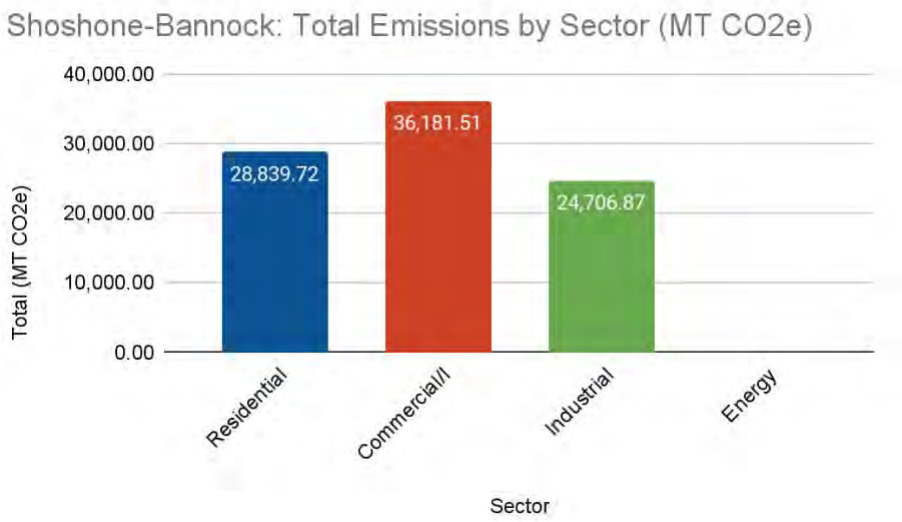


Figure 29. SBT total emissions by sector.

The SBT sector emissions inventory is relatively close to the national per capita emissions of GHG, with an estimate of **17.1 (MT CO2e/person)** for people living on the Fort Hall Reservation in southeast Idaho. For the purposes of the PCAP, USRT and the SBT focused on areas of emissions that could be addressed by the Tribal Council in the near-term that are directly within their scope of influence. As with the national emissions for GHG, transportation is the driving force behind the majority of emissions for the SPT community and is a focus of near-term PCAP measures proposed for implementation.

The figures below show a simple breakdown of total emissions by source for the SBT. Understanding the source of the emission is critical because the evaluation of implementation measures requires each applicant to identify specific actions that will address an issue within their community. While the information by sector provides a high-level overview, the detailed inventory developed through the TGIT will help the SBT engage in meaningful reduction measures in the spaces where those actions will be most meaningful. It is apparent that there are industrial and commercial sector emissions within the counties on the Reservation that are not likely directly attributable to the SBT and a more refined estimate will be recommended for the tribe specifically to assess the quantity of emissions directly from their tribal lands. The figure below shows that by source, it is almost the same conclusion as the other USRT member tribes; tribal communities need near-term support to retrofit existing homes, deploy available renewable energy systems, and provide infrastructure to support a transition to electrical transportation.

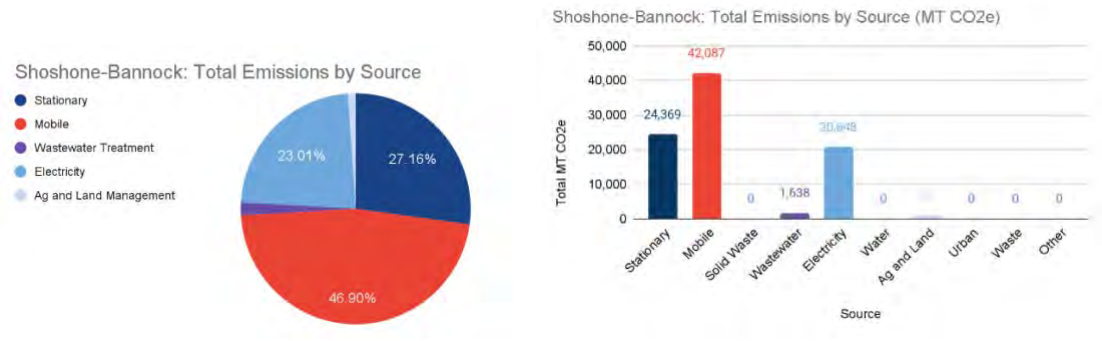


Figure 30. SBT total emissions by source.

The challenges with downscaling emissions directly to a Reservation utilizing the publicly available datasets for GHG emissions like the NEI is that specific landscape level detail is often not reflected at the preliminary assessment phase. Fort Hall is associated with four counties in Southeastern Idaho (Bingham, Bannock, Caribou, and Power counties) with a large variance on emissions within those counties for the tribal community, including facilities that are not directly located on tribal lands or under tribal jurisdiction for implementing GHG reduction measures directly at the source of those emissions. It should be noted that regardless of source, the SBT are committed to being an active participant in ameliorating the worst effects of climate change by building more resilient communities.

While the development of this high-level GHG emissions inventory was relatively straightforward, given the assumptions made during the coarse downscaling for a per capita emissions estimate, there were still challenges that will need to be addressed during the development of the CCAP. Another critical note is that there will need to be an evaluation of the contributions of wildfire emissions and agricultural emissions during the CCAP development. The emissions data for the SBT is still relatively consistent with other communities and access to rail freight and electrical infrastructure make the Fort Hall Reservation a prime candidate for developing carbon negative projects on tribal lands, so a more detailed evaluation of those measures is likely warranted. Finally, the proximity of nearby urban centers (within 25 miles of the Reservation) makes the deployment of an electric fleet potentially more viable than on other USRT member tribal lands.

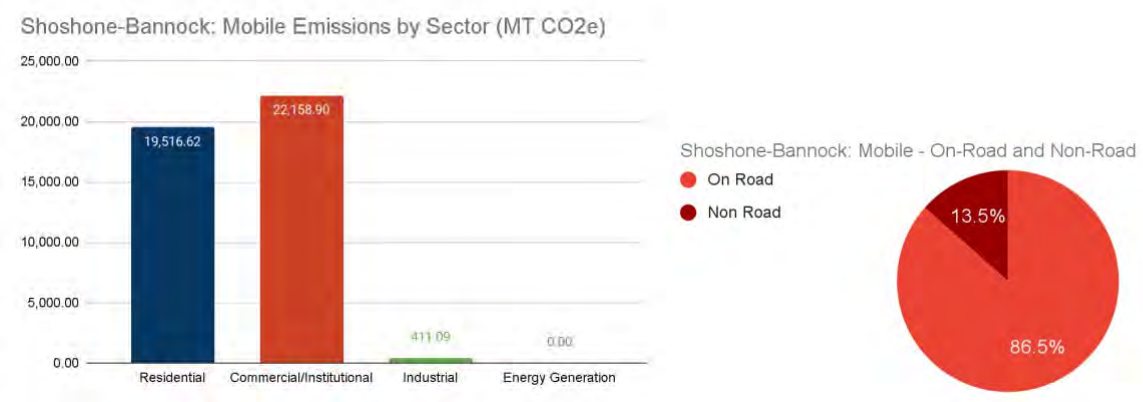


Figure 31. SBT mobile emissions by sector.

Essentially mobile emissions by sector in the SBT inventory are split between commercial and residential, with a significant portion of the emissions being from on-road sources. Maintaining these

levels of emissions from the mobile source wouldn't allow for the tribes to easily meet GHG emissions goals in the near-term. Given the relative abundance of electric options for vehicles (both on and off-road) this does seem like a specific focus area where immediate emissions reduction can occur with clear investments on this issue. All of the USRT member tribes set priority measures associated with near-term reductions in the mobile category for their communities.

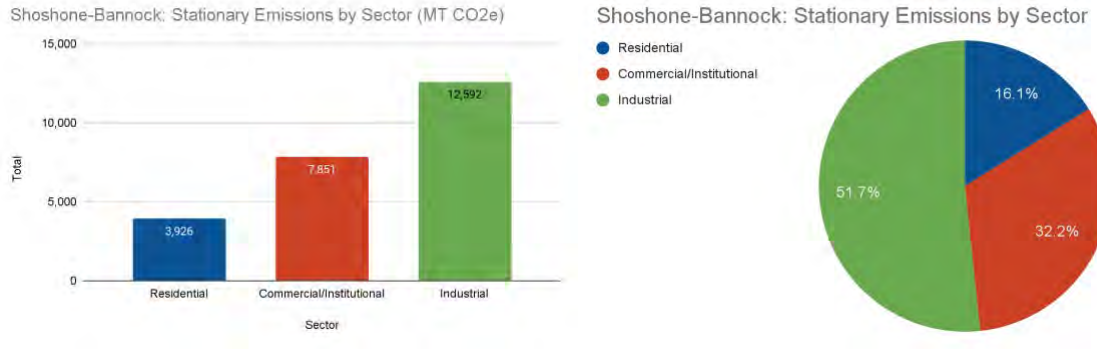


Figure 32. SBT stationary emissions by sector.

The SBT stationary emissions are relatively skewed toward the industrial and commercial, which mirrors the composition of structures on the Fort Hall Reservation. Stationary emissions are relatively simple to mitigate and the tribe has prioritized maximizing the efficiency of structures, ensuring they are updated enough to change to electrical infrastructure, and also that when commercial facilities are generating solid/organic waste it is diverted into adequate mitigation structures. All of the USRT tribes prioritized offering direct assistance to their membership to the maximum extent possible; recognizing that community structures are also used to benefit the members there are measures associated with upgrading those facilities.

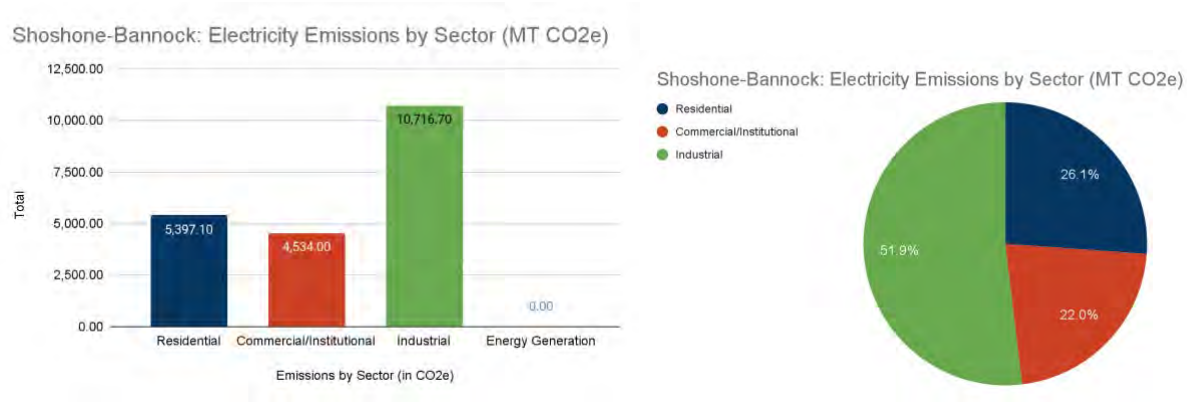


Figure 33. SBT electricity emissions by sector.

The emissions associated with electricity use for the SBT skew heavily toward industrial emissions although each of the categories have meaningful opportunities for GHG reduction measures. This is likely related to the SBT emissions inventory issues that do assign a high per capita emission of GHG for the tribes, but are directly related to those industrial emissions that are outside of the tribes' direct line of authority. As with other sectors the tribes are prioritizing delivering meaningful services to the membership so there is resiliency built into tribal communities. It should be noted that developing

additional electrical infrastructure is a critical component to modernizing our grid and making our projects valuable for the reservation.

10.2 SBT GHG Reduction Targets

This PCAP does not set formal reduction targets for our member tribes, in part due to the complex nature of preparing a GHG inventory in a short amount of time and the focus on developing near-term priorities for implementation. During the development of the CCAP this section will include both an emissions reduction target, conceptual measures to meet those targets, and an associated feasibility analysis to meet those targets. It is worth noting that the national targets vary widely based on the State/Country/Global Region but the consensus from the International Community[59] is to reduce GHG emissions are as follows:

- (United States) Reduce GHG emissions by ~28% to meet 1990 levels of emissions by 2025.
- (United States) Reduce GHG emissions by 45% by 2030.
- (United States) Fully transition to a carbon negative economy by 2050

The State of Idaho does not set an emissions reduction target in their PCAP and have not acted administratively or legislatively to set a GHG emissions reduction goal for their State. The focal areas of reducing GHG emissions across the agricultural, energy, and transportation sectors clearly are in line with the measures proposed by the SBT on the Fort Hall Reservation.[60] As with the State of Idaho, the Fort Hall Reservation has a large task in reducing emissions associated with the Agricultural sector; particularly with over 65,000 acres of agricultural land in high-intensity, modern farming for barley, wheat, potatoes, sugar beets, and alfalfa. The SBT look forward to collaborating with federal and state partners on agricultural issues and will specifically examine implementing best management practices during the development of the CCAP. It is also clear that developing measures associated with restoring functional ecosystems is a priority for both the State of Idaho and the SBT, with a specific measure from the tribes to employ conservation measures on the largest contiguous cottonwood forest and wetland complex remaining in the Snake River basin, the Fort Hall Bottoms.[61]

The measures proposed in this PCAP are intended to provide a significant shift in GHG emissions in the next three years for our member tribes, although each will vary based on the availability of funding to implement the measures. For example, the average per capita GHG emissions for a member of the Shoshone-Bannock Tribe is 17.1 MT/CO2 annually and the bulk of those emissions inventoried are mobile or electrical emissions. In order to make progress to a 'net-zero' transition in the coming two decades the infrastructure for renewable electricity (residential and commercial) and electrical transportation must be completed in the near-term or you will not see a meaningful declines in GHG emissions. The USRT member tribes are committed to developing and implementing projects to be net-zero or carbon negative by 2050.

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[59] United Nations Net Zero Coalition Homepage; searched and located on January 12, 2024 (Daniel Stone).

[60] See State of Idaho PCAP, pages 6-22 (PCAP measures).

[61] The Fort Hall Bottoms refers to the area of the Fort Hall Reservation bordered by the American Falls Reservoir, and the confluence of the Snake, Blackfoot, and Portneuf Rivers and the Bannock Creek watershed. This area is approximately 33,000 acres of intact wetlands, spring-fed streams, and cottonwood forests. It is home to ESA-listed species, migratory waterfowl, raptors, a sustainable trout fishery, and myriad medicinal plants tribal members have protected from time immemorial. See SBT Climate Adaptation Plan for additional information.

10.3 SBT Priority GHG Reduction Measures

The SBT has reviewed the available material and has selected the following priority items for the Phase II implementation funding grant. Each of the items are severable in the event there is a limit on available funding and the construction is contingent on funding for near-term implementation due to current constraints in tribal budgets. The SBT is committed to implement the projects selected for implementation within the next three years and to work collaboratively with USRT staff on each reservation to complete the CCAP. Each table with the priority measure is followed with brief narrative, simple budget, and workplan; as well as a description of emissions reduction for that specific measure. The following PCAP measures are intended to be severable in the event one or more are not funded for implementation; it should be noted that the tribes view the order of priorities to focus on infrastructure and the immediate deployment of ubiquitous renewable energy systems for tribal members living on the reservation.

Measure 1: Renewable Energy Revolving Loan Fund

Shoshone Bannock Tribes: Renewable Energy Revolving Loan Fund Program	
Implementing agency	Shoshone-Bannock Tribes
Implementation milestones	*Develop Loan Program; Develop contract and loan documents; develop subsidy/grant program for elders; develop tax documents for tribe and tribal members; install PV on 10% eligible households*
Geographic location	*Shoshone-Bannock Tribal Lands*
Funding sources	*EPA CPRG Phase II grant; IRA Renewable Energy Tax Credits; Tribal cost-share*
Metrics tracking	*Quarterly and annual reporting; independent fund audit (annual); documentation of installation and maintenance (annual).*
Cost	*$45,000 cap/per installation (all inclusive); $2,500,000 capitalized through EPA, cost-share match may be provided by the Shoshone-Bannock Tribes based on project demand.*
Annual estimated GHG and criteria air pollutant emission reductions	*Each 10 kwh solar installation off-sets up to 10.6 tons of GHG emissions per year, at full participation up to 318 tons of carbon can be off-set in the initial year; following incentives and payback the revolving loan program will strive maintain a minimum of 50 active participants through 2050. The goal of the program is to provide funding to 500 tribal homes through 2050; removing an estimated 1,250 tons of residential GHG emissions for electricity at project completion, or approximately 25% of current residential GHG emissions by 2050 through this single program.*
Implementation authority milestones	Shoshone-Bannock Tribes, Tribal Council approves receipt of implementation funds

Table 17. Renewable energy revolving loan program.

Access to capital has traditionally stifled tribal communities throughout the reservation era, with loans for everything from housing to farm operating loans being denied to tribal members due to insufficient credit and/or the inability to use trust lands as collateral for loans. In an effort to ensure that lending is available for tribal members, the tribes request that a small portion of CPRG funds be made available for long-term lending through a dedicated renewable energy fund administered by the tribes. The fund will

be audited independently by a third-party selected by the tribes and EPA, based on competitive solicitation, and provided openly to the membership and public. The Tribes will administer the funds to provide capital to qualified applicants with a low-interest rate loan, and subsidized underwriting services. The Tribes will continue to explore options with qualified applicants for residential tax credits and other renewable energy incentives to maximize the effect of the program.

Measure 2: Residential Smart Panel Installation

Shoshone Bannock Tribes: Residential Smart Panel Program	
Implementing agency	Shoshone-Bannock Tribes
Implementation milestones	Develop open solicitation period for interested Tribal members, develop a priority list to ensure a minimum of 40% of program benefits flow to Low-Income or Elder households.
Geographic location	Shoshone-Bannock Tribal Lands
Funding sources	EPA CPRG Phase II grant; IRA Renewable Energy Tax Credits (Community Outreach)
Metrics tracking	Implementation/status reports, certified installer report
Cost	$2,250,000 Installation on minimum of 10% of eligible households; up to 200 households.
Annual estimated GHG and criteria air pollutant emission reductions	Certified smart panels have an estimated range of 10-15% improvement in efficiency; but more critically they are the crux of installing level 2 charging stations in a home for plug-in vehicles, adding new electrical appliances, solar panels, or renewable energy battery systems. A 10% reduction in GHG emissions associated with residential electricity for the 200 households would constitute ~50 m/tons GHG emissions per year overall.
Implementation authority milestones	Shoshone-Bannock Tribes, Tribal Council approves receipt of implementation funds

Table 18. Residential service panel upgrade.

The installation of 'renewable-ready' service panels in residential homes serves as a barrier to transitioning tribal homes away from non-renewable sources and/or grid based electrical services. One of the purposes of the coming energy transition is to prepare for shifts in infrastructure and utilities, with a specific focus on electrification through renewable energy. Interested tribal members are currently reviewing the industry potential, especially because of the high utility bills on reservation, but are finding that in order to implement an energy project on their land it will require upgrades on their residential service panel. This initial point of engagement with residential electricity can be the determining factor between installing feasible renewable energy and/or electric-vehicle charging capacity; costs for this upgrade service are currently cost-prohibitive for many tribal households, with additional burdens falling on elders and households on fixed income. This program is meaningful, straightforward and a necessary step before developing additional GHG emissions projects.

The intent of this program is to subsidize the installation of upgraded electrical service panels that mitigate the use of electricity in up 200 households (or ~10% of the total households on the Fort Hall Reservation). The service panel upgrades will also include evaluations for solar and wind potential, and a certified energy audit to describe efficiency recommendations the home-owner can implement to

maximize the energy savings from this installation. The Tribes are not endorsing a specific type of panel at this time and will allow for responsive bids and landowner consent to determine the precise panel type installed at each home. While this program would leave the majority of households without this upgrade, the program will also engage in outreach and education about the current tax incentives available to working households on the reservation.

Measure 3a: Install electric vehicle charging station and solar array

Shoshone Bannock Tribes: Electric Vehicle Charging Station Program	
Implementing agency	Shoshone-Bannock Tribes
Implementation milestones	Develop site plan, develop utility agreement for power upgrade, install charging station with up to 10 charging ports
Geographic location	Fort Hall Reservation: 1 Bannock Peak Truck stop on I-86; 1 Shoshone-Bannock Hotel and Casino; 1 Sage Hill Truck Stop
Funding sources	EPA CPRG Phase II Implementation funds
Metrics tracking	Use data, captured via surveillance video and electrical consumption report
Cost	$250,000 per location; 3 charging station locations on Fort Hall Reservation – total cost $750,000 for three locations
Annual estimated GHG and criteria air pollutant emission reductions	Each of the locations is located at vehicle re-fueling stations off of major interstates that are commonly used by members of the public. Use of the charging stations will be complementary for the first three-years for any member of the public. With a 100kwh solar array and battery storage system, it can be assumed that providing this service at all three locations can offset up to 150,000 VMT or almost 200 tons of GHG; actual reporting on charger usage will be compared with this estimate during the implementation phase.
Implementation authority milestones	Shoshone-Bannock Tribal Council accepts implementation grant funding, site contractor is selected and project is implemented

Table 19. Electric Vehicle charging stations.

The Fort Hall Reservation does not have access to fee-free EV charging stations, either at their Enterprises or public-facing government offices and is in dire need to access to this piece of infrastructure. The lack of critical charging infrastructure will continue to limit the electrification of fleet vehicles generally across the West, but specifically for our member tribes. Access to free charging will be a critical incentive for tribal communities to move away from fossil fuels and transition their daily driving vehicles to an EV; without adequate infrastructure there will continue to be an incentive to maintain their fuel-based vehicles and ultimately continue to emit GHG from those mobile sources. This program is specifically designed to utilize the tribal community centers and enterprise locations to build, maintain, and offer fee-free charging services for up to three years from completion. This will encourage the public to use those facilities, but most specifically have adequate facilities for the tribal membership to use for their EVs. This measure and the installation of commercial solar facilities are proposed as collaborative projects, but either can be implemented with GHG reduction benefits as a stand-alone project.

Measure 3b: Install 100KW Solar Array for Charging Stations

Shoshone Bannock Tribes: Electric Charging Station Solar Installation	
Implementing agency	Shoshone-Bannock Tribes
Implementation milestones	*Develop site plan, develop utility agreement for grid interconnection, install PV array near charging station*
Geographic location	*Shoshone-Bannock Tribal Lands*
Funding sources	*EPA CPRG Phase II Implementation funds*
Metrics tracking	*Electrical generation data, captured via surveillance video and electrical consumption report*
Cost	*$450,000 per charging station; 3 locations on Fort Hall Reservation – total of $1,350,000.*
Annual estimated GHG and criteria air pollutant emission reductions	Developing adequate solar and battery storage to power the charging stations will help ensure the process is net-zero for GHG emissions resulting from the added electrical demand. Any power produced by the solar panels that is not needed for the charging station will offset electrical demand by the adjacent facility.
Implementation authority milestones	Shoshone-Bannock Tribal Council accepts implementation grant funding, site contractor is selected, and project is implemented

Table 20. Solar installation and battery backup for EV charging stations.

The Tribes will install a 100kw photovoltaic and battery storage project associated with the commercial charging station that is proposed for electric vehicles. This measure would provide for a 100kwh source of energy to offset the cost of energy at the 'fee-free' charging stations and reduce the long-term reliance on the grid for energy to charge electric vehicles. The solar installation would be located in close proximity to the charging station to maximize its effectiveness and would contain sufficient battery storage on-site to operate for 24 hours at full capacity for EV's. Tribal members would receive a permanent fee waiver for these on-reservation charging stations and members of the general public would receive a fee waiver for not less than three years.

Measure 4: Tribal mobile incentive for electric bikes, electric outdoor tools and/or electric vehicles

Shoshone Bannock Tribes: Electric Transportation Incentive Program	
Implementing agency	Shoshone-Bannock Tribes
Implementation milestones	Develop tribal incentive for purchasing a plug-in Electric Vehicle, Electric Bike, Electric outdoor tools, or Electric OHV, develop distribution plan and compliance documentation, distribute incentives to qualifying tribal members.
Geographic location	Fort Hall Reservation
Funding sources	EPA CPRG Phase II Implementation funds
Metrics tracking	Electrical generation data, captured via surveillance video and electrical consumption report
Cost	$1,500,000 Up to $1,500 per qualifying tribal member (up to 1,000 members); based on current 2024 enrollment data as determined by the Tribes.

Annual estimated GHG and criteria air pollutant emission reductions	The Tribal non-road 'mobile' GHG emissions is approximately 13.5% of the total mobile emissions. This incentive is intended to reduce those non-road emissions by using available technology to replace fossil fuel yard maintenance equipment and/or off-highway vehicles.
Implementation authority milestones	Shoshone-Bannock Tribal Council accepts implementation grant funding, site contractor is selected and project is implemented

Table 21. Energy incentives for tribal members.

The proposed incentive program would help the Tribes incentivize the purchase and maintenance of electric off-highway vehicles (such as electric bikes) and electric yard maintenance equipment (battery powered hand tools and lawn mowers). While the majority of all mobile emissions are 'road' emissions, there is a significant proportion of those emissions attributed to 'non-road' sources; this proposal would provide capital for some tribal household to continue their de-carbonization efforts in the near-term.

Measure 5: Develop GHG sequestration on Fort Hall Reservation

Shoshone Bannock Tribes: Fort Hall Reservation Climate Stewardship Program	
Implementing agency	Shoshone-Bannock Tribes
Implementation milestones	Develop site plan, develop conservation measures in situ, select contractor, implement conservation measures
Geographic location	Fort Hall Bottoms and adjacent lands.
Funding sources	EPA CPRG Phase II Implementation funds, Tribal Competition; conservation funds (USDA, FSA, NRCS); Tribal cost-share
Metrics tracking	Published outreach materials, status reports, project completion report
Cost	$3,500,000 (5-year pilot project for stewardship program managed by the SBT Natural Resources Division)
Annual estimated GHG and criteria air pollutant emission reductions	The Fort Hall Reservation has ~544,000 acres and over 97% is owned by the Tribes and its members. There is a broad range of habitat types from alpine meadows, non-commercial forests, shrub-steppe, and freshwater riparian areas present on the Reservation. The Fort Hall Bottoms is the largest intact cottonwood forest and wetland complex remaining in the Upper Snake River basin. The area is impacted by operations of the American Falls Reservoir and a superfund site located along the Portneuf River.
Implementation authority milestones	Shoshone-Bannock Tribal Council accepts implementation grant funding, site contractor is selected, and project is implemented

Table 22. Climate stewardship program.

At 33,000 acres the Fort Hall Bottoms is the largest intact cottonwood forest remaining on the Upper Snake River and is home to multiple ESA-listed, rare, and sensitive species of plants and wildlife. The area is primarily used to support local tribal members procure subsistence foods and to pasture livestock during the winter months; the area also supports the Tribes bison herd. The Tribes would support additional measures to promote resource integrity over the long-term to support efforts to sequester carbon in this relatively undeveloped area of the Fort Hall Reservation. The Tribes are actively restoring small stream reaches and managing invasive species with a blend of tribal and federal funding,

but have lacked a significant investment to complete the planned restoration in the next five years, as opposed to the next two decades. The Tribes would follow a completed Tributary Assessment that was funded by the Bonneville Power Administration, as well as any other restoration actions that have scientific merit to sequester additional carbon in this natural setting.

The Tribes will work with qualified contractors, staff, and regional Universities to develop appropriate studies that can measure the effect of implementation actions to increase the surface area of existing wetlands or riparian areas. The most significant co-benefit of engaging in conservation work include the primary goal of leaving intact and functional wetlands and riparian areas intact and undisturbed, these areas contain significant carbon and methane stores that are released when disturbed. Another opportunity that conservation programs have is to utilize areas that could be new wetlands or enhanced riparian areas to store 'new' atmospheric carbon in the soil. The final component of the conservation program is directly related to the ecological health of the wetland or riparian system, including benefits to water, soils, plants, animals, and aquatic organisms.

Measure 6: Install replacement wood stoves or electric furnaces

Shoshone-Bannock Tribes: Wood Stove Replacement Program	
Implementing agency	Shoshone-Bannock Tribes
Implementation milestones	Shoshone-Bannock Tribes accepts CPRG implementation grant funds, develops agreements with willing participants, approves contractor(s) for installation
Geographic location	Fort Hall Reservation, up to 100 homes.
Funding sources	EPA CPRG Phase II Implementation Grant funds
Metrics tracking	Published project outreach materials, quarterly status reports, and final project report
Cost	$750,000 for total project costs; includes administration of project and up to 100 homes with complete replacement of wood burning stoves with new stoves or electric furnaces.
Annual estimated GHG and criteria air pollutant emission reductions	Using the EPA calculator, it is estimated that this program will reduce GHG emissions by ~6 m/tons annually, while also improving indoor air quality for tribal member households.
Implementation authority milestones	Shoshone-Bannock Tribes, Tribal Council approval of contractor(s) and homeowner agreement.

Table 23. Residential wood burning stove replacement program.

This measure is specifically designed to accomplish the goal of providing tribal households with access to reliable and sustainable winter heating on the reservations, with a specific focus on those households that are utilizing wood as a heating source. While wood stoves can be considered a sustainable energy source for heating, antiquated systems have the potential to increase indoor air pollution, increase soot production that can cause dangerous house fires, and result in an inefficient fire per mass ignited. The purpose is to provide multiple options, including a complete system change-out, for eligible tribal households for their heating needs. The Tribe will complete an evaluation of eligible households and distribute the benefits to qualifying tribal members on a rolling basis as applications are received. Each annual report, for the three proposed funding cycles, will describe the nature of the stove replacement

and have a specific estimate on the reduction of GHG associated with that year's program accomplishments.

10.4 SBT Priority GHG Reduction Measures Benefits Analysis

The benefits of GHG reduction measures can be roughly placed into three topic spaces; infrastructure transition to sustainable renewable energy for tribal communities, deployment and installation of adequate renewable energy projects on tribal lands to support those communities, and policy measures to increase community support for climate resiliency and carbon neutrality goals. Each of those broad topics are addressed in the USRT member tribes' individual PCAP measures to achieve goals of carbon neutrality, but there is a need for sustained technical and financial support for tribal communities. The unique relationship between the federal government and the tribes should be viewed as a natural partnership to implement renewable energy projects and to pilot programs for carbon neutrality across the Upper Snake River basin. While every development has the potential to have deleterious effects on the environment, the projects selected by the tribes for implementation are carefully designed to increase climate resilience and support transitioning existing developments with sustainable technology.

The benefit assessment for each measure was developed by using the emissions inventory developed for the SBT, relying on NEI source data for each of the counties as inputs in the TGIT, and reviewing relevant information on the average reduction in emissions from associated actions. The measures proposed above were then individually evaluated to ensure there wouldn't be any significant negative effects to the tribal community or the reservation environment. It is reasonably foreseeable that a complete transition to renewable energy will necessitate dramatic changes and potentially negative consequences for the environment if projects aren't adequately developed. By focusing the PCAP measures on immediate 'tailpipe' emissions, electrical service infrastructure, and near-term policies to improve ecosystem function, the tribes can effect positive change while developing sound projects to service reservation residents that don't impact the character of their homelands.

Measure 1 - Revolving Loan Fund

The Biden Administration recognized that access to capital to fund renewable energy projects is a national issue that will require significant investments from the public to existing private lenders.[62] The issue of access to financing for everything from home ownership to business lending is historically limited throughout Indian Country, and the members of USRT are no exception. The Shoshone-Bannock Tribes would like to engage in providing access to their membership through their existing lending programs, specifically for the installation and maintenance of renewable energy projects on their homes.

The EPA has a calculator[63] that shows the average 10 kwh solar installation off-sets up to 6.1 tons of GHG emissions per year, at full participation up to 305 tons of carbon can be off-set in the initial year. The SBT will strive to implement additional incentives encouraging rapid payback to the revolving loan program and will strive maintain a minimum of 50 active participants through 2050. The goal of the program is to provide funding to 500 tribal homes through 2050; removing an estimated 3,050 tons of

[62] see generally, National Clean Energy Investment Fund - https://www.epa.gov/greenhouse-gas-reduction-fund/national-clean-investment-fund

[63] See generally, EPA Greenhouse Gas Equivalencies Calculator at https://www.epa.gov/energy/greenhouse-gas-equivalencies-calculator#results

residential GHG emissions for electricity at project completion; a significant proportion of the annual carbon emissions budget for the Fort Hall Reservation.

Another benefit from developing a revolving loan program is that it allows for households from a range of economic conditions to apply for funding based on their unique circumstances. It is difficult to obtain financing based on projected lease payments or to receive financing for projects that are taking place on trust lands, even if those homes are mortgage free. Working in a tribal community requires knowledge and trust, providing the funding directly to the Shoshone-Bannock Tribes would allow them to prioritize the placement of projects directly. Each Tribal applicant would be assisted directly by tribal staff to get the full range of options for energy efficiency, renewable energy systems, and, the requirements of financing from the program.

Measure 2 – Residential Electrical Service Panel Upgrade

A key component to engaging the tribal membership in the electrical transition, particularly for home energy use and electric vehicle transportation, is to ensure that the entry point for those electrical components is appropriate for the residence. The electrical service panel on many tribal homes will require upgrades prior to the installation of solar systems, battery powered backups, level 1 and 2 EV charging stations, and other electrical appliances. The benefits of engaging in upgrades to electrical service panels with new service panels are both direct and indirect.

The Tribes won't endorse a particular brand of service panel, preferring to allow an open solicitation process to select the appropriate equipment for their geography. The range of estimates for upgrading this component in the household range from 5% - 10% improvements in electrical efficiency, providing an immediate benefit to the household in terms of GHG emissions.[64] The most important benefit is indirect, primarily because this component provides the household with options to install EV chargers, renewable energy and battery storage systems, and transition from fossil fuel heat sources into electrical heat sources.

Measure 3 (a & b) – Electric Vehicle Charging Stations and Solar Array

The US Energy Information Administration publishes information monthly on the presence of electric vehicle (EV) charging stations across the country.[65] The number of charging stations locally remains a barrier for tribal members seeking to transition to an EV for their daily commute and keeps those tribal members in their gasoline powered vehicles for the foreseeable future. As noted above in Measure 2, residential charging is also a necessary to complete the transition to electric transportation so this particular action is directed at providing a fee-free service for members of the public using EV's for transportation at strategically located service stations and commercial locations.

This measure would benefit from the addition of a 100 kwh solar system with a battery storage facility that accommodates a Level 3 charging station for prompt charging at the station. A 100kwh solar system offsets approximately 61 tons of GHG emissions per year, or phrased another way, avoids approximately 150,000 vehicle miles travelled.[66] The project would be located on the Fort Hall

[64] Like the other USRT member tribes, installation of new residential service panels have the potential to immediately update a tribal household and increase the residence's efficiency.
[65] See generally, https://www.eia.gov/tools/faqs/faq.php?id=93&t=11 (information on EV charging stations)
[66] See generally, EPA Greenhouse Gas Equivalencies Calculator at https://www.epa.gov/energy/greenhouse-gas-equivalencies-calculator#results

Reservation at three high-traffic commercial areas (Bannock Peak Truck Stop, Shoshone-Bannock Hotel and Event Center, and the Sage Hill Truck Stop) along I-15 and I-86 to service travelers from across the intermountain west. It is anticipated that this project will reduce tailpipe emissions across the reservation and provide a necessary component of local infrastructure to encourage the membership to adopt EVs for daily transportation.

Measure 4 – Electric Transportation Incentive Program

Offering public incentives to transition to new electric technology will assist tribal members struggling to adopt new transportation options and/or replace aging equipment with electrical options rather than continuing to use fossil fuels. The incentive will be offered to adult tribal members who purchase electric vehicles (including electric bikes) or replace non-road equipment like yard equipment with electric options. The use of the incentive is not anticipated to have an immediate impact on actual 'tailpipe' emissions, rather the benefits will likely remain indirect for the duration of the three-year incentive program. These benefits include increasing community support and awareness of electric technology available to tribal members for everyday activities.

Measure 5 - Addressing Policies to Support Carbon Neutrality in Tribal Community

Carbon sequestration in freshwater wetlands is a critical part of the carbon cycle and anthropogenic modifications of this habitat type have inhibited parts of this cycle; but wetland restoration remains a promising avenue for mitigating climate impacts.[67] Direct carbon sequestration in specific soils will need to be determined as a component of the project, but analogous re-forestation and wetland conservation efforts have yielded a wide range of sequestration estimates.[68] The presence of large and intact wetlands are an opportunity for this project to engage in meaningful conservation work for numerous sensitive species of wildlife, continue to regulate surface temperatures locally, regulate water quality, and reduce the effect of GHG emissions. The goal of the project will be to return affected systems to normative conditions associated with a riverine or riparian habitat type; and, to conserve existing, functional wetlands in their current condition.

An acre of wetland can store a range of 80-200 tons of carbon in its soil, while the range is determined by the type of wetland habitat the Fort Hall Bottoms is a prime candidate for additional study and conservation work. It is rare to find an opportunity with a willing partner to engage in landscape level conservation that encompasses over 30,000 acres; based on the most conservative benefits analysis there is an opportunity to contribute to climate resilience locally and continue to provide sequestration benefits nationally. Working with qualified contractors and local university specialists, the Tribes would develop a series of measures across the landscape and develop real-time estimates of current carbon storage, carbon storage potential from conservation practices, and low-tech projects to increase the surface area of existing wetlands where feasible.

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[67] M.S. Fennessy, D.H. Wardrop, J.B. Moon, S. Wilson, C. Craft, Soil carbon sequestration in freshwater wetlands varies across a gradient of ecological condition and by ecoregion, Ecological Engineering, Volume 114, 2018, Pages 129-136, ISSN 0925-8574, https://doi.org/10.1016/j.ecoleng.2017.09.013. (https://www.sciencedirect.com/science/article/pii/S0925857417305335)

[68] See https://www.nature.com/articles/ncomms13835 for additional information on variation for habitat types and the need to specifically study potential benefits from wetland conservation.

Measure 6 – Wood Stove Replacement Program

Some of the tribal membership on the Fort Hall Reservation rely on wood burning stoves as a primary heat source during the winter months. The SBT offer numerous programs to support tribal elders and low-income households with 4-6 cords of firewood each winter to support their heating needs and have received funding in the past to help replace aging wood stoves with new, EPA-certified, stoves in elders households. The direct impacts of replacing a wood burning stove depend heavily on the type of fuel burned in the household and the age of the stove used as the heat source, but generically the program is anticipated to reduce approximately 6 m/tons of GHG per year.

It is relatively clear that this program will have an immediate impact on GHG emissions from wood burning stoves during the winter months. The SBT are also optimistic that this project will have associated co-benefits noted in other similar projects that have been implemented on tribal lands. The SBT expect to see reductions in indoor air pollutants following the replacement and will work directly with willing program participants to conduct post-replacement measurements of indoor air pollutants. This should also help reduce outdoor air pollution on the reservation during winter months, specifically when there are high-pressure inversions present across the Snake River plain.

10.5 SBT Authority to Implement Priority Reduction Measures

Federally recognized tribes in the United States, including the USRT member tribes, have a relatively high degree of sovereignty and self-governance over their own reservation lands. This authority is rooted in the recognition that tribes, like any other sovereign entity, possessed authority to govern their own constituents and handle their own affairs within their land base; this authority pre-dated any limitations on that authority imposed by the U.S. Constitution, treaties, statutes, and court decisions. It is critical to note that the inherent rights associated with self-governance are not grants of rights to tribes, rather they are a component of their inherent sovereignty that has always existed.

While there are a number of nuanced issues within the subject matter of tribal jurisdiction, the primary legal frameworks governing the implementation of PCAP recommended measures will include the following:

- U.S. Constitution: The Constitution recognizes tribes as separate sovereigns, and the Commerce Clause grants Congress the authority to regulate commerce with Indian tribes. This early relationship formed the basis for tribal relations that impact our member tribes through present.
- Treaties and Executive Order: While some tribes have treaties with the U.S. government that outline the tenets of their 'nation to nation' relationship, some tribes were established with other mechanisms during the eighteenth and nineteenth centuries. Common features of both mechanisms for developing relationships with tribes include setting boundaries of reservations, establishing a fiduciary relationship, and defining the scope of their self-governance. The Shoshone-Bannock Tribes and the Fort Hall Reservation was formed under the Fort Bridger Treaty of 1868 (ratified), and while the other three USRT member tribes were present and negotiated direct treaties they were never ratified by Congress. Each of the remaining USRT member tribes (BPT, SPT, and FMPS) were established through Executive Order or a formal act of Congress and each has an intact land base and active, engaged tribal community-based government. All four of the tribes possess the inherent authority to manage their own internal affairs and maintain the capacity to contract services or manage the scope of programs described in this PCAP.

- Indian Reorganization Act (IRA) of 1934: The IRA marked a shift in federal Indian policy towards supporting tribal self-governance after a scathing review of federal Indian policy around the turn of the century. Tribes who adopted IRA constitutions operate under a constitution, with a tribal council who manages the daily affairs of the tribes. Not all tribes adopted an IRA constitution and continue to manage their government affairs based on the direction of their general membership; both systems will be present across our USRT member tribes.
- Indian Self-Determination and Education Assistance Act of 1975 (PL 93-638): This legislation reinforced tribal self-governance by giving tribes greater control over their own affairs, including the management of their lands and resources. In its contemporary iteration, 93-638 contracts and/or cooperative agreements can be developed directly with eligible tribes seeking to utilize federal funding on their lands with their own staff. In some instances USRT member tribes may still need to consult with the BIA to determine the applicability of an environmental review process prior to ground disturbance.
- Federal Trust Responsibility: The U.S. government has a trust responsibility to protect tribal lands, resources, and treaty rights. This principle has been interpreted by tribes to imply a fiduciary duty to assist tribes in managing their lands and resources for the benefit of tribal members.
- Tribal Sovereign Immunity: Tribal governments generally possess sovereign immunity, protecting them from lawsuits without their consent. This immunity extends to actions related to land management.

All four of the USRT member tribes are aware of their obligations to manage federal funds to accomplish the intended purpose and have reviewed the proposed climate pollutant reduction measures associated with this PCAP. Each of the measures associated with this PCAP are directly intended to alleviate a current burden on their respective communities and help make each of their homes more resilient to the worst impacts from global climate change. There aren't any measures contemplated for the PCAP that will exceed the limits of tribal sovereignty and if there are any perceived inconsistencies for future project recommendations during the CCAP process, they will be noted accordingly.

10.6 Identification of Other Funding Mechanisms

Although this section is optional for the PCAP, USRT staff have noted that the Biden/Harris Administration, in concert with the release of federal funding through the Bipartisan Infrastructure Law and Inflation Reduction Act, has developed an online tool to help Tribes access funding opportunities. The intent of the Access to Capital web portal, hosted by the Bureau of Indian Affairs, is to provide tribal professionals a 'one-stop' portal to access federal programs to engage in meaningful community change.[69] The website is functional, as of December 6, 2023, and will be utilized to help the USRT member tribes access specific funding mechanisms to implement meaningful measures that reduce GHG emissions on tribal lands.

Specific funding sources for the PCAP measures identified above may include working with a number of program(s) within the federal administration to accomplish specific tribal climate goals. Given the nature of the 2024 funding environment, USRT staff has noted that a number of funding opportunities are related to one-time grants for projects or competitive grant notices. USRT technical staff have chosen to work directly with Tribal staff to identify opportunities to accomplish near-term PCAP measures, while acknowledging that accomplishing meaningful GHG emissions reduction will require

[69] https://www.bia.gov/atc

long-term funding opportunities rather than single projects. In a similar perspective to our USRT member tribes, the SBT would advocate for more consistent, programmatic funding resources within the federal government for tribes to prepare their communities for climate change.

10.7 Workforce Planning Analysis

Transitioning a workforce to accomplish new tasks can be a generational task in small Tribal communities, where dedicated tribal members are often working diligently for their tribe already. Developing a climate ready workforce is a priority for the USRT member tribes, although the PCAP measures detailed in the preceding sections are not intended to build that workforce. Achieving near-term climate goals and allowing the PCAP measures to be a catalyst for generating community support and 'buy-in' are critical components of each of those measures.

The workforce planning analysis was an optional section and due to the complex nature of the evaluation by USRT technical staff, we have opted to work with our member tribes on this issue for the CCAP. Tribal members from each of our member tribes have dedicated their entire careers to working for their people and are already working to protect natural and cultural resources on their reservations. USRT is committed to helping our tribal communities engage in climate stewardship activities and helping instill traditional values of resilience, accountability, and reciprocity in all of our GHG emissions reduction measures. For the CCAP, USRT staff will work directly with each of the tribes to develop the appropriate workforce planning measures to help maximize emissions reductions and to ensure that tribal communities have locally available labor to meet the demands of an uncertain future.

11 CPRG Implementation and CCAP Proposal 2024-2027.

In an effort to focus the PCAP on actionable, near-term priorities for reducing climate pollutants at each of our member tribes' homelands that can be realistically implemented prior to the submittal of the CCAP. USRT staff determined that a community focused effort to directly get actions implemented within the community and tribal government within a short timeline. Long-term comprehensive planning is appropriate given the scope and scale of the ongoing climate crisis on our member tribes' communities. The development of the CCAP will follow a necessarily longer evaluation and community engagement program; with the final deliverables being made accessible for multiple different reader levels within the community.

Each of the associated States of Idaho, Nevada, and Oregon have focal areas of engaging directly with LIDAC communities during the development of their respective CCAPs; USRT also has an obligation to participate in those forums. Developing meaningful engagement opportunities between tribal communities and external agencies requires additional capacity located at each of or member tribes' reservations. The proposed addition of positions is in line with EPA priorities to include the unique perspective of tribal communities during this planning process and the request would be a modest addition to the existing CPRG planning contract to ensure the regional planning process for USRT member tribes and their respective states are working 'hand in glove' with one another.

USRT staff worked collaboratively to develop a series of PCAP measures for each of our member tribes to implement in the near-term to reduce GHG emissions in their communities. A critical component of evaluating the efficacy of these measures and to adaptively manage projects is having dedicated staff who are located on each reservation. USRT staff would, pending available funding from the Phase 2 Implementation Grant or other federal resources, play a critical role in supporting the implementation

of projects, evaluation of project success, and conducting outreach at each reservation for climate change programs. In order to accomplish the appropriate community engagement for this effort, USRT staff would also be present in our member tribes' communities during the development of the CCAP.

Measure 1: USRT Climate Steward Program

Upper Snake River Tribes Foundation: Climate Stewardship Program	
Implementing agency	Upper Snake River Tribes Foundation
Implementation milestones	Develop community climate engagement plan for each of the member tribes, hire tribal coordinators with a dedicated work site on each tribes' reservation, deliver technical assistance during the CPRG and PCAP Implementation process.
Geographic location	4 Remote Work Stations, 1 FTE located on or near each member tribe's reservation, supervised by Environmental Program Director. With agreement from member tribe, the position can be considered fully remote and still provide community services as necessary.
Funding sources	EPA CPRG Phase II Implementation funds
Metrics tracking	Quarterly status reports, annual reports, all published education and outreach materials, and implementation tracking progress reports.
Cost	$1,750,000 for 4 FTE's over 3 calendar years. (see Implementation Grant Application for additional details on proposal)
Annual estimated GHG and criteria air pollutant emission reductions	The Climate Stewardship Program is intended to provide technical assistance, outreach and education, and, community project support over the next four years. This technical assistance would support developing funding proposals to support the tribal climate initiatives associated with this PCAP and the CCAP for USRT member tribes.
Implementation authority milestones	Upper Snake River Tribes Foundation accepts implementation grant funding, on-site coordinators are selected, and technical assistance project is implemented

Table 24. Climate stewardship technical assistance program.

During the development of the CCAP it is important to have consistent engagement and professional presence available to each of our member tribes. Having dedicated staff to assist in the development of CCAP elements for each of the tribes will reduce travel distances, increase community engagement, and allow for on-site monitoring of project implementation. The CPRG planning process provided USRT member tribes the opportunity to assess their own GHG emissions and develop local solutions to contribute to the reduction in climate pollutants. These Climate Policy Analyst positions would be directly supervised by USRT and assigned to work on-site in each of the reservation locations for that tribe in a technical support capacity. These positions are anticipated to directly serve as key positions for the Tribes to seek and apply for additional funds for implementation from across the federal administration to reduce GHG emissions and prepare their communities for the potential impacts of climate change.

Measure 2: Develop Incentives for Remote/Hybrid Work Policies

Upper Snake River Tribes: Remote/Hybrid Work Policies	
Implementing agency	Upper Snake River Tribes Foundation

Implementation milestones	Conduct existing workforce analysis, engage employees and supervisors on work plans, implement remote/hybrid work models in tribal workforce.
Geographic location	Upper Snake River Tribes Foundation workforce
Funding sources	EPA CPRG Phase II Implementation Funds
Metrics tracking	Vehicles miles travelled for work commute; voluntary reporting for remote/hybrid workers; completed remote/hybrid policies for USRT.
Cost	$75,000 over three years for workforce subsidies (electric vehicle incentive, renewable energy subsidy, internet, cell, etc.)
Annual estimated GHG and criteria air pollutant emission reductions	USRT staff (4FTE) are currently working in an weekly office setting, with one FTE working remotely in Fort Hall, ID. The purpose of this measure is to mitigate 'tailpipe' emissions associated with commuting to and from an office setting for a minimum of 4 out of 10 business days (essentially a 40% reduction in those emissions).
Implementation authority milestones	Develop workforce analysis, USRT Commission and Executive Director accepts Phase II Implementation funds.

Table 25. Remote work transition for full-time staff.

Commuting to and from work is increasingly difficult in a rural setting, particularly when there aren't adequate options for maintain an EV charge during a transit that can be over 50 miles per day. In an effort to combat direct 'tail-pipe' emissions from a daily commute, the USRT will offer a combination of incentives and subsidies to allow USRT staff to work remotely or in a hybrid setting. This reduction in emissions is likely to be small, given the limited number of staff affected by the change, but the thrust of the project is to continue the dialogue with our member tribes on the positive effect of reducing the daily commute "vehicle-miles-travelled" category of mobile emissions. The current structure of USRT will need to be re-imagined and current 'in-office' employees will need additional office infrastructure to manage the change in work-site location.

1 Appendix A – Tribal Greenhouse Inventory Tool Spreadsheets and Figures

Inventory Emissions Summary

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Please use the drop-down menu in the Scope 2 Emissions Selection box to determine which scope 2 emissions methodology is used in the summary tables below.

Scope 2 Emissions Selection:	Market Based

27.79 Per capita Emissions for Fort McDermitt (MT CO2e/person)

Total Fort McDermitt Emissions (MT CO2e)

	CO_2	CH_4	N_2O	HFCs	PFCs	SF_6	Total MT CO_2e	Percent of Total
Scope 1	4,748.69	93.07	0.61	-	-	-	4,842.37	62%
Scope 2 - Location Based	3,003.87	7.85	10.61	-	-	-	3,022.34	
Scope 2 - Market Based (for informational purposes only)	3,003.87	7.85	10.61				3,022.34	38%
Scope 3	-	-	-	-	-	-	-	0%
Total Gross Emissions	**7,752.56**	**100.92**	**11.23**	**-**	**-**	**-**	**7,864.71**	**100%**
Total Net Emissions	**7,752.56**	**100.92**	**11.23**	**-**	**-**	**-**	**7,864.71**	**100%**

Emissions by Source (MT CO_2e)

Source	CO_2	CH_4	N_2O	HFCs	PFCs	SF_6	Total	Percent of Total
Stationary Combustion	1,206.54	3.00	0.60	-	-	-	1,210.14	15%
Mobile Combustion	1,068.03	-	-	-	-	-	1,068.03	14%
Solid Waste	-	-	-	-	-	-	-	0%
Wastewater Treatment	-	89.92	-	-	-	-	89.92	1%
Electricity - Location Based	3,003.87	7.85	10.61	-	-	-	3,022.34	
Electricity - Market Based (for informational purposes only)	3,003.87	7.85	10.61				3,022.34	38%
Water	-	-	-	-	-	-	-	0%
Ag & Land Management	-	-	-				-	0%
Urban Forestry	-	-	-				-	0%
Waste Generation	-	-	-				-	0%
Other	2,474.13	0.14	0.01	-	-	-	2,474.28	31%
Total (Gross Emissions)	**7,752.56**	**100.92**	**11.23**	**-**	**-**	**-**	**7,864.71**	**100%**
Total (Net Emissions)	**7,752.56**	**100.92**	**11.23**	**-**	**-**	**-**	**7,864.71**	**100%**

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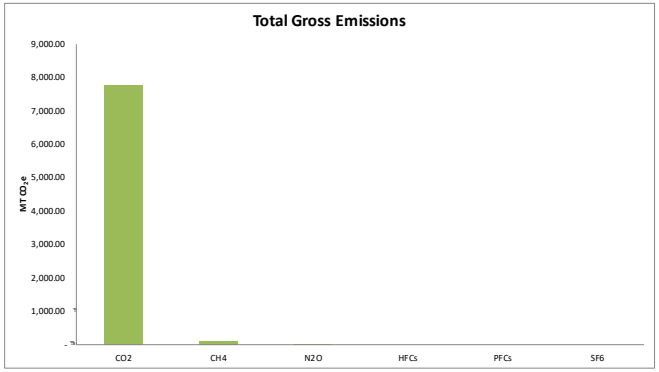
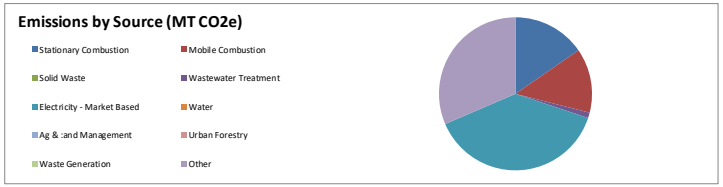
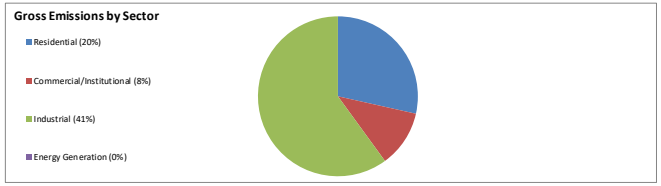
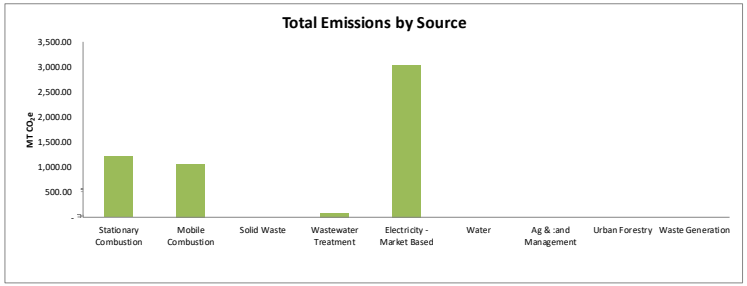


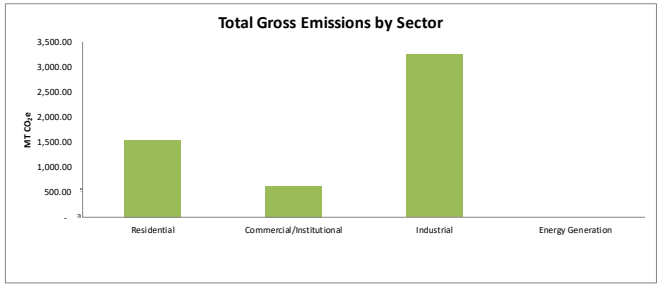




Gross Emissions by Sector

Sector	Total (MT CO_2e)	Percent of Total
Residential	1,536.32	20%
Commercial/Institutional	619.09	8%
Industrial	3,235.02	41%
Energy Generation	-	0%
Total	**5,390.43**	**69%**





Total Emissions by Sector and Source (MT CO_2e)

Sector	Stationary	Electricity	Mobile	Solid Waste	Waste water	Water	Agriculture & Land Management	Urban Forestry	Other	TOTAL GROSS	TOTAL NET
Residential	161.50	306.79	1,068.03	-	-	-	-	-	-	1,536.32	1,536.32
Commercial/Institutional	146.15	383.02	-	-	89.92	-	-	-	-	619.09	619.09
Industrial	902.49	2,332.53	-	-	-	-	-	-	-	3,235.02	3,235.02
Energy Generation	-	-	-	-	-	-	-	-	-	-	-
Total	1,210.14	3,022.34	1,068.03	-	89.92	-	-	-	-	**5,390.43**	**5,390.43**

Inventory Emissions Summary

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Please use the drop-down menu in the Scope 2 Emissions Selection box to determine which scope 2 emissions methodology is used in the summary tables below.

Scope 2 Emissions Selection:	Market Based

17.10 Per capita Emissions for Sho-Ban TRIAL (MT CO2e/person)

Total Sho-Ban TRIAL Emissions (MT CO2e)

	CO_2	CH_4	N_2O	HFCs	PFCs	SF_6	Total MT CO_2e	Percent of Total
Scope 1	65,067.54	1,682.90	8.68	-	-	-	66,759.12	76%
Scope 2 - Location Based	20,521.78	53.63	72.51	-	-	-	20,647.93	
Scope 2 - Market Based (for informational purposes only)	20,521.78	53.63	72.51				20,647.93	23%
Scope 3	-	-	-	-	-	-	-	0%
Total Gross Emissions	**85,589.32**	**1,736.53**	**1,068.14**	**-**	**-**	**-**	**88,393.99**	**99%**
Total Net Emissions	**85,589.32**	**1,736.53**	**1,068.14**	**-**	**-**	**-**	**88,393.99**	**99%**

Emissions by Source (MT CO_2e)

Source	CO_2	CH_4	N_2O	HFCs	PFCs	SF_6	Total	Percent of Total
Stationary Combustion	17,107.09	42.55	8.57	-	-	-	17,158.21	19%
Mobile Combustion	18,462.98	-	-	-	-	-	18,462.98	21%
Solid Waste	-	-	-	-	-	-	-	0%
Wastewater Treatment	-	1,638.02	-	-	-	-	1,638.02	2%
Electricity - Location Based	20,521.78	53.63	72.51	-	-	-	20,647.93	
Electricity - Market Based (for informational purposes only)	20,521.78	53.63	72.51				20,647.93	23%
Water	-	-	-	-	-	-	-	0%
Ag & Land Management	-	-	986.94				986.94	1%
Urban Forestry	-	-	-				-	0%
Waste Generation	-	-	-				-	0%
Other	29,497.47	2.33	0.11	-	-	-	29,499.91	33%
Total (Gross Emissions)	**85,589.32**	**1,736.53**	**1,068.14**	**-**	**-**	**-**	**88,393.99**	**100%**
Total (Net Emissions)	**85,589.32**	**1,736.53**	**1,068.14**	**-**	**-**	**-**	**88,393.99**	**100%**

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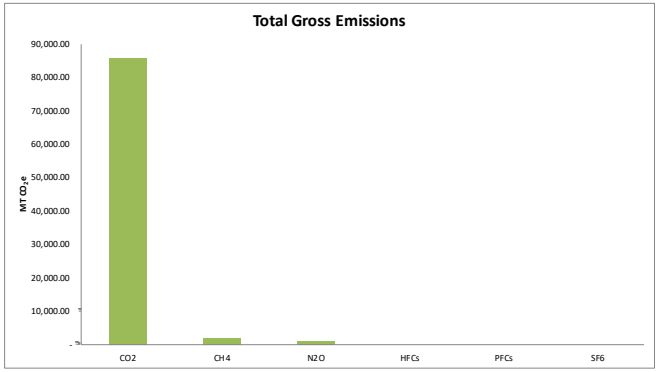
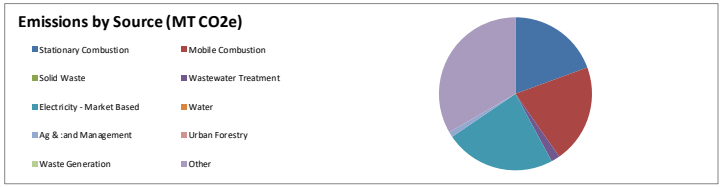
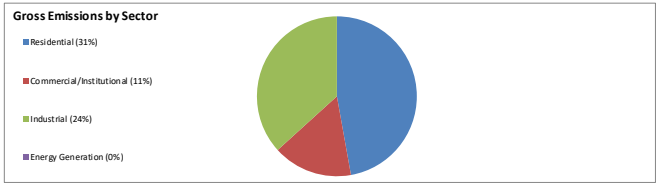
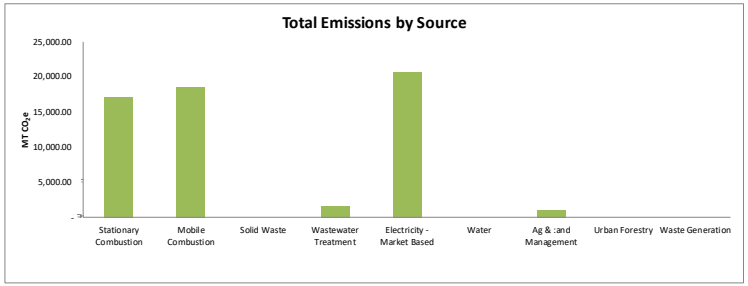


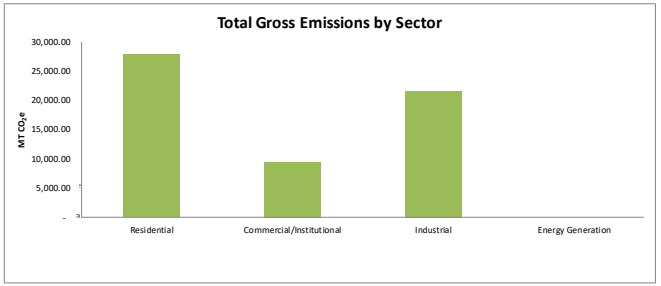




Gross Emissions by Sector

Sector	Total (MT CO_2e)	Percent of Total
Residential	27,785.52	31%
Commercial/Institutional	9,479.80	11%
Industrial	21,628.76	24%
Energy Generation	-	0%
Total	**58,894.08**	**67%**





Total Emissions by Sector and Source (MT CO_2e)

Sector	Stationary	Electricity	Mobile	Solid Waste	Waste water	Water	Agriculture & Land Management	Urban Forestry	Other	TOTAL GROSS	TOTAL NET
Residential	3,925.43	5,397.12	18,462.98	-	-	-	-	-	-	27,785.52	27,785.52
Commercial/Institutional	3,307.76	4,534.02	-	-	1,638.02	-	-	-	-	9,479.80	9,479.80
Industrial	9,925.03	10,716.78	-	-	-	-	986.94	-	-	21,628.76	21,628.76
Energy Generation	-	-	-	-	-	-	-	-	-	-	-
Total	17,158.21	20,647.93	18,462.98	-	1,638.02	-	986.94	-	-	**58,894.08**	**58,894.08**

Inventory Emissions Summary

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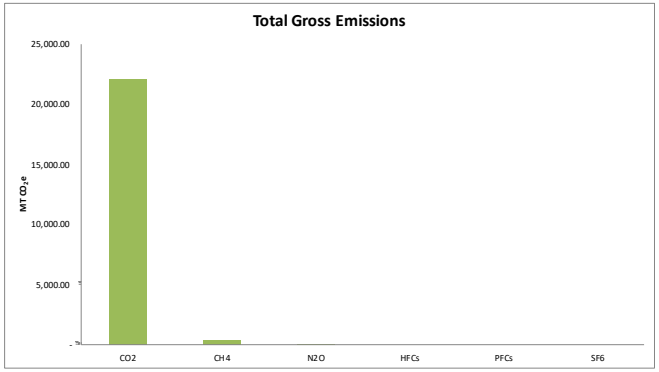
Please use the drop-down menu in the Scope 2 Emissions Selection box to determine which scope 2 emissions methodology is used in the summary tables below.

Scope 2 Emissions Selection:	Market Based

19.90 Per capita Emissions for Sho-Pai TRIAL (MT CO2e/person)

Total Sho-Pai TRIAL Emissions (MT CO2e)

	CO_2	CH_4	N_2O	HFCs	PFCs	SF_6	Total MT CO_2e	Percent of Total
Scope 1	14,570.70	317.38	1.29	-	-	-	14,889.38	67%
Scope 2 - Location Based	7,451.30	19.47	26.33	-	-	-	7,497.10	
Scope 2 - Market Based (for informational purposes only)	7,451.30	19.47	26.33				7,497.10	33%
Scope 3	-	-	-	-	-	-	-	0%
Total Gross Emissions	**22,022.00**	**336.85**	**27.62**	**-**	**-**	**-**	**22,386.48**	**100%**
Total Net Emissions	**22,022.00**	**336.85**	**27.62**	**-**	**-**	**-**	**22,386.48**	**100%**



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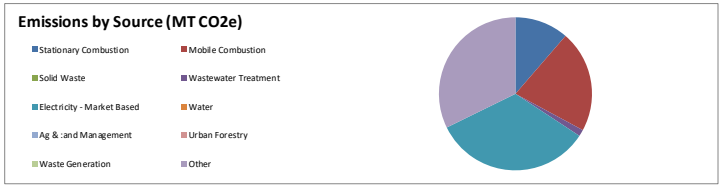
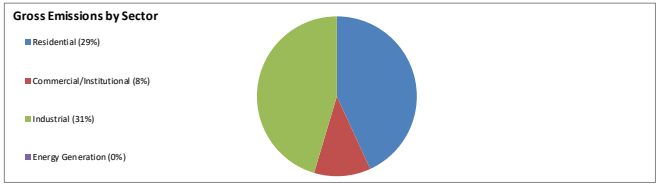
Emissions by Source (MT CO_2e)

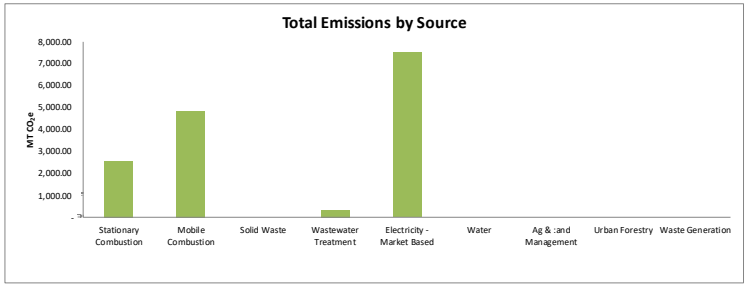
Source	CO_2	CH_4	N_2O	HFCs	PFCs	SF_6	Total	Percent of Total
Stationary Combustion	2,533.12	6.30	1.27	-	-	-	2,540.69	11%
Mobile Combustion	4,817.19	-	-	-	-	-	4,817.19	22%
Solid Waste	-	-	-	-	-	-	-	0%
Wastewater Treatment	-	310.65	-	-	-	-	310.65	1%
Electricity - Location Based	7,451.30	19.47	26.33	-	-	-	7,497.10	
Electricity - Market Based (for informational purposes only)	7,451.30	19.47	26.33				7,497.10	33%
Water	-	-	-	-	-	-	-	0%
Ag & Land Management	-	-	-				-	0%
Urban Forestry	-	-	-				-	0%
Waste Generation	-	-	-				-	0%
Other	7,220.39	0.43	0.03	-	-	-	7,220.85	32%
Total (Gross Emissions)	**22,022.00**	**336.85**	**27.62**	**-**	**-**	**-**	**22,386.48**	**100%**
Total (Net Emissions)	**22,022.00**	**336.85**	**27.62**	**-**	**-**	**-**	**22,386.48**	**100%**

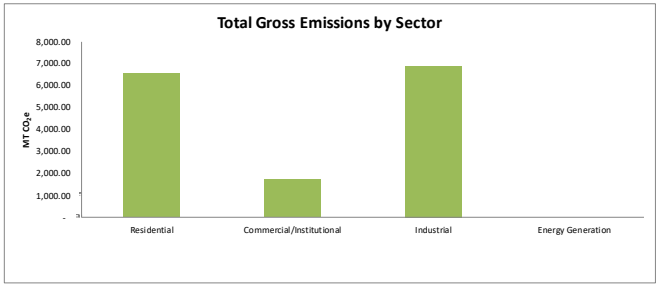




Gross Emissions by Sector

Sector	Total (MT CO_2e)	Percent of Total
Residential	6,545.30	29%
Commercial/Institutional	1,736.77	8%
Industrial	6,883.56	31%
Energy Generation	-	0%
Total	**15,165.63**	**68%**





Total Emissions by Sector and Source (MT CO_2e)

Sector	Stationary	Electricity	Mobile	Solid Waste	Waste water	Water	Agriculture & Land Management	Urban Forestry	Other	TOTAL GROSS	TOTAL NET
Residential	597.15	1,130.96	4,817.19	-	-	-	-	-	-	6,545.30	6,545.30
Commercial/Institutional	703.79	722.33	-	-	310.65	-	-	-	-	1,736.77	1,736.77
Industrial	1,239.75	5,643.81	-	-	-	-	-	-	-	6,883.56	6,883.56
Energy Generation	-	-	-	-	-	-	-	-	-	-	-
Total	2,540.69	7,497.10	4,817.19	-	310.65	-	-	-	-	**15,165.63**	**15,165.63**

Inventory Emissions Summary

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Please use the drop-down menu in the Scope 2 Emissions Selection box to determine which scope 2 emissions methodology is used in the summary tables below.

Scope 2 Emissions Selection:	Market Based

17.40 Per capita Emissions for Burns Paiute (MT CO2e/person)

Total Burns Paiute Emissions (MT CO2e)

	CO_2	CH_4	N_2O	HFCs	PFCs	SF_6	Total MT CO_2e	Percent of Total
Scope 1	1,499.68	0.77	0.01	-	-	-	1,500.46	83%
Scope 2 - Location Based	307.66	0.80	1.09	-	-	-	309.55	
Scope 2 - Market Based (for informational purposes only)	307.66	0.80	1.09				309.55	17%
Scope 3	-	-	-	-	-	-	-	0%
Total Gross Emissions	**1,807.34**	**1.58**	**1.10**	**-**	**-**	**-**	**1,810.01**	**100%**
Total Net Emissions	**1,807.34**	**1.58**	**1.10**	**-**	**-**	**-**	**1,810.01**	**100%**

Emissions by Source (MT CO_2e)

Source	CO_2	CH_4	N_2O	HFCs	PFCs	SF_6	Total	Percent of Total
Stationary Combustion	16.13	0.04	0.01	-	-	-	16.18	1%
Mobile Combustion	487.33	-	-	-	-	-	487.33	27%
Solid Waste	-	-	-	-	-	-	-	0%
Wastewater Treatment	-	0.55	-	-	-	-	0.55	0%
Electricity - Location Based	307.66	0.80	1.09	-	-	-	309.55	
Electricity - Market Based (for informational purposes only)	307.66	0.80	1.09				309.55	17%
Water	-	-	-	-	-	-	-	0%
Ag & Land Management	-	-	-				-	0%
Urban Forestry	-	-	-				-	0%
Waste Generation	-	-	-				-	0%
Other	996.22	0.18	0.00	-	-	-	996.41	55%
Total (Gross Emissions)	**1,807.34**	**1.58**	**1.10**	**-**	**-**	**-**	**1,810.01**	**100%**
Total (Net Emissions)	**1,807.34**	**1.58**	**1.10**	**-**	**-**	**-**	**1,810.01**	**100%**

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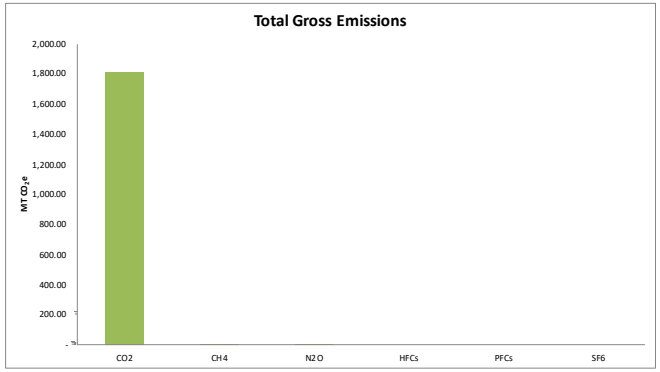
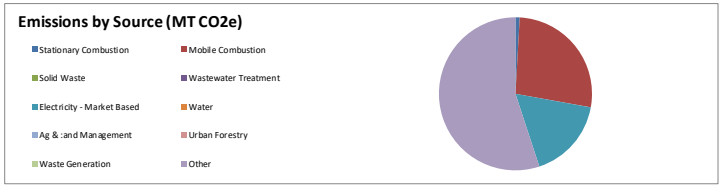
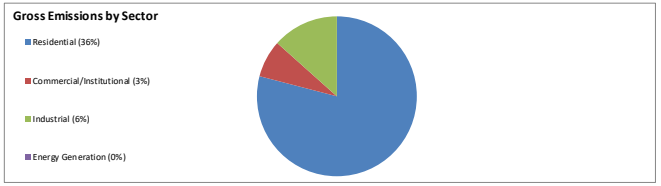
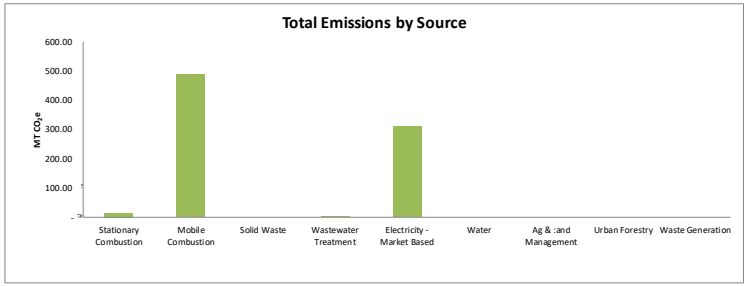


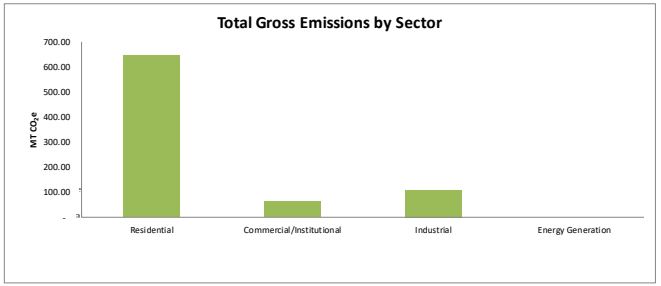




Gross Emissions by Sector

Sector	Total (MT CO_2e)	Percent of Total
Residential	643.16	36%
Commercial/Institutional	61.40	3%
Industrial	109.05	6%
Energy Generation	-	0%
Total	**813.61**	**45%**

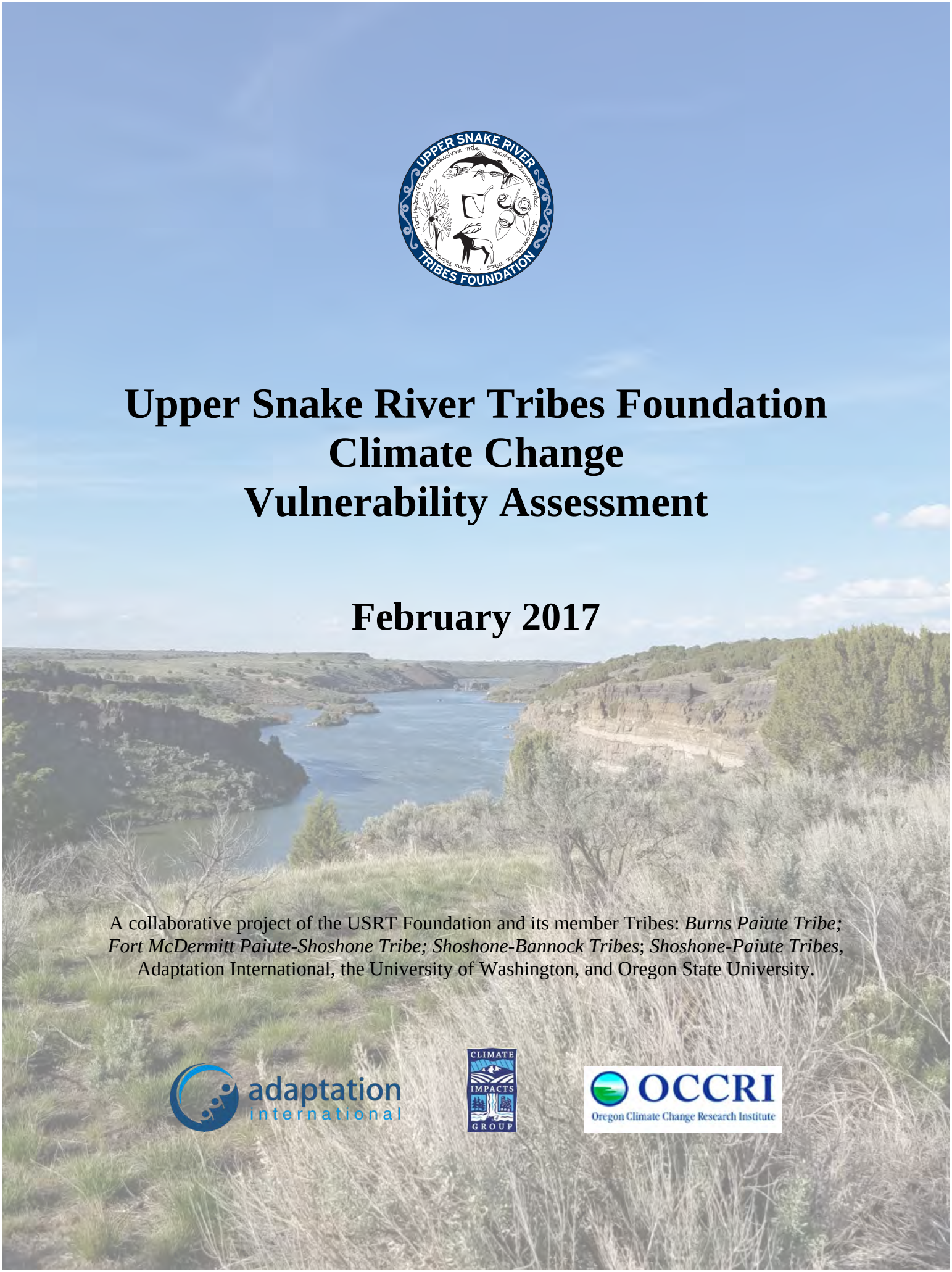




Total Emissions by Sector and Source (MT CO_2e)

Sector	Stationary	Electricity	Mobile	Solid Waste	Waste water	Water	Agriculture & Land Management	Urban Forestry	Other	TOTAL GROSS	TOTAL NET
Residential	4.40	151.44	487.33	-	-	-	-	-	-	643.16	643.16
Commercial/Institutional	0.72	60.13	-	-	0.55	-	-	-	-	61.40	61.40
Industrial	11.06	97.99	-	-	-	-	-	-	-	109.05	109.05
Energy Generation	-	-	-	-	-	-	-	-	-	-	-
Total	16.18	309.55	487.33	-	0.55	-	-	-	-	**813.61**	**813.61**

2 Appendix B – USRT Climate Vulnerability Assessment



Upper Snake River Tribes Foundation Climate Change Vulnerability Assessment

February 2017

A collaborative project of the USRT Foundation and its member Tribes: *Burns Paiute Tribe; Fort McDermitt Paiute-Shoshone Tribe; Shoshone-Bannock Tribes*; *Shoshone-Paiute Tribes*, Adaptation International, the University of Washington, and Oregon State University.

The Upper Snake River Tribes (USRT) Foundation would like to acknowledge and thank the U.S. Department of the Interior, Bureau of Indian Affairs, for their generous funding contributions to this project.

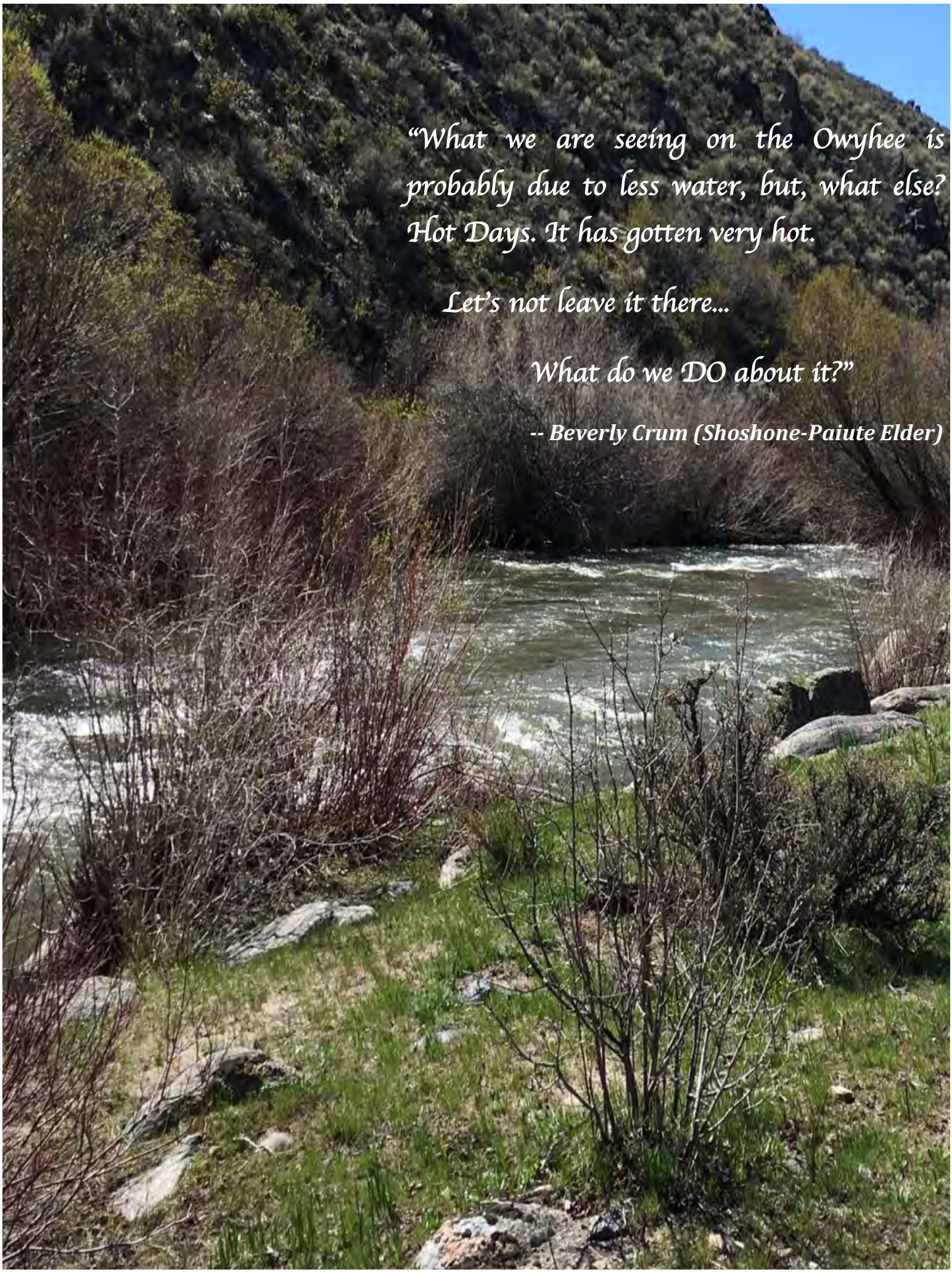
The USRT Foundation would like to acknowledge and thank the Environmental Protection Agency (EPA), Regions 9 and 10, for providing funding through the Indian General Assistance Program to assist in the completion of this report. A further thank you goes to USRT's EPA project officers Gilbert Pasqua (Region 9) and Jim Zokan (Region 10).

The USRT Foundation and the member tribes would also like to express gratitude to Alexis Malcomb, USRT office manager, and Jennifer Martinez, USRT administrator, for their dedicated work behind the scenes to administer this grant effectively, efficiently, and on schedule. Thank you, Alexis and Jennifer!

Cover Photo: Upper Snake River at Massacre Rocks. Scott Hauser. 2016

Third Page Photo: The Owyhee River on the Shoshone-Paiute Tribes of the Duck Valley Reservation. Sascha Petersen. 2016

Recommended Citation: Petersen, S., Bell, J., Hauser, S., Morgan, H., Krosby, M., Rudd, D., Sharp, D., Dello, K., and Whitley Binder, L., 2017. Upper Snake River Climate Change Vulnerability Assessment. Upper Snake River Tribes Foundation and Member Tribes. Available: http://www.uppersnakerivertribes.org/climate/



"What we are seeing on the Owyhee is probably due to less water, but, what else? Hot Days. It has gotten very hot.

Let's not leave it there...

What do we DO about it?"

-- Beverly Crum (Shoshone-Paiute Elder)

THANK YOU to the tribes involved in this project. They graciously hosted workshops and shared knowledge throughout the project.

Burns Paiute Tribe	Fort McDermitt Paiute-Shoshone Tribe	Shoshone-Bannock Tribes of the Fort Hall Reservation	Shoshone-Paiute Tribes of the Duck Valley Reservation

Special thanks to the members of our project Core Team who identified Shared Concerns across the Upper Snake River Watershed, reviewed climate projections, and offered their expertise on local climate vulnerabilities.

Core Team	Organization	Core Team	Organization
Scott Hauser	Upper Snake River Tribes Foundation	Billy Bell	Fort McDermitt Paiute-Shoshone
Bob Austin	Upper Snake River Tribes Foundation	Dan Stone	Shoshone-Bannock
Alexis Malcomb	Upper Snake River Tribes Foundation	Wayne Crue	Shoshone-Bannock
Erica Maltz	Burns Paiute	Travis Stone	Shoshone-Bannock
Jason Fenton	Burns Paiute	Ted Howard	Shoshone-Paiute
Jason Kesling	Burns Paiute	Buster Gibson	Shoshone-Paiute
Charlotte Rodrique	Burns Paiute	Carol Perugini	Shoshone-Paiute
Bradley Crutcher	Fort McDermitt Paiute-Shoshone	Jinwon Seo	Shoshone-Paiute
Duane Masters Sr.	Fort McDermitt Paiute-Shoshone	Heather Lawrence	Shoshone-Paiute
Justina Paradise	Fort McDermitt Paiute-Shoshone	Chris Cleveland	Shoshone-Paiute

Project Team	Organization	Project Team	Organization
Sascha Petersen	Adaptation International	Lara Whitley Binder	UW's Climate Impacts Group
Jake Bell	Adaptation International	Meade Krosby	UW's Climate Impacts Group
Ellu Nasser	Adaptation International	Harriet Morgan	UW's Climate Impacts Group
Kim Rodgers	Adaptation International	Kathie Dello	Oregon Climate Change Research Institute
Michelle Fox	Adaptation International	Darrin Sharp	Oregon Climate Change Research Institute
Molly Ellsworth	Adaptation International	David Rupp	Oregon Climate Change Research Institute

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I. Executive Summary

The Upper Snake River Watershed has been home to humans for more than 10,000 years. Many of their ancestors still reside on the landscape and are members of the Burns Paiute Tribe, Fort McDermitt Paiute-Shoshone Tribe, Shoshone-Bannock Tribes of the Fort Hall Reservation, and Shoshone-Paiute Tribes of the Duck Valley Reservation. Together, these four member tribes comprise the Upper Snake River Tribes (USRT) Foundation.[1]

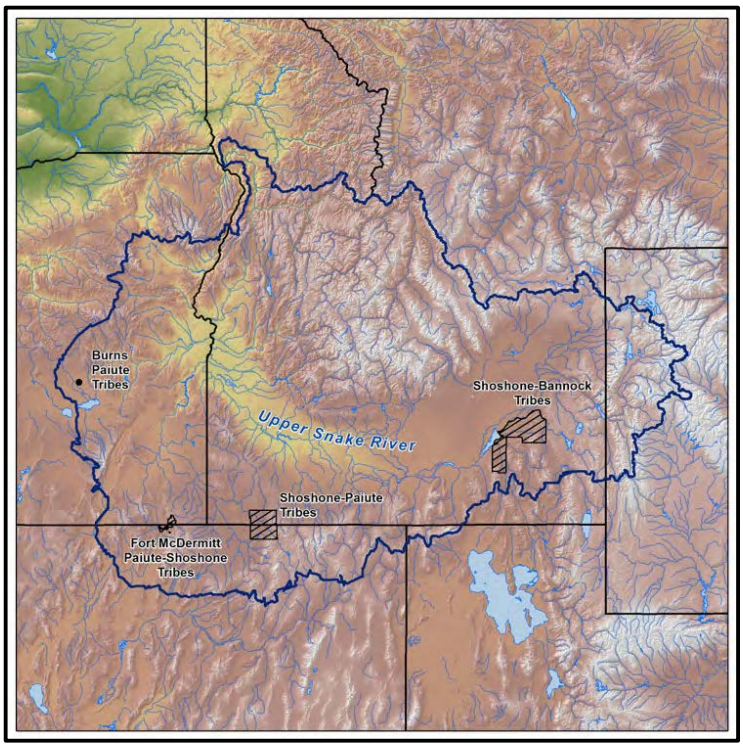


Figure 1: The Upper Snake River Watershed project area for this assessment, an area of more than 97,000 square miles.

The climate around the Upper Snake River is changing. USRT member tribes have already noticed shifts in species and habitats driven by increasing temperatures and changing precipitation patterns. Such changes in temperature and precipitation have resulted in drying sagebrush steppe habitat, extended wildfire seasons, less winter precipitation falling as snow, earlier spring run-off, low summer river flows, higher water temperatures, reduced flow from springs/seeps, proliferation of invasive weeds, and the decreasing productivity of rangelands. The project area is shown in Figure 1.

A. Collaborative Process

This collaborative vulnerability assessment expressly considered the species, habitats, and resources that are important and valuable to USRT member tribes. Climate change impacts on these resources have the potential to affect tribal members' culture, spirituality, and lifeways.

The collaboration involved the direct and ongoing participation of USRT staff and the leadership, staff, and membership of the four member tribes. Combining the best available localized climate projections with traditional knowledge, tribal priorities, and local observations was central to the success of this assessment (Figure 2).

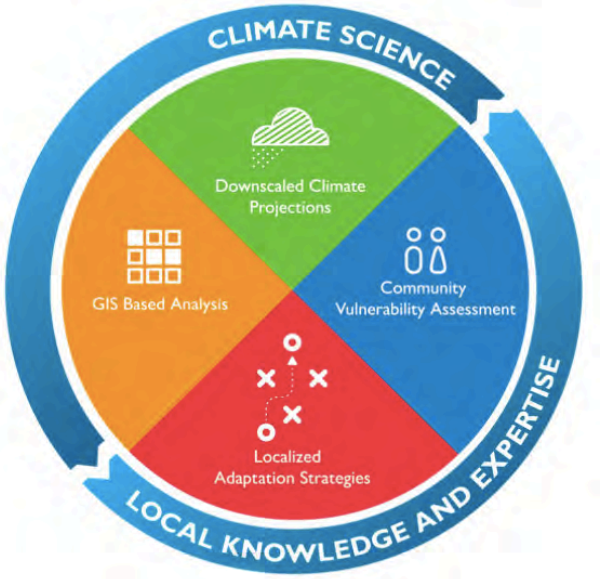


Figure 2: The collaborative process used in this project combined the best available climate science with local and traditional knowledge.

This vulnerability assessment included four steps:

1. *Analyzing downscaled temperature and precipitation projections for the project area;*
2. *Site visits to USRT member tribes' reservations to identify Shared Concerns;*
3. *Use of the NatureServe Climate Change Vulnerability Index (CCVI)[2] and other methods to determine relative vulnerability rankings; and*
4. *A collaborative vulnerability assessment workshop in Boise with USRT member tribes' staff and leadership.*

B. Downscaled Climate Projections

This assessment used the project area as a starting point for developing localized climate projections. With guidance from the Core Team, the Project Team identified three subdomains within the project area with somewhat distinct elevations, climates, and ecosystems. The Oregon Climate Change Research Institute (OCCRI) developed downscaled climate projections from the Multivariate Adaptive Constructed Analogs (MACA)[3] project for the full project area as well as the three subdomains. To focus the range of climate changes projections for the region, the Project Team selected two climate change scenarios: a lower warming scenario Representative Concentration Pathway (RCP) 4.5, an aspirational but still achievable future where global agreements and policies work to dramatically reduce greenhouse gas emissions; and a higher warming scenario, RCP 8.5, where global greenhouse gas emissions continue to increase at their present rate for the next several decades, often colloquially referred to as "business-as-usual". Details on these projections are available in Section III of the main report.

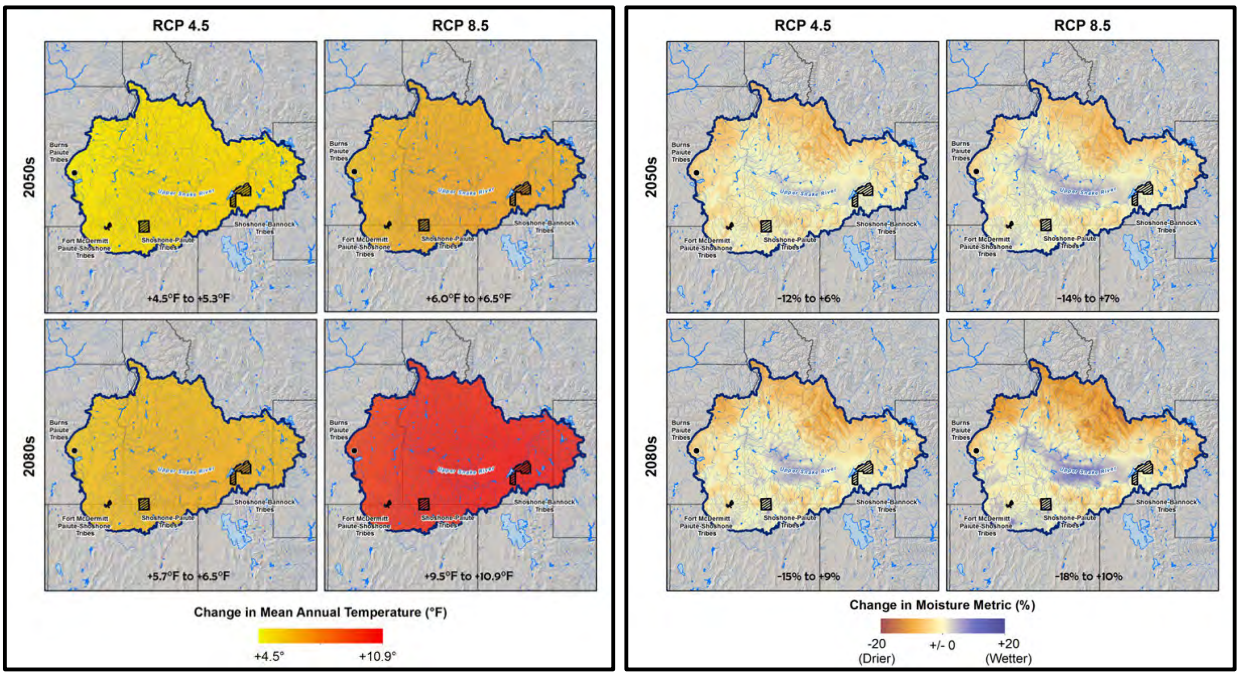


Figure 3: Projections of average annual temperature change (left) and changes to an average annual Hamon moisture metric (right) across the full project domain. For both figures, projections are provided for two different time periods (2050s upper row, and 2080s lower row) and two different climate scenarios (RCP 4.5 "less warming" - first column of both panels, and RCP 8.5 "more warming" – second column of both panels).

The downscaled climate projections provide information on potential future temperature, precipitation, and evapotranspiration on seasonal and annual time-frames. This information was analyzed by the Core Team, tribal leaders, and tribal members during site visits and the collaborative workshop. They were also utilized in the CCVI vulnerability ranking tool.

Oftentimes *annual* climate change projections do not tell the complete story of shifting climate variables within the seasons and how species, habitats, and ecosystems will be differentially affected. Seasonal projections can help tell that story. Below are the seasonal climate change projections for the "South" subdomain, which broadly covers the Upper Snake River Plains and most of the USRT member tribes' reservations (Figure 4).

Seasonal Climate Change Projections for the South Subdomain of the Upper Snake River Watershed in the 2050s

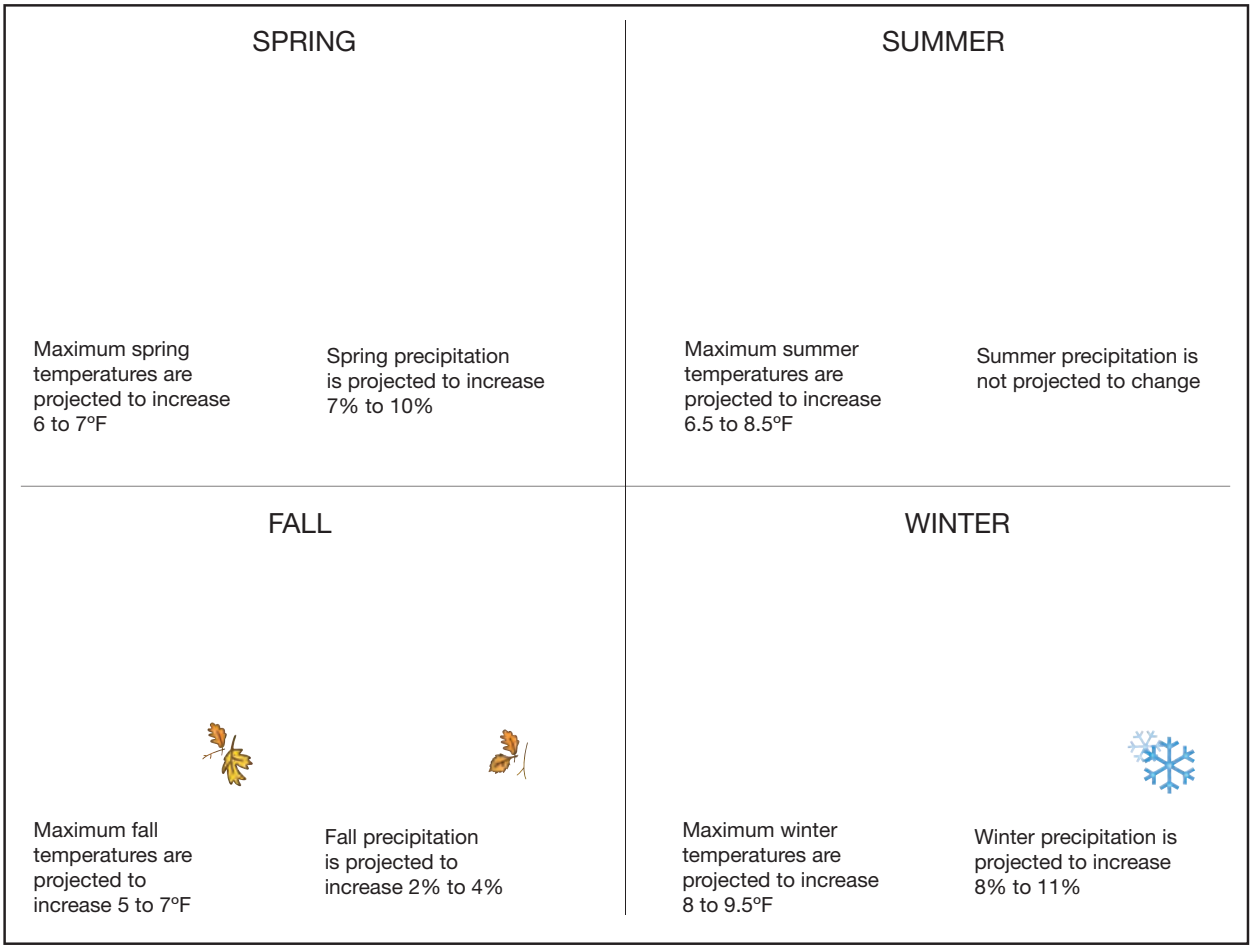


Figure 4: Seasonal temperature and precipitation projections for the 2050s (2040-2069) in the South subdomain of the Upper Snake River Watershed. Temperature increases and percent precipitation change are relative to modeled historical averages from 1950-2005. The range of values represent the average of the lower climate scenario model projections (RCP 4.5) and the average of the higher climate scenario model projections (RCP 8.5) across all models.

C. Site Visits and Shared Concerns

The project was led by a Core Team composed of leadership and staff from USRT's four member tribes and USRT (see Section IV for more details on the Core Team and the project process). The

Core Team attended and helped organize site visits to each of the four tribes' reservations in April 2016. During these site visits, the tribes identified many species, habitats, and resources they had seen affected by changing climate conditions or they were concerned about being affected by future climate change. Concerns that were documented by two or more tribes are considered Shared Concerns. Due to time and budget constraints, the complete list of Shared Concerns was not assessed during this project. While not comprehensive, the set of 28 Shared Concerns assessed for climate change vulnerability in this project provided a balanced cross-section of the species, habitats, and resource issues important to the USRT member tribes (Table 1).

Table 1: Shared Concerns identified by the USRT member tribes and assessed over the course of this project. Those assessed quantitatively using the CCVI are indicated with an "X." All other concerns were assessed qualitatively.

Plant Species	Assessed with CCVI Tool
Antelope Bitterbrush	
Big Sagebrush	X
Black Cottonwood	X
Camas Root	
Common Chokecherry	X
Geyer's Willow	X
Meadow Hay	
Noxious Weed: Medusahead	
Noxious Weed: Whitetop	
Quaking Aspen	X
Redosier Dogwood (Red Willow)	X

Animal Species	Assessed with CCVI Tool
Beaver	X
Black-tailed Jackrabbit	X
Bull Trout	X
Cattle	
Chinook Salmon	X
Columbia Spotted Frog	X
Elk	X
Golden Eagle	X
Mule Deer	X
Redband Trout	X
Steelhead	X

Habitats	Assessed with CCVI Tool
Sagebrush Steppe	
Riparian	
Wet-meadow	
Springs and Seeps	

Resource Issues	Assessed with CCVI Tool
Asthma	
Wildfire	

D. Climate Change Vulnerability Index (CCVI)

NatureServe's CCVI tool was used to analyze the climate change vulnerability of species identified as Shared Concerns. The CCVI tool utilizes data inputs that include: projections of changes in air temperature and moisture availability, species range data, and species-specific life history characteristics. These data are used to calculate a species' relative vulnerability ranking using 23 distinct factors that affect the species' climate change exposure[i], sensitivity, and adaptive capacity.

[i] The CCVI tool defines these terms as follows. *CCVI Exposure*: Projected climate change (shifts in temperature and moisture) across the range of the species within the assessment area. *CCVI Sensitivity*: The extent to which a species will respond to shifts in climate. *CCVI Adaptive capacity*: The ability of the species to withstand environmental changes.

Based on these calculations, species are assigned one of four climate change vulnerability rankings.

(1) **Extremely Vulnerable**: Species abundance and/or range extent within the project area is extremely likely to substantially decrease or disappear.

(2) **Highly Vulnerable**: Species abundance and/or range extent within the project area is likely to decrease significantly.

(3) **Moderately Vulnerable**: Species abundance and/or range extent within the project area is likely to decrease.

(4) **Less Vulnerable**: Available evidence does not suggest that species abundance and/or range extent within the project area will change substantially, though there may be changes elsewhere across the species' full range.

The CCVI tool was used to generate draft *quantitative* vulnerability rankings for the 16 plant and animal species that had sufficient range and life history data to use the tool. The remaining 12 Shared Concerns were given draft *qualitative* vulnerability rankings based on available research and local knowledge, and in some cases sensitivity information from the CCVI.

E. Collaborative Workshop and Final Results

An essential step in this project process was the collaborative vulnerability assessment workshop held July 28, 2016 in Boise, Idaho. Two members of the Project Team and ten members of the Core Team, representing USRT and each of the four USRT member tribes, gathered for this one-day workshop. The focus of the workshop was to incorporate local and traditional knowledge into the draft vulnerability assessment results for each of the Shared Concerns.

This collaborative review was accomplished using a combination of large group discussions and small group breakout sessions during which the Core Team members reviewed, evaluated, and commented on the *quantitative* and *qualitative* results of the CCVI assessment process for each of the Shared Concerns. Local knowledge was extremely valuable in modifying these results to account for local variance in factors of exposure, sensitivity, and adaptive capacity, such as: local changes in the landscape, observed interactions between species, and species' existing response to extreme weather, climate change, and changes in habitat. Ultimately, incorporation of this information led to an adjustment of 19 individual factors affecting vulnerability and the re-ranking of one species' relative vulnerability ranking.

Figure 5: Photos from the Collaborative Vulnerability Assessment Workshop. Photo credit: Sascha Petersen.

Following review and update by the Core Team at the vulnerability assessment workshop, Table 2 presents the final vulnerability rankings for the Shared Concerns species assessed *quantitatively* in this assessment.

Table 2: Overall vulnerability rankings for the 16 quantitatively assessed species of Shared Concern for the 2050s. Column titles reflect the climate change scenario with less warming (RCP 4.5) and more warming (RCP 8.5). Labels are the overall vulnerability ranking: EV = Extremely Vulnerable; HV = Highly Vulnerable; MV = Moderately Vulnerable, and LV = Less Vulnerable.

Species	2050s RCP4.5	2050s RCP8.5
Bull Trout	EV	EV
Chinook Salmon	EV	EV
Redband Trout	EV	EV
Steelhead	EV	EV
Columbia Spotted Frog	HV	EV
Big Sagebrush	MV	HV
Black-tailed Jackrabbit	MV	HV
Elk	MV	HV
Mule Deer	LV	MV
Black Cottonwood	LV	MV
Quaking Aspen	LV	MV
Golden Eagle	LV	LV
American Beaver	LV	LV
Common Chokecherry	LV	LV
Geyer's Willow	LV	LV
Redosier Dogwood	LV	LV

F. Next Steps

Planning for and adapting to climate change is a process and not the outcome of a single project. This assessment is the first in a series of three steps USRT and its member tribes plan to undertake over the next several years as part of a comprehensive climate change effort, including:

- Climate Change Vulnerability Assessment – *Completed in early 2017;*
- Adaptation Plan – *To be completed in 2017-18;* and
- Implementing Adaptation Actions and Monitoring – *Dependent on future funding.*

Strengthened collaboration between the four tribes and assessment of their Shared Concerns under regional climate change was, perhaps, the most important outcome of this assessment. The collaborative results of this assessment help establish a common foundation for future adaptation efforts among and between the USRT member tribes. The species-specific vulnerability information in this report can assist in the development of truly localized adaptation strategies and actions that minimize the negative effects of climate change and take advantage of emerging opportunities. Continued collaboration and action to address these vulnerabilities and prepare for the future will help ensure that the tribes who have lived and subsisted in the Upper Snake River Watershed for thousands of years will continue to thrive for generations to come.

II. Introduction

The Upper Snake River Watershed has been home to Indian tribes for more than 10,000 years. Many of their ancestors still reside on the landscape and are members of the Burns Paiute Tribe, Fort McDermitt Paiute-Shoshone Tribe, Shoshone-Bannock Tribes of the Fort Hall Reservation, and Shoshone-Paiute Tribes of the Duck Valley Reservation; the four member tribes of USRT.[4]

Maintaining a cultural tradition on a landscape over the course of more than 10,000 years is fundamentally an exercise in effective adaptation. In the Upper Snake River Watershed, this time-period included: a transition out of an ice age; mass emergence and migration of plants and animals; and the collision of societies, materials and goods, and disease from the opposite side of the world. USRT member tribes now face the environmental, societal, and cultural effects of human-driven global climate change and will look both to their proven cultural strengths and the adoption of innovative techniques to continue to successfully adapt and thrive on the landscape.

The climate around the Upper Snake River is changing. Tribal members have already noticed changes in precipitation patterns, increasing temperatures, and shifts in species and habitats. Such changes have manifested themselves in impacts such as drying sagebrush steppe habitat, extended wildfire seasons, less winter precipitation falling as snow, earlier spring run-off, low summer streamflows, high water temperatures, reduced flow from springs/seeps, proliferation of invasive weeds, and diminishing productivity of rangelands.

Figure 6: Photos from Site Visits to USRT Member Tribes' Reservations. Clockwise from top left: Shoshone-Paiute, Shoshone-Bannock, Fort McDermitt Paiute Shoshone, and Burns Paiute. Photo credits: Sascha Petersen and Scott Hauser.

To better understand these changes, USRT and its four member tribes collaborated with Adaptation International, the University of Washington's Climate Impacts Group, and the Oregon Climate Change Research Institute, to complete a climate change vulnerability assessment. This assessment is the first in a series of three steps USRT plans to undertake over the next several years as part of a comprehensive climate change response that includes:

- Conducting a Climate Change Vulnerability Assessment – *Completed in 2017;*
- Developing a Climate Change Adaptation Plan – *To be completed in 2017-18;* and
- Implementing Adaptation Actions and Monitoring – *Dependent on future funding.*

The information gathered during this vulnerability assessment will provide the foundation for developing adaptation strategies and actions that assist USRT member tribes in successfully minimizing the negative effects of climate change, while also taking advantage of any positive opportunities that may arise. Participation by tribal leadership, membership, and staff in conference calls, webinars, meetings, and site visits were key to the success of the vulnerability assessment and will continue to be invaluable in future efforts to prepare for and respond to climate change.

This collaborative assessment expressly considered the species, habitats, and resources that are important and valuable to USRT member tribes. Climate change impacts on these resources have the potential to affect tribal members' culture, spirituality, and lifeways. Tribal governments and other tribal entities will likely realize cost savings by integrating the results of this climate change vulnerability assessment into their existing wildlife management, community development, and/or other long-range plans.

A. Background on USRT and Member Tribes

Recognizing the four USRT member tribes' historical use of the landscape, which extends beyond the boundaries of their current reservations, this climate change vulnerability assessment applies to the complete Upper Snake River Watershed, an area of 97,060 square miles (~ 62,118,234 acres) shown within the blue polygon in Figure 7. The tribes maintain and utilize rights to resources, cultural properties, and practices that occur in this area, which include but are not limited to hunting, fishing, gathering, and subsistence uses.

Upper Snake River Tribes Foundation

The USRT Foundation is a 501(c)(3) non-profit corporation, composed of four Indian tribes that currently live in the Upper Snake River Watershed in Idaho, Nevada, and Oregon: Burns Paiute Tribe, Fort McDermitt Paiute-Shoshone Tribe, Shoshone-Bannock Tribes of the Fort Hall Reservation, and Shoshone-Paiute Tribes of the Duck Valley Reservation. In 2007, the USRT Charter was adopted pursuant to the Motherhood Document of 1998. USRT's primary goals are to facilitate tribal unity to protect and nurture all compacting tribes' rights, languages, cultures, and traditions in addressing issues related to the Snake River Basin. USRT priorities include the sustained availability of fish and wildlife, land, water, and air, cultural resources, and the federal trust responsibility.

The four member tribes have common vested interests in protecting rights reserved through the United States Constitution, federal treaties, federal unratified treaties, executive orders, inherent rights, and aboriginal title to the land, which has never been extinguished by USRT member tribes. USRT works to ensure the protection, enhancement, and preservation of the tribes' rights, resources, cultural properties, and practices. These rights include but are not limited to hunting, fishing, gathering, and subsistence uses.

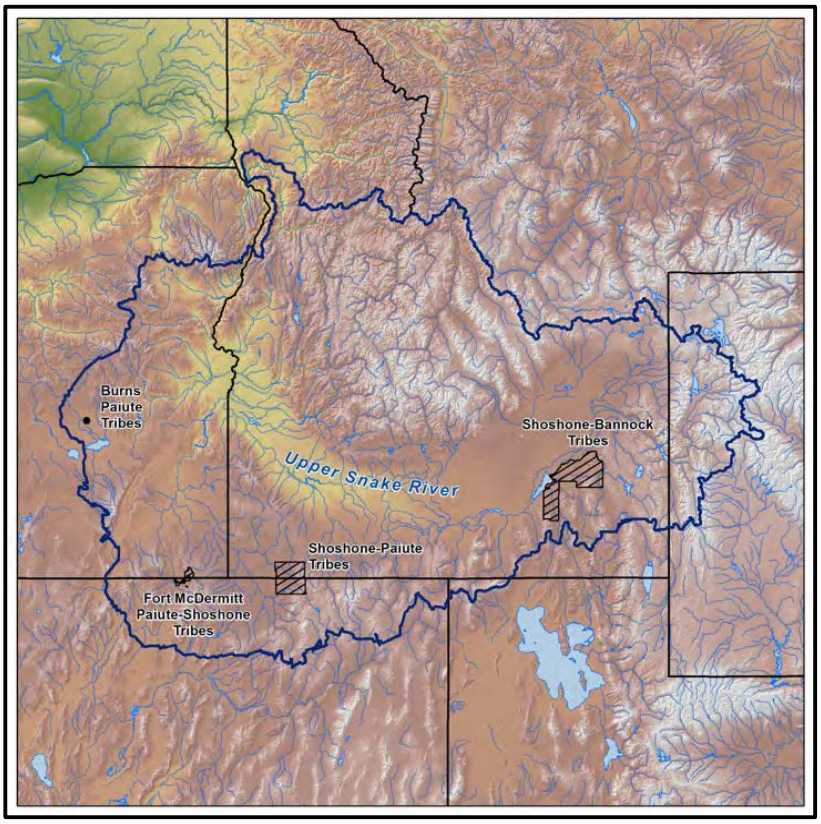


Figure 7: Upper Snake River Watershed study area (dark blue boundary), along with the four USRT member tribes' reservations and locations (black dots and shaded areas).

Several years ago, the USRT Commission recognized that the effects of climate change could impact the goals of the USRT Charter. Since 2012, USRT has been working to: identify climate impacts that affect USRT's member tribes, attend climate change trainings and workshops, and seek funding to complete work on climate change planning. In 2015, USRT received funding from the Bureau of Indian Affairs and Environmental Protection Agency (Regions 9 and 10) to conduct a climate change vulnerability assessment for the Upper Snake River Watershed.

Burns Paiute Tribe

The Burns Paiute Reservation is composed of 760 acres north of Burns, Oregon, in the arid region of the Great Basin,[5] with a total of 966 acres held in trust by the Tribe. There are approximately 412 people who hold membership with the Burns-Paiute Tribe.[6] They consist primarily of descendants of the Wadatika (Wada Root eaters) Band of Northern Paiute Indians, along with surviving peoples of six other eastern Oregon Northern Paiute bands.[7]

The Tribe's aboriginal territory and traditional use areas include portions of the Cascade Mountains, the Columbia River, the western Great Basin, and the High Plains/Plateau of western Idaho. Major campsites were historically along lakes, streams, and rivers, where water sources as well as food could be harvested. The Paiutes used willow, tule plant, and sagebrush to make baskets, sandals, fishing nets, and traps. The resources found within this ancestral territory were visited seasonally and sustained the Wadatika, providing for their material, spiritual, and medicinal needs.[8] The natural resources of the Upper Snake River Watershed continue to sustain the dietary, cultural, spiritual, and economic needs of the Burns Paiute Tribe.

Fort McDermitt Paiute-Shoshone Tribe

The Fort McDermitt Paiute-Shoshone Tribe's Reservation spans the Nevada–Oregon border, in Humboldt County, Nevada, and Malheur County, Oregon, near the Quinn River, which runs through the Tribe's Nevada lands, east to west. The reservation includes 16,354 acres in Nevada and 19,000 acres in Oregon. There are 1,016 enrolled members of the Fort McDermitt Paiute-Shoshone Tribe.[9] The valley of the Quinn River was the location of a winter campsite utilized by nomadic Northern Paiutes and a few Western Shoshone peoples, when it was occupied by the cavalry for a military fort in the 1860's and eventually closed in the 1890's.

The Paiute in this area became known as the "Northern Paiute" and are related culturally and linguistically to the Shoshone, Bannock, and other tribes of the region. They had traditional seasonal territory ranging from the southwest into Nevada, Oregon, and southwestern Idaho. Paiute bands in the Great Basin typically ate roots, seeds, fish, small mammals, birds, waterfowl, and some larger animals like antelope, deer, and mountain sheep. The natural resources of the Upper Snake River Watershed continue to sustain the dietary, cultural, spiritual, and economic needs of the Fort McDermitt Paiute-Shoshone Tribe.

Shoshone-Bannock Tribes of the Fort Hall Reservation

The Fort Hall Reservation is in the eastern Snake River Plain of southeastern Idaho, north and west of the town of Pocatello. Initially the Reservation was 1.8 million acres, an amount that was reduced to 1.2 million acres in 1872, the result of a survey error. The Reservation was further reduced to its present size (546,500 acres) through subsequent legislation and the allotment process. [10] There are more than 5,800 people who hold membership with the Shoshone-Bannock Tribes.[11] When the Northern Paiutes left the Nevada and Utah regions for southern Idaho in the 1600s, they began to travel with the Shoshones in pursuit of buffalo. They became known as the Bannocks.

The Tribes generally subsisted as hunters and gatherers, traveling during the spring and summer seasons, collecting foods for use during the winter months. They hunted wild game, fished the region's abundant and bountiful streams and rivers (primarily for salmon), and collected native plants and roots such as the camas bulb. The natural resources of the Upper Snake River Watershed continue to sustain the dietary, cultural, spiritual, and economic needs of the Shoshone-Bannock Tribes of the Fort Hall Reservation.

The Snake and Blackfoot rivers and the American Falls Reservoir border the Reservation on the north and northwest. In addition to vast populations of fish, there are moose, deer, wild horses, and buffalo in the area. The ecosystem faces ongoing environmental challenges, such as loss of vegetation, erosion of stream banks, warmer water temperatures, and siltation in spawning gravels brought on by unrestricted grazing and rapid flooding.

Shoshone-Paiute Tribes of the Duck Valley Reservation

Descendants of the Western Shoshone and the Northern Paiute occupy the Duck Valley Reservation on the border of southwestern Idaho and northeastern Nevada along the East Fork of the Owyhee River.[12] The reservation is 289,819 acres, including 22,231 acres of wetlands. There are approximately 2,200 people who hold membership with the Shoshone-Paiute Tribes.[13] The Tribes once traveled seasonally through the land which is now the tristate area of Idaho, Nevada,

and Oregon and beyond. The Reservation was established in 1886 for the Western Shoshone and was later expanded in 1910 for the Northern Paiute through respective executive orders.

The Tribes' lifestyle was well adapted to the desert environment in which they lived. Each band or tribe generally centered on a lake or wetland, which supplied fish and waterfowl for subsistence. Surrounding areas provided salmon, steelhead, rabbits, pronghorns, pinyon nuts, grass seeds, and roots as important parts of their diet. The natural resources of the Upper Snake River Watershed continue to sustain the dietary, cultural, spiritual, and economic needs of the Shoshone-Paiute Tribes of the Duck Valley Reservation.

B. USRT Project Scope and Objectives

As the USRT member tribes' diverse experiences within the same shared region illustrate, the Upper Snake River Watershed encompasses a complex and unique range of ecosystems, plants, and animals. The large geographic scope of the project provided the bounds of the localized climate change projections (Section III). The diversity of natural resources throughout the region is reflected in the range of Shared Concerns identified by the USRT member tribes in this project (see Section IV, Table 5).

USRT identified the following seven objectives for completing a climate change vulnerability assessment for the Upper Snake River Watershed and USRT's member tribes' reservations.

- Identify the audience for the climate change vulnerability assessment.
- Engage tribal leadership, staff, and membership during development of the vulnerability assessment.
- Identify species, habitats, and waterbodies most vulnerable to climate change.
- Integrate Traditional Ecological Knowledge to inform climate change planning and ensure its relevance.
- Complete a climate change vulnerability assessment to position USRT effectively for future adaptation planning and implementation.
- Increase ability to achieve future conservation and subsistence goals and objectives in the face of added impacts and complexities of climate change, alongside other stressors.
- Incorporate adaptive management planning into all USRT member tribes' fish and wildlife, natural resources, and other relevant land management plans to better reflect future changing conditions and resource requirements.

III. Climate Change in the Upper Snake River Watershed

Climate is the long-term average of weather over a given area; whereas *weather* is what is happening in the atmosphere at a given place and time. For example: in Boise, the temperature and amount of rain on a given day is the *weather*, while the average precipitation in December (typically over a 30-year span) is the *climate*. Climate can be calculated across different spatial scales: globally, regionally, and locally. Each scale is useful for understanding a component of the climate system. For this assessment, the climate analysis starts at the global scale, but quickly downscales to the Upper Snake River Watershed, as it is most relevant to the USRT member tribes' climate change preparedness work.

A. Changing Climate Conditions

Global average annual temperature has increased about 1.5˚ Fahrenheit from 1880 to 2012, as calculated using a combination of observations and measurements based on thermometers, satellites, and other means. This may seem like a small increase, but globally, this change is beyond the range of natural variability or annual and decadal changes that occur under the influence of climate events such as the El Niño Southern Oscillation.[14] More than half of the warming observed from 1951-2010 is attributed to human activities,[15] such as the burning of fossil fuels, which release heat-trapping greenhouse gasses (e.g. carbon dioxide, CO_2) into the Earth's atmosphere. This increase in temperature has caused many environmental changes that have been measured around the world (Figure 8).[16]

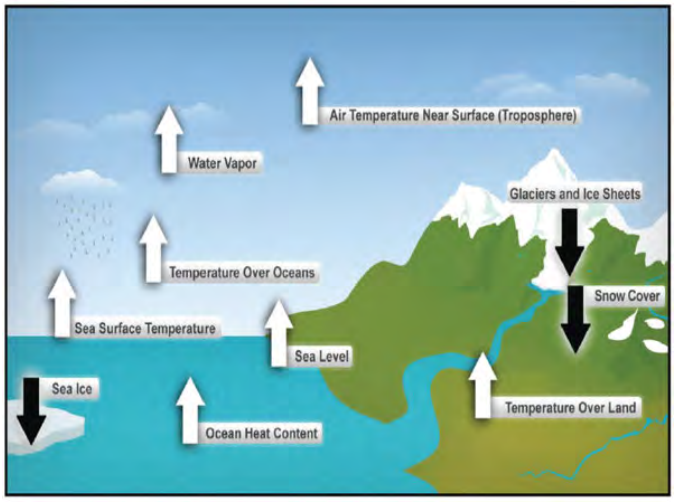


Figure 8: Some of the global indicators showing that the Earth's climate is warming. White arrows indicate increasing trends while black arrows indicate decreasing trends.[16]

The USRT member tribes have been documenting changes on the land for many centuries. Direct observations and measurements of temperature and precipitation around the region can be used to help understand these changes over the last 100 years. Figure 9 show changes in temperature across the inland Pacific Northwest during the period 1895-2014.[17] Annual temperature has increased at

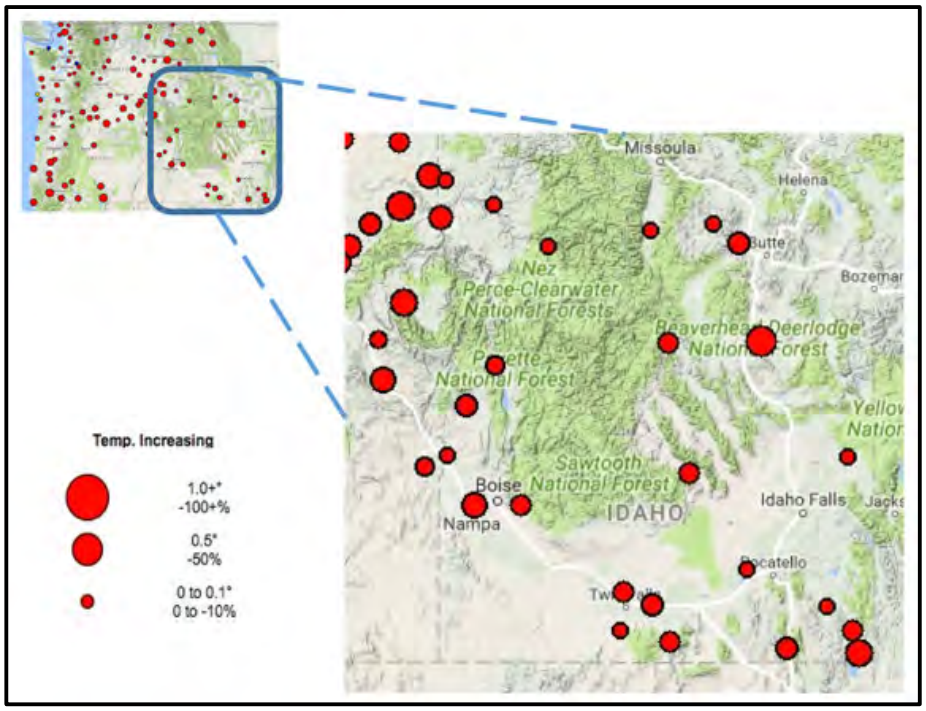


Figure 9: Past change in temperature at long-term climate station locations in the Pacific Northwest from 1895-2014.[17]

all stations across the domain, though by different amounts. Averaged over the entire Pacific Northwest, temperature has increased about 1.3˚ Fahrenheit[18] over that time.

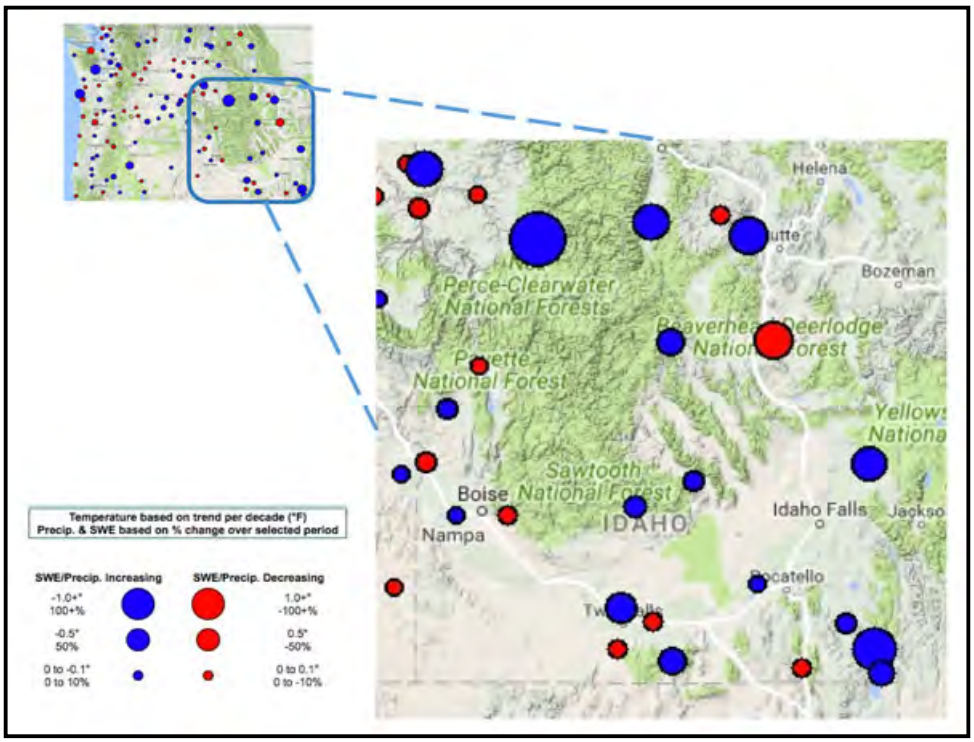


Figure 10: Past change in precipitation at long-term climate stations in the Pacific Northwest from 1895-2014.[19]

Changes in precipitation have been much more variable. Some stations in the Pacific Northwest have shown an increase in annual precipitation, others a decrease over the same 1895-2014 time period.[19] Averaged over the area, there is not much of a trend in the change in annual precipitation over that time.[20] Seasonal trends in precipitation are explored in the detailed analysis of climate projections completed for this project (Section III.D.).

B. Climate Projections

Climate projections refer to the output from global and regional-scale climate models and should not be considered "forecasts" but instead attempts to answer a "what if?" question. These projections are simulations of *what* the climate might be like *if* society follows a particular trajectory of greenhouse gas emissions. The amount of greenhouse gasses the global society ultimately emits will be determined by factors like: global population growth, changes in global economic activity, and preferred energy sources (e.g., the balance of fossil fuels vs. clean energy technologies).

The latest generation of global climate models uses a set of future scenarios called Representative Concentration Pathways (RCP). Each RCP scenario represents a trajectory of atmospheric concentrations of greenhouse gases to, and beyond, the end of the 21st century, and provides a flexible way of defining a set of climate futures that make a variety of socio-economic assumptions.[21] This report focuses on two of the scenarios, RCP 4.5 and RCP 8.5. RCP 4.5 represents a future where global agreements and policies work to dramatically reduce greenhouse

gas emissions. In RCP 4.5, greenhouse gas emissions peak in the 2040s, then decline. The socio-economic assumptions of RCP 4.5 are largely aspirational, but still achievable with significant global action in the next decade. RCP 8.5 assumes continued dominance of fossil fuel energy sources, where global greenhouse gas emissions continue to increase at their present rate for the next several decades. RCP 8.5 is often colloquially referred to as the "business-as-usual" scenario. RCP 4.5 and 8.5 scenarios provide a range of possible future global and regional temperatures and precipitation trends, with more significant changes projected in the RCP 8.5 scenario.

While it is useful to understand global climate change projections, it is the regional and local projections that are most important for assessing the potential impacts to the habitats, plants, and animal species and other resources important to the USRT member tribes. To develop regional projections of a future climate, scientists downscale global climate model outputs using a series of statistical and/or dynamical (modeled) processes. This assessment presents the future regional projections of climate using a downscaled dataset called the Multivariate Adaptive Constructed Analogs (MACA).[22]

C. Study Area and Data

The Project Team selected the large boundary for the project (shown in blue in Figure 11) based on watershed boundaries that encompass the four USRT member tribes. The 97,060 square miles (62,118,234 acres) included in the assessment covers large sections of southern Idaho and eastern Oregon, and small portions of northern Nevada, northern Utah, and western Wyoming.

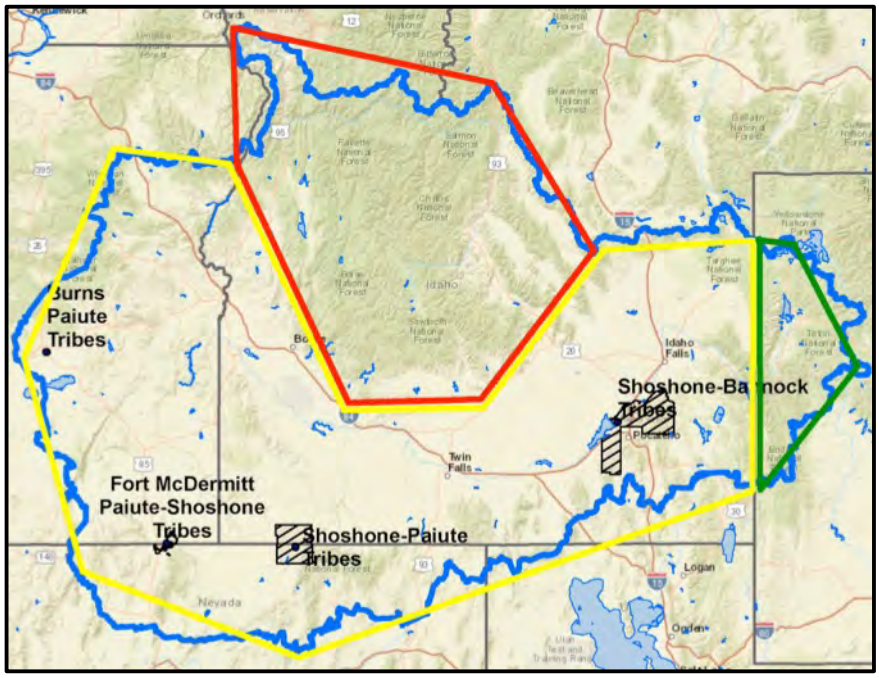


Figure 11: Study area (blue polygon – 97,060 square miles) and subdomains (red - North, yellow - South, and green –East, polygons) used for climate analysis.

This larger domain was divided into three smaller subdomains, each with somewhat distinct elevations, climates, and ecosystems. These subdomains are hereby referred to as the North (shown outlined in red), South (outlined in yellow), and East (outlined in green) (Figure 11). Downscaled climate projections from the region are from 20 global climate models (GCMs) run with two emissions scenarios (RCPs 4.5 and 8.5). These outputs were used to calculate potential future

changes in temperature and precipitation. Since climate is considered the long-term (>30-year) average of weather for a specific location, it is important that changes be compared between multi-decadal periods. These projections were analyzed in reference to a baseline period (1950-2005) for three future time periods: the 2030s (which represents the years 2020-2049), the 2050s (which represents the years 2040-2069), and the 2080s (which represents the years 2070-2099). While most of the figures in the next section focus on either the 2050s or the 2080s, the full set of projections for each domain and each time-period are available in Appendix A.

D. Future Change in the Upper Snake River Watershed

Temperature

Across the entire project area and the three subdomains, average annual temperatures are projected to increase in both future climate scenarios and across all time periods. RCP 4.5 (left column in Figure 12) shows a smaller magnitude of warming in both mid-century (2050s - first row Figure 12) and late century (2080s - second row Figure 12) than RCP 8.5 (right column Figure 12). Mid-century annual average temperature under RCP 8.5 (6.0-6.5°F) is projected to be similar to end of the century warming under RCP 4.5 (5.7-6.5°F). Figure 12 displays the average value of the 20 models. Figures in Appendix A show the individual model outputs and the complete range of future projections by RCP in each subdomain.

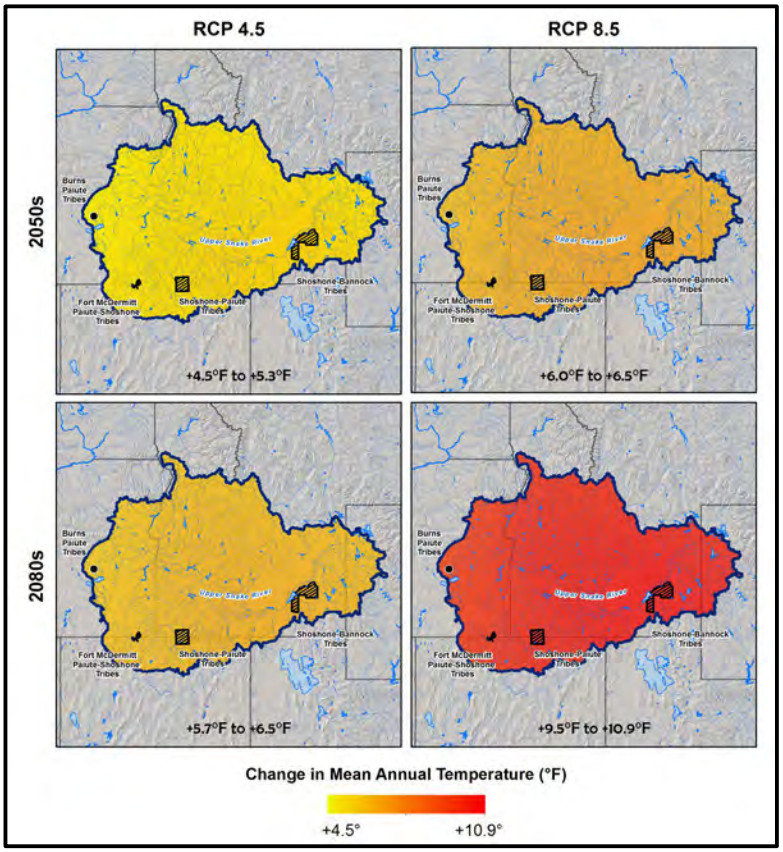


Figure 12: Future projected change in temperature through 21st century in the full project domain.

Presented in another way, Figure 13 shows the projected annual temperature in the South subdomain over time. The light lines are the individual model results and illustrate how temperature varies year to year. The dark lines are the average of all 20 models and more closely represent the general climate trend. Modeled historical temperatures for the subdomain are shown in gray and projected future temperatures are shown in yellow (RCP 4.5) and in red (RCP 8.5).

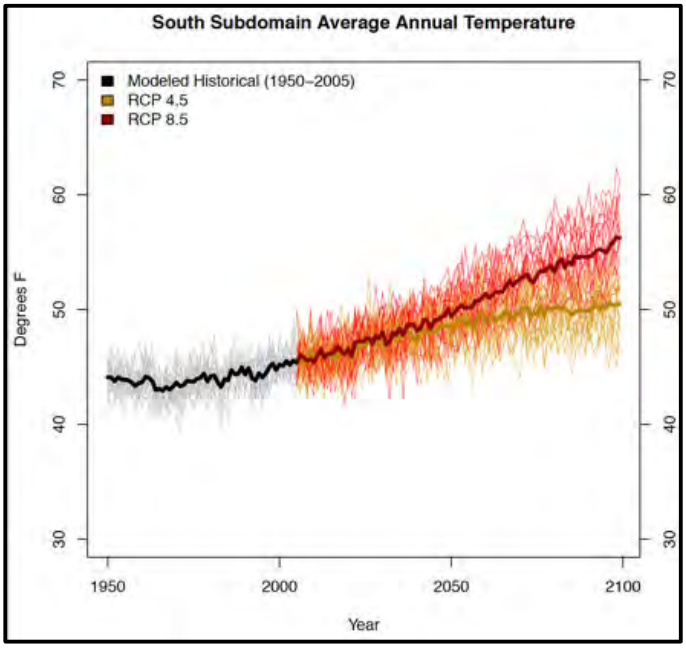


Figure 13: Average annual temperature projections for the South domain. Modeled historical past shown in gray. Future projections shown in Yellow (RCP 4.5) and Red (RCP 8.5), where light colored lines are the individual model results and the dark lines are the average of all 20 climate models.

Seasonal temperature projections are generally more relevant for species-level vulnerability assessment purposes. Much like annual temperature, each season is projected to be warmer in the future. RCP 4.5 shows slightly less warming in all seasons than the RCP 8.5 scenario. Winter and summer are projected to warm the most significantly from historical conditions in all domains. The largest increase in temperature is in the South subdomain, which includes the lower elevation and historically warmer areas in the region.

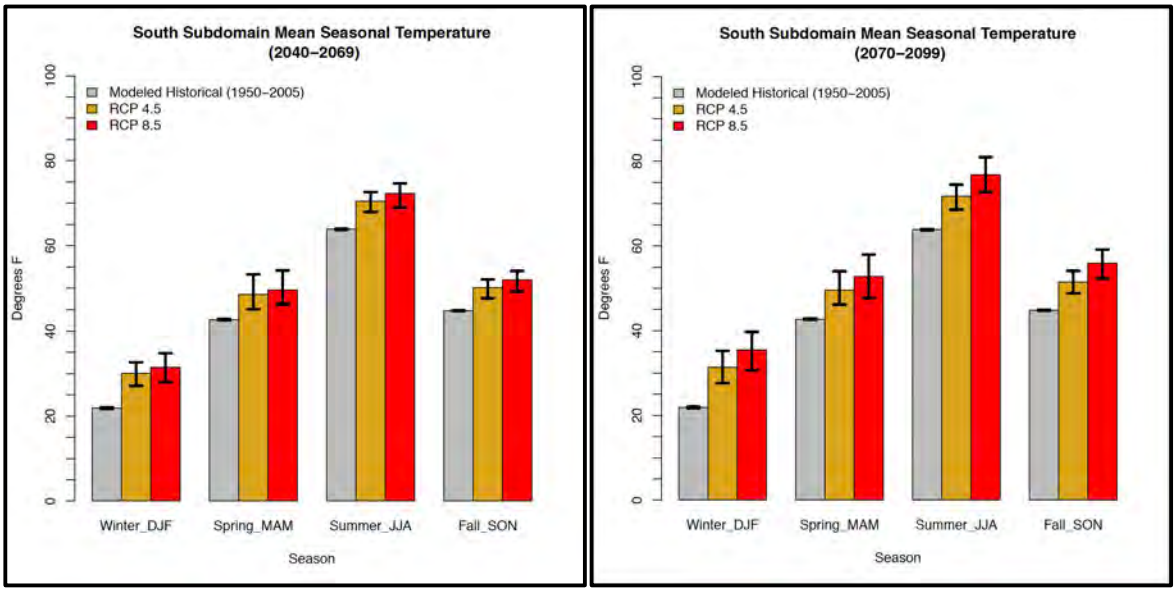


Figure 14: Seasonal average temperature projections for the South subdomain for two time periods analyzed. The modeled historical past for the subdomain is shown in gray and the two RCP scenarios are shown in the different colors (yellow is RCP 4.5 and red is RCP 8.5). Projections are displayed for time periods, 2040-2069 and 2070-2099. Bar heights show the mean from 20 climate models and the vertical lines show the range of all 20 climate models.

Precipitation

Average annual precipitation is not projected to change much in either RCP 4.5 or RCP 8.5 through the 21st century. Figure 15 shows the projected average annual precipitation in the South subdomain over time. The lighter lines are the individual model results and the darker lines are the average of all 20 models. Modeled historical precipitation for the subdomain is shown in gray and projected future precipitation is shown in light blue (RCP 4.5) and dark blue (RCP 8.5). The mean of both scenarios (bolded blue lines) shows only a slight increase over time, and this increase is much smaller than the year-to-year variability shown by the individual models.

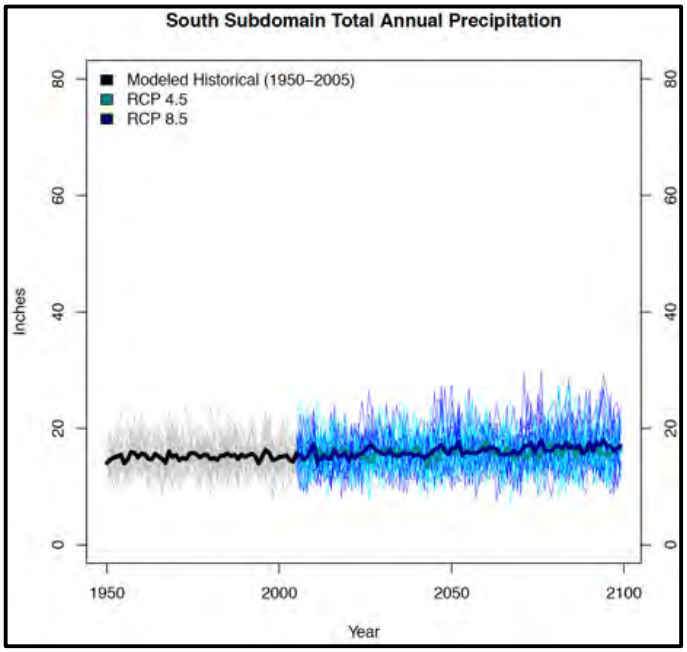


Figure 15: Average annual precipitation projections for the South subdomain. Modeled historical past shown in gray. Future projections shown in light blue (RCP 4.5) and dark blue (RCP 8.5), where light colored lines are the individual model results and the dark lines are the average of all 20 climate models.

Seasonal changes in precipitation may be the most useful projections for planning purposes. Winter and spring are projected to get wetter in all three subdomains, with the largest increase in the higher elevation North and East subdomains. There is little projected precipitation change for summer and fall seasons, for both time periods under both scenarios and across all subdomains, apart from possibly slightly drier summers in the North (see Figure 16).

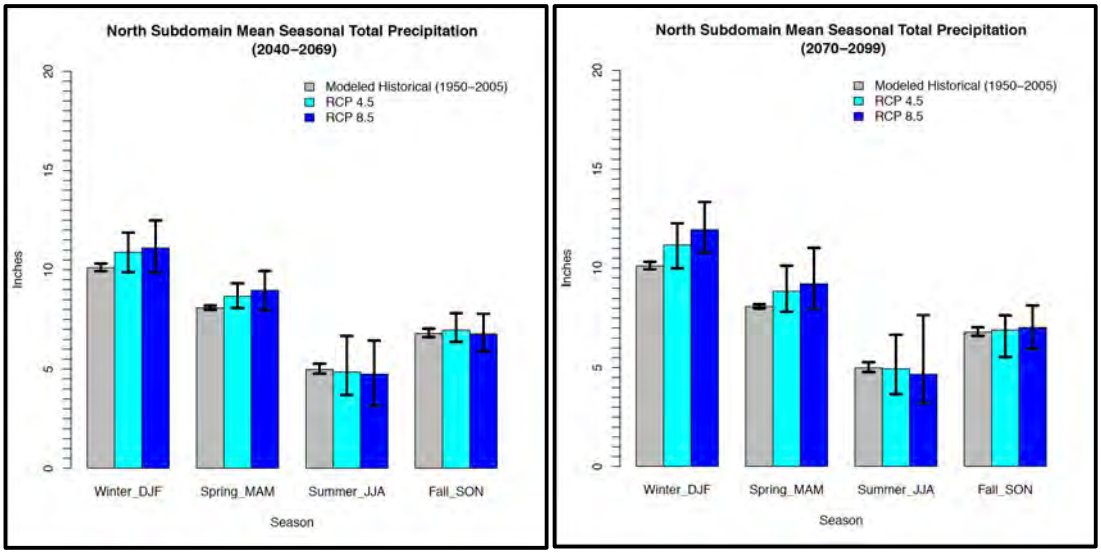


Figure 16: Seasonal precipitation projections for the North subdomain for two of the time-periods analyzed. Trends in these results are similar for the other subdomains. The modeled historical past for the subdomain is shown in gray and the two RCP scenarios are shown in the different colors (light blue is RCP 4.5 and dark blue is RCP 8.5). Projections are displayed for time periods 2040-2069 and 2070-2099. Bar heights show the mean from 20 climate models and the vertical lines show the range of all 20 climate models.

Changes to Hydrology

Climate change is expected to have important impacts on water availability and seasonal streamflows in the Snake River system because of warmer temperatures and declining snowpack. These changes will have direct and indirect effects on USRT member tribes by affecting the amount of water available in the region for: summer irrigation, instream flows for aquatic species, public water supply, hydropower production, and recreation.

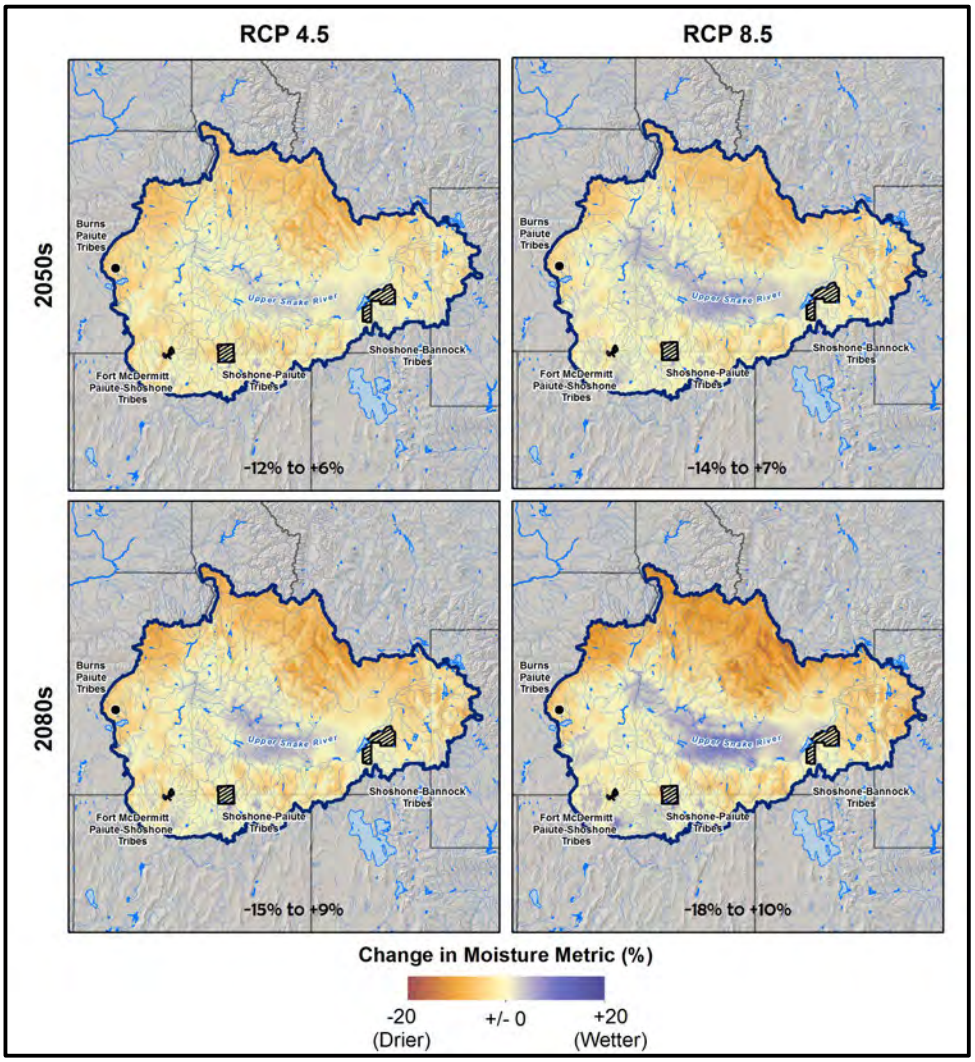


Figure 17: Percentage change in the Hamon moisture metric (a consideration of evaporation and evapotranspiration). Change is shown by time-period (rows 2050s & 2080s) and climate scenarios (columns - RCP 4.5 left & RCP 8.5 right).

Even with precipitation patterns staying relatively consistent, the warmer temperatures are likely to increase evaporation and evapotranspiration, which will decrease moisture availability and dry soils. However, this impact is not consistent across the region, as the more mountainous regions are projected to have less overall moisture available, while the Upper Snake River Plain is projected to have an overall increase in moisture availability.

Declining Snowpack

A major factor shaping how climate change affects streamflow in the Snake River Watershed is changes in snowpack. Snowpack provides a key form of water storage in the Pacific Northwest and, as winter temperatures increase, more winter precipitation will fall as rain rather than snow. This will lead to lower snow accumulation and more instantaneous runoff into rivers and streams. Warmer spring temperatures also result in earlier spring snowmelt.

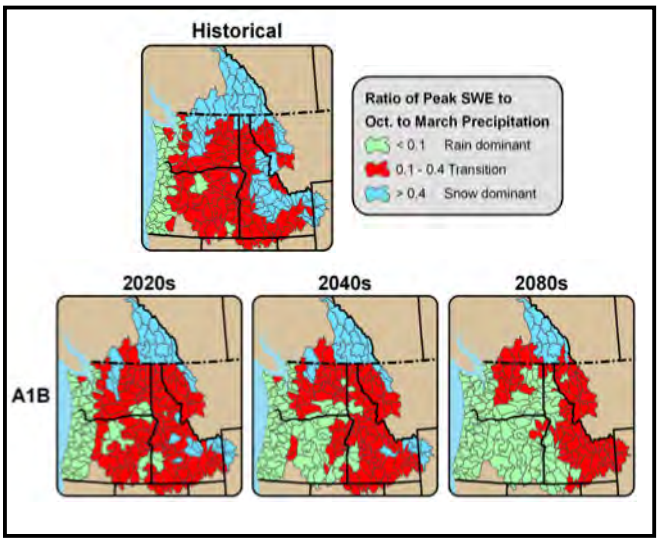


Figure 18: Historical and projected future watershed classification (rain-dominant = green, mixed rain/snow = red, snow-dominant = blue) for 10-digit Hydrologic Unit Code watersheds for a moderate warming scenario (the A1B scenario; bottom maps) for three future time periods.[23]

Watershed sensitivity to changes in winter temperature and snowpack will vary by basin-type. Snowpack losses are projected to be most acute in mid-elevation rain/snow mix watersheds where average winter temperatures are currently close to freezing. In these watersheds, even a small amount of warming can push average winter temperatures above freezing for longer periods of the winter. Snowpack in high elevation snow-dominant watersheds will also be affected, particularly after midcentury, as winter warming becomes more pronounced.[23,24] By the 2080s, the Snake River Watershed is projected to lose its snow-dominant watersheds and shift to more rain/snow mix and rain-dominant watersheds[ii] (Figure 18).

Table 3 shows the projected loss in April 1st snowpack for three locations in the Upper Snake River Watershed. These changes are consistent with overall changes in Columbia River Basin snowpack. Relative to the long-term average for 1916 to 2006, April 1st snowpack in the Columbia River Basin is projected to decline −29% for the 30-year period spanning 2030-2059 (i.e. 2040s) and −52% for the for the period spanning 2070-2099 (i.e. 2080s) for a moderate (A1B) greenhouse gas emissions scenario.[25] Scenario A1B assumes a more balanced energy portfolio than RCP 8.5, with greenhouse gas emissions leveling off by the middle of the 21st century.[26] In terms of greenhouse gas concentrations in the atmosphere, A1B closely tracks RCP 8.5 until about 2040; near that time the two scenarios diverge with A1B falling roughly halfway between RCP 8.5 and RCP 4.5 by the end of the 21st century.

Table 3: Projected changes in April 1st snowpack for three streamflow locations in the Upper Snake River region. Projected changes are for two time periods (2040s, 2080s) and a moderate warming scenario (the A1B scenario) relative to the long-term average 1916-2006.[27]

Monitoring Location	2040s (2030-2059)	2080s (2070-2099)
Salmon River at White Bird	- 35%	- 64%
Snake River at Brownlee Dam	- 37%	- 61%
Owyhee River below Owyhee Dam	- 70%	- 88%

[ii] Rain-dominant watersheds are watersheds where winter temperatures typically remain above freezing, making rain the dominant form of winter precipitation. As a result, streamflow in rain-dominant watersheds is highest in fall and winter months relative to other parts of the year.

Changes in Streamflow Volume, Timing, and Temperature

The increase in winter rains and decrease in winter snow will affect the behavior of Pacific Northwest rivers in important ways, although the magnitude of those changes will vary by basin-type. In general, the temperature-driven shift to more rain in the cool season produces higher fall and winter streamflows, increasing the risk of winter flooding (Figure 19). Warmer spring and summer temperatures lead to earlier peak runoff, increased evapotranspiration, and lower late-summer streamflows, which can exacerbate existing problems with summer drought and summer stream temperatures.[28,29,30,31] Hydrographs, like those in Figure 19, show the combined monthly average total runoff and base flow over the entire basin, expressed as an average depth in inches. They help show the potential shift in the timing of peak and low streamflow conditions as temperatures warm and snowpack melts.

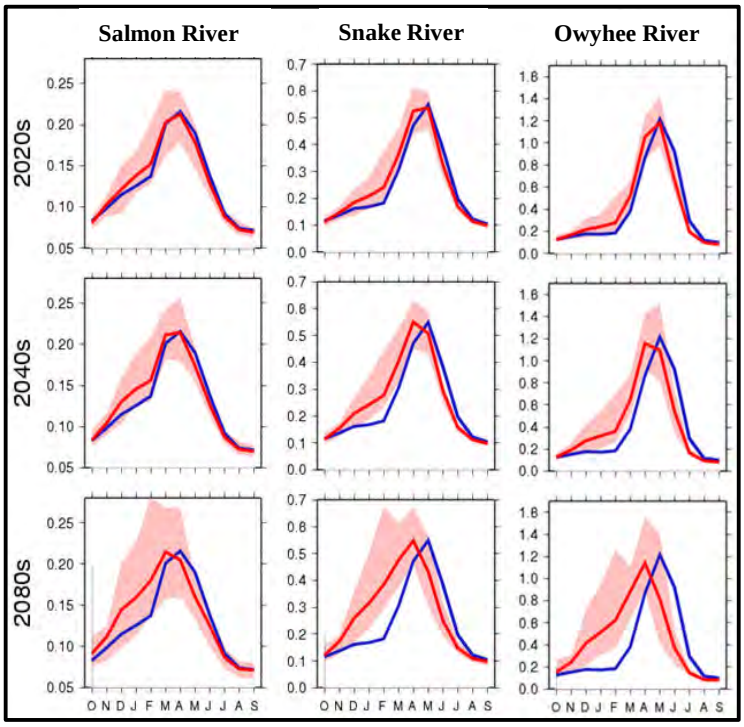


Figure 19: Projected naturalized changes in streamflow (shown in inches) for the Salmon River at White Park (left column), the Snake River at Brownlee Dam (center), and the Owyhee River below Owyhee Dam (right). Blue line shows the simulated historical values (1916-2006), light red bands show the range of all hybrid delta scenarios for the future time-period and emissions scenario (10 GCMs), and dark red lines show the ensemble average for the hybrid delta future projections. Results are shown for a moderate warming scenario, A1B.[26]

For the same moderate warming scenario shown in figure 19 (A1B), climate change is projected to increase maximum weekly mean stream temperatures across the Pacific Northwest by +1.8 to +7.2°F for the 2030–2069 period and +3.6 to +10.8°F by the 2070–2099 period (relative to 1970-1999).[32] Changes in stream temperature are projected to be the largest in the Snake and Willamette River basins relative to other areas of the Pacific Northwest.

Wildfire Risk

Changing fire risk under climate change holds potential for large-scale impacts to forests and grasslands in the western U.S. Multiple factors contribute to an overall increased risk of fire due to climate change. These factors include declining snowpack, more intense summer drought, reduced summer soil moisture, earlier onset of the growing season, and higher fuel loading; all of which have been found to be important drivers of increased fire activity in the Northern Rockies and across the western U.S.[33,34,35,36] Soil moisture deficits develop when the amount of water available in the soil is less than what is needed by plants for optimal growth (i.e., they become water-limited systems). Increases in summer soil moisture deficits (shown for June, July, and

August (JJA) – Figure 20) create more stressful conditions for forests and grasslands, leaving those areas more susceptible to fire as well as insect attacks and disease.

In addition to the factors noted above, fire risk in more arid, fuel-limited areas is governed by precipitation in the previous years. Abundant precipitation can lead to increased plant productivity and a higher fire risk in the year that follows.[37] This may have important implications for invasive species like cheatgrass, which has been found to be a significant factor in the size, duration, spread rate, and inter-annual variability of fires in Great Basin grasslands. Fires in areas with cheatgrass can be disproportionately more frequent, larger, and quicker to spread than in areas with other native vegetation types. Warmer and wetter winter and spring conditions in the northern Great Basin would favor cheatgrass growth, increasing the risk of fire in those areas.[38]

Climate change impacts on fire risk are frequently described in terms of changes in fire frequency, intensity (and severity), and area burned.[39]

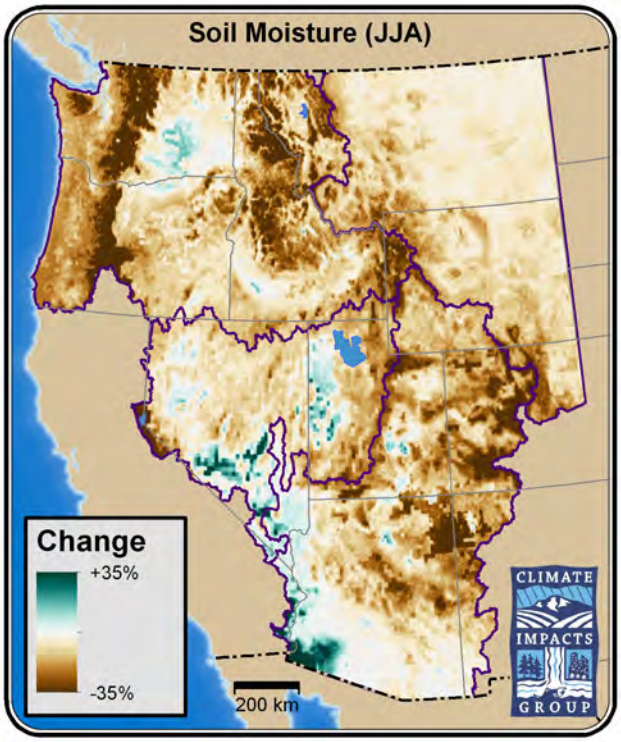


Figure 20: Projected change in total soil column moisture, in percent relative to historical (1916-2006), for the 2040s for a moderate warming scenario (A1B) using the Miroc 3.2 and PCM1 global climate models and the VIC hydrologic model.[32]

- *Fire frequency* is the number of fires in an area over a certain time period and is affected by the amount of fuel in a given area (i.e. fuel load), how moist or dry the fuels are (i.e. the flammability of those fuels), and the presence of ignition sources such as lightning.[40] In the short-term, fire frequency is expected to increase due to warmer, longer, and drier fire seasons and high fuel loads in many forests.[41] Long-term changes in fire frequency are less certain. While there will likely continue to be soil moisture deficits (increasing fire risk), more frequent wildfires, over the next few decades, could reduce fuel loads in lower montane forests and decrease the fuel available for fires in the longer-term.[42] Increased water stress could also lower productivity, reducing fuel accumulation rates.[43] However, these scenarios are dependent on the balance between future fuel conditions, production, and fire suppression, all of which are uncertain.[44,45,46]

- *Fire intensity* is the amount of energy released by a fire (i.e. how hot it burns). Fire intensity is often discussed in correlation with *fire severity*, which refers to the overall effects of fire on vegetation (e.g. tree mortality), forest structure, and other issues such as human infrastructure. Factors contributing to fire severity and intensity include: the arrangement and availability of fuel loads; summer precipitation and temperature; short-term weather conditions before and during a fire; and topography.[47,48]

- *Fire area burned* refers to the total area burned by fire over a specific time-period (e.g. one year). Fire area burned is expected to increase in the western U.S. through at least mid-century (Figure 21).[49,50,51] In the Northwest, the median annual area burned under a moderate warming scenario is projected to increase from about 0.5 million acres historically (1916-2006) to 0.8 million acres in the 2020s, 1.1 million acres in the 2040s, and 2.0 million acres in the 2080s.[52] However, confidence in the projected changes in area burned after mid-century is lower, given the amount of fuel required to reach that level of area burned.[53,54] Shifts in vegetation over time in response to increasing moisture stress may also reduce the amount and connectivity of fuels.[55,56,57]

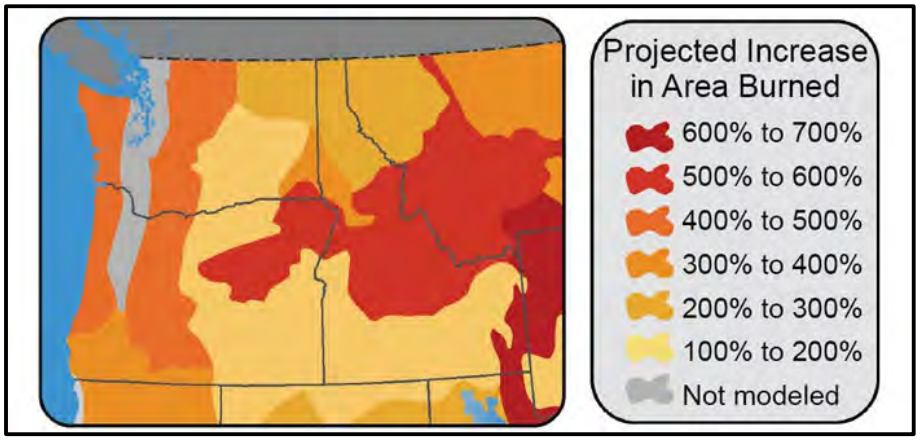


Figure 21: Projected increases in median annual area burned that would result from the regional temperature and precipitation changes associated with a 2.2° F global warming across areas that share broad climatic and vegetation characteristics. Local impacts will vary greatly within these broad areas with sensitivity of fuels to climate. Figure and caption (adapted).[59]

Another important component of future fire risk is the impact of climate change on forest insects and disease. Climate change is projected to change the frequency and location of insect and disease outbreaks, although changes will be species- and host-specific. Some insects and diseases may benefit from changing climate and host conditions, while other insects and diseases may become more limited.[58] These disturbance agents will affect tree mortality and habitat in the near-term, while also changing forest structure and composition over the longer-term.[59,60,61]

IV. Collaborative Project Process

This collaborative vulnerability assessment evaluated the climate-related vulnerability of species, habitats, and resources that are important and valuable to tribal members. This focus was achieved through direct and ongoing participation with USRT's leadership, staff, and membership. The sharing of traditional knowledge, local scientific observation, and tribal priorities is a crucial part of this assessment's relevance to the on-the-ground experiences of the USRT member tribes. Approximately 90 people affiliated with the USRT member tribes participated in this vulnerability assessment. This section describes the collaborative project processes used in this project.

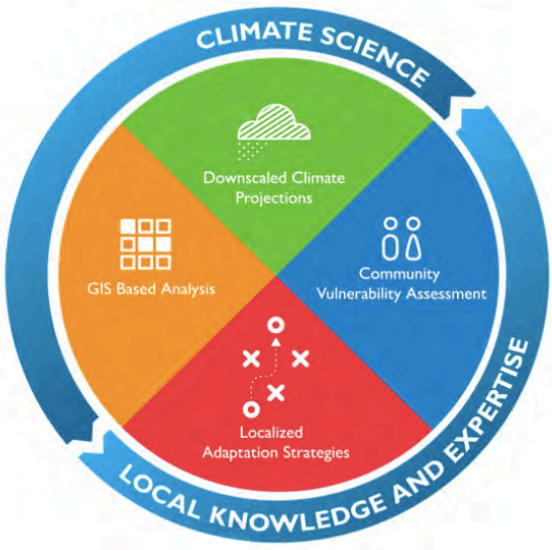


Figure 22: The collaborative process used in this project integrated downscaled climate projections with local knowledge and expertise.

A. Core Team

The first step in initiating the collaborative process with the four tribes was the creation of a Core Team with leadership and staff representatives from each tribe. This team met via webinar and phone throughout the course of the project. The Core Team also helped organize and attend site visits to the individual tribal reservations; review project materials; review the draft outputs of the Climate Change Vulnerability Assessment (CCVI); and attend a final vulnerability workshop on July 28, 2016 in Boise, Idaho. See Table 4 for a list of Core Team members.

Table 4: Core Team members of the USRT climate change vulnerability assessment.

Name	Organization	Name	Organization
Scott Hauser	Upper Snake River Tribes Foundation	Billy Bell	Fort McDermitt Paiute-Shoshone
Bob Austin	Upper Snake River Tribes Foundation	Dan Stone	Shoshone-Bannock
Alexis Malcomb	Upper Snake River Tribes Foundation	Wayne Crue	Shoshone-Bannock
Erica Maltz	Burns Paiute	Travis Stone	Shoshone-Bannock
Jason Fenton	Burns Paiute	Ted Howard	Shoshone-Paiute
Jason Kesling	Burns Paiute	Buster Gibson	Shoshone-Paiute
Charlotte Rodrique	Burns Paiute	Carol Perugini	Shoshone-Paiute
Bradley Crutcher	Fort McDermitt Paiute-Shoshone	Jinwon Seo	Shoshone-Paiute
Duane Masters Sr.	Fort McDermitt Paiute-Shoshone	Heather Lawrence	Shoshone-Paiute
Justina Paradise	Fort McDermitt Paiute-Shoshone	Chris Cleveland	Shoshone-Paiute

B. Site Visits and Identifying Shared Concerns

The four USRT member tribes reside in environments similar enough to have many common concerns related to the potential impacts of a changing climate on their valuable natural and cultural resources. Because USRT works to support all four of its member tribes, this project focused on evaluating the climate change vulnerability of "Shared Concerns". These Shared Concerns were identified through an extensive set of site-visits conducted by USRT staff,

Adaptation International, and Oregon Climate Change Research Institute in April 2016. These site visits roughly followed a similar agenda (Figure 23).

The site visits offered an opportunity for the Project Team to introduce the assessment process and describe both climate science principles and localized climate change projections. Most importantly, the site visits provided space for a broad discussion of climate change concerns with tribal leadership, staff, and membership. The photos in Figure 24 illustrate the broad participation across the site visits. A summary of individual tribe's climate change concerns identified during each site visit can be found in Appendix B.

2:00pm-5:00pm **Meeting with tribal staff & council members**

- Brief Introductions
- Climate Change Vulnerability Assessment Overview
- Localized Climate Change Projections
- Discussion: Tribal Climate Change Concerns

5:30pm -7:00pm **Community Meeting** *(with Food)*

- Brief Introductions
- Climate Change Vulnerability Assessment Overview
- Localized Climate Change Projections
- Discussion: Tribal Climate Change Concerns

Figure 23: Burns Paiute site visit meeting agendas. Meeting agendas for site-visits were similar in structure.

Figure 24: Photos from the USRT member tribes Site Visits. Clockwise from top left in chronological order: Shoshone-Paiute, Fort McDermitt Paiute-Shoshone, Burns Paiute, and Shoshone Bannock tribes. Photo credits: Sascha Petersen and Scott Hauser.

Following the site visit with each of the four tribes, the Project Team synthesized notes and information gathered during the visits. ***The resulting list of climate change concerns included 46 animal species, plant species, habitats, and resource issues that were Shared Concerns.*** The information contained within this list was verified for accuracy by the Core Team via email and phone conversations.

Unfortunately, the available time and budget for this project did not allow for a detailed vulnerability assessment for all 46 Shared Concerns. A complete list of the 46 Shared Concerns is displayed in Table 5. Recognizing this, the Core Team, Project Team, and the University of Washington's Climate Impacts Group (CIG) worked together to select ***28 Shared Concerns*** (green highlight in Table 5) that were assessed during the remainder of this project. While this list is not comprehensive, it provides a representative cross-section of the species, habitats, and resource issues identified by the USRT member tribes during site visits. This selection of Shared Concerns was *not* a prioritization of any issue or resource, as all species, resources, and habitats identified by the member tribes are interconnected and important. ***USRT sees an urgent need to assess the climate change vulnerability for ALL Shared Concerns identified by USRT member tribes, perhaps under future funding and vulnerability assessment efforts.***

Table 5: Full Shared Concerns list from Site Visits April 18-21, 2016. Those species, habitats, and resource issues shown in green were included in this assessment process. Those issues assessed quantitatively with the CCVI tool are indicated with an "x", those unmarked were assessed qualitatively.

Plant Species	Assessed with CCVI Tool
Antelope Bitterbrush	
Big Sagebrush	X
Black Cottonwood	X
Camas Root	
Common Chokecherry	X
Geyer's Willow	X
Meadow Hay	
Noxious Weed: Medusahead	
Noxious Weed: Whitetop	
Quaking Aspen	X
Redosier Dogwood (red willow)	X
Booth Willow	
Burdock Root	
Coyote Willow	
Currants	
Mountain Sagebrush	
Noxious Weed: Canada Thistle	
Noxious Weed: Cheatgrass	
Peachleaf Willow	
Rubber Rabbitbrush	
Wyoming Sagebrush	

Animal Species	Assessed with CCVI Tool
Beaver	X
Black-tailed Jackrabbit	X
Bull Trout	X
Cattle	
Chinook Salmon	X
Columbia Spotted Frog	X
Elk	X
Golden Eagle	X
Mule Deer	X
Redband Trout	X
Steelhead	X
Cutthroat Trout	
Northern Leopard Frog	
Greater Sage-grouse	
White-tailed Jackrabbit	

Habitats	Assessed with CCVI Tool
Sagebrush Steppe	
Riparian	
Wet-meadow	
Springs/ Seeps	
Reservoirs	

Resource Issues	Assessed with CCVI Tool
Asthma	
Wildfire	
Juniper Encroachment	
Runoff	
Traditional Medicines	

Of the 28 Shared Concerns assessed in this project (green highlight in Table 5) 16 of the plant and animal species selected were assessed *quantitatively* using NatureServe's CCVI[62] tool, and an additional 12 Shared Concerns were assessed *qualitatively* (see Section IV for vulnerability assessment results). A graphic of this scoping process for Shared Concerns is illustrated in Figure 25.

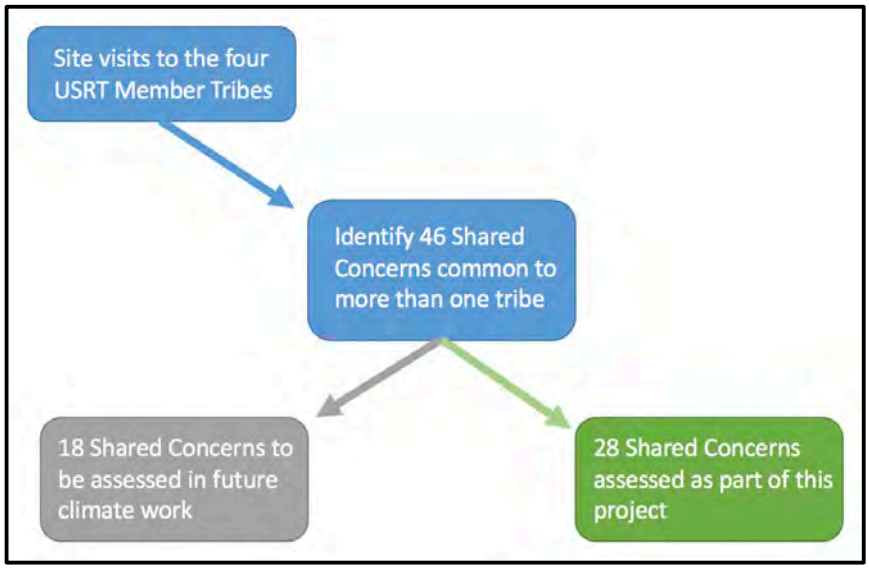


Figure 25: Scoping process for identifying and assessing Shared Concerns.

C. Climate Change Vulnerability Index (CCVI) Analysis

For the 16 Shared Concern species with readily available geographic range data, climate vulnerability was assessed *quantitatively* using NatureServe's CCVI. All four habitat types, the six species that lacked sufficient geographic range data, and the two resource issues were analyzed *qualitatively*.

NatureServe CCVI

The NatureServe CCVI Release 3.0[63] is a tool that estimates a species' relative vulnerability to climate change within a given assessment area. The CCVI uses projected changes in air temperature and moisture availability, species range data, and species-specific life history characteristics to calculate a species' direct and indirect climate exposure, sensitivity, and adaptive capacity[iii], ultimately generating a numerical sum quantifying a species' relative vulnerability. The CCVI tool has several benefits: it is publicly available, reproducible, and frequently used. These attributes will help to facilitate future updates to the vulnerability assessment as additional information becomes available. In addition, the results from this CCVI approach can be easily compared to results of other assessments also using the CCVI, such as the assessment currently being conducted by the Shoshone-Bannock Tribes. The CCVI tool also highlights species-specific sensitivities that contribute to vulnerability, offering detailed information to help guide future climate adaptation efforts.

Direct climate exposure was measured by calculating the percent of each species' range that is exposed to different levels of projected change in temperature and moisture. Indirect exposure to climate change, as well as species-specific sensitivities and adaptive capacity, were evaluated using a suite of 23 variables (Table 6).[iv] For more specific details on data sources and quantitative and qualitative assessment methods, please refer to Appendix C.

[iii] The CCVI tool defines these terms as follows. *CCVI Exposure*: Projected climate change (shifts in temperature and moisture) across the range of the species within the assessment area. *CCVI Sensitivity*: The extent to which a species will respond to shifts in climate. *CCVI Adaptive capacity*: The ability of the species to withstand environmental changes.

[iv] Though the CCVI includes 27 species- specific factors, we did not evaluate the four factors related to the "Documented response to climate change" due to lack of readily available data, leaving a total of 23 species-specific factors for the assessment.

Table 6: Factors used to evaluate species climate vulnerability in the CCVI analysis.

Factor	Description
Indirect Climate Exposure Factors	
Sea Level Rise	Effects of sea level rise on species habitat (not relevant for USRT species)
Natural Barriers	Geographic features of the landscape that may restrict a species from naturally dispersing to new areas
Anthropogenic Barriers	Features of anthropogenically altered landscapes (urban or agricultural areas, roads, dams, culverts) that may hinder dispersal for terrestrial and aquatic species
Climate Change Mitigation	Effects of land use changes resulting from human responses to climate change (seawall development, wind farm, biofuel production)
Species Sensitivity and Adaptive Capacity Factors	
Dispersal / Movement	Ability of species to disperse or migrate across the landscape to new locations as conditions change over time
Historical Thermal Niche	Exposure to temperature variation over the past 50 years
Physiological Thermal Niche	Dependence on cool or cold habitats within the assessment area
Historical Hydrological Niche	Exposure to precipitation variation over the past 50 years
Physiological Hydrological Niche	Dependence on a specific precipitation or hydrologic regime
Disturbance	Dependence on a specific disturbance regime likely to be impacted by climate change
Dependence on Ice / Snow	Dependence on ice, ice-edge, or snow-cover habitats
Restriction to Uncommon Geologic Features	Dependence on specific substrates, soils, or physical features such as caves, cliffs, or sand dunes
Habitat Creation	Dependence on another species to generate habitat
Dietary Versatility	Breadth of food types consumed; dietary specialists vs. generalists (animals only)
Pollinator Versatility	Number of pollinator species (plants only)
Propagule Dispersal	Dependence on other species for propagule dispersal
Sensitivity to Pathogens or Natural Enemies	Pathogens and natural enemies (e.g., predators, parasitoids, herbivores, and parasite vectors) that can increase or become more pathogenic due to climate change
Sensitivity to competition from native or non-native species	Species may suffer when competitors are favored by changing climates
Interspecific Interactions	Other interspecific interactions not including diet, pollination, and habitat creation
Genetic Variation	Measured genetic variation (high, medium, low)
Genetic Bottlenecks	Occurrence of bottlenecks in recent evolutionary history
Reproductive System	A plant's reproductive system may serve as a proxy for a species' genetic variation or capacity to adapt to novel climatic conditions (plants only)
Phenological Response	Phenological response to changing seasonal temperature and precipitation dynamics

Each factor listed in Table 6 was evaluated independently for each species and given a classification defined by NatureServe.[64] The five categories are: *1) Greatly Increases Vulnerability, 2) Increases Vulnerability,3) Somewhat Increases Vulnerability, 4) Neutral, and 5) Unknown*.

More than one categorical ranking can be selected to capture uncertainty or intermediate rankings regarding a species' sensitivity, adaptive capacity, or indirect climate exposure. In addition, not all

sensitivity factors can receive the full range of categorical responses, as they do not all equally affect overall species vulnerability. For example, scores for "genetic variation" range only from *Neutral* to *Increase Vulnerability*.

Direct and indirect exposure to climate change and species-specific sensitivities are used to calculate an overall numerical vulnerability index score. This score is then converted to one of five possible vulnerability categories, based on threshold values. The four vulnerability ranking categories seen in this assessment are described below.[65]

- **Extremely Vulnerable**: Species abundance and/or range extent within the project area is extremely likely to substantially decrease or disappear.
- **Highly Vulnerable**: Species abundance and/or range extent within the project area is likely to decrease significantly.
- **Moderately Vulnerable**: Species abundance and/or range extent within the project area is likely to decrease.
- **Less Vulnerable**: Available evidence does not suggest that species abundance and/or range extent within the project area will change substantially, actual range boundaries may change.

These initial assessment findings were reviewed and revised during the Vulnerability Assessment Workshop using the expertise and local knowledge of USRT staff and the four member tribes. Two members of the Project Team and ten members of the Core Team representing USRT and each of the four USRT member tribes gathered in Boise for this one-day workshop. The focus of the workshop was on gathering and incorporating local and traditional knowledge into the draft vulnerability assessment results for each of the Shared Concerns.

Figure 26: Vulnerability assessment workshop in Boise on July 28th. Participants included leadership and staff from USRT and all four USRT member tribes. Photo credit: Sascha Petersen.

This collaborative review was accomplished using a combination of large group discussions and small group breakout sessions during which the Core Team members reviewed, evaluated, and commented on the *quantitative* and *qualitative* results of the CCVI assessment process for each of the species of Shared Concern. Local knowledge was extremely valuable in modifying the draft results to account for local variance in factors of exposure, sensitivity, and adaptive capacity, such as: local changes in the landscape, observed interactions between species, and species' existing response to extreme weather, climate change, and changes in habitat. Due to time constraints, not all the habitats and resource issues were addressed during the workshop. The Project Team conducted follow-up conference calls with select Core Team members to gather additional input on Shared Concerns including cattle, meadow hay, riparian habitat, sagebrush steppe habitat, springs and seeps, wet meadow habitat, and wildfire.

Following these meetings, CIG made modifications to the CCVI inputs as needed and re-ran the assessment for all species. Ultimately, incorporation of this information led to an adjustment of 19 individual factors affecting vulnerability and the re-ranking of one specie's relative vulnerability ranking.

This step in the overall process of the climate change vulnerability assessment was critically important for evaluating the relative vulnerability of plants, animals, and habitats of the Upper Snake River Watershed. Key staff members from all four USRT member tribes intensely reviewed the science-based CCVI metrics for each Shared Concern to incorporate traditional knowledge and local expertise. The workshop also strengthened connections between the four tribes and highlighted the shared challenges they face with changing climate conditions. These strengthened connections were perhaps the most important output of the workshop and helped establish a common foundation for future adaptation efforts.

V. Regional Vulnerability Assessment Results

A. Holistic Landscapes

This vulnerability assessment considers the ecosystems of the Upper Snake River Watershed through the perspective of individual habitats, plants, and animal species. Tribal elders who participated in this project emphasized the importance of a holistic vision of ecosystems. As they described, the assessment of any species requires that you consider both the habitats and species that depend on it. They described how it is inaccurate, and perhaps disrespectful, to suggest species lead their own existence apart from the whole. The elders explained how everything is connected within the Upper Snake River Watershed, and how this region is connected to the entire Earth. Planning for climate change is by its very nature an exercise in holistic thinking: warming temperatures and shifting precipitation patterns influence every living being on Earth, who in turn influence each other, and together have actions that further influence the global atmosphere.

Although this assessment discusses species and habitats individually, the information presented attempts to acknowledge and celebrate the true interconnection and holistic nature of the landscape and pay respect to the wisdom shared by the elders of the USRT member tribes.

B. The Environment is Medicine

"*First: Water is life. The value of clean water cannot be overestimated.*"[66]
–Lindsey Manning, Shoshone-Paiute Tribe Chairman

The landscapes and ecosystems utilized by USRT member tribes provide nutritional sustenance, water for drinking and irrigation, materials for cultural practices, and a spiritual grounding for tribal members. During this assessment, water, plants, animals, and habitats were described by USRT member tribes as crucial components of community health and wellness. Any significant change to this landscape jeopardizes these valued connections between the tribes and the environment.

The climate change vulnerabilities described in this section raise very important questions about the future of nutrition, clean water, culture, and spirituality in the Upper Snake River Watershed. USRT was not able to fully explore these questions given the time and budget constraints of this

project. During site visits, USRT member tribes identified **asthma** and **traditional medicines** as climate change Shared Concerns. Many of the described vulnerabilities of habitats, plants, and animals hold important implications for both asthma and traditional medicines. Some of these implications are summarized here, while many other issues will require attention in future climate change vulnerability assessments.

Traditional Medicines

In the Upper Snake River Watershed, climate change could influence conditions that are harmful to native plants and allow non-native invasive species to gain a foothold or expand in the region. While not directly assessed in this project, in many cases, the loss of native plants translates to the loss of traditional medicines, an important component of tribal culture, spirituality, and community health.

Asthma

Asthma is a non-curable chronic disease of the airways that affects the ability to breathe and can be controlled through medical management and avoidance of asthma triggers.[67] Some common asthma triggers related to climate include outdoor air pollution, pollen, mold, and smoke from wildfires or burning wood or grasses.[68] In the face of a changing climate, a central concern is that these conditions may become more common and cause additional respiratory impacts to tribal members with asthma.

Key climate change issues for asthma include:

- Increasing frequency or severity of wildfires (wildfire smoke can trigger or worsen asthma);
- Increasing summer temperatures and shifting precipitation patterns may increase drought conditions and related dust storms, which can trigger or worsen asthma; and
- Warming temperatures and shifting precipitation patterns may increase allergens that can trigger or worsen asthma.

Asthma has high health costs due to hospitalizations, missed work or school days, and in severe cases, loss of life. The Centers for Disease Control and Prevention estimates that nationally, asthma is the fourth leading cause of work absenteeism and diminished work productivity for adults.[69]

Wildfire and Air Pollution

The most damaging component of wildfire smoke is particulate matter. The tiny size of the particulates means they can move directly into the bloodstream, allowing the body to interact with complex chemicals adhered to the particulates.[70] Particulates under 2.5μm in aerodynamic diameter ($PM_{2.5}$) are especially toxic because they can penetrate deeply into lung tissue, with lasting effects from a single exposure.

The observations and projections in this report point to continued summer warming, continued summer drying of plants and soils, and an extended wildfire season. These changes would likely increase regional particulate matter and both exacerbate and create asthma health effects in the local population. Along with fine particulates, wildfire smoke also contains the precursors to ozone (O_3). During warm summer days, these precursors can create ground level O_3, which is known to worsen asthma and other lung conditions.[71] Even without wildfires, ground-level O_3 and particulate matter are expected to increase under climate change. O_3 formation increases with temperature, and the projected higher summer temperatures could cause modest increases in both particulate air pollution and ground-level O_3 in the Pacific Northwest.[72]

Dust Pollution

As with wildfire smoke, the most health-damaging components of dust are particles under 2.5µm in aerodynamic diameter and up to 10µm in diameter (PM_{10}). Increase in this type of air pollution in Idaho is associated with increased healthcare treatment for acute upper and lower respiratory illnesses.[73] The observations and projections in this report point to continued summer warming, continued summer drying of plants and soils, and potential increased risk of dust storms.

Allergens

For asthmatics, whose asthma attacks are triggered by exposure to allergens such as pollen and molds, climate-driven increases in temperatures and shifting seasons has been shown to increase pollen production, circulation, and dispersion.[74] Projected climate changes are expected to contribute to increasing levels of some airborne allergens, with associated increases in asthma episodes and other allergic illnesses.[75]

C. Climate Change Vulnerability of Habitats

Sagebrush Steppe Habitat

The sagebrush steppe habitat in many ways defines the Upper Snake River Watershed. The plants, animals, and springs of this landscape have been utilized by USRT member tribes for thousands of years and still provide important wildlife habitat and grazing areas for managed species.

Figure 27: Sagebrush Steppe Habitat. Photo credit: Matt Lavin

Existing Conditions & Observations by USRT Member Tribes[76]

Tribes have reported seeing large stands of dead and drying sagebrush, likely attributable to recent drought and a large-scale moth infestation in 2006. Sagebrush in this ecosystem is critically tied to snowpack. Seeds survive best when they drop before the first snowfall. The insulating snowpack helps keep them in contact with the soil, then as seeds migrate into the soil seed bank, snowmelt nurtures their development through the slow release of water over the spring season. In some areas, lower elevation sagebrush has been outcompeted by invasive cheatgrass and medusahead. These invasive species can sprout earlier and under snow, before the sagebrush comes out of dormancy, are more tolerant of drought, and can grow back more quickly after wildfire. The sagebrush steppe habitat is very sensitive to landscape-wide disturbance and, with recent changes to rangeland conditions and more frequent wildfires in the region, appears to be losing resiliency to these disturbances.

Conversion to Rangeland[77]

The sagebrush steppe ecosystem is the habitat most often converted to rangeland for cattle. There have been ongoing dry and drought conditions throughout the region for the past half-decade. With less water available, the native perennial grasses valuable to cattle can be out-competed by invasive

annual grasses (e.g. cheatgrass, medusahead) and plants such as knapweed and thistle that thrive better in dry conditions. When the landscape gets too dry, the cattle must come in from the range earlier than expected and usually have put on less weight. Dry rangelands also have effects on nesting birds and waterfowl/shorebirds that use the grasses for habitat. In addition, cutting a grass field too early can decrease the browse available for deer. Even with a recent large snowpack at higher elevations, there did not seem to be much water available for native rangeland grasses.

Wildfire[78]

The wildfire season in the region historically occurred from July to September. The tribes have observed the wildfire season now extending from April to October on their reservations. Wildfire compounds the impacts of climate change and tribes have reported seeing large stands of dead and drying sagebrush, which increases overall fire risk for the ecosystem. It is common to see stand-replacing wildfire events in the sagebrush steppe, where almost all the vegetation is killed by the fire. Recent weather patterns have increased fuel loading with an early spring encouraging plant growth, and long, dry, hot summers turning this biomass into fuel. This ecosystem did evolve with wildfire; however, the system is currently faced with a shortened fire return interval and growing conditions that favor invasive plants. The ecosystem's historical mosaic of shrubs, forbs, and grasses has, in some areas, given way to dense stands of invasive grasses that burn hotter and create faster moving fires. This is especially true in the lower elevation sagebrush steppe. A fire return interval of 3-5 years is thought to be too frequent to allow successful recovery of the habitat and rangeland. At higher elevations, it can take 10-15 years for sagebrush steppe habitat to recover from a fire. Frequent wildfires increase the opportunity for erosion and sediment run-off into rivers as there are less plant roots to retain the soil. Best management practices generally aim to keep cattle off a landscape for two years following a fire.

Climate Change Vulnerability

Sagebrush steppe habitat estimated vulnerability: MODERATE.

This vulnerability ranking reflects the sagebrush steppe system's medium climate *sensitivity* and projected high *exposure* to temperature and precipitation changes in the Upper Snake River Watershed.

Key Sensitivities[79]:

- **Temperature change sensitivity** *(scored 3 out of 7)*

Sagebrush steppe is a widespread arid ecosystem in the western U.S. The distribution of sagebrush steppe is controlled by seasonal temperatures; it thrives in regions with cold winters and hot summers. Lying east of the Cascade Range, the Upper Snake River Watershed is buffered from the climatic influence of the Pacific Ocean and experiences significant seasonal temperature change with cold winters and hot summers.[80] While sagebrush steppe ecosystems in the region have adapted to warm, dry summers, projected increases in air temperatures[81] could further reduce soil moisture levels in the region through increases in evapotranspiration.[82]

- **Precipitation change sensitivity** *(scored 3 out of 7)*

Sagebrush steppe ecosystems receive most their annual precipitation during winter months. Some sagebrush steppe shrubs, such as the big sagebrush, have deep root systems which facilitate access to deep soil moisture provided by winter snow melt.[83] Their root system enables these species to survive through late-spring and summer when the availability of other water sources may be

limited.[84] Despite the adaptations for some of the sagebrush species, the sagebrush steppe ecosystem is still susceptible to both summer and winter drought.[85]

- **Sensitivity to indirect factors** *(scored 5 out of 7)*

Sagebrush steppe ecosystems are sensitive to some of the indirect factors associated with climate change, specifically invasive species and shifts in fire regimes. Cheatgrass invasion has increased fire frequency in sagebrush steppe ecosystems because cheatgrass provides a continuous, highly flammable fuel source. This additional fuel source enables fires to cover larger areas and burn more frequently.[86] Decreasing fire return intervals reduce the likelihood of sagebrush establishment following a fire disturbance, which further facilitates the spread of cheatgrass. Sagebrush steppe ecosystems are also susceptible to invasion from juniper trees.[87] Early stages of juniper invasion can be reversed with fire treatment; however, the middle and late invasion stages are unlikely to be reversed with fire treatment. As the ecosystem transitions from shrub-dominant to one dominated by woody plants and trees (e.g., juniper), the overall likelihood of a shrub-dominated system declines.[88]

Riparian Habitat

Riparian areas are those terrestrial habitats found immediately alongside rivers and streams throughout the Upper Snake River Watershed. In this relatively dry landscape, riparian areas and their associated waterways provide essential water resources for plants and animals. Healthy riparian systems rely on an appropriate range of water temperature, volumes, and quality.

Figure 28: Riparian Habitat. Photo credit: Matthew Pintar.

Existing Conditions & Observations by USRT Member Tribes[89]

The presence of riparian plants, such as willows, is known to help shade streams and lower water temperatures, provide browse for animals, and support insect populations. Conversely, removal of this vegetation, for agricultural or housing development or due to wildfire, contributes to warmer stream temperatures. Small tributaries and springs that feed rivers can provide cold water input to streams and help moderate temperatures as well. Nearby groundwater withdrawals from agriculture can diminish the flow of these tributaries and groundwater into river systems and riparian habitat. Nutrient loads in river systems have increased in modern times due to agricultural run-off.

Reservoirs[90]

Many riparian habitats in the region are downstream from man-made reservoirs that store water for irrigation. These reservoir-types include stop water, irrigation, catchment basins, and run-off reservoirs. Consequently, many riparian habitats are affected by human-controlled releases from reservoirs. Water releases from reservoirs are generally scarce between October to April, so riparian habitats often depend on the availability of other water during this time. Reservoirs themselves are subject to higher nutrient loads from agricultural runoff, higher temperatures, and

increasing plant and algae growth, which decreases water quality even before it is released downstream. Upstream of reservoirs, riparian habitats are subject to erosion as water storage backs up creeks, which saturates side soils. As the water is released, it drops quickly, sloughing the banks and bellying out bends. At low flow periods, these streams are consequently wider, more shallow, and therefore warmer.

Climate Change Vulnerability

Riparian habitat estimated vulnerability: MODERATE or HIGH.

This vulnerability ranking reflects this system's medium climate *sensitivity* and high projected *exposure* to temperature and precipitation changes in the Upper Snake River Watershed.

Key Sensitivities:[91]

- **Temperature change sensitivity** *(scored 5 out of 7)*

Riparian habitats in the assessment area are found along rivers and adjacent to bodies of water with relatively cool climates. Therefore, riparian habitats are moderately sensitive to shifts in temperature. Increasing temperatures could lower water levels, and in some instances, dry up small creeks or streams. In addition, changing precipitation regimes could dry groundwater springs or reduce the duration of their seasonal wetness. This could significantly change the species composition and structure of riparian habitats. If temperatures warm considerably, some of these systems could disappear completely.

- **Precipitation change sensitivity** *(scored 4 out of 7)*

Soil moisture, which is largely driven by regional precipitation and evapotranspiration regimes, is an important determinant of riparian species composition and structure. Hardwood tree species are typically an important component of riparian habitats, and these trees can be particularly sensitive to declines in water availability.

- **Sensitivity to indirect factors** *(scored 4 out of 7)*

Riparian habitats are particularly sensitive to shifts in streamflow and droughts. In general, the temperature-driven shift to more rain in the cool season produces higher fall and winter streamflows, increasing the risk of winter flooding. Additionally, increasing spring and summer temperatures will lead to earlier peak spring streamflow. This shift in peak runoff timing may lead to a reduction in riparian tree recruitment due to a mismatch between peak flow timing and seed release. Shifts in the timing and amount of summer stream flows will also affect water tables and soil moisture levels. Reductions in summer flows may negatively affect riparian plants with shallow root systems, including seedlings and juvenile trees.[92] Riparian habitats are also very sensitive to invasions from non-native species.

Wet-meadow Habitat

Figure 29: Wet-meadow Habitat. Photo Credit: Migiel Vieira.

Wet-meadow habitat broadly represents permanently saturated areas of the landscape, though meadow saturation can vary greatly in amount and in seasonal presence. Wet-meadows that are only flooded for half the year, or even a single month, can still hold value for habitat, groundwater recharge, and water purification.

Existing Conditions & Observations by USRT Member Tribes[93]

Higher elevation meadows are typically the result of precipitation patterns, while lower elevation meadows are the result of both precipitation and run-off from upstream landscapes. Wet-meadows are an important habitat for migratory birds in the Pacific Northwest flyway. That migration may be influenced by the condition of wet-meadows; for instance, if some wet meadows do not have adequate water or plant growth, birds may not stop and continue past those areas in search of other, more suitable stopovers. This, in turn, could increase the pressure on other wet meadows to support migratory birds. Most areas that are now used for agriculture in the region were once wet-meadow ecosystems. Intensive agricultural groundwater withdrawals (e.g. flood or pivot irrigation) have contributed to the drying out of some wet-meadow habitats.

Climate Change Vulnerability

Wet-meadow habitat estimated vulnerability: HIGH

This vulnerability ranking reflects the system's high climate *sensitivity* and high projected *exposure* to temperature and precipitation changes in the assessment area.

Key Sensitivities[94]:

- **Temperature change sensitivity** *(scored 5 out of 7)*

Wet-meadow habitat is generally found in high-elevation (3,200-9,800 feet) regions and is dominated by herbaceous species. Wet-meadow habitat is found on sites with extremely slow surface and sub-surface water flow.[95] Because soil moisture plays such a critical role in wet-meadow establishment and suitability, increasing temperatures could decrease soil moisture levels through increases in potential evapotranspiration, subsequently reducing the area of suitable wet-meadow habitat in the assessment area.[96]

- **Precipitation change sensitivity** *(scored 7 out of 7)*

Shorter snow duration in meadows due to earlier onset of spring snow melt could lead to increased growth and potentially a greater diversity of flora. However, projected declines in snowpack, resulting from a greater proportion of winter precipitation falling as rain rather than snow, will reduce summer soil moisture, a significant determinant of plant growth.

- **Sensitivity to indirect factors** *(scored 6 out of 7)*

Wet-meadows are typically more sensitive to the indirect effects of climate change because they are smaller and more fragmented than other habitat types. Increases in fire, flooding, disease, and shifts in wind will be magnified within wet-meadow habitats because the disturbance will affect a greater proportion of the total habitat area. Increasing distances between wet-meadows following major disturbances will affect species dispersal and seed regeneration.

Springs and Seeps Habitat

Springs and seeps refer to areas on the landscape where groundwater comes to the surface, creating an isolated wetland habitat before infiltrating back into the ground or continuing as a stream. Springs can be either cold or warm. On a dry landscape, these habitats can be the only water available for all surrounding plant and animal life.

Figure 30: Spring and Seep Habitat with impacts from Cattle. Photo credit: Sascha Petersen.

Existing Conditions & Observations by USRT Member Tribes[97]

Species diversity at a spring can be 100 to 500 times greater than surrounding areas. Tribal members use springs and seeps for drinking water and as important ceremonial sites. In general, USRT member tribes report reduced flows in many springs and seeps on their reservations. There have also been some reports of new springs emerging on reservations and decreased flows from springs known to only run during wet weather, likely directly tied to recent periods of drought. Like most bodies of water, a shallower spring with lower flow rates is subject to higher overall water temperatures and less dissolved oxygen than a larger spring with higher flow rates. Reduced flow and the loss of a spring altogether has been observed to concentrate wildlife species at other springs, creating a secondary impact on that habitat and increasing competition for water.

Historically, many springs and seeps have been used by ranchers to provide water for their cattle. This has had detrimental impacts on wildlife that use springs, as the cattle can cause erosion, soil compaction, and, in some cases, stop the water flow entirely. The tribes have undertaken both successful and unsuccessful efforts to protect these springs, while still providing water to cattle. It is not clear how wildfire may affect springs. The Shoshone-Paiute have replaced watering troughs at springs following wildfires and found some lower flow rates at those springs. Intensive agricultural withdrawal of groundwater has contributed to the drying out of certain springs. The extended agricultural growing season appears to be worsening this problem.

Climate Change Vulnerability

Springs and seeps habitat estimated vulnerability: N/A

Springs and seeps habitat was not given an overall vulnerability ranking in this project, as the available research does not provide enough data to make that determination.

Key Vulnerabilities:

- Decreasing snowpack and changes in the timing of seasonal spring run-off may result in decreasing inputs to the groundwater that ultimately supports springs and seeps.
- Increasing water temperatures in springs and seeps, associated with rising air temperatures, can have cascading ecological impacts to species and species diversity.
- More agricultural use of ground water could diminish spring/seep flow as the extended growing season increases demand for irrigation.

D. Vulnerability Assessment Results for Species

The final CCVI vulnerability rankings for 16 plant and animal species are provided in Table 7. These rankings are based on projected climate exposures for the region and the weighted sum of 23 distinct species-specific factors of sensitivity and adaptive capacity.

Table 7: Vulnerability rankings for the 16 plant and animal species assessed quantitatively using the CCVI. Results are shown by species (rows) and for the two different climate scenarios (RCP 4.5 and RCP 8.5) for two different time periods (2050s and the 2080s).

Common Name	Taxon	2050s RCP4.5	2050s RCP8.5	2080s RCP4.5	2080s RCP 8.5
Columbia Spotted Frog	Amphibian	HV	EV	EV	EV
Bull Trout	Fish	EV	EV	EV	EV
Chinook Salmon	Fish	EV	EV	EV	EV
Redband Trout	Fish	EV	EV	EV	EV
Steelhead	Fish	EV	EV	EV	EV
Golden Eagle	Bird	LV	LV	LV	LV
American Beaver	Mammal	LV	LV	LV	LV
Black-tailed Jackrabbit	Mammal	MV	HV	HV	HV
Elk	Mammal	MV	HV	HV	HV
Mule Deer	Mammal	LV	MV	MV	MV
Big Sagebrush	Plant	MV	HV	HV	HV
Black Cottonwood	Plant	LV	MV	MV	MV
Chokecherry	Plant	LV	LV	LV	LV
Geyer's Willow	Plant	LV	LV	LV	LV
Quaking Aspen	Plant	LV	MV	MV	MV
Redoier Dogwood	Plant	LV	LV	LV	LV

For a more comprehensive description of these vulnerability rankings, including detailed rankings of individual factors, please refer to Appendix C. For more information on projected climatic changes under each of the two climate scenarios (RCP 4.5 and RCP 8.5) for the two future time periods (2050s and 2080s) please refer to Section III. Species and habitats that were assessed qualitatively and *do not* have an overall vulnerability ranking are also discussed in this section but are not displayed in Table 7. In the following section, species-specific factors of sensitivity and adaptive capacity are described as "*Factors Affecting Vulnerability*". Species rankings for each of these factors reflects information from both the scientific literature and USRT member tribes.

E. Climate Change Vulnerability of Plants

This section provides further detail on some of the most important species-specific factors affecting climate change vulnerability for plants selected as Shared Concerns in this project. Species are listed alphabetically, and vulnerabilities are described quantitatively and qualitatively, as appropriate.

Antelope Bitterbrush (*Purshia tridentata*)

Figure 31: Antelope Bitterbrush. Photo credit: Andrey Zharkikh.

Existing Conditions & Observations by USRT Member Tribes[98]

USRT member tribes recognize antelope bitterbrush as important to big game and small mammals alike. The plant comes to maturity at approximately seven years and the seed crop (important for small mammals) is productive only once every seven years. During recent drought conditions (2012-2015), there was no viable seed crop. Antelope bitterbrush plants can recover from some fires, but must compete with invasive cheatgrass and take seven years to produce their first seeds.

Antelope Bitterbrush Vulnerability Rankings

Due to insufficient detailed information on the range of antelope bitterbrush within the project area, the species was assessed qualitatively and not given an overall vulnerability ranking in this project.

Factors Affecting Vulnerability

- **Dispersal/Movement *greatly increases vulnerability*.** Generally, antelope bitterbrush seed is dispersed 20-30 feet, by small mammals.[99] This limited seed dispersal distance restricts the plant's ability to repopulate areas burned by wildfire or move in response to changing temperature and precipitation patterns.
- **Dependence on Other Species for Propagule Dispersal *somewhat increases vulnerability*.** Small mammal caches of antelope bitterbrush seeds play an important role in the natural regeneration of the plant. Observations suggest that small mammals and ants can cache the entire crop of antelope bitterbrush seed.[100] This vulnerability ranking reflects how propagule dispersal for the antelope bitterbrush is almost completely dependent on a small number of species, who are also potentially vulnerable to the effects of climate change.
- **Sensitivity to Competition *somewhat increases vulnerability*.** Antelope bitterbrush competes with invasive grasses, specifically cheatgrass, for resources. Cheatgrass is expected to be more tolerant of future climatic conditions in the assessment area and this competitive advantage may decrease establishment of antelope bitterbrush seedlings within the assessment area.
- **Interspecific Interaction *somewhat increases vulnerability*.** Antelope bitterbrush has a mutualistic relationship with nitrogen-fixing bacteria from the genus *Frankia*.[101] This mutualism increases the vulnerability of the antelope bitterbrush, as there are no potential candidates for mutualism partners outside of *Frankia*. It is not known how *Frankia* may be affected by climate change.
- **Disturbance Regime *somewhat increases vulnerability*.** Antelope bitterbrush is very susceptible to wildfire. It is considered a weak sprouter and is often killed by fire. In some areas, antelope bitterbrush may sprout after low-severity fire.[102]

- **Physiological Thermal Niche has a *neutral effect on vulnerability*.** Antelope bitterbrush is not significantly affected by thermal characteristics of the environment in the assessment area.[103]
- **Physiological Hydrological Niche has a *neutral effect on vulnerability*.** Antelope bitterbrush is not dependent on a strongly seasonal hydrologic regime, specific wetland habitat, or localized moisture regime. Antelope bitterbrush survives on arid and rocky sites due to its long taproots.[104]

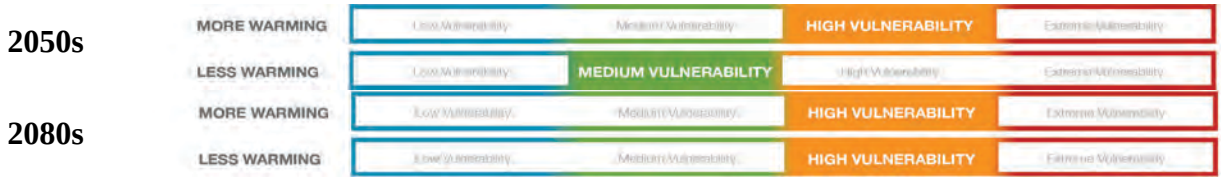
Big Sagebrush (*Artemisia tridentata*)

Figure 32: Big Sagebrush. Photo Credit: Andrey Zharkikh.

Existing Conditions & Observations by USRT Member Tribes[105]

Tribes have reported seeing large stands of dead and drying sagebrush, some of which is attributable to a large-scale moth infestation in 2006. In some areas, lower elevation sagebrush has been outcompeted by invasive cheatgrass and medusahead. These invasive species can sprout earlier and under snow before the sagebrush comes out of dormancy, are more tolerant of drought, and can grow back more quickly after wildfire. Sagebrush has critical recruitment timing in its relationship to snowpack. Seeds survive best when they fall before the first snow. The insulating snowpack then keeps them in contact with the soil and as seeds migrate into the soil, snowmelt then nurtures their development through the slow release of water over the spring season.

Big Sagebrush Vulnerability Rankings



Rankings above represent climate change vulnerability in the 2050s and 2080s for two different climate change scenarios. The higher climate change scenario (RCP 8.5) is labeled "More Warming" and the lower climate change scenario (RCP 4.5) is labeled "Less Warming". The rankings reflect the assessment of local climate change projections and species-specific sensitivities and adaptive capacity from the CCVI analysis.

Factors Affecting Vulnerability

- **Dispersal/Movement *greatly increases vulnerability*.** While big sagebrush is primarily wind dispersed, animal and water dispersal has also been documented. Around 90% of big sagebrush seeds are dispersed within 30 feet of the parent shrub. A few seeds can be carried more than 100 feet away from the parent plant.[106] This limited dispersal distance affects big sagebrush's ability to repopulate areas after a disturbance (e.g., wildfire) or to adjust its range in response to changing temperature and precipitation patterns.
- **Climate Change Mitigation *somewhat increases vulnerability*.** Big Sagebrush grows in relatively flat and open sagebrush steppe habitat that could be suitable sites for installation of wind turbines and arrays of solar panels.
- **Disturbance Regime *somewhat increases vulnerability*.** Wildfire kills big sagebrush when aboveground plant foliage is charred. Foliage exposed to temperatures exceeding 195°F for more than 30 seconds is also fatal for big sagebrush.[107,108,109] Seedlings can re-establish following a fire, but more frequent and intense fires are likely to reduce the overall success of re-establishment.

- **Sensitivity to Competition *somewhat increases vulnerability*.** Sagebrush habitat is susceptible to loss due to cheatgrass invasion.[110] Cheatgrass is expected to be more tolerant of future climate change conditions in the assessment area.
- **Physiological Thermal Niche has a *neutral effect on vulnerability*.** Big sagebrush distribution is not significantly affected by thermal characteristics of the environment.
- **Physiological Hydrological Niche has a *neutral effect on vulnerability*.** Big sagebrush is not dependent on a strongly seasonal hydrologic regime, specific wetland habitat, or localized moisture regime.

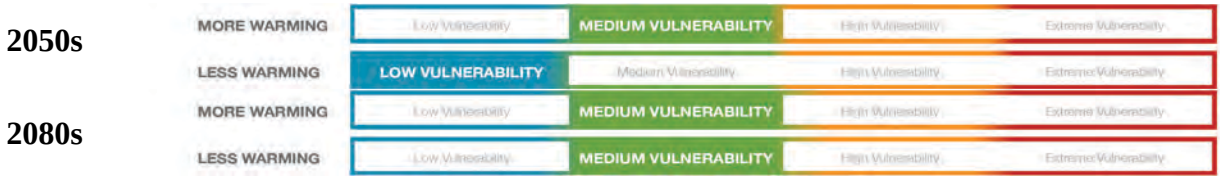
Black Cottonwood (*Populus balsamifera* subsp. *trichocarpa*)

Existing Conditions & Observations by USRT Member Tribes[111]

Tribes reported reduced cottonwood abundance and low age-class diversity on the reservations. They attributed this to the combined effects of man-made interventions controlling water flows and increasing grazing, agricultural use, and other development in riparian areas. Cottonwood depend on occasional flooding events to scour floodplains and facilitate seed dispersal and establishment of young trees. These natural flooding events have become rare, with man-made interventions in water use across the landscape. Flood control infrastructure, such as diking and rip-rap, covers habitat where cottonwoods would otherwise grow.

Figure 33: Black Cottonwood Branch. Photo credit: Andrey Zharkikh.

Black Cottonwood Vulnerability Rankings



Rankings above represent climate change vulnerability in the 2050s and the 2080s for two different climate change scenarios. The higher climate change scenario (RCP 8.5) is labeled "More Warming" and the lower climate change scenario (RCP 4.5) is labeled "Less Warming". The rankings reflect the assessment of local climate change projections and species-specific sensitivities and adaptive capacity from the CCVI analysis.

Factors Affecting Vulnerability

- **Disturbance Regime *somewhat increases vulnerability*.** Water-based black cottonwood seed dispersal occurs after peak-flows in the spring. Therefore, abnormally high river flows may carry black cottonwood seeds for so long that they are no longer viable once they reach a site to establish.[112] Black cottonwood is tolerant of brief periods of flooding and some populations are more tolerant of recurrent and prolonged flooding.[113] The black cottonwood has a shallow root system, which makes the species susceptible to ice, snow, and wind damage.[114] Shifting precipitation patterns may affect the timing and strength of these disturbance events.
- **Physiological Hydrological Niche *somewhat increases vulnerability*.** In southern and eastern Idaho, black cottonwood will establish on recently formed gravel bars. However, without recurrent flooding and sediment deposition, the black cottonwood is likely to be outcompeted by other species.[115] Shifting precipitation patterns as a result of climate change may affect the timing and strength of these disturbance events.
- **Sensitivity to Pathogens or Natural Enemies *somewhat increases vulnerability*.** Young and fire-damaged black cottonwood stands are susceptible to *Cytospora* canker. Black cottonwood seedlings are also susceptible to wood-decaying fungi, which include *Polyporus delectans* and *Philota destruens.*[116] Climate change could potentially impact black cottonwood by amplifying the effects of these diseases and parasites. For example, hotter and drier conditions expected with climate change can stress tree species and increase susceptibility to infection.

- **Dispersal/Movement has a *neutral affect or may somewhat increase vulnerability.***[v] Black cottonwood seeds are light and dispersed by both water and wind. Seeds typically disperse several hundred feet, but dispersal distances up to several miles have been documented.[117] These dispersal distances may help facilitate cottonwood migration as temperature and precipitation patterns change.
- **Physiological Thermal Niche has a *neutral effect on vulnerability*.** Black cottonwood grows in a wide variety of climates, including both coastal and arid areas.[118]

[v] This factor is ranked as both *neutral* and *somewhat increases* as seeds can disperse several hundred feet (somewhat increase vulnerability) and, in some cases, travel farther than 0.6 miles (neutral affect).

Common Camas (*Camassia quamash*)

Existing Conditions & Observations by USRT Member Tribes[119]

Tribes report that diversion of water for agriculture and other development has reduced the extent of suitable habitat for camas. Common camas harvests have also reportedly shifted as much as two weeks earlier in the year.

Figure 34: Camas Root. Photo credit: Sarah Amoff.

Common Camas Vulnerability Rankings

Due to insufficient detailed information on the range of common camas within the project area, the species was assessed qualitatively and not given an overall vulnerability ranking in this project.

Factors Affecting Vulnerability

- **Dispersal/Movement *increases vulnerability*.** Common camas seeds form in dry capsules lacking an obvious mechanism for dispersal.[120] The seeds fall close to the parent plant. This dispersal method could limit the ability of common camas to migrate or repopulate areas as habitat conditions are altered with changing climate conditions.
- **Physiological Hydrological Niche *increases vulnerability*.** Common camas depends on seasonal moisture availability for growth. Common camas habitat is generally saturated in spring, drying out by summer.[121] Shifting precipitation patterns under climate change could alter this seasonal moisture availability.
- **Reproductive System *increases vulnerability*.** Common camas reproduces vegetatively by offset bulblets.[122] Genetic variation of plant species restricted to asexual reproduction (vegetative or apomictic) is assumed to be very low. Lack of genetic variation is expected to hinder species' ability to adapt to climate change.[123]
- **Disturbance Regime *somewhat increases vulnerability*.** Fire disturbance can top-kill common camas. It is expected that short-interval fires would reduce the extent of common camas populations as growth and flowering occur throughout spring and summer.[124]
- **Physiological Thermal Niche has a *neutral effect on vulnerability*.** Common camas distribution is not significantly affected by thermal characteristics of the environment in the assessment area.

Common Chokecherry (*Prunus virginiana*)

Existing Conditions & Observations by USRT Member Tribes[125]

Common chokecherries are an important traditional food of the USRT member tribes. Tribes report that common chokecherries have been blooming prematurely with recent changes in freeze/thaw cycles. This premature blooming has caused them to be exposed to additional freezing temperatures, which has reportedly impacted some of the berry crop.

Figure 35: Common Chokecherries. Photo credit: John Rusk.

Common Chokecherry Vulnerability Rankings

Rankings above represent climate change vulnerability in the 2050s and the 2080s for two different climate change scenarios. The higher climate change scenario (RCP 8.5) is labeled "More Warming" and the lower climate change scenario (RCP 4.5) is labeled "Less Warming". The rankings reflect the assessment of local climate change projections and species-specific sensitivities and adaptive capacity from the CCVI analysis.

Factors Affecting Vulnerability

- **Physiological Hydrological Niche *somewhat increases vulnerability*.** Common chokecherries grow between low and mid-elevations in areas with above average soil moisture levels and adequate drainage.[126,127] Future precipitation patterns under climate change may fall outside common chokecherry's hydrological niche.
- **Sensitivity to Pathogens or Natural Enemies *somewhat increases vulnerability*.** Common chokecherry is susceptible to *Plowrightia stansburiana*, a fungus which causes cankers to develop on the plant stem. This fungus eventually kills infected stems.[128] It is currently unclear how this fungus will be affected by climate change. However, climate change can increase the common chokecherry's overall susceptibility to an infection by enhancing other environmental stressors.[129]
- **Dispersal/Movement has a *neutral effect on vulnerability*.** While most common chokecherry seeds are deposited in close vicinity to parent plants, fruit-eating birds and animals also disperse seeds longer distances. Bears, moose, coyotes, bighorn sheep, pronghorn, elk, deer, and many bird species consume the fleshy fruit, and subsequently disperse common chokecherry seeds.[130] This wide range of seed dispersal mechanisms and distances could help facilitate migration and repopulation of habitats under the shifting climate conditions.
- **Physiological Thermal Niche has a *neutral effect on vulnerability*.** Common chokecherry distribution is not significantly affected by thermal characteristics in the assessment area.
- **Disturbance Regime has a *neutral effect on vulnerability*.** Common chokecherry is well adapted to wildfire disturbance. While common chokecherry is susceptible to top-kill by fire, the species sprouts from remaining root crowns and rhizomes beneath the soil surface. Studies

have shown that common chokecherry sprouting success increases with heat, suggesting that fire's ability to break down the seed coat is an important adaptation.[131]

- **Dependence on Other Species to Generate Habitat has a *neutral effect on vulnerability*.** Common chokecherries do not require any uncommon/restricted habitats that are generated or maintained by other species. Common chokecherry frequently inhabits mixed-stands with tall shrubs. In southern and central Idaho, common chokecherry grows in several Rocky Mountain Douglas-fir habitat types, along with Pacific ponderosa pine, Rocky Mountain maple, quaking aspen, and other habitat types.[132] Common chokecherry's success as a habitat generalist may be helpful under shifting environmental conditions due to climate change.

Geyer's Willow (*Salix geyeriana)*

Existing Conditions & Observations by USRT Member Tribes[133]

Tribes have reported seeing willow die-offs on the reservations, likely tied to recent land use practices in riparian areas such as agriculture, grazing, and development. These die-offs may also be influenced by changes in temperature and cyanobacteria blooms. Willows are known to lower nearby water temperature and some of the tribes are actively restoring willows on their reservations. Geyer's willow generally uses rhizomatous dispersal with some additional dispersal by wind and branch cuttings from beavers. Geyer's willow is typically an upper elevation species.

Figure 36: Geyer's Willow Branches. Photo credit: Andrey Zharkikh.

Geyer's Willow Vulnerability Rankings

Rankings above represent climate change vulnerability in the 2050s and the 2080s for two different climate change scenarios. The higher climate change scenario (RCP 8.5) is labeled "More Warming" and the lower climate change scenario (RCP 4.5) is labeled "Less Warming". The rankings reflect the assessment of local climate change projections and species-specific sensitivities and adaptive capacity from the CCVI analysis.

Factors Affecting Vulnerability

- **Physiological Hydrological Niche *somewhat increases vulnerability*.** Geyer's willow is found in wet meadows and marshes, adjacent to seeps and springs, and alongside the borders of slow moving streams and beaver ponds. It can also be found in wide, low-gradient valley bottoms.[134] Shifting precipitation patterns under climate change may alter water velocity and availability in these aquatic habitats.
- **Dependence on Other Species to Generate Habitat *has a neutral effect or somewhat increases vulnerability.*[vi]** Geyer's willow habitat is often associated with abandoned and sediment-filled beaver ponds.[135] Species that are dependent on a few other species for habitat generation are more likely to be vulnerable to climate change.
- **Dispersal/Movement has a *neutral effect on vulnerability***. Geyer's willow is wind- and water-dispersed,[136] increasing its ability to migrate as climate change alters habitat conditions.
- **Physiological Thermal Niche has a *neutral effect on vulnerability***. Geyer's willow distribution is not significantly affected by thermal characteristics of the environment in the assessment area.

[vi] This factor is ranked as both *neutral* and *somewhat increase* because the Geyer's willow is occasionally associated with beaver ponds (somewhat increase vulnerability) but also resides in other meadow and marsh habitats which are not generated by a specific species (neutral affect).

- **Disturbance Regime has a *neutral effect on vulnerability***. Geyer's willow sprout following a top-kill by wildfire. While fast, hot fires typically result in numerous sprouts per plant, longer, slower burning fires reduce the species ability to sprout, as these fires often burn down below the soil surface into the roots.[137]

Meadow Hay

Existing Conditions & Observations by USRT Member Tribes[138]

Meadow hay is one of the most important feed stocks grown by tribal members for cattle. Hay producers have recently witnessed an extended growing season, which requires an extended watering season. However, they have also had to face drought conditions. Disagreement between hay producers and water managers has emerged during these difficult environmental conditions.

Figure 37: Meadow Hay. Photo credit: Lanjew Farms.

Meadow Hay Vulnerability Rankings

Meadow hay did not receive an overall vulnerability ranking in this project as the CCVI tool is not designed for managed species. Its climate change vulnerability was therefore investigated qualitatively.

Factors Affecting Vulnerability

- Decreasing water supply reliability for irrigation
- Increasing pests and pathogens affecting crop timing, location, and productivity

Warmer temperatures due to climate change are already directly affecting agricultural production[139] and changing precipitation patterns could further exacerbate these issues. Indirect impacts, such as increases in pests and pathogens due to warmer temperatures, are also of concern, because they affect crop timing, location, and productivity.[140] These have troubling implications for the nutrition of agricultural feed. As the EPA states:

> *Increases in atmospheric CO_2 can increase the productivity of plants on which livestock feed. However, studies indicate that the quality of some of the forage found in pasturelands decreases with higher CO_2. As a result, cattle would need to eat more to get the same nutritional benefits.*[141]

In addition, with projected increases in summer temperature and precipitation declines, there may be fewer grasses on which to graze,[142] thereby increasing the need to grow meadow hay to support cattle ranching. Climate change models seem to suggest that dryland agriculture in hay fields without irrigation could decline,[143] while irrigated hay fields could benefit from warmer temperatures, especially after mid-century.[144] This assumes that there will be enough water available to continue irrigation.

Extreme events may pose the largest unknown risk to future crop productivity. The impact of extreme precipitation events, such as wildfires, and the associated post-event impacts of weed proliferation, insects, and diseases, could significantly increase losses in agricultural productivity.[145]

Noxious Weed: Medusahead (*Taeniatherum caput-medusae*)

Existing Conditions & Observations by USRT Member Tribes[146]

Tribes report that noxious weeds, such as medusahead, are continuing to spread across the landscape at the expense of native plants. Compared to native plants, these weeds can establish themselves more quickly after fires, during periods of drought, and following other extreme events. Medusahead is also capable of being transported by grazing cattle. In some lower elevation areas, sagebrush has been outcompeted by invasive cheatgrass and medusahead, as these species can sprout earlier and under snow before the sagebrush comes out of dormancy. Tribes currently use weed control techniques such as controlled chemical spraying and rangeland management (e.g., allowing cattle on the range to eat noxious weeds) to help limit the spread of these species.

Figure 38: Medusahead. Photo credit: Jason Hollinger.

Medusahead Vulnerability Rankings

Due to insufficient detailed information on the range of medusahead within the project area, the species was assessed qualitatively and not given an overall vulnerability ranking in this project.

Factors Affecting Vulnerability

- **Sensitivity to Competition *somewhat increases vulnerability***. Medusahead and cheatgrass compete for habitat.[147] Medusahead may suffer, as cheatgrass is likely to respond more favorably to climate change.
- **Dispersal/Movement has a *neutral effect on vulnerability*.** Medusahead seed is wind-, water-, and animal-dispersed.[148] These various dispersal mechanisms increase the likelihood that the species will hold some adaptive capacity to shifting climate conditions.
- **Physiological Thermal Niche has a *neutral effect on vulnerability*.** Medusahead distribution is not significantly affected by thermal characteristics of the environment in the assessment area.[149]
- **Physiological Hydrological Niche has a *neutral effect on vulnerability*.** Medusahead has little dependence on a seasonal hydrologic regime or localized moisture regime that will be affected by climate change.[150]
- **Disturbance Regime has a *neutral effect on vulnerability***. Medusahead inhabits disturbed sites with high soil-moisture levels.[151] Following a fire, medusahead often outcompetes native vegetation and establishes on the disturbed site.[152] Medusahead completes its lifecycle before the start of the normal wildfire season. Fires that burn quickly may not be hot enough to kill seeds buried beneath the soil surface.[153]
- **Pollinator Versatility has a *neutral effect on vulnerability*.** Medusahead is mainly self-fertile, with intermittent occurrences of wind cross-pollination.[154] Therefore, the species is not dependent on a small number of species for pollination.

- **Sensitivity to Pathogens or Natural Enemies has a *neutral effect on vulnerability***. In the foreseeable future, there is no indication that medusahead will be significantly affected by a pathogen or natural enemy that would benefit from the effects of climate change.
- **Phenological Response has a *neutral effect on vulnerability.*** Temperature is an important factor in controlling medusahead's leafing, flowering, and maturation period (i.e., phenology).[155] As temperatures increase, it is expected that medusahead phenology will shift productively with the longer growing season.

Noxious Weed: Whitetop *(Cardaria draba)*

Existing Conditions & Observations by USRT Member Tribes[156]

Tribes report noxious weeds, such as whitetop, continuing to spread across the landscape at the expense of native plants. Compared to native plants, these weeds can establish themselves more quickly after fires, during periods of drought, and following other extreme events. Whitetop is also capable of being transported by grazing cattle. Tribes use weed control techniques such as controlled chemical spraying and rangeland management (e.g., allowing cattle on the range to eat noxious weeds) to help limit the spread of these species.

Figure 39: Whitetop. Photo credit: Thayne Tuason.

Whitetop Vulnerability Rankings

Due to insufficient detailed information on the range of whitetop within the project area, the species was assessed qualitatively and not given an overall vulnerability ranking in this project.

Factors Affecting Vulnerability

- **Reproductive System *somewhat increases vulnerability*.** Vegetative reproduction is more important than sexual reproduction in the local spread of whitetop.[157] In plants, the genetic variation of species reliant on asexual forms of reproduction (vegetative or apomictic) is assumed to be very low. Lack of genetic variation is expected to hinder species' ability to adapt to rapid climate change.[123]
- **Dispersal/Movement has a *neutral effect on vulnerability*.** Seeds are distributed via wind, water, and attachment to vehicles and equipment.[158] This range of dispersal mechanisms increase the likelihood that the species will have some adaptive capacity to shifting climate conditions.
- **Physiological Thermal Niche has a *neutral effect on vulnerability*.** Whitetop distribution is not significantly affected by thermal characteristics of the environment in the project area. Whitetop is found in western North America rangelands and can exist in regions with heavy frosts and snowfall.[159]
- **Physiological Hydrological Niche has a *neutral effect on vulnerability*.** Whitetop has little dependence on a seasonal hydrologic regime, or localized moisture regime, that would be affected by climate change. Whitetop is well adapted to moist habitats and is not abundant in semiarid environments.[160]
- **Disturbance Regime has a *neutral effect on vulnerability***. Whitetop is an early successional species, inhabiting disturbed, open sites. Whitetop's extensive root system enables the species to sprout following severe fires, depending on site conditions. Whitetop may also establish by seed after a fire.
- **Sensitivity to Pathogens or Natural Enemies has a *neutral effect on vulnerability*.** In the foreseeable future, there is no indication that the species will be significantly affected by a pathogen or natural enemy that will benefit from the effects of climate change.

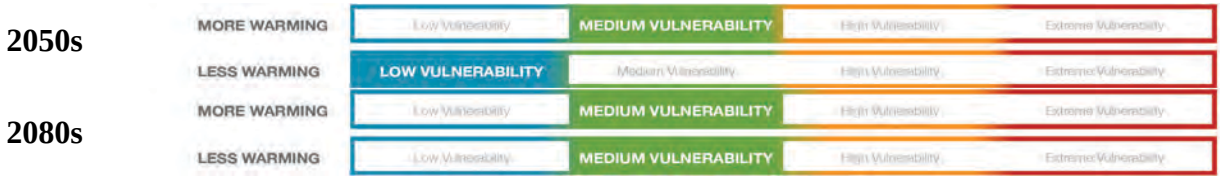
Quaking Aspen (*Populus tremuloides*)

Existing Conditions & Observations by USRT Member Tribes[161]

Quaking aspen thrive in specific post-glacial habitats, an ecological niche that is no longer emerging on reservations or across the Upper Snake River Watershed. Quaking aspen can respond successfully to wildfire.

Figure 40: Quaking Aspen. Photo credit: Famartin.

Quaking Aspen Vulnerability Rankings



Rankings above represent climate change vulnerability in the 2050s and 2080s for two different climate change scenarios. The higher climate change scenario (RCP 8.5) is labeled "More Warming" and the lower climate change scenario (RCP 4.5) is labeled "Less Warming". The rankings reflect the assessment of local climate change projections and species-specific sensitivities and adaptive capacity from the CCVI analysis.

Factors Affecting Vulnerability

- **Dispersal/Movement *somewhat increases vulnerability*.** The feathery seeds of quaking aspen are generally dispersed by wind and travel less than 3,000 feet, though in heavy winds they can travel several miles. Quaking aspen seeds also are water dispersed and can germinate while floating or submerged in water.[162] Climate change conditions may challenge the success of these dispersal mechanisms.
- **Physiological Thermal Niche *somewhat increases vulnerability*.** Quaking aspen are found in high elevation areas and northern latitudes that often include low seasonal temperatures and short growing seasons.[163] Projected increases in temperature and growing season length could negatively affect quaking aspen.
- **Sensitivity to Pathogens or Natural Enemies *somewhat increases vulnerability*.** Droughts may increase the susceptibility of quaking aspen to canker infections. Drier, warmer, climate conditions may favor invasion of gypsy moths –a known pest of quaking aspen – in the western United States.[164]
- **Physiological Hydrological Niche has a *neutral effect on vulnerability*.** Suitable climate conditions for quaking aspen vary widely across its range. However, quaking aspen is generally found in regions where annual precipitation is greater than evapotranspiration.[165] Because quaking aspen is not dependent on a narrowly defined hydrological regime that is vulnerable to loss or reduction with climate change, its physiological hydrological niche has a neutral effect on its vulnerability.

- **Disturbance Regime has a *neutral effect on vulnerability*.** Quaking aspen colonizes sites after fires and other disturbances. While moderate-severity fires do not damage quaking aspen roots, severe fires may damage or kill roots growing near the soil surface, preventing post-fire sprouting.[166]

Redosier Dogwood (*Cornus sericea*)

Existing Conditions & Observations by USRT Member Tribes[167]

Figure 41: Redosier Dogwood. Photo credit: Matt Lavin.

Redosier dogwood is an important cultural resource, utilized for cradle boards and baskets. Tribal members sometimes refer to Redosier dogwood as "red willow" and have reported seeing die-offs on the reservations that are likely tied to recent land-use practices in riparian areas (e.g., agriculture, grazing, and development). Redosier dogwood may also be affected by changes in temperature and cyanobacteria blooms. When growing near streams they are known to lower nearby water temperatures and some of the tribes are actively restoring plants in riparian corridors. Tribal members have reported noticing more brown dots on plants, which diminishes their suitability for baskets. Therefore, tribal members have had to travel farther to harvest suitable plants. Redosier dogwood generally uses rhizomous dispersal but is sometimes dispersed via branch cuttings from beavers and birds.

Redosier Dogwood Vulnerability Rankings

Rankings above represent climate change vulnerability in the 2050s and 2080s for two different climate change scenarios. The higher climate change scenario (RCP 8.5) is labeled "More Warming" and the lower climate change scenario (RCP 4.5) is labeled "Less Warming". The rankings reflect the assessment of local climate change projections and species-specific sensitivities and adaptive capacity from the CCVI analysis.

Factors Affecting Vulnerability

- **Physiological Hydrological Niche *somewhat increases vulnerability*.** Redosier dogwood establishes in areas adjacent to lakes, ponds, streams, and wetlands. Redosier dogwood thrives along edges of nitrogen-rich wetlands, which are inundated during spring and dry out in summer. The redosier dogwood is unable to tolerate root saturation for extended periods of time, but can inhabit areas with fluctuating water tables.[168] Shifting precipitation patterns driven by climate change may disturb these hydrological conditions, somewhat increasing redosier dogwood's vulnerability to climate change.
- **Dispersal/Movement has a *neutral effect on vulnerability*.** Seeds are dispersed by several bird species from autumn through winter, including crows, vireos, redheaded woodpeckers and bluebirds.[169] These birds can transport the seeds over distances of 1 km (0.6 miles). These longer distance dispersal events increase the likelihood that the red willow has the capacity to adapt to shifting climatic conditions.
- **Physiological Thermal Niche has a *neutral effect on vulnerability*.** Redosier dogwood distribution is not significantly affected by thermal environmental characteristics in the assessment area.[170]

- **Disturbance Regime has a *neutral effect on vulnerability*.** Redosier dogwood is tolerant of flooding and scouring events[171], and is also relatively fire tolerant. Fires generally top-kill redosier dogwood shrubs, but mortality only occurs with severe fires where the upper soil layers are heated for extended periods of time.[172]

F. Climate Change Vulnerability of Animals

This section provides further detail on some of the most important species-specific factors affecting the climate change vulnerability for animal species selected as Shared Concerns for this project. Species are listed alphabetically, and vulnerabilities are described quantitatively and qualitatively, as appropriate.

American Beaver (*Castor Canadensis*)

Existing Conditions & Observations by USRT Member Tribes[173]

Tribes report beaver populations increasing across reservations, noting they were "trapped out" of many basins within their historic range. Beaver dam habitats depend on the presence of willows, aspen, and cottonwood. Beaver dams improve water quality and water storage on the landscape, creating new pools and wet-meadow habitats, which, in turn, protect streams from flash-flooding. However, these upstream effects can also increase drying of downstream wetland and wet-meadow habitats.

Figure 42: Beaver. Photo credit: Minette Layne.

American Beaver Vulnerability Rankings

Rankings above represent climate change vulnerability in the 2050s and 2080s for two different climate change scenarios. The higher climate change scenario (RCP 8.5) is labeled "More Warming" and the lower climate change scenario (RCP 4.5) is labeled "Less Warming". The rankings reflect the assessment of local climate change projections and species-specific sensitivities and adaptive capacity from the CCVI analysis.

Factors Affecting Vulnerability

- **Anthropogenic Barriers *somewhat increases vulnerability*.** Roads can act as barriers to American beaver dispersal.[174] Railways, roads, and land clearing next to bodies of water may reduce habitat suitability for the American beaver.[175] These barriers may decrease the ability of the American beaver to migrate in response to changing climate conditions.
- **Physiological Hydrological Niche *somewhat increases vulnerability*.** American beavers avoid fast-flowing streams, lakes with strong waves,[176] and steams with significant stream-flow fluctuations.[177] Shifting precipitation regimes under climate change may alter hydrologic conditions in ways that negatively affect beaver habitat suitability.
- **Natural Barriers has a *neutral effect on vulnerability*.** American beavers are good dispersers[178] with a maximum annual dispersal distance between 15 and 30 miles.[179] It is unlikely that natural barriers will decrease the ability of the American beaver to migrate in response to changing climate conditions.

- **Dispersal/Movement has a *neutral effect on vulnerability*.** The species has a maximum annual dispersal distance of 15-30 miles.[180] Sub-adult American beavers (typically 2-3 years old) migrate an average of 5 to 10 miles from the family.[181,182] The beaver's excellent dispersal ability increases the likelihood that the species has the capacity to adapt to shifting climatic conditions.
- **Physiological Thermal Niche has a *neutral effect on vulnerability*.** American beaver distribution is not significantly affected by thermal characteristics of the environment in the project area. Beaver habitat is found in both warm, low-lying areas and cooler, high elevation areas.[183]
- **Disturbance Regime has a *neutral effect on vulnerability*.** Wildfire within riparian areas benefits American beaver populations as the species is adapted to the early stages of forest succession.[184]
- **Dependence on Other Species to Generate Habitat has a *neutral effect on vulnerability*.** The American beaver does not require any uncommon habitats that are generated or maintained by another species.[185]
- **Diet has a *neutral effect on vulnerability*.** American beavers consume a wide variety of woody vegetation, including aspen, willow, cottonwood, and birch. During summer months, the American beaver consumes aquatic plants, including pond lilies, duckweed, pondweed, and algae.[186] Species that can readily switch among different food types are less likely to be negatively affected by climate change.
- **Sensitivity to Pathogens or Natural Enemies has a *neutral effect on vulnerability*.** There is no indication that the American beaver will be significantly affected by a pathogen or natural enemy likely to benefit from the effects of climate change.
- **Sensitivity to Competition has a *neutral effect on vulnerability*.** The American beaver is not currently sensitive to competition from native or non-native species, and there is no indication that climate change will cause a species to become a competitor in the future.

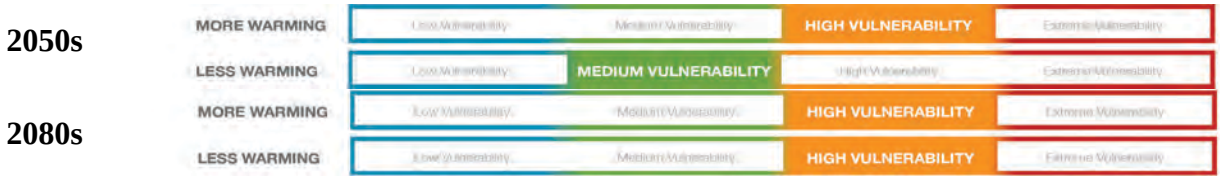
Black-tailed Jackrabbit (*Lepus californicus)*

Existing Conditions & Observations by USRT Member Tribes[187]

The black-tailed jackrabbit is the rabbit species most utilized by USRT member tribes. Black-tailed jackrabbit can live in marshes or sagebrush steppe habitats and depend on sagebrush and greasewood plants. Tribes reported a decline in black-tailed rabbit species across the reservations, beyond the species' cyclical population trends. Black-tailed jackrabbit habitat has decreased due to energy and agricultural development and wildfire. Though isolated colonies remain within natural habitat, many populations have adapted to habitat loss by living in alfalfa fields.

Figure 43: Black-tailed Jackrabbit. Photo credit: Larry Smith.

Black-tailed Jackrabbit Vulnerability Rankings



Rankings above represent climate change vulnerability in the 2050s and the 2080s for two different climate change scenarios. The higher climate change scenario (RCP 8.5) is labeled "More Warming" and the lower climate change scenario (RCP 4.5) is labeled "Less Warming". The rankings reflect the assessment of local climate change projections and species-specific sensitivities and adaptive capacity from the CCVI analysis.

Factors Affecting Vulnerability

- **Disturbance Regime *increases vulnerability*.** Smaller, intermittent wildfire in big sagebrush habitat can benefit black-tailed jackrabbit by increasing the prevalence of grasses and flowering plants, alongside shrub cover. However, recent large-scale fires have caused a decline in big sagebrush and an increase in cheatgrass encroachment,[188] negatively affecting black-tailed jackrabbit habitat.
- **Anthropogenic Barriers *somewhat increases vulnerability*.** Roads can act as barriers to dispersal and can be a source of mortality for the black-tailed jackrabbit.[189] This may limit the ability of black-tailed jackrabbit to migrate in response to changing climate conditions.
- **Climate Change Mitigation *somewhat increases vulnerability*.** Black-tailed jackrabbit habitat could be potential sites for solar array or wind farm development due to the open characteristics of the landscape. If those developments were to occur it, they would decrease habitat available for black-tailed jackrabbit.
- **Sensitivity to Pathogens or Natural Enemies *somewhat increases vulnerability*.** Climate change may potentially impact black-tailed jackrabbits by amplifying effects of parasites and disease (e.g., tularemia, bubonic plague, and Lyme disease).[190] Warming temperatures and subsequent shifts in seasonal patterns are expected to lead to earlier tick activity and

an expansion of suitable tick habitat, increasing the risk of black-tailed jackrabbit exposure to ticks.[191]

- **Dispersal/Movement has a *neutral effect on vulnerability*.** The black-tailed jackrabbit is an excellent disperser, and dispersal commonly extends several miles. In Idaho, the species was observed moving up to 28 miles over a 17-week period.[192] The black-tailed jackrabbit's excellent dispersal ability increases the likelihood that it will be able to move in response to shifting climatic conditions.
- **Physiological Thermal Niche has a *neutral effect on vulnerability*.** Black-tailed jackrabbit distribution is not significantly affected by thermal characteristics of the environment. Black-tailed jackrabbits are known to inhabit multiple habitat types with varying temperature regimes.[193]
- **Physiological Hydrological Niche has a *neutral effect on vulnerability*.** The black-tailed jackrabbit has little dependence on a strongly seasonal hydrologic regime or a specific wetland habitat that would be affected by climate change.
- **Diet has a *neutral effect on vulnerability*.** During summer, the black-tailed jackrabbit diet consists primarily of grasses, flowering plants, crops, and hay. During the winter, its diet consists primarily of buds, bark, and leaves of woody plants.[194] Species that can readily switch among different food types are less likely to be negatively affected by climate change than dietary specialists.
- **Sensitivity to Competition has a *neutral effect on vulnerability*.** The black-tailed jackrabbit is not currently sensitive to competition from native or non-native species, and there is no indication that climate change will cause a species to become a competitor in the future.

Bull Trout *(Salvelinus confluentus)*

Existing Conditions & Observations by USRT Member Tribes[195]

Figure 44: Bull Trout. Photo credit: USFWS Mountain-Prairie.

Portions of the Malheur River and other streams throughout the project area have already been observed to exceed suitable temperature limits for bull trout. Springs and groundwater inputs to streams are known to help moderate rising temperatures, but it is not known to what point they can offer protection from high temperatures. Man-made stream barriers have decreased interactions between bull trout populations, potentially isolating them genetically. Increasing sediment inputs (from erosion or wildfire) and nutrient run-off from agriculture have been observed in bull trout streams. Wildfires have been observed destroying riparian vegetation, which decreases river shading, and thereby increases river temperatures.

Bull Trout Vulnerability Rankings

Rankings above represent climate change vulnerability in the 2050s and 2080s for two different climate change scenarios. The higher climate change scenario (RCP 8.5) is labeled "More Warming" and the lower climate change scenario (RCP 4.5) is labeled "Less Warming". The rankings reflect the assessment of local climate change projections and species-specific sensitivities and adaptive capacity from the CCVI analysis.

Factors Affecting Vulnerability

- **Physiological Thermal Niche *greatly increases vulnerability*.** Bull trout require extremely cold water temperatures (45-50°F), with optimum temperatures for egg incubation ranging between 36°F and 39°F.[196] As stream temperatures continue to rise, the frequency with which these thresholds are exceeded, and the stream range over which they are exceeded, may increase.
- **Physiological Hydrological Niche *greatly increases vulnerability*.** Bull trout spawning habitat consists of gravel riffles in small tributary streams and lake inlet streams, which are often in close proximity to springs. Bull trout inhabit deep, cold pools; fast-flowing streams; and large, cold lakes.[197] Shifting precipitation patterns under climate change could threaten the availability of these narrow hydrological conditions.
- **Anthropogenic Barriers *increases vulnerability*.** Many streams and rivers within the project area have dams that prevent bull trout access to cooler habitat if their current habitat becomes too warm under climate change. There are eight dams on the mainstem of the Snake River, from below Shoshone Falls to Hells Canyon. These dams include Upper Salmon Falls Dam,

Lower Salmon Falls Dam, Bliss Dam, C.J. Strike Dam, Swan Falls Dam, Brownlee Dam, Oxbow Dam, and Hells Canyon Dam.[198]

- **Disturbance Regime *increases vulnerability*.** The survival of salmonid (i.e., salmon, trout, and char) eggs and embryos is strongly influenced by sediment deposition, water quality, and streambed scour and fill.[199] As air temperatures rise, watersheds are projected to become increasingly rain-dominant. This shift will increase the risk of winter flooding and increase sediment transport, which can negatively affect the survival of salmonid eggs.
- **Sensitivity to Pathogens or Natural Enemies *increases vulnerability*.** Warming stream temperatures may increase mortality caused by fish pathogens and diseases. *Vibrio* and *Ceratomyxa shasta* are two infections known to negatively affect salmonids and their effects could be exacerbated with warming stream temperatures.[200] Increasing water temperatures can stress salmonids, reducing their ability to mount an effective immune response to disease. Many important salmonid diseases become virulent when water temperatures reach or exceed 60-61°F.[201]
- **Sensitivity to Competition from Native or Non-Native Species *increases vulnerability*.** Warming stream temperatures will enable other trout species to inhabit rivers and stream reaches that were historically too cold for them. The bull trout's competitive advantage as a cold-water specialist could thus decline, as warming temperatures allow competing species to disperse into its current range.[202]
- **Measured Genetic Variation *increases vulnerability*.** There is relatively little genetic variation within bull trout populations in the northwestern United States.[203] Species with low levels of genetic variation are expected to have difficulty adapting to climate change because the occurrence of new, beneficial mutations is not expected to keep up with the rate of climate change.[204]
- **Climate Change Mitigation *somewhat increases vulnerability*.** Future dam building is possible in the region. Dams act as barriers to bull trout movement into some portions of the Upper Snake River watershed.[205] Additional dam building could hinder bull trout's ability to move into cooler streams as temperatures rise.
- **Dispersal/Movement has a *neutral effect on vulnerability*.** Migratory forms of bull trout hatch and develop in streams with fast currents before migrating downstream into slower, more productive rivers or lakes, which they inhabit before returning upstream to spawn.[206] One study of bull trout migrations in the mid-Columbia and Snake River Basin found that bull trout are excellent dispersers and can migrate 8-89 km (5-55 miles).[207] The bull trout's excellent dispersal ability increases the likelihood that the species has the ability to adapt to shifting climate conditions.

Cattle

Existing Conditions & Observations by USRT Member Tribes[208]

Figure 45: Cattle. Photo credit: Pamela @Pamzpix

Tribes report that cattle are not gaining weight on rangeland like they have in the past. Cattle lose weight during drought events and are having difficulty finding nutritious foods on rangeland as native plant abundance decreases, while noxious weeds become more prevalent. Wildfires also diminish the availability of nutritious feed on the landscape. Drought conditions and the disappearance, or reduction, of water flows from some springs have forced cattle owners to use domestic water supplies for their cattle. Shifts in the timing of grass growth has also decreased the effectiveness of rangeland management, as the traditional synchronization of grass yield and cattle access is becoming less reliable. Cattle prefer wet-meadow areas of the landscape, but their presence there, without appropriate protections to sensitive habitats, can have negative repercussions on water quality and water availability that ultimately impact the cattle themselves. In many instances, ranchers are just barely turning a profit, making them highly sensitive to changes in their herd's health and weight.

Cattle Vulnerability Rankings

Cattle did not receive an overall vulnerability ranking in this project, as the CCVI tool is not designed for domesticated species. The climate change vulnerability of cattle was therefore investigated qualitatively.

Factors Affecting Vulnerability

Climate change effects on cattle and ranching include the decreasing reliability of water supplies, increasing risk of wildfire in rangelands, increasing heat stress on cattle, potential increases in disease and pathogens, and reduced quality of feed. Collectively, these impacts can have economic implications for USRT tribal members by increasing the time and resources required to access quality rangelands and reach finish weights. These changes could also decrease leasing revenue.

Impacts on Animal Physiology

Increasing summer temperatures, more extreme heat events, and the potential for increases in pathogens and parasites are climate change-related factors that directly influence cattle's physiological health. High temperatures (particularly heat events that occur in spring and early summer when cattle are less acclimated to heat)[209] can increase the risk of heat stress. Heat stress results in higher respiration rates, increasing body temperature, reduced food intake, and reduced performance.[210] Mortality can occur with more severe heat events, such as those that last three or more days.[211] Cattle at higher risk of heat stress include: newly arrived cattle that may have already been stressed by weaning, processing, or transportation; finished or nearly finished cattle, especially heifers; cattle that have been sick in the past and may have some preexisting lung damage; black or very dark-hided cattle; heavy bred cows that will calve sometime during the summer; older cows; and cattle which may be thin due to inadequate nutrition.[212]

Night-time cooling and access to shade, water, and active cooling (e.g., spray cooling) are important tools for limiting the effects of heat events on cattle. Warmer seasonal temperatures may also increase the survivability of pathogens and parasites by creating conditions more favorable to their reproduction, survival, and transmission. This includes diseases transmitted between livestock, as well as transmission of diseases between wild species and livestock. Climate change may facilitate these transmissions by altering wild animal distribution, movement, and feeding patterns.[213]

Impacts on Rangelands

In addition to direct impacts on cattle physiology, climate change will affect cattle and ranching practices through impacts on rangelands. These impacts include decreases in sagebrush steppe habitat utilized as rangeland across the Upper Snake River Watershed. Climate changes that directly affect rangeland include: a lengthening of the growing season, changes in plant productivity, shifts in rangeland species, reduced nutritional value of rangelands, the potential spread of invasive species, and increases in wildfire risk.

Projected changes in plant productivity and distribution vary with temperature, elevation, and carbon dioxide levels. Increasing temperatures, declining snowpack, and earlier snowmelt are expected to lead to earlier spring greening and lengthening of the growing season, particularly in cooler, higher elevation rangelands.[214] These changes may also allow for migration of rangeland plant communities to higher elevations.[215]

In contrast to cooler locations, productivity in warmer, lower elevation rangelands may decline. A key issue in these lower elevation rangelands is increasing summer drought stress, which is expected to reduce the reproductive viability of native perennials.[216] Over-grazing and increased fire frequency (whether due to climate change or fire management practices) can also affect productivity and lead to shifts in rangeland species.[217]

Some plant species (including some species of weeds) may benefit from higher levels of carbon dioxide in the atmosphere, which can stimulate plant productivity through increased efficiencies in photosynthesis and water use.[218] Plants that employ the C_3 photosynthetic pathway, including cheatgrass, are most likely to benefit from the higher atmospheric carbon dioxide concentrations. However, this benefit may be offset by rising temperatures and changes in precipitation patterns.[219] In more water-limited systems, warmer temperatures and drier conditions tend to favor C_4 species over C_3 species.[220]

Increasing atmospheric carbon dioxide and temperature have also been found to affect the nutritional quality of rangelands. Studies on shortgrass steppe species, and short- and tallgrass species in the Great Plains, found reduced forage quality (e.g., less protein and nitrogen) and decreased digestibility with higher temperature and higher atmospheric carbon dioxide concentrations.[221] Similar findings were reported for perennial forage grasses in the Northwest.[222]

Chinook Salmon (*Oncorhynchus tshawytscha*)

Existing Conditions & Observations by USRT Member Tribes[223]

Figure 46: Chinook Salmon. Photo credit: Andy Kohler.

Chinook salmon have been central to the culture and diet of the four USRT member tribes for thousands of years. They played an especially important part in the tribes' seasonal migration and subsistence diet. Unfortunately, these connections have been greatly diminished over the last century as eight dams on the Upper Snake River have prohibited Chinook salmon from reaching the USRT member tribes' traditional harvest areas. The Burns Paiute Tribe and Shoshone-Paiute Tribes have recently reinitiated ceremonial Chinook salmon fisheries on the upper Malheur River and East Fork Owyhee River by live-transporting Chinook salmon around the dams. Currently, the Fort McDermitt Paiute-Shoshone do not have access to Chinook salmon, while the Shoshone-Bannock Tribes can exercise their treaty right to harvest Chinook salmon. Climate change poses additional complex stressors to this already significantly impacted fishery.

Chinook Salmon Vulnerability Rankings

Rankings above represent climate change vulnerability in the 2050s and 2080s for two different climate change scenarios. The higher climate change scenario (RCP 8.5) is labeled "More Warming" and the lower climate change scenario (RCP 4.5) is labeled "Less Warming". The rankings reflect the assessment of local climate change projections and species-specific sensitivities and adaptive capacity from the CCVI analysis.

Factors Affecting Vulnerability

- **Physiological Thermal Niche** ***greatly increases vulnerability.*** Chinook salmon inhabit deep, cold pools prior to spawning.[224] Water temperatures exceeding 48-50°F may reduce survival of Chinook salmon embryos and alevins.[225] Additionally, migration delays and blockages can form when stream temperatures exceed 69.8°F and can contribute to reproductive failure.[226] As stream temperatures continue to rise, the frequency with which these thresholds are exceeded and total river miles affected may increase.
- **Physiological Hydrological Niche** ***greatly increases vulnerability.*** Large, deep, pools offer important holding habitat for Chinook salmon prior to spawning. While sufficient flows are required to ensure incubating embryos receive sufficient oxygenation, extreme low or high flows can destroy embryos and fry residing within the streambed.[227,228] Shifting precipitation patterns under climate change could threaten these sensitive hydrological conditions.

- **Anthropogenic Barriers *increases vulnerability*.** Many streams and rivers within the assessment area have dams that would prevent Chinook salmon access to more suitable, cooler habitat if the present habitat becomes too warm. There are eight dams on the mainstem Snake River from below Shoshone Falls to Hells Canyon include the Upper Salmon Falls Dam, Lower Salmon Falls Dam, Bliss Dam, C.J. Strike Dam, Swan Falls Dam, Brownlee Dam, Oxbow Dam, and Hells Canyon Dam.[229]
- **Sensitivity to Pathogens or Natural Enemies *increases vulnerability*.** Warming stream temperatures may increase mortality caused by fish pathogens and diseases. *Vibrio* and *Ceratomyxa shasta* are two infections known to negatively affect salmonids, and their effects could be exacerbated with warming stream temperatures.[230] Increasing water temperatures can stress salmonids, reducing their ability to mount an effective immune response to disease. Many important salmonid diseases become virulent when water temperatures reach or exceed 60-61°F.[231]
- **Climate Change Mitigation *somewhat increases vulnerability*.** Future dam building is possible in the region. Dams act as barriers to movement for Chinook salmon accessing stream reaches in the Upper Snake River and more dams could further limit their ability to move as habitat conditions change.[232]
- **Disturbance Regime *somewhat increases vulnerability*.** The survival of salmonid (i.e., salmon, trout, and char) eggs and embryos is strongly influenced by sediment deposition, shifts in water quality, and streambed scour and fill.[233] As air temperatures rise, watersheds are projected to become increasingly rain-dominant. This shift will increase the risk of winter flooding and sediment transport, which can negatively affect the survival of salmonid eggs.
- **Sensitivity to Competition from Native or Non-Native Species *somewhat increases vulnerability*.** Chinook salmon compete with resident brook trout, which feed on other fish species and are known to prey on young salmonids.[234] Climate change may alter this competitive interaction.
- **Measured Genetic Variation *somewhat increases vulnerability*.** Populations of Chinook salmon in the Snake River have low genetic variability compared to Chinook salmon populations in the Columbia River Basin.[235] Less genetic variability may somewhat restrict the ability of Chinook salmon to adapt to changing climate conditions.
- **Diet has a *neutral effect on vulnerability.*** In freshwater, juvenile Chinook salmon feed on terrestrial and aquatic insects. In salt water, Chinook salmon eat crustaceans and other bottom invertebrates. Adult Chinook salmon mostly prey on fish.[236] Species that can readily switch among different food types are less likely to be negatively affected by climate change than dietary specialists.
- **Dispersal/Movement has a *neutral effect on vulnerability*.** Chinook salmon are excellent dispersers, as they are anadromous and migrate several hundred miles to the stream in which they were spawned.[237] This dispersal ability may help facilitate successful response to changing climate conditions.
- **Phenological Response has a *neutral effect on vulnerability*.** No observed shift in Chinook salmon run timing has been recorded in the Snake River.[238]

Columbia Spotted Frog (*Rana luteiventris*)

Existing Conditions & Observations by USRT Member Tribes[239]

USRT member tribes have reported an overall decrease in amphibian abundance. The Columbia spotted frog utilizes both low elevation and high elevation habitats. Its habitat can be affected (both positively and negatively) by the presence of American beavers in a watershed. Its habitat is also influenced by groundwater availability, which has been diminishing in some areas due to high groundwater withdrawals for agriculture. The Columbia spotted frog also uses springs and seeps as habitat and are sensitive to reductions in water flows in these habitats.

Figure 47: Columbia Spotted Frog. Photo credit: USFS.

Columbia Spotted Frog Vulnerability Rankings

Rankings above represent climate change vulnerability in the 2050s and 2080s for two different climate change scenarios. The higher climate change scenario (RCP 8.5) is labeled "More Warming" and the lower climate change scenario (RCP 4.5) is labeled "Less Warming". The rankings reflect the assessment of local climate change projections and species-specific sensitivities and adaptive capacity from the CCVI analysis.

Factors Affecting Vulnerability

- **Physiological Hydrological Niche *increases vulnerability*.** The Columbia spotted frog inhabits shallow lakes, ponds, marshes, and small springs[240] during breeding and egg laying. Columbia spotted frogs typically inhabit permanent bodies of water, although some populations do inhabit seasonal pools. The Columbia spotted frog avoids dry uplands, except during migration to winter sites.[241] Shifting precipitation patterns under climate change may disturb or reduce the prevalence of these sensitive hydrological environments.
- **Sensitivity to Pathogens or Natural Enemies *increases vulnerability*.** Brook trout, cutthroat trout, and rainbow trout reduce the distribution and abundance of Columbia spotted frogs. Cutthroat trout prey on spotted frog tadpoles and juveniles, reducing the number of frogs that develop into adults.[242] Warming stream temperatures will enable trout species to inhabit rivers and streams that were previously too cold. In addition, climate change could potentially affect the Columbia spotted frog by amplifying the effects of diseases and parasites (e.g., chytrid fungus and trematodes).[243]
- **Measured Genetic Variation *increases vulnerability*.** Columbia spotted frog populations in Oregon are small and exhibit low levels of genetic variation. Small, isolated populations are vulnerable to reductions in genetic diversity and inbreeding. These limits to genetic diversity can increase the probability of local extinction with changing climate conditions.[244]

- **Natural Barriers *somewhat increases vulnerability*.** The Columbia spotted frog predominately inhabits areas with permanent water sources.[245] Therefore, stretches of land without wetlands, streams, ponds, or lakes can act as natural barriers to dispersal. Increasing temperatures and shifting precipitation patterns under climate change may alter the prevalence of these natural barriers within the assessment area.
- **Anthropogenic Barriers *somewhat increases vulnerability*.** Roads can act as barriers to dispersal and can be a source of mortality for the Columbia spotted frog.[246] These barriers may limit the Columbia spotted frog's ability to migrate in response to changing climate conditions.
- **Dispersal/Movement *somewhat increases vulnerability*.** The Columbia spotted frog has fairly limited dispersal abilities. In central Idaho, Columbia spotted frogs were documented dispersing up to 3,300 feet from breeding sites to reach summer habitats, though females typically remained within 1,600 feet of breeding sites.[247] These limitations to dispersal may impact the species' ability to migrate in response to changing climate conditions.
- **Physiological Thermal Niche has a *neutral effect on vulnerability***. Columbia spotted frog distribution is not significantly affected by thermal characteristics of the environment in the assessment area. The species inhabits both warmer low-lying areas and cooler higher elevation areas.[248]
- **Diet has a *neutral effect on vulnerability***. The Columbia spotted frog has a diverse diet composed of insects, mollusks, crustaceans, and arachnids. During the larval stage, the species consumes algae, organic debris, plant tissue, and small aquatic organisms.[249] Species that can readily switch among different food types are less likely to be negatively affected by climate change than dietary specialists.
- **Phenological Response has a *neutral effect on vulnerability*.** The timing of Columbia spotted frog egg deposition may be affected by water temperature, but other factors likely trigger movement of frogs to the egg-laying site.

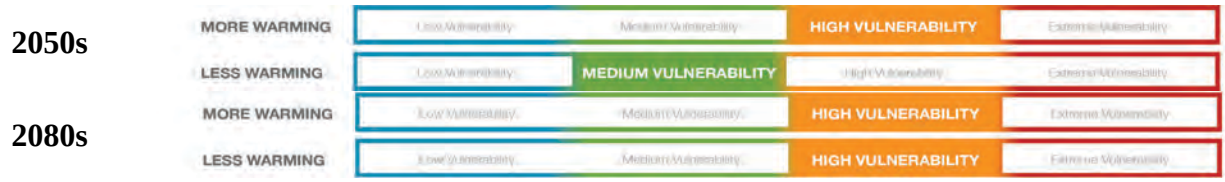
Elk *(Cervus canadensis)*[250]

Existing Conditions & Observations by USRT Member Tribes[251]

Elk have reportedly migrated into some new areas on reservations, as they have been pushed out of other lands by cattle and development. They have a high capacity for migration and can traverse many rugged features of the landscape. Elk are "generalists," able to graze and browse on a diversity of plant foods.

Figure 48: Elk. Photo credit: Matt Knoth.

Elk Vulnerability Rankings



Rankings above represent climate change vulnerability in the 2050s and 2080s for two different climate change scenarios. The higher climate change scenario (RCP 8.5) is labeled "More Warming" and the lower climate change scenario (RCP 4.5) is labeled "Less Warming". The rankings reflect the assessment of local climate change projections and species-specific sensitivities and adaptive capacity from the CCVI analysis.

Factors Affecting Vulnerability

- **Measured Genetic Variation *increases vulnerability*.** There is a lack of genetic variation within elk populations.[252] Less genetic variation may somewhat restrict the ability of elk to adapt to changing climate conditions.

- **Physiological Hydrological Niche *somewhat increases vulnerability*.** Elk seasonally inhabit riparian areas. In the western U.S., elk generally prefer habitats that are in close proximity (< 2,600 ft.) to surface water. Water availability may be especially important for elk during periods of forage desiccation, lactation, or heat stress. One study focused in south-central Washington, found that elk movements and home ranges decreased during summers with drought. Elk movements were centered near permanent water sources and along riparian zones with sufficient forage.[253] Shifting precipitation patterns under climate change could alter the suitability of these habitats.

- **Anthropogenic Barriers *somewhat increases vulnerability*.** Elk are sensitive to anthropogenic disturbance. Elk avoid roads and disturbances created by logging. Recurrent anthropogenic disturbance may reduce elk reproduction and the survival of offspring.[254] These barriers may restrict migration in response to changing climate conditions.

- **Sensitivity to Pathogens or Natural Enemies *somewhat increases vulnerability*.** Warming temperatures are expected to lead to earlier tick activity and an expansion of suitable tick habitat. Both changes may increase the risk of elk exposure to ticks.[255] While fire may reduce populations of parasites known to impact elk, this effect is likely to be short-term. Fire may

reduce winter tick populations, however the long-term effect of fires on winter tick populations is unknown.[256]

- **Sensitivity to Competition *somewhat increases vulnerability*.** Elk and livestock diets overlap when forage availability is reduced. Therefore, the potential for competitive interactions is likely to be greatest on low-elevation winter ranges with adjacent foothills.
- **Natural Barriers has a *neutral effect on vulnerability*.** In the assessment area, elk have been observed traversing rugged mountain ridges.[257] It is unlikely that natural barriers will limit the ability of elk to shift its range in response to climate change.
- **Dispersal/Movement has a *neutral effect on vulnerability*.** Elk have excellent dispersal abilities. In mountainous regions, the species disperse between alpine meadows in summer and valleys in winter. On more level terrain, elk move between hillsides in the summer and open grasslands in the winter.[258] The elk's excellent dispersal ability increases the likelihood that the species will be able to move and keep pace with shifting climatic conditions.
- **Physiological Thermal Niche has a *neutral effect on vulnerability*.** Elk distribution is not significantly affected by thermal characteristics of the environment in the assessment area.
- **Disturbance Regime has a *neutral effect on vulnerability*.** Elk are associated with fire-dependent and fire-adapted plant species. Decreases in elk populations have been observed when fire frequency in these plant communities decrease.[259]
- **Ice/Snow Dependence has a *neutral effect on vulnerability*.** Deep snowpack can obstruct elk movement during winter and can bury forage. Because elk occasionally move from areas with deep snowpack to areas with less snow,[260] declining snowpack may be beneficial for the species by increasing their winter mobility.
- **Restriction to Uncommon Geological Features has a *neutral effect on vulnerability*.** Elk are habitat generalists, inhabiting grasslands, wetlands, shrublands, and forests.[261] Because elk are not tied to any specific geologic features they are more likely to be able to adapt to habitat loss from climate change, compared to species that are dependent on uncommon geologic features.
- **Diet has a *neutral effect on vulnerability*.** Elk have a diverse diet. Elk are grazers, but also eat flowering plants or mushrooms. They will also browse on willow, aspen, and oak in regions without grasses.[262] Species that can readily switch among different food types are less likely to be negatively affected by climate change than dietary specialists.

Golden Eagle (*Aquila chrysaetos*)

Existing Conditions & Observations by USRT Member Tribes[263]

Golden eagle feathers are an important part of ceremonial activities for the USRT member tribes. Tribal members have reported declines in golden eagle populations. No shifts in the timing of golden eagle nesting have been observed.

Figure 49: Golden Eagle. Photo credit: Peter G.W. Jones.

Golden Eagle Vulnerability Rankings

Rankings above represent climate change vulnerability in the 2050s and 2080s for two different climate change scenarios. The higher climate change scenario (RCP 8.5) is labeled "More Warming" and the lower climate change scenario (RCP 4.5) is labeled "Less Warming". The rankings reflect the assessment of local climate change projections and species-specific sensitivities and adaptive capacity from the CCVI analysis.

Factors Affecting Vulnerability

- **Climate Change Mitigation *somewhat increases vulnerability*.** Portions of the golden eagle's range within the USRT project area include land with 'good' wind power classifications. Development of these areas would leave the golden eagle susceptible to injury or mortality from wind turbines.[264]

- **Sensitivity to Pathogens or Natural Enemies *somewhat increases vulnerability*.** While disease is not currently a major threat to golden eagle populations, West Nile virus is an emerging concern. Presently, in the western U.S., the golden eagle resides in semiarid landscapes with low mosquito (the vector for West Nile transmission) prevalence.[265] Shifting precipitation patterns under climate change could alter mosquito prevalence in the project area.

- **Dispersal/Movement has a *neutral effect on vulnerability*.** Golden eagles have excellent dispersal capabilities. For example, golden eagles from northern breeding areas (> 55°N) migrate more than 3,000 miles between breeding and wintering sites.[266] The golden eagle's excellent dispersal ability increases the likelihood that the species will be able to move and keep pace with shifting climate conditions.

- **Physiological Thermal Niche has a *neutral effect on vulnerability*.** Golden eagle distribution is not significantly affected by thermal characteristics of the environment in the assessment area.[267]

- **Physiological Hydrological Niche has a *neutral effect on vulnerability*.** The golden eagle has little dependence on a strongly seasonal hydrologic regime or a specific wetland habitat that would be affected by climate change.

- **Diet has a *neutral effect on vulnerability*.** The golden eagle has a broad diet that consists primarily of small mammals (e.g., rabbits, hares, marmots, prairie dogs, and ground squirrels) and occasionally includes large insects, snakes, birds, juvenile ungulates, and carrion.[268,269] Species that can readily switch among different food types are less likely to be negatively affected by climate change than dietary specialists.
- **Sensitivity to Competition has a *neutral effect on vulnerability*.** The golden eagle is not currently sensitive to competition from native or non-native species and there is no indication that climate change will cause another species to become a competitor in the future.
- **Measured Genetic Variation has a *neutral effect on vulnerability*.** Genetic diversity of golden eagle populations is comparable with that of other large raptor populations.[270] Species with average to high levels of genetic variation are expected to be better able to adapt to changing climatic conditions.[271]

Mule Deer (*Odocoileus hemionus*)

Existing Conditions & Observations by USRT Member Tribes[272]

Tribes have noticed declines in mule deer populations. The mule deer historically browsed along alfalfa fields and may have been pushed out by development and water quality impacts from cattle. Constraints on traditional movement patterns are thought to increase opportunities for predators to access deer.

Figure 50: Mule Deer. Photo credit: Calla Hagle.

Mule Deer Vulnerability Rankings

Rankings above represent climate change vulnerability in the 2050s and 2080s for two different climate change scenarios. The higher climate change scenario (RCP 8.5) is labeled "More Warming" and the lower climate change scenario (RCP 4.5) is labeled "Less Warming". The rankings reflect the assessment of local climate change projections and species-specific sensitivities and adaptive capacity from the CCVI analysis.

Factors Affecting Vulnerability

- **Physiological Hydrological Niche *somewhat increases vulnerability*.** Mule deer require water during extended heat events.[273] Extended dry periods and warm temperatures under climate change, especially in the summer months, may decrease overall water availability.
- **Anthropogenic Barriers *somewhat increases vulnerability*.** Fences are a major barrier to mule deer movement in the western U.S. When installed incorrectly, fences obstruct mule deer movement and may cause mortality. In addition to fences, urban, suburban, or rural housing developments can also obstruct mule deer movement.[274] These barriers to migration may limit the mule deer's ability to effectively move in response to changing climate conditions.
- **Sensitivity to Pathogens or Natural Enemies *somewhat increases vulnerability*.** There are many bacterial diseases and parasites that infect mule deer and may cause mortality. For example, bluetongue virus (BT) is transmitted to mule deer by biting gnats.[275] BT is typically most prevalent in deer populations during the summer months when hot and dry conditions are advantageous for the gnats. Increasing incidence of drought and warming temperatures may benefit gnat populations and increase the window of opportunity for outbreaks of BT in mule deer populations. [276]
- **Sensitivity to Competition *somewhat increases vulnerability*.** Mule deer habitat use may be indirectly affected by other wildlife species. Researchers concluded that mule deer habitat

selection was largely explained by avoidance of areas inhabited by elk. Elk can eat a greater variety of forage than mule deer, giving elk a competitive advantage.

- **Physiological Thermal Niche has a *neutral effect on vulnerability*.** Mule deer distribution is not significantly affected by thermal characteristics of the environment in the assessment area.[277]

- **Dispersal/Movement has a *neutral effect on vulnerability*.** Mule deer have excellent dispersal abilities. Studies in Montana observed migration distances ranging 7-87 miles for males and 8-16 miles for females. Research suggests that longer mule deer migrations may be more common in patchy environments with greater distances between suitable habitat areas.[278] The mule deer's dispersal ability increases the likelihood that the species will be able to move and keep pace with shifting climate conditions.

- **Disturbance Regime has a *neutral effect on vulnerability*.** Mule deer are known to graze on early successional vegetation that re-colonizes after a disturbance event.[279] Mule deer are associated with fire-dependent and fire-adapted plant species and communities. Decreases in mule deer populations have been observed when fire frequency in these plant species and communities decrease.

- **Measured Genetic Variation has a *neutral effect on vulnerability*.** Studies of mule deer genetics have found high levels of genetic diversity throughout the species range.[280] Species with average to high levels of genetic variation are expected to be better able to adapt to changing climatic conditions.[281]

Redband Trout (*Oncorhynchus mykiss gairdnerii*)

Existing Conditions & Observations by USRT Member Tribes[282]

Redband trout have habitat refugia on USRT member tribe's reservations. Tribes have reported low river levels in summer affecting their ability to fish trout, sometimes restricting fishing to the higher water levels in the spring season. Warmer stream temperatures following the removal of streamside vegetation by wildfire have also affected trout on reservations. Redband trout are fish-eaters and eat young salmonids.

Figure 51: Redband Trout. Photo credit: Joel Santore.

Redband Trout Vulnerability Rankings

Rankings above represent climate change vulnerability in the 2050s and 2080s for two different climate change scenarios. The higher climate change scenario (RCP 8.5) is labeled "More Warming" and the lower climate change scenario (RCP 4.5) is labeled "Less Warming". The rankings reflect the assessment of local climate change projections and species-specific sensitivities and adaptive capacity from the CCVI analysis.

Factors Affecting Vulnerability

- **Physiological Hydrological Niche *greatly increases vulnerability*.** During winter, redband trout inhabit cold, deep pools in mountain streams. During summer, redband trout inhabit low-gradient, medium-elevation stream reaches with pools, which are critical spawning habitat.[283] Redband trout also inhabit higher gradient channels with riffles or areas with boulder and cobbles. Shifting precipitation patterns under climate change could alter the suitability of these habitats for redband trout.
- **Anthropogenic Barriers *increases vulnerability*.** Many streams and rivers within the assessment area have dams that prevent redband trout access to more suitable, cooler habitat if their present habitat becomes too warm. Dams in the assessment area include Antelope Dam, Owyhee Dam, Bully Creek Dam, Malheur Dam, and Brownlee Dam. These barriers to migration may hamper the redband trout's ability to respond effectively to changing climate conditions.
- **Physiological Thermal Niche *increases vulnerability*.** While redband trout have often been considered more tolerant of warmer water temperatures than other salmonid species, recent research suggests that the thermal tolerances of redband trout populations in southeastern Oregon differ only slightly from other salmonids. It could therefore be concluded that the redband trout is not uniquely tolerant of warm water temperatures compared to other salmonids.[284] Thus, rising stream temperatures under climate change could negatively affect redband trout populations.[285]

- **Disturbance Regime *increases vulnerability*.** The survival of salmonid (i.e., salmon, trout, and char) eggs and embryos is strongly influenced by sediment deposition, water quality, and streambed scour and fill.[286] As air temperatures rise, watersheds are projected to become increasingly rain-dominant. This shift will increase the risk of winter flooding and sediment transport, which can negatively affect the survival of salmonid eggs.
- **Sensitivity to Pathogens or Natural Enemies *increases vulnerability*.** Warming stream temperatures may intensify mortality from fish pathogens. *Vibrio* and *Ceratomyxa shasta* are two infections known to negatively affect salmonids and these effects could be exacerbated with warming stream temperatures.[287] Increasing water temperatures can stress salmonids, reducing their ability to mount an effective immune response to disease. Many important salmonid diseases become virulent when water temperatures reach 60-61°F.[288]
- **Sensitivity to Competition from Native or Non-Native Species *somewhat increases vulnerability*.** Redband trout compete with resident brook trout, which are fish-eaters and known to eat young salmonids. It is estimated that there have been at least 35 non-native fish species introduced to the redband trout range within the Columbia River Basin.[289] Climate change may influence the success of redband trout as it competes for resources.
- **Climate Change Mitigation *somewhat increases vulnerability*.** Future dam building is possible in the region. Dams act as barriers to movement of redband trout to stream reaches in the Upper Snake River region and may limit their ability to migrate in response to warming water temperatures.[290]
- **Measured Genetic Variation has a *neutral effect on vulnerability*.** Substantial genetic divergence has been observed among the 17 native Columbia River redband trout populations.[291] Species with average to high levels of genetic variation are expected to be better able to adapt to changing climatic conditions.[292]

Steelhead (*Oncorhynchus mykiss*)

Existing Conditions & Observations by USRT Member Tribes[293]

Three of the four USRT member tribes no longer have access to Steelhead on their reservations. Over the last century, eight dams on the Upper Snake River have limited the ability of steelhead to reach the USRT member tribes' traditional harvest areas. USRT tribes are actively working to help reintroduce steelhead into their historical habitat on reservations.

Figure 52: Steelhead. Photo credit: USFWS Mountain-Prairie.

Steelhead Vulnerability Rankings

Rankings above represent climate change vulnerability in the 2050s and 2080s for two different climate change scenarios. The higher climate change scenario (RCP 8.5) is labeled "More Warming" and the lower climate change scenario (RCP 4.5) is labeled "Less Warming". The rankings reflect the assessment of local climate change projections and species-specific sensitivities and adaptive capacity from the CCVI analysis.

Factors Affecting Vulnerability

- **Physiological Thermal Niche *greatly increases vulnerability.*** Optimal water temperature for steelhead egg hatching is 50°F. Optimal growth for juvenile steelhead occurs between 57.2°F and 59°F. Water temperatures of 69.8°F lead to the formation of thermal migration barriers for steelhead in the Snake River. Daily maximum water temperatures above 66.2-68°F present lethal conditions for steelhead.[294] Warming water temperatures under climate change may increase the frequency with which these sensitive thermal limits are exceeded.

- **Physiological Hydrological Niche *greatly increases vulnerability.*** Steelhead inhabit cool, clear lakes and cold, fast-flowing streams. During winter, steelhead require deep pools in slow-moving streams.[295] Warming water temperatures under climate change may impact some of these sensitive hydrological requirements.

- **Disturbance Regime *increases vulnerability.*** The survival of salmonid (i.e., salmon, trout, and char) eggs and embryos is strongly influenced by sediment deposition, water quality, and streambed scour and fill.[296] As air temperatures rise, watersheds are projected to become increasingly rain-dominant. This shift will increase the risk of winter flooding and sediment transport, which can negatively affect the survival of salmonid eggs.

- **Sensitivity to Pathogens or Natural Enemies *increases vulnerability*.** Warming stream temperatures may increase salmonid mortality from fish pathogens. *Vibrio* and *Ceratomyxa shasta* are two infections known to negatively affect salmonids and these effects could be

exacerbated with warming stream temperatures.[297] Increasing water temperatures can stress salmonids, reducing their ability to mount an effective immune response to disease. Many important salmonid diseases become virulent when water temperatures reach 60-61°F.[298]

- **Anthropogenic Barriers *increases vulnerability*.** Many streams and rivers within the project area have dams that would prevent steelhead from accessing more suitable, cooler habitat if their current habitat becomes too warm. There are eight dams on the mainstem Snake River from below Shoshone Falls to Hells Canyon include the Upper Salmon Falls Dam, Lower Salmon Falls Dam, Bliss Dam, C.J. Strike Dam, Swan Falls Dam, Brownlee Dam, Oxbow Dam, and Hells Canyon Dam.[299] These barriers to migration may hamper steelhead ability to respond effectively to changing climate conditions.

- **Climate Change Mitigation somewhat *increases vulnerability*.** Future dam building is possible in the region. Dams act as barriers to steelhead movement and may limit their ability to move in response to changing climate conditions.[300]

- **Sensitivity to Competition from Native or Non-Native Species somewhat *increases vulnerability*.** Resident brook trout, which are known to eat young salmonids, compete with steelhead.[301] Climate change may affect this competitive dynamic.

- **Measured Genetic Variation has a *neutral effect on vulnerability*.** Steelhead populations in the Upper Snake River exhibit relatively high genetic variation.[302] Species with average to high levels of genetic variation are expected to be better able to adapt to changing climatic conditions.[303]

- **Diet has a *neutral effect on vulnerability*.** Steelhead have a broad diet in both lakes and streams. In lakes, their diet mainly consists of bottom-dwelling invertebrates (e.g., aquatic insects, amphipods, worms, fish eggs) and plankton. In streams, steelhead consume drift organisms. In the ocean portion of their lifecycle, the steelhead diet includes fish and crustaceans.[304] Species that can readily switch among different food types are less likely to be negatively affected by climate change than dietary specialists.

- **Dispersal/Movement has a *neutral effect on vulnerability*.** Steelhead have excellent dispersal abilities. Anadromous forms can migrate hundreds of miles between spawning streams and non-spawning marine waters.[305] Steelhead's dispersal ability increases the likelihood that it has the ability to adapt to shifting climatic conditions.

VI. Conclusion

Changing climate conditions have already altered, and will continue to affect, the natural resources, landscapes, and people of the Upper Snake River Watershed. By taking the initiative to explicitly identify Shared Concerns and assess their climate change vulnerability, USRT's four member tribes have begun the process of climate change adaptation.

The results of this first phase of climate work by USRT's member tribes will create a foundation on which future phases can be built. The outputs of this project go beyond the relative vulnerability rankings presented in this report. ***The collaboration required throughout the project has strengthened the connections between the four tribes and enhanced understanding about the shared challenges they face under climate change.*** This is, perhaps, the most important outcome of this assessment. The specific vulnerability information in this assessment can be used in the development of customized adaptation strategies and actions that will ultimately assist USRT member tribes in minimizing the negative effects of climate change, take advantage of positive opportunities, and build climate resilience.

Plant and animal species, habitats, and natural resources are critically important to the tribes and have been an intrinsic part of their tribal culture for thousands of years. By proactively responding to climate change, USRT and its member tribes are working to ensure that these resources will be an integral part of their communities for generations to come.

VII. List of Appendices

Appendix A – Climate Modeling and Analysis

Appendix B -- Collaboration, Site Visits, and Shared Concerns Notes

Appendix C – Climate Change Vulnerability Index Analysis

Appendix D – GIS Analysis Details

VIII. References

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3 Appendix C – Shoshone-Bannock Tribes Climate Assessment and Adaptation Plan

Climate Change Assessment and Adaptation Plan

May 2017

A collaborative assessment conducted by the Shoshone-Bannock Tribe Fish and Wildlife Department, Adaptation International, the University of Washington's Climate Impact Group, and Oregon State University's Oregon Climate Change Research Institute.

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Executive Summary

The Shoshone-Bannock Tribes, comprised of many bands of Shoshone and Bannock peoples whose very culture and history is intertwined with the lands in which they live, have historically subsisted through hunting and gathering. The Snake River Watershed, in present-day Idaho, continues to sustain the Tribes' cultural, spiritual, dietary, and economic needs. Climate change presents a threat to critical cultural resources, thereby also threatening the lifeways and wellbeing of the Tribes. This creates an urgent need to build climate resilience to protect and preserve these resources for future generations.

This climate change vulnerability assessment and adaptation plan outlines a collaborative 12-month project wherein a Climate Change Core Team of Tribal Staff (hereafter "Core Team") worked collectively with outside consultants (hereafter "project consultants") to assess climate vulnerability and identify adaptation actions for critical plant and animal species and their habitats. This project lays a foundation for building resilience among the Shoshone-Bannock Tribes and enhancing the resilience of natural resources that are an integral part of their culture. This report includes a summary of downscaled ***future climate projections*** for the project area, a detailed description of the ***vulnerability assessment process and outcomes***, discussion of the Tribes' ***adaptation planning process***, and a listing of the ***adaptation actions*** developed for the plant and animal species assessed.

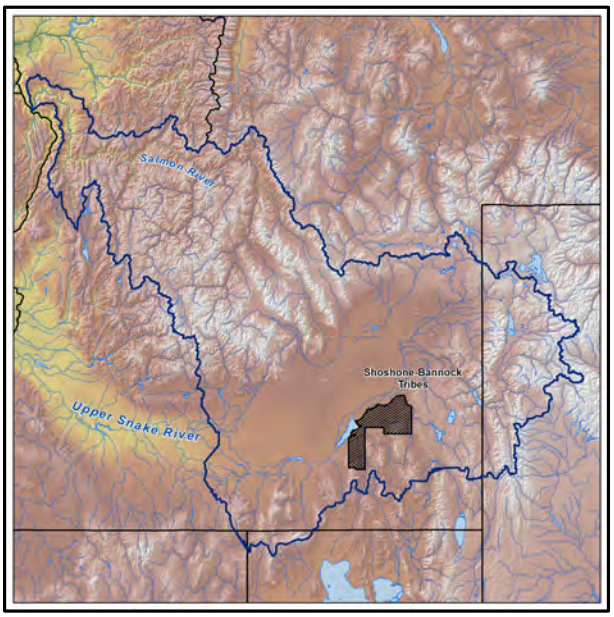

Figure 1: Project boundaries for the Shoshone-Bannock Tribes' Vulnerability Assessment and Adaptation Plan are shown in dark blue. Total area encompasses 45,431 square miles and includes important natural resources both inside and outside the reservation boundaries. The Reservation is shown with hash mark shading.

Future Climate Projections

Across the entire project area, average annual temperatures are projected to increase under two future climate scenarios through the 21st century. Projected changes to water availability and seasonal streamflows in the Upper Snake River system are primarily due to warming air temperatures and declining snowpack. These changes will have direct and indirect effects on Shoshone-Bannock Tribes and the plant and animal species on which they rely.

Vulnerability Assessment Process and Outcomes

Through a series of in-person meetings, the Core Team identified 35 plant and animal species, seven resource issues, and four habitats of concern for inclusion in this assessment. Thirty-four species were assessed quantitatively using NatureServe's Climate Change Vulnerability Index (CCVI); one additional species of concern was not analyzed due to lack of adequate data. In a one-day workshop, the project consultants and Core Team worked collaboratively to vet preliminary CCVI results and integrate local and traditional knowledge (as appropriate), which ultimately resulted in changes to some species' vulnerability rankings. Final CCVI results are shown below,

where Extremely Vulnerable=(EV); Highly Vulnerable=(HV); Moderately Vulnerable=(MV); and Less Vulnerable (LV).

Table 1: Vulnerability rankings for the 34 plant and animal species assessed quantitatively using the CCVI. Results are shown by species (rows) and for the two different climate scenarios (RCP 4.5 and RCP 8.5) for two different time periods (2050s and 2080s). Species with an asterisk (*) do not currently have available spatial data layers for species ranges. For these species, the project team assumed that the distribution of these species spans the entire assessment area. This assumption was vetted by Shoshone-Bannock tribal staff, and was determined to be appropriate except for Single-leaf Pinyon, which is confined to a small area in the southern portion of the domain.

Common Name	Taxon	Habitat	2050s RCP4.5	2050s RCP8.5	2080s RCP4.5	2080s RCP 8.5
Greater Sage-Grouse	Bird	Sagebrush Steppe	EV	EV	EV	EV
Black-tailed Jackrabbit	Mammal		MV	HV	HV	HV
Wyoming Sage*	Plant		HV	EV	EV	EV
Big Sagebrush	Plant		MV	HV	HV	HV
Rubber Rabbitbrush*	Plant		MV	HV	HV	HV
Cheatgrass*	Plant		LV	LV	LV	LV
Bald Eagle	Bird	Riparian	MV	MV	MV	HV
Yellow-billed Cuckoo	Bird		LV	LV	LV	LV
American Beaver	Mammal		LV	LV	LV	LV
Black Cottonwood	Plant		MV	MV	MV	HV
Redosier Dogwood	Plant		LV	LV	LV	LV
Geyer's Willow	Plant		LV	LV	LV	LV
Coyote Willow	Plant		LV	LV	LV	LV
Moose	Mammal	Coniferous Forest	MV	HV	EV	EV
Quaking Aspen	Plant		LV	MV	MV	MV
Single-leaf Pinyon*	Plant		MV	EV	EV	EV
Mallard	Bird	Aquatic	LV	LV	LV	LV
Northern Leopard Frog	Amphibian		HV	HV	HV	HV
Columbia Spotted Frog	Amphibian		EV	EV	EV	EV
Pacific Lamprey	Fish		EV	EV	EV	EV
Bull Trout	Fish		EV	EV	EV	EV
Chinook Salmon	Fish		EV	EV	EV	EV
Steelhead	Fish		EV	EV	EV	EV
Yellowstone Cutthroat Trout	Fish		EV	EV	EV	EV
Mountain Lion	Mammal	Generalists	LV	LV	LV	LV
Elk	Mammal		MV	HV	HV	HV
Mule Deer	Mammal		LV	MV	MV	MV
Golden Eagle	Bird		LV	LV	LV	LV
Gopher Snake	Reptile		LV	LV	LV	LV
Saskatoon*	Plant		LV	MV	MV	MV
Common Chokecherry	Plant		LV	LV	LV	LV
Thistle*	Plant		LV	LV	LV	LV
Spotted Napweed*	Plant		LV	LV	LV	LV
Russian Olive*	Plant		LV	MV	MV	MV

Adaptation Planning Process and Actions

The final phase of the project focused on developing strategies and actions to increase the resilience of the habitats within which the 34-assessed species live. Given time and budget constraints, a subset of 11 focus species and their associated habitats were selected for adaptation planning. Due to the interconnected nature of the ecosystems and habitats on which these species depend, the focus of adaptation planning was on developing strategies and actions that would strengthen the climate resilience of habitats, thereby supporting the needs of the individual species. For example, actions that help protect, preserve, or restore Sagebrush Steppe habitat may increase the climate resilience of both Sage Grouse and Wyoming Sage. Sample actions to build resilience for Sagebrush Steppe habitat are shown below.

Table 2: Select adaptation actions for Sagebrush Steppe habitat, which supports both Sage Grouse and Wyoming Sage, two species important to the Shoshone-Bannock Tribes.

Climate Concern	Select Adaptation Action	Timeframe
Wildfire	Incorporate climate change into fire-management plans (include wildfire projections if possible); anticipate more opportunities to use wildfire for resource benefit.	Immediate
Wildfire	Identify areas important for Wyoming Sage in situ gene conservation to provide a baseline for measuring fire impacts and informing post-fire planting/rehabilitation.	Medium-Term
Species Range Shifts	Coordinate among/across states and their federal counterparts to protect habitat core areas to promote large-scale, continuous sage grouse habitat that would be protected from further development.	Immediate
Increase in Invasive Species	Rehabilitate burned areas for using native plant materials or introduced materials, that encourage the long-term sustainability of native species, and as approved by Resource Managers.	Immediate
Reduce Non-Climate Stressors	Install fence markers or remove fences where sage-grouse mortality due to collision with fences is documented or likely to occur due to new fence placement (avoid new fences within 0.5 mile of a lek).	Immediate
Outreach and Education	Develop and expand education efforts for the public regarding invasive species impacts, such as improving identification of non-native species, encouraging the use of native species, and promoting the use of strategies to prevent and remove invasive species.	Immediate

Conclusions

The Shoshone-Bannock Tribes are already experiencing the impacts of climate change on their natural resources, landscapes, and people. By engaging in efforts to identify adaptation strategies and actions to minimize the negative effects of climate change, the Tribes have demonstrated their continued commitment to protecting their vital natural resources. The Tribes will continue to implement projects across landscapes in the near term and utilize the information in this report to plan long-term strategies and projects to build resilience. These efforts, will help ensure that culturally significant natural resources are preserved for future generations.

1.0 Introduction

The lives of the Shoshone-Bannock Tribes are intricately connected to the sacred waters of the Snake River and the lands which surround it. Historically, the Tribes (comprised of many bands of Shoshone and Bannock peoples) subsisted primarily as hunters and gatherers, traveling during the spring and summer seasons to collect foods for use throughout the year. They hunted wild game, fished the region's abundant and bountiful streams and rivers, and gathered native plants and roots such as the camas bulb. The natural resources of the Upper Snake River Watershed continue to sustain the dietary, cultural, spiritual, and economic needs of the Shoshone-Bannock Tribes of the Fort Hall Reservation.

More than 5,800 people hold membership with the Shoshone-Bannock Tribes.[1] When the Northern Paiutes left the Nevada, Oregon, and Utah regions for southern Idaho in the 1600s, they began to travel with the Shoshones in pursuit of buffalo. The Shoshone nation occupied an area stretching from Canada to California. The Northern Shoshone peoples came from across the Snake River, Upper Missouri, and Columbia River basins to Fort Hall during the Treaty era to permanently reside on the current reservation; living in harmony with the pulse of riverine ecosystems. They became known as the Bannocks and became permanent residents of the Snake River basin, while also occupying significant portions of southwest Montana and Wyoming.

The Shoshone-Bannock Reservation Area

The Fort Hall Reservation is in the eastern Snake River Plain of southeastern Idaho, north and west of the town of Pocatello. In 1868 when the Reservation was established, it was 1.8 million acres, an amount that was reduced to 1.2 million acres in 1872 due to a survey error. The Reservation was further reduced to its current size (546,500 acres) through subsequent legislation and the allotment process.[2] The Fort Hall Reservation, the permanent home of the Tribes, is bordered to the north and northwest by the Snake and Blackfoot Rivers and the American Falls Reservoir border. In addition to vast populations of fish, the area is home to moose, deer, wild horses, and buffalo. The ecosystems of the Shoshone-Bannock Reservation area face ongoing environmental challenges, such as habitat loss, erosion of stream banks, warmer water temperatures, and siltation in spawning gravels brought on by unrestricted grazing and rapid flooding.

Climate change has the potential to fundamentally change the ecological processes that have defined and supported the Tribes' unique lifeways from time immemorial. For example, climate change may increase the risk of catastrophic wildfire across the reservation landscape. The Tribes have an obligation to promote a sustainable balance between development and natural resource sustainability, a calculus that becomes more complicated with climate change.

In response to the threat of climate change, the Shoshone-Bannock Tribes secured funding for this climate change vulnerability assessment and adaptation plan. This report outlines a collaborative 12-month project wherein a Climate Change Core Team of Tribal Staff worked collectively with outside consultants to assess climate vulnerability and identify adaptation actions for critical plant and animal species and their habitats to lay a foundation for building resilience among the Shoshone-Bannock Tribes.

Project Area

For this climate change vulnerability assessment and adaptation plan, the Core Team selected an area of 45,431 square miles (Figure 1), which includes both the reservation itself, but also key man-made and natural resources within the Tribes' ancestral territory (e.g., American Falls Reservoir, the Teton Range). This project area was used to focus the analysis of the climate projections and the assessment of species-specific vulnerabilities. It should be noted this assessment was closely coordinated with the Upper Snake River Tribes' (USRT) climate change vulnerability assessment, which included a larger domain spanning the four USRT Tribes' homelands in Oregon, Nevada, and western Idaho.

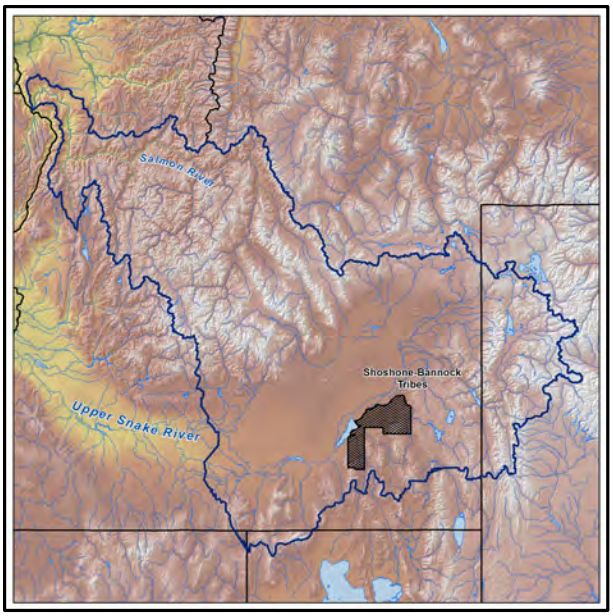

Figure 2: Project boundary for the Shoshone-Bannock Tribes' Vulnerability Assessment and Adaptation Plan (dark blue line). The total area encompasses 45,431 square miles and includes important natural resources both inside and outside the reservation (dark shaded area).

Purpose of This Report

The purpose of this report is to summarize the process and outcomes of this 12-month long project that assessed climate vulnerability and identified adaptation actions for critical plant and animal species and their habitats. This effort and its resulting products lay a foundation for building resilience among the Shoshone-Bannock Tribes. This report includes a summary of ***future climate projections*** for the project area, a detailed description of the ***vulnerability assessment process*** and outcomes, and a discussion of ***adaptation planning*** that includes a suite of ***adaptation actions*** developed for the plant and animal species assessed.

2.0 Project Process

This collaborative vulnerability assessment expressly considered many of the plant and animal species, habitats, and resources that are important and valuable to Shoshone-Bannock Tribes. Climate change impacts on these resources have the potential to affect Tribal members' culture, spirituality, and lifeways. The collaboration involved the direct and ongoing participation of a select group of Shoshone-Bannock staff who formed a Climate Change Core Team. Combining the best available localized climate projections with traditional knowledge (as appropriate), tribal priorities, and local observations was central to the success of this assessment (Figure 3).

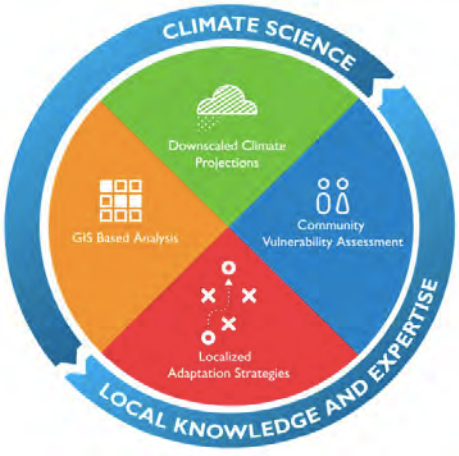

Figure 3: The collaborative process used in this project combined the best available climate and biological science with local and traditional knowledge (as appropriate).

This vulnerability assessment and adaptation planning process followed six key steps:

1. **Identify key species of concern.** Through a series of site visits and conference calls, the Core Team identified a suite of key plant and animal species of concern for inclusion in this assessment. Ultimately, 35 species, four habitats, and seven resource issues were included in the assessment.

2. **Analyze downscaled temperature and precipitation projections.** Downscaled temperature and precipitation projections for the project area are summarized in Section 3.0 of this report. It is important to note that this work built on the climate analysis recently completed for the USRT Climate Vulnerability Assessment. Project boundaries (domain), climate thresholds of interest, and hydrologic questions investigated were defined in collaboration with the Core Team during an in-person meeting at the start of the project.

3. **Calculate draft species-specific vulnerability rankings using the NatureServe Climate Change Vulnerability Index (CCVI).**[3] 34 key plant and animal species were assessed quantitatively using NatureServe's Climate Change Vulnerability Index tool. The results of this assessment formed the foundation for the discussions during the vulnerability assessment workshop. These detailed results are summarized in Section 4.0 of this report.

4. **Refine CCVI vulnerability rankings.** Through a day-long, collaborative vulnerability assessment workshop, the Core Team vetted the inputs and initial results of the CCVI assessment. Over the course of the day, the group delved into the species-specific sensitivities and adaptive capacities, refined those inputs based on local knowledge and traditional knowledge (as appropriate) and adjusted the rankings for sensitivity or adaptive capacity factors as needed. Following the workshop, the Climate Impacts Group re-ran the CCVI assessment for those species whose rankings had changed, and calculated the final relative vulnerability rankings. Detailed results are provided in Section 4.0 of this report.

5. **Focus adaptation planning efforts.** To make the best use of the time and resources available, the Core Team selected a set of 11 species on which to focus the adaptation planning phase of the project. The Shoshone-Bannock Tribes recognize the holistic and interconnected nature of ecosystems and the need for vibrant habitats to support individual species. Because of this, the 11 species were grouped by their primary habitats and the adaptation planning effort focused on identifying promising adaptation actions for each of these habitats. The detailed results are summarized in Section 5.0 of this report.

6. **Refine and customize adaptation actions.** Draft adaptation strategies and actions were collaboratively assessed and refined by the Core Team during a day-long adaptation planning workshop. Tribal staff-led discussions following the workshop further refined actions and examined additional aspects of implementation, including time frame for completion, financial cost, political feasibility, and cultural significance. This process resulted in a prioritized list of strategies, which are summarized in Section 5.0 of this report.

Building on the USRT Climate Vulnerability Assessment Project

This project benefitted by following closely behind the Upper Snake River Tribes Foundation (USRT)'s Climate Change Vulnerability Assessment project (the results of which can be found at: www.uppersnakerivertribes.org/climate). The Shoshone-Bannock Tribes are members of USRT and actively participated in the USRT vulnerability assessment project. Building off this previous collaboration allowed the Shoshone-Bannock Tribes to go farther in their assessment and planning efforts. For example, species included in this project that had already been assessed using the same methodology for USRT (such as Chinook Salmon and Mule Deer) could be refined with much less effort, by simply reviewing their vulnerability rankings for specific factors and re-running the CCVI assessment for the smaller, more focused project boundaries. Through their internal process, the Shoshone-Bannock Tribes decided to include 15 USRT species in their assessment.

3.0 Climate Projections and Hydrology Overview

This project built off the initial analysis of climate projections completed for the Upper Snake River Basin as part of the USRT Climate Change Vulnerability Assessment. That assessment focused primarily on changes in temperature, precipitation, and moisture for a larger region and are summarized in the Upper Snake River Tribes Foundation Climate Change Vulnerability Assessment.[4] This assessment looked at how changes to those primary variables could affect regional wildfire risk, snowpack, stream temperatures, water availability, and the timing of streamflows and run-off. Building on that foundation allowed this project to go further into more specific local issues and evaluate changes to key variables that affect the species and ecosystems on which the Shoshone-Bannock depend.

Climate Projections

Climate projections are not "forecasts" but rather attempts to answer a "what if?" question. These projections are simulations of *what* the climate might be like *if* society follows a particular greenhouse gas emissions trajectory. The amount of greenhouse gases in the atmosphere will ultimately depend on factors like global population growth, changes in global economic activity, and preferred energy sources, all of which are difficult to predict.

Rate of Emissions	Scenario names
Low	RCP 4.5, B1
Medium	A1B
Business as Usual	RCP 8.5

Figure 4: Rate of Greenhouse Gas Emissions and associate emissions scenario name.

The latest generation of global climate models uses a set of future scenarios called Representative Concentration Pathways (RCPs). Each RCP represents a trajectory of atmospheric concentrations of greenhouse gases to, and beyond, the end of the 21st century, and provides a flexible way of defining a set of climate futures that make a variety of socio-economic assumptions.[5] This report focuses on two of the four RCP scenarios: RCP 4.5 and RCP 8.5. RCP 4.5 represents a future where global agreements and policies work to dramatically reduce greenhouse gas emissions. In RCP 4.5, greenhouse gas emissions peak in the 2040s, then decline. The socio-economic assumptions of RCP 4.5 are largely aspirational, but still achievable with significant global action in the next decade. RCP 8.5 assumes continued dominance of fossil fuel

energy sources, where global greenhouse gas emissions continue to increase at their present rate for the next several decades. RCP 8.5 is often colloquially referred to as the "business-as-usual" scenario. Together, RCP 4.5 and 8.5 provide a range of possible future global and regional temperatures and precipitation trends, with more significant changes projected in the RCP 8.5 scenario. The B1 and A1B scenarios represent similar but slightly different sets of projections and are also used in this project, though the focus is on the RCP scenarios. For this analysis, the Project Team analyzed downscaled climate projections for each of the four areas (sub-domains) shown in Figure 5.

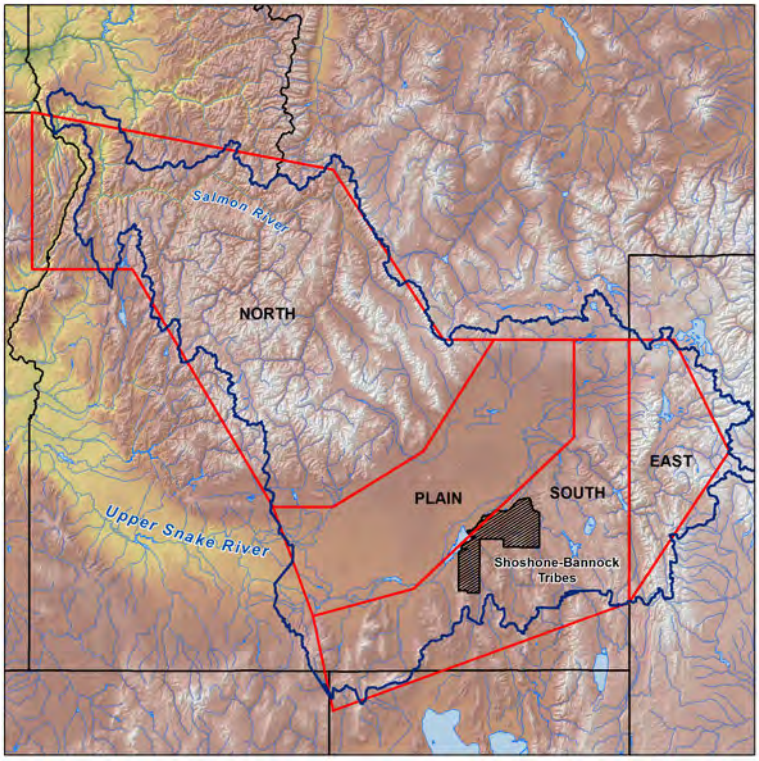

Figure 5: Outline of the four sub-domains (outlined in red) used for the climate analysis overlaid on the project boundary (outlined in blue).

While it is useful to understand global climate change projections, it is the regional and local projections that are most important for assessing the potential impacts to the habitats, plants, animal species, and other resources important to the Shoshone-Bannock Tribes. To develop regional projections of future climate, scientists downscale global climate model outputs using a series of statistical and/or dynamical (modeled) processes. This assessment presents the future regional projections of climate using a downscaled dataset called the Multivariate Adaptive Constructed Analogs (MACA).[6]

Since climate is considered the long- term (greater than 30-year) average of weather patterns for a specific location, it is important that changes be compared between multi-decadal periods. Throughout the report, projections were analyzed in reference to a baseline period (1950-2005, or for growing season length 1970-1999) for three future time periods: the 2020s (which represents the years 2010-2039), the 2050s (which represents the years 2040-2069), and the 2080s (which represents the years 2070-2099). While most of the figures in the next section focus on either the 2050s or the 2080s, the full set of projections for each domain and each time-period are available in the supplementary materials included with this report.

Future Change to the Shoshone-Bannock Project Area

Temperature

Across the entire project area, average annual temperatures are projected to increase under both future climate scenarios and for all time periods. RCP 4.5 (left column in Figure 6) shows a smaller magnitude of warming for both mid-century (2050s - first row) and late century (2080s - second row) than RCP 8.5 (right column Figure 6). Mid-century annual average temperature under RCP 8.5 (6.2-6.9°F) is projected to be similar to end of the century warming under RCP 4.5 (5.9-6.5°F). The highest projected annual temperature increases are expected under RCP 8.5 at the end of the century (bottom right panel) and may exceed 10°F. Figure 6 displays the average range of the 20 models.

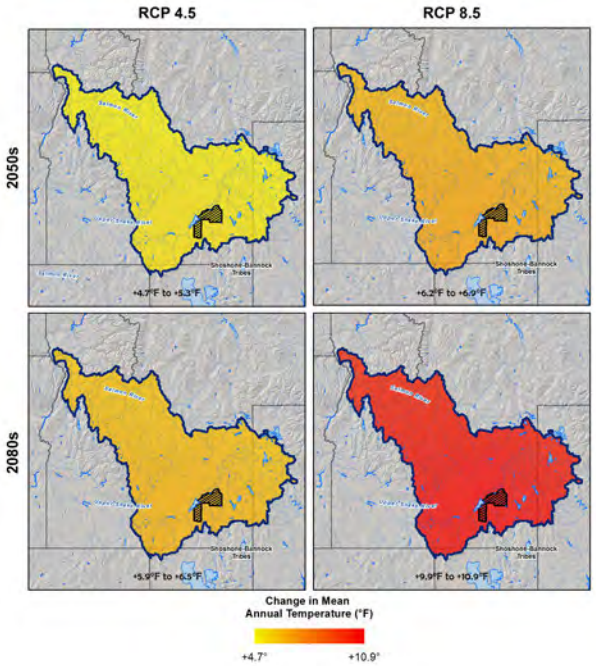

Figure 6: Future projected change in temperature through 21st century in the full project domain.

Hydrology

Climate change is expected to have important impacts on water availability and seasonal streamflows in the Snake River system, primarily due to warmer temperatures and declining snowpack. These changes will have direct and indirect effects on the Shoshone-Bannock Tribes by affecting the amount of water available in the region for summer irrigation, instream flows for aquatic species, domestic water supply, hydropower production, and recreation.

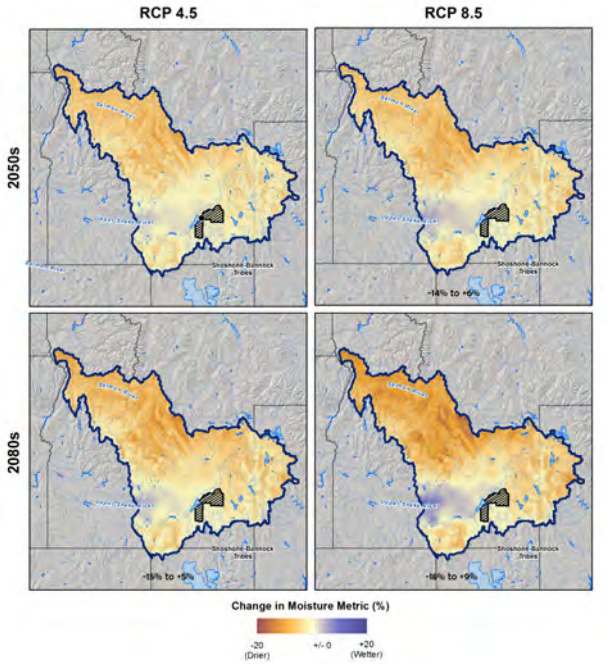

Figure 7: Percentage change in the Hamon Moisture Metric (a consideration of evaporation and evapotranspiration). Change is shown by time-period (rows 2050s & 2080s) and climate scenarios (columns - RCP 4.5 left & RCP 8.5 right).

Even with precipitation patterns staying relatively consistent (though still highly variable from year to year), the warmer temperatures are likely to increase evaporation & evapotranspiration. One way to consider these changes in a way that is important for species in the region is by looking at how they impact moisture availability. That impact can be seen in Figure 7 as a calculated change to the Hamon Moisture Metric[7] which considers both evaporation and evapotranspiration potential for the region. The general change is towards decreased moisture availability and drier soils. However, this impact is not consistent across the region as the more mountainous regions are

projected to have less overall moisture available while a large portion of the Upper Snake River Plain is projected to have an overall increase in moisture availability.

Shoshone-Bannock staff identified additional changes that are important in determining species-specific climate vulnerabilities. These changes included: (1) length of the frost-free season, (2) heat wave frequency, (3) frequency of heavy precipitation events, (4) streamflow variability brought on by a diminished snowpack, and (5) increases in stream temperature.

Frost-Free Season

The frost-free season is defined as the period between the last day of Spring when there is an overnight freeze (i.e., when the minimum daily temperature is at, or below, 32°F) and the first day of the following fall that dips below freezing (i.e., when the minimum daily temperature falls at, or below, 32°F).

The frost-free season in all subdomains lengthens appreciably as early as the 2020s under both RCP4.5 and RCP8.5. For example, in the Plain subdomain under RCP8.5, the frost-free season is projected to be 3 weeks longer by the 2020s than it has been historically (see Figure 8). By the 2080s, the frost-free season is projected to be 10 weeks longer (beginning six weeks sooner and ending four weeks later).

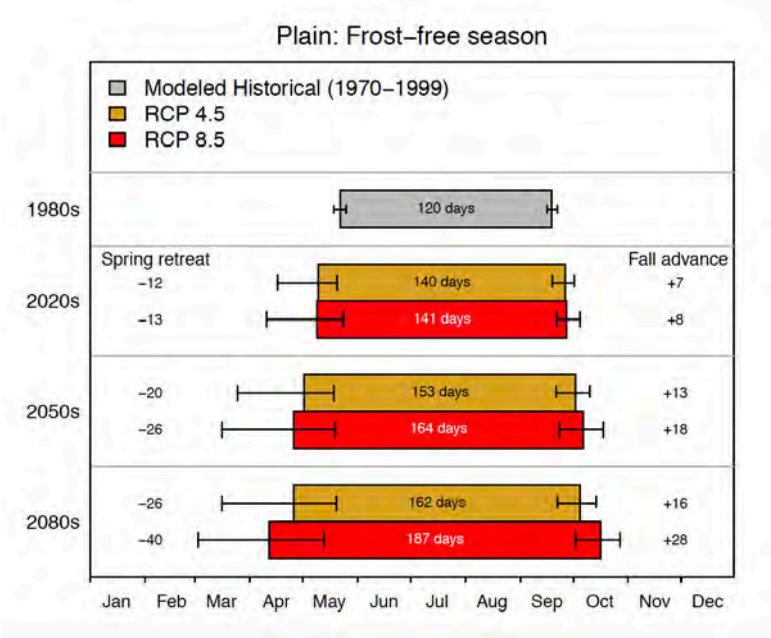

Figure 8: Frost-free season in the Plain subdomain for the historical period (1970-1999; the "1980s") and under the RCP4.5 and RCP8.5 scenarios by the 2020s, 2050s, and 2080s. Shaded rectangles show the average from 20 climate model simulations and horizontal bars show the range from all climate model simulations. The values to each side of the rectangles show the change in frost-free season length relative to the historical (1970-1999) average.

Heat waves

A heat wave, for purposes of this study, is defined as a period of four to seven consecutive days with the maximum daily temperature at or above 100°F. More than seven consecutive days spent above this threshold is considered two (or more) back-to-back heat waves. The project team also examined "Winter heat waves". A winter heat wave occurs when the minimum daily temperature exceeds 35°F for four to seven consecutive days between December and February.

Both types of heat waves have historically been very rare, if not absent, in the study area. However, in the Plain subdomain, heat waves are projected to occur at least once per year on average under RCP4.5 and about five times per year by the 2080s under RCP8.5 (see Figure 9). Also by the 2080s, winter heat waves are projected to occur nearly twice per year under RCP 8.5 and about once every two years under RCP 4.5.

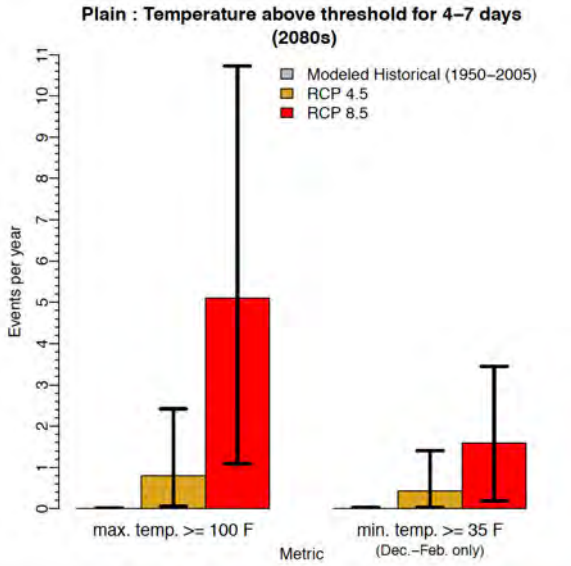

Figure 9: Frequency of heat waves (left) and "winter heat waves" (right) in the Plain subdomain during the historical period (1950-2005 – shown in gray) and under the RCP4.5 (orange bars) and RCP8.5(red bars) scenarios by the 2080s. Shaded bars show the average from 20 climate model simulations and the vertical lines show the range from all climate model simulations.

Extreme precipitation

In this study, extreme precipitation events are daily precipitation totals equaling or exceeding one inch or three inches. Precipitation statistics were calculated first for each cell in the gridded dataset (2.5 x 2.5 miles) and then averaged over each subdomain. This is important because heavy precipitation events can be very localized, and analyses of extremes depend strongly on the size of area over which the precipitation is averaged. For example, while a single precipitation gauge may record over three inches in one day, it may not rain as much as three inches in one day averaged across an area as large 2.5 x 2.5 miles, much less over an area the size of one of this study's subdomains.

Thus, precipitation events of three inches or more do not appear in any subdomains in the historical period. In the future, they are projected to be very rare; only in the north and east subdomains do they appear but only once in 20 years, and then only by the 2080s under RCP 8.5.

Precipitation events of one inch or more become more common in all subdomains, but most so in the East domain (see Figure 10). Historically in this domain, these events would occur approximately three times a year. By the 2080s, the frequency of these events is projected to increase to four days a year under RCP 4.5 (a 33% increase) and to five days per year under RCP 8.5 (a 66% increase).

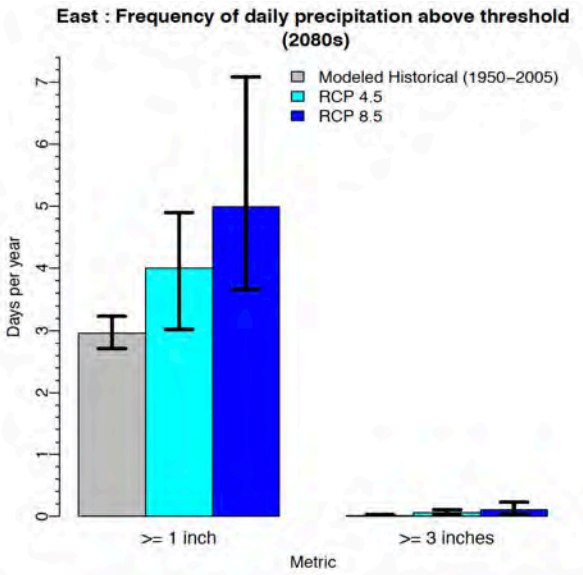

Figure 10: Frequency of extreme precipitation events in the East subdomain during the historical period (1950-2005, gray bars) and under the RCP4.5 (light-blue bars) and RCP8.5 (dark-blue bars) scenarios by the 2080s. Shaded bars show the average from 20 climate model simulations and the vertical lines show the range from all climate model simulations.

Snowpack and streamflow

As expected under a warmer climate, snowpack is projected to diminish across the region. The largest reductions are seen in the North subdomain: April 1 snowpack [reported as equivalent amount of melted water in the snowpack, or snow-water-equivalent (SWE)] decreases by 20% and 40% by the 2080s under RCP4.5 and RCP8.5, respectively. In the East subdomain, reductions are smaller, because much of area remains below freezing for much of the winter even under increased temperatures. In the near future (2020s), the small increase in precipitation (as snow) in the East subdomain even counteracts the effect of increasing temperatures. April 1 snowpack has historically been used to approximate the maximum winter snowpack in the western U.S., and has been a useful index for reservoir operations. However, for the North domain, April 1 snowpack would no longer serve this purpose as March 1 snowpack exceeds April 1 snowpack by the 2080s.

Reductions in snowpack due to a greater proportion of winter precipitation falling as rain instead of snow, will shift peak streamflow earlier in the year, increase winter streamflow, and decrease spring and summer streamflows. Beyond these changes in long-term average flow, some locations may also experience large changes in flow variability. In basins where winter precipitation historically falls largely as snow, year-to-year variability in winter monthly flows is relatively small because the precipitation accumulates as snow instead of making its way to streams. This creates a winter flow regime that is relatively stable year-to-year. Using the Salmon River at White Bird as an example, this stability can be seen in Figure 11, which shows the small range in historical monthly flows through the winter months[8] (black boxes: O, N, D, J, F). Because its winter temperatures historically are just below freezing, the Salmon River Basin is poised to shift to receiving a substantially larger proportion of its winter precipitation as rain. This means that variability in winter flow becomes much more closely tied to variability in winter precipitation. For example, the year-to-year range in January flow may increase by a factor of ten. For aquatic species accustomed to a relatively stable winter flow regime, such a change could be very disruptive. However, not all locations in the Upper Snake River Basin would see changes in variability of this magnitude.

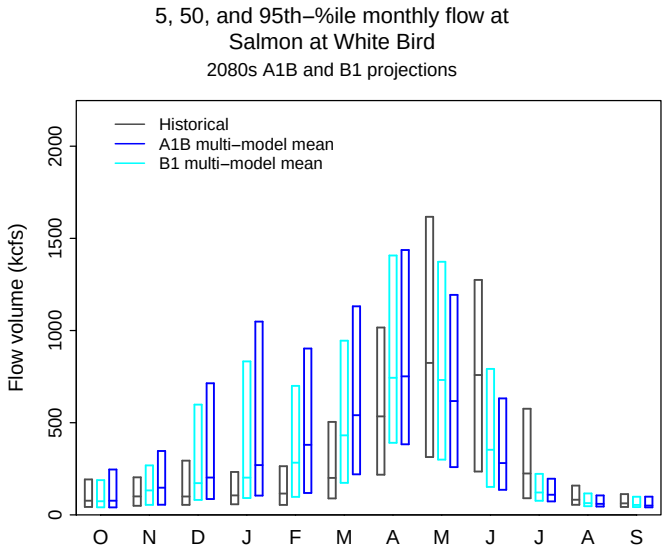

Figure 11: Statistics of monthly naturalized flow from October (O) to September (S) for the Salmon River at White Bird for the historical period (the 1980s –black boxes) and under the A1B (dark-blue boxes) and B1 (light-blue boxes) scenarios by the 2080s. The bars show 5th, 50th, and 95th percentiles of monthly flow. Data source: Hamlet et al. (2010).

Summer stream temperatures

Summer stream temperatures are projected to rise as air temperatures rise. Along the Upper Snake River and its tributaries, this may result in summer temperatures reaching thresholds above which the aquatic environment ceases to provide suitable habitat for some species. As an example, Figure 12 shows river segments in which the August mean water temperature is projected to exceed 63.5°F by the 2040s.[9] This temperature threshold was chosen for illustrative purposes; 63.5°F temperature thresholds are representative of cold-water biota habitat needs and have been defined as an upper limit of suitability for Bull Trout,[10] though Bull Trout do not currently inhabit all streams in the Upper Snake River Basin.

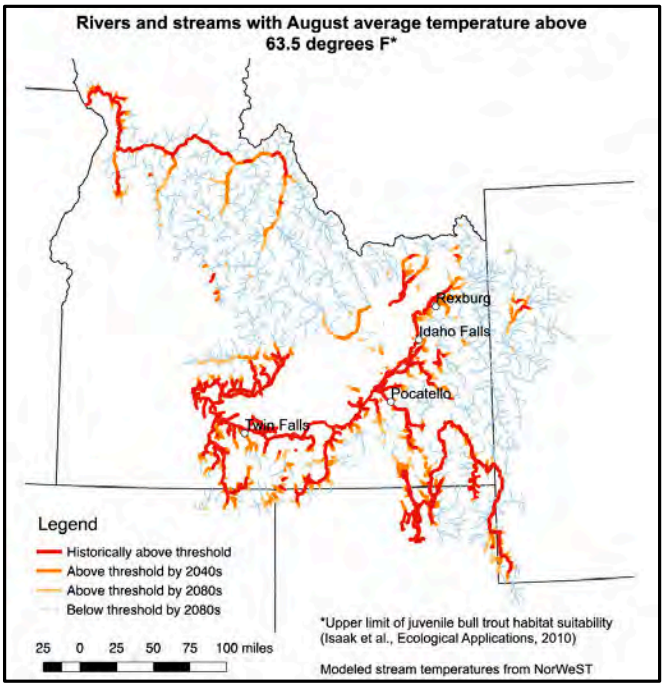

Figure 12: Stream segments in the Upper Snake River with mean August temperature above the 63.5°F threshold historically (red) and by the 2040s (dark orange) and 2080s (light-orange) under the A1B scenario. Data source: Isaak et al. (2016).

Projected increases in temperature as well as shifts in precipitation and associated hydrological changes will all affect the species and resources that the Tribes care about. These changes will create both direct and indirect changes that will impact aquatic species. Planning for these changes will require a focused shift in attention towards building resilience, supporting ecosystem and habitat health, decreasing non-climate stressors, and improving watershed retentive capabilities to help buffer these climate changes.

4.0 Vulnerability Assessment Process and Results

Identifying Species of Concern

The project team initiated the vulnerability assessment by conducting a series of in-person meetings, site visits, and conference calls to identify key species of concern for the analysis.

Figure 13: Shoshone-Bannock Tribal staff working to identify key species of concern during and in-person meeting held in April and August 2016.

The result of this series of meetings was the identification of 18 plant species, 17 animal species, seven resource issues, and four habitats of critical concern (Table 3). The 35-species chosen include some species that were originally analyzed in the larger USRT project domain and reanalyzed for the Shoshone-Bannock project (shaded in gray in Table 1 below).

Table 3: Final list of species, habitats, and resources analyzed in the vulnerability assessment. Items in green are specific to the Shoshone-Bannock Tribes assessment, while those in grey were also analyzed as part of the Upper Snake River Tribes assessment. Issues assessed quantitatively with the CCVI tool are indicated with an "X"; others were assessed qualitatively.

Plant Species	Assessed with CCVI Tool
Wyoming Sage	X
Service Berry	X
Coyote Willow	X
Pinyon Pine	X
Rubber Rabbitbrush	X
Yampah "Wild Carrots"	
Noxious Weed: Thistle	X
Noxious Weed: Spotted Knapweed	X
Invasive Species: Cheat Grass	X
Invasive Species: Russian Olive Tree	X
Big Sagebrush	X
Chokecherries	X
Quaking Aspen	X
Geyers Willow	X
Redosier Dogwood	X
Black Cottonwood	X
Camus Root	X
Antelope Bitterbrush	X

Animal Species	Assessed with CCVI Tool
Yellowstone Cutthroat Trout	X
Sage Grouse	X
Yellow-billed Cuckoo	X
Bald Eagle	X
Northern Leopard Frog	X
Pacific Lamprey	X
Gopher Snake	X
Mallard Duck	X
Moose	X
Mountain Lion	X
Bull Trout	X
Mule Deer	X
Elk	X
Chinook Salmon	X
Beaver	X
Black-tailed Jackrabbit	X
Sockeye	X

Resource Issues
Gay Mine Restoration Site
Traditional Foods
Meadow Hay
Cattle
Wildfire
Asthma
Reservoirs

Habitats
Coniferous Forests
Aspen Forest
Sagebrush Steppe
Riparian

Overview

The NatureServe Climate Change Vulnerability Index[11] (CCVI) was used to analyze the climate change vulnerability of species selected by the Shoshone-Bannock Tribes. The CCVI tool utilizes data inputs that include projections of changes in air temperature and moisture availability (Figures 6 and 7), species range data, and species-specific life history characteristics. These data are used by the CCVI tool to calculate a species' relative vulnerability ranking using 23 distinct factors that affect the species' climate change exposure, sensitivity, and adaptive capacity. The CCVI tool defines *exposure* as the projected changes in climate (e.g., temperature and moisture) across the range of a species within the assessment area; *sensitivity* as the extent to which a species will respond to shifts in climate; and *adaptive capacity* as a species' ability to withstand environmental changes. Based on these calculations, species are assigned one of four climate change vulnerability rankings.

The CCVI tool was used to produce draft climate change vulnerability rankings for 34 of the 35 plant and animal species that had sufficient range and life history data. Only one species, the yampah (*Perideria gairdneri*), had insufficient data available to complete either a quantitative (CCVI) or qualitative analysis. Thus, while it is not included in these results, it remains an important species to the Tribes.

NatureServe CCVI

The NatureServe CCVI is a Microsoft Excel-based tool that estimates a species' relative vulnerability to climate change within a given assessment area. The CCVI tool has several benefits: it is freely available for public download, relatively easily reproducible, and frequently used. These attributes may help to facilitate future updates to the climate change vulnerability assessment as additional information becomes available for the key plant and animal species of concern. In addition, results from this CCVI analysis can be easily compared to results of other assessments also using the CCVI, such as the assessment recently completed by the Upper Snake River Tribes Foundation. The CCVI tool highlights species-specific sensitivities that contribute to a species' vulnerability, offering detailed information to help guide future climate adaptation efforts. Direct climate exposure was measured by calculating the percent of each species' range within the assessment area that is exposed to different levels of projected change in temperature and moisture. Indirect exposure to climate change, as well as species-specific sensitivities and adaptive capacity, were evaluated using a suite of 23 variables (Table 4). Though the CCVI includes 27 species-specific factors, we did not evaluate the four factors related to the "Documented response to climate change" due to lack of readily available data, leaving a total of 23 species-specific factors for the assessment. Additional detail on data sources and quantitative and qualitative assessment methods are included in the supplementary materials accompanying this report.

Table 4: Factors used to evaluate species' climate vulnerability in the CCVI analysis.

Factor	Description
Indirect Climate Exposure Factors	
Sea Level Rise	Effects of sea level rise on species habitat (not relevant for Shoshone-Bannock species)
Natural Barriers	Geographic features of the landscape that may restrict a species from naturally dispersing to new areas
Anthropogenic Barriers	Features of anthropogenically altered landscapes (urban or agricultural areas, roads, dams, culverts) that may hinder dispersal for terrestrial and aquatic species
Climate Change Mitigation	Effects of land use changes resulting from human responses to climate change (seawall development, wind farm, biofuel production)
Species Sensitivity and Adaptive Capacity Factors	
Dispersal / Movement	Ability of species to disperse or migrate across the landscape to new locations as conditions change over time
Historical Thermal Niche	Exposure to temperature variation over the past 50 years
Physiological Thermal Niche	Dependence on cool or cold habitats within the assessment area
Historical Hydrological Niche	Exposure to precipitation variation over the past 50 years
Physiological Hydrological Niche	Dependence on a specific precipitation or hydrologic regime
Disturbance	Dependence on a specific disturbance regime likely to be impacted by climate change
Dependence on Ice / Snow	Dependence on ice, ice-edge, or snow-cover habitats
Restriction to Uncommon Geologic Features	Dependence on specific substrates, soils, or physical features such as caves, cliffs, or sand dunes
Habitat Creation	Dependence on another species to generate habitat
Dietary Versatility	Breadth of food types consumed; dietary specialists vs. generalists (animals only)
Pollinator Versatility	Number of pollinator species (plants only)
Propagule Dispersal	Dependence on other species for propagule dispersal
Sensitivity to Pathogens or Natural Enemies	Pathogens and natural enemies (e.g., predators, parasitoids, herbivores, and parasite vectors) that can increase or become more pathogenic due to climate change
Sensitivity to competition from native or non-native species	Species may suffer when competitors are favored by changing climates
Interspecific Interactions	Other interspecific interactions not including diet, pollination, and habitat creation
Genetic Variation	Measured genetic variation (high, medium, low)
Genetic Bottlenecks	Occurrence of bottlenecks in recent evolutionary history
Reproductive System	A plant's reproductive system may serve as a proxy for a species' genetic variation or capacity to adapt to novel climatic conditions (plants only)
Phenological Response	Phenological response to changing seasonal temperature and precipitation dynamics

For each factor listed in Table 4, species were evaluated and assigned a categorical ranking in accordance with CCVI guidelines. The five available categories include 1) *Greatly Increases Vulnerability*, 2) *Increases Vulnerability*, 3) *Somewhat Increases Vulnerability*, 4) *Neutral*, and 5) *Unknown*. More than one categorical ranking can be selected to capture uncertainty or intermediate rankings regarding a species' sensitivity, adaptive capacity, or indirect climate exposure. In

addition, the full range of categorical rankings are not available for all sensitivity factors, as all factors do not equally affect overall species vulnerability. For example, scores for "genetic variation" range only from *Neutral* to *Increase Vulnerability*. Direct and indirect exposure to climate change and species-specific sensitivities are used to calculate an overall numerical vulnerability index score. This score is then converted to a vulnerability ranking, based on threshold values. There are four possible vulnerability rankings:

- **Extremely Vulnerable (EV)**: Species abundance and/or range extent within the project area is extremely likely to substantially decrease or disappear.
- **Highly Vulnerable (HV)**: Species abundance and/or range extent within the project area is likely to decrease significantly.
- **Moderately Vulnerable (MV)**: Species abundance and/or range extent within the project area is likely to decrease.
- **Less Vulnerable (LV)**: Available evidence does not suggest that species abundance and/or range extent within the project area will change substantially, actual range boundaries may change.

These initial assessment findings for the 34 plant and animal species were reviewed and revised during the one-day vulnerability assessment workshop using the expertise and local and traditional knowledge (as appropriate) of the Shoshone-Bannock Core Team. Local knowledge was extremely valuable in modifying the draft rankings to account for local variance in exposure, sensitivity, and adaptive capacity. Factors captured by local experience included local changes in the landscape; observed interactions between species; and species' observed responses to extreme weather, climate change, and changes in habitat.

Following these meetings, the University of Washington's Climate Impacts Group (CIG) incorporated the suggested modifications to the CCVI inputs and re-ran the assessment for all affected species. Ultimately, incorporation of this information led to an adjustment of 12 individual factors affecting four species' vulnerability ranking.

Vulnerability Assessment Results for Species

The final CCVI vulnerability rankings for the 34 plant and animal species assessed are provided in Table 5. Detailed rankings of individual factors are included in the supplementary materials for this report.

Table 5: Vulnerability rankings for the 34 plant and animal species assessed quantitatively using the CCVI. Results are shown by species (rows) and for the two different climate scenarios (RCP 4.5 and RCP 8.5) for two different time periods (2050s and 2080s) Species with an asterisk (*) do not currently have available spatial data layers for their geographical ranges. For these species, the project team assumed that the distribution of these species spans the entire assessment area. This assumption was vetted by Shoshone-Bannock tribal staff, and was determined to be appropriate, except for Single-leaf Pinyon, which is confined to a small area in the southern portion of the domain.

Common Name	Taxon	Habitat	2050s RCP4.5	2050s RCP8.5	2080s RCP4.5	2080s RCP 8.5
Greater Sage-Grouse	Bird	Sagebrush Steppe	EV	EV	EV	EV
Black-tailed Jackrabbit	Mammal		MV	HV	HV	HV
Wyoming Sage*	Plant		HV	EV	EV	EV
Big Sagebrush	Plant		MV	HV	HV	HV
Rubber Rabbitbrush*	Plant		MV	HV	HV	HV
Cheatgrass*	Plant		LV	LV	LV	LV
Bald Eagle	Bird	Riparian	MV	MV	MV	HV
Yellow-billed Cuckoo	Bird		LV	LV	LV	LV
American Beaver	Mammal		LV	LV	LV	LV
Black Cottonwood	Plant		MV	MV	MV	HV
Redosier Dogwood	Plant		LV	LV	LV	LV
Geyer's Willow	Plant		LV	LV	LV	LV
Coyote Willow	Plant		LV	LV	LV	LV
Moose	Mammal	Coniferous Forest	MV	HV	EV	EV
Quaking Aspen	Plant		LV	MV	MV	MV
Single-leaf Pinyon*	Plant		MV	EV	EV	EV
Mallard	Bird	Aquatic	LV	LV	LV	LV
Northern Leopard Frog	Amphibian		HV	HV	HV	HV
Columbia Spotted Frog	Amphibian		EV	EV	EV	EV
Pacific Lamprey	Fish		EV	EV	EV	EV
Bull Trout	Fish		EV	EV	EV	EV
Chinook Salmon	Fish		EV	EV	EV	EV
Steelhead	Fish		EV	EV	EV	EV
Yellowstone Cutthroat Trout	Fish		EV	EV	EV	EV
Mountain Lion	Mammal	Generalists	LV	LV	LV	LV
Elk	Mammal		MV	HV	HV	HV
Mule Deer	Mammal		LV	MV	MV	MV
Golden Eagle	Bird		LV	LV	LV	LV
Gopher Snake	Reptile		LV	LV	LV	LV
Saskatoon*	Plant		LV	MV	MV	MV
Common Chokecherry	Plant		LV	LV	LV	LV
Thistle*	Plant		LV	LV	LV	LV
Spotted Napweed*	Plant		LV	LV	LV	LV
Russian Olive*	Plant		LV	MV	MV	MV

The habitats selected were assessed qualitatively using a combination of approaches. The sensitivity rankings came from the Climate Change Sensitivity Database (found at: www.climatechangessensitivity.org), a publically available, on-line database of climate change sensitivity estimates based on information from both peer-reviewed literature and expert knowledge of species and habitats. The project team used the downscaled climate projections analyzed for this project to assess the climate exposure for each habitat type and assign a relative vulnerability ranking. The results are summarized below in Table 6. This sensitivity information was combined with projected climate exposure for the study region to estimate a habitat vulnerability ranking of low, medium, or high.

Table 6: Relative climate vulnerability rankings for Shoshone-Bannock habitats of concern, including scores for sensitivity to changes in temperature, precipitation, and other indirect climate factors, climate change exposure, and overall vulnerability ranking. Sensitives are ranked from 0-7 with 0 being not sensitive and 7 being highly sensitive.

Qualitatively Assesses Habitats					
Habitat Type	**Sensitivities**			**Exposure**	**Vulnerability Ranking**
	Temperature Changes	*Precipitation Change*	*Indirect Factors*		
Sagebrush Steppe	3	3	5	High	Low/Moderate
Coniferous Forest	5	4	4	Moderate/High	Moderate
Riparian	5	4	4	Moderate	Moderate/High
Aspen	6	7	6	High	High

Note that this qualitative habitat ranking result for Aspen Habitat differs from the quantitative CCVI ranking for quaking aspen (*Populus tremuloides*). This discrepancy is not surprising given the widely divergent methodologies employed by these two approaches (i.e., the NatureServe CCVI and the Climate Change Sensitivity Database). The habitat sensitivities were evaluated for the entire Pacific Northwest Region and the CCVI assessment was focused on the project area. In a study comparing the similarity of vulnerability rankings across varying assessments and methodologies, Lankford et al. (2014) found little agreement between three frequently used assessments, including the NatureServe CCVI and the Climate Change Sensitivity Database. Finally, the CCVI Assessment results are relative to all the species assessed. Quaking Aspen may indeed be affected by changing climate conditions, but they are not nearly as sensitive to the projected changes as many of the aquatic species assessed in this project.

All resource issues were qualitatively assessed through discussions with Tribal staff; results are described in Section 6.0 of this report.

5.0 Adaptation Planning Results

This final phase of the project focused on developing adaptation strategies and actions to increase the resilience of species and habitats. The Core Team selected 11 focus species for adaptation planning (Table 7). Given the holistic and interconnected nature of ecosystems and the habitats that these species depend on, the Core Team decided to focus on these species' primary habitats rather than the species themselves. They worked to develop strategies and actions that would strengthen the ability of each habitat to persist and thrive with changing climatic conditions, and thereby support the needs of select species within them. This is not to suggest that identified actions and strategies are going to ameliorate the impacts of climate change for *all* species within the habitat. Though, in general, actions that help protect, preserve, or restore the Sagebrush Steppe habitat are expected to increase the climate resilience of both Sage Grouse and Wyoming Sage.

Table 7: Final habitat and species groupings selected for adaptation planning efforts.

Habitat: Sagebrush Steppe
Wyoming Sage
Sage Grouse

Habitat: Coniferous Forest
Pinyon Pine
Aspen

Habitat: Generalists
Mule Deer
Serviceberry

Habitat: Aquatic
Yellowstone Cutthroat Trout
Pacific Lamprey
Chinook Salmon

Habitat: Riparian
Bald Eagle
Black Cottonwood

Using this framework, the project team conducted a literature review to identify promising adaptation actions and strategies, and identified a suite of potential adaptation actions for each habitat. Where relevant, the team also identified additional species-specific adaptation actions. These draft actions were then presented to the Core Team in a day long, collaborative adaptation planning workshop wherein the group worked to customize and refine the strategies and actions so that they would ultimately be effective and useful for the Tribes. Separate staff-led discussions following the workshop further refined the list by examining and evaluating additional aspects of implementation, including time frame for completion, financial cost, political feasibility, and cultural significance. This process resulted in a prioritized list of strategies, which are summarized below for each habitat type and species grouping. The Tribes will use this process to produce more detailed adaptation strategies for additional species and is considered a 'living' planning process.

Sagebrush Steppe

Sagebrush steppe is an arid ecosystem in the Intermountain West whose distribution is strongly controlled by seasonal temperatures. While sagebrush steppe ecosystems do experience warm, dry summers, projected increases in air temperatures could further reduce soil moisture levels through increasing potential evapotranspiration. Sagebrush steppe ecosystems are sensitive to indirect effects of climate change such as invasive species and shifts in fire regimes. Cheatgrass invasion into sagebrush steppe ecosystems has increased fire frequency by acting as a continuous, highly flammable, fuel source that enables fires to cover a larger area and burn more frequently.[12] While sagebrush species typically re-establish following a disturbance, a decreasing fire interval makes it harder for sagebrush to establish following disturbance, further promoting cheatgrass spread. Two species of concern for the Shoshone-Bannock Tribes within this habitat area are ***Sage Grouse*** and ***Wyoming Sage***. In Table 8 are strategies and actions which benefit both the habitat itself, as well as the critical species within it. All *actions* have been ranked by priority within each *strategy* group.

Aquatic

Aquatic habitats support species of critical importance to the Shoshone-Bannock Tribes, and include springs, seeps, creeks, rivers, and other water-dependent ecosystems within the project area. Aquatic habitats are generally sensitive to changing climate conditions. Human activities such as restoring and maintaining riparian areas and limiting groundwater withdrawals can help reduce projected increases in stream temperatures.[13] Three species of concern for the Shoshone-Bannock Tribes that utilize this habitat type include ***Yellowstone Cutthroat Trout***, ***Pacific Lamprey*** and ***Chinook Salmon***. Table 9 includes strategies and actions that benefit both the habitat itself, as well as the critical species within it. *Actions* have been by priority within each *strategy* group.

Riparian

Riparian areas are the terrestrial habitats found immediately alongside rivers and streams. In the relatively dry landscape of the Upper Snake River Watershed, riparian areas and their associated waterways provide essential water resources for plants and animals. Healthy riparian systems rely on an appropriate range of water temperatures, volumes, and quality. Two species of concern for the Shoshone-Bannock Tribes that utilize this habitat type are ***Bald Eagle*** and ***Black Cottonwood***. Table 10 includes strategies and actions that benefit both the habitat itself, as well as the critical species within it. *Actions* have been ranked by their priority within each *strategy* group.

Coniferous Forest

The mixed conifer forests found within the Upper Snake River Watershed are sensitive to warming temperatures, as reduced soil moisture availability may negatively affect more drought-sensitive species, leading to shifts in species composition and habitat structure. These forests are also sensitive to the indirect effects of climate change; for example, declining snowpack and warming air temperatures are likely to increase the likelihood of stand-replacing fires and insect outbreaks (e.g., bark beetle and western spruce budworm). These risks are amplified in those forests largely composed of fire-intolerant species. Two forest species of concern for the Shoshone-Bannock Tribes are ***Pinyon Pine*** and ***Aspen***. In Table 11 below are strategies and actions which benefit both the habitat itself, as well as the critical species within it. *Actions* have been ranked by priority within each *strategy* group.

Habitat Generalists

Two key species of concern for the Shoshone-Bannock Tribes – ***Mule Deer*** and ***Serviceberry*** – are habitat generalists: they depend on and can be found in a wide variety of habitats. Tables 12 and 13, below, include strategies and actions expected to benefit these species. *Actions* have been ranked in order of their priority within each *strategy* group. These species are also likely to benefit from many of the actions identified for the various habitats they utilize.

Table 8: Adaptation Actions for Sagebrush Steppe Habitat, including adaptation actions specific to Sage Grouse and Wyoming Sage.

ADAPTATION OBJECTIVES	ADAPTATION STRATEGIES	ADAPTATION ACTIONS	PRIORITIZATION CRITERIA			
			Summary Score	Timeframe for Implementation (immediate > 3 years medium 3-5 years, long-term 5+ years)	Notes: Legal Feasibility	Notes: Cultural Significance
Objective 1: Plan and prepare for increases in frequency and severity of wildfires.	SAGE-1: Plan and prepare for greater area burned.	Incorporate climate change into fire-management plans (wildfire projections); anticipate more opportunities to use wildfire for resource benefit.	18	immediate	no permit	high
		Identify areas important for Wyoming Sage in situ gene conservation (quantifiable measurement) to provide a baseline for measuring fire impacts and informing post-fire planting/rehabilitation.	18	medium	no permit	high
		Increase production of native plants for post-fire plantings (reduce the potential for anthropogenic impacts).	17	medium	requires EC	medium
	SAGE-2: Increase resilience of existing vegetation by reducing hazardous fuels and forest density and maintain low densities.	Increase interagency communication of shared fire risk (between tribes and other natural resource managers in the region).	17	immediate	no permit	medium
	SAGE-3: Increase resilience through post-fire management.	Consider climate change in post-fire rehabilitation and determine where native seed may be needed for post-fire planting. Enhance plans for post-fire responses for large fires (i.e., limiting cheatgrass spread, looking at burn severity, replant when needed, keeping cattle out of burned area).	17	immediate	component EC	medium
		Monitor post-fire regeneration to determine what can be expected after large fires and to inform emergency stabilization and long term restoration efforts.	17	medium	component EC	low
		Experiment with planting native species to compete with invasive species post-fire.	14	long-term	no permit	high
	SAGE-4: Manage vegetation to reduce fire severity and fire patch size; protect fire refugia.	Map and identify (through GIS and remote sensing) processes/conditions that create fire refugia or areas less prone to fire.	16	medium	component EC	medium
	SAGE-5: Manage landscapes to encourage fire to play a natural role.	Identify, create, and/or retain fuel breaks at strategic locations.	15	long-term	requires EC	low
Objective 2: Prepare for climate-driven shifts in habitat and species distributions.	SAGE-6: Prevent loss of relict populations of vascular and nonvascular species.	Engage in mapping areas where sagebrush could be established or re-established (relict ranges). *Underway.*	18	medium	no permit	high
	SAGE-7: Support movement of Sagebrush habitat and species. Monitor and detect change in survival, species composition, and mortality of sagebrush.	Plant species from future climate appropriate seed zones.	18	medium	component EC	high
		Identify if there is a need for additional plots to gather trend information over time, targeting areas where changes are expected.	17	long term	no permit	low
		Consider assisted migration to help Wyoming Sage Brush keep pace with suitable climate parameters.	17	long-term	component EC	high
	SAGE-8: Increase habitat connectivity.	Coordinate among/across states and between states and their federal counterparts to protect habitat core areas to promote large-scale, continuous sage grouse habitat that would be protected from further development.	16	immediate	no permit	low
		Identify, maintain and restore corridors that span elevation gradients to facilitate the dispersal of shrub steppe species into cooler, higher elevation habitats as the climate warms.	16	long-term	component EC	medium
		Diminish habitat fragmentation through human-related disturbances including habitat conversion to other land use types, overgrazing, energy development and roads which disrupt the habitat. Work instead to preserve large scale, continuous habitat protected from development. Engage private landowners in efforts to preserve sagebrush habitat.	15	immediate	component EC	high
Objective 3: Increase resilience to future changes by reducing existing stressors.	SAGE-9: Establish conservation and protected areas to expand the area of suitable sagebrush habitat under future climate conditions.	Pilot rotation for pastures from grazing (near occupied leks) during periods of fastest growth of dominant perennial grasses and forbs, as this enhances reproduction in sagebrush steppe (e.g. paid deferments through conservation programs).	16	long-term	requires EC	low
		Ensure that new and existing livestock troughs and open water storage tanks are fitted with ramps to facilitate the use of and escape from troughs by sage-grouse and other wildlife.	13	immediate	no permit	low
		Install fence markers or remove fences where sage-grouse mortality due to collision with fences is documented or likely to occur due to new fence placement (avoid new fences within 0.5 mile of a lek).	12	immediate	no permit	medium
	SAGE-10: Increase resilience by promoting native species and drought-adapted native species.	Work to reestablish Wyoming Sage Brush where it is desired through seed imprinting, seed broadcasting or seed plugs.	17	long-term	component EC	high
		Use native plant species that will be robust to climate change (e.g., drought-adapted species) in restoration projects.	19	medium	component EC	high

ADAPTATION OBJECTIVES	ADAPTATION STRATEGIES	ADAPTATION ACTIONS	PRIORITIZATION CRITERIA			
			Summary Score	Timeframe for Implementation (immediate > 3 years medium 3-5 years, long-term 5+ years)	Notes: Legal Feasibility	Notes: Cultural Significance
Objective 4: Increase invasive species control efforts to decrease wildfire risk, protect Wyoming Sage Brush regeneration, and provide for Sage Grouse habitat.	SAGE-11: Increase invasive species control efforts.	Increase coordination between other tribes and natural resource managers/agencies in the region and enhance funding for invasive species management.	16	immediate	no permit	medium
		Initiate early detection and rapid response programs (e.g. chemical, biological applications, mechanical removal, prevention methods [e.g. wash stations]) by establishing baseline conditions for invasive species and insects both on and off Tribal lands.	14	immediate	requires EC	low
		Identify and target known sources/vectors for invasive species (e.g., rock pits, weed-free materials for restoration).	12	medium	no permit	low
	SAGE-12: Prevent invasive species from establishing after disturbances.	Rehabilitate burned areas for the ecological site using native plant materials or introduced materials, that encourage the long term sustainability of native species, and as approved by Resource Managers.	19	immediate	component EC	medium
		Consider strategies regarding prevention and spread of invasive species in all phases of restoration, construction, and other projects (e.g., planning, implementation, monitoring).	17	immediate	no permit	low
	SAGE-13: Prevent widespread outbreaks of invasive species or pathogens.	Continue to maintain permits for aggressive treatment of invasive species (e.g., burning and herbicide).	14	immediate	requires EC	low
Objective 5: Increase monitoring and evaluation efforts to protect habitat and species.	SAGE-14. Monitor and detect change in species composition, distribution, seedling survival, and mortality of sagebrush in sagebrush steppe habitats.	Conduct baseline assessment of sagebrush steppe habitat and design long-term trend monitoring programs for sage brush steppe habitats adding additional plots as needed.	16	medium	component EC	low
		Identify and focus monitoring on sensitive habitats and species in priority regions and prioritize these habitats for active management, acquisition, and protection across jurisdictional boundaries.	14	medium	component EC	low
Objective 6: Enhance outreach and educational activities	SAGE-15. Enhanced outreach and education on Sagebrush Steppe Issues.	Develop and expand education efforts for the public regarding wildfire reduction efforts on the Wildland Urban Interface.	18	immediate	no permit	high
		Develop and expand education efforts for the public regarding invasive species impacts, such as improving identification of non-native species, encouraging the use of native species, and promoting the use of strategies to prevent and remove invasive species.	18	immediate	no permit	medium
		Conduct outreach and education to policy-level tribal decision-makers about the Adaptation Planning efforts.	18	immediate	no permit	high
		Conduct outreach and education to all land users (e.g. ranchers) about the Adaptation Planning efforts.	18	immediate	no permit	high
		Consider program to engage citizen scientists to help with invasive species monitoring, detection, and response efforts (e.g. LEO network).	13	immediate	no permit	low
		Conduct outreach and education to nurseries regarding selling invasive species and addressing invasive seeds and pathogens in native plantings.	13	immediate	no permit	low

Table 9: Adaptation Actions for Freshwater Aquatic Habitat, including resilience building actions for Yellowstone Cutthroat Trout, Pacific Lamprey, and Chinook Salmon.

ADAPTATION OBJECTIVES	ADAPTATION STRATEGIES	ADAPTATION ACTIONS	PRIORITIZATION CRITERIA			
			Summary Score	Timeframe for Implementation (immediate > 3 years medium 3-5 years, long-term 5+ years)	Notes: Legal Feasibility	Notes: Cultural Significance
Objective 1: Increase resilience of freshwater habitats to shifts in winter hydrologic regimes.	FW-1: Improve flood storage capacity to maximize the benefits of spring flows.	Work with key state and federal agencies to continue to protect, enhance and restore natural channel migration zones (e.g. Fort Hall Bottoms).	17	medium	EC required	medium
		Work with private landowners, key state and federal agencies to set back dikes, remove armoring, and address other barriers that limit floodplain connectivity.	15	medium	EC required	low
	FW-2: Increase fish habitat resilience to higher winter streamflows by restoring stream structure and ecological function.	Increase use of logjams where feasible to provide refugia during high flow events.	17	medium	EC required	medium
		Explore landscape water retention projects to protect habitat against extreme runoff events and low flow/high temperature events (eg. Increase and/or reconnect floodplain habitat to streams and rivers, alternate tillage practices) (e.g. Bannock Creek).	14	immediate	component EC	high
	FW-3: Develop better information about winter streamflow regimes.	Review and evaluate stream monitoring network and identify locations for additional streamflow and temperature monitoring.	13	immediate	no permit	low
Objective 2: Increase resilience of freshwater habitats to declining summer flows and warming stream temperatures.	FW-4: Increase aquatic habitat resilience to low summer flows and warming stream temperatures.	Restore beaver habitat and beaver populations to maintain summer base flows and reduce water temperatures.	19	immediate	no permit	high
		Increase stream complexity to provide refugia during low flow events (i.e., maintain woody material and/or bolders in the stream reach) *In the Tributary Management Plan.*	19	long-term	EC required	high
		Maintain or restore riparian vegetation to limit channel exposure to solar radiation *In the Tributary Management Plan*	18	medium	EC required	high
		Restore riparian areas to maintain summer base flows and reduce water temperatures, and consider riparian treatments that enhance these benefits *In the Tributary Management Plan.*	18	long-term	EC required	high
		Prevent livestock grazing in the riparian zone (i.e., install localized fencing) and other ecologically sensitive zones *In the Tributary Management Plan.*	17	long-term	component EC	medium
	FW-5: Increase understanding of how summer streamflow regimes, thermal heterogeneity, and cold water refugia could be affected by climate change.	Identify and monitor stream temperatures, cold water refugia, springs, and groundwater input to springs in the Upper Snake watersheds and identify river stretches with highest potential for thermal blockages and reduce potential for blockage where possible.	14	immediate	no permit	medium
		Research and evaluate the influences of lakes, ditches, hyporheic zones, glacier and snow melt and groundwater on stream temperatures, and how climate change could affect those influences.	12	medium	no permit	medium
	FW-6: Increase understanding of thermal tolerance of fish species.	Research and monitor fish use of thermal refugia; evaluate and include a cold water standard to help protect aquatic fish species.	13	immediate	no permit	medium
	FW-7: Implement water conservation approaches that increase summer streamflows and buffer against rising stream temperatures.	Develop and implement watershed-specific headwater flow and temperature protection plans.	18	medium	EC required	high
		Work with stakeholders to identify opportunities for water conservation practices in sensitive areas/priority watersheds.	15	immediate	no permit	medium
		Identify priority watersheds to work with partners to meter water withdrawals to better quantify how much water is being used within the ShoBan assessment area.	15	immediate	no permit	low
		Reduce or eliminate thermal water pollution from human sources (i.e. irrigation returns).	13	medium	component EC	low
		Identify cold-water storage sources for application at critical periods.	11	medium	no permit	low
	FW-8: Reduce migration/dispersal barriers to fish populations (e.g., culverts, dams, etc.).	Ensure appropriate site characterization to develop adequate barrier mitigation measures for action implementation.	17	long-term	component EC	low
		Investigate fish passage technologies and opportunities (e.g., design of fish friendly culverts, bottomless arches and bridge), and ensure these are implemented where necessary.	15	medium	component EC	low
		Assess the feasibility and benefit of removing unneeded or marginal barriers that block salmon from headwater habitats (i.e., removing low-value dams, acquiring water to restore de-watered streams and protect thermal refugia, accelerate culvert replacements).	13	long-term	no permit	low
		Use stored cold water, additional ladders, ladder improvements, and ladder maintenance to enhance mainstem adult passage; incorporate 24-hour video fish counting.	12	long-term	component EC	low
		Require experimental fish passage (dam modification, capture technologies, or both) in federal license renewals for relevant private dams.	11	long-term	component EC	medium
		Assess the feasibility and potential benefits of removing aged and/or unprofitable tributary dams in the lower Snake River to reopen tributary habitat to anadromous fish.	9	long-term	EC required	low

ADAPTATION OBJECTIVES	ADAPTATION STRATEGIES	ADAPTATION ACTIONS	PRIORITIZATION CRITERIA			
			Summary Score	Timeframe for Implementation (immediate > 3 years medium 3-5 years, long-term 5+ years)	Notes: Legal Feasibility	Notes: Cultural Significance
Objective 3: Reduce the impact of non-native species on freshwater habitats.	FW-9: Stop the arrival and spread of non-native species to reduce the risk of invasive species.	Maintain or construct cleaning and inspection stations to prevent spread of invasive species, where appropriate.	16	immediate	EC required	high
		Remove or control aquatic invasive species (i.e. New Zealand mud snails, quagga mussels, purple loosestrife).	15	immediate	EC required	high
		Research and evaluate how invasive riparian and aquatic species could be affected by climate change.	13	immediate	no permit	high
Objective 4: Reduce the impact of diseases and parasites on freshwater habitats.	FW-10: Improve monitoring for fish disease and parasites.	Certify releases of fish from artificial production as disease free.	15	immediate	component EC	low
		Collaborate and standardize fish health survey methods among agencies.	13	immediate	component EC	low
Objective 5: Increase understanding of the link between climate change and shifts in water quality.	FW-11: Improve understanding of changes in water quality in response to climate change.	Begin improving in-channel stream conditions for anadromous fish by improving or eliminating land-use practices that degrade watershed quality.	17	medium	EC required	medium
		Improve mainstem and tributary water quality by eliminating sources of toxic pollution and by reducing discharges of other contaminants to meet water quality criteria for salmonids and pacific lamprey across all life stages.	16	long-term	EC required	high
		Continue to invest in monitoring surface and ground water quality and quantity parameters such as dissolved oxygen, nutrients, pH, turbidity, and sedimentation in response to decrease flows and increased stream temperatures.	15	immediate	component EC	low
Objective 6: Species Specific: monitor, and where appropriate, restore freshwater habitat and reintroduce or supplement chinook, lamprey, and Yellowstone Cutthroat trout habitat.	FW-12: Monitor and where appropriate, recover salmonid and lamprey populations through recovery efforts driven by population supplementation and reintroduction.	Follow and Implement appropriate Fort Hall Tributary Management and Fish Management Plans to protect, enhance and restore habitat for native salmonids.	17	immediate	EC required	high
		Use supplementation to reintroduce salmon or help rebuild populations to watersheds from which they have been eliminated, or are under a high risk of extinction.	17	long-term	EC required	high
		Manage for life history and genetic diversity among salmonid populations.	15	medium	component EC	high
		Closely monitor tributary salmon production and escapement to improve management.	14	immediate	component EC	high
		Supplement and/or augment interior lamprey populations by reintroduction and translocation of adults and juveniles into areas where they are severely depressed or extirpated.	13	long-term	EC required	medium
		Continue research and establish long term monitoring around macroinvertebrate community including aquatic species and other species in the trophic level to respond to the shift in taxa.	13	long-term	EC required	low
		Collaborate with NOAA on the recovery of fall run of Chinook Salmon above the Hells Canyon Dam Complex (e.g., evaluate feasibility of adult and juvenile fish passage to and from spawning and rearing sites).	8	long-term	EC required	high
	FW-13: Restore habitat necessary to the survival of salmonids.	Restore mainstem, floodplain, and estuary habitats to more natural conditions where possible, which will reduce predation rates on migrating juvenile salmon and provide more rearing and resting habitat.	19	medium	EC required	medium
Objective 7: Increase outreach and education for freshwater species.	FW-14: Increase public education regarding vulnerable species.	Develop and expand education efforts for the public regarding invasive species impacts, such as improving identification of non-native species, encouraging the use of native species, and promoting the use of strategies to prevent and remove invasive species.	19	immediate	no permit	medium
		Consider program to engage citizen scientists to help with invasive species monitoring, detection, and response efforts (e.g. LEO network).	19	immediate	no permit	medium
		Conduct outreach and education to policy-level tribal decision-makers about the Adaptation Planning efforts.	17	immediate	no permit	medium
		Increase human health advisory efforts to the public regarding fish consumption and toxins through increased coordination with the Idaho Health & Welfare website.	14	immediate	no permit	high
Objective 8: Increase understanding of how changing seasonal temperature or precipitation influence freshwater species phenology.	FW-15: Improve understanding of changes in, and implications of, phenological changes and species interactions.	Monitor phenological changes and species interactions in riparian and aquatic species.	20	long-term	component EC	low

Table 10: Adaptation Actions for Riparian Habitat, including resilience building actions for Black Cottonwood and Bald Eagle.

ADAPTATION OBJECTIVES	ADAPTATION STRATEGIES	ADAPTATION ACTIONS	PRIORITIZATION CRITERIA			
			Summary Score	Timeframe for Implementation (immediate > 3 years medium 3-5 years, long-term 5+ years)	Notes: Legal Feasibility	Notes: Cultural Significance
Objective 1: Increase resilience of riparian habitats to increasing regional drought.	RIP-1: Maintain and enhance riparian forest productivity regardless of tree species; focus on functional ecosystems and processes.	Identify restoration areas to plant native riparian species (i.e. hand planting/cuttings).	18	immediate	EC required	medium
		Work with private, state and federal agencies to promote the restoration of natural stream and river flooding to maintain riparian areas and provide flow rates high enough for Cottonwood germination.	16	medium & long-term	EC required	high
	RIP-2: Store more water on the landscape to reduce impacts to riparian habitats.	Increase beaver populations to create more wetland habitat.	18	immediate	no permit	high
	RIP-3: Protect and increase instream flows.	Restore riparian vegetation and prevent soil compaction and wetland destruction.	17	immediate	EC required	high
Objective 2: Plan and prepare for increased rates of erosion.	RIP-4: Decrease erosion potential by reseeding and restoration, which can be used following disturbances and for vulnerable exposed soil surfaces (near roads, or after fire).	Restore and revegetate riparian plant communities where needed to store sediment and maintain channel geomorphology.	18	immediate	EC required	high
		Implement streambank stabilization and floodplain restoration techniques to help reduce bank erosion from higher flows (i.e. Bannock Creek, the Bottoms).	16	medium	EC required	medium
		Continue and expand monitoring of existing riparian communities using GIS/remote sensing.	15	medium	no permit	low
		Develop a geospatial layer of debris flow potential for pre-fire planning.	14	medium	component EC	low
		Link stream inventory with topographic, geomorphic, and vegetation layers to assess existing hazard and risk for flooding and erosion.	13	medium	component EC	low
Objective 3: Prepare for unavoidable shifts in the distribution of riparian species and habitats.	RIP-5: Prevent loss of relict populations of vascular and nonvascular riparian species	Identify areas where riparian relict plants could be established or re-established (i.e. black cottonwood).	17	medium	EC required	medium
	RIP-6: Monitor and detect change in seedling survival, species composition, and mortality of mature trees in subalpine forests.	Use Forest Inventory and Analysis plot information to determine trends in riparian forests.	13	immediate	no permit	medium
	RIP-7: Increase late-successional habitat area and habitat quality.	Identify important habitat manipulations for promoting late-successional stage (e.g., thinning and prescribed burns on the Fort Hall Bottoms) based on monitoring.	19	immediate	no permit	high
		Identify priority areas for acquisition, protection, and restoration.	17	immediate	no permit	medium
Objective 4: Prepare to monitor changes in species phenology.	RIP-8: Increase resilience of riparian habitat by preserving biodiversity.	Continue to create, promote, and protect legacy structures in riparian forests which will provide current or future nest structure for the Bald Eagle.	20	immediate	no permit	high
		Protect critical riparian areas and promote connectivity.	17	medium	EC required	medium
		Examine biotic associations that promote resistance and resilience to a changing environment.	13	long-term	no permit	low
	RIP-9: Monitor and prioritize regions for riparian management.	Identify and focus monitoring on sensitive riparian habitats and species (e.g. frogs, yellow billed cuckoo) in priority regions and expand long-term monitoring programs.	17	medium	no permit	medium
Objective 5: Limit the impact of increased sediment transport on riparian habitats.	RIP-10: Reduce water turbidity levels by reducing sediment loading and facilitating sediment deposition.	Increase channel to floodplain connectivity to allow for sediment deposition.	20	medium	EC required	medium
		Work with partners to monitor and identify areas prone to road failure, unstable slopes, and mass wasting and how these areas might be impacted by climate change.	14	immediate	component EC	low
		Manage cultivated and riparian areas to maximize sediment retention and reduce erosion.	14	immediate	component EC	low

ADAPTATION OBJECTIVES	ADAPTATION STRATEGIES	ADAPTATION ACTIONS	PRIORITIZATION CRITERIA			
			Summary Score	Timeframe for Implementation (immediate > 3 years medium 3-5 years, long-term 5+ years)	Notes: Legal Feasibility	Notes: Cultural Significance
Objective 6: Increase resilience of riparian habitats to invasive species through early detection, response, and prevention.	RIP-11: Increase invasive species control efforts.	Survey and map invasive riparian and aquatic species.	18	medium	no permit	low
		Implement early detection and rapid response for invasive species and insects both on and off Tribal lands.	18	immediate	EC required	low
		Decrease resilience of existing invasive species with appropriate management practices (e.g., weed removal).	18	immediate	EC required	low
		Identify and target known sources/vectors for invasive species (e.g., streambank restoration using weed free materials/sanitary fill).	16	immediate	component EC	low
		Coordinate invasive species management, funding, and support between other tribes and natural resource managers/agencies in the region.	16	medium	no permit	low
		Work to reduce/eliminate Russian olive encroachment (as well as other exotic plants) which can reduce recruitment of black cottonwood.	15	immediate	EC required	low
		Consider strategies regarding prevention and spread of invasive species in all phases of projects (e.g., planning, implementation, monitoring).	12	immediate	component EC	low
Objective 7: Enhance climate outreach and education.	RIP-12: Enhance outreach and educational activities around riparian issues.	Develop and expand education efforts for the public regarding invasive species impacts, such as improving identification of non-native species, encouraging the use of native species, and promoting the use of strategies to prevent and remove invasive species.	19	immediate	no permit	medium
		Develop and implement education efforts for the public regarding irrigation efficiencies. Identify restoration areas and promote best practices for irrigation methods in those areas.	17	immediate	no permit	medium
		Conduct outreach and education to policy-level tribal decision-makers about the Adaptation Planning efforts.	17	immediate	no permit	medium
		Consider program to engage citizen scientists to help with invasive species monitoring, detection, and response efforts (e.g. LEO network).	17	immediate	no permit	medium

Table 11: Adaptation Actions for Coniferous Forest Habitat, including resilience building actions for Pinyon Pine and Aspen.

ADAPTATION OBJECTIVES	ADAPTATION STRATEGIES:	ADAPTATION ACTIONS	PRIORITIZATION CRITERIA			
			Summary Score	Timeframe for Implementation (immediate > 3 years medium 3-5 years, long-term 5+ years)	Notes: Legal Feasibility	Notes: Cultural Significance
Objective 1: Prepare for and limit the effects of more frequent or intense droughts and wildfires.	FOR-1. Use native as well as drought and future temperature tolerant species in restoration efforts post disturbance.	Experiment with native species from other elevations/ latitudes, and/or introduce drought tolerant species for reseeding and restoration.	14	long-term	EC required	medium
Objective 2: Prepare for shifts in the distribution of forest species and habitats.	FOR-2. Prevent loss of culturally important populations of vascular and nonvascular species.	Protect, restore, connect, and enhance climate refugia (e.g., colder north-facing aspects of hard to access areas).	17	medium	EC required	high
	FOR-3. Increase habitat connectivity.	Prepare for tree species migration by managing for multiple species across large landscapes.	18	immediate	EC required	high
		Continue to acquire new tribal properties for conservation and where possible, expand or adjust protected areas to incorporate greater diversity of topographic and climatic conditions to allow for shifts in species distributions in response to climate change.	16	medium	EC required	high
		Increase extent of protected areas; collaborate with neighbors regarding priority areas for treatments (e.g., removing dispersal barriers) and land acquisitions.	15	medium	EC required	medium
	FOR-4. Increase habitat quality and biodiversity.	Continue to protect legacy structures.	17	immediate	no permit	high
		Continue to restore degraded sites and identify priority areas for acquisition, protection and restoration. (both within and across jurisdictions).	16	long-term	EC required	low
		Continue to thin stands / prescriptive burning to promote tree vigor, complex forest structure, and produce future legacy structures. Consider ungulate pressure in areas and how it will affect the success of regeneration.	15	immediate	EC required	medium
Objective 3: Species specific resilience or survival strategies.	FOR-5. Protect existing and potential future habitat.	Increase connectivity to and among potential climate refugia.	17	medium	EC required	medium
	FOR-6. Reduce browsing pressure on aspen.	Continue to create exclosures using fencing or jackstraw (heavy tree-fall) to encourage aspen regeneration.	18	immediate	EC required	high
	FOR-7. Protect and spread aspen.	Separate roots of aspen.	11	long-term	EC required	low
Objective 4: Limit the effect of invasive species to enhance the natural resilience of forest habitats.	FOR-8. Increase invasive species control efforts.	Implement early detection and rapid response for insects both on and off Tribal lands.	18	medium	no permit	low
		Coordinate invasive species management, funding, and support between other tribes and natural resource managers/agencies in the region.	18	immediate	EC required	low
		Identify and target known sources/vectors for invasive species.	18	immediate	EC required	low
	FOR-9. Prevent widespread outbreaks of invasive species or pathogens.	Maintain permits for aggressive treatment of invasive species (e.g., burning and herbicide).	16	immediate	EC required	low
		Identify and promote early-successional natives that may be able to compete with non-natives.	16	medium	no permit	low
		Reduce existing invasive species populations with appropriate management practices (e.g., weed removal).	15	immediate	EC required	low
		Apply herbicides and other direct eradication methods to select invasive species when necessary.	15	medium	EC required	low
	FOR-10. Increase forest landscape resilience to large and extensive insect or pathogen outbreaks.	Design forest gaps that create establishment opportunities for unaffected species (e.g., meadow) or different forest species (e.g., alder, cedar).	17	medium	EC required	medium
		Consider planting desired species in addition to relying on natural regeneration and migration, when necessary.	16	long-term	EC required	medium
		Monitor insect/pathogen infestations using technology (drone, remote sensing/GIS) to map the extent and progression of the infestation.	14	medium	component EC	low

ADAPTATION OBJECTIVES	ADAPTATION STRATEGIES:	ADAPTATION ACTIONS	PRIORITIZATION CRITERIA			
			Summary Score	Timeframe for Implementation (immediate > 3 years medium 3-5 years, long-term 5+ years)	Notes: Legal Feasibility	Notes: Cultural Significance
Objective 5: Enhance forest health to increase resilience to disturbance.	FOR-11. Increase resilience of forest stands to disturbance by increasing tree vigor.	Identify priority areas for protecting pinyon pine and aspen; consider removal of competing conifers and vegetation.	17	immediate	EC required	medium
		Instead of thinning for late-successional forest conditions, also consider thinning/creating gaps to promote a more complex vertical forest structure that allows for native understory development and increased diversity.	15	medium	EC required	low
	FOR-12. Promote diverse native species and forest structure.	Practively plant and replant with native seedings in restoration areas and post disturbance in re-growth areas.	17	immediate	component EC	high
Objective 6: Invest in Monitoring, Evaluation, and Research to better understand how changing climate conditions are affecting forests, aspen, and pinyon pine.	FOR-13. Monitor and Update management plans.	Periodically review and revise the Forest Inventory to balance harvest of forest health.	15	long-term	EC required	low
		Expand long-term monitoring programs and share data.	13	medium	component EC	low
Objective 7: Enhance outreach and education efforts within the tribal community to build climate literacy and support for future actions.	FOR-14. Community Engagement.	Conduct outreach and education to all land users (e.g. ranchers) about the Adaptation Planning efforts.	19	immediate	no permit	medium
		Develop and expand education efforts for the public regarding wildfire reduction efforts on the wildland urban interface.	18	immediate	no permit	high
		Conduct outreach and education to policy-level tribal decision-makers about the Adaptation Planning efforts.	18	immediate	no permit	medium
		Develop and expand education efforts for the public regarding invasive species impacts, such as improving identification of non-native species, encouraging the use of native species, and promoting the use of strategies to prevent and remove invasive species.	18	immediate	no permit	medium

Table 12: Adaptation Actions for Mule Deer.

ADAPTATION OBJECTIVES	ADAPTATION STRATEGIES	ADAPTATION ACTIONS	PRIORITIZATION CRITERIA			
			Summary Score	Timeframe for Implementation (immediate > 3 years medium 3-5 years, long-term 5+ years)	Notes: Legal Feasibility	Notes: Cultural Significance
Objective 1: Prepare for and limit the effects of more frequent or intense droughts.	MD-1: Ensure water availability for Mule Deer Populations.	Ensure that water distribution is maintained in areas where freestanding water is documented to be important to Mule Deer.	14	medium	no permit	high
Objective 2: Prepare for unavoidable shifts in the distribution of species and habitats.	MD-2: Enhance the quality current habitat.	Ensure that security cover requirements for Mule Deer are incorporated in all restoration plans developed to improve Mule Deer habitat.	18	immediate	component EC	medium
		Identify and map critical Mule Deer habitat (including calving, winter, summer, and yearlong) and work with public and private land managers to protect and enhance those areas.	17	medium	no permit	medium
		Based on Mule Deer habitat requirements, use future climate projections (i.e., snow or lack of moisture) to develop maps of future critical areas for Mule Deer.	16	medium	no permit	high
		Assure future availability of habitats where Mule Deer are most secure from heat stress by undertaking conservation initiatives such as conservation easements, mitigation banking, and others deemed viable.	14	long-term	no permit	medium
	MD-3: Improve habitat connectivity.	Locate passage structures in proximity to existing or traditional travel corridors or routes (Singer and Doherty 1985, Bruinderink and Hazebroek 1996), and in proximity to natural habitat	12	long-term	EC required	low
		To maximize use by deer and other wildlife, passage structures should be located away from areas of high human activity and disturbance. For established passage structures in place >10 years, Clevenger and Waltho (2000) found that structural design characteristics were of secondary influence to ungulate use compared to human activity.	11	long-term	EC required	low
	MD-4: Decrease human development pressure on Mule Deer Habitat.	Evaluate road densities and ensure that road densities are not adversely impacting Mule Deer habitat, particularly during times when fawns are being born and reared.	17	immediate	no permit	medium
		Limit human development impacts on important Mule Deer habitats.	16	medium	component EC	medium
Objective 3: Prepare for shifts in phenology and/or enhanced competition.	MD-5: Limit interaction and competition between Mule Deer and Elk.	Identify locations/situations where Mule Deer and Elk competitive interactions may exist (i.e., winter range) and develop recommendations to reduce conflict between the species.	13	medium	no permit	medium
Objective 4: Increased risk of pathogens/disease.	MD-6: Monitor and decrease the affect of pathogens/disease on Mule Deer.	Develop a west-wide Mule Deer disease and parasite monitoring plan that recommends standardized surveillance, testing, data storage and reporting procedures.	13	immediate	no permit	high
		Track Mule Deer mortality and determine the root cause of the mortality.	13	immediate	no permit	low
		Provide comprehensive technical training to biologists and managers on disease and parasite detection, identification, surveillance, monitoring, and management.	12	immediate	no permit	low
Objective 5: Monitoring species status, distribution.	MD-7: Develop and enhance monitoring and data gathering.	Monitor Mule Deer buck: doe ratios on a 3-year moving average to better account for annual variation.	16	immediate	no permit	low
		Host an annual meeting with other agencies and resource managers such as state agencies, federal agencies, local resource managers, tribal resource managers, and others to discuss and coordinate Mule Deer management.	14	immediate	no permit	medium
		Monitor the effects of harvest levels on population demographics and abundance. Use monitoring data to set and adjust harvest rates, timing, duration of hunts, and bag limits to achieve population objectives.	14	immediate	component EC	low
		Digitally map current mule deer distributions.	11	medium	no permit	low
Objective 6: Outreach and Education.	MD-8: Enhance outreach and education.	Develop a landowner's guide to Mule Deer management and disseminate across the reservation.	16	immediate	no permit	medium
		Educate the public about potential changes in Mule Deer populations due to climate change.	14	immediate	no permit	high
		Develop and distribute educational materials to department leadership and public on climate impacts on Mule Deer and need for healthy habitat, travel management, and sustainable winter ranges.	14	immediate	no permit	medium

Table 13: Adaptation Actions for Serviceberry.

ADAPTATION OBJECTIVES	ADAPTATION STRATEGIES	ADAPTATION ACTIONS	PRIORITIZATION CRITERIA			
			Summary Score	Timeframe for Implementation (immediate > 3 years medium 3-5 years, long-term 5+ years)	Notes: Legal Feasibility	Notes: Cultural Significance
Objective 1: Prepare for and limit the effects of more frequent or intense droughts and wildfires.	SB-1: Use native species (particularly drought- and heat-tolerant ones) in post-disturbance restoration efforts.	Use traditional species mix including Service Berries for reseeding and restoration.	20	immediate	component EC	high
	SB-2: Maintain and enhance forest productivity regardless of tree species; focus on functional ecosystems and processes.	Manage species densities to maintain tree and bush (understory) vigor and growth potential.	18	immediate	requires EC	high
	SB-3: Support drought adapted and drought tollerant plants.	Identify and promote individual Service Berries that exhibit adaptation to water stress and collect seed for future regeneration.	not scored - technical feasibility unknown	medium	no permits	high
Objective 2: Create more forest openings and other suitable habitat for service berries.	SB-4: Increase habitat connectivity.	Determine if a program supporting assisted migration of Service Berry is necessary; develop one if it is.	19	immediate	no permit	high
		Increase extent of protected areas; collaborate with neighbors regarding priority areas for treatments (e.g., removing dispersal barriers) and land acquisitions.	17	medium	requires EC	medium
		Acquire new tribal properties for conservation and, where possible, expand or adjust protected areas to incorporate greater diversity of topographic and climatic conditions to allow for shifts in species distributions in response to climate change.	16	medium	requires EC	medium
		Prepare for species migration by managing for multiple species across large landscapes.	16	long-term	requires EC	medium
	SB-5: Enhance growth and productivity of Service Berries.	Implement thinning within anthropogenic openings to encourage understory shrub growth and maximize productivity.	14	long-term	requires EC	low
		Where appropriate, use prescribed fire to promote more frequent and less intense fires that enhance Service Berry reestablishment.	13	long-term	requires EC	medium
Objective 3: Increase resilience to future changes by reducing existing stressors.	SB-6: Reduce grazing and browsing pressure from cattle and other animals.	Create protected areas for service berry growth, removed or fenced off from cattle and range land.	18	medium	requires EC	high

6.0 Resource Issues of Concern

The resource issues described in this section highlight significant questions about the future of important ecological processes in the Snake River basin that have sustained the Shoshone and Bannock peoples for centuries. This project was not able to fully explore every resource issue given time and budget constraints. However, by building on the Core Team's new knowledge of landscape level effects of climate change, it is possible for Tribal staff to develop specific adaptation strategies and actions for species or resources on or around the reservation. Tribal staff identified additional resource concerns, including mine reclamation, traditional medicines and foods, water storage, agricultural, and human health. Each of these resources are an important part of Tribal members' daily lives. This project focused on larger landscape level issues, so the following resource-related topics will require attention in future planning efforts by Tribal staff.

Gay Mine Restoration Site

Figure 14: Gay Mine Restoration Site.

The Fort Hall Reservation is home to rich deposits of phosphorous, a key mineral used to develop agricultural products, interspersed among the rock formations along the eastern uplands. In the mid-twentieth century, the Shoshone-Bannock Tribes entered into mineral leasing agreements to mine those minerals with several companies. Mining activities lasted for approximately fifty years and the result of those mining activities remain present on the landscape today.

Climate change has the potential to increase the frequency of extreme events, including wildland fire, particularly in sagebrush steppe and grassland type habitats that are common throughout the Gay Mine site. Currently, the design for restoration includes populating the contours of reclaimed sites with shallow rooted grass for range production, likely increasing the vulnerability of these reclamation actions over the long term to wildfire. Further, there may be increases in disturbance due to more frequent wildfire and a higher risk of invasive species colonization. As a general strategy, future reclamation and site management plans should include plans for rapid response invasive species and wildfire mitigation measures to protect investments in restoration actions.

The Gay Mine site was mined over decades, often without the protections offered by contemporary environmental regulations, so reclamation efforts have included contouring the accessible parts of the mine area and leaving large pits or highwalls after mining was complete. Most soils in the area were already classified as moderate to highly erodible soils. With the removal of deep rooted shrubs like sagebrush and bitterbrush, the area became more susceptible to erosion. Tribal staff have observed significant erosion events in the past several years during extreme weather events throughout the mine site, with concerns about erosion running through the open pits and across the remaining high walls. Future planning for reclamation should characterize unconsolidated mine tailings for risk of contaminants into adjacent perennial watersheds and develop erosion or sediment control plans for the entire mine area.

Traditional Foods and Medicines

Throughout the homeland of the Shoshone and Bannock peoples, climate change could influence established ecological processes that allowed native plants to flourish in the Snake River basin by allowing non-native invasive species to gain a foothold or expand throughout the region. While not directly assessed in this project, in many cases, the loss of native plants translates to the loss of traditional foods and medicines, an important component of tribal culture, spirituality, and community health. Often traditional foods and medicines are viewed holistically, with the consumption of the traditional food having a medicinal value for the person consuming it.

During the assessment process, several traditional foods were evaluated, including pinyon pine and serviceberry, which had sufficient quantitative data for inclusion in the CCVI based vulnerability assessment. One important species, *yampah,* did not have adequate literature to develop a quantitative ranking. A component of the landscape level planning for the native habitats described above was intended to develop an implementation framework for improving the sustainability and resiliency of all native plant communities within that habitat type. As an example, *yampah* (wild carrots) are typically found in riparian and/or wet meadow habitat that are influenced by the development of complex watersheds from beavers, instream structures, and adequate access to a floodplain during seasonal run-off.

From a qualitative perspective, developing low-risk implementation actions like exclosure fencing or stream rehabilitation improves the conditions that allow a traditional food/medicine like *yampah* to thrive. The purpose of developing a prioritization matrix for restoration actions that focuses on larger habitat types across the landscape is to value all species within the community and maximizes opportunities for sustainable harvest of traditional foods/medicines for the Tribal community. Implementation of landscape level efforts will be closely coordinated with staff and community members to improve their access to important resources and to develop restoration actions if conditions on the ground no longer support resources they once did due to anthropogenic modification or climate change.

Asthma

Asthma is a non-curable chronic disease of the airways that affects the ability to breathe and can be controlled through medical management and avoidance of asthma triggers.[14] Some common asthma triggers related to climate include outdoor air pollution, pollen, mold, and smoke from wildfires or burning wood or grasses.[14] In the face of a changing climate, a central concern is that these conditions may become more common and cause additional respiratory impacts to tribal members with asthma.

Key climate change issues for asthma include:

- Increasing frequency or severity of wildfires (wildfire smoke can trigger or worsen asthma);
- Increasing summer temperatures and shifting precipitation patterns may increase drought conditions and related dust storms, which can trigger or worsen asthma; and
- Warming temperatures and shifting precipitation patterns may increase allergens that can trigger or worsen asthma.[14]

Asthma has high health costs due to hospitalizations, missed work or school days, and in severe cases, loss of life. The Centers for Disease Control and Prevention estimates that nationally, asthma is the fourth leading cause of work absenteeism and diminished work productivity for adults.[14]

Wildfire and Air Pollution

The most damaging component of wildfire smoke is particulate matter. The tiny size of the particulates means they can move directly into the bloodstream, allowing the body to interact with complex chemicals adhered to the particulates.[15] Particulates under 2.5μm in aerodynamic diameter ($PM_{2.5}$) are especially toxic because they can penetrate deeply into lung tissue, with lasting effects from a single exposure.

The observations and projections in this report point to continued summer warming, continued summer drying of plants and soils, and an extended wildfire season. These changes would likely increase regional particulate matter and both exacerbate and create asthma health effects in the local population. Along with fine particulates, wildfire smoke also contains the precursors to ozone (O_3). During warm summer days, these precursors can create ground level O_3, which is known to worsen asthma and other lung conditions.[16] Even without wildfires, ground-level O_3 and particulate matter are expected to increase with climate change.

Dust Pollution

As with wildfire smoke, the most health-damaging components of dust are particles under 2.5μm in aerodynamic diameter and up to 10μm in diameter (PM_{10}). Increase in this type of air pollution in Idaho is associated with increased healthcare treatment for acute upper and lower respiratory illnesses.[17] The observations and projections in this report point to continued summer warming, continued summer drying of plants and soils, and potential increased risk of dust storms.

Allergens

For asthmatics, whose asthma attacks are triggered by exposure to allergens such as pollen and molds, climate-driven increases in temperatures and shifting seasons has been shown to increase pollen production, circulation, and dispersion.[18] Projected climate changes are expected to contribute to increasing levels of some airborne allergens, with associated increases in asthma episodes and other allergic illnesses.[19]

Meadow Hay

Meadow hay is an important component of livestock management on the Fort Hall Reservation, with the Fort Hall Bottoms comprising a significant source of feed for livestock throughout the winter months. Conditions in the Fort Hall Bottoms have been influenced by a variety of factors including: groundwater diversions, invasive species, and changing growing seasons. Hay meadows have recently experienced a decline in the quantity and quality of grass production due to drought conditions and a change from snow to a mix of rain and snow throughout the winter months.

Meadow hay did not receive an overall vulnerability ranking in this project as the CCVI tool is not designed for managed or cultivated species like the grasses meadow hay is derived from. This resource concern was assessed qualitatively for the reservation. The primary concerns for maintaining a sustainable yield of meadow hay are a lower water table throughout the Fort Hall Bottoms that limits water access for shallow rooted plants. The rise of noxious and invasive species has also directly affected the quality of this resource.

Warming temperatures are already directly affecting agricultural production[20] and changing precipitation patterns could further exacerbate these issues by leading to an increase in groundwater diversions above the Fort Hall Bottoms. Indirect impacts, such as increases in pests and pathogens due to warmer temperatures, are also of concern, because they affect crop timing, location, and productivity.[20] These have troubling implications for the nutrition of agricultural feed. As the EPA states:

> *Increases in atmospheric [carbon dioxide] CO_2 can increase the productivity of plants on which livestock feed. However, studies indicate that the quality of some of the forage found in pasturelands decreases with higher CO_2. As a result, cattle would need to eat more to get the same nutritional benefits.*[21]

In addition, with projected increases in summer temperature and declines in summer precipitation, there may be fewer grasses on which to graze while livestock are on reservation rangelands,[21] thereby increasing the need to grow meadow hay to support cattle ranching during critical winter months. Climate change models suggest that dryland agriculture in hay fields without irrigation could decline,[22] while irrigated hay fields could benefit from warmer temperatures, especially after mid-century.[23] This assumes that there will be enough water available to continue irrigation and that the Tribes would support an emphasis on livestock production over the sustainability of ecological processes in sensitive areas like the Fort Hall Bottoms.

Extreme events may pose the largest unknown risk to future crop productivity. The impact of events such as wildfires and the associated post-event impacts of weed proliferation, pests, and diseases, could significantly increase losses in agricultural productivity.[20] Future planning efforts should focus on building resilient and sustainable hay meadows in the Fort Hall Bottoms, while promoting conservation efforts to protect sensitive species that also utilize meadow habitats.

Water Storage

One of the primary economic drivers for Southeast Idaho, and the Fort Hall Reservation, is the production of agricultural products like wheat and potatoes. This industry requires significant investments in water storage and delivery infrastructure to maintain a steady supply of contracted water and secure our Tribal reserved water rights. Many of the water storage projects were developed in the early decades of the twentieth century by the Bureau of Reclamation and may not be adequate for the projected impacts of climate change. The Tribes identified water project planning as a component of this assessment process, however there was not time to adequately address this issue quantitatively for adaptation planning purposes.

Fortunately, an alternate planning process is already underway through the Tribes' Water Resources Department to comprehensively evaluate the necessary infrastructure to ensure sustainable delivery of contracted water to agriculture producers. Generally speaking, total precipitation in the region is not expected to vary significantly from historic trends but the form (e.g., snow versus rain) of that precipitation will require a change in water management paradigms. From a broader perspective, the impacts to the region from a changing climate will focus on the shift from the current approach (large spring runoff events being stored in large reservoir systems) to managing facilities for rain driven events throughout the year. One issue that will require a more detailed planning effort is careful monitoring of groundwater resources, particularly those already showing strain from drought and groundwater withdrawals for agricultural purposes. Tribal staff

will continue to coordinate with contractors to share the results of this assessment as the continual evaluation of water storage and delivery infrastructure for the Fort Hall Reservation is conducted. Discussions throughout this project about the contemporary water management system leads Tribal staff to believe that future efforts to promote water conservation efforts, improve delivery systems, and adjust system management will be necessary to have access to sustainable sources of water.

Reservoirs

Tribal staff expressed concern about the impacts of climate change, specifically drought, on the reservoir systems, which are central to providing water to the region. As a result, the Water Resources Department staff were active participants in the discussions that occurred throughout this project. Due to the size and complexity of this hydrologic challenge, it is outside the scope of this climate vulnerability assessment and adaptation plan. However, a separate, comprehensive project is underway as of this report's publication (expected completion September 2017) investigating the impacts of drought on the region's water resources. The project is being completed by outside consultants in tandem with the Shoshone-Bannock Tribes' Water Resources Department and brings critical information to the Tribes about historical occurrences of and future projections of drought in the region. Further, drought scenario-based modeling of the region's capacity, incorporating streamflow and reservoir storage measurements, will be conducted to document the cultural, economic, and water resource effects of these droughts. Ideally, this project will support water use planning and climate resilience efforts for high risk areas. This effort to plan for drought impacts on reservoirs can be incorporated into planning efforts and other climate adaptation actions described in this plan.

Cattle

Tribal cattle producers and the Tribes' Range Program report that cattle are not gaining weight on reservation rangeland like they have in the past. Cattle are losing weight during drought events and are having difficulty finding nutritious foods on rangeland as native plant abundance decreases and noxious weeds become more prevalent. Wildfires also diminish the availability of nutritious feed on the landscape. Significant disturbances frequently increase the prevalence of annual grasses across the burned area. Drought conditions and the reduction, or disappearance, of water flows from some springs have forced cattle owners to use alternative water supplies for their cattle. Shifts in the timing of grass growth has also decreased the effectiveness of rangeland management, as the traditional synchronization of grass yield and cattle access is becoming less reliable. Cattle prefer wet-meadow areas of the landscape, but their presence there, without appropriate protections to sensitive habitats, can have negative repercussions on water quality and water availability that ultimately impact the cattle themselves. In many instances, ranchers are just barely turning a profit, making them highly sensitive to changes in their herd's health and weight.

Cattle as a species did not receive an overall vulnerability ranking in this project, as the CCVI tool is not designed for domesticated species. The climate change vulnerability of cattle was therefore investigated qualitatively. Climate change effects on cattle and ranching include the decreasing reliability of water supplies, increasing risk of wildfire in rangelands, increasing heat stress on cattle, potential increases in disease and pathogens, and the reduced quality of feed. Collectively, these impacts can have economic implications for Tribal producers by increasing the time and resources required to access quality rangelands and reach finish weights. These changes could also decrease leasing revenue for individual Tribal allottees.

Increasing summer temperatures, more extreme heat events, and the potential for increases in pathogens and parasites are climate change-related factors that directly influence cattle's physiological health. High temperatures (particularly heat events that occur in spring and early summer when cattle are less acclimated to heat)[24] can increase the risk of heat stress. Heat stress results in higher respiration rates, increasing body temperature, reduced food intake, and reduced performance.[25] Mortality can occur with more severe heat events, such as those that last three or more days.[24] Cattle at higher risk of heat stress include: newly arrived cattle that may have already been stressed by weaning, processing, or transportation; finished or nearly finished cattle, especially heifers; cattle that have been sick in the past and may have some preexisting lung damage; black or very dark-hided cattle; heavy bred cows that will calve sometime during the summer; older cows; and cattle which may be thin due to inadequate nutrition.[26]

Night-time cooling and access to shade, water, and active cooling (e.g., spray cooling) are important tools for limiting the effects of heat events on cattle. Warmer seasonal temperatures may also increase the survivability of pathogens and parasites by creating conditions more favorable to their reproduction, survival, and transmission. This includes diseases transmitted between livestock, as well as transmission of diseases between wild species and livestock. Climate change may facilitate these transmissions by altering wild animal distribution, movement, and feeding patterns.[27]

Rangelands

In addition to direct impacts on cattle physiology, climate change will affect cattle and ranching practices through impacts to rangelands. These impacts include decreases in sagebrush steppe habitat utilized as rangeland across the Snake River basin. Climate changes that directly affect rangeland include a lengthening of the growing season, changes in plant productivity, shifts in rangeland species, reduced nutritional value of rangelands, the potential spread of invasive species, and increases in wildfire risk.

Projected changes in plant productivity and distribution vary with temperature, elevation, and carbon dioxide levels. Increasing temperatures, declining snowpack, and earlier snowmelt are expected to lead to earlier spring greening and a lengthening of the growing season, particularly in cooler, higher elevation rangelands.[27] These changes may also allow for migration of rangeland plant communities to higher elevations.[27]

In contrast to cooler locations, productivity in warmer, lower elevation rangelands may decline. A key issue in these lower elevation rangelands is increasing summer drought stress, which is expected to reduce the reproductive viability of native perennials.[27] Over-grazing and increasing fire frequency (whether due to climate change or fire management practices) can also affect productivity and lead to shifts in rangeland species.[28]

Some plant species (including some species of weeds) may benefit from higher levels of carbon dioxide in the atmosphere, which can stimulate plant productivity through increased efficiencies in photosynthesis and water use.[27] Annual grasses, like cheatgrass, are most likely to benefit from the higher atmospheric carbon dioxide concentrations and varying precipitation regimes due to their growth cycle. The proliferation of annual grasses across the Fort Hall Reservation continues to be a concern for natural resource managers and livestock producers because it is fundamentally changing the forage base for these animals.

7.0 Conclusions

The natural resources of the region are intimately intertwined with the lifeways and wellbeing of the Shoshone-Bannock Tribes. Yet, these critically important resources are already being affected by changing climate conditions and these changes not only affect the species and habitats that are important to the Tribes, but the people themselves.

By acknowledging, researching, and ultimately working to address the many ways that climate change will affect the Tribes, the Shoshone-Bannock Tribes have taken a significant step toward becoming more resilient. This climate change vulnerability assessment and adaptation plan is the first step in an on-going process to continue to respond to and prepare for the impacts of a changing climate. It serves a foundation for future efforts and the Tribes. The adaptation strategies and actions collaboratively developed through this project are a starting point and provide a framework for the development of additional strategies and actions for other important species and habitats that the Tribes depend on throughout the region.

Key next steps will include integrating specific adaptation strategies and actions into on-going planning and management efforts as well as regular monitoring and evaluation of the effectiveness of action to build resilience. This project and the on-going efforts and commitment by the Tribes to work together to build climate resilience will ensure that these and many other culturally significant natural resources are preserved for generations to come.

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