Partnership for Lake Abert and the Chewaucan

SHARED NARRATIVES

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Joint Fact-Finding Subcommittee

Draft 12: In-Progress, June 19th, 2024

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The Partnership's purpose, as defined in the Charter is to:

1. Develop a shared understanding of water management in the Chewaucan River watershed
2. Identify broadly supported actions related to the Chewaucan River watershed that will strive to:
    a. Meet water needs, including needs for agricultural operations, communities, Lake Abert, wet meadows, and fish and wildlife
    b. Address the ecological health of Lake Abert and the entire Chewaucan River watershed and consider social, economic, and environmental benefits and impacts
    c. Address current and future in-stream and out-of-stream water needs

Significant Changes

This section summarizes key edits throughout the report since the last opportunity for the entire PLACe group to review. It is provided here for additional context as you review the final draft, and will be removed prior to publication.

Executive Summary & Setting

- These sections are new! Please review.

Water Resources

- Several descriptions of water measurement methods and values from the Phillips and VanDenburgh report (1971) were re-written or edited for clarity. *(Throughout)*

Agricultural Practices

- The descriptions of total irrigated acres in the basin were edited for clarity. *(Throughout)*

Fish & Wildlife

- Discussion of sage grouse habitat in the marshes was updated to include a description of leks near Tucker Hill and the Coglan Buttes. *(Subsection 3.1.4)*
- Several phrases were added to provide additional context on Lake Abert's role within the larger system of saline lakes across the Great Basin/ North American West. (*Throughout)*

Upland Processes

- More specificity was provided on the data collection completed by the River Design Group *(Subsection 4.4: Soil Erosion.)*

Cultural Heritage/Lived Experiences

- Policy implications was moved to the top of the chapter. It also had additional text included to better describe and emphasize tribal sovereignty, reserved rights, and claims. *(Subsection 5.2)*

Drought Considerations

- No significant edits occurred.

Appendix A.

- This section was significantly edited for clarity. Please review.

Executive Summary

Across the Partnership for Lake Abert and the Chewaucan's individual and small group sorting exercises between June - December 2023 about information and activities regarding water in the basin, a few key questions and topics seemed to rise to the top. The OSU Team, in conjunction with the JFF Subcommittee, grouped these by themes: water, water chemistry/quality, Lake Abert ecosystem, upland processes, agriculture, birds, fish, and other wildlife, decision-making, and precipitation & climate. These themes were then organized into the outline below. Additional sections were included for information necessary for drought mitigation and cultural sites, as both topics were regularly mentioned as priorities. This document is part of the larger Partnership's collaborative process and will be updated as the group works towards building consensus on the report itself. The purpose of this collaboratively-developed document is to memorialize what information is known and what information is still needed to understand and ultimately make decisions regarding the basin. *Participation and involvement in the drafting of this document does not necessarily indicate agreement by all members or organizations.*

This document is organized into six sections. Section 1 lays the foundation for the report by providing a shared understanding of water resources in the Chewaucan Basin. Despite limited data on water resources, the section presents information on inflow (rainfall and snowmelt), consumption (irrigation, evapotranspiration), and impacts (temperature, wildfire) related to surface and groundwaters. The section highlights the location of and data from climatological and hydrological monitoring stations in the Basin, and indicates where more data is needed. Throughout, the section also considers Oregon's policies around water rights alongside the hydrologic reality.

In section 2, the authors review agricultural practices and associated impacts in the Chewaucan Basin. Agriculture in the Basin is primarily in the form of ranching and growing hay for feed, supported by flood irrigation and, to a lesser extent, groundwater. Production of hay/grass/pasture mimics wetland hydrology and supports Pacific Flyway waterbirds and other wildlife. The section details monthly interactions between agricultural activities and wildlife, and concludes with a description of wet meadow environments.

Section 3 describes the numerous fish and wildlife species that utilize various aspects of the basin's hydrology. The section is divided into four key geographic areas: the Chewaucan Marshes, Lake Abert, the Chewaucan River, and the Rivers End Reservoir. Wildlife interactions between the lake and the marsh are also emphasized, as is the larger setting of Lake Abert within a system of saline lakes along the Pacific Flyway. Additional detail is also provided on species of conservation concern, and the section concludes with an overview of red band trout in the basin.

Recognizing the importance of the Upper Chewaucan Watershed for water resources, wildlife, and landcover, section 4 describes the upland processes of the Chewaucan Basin. In particular, the section provides an overview of the setting of the Upper Chewaucan, particularly the topography and landcover, and how this supports wildlife. The section further discusses the impacts and prevalence of fire on watershed processes, and concludes with a detailed account of important wildlife species and habitat in the Upper Chewaucan Watershed.

Indigenous people have been present in the Chewaucan Basin since time immemorial. The region has also been inhabited by settlers since the late 1800s. Section 5 opens with an emphasis on Tribal sovereignty, as well as a summary of relevant Burns Paiute Tribal policy documents discussing the Chewaucan Basin. The section then shifts into three key perspectives from knowledge holders and local experts. These perspectives are summaries of phone calls, in-person conversations, and email exchanges. They offer a broad perspective on the cultural heritage, history, and lived experiences of those who live, work, and relate to the basin both historically and currently.

Section 6 is informed by discussions from the June 2023 Paisley meeting. The section provides an overview of broader regional water and climate patterns, as well as the interplay between drought and ecological resilience. Different approaches to drought planning are also outlined, and the section concludes with a list of various avenues of scientific enquiry that could inform future decision making. This section does not offer any direction for future decision making.

Throughout the process of writing this report, the authors identified many questions for further investigation. These are detailed in Appendix A, which includes detailed description of how they were collaboratively produced.

Disclaimer: *This document represents a collaborative effort by multiple authors, each contributing their unique viewpoints, knowledge bases, and interests. It is important to note that the content herein was not reviewed by readers or experts outside of the Partnership for Lake Abert and the Chewaucan. As such, the perspectives and conclusions presented are solely those of the contributing authors and may not reflect a consensus view on the topics discussed, nor have all the contributions and compilations of information contained herein been subject to a scientific peer review process. Readers are encouraged to consider this context when interpreting the information provided.*

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Land Acknowledgement

The Joint Fact-Finding Subcommittee of the Partnership for Lake Abert and the Chewaucan (PLACe) recognizes past, present, and future contributions of Indigenous people across the landscapes now called the Great Basin, Oregon, Lake County, and the Chewaucan Basin. We extend our appreciation and respect to all Tribes and individuals with traditional connections to these lands, and acknowledge and honor their continued and vital presence.

The Northern Paiute (Numu) people were forcibly relocated from their traditional homelands, which included the Chewaucan Basin and Lake Abert. Today, living descendants of these people are part of, but not limited to these Tribes that PLACe has engaged: The Burns Paiute, Confederated Tribes of Warm Springs, and Klamath Tribes. Living descendants of these people are also part of the Fort Bidwell Indian Community and the Fort McDermitt Paiute and Shoshone Tribes.

We also extend our respect to the other federally recognized Tribes in Oregon, which were also engaged: Confederated Tribes of Coos, Lower Umpqua, and Siuslaw, Confederated Tribes of Grand Ronde, Confederated Tribes of Siletz, Confederated Tribes of Umatilla, Cow Creek Band of Umpqua Indians, and Coquille Indian Tribe.

We offer our gratitude for this land, and for those who have cared for it since time immemorial. The Joint Fact-Finding Subcommittee of PLACe is committed to understanding the impact of history on these communities and sovereign Nations. We are also dedicated to elevating Indigenous and traditional ecological knowledge in our fact-finding efforts, and reflecting its importance in this Shared Narrative Report.

Glossary of Terms

TAF

An acre-foot is the amount of water it would take to cover an acre of land with water to a depth of one foot.

Volume: One acre-foot is equivalent to approximately 43,560 cubic feet (which is approximately 1,233 cubic meters).

Hydrograph

Least-squares regression analysis

Consumptive use/water

Seeps

Bird-Use Day

LSWCD…

Setting

Since time immemorial, the livelihoods and wellbeing of people living in and around Lake Abert and the Chewaucan River have been connected to water. Water also underpins the rich fish and wildlife communities of the region. Those interconnections are inseparable. Native people have lived and traveled through the area following the seasonal paths of food and water supply. Ranchers also have generational ties to the land in the Chewaucan Basin. This report, created by the Joint Fact-Finding Subcommittee of the Partnership for Lake Abert and the Chewaucan (PLACe), aims to develop a shared understanding of water management in the Chewaucan River watershed.

The Lake Abert-Chewaucan Marsh Basin is located in south-central Oregon in Lake County. The area has seen many transformations since the late Pleistocene period when it was the large, 480 square mile pluvial Lake Chewaucan (Allison, 1982). Over time, as this ancient lake shrunk, it created the Summer Lake and Abert Lake Basins that we now know. In the late 1800's and early 1900's, European settlers irreversibly altered historic wetlands in the Lower Chewaucan Basin. The Chewaucan River was diked and aligned to a mostly straight channel. Prior to settlement there was no channel to the lake. In the early 1900s, the river was dredged and it broke through an underground sill at the Narrows, thus creating a channel to the lake. The 53-mile Chewaucan River originates in upland forests of Gearhart Mountain, flows through the Upper and Lower Chewaucan Marshes, and drains into Lake Abert, connecting the three sub-basins. In addition to flows from the Chewaucan River, the Lake Abert-Chewaucan Marsh Basin receives water from precipitation, ephemeral streams, and springs and seeps.

The Chewaucan Basin is home to many peoples. Indigenous people have been present in the Chewaucan Basin since time immemorial and maintain relationships with the land. The entirety of the Basin is part of the traditional territory of the northern Paiute people. Settlers have also inhabited the area since the late 1800s, many of whom established multi-generational ranches that are still in existence today. The City of Paisley (population 254) sits at the midpoint of the Chewaucan River in Lake County. Incorporated in 1911, Paisley has been a hub for ranching and timber since the late 1800s. The Paisley sawmill operated until its closure in 1996. The area is also home to a ranger station for the Fremont Winema National Forest. The government employs a significant portion of Paisley residents, with approximately 70% working for government agencies of some kind.

The Basin is also home to abundant wildlife. Irrigated pasture land serves as important wetland habitat for a wide variety of Pacific Flyway waterbirds and other wetland species. About 180 bird, 35 mammal, 14 reptile, and four amphibian species are known or likely to occur in flood irrigated wetlands, adjacent uplands, and the Chewaucan River riparian area. In Spring 2002 and 2003, daily peak populations of more than 75,000 waterfowl were observed in the Chewaucan marshes. Lake Abert itself attracts tens to hundreds of thousands of shorebirds annually. These shorebirds utilize Lake Abert, Oregon's only hypersaline lake, during migration for brine shrimp and alkali flies. Three native fish species also occur in the Chewaucan Basin: the Chewaucan Redband Trout, Speckled Dace, and Tui Chub (Harris 2000). The forested floodplains in the Upper Chewaucan also support species such as deer, elk, rabbit, quail, and migratory songbirds.

Most of the economic development in Paisley is generated by a combination of value-added manufacturing, renewable energy, and tourism. Jobs in the agriculture and service/tourism sectors grew in the period up to 2019. In 2022, Lake County farms sold about $175 million in goods (about

$56 million from cattle and calves), with 45% of farms selling more than $100,000 in goods. About 91% of these are family farms. The region is also economically important to visitors who come to the area for birding, premium trout fishing, rockhounding, other outdoor recreation activities, and experiencing the culture. Hunting is a large draw for visitors to the region – for waterfowl, upland birds, and large ungulate hunting. Additionally, much of the watershed is visible from scenic byways for bicycle and vehicular touring. In 2023, visitors spent $20 million in Lake County, supporting about 220 jobs (about 2% of total economic activity in the county). Irrigated land is often valued at $3,000-$5,000 per acre, whereas non-irrigated pasture is worth $600-$1500 per acre on average. These land values contribute to the County's property tax base, which in turn supports investment in critical infrastructure and services. Rural communities, with small populations, can be vulnerable to small changes in employment, tax base, or external economic shocks. For example, the Paisley school welcomes exchange students to increase enrollment and keep the school open. Rural Fire Protection Associations are largely volunteer and require a certain population of locals to be adequately responsive to wildfire. The property tax base underpins health and human services, public safety, roads, and other essential services that also form a foundation for future economic opportunity.

Whether your family is growing hay or cattle, teaching school, visiting Lake Abert to watch birds, working in the forest, or commuting to a nearby town for a mill job, livelihoods depend on water. However, water availability is becoming less predictable. Lake County has been in varying degrees of drought for most of the past two decades. Drought has critical implications for agriculture, fish, wildlife, and natural resources.

I. Water Resources

(Lead: Ron Larson, supported by Georgina Mukwirimba)

Understanding water resources in the Chewaucan Basin is one of the key goals identified in both the draft of HB3099, HB2010, as well as by the Partnership for Lake Abert and the Chewaucan (PLACe), during recent collaborative meetings. Several key themes were established and refined to produce specific questions that could help improve water management in the Chewaucan Basin. These questions have centered on a few key areas:

- the required quantity of water in Lake Abert to maintain ecological integrity (desired range of salinity; lake elevation for optimal larval habitats);
- the quantity of water that enters the lake through precipitation & inflows and the relationship with groundwater and evapotranspiration;
- upland dynamics impacting river and lake levels; and,
- the likely trends in the hydrologic cycle, given a changing climate.

Photo 1. Chewaucan River a little over a mile above Paisley, June 2017. Credit: Ron Larson.

1.1 Introduction

In Oregon, all water legally belongs to the public pursuant to ORS 537.110. Private citizens may apply for the right to use water, but that water remains a shared, public resource. The doctrine of "prior appropriation" governs all water use in the State of Oregon. This "first in time, first in right" approach affords priority to the senior water user. In times of shortage, the senior user may use water without regard for the needs of junior users.

All water use requires a valid state water right. Water users must adhere to the rate, volume, season, and type of use limitations of a water right. Under OAR 690-513-0050, allowable types of water use in the Chewaucan Basin include irrigation, stock, domestic, municipal, industrial, reservoir storage, and instream. However, unless a type of use has applied for and received a valid state water right, no legal entitlement to water exists. As water shortages worsen with climate change, junior water users can increasingly find themselves without water. For water needs that currently lack water rights altogether, such as instream flows or Lake Abert, the implications are particularly dire.

Recent high severity wildfires such as the 400,000+ acre Bootleg Fire that ravaged the area in 2021, and the drying events that left Lake Abert bright red and then dry in 2014-2015 and 2021-2022 are alarming. Climate change is a reality and building resistance to these types of events depends on adequate climate and hydrological data. Better data enables open discussions and informs future decision-making.

Hydrology and hydro-climatology are data-intensive sciences. Though there are several flow-measuring gauges and weather stations in Lake County, not many are located in the basin (Figure 1.1). However, the area shown is nearly 5,000 square miles in size and only a few stations are located in the Chewaucan Basin. Furthermore, the area shown in the map represents a broad range of climatic conditions, from high-elevation areas that get 40 inches of annual precipitation to basin floors that only get 10 inches annually, thus making it difficult to extrapolate data from most of the sites for use in the Chewaucan Basin.[1] An AgriMet station was installed at Paisley in December 2023, so more weather and climate data will be available from the Chewaucan Basin.

[1] See Appendix A

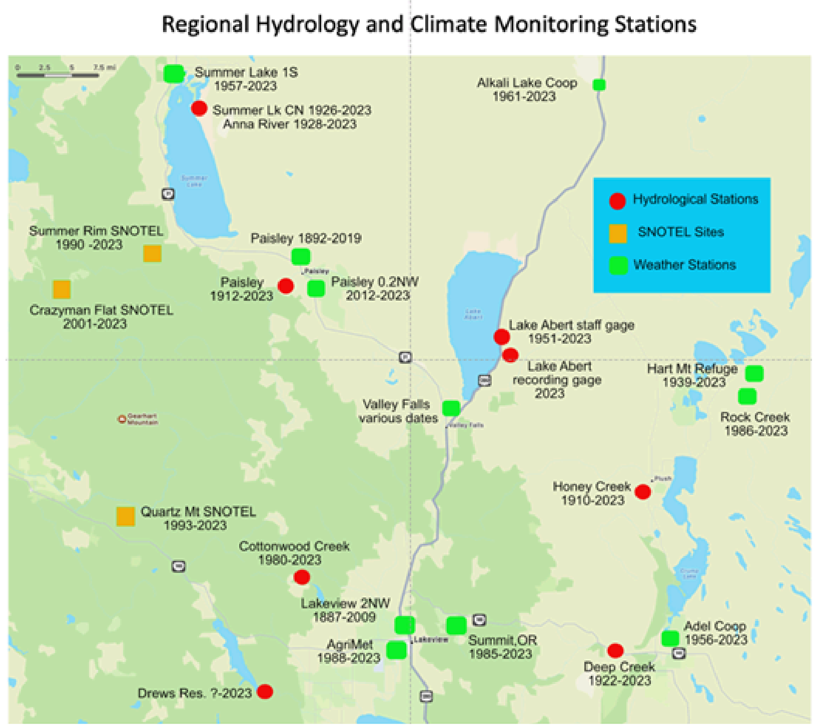


Figure 1.1 Climate and hydrology monitoring sites in and around the Chewaucan Basin. Not shown is the AgriMet station "Paisley" installed in the Chewaucan Basin in December 2023, by the US Bureau of Reclamation. Weather and climate data from this site can be accessed at: https://www.usbr.gov/pn/agrimet/agrimetmap/psloda.html.

1.2 Precipitation in the Chewaucan Watershed

The Chewaucan Basin has two distinct hydro-climatological areas. The first catchment, outlined in red, is a forested upland to the south and southwest that gets >12 inches of annual precipitation. This catchment also has perennial streams, the largest being the Chewaucan River. According to the Oregon State University PRISM group, most of the lower-elevation areas consisting of the Upper and Lower Chewaucan Marshes have recently received an annual average of ~10 inches of precipitation. According to PRISM, annual precipitation on Lake Abert has recently averaged 11.7 inches, with a range of 13.0 to 10.6 to inches, going from south to north up the lake.

The second catchment, outlined in purple, is a high-desert-like "shrub steppe" area to the north and northeast that gets <12 inches of annual precipitation and only has ephemeral streams (Figure 1.2.1).

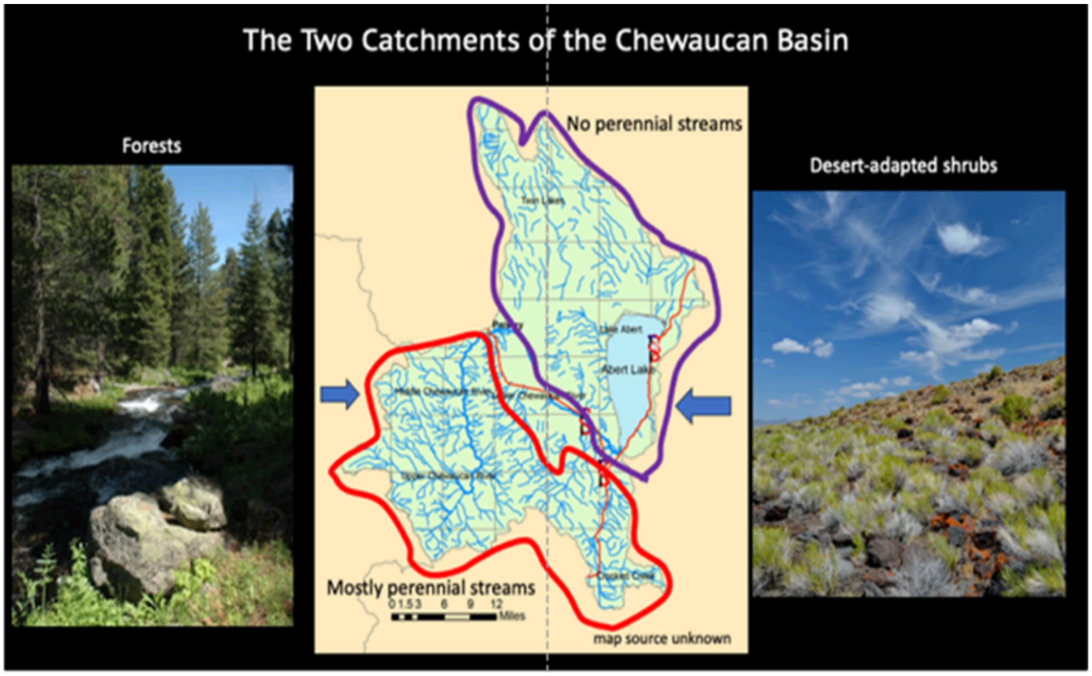


Figure 1.2.1 The two catchments of the Chewaucan Basin.

Most of the water in the Chewaucan Basin comes from precipitation falling at higher elevations in its watershed, especially on the east side of Gearhart Mountain and Dead Horse Rim. These areas are drained by Augur, Dairy, Dead Horse, and Elder Creeks, all with their headwaters at or above 7,000 feet elevation. Based on the climate modeling by the OSU PRISM group, annual precipitation in the Chewaucan Basin from the 1991 to 2020 period has ranged from ~41 inches on Gearhart Mountain at 8,000 feet elevation, to 10 inches in the Upper Chewaucan Marsh at 4,300 feet elevation. Although there are no precipitation measurements for the higher elevations of the watershed, the Summer Rim SNOTEL site, located at 42° 42’ N, 120° 48’ W, is near the Chewaucan watershed at an elevation of 7,000 feet. At the Summer Rim site, over the 1979 to 2022 period, there was an average annual precipitation of 27.6 inches and an annual range from 12 to 54 inches. Based on an analysis of changes in precipitation at the Summer Rim site, there has been a decline in annual precipitation from 30.6 inches to 24.4 inches, equivalent to a reduction of 20% over 43 years (Figure 1.2.2). The validity of the data from the Summer Rim site is contested due to drifting and blowing snow.

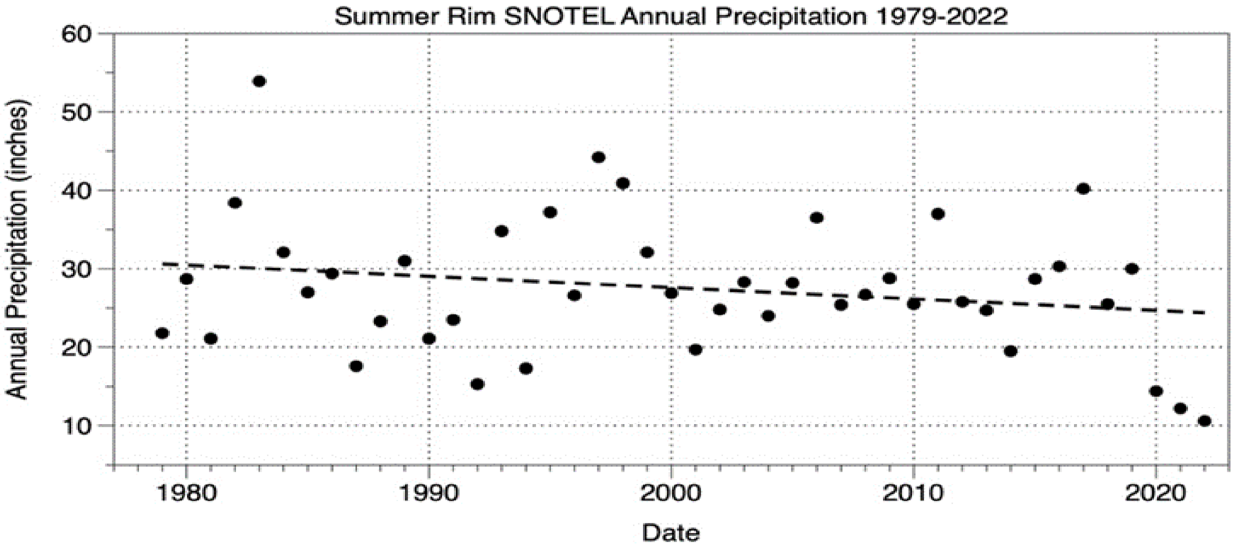


Figure 1.2.2. Scatterplot of annual precipitation at the Summer Rim SNOTEL site, 1979-2022, and least-squares regression line. Data source: https://wcc.sc.egov.usda.gov/nwcc/site?sitenum=800. Figure source: Larson, unpublished.

1.3 Precipitation Changes at Paisley and Valley Falls

Over the past 44 years (1979-2023), annual precipitation at Paisley has averaged 12.6 inches and has varied from 7.3 to 20.7 inches. At Valley Falls over the same period, it has averaged 12.9 inches and has varied from 8.1 to 21.1 inches. At Paisley, there has been a decline in annual precipitation from 14.2 to 11.0 inches since 1979, based on the analysis below (Figure 1.3). Valley Falls also had a decline in precipitation over the same period, going from 14.2 to 11.6 inches (Figure 1.3). Both Paisley and Valley Falls had similar reductions in precipitation amounting to ~3 inches over the 45-year period, or 20%.

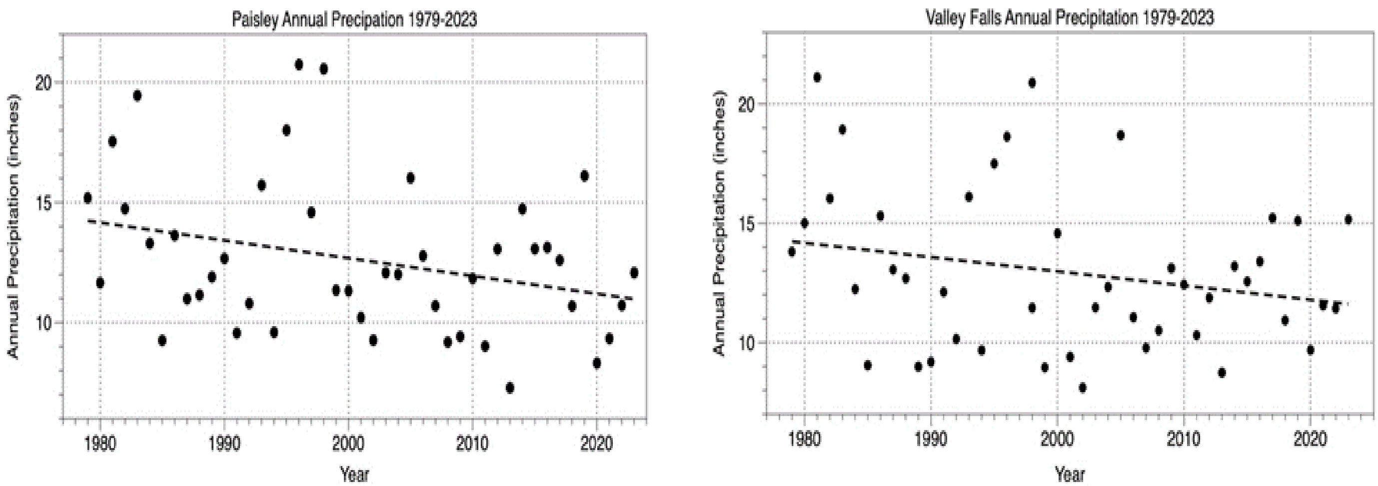
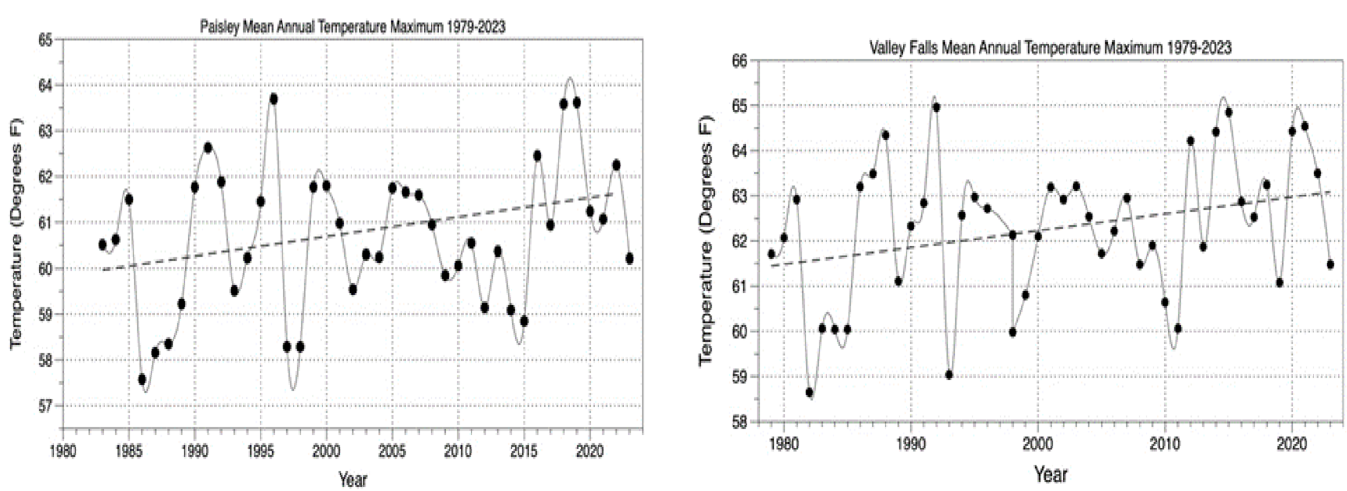


Figure 1.3. Scatterplot of precipitation at Paisley and Valley Falls, 1979-2023, and least-squares regression line. Date source: https://climatetoolbox.org. Figure source: Larson, unpublished.

1.4 Temperature Changes at Paisley, Valley Falls, and Lakeview

Temperature is an important hydro-climatological variable because higher temperatures increase the amount of moisture the air can hold by raising the vapor-pressure deficit, which results in greater evaporation. Maximum average air temperatures at Paisley and Valley Falls have increased slightly since 1979, with both Paisley and Valley Falls increasing ~1.5° F over that period (Figure 1.4). At Lakeview, about 20 miles south of the Chewaucan Basin, the average temperature rose by ~1° F between 1989 and 2023. Thus, temperatures are increasing.



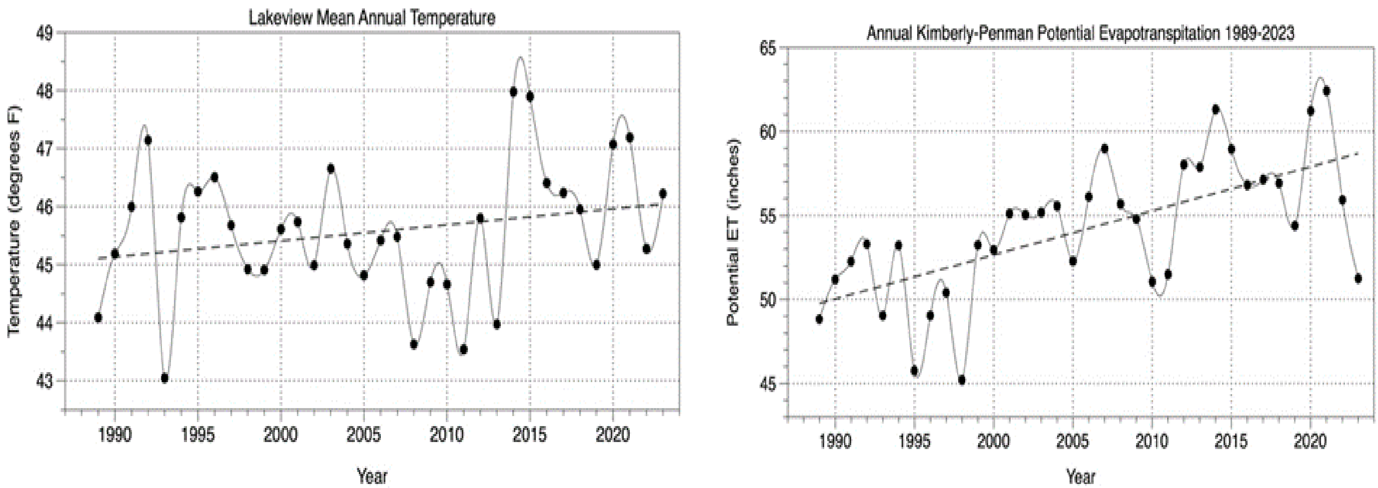


Figure 1.4. Scatterplot of climate data from Paisley, Valley Falls, and Lakeview. Top: average annual maximum temperature at Paisley and Valley Falls, and least-squares regression line. Data source: https://climatetoolbox.org.

Bottom left: Average annual maximum temperature at Lakeview. Bottom right: Average annual potential evaporation at Lakeview. Data source: USBR AgriMet, https://www.usbr.gov/pn/agrimet/webarcread.html. Figure source: Larson, unpublished.

1.5 Evapotranspiration (ET) at Upper Chewaucan Marsh, Lake Abert, and Lakeview

Changes in evaporation and evapotranspiration (ET), which includes water losses from plants, can have substantial effects on water resources, especially when they affect large areas such as the Upper and Lower Chewaucan Marshes and Lake Abert.

The [online application OpenET]() uses remotely-sensed and other data to estimate ET. It was used here to estimate ET data for the 2018-2023 period for which data are available. Upper and Lower Chewaucan Marshes are areas totaling ~30,000 acres of remnant marsh (classified as palustrine emergent wetland) and flood-irrigated grass hay. According to OpenET, annual ET in the upper marsh averaged 31 inches over 2018-2023, and varied from 29 to 38 inches depending on the area selected and the year (Figure 1.4). At the lower marsh, annual ET was about two-thirds of the upper marsh and varied from ~30 inches in 2018-2019 and 2023, to 20 inches in 2022, to only 6 inches in 2021.

At Lake Abert over the same period, annual ET was estimated by OpenET to have averaged 41 inches, and varied annually depending on the area and year, from 26 to 48 inches, with the lowest values coming from areas of the lake that were exposed during the 2021-2022 desiccation event. However, since the OpenET application estimates ET based on freshwater, and the presence of salt ions reduces ET (Phillips and VanDenburgh, 1971), thus the ET estimates must be adjusted downward to account for Lake Abert's salinity. In this case, the 41-inch value may be overestimated by as much as 10% and actually be closer to the 38-inch value of the upper marsh (Phillips and VanDenburgh, 1971).

At Lakeview, potential evaporation was measured over the 1989-2023 period at the US Bureau of Reclamation AgriMet station. Potential evaporation is the amount of evaporation that could occur when sufficient water is present. It rose ~8 inches, or ~15% over that period (Figure 1.4, above). This suggests that evaporation in the region is increasing.

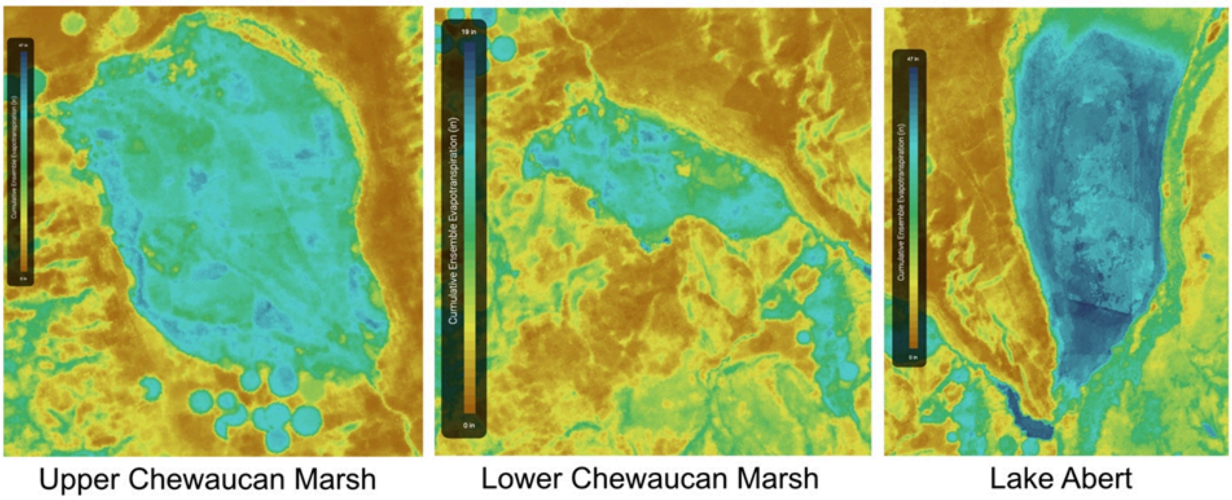


Figure 1.5. Graphic estimates of cumulative annual ET in 2023 at Upper and Lower Chewaucan Marshes and at Lake Abert from OpenET. The colored scale on the left side of each image varies from 0 inches (brown) to 47 inches (dark blue). The blue color in the lake shows that the ET was higher at the lake than in the marshes, which are mostly green and light blue, in 2023. Source: https://explore.etdata.org/.

1.6 Chewaucan Basin Streams

The Chewaucan Basin is a closed-basin river system coded as 171200 for "Oregon Closed Basins" in the USGS's hydrologic unit code (HUC) system. It has one major stream, the Chewaucan River that stretches for a total of 53 miles. At the Paisley gauge, located at 4,400 feet elevation and upstream of Paisley, the river drains ~275 square miles. As mentioned previously, the northern and eastern sides of the basin lack perennial streams. The same is true of the basin floor between Paisley and Valley Falls, which has three primary ephemeral streams: Moss, Willow and Crooked Creek, with the last being the largest. According to Peets and Friedrichsen (1999),the Upper Chewaucan Watershed Assessment (USDA Forest Service, Paisley), the Upper Chewaucan Watershed (HUC 17120006) consists of nine sub-watersheds draining 650 square miles. The drainage network comprises 621 miles of stream channels that culminates in the Chewaucan River. These streams are distributed among eight sub-watersheds: Bear Creek (42 miles); Coffeepot Creek (57 miles); Ben Young Creek (35 miles); Swamp Creek (19 miles); South Creek (110 miles); Dairy Creek (113 miles); Elder Creek (84 miles). Approximately 252 miles of these streams are perennial or continuously flowing. Intermittent streams that usually only flow immediately after a storm event account for 215 miles. Finally, ephemeral channels, which are similar to intermittent types but dry up more rapidly due to porous soils and a lack of connection to saturated water tables, account for the remaining 154 miles.

Lake Abert occupies one of nine major sub-basins within the Oregon Closed Basins hydrologic unit covering ~17,000 square-miles. Three ephemeral/intermittent streams – Coldwater, Juniper, and Poison– flow into the lake from Abert Rim, with Poison Creek being the largest (Figure 1.6). Numerous springs enter the lake, but most are quite small and appear as seeps (groundwater reaching the earth's surface) when the lake is low. The largest groundwater fed source for the lake is the Milepost 74 Spring complex (Figure 1.6). Larson et al. (2016) estimated the total of all local inflows into the lake was 15 TAF/y (TAF = one-thousand acre-feet), which is twice the 7 TAF/y value of Phillips and VanDenburgh (1971).The 15 TAF/y was partially based on a single flow measurement of the spring discharge near milepost 74, as described in the paper, but discharges from other springs and seeps around the lake were unmeasured.

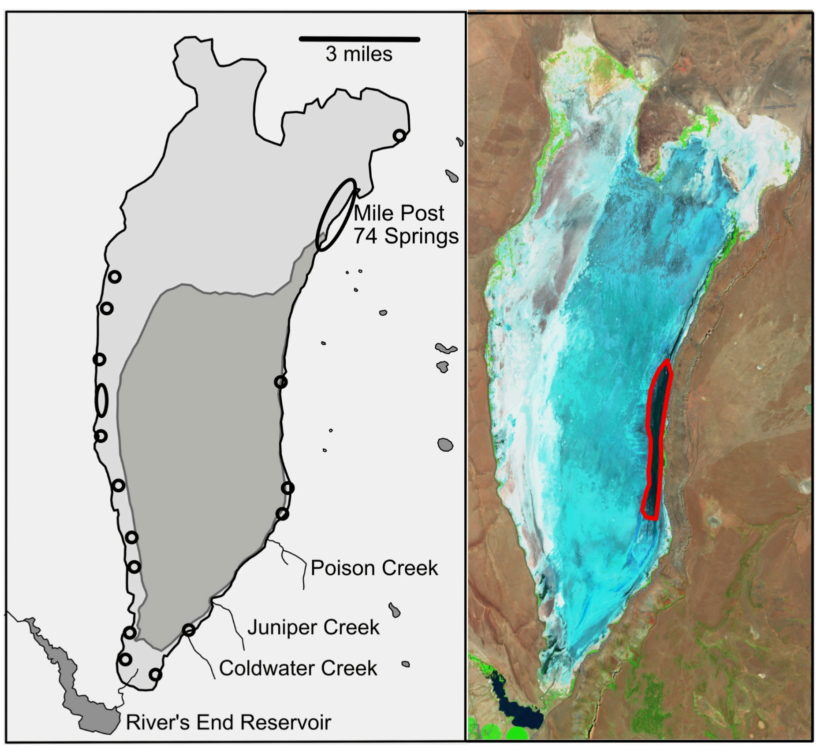


Figure 1.6. Map of Lake Abert showing locations of creeks and larger springs. Right: Satellite image of Lake Abert taken July 2022 showing the very shallow pool of water formed by the Milepost 74 Spring complex (outlined in red). The light blue area is damp mud that shows up as a result of absorption of the shortwave infrared band. Source: Larson unpublished.

1.7 Changes in Chewaucan River Discharges

Chewaucan River flows have been monitored continuously at the Oregon Water Resources Department (OWRD) gauge upstream from Paisley for over a century. From 1925 to 2023, annual flows have varied from 25 to 256 TAF, with a mean and median of 106 and 92 TAF, respectively. Flows were lowest during the Dust Bowl era of the 1920s and 1930s, especially between 1929 and 1934, which had a 5-year annual average of 49 TAF. More recently between 1979-2023, annual flows have averaged 107 TAF and have varied from 33 to 225 TAF. Based on the least-squared regression analysis, annual flows have declined over the 1979-2023 period, going from 121 to 93 TAF, a reduction of 28 TAF or 23% (Figure 1.7).

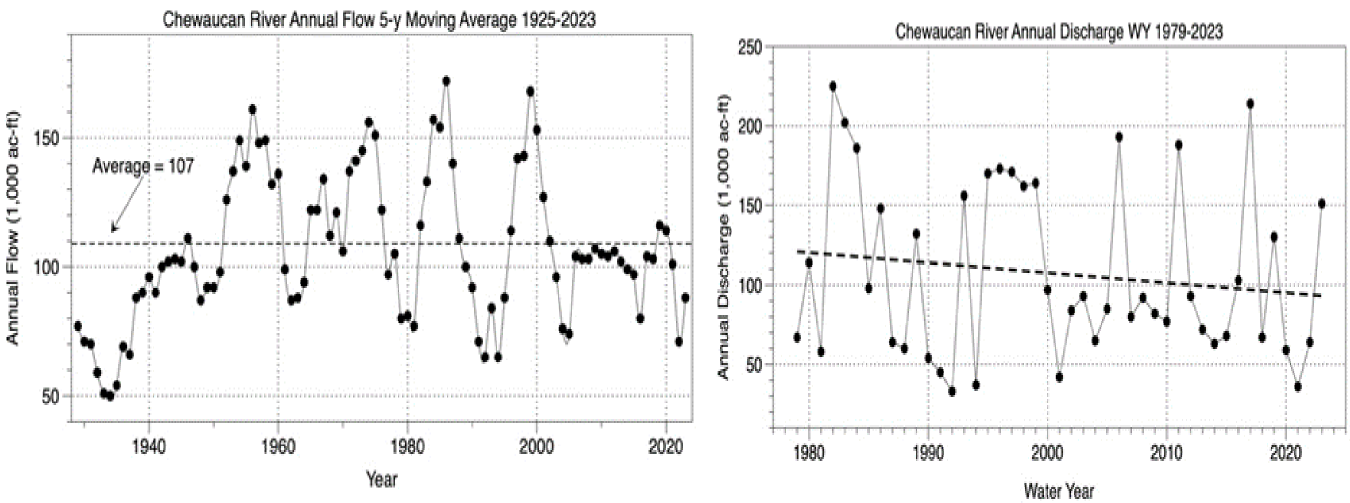


Figure 1.7. Scatterplot of Chewaucan River annual discharge. Left: Water years 1925-2023, 5-y moving average, with mean shown. Right: Water years 1979-2023, and least-squares regression line shown. Data from OWRD Chewaucan River gauge near Paisley https://apps.wrd.state.or.us/apps/sw/hydro_near_real_time/display_hydro_graph.aspx?station_nbr=10384000. Figure source: Larson, unpublished.

1.8 Using a Water Budget to Understand the Chewaucan Basin

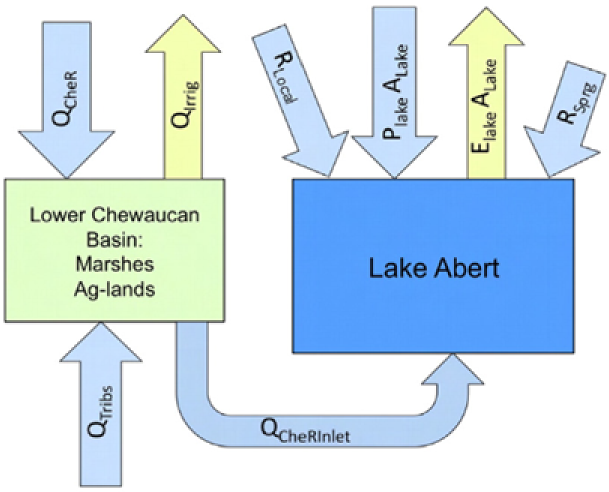


Figure 1.8. A diagrammatic water-balance model for Lake Abert. Source: Moore (2016). Q_{CheR} is the discharge of the river measured at the Paisley gauge. Q_{Tribs} is the discharge from the tributaries into the river below Paisley. Q_{Irrig} is the amount of river water diverted for irrigation. $Q_{CheRinlet}$ is the amount of river flow that reaches the lake. R_{Local} is local runoff into the lake. $P_{Lake}A_{Lake}$ is the amount of precipitation that falls on the lake times the lake area. $E_{Lake}A_{Lake}$ is the amount of evaporation from the lake times the lake area. And, R_{Spring} is the volume of water flowing into the lake from nearby springs. Thus, for steady state, $E_{Lake} * A_{Lake} = P_{Lake} * A_{Lake} + R_{Sprg} + R_{Local} + (Q_{CheR} + Q_{Tribs} - Q_{Irrig})$.

Moore (2016) used a water-balance model for the lake to show how water diversions from the river affect the lake and to develop a water-quantity goal for the lake (Figure 1.8). A water budget is an accounting method to show how the balance between all sources of inflows to the lake: river, precipitation, and local springs and creeks, and water loss as a result of evaporation, determines the amount of water in the lake. Figure 1.8 shows this as a graphic. See Appendix B for relevant model inputs. A water-budget model populated with real data may prove useful to assess different management options.[2]

1.9 Water Diversions from the Chewaucan River between Paisley and Lake Abert

The amount of water actually diverted from the river for agriculture in the Chewaucan Basin is not reported; however, water rights records show the amount allocated to water users through permits. According to Moore (2016), there are 255 permitted surface-water diversion points on the river and its tributaries upstream of Lake Abert, with 153 from the main stem of the river. Water rights for mostly agricultural use were first established in the basin in the 1870s and grew substantially through the turn of the 20th century. LaMarche and Thomas (2023) stated that based on the OWRD WRIS database, surface rights to the Chewaucan River exceeds 119 TAF,

[2] See Appendix A

which is in excess of both the mean and median annual flows, which to date are 106 and 92 TAF, respectively. OWRD still considers the Chewaucan Basin open to new appropriations of water during most months of the year (see: Water Availability Analysis (state.or.us). However, there currently are no instream water rights protecting instream flows below Paisley, and no water rights for Lake Abert. This means that new irrigation water rights could still be issued even though instream flows and the lake have no legal protections.

As of 1971, Phillips and VanDenburgh using a water budget, estimated that the annual net diversion of surface water in the basin equaled 48 TAF, based on an estimated total of 41,000 irrigated acres as of 1963. Since 1963, an additional 2,500 acres have been irrigated using surface water, and groundwater is permitted to irrigate ~9,500 acres, whereas in 1963, groundwater use was negligible. Actual groundwater irrigation usage is closer to 3,500 acres (pers. comm., J. Ferrell), and a portion of those 9,500 permitted acres are non-cancelled. In 2016, Moore, using a water budget analysis, estimated that median annual net diversion of water from the river for irrigation equaled 88 TAF. LaMarche and Thomas (2023), using OpenET data, calculated that annual consumptive use to meet ET needs, from 2016 to 2021, varied from 55 to 87 TAF (Figure 1.9), with the higher value being similar to Moore's median estimate.

It should be noted that water budgets and OpenET measure different quantities and include many assumptions. Water budgets measure the amount of water lost between two measurement points, whereas OpenET estimates how much water is used by plants for ET and does not include water that is lost before reaching the plants as a result of evaporation and seepage losses from canals, or that seeps into the groundwater at the field, or that evaporates from water that accumulates in low areas, so the estimates should be different. At this time, the exact amount of water diverted for agriculture is unknown because there is only one measurement point and diversions are not reported. OpenET consumptive use estimates, combined with an improved water model that better estimates evaporative water losses, likely provides the closest approximations available at this time until such time that an additional flow-measurement gauge is located near the lake.[3]

[3] See Appendix A

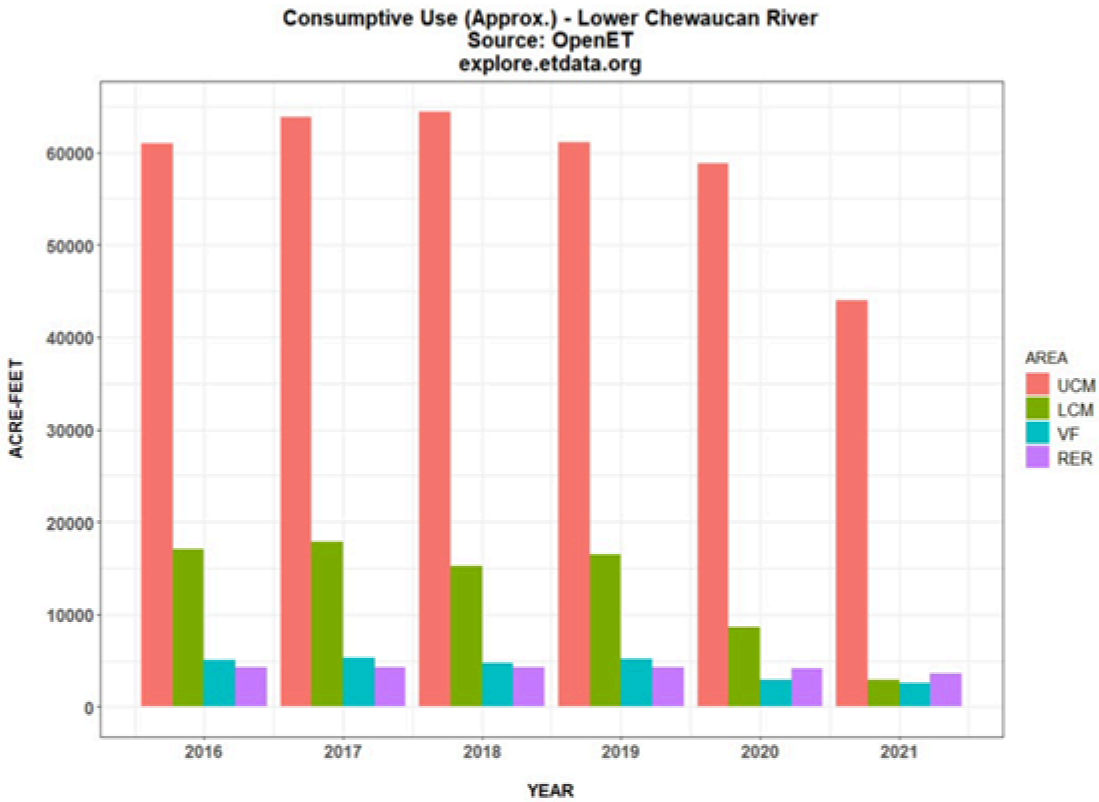


Figure 1.9. Bar graph showing estimated consumptive use for the four areas of the lower Chewaucan River, Upper (UCM) and Lower Chewaucan Marsh (LCM), Valley Falls area (VF), and Rivers End Reservoir (plus irrigated lands, RER), between 2016-2020, based on OpenET. Source: LaMarche and Thomas (2023).

1.10 Groundwater Resources

There has not been a comprehensive assessment of groundwater resources in the Chewaucan Basin but groundwater rights exist within the lower Chewaucan River drainage area. The most recent appraisal of groundwater resources in the Chewaucan Basin was a brief account by Grondin (2022) attached as an appendix to LaMarche and Thomas (2023), from which most of this information is taken. Paper groundwater rights have increased since the 1960s, which amount to ~9,500 acres. (LaMarche and Thomas 2023, Figure 1.10.1). Actual groundwater use is closer to 3,500 acres (pers. comm., J. Ferrell). LaMarche and Thomas (2023) stated that up to ~15 TAF of groundwater could be annually used in a dry year when supplemental rights apply, but would decline to ~7 TAF in a wet year when primary rights apply.

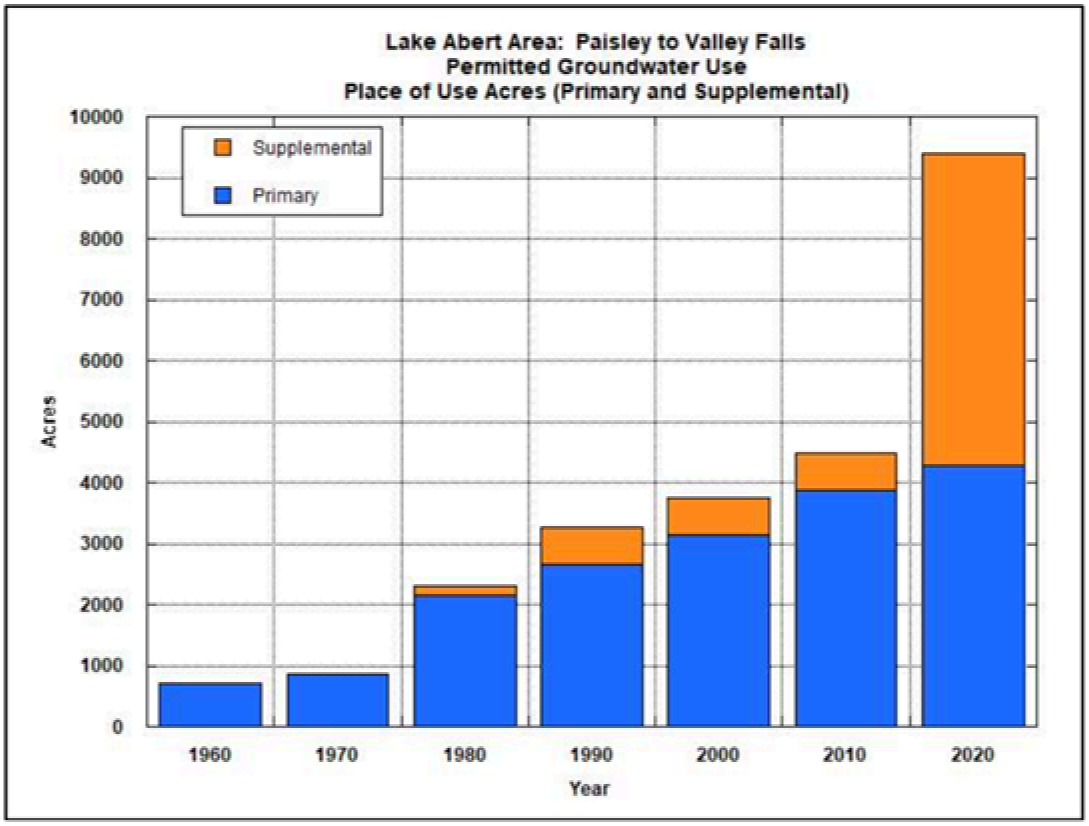


Figure 1.10.1. Bar graph of total groundwater use acreage permitted for irrigation at the start of each decade. Source: Grondin in LaMarche and Thomas (2023).

Groundwater monitoring shows that water levels are declining within the basin, with persistent declines of about 0.5 ft / year since the 1970s occurring in the Paisley and The Narrows areas where there are concentrations of wells in LaMarche and Thomas (2023). At one observation well (LAKE1633), water levels have declined by ~20 feet (Figure 1.10.2). These observations led Grondin to conclude that "Groundwater appropriation is likely contributing to reduced surface water flow in the Chewaucan watershed because of a general hydraulic connection between groundwater and surface water." LaMarche and Thomas (2023) went even further and stated "…since Lake Abert is the hydrologic sink for the basin, groundwater development likely influences the amount of water ultimately reaching the lake…" Despite these declines, OWRD would still be legally obligated to approve new groundwater wells in this aquifer. Based on this research from LaMarche and Thomas, there is reason to believe that additional wells would further exacerbate the drying of Lake Abert. Yet, more wells legally can be drilled at any point.

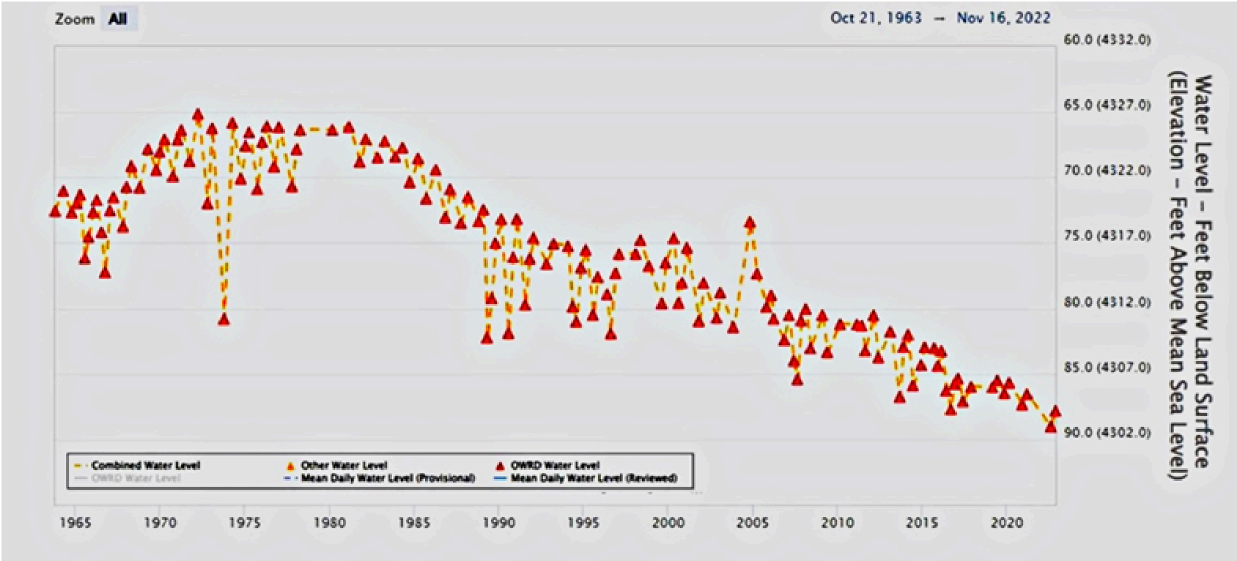


Figure 1.10.2. Plot of groundwater elevations at OWRD observation well LAKE1633 in the Chewaucan Basin, 1963 to 2022. Source: LaMarche and Thomas 2023.

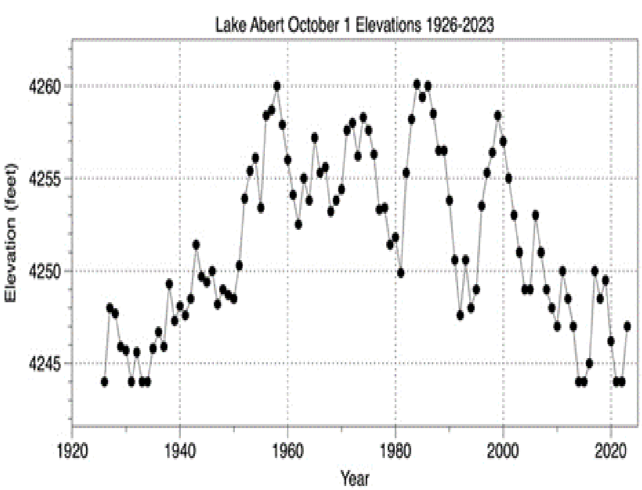
To improve water resource management in the basin, Grondin recommended that the Chewaucan sub-basin rule (OAR 690-513-0050) be amended to include: additional groundwater level measurements; flow meters on wells; surface-water diversion measurement, recording, and reporting at surface water point-of-delivery sites; construction of three observation well pairs; and establishment of three Chewaucan River stage sites, one each at Paisley, The Narrows, and one at River's End Ranch reservoir outlet (LaMarche & Thomas, 2023).[4]

[4] See Appendix A

1.11 Changes in Lake Abert Surface Area

Figure 1.11.A. Lake Abert looking north from near Coldwater Creek, September 2012. Credit: Ron Larson.

Lake Abert has been monitored for some time. Historical elevation data for the lake dating back to the 19th Century were presented in Phillips and VanDenburgh (1971), and Keister (1991), and more recently by Larson et al. (2016) and Moore (2016). Elevations were very low during the Dust Bowl era of the 1920 and 30s and the lake was thought to have desiccated for a total of 4-5 non-consecutive years during that period (Figure 1.11.2). This corresponds to the very low flows in the river during that period, as mentioned above. More recently, the lake was mostly desiccated during 2014-2015 and was even lower in 2021-2022, having the lowest elevations in nearly 80 years, also corresponding to the low river flows during that time In 2014, low water levels in the lake increased salinities sharply, perhaps reaching as high as 25%. Previous to 2023, elevations were monitored irregularly at a staff gauge, so satellite images, made since the early 1970s, have been used to monitor more recent changes in surface area. Since 1979, there has been a substantial decline in surface area (Figure 1.11.2). Based on the least-squares regression analysis of surface area over the 1979-2023 period, the lake has declined from 69 to 27 square-miles, totalling 42 square-miles over 44 years, for a 60% decrease.



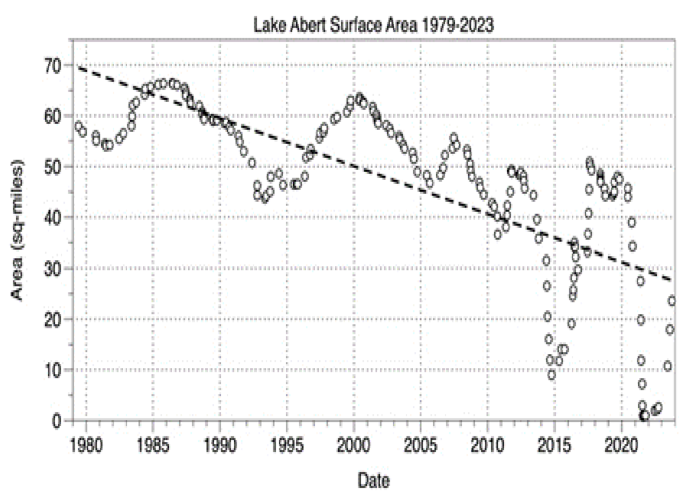


Figure 1.11.2 Scatterplot of changes in Lake Abert over time. Left: Plot of October 1 elevations, 1926-2023. Data from Phillips and VanDenburgh (1971), Keister (1991), Larson et al (2016), and Larson unpublished. Right: Plot of surface area, 1979-2023, based on 5-year moving average, from measurements of area using Landsat and Sentinel-2 satellite images, and least-squares regression line. Data source: https://apps.sentinel-hub.com/. Figure source: Larson, unpublished.

1.12 Lake Abert Ecosystem and Its Water Needs.

Recent monitoring in the lake, especially of the desiccation events in 2014-2015 and 2021-2022, show that when the lake goes dry, it is unable to support the large numbers of migratory waterbirds that rely upon it. Additionally, when enough river water doesn't reach the lake, the lake is less ecologically productive. Productivity of the lake ecosystem, at all levels from plants to animals, is reduced when the salinity increases above ~10% because energy is used to maintain internal salt balance and that leads to reduced growth, reproduction, and even survival when its too high (Herbst 1988, 1994; Herbst and Bradley 2004; Herbst and Castenholz 1994). This loss of productivity continues to adversely impact the overall Lake Abert ecosystem, including affecting the migratory waterbirds that utilize the lake. There could be a tipping point where the lake's ecosystem is fundamentally altered, and the loss of productivity will impact bird populations. Quantifying exactly where the tipping point is located is difficult because those studying Lake Abert are still learning about the ecosystem and how the species, especially the birds, would respond to future climatic conditions. Lake Abert is one of many saline lakes throughout the American west.

These saline and alkaline systems create a network of productive ecosystems that millions of birds rely on during migration (Wilsey et al. 2017). Ensuring redundancy in this network, means ensuring each lake's water requirements are met in order to support the productivity on which crucial migratory connectivity throughout the Pacific Flyway is based (Taylor and Norris 2010). With increasing threats from climate change and water diversions, maintaining the ecological integrity of these lakes is more important than ever (Wilsey et al. 2017; Wurtsbaugh et al. 2017). [HE1] Nevertheless, ongoing research and collaborative science are continually enhancing our understanding of the environmental conditions that affect the algae and invertebrates that form the base of the lake's food web, upon which the birds depend. This growing body of knowledge can help inform a shared understanding of Lake Abert's water needs.

1.13 Seasonal Hydrology of Lake Abert and its Effects on the Ecosystem.

Quantifying how much additional water the lake will need to support its ecosystem requires an understanding of how seasonal hydrology, and resultant changes in salinity, affects the key species: algae, flies, shrimp, and birds. Historically the natural hydrograph of the lake was driven by high river flows in spring that increased water levels in the lake, and also lowered the salinity, and evapotranspiration (ET) that lowered water levels during the rest of the year. Under existing conditions, which are affected by upstream diversions, the lake reaches its highest elevation in May or June when the accumulated river inflows are greatest (Figure 1.13). The lake level then declines as inflows from the Chewaucan River lessen and ET increases (Figure 1.13).

Precipitation on the lake in winter and spring and local inflows from ephemeral streams and springs, all contribute some water to the lake, but in total they are a minor source of water compared to the inflows from the river (Phillips and VanDenburgh 1971). Phillips and VanDenburgh estimated that over the 1913-1963 period, average annual inflow to the lake from the river was 48 TAF and that local inflows averaged 7 TAF. In some years when river flows are low, very little inflow reaches the lake, or, as was the case in 2021, no water reached the lake. Evapotranspiration happens year-around, but is highest in mid-summer as a result of increasing temperatures, which have a significant effect on ET rates (Figure 1.13).

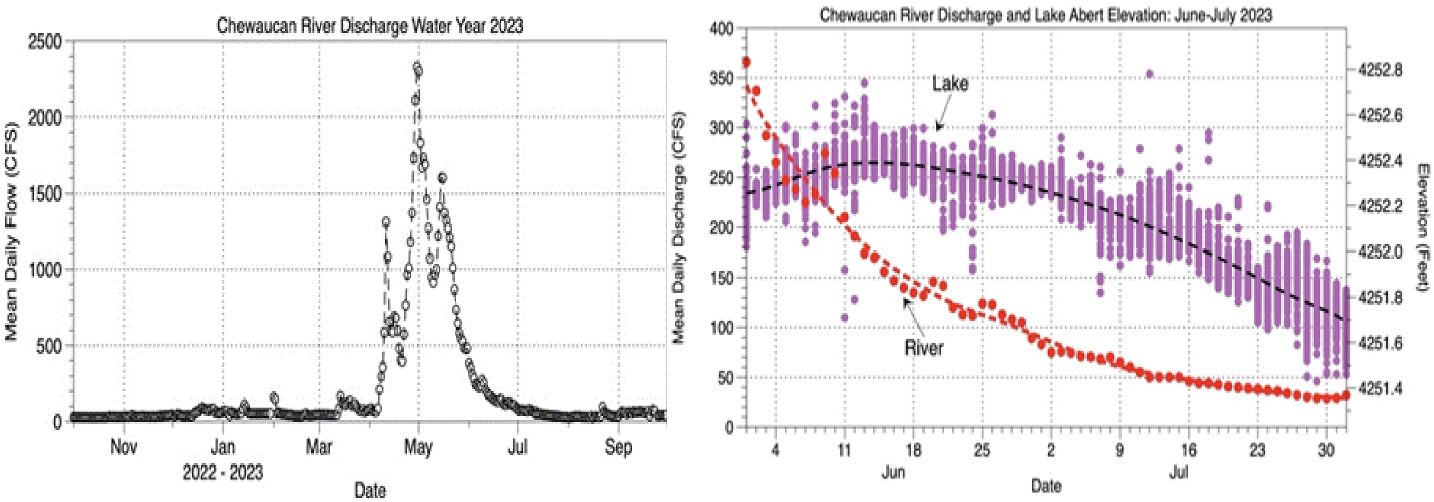


Figure 1.13. Top left: Chewaucan River discharge water year 2023, measured at the OWRD Paisley gauge. Top right: Chewaucan River discharge and Lake Abert elevation June-July 2023, measured with the newly installed USGS surface level gauge. The purple dots represent the lake elevation measurements and the line through them is the best fit line as determined by the LOESS statistic, which is a locally-weighted scatter-plot smoothing technique. The red dots are the flow measurements and the red line was determined by LOESS. Sources:https://apps.wrd.state.or.us/apps/sw/hydro_near_real_time/display_hydro_graph.aspx?station_nbr=10384000 and

1.14 Effect of Salinity on the Lake Abert Ecosystem.

Even though the biota of Lake Abert is adapted to living in a saline environment, salinity has a major influence on every species, and thus it's important to understand its effects. Rising lake levels in the spring reduce the lake's salinity, providing optimal conditions for brine shrimp to hatch and for algae to grow. It also helps flies by providing algae for them to eat as well as creating suitable habitat. If lake level and salinity are adequate by July, when most of the birds start to arrive, they will have adequate shrimp and flies to eat. August and September are also key months because there are still many birds present at the lake feeding in preparation for migration. As the summer progresses and salinities rise as a result of lower water levels, it can reduce the growth of the shrimp and flies and consequently there might not be enough for the birds to eat at a key time. Conversely, if the lake level gets quite high, plant nutrients are diluted and that could reduce algae productivity and consequently there could be less food for brine shrimp and flies. However, under current conditions high water levels have been rare, especially after the year 2000 when water levels have been declining (Figure 1.13, above), and thus that concern is minor compared to the threat posed by low lake levels and high salinity.

Ctenocladus, a type of green algae, is apparently the major primary producer in the lake and is eaten directly by some invertebrates or supports bacteria as it decomposes and that supports other invertebrates. Alkali flies (*Ephydra hians*), and brine shrimp (*Artemia franciscana*), are the two primary invertebrates in the lake and are also essential food for waterbird populations. Information on salinity requirements for alkali flies, *Ctenocladus* algae, and brine shrimp are found in Herbst (1994); Herbst and Castenholtz (1994); Herbst and Bradley (2004); and Gajardo and Beardmore (2012). These species occur at salinities of approximately 2.5-10%, or greater, and at Lake Abert at elevations above 4248 feet. But according to Herbst (1994), optimal conditions occur between 4250-4258 feet (Green section, Figure 1.14.1). This range provides optimal salinities as well as sufficient rocky substrate for flies to attach their pupae to nearshore rocks, and also supports *Ctenocladus* algae and brine shrimp.

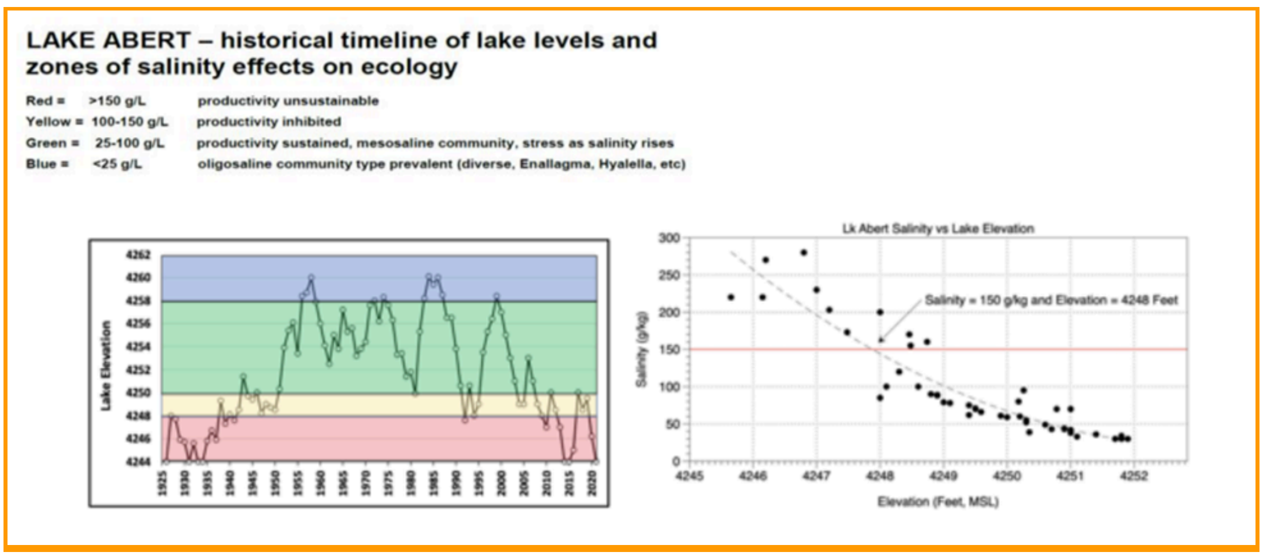


Figure 1.14.1. Left: Lake Abert elevations 1925-2022 with colored zones showing the effects of salinity on productivity. Diagram source: David Herbst. Right: Relationship between Lake Abert elevation and salinity. The 15% salinity maximum for productivity is shown as a red line. Lake elevation and salinity data from Phillips and VanDenburgh (1971), and Herbst, Kreuz, and Larson pers. com. Figure source: Larson and Wood (2022).

As shown in Figure 1.14.1, the lake was historically in the yellow and red salinity zones for extensive time periods, such as the 25-year period prior to 1950, and more recently in the early 1990s, and again starting about 2005, and continuing until today. But the lake was also in the green zone for a long period from 1950 to near 2005. Prior to 1986, nothing was written down about the ecology of the lake, so conditions can only be inferred. In 1986, K. Boula reported the lake supported a diversity of waterbirds and based on the high lake levels then, the lake was likely relatively productive.

More recently, Senner et al. (2018) examined the relationship between Lake Abert water levels, brine shrimp, and waterbird abundances over an extended period. They found that as the area of the lake decreased [and thus both the elevation and volume also decreased], and salinity increased, both invertebrate and waterbird numbers declined, with especially high salinities associated with fewer invertebrates and waterbirds being present. Conversely, they found that at high lake levels and lower salinities, the abundance of brine shrimp and waterbirds usually either plateaued or declined. Additionally, in agreement with Herbst and Senner et al., Larson and Wood (2022) found that alkali flies and birds were mostly present in higher abundances when the lake was higher and conversely were less abundant when the lake was lower and more saline. Thus, when the lake was mostly dry in 2014-2015 and 2021-2022, the abundance of waterbirds was much less than when the lake was higher (Figure 1.14.2). This relationship was most pronounced for Eared Grebes which were nearly totally absent from the lake when it was desiccated in 2014-2015 and in 2021-2022 (Figure 1.14.2), but other species were also impacted, such as phalaropes. However, some species were less affected, including avocets and willets.

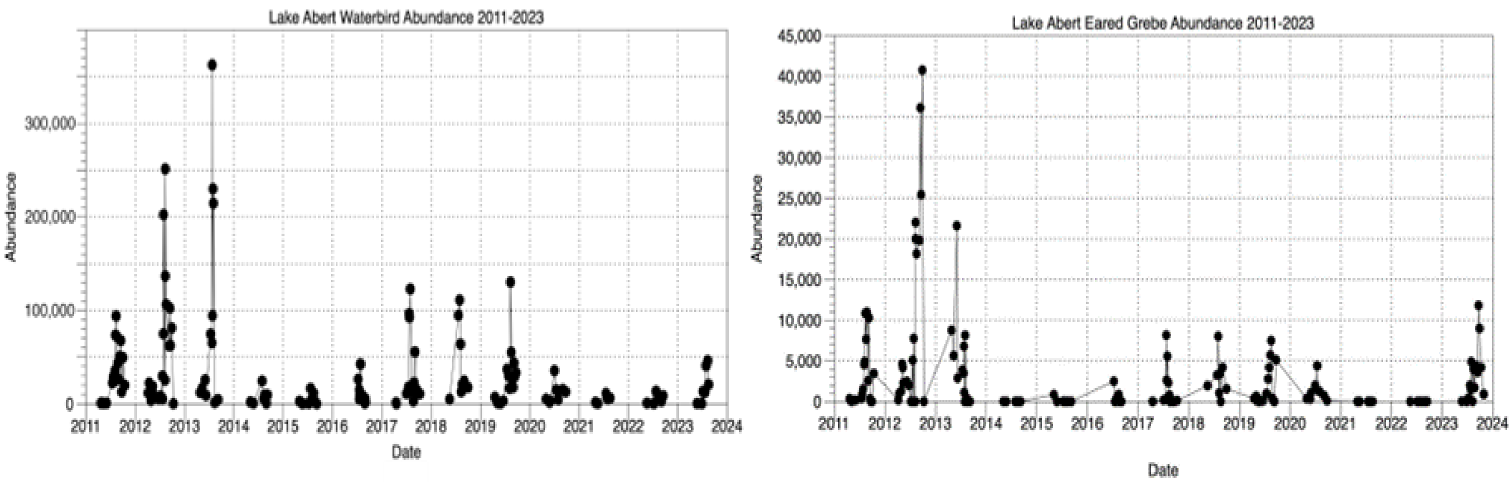


Figure 1.14.2. Left: Lake Abert waterbird abundance 2011-2023. Right: Eared Grebe abundance at Lake Abert 2011-2023. Figure sources: Larson, unpublished. Data from: John Rueland, East Cascade Audubon Society and Haley Tobiason, Oregon Natural Desert Association.

While there appears to be a well-documented relationship between Lake Abert water levels and the abundances of invertebrates and birds, it is less clear what happens to these species when the lake is desiccated for long periods or more frequently, and especially if there is a tipping point where the ecosystem is unable to recover. As mentioned above, prior to 1950, the lake was likely in a low productive state based on the relatively high elevations, but it was nearly three decades later before the first ecological observations were made, so it's unknown how long it took for the ecosystem to recover. Based on more recent data, there is evidence of some ecological recovery following the near-complete desiccation of the lake in 2014-2015 and in 2021-2022 (Figure 1.14.3). While this is positive news indicating the Lake Abert ecosystem is resilient and recovers from desiccation events, it should not be concluded that the system will always quickly recover from similar or more extreme events in the future, because the processes involved are likely complex and the documentation of the effects and recovery from these events has just begun.

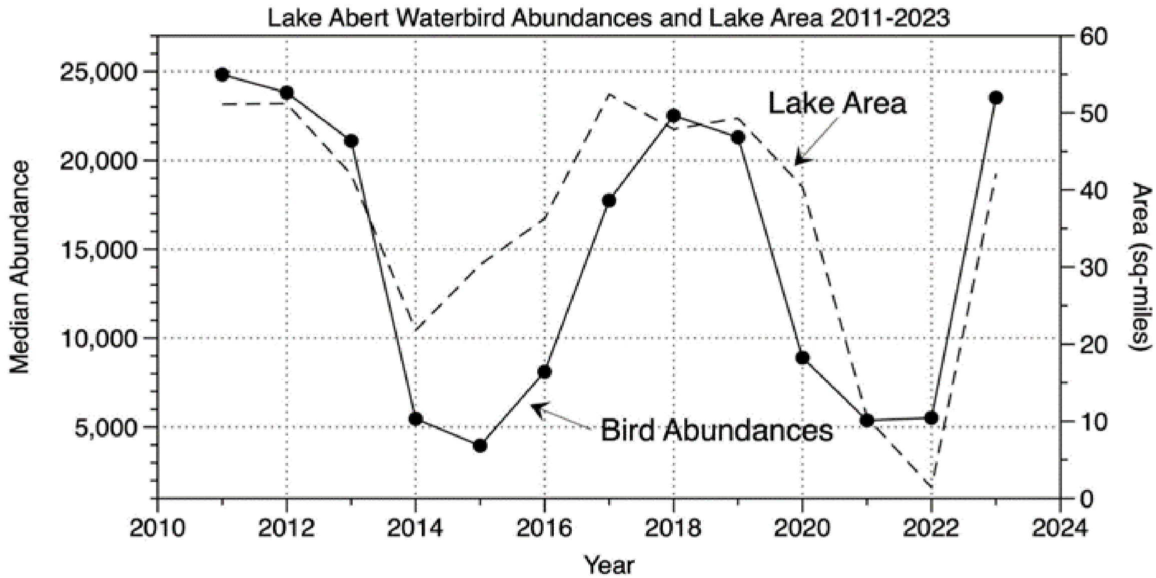


Figure 1.14.3. Plot of median annual waterbird abundances and maximum annual lake surface area measured from satellite images, 2011-2023. Bird data: John Rueland, East Cascade Audubon Society and Haley Hobiason, Oregon Natural Desert Association. Satellite area measurements from Sentinel Hub (https://apps.sentinel-hub.com). Figure source: Larson unpublished.

Based on the above information, there is reason to believe that if the lake is in the green zone of 4250-4258 feet, the ecosystem will likely be productive and will support the birds and other species that depend on it. However, based on events in the past decade and likely future conditions, there will be droughts and those events will desiccate the lake resulting in lost productivity and the presence of fewer birds. If the future will be somewhat like the recent past, the lake may need additional water to ensure the lake ecosystem is productive and supports its biota, especially birds. The solution to that will be ultimately determined by at least these four factors: 1) the amount of river flow above Paisley; 2), the amount of precipitation and local inflows (groundwater and surface water) that flow into the lake; 3) amount of water that is evaporated from the lake; but especially 4) how much river water is diverted between Paisley and the lake (that is the only quantity that can be managed).

1.15 The Record of Decision for Lake Abert Area of Critical Environmental Concern

Moore (2016) brings another dimension to how much water is needed, and when, in Lake Abert to maintain the right timing of lake levels to a) maintain the desired salinity, and b) activate invertebrate food webs at the lake. The Bureau of Land Management's Record of Decision for the Lake Abert Area of Critical Environmental Concern (1995) provides guidance around water quantity and desired salinity that may be helpful. The following management objective is stated on page 16:

> *"Authorize no future discretionary human action which will increase the number of years by more than 5%, when compared to the 1926-1994 baseline, that the average total*

dissolved solid concentration in Lake Abert exceeds l00 grams per liter (g/1) or reduces the level of the lake below 4,251 feet in elevation."

II. Agricultural Practices

(Lead: Jack O' Leary, supported by Hannah Steele)

To reach a holistic understanding of the Chewaucan Basin, the current and historical impacts of agricultural activities must be considered. In this section, several key areas have been established to help address questions related to agricultural practices taking place in the basin. These key areas include:

- The most current information on both surface water and groundwater irrigation usage;
- Typical agricultural yields and the impacts of variable climate on those yields;
- Information regarding historical marshes and their development into agricultural lands;
- A timeline of agricultural activities and their relation to wildlife, and rangeland animals; and,
- The importance of wet meadows for providing habitat and ecosystem services to migratory and native species.

2.1 Current Agricultural Practices

Current practices in the Chewaucan Basin are dominated by ranching and growing hay for feed. Approximately 10% of the basin area is dedicated to hay/grass/pasture production, while ~50% is classified as rangeland/scrub (Wigal et al., 2022). This 10% is equivalent to 41,000 acres of irrigated land centered around the lower Chewaucan River and the surrounding marshes (Lamarche & Thomas, 2023). While multiple forms of irrigation are practiced throughout the basin, flood irrigation is the most widely used strategy and accounts for ~30,000 acres of all irrigated lands in the basin, while groundwater irrigation accounts for 9,500 acres (Lamarche & Thomas, 2023). Flood irrigation in the upper and lower marshes of the basin involves the diversion of water from the Chewaucan River through 4 to 5 main ditches (see Figure 2.1). This water is further partitioned by using a network of gates to flood or drain different fields depending on the stage of vegetation growth, weather, and other factors. Using the natural gradation of the land, diverted water will be used to flood the highest elevation field before the water is allowed to move to the next (slightly lower elevation) field. Eventually, excess water will be returned to the Chewaucan River. Diverted water is never more than about three miles from the main stem of the river. Since the early 1900s, the acreage of irrigated lands has remained fairly stable, with an estimated increase of about 2,500 acres of irrigated land (using surface water) since the last comprehensive USGS study in 1972 (Lamarche & Thomas, 2023).

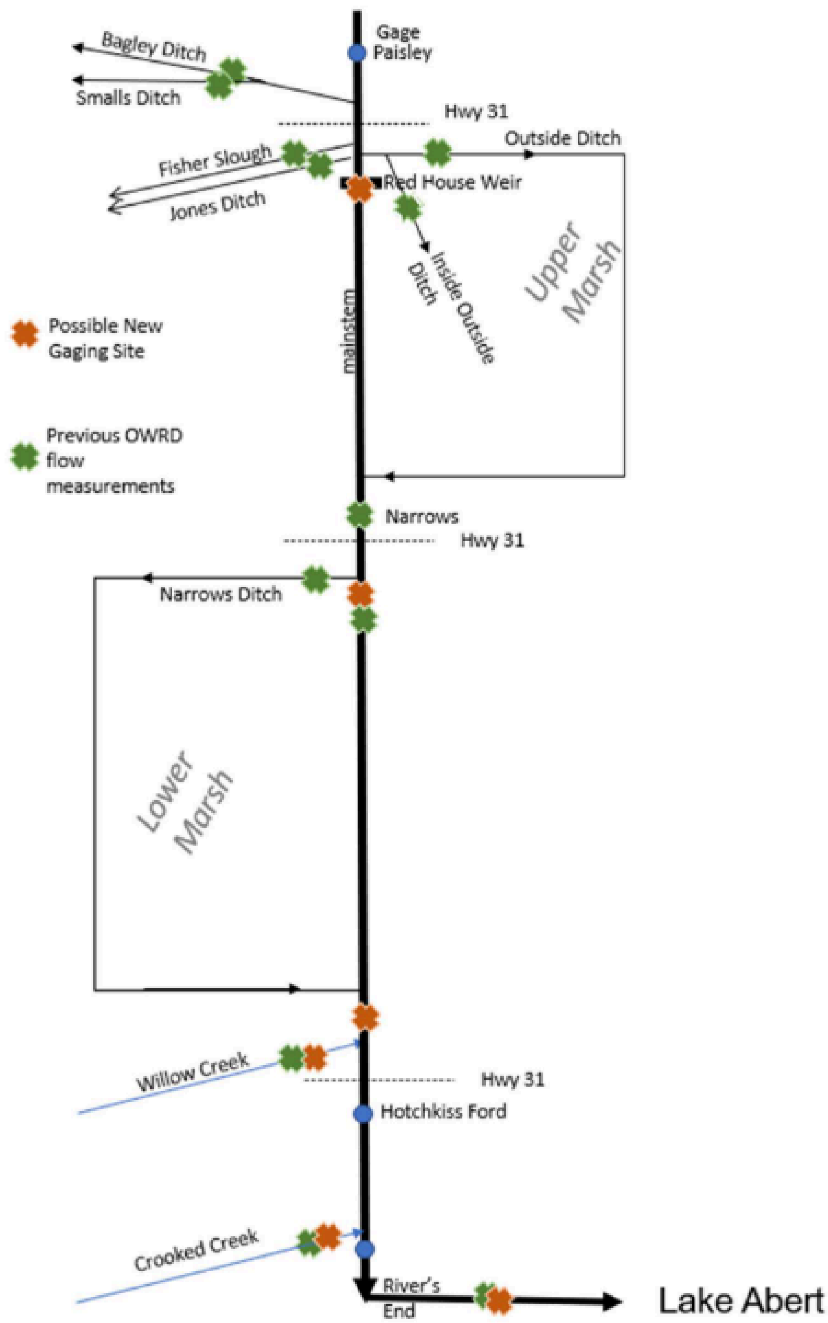
Decisions about timing and amount of water being released into the main ditches from the river are typically managed by a retired ranch manager in Paisley, whose experience, knowledge and connections to local landowners allows them to serve as a fair and impartial advisor on water allocation. There is no irrigation district. Landowners collaborate about when and how to manage water to ensure that downstream producers have access to water when needed for their own fields. There is also a Regional Watermaster assigned to the basin by OWRD who enforces water rights and ensures landowners stay within their allocated rights.

The flood irrigation practiced throughout the Chewaucan Basin takes place on private lands, with producers making decisions based primarily on their lived experiences (See *Characteristics of Wet Meadow Environments* Section). The main consideration for hay and pastureland is soil moisture, ensuring that seeds have enough water to grow but are not oversaturated or flooded out. Gauging to track water usage is not widely practiced because it does not help landowners evaluate the many different conditions they take into account when managing irrigation (temperature, precipitation patterns, soil moisture, etc.). In addition, gauging is often difficult due to the low landscape gradient and vegetation interference within the marshes when attempted in the past. It is estimated that agricultural diversion accounts for 48% of the outflows in the lower Chewaucan Basin (Phillips & Van Denburgh, 1971).

As early as January periods of warmer temperatures result in increased flows in the Chewaucan River. During this early period water is diverted at weirs into distribution canals in the north and east portions of Upper Marsh. When river flow increases during early spring (April), diversion increases dramatically and irrigation of western portions of the marsh begins. Water depth rarely exceeds one to two feet except at lower elevations within fields or against dikes and levees. Water depth also increases along roads, behind low elevation dikes that spread water, along canal banks and in depressions and sumps. Run-off is collected in canals and ditches and delivered to other downslope fields or back into the river. Topography is varied and irregular across many fields and locations.

In most years about 13-14,000 acres (2-3,000 acres on historic family ranches and 11,000 acres on ZX Ranch) are cut for hay in the Upper Marsh. Drying of fields starts in mid to late June. Mowing begins early in July and is completed by the end of July on the family ranch lands, but continues through mid-September on the ZX Ranch. Hay is either baled and removed and fed to cattle in the fields during winter or baled and left on the fields for the winter. The processes of hay cutting, baling, and removal result in seed shatter of grass, forbs, sedges, and rushes. Following baled hay removal, flood irrigation resumes in April. The extent of that flooding depends on water availability. The other option for hay production is to bale the hay and leave it on the fields, this is done on roughly 7,000 acres in the Upper Marsh. This "bale-bunch" haying system is completed by the end of September in most years. Cattle are moved on to the bale-bunch fields during winter and are rotated from field to field as forage is utilized. This method also results in seed shatter and the remnants of the hay provide habitat for invertebrates and wildlife the following spring. During typical years, very little hay is cut in Lower Marsh and is used as grazing land instead. This management results in large fields with greatly reduced decadent or residual vegetation and diverse habitat features as a result of remnant features such as sumps and sloughs.

Seeds, invertebrates, and new green growth sustain a wide variety of waterbirds. In late winter and early spring, these fields absorb solar radiation, warming soils and stimulating vegetative growth and invertebrate activity. Hay is removed from fields and fed back to cattle and grazing in bale-bunch fields, which further scatters seeds. The aftermath of vegetation left on the ground sustains a wide variety of invertebrates. Manure and urine provide additional fertilization that is beneficial to invertebrate and vegetation growth. Small areas along fences, ditches, and canals, around water control structures, field corners, and damp or wet areas are not mowed and provide hiding and nesting cover for many breeding species. Larger sumps that are poorly drained sometimes hold deeper water resulting in tall emergent vegetation (bulrush and cattails) found in semi-permanent wetlands and host a variety of overwater nesting waterbird species. There are also acres where there are water bodies like the river, canals, sumps, and other semi-permanent wetlands that cannot be effectively hayed or grazed. Other areas are not grazed because they are inaccessible by the large machinery required for haying (narrow crossings, ditch banks, other geographic impediments). There are a multitude of other reasons an area may not be hayed. This leaves a large amount of land that provides habitat to wildlife year-round, even during harvest and grazing.[5]



[5] See Appendix A

Figure 2.1. A schematic of major diversions on the Chewaucan River as well as recent OWRD monitoring activities and potential gauging locations that would help improve water budget calculations (Lamarche & Thomas, 2023).

2.2 Agricultural Yields

Climate has a direct impact on agricultural yields within the Chewaucan Basin. A PLACe member provided the example that hay yields on the Chewaucan Marshes in recent dry years (2021, 2022) were between 50% and 65% of yields in a wet year like 2023. This can have a major financial impact on producers. While hay from the marshes is very rarely, if ever sold for feed outside the Chewaucan, some producers own pivots that allow the use of groundwater to produce hay surplus to minimize the economic impact of dry years. However, a dry year often means that producers must keep all the hay they produce instead of selling the excess, and they potentially must sell cattle to make up for any financial losses and/or reduced feed availability.

During the winter months cows are typically brought to the marshes to graze. When cows are in the valley and hay production is stopped, producers have separate stock water rights that allow them to pump from the Chewaucan River. Some producers water their herds from the irrigation ditches, but this is not preferred by producers due to water quality impacts and environmental degradation.

2.3 Groundwater

Center pivot irrigation is found in the lower basin primarily near Valley Falls. These center pivots rely on groundwater and are often used by producers to supplement their hay production in the marshes or to earn additional income. Historically groundwater has not been heavily utilized throughout the Chewaucan (Philips and Van Denburgh, 1971). However, since 1955 primary and supplemental groundwater rights have increased from 0 acres to approximately 9,500 acres, with supplemental rights increasing significantly between 2010 and 2020. 4,500 acres have been certified for the ZX Ranch on the east side of the marsh, with a priority date of 2013. The 9,500 total groundwater rights (if fully utilized) range from 4% (6,700 ac-ft) during wet years when only primary rights are used, to 10% (15,200 ac-ft) of the total water budget during dry years (Figure 2.3). Groundwater usage accounts for less than 10% of all permitted agricultural water use in the basin, and is closer to 3,500 acres (pers. comm., J. Ferrell).

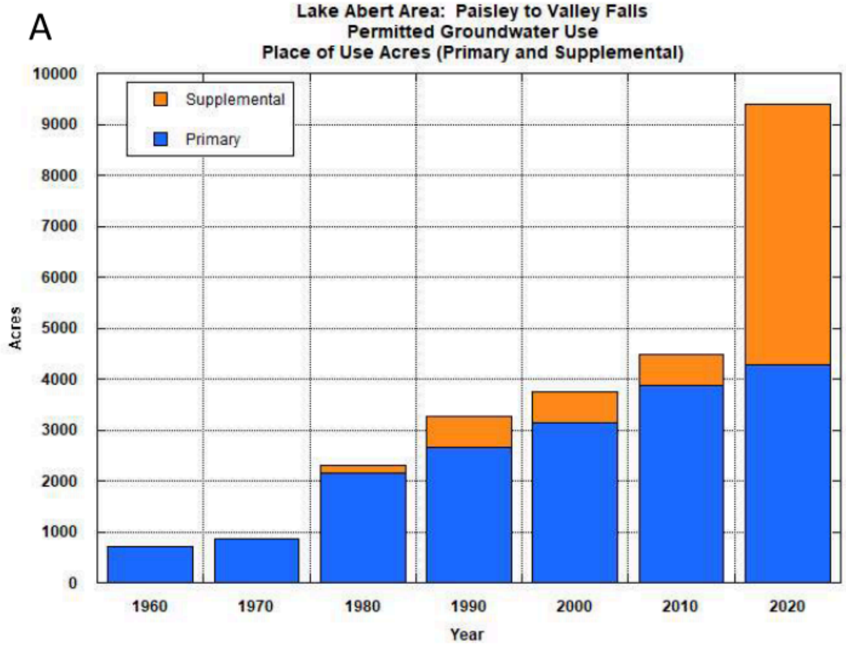


Figure 2.3. The increase in permitted groundwater use in the Chewaucan Basin. (Lamarche & Thomas, 2023).

2.4 Historical Marshes

The marshes surrounding the lower Chewaucan River today host the majority of the agricultural activities in the basin and have been modified to support an extensive irrigation network. Historic wetlands in the Lower Chewaucan Basin were irreversibly altered following European settlement in the late 1800's and early 1900's. Flood irrigated systems to support livestock management were constructed for development of hay and grazing pasture on private lands. The Chewaucan River was diked and aligned to a mostly straight channel. Weirs were constructed to raise water levels for diversion into canals in order to supply water broadly across wetland areas totaling over 30,000 acres. These wetland areas include Upper Chewaucan Marsh (~17,000 ac.), Lower Chewaucan Marsh (~7,500 ac.), Crooked Creek and Willow Creek floodplains (~4,700 ac.) and Rivers End Ranch (~1,000 ac.). The geographic extent and area of the historical wetlands is unknown.

Water management today mimics some aspects of historic floodplain wetland hydrology and provides important wetland habitat for a wide variety of Pacific Flyway waterbirds and other wetland obligate, riparian, and associated wildlife species. The Lower Chewaucan marshes primarily function as seasonally flooded, and to a lesser extent semi-permanent palustrine wetlands. Rivers End Ranch reservoir functions as a permanently flooded palustrine (marsh-like) wetland. Numerous historic river and overflow channels still exist, especially in the northern portion of the Upper Marsh. Water delivery and drainage canals are found throughout the marsh which result in areas of open water that sometimes lasts into late summer and early fall. In a few lower elevation areas, the marsh is poorly drained, and sumps hold deeper water well into late summer, functioning as semi-permanent wetlands.

2.5 Agricultural and Wildlife Interactions

There are three main types of animal interactions in the Chewaucan Basin related to agricultural land use and activities. These interactions have to do with wildlife (both migratory and permanent populations), livestock, and fish populations. Each of these animal groups have unique activities tied heavily to seasonality. The table below does not specifically address interactions with Lake Abert.

Table 2.5 Overview of Agriculture and Wildlife Cycles

Month	Livestock	Wildlife	Water/Fish
Jan	Cattle are in the valley, on the marshes and eating hay (bales or stacks).	Bales of hay in the marshes are used by native mammals and some migratory birds as food (For more species information see appendix B, pg. 101)	Small amounts of water from snowmelt are making their way to the marshes.
Feb	Calving begins, with animals still on the marshes and eating hay with supplemental alfalfa.	More birds are arriving in the basin, scavenger animals are present in the marsh due to the results of calving (i.e. placenta to scavenge on, or sick/disabled migratory waterbirds).	More snowmelt is making its way to the marshes. Mature redband trout populations within the Rivers End Reservoir begin their runs upstream.
Mar	Cattle are still on the marshes and being fed hay. Calving is being wrapped up and branding is taking place.	Water availability is increasing during this time as snowmelt ramps up. Large numbers of migratory birds are now present throughout the basin and they are often feeding on seed shatter from hay that is now floating on the waters, rhizomes, and invertebrates.	Juvenile redband trout in Dairy Creek begin moving downstream, though some populations are permanent upstream.
Apr	Cattle are moved off the marsh and to the desert for grazing and breeding season. Groundwater irrigation begins on the outside of the marshes.	High levels of migratory bird activity (breeding, nesting, foraging, and rearing).	Remainder of water rights on the marshes start now, with Jan 1st rights seceding to April senior rights.

Month	Livestock	Wildlife	Water/Fish
May	Cattle come out of the desert and move into forest uplands usually on allotments by the Forest Service. Cattle will stay in uplands all of summer and into fall to stay in cooler temperatures and to have access to fresh grass.	Tail end of migration season. Some species of waterfowl and shorebirds will stick around longer to breed, nest, and rear.	Surface water diversions are peaking during this time. Mature redband trout are now near Dairy Creek and Elder Creek.
Jun	With cattle staying in the forested uplands. Marshes are being prepped for haying.	Migratory passerines and other wildlife begin moving into the forest for cooler temperatures.	Juvenile redband trout complete their downstream migrations.
Jul	Haying begins around 4th of July with small ranches usually taking a month to clear fields while larger operations may take two months. Meadow hay is not sold outside of the valley. There are approximately 55 perennial species of grass. During haying, one cutting is performed, but lingering water may produce enough late growth for fall forage and habitat. Small diversions of stock water occur for older animals.	Passerines and other local nesting birds on second nests, rearing young, or moving to post-breeding seasonal habitat. Early fall migrants arriving. Some local nesting birds are staging to head south.	
Aug	Cattle still in the forest. In the marshes, pivot-irrigated lands are hayed end of June, July and Sept. with some alfalfa being grown. Most production stays in the valley, some alfalfa is sold if excess is produced.	This is a critical feeding time for young sage grouse as there is high access to bugs and invertebrate food sources. Sumps and sloughs provide a much needed water source for wildlife in this hot, dry time of year. Increasing numbers	

Month	Livestock	Wildlife	Water/Fish
		of post-breeding birds and fledged young occur and southbound migrants are increasing.	
Sep	Cattle still in the forest.	Sumps and stock water diversions are functioning as habitat as migratory bird activity picks up.	
Oct	Begin bringing down calves and weaning them while adult cattle stay in the forest a bit longer. Typically calves will stay about 45 days before being sold or sent to a feedlot.	Southward bird migration continues. Many bird species are feeding on seed shatter from hay harvests on the marshes.	Groundwater irrigation has finished at this point.
Nov	Herds are brought down from the uplands and calves are gone. No water is being used for irrigation, only stock water is being used.	Southward bird migration fades. Native wildlife transition to their winter ranges, typically not on the marshes. Majority of migrant waterbirds have moved south due to freezing temperatures. A few hardy species such as swans, Canada geese, and mallards remain.	
Dec	Preparing to calve. Herds on the marshes are bale grazing.	Few migratory birds remain, mostly resident species in the area.	

2.6 Characteristics of Wet Meadow Environments

Maintaining flood irrigation practices is especially important as desiccation of nearby habitats becomes common in response to higher temperatures and dry conditions associated with climate change. Irrigated pasturelands have the ability to offset drying of other public and private wetlands as well as maintain the diversity of wetland types in the face of climate and land-use changes (Donnelly, Moore, Casazza, & Coons, 2022). The Intermountain West Joint Venture, NRCS, NAWCA, Ducks Unlimited, ODFW, USFWS, and private landowners have invested decades of funding and resources in enhancing and preserving working wetlands in the surrounding Southern Oregon Northeastern California (SONEC) region. Wet meadows upstream of Paisley also enhance habitat and natural water storage capacity. Many of these meadows are privately owned inholdings bordered by USFS land.

Flood irrigation supports the growth of grass, while cattle and haying equipment are used to harvest it. Within the agricultural system land managers use flood irrigation practices to grow and harvest an estimated 50-60 different, perennial grass or grass-like species such as reeds, rushes, and sedges. Flooding supports a biodiverse grass community with no tillage or seeding. Flood irrigation and the harvesting of the grass mimics some aspects of historic wetland behavior and tribal burning practices (tribal burning information per Wilson Wewa, a Tribal Elder, spiritual leader, and knowledge holder of the Confederated Tribes of the Warm Springs, at a PLACe meeting in Paisley, June 2023). Variations in water depth on the marshes results in a diverse assemblage and variety of native and introduced pasture grasses, rushes, and sedges. Because of this vegetation diversity and variable water depths, many guilds and species of waterbirds utilize these habitats to meet most parts of their life cycle (See 'Southern Oregon & Northern California Wetlands' section in Chapter III for additional discussion).

This combination of geography and land management practices have created symbiotic relationships among livestock, birds, and wildlife (See Table 1. Overview of Agriculture and Wildlife Cycles). The Chewaucan Marshes are on the migratory route for waterbirds, especially dabbling ducks and wading birds (such as swans, arctic nesting geese and shorebirds), traveling between wintering areas in southern latitudes to breeding areas in the north and also provides local breeding habitat. These marshes lie in the heart of the (SONEC) region which is of continental importance to sustaining populations of migratory birds. Wetland habitat analysis has found that up to 70% of SONEC wetlands are found on private lands like the Chewaucan Marshes, where working meadows with shallow water mimic historic flood regimes (Donnelly et al., 2019). [6]

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[6] See Appendix A

III. Fish & Wildlife

(Lead: Stan Senner, supported by Henry Pitts)
(*Includes significant contributions from Ron Larson, Marty St. Louis, and Craig Foster)*

Building a shared understanding around the ways that fish and wildlife utilize different parts of the Chewaucan Basin is a critical aspect of the joint fact-finding process. This chapter breaks down the basin into four key areas: marshes, the lake, riparian zones, and the reservoir. Upland species are considered in more specific detail within the Upland Processes chapter. Key themes in this chapter include:

- Obligate species for each area;
- The importance of Lake Abert for shorebirds, and;
- The role of the marshes for waterfowl, shorebirds, raptors, and other waterbird species.

A comprehensive breakdown of species in the basin can be found in Appendix B. Outstanding areas for resolution and further investigation can be found in Appendix A.[7]

3.1 Marsh Use

3.1.1 Introduction

Waterbird and other wildlife use of flood irrigated wetlands in the lower portion of the Chewaucan River Watershed (specifically Upper and Lower Marshes, Crooked Creek and Willow Creek flood plains including Rivers End Ranch) has not been extensively documented. This is due to these areas being privately owned and not readily accessible to the public. However, monitoring, research, and surveys for waterfowl and some waterbirds in Lake County including the Lower Chewaucan Watershed (LCW) have been conducted by Federal ((US Fish and Wildlife Service (USFWS) and US Geological Survey (USGS)), State ((Alaska Department of Fish and Game (ADFG), California Department of Fish and Wildlife (CDFW) and Oregon Department of Fish and Wildlife (ODFW)) and private contractors. These efforts have shown the importance and significance of wetland habitat in the LCW to waterfowl and waterbirds because of flood irrigation agricultural practices on private lands. The purpose of this summary is to describe information from monitoring, research and surveys conducted since the late 1980’s as well as anecdotal observations of many waterbird species in the LCW.

LCW wetlands are very similar to those found at Summer Lake Wildlife Area (SLWA) (about 25 miles north) where waterbird occurrence and populations have been monitored extensively for the past 75 years. Nearly all waterbirds and wetland-associated species documented at SLWA are found in the LCW.

[7] See Appendix A

About 180 bird species are known or likely to occur in flood irrigated wetlands and adjacent uplands and in the Chewaucan River riparian area. Many of these species (e.g., northern pintail; sandhill crane, etc.) utilize flood irrigated wetlands during late winter and spring as they migrate north from wintering areas in California and Central America (pers. obsv., M. St. Louis). About 110 species nest in the area. Breeding season begins as early as late March, is at a peak during May and June, and declines dramatically by mid-July. Approximately 70 of the 180 bird species are present in small numbers or rarely (pers. obsv., M. St. Louis, ODFW; unpublished data files). Thirty-five (35) mammal species are known or expected to use the LCW marshes, along with 4 amphibians and 14 reptile species (Csuti, 2001).

Information and observations, primarily collected during aerial surveys from the late 1980's through 2020, have shown significant use of the LCW by a variety of wetland and waterbirds (grebes, waterfowl, gulls and terns, secretive marsh birds, shorebirds, and waders) as well as raptors during breeding season and periods of migration (pers. obsv., M. St. Louis,).

3.1.2. Southern Oregon & Northern California Wetlands

The Chewaucan Marshes are part of the greater Southern Oregon-Northeast California (SONEC) part of the Great Basin, which has distributed wetlands of high importance to wildlife. In the early 2000's USGS wildlife biologists from Dixon Field Station in California initiated research on northern pintail (pintail), a species of special management concern in the Pacific Flyway due to the low continental population. Pintail movements and habitat utilization in California's Central Valley wintering area and spring migration were the major focus of this work. Utilizing satellite telemetry, Miller et al. (2005) documented very important habitat use in northeastern California and southern Oregon by pintail migrating north to breeding areas in Canada and Alaska.

Fleskes and Battaglia (2004) documented extensive use of Great Basin and Klamath Basin wetlands by pintail and other waterfowl during spring migration. Most of this use occurred on flood-irrigated private lands in northeastern California and southern Oregon. The Southern Oregon-Northeast California (SONEC) landscape is a unique region identified as a continentally significant migration and breeding area for Pacific Flyway birds. This region was identified as SONEC by Fleskes and Yee (2007). Comprising eight counties across Oregon, California, and Nevada, this is one of the most productive landscapes on the continent for a wide variety of migrating and breeding wetland and waterbirds. It is estimated that nearly 70% of Pacific Flyway waterfowl from wintering areas in California, Mexico, and Central America migrate through the SONEC region (Haig et al., 2019).

Many species remain in the area and breed in Great Basin wetlands. Others continue to Alaska, Canada, and Arctic breeding areas which includes Russia. About 75% of all freshwater wetlands within SONEC are privately owned, and those lands are essential to strategic bird conservation efforts. Klamath Basin, especially Lower Klamath and Tulelake National Wildlife Refuges (NWRs), was once the most important SONEC sub-basin. However, in recent years wetlands on the NWRs have struggled due to conflicts with competing water demands to satisfy the needs for Endangered Species Act listed fish species and irrigation uses. Wetlands in portions of the Klamath Basin that once held the majority of SONEC waterbirds have been greatly reduced or in some cases completely desiccated. This loss of wetland habitat has resulted in LCW and other sub-basins of SONEC being of greater importance now (Donnelly et al. 2022).[8]

3.1.3. Research and Documentation Efforts

Aerial population surveys of waterfowl in Lake County were conducted by USFWS pilot biologists and observers in March and early April 2002 and 2003 (Fleskes & Yee, 2007). They documented daily peak populations of more than 75,000 waterfowl in the Chewaucan Marshes. When accounting for continual arrival, time of staging and departure dates, use and movement by birds through Chewaucan Marshes during spring is likely significant. Flood irrigation in historic floodplains, haying, and livestock grazing create an ideal setting for some wetland and waterbirds. The region's wet meadow habitats provide rich food resources that help fuel migration and breeding activities. Without this critical habitat during spring migration, these birds might suffer higher mortality rates and reduced ability to produce young at breeding grounds.

While pintail migration habitat use and movement was the major focus of USGS research in the early 2000s, many other migratory waterbirds and wetland-associated wildlife utilize flood-irrigated wetlands extensively during spring migration, with many species remaining to breed.

Table 3.1.3. Regularly-seen Northern Great Basin Waterbirds (75 total)

Source: Ryser, F.A, Jr. 1985. Birds of the Great Basin. Univ. Nevada Press

Waterbird Group	Breeding	Migrating Through	Totals
Grebes	Clark's, eared, pied-billed, and western grebes (4)	horned grebe	5
Pelicans	American white pelican		1
Cormorants	double-crested cormorant		1
Bitterns, Egrets, Herons, and Ibis	American bittern; snowy and great egrets, black-crowned night-heron, great blue and green herons, white-faced Ibis (7)		7

[8] See Appendix A

Waterfowl	tundra and trumpeter swans, Canada goose, wood duck, mallard, northern pintail, gadwall, American widgeon, northern shoveler; blue-winged and cinnamon teals, lesser scaup, ring-necked duck, canvasback, redhead, common and hooded mergansers, ruddy duck (18)	greater white-fronted, Ross's, snow goose, green-winged teal, greater scaup, common and Barrow's goldeneye, bufflehead (8)	26
Coots, Rails, and Cranes	sora, and Virginia rails, American coot, sandhill crane (5)		5
Shorebirds	snowy plover, killdeer, black-necked stilt, American avocet, willet, long-billed curlew, spotted sandpiper, Wilson's snipe, Wilson's phalarope (9)	semipalmated plover, lesser and greater yellowlegs, long-billed dowitcher, marbled godwit, sanderling; Baird's, western, least, pectoral, solitary, and semipalmated sandpipers, dunlins, red-necked phalarope (14)	23
Gulls and Terns	California, Franklin's, and ring-billed gulls; Caspian, black and Forster's terns (6)	Bonaparte's	7

Further research conducted by USGS on the Chewaucan Marshes (specifically the ZX Ranch) in 2008-2009 documented a wide variety of foods, predominantly wetland plants, seeds and invertebrates consumed by several species of waterfowl (Fleskes et al. 2010). Food availability was assessed and documented. Pintails were able to increase body condition by consuming reed canary grass and other seeds prior to migrating to breeding areas in Alaska and Canada. American wigeon favored newly growing green vegetation, green-winged teal consumed seeds from native sedges and rushes and northern shoveler diets focused largely on invertebrates.

3.1.4. Additional Context on Key Species

Arctic nesting waterfowl such as lesser snow geese and tundra swan stage in the Lower Chewaucan Watershed in the early spring to build body conditions and fat reserves as they migrate north to breeding areas above the Arctic Circle. Of note are lesser snow goose populations that continue beyond Alaska to Wrangel Island, Russia to nest.

Tule subspecies of greater white-fronted geese (Tule geese) utilize the Chewaucan Marshes during their spring migration from winter areas in California to breeding areas in Alaska. Tule geese are of management concern due to their small population size. Yparraguirre et al. (2020) estimated population size to be about 15,000 individuals, making them the rarest subspecies of geese in North America. Tule geese utilize seasonally flooded and semi-permanent wetlands foraging on rhizomes and tubers of several species of bulrush and other emergent plants. Rarely are they found in croplands or irrigated upland sites. Their distribution in Oregon is largely confined to Summer Lake Wildlife Area (SLWA), the Chewaucan Marshes, and Warner Valley. They are also found in the Klamath Basin, usually at Lower Klamath NWR in California, if seasonally flooded and semi-permanent wetlands exist. Following arrival at Summer Lake Wildlife Area and the Chewaucan marshes as early as mid-January in some years, Tule geese feed on wetland rushes and sedges through mid to late April, building body reserves necessary for a mostly nonstop flight to breeding grounds in Alaska. This very important habitat use has been documented yearly since the early 1990s through VHF radio monitoring (aerial and ground) conducted by ODFW and the California Department of Fish and Wildlife (CDFW). USGS has increased monitoring intensity through the use of Global Positioning System (GPS) technology that documents precise Tule goose locations and movement patterns within the Chewaucan Marshes and SLWA. This unique population has been a part of cooperative management and research conducted by CDFW, ODFW, ADFG, USGS, and USFWS (Yparraguirre et al., 2020).

Western Canada geese make extensive year-round use of the Lower Chewaucan Watershed. Breeding occurs in emergent wetlands with excellent connectivity for brood-rearing areas via canals, ditches, and sloughs draining into the Chewaucan River that leads downstream to Rivers End Ranch reservoir. The upper reaches of the reservoir contain many historic floodplain channels, back bays, islands, and oxbows that provide considerable waterfowl, other waterbird and shorebird nesting sites, and brood-rearing habitats. Open water areas serve as very important brood-rearing and molting areas. The reservoir also serves as an important and secure fall and spring migration loafing and roost site.

Increasing numbers of trumpeter swans from the Rocky Mountain Population (predominantly Canadian flocks) utilize spring wetland habitat in the Chewaucan Marshes and Rivers End Ranch Reservoir during fall. Successful nesting in Upper Chewaucan Marsh has been documented and as the Summer Lake Wildlife Area resident population continues to increase, it is expected that the Chewaucan Marshes will support additional nesting (pers. obsv., M. St. Louis).

ODFW initiated a statewide waterfowl breeding population survey in 1994. A stratum covering nearly all wetland basins in Harney, Klamath, Lake Counties was delineated (basically outlining springtime wetland footprints), and randomly selected transects were established. Aerial surveys have been conducted annually, where all waterfowl, American coots, sandhill cranes, and trumpeter swans are counted. Five transects are within the Chewaucan marshes and Lake Abert (a very small portion of the 2,863 square miles of Southeast Oregon seasonal wetland strata). An estimate of annual abundance for the LCW is 6,000 to 8,000 breeding ducks (B. Reishus ODFW Migratory Bird Coordinator, pers. comm.). Breeding species observed have been mallard, gadwall, pintail, cinnamon, and American green-winged and blue-winged teal, American wigeon, northern shoveler, redhead, canvasback, lesser scaup, ringneck, ruddy duck, Canada geese, American coot, sandhill cranes, and trumpeter swans.

In late spring and early summer, large aggregations of drake and unsuccessful nesting hen ducks gather in sumps and along drain ditches and canals to molt. Rivers End Ranch reservoir is an important molting area for many species of waterfowl, especially Canada geese.

Important greater sandhill crane breeding habitat is found in the Lower Chewaucan Marsh. A statewide survey of Greater sandhill cranes conducted by Ivey and Herziger in 1999 and 2000 found 1,151 pairs in Oregon and recognized that 62% were found on private lands. Lake County wetlands held the second largest number of pairs (405 or 35.2%). In Lake County, the survey documented 45 pairs in Upper Chewaucan Marsh, 35 in Lower Chewaucan Marsh, 3 in Crooked Creek Valley and one at Lake Abert. New west-wide greater sandhill crane habitat models indicate that 60% of breeding habitat are associated with flood-irrigated hay and pasture lands (Donnelly 2024).

ODFW initiated aerial surveys of Lake County colonial nesting waterbird colonies in 1987 (pers. obsv., M. St. Louis, ODFW; unpublished data files). The 2023 report from ODFW, which includes breeding waterfowl populations across the state, can be found in the PLACe database . Species included black-crowned night-heron, black and Forster's tern, double-crested cormorants, Franklin's gulls, great blue heron, great egret, snowy egret, and white-faced ibis. Surveys were conducted annually in most years (26 of 33) through 2019. All Lake County wetland basins (Chewaucan, Goose Lake, Silver Lake, Sycan Marsh, Summer Lake, and Warner Valley) were surveyed by fixed-wing aircraft during late June or early July, and numbers of nests were estimated.

White-faced ibis also heavily rely on flood-irrigated land for foraging habitat during the breeding season (Coons et al., n.d.). The Chewaucan Marshes were detected in 18 of the 26 years of surveys and ranged from 95 to 2,700 nests. Small numbers of black-crowned night-herons, great and snowy egrets, and black and Forster's terns were also found in some years (ODFW unpublished data). Double-crested cormorants, and great and snowy egrets were documented at Rivers End Ranch reservoir.

Migrant bald and golden eagles and several species of hawks and falcons utilize the Lower Chewaucan Watershed . The eagles are associated with livestock operations as well as flood-irrigated wetlands that attract large numbers of staging waterfowl. Eagles are attracted to food sources during calving season (afterbirth and sometimes livestock mortality) and waterfowl that utilize flood-irrigated fields in large numbers. Also, when fields are being flooded, small mammals displaced from dry sites become available to foraging raptors.

Winter raptor surveys have been conducted by volunteers for the past 20 years, and are spearheaded by the East Cascades Audubon Society (see surveys here). The North Lake County route (Silver Lake to Valley Falls) contains about 34.5 miles that follows the edge of Lower Chewaucan Watershed wetlands. Sections of the survey include portions of the Upper Chewaucan marsh interior in the vicinity of Red House and Lovers Lane near the town of Paisley. From 2020 through 2023, an average of 53.5 raptors have been observed along the survey route. An average of 38.5

eagles (both species) has been documented (M. St. Louis, personal observation).[9] In 2024, averages increased to 71.1 for raptors and 45.9 for eagles.

Greater sage-grouse utilize the Chewaucan Marshes for brood-rearing areas. ODFW has conducted brood surveys since the early 1950's. Due to wildfire impacts to nesting habitat in the Coglan Buttes and Tucker Hills the number of sage grouse using the marshes has declined. However, the remaining birds still use the east edge of the upper marsh between Red House and the Narrows, and the western edge of the lower marsh (pers. com., C. Foster). There are also sage grouse leks in the Tucker Hills which are adjacent or nearby to the lower marsh, and numbers are currently stable. The leks in the Coglan Buttes adjacent to the Upper Marsh are performing poorly. There are additional leks north of the marsh in the Diablo range that are doing well. (pers. comm., Jon Muir, District Wildlife Bio for ODFW).

3.1.5. Conclusion

In summary, flood-irrigated wetlands, sustained through agricultural operations on private lands in the LCW are important to a wide variety of Pacific Flyway wetland and waterbirds, providing both migration and breeding habitat. The ODFW Oregon Comprehensive Conservation Strategy identifies protection and enhancement of wetland values as a conservation strategy habitat in the North Basin Ecoregion as follows:

"The Northern Basin and Range ecoregion contains several large, deep freshwater marshes. Significant large wetlands are associated with the large lake basins, including Abert, Summer, Malheur, and Harney Lakes, and the Warner Basin. However, many of the ecoregion's smaller historical wetlands have been lost due to conversion or degradation from stream channelization, water diversions, and historical overgrazing. The creation of watering holes for livestock and wildlife has altered the hydrology at many major playas, making them one of the most altered habitat types in the ecoregion.

In some areas, flood-irrigation of private pasture and hay meadows provides important seasonal habitat for migrating and breeding birds. In areas where flood irrigation is being applied to row crops, converting flood irrigation to piped sprinkler systems can improve water quality, reduce sedimentation, and reduce water loss due to evaporation. However, loss of flood irrigation without restoring wetlands in the landscape will negatively affect wetland species now dependent on flooded habitats". [10]

3.1.6. Wildlife Interactions Across the Lake & Marsh

Questions have been raised about whether the Chewaucan marshes can serve as an alternative habitat for birds when Lake Abert is dry or conditions are otherwise poor (e.g., salinity too high). There is considerable overlap among the birds that use the Chewaucan Marsh and Lake Abert

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[9] See Appendix A
[10] See Appendix A

habitats. Green-winged teal, northern pintail, black-necked stilt, American avocet, long-billed curlew, and white-faced ibis are examples of species that can and do use both habitats. However, the marsh and lake habitats are quite different, and these differences are reflected in the seasonality, numbers, and use by the various types and species of birds visiting them.

For example, marshes like the Chewaucan are especially useful to north-bound spring-migrating waterfowl, such as Northern Pintails (Moulton et al.,2013). And, as described above, the Chewaucan marshes provide nesting habitat for several species of waterfowl, as well as other wetland and waterbirds including sandhill cranes, Wilson's phalaropes, American coot, white-faced ibis, long-billed curlew, and others (pers. obsv., M. St. Louis). In the case of ground-nesting birds, such as sandhill cranes, Ivey (2000) and Ivey and Herzinger (2006) point out that private landowners typically dewater their wetlands in mid June and begin cutting hay in late June. In the Lower Chewaucan marsh, half of the marshes is hayed, while the other half holds water for most, if not all, of the year. For more detail, see the Agricultural Practices.

Haying practices can have varying effects… can result in nest abandonment and loss of production, reduces food availability causing young birds to move long distances to water and increases their vulnerability to predators, and can kill unfledged birds, especially Sandhill cranes that remain in the meadows. Despite these potential dangers, flood irrigated wetlands provide crucial breeding and migration habitat for Sandhill cranes (Ivey, 2000).[11]

Lake Abert supports migrant wetland and waterbirds in both spring and fall seasons, but it is most important during the summer post-breeding season prior to and during fall migration, when there is little or no water on the half of the Chewaucan Marshes that are hayed. Further, what attracts very large numbers of birds to the lake, such as Wilson's and red-necked phalaropes, eared grebes, green-winged teal, and ruddy ducks, is the enormous abundance of alkali flies and brine shrimp. Abert is one of only three large, hypersaline lakes in the Great Basin, and it supports concentrations of superabundant salt-tolerant prey, which are not available in such abundance in freshwater marsh habitats. During their time at Lake Abert, eared grebes and Wilson's phalarope may be flightless for a short period during molting and thus need open water and access to superabundant prey (Jehl 1988; Jehl, 1997).

Though some Wilson's phalaropes may nest in the Chewaucan marshes and wet meadows, the numbers produced from the marsh-related habitats are small relative to the overall Wilson's phalarope population (*circa* 1 million; (Castellino et al. 2024) .). However, when conditions are good, tens and even hundreds of thousands of fall-migrating phalaropes use Lake Abert as a migratory stopover site (Larson, 2023).

Lake Abert also supports some nesting birds, the most important of which is the western snowy plover. This species nests on open playa and shoreline habitats–mostly free of vegetation and with access to fresh water–at terminal lakes like Abert and Harney and Summer. For this species, the marsh habitat is of relatively low value.

Finally, the American avocet may also nest around Lake Abert, but nests in larger numbers at places like Summer Lake. It is well documented, however, that adults and young of the year often commute daily to Lake Abert from Summer Lake to take advantage of the superabundant prey

[11] See Appendix A

during the post-breeding period (Plissner et al. 1999, 2000). Feeding at Lake Abert is especially important for fledged avocets that need the protein they can acquire from the superabundant prey at Lake Abert. In turn, they get the freshwater they require at Summer Lake. It is also well documented that post-breeding avocets come north from as far away as the Lahontan Valley in Nevada to Lake Abert to feed and possibly molt.

3.1.7. Birds of Conservation Concern Across the Lake & Marsh

Both Lake Abert and the Chewaucan Marshes support several bird species of conservation concern. More than 200 species of birds have been recorded at and around Lake Abert, including riparian and adjacent upland habitats. Fourteen of these species are included on the list of Oregon Species of Greatest Conservation Concern for the Northern Basin and Range ecoregion. Seventeen species are included in the U.S. Fish and Wildlife Service list of Birds of Conservation Concern for the Great Basin bird conservation region. It is also noteworthy that three species—American White Pelican, Snowy Plover (Western), and Franklin's Gull—are on both the state and federal lists. Use of habitats around Lake Abert by nesting snowy plovers is well documented elsewhere in this report. The following species are known or likely to occur at or near Lake Abert and the Chewaucan Marshes.[12]

[12] *Based on eBird records from local hotspots (2 sites at Paisley; 4 sites at Lake Abert) or eBird records outside the hotspots but in the immediate vicinity, or expert local knowledge.*

Table 3.1.7. Birds of Conservation Concern

Species	Oregon List[13]	USFWS List[14]	Occurrence (Lake Abert)	Occurrence Chewaucan marshes
Trumpeter Swan	X		●	●
Greater Sage-Grouse	X			●
Western Grebe		X	●	●
Clark's Grebe		X	●	●
Calliope Hummingbird		X	●	●
Rufous Hummingbird		X	●	●
Sandhill Crane (Greater)	X		●	●
Black-necked Stilt	X		●	●
American Avocet		X	●	●
Snowy Plover (Western/Interior)[15]	X	X	●	
Long-billed Curlew	X		●	●
Marbled Godwit		X	●	●
Pectoral Sandpiper		X	●	
Lesser Yellowlegs		X	●	●
Willet		X	●	●
Franklin's Gull	X	X	●	●
California Gull		X	●	●
Caspian Tern	X		●	●
Black Tern		X	●	●
Forster's Tern		X	●	●
American White Pelican	X	X	●	●
Snowy Egret	X		●	●
Northern Harrier		X	●	●
Swainson's Hawk	X		●	●
Ferruginous Hawk	X		●	●
Burrowing Owl	X		●	●
Short-eared Owl		X	●	●
Lewis's Woodpecker		X	●	●

[13] Oregon Species of Greatest Conservation Concern, "Northern Basin and Range Ecoregion" (as defined by ODFW)

[14] U.S. Fish and Wildlife Service 2021 Birds of Conservation Concern, "Great Basin Bird Conservation Region" (No. 9)

[15] Western Snowy Plover is listed by the State of Oregon as a "Threatened" species statewide.

Peregrine Falcon	X		●	●
Olive-sided Flycatcher		X	●	●
Willow Flycatcher	X		●	●
Pinyon Jay		X	●	
Sage Thrasher		X	●	●
Evening Grosbeak		X		●
Cassin's Finch		X	●	●
Bobolink	X	X		●
Total number of species	**16**	**24**	**33**	**32**

[1] Oregon Species of Greatest Conservation Concern, "Northern Basin and Range Ecoregion" (as defined by ODFW)
[2] U.S. Fish and Wildlife Service 2021 Birds of Conservation Concern, "Great Basin Bird Conservation Region" (No. 9)
[3] Western Snowy Plover is listed by the State of Oregon as a "Threatened" species statewide.

3.2 Lake Use

3.2.1. Waterbird diversity and abundance at Lake Abert

Great Basin saline lakes and other wetlands, like Lake Abert, matter through all life stages to many migratory wetland and waterbirds (Oring and Reed 1997, Wilsey et al. 2017, Haig et al. 2019). The entire North American population of Eared Grebes, up to 90% of all Wilson's Phalaropes, and over 50% of American Avocets utilize these wetlands for part of the year (Wilsey et al. 2017). Moreover, this interconnected network of saline lakes across the Intermountain West plays a vital role in sustaining the delicate balance of ecosystems and supporting diverse wildlife populations. These lakes serve as crucial stopover points for migratory wetland and waterbirds during their long journeys, providing essential rest and refueling opportunities. (Wilsey et al. 2017). Disruption or loss of these interconnected habitats could lead to significant alterations in migration patterns, jeopardizing the survival of numerous bird species and potentially triggering population declines.

Lake Abert annually attracts tens to hundreds of thousands of wetland and waterbirds, including: grebes, gulls, wading birds, shorebirds, and waterfowl, with nearly 80 species having been reported. Taking into account all types of birds, more than 200 species have been recorded at or in the immediate vicinity of Lake Abert, including the lake itself and adjacent playa, riparian, and upland habitats (eBird.org records as reviewed by S. Senner).

Seven species have been seen at the lake in abundances greater than 10,000 based on single-day counts (Table 1): American avocet, eared grebe, California and ring-billed gulls (combined), northern shoveler, western sandpiper, and red-necked and Wilson's phalaropes. This last species, Wilson's phalaropes, has been present on a number of occasions in excess of 200,000, according to surveys done by the Bureau of Land Management (BLM), East Cascade Audubon Society (ECAS), and other volunteers, (posted at eBird.org). These same species are usually present at the lake in the summer.

The abundance of the birds changes considerably from year to year depending on water and salinity conditions. For example, under good conditions, Eared Grebes can be numerous, with 5,000 or more being frequently seen, but when the lake is desiccated, they are nearly absent, with only two seen in 2014 (see Table 3.2.1 below). The abundances of most of the birds listed in Table 1 are higher than for any other area of the state, according to Marshall et al. 2003, *Birds of Oregon, A General Reference*, which points to the importance of Lake Abert for waterbirds.

Figure 3.2.1 Lake Abert waterbirds. Top (left to right)- American Avocets, Eared Grebes, Wilson's Phalarope. Bottom: Red-necked Phalarope, Snowy Plover, Western Willet. Source: R. Larson.

Waterbird Species	Seasonal Occurrence	Season of Peak Abundance	Peak Number and Date
American Avocet	March-December	Summer	40,000 on 9/8/1993
Black-necked Stilt	March-October	Summer and fall	8,350 on 8/13/2020
Eared Grebe	Year Around	Spring	40,000 on 9/28/2012
Wilson's Phalarope	Spring and Summer	Summer	300,000 on 7/24/2013[1]
California Gull and Ring-billed Gull	Year Around	Summer	18,400 on 8/10/1993
Northern Shoveler	Year Around	Fall through Spring	22,800 on 9/14/2012
Western Sandpiper	Spring and Summer	Summer	12,000 on 4/28/1994
Red-necked Phalarope	Spring and Summer	Summer	11,400 on 9/1/1994

Table 3.2.1. Seasonal and peak abundance data, based on 1-day counts, for common waterbirds at Lake Abert unpublished 1988-1998 BLM census data, data reported by Kristensen et al. (1991), and data reported

by over 100 volunteers from East Cascade Audubon Society and others and posted on eBird (https://ebird.org/hotspot/L159585?yr=all&m=&rank=hc).

Walt Devaurs, BLM Lakeview District Wildlife Biologist, surveyed birds in the Lake Abert Area of Critical Environmental Concern during the years 1992-1996 and calculated total "bird-days use" in the ACEC for ducks/geese, shorebirds, and grebes. His most complete coverage was in the years 1994-1996, in which he reported bird-use days of 5,321,685 (1994), 8,838,760 (1995), and 11,896,195 (1996). It is unclear if gulls were included in his accounting for shorebirds. If not, those bird-day use numbers would be considerably higher.

3.2.2. The Significance of Lake Abert for Waterbirds

The main benefit most birds get from the lake is access to an abundant food source – primarily brine shrimp and alkali flies that live in the lake. The number of shrimp and flies in the lake are substantial when the lake has adequate water and appropriate salinities to support them. For example, Conte and Conte (1988) estimated that brine shrimp at the lake numbered three hundred billion and had an estimated weight of nearly 8,000 tons. While precise estimates of alkali fly populations are unavailable, they are known to exist in significant numbers. Adult flies congregate in dense masses along the shoreline, sometimes numbering hundreds of individuals per square foot, creating an appearance akin to tar washed ashore (Figure 3.2.2.A). Additionally, it's important to note that adult flies represent just one of the three life stages found in the lake, suggesting that the overall fly population (at different stages) is even more extensive.

Figure 3.2.2.A. Alkali fly adults forming dense masses along the eastern shore of Lake Abert and on the lake surface, September 2011. Source: R. Larson

Most birds are not present when conditions are poor at the lake, and during the recent two drying events (2014-2015 and 2021-2022), the numbers of birds were very low (Figure 3.2.2.B).

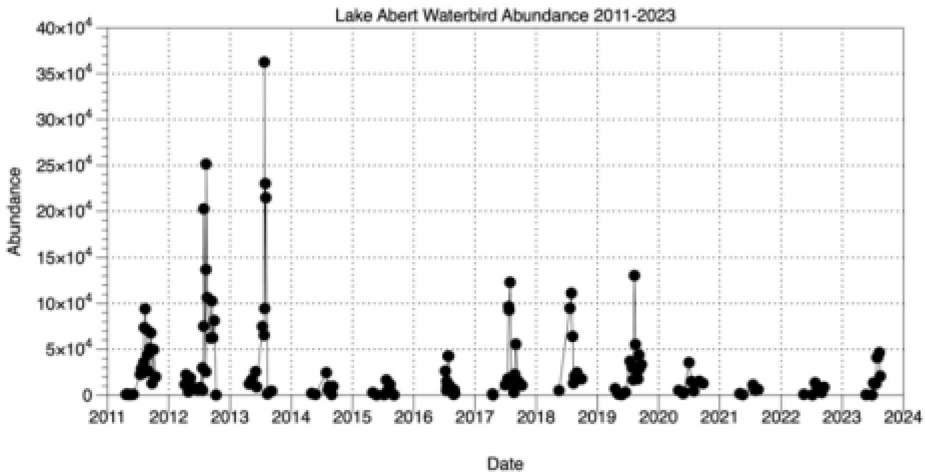

Figure 3.2.2.B. Lake Abert waterbird abundance 2011-2023. Data from East Cascade Audubon Society and other volunteers, and H. Tobiason (pers. comm.) and posted at eBird.org. Figure from R Larson.

3.2.3. What Happens to the Birds When Lake Abert is Dry?

In dry conditions birds must search for alternate sites with suitable habitat and food, which may or may not be readily available. In this regard, Jehl (1994) reported the following:

The health of bird populations that use unstable habitats [in the Great Basin] is to a large extent dependent on the availability of back-up sites that can be used when conditions change. Unfortunately, there is not much redundancy left in the saline and alkaline lakes of the west.

Although there is no data specific to Lake Abert when it is dry, there are several alternative scenarios. Depending on the species and their condition when they reach Lake Abert:

- Some birds arriving in good condition may find satisfactory alternate habitats nearby or at long distances from the lake and are able to rest, refuel, and continue their migrations in good condition.
- Some birds arriving in poor condition may be able to find alternate habitats nearby or at a distance and are able to rest, refuel, and continue their migrations in good condition.
  - However, if those alternate habitats do not meet their needs or are too few or too distant, their subsequent fitness, ability to migrate, and overwinter survival may be compromised.
- Some birds arriving in poor condition may be unable to continue their migration and die or are unable to reach wintering areas, which may be distant (e.g., Argentina in the case of Wilson's phalaropes).

The biology of shorebirds (and eared grebes) that concentrate at a few, scattered sites in migration make them especially vulnerable to loss of quality habitats with predictable, abundant food supplies where they can rest and refuel (Senner and Howe 1984, Myers et al. 1987) and in some cases also molt. As is true for northern pintails and many other species of waterfowl (see marsh account above), fat is the fuel that drives migration, especially when quality resting and feeding sites are limited over long distances. Indeed, there are ample studies from around the world on what happens to shorebirds when key habitat areas or food supplies are no longer available (e.g., Baker et al. (1994), on the rapid decline of the Atlantic coast Red Knot population, and Studds et al. (2016), on the rapid decline of shorebird populations using intertidal habitats on the Yellow Sea coast in China and Korea). The interconnected network of migratory habitats (such as saline lakes and their associated wetlands across the Great Basin) provides a layer of redundancy essential for the survival of these vulnerable shorebirds and waterbirds. This redundancy ensures that if one habitat area is compromised, there are alternative sites available to mitigate the impact on migratory populations. Without this redundancy, the loss of quality habitat with abundant food sources could jeopardize the ability of migratory birds to complete long-distance journeys and thereby sustain healthy populations (Iwamura et al., 2013; Shuford and Page, 2002). Preserving and maintaining the integrity of this network of habitats is paramount for safeguarding the resilience and long-term viability of migratory species.

3.2.4. Examples of Three Species of Concern

Eared Grebes, Wilson's Phalaropes, and Snowy Plovers are three species that heavily depend on salt lakes, at least seasonally.

-Eared Grebes nest in regional freshwater wetlands, but they are saline-lake specialists for part of the year. The grebes forage where prey are super abundant during the mid-summer and fall periods when they are replacing their flight feathers and thus are flightless and almost totally dependent on Great Salt Lake, Mono Lake, and Lake Abert to provide a high biomass of invertebrate food (Jehl 1988, 1994, 2007, Jehl et al. 2003, Delahoussaye 2019, Boyd et al. 2021). If conditions at Lake Abert are poor, some of these birds can try to move to one of the other salt lakes. Jehl (1988) and Boyd et al (2021) found at Mono Lake that once brine shrimp abundances fell below a certain level, mass movements or mortality of Eared Grebes resulted. At Lake Abert, Eared Grebes were nearly or totally absent in 2014-2015 and 2021-2022, when the lake was desiccated (Figure 3.2.4.A).

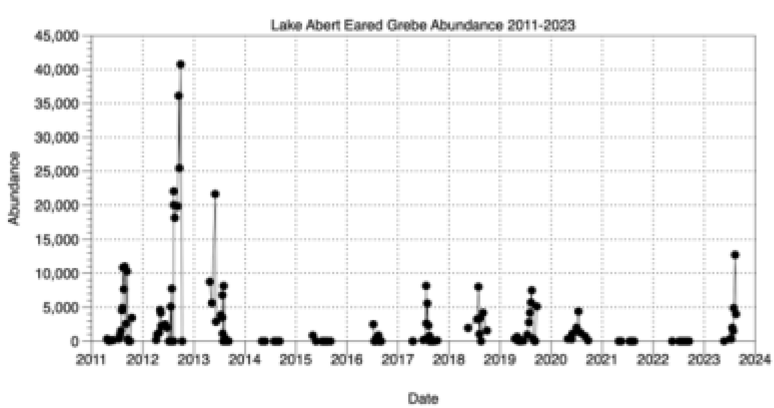

Figure 3.2.4.A Eared Grebe abundance at Lake Abert 2011-2023. Data from East Cascade Audubon Society and from other volunteers and posted on the eBird website, and H. Tobiason (pers. comm.). Figure from R. Larson.

-Wilson's Phalaropes are also dependent on the high productivity of saline lakes, such as Lake Abert. Wilson's Phalaropes undergo "hyperphagia," where the birds feed constantly, both day and night, enabling them to increase their weight so much they can become temporarily flightless (Jehl 1997). The extra fat is essential to provide the energy needed during the 3,000 to 5,000-mile flight to wintering sites in South America. Those flights may be nonstop (Jehl 1997). The importance of Lake Abert for Wilson's Phalaropes has been documented by their high abundance. For example, in late July 2013, an East Cascades Audubon Society volunteer (C. Hinkle) counting birds at the lake, photographed a Wilson's Phalarope "superflock" containing an estimated 150,000 birds (ECAS data, July 24, 2013; Figure 3.2.4.B).

Figure 3.2.4.B. Part of a Wilson's Phalarope "superflock" photographed at Lake Abert 7/24/2013 by C. Hinkle and posted on the eBird website (https://ebird.org/profile/MjUxODA0/US-OR-037).

Because Lake Abert attracts so many Wilson's Phalaropes, it is recognized as being globally important (Lesterhuis and Clay 2010). The only other such site in Oregon is Harney Lake, but numbers there, with a high count of 18,000, are just a fraction of those typically present at Lake Abert (Figure 3.2.4.C). Phalaropes were much less numerous in the lake during the desiccation events of 2014-2015 and 2021- 2022 (Figure 3.2.4.C). Following the earlier event, phalaropes became more abundant in 2017-2019, when lake levels increased, but declined sharply during the 2021-2022 event. Counts in the summer of 2023 indicate phalaropes have increased somewhat from the 2021-2022 event (Figure 3.2.4.C), but not to the same abundances seen in 2017-2019 (H. Tobiason; pers comm.).

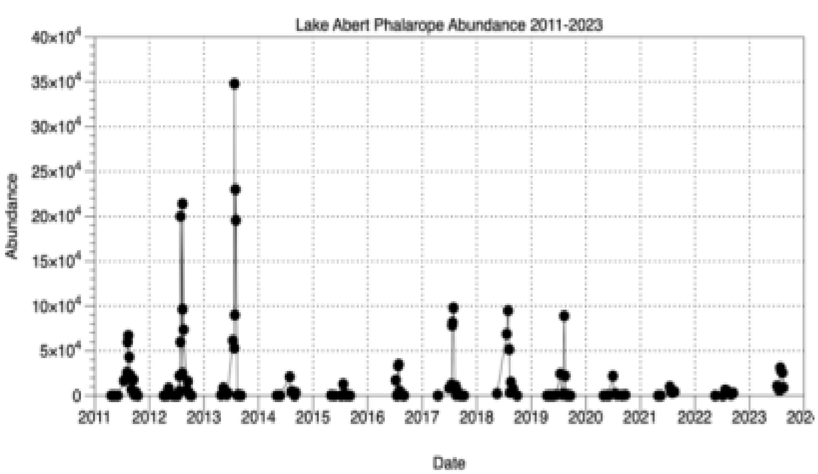

Figure 3.2.4.C. Phalarope abundance at Lake Abert 2011-2023. Data from East Cascade Audubon Society and from other volunteers and posted on the eBird website. The values are for both Red-necked Phalarope and Wilson's Phalarope because they are difficult to

distinguish from a distance. The latter species is the most numerous. The numbers are in scientific notation so, 5x104 = 50,000. Figure from R. Larson

In 2015, a National Audubon climate change report considered this species to be "climate endangered" as a result of an estimated 98% decrease in summer range by 2080 (http://climate.audubon.org/birds/wilpha/wilsons-phalarope).

Additional concerns for Wilson's Phalarope have been raised recently, including specific information coming from monitoring done at Lake Abert indicating the importance of the lake for Wilson's Phalarope and concerns about the effects of climate change and water diversions on the species. On March 28, 2024, The Center for Biological Diversity petitioned the Secretary of the Department of Interior to provide Endangered Species Act protections to the Wilson's Phalarope (https://ecosphere-documents-production-public.s3.amazonaws.com/sams/public_docs/petition/12618.pdf). The 119 page petition provided the following as justification for the listing:

- The species has lost 70% of its population since the 1980s.
- Loss of a single staging site like Great Salt Lake or Lake Abert could cause abrupt decline.
- Smaller staging sites have been degraded reducing "back up" habitat.
- Climate change in North America is projected to cause an additional 30-46% of habitat loss by 2100, primarily by reducing water surface area.
- There are no legal protections for the species at its primary staging habitats at Great Salt Lake and Lake Abert, and little or no guarantee of water rights.

-Snowy plovers are another example of an obligate user of saline habitats reported from Lake Abert. Snowy plovers nest on ocean beaches and at inland salt lakes, including at Lake Abert. They were studied at Lake Abert by Mark Stern and coworkers during the spring and summers of 1988-1990 (Stern et al. 1991, Page et al 1995). They saw a peak abundance of nearly 260 adults. To assess movements from the lake, Stern and coworkers banded nearly 400 plovers. During the following winters the marked birds were seen along the California coast as far south as San Diego and into Baja, Mexico. Twelve birds banded on the California coast were seen during the breeding season at Oregon interior sites, including Lake Abert. During the summer of 1990, nearly 50% of the banded adults and 15% of the banded young were re-sighted at the lake. This study showed that the lake is an important breeding site for Snowy Plovers that also use other saline habitats as far away as Mexico.

During the 1990s, BLM biologists surveyed Snowy Plovers at Lake Abert on 26 occasions from April to October, with most being seen in May. The number of birds observed per day ranged from 2 to 343, with an average of 83 birds per survey. Beginning in 1980, ODFW staff and volunteers counted adult Snowy Plovers at up to 20 sites in Oregon's interior, including at Lake Abert (S. Wray, ODFW, pers. comm.). During the 21 surveys, a total of over 11,000 Snowy Plovers were counted, and of these, the birds seen at Lake Abert accounted for nearly one-third. The numbers of Snowy Plovers counted at the lake ranged from 7 to 345, with an average of 211 birds per survey (Figure 3.2.4.D).

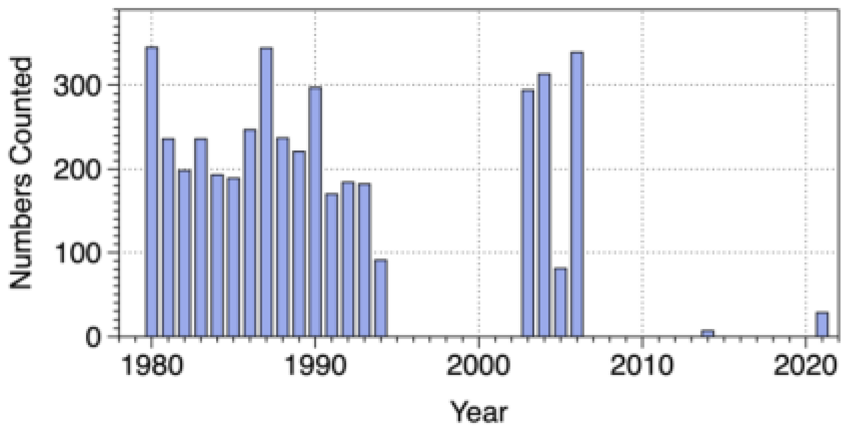

Figure 3.2.4.D. A bar graph of Snowy Plover survey count results made at Lake Abert 1980 – 2021 by ODFW staff and volunteers. Data source: K. Adkins and S. Wray, ODFW. Figure from R. Larson.

The numbers of Snowy Plovers counted at Lake Abert during the past two surveys were the lowest seen during the 21 years that the surveys were conducted. The low numbers seen in 2014 and in 2021 are understandable, considering that the lake was nearly dry during both years. Thomas et al. (2012) conducted a range-wide status survey of the Snowy Plover in 2008, and Lake Abert was among the sites surveyed. Based on those surveys, the numbers of Snowy Plovers at the lake were determined to be 333, which is within the range of counts by the BLM and ODFW. The two other Oregon sites surveyed then were Harney Lake and Summer Lake, which had counts of 242 and 655, respectively.

Snowy Plovers are considered imperiled because of declines, a small population size, negative effects of predators and invasive plants, as well as impacts from human recreation and coastal development (Thomas et al. 2012). In Oregon, ODFW lists the western Snowy Plover as a "threatened" species on the state list of threatened and endangered species. At the federal level, the U.S. Fish and Wildlife Service lists the Snowy Plovers nesting along the Pacific coast as "threatened" under the Endangered Species Act. The range-wide survey of Snowy Plovers done in 2007 and 2008 by Thomas et al. (2012) determined that its North American population size was only 26,000 birds. Only 12 of 50 shorebirds regularly breeding in the U.S. and Canada had smaller populations than the Snowy Plover (Andres et al. 2012).

3.2.5. Importance of Lake Abert for Shorebird Conservation.

The birds that most rely on Lake Abert are shorebirds. Also, the State of the Birds 2022 report documented that as a group, shorebirds had declined by 33% between 1970 and 2019. Smith et al. (2023) evaluated the population status of 28 shorebird species and relied on abundance data obtained from 1980 to 2019 using data from several international monitoring programs. Over half of the species analyzed had declines of 50% or more during the study period.

Lake Abert is of international conservation importance for five shorebird species listed in Table 3.2.5. This is based on the criterion that a wetland is of global importance if it supports at least 1% of a species' North American population (Andres et al. 2012). This criterion is used by the Ramsar Convention for Wetlands of International Importance, the Important Bird Areas Program of

BirdLife International and National Audubon Society, and the Western Hemisphere Shorebird Reserve Network. Within Oregon, Lake Abert is ranked among the highest sites in terms of peak abundances for the following 11 waterbirds: American Avocet, Black-necked Stilt, California Gull, Eared Grebe, Least Sandpiper, Northern Shoveler, Red-necked Phalarope, Ring-billed Gull, Western Sandpiper, Western Willet, and Wilson's Phalarope.[16]

From the Intermountain West Joint Venture Implementation Plan (2005):

> *"Salinities in large Great Basin hypersaline lakes such as the Great Salt Lake, Lake Abert, and Mono Lake and the saline sinks of Lahontan Valley are of increasing concern for shorebirds. Each of these areas face human-induced water level manipulations which alter salinity concentrations and can influence contaminant cycling (Naftz et al. 2008). Furthermore, altered hydrology can cause reduced or increased salinities beyond the tolerance of shorebird chicks and prey (e.g., brine flies and brine shrimp; Oring et al. 2000; Oring et al., 2013). Therefore, maintaining optimal salinity levels and protecting these habitats from further disruption is crucial for the survival and health of shorebird populations."*

Species	Estimated North American Population Size	Maximum Abundance at Lake Abert	Date of Count	Percent of North American Population
American Avocet	450,000	35,000*[1]	September 1993	8
Snowy Plover	25,800	345*[2]	June 1987	1.3
Black-necked Stilt	175,000	5,000*[3]	September 2012	2.9
Red-necked phalarope	2,500,000	52,000*[1]	August 1995	2.1
Wilson's Phalarope	1,500,000	300,000*[3]	July 2013	20

*Table 3.2.5. The maximum single year abundances of shorebird species at Lake Abert which represents at least 1% of the North American population as reported by Andres et al. (2012) and Lake Abert bird abundances from various sources. Data sources: *1=BLM, *2=ODFW, *3=ECAS.*

[16] See Appendix A

3.3 Riparian Use

Riparian habitat along the Chewaucan River and its tributaries include deciduous trees (cottonwood and willow) and a variety of shrubs, grasses, forbs, rushes, and sedges. These habitats support many passerines and other bird species during migration and breeding seasons. See Appendix B for examples. Some of these species are found in upland sites adjacent to, and are attracted to features provided by, flood irrigated wetlands.

3.3.1. Fish in the Chewaucan Basin

Three native fish species also occur in the Chewaucan Basin. Species include the Chewaucan Redband Trout (*Oncorhynchus mykiss ssp.*), Speckled Dace (*Rhinichthys osculus*), and Tui Chub (*Siphateles oregonensis*) (Harris 2000).

Redband trout are a flagship species in the Chewaucan/Lake Abert Basin. Redband trout inhabiting Oregon's inland desert basins are recognized as *O. mykiss newberr*i by Behnke (1992), but redband trout are typically referred to as *O. mykiss ssp*. by management agencies. In 1997, several environmental groups petitioned the U.S. Fish and Wildlife Service to list redband in the Great Basin under the Endangered Species Act. Inland redband trout were reviewed for possible listing under the Endangered Species Act (ESA), but listing was determined to be not warranted by the U.S. Fish and Wildlife Service (USFWS 2000). Reasons given for not listing redband trout under the ESA included moderate to high numbers of redband trout as compared to state-wide averages, improving trend in habitat, return of adfluvial populations in the Goose Lake and Chewaucan systems, and strong conservation efforts through various working groups and watershed councils. The State of Oregon recognizes inland redband trout as a Sensitive species and the U.S. Forest Service Region 6 lists Great Basin redband trout as a Regional Forester sensitive species. In 2016, the Interior Redband Trout Conservation Strategy was completed by a multi-agency group across the range of the species which covers several states in the western United States (Interior Redband Conservation Team, 2016). The Conservation Strategy has eight Geographic Management Units (GMU's) and includes the Oregon Closed Basin GMU which contains the Lake Abert subbasin. Each GMU has specific goals, objectives, and action items for further the conservation efforts and continued viability of redband trout. .

The Oregon Department of Fish and Wildlife (ODFW) completed a Native Fish Status Assessment for 69 native fish species in Oregon in 2005, which included redband trout, with each species having Species Management Unitis (SMU's). Redband trout has seven SMU's which includes the Chewaucan. The Chewaucan Redband Trout species management unit (SMU) consists of four populations, three in Lake Abert Basin and one in Summer Lake Basin. The Chewaucan population is one of the three Lake Abert Basin populations. Redband Trout in Lake Abert Basin are distributed throughout the basin and are moderately abundant (ODFW, 2005). Chewaucan Redband Trout exhibit both resident and migratory life history strategies. Resident fish remain in tributary streams. Fluvial fish migrate between tributaries and the mainstem Chewaucan River. Adfluvial fish are juveniles that migrate downstream from tributaries to the Rivers End Reservoir where they grow rapidly in the productive shallow reservoir environment. Degraded habitat conditions and barriers to migration are the most persistent threats to populations in the SMU (ODFW, 2005). The Chewaucan SMU met four of the six interim criteria and is classified as 'potentially at risk'. The Chewaucan population passes all six of the interim criteria (ODFW, 2005). Fish passage at the three main stem diversions on the lower Chewaucan River have been addressed with fish passage facilities although facility operations may still limit upstream passage in some years.

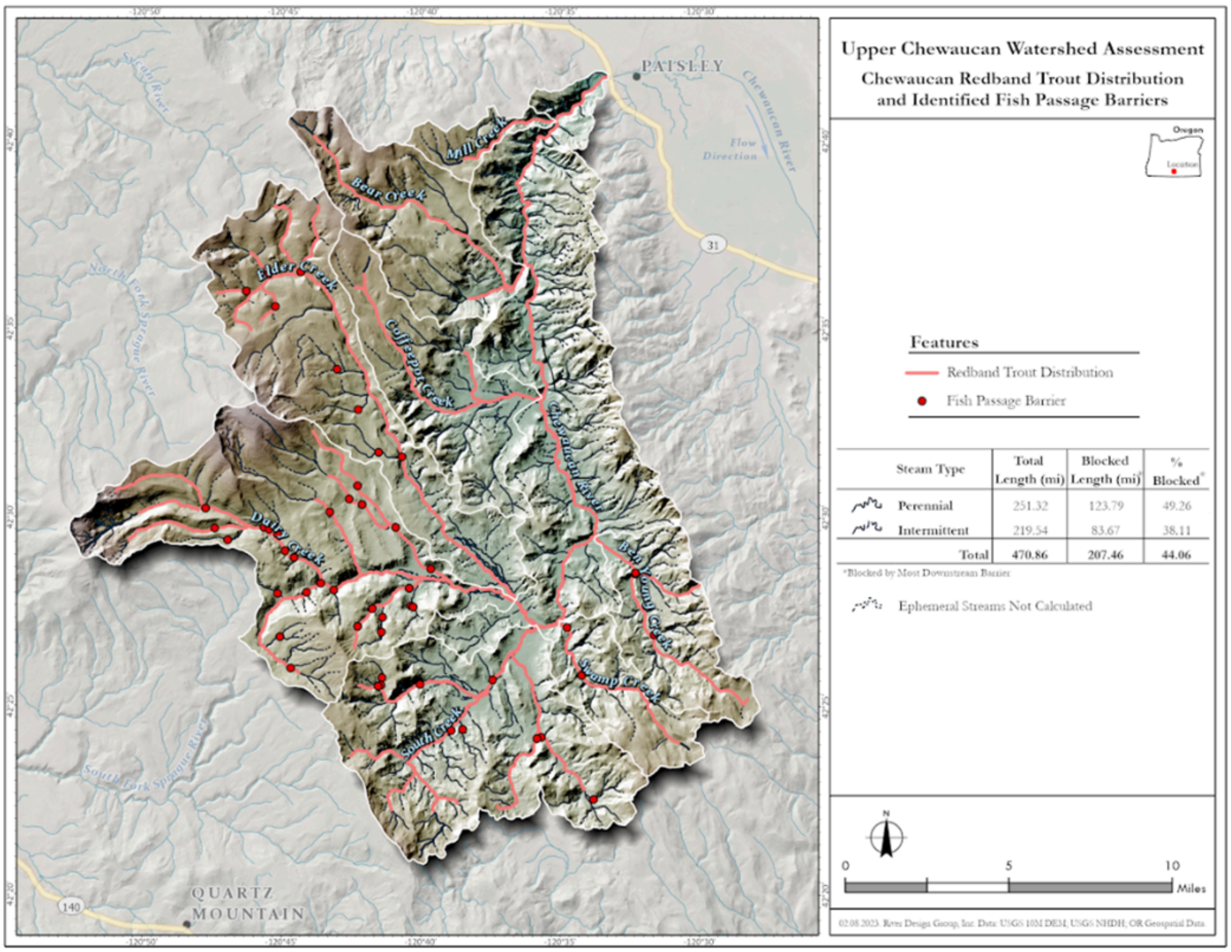

Figure 3.3.1. A map of Redband Trout Distribution in the Chewaucan with labeled fish barriers; (Figure produced by River Design Group, 2023)

3.4. Reservoir Use

Rivers End reservoir also provides deep water rearing habitat for adfluvial run Redband trout in the Chewaucan River. Juvenile Redband that hatched in the river above Paisley migrate downstream to the reservoir during the high flows of spring runoff. They rear in the reservoir until reaching sexual maturity then migrate upstream to spawn. ODFW and the private landowners have installed two fish ladders and two fish screens on the major diversions. There is one more screen that needs to be installed to protect this migration. Historical rearing habitat of this adfluvial life cycle was the deep-water wetlands in the upper and lower marsh, which were drained early in the 20th century. With development of Rivers End Reservoir, rearing habitat was again available.[17]

[17] See Appendix A

IV. Upland Processes

(Lead: Autumn Muir, supported by Hannah Steele)
(Includes significant contributions from Stan Senner)

The Upper Chewaucan Watershed is an area of critical importance for water resources, wildlife, and ecosystems in the Chewaucan system. This section addresses key points relating to:

- Major topographic features and hydrological boundaries;
- Landcover and land ownership;
- Current and historical impacts of fire on vegetation and land cover; and
- Important wildlife species and habitat.

The Chewaucan River begins in the mountains of the Fremont-Winema National Forest from a number of creeks, streams, and springs. It then flows downstream to the town of Paisley, Oregon. The upper reaches of this watershed provide invaluable habitat for species such as redband trout and mule deer. Many state agencies and watershed groups have been working in the Upper Chewaucan to improve the hydrologic and ecological systems there to improve fish passage and riparian habitat. The upper watershed was heavily impacted by fires in 2020 and 2021, leaving many public and private land managers with questions regarding how and where to focus recovery efforts such as revegetation (Oregon Consensus, 2023). The Chewaucan Watershed

> *"*includes the Middle Chewaucan River and Upper Chewaucan River delineated at the 10-unit hydrologic unit code (HUC, Figure 4.0.2). The Middle Chewaucan River watershed extends from the mouth of the Chewaucan River canyon west of Paisley, upstream to the Coffeepot Creek confluence with the Chewaucan River. The Upper Chewaucan River Watershed unit extends from the Coffeepot Creek confluence, upstream to the watershed divide.

Figure 4.0.1 *A pyrocumulus cloud rises above the Bootleg Fire in July 2021. Credit: Ron Larson.*

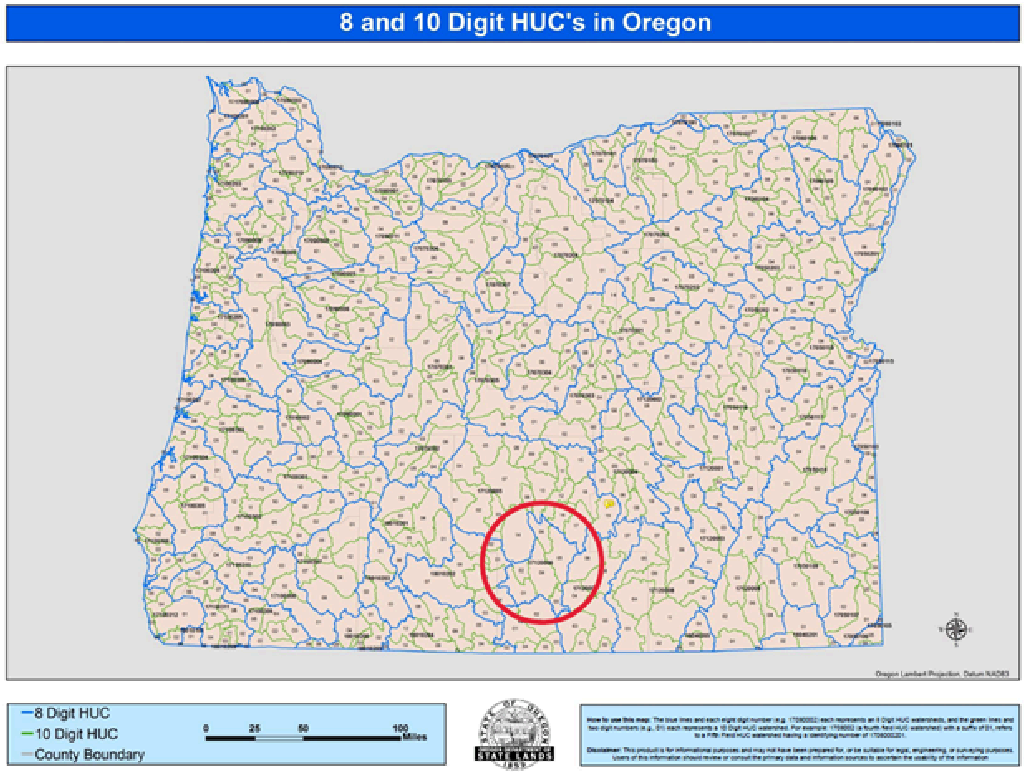

Figure 4.0.2. Oregon Hydrologic Unit Codes (HUC) with the Chewaucan Basin circled in red (produced using https://maps.dsl.state.or.us/hucs/)

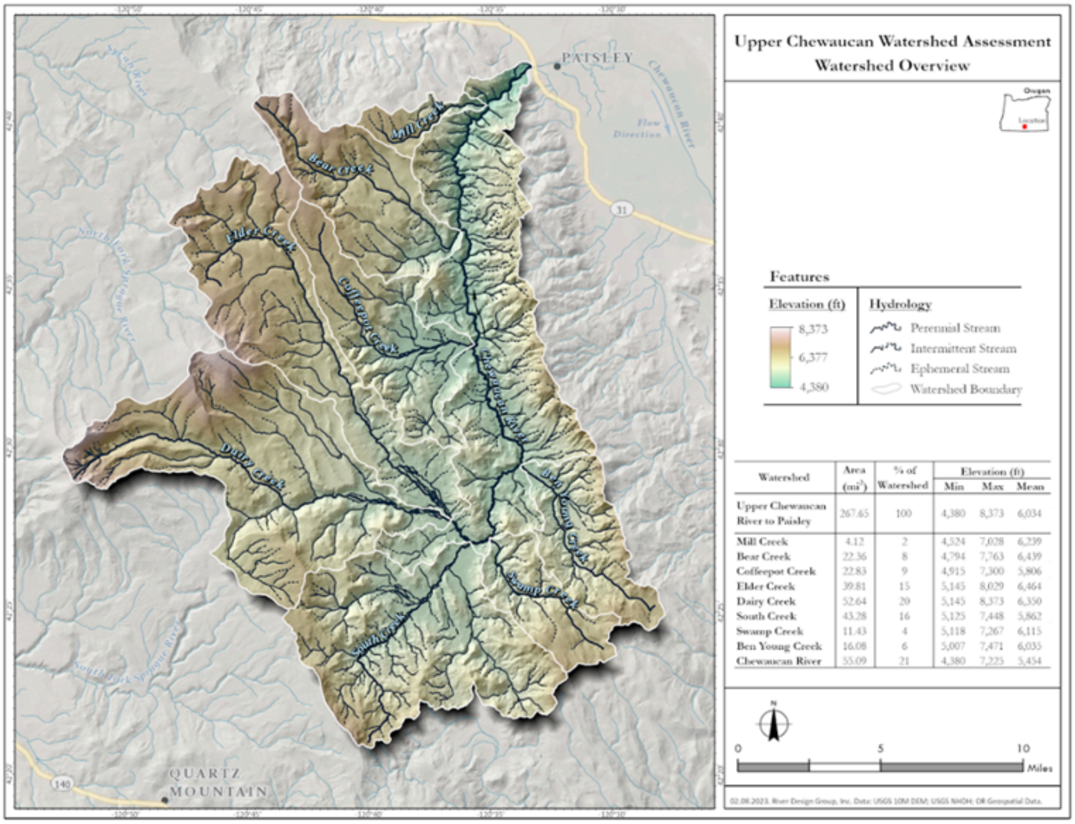

Figure 4.0.3. A relief map of the Upper Chewaucan Watershed (Figure produced by River Design Group, 2023)

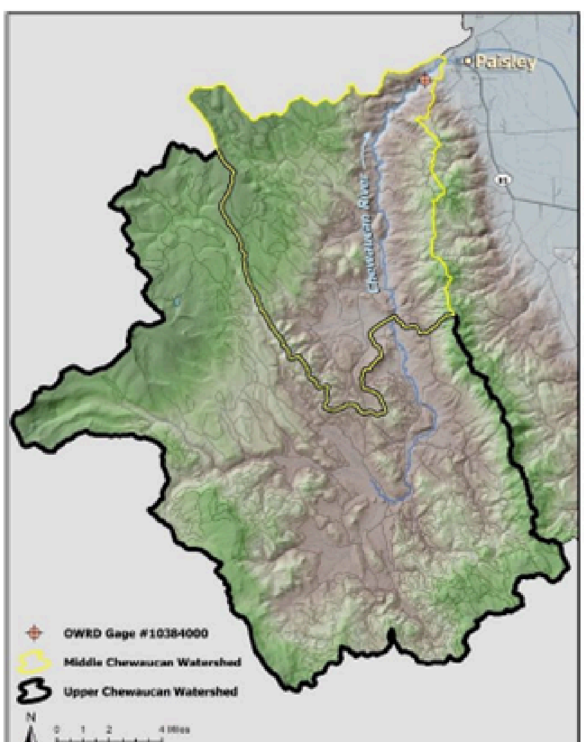

Figure 4.0.4. The delineation of the Middle Chewaucan River and Upper Chewaucan River watershed (Figure from River Design Group, 2023; pg. 7)

4.1 Topography and Land Ownership

The Upper Chewaucan Watershed is made up of large hills, valleys, and mountainous terrain. It is largely forested with interspersed meadows and grassy areas. The land management of the uplands is split into three categories, US Forest Service lands which make up 72% of the total area, Bureau of Land Management lands which make up 2% of the total area, and privately held lands which make up the remaining 26% of the land (see Figure 4.1).

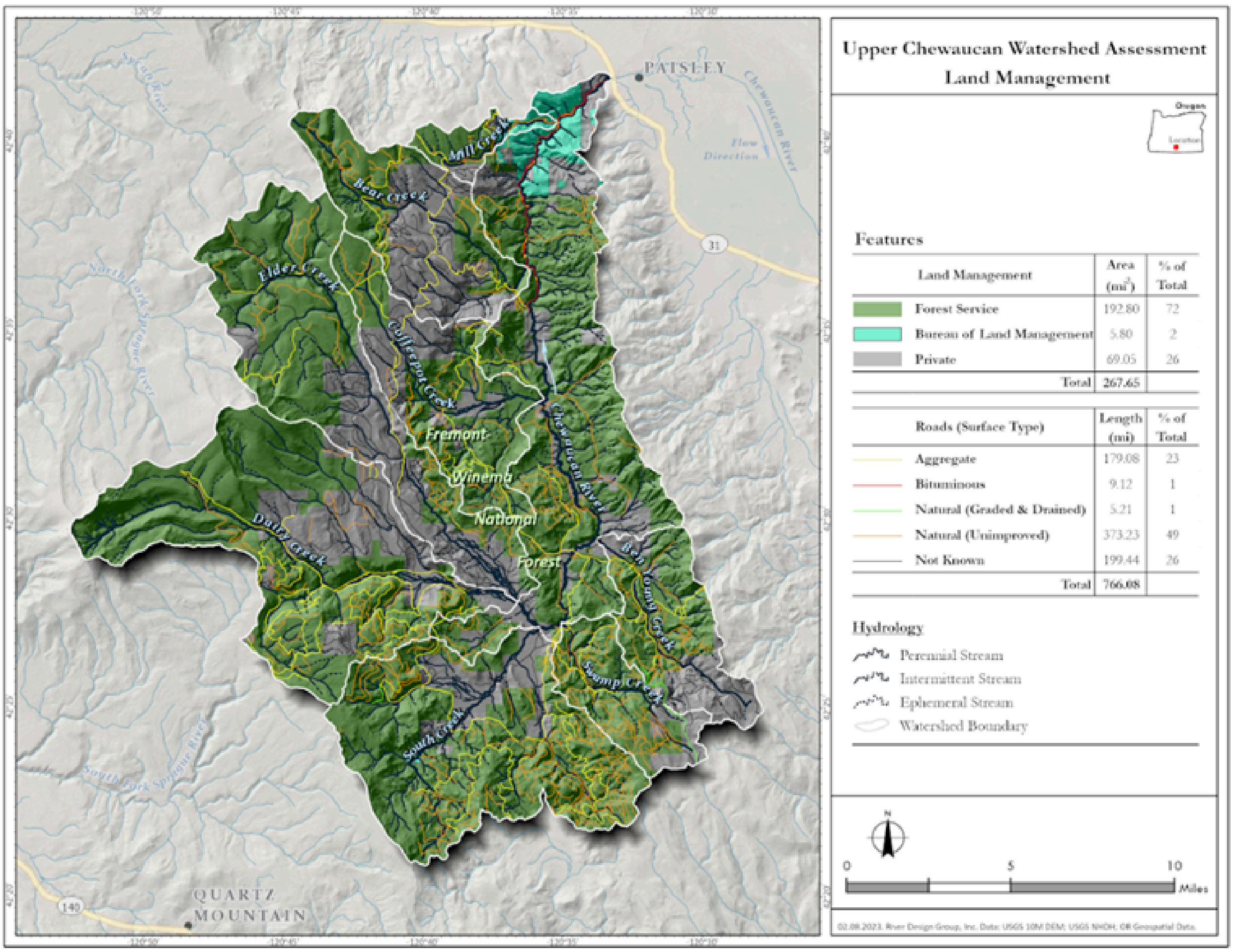

Figure 4.1. A map of land management in the Upper Chewaucan Watershed (Figure produced by River Design Group, 2023)

4.2 Vegetation

The Upper Chewaucan Watershed is home to a wide variety of plants. Riparian vegetation is a major source of energy, nutrients, and shade for stream communities. This vegetation is especially important in small, headwater streams where overhanging riparian vegetation keeps water cool during the summer, which is crucial for trout populations. Riparian buffers provide valuable habitat and forage for wildlife and also serve as important travel corridors for a variety of wildlife.

Riparian thickets also provide shelter and shade for the livestock that graze in the uplands during the summers. Additionally, riparian vegetation slows floodwaters, thereby helping to maintain stable streambanks and allows water to soak into the ground and recharge groundwater. The forested floodplains in the Upper Chewaucan also benefit game species such as deer, elk, rabbit, quail, and nongame species like migratory songbirds. However, the encroachment of noxious weeds has been noted as an issue in the upper basin. Major land cover types and areas can be seen in Figure 4.2.

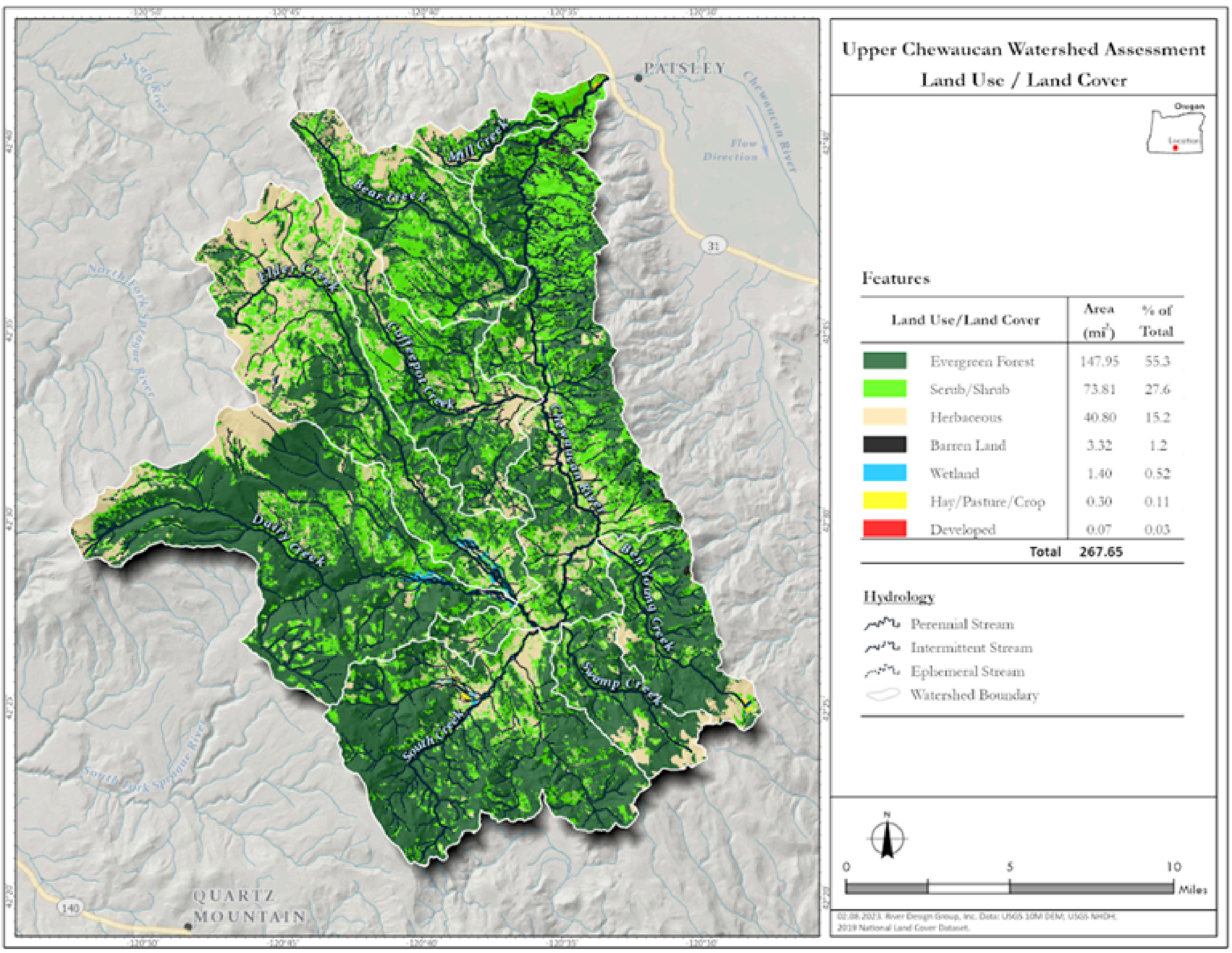

Figure 4.2. Land use and land cover types present in the Upper Chewaucan Watershed (Figure produced by River Design Group, 2023)

4.3 Impacts and Prevalence of Fire on Watershed Processes

According to Neary et al. (2004), “Wildfire is the forest disturbance that has the greatest potential to change watershed conditions.” Unfortunately, south central Oregon, including the Chewaucan Watershed, has recently seen more frequent, larger, and higher-intensity wildfires, and as the quote above states, those events have consequences that extend well beyond the fire itself, including effects to watershed and aquatic systems. In 2021, one of the largest fires in Oregon’s history, the Bootleg Fire, burned over 400,000 acres in Lake and Klamath Counties, including a substantial area of the Chewaucan River Watershed (Figure 4.3.1) . Fire impacts might lead to different runoff yields in upcoming years, thereby affecting lower basin hydrology.

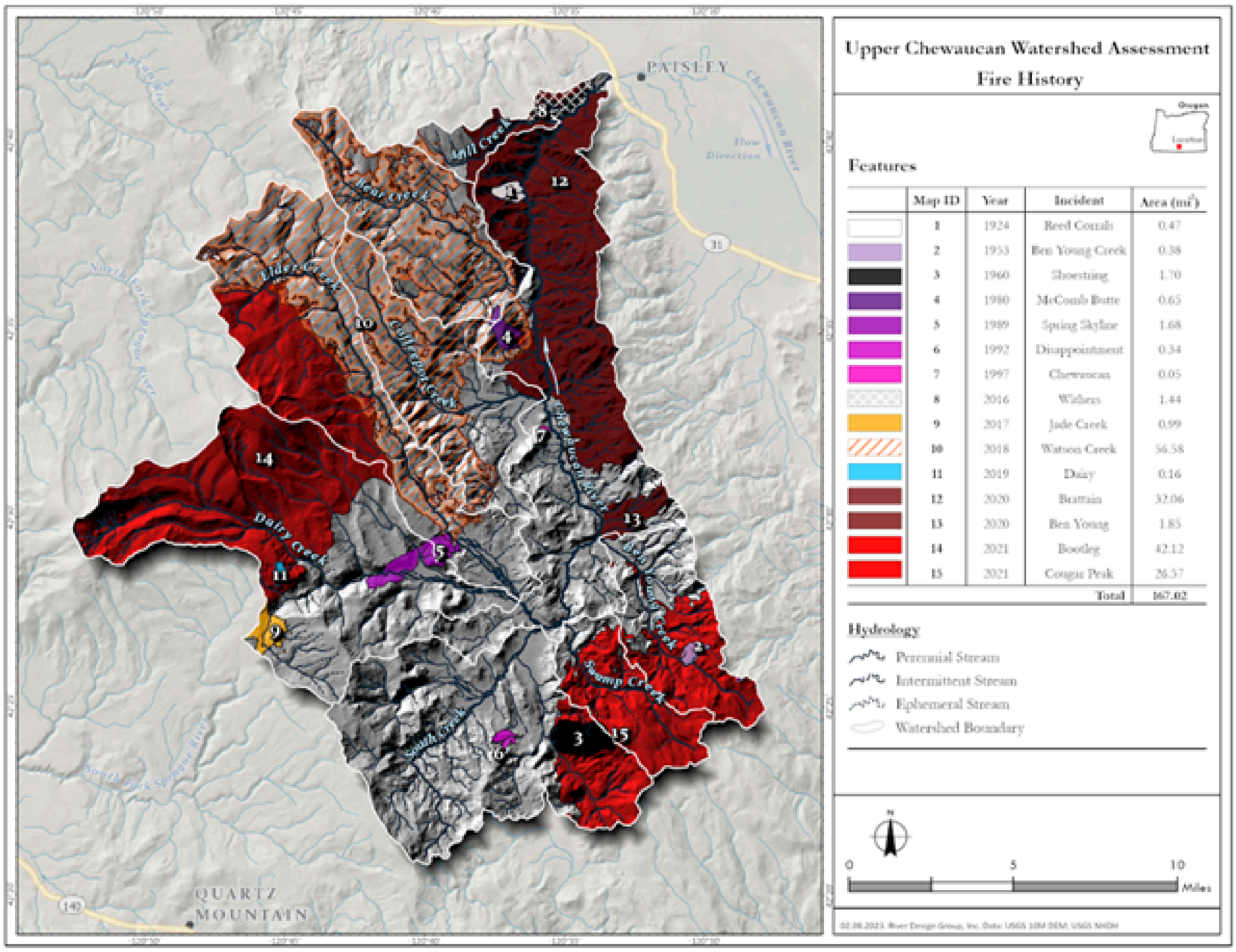

Figure 4.3.1. Fire history of the Upper Chewaucan watershed (Figure produced by River Design Group, 2023)

According to Ice et al. (2004), “Wildfire can cause water repellency and consume plant canopy, surface plants and litter, and structure-enhancing organics within soil. Changes in soil moisture, structure, and infiltration can accelerate surface runoff, erosion, sediment transport, and deposition. Intense rainfall and some soil and terrain conditions can contribute to overland runoff and in-channel debris torrents. Mineralization of organic matter, interruption of root uptake, and loss of shade can further impact water quality by increasing stream temperatures and nutrient concentrations. Where wildfires are unnaturally large and severe, watershed effects are likely to be negatively skewed." As Figure 4.3.3 indicates, areas of the upper Chewaucan watershed were burned by a high-intensity fire and the watershed has been potentially impacted.

The Chewaucan Basin has experienced 16 recorded fires since 1924 (see Figure 4.3.2). Fires prior to 2018 tended to be small starts that were extinguished by firefighting efforts. However, since 2018, four substantial fires have burned 157.3 square miles (59%) of the 267.7 square mile Upper Chewaucan River Watershed (Table 4-7). The Bootleg Fire in 2021 had the largest burn area and the greatest severity (high and moderate severity) of the four recent fires (Table 4-8) (River Design Group, 2023). Over 75% of the Upper Chewaucan Watershed was impacted by five catastrophic recent wildfires. The geographic areas impacted by recent fires can be seen in Figure 4.3.2.

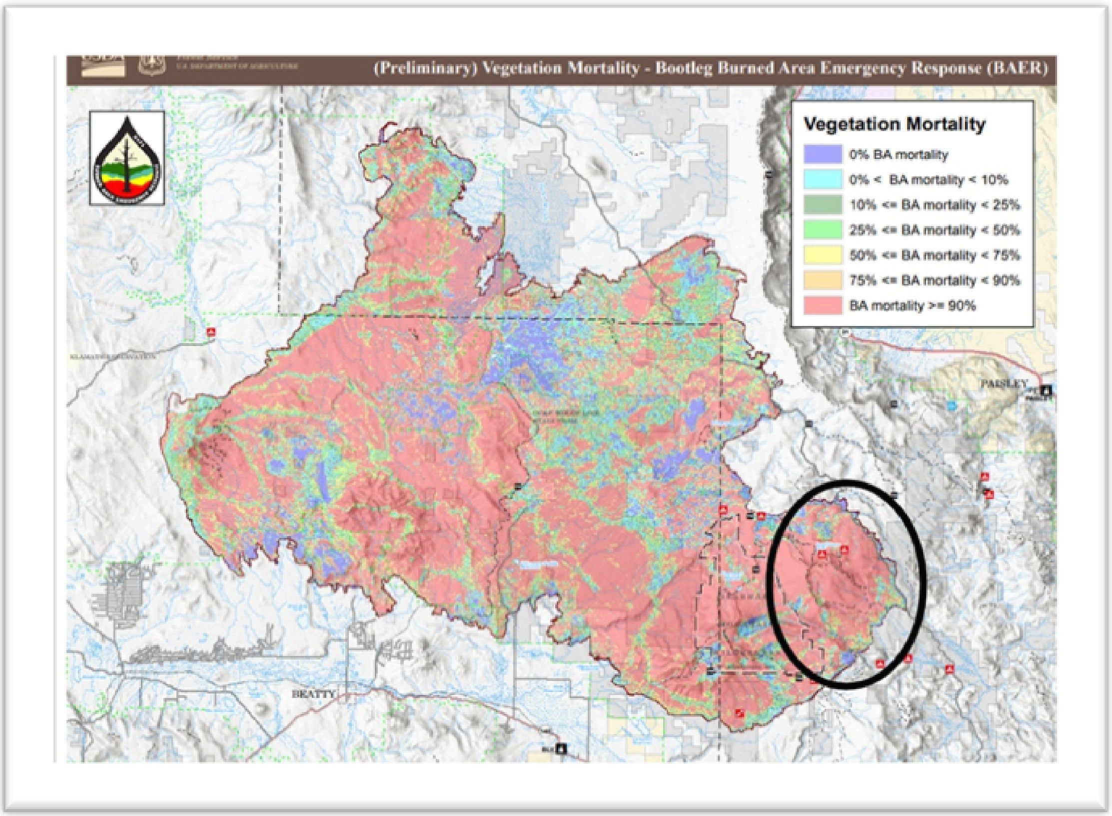

Figure 4.3.2. Map showing Bootleg Fire vegetation mortality. The oval indicates the area of the burn that affected the Chewaucan River Watershed. Vegetation mortality is indicated by colors ranging from blue to red, with red being >90% mortality. Source: US Forest Service

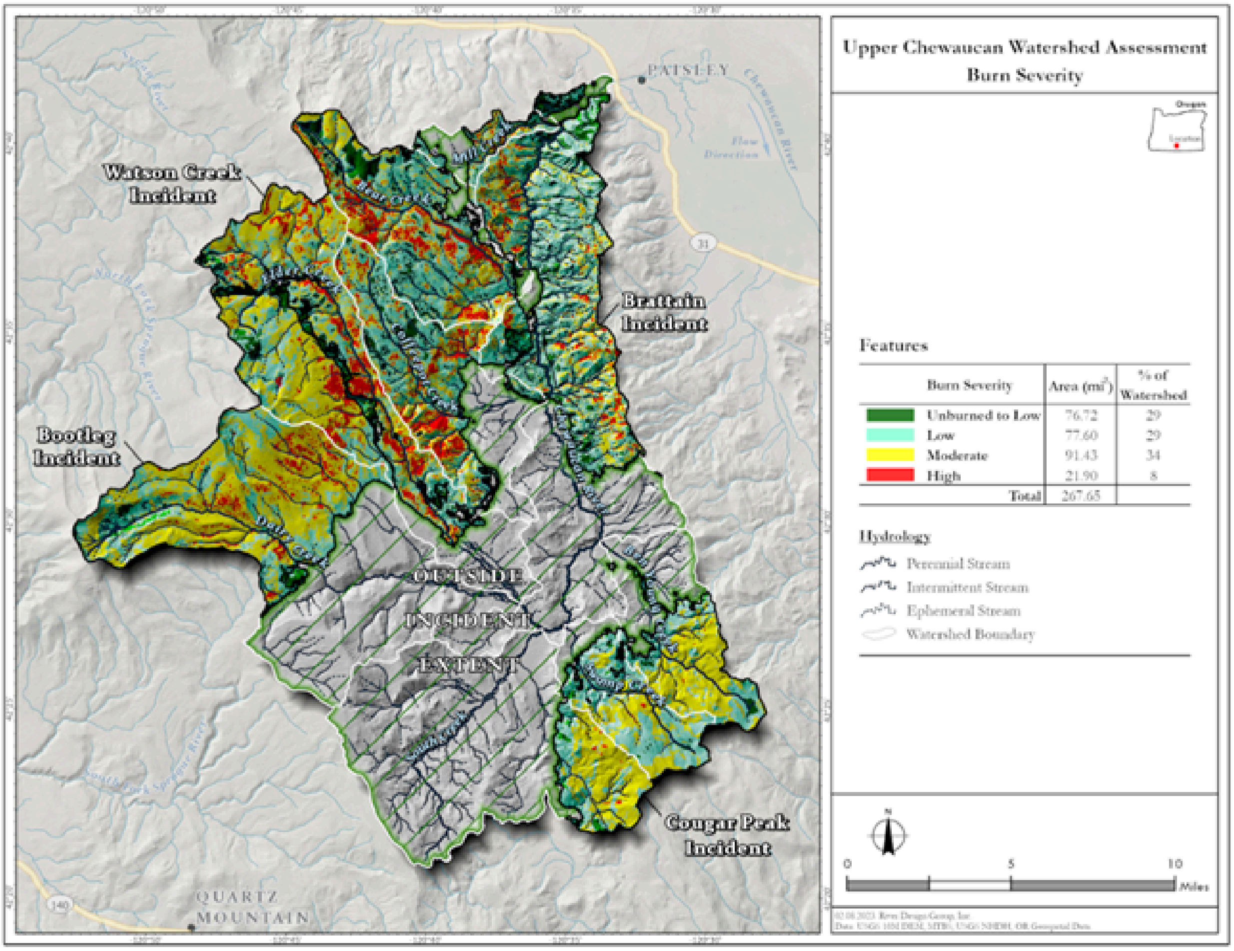

Figure 4.3.3. Soil Burn severity of recent fires in the upper Chewaucan basin (Figure produced by River Design Group, 2023)

Table 4-7. Fire incidents in the Upper Chewaucan watershed between 1924 and 2023.

Year	Incident	Area (mi^2)	% of Watershed
2018	Watson Creek	56.6	21%
2019	Dairy	0.2	0%
2020	Brattain	32.1	12%
2020	Ben Young	1.8	1%
2021	Bootleg	42.1	16%
2021	Cougar Peak	26.6	10%
2023	Morgan Creek	3.6	1%
Total		170.6	63%

Table 4-7. Fire incidents in the Upper Chewaucan watershed between 1924 and 2023.

Year	Incident	Area (mi^2)	% of Watershed
1924	Reed Corrals	0.5	0%
1953	Ben Young Creek	0.4	0%
1960	Shoestring	1.7	1%
1980	McComb Butte	0.6	0%
1989	Spring Skyline	1.7	1%
1992	Disappointment	0.3	0%
1997	Chewaucan	0.1	0%
2016	Withers	1.4	1%
2017	Jade Creek	1.0	0%

Table 4-8. Burn severity associated with four recent fires in the Upper Chewaucan watershed.

Burn Severity	Bootleg Fire (mi^2)	Brattain Fire (mi^2)	Cougar Peak Fire (mi^2)	Watson Creek Fire (mi^2)	Total (mi^2)
Unburned	6.8	6.9	1.4	8.1	23.1
Low	27.2	16.5	11.4	22.5	77.6
Moderate	51.9	6.9	13.7	18.9	91.4
High	8.8	2.3	0.2	10.6	21.9
Total	94.8	32.5	26.7	60.1	214.1

4.4 Soil Erosion

River Design Group (RDG) completed remote sensing and field reconnaissance tasks for the Upper Chewaucan River Strategic Implementation Area to assess existing conditions and to identify opportunities for improving water quality on watershed tributaries and the mainstem Chewaucan River (River Design Group, 2023). RDG coordinated field data collection with Lake County Soil and Water Conservation District (LSWCD) and local landowners. First, River Design Group used the U.S.G.S. StreamStats program to complete a flow duration analysis and generated watershed statistics for the "water quality station locations on three tributaries and the mainstem Chewaucan River. The watershed statistics are helpful for understanding characteristics that affect watershed hydrology" A flow duration analysis was also completed for the OWRD gauge #1038400 Chewaucan River Near Paisley, OR, which provided on total suspended sediments in mg/L. Further details are available in the Upper Chewaucan SIA document, page 107.

> *"Based on stream reach conditions, Upper Chewaucan River tributaries are influenced by historical and contemporary land use decisions including grazing management, irrigation infrastructure, high road densities, fire suppression and post-fire recovery treatments, road building, and riparian vegetation management. Catastrophic fires in the last four years, riparian grazing, and irrigation infrastructure are the contemporary processes with the greatest influence on stream corridors and water quality.* Historical grazing, possible mechanical removal or herbicide treatment of riparian shrubs, and road building continue to affect stream and floodplain stability, aquatic habitat, and water quality. Compared to current conditions, the historical Upper Chewaucan River Watershed with broad meadow reaches and extensive beaver-constructed wetlands, was likely less responsive to high magnitude precipitation events and spring runoff. Burned watershed conditions, suppressed riparian communities, straightened channels, and undersized crossings have resulted in a more sensitive watershed that rapidly responds to precipitation events.*"*

It is likely that the loss of upland vegetation will increase the rate of snowpack runoff. Flashier hydrology is expected to increase stream erosion, sediment loading, and habitat degradation. Given the anticipated hydrologic changes and channel instability a decline in water quality is possible until the landscape adjusts to the hydrologic regime resulting from the catastrophic disturbance. It has been documented that in some regions, up to 60% of total landscape sediment production is fire related. Sediment loss can occur in the first few years and recovery to pre-fire conditions can take decades. The recovery of aquatic species is dependent on conditions upstream and downstream from the burned areas and their ability to access stream reaches.

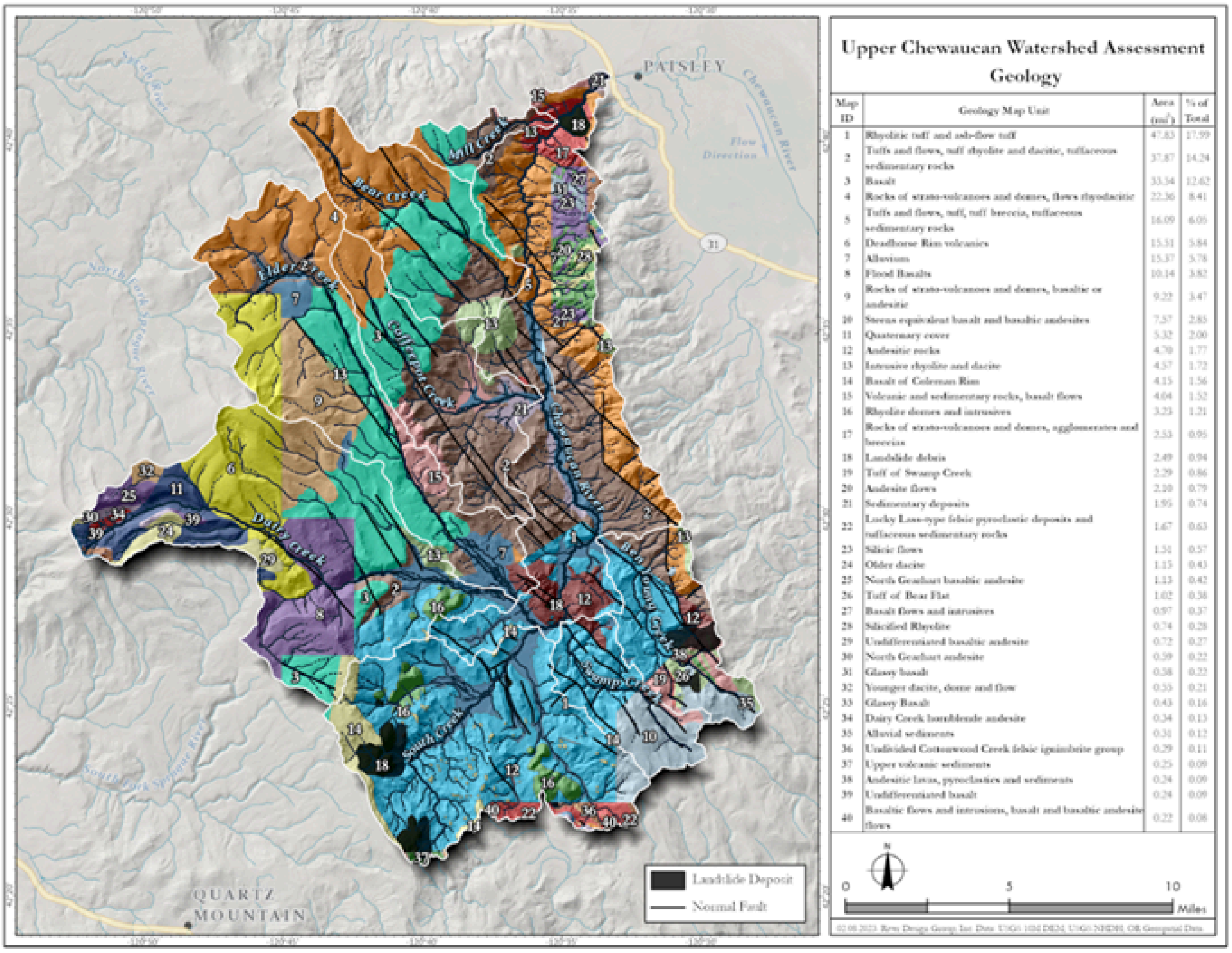

Figure 4.4. Geology of the Upper Chewaucan Watershed (Figure produced by River Design Group, 2023)

4.5 Upland Habitats and Wildlife in the Chewaucan Watershed

Upland areas in the Chewaucan watershed include two ecological types (ecoregions) (ODFW COMPASS 2010): the East Cascade ecoregion and Northern Basin and Range ecoregion. The East Cascade ecoregion comprises forested habitats that include: late successional mixed conifer stands in the highest elevations of the watershed and ponderosa pine woodlands. Flowing water/riparian habitats occur along the perennial streams, and wetland habitats are present in

Coffee Pot Flat, South Flat, and numerous springs, seeps and small meadows. Aspen stands are commonly associated with riparian and wetland habitats. Sagebrush/Juniper dominated habitats in the watershed are part of the Northern Basin and Range ecoregion. This habitat type is upstream from Paisley along the front range around Clover Flat, and is the dominant vegetation type in the Tucker Hills, Coglan Buttes and Abert Rim. Average annual precipitation delineates the two ecoregions. Average precipitation exceeds 15 inches in the East Cascade ecoregion and is less than 15 inches in the Northern Basin and Range ecoregion.

In general, within the Northern Basin and Range ecoregion, the occurrence of wildfire negatively affects wildlife. Most of the dominant shrub species are not fire tolerant and it takes decades or centuries for them to recover to densities which support shrub dependent wildlife species. Recovery times are longer with the establishment of non-native grass species. Within the East Cascade ecoregion wildfire can have a positive or negative affect on wildlife species depending on their habitat requirements.

A variety of large mammals are present in the upper watershed. Mule deer are common throughout the watershed. Sagebrush/Juniper and the lower elevation ponderosa pine habitats provide important winter range for deer, which summer in forested habitats at higher elevations within and outside the watershed. Retention of winter range quality is an important management concern. Since 65% of the winter range is privately owned, a working relationship with landowners and land managers is imperative. Overstocked forest stands in summer habitats have negatively affected mule deer by decreasing forage quantity and quality. Recent wildfires in a significant portion of the summer range are expected to positively affect forage availability, and increase vegetation diversity, which should benefit mule deer. Rocky Mountain elk are present throughout the forested habitats of the watershed. Reports published in the 1880's indicate that elk are native to Lake County however they occur in low numbers as compared to other occupied areas in Oregon (pers. comm., ODFW). As with mule deer, the recent wildfires are expected to positively affect forage quality and habitat diversity for elk.

Within the watershed pronghorn are present in areas of sage steppe habitat with gentle slopes. Upland areas north and west of Lake Abert and the Tucker Hills are used year round. Some of the pronghorn that summer in the Goose Lake Valley migrate to Clover Flat for winter. California bighorn sheep are a native species using available habitat in the watershed. Historic populations were extirpated by 1912. Bighorns were reintroduced between 1977 and 1992 and are now present on Abert Rim, Coglan Buttes, Tucker Hills and above Paisley along the Chewaucan River. Black bear and cougar are both native predator species. Cougars are habitat generalists and occur throughout the watershed. Black bears primarily select forested habitats. Populations of both species have increased since 1994 and population size is determined by availability of prey.

This section concludes with an overview of how key species are impacted by upland processes in the Chewaucan Basin. A number of important Oregon Conservation Strategy species and their habitats are found in the upper Chewaucan (a full list is provided in Table 1 found in Appendix B). These include Chewaucan redband trout, greater sage-grouse, pygmy rabbit, greater sandhill crane, black-backed woodpecker, white-headed woodpecker, American marten, and bald eagle.

Chewaucan Redband Trout have management status as a distinct population unit due to separation from other populations of redband trout. As described in the wildlife section for the lower Chewaucan watershed there is an adfluvial run of red band from Rivers End Ranch Reservoir upstream to spawning habitat in the river and its tributaries above Paisley. There is no spawning habitat below Paisley.

Greater Sage Grouse and Pygmy Rabbit populations throughout the watershed declined significantly after the Sharp Top Fire (1982) removed most of the sagebrush habitat between Coglan Buttes and Lake Abert. It is expected to take several more decades before sagebrush re-establishes with enough density to support either of these species.

Coffee Pot Flat, South Flat and some of the larger meadows associated with the Upper Chewaucan River are used as summer habitat by greater sandhill cranes. Cranes have not been found nesting in these areas (Ivey and Herziger, 2000) but non-breeders or what are assumed to be unsuccessful breeders use these areas for feeding.

Black-backed woodpeckers are known to reach their highest population densities in burned forest stands. Considering the recent wildfire history in the forested portion of the watershed, populations of this species are expected to increase. White-headed woodpeckers select mature ponderosa pine stands. Because of the wildfire impact on their habitat, populations of this species are expected to decrease.

Winter track surveys completed in the early 1990's found American marten in the higher elevations of Dairy Creek and on Dead Horse Ridge. There have been no surveys since that time and it is unknown what effect the pine beetle outbreak of the early 2000's and the Bootleg Fire in 2021 had on marten populations. Marten do use forested habitats burned in wildfires but they select for areas with light to moderate fire impacts (Volkman and Hodges, 2021).

V. Cultural Heritage/Lived Experience

(Lead: Wilson Wewa, Brenda Morgan, Marie Lee; supported by Henry Pitts)

5.1 Introduction

Indigenous people have been present in the Chewaucan Basin since time immemorial. The area has also been inhabited since the late 1800s by settlers, many of whom established multi-generational ranches that are still in existence today. This chapter includes three perspectives on history and knowledge of the basin from local experts. The first perspective is from Wilson Wewa, a Tribal Elder, spiritual leader, and knowledge holder of the Confederated Tribes of the Warm Springs. The second perspective is from Marie Lee, the Director of the Lake County Museum and a local resident. The third perspective is from Brenda Morgan, a local historian and expert. Ms. Morgan is also currently working on a book on the history of the area. These perspectives are summaries of continued conversations with each expert, and have been approved by their respective expert. The chapter opens with a brief overview of Tribal sovereignty, as well as a few specific Tribal policies that might impact decision making or management in the basin.

5.2 Tribal Sovereignty, Reserved Rights, and Claims

Tribal nations are sovereign entities that may be recognized by both the U.S. government and state governments. Tribes may have certain rights and claims reserved to them in treaties with the federal government, and may have ceded portions of their ancestral territories as a condition of reserving these treaty rights. In the Chewaucan Basin, multiple different Tribes located in what is now Oregon and California recognize reserved rights and claims. Honoring these reserved rights and claims is critical to upholding federal treaty obligations and maintaining the trust responsibilities that federal and state agencies have to Tribes, including the protection of sacred cultural sites and fish and wildlife.The Burns Paiute Tribe recognizes the entirety of the Chewaucan Basin, as well as all of Lake County, as part of their traditional territory (Traditional Territory). They further recognize "the Chewaucan River Drainage, Abert Rim, Tucker Hill, and the River's End Ranch area as sacred sites which include spiritual quest, sacred and cultural sites" (Resolution No. 95-04). The Tribe's aboriginal protection policy, adopted in 2006, further protects specific culturally significant materials (Resolution No. 2006-12). These materials include water, river bottom rocks, salmon and trout (Resolution No. 2006-12). Water and river bottom rocks are of particular importance, as the flow of water throughout the Chewaucan Basin is directly related to the goals outlined in HB3099. HB3099 was a draft bill, which was incorporated into HB2010, which passed. It is worth noting that the cultural significance of water for many Paiute bands could be tied to Numic religious and spiritual traditions. These traditions include the recognition of "puha" (power) flowing across the landscape, in ways that mirror and follow the flow of water on the landscape (Miller, 1983). Miller further notes that all sources of water are thus considered sacred, as they are reservoirs of power (1983). Caves, which are present along the eastern side of the Chewaucan Basin, are also considered sacred in the Numic tradition as they help to "attract and direct the flow of water." (1983). This could have significant implications for the Chewaucan Basin, as the connections between groundwater and surface water are further explored.[18]

[18] See Appendix A

5.3 Perspective 1: Wilson Wewa

Introduction

The Paiute people have maintained their presence on the landscape forever, since time immemorial. The land has provided a lifeway that has continued year after year into the present day.

Forcing their people onto reservations, which was supposed to be part of assimilation into 'civilization', hasn't erased the need to maintain relationships with the land, and to utilize the gifts of the land. They still gather roots and medicine, and honor their ancestors in these spaces.

There weren't any structured cemeteries- ancestors are located across the landscape. Their people utilized land around Silver Lake, Summer Lake (the Paiute place name means 'dusty lake'), Hart Mountains, Warner Mountains, the Steens, up to Boise and north to Baker City down to the John Day Watershed. These lands and territories were recorded in Army documents as Oregon territorial commissioners examined the "Indian Problem." There are sacred places in these lands that were used repeatedly throughout the generations. They were used because of the medicines or because of the unusual geographic features. Just because their people are not there still doesn't mean they're any less sacred. Northern Paiutes can hunt and fish and gather any waterway within their aboriginal territory. Though one of their original treaties from 1859 wasn't ratified, the presiding federal judge and a solicitor from litigation in the 1990s made statements that supported the idea that Northern Paiutes were a sovereign Nation in 1872 with the Malheur Reservation.

The whole area is rich with pictographs, cairns, hunting blinds, and house circles- which were strategically placed in locations with an abundance of water. There are hunting blinds near Tucker Hill. They're all positioned in such a way that if someone heard deer or game from the flats where the ZX Ranch is, it would be easy to draw the game up and kill them. Those things are there for a purpose, and are a footprint left by the Paiute people for tens of thousands of years. The digs at the Paisley Caves went back between 25,000-27,000 years. Cultural debris on each of the five levels proves their people had been there for a long time. There were books written by amateur collectors, which included many of the low places from Paisley to Rivers End Ranch- some of the house rings are now gone, on land now plowed for alfalfa.

Importance of Water & Wildlife

When you talk about water and its location it's incredibly important, or those thousand year old village sites wouldn't be there. You also can't have animals on the land without water. When it's moved, it can affect the whole ecosystem and the animals. The flyway numbers for birds are declining, and it all has to do with water. The antelope and deer and other animals might leave too if the birds do- time will tell. For thousands and thousands of years the land was there without the hay farming. Plants along the edge of streams can take decades to build up- it's not just about the grasses that spring up last year. A substantial amount of tulles and cattails and natural grasses are needed to support natural habitat- when the Chewaucan was running there were more meadows and river channels and tulles to support nests.Certain aspects of life have definitely been altered because of the decline of water.

In the 1970s, there was an eagle on every light pole along the highway in the fall and winter in this area. Bald eagles are carrion eaters- they also like to hunt squirrels, mice, and rabbits. Their decline could be linked to the decline of birds at the lake.

Cultural aspects of water and land aren't treated as important. But they paint a picture of a land that was once self-sustaining, when people and the land and the animals were in a mutual relationship. If one part of the ecosystem is destroyed by man, man needs to come back and fix it so it will thrive again. Sometimes man can't put it back together.

Stories & Oral Tradition

You have to keep these things in your memory. It's hard when you don't talk about it. Wilson learned these stories from his parents and grandparents.

There are legends about meteorites that killed a lot of people, animals, and plants. There is a pictograph up by Bend, Oregon. It brought death to many things. There are arguments from people that it didn't happen- but one did strike in the southwestern US at that time, and it did kill a bunch of people. The Paiute people never claimed it struck here- they saw it and heard about it. Over 20,000 years, the story could make its way up to their people. That also spells how long they've been there.

There are stories and legends about a creature or creatures that lived in the lakes- Pyramid, Surprise, Summer, Goose- even in historical times, white people saw those creatures too. When they went to go look for them, or the lakes went dry, they'd look for the remains.

The creature looked like a giant snake. It was ravaging the land- the only thing their people could chase it away with was fire when it came out of the water onto the land.

In Cedarville, there's a place next to the hill bigger than this building– if you know what to look for you can see it. That was its sleeping place, it curled up there. It crawled along away from the fire they chased it with on the west side of Surprise lake. You can see a trough along the hillside- that's where it crawled along. It went into the water there and came back out in Pyramid Lake. Their people chased it again and it came out by Walker Lake. They drove it out into the desert by a huge hill in Fort Bidwell and it coiled around there and it defended itself. They lit the grass on fire and killed it. There's one hill northeast of Walker Lake that is all black. It's been black ever since then. That's why the old people said the lakes were connected- whether they are or aren't is unclear. The underground caves could be a remnant of Lake Lahontan when the valleys and lakes were all connected- they say people weren't here when it was at its highest point. But a pictograph has been found above the highest level.

That's why the water is important- you can't upset the balance of nature- you have to try to keep some sense of original form.

They're not just dealing with a small area like Lake Abert. If an aquifer connects all these places, their water and its usage is all connected. When they first built dams on the Deschutes it scared his people that something bad would happen. It chased the snow away and changed the weather. The old people were smart.

The Paiute people don't all live there anymore, but they know about it. This land was where we made war, gathered food. They lived off the land.

That was their home.

5.4 Perspective 2: Marie Lee

General Basin History

Mrs. Lee's ancestors came to the area in 1871. Her brother Lytle "Sonny" Simms and her nephew, Dustin Simms, own and operate the Simms Ranch LLC. The Simms Ranch is located in the Crooked Creek Basin, and is a part of the Chewaucan Watershed Collaborative. They were close to the first people in the basin, though the Colvins might have arrived in the lower part of the valley in 1869. She grew up on the ranch, which was a grand way to spend childhood.

Her family initially arrived in the basin with dairy cattle, which was a bit of an error as there was not a railroad in the area. Her great grandfather, SB Chandler, had sheep and a small ranching empire on the north end of Lake Abert down to Lakeview. There weren't any crop operations in the area, aside from a few small orchards near Summer Lake.

There were tensions between cattle ranchers and sheepherders, including famous range wars in northern Lake County. It was a bit of a spillover from conflicts in Deschutes County, and further east from there. Mrs. Lee's great grandfather passed on stories, including being advised not to stay overnight in Silver Lake when he went to check on sheep he leased in the area. A band of sheep was attacked that night.

Further south in Lake County, tensions between sheep and cattle ranchers were less prevalent. Many ranches raised both sheep and cattle. However, sheep farming became increasingly unprofitable over time. Fleece was the most economically valuable aspect of sheep, though lamb meat was also considered a delicacy. The demand for wool surged during wartime, particularly for military uniforms, but the rise of synthetic materials like polyester led to a decline in wool's popularity. Additionally, mutton was extensively used for military rations during WWII. With the end of the war, the demand for mutton dwindled, and imports from countries like New Zealand and Australia replaced domestic production.

There was a shift in agricultural practices during World War II, with grain cultivation surging particularly in areas like Goose Lake and Valley Falls. However, by the 1960s, government initiatives like the Conservation Reserve Program (CRP) prompted a shift away from grain cultivation. The Simms Ranch, now managed by Mrs. Lee's brother and nephew, was a part of those programs.

Impact on Tribal Members & Indigenous People

The stories of the Paiute people that lived in the area were often overlooked. The government carried out a cruel process of removing Indigenous people from their land, and often failed to understand distinctions between different tribes. Camp Warner, a military site in the area, was eventually disbanded. A stockade was built in the Crooked Creek Valley during the Modoc War, as well as another south of Paisley after the Modoc War, though they were never used. There were thought to be a few hundred Paiute people in the Chewaucan area at that time, though they were nomadic and were thought to spend time around Dead Man Canyon.

A group of Paiute people lived in the area just south of Lake Abert, from the 1870s until around 1910. They were known to also live in Bullard Canyon and Deadman Canyon near Lakeview, Oregon. Their leader was understood to be a man named Lakeview John, who died in 1921 at 100 years of age. His wife Maggie tragically passed away in 1910 after freezing to death in Lakeview. John moved onward to Fort Bidwell after this occurred.

Many Paiute people also returned to the area for the Lakeview Roundup, which first occurred in 1920. Mrs. Lee remembers them still returning in the 1950s when she was a child. They would set up camp at the edge of the fairgrounds, which was a great opportunity for local people to understand and experience Paiute culture. It occurred on a smaller scale than the events at the Pendleton roundup.

They were terribly discriminated against, and some were sent further south to the Fort Bidwell Indian School. In modern times, there are still people in the area that have ancestral ties to the Paiute people that lived on these lands.

Recollections on Lake Abert

The lake has been dry before. Mrs. Lee's father was born in 1919, and thinks it was dry in 1924. Her father's family used to go down to Poison Creek to have a picnic for Easter, and they used to walk out across the lake. Her father remembers getting tired, and having his dad pick him up. He talked about walking across it often. One Thanksgiving on the ranch the alkali dust from Goose Lake was so intense, it grew dark like night and they had to light all the lamps. It is unclear if there were wagon trails across Lake Abert, though there were tracks on the far end of Goose Lake, which would have been a part of the Applegate Trail.

Her father also spoke about being done haying by the 4th of July when he was 10, which would have been 1929. Haying is typically done in mid-August, so this was an unusual year.

5.5 Perspective 3: Brenda Morgan

Description of Land Use

The first white settlers to stay in the area arrived in 1871, though there are a few instances of people visiting or traveling through the area prior to that date. Most of the early settlers arriving in Chewaucan, as it was known before being named Paisley, came from Willamette Valley primarily, Linn, Benton, and Lane Counties.

Horses and cattle were among the first livestock to arrive in the region. Horses were particularly abundant due to their profitability and low feeding costs. They also served as essential transportation, especially for the military which had a high demand. Cattle were also present in the area, but without nearby railroads, they had to be trailed to California to be sold. Cattle had to be three years of age to make the journey.

Hogs were also common for personal use, although the area's climate wasn't ideal for large-scale swine raising. Bands of sheep existed, but their numbers likely increased notably after the arrival of the Irish around 1910-15.

Grain cultivation, particularly around the Grain Camp area by the ZX Ranch in the 1930s and 40s, primarily focused on rye for livestock feed before the rise of pivot irrigation and alfalfa production. Mint was grown briefly in the 1970s by one farmer. Wheat was likely grown primarily for local flour production, albeit not in substantial quantities due to the region's limited moisture.

The Forest Service also tried to grow trees in the desert in an orchard north of Paisley in the 1990s. They drilled a well and fenced it in with a chain link, but all the trees died. This was likely due to boron exposure in the water, though it could have been arsenic. Trees were also planted in the timber culture era too, but the results supposedly weren't optimal. People are less dependent on the timber harvest now since the sawmill no longer exists. The Forest Service also doesn't offer many, if any, timber sales.

The Chewaucan River is primarily used for irrigation, which is the largest economic use that still exists. It was also a wonderful place for young children to learn how to fish using a worm, as well as a recreation site for the elderly because of ease of access. Now the river is primarily just fly fishing, which eliminates most of the first two categories. People still swim in the river particularly at "The Falls" which is the local swimming hole and has been for generations. The location is very popular with children and younger adults. People also camp along the river, but the Forest Service road is not maintained and has numerous potholes large enough to destroy a vehicle so people don't like to travel the road. Its scenic value has also been diminished since fires destroyed the beautiful pines. Most of what you see now are black standing snags. Fire history shows the area burned every 10-15 years.

There was nothing catastrophic, and it was primarily low intensity. The intensity of fires in the past five years is unprecedented.

Photographs from the early 1900s depict the evolving landscape around Coglan Butte and Paisley Hills.

Notable Events

The winter of 1889-90 was a hard winter with deep snow. Many animals perished, as this was before hay was stacked for winter use.

The Morrill Act of 1862 resulted in the federal government giving Oregon 90,000 acres of land. Over 19,000 of those acres were in the Chewaucan Valley – this land was sold for $2.50/acre initially and later reduced.

Range wars occurred in the early 1900s. After the Taylor Grazing Act, the sheep and cattlemen likely got along well enough. Sheep were fading from the valley in the 1950s, and they were pretty much gone in the 1960s due to declining markets. Hiring sheepherders was also difficult.

There was also a significant dispute that dealt with the Desert Land Board, Paisley Irrigation Project (aka Northwest Townsite Company) that started about 1912. The case went to the Oregon Supreme Court, which reaffirmed local court determination that the locals had the water rights, not this company.

During the 1920s and 1930s, a severe drought struck the region, leading to a reduction in herd sizes among ranchers. This economic hardship hit families hard, as Ms. Morgan recalls her father struggling to pay off grocery bills due to financial strain. Ranchers traditionally settled their debts once a year, typically in the fall after selling their stock or crops, a practice that persisted for years beyond this period.

The Great Depression of the 1930s also drove many city or urban people to rural areas in search of work. Many were willing to work for food and shelter alone.

In December 1964, a major flood wreaked havoc on the town following heavy snowfall and subsequent rain. The marshlands filled rapidly, resulting in the deaths and stranding of numerous cattle. Bridges washed out cutting off access to Paisley via Highway 31, which resulted in the use of a boat at the Narrows to ferry mail across the river. The floodwaters destroyed homes and other structures, causing significant erosion which is still visible today. Ms. Morgan also recalls her relatives who lived on Mill Street evacuating during the flood, as they stayed on the family ranch afterwards.

Federal funding was allocated to channel the river after the 1964 flood which effectively mitigated future flooding in Paisley. Prior to the channelization, flooding was a common occurrence.

1977 was an exceptionally dry year. Ms. Morgan recalls her father being unable to harvest any hay. The winter of 1993 was also quite harsh, with snow starting in December and not leaving until May.

Perspective on the Marshes

It's important to understand that the federal government determined that the marsh was 'Swamp Land,' and that they provided incentive to develop and reclaim the land. This occurred under the Swamp Lands Act of 1850. There are thousands of birds that camp in the marsh at different times of the year. The bald eagles mark their calendars to arrive for calving season and serve as clean-up committee. The cranes like to serenade us in the spring and hatch their young. Ducks and geese are all over the flooded fields. There are many other species too.

People don't seem to realize how small the drainage area is that feeds the Chewaucan, and the desert component is often forgotten. They see the beautiful green marsh thanks to the ranchers' work. Ms. Morgan believes the marsh would stink without the canal, just like it did this past summer when ZX could not get a small area drained. The stench was so bad, Ms. Morgan and her husband thought there was a septic tank problem until they investigated just as everyone else had. It was awful and it lasted for months and permeated the entire valley.

Interactions with Tribal Members

The government treated the Tribes and Indigenous people horribly, and forced them onto reservations. They showed them no respect, and lied consistently against their promises and treaties. Since history has not been properly taught, the ugly events keep repeating.

Initial interactions were likely amicable at first, but as settler numbers increased and encroached on their lands relationships deteriorated. They came here to gather food i.e. roots, wild plums, chokecherries, elderberries, game, fish. There were over-sensationalized newspaper articles written in 1873 when the Modoc War occurred

Ms. Morgan also described memories passed on from her grandmother, who was born in 1891.. Her grandmother was born here and lived her entire life here. She spoke about Indigenous people living near their homestead, and that their kids played together. Mrs. Morgan has also heard stories of others experiencing the same thing. She remembers an Indigenous woman, Mrs. Martin, coming to visit her grandmother in the 1950s. The woman owned a ranch and lived in the Bly area, but had business dealings here. The two women shared a great relationship with mutual respect. Mrs. Martin was ahead of her time as a businesswoman in an era when most women stayed at home.

Indigenous people were still coming and camping in the area in the 1930s, and potentially into the early 1940s. Locals recall taking deer hides to their camps to exchange for a fine pair of soft leather gloves.

VI. Drought Considerations

(*Lead: Ed Contreras, supported by Aaron Wolf*)

This section comes from discussions at the June 2023 *Paisley* meeting, where the following questions were raised:

- What are the critical water needs in the basin during drought years?
- What are options to adapt to and mitigate the impacts of drought?

The point of this section is only to offer the scientific basis for any future decision making around drought mitigation and planning, **not** to to offer any direction for decision making — that role belongs to the group at large. It offers the experiences of other basins in the region, and points to further scientific investigations that may help in the future. Key themes from this section include larger regional water and climate patterns, as well as the interplay between drought and ecological resilience.

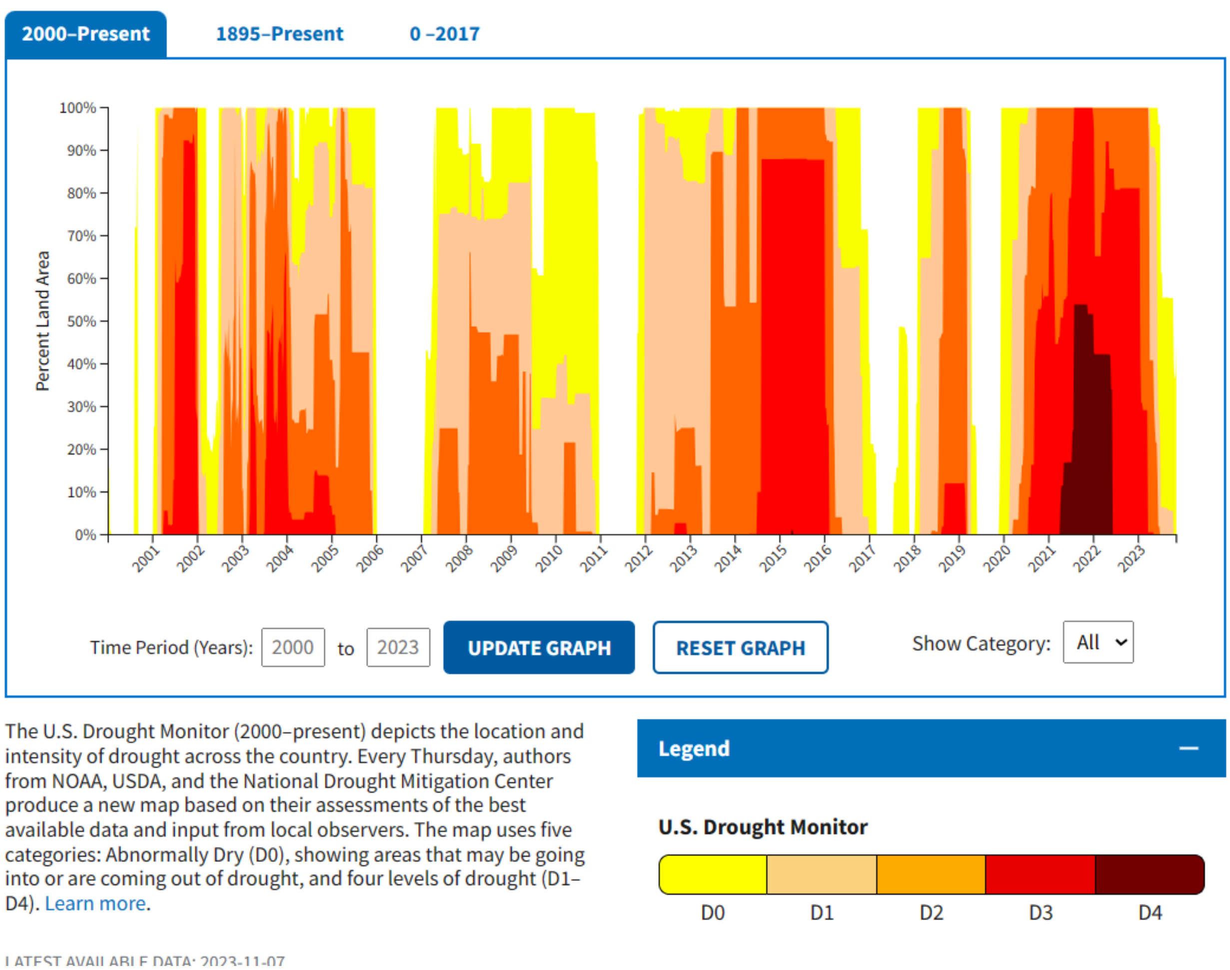

Figure 6.0. Lake County, OR Drought Monitor 2000-2023 Lake County Conditions | Drought.gov Accessed: 11/10/2023

6.1 Drought

A common definition of drought: is a *period of drier than normal conditions*. Droughts are considered resolved once "normal" or "above normal" hydrologic conditions return. The US Drought Monitor shows Lake County, OR being under some extent and level of drought for the majority of the time-period between 2000-2023 (Figure 6.0). This graph highlights how drought has become a persistent factor in Lake County over the last two decades. The implications of drought and specifically water scarcity on agriculture, fish and wildlife have been communicated in PLACe meetings (agriculture presentation, 10/24/23) and are identified in sections of this document. Furthermore, drought designations by local, state and federal entities impacts programs and policy that affect natural resources and agriculture in the region.

6.2 Regional Climate & Surface Water Patterns

Surface water availability in the Northern Great Basin is driven by multiple factors (as noted in the water resource section) including precipitation, runoff, evapotranspiration and anthropogenic water uses (Donnelly 2020). As a result water bodies like wetlands can be extremely dynamic.Variation between wet and dry years can be extreme and conditions can change rapidly (Figure 6.0).

In addition to annual variability, there are long term trends that have been recently identified in closed-basin (endorheic) lakes and wetlands throughout the Northern Great Basin. Satellite-based surface water monitoring shows a long-term (35+ year) drying pattern on Lake Abert with a 17% decrease in surface water area between the time period of 1984–1999 and 2000–2018. This trend is similar to drying patterns in other closed basin watersheds across the Northern Great Basin, where lakes on average have declined by 27% , and wetlands have declined by 47% (Figure 3, Donnelly 2020). Climate models (Figure 4, Donelly 2022) for this region predict higher temperatures leading to higher evapotranspiration rates that would further exacerbate this drying trend. Worsening droughts around the globe have been attributed to climate change (Dai, 2013) Given this information, it is important to distinguish that although there is annual variability with dry years that have direct impact on people and wildlife in the near-term, there are also climate change drivers that are having measurable long-term drying effects in the Lake Abert/Chewaucan Basin and throughout the region.

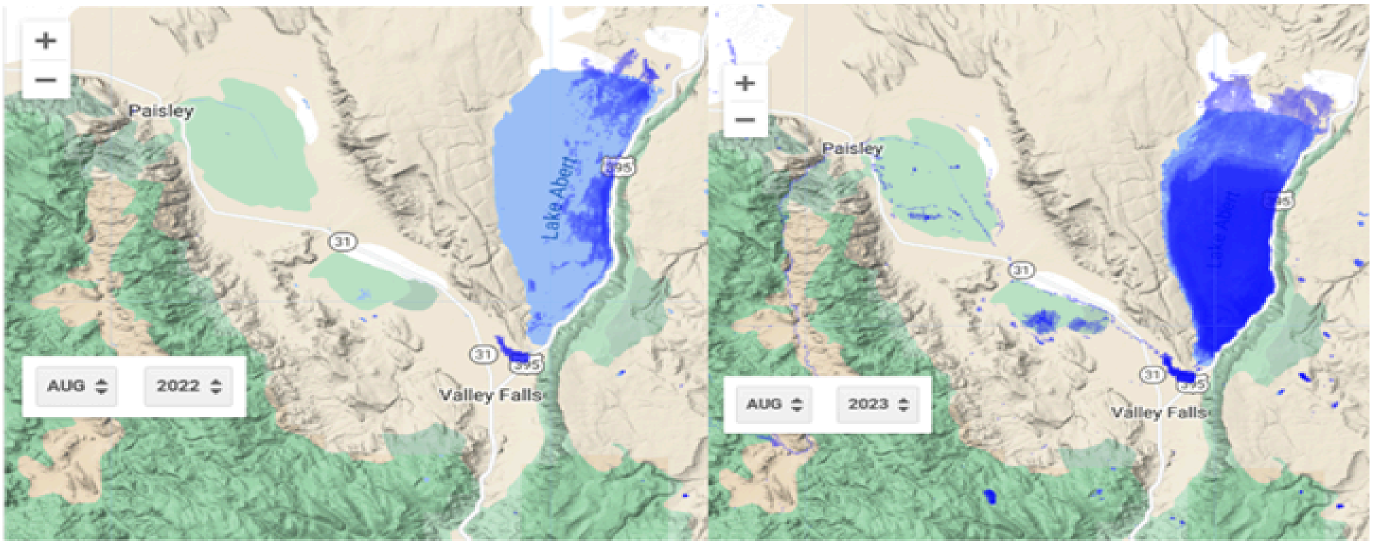

Figure 6.2.A. Image modeling surface water (blue pixels) in the Chewaucan Marsh and Abert Lake in August 2022 & August 2023. Source: Wetland Evaluation Tool

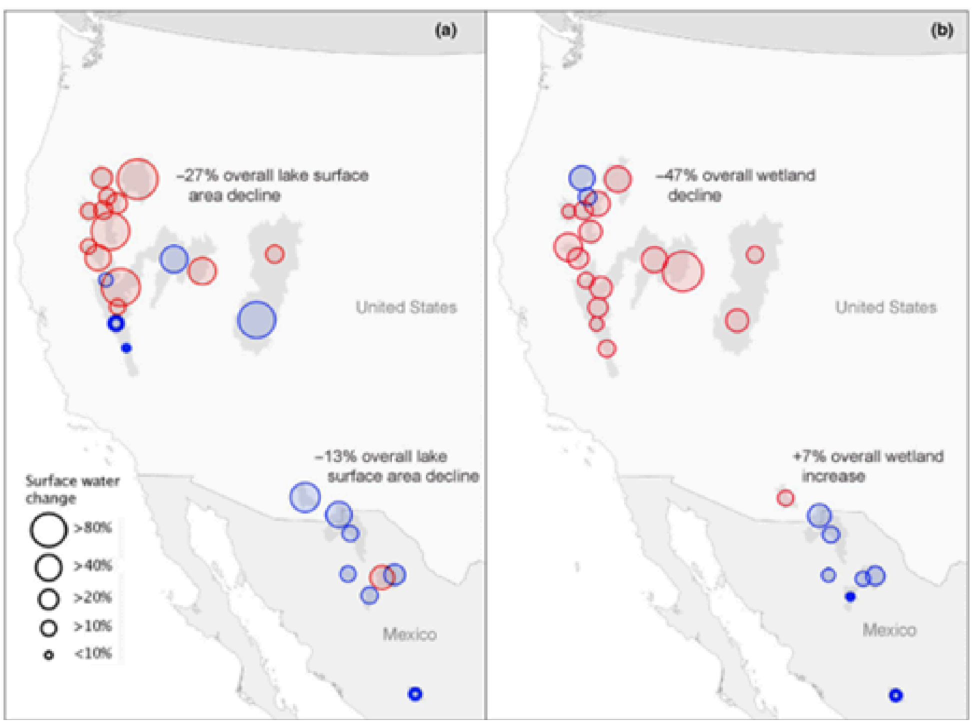

Figure 6.2.B. Magnitude of surface water changes for 26 endorheic watersheds between 1984–1999 and 2000–2018. Change is partitioned by lakes (a) and wetlands (b). Statistically significant (p < .05) declines are shown in red and insignificant declines shown in blue. Increases to surface water area are shown in bold blue outline. Source: Donnelly, 2020.

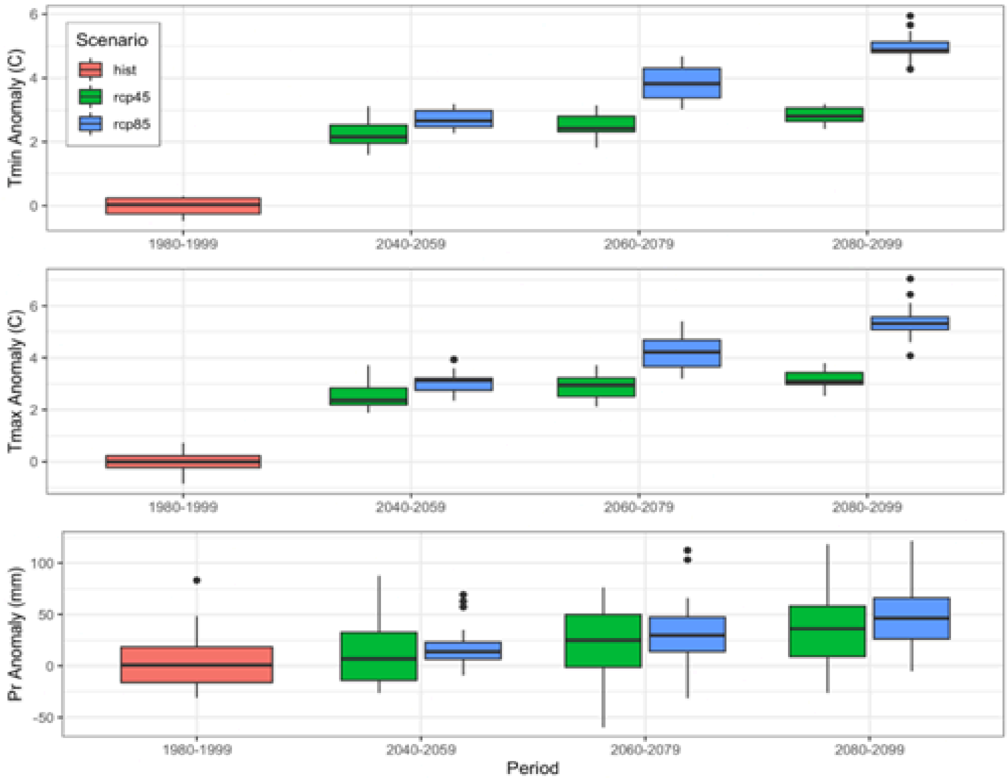

Figure 6.2.C. Future Southern Oregon and Northeast California (SONEC) climate projections for historic RCP 4.5, and RCP 8.5 emission scenarios. Estimates were derived from an ensemble of seven downscaled climate models extracted from the MACAv2 dataset. Source: Donnelly, 2022

6.3 Drought & Ecological Resilience

Enhancing the resiliency of a system to environmental stressors like drought is often an objective in drought mitigation and planning. Many drought plans and reports focus on improving water management and infrastructure to improve drought resiliency of human communities. Ecological resilience is the ability of an ecosystem to resist and recover from a disturbance. Features like wetlands are considered important resources to mitigating extreme climate-based stressors (Ferreira 2023). The Chewaucan Marshes that existed pre-settlement covered ~30,000 acres and likely played a role in attenuating flooding/runoff events and storing water in saturated soils and shallow aquifers. Conservation practitioners in the PLAC have also noted the restoration work that is occurring in meadows and tributaries in the Upper Chewaucan watershed. Given that degradation of wetlands and floodplains affects the resiliency of a system to withstand stressors like drought (Kumar, 2017), these watershed features may be important to consider in enhancing ecological resilience across the basin. Although few examples exist of large-scale restoration activities that enhance resiliency at a watershed scale, studies of smaller meadows and riparian restoration projects in the west demonstrate that it is possible to maintain habitat productivity through dry periods and reduce sensitivity to precipitation (Silverman 2019).

6.4 Drought Planning Approaches

As noted in the Water Resources section, and by many participants' personal observations, during periods of low river flows, there is insufficient water to meet both irrigation demands and to fill Lake Abert to an elevation where the lake is functioning for waterbirds by producing the food web that attracts shorebirds and fuels the fall migration. When water is limited in the systems, options to conserve or stretch the impact of available water are also limited. Furthermore, Juniper encroachment, ladder fuels, major soil erosion, and invasive weeds are all chain reactions from drought-driven fire events Therefore, responding to drought during a drought year may not yield a desired outcome of meeting multiple water demands. To develop drought mitigating solutions other drought response plans include planning before, during and after droughts (see Figure 5). Considering long-term hydrologic trends and actions that capitalize on years when water is more abundant in the system may inform better drought mitigation solutions. Finally, if the predicted patterns of worsening, long-term drying are realized, an even more adaptive response plan will be required.

Various planning frameworks and technical documents exist that scientists globally have developed for responding to drought and changing ecosystems. The United Nations has developed a drought planning framework to assist countries plan, prepare and respond to drought (Figure 6.4.A). The Environmental Protection Agency has also developed recommendations in a technical brief for Drought Resilience and Water Conservation. In Oregon, Placed-Based Integrated Water Planning is one approach that has been initiated to develop collaborative and community led water planning to respond to water scarcity and drought. A similar closed-basin in eastern Oregon engaged in this type of planning is the Harney Basin just northeast of Abert/Chewaucan.

The USGS has developed the RAD model (Respond-Accept-Direct, Figure 6.4.B) to assist managers with responding beyond drought to large-scale, long-term ecosystem shifts.

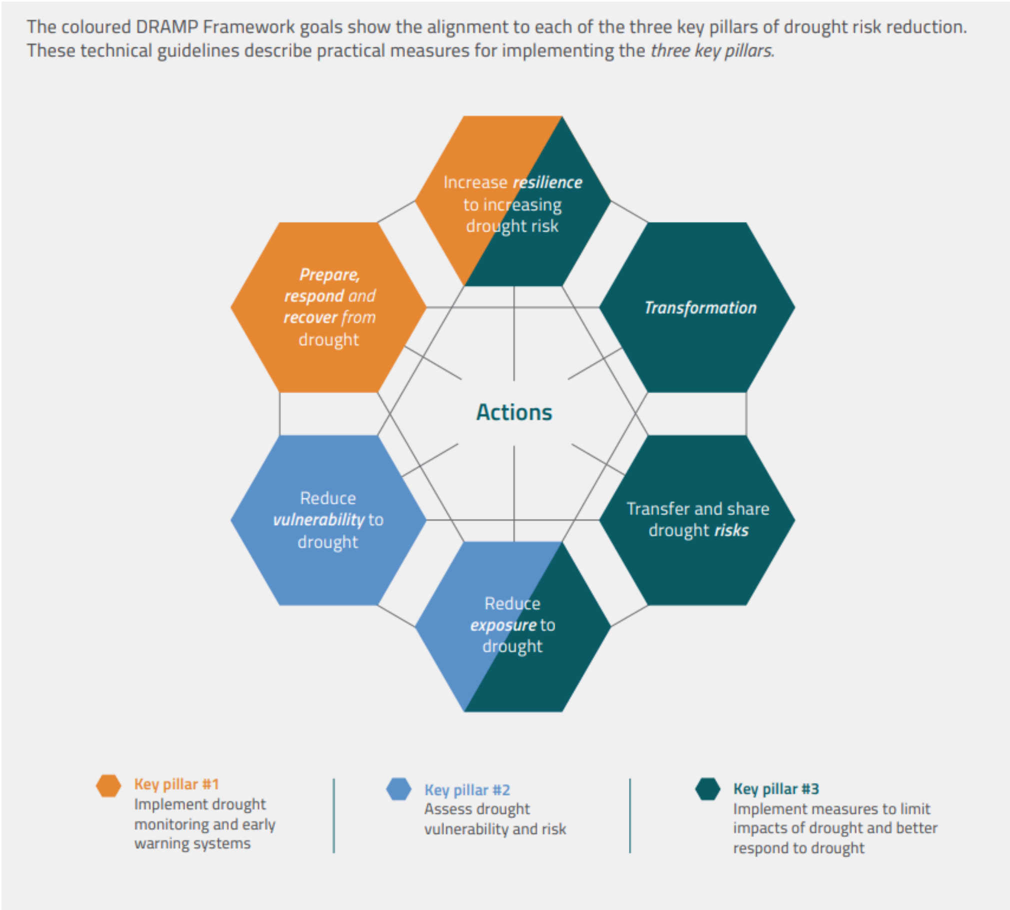

Figure 6.4.A. Drought Resilience, Adaptation and Management Policy (DRAMP) Framework | UNCCD

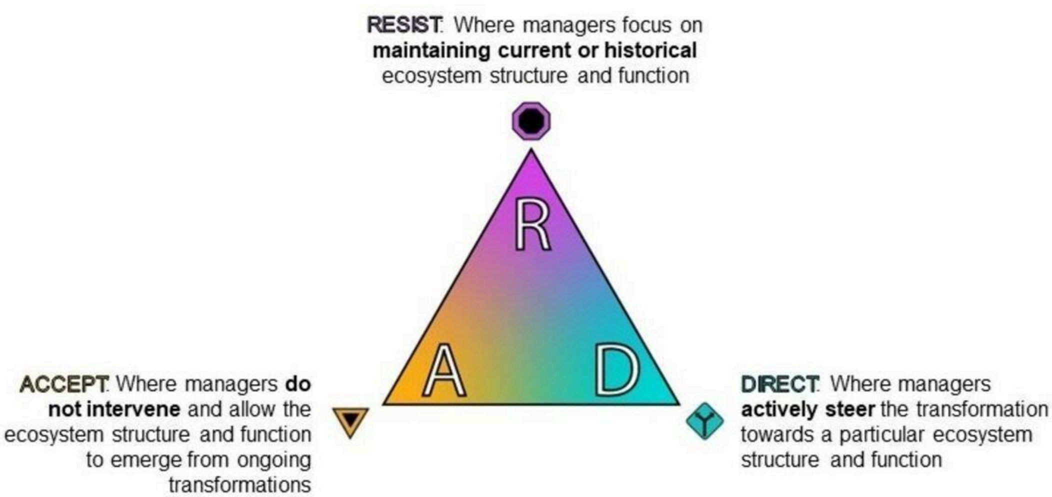

Figure 6.4.B. Resist-Accept-Direct. Source: Resist-Accept-Direct (RAD) Framework | U.S. Geological Survey (usgs.gov)

6.5 Scientific Enquiry That May Assist Future Decision Making[19]

-What are the economic impacts of drought on the ranching community, and how can they be mitigated?

-What is the minimum amount of water and at what timing that will allow the Lake Abert ecosystem to function at a level where it supports the water birds through periods of water stress?

-Is the geology in the basin suitable for artificial recharge and recovery and at what cost? Also, what would the legal ramifications be of such an arrangement?

-What would the impacts be of storing water in the marsh soil during periods of high flow, both for grazing and for evaporative losses? Also, would enough water be available for the lake during drought to make a difference? Also, would this be within existing water rights and what would the ecological impacts be?

-What would the impacts be of permanent water right transfers or temporary water rights leasing (full season or split season) during drought, both economically, socially, and to the cattle? Would this vary by type of farming operation (size, location, other parameters) and if so, how?

-Could enough water be generated, either through greater efficiencies, willing seller transfers or leases or a combination, to make a difference to the lake, or other parts of the ecosystem, and how much would it cost in dollars?

-How can collaborative governance help enhance resilience within the ranching community and the lake during periods of water shortage?

6.6 Websites and Tools:

Drought Resilience and Water Conservation | US EPA

US Drought Monitor: Lake County Conditions | Drought.gov

Wetland Evaluation Tool. wetSurfaceWaterV2.4 (earthengine.app)

[19] See Appendix A

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APPENDIX A.

Appendix A consolidates the areas for further investigation/ to be resolved that emerged throughout the joint fact-finding report, and it prioritizes these areas based on the results of the in-person PLAC Meeting #6 prioritization activity. Participants were asked to join small groups organized by report chapter and prioritize areas in the report that had been flagged as "For Further Investigation" or "To Be Resolved." "For Further Investigation" indicates no data had been collected or found by the Joint Fact-Finding Team (this does not mean to imply it does not exist). "To Be Resolved" indicates that the Joint Fact-Finding Team had data, but there are various sources that differ on the same concept/topics. These categories were combined in this memo and organized by HIGH priority and MEDIUM/LOW priority.

Appendix A is not a final list of items to investigate or resolve, and it is not meant to be restrictive or limiting. Appendix A exists as a live document and a work in progress as the PLAC members continue to gather data and resources that will inform current and future PLAC work.

Please reach out to the JFF Team at chewaucanteam@oregonstate.edu if you have any questions. The list used during the Meeting #6 prioritization activity can be found here.

HIGH PRIORITY

Water Resources

Areas for Further Investigation/ To Be Resolved

- Understanding how much groundwater is used (groundwater allocations) and "The extent and details of how the groundwater system is interacting with or influencing lake levels". Grondin in LaMarche and Thomas (2023) suggest that "Groundwater appropriation is likely contributing to reduced surface water flow in the Chewaucan watershed because of a general hydraulic connection between groundwater and surface water." They went on to express how this can be investigated and this has been outlined in the groundwater subsection of the water resources section.

- **Footnote 1/3:** Precipitation over Lake Abert is unknown- the nearest weather stations are about 25 miles away, the discharges from input creeks are un-gauged, and have not been reported (only estimated), direct ET is unknown, USGS work is ongoing. To fully understand how the basin's water resources are being impacted by climate change, and to propose solutions to increase resilience, there is a need to add further water- and climate-monitoring capabilities. More weather stations and hydrological stations for localized data are needed around the basin including Lake Abert.

- **Footnote 4** :A water-budget model populated with real data may be useful to assess different management options. The water budget model will need to be populated with more accurate data from weather & hydrological stations and reported volumes of water diversions as identified in the water resources chapter.

- Precipitation in the Chewaucan Basin is unknown. The nearest SNOTEL site is on Summer Rim, which is part of the Summer Lake watershed, not the Chewaucan watershed. There is a need for a SNOTEL site in the Chewaucan Basin.

- What would be the impacts of permanent water right transfers or temporary water right leasing (full season or split season) on the lake?
    - How does the timing of these transfers and/or leases impact drought preparedness and drought mitigation in the lake and basin?
    - How would transfers and/or leases impact the area community, economy, agricultural practices, and fish and wildlife?
    - Which water rights would participate in these efforts? How would participation be determined? Would it be based on size, location, type of farming operation, or other such parameters?

- Could enough water be generated, either through greater efficiencies, willing seller transfers or leases or a combination, to make a difference to the lake, or other parts of the ecosystem?
    - What are the economic and legal requirements of implementing such efficiencies or water transfers and leases?
- How do shifts in the timing of discharges compare to shifts in the overall magnitude of runoff? What are the implications for drought and or climate change patterns?

Agricultural Activities

Areas for Further Investigation/ To Be Resolved

- Prioritize learning consumptive use over measurement of diversion (gaging for ET in developed vs non-developed, and below the marshes)
- Understanding impacts of dredging
- Understanding the historical extent of the marshes
- Gauges on Small Creek and Bagley (yes/no)
- Historical extent of wetlands
- Importance of wet meadows

Fish & Wildlife

Areas for Further Investigation

- What specific drivers determine if shorebirds can continue on from Abert if it is dry?
- More context is needed beyond peak bird counts

- Incorporating other non-bird species substantively within the report to highlight gaps
- **Footnote 9:** What are the main sites that waterbirds are arriving from? What are the main sites they travel onwards to from the Chewaucan basin? (Waterfowl & Shorebirds). Though some stakeholders said this is reflected in the SONEC surveys, these surveys mainly address dabbling ducks.
- The importance of flood irrigation in the Chewaucan Marshes (informed by larger SONEC studies)

Areas to Be Resolved

- Compile available bird data, including presence and magnitude.
- Develop specific questions that USGS bird data could answer
- Interactions across the lake and the marsh for species (both resident and migratory)

Cultural Heritage/Lived Experience

Areas for Further Investigation/To Be Resolved

Upland Processes

Areas for Further Investigation/ Resolved

Drought Considerations

Areas for Further Investigation /to Be Resolved

- Demand and timing in lake to sustain ecosystems during drought[SH1] (* the part of how much water does the lake need has been answered in the water resources section although some further studies to support the volumes suggested can may beneficial in the future)
- Is the geology in the basin suitable for artificial recharge and recovery?
    - What would be the ecological, economic, and legal ramifications of such an arrangement?
- Storage from wet to dry years, possibilities to investigate: 1a) storage in meadows/marsh soil (both for grazing and evaporative losses); 1b) uplands restoration; 2) artificial recharge; 3) storage in the lake itself
    - With storage, would enough water be available for the lake during drought to make a difference? (suggest defining or clarifying what “difference” means)
    - What would be the ecological impacts of storage?
    - Could storage be accomplished with existing water rights, or what water rights would be needed? [SH4]
- -Water budget & conceptual model

MEDIUM-LOW PRIORITY

Water Resources

Areas for Further Investigation/ to Be Resolved

- **Footnote 2**: No reliable, continuous measurements and reporting of water diversions from the river for irrigation. (These values can only be estimated).Measuring/ reporting the actual water diversions would be greatly beneficial.
- Tipping point for prolonged lake levels outside of the optimum that would change the ecology & food web of the lake.
- How the burns or wildfires affect water flows, sediment capture as well as snowpacks(data from Fremont Winema).
- Time element - what happens 3 years earlier in the system ideally affects the lake system even 3 years later.
- How river channelisation affects the whole hydrologic system
- Connection of Lake Abert to Summer lake

Agricultural Activities

Areas for Further Investigation/ to Be Resolved

- The impacts of juniper encroachment/noxious weeds
- Corporate acquisitions – how these impact agricultural activities, as well as water resources and fish & wildlife
- The impact of ET in the winter on the overall water budget

Fish & Wildlife

Areas for Further Investigation

- Cooperative projects, such as settling ponds designed for cleaning flood irrigation "tailwater", may offer a way to address water quality and wetland habitat issues."
- Protocols for decision making
- Specific red-banded trout historical data
- **Footnote 9:** How are other species (non-birds) affected by dry conditions?
- **Footnote 11:** Could cooperative projects, such as settling ponds designed for cleaning flood irrigation "tail water", offer a way to address water quality and wetland habitat issues?
- -Shifts in local and resident populations of raptors, as a proxy for other species shifts.

Areas to Be Resolved

- Building and explain a migration chronology for each species
- The role of the marsh as an alternative habitat for some of some species.

Cultural Heritage/Lived Experience

Areas for Further Investigation

Areas to Be Resolved

- The cultural significance of caves in the basin
- Tribal & Indigenous history
- Testimony from ranching families
- The role of the East Lake Abert Archeological District

Upland Processes

Areas for Further Investigation

Areas to Be Resolved

Drought Mitigation

Areas for Further Investigation

- What are the economic impacts of drought on the ranching community and other local industries, and how can they be mitigated?
- How can collaborative governance help enhance resilience within the ranching community, Lake Abert, and the entire Chewaucan Basin during periods of water shortage?

Areas to Be Resolved

APPENDIX B.

I. Water Resources

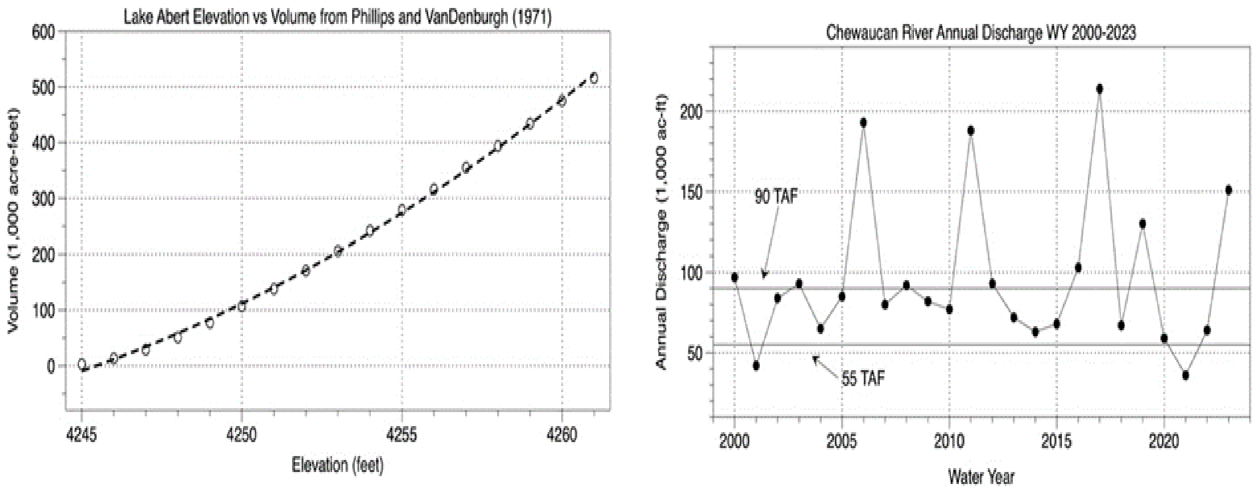


Figure B.1.A Left: plot of Lake Abert volume vs elevation. Data from Phillips and VanDenburgh (1971). Table 4, p. B9). Right: Plot of Chewaucan River discharge measured at the OWRD Paisley gauge, water year 2000-2023 with 55 and 90 TAF discharges shown. Figure sources: Larson unpublished.

II. *Agricultural Practices*

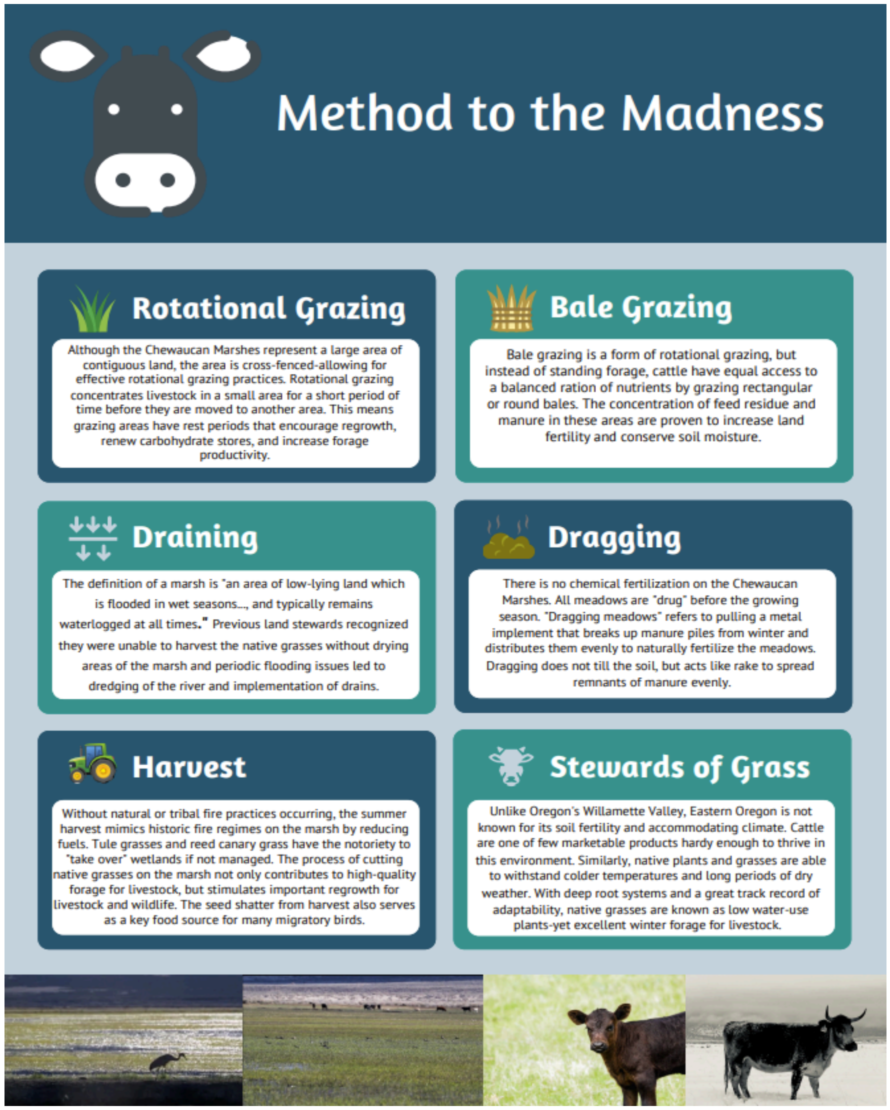
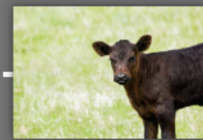


Figure B.1.B. A supplemental document outlining agricultural activities in the Chewaucan Basin, provided at the Oct. 5th meeting by Colleen Withers, Tess Baker, & Dan Withers

Figure B.1.C. (Below) A supplemental timeline document of ranching activities in the Chewaucan Basin provided at the Oct. 5th meeting by Tess Baker, Colleen Withers, & Dan Withers.

Ranching Activity in the Chewaucan Basin

CHEWAUCAN WATERSHED COLLABORATIVE



January:
First Diversion, First Stopover

Limited January 1 surface water right, migrating birds arrive in the Basin, cattle are bale grazing or fed the previous year's forage on the marsh and preparing to calve.

February:
Calving Season, Feeding

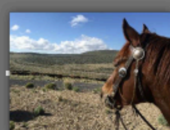
Snowpack is releasing little to no water at this stage. Small amounts of water are diverted onto the marsh as it is available, thus charging the soil for growing conditions. Cows begin to calve, and scavengers enjoy a seasonal feast.

March:
"Here Comes the Sun..."

Sunlight increases water availability, encourages forage growth, and initiates tremendous invertebrate production as water begins to move across the landscape. Calving slows and the cow-calf pairs are fed hay. Migrant water fowl arrive by the thousands.

April:
Primetime

Remaining surface water rights and groundwater rights have an April 1 priority date. Calves are branded and the majority of cattle are moved off the marsh to crested wheat seedings on "the desert." Temperature usually rises, native grasses begin growth, and migratory bird use remains high. Bird watchers galore!

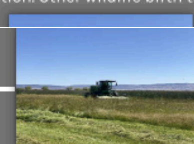


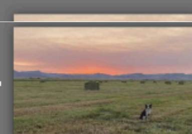
May: Peak Snowmelt, High Country

Surface water peaks in early May and dwindles as snowpack reduces. The majority of cattle are moved from "the desert" to the high, forest country where they will raise calves and spend the summer. Migratory bird activity remains high before continuing migration. Other wildlife birth their young.

June: Down the Drain!

Surface water is drained from the marsh and returned to mainstem Chewaucan via channels and seepage as fields are dried in preparation for haying. Cattle remain in the forest. Wildlife move their young to the forest in pursuit of cooler temperatures. Some cattle and wildlife find a home on the marsh for the summer.



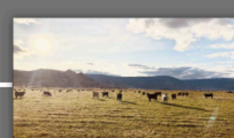


July: Hopeful Harvest

Surface water continues to drain, a small amount of stockwater is diverted for the cattle that remain on the marshes, the majority remain in the forest, and native grasses can now be harvested and stored for next winter.

August: New Season, New Arrivals

Cattle are still grazing in the high country and haying season concludes on the marshes. Resurgence of migrant waterfowl and other birds to feast on seed shatter from harvest.

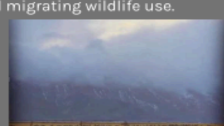


September:
Preparation for Winter

Haying season concludes on groundwater irrigated pivots. Cattle are gathered and moved to the marshes in preparation for fall processing, weaning, and pending cold weather. Cattle graze on any new growth after harvest. Fall migrating wildlife use.

October:
Winter is Coming, Calves Weaned

Groundwater use ends. Ranchers continue to gather cattle from the high country. Calves are weaned, vaccinated, and prepared for sale. Cows are vaccinated. New growth helps reduce stress of weaning for cattle.



November:
Last Call

Ranchers gather final "stragglers" from the forest and finish processing/weaning. All cattle back in the Basin for looming winter months. Hay feeding and bale grazing from summer harvest begins.

December: Cycle Begins Again...

All cattle are back on the marsh as they reach late-term pregnancies. They rely solely on the July/August harvest for nutrition to support them in cold temperatures and prepare them for calving.

III. Fish & Wildlife

<u>Wildlife Species found within the Chewaucan Watershed</u>

Mammals

Badger, Beaver, Bighorn sheep, Bobcat, Cougar, Coyote, Gray Fox, Marten, Mink, Mule deer, Muskrat, Otters, Pronghorn, Racoon, Red Fox, Spotted skunk, Striped Skunk, and Wolves

Rodents

Belding's Ground Squirrel, Black-tailed Jackrabbit, Bushy-tailed Woodrat, California Ground Squirrel, Canyon Mouse, Dark Kangaroo Mouse, Deer Mouse, Desert Woodrat, Golden-mantled Ground Squirrel, Great Basin Kangaroo Rat, Great Basin Pocket Mouse, House Mouse, Least Chipmunk, Long-tailed Vole, Merriam's Shrew, Moles, Montane Vole, Northern Grasshopper Mouse, Northern Pocket Gopher, Nuttall's Cottontail, Ord's Kangaroo Rat, Porcupine, Preble's Shrew, Pygmy Rabbit, Sagebrush Vole, Townsend's Ground Squirrel, Townsend's Pocket Gopher, Vagrant Shrew, Water Shrew, Weasel, Western Harvest Mouse, Western Jumping Mouse, White-tailed Antelope Squirrel, and Yellow-bellied marmot

Bats

Big Brown Bat, California Myotis, Fringed Myotis, Hoary Bat, Little Brown Myotis, Long-eared Myotis, Long-legged Myotis, Pallid Bat, Silver-haired Bat, Small-footed Myotis, Spotted bat, Townsend's Big-eared Bat, Western Pipistrelle, and Yuma Myotis

<u>Other Birds</u>

(yellow highlight = previously mentioned in report)

Include Theo's Report sent over!

American Avocet, American Bittern, American Crow, American Dipper, American Golden Plover, American Goldfinch, American Kestrel, American Pipit, American Redstart, American Robin, American Tree Sparrow, American White Pelican, American Wigeon, Ash-throated Flycatcher, Baird's Sandpiper, Bald Eagle, Bank Swallow, Barn Owl, Barn Swallow, Barrow's Goldeneye, Bay-breasted Warbler, Belted Kingfisher, Bewick's Wren, Black and White Warbler, Black Tern, Black-bellied Plover, Black-billed Magpie, Black-capped Chickadee, Black-chinned Hummingbird, Black-crowned Night Heron, Black-headed Grosbeak, Black-necked Stilt, Black-throated Sparrow, Black-throated Warbler, Blackpoll Warbler, Blue Jay, Blue-gray

Gnatcatcher, Blue-winged Teal, Bobolink, Bohemian Waxwing, Bonaparte's Gull, Brant, Brewer's Blackbird, Brewer's Sparrow, Brown Creeper, Brown Thrasher, Brown-headed Cowbird, Bufflehead, Bullock's Oriole, Burrowing Owl, Bushtit, California Gull, Calliope Hummingbird, Canada Goose, Canvasback, Canyon Wren, Cape May Warbler, Caspian Tern, Cassin's Finsh, Cassin's Vireo, Cattle Egret, Cedar Waxwing, Chestnut-sided Warbler, Chipping Sparrow, Cinnamon Teal, Clark's Grebe, Clark's Nutcracker, Cliff Swallow, Common Goldeneye, Common Loon, Common Merganser, Common Nighthawk, Common Poorwill, Common Raven, Common Redpoll, Common Tern, Common Yellowthroat, Cooper's Hawk, Coot, Cordilleran Flycatcher, Crow, Dark-eyed Junco, Double-crested Cormorant, Downy Woodpecker, Dunlin, Dusky Flycatcher, Eared Grebe, Eastern Kingbird, Eurasian Collared Dove, Eurasian Wigeon, European Starling, Evening Grosbeak, Ferruginous Hawk, Flammulated Owl, Forster's Tern, Fox Sparrow, Franklin's Gull, Gadwall, Golden Eagle, Golden-crowned Kinglet, Golden-crowned Sparrow, Gray Catbird, Gray Flycatcher, Gray-crowned Rosy-Finch, Great Blue Heron, Great Egret, Great Horned Owl, Great-tailed Grackle, Great/Lesser Sandhill Crane, Greater Scaup, Greater White-fronted goose, Greater Yellowlegs, Green Heron, Green-tailed Towhee, Green-winged Teal, Hairy Woodpecker, Hammond's Flycatcher, Harris's Sparrow, Hermit Thrush, Herring Gull, Hooded Merganser, Horned Grebe, Horned Lark, House Finch, House Sparrow, House Wren, Killdeer, Lark Sparrow, Lazuli Bunting, Least Bittern, Least Flycatcher, Least Sandpiper, Lesser Goldfinch, Lesser Scaup, Lesser Yellowlegs, Lewis's Woodpecker, Lincoln's Sparrow, Loggerhead Shrike, Long-billed Curlew, Long-billed Dowitcher, Long-eared Owl, MacGillivray's Warbler, Magnolia Warbler, Mallard, Marbled Godwit, Marsh Wren, Merlin, Mountain Bluebird, Mountain Chickadee, Nashville Warbler, Northern Flicker, Northern Goshawk, Northern Harrier, Northern Mockingbird, Northern Parula, Northern Pintail, Northern Rough-winged Swallow, Northern Saw-whet Owl, Northern Shoveler, Northern Shrike, Northern Waterthrush, Olive-sided Flycatcher, Orange-crowned Warbler, Osprey, Ovenbird, Pectoral Sandpiper, Peid-billed Grebe, Peregrine Falcon, Pine Grosbeak, Pine Siskin, Plumbeous Vireo, Prairie Falcon, Purple Finch, Pygmy Nuthatch, Pygmy Owl, Red Crossbill, Red-breasted Nuthatch, Red-breasted Sapsucker, Red-eyed Vireo, Red-naped Sapsucker, Red-necked Phalarope, Red-shouldered Hawk, Red-tailed Hawk, Red-winged Blackbird, Redhead, Ring-billed Gull, Ring-necked Duck, Rock Pigeon, Rock Wren, Rose-breasted Grosbeak, Ross's Goose, Rough-legged Hawk, Ruby-crowned Kinglet, Ruddy Duck, Ruddy Turnstone, Rufous Hummingbird, Sage Sparrow, Sage Thrasher, Sanderling, Savannah Sparrow, Say's Phoebe, Scrub Jay, Semipalmated Plover, Sharp-shinned Hawk, Short-eared Owl, Snow Bunting, Snow Goose, Snowy Egret, Snowy Plover, Solitary Sandpiper, Song Sparrow, Sora, Spotted Sandpiper, Spotted Towhee, Stellar's jay, Stilt Sandpiper, Surf Scoter, Swainson's Hawk, Swainson's Thrush, Tennessee Warbler, Townsend's Solitaire, Townsend's Warbler, Tree Swallow, Trumpeter Swan, Tundra Swan, Turkey Vulture, Varied Thrush, Vaux's Swift, Veery, Vesper Sparrow, Violet-green Swallow, Virginia Rail, Warbling Vireo, Western Bluebird, Western Grebe, Western Kingbird, Western Meadowlark, Western Sandpiper, Western Screech Owl, Western Tanager, Western Wood Pewee, Whimbrel, White-breasted Nuthatch, White-crowned Sparrow, White-face Ibis, White-headed Woodpecker, White-throated Sparrow, Willet, Williamson's Sapsucker, Willow Flycatcher, Wilson's Phalarope, Wilson's Snipe, Wilson's Sniper, Wilson's Warbler, Winter Wren, Wood Duck, Yellow Warbler, Yellow-billed Cuckoo, Yellow-breasted Chat, and Yellow-headed Blackbird

Upland Birds

California Quail, Chukar, Greater Sage-grouse, Hungarian Partridge, and Mountain Quail

Table B.2.0.A Birds and Species Present

Groups of Birds	Species Present
Waterfowl (23 species)	tundra and trumpeter swans, Canada, greater white-fronted [esp. the Tule ssp.], lesser snow geese, mallards, American green-winged, blue-winged, and cinnamon teal, gadwall, American and Eurasian wigeon, northern shoveler, wood duck, canvasback, redhead, ringneck, lesser scaup, bufflehead, common goldeneye, ruddy duck, (common and hooded merganser), common loons
Grebes (5 species)	Grebes (Clark's, eared, horned, pied-billed, western), double-crested cormorant, Am. white pelican
Wading birds (6 species)	American bittern, egrets [cattle, great and snowy egrets], herons [black-crowned night and great blue]
Diurnal Raptors (14 species)	eagles [bald and golden], northern harriers, hawks [Coopers, Ferruginous, red-shouldered, red-tailed, rough-legged, sharp-shinned, Swainson's], falcons [Am. kestrel, merlin, peregrine, prairie]), turkey vulture, California quail, greater sage-grouse,
Gruiformes (2-3 species)	sora, Virginia rail, possibly yellow rail, American coot, sandhill crane (greater and lesser)

Shorebirds (21-22 species)	American avocet, black-necked stilt, killdeer, plovers [American golden, semi-palmated, possibly snowy], long-billed curlew, western willet, yellowlegs [greater and lesser], long billed dowitcher, dunlin, sandpipers [Baird's, least, pectoral, semi-palmated, spotted, western], Wilson's snipe, phalarope [red-necked and Wilson's]
Gulls (4 species)	Bonaparte's, California, Franklin's, ring-billed
Terns (3 species)	black, Caspian, Forster's

Table B.2.0.B Riparian Birds and Species Present

Groups of Birds	**Species Present**
Doves (2 species)	Eurasian-collared and mourning
Owls (5 species)	common barn, burrowing, great-horned, long-eared and short-eared
Goatsuckers and swifts (3 species)	common nighthawk, Vaux's and white-throated swifts
Kingfishers (one species)	belted
Woodpeckers (4 species)	downy, hairy, Lewis', northern flicker
Tyrant Flycatchers (6 species)	ash-throated, dusky, gray, Say's, western wood-pewee, western kingbird
Shrikes and vireos (4 species)	loggerhead and northern shrikes, Cassin's and warbling vireos
Jays, crows and their allies (5 species)	California-scrub and Stellar's jay, American crow, black-billed magpies, common raven
Lark (1 species)	horned
Swallows (6 species)	bank, barn, cliff, northern rough-winged, tree, violet-green
Chickadees and their allies (2 species)	mountain, bushtit
Nuthatches and creepers	pygmy, red-breasted and white-breasted nuthatches, brown creeper

Wrens (2 species)	house, marsh
Old world warblers, thrushes, and their allies (10 species)	American dipper, golden-crowned and ruby -crowned kinglets, Townsend's solitaire, mountain and western bluebird, American robin, hermit, Swainson's, and varied thrushes
Mimids (one species)	sage thrasher
Starlings and mynas (one species)	European starling
Wagtails and pipits (one species)	American pipit
Waxwings (one species)	cedar
Wood warblers (9 species)	black-throated gray, common yellowthroat, MacGillivray's, Nashville, orange-crowned, Wilson's, yellow, yellow-breasted chat, yellow-rumped
Tanagers, cardinals and their allies (3 species)	Black-headed grosbeak, western tanager, Lazuli bunting
Emberizine sparrows and their allies (11 species)	Spotted towhee, Brewer's, chipping, fox, golden-crowned, Lincoln's, sagebrush, savannah, song, white-crowned, vesper sparrows, dark-eyed junco,
Icterids (7 species)	Western meadowlark, bobolink, brown-headed cowbird, blackbirds (Brewer's, red-winged, yellow-headed), Bullock's oriole
Finches and old world sparrows (7 species)	Cassin's, house, purple, goldfinches (American and lesser), pine siskin, evening grosbeak

IV. Upland Processes

ECOREGION	STRATEGY HABITATS	DOCUMENTED FISH	OBSERVED STRATEGY WILDLIFE	MODELED STRATEGY WILDLIFE HABITAT
East Cascades	Aspen Woodlands	Chewaucan Red Band Trout (SMU)	American Marten	American Marten
Northern Basin and Range	Late Successional Mixed Conifer Forests	Speckled Dace	Peregrine Falcon (American)	Peregrine Falcon (American)
	Natural Lakes	Tui Chub	American Three-toed Woodpecker	American Pika
	Ponderosa Pine Woodlands	Brook Trout (non-native)	Black-backed Woodpecker	American Three-toed Woodpecker
	Flowing Water and Riparian Habitats		California Myotis	Black-backed Woodpecker
	Sagebrush Habitats		Ferruginous Hawk	Black-necked Stilt
	Wetlands		Flammulated Owl	California Myotis
	Cliff and Talus		Franklin's Gull	Caspian Tern
			Fringed Myotis	Ferruginous Hawk
			Great Gray Owl	Flammulated Owl
			Greater Sage-Grouse	Fringed Myotis
			Greater Sandhill Crane	Great Gray Owl
			Hoary Bat	Greater Sage-Grouse
			Lewis's Woodpecker	Greater Sandhill Crane
			Long-billed Curlew	Hoary Bat
			Long-legged Myotis	Lewis's Woodpecker
			Northern Goshawk	Long-billed Curlew
			Olive-sided Flycatcher	Northern Goshawk
			Oregon Semaphore Grass	Northern Spotted Owl
			Pallid Bat	Olive-sided Flycatcher
			Pygmy Rabbit	Pallid Bat
			Silver-haired Bat	Pygmy Rabbit
			Snowy Egret	Silver-haired Bat
			Spotted Bat	Snowy Egret
			Swainson's Hawk	Swainson's Hawk
			Townsend's Big-eared Bat	Townsend's Big-eared Bat
			Burrowing Owl (Western)	Burrowing Owl (Western)
			Western Toad	Western Toad
			White-headed Woodpecker	White-headed Woodpecker
			Willow Flycatcher	White-tailed Jackrabbit
				Willow Flycatcher

Table B.4.A. ODFW's Compass tool was used to generate a list of habitats and strategy wildlife species which occur in the upland portion of the watershed.

Level 3 (HUC 6)	
Oregon Closed Basin	171200
Level 4 (HUC 8)	
Lake Abert	17120006
Level 5 (HUC 10)	
Upper Chewaucan	1712000601
Middle Chewaucan	1712000602
Crooked Creek	1712000603
Lower Chewaucan	1712000604
Sand Canyon-Lake Abert	1712000605
Twin Lakes	1712000606

Table B.4.B. HUC codes and their corresponding areas within the Chewaucan Basin (produced by Autumn Muir via https://maps.dsl.state.or.us/hucs/)

V. Cultural Heritage/Lived Experience

Elder Family History

"[*The first pioneers probably*] believed that perhaps the land in front of them was near to being perfect. In our ancestors' case, ranch land, horse land, cow land. Water.

As they migrated from location to location many of our ancestors were thinking, "can I/we really do this long trek"? "Go west, young man, go west." was often ringing in their ears.

They, and their families set their dreams as well as their lives on the future. They had the mental, plus physical strength to hope and accomplish that feat. They loved their land that they found.

We, this generation lives on their strength, wisdom and caring for the future generations. We listened and learned. We experimented, we visited. We shared, and we stayed.

The Elder family was not alone in reaching the desert in the mid 1860's. 1870's brought more traffic and the 1880's was more people, more animals, more trying to conquer the water and dust in the Chewaucan and Summer Lake Valley's.

We often had wondered when the pioneer, Robert "Bob" Elder, arrived with his family to his promised land. We know he took a land claim on the Calapooya river near today's Shedd, Oregon. There he settled into a cabin with his sons John, the infant James Oliver, and daughters Jane and Alvira .(Alvira's twin sister died between Tennessee and Oregon.) Soon after arriving in Oregon City in the autumn of 1850, and before they got to the claim, Catherine, the wife and mother passed away. Her body was carried to the cabin on the river and she was buried on that claim. In order to keep the 160 acres, the wife and husband had to be on the land together. We do not know when daughter, Alvira passed, but family history repeats as she was buried beside her mother on that claim. There are records that show at one time there was a headstone for each. The tiny cemetery is shown on some older land records. Sad times.

Life goes on and we have wondered when Bob Elder and why he came to the valleys here? What or brought him here? That we do not know. What we do know is based on the Gillespie family records and quoted from the History of the Willamette Valley by Clarke "Marcellus Gillespie was eight years old when brought to the locality (Willamette Valley, Oregon) and about the time he attained his majority, he went to Paisley, Crook (sic), Oregon where he homesteaded one hundred and sixty acres of land, where he ran stock cattle for a few years. Returning to Eugene about 1873, he located on a ranch a few miles north of the city, but later sold that place and bought ninety acres of land close by".

At that time when a male reached the age of 18, that was the year of his majority.

Tom and brother, Jake Brattain, as well as James E. Elder, told much the same story with these added details. "Ole man" Gillespie (aka Marcellus Gillespie) spent a winter in the Moss Creek Valley. His camp was by a slightly warm spring on the east side of the valley. The locals have named this spring Gillespie Spring. Tom and Jake said he had a nice bunch of cattle and during the spring he went back to Eugene, Oregon. He married Salina Goodpasture in November 1865 when he was 19 years old.

The Brattain brothers told me (Diane Elder), several times that their uncle, Marcellus Gillespie said there was no one in the valley when he was here with his herd of cattle, until the next spring when Elder brought in horses. So with that, we believe that Bob Elder and sons brought their horses to the Chewaucan Valley in 1865.

So for 158 years, generations of the Elder family have lived in the Summer Lake/Chewaucan Valleys. Ranched here. Buried their dead here. Used and improved the land.

This family is no better or worse than the many other families who came, saw and stayed. This is the way ranchers, farmers and loggers are. They care for their property, improve, work hard, study and use the land for which it was created.

Today there are seven Elder generations who, were, now and could be building their land and future in Lake County, Oregon."

-Bob & Diane Elder, submitted to Tess Baker via email and shared with permission