**Photo From Ava Donelan**

# River to Raven: An Educational Restoration Project

**A Report by Ava Donelan, Abby Steinshouer, Elsa Lincoln, and Adeline Coggins**

**Western Washington's Sustainability Pathways Program in collaboration with Lee Whittaker and Sparrow Song Consulting**

SUSTAINABILITY PATHWAYS

WESTERN WASHINGTON UNIVERSITY
MAKE WAVES.

**Photo from Benj Drummond and Sara Steele of a drone image of the River to Raven site**

## 1.0 Executive Summary

Sustainability Pathways has partnered with long time Methow Valley resident, Mazama landowner, and WWU ‘68 alumni, Lee Whittaker, to create an ecological restoration and education plan for his property. Lee has a vision for his land in the future that he calls Project 2050. This vision includes better trail systems, a corridor and safe habitat for animals, native plants, and an educational resource to inform on the history of the site. Our goal is to help Lee realize this vision.

There are three main components to this project, the first being the ecological restoration plan. The plot of land that Lee allowed us to survey for proposed ecological restoration is just south of Mazama and is 36 acres in total. The plot is split in half by the North Cascades Highway. North of the highway, Lee’s land consists of five ecosystems: river, riparian, meadow, wetland and forested. On the other side of the highway, his land consists of three different ecosystems: agricultural, wetland, and mountain. Our project is called River to Raven because of the seven diverse ecosystems that make up the plot of land, from the river all the way to McKinney Mountain. Lee established trail systems on the mountain ecosystem and through the forested area to the river. Aside from the trail systems and the old agricultural fields, the land has been undisturbed by humans. We conducted an ecological land survey with Julie Vanderwal, a local ecological restoration consultant. From the results of this survey, we found that the main problem areas were the two old agricultural fields. They are the least ecologically diverse and supply very little useful habitat for animals. On the bigger agricultural field, on the south side of highway 20, we recommend creating ten 20’x30’ plots and testing different restoration techniques on each.

Changing the invasive species mitigation and soil preparation in each plot but planting the same native species in every plot will inform us what techniques are best suited for restoring old agricultural fields. We also include restoration recommendations for the other five ecosystems, such as using cardboard and woodchips to smother invasive species, planting willow and red osier dogwood in the rip rap on the riverbank, and interplanting and interseeding shrub steppe plants in the meadow ecosystem. We also include steps to monitor and evaluate the land after the initial restoration plan is completed.

The second component is educational, in which we researched the history of the land from the geologic era (before humans) until the present. Lee wants to incorporate an educational station among the trails that informs the visitor of the history of the land that they are enjoying. The geologic narrative tells the story of the Mazama area in relation to tectonic movement, mountain ranges, glaciers, and early species. The Indigenous narrative tells the story of the sp̓aƛ̓mul̓əxʷəxʷ or Methow people, who have lived in the area we now call Mazama since time immemorial. This narrative outlines the historical ways of life of the Methow people, their past and current connection to native plant and animal species, the establishment of the Colville Confederated Tribes reservation, and modern examples of tribal sovereignty. The settler narrative briefly outlines important milestones and dates when settlers started inhabiting the Methow Valley. The current narrative briefly reviews Whittaker's ownership of the land, and his vision for it. Ideally, parts of these narratives will be included on an informational station on the land.

The third component of this project is youth and community engagement. An important aspect of sustainability is intergenerational learning. Engaging the youth specifically on this project will ideally get them excited about the outdoors, sustainability, and give them hands on experience with restoration and project management and provide new ways for them to engage with community. We provided several recommendations for projects that can be completed by youth (specifically Independent Learning Center students, and Liberty Bell High School students). Additionally, engaging the youth on this project will introduce a new generation of people to look after this land.

The combination of these three components helped us create a restoration and education plan that is digestible and will last through the years of it being handed down from project group to project group.

Map 1. The study site area in relation to the towns of Mazama and Winthrop in the greater Methow Valley, Washington.

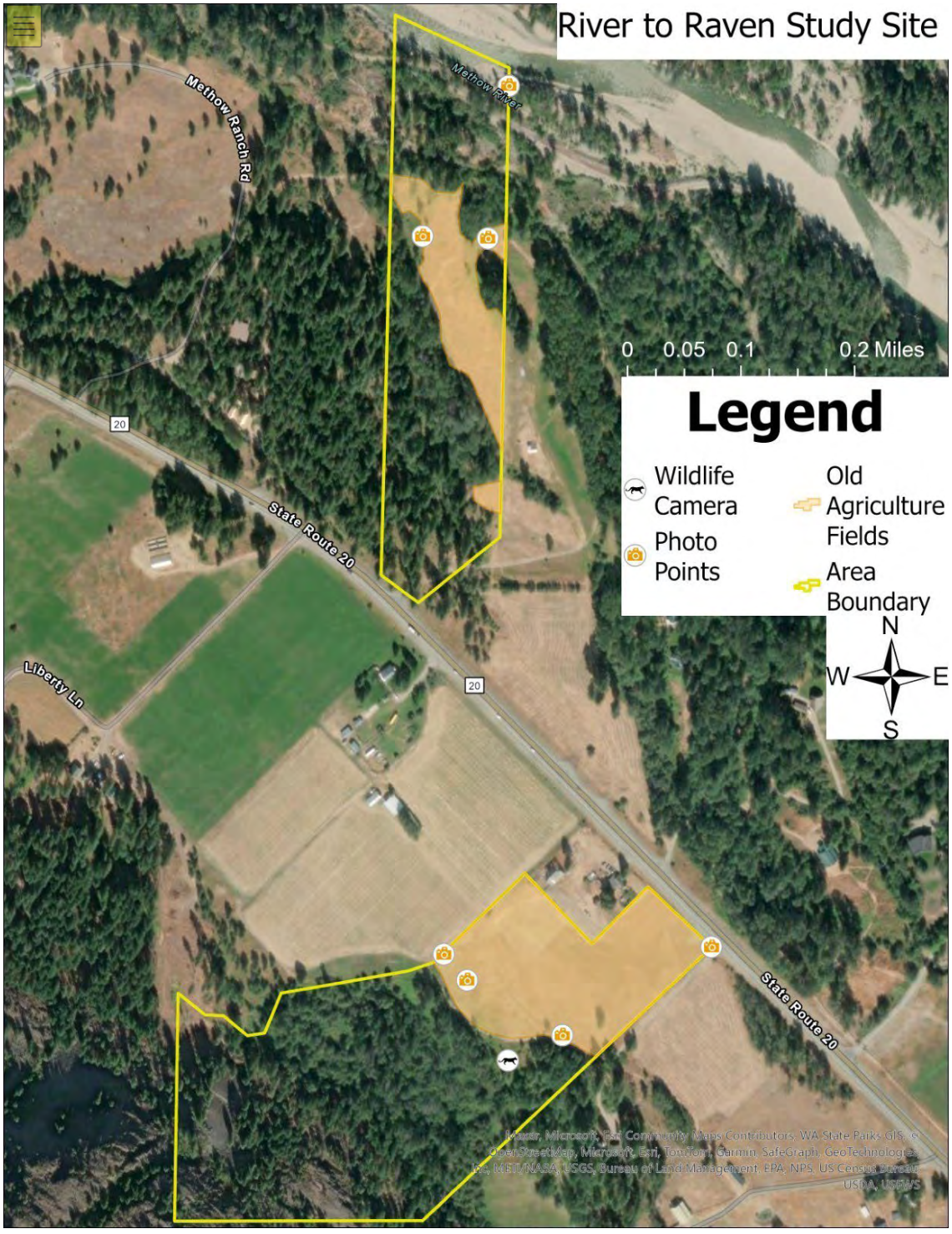
**Photo from Benj Drummond and Sara Steele of a drone image of the River to Raven site**

# 2.0 Introduction

## 2.1 Project Background

The image below depicts the exact River to Raven site. Starting at the very top of the image (North) is the Methow River. The riverbank ecosystem adjacent to the river is called a riparian ecosystem. The riparian ecosystem includes riprap on the bank of the river. The other two ecosystems on the north side of the highway are forested and meadow. The meadow falls between forested areas, with its key characteristic of being light brown, which is a stark difference from its surroundings. South of State Route 20 is the old agricultural field with the forested area behind it quickly turning into the wetland. Farther in the wetland, the land turns into the mountain ecosystem.

For the old agricultural field, we propose a detailed restoration plan for on the south side of the highway, 6 acres in total, and covered in invasive grasses. The invasive grasses dominate the area prohibiting other species from growing. The lack of plant diversity creates an unfit habitat for most animals. The agricultural field also breaks up the other ecosystems on the land, which disrupts any flow between habitats. Our goal is to create a plan to help future River to Raven participants test different strategies for reintroducing native plants onto the old agricultural field. By reintroducing native plants onto the ag field and smothering or removing the invasive plants, the habitat will become viable for more animals and increase the flow of the collective habitats.




Map 2. A map depicting the study site with the 36-acre area boundary, the old agricultural fields, photo points and the wildlife camera location. Map made by Ava Donelan using ArcGIS Pro.

The trail systems that Lee incorporated on his land run through the mountain, forested and meadow ecosystems. On the mountain side there is a constructed ATV accessible trail made of

switchbacks that reaches the top of a peak. Other than the gravel trail, this ecosystem is undisturbed. The trail that goes through the meadow is mowed and not strictly maintained. The trail through the forested area connects with the Mazama Community Trail, a gravel road from Mazama to Winthrop along the river. This trail occupies space that used to be flood plain, but since the river has reduced over the last centuries, the land adjacent to it no longer floods.

Our intention is to incorporate youth on this project in the future because it will give them a chance to do hands on restoration work, connect with the land, learn about the land, and keep land maintenance relevant for a new generation. We propose projects for the Independent Learning Center (ILC) and Liberty Bell High School. The ILC is a public independent school district that focuses on interest driven and personal learning supported by real world contexts. It is a hands-on school model and working on River to Raven would align with the type of work they do. We also wanted to include the local public school, Liberty Bell High School, to give those a chance to get in on the work even if they don't choose to go the ILC.

Sustainability Pathways is a program through Western Washington, developed and run by Joshua Porter. The mission of Sustainability Pathways Fellowship is to "apply a systems thinking lens to a paid fellowship experience where students are placed with a local organization, school, agency or business to advance place-based sustainability initiatives in the Methow and Okanogan Valleys in North-Central Washington." That said, sustainability guided our project, and we use the United Nations Development Goals to define that. The 17 UN Sustainable Development Goals (SDGs) are broad goals that inform participating countries what issues to work on to improve their sustainability. The UN SDGs are intersectional and broad, leaving it up to the reader to interpret how they will implement said goal. The SDGs that relate most to our project are #15, Life on Land, #13, Climate Action, #4, Quality Education and #3, Good health and Wellbeing.

**Life on Land**

This SDG aims to protect, restore and promote sustainable use of terrestrial ecosystems, sustainably manage forests, combat desertification, and halt and reverse land degradation and halt biodiversity loss. This aligns directly with our goal of reintroducing native plants to the old agricultural field which will create a corridor for animals to safely move through.


**Climate Action**

This SDG aims to take urgent action to combat climate change and its impacts. This goal relates to our project because we are not trying to recreate the landscape of centuries ago. Our goal is to plant the right kind of native plants that will be able to withstand the changes that the land has undergone due to climate change/human impact. We also want to include youth in the project to help them connect with the earth and make changes with their own hands.

**Quality Education**

This SDG aims to ensure inclusive and equitable quality education and promote lifelong learning opportunities for all. This relates to our goal of including an informative aspect in this project that informs whoever is walking on the land of history and people who were there before them. Making that information accessible to all who use the trail is important because it doesn't limit who can and cannot learn the information. Including the youth in the project will incorporate other aspects of hands-on learning and education.


**Good health and Wellbeing**

This SDG aims to ensure healthy lives and promote well-being for all at all ages. This relates to our project because trail access and access to greenspace is incredibly important for well-being. We hope to create a plan that increases access and community engagement therefore increasing community wellbeing.

Aside from the UN SDG goals, other sources that heavily informed the outcome of River to Raven are Julie Vanderwal and the Colville Confederated Tribes website.

Julie Vanderwal is a local ecological restoration consultant. She works for the Methow Beaver Project, a nonprofit that works with landowners to restore land and make it viable for beavers to inhabit again. Beavers play a huge role in river ecosystems because they block up the rivers with their dams causing deeper pools for fish and animals to live and spawn, and it makes the river more likely to flood, increasing the vitality of the floodplain and riparian areas as well as ground water stores. Safe to say she is an expert on ecology and has years of experience doing land surveys and making restoration plans. She equipped our team with the tools and skills necessary to complete a land survey and gave us dozens of suggestions and examples.

The Colville Confederated Tribe website contains immense knowledge of the land that we now call the Methow Valley. On the website, we found many resources, including culturally significant plants, traditional names of plants, and the history of the land. These resources guide our project to acknowledge and implement strategies of land stewardship that have been practiced by the Methow people since time immemorial.

**Photo from Benj Drummond and Sara Steele of a drone image of the River to Raven site**

## 3.0 Methodology

### 3.1 Historical resources

For this report, we had access to many resources about the land and did research online. With all this information, we wrote narratives for the land describing the history and suggested trajectory and information on the land itself. This was important because Whittaker wanted an in-depth narrative on the land along with the restoration plan. He allowed us to use many of his historical and personal documents.

A list for documents we had and used for this project:

- Whittaker Property – Contiguous Ownership Block Conservation Easement
- Colville Confederated Tribes Climate Activities – NAQS Action Plan
- History of the McKinney Mountain regional irrigation system
- Wetland Surveys by George Wooten
- A Key to the Common Flowering Plant Families of the Methow
- Evaluation of ecosystem recovery form
- Ecological Restoration Recovery Wheel outline
- Grant Deed of Scenic/Agricultural Conservation Easement
- Wetland Determination on Mazama Parcel
- A Baseline Monitoring Report for Conservation Easements: the Redman Property
- Wetland Determination on Mazama Parcel

- Grant Deed of Scenic/Agricultural Conservation Easement
- GIS base layers
- Decades worth of images of the Whittaker property
- Lost Homeland by E. Richard Hart
- Louping Reciprocity by Emily Amos, Emma Burgess, and Renee Wehrly

Some other organizations we got information from:

- Western Washington University – access to Western Library (peer reviewed sources)
- Native Plant Center/Methow Natives - information on native plants to the area and their uses
- US Geological Survey – in depth past and current history of the geology of the land
- Department of Natural Resources – current and history of the land
- WA100 – a non-profit that has a geological story of the Methow valley
- Methow Naturalist – a blog that has a lot of history and resources of the land
- Colville Confederated Tribes website
- Washington Department of Fish and Wildlife – history and present-day status of the land
- Methow Conservancy – current news regarding tribal relations

Map 3. An aerial image of Lee Whittaker's Land in the Methow Valley featuring Ponderosa forests, agricultural fields, wetlands, Washington State Route 20, and the Methow River and its floodplain.

### 3.2 Interviews

We had the opportunity to interview several people for input on our project. We chose people that are knowledgeable on ecological restoration, native plants, pollinators and hydrology* (See glossary for asterisked words) and riparian habitats.

We interviewed Lee Whittaker, the landowner. He has many ideas for the land and is very passionate about its history and how it can be used as an educational resource. We interviewed him when we first started working on the project with general questions about what he wanted from the project. And later in the summer, Emily Davis, another Sustainability Pathways Program member, interviewed him, and we had access to an audio and written transcript. We've considered quotes and ideas from both interviews.

We also got to talk to Julie Vanderwal, an ecological restoration consultant and specialist in Okanogan County. She played a big role in our project, and she helped us come up with our restoration plan and taught us a lot about the ecology of the land.

We also had the chance to speak with Eric Wittenbach, a farmer from Willow Brook Farms in Carlton who is knowledgeable about native and good species for pollinators. We sent an email to him asking him specific questions about pollinators to see how we could plant native species to bring out the native pollinators.

We also met with Nate Fuchs, a biologist from the Colville Confederated Tribes Department of Fish and Wildlife. Currently, he is working on a Beaver Dam Analog (BDA's)* on Beaver Creek on a ranch outside of Twisp. Through him we learned a lot about river and riparian health and hydrology. We reached out to him with questions for how we could restore the section of river that's on the River to Raven site and make it healthier and diverse for the vegetation and animals.

### 3.3 Land Survey

Another part of this project was going out and surveying the land. We wanted to get an overview on the species, photo points and make a restoration recovery wheel. This will ultimately help us with our goal of coming up with a restoration plan for the land. We went out to the field with Vanderwal to help us identify plants and animals, do the photo points and the restoration wheels.


Map 3. Photo points from the large agricultural field from the appraisal from 2014 done by Terra Valuations, LLC.

We took photos from photo points 10, 12, 11, and a few more we've added to compare throughout the years that the restoration process can be visibly tracked throughout the years. For simplicity, we've changed photo point 10 to 1, 12 to 2 and 11 to 3. We decided to use some of the same photo points because there are photos from 2014, and it would be beneficial to compare those same photos with the restoration to come. We used Avenza to take the photo points, the app then tells you the coordinates and the way you were pointing.

For the restoration wheel, we filled out two, one for the old agricultural fields and one for the rest of the land. The restoration wheel is a useful tool in restoration because it can be compared throughout the restoration process. We decided to make two different ones because the habitats are different from each other and the agricultural fields are the restoration's focus. There are six main categories: species composition, structural diversity, ecosystem function, external changes, absence of threats and physical conditions. Each category has 3 subsets graded on a score from 0 to 5, where 0 is unsustainable and an unhealthy habitat and 5 is perfect and can be sustained indefinitely. We got help from Julie Vanderwal who has a lot of experience using them and guided us through the process. The recovery wheel template can be found on the Society for Ecological Restoration (SER) website under their International Standards for the Practice of Ecological Restoration section.

We also had access to a wildlife trail camera provided by Joshua Porter. We wanted to put one up to capture the different kinds of wildlife that live and use the site. And hopefully as more restoration happens, more creatures will be spotted. We wanted to put it in an area that sees many types of animals, so we decided to put it in the wetland closest to the mountain next to the old agriculture field.

We also did pollinator surveys on the land. From the Methow river up to the base of McKinney Mountain. To do this we took a butterfly net, ice, jars, and a Xerces bumble bee pollinator survey sheet. We tried to capture as many butterflies and Bumblebees as possible and identify them. Butterfly hours are 10:45am to 3:45pm and the way they are conducted is the surveyor walks in a transect, in this case, the trail, and identifies as many butterflies as possible using butterfly binoculars, a net, the naked eye and or jars.

Photos from Abby Steinshouer of pollinators. A black tailed bumble bee *(Bombus melanopygus*) on the left and a wood nymph (*Cercyonis*) on the right.

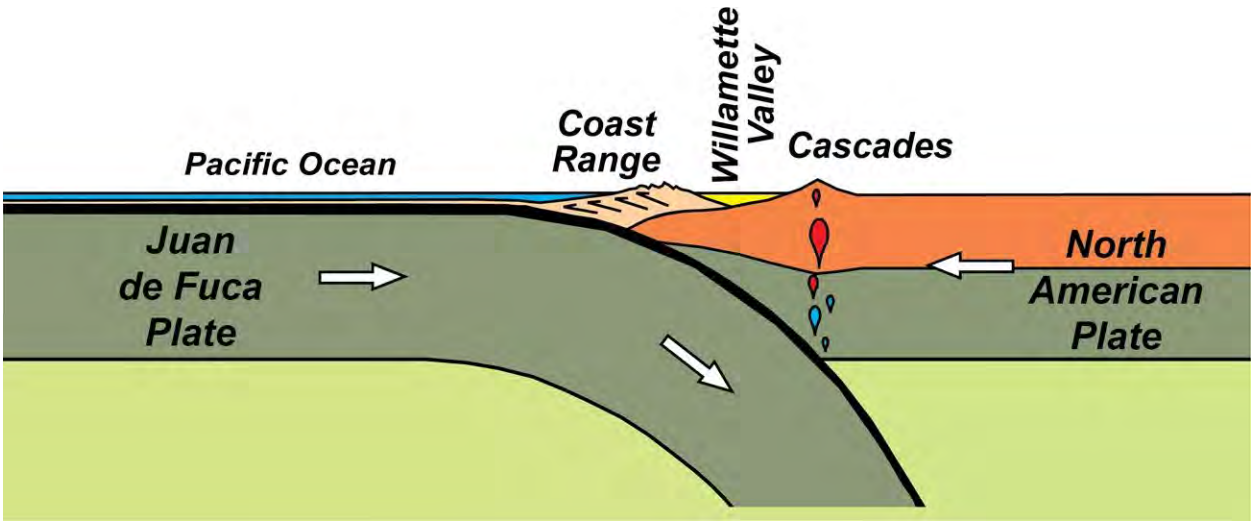
**Photo from Benj Drummond and Sara Steele of a drone image of the River to Raven site**

# 4.0 Results

## 4.1 Geologic Narrative

The land of the river to Raven study site sits in the Methow Valley of Washington state, near the present-day town of Mazama, Washington. This land's earliest history is a geological one.

The oldest part of the valley is the Sawtooth Mountains, metamorphic rocks that formed 300 million years ago. The metamorphic rocks* formed from sedimentary rocks* on an ancient continent* 600 million years ago. Three hundred million years ago (mya), amphibians, reptiles, and conifers were emerging. Island microcontinents* collided with the western North American continent. The Quesnellia terrane joined the North American continent 180 mya and is the present-day highland between the Columbia and Okanogan Rivers. Tiffany mountain and other granitic mountains in the eastern valley were formed by upwelling of granite magma. Sandstone, marine shale and volcanic sedimentary rock formed the Newby Group 150 – 120 mya, which consists of the Twisp Formation and the Buck Mountain Formation.

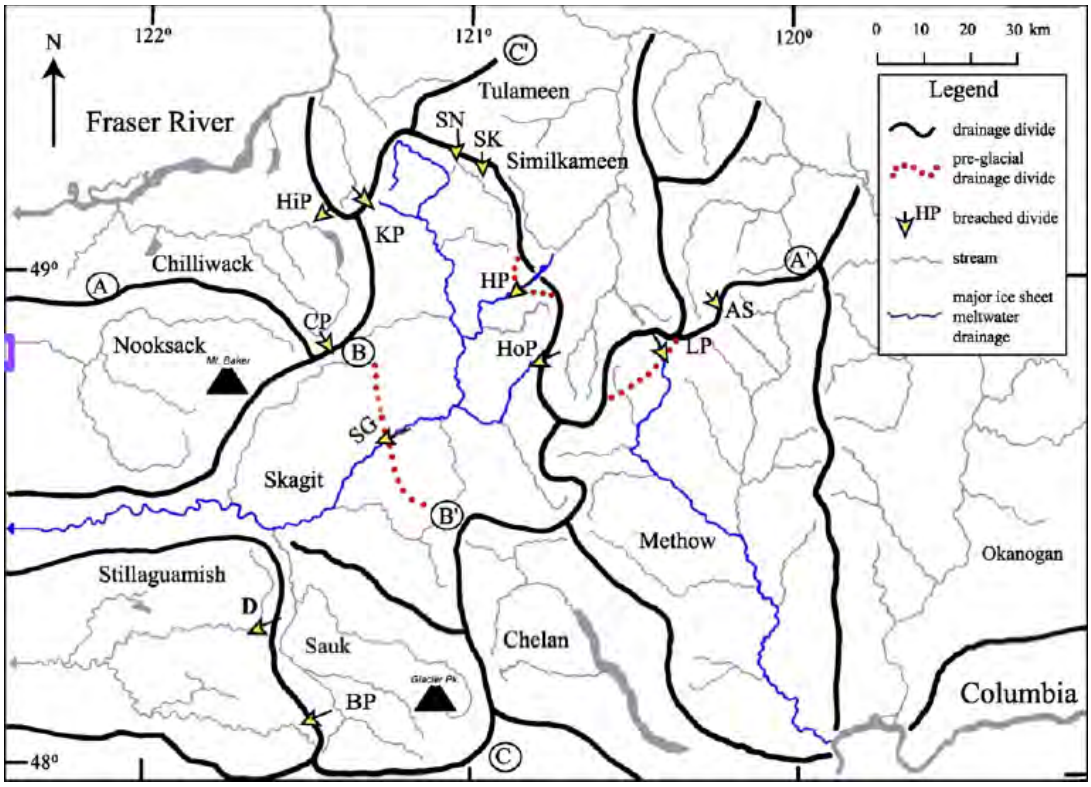



**Infographic by National Park Service**

The Cascade Mountain range was formed 40 to 60 mya when the Juan de Fuca plate* collided with the North American plate. The Cascade Range is made up of many volcanoes including Mount Rainier. Glacier Peak had a major eruption 12,000 years ago. Other volcanoes such as Mt. Mazama in Oregon and Mt. St. Helens also have erupted more recently have deposited ash into the Methow Valley, which has made the soil very fertile. Specifically on the River to Raven site it has a mostly Muckamuck silt loam in the old agricultural field. Which is commonly found in the Methow Valley and surrounding Okanagan Valley. This soil is very commonly used in agricultural uses because it is so fertile. Before settler agriculture and now in areas that aren't disturbed, this soil commonly grows “ponderosa pines, Douglas firs, cottonwood, snowberry, saskatoons, lupines, tall Oregon grape and shiny leaf spirea.” (USDA, Muckamuck series). All of which are seen in the non-agriculture fields.

**Mt. Mazama in Oregon and Mt. Rainier in Washington. Photos from the USGS and WA100 respectively.**

The North Cascades crest which separates the Methow Valley, Okanogan Valley and Puget Sound, was formed in part by the last glacial advance in North America, by the Fraser Glacier. This ice sheet ended 12,000 years by a glacial retreat and melting which what caused the drainage moving south. This reversal of drainage* is what allows the linking of the Puget Sound and the Okanogan Valley through valleys like the Methow. Showing in the V-shaped drainages formed by water drainage. On a much smaller scale in the Methow Valley glacial retreat is shown through the rolling hills, coulees, u-shaped drainages, elevated benches, glacial till, and kettle ponds, some of which act as present-day lakes.

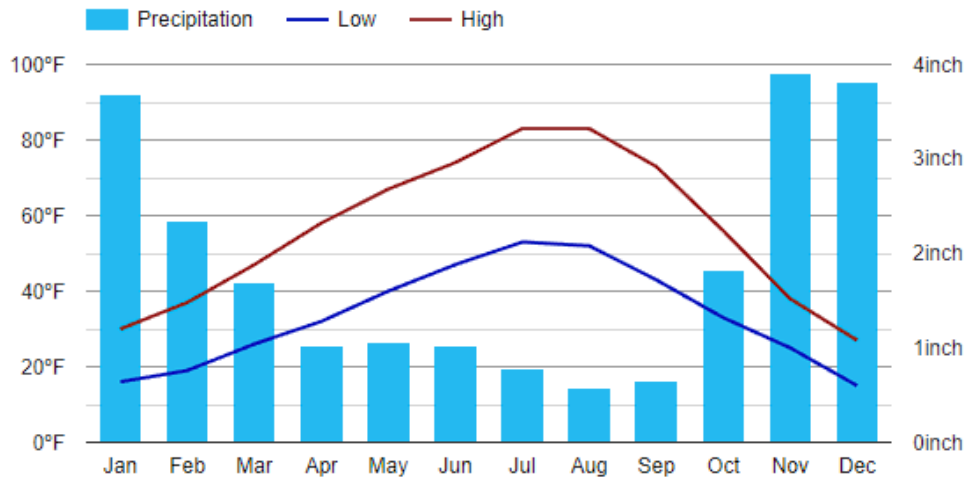



**Infographic by J.L. Riedel, R.A. Haugerud, J.J. Clague in Geomorphology**

## 4.2 Ecological Narrative

The River to Raven project site sits at the top of the Methow valley near Mazama which is a more forested and cooler average temperature than the Twisp area which is more shrub-steppe and has warmer average temperatures. The dry grasses, hot climate, and many dry thunderstorms that happen in the valley cause many wildfires. The wetter springs from winter snow and glacial melt help provide water to the landscape in the springs and summer.

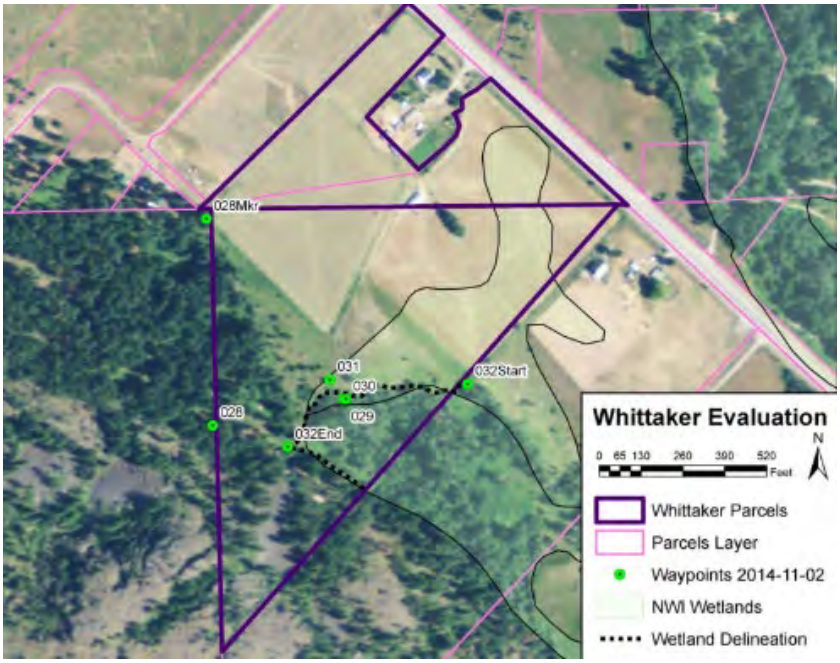
After the last glaciation, the valley began to be recolonized by plants and animals. Much like the landscape we see today, there were understories with grasses and shrubs, and dominant overstory conifers like ponderosa pines, Douglas firs, and western larch. Currently in the River to Raven project, we see an overstory of ponderosa pines in the wooded areas, different willow species in the wetland, and many different types of understory plants throughout the land. This landscape is very droughty and snow tolerant with the average annual precipitation being 22.41 inches a year and annual snowfall being 115 inches. The climate being this drastic in temperature and precipitation levels is shown in very drought/snow tolerant plants with lots of evergreens and long taproot drought-adapted roots.

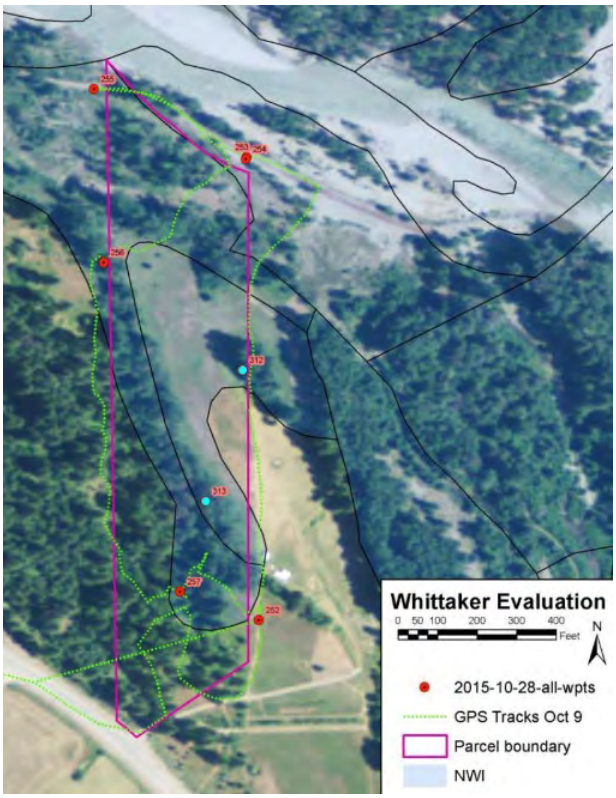



**Infographic showing Mazama average annual precipitation and temperature levels by U.S. Climate Data**

The fire regime before present-day human-made fires, not including indigenous fire management practices, and climate change were characterized by frequent, low- to moderate-intensity fires. On intervals from 5 to 30 years, fires were regular and helped reduce a large buildup of fuels. Larger mature trees and other fire-adapted species would remain after fires and even help many species disperse seeds and thrive. The Methow Valley has been a fire-adapted landscape for thousands of years. This adaptiveness is shown through the plants, Ponderosa pines “begins to develop thick bark and deep roots and sheds its lower limbs." (National Park Service), all of which increase the chance of fire survival, but recently the fires have been more high intensity due a lot to old forest management processes that don't have planned thinning projects in heavily forested areas and climate change making the chances fires happening higher.

The site also features two wetlands. One of which is on the large agricultural field and the other is closer to the river. Wetland surveys were done in 2014 and 2015, and the maps are below.






Maps 4 and 5. Wetlands on the site surveyed by George Wooten in 2014 and 2015. Map 3 shows a wetland near the large agricultural field. Map 4 shows the wetland near the Methow River floodplain.

### 4.3 Indigenous Narrative

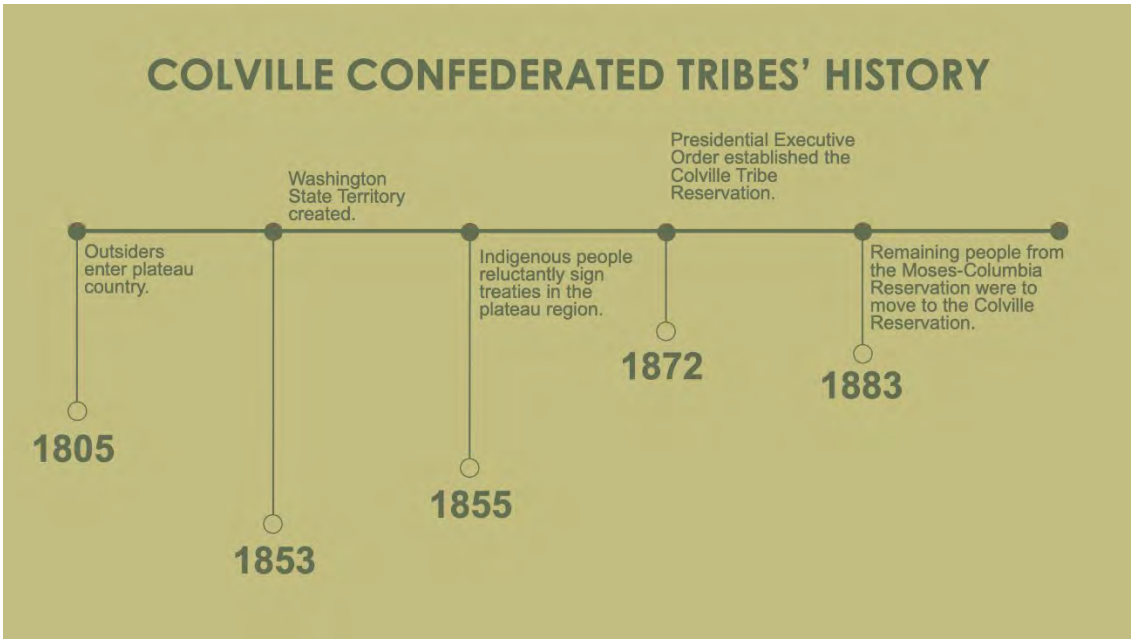
The Methow people, or traditionally called sp̓aƛ̓mul̓əxʷəxʷ, have lived in harmony with the land in what we now call the Methow Valley since time immemorial*. Their deep history and knowledge of the area should be a guide for our restoration efforts. The Indigenous name for the area, mətx̌ʷu, translates to “blunt hills around a valley” (Vaughn, 2023, p. 29).


**Map indicating the historic Methow area from the Colville Confederated Tribes website**

The Methow people's way of life is profoundly aligned with the seasons and geography of the valley. They traveled in small groups, moving throughout the valley based on their needs. In warmer months, they gathered roots and ascended into the mountains to gather berries and hunt. During colder months, they returned to the lower valley, seeking protection from the wintery conditions. Daily life for the Methow involved foraging and hunting, with both activities playing crucial roles for the tribe. Women primarily gathered, while men hunted fish and larger game such as elk and bears. Women sought out berries and wild vegetables, including bitterroot, Indian potatoes, Indian carrots, Indian celery, raspberries, huckleberries, and serviceberries. "The woman's major economic role of gathering was so important that they were considered equal in status to men by everyone in the society." (Hart, 2015, p.15). This way of life is still prominent in the Methow people's lives today.

Roots, leaves, flowers, and fruits are utilized for either food or medicinal purposes. Many plants are boiled and mashed, or dried for medicinal use, with teas being an essential aspect of Methow medicine (Hart, 2015, p. 19, p. 24). Important plants for the Methow People include Serviceberry, Paper and Water Birch, Arrowleaf balsamroot, Scouler's willow, and many more.

In 1872, an Executive Order* signed by President Ulysses Grant established the Colville Reservation for tribes or bands not a part of any treaty* in Eastern Washington. The Methow people were briefly part of the Moses-Columbia Reservation (also established by Executive Order) around the year 1883, but shortly after, the reservation was dissolved, causing many Methow people to move to the Colville Reservation. Here is a timeline of the significant treaties and events:



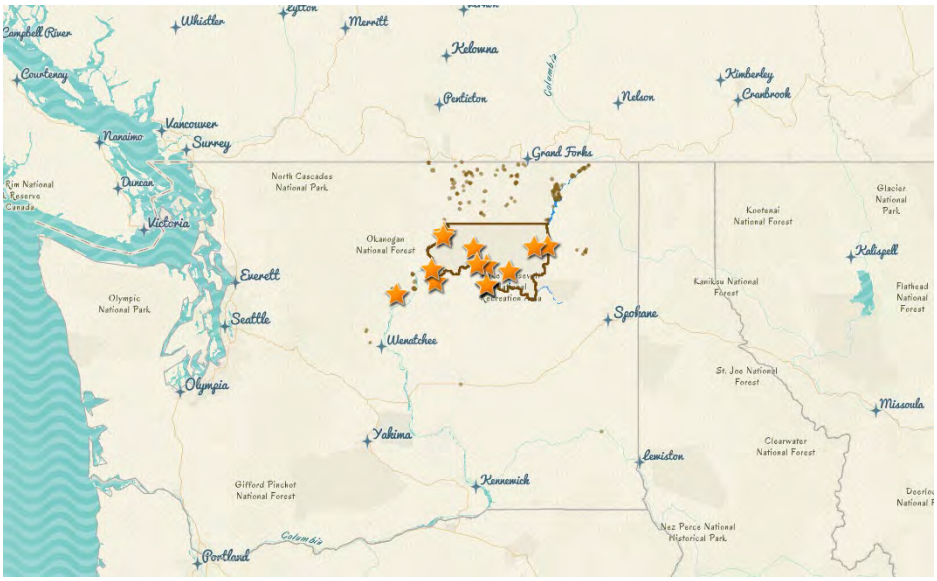

**Information sourced from *Through History: The Confederated Tribes of the Colville Reservation***

The traditional territories of the Colville tribes once spanned vast areas, far greater than the lands they hold today. Like many other Indigenous peoples, they experienced profound losses as their lands were unjustly taken. The treaties signed with colonizers were deeply unfair, as many Natives were not fully informed or did not have the ability to understand the English language in which the treaties were written. In many cases, they were pressured into signing documents whose terms and consequences were unclear, leading to further displacement of their people (Wright, n.d.). This

process of land theft and broken promises continues to impact the Colville tribes as they fight to preserve and reclaim their cultural heritage and sovereignty.

Below are maps of the traditional territories of the Colville people along with the current territory the tribe has:


**Map indicating the historic tribal areas from the Colville Confederated Tribes website**




**Map indicating the current tribal area from the Colville Confederated Tribes website**

The Methow People, now part of the 12 tribes within the Colville Confederated Tribes, maintain a deep and enduring connection to their ancestral lands. In May of 2022, the Methow Conservancy returned 328 acres up the East Chewuch to the Confederated Tribes of the Colville Reservation to acknowledge and appreciate the Methow People. The Methow Descendants named the land **x**ʷnámx̌ʷnam, the Interior Salish term evoking the gentle sound of hummingbird wings (Methow Conservancy, 2021). The tribes plan to restore the property's riverfront to

enhance salmon habitat, renewing their relationship with the land and reaffirming their cultural presence.

### 4.31 Culturally Significant Native Plants

In restoration* projects, the goal isn't always to return the land to its original state, but rather to enhance its current conditions. Expecting buffalo or mountain goats to reclaim land that has been developed into a neighborhood and stripped of its natural qualities is unrealistic. The changes and disturbances during the settler period have rendered the land inhospitable for some traditional plants and animals. Our aim is to increase the presence of native plants and create a corridor that allows current wildlife to safely move between ecosystems. We also aim to include plants in the restoration that are important to the Methow People, which are listed below.

Many of the plants listed are from the Colville Tribes Natural Resources Climate Change Vulnerability Assessment. Additional plants that do not state their vulnerability were sourced from Kamea Pino, the Curriculum Developer for Colville Tribes.

| | |
|---|---|
| **Soapberry/Buffaloberry, *Sapindus saponaria*** | Moderately vulnerable |
| **Tamarack/Western Larch, *Larix laricina*** | Moderately vulnerable but will be considered highly vulnerable int the future. |
| **Tule, *Schoenoplectus acutus*** | |
| **Chokecherry, *Prunus virginiana*** | |
| **Thinleaf Huckleberry, *Vaccinium myembranaceum*** | Moderately vulnerable but will be considered extremely vulnerable in the future. |
| **Saskatoon Serviceberry, *Amelanchier alnifolia*** | Low vulnerability |
| **Black Tree Moss, *Bryoria fremontii*** | |
| **Scouler's Willow, *Salix scouleriana*** | Low Vulnerability |
| **Ponderosa Pine, *Pinus ponderosa*** | Moderately vulnerable but will be considered highly vulnerable in the future. |

The indigenous names for each of these plants can be found in the nsəlxcin dictionary from the Okanogan Language Program.

### 4.4 Settler Narrative

For a broader settler history of the valley, the first people of European descent to come to the valley were fur trappers in the 1800s. In 1883, the appeal of gold brought settlers to the valley, including James Ramsey, Ben Pearrygin, and Guy Waring. They settled at the forks of the Chewuch and Methow rivers.

Early settlers came to the actual site for logging and mining and later realized the land was good for agriculture. The region was named after John McKinney, an early settler. Later the Briggs and then the Kumm family would also build homesteads and begin to farm the muckamuck alluvial* clay-loam soil rich land. Water rights, ditches and irrigation were set up during this time. There was also a school on the site called the McKinney school built in 1910. The schools' children were mostly kids of parents that worked at the Fender Mill which closed in the 1930s along with the school.

Landowner Lee Whittaker has many more resources and knowledge on the settler history of the land and plans to do an in-depth report on it.

### 4.5 Current State of the Land

The land is currently owned by Lee Whittaker who moved to the land in 1995. He has a long-term vision for the land that this project fits into. This vision includes low-income community-based housing and trail systems that show and explain the history of the land from the Methow River to the McKinney Mountain from geologic history to current day and future hopes. With the rich history, beautiful scenery, and the hundreds of native plant and animal species that live on the land, it makes sense that he would want it preserved, restored and to serve as an educational and recreational site.

### 4.6 Interview Results

In our interview with Lee Whittaker, we asked him about his idea for the future of the land. He is interested in the River to Raven site being an educational haven for students. “And I think one of the things that hopefully comes out of it is that young people will be interested in conservation* or stewardship or working in some of these agencies” (Lee Whittaker 8/5/24). He also wants the area to be used to bring people together outdoors and to explore history. “Use it as a site on the trail system for people that are exploring river to Raven and bring in what the communities over time, whether it was indigenous communities or the settlers or now and then having McKinney Ridge as an intentional community right here also, and trying to create a proof of concept for how people can live a little differently than just having a house that you visit 1/3 of the time”. (Lee Whittaker 8/5/24) One of his main projects is making housing affordable and more of a community, and he’s especially interested in making that happen in Eastern Washington. “I like the idea of fostering a community instead of people separating out. It’s much more environmentally positive to cluster homes and create community, which is a little bit different than most people think over here in eastern Washington”. (Lee Whittaker 8/5/24)

In our interview with Julie Vanderwal, we asked her about restoration techniques and why it’s important to involve youth in restoration projects. “Involving students in every phase of restoration helps create an understanding of how you can make a positive difference in the world” (Julie Vanderwal 8/7/2024). “It can make a difference in a student’s life, to have meaningful hands-on project experience that you can talk about in a job interview, or a college application -- it can open doors for young people”. She gave us a lot of insight on species to use in our restoration, which invasive species would be good to pull, and techniques for the different restoration practices.

On August 8th we started an email chain with Eric to inquire about what species he has had success with and any tips he might have for us. Eric listed Ponderosa, wood rose, snowberry,

gaillardia, bunch grasses, and Saskatoon as species that he has had success within his drought resistant garden. Eric explained that he puts “pieces of wood and other natural debris” among his garden to provide natural habitat for the pollinators. As far as ensuring long term health of our project, Eric mentioned using deer fencing around the early establishment.

### 4.7 Land Survey Results

We got a lot of good information from the land survey. We were able to map out photo points and conduct two restoration wheels, one for the old agricultural fields and one for the existing land that hasn’t been used for degrading agricultural uses. We also were able to come up with a comprehensive list of plant and animal species that have been seen and made a map of the existing habitat types.

We do recommend that more in-depth butterfly, bird and pollinator* surveys be done on the land to get a more accurate picture of what organisms are on the land. One can be done before the restoration takes place, during, and after the restoration to see if there is a difference in pollinator species richness and abundance. And it would be helpful for future restoration projects and give insight into the importance of restoration.

We did a pollinator bumble bee and butterfly survey on July 14th, 2024. We were able to capture three bumblebees and weren't able to catch butterflies but saw three dark wood nymphs and lots of small orange and yellow spp. Most likely a skipper of some sort and a sulpher butterfly. The bumble bees were identified by someone new and inexperienced to bumble bee identification, but said they looked like a Black tailed (*Bombus melanopygus*), and two half-black (*Bombus vagans)* bumble bees, they were found near the mountain on the westside of the wetland. They were both caught on fireweed, and that seemed to be all the other bumble bees. We accidentally caught three honeybees, two on goldenrod and one on fireweed. In total we saw about ten.

### 4.71 Photo Points

Photo Point 1. Looking out into the large old agricultural fields.

Photo Point 2. Looking at the aspens on the edge of the wetland.

Photo Point 3. Looking at the extent of the large old agricultural field with Goat Peak in the background.

Photo Point 4. Looking at the extent of the field from the corner by the road.

Photo Point 5. Looking out on the other smaller agricultural field.

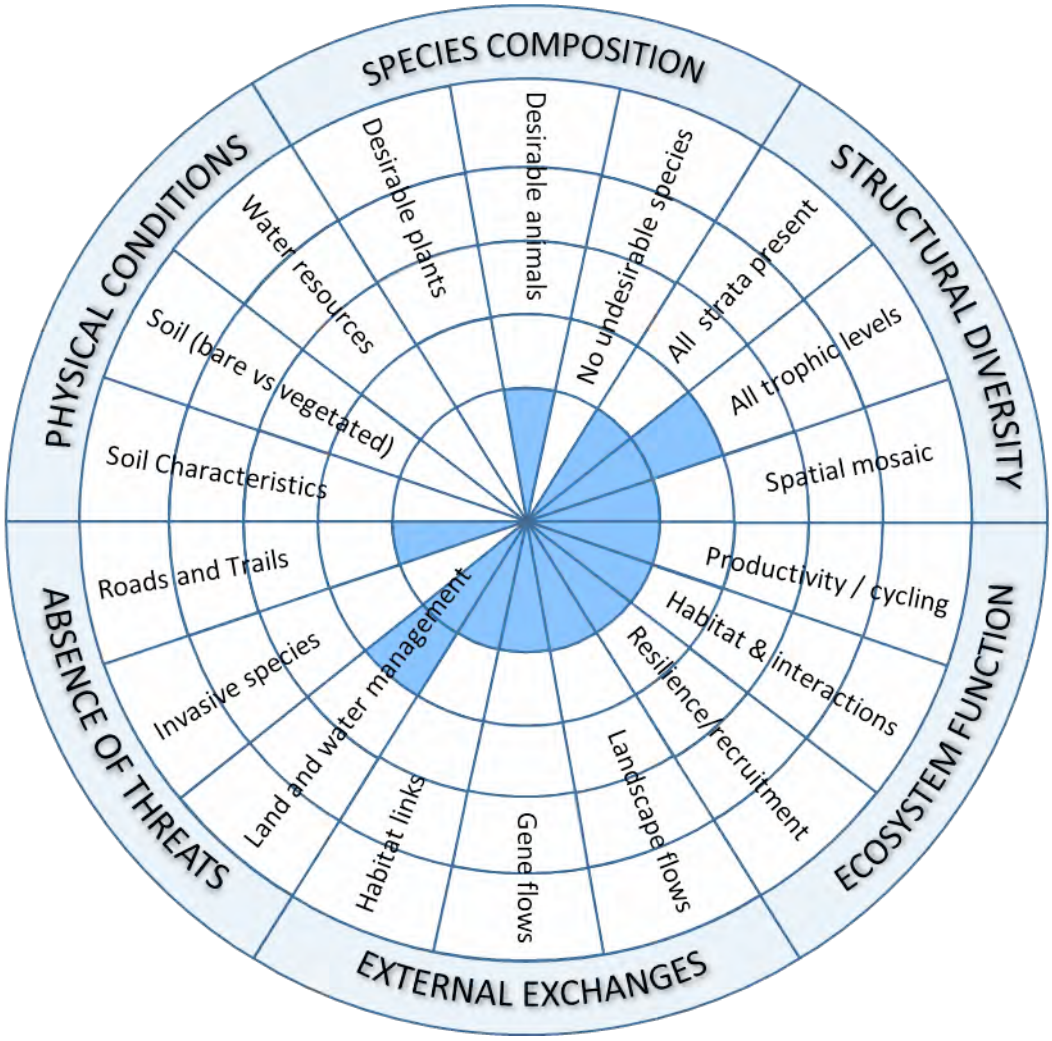
Photo Point 6. Looking out on the other side of the smaller agricultural field.

Photo Point 7. Looking at the riparian habitat from the site boundary.

**Photo Points Locations Table**

| Photo Point Location | GPS Coordinates | Direction Facing | More in-depth Instructions |
|---|---|---|---|
| 1 | 48.554398, -120.357229 | 123 ESE | 5 paces (13 feet) from post |
| 2 | 48.554336, -120.356931 | 18 NNE | Lined up with weeping willow in the red house |
| 3 | 48.554208, -120.355922 | 313 NW | 101 feet from the pine tree in the middle of the field |
| 4 | 48.554977, -120.354219 | 218 SW | On a fence post facing southwest |
| 5 | 48.561039, -120.357997 | 181 S | On the edge of the property boundary 5 paces away from a big ponderosa in the field |
| 6 | 48.560822, -120.3566853 | 267 W | On the edge of the boundary standing in front of a wooden post |
| 7 | 48.562193, -120.356951 | 189 S | 3 paces from the green post |

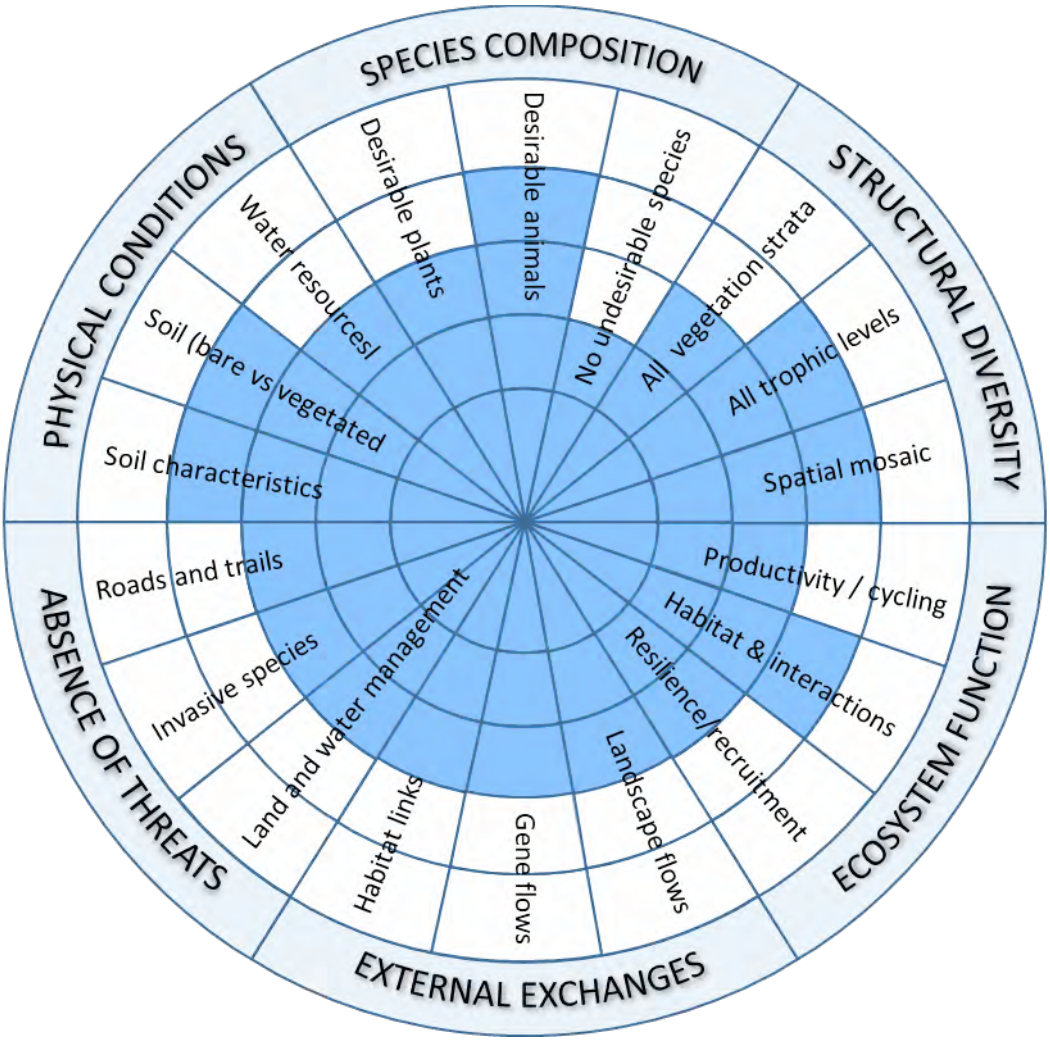
### 4.72 Restoration Recovery Wheels




Recovery Wheel 1. A recovery wheel for the old agricultural fields.

| Attribute Category | Recovery | Evidence for Recovery Level |
|---|---|---|
| **Attribute 1: Absence of threats** | | |
| Roads and trails | 2 | There are trails that go through and around both old agricultural fields |
| Invasive species | 0 | The fields are only full of invasive grass species |
| Land and water management | 1 | There isn't any management of the land |
| **Attribute 2: Physical conditions** | | |
| Water resources, including wetlands and river temperatures | 0 | There is no water directly on the agricultural fields, one is near a wetland and the other is near a the Methow river |

| | | |
|---|---|---|
| Soil – bare/disturbed vs. vegetated | 0 | The ground is 40%/35% bare |
| Soil characteristics | 0 | Mostly Muckamuck silt loam |
| **Attribute 3: Species composition** | | |
| Desirable plants | 0 | There is one Pine tree, but lots of invasive grasses |
| Desirable animals | 1 | We don't know of any animals living in the fields, but they do come through and feed in the area, birds, deer, cougars |
| No undesirable | 0 | There are only invasive grasses left over from when the field was used for agriculture |
| **Attribute 4: Structural diversity** | | |
| All strata present | 1 | There are no strata except for one large pine tree. |
| All trophic levels | 2 | There are some trophic levels present, but no animals fully live in the fields, and they aren't enough to support all trophic levels. |
| Spatial mosaic | 1 | There is no difference in landscape habitats, it is only old ag fields |
| **Attribute 5: Ecosystem function** | | |
| Productivity, cycling, etc. | 1 | Not much nutrient cycling because of dried invasive grasses. not much oxygen is being produced because lack of species diversity |
| Habitat interactions | 1 | Not much species diversity because of dominance from invasive grasses, not viable for animal life |
| Resilience, recruitment etc, | 1 | Very little comeback by native species, invasive grass too dominant |
| **Attribute 6: External exchanges** | | |
| Landscape flows | 1 | The field disrupts connectivity between ecosystems |
| Gene flows | 1 | There aren't really species on site that can exchange genetics |
| Habitat links | 1 | Is near a wetland and a pine forest which allows for animals to move |




Recovery Wheel 2. A recovery wheel for every other ecosystem besides the old agricultural fields, including the river, riparian zone, forests, wetlands, and mountain.

| Attribute Category | Recovery | Evidence for Recovery Level |
|---|---|---|
| **Attribute 1: Absence of threats** | | |
| Roads and trails | 3 | Invasive species on trails, disturbed ground, with habitat disrupted by highway and car pollution. |
| Invasive species | 3 | Certain invasive species are present all over. |
| Land and water management | 3 | Riprap on the river is present, no vegetation on the rocks, river no longer floods so floodplain is not in use. |
| **Attribute 2: Physical conditions** | | |
| Water resources, including wetlands and river temperatures | 4 | Vegetation is doing well in the wetlands and in the riparian zones. River is flowing from glaciers. Upstream and seems to be in good condition besides the disappearing floodplain. |

| | | |
|---|---|---|
| Soil – bare/disturbed vs. vegetated | 4 | Soil not on trail is sustaining vegetation well and seems to be healthy. |
| Soil characteristics | 3 | Unsure of soil conditions as we did not test it but seems to be in good shape as vegetation is diverse and in good shape. |
| **Attribute 3: Species composition** | | |
| Desirable plants | 3 | Native species of all kinds are present and thriving, but some invasive species are onsite. |
| Desirable animals | 4 | Native animals are present and doing well on the land. Unsure of any invasive animals that are present in the area. |
| No undesirable | 2 | There are some key invasive species, but the ecosystem overall seems to be doing well. |
| **Attribute 4: Structural diversity** | | |
| All strata present | 3 | There is old growth, new growth, understory, and shrubs, but there are invasive mullein and grasses as groundcover. |
| All trophic levels | 4 | There are all trophic levels present, cougars, bears, rodents, deer, insects, and birds. |
| Spatial mosaic | 4 | There are wetlands, pine forests, aspen groves, river areas, and other forest types. |
| **Attribute 5: Ecosystem function** | | |
| Productivity, cycling, etc. | 3 | There are lots of nutrient cycling because of plant diversity, but there are some disturbances like the old ag field and highway. |
| Habitat interactions | 4 | There are numerous ecosystems including wetland, riparian zone, river, mountain, and forested. |
| Resilience, recruitment etc, | 3 | These habitats seem to show resiliency but unsure if animals and species are spreading amongst the ecosystems or if they are individually successful. |
| **Attribute 6: External exchanges** | | |
| Landscape flows | 3 | Despite the success of the non ag field ecosystems, they are broken up by the old ag fields and the highway, the healthy ecosystems are not connected. |
| Gene flows | 3 | Unsure of exact gene flows, but the ecosystems show viable habitats with many animal species thriving. |
| Habitat links | 3 | Ecosystems include river ecosystem, riparian ecosystem, and wetland ecosystem, but they are broken up by old ag fields and highway. |

### 4.73 Plant and Animal Species List

We identified over 100 plant and animal species on the land. We identified them using online guides, Vanderwal's intensive plant knowledge, and sources we were provided by Lee and Joshua. We have included the list in the appendix.

### 4.74 Wildlife Camera

Photo from Elsa Lincoln of the River to Raven group setting up the trail camera and bear evidence

We put up the wildlife camera in the wetland near the large agricultural field. We found an already established wildlife camera in the wetland owned by one of Whittaker's renters that lives in front of the large old agricultural field. There were signs of a bear that had been using the tree as a scratching post and had ripped the camera down. Images of the event are above. We decided to set up our camera in a nearby tree in hopes of capturing the bear and other wildlife that use the wetland.

| GPS Coordinates | Direction Facing | More in-depth Instructions |
|---|---|---|
| 48.553756, -120.356864 | NE | On a tree down a small trail into the wetland. |

Photo from: Ava Donelan

# 5.0 Recommendations

## 5.1 Restoration Plan

For the River to Raven restoration plan, we were tasked to create plans that will re-wild* the two old agricultural fields on Lee Whittaker's land and create space for native animals and plants to thrive. We recommend that the big old agricultural field, SW of highway 20, be separated into plots and then have different experiments run on them by future students to find the best way to establish native plant species into the area and in doing so bring more animals back. We wanted to make small project plans for students and teachers to be able to pick up and have a set plan for how to work on the restoration. We also suggest a couple other restoration plans that can be done on the River, Meadow, and Wetland areas.

We suggest getting cardboard from Methow Recycles and using Asplundh Vegetation Management for the woodchips (they are contractors that cut trees around power lines into wood chips) but to be careful with storing the wood chips because if they sit for too long, they are known to spontaneously combust. To get the native potted plants we suggest using many plant nurseries to ensure biodiversity* on the site, such as Beaver Food Forest, Methow Natives, Wild Hearts Nursery, and Red Shed. The Liberty Bell high school horticulture program could be commissioned to grow native plants to sell to the project as well.

We suggest ten 20’ by 30’ planting plots located in the old agricultural field, each having different soil preparation and weed control methods. Additionally, we suggest using high-quality deer fencing around all the plots to lessen the need for metal plant cages. These plots are to experiment the easiest and best ways to control the weeds in the agricultural field. We hope to make the guidelines easy enough to be picked up and used by teachers and students during school years. There are also more singular projects that we suggest having done not only to help the land re-wild but also as a teaching experience for high school students about ecology* and restoration*.

The plants we have decided to plant at first are yarrow ( *Achillea millefolium L.*), blanket flower (Gaillardia aristata ), silky lupine (Lupinus sericeus ), sulfur lupine, (*Lupinus sulphureus* ) Idaho fescue (*Festuca idahoensis*), Bluebunch wheatgrass (*Pseudoroegneria spicata*), Rough fescue (*Festuca campestris*), Sandberg's Bluegrass (*Poa secunda*), and scouler willow (*Salix scouleriana*). We chose these plants with the help of Julie Vanderwal, who has used these in past restoration sites. The plants we chose are all very drought adapted and would work well in the old agriculture field. Choosing a couple plants to use as variables* and only changing how the soil preparation happens in the plots will allow for an easier way to establish native plants over the invasive ones. But after a healthier ecosystem* has been established more plants can be grown in the River to Raven site.

We want students to find out what soil preparation method works best, and then use that plant methodology* in other parts of the project site.

| **Soil Preparation Methods for Establishing Native Plants** | |
|---|---|
| **Plot one** | Interplant* and interseed* native species with no soil preparation. |
| **Plot two** | Mow the invasive grass five times in a growing season (April to September) and afterwards interplant and interseed native plants. |
| **Plot three** | Hand-pull larger non-native plants and clumps of non-native grasses out and then interplant and interseed with native plants. |
| **Plot four** | Deep plow the ground with a tractor/large equipment and then interplant and interseed with native plants. |
| **Plot five** | Shallow tilling with a rototiller and afterwards interplant and interseed with the native plants. |
| **Plot six** | Broadfork* till and then interplant and interseed with native plants. |
| **Plot seven** | Put cardboard and woodchips down on the entire plot area.<br>- Install potted (container) plants in the ground<br>- Add cardboard around the potted plants and across site<br>- Put woodchips on top of cardboard (the wood chips should be at least 6” deep)<br>- Make “craters” in the woodchips<br>- Add weed-free potting soil to fill in the “craters” plant seeds in the potting soil |
| **Plot eight** | Put cardboard and woodchips just around plants.<br>- Install potted (container) plants in the ground<br>- Add cardboard only around the planted plants<br>- Put woodchips on top of the cardboard |

| | |
|---|---|
| | - Interseed in the bare spots between the potted plants |
| **Plot nine** | Have a just woodchip layer and plant and seed with the "crater" method.<br>- Install potted (container) plants in the ground<br>- Put woodchips across the whole plot<br>- Make "craters" in the woodchips<br>- Add weed-free potting soil to fill in the "craters" plant seeds in the potting soil |
| **Plot ten** | Use plastic as a pre-planting weed-suppression.<br>- Lay heavy duty plastic over the entire plot for a whole growing season (April to September)<br>- Remove plastic after season is finished<br>- Interplant and Interseed in the ground after season is finished |

### 5.12 Plot Timeline

- In spring/summer do as much soil preparation as possible, such as tilling the ground or starting the mowing process. (except for the methods with cardboard)
- During this time setting up the deer fencing would be helpful. Using mid-heavy duty Deer Buster fence will allow for it to be reused.
- A watering system should be put in before the plants are planted.
- Then in the fall plant the potted plants and seeds.

We also suggest that the rest of the big old agricultural field be mowed 5 times during the growing season (April to September) while the rest of the plot experiments are going on so that weed prevention is happening everywhere.

Julie Vanderwal's note on using plastic as a weed suppression. "Plastic is best for temporary uses such as one or two spring/summers of smothering weeds, then removing before planting. If you plant with plastic in place, it begins to degrade, some plants may grow through it making it hard to remove, and it becomes garbage on the landscape, and contributes more to microplastic issues." (Julie Vanderwal 8/7/24) Vanderwal has made three PowerPoints that we will link in the SharePoint and the appendix that go in-depth on using sustainable practices on restoration sites.

### 5.13 Wetland Restoration

The wetland area has a lot of reed canary grass, an invasive species. Our suggestion is to put cardboard and woodchips over the grass.

- Put cardboard down over reed canary grass and then cover with woodchips
- Use a post digger to dig holes straight into the ground
- Put willow tree branch cuttings into the holes
- Fill the holes with a dirt silt mixture

The wetland also has non-native grasses and non-native thistles that should be taken out. The thistles can be pulled out and native grasses can be planted around the non-native ones.

### 5.14 Meadow Restoration

For this restoration area, we decided to instead of reverting to what the land looked like 100s of years ago, turn it into a grouse and mule deer habitat. To do this, instead of planting pine, willow, and other trees, we would suggest planting bitterbrush *(Purshia tridentata)*, big sagebrush (*Artemesia tridentata*), grey rabbitbrush *(Chrysothamnus nauseosus)*, yarrow ( *Achillea millefolium L.*), blanket flower (*Gaillardia aristata* ), silky lupine (*Lupinus sericeus* ), sulfur lupine, (*Lupinus sulphureus* ) Idaho fescue (*Festuca idahoensis*), Bluebunch wheatgrass (*Pseudoroegneria spicata*), Rough fescue (*Festuca campestris*),and Sandberg's Bluegrass (*Poa secunda*). It should also be considered that the Yakama Nation has land on the meadow next to Lee Whittaker's land. We suggest contacting them to see if collaboration on restoration of the land is possible.

- First, we suggest doing a land survey and seeing what is growing in the meadow. It seems there might already be some shrub bushes growing in there, so to be cautious of not harming the already growing plants.
- We suggest mowing the grass in the growing season (April-September) five times to stop the invasive grasses from seeding.
- Then interplanting and interseeding shrub steppe plants. Such as the ones listed above.

### 5.15 River Restoration

We suggest planting coyote willow *(Salix exigua)*and red osier dogwood in the rip rap* around the river area to support biodiversity and river shade cover to bring down water temperature in the river area. We also suggest seeing if a collaboration between the Washington Department of Fish and Wildlife, the adjourning landowners and the Yakama Nation, if possible, to put Beaver Dam Analogs and wood back into the river system. This would allow for better beaver and salmon habitat and for floodplains to be reintroduced which brings water back to the land.

- Planting willow in the riprap (pictured below) would require putting weed-free potting soil in-between the rocks
- Collecting coyote willow cuttings and planting them as deep down into the soil as possible
- Then water the cuttings thoroughly and add more potting soil afterwards. Water them again and add more potting soil until the media stays by itself.
- Irrigate the cuttings until they are well established.

**Photo from Ava Donelan of the Riprap on the Methow River on Whittaker's land**

Restoration in the forested areas: In the forested area NE of Highway 20 planting shrubs such as elderberry and saskatoon would help the strata of the area. Meaning that there are layers of growth, short plants, medium plants and tall plants. Planting more pollinator friendly plants like fireweed, goldenrod, aster, yarrow, blanket flower. These plants can be planted in both forested areas.

### 5.16 Other Projects

Collecting local and region-specific seeds: This would entail going around and collecting willow stalks, yarrow seeds, blanket flower seeds, gray rabbitbrush seeds, lupine variety seeds, and other wildflower/plant seeds from the local region.

Taking photo points: Photo points should be taken twice a year at the beginning and end of the growing season (April and September) which coincides with school ending and beginning mostly. Avenza, which is a free online mapping service that allows you to take points using GPS and aerial data, can be used for finding where the photo points are. In the descriptions of the points, they say where to find the site and the exact angle it is pointing at. We have mapped out photo-points using Avenza.

Collect local mycorrhizae: To ensure that mycorrhizae* are being put back into the ecosystem we suggest digging about 10 inches down into the ground around a plant to collect mycorrhizae which is a symbiotic* fungus that provides more resources to the plants it attaches to. Then that dirt would be put around newly planted potted plants to hopefully attach to the planted plants. Below in the Appendix is an article that goes more in-depth.

Removing weeds: We recommend that key invasive* species like this are removed, in the Appendix there will be a photo guide on the plants.

- Mullein, v*erbascum thapsus*

- Bull Thistle, *cirsium vulgare*
- Canada Thistle, *cirsium arvense*
- Reed Canary Grass, *phalaris arundinacea*
- Russian Knapweed, *rhaponticum repens*
- Diffuse knapweed, *Centaurea diffusa*
- St. John's Wort, *hypericum perforatum*
- Yellow Salsify, *tragopogon dubius*
- Tumble Mustard, *sysimbrium sp.*
- White Top/Hoary Cress, *lepidium draba*
- Bulbous Bluegrass, *poa bulbosa*
- Cheatgrass, *bromus tectorum*

The best way to remove the non-grass species is to pull them out. Some plants like knapweed have seeds that last in the soil seedbank for years and can still germinate. So, pulling them every year is the only fully sustainable option to remove them. Hoary aster (*dieteria canescens)* competes well with diffuse knapweed which is an invasive plant and is along trails, the wetland, and old agricultural fields. But for the invasive grasses it is impossible to fully exterminate them, so introducing more native plants is a good way to hopefully restore biodiversity and out compete them.

### 5.17 Further Suggestions

In doing the restoration, it is important to keep in mind some key locations. There are two points where Julie Vanderwal suggested mullein be pull. There is also an area where Lee Whittaker does not want anything to be planted and that the trail be kept clear. There is also a suggestion from Vanderwal on a possible photo point location for on top of the McKinney Ridge. There is a table in the appendix with the GPS coordinates for all of these locations.

### 5.2 Monitoring and Evaluation

We recommend that pictures at the photo point sites are taken once a month to track the progress. Photos should be taken around May and mid-September. It is also recommended that photo points be added on the mountain and trail up to the mountain. We did not get around to that in this project, but it would be beneficial.

We recommend taking data from wildlife cameras set up on the property, to track the progress and introduction of new animal species.

We also recommend that the plots are monitored each month to track the progress of the restoration project. This can be tracked through pictures and more in-depth species lists.

We recommend continually as the restoration projects go on doing pollinator surveys. For the bumblebee survey we suggest using the Pacific Northwest Bumble Bee Atlas project which is an easy way to track the types and amounts of bumble bees there are on the site. That way we can track and see whether new and different types of bumble bees are coming back onto the land.

Trail maintenance: On the many trails around the property, it is important to continually upkeep the weed management around them so to suppress weeds from moving to and from bikes and motorized vehicles. The weeds should be pulled yearly before they seed and spread more. Which

Methow trails has a rapport with Lee Whittaker and can be contacted to see if they can help with the upkeep of the trails.

### 5.3 Budget Estimate

The budget for a project like this can vary throughout the process. Resources and finding contractors to help supply can be costly. To cut down on these costs, partnering with organizations like Methow Recycles and Methow Trails can help in attaining these resources along with cutting back on potential waste created in the project.

Materials like seeds, plants, and irrigation are costs that cannot be avoided and will be the most expensive factors.

We suggest tilling and plowing be done by Lee Whittaker, so expenses for that should not be considered.

**Budget Table**

| | |
|---|---|
| Seeds | $10-$100/unit |
| Container Plants | $10.75/gallon |
| Woodchip Mulch | $22/cubic yard<br>Or provided by Asplundh |
| Drip Irrigation System | $29.98/roll<br>6000 ft of tubing required for total |
| Irrigation Tubing Staples | $15 (100pc pack)<br>1500 required for total |
| Cardboard | Provided by Methow Recycles |
| Soil | $50-$75/yard |
| Fill Dirt/Silt | $30/yard |
| Deer Buster Fencing | $220 (100 feet) |
| Weed Suppression Fabric | $159.00/roll<br>Each roll 4’x300’ |
| Project Management<br>(provided by ZipRecruiter) | $31.50/hr |

## 6.0 Conclusion

This ecological restoration and education plan aimed to make a feasible guide for future students and Methow Valley locals to replace invasive species with native plants. The plan is meant to include high school aged youth on the project to increase their connection with the land and include younger perspectives on the project. With the narratives, we intended to inform the reader of the history of the land. By conducting the research and including numerous ways for the reader to implement change on the ecological site, this guide will help increase wildlife biodiversity, reciprocal human interaction on trail systems, educational opportunities, and climate change adaptation.

In our project, we provide specific, informed examples of native plants that will likely have success on the site, but we also encourage future generations to conduct more research and continue adapting to climate change. We listed many ideas of how to restore the land using different methods and school projects appropriate for high school students. We aimed to recount the narrative of the land from different perspectives and eras. It is incredibly important to acknowledge the reciprocal relationship that was and still is held with the land by the Methow Indigenous people. Part of our project also aims to incorporate some of their understanding of the land and include their Indigenous names for plants in the restoration site. We acknowledge the

limitation of our research given that we only had 9 weeks (about 2 months) to complete the project. Due to this short time period, we were unable to do any trial periods for restoration techniques. For this reason, we included lots of suggestions for readers and ideas for future research. This project is important because it creates the foundation for years of climate work and youth involvement in the outdoors. Making the land habitable for animals again by reintroducing native plants is critical for the landscape because it will enhance soil quality and potential, restore cultural significance, mitigate invasive species, and make the landscape more prepared for climate change.

### 6.1 Acknowledgements

This project would not have been possible without Lee Whittaker. He allowed us to conduct land surveys and create a restoration plan for his land. His trust in us, vision for the land, and many documents and historical resources made this project what it is. Thank you, Lee.

Julie Vanderwal also had a huge impact on our results. Vanderwal bestowed so much knowledge on us and helped us understand the ecological tools we could use to succeed. Vanderwal has valuable restoration experience as well as experience working with kids, and she shared those experiences with us to help us from our recommendations and plan. She provided unwavering support throughout the entire project, offering useful feedback and advice.

The Colville Confederated Tribes website has a plethora of information accessible to the public. This information helped us choose native plants to include on the restoration plan. The history section of the website also informed us as to how the land was and continues to be stewarded by the Methow people.

Additionally, we would like to thank Eric Wittenbach, Nate Fuchs, and Mark and Crystal Miller for their knowledge that guided our project.

## 7.0 Glossary

**Sustainability**: “The long-term viability of a community, set of social institutions, or societal practice. In general, sustainability is understood as a form of intergenerational ethics in which the environmental and economic actions taken by present persons do not diminish the opportunities of future persons to enjoy similar levels of wealth, utility, or welfare.” (Brittanica)

**Floodplain**: “Flat land area adjacent to a stream, composed of unconsolidated sedimentary deposits (alluvium) and subject to periodic inundation by the stream. Floodplains are produced by lateral movement of a stream and by overbank deposition; therefore they are absent where downcutting is dominant.” (Brittanica)

**Hydrology**: “Scientific discipline concerned with the waters of the Earth, including their occurrence, distribution, and circulation via the hydrologic cycle and interactions with living things.” (Brittanica)

**Beaver Dam Analogs (BDA’s)**: “A Beaver Dam Analog (BDA) is a man-made structure designed to mimic the form and function of a natural beaver dam.” (AnaBranch Solutions)

**Metamorphic rocks**: “Any of a class of rocks that result from the alteration of preexisting rocks in response to changing environmental conditions, such as variations in temperature, pressure, and mechanical stress, and the addition or subtraction of chemical components” (Brittanica)

**Sedimentary rocks**: “Rock formed at or near Earth’s surface by the accumulation and lithification of sediment (detrital rock) or by the precipitation from solution at normal surface temperatures (chemical rock)” (Brittanica)

**Continents**: “One of the larger continuous masses of land, namely, Asia, Africa, North America, South America, Antarctica, Europe, and Australia, listed in order of size.” (Brittanica)

**Tectonic plates**: “Theory dealing with the dynamics of Earth’s outer shell—the lithosphere—that revolutionized Earth sciences by providing a uniform context for understanding mountain-building processes, volcanoes, and earthquakes as well as the evolution of Earth’s surface and reconstructing its past continents and oceans.” (Brittanica)

**Drainage**: “Area from which all precipitation flows to a single stream or set of streams.” (Brittanica)

**Since Time immemorial**: “If you say that something has been happening since time immemorial or from time immemorial, you are emphasizing that it has been happening for many centuries.” (Collins dictionary)

**Executive Order:** “Principal mode of administrative action on the part of the president of the United States.” (Brittanica)

**Treaty:** “a binding formal agreement, contract, or other written instrument that establishes obligations between two or more subjects of international law (primarily states and international organizations).” (Brittanica)

**Alluvial:** “Material deposited by rivers. It consists of silt, sand, clay, and gravel, as well as much organic matter.” (Brittanica)

**Conservation:** “Study of the loss of Earth’s biological diversity and the ways this loss can be prevented.” (Brittanica)

**Restoration:** “The process of repairing sites in nature whose biological communities (that is, interacting groups of various species in a common location) and ecosystems have been degraded or destroyed.” (Brittanica)

**Pollinator:** “Pollination is essential to the perpetuation of the vast majority of the world’s wild plants—and thus the perpetuation of nearly all terrestrial ecosystems—as well as to the production of most of the fruit and seed crops that feed humanity.” (Brittanica)

**Re-wild:** “Is a progressive approach to conservation. It’s about letting nature take care of itself, enabling natural processes to shape land and sea, repair damaged ecosystems, and restore degraded landscapes.” (Rewilding Europe)

**Spontaneously combust:** “The outbreak of fire without application of heat from an external source.” (Brittanica)

**Ecology:** “study of the relationships between organisms and their environment.” (Brittanica)

**Biodiversity:** “the variety of life found in a place on Earth or, often, the total variety of life on Earth. A common measure of this variety, called species richness, is the count of species in an area.” (Brittanica)

**Ecosystem:** “the complex of living organisms, their physical environment, and all their interrelationships in a particular unit of space." (Brittanica)

**Method:** “mathematical and experimental technique employed in the sciences. More specifically, it is the technique used in the construction and testing of a scientific hypothesis.” (Brittanica)

**Control:** “The standard to which comparisons are made in an experiment. Many experiments are designed to include a control group and one or more experimental groups.” (Brittanica)

**Riprap:** “Riprap is a layer of large stones that protects soil from erosion in areas of high or concentrated flows.” (Environmental Protection Agency)

**Interplant:** “Plant (a crop or plant) together with another crop or plant.” (Merriam Webster)

**Interseed:** “Plant seeds together with other crops/plants.” (Merriam Webster)

**Broadfork till:** “Human-powered hand-tool that can be a great addition for small farms and market gardens operating with minimal to no-till systems.” (The Market Gardener)

**Plow:** “Plow, most important agricultural implement since the beginning of history, used to turn and break up soil, to bury crop residues, and to help control weeds.” (Brittanica)

**Mycorrhizae**: “A large number of fungi infect the roots of plants by forming an association with plants called mycorrhiza (plural mycorrhizas or mycorrhizae).” (Brittanica)

**Symbiotic: A**ny of several living arrangements between members of two different species, including mutualism, commensalism, and parasitism.

**Invasive:** “Any nonnative species that significantly modifies or disrupts the ecosystems it colonizes.” (Brittanica)

## 8.0 Appendix

**Species List**

| Name | Scientific Name | Native, introduced, or invasive | Type of Plant |
|---|---|---|---|
| Alfalfa | *Medicago sativa* | Introduced | herbaceous |
| Arrowleaf Balsamroot | *Balsamorhiza sagittata* | Native | herbaceous |
| Arrowleaf Groundsel | *Senesio triangularis* | Native | herbaceous |
| Aspen, quaking | *Populus tremuloides* | Native | tree |
| Aster spp. | *Asteraceae* | Native | herbaceous |
| Basin Wildrye | *Leymus cinereus* | Native | herbaceous |
| Beardtongue | *Penstemon* | Native | herbaceous |
| Birch, paper | *Betula papyrifera* | Native | tree |
| Birch, water | *Betula occidentalis* | Native | tree |
| Bitterbrush spp. | *Pursia tridentata* | Native | herbaceous |
| Bitterbrush, Antelope | *Purshia tidentate* | Native | shrub |
| Bittercherry | *Prunus emarginata* | Native | small tree/tall shrub |
| Black Eyed Susan | *Rudbeckia triloba* | Introduced | herbaceous |
| Black Hawthorn | *Crataegus douglasii* | Native | small tree/tall shrub |
| Black Lichen | *Peltigera collina* | n/a | algae/fungus |
| Black Twinberry | *Lonicera involucrata* | Native | shrub |
| Blanket Flower | *Gaillardia aristata* | Native | herbaceous |
| Bluebunch Wheatgrass | *Pseudoroegneria spicata* | Native | herbaceous |
| Bluegrass, Bulbous | *Poa bulbosa* | Invasive | herbaceous |
| Bluegrass, Sandberg | *Agropyron sandbergii* | n/a | herbaceous |
| Bluegrass, spp. | *Poa pratensis* | Native and Introduced | herbaceous |
| Bracted Lousewart | *Pedicularis bracteosa* | Native | herbaceous |
| Bull Thistle | *Cirsium vulgare* | Invasive | herbaceous |
| Buttercup | *Ranunculus* | n/a | herbaceous |
| Canada Golden Rod | *Solidago canadensis* | Native | herbaceous |
| Cat's-ear Lily | *Calochortus lyalli* | Native | herbaceous |
| Cattail | *Typha latifolia* | Native | herbaceous |
| Ceanothus | *Ceanothus velutinus* | Native | small tree/tall shrub |
| Cheatgrass | *Bromus tectorum* | Invasive | herbaceous |
| Chokecherry | *Prunus virginiana* | Native | small tree/tall shrub |
| Cinqefoil, Sulphur | *Potentilla recta* | Inroduced | herbaceous |

| | | | |
|---|---|---|---|
| Cinquefoils, spp. | *Potentilla* | n/a | herbaceous |
| Common Harebell | *Campanula rotundifolia L.* | n/a | herbaceous |
| Common Horsetail | *Equisetum arvase* | Native | herbaceous |
| Common Tansy | *Tanacetum vulgare* | Introduced | herbaceous |
| Cottonwood, Black | *Populus trichocarpa* | Introduced | tree |
| Currant | *Ribes* | n/a | shrub |
| Currant, Wax | *Ribes cereum* | Native | shrub |
| Desert Parsley | *Lomatium species* | Native | herbaceous |
| Devil's Club | *Opopanax horridus* | Native | shrub |
| Douglas Catchfly | *Silene douglasii* | Native | herbaceous |
| Douglas Maple | *Acer glabrum* | Native | tree |
| Draba | *Draba* | n/a | herbaceous |
| Elderberry | *Sambucus nigra* | Blue native, Black introduced | small tree/tall shrub |
| Englemann Spruce | *Picea engelmannii* | Native | tree |
| Fern, Western Bracken | *Pterudium aquilinum* | Native | herbaceous |
| Fernleaf Biscuitroot | *Lomatium dissctum* | Native | herbaceous |
| Fescue | *Festuca species* | n/a | herbaceous |
| Fescue, Idaho | *Festuca idahoensis* | Native | herbaceous |
| Fir, Douglas | *Pseudotsuga* | Native | tree |
| Fir, Grand | *Abeis grandis* | Native | tree |
| Fir, Subalpine | *Abies lasiocarpa* | Native | tree |
| Globeflower | *Trollius europaeus* | Native | herbaceous |
| Hemlock, Western | *Tsuga* | Native | tree |
| Huckleberry, spp. | *Vaccinium species* | Native | shrub |
| Huckleberry, Thinleaf | *Vaccinium membranaceum* | Native | small tree/tall shrub |
| Kinnikinnik | *Artctostaphylos uva-ursi* | Native | shrub |
| Knapweed | *Centaurea species* | Invasive | herbaceous |
| Larch, Subalpine | *Laryx lyallii* | Native | tree |
| Larch, Western | *Larix occidentalis* | Native | tree |
| Larkspur spp. | *Delphinium* | n/a | herbaceous |
| Lewis's Monkeyflower | *Mimulus lewisii* | Native | herbaceous |
| Lupine, Arctic | *Lupinus arcticus* | Native | herbaceous |
| Lupine, Silky | *Lupinus sericeus* | Native | herbaceous |
| Lupine, spp. | *Lupinus species* | Native | herbaceous |
| Lupine, Sulphur | *Lupinus sulphureus* | Native | herbaceous |
| Lyall's Angelica | *Angelica arguta* | Native | herbaceous |
| Mertens Sedge | *Carex mertensii* | Native | herbaceous |

| | | | |
|---|---|---|---|
| Mock Orange | *Philadelphus lewisii* | Native | shrub |
| Moss Campion | *Silene acaulis* | Native | herbaceous |
| Mountain Alder | *Alnus incana* | Native | small tree/tall shrub |
| Mullein | *Verbascum thapsus* | Introduced | herbaceous |
| Needlegrasses | *Nassella viridula* | Native | herbaceous |
| Oceanspray | *Holodiscus discolor* | Native | shrub |
| Orchard Grass | *Dactylis glomerata* | Introduced | herbaceous |
| Oregon Grape | *Mahonia species* | Native | shrub |
| Parry's Campion | *Silene parryi* | n/a | herbaceous |
| Pine, Lodgepole | *Pinus contorta* | Native | tree |
| Pine, Ponderosa | *Pinus ponderosa* | Native | tree |
| Pine, spp. | *Pinus* | Native | tree |
| Quack Grass | *Elymus repens* | n/a | herbaceous |
| Rabbitbrush | *Chrysothamnus species* | Native | shrub |
| Red Clover | *Trifolium pratense* | Native | herbaceous |
| Red-osier Dogwood | *Swida sericea* | Native | shrub |
| Reed Canary Grass | *Phalaris arundinacea* | Invasive | herbaceous |
| Rose Twisted Stalk | *Streptopus lanceolatus* | Native | herbaceous |
| Russian Knapweed | *Rhaponticum repens* | Invasive | herbaceous |
| Sagebrush | *Artemesia species* | Native | herbaceous |
| Scouring Rush | *Esuisetem hyemale* | Native | herbaceous |
| Serviceberry | *Amelanchier anfolia* | Native | small tree/tall shrub |
| Showy Milkweed | *Asclepias speciosa* | Native | herbaceous |
| Sitka Valerian | *Valeriana Sitchensis* | Native | herbaceous |
| Smooth Brome | *Bromus inermis* | Introduced | herbaceous |
| Snowberry, common | *Symphoricarpos albus* | Native | small tree/tall shrub |
| Snowberry, Roundleaf | *Symphoricarpos rotundifolius* | Native | shrub |
| Snowberry, spp. | *Symphoricarpos* | Native | shrub |
| St. John's Wort | *Hypericum perforatum* | Invasive | herbaceous |
| Sulphur Buckwheat | *Eriogonum umbellatum* | Native | herbaceous |
| Tamarack | *Larix laricina* | Native | tree |
| Timothy | *Phleum pratense* | Introduced | herbaceous |
| Tule | *Schoenoplectus acutus* | Native | herbaceous |
| Tumble Mustard | *Sysimbrium species* | Invasive | herbaceous |
| Western Meadowrue | *Thalictrum occidentale* | Native | herbaceous |
| Western White Clematis | *Clematis ligusticifolia* | Native | herbaceous |
| White Top/Hoary Cress | *Cardaria draba* | Invasive | herbaceous |

| | | | |
|---|---|---|---|
| Wild Buckwheat | *Eriogonum species* | Native | shrub |
| Wild Raspberry | *Rubus idaeus* | Native | shrub |
| Wild Strawberry | *Fragaria species* | Native | herbaceous |
| Willow, Scouler | *Salix scouleriana* | Native | tree |
| Willow, Shining or Pacific | *Salix lucida* | Native | tree |
| Wood's Rose | *Rosa woodsii* | Native | shrub |
| Yellow Salsify | *Tragopogon dubius* | Invasive | herbaceous |

| **Key Invasive Plant species to remove** | |
|---|---|
| Mullein, V*erbascum thapsus* |  **L.L. Berry, Bugwood.org** |
| Bull Thistle, *cirsium vulgare* |  **Rob Routledge, Sault College, Bugwood.org** |

| | |
|---|---|
| Canada Thistle, *cirsium arvense* |  **Leslie Dietz, Bugwood.org** |
| Reed Canary Grass, *Phalaris aruninacea* |   **Rob Routledge, Sault College, Bugwood.org** |
| Russian Knapweed, *rhaponticum repens* |  **Eric Coombs, Oregon Department of Agriculture, Bugwood.org** |
| Diffuse knapweed, *Centaurea diffusa* | |

| | |
|---|---|
| |     **L.L. Berry, Bugwood.org** |
| St. John's Wort, *hypericum perforatum* |   **Ohio State Weed Lab , The Ohio State University, Bugwood.org** |
| Yellow Salsify, *tragopogon dubius* |    **Michael Rasy, University of Alaska, Bugwood.org** |

| | |
|---|---|
| Tumble Mustard, *sisymbrium sp.* |  **Mary Ellen (Mel) Harte, Bugwood.org** |
| White Top/Hoary Cress, *lepidium draba* |  **Mark Schwarzlander, University of Idaho, Bugwood.org** |
| Bulbous Bluegrass, *poa bulbosa* |  **Leslie J. Mehrhoff, University of Connecticut, Bugwood.org** |

| | |
|---|---|
| Cheatgrass, *bromus tectorum* |   **Chris Evans, University of Illinois, Bugwood.org** |

**Further Suggestions Locations Table**

| **Location Name** | **GPS** |
|---|---|
| Mullein Location 1 | 48.554050, 120.360225 |
| Mullein Location 2 | 48.331514, 120.213854 |
| Trail to be kept clear | 48.331680, 120.212833 |
| Potential ridge photo point | 48.330989, 120.213331 |

Julie Vanderwal's weed suppression slideshows:

- Weed Suppression Methods
- Marking Responsibly in the Wild
- Plant Protection or Garbage?

### 8.1 Sources and Citations


*About*. (2023, October 4). Mazama Community Club. https://mazamacommunityclub.org/about/

BARKSDALE, J. D. & WASHINGTON STATE LIBRARY. (1975). *GEOLOGY OF THE METHOW VALLEY OKANOGAN COUNTY, WASHINGTON*. https://www.dnr.wa.gov/publications/ger_b68_geol_methow_valley.pdf

*Cascadia Subduction Zone Marine geohazards | U.S. Geological Survey*. (2022, July 5). https://www.usgs.gov/centers/pcmsc/science/cascadia-subduction-zone-marine-geohazards

*Convergent Plate Boundaries—Subduction Zones - Geology (U.S. National Park Service)*. (n.d.). https://www.nps.gov/subjects/geology/plate-tectonics-subduction-zones.htm

Fuchs, N (2024, August 7th) Discussing river restoration (A. Steinshouer, E. Lincoln, A. Donelan) [informal interview].

History/Archaeology Department (2024). *Confederated Tribes of the Colville Reservation: A Brief History*. ArcGIS StoryMaps.

Landes, H., Thyng, WM. S., Lyon, D. A., Roberts, M., & GEOLOGICAL SURVEY. (1902). ANNUAL REPORT FOR 1901. In GWIN HICKS, *WASHINGTON: Vol. VOL UME I* (p. vi). https://www.dnr.wa.gov/publications/ger_ar1901_v1_pt2.pdf

Methow Conservancy (2021). *x̌ʷnámx̌ʷnam/Hummingbird: land of the mətx̌ʷu/Methow People*. Methow Conservancy. https://methowconservancy.org/news/entry/faq_land_justice

*Methow River Basin | U.S. Geological Survey*. (2015, January 23). https://www.usgs.gov/centers/washington-water-science-center/science/methow-river-basin

*Mycorrhizal Inoculum – A simple method for making your own – Sub-Tropical Fruit Club of Qld Inc.* (n.d.). https://stfc.org.au/articles/mycorrhizal-inoculum-a-simple-method-for-making-your-own-2/

*Official Series Description - MUCKAMUCK Series*. (2007, July). https://soilseries.sc.egov.usda.gov/OSD_Docs/M/MUCKAMUCK.html

Okanogan Language Program. (2022). *nsəlxcin dictionary*. https://static1.squarespace.com/static/54fdb21ce4b01792f1ee3d0f/t/6351ad7dc1b74b13c851ba3c/1666297215708/2022+ns%C9%99lxcin+Dictionary.pdf

Richard Hart, E. (2015). *Lost Homeland: The Methow Tribe and the Columbia Reservation*. Shafer Historical Museum.

*Shafer Historical Museum - Sawmills in the Methow Valley*. (n.d.). https://www.shafermuseum.org/learn/Rockview

*THE 17 GOALS | Sustainable Development*. (n.d.). https://sdgs.un.org/goals

Vanderwal, J. (2024, August 7) Discussing restoration techniques (A. Steinshouer, A. Coggins, E. Lincoln, A. Donelan) [personal communication].

Vaughn, N. (2023). *Through History: The Confederated Tribes of the Colville Reservation.* Confederated Tribes of the Colville Reservation.

Visalli, D. (n.d.). *A geologic history of the Methow Valley*. https://www.methownaturalist.com/8-2014-Methow%20Geology.pdf

*Washington 100*. (n.d.). https://wa100.dnr.wa.gov/north-cascades/methow-valley

*Weather averages Mazama, Washington*. (n.d.). US Climate Data. https://www.usclimatedata.com/climate/mazama/washington/united-states/uswa0264#google_vignette

*Weed Images: The source for images of weeds and weed management in agriculture*. (n.d.). https://www.weedimages.org/index.cfm

Whitaker, L (2024, June 24 ) Discussing plans for his land (A. Steinshouer, E. Lincoln, A. Donelan) [personal communication].

Whitaker, L (2024, August 5) Discussing plans for his land (E. Davis) [personal communication].

*Wildland fire in Ponderosa Pine: Western United States (U.S. National Park Service)*. (n.d.). https://www.nps.gov/articles/wildland-fire-in-ponderosa-pine.htm#:~:text=But%2C%20beginning%20in%20the%20fifth,fire%20climbing%20to%20the%20crown

Winthrop, Washington. (2023, May 11). *The history of Winthrop Washington in the Methow Valley*. Winthrop Washington. https://winthropwashington.com/about/history/#:~:text=The%20first%20white%20men%20to,and%20Methow%20rivers%20in%201891

Wittenbach, E.(2024, August 16) Discussing pollinator plants (E. Lincoln,) [email communication].

Wright, T. (n.d.). *A History of Treaties and Reservations on the Olympic Peninsula: A Curriculum Project for Washington Schools, 1855-1898.* Washington State University.

WTU Herbarium, Burke Museum, University of Washington. (n.d.). *Burke Herbarium Image collection*. Copyright (C) 2004-2024 WTU Herbarium, Burke Museum, University of Washington. https://burkeherbarium.org/imagecollection/keys.php?Key=1