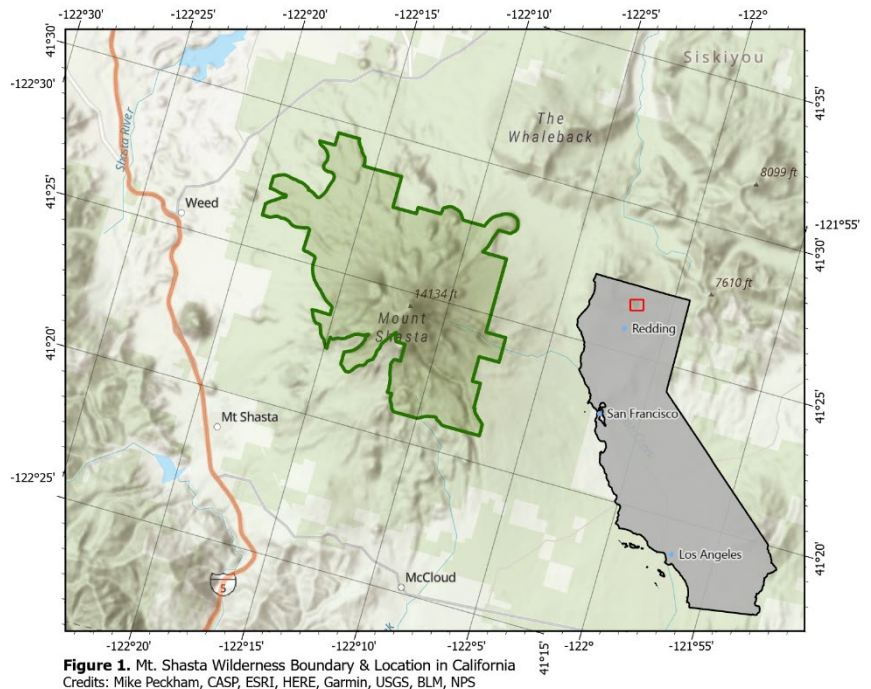


Mt. Shasta Wilderness

If you have ever driven from San Francisco to Oregon on Interstate 5, you likely noticed the enormous mountain protruding from the landscape off to the northeast. At first glance it appears to be a desolate snowcapped mountain with the top masked by lenticular clouds. If you were to pull off and venture down a road into the Shasta-Trinity National Forest east of the town of Mt. Shasta, you would immediately realize that there is so much more to it than just a desolate snowcapped mountain. In fact, it is not only a mountain, but an active yet dormant volcano in the Cascade Range. As you make your way to the end of a Forest Service Road you would reach the Mt. Shasta Wilderness boundary, sprawling 36,981 acres, it was officially designated by Congress under the Wilderness Act in 1984 (STNF n/a). Accessible only on foot, Mt. Shasta Wilderness is comprised of a variety of physical geographic features. In lower elevations there are meadows, forests, rivers, streams, and waterfalls on landforms manipulated by volcanic and glacial activity. As you climb a bit higher, there are a variety of rocky outcrops and cliff faces, intermittent streams and rivers, glacial lakes, exposed lava rock and ancient lava flows. As you venture even higher in elevation, there are glaciers, crevasses, non-eruptive fissures, and of course craters caused by past eruptions. From outdoor recreation to the source of the Sacramento River headwaters, Mt. Shasta Wilderness' diversity and scale of physical features provide a unique place to explore, research, and protect.

Located within California's largest National Forest, the Shasta-Trinity, Mt. Shasta Wilderness is situated on the 41st parallel and the 122nd meridian, about 60 miles north of Redding (Fig1). The most prominent feature in the wilderness is Mt. Shasta, a stratovolcano rising 14,179' above sea level. It is the 5th tallest mountain in CA and the 2nd tallest in the Cascade Mountain Range. The Cascade Range is part of the Pacific Ring of Fire which follows the boundaries of several different tectonic plates in the Pacific Ocean, including the North American and the Juan de Fuca Plates. The Ring of Fire hosts 75% of the world's

volcanoes and contributes to 90% of the world's earthquakes (NatGeo 2023). Mt. Shasta is one of the High Cascade Volcanoes making up the southern end of the Cascade Range, which has slowly been created by volcanic eruptions over millions of years (NPS 2020). Recently the most notable eruption in the Cascades was around 450 miles north of Mt.



Shasta, in 1980, at Mt. Saint Helens. Mt. Shasta is a result of the Juan de Fuca Plate moving under the North American Plate, known as the Cascadia Subduction Zone. The subduction process of tectonic plates causes rocks to melt, then turns into magma which is pushed towards the surface and can lead to volcanic eruptions of lava. (NPS 2020; Christiansen et al 2020) After millions of years of volcanic eruptions, stratovolcanoes become uniquely defined by hardened lava.

Stratovolcanoes, known for steep sides and viscous lava, are prone to explosive eruptions. (BGS, 2023). Most of the views of the stratovolcano in the surrounding valley are from 10,000' below the peak, giving it an even more cone shaped definition. The mountain is made of hardened lava, tephra, and volcanic ash. The oldest lava rocks have been carbon dated to 10,940,000 years ago. Viewing the mountain from the north, you can see three cones that were created during the more recent eruptions of the volcano. The Hotlum Cone makes up the summit of Mt. Shasta and is dated to about 8,500 years old (Christiansen et al 2020). The Shastina Cone, also known as the false summit to mountaineers, formed around 10,000 years ago, and the Misery Hill Cone formed between 30,000 and 60,000 years ago.

In 1784 a French Explorer claimed to have observed an eruption while sailing on the Pacific Ocean, and that is still believed by some to be the most recent volcanic activity. However, the youngest carbon dated lava rocks documented are between 600 and 10,000 years old, and predicting future volcanic eruptions is incredibly difficult. Based on current data an eruption is likely to happen every 600-800 years. Due to the extreme weather conditions and glaciers covering large portions of the surface, collecting suitable material for dating has proved difficult, making these age ranges somewhat uncertain (Christiansen et al 2017). Rockslides and rock fall are common hazards on Mt. Shasta due to ice melting and rocks breaking free, especially where glaciers have carved out and eroded sections of volcanic rock (Christiansen et al 2017; MSAC n/a).

Mt. Shasta has 7 glaciers, which formed during the last 1,000 years, a period known as the Little Ice Age. The largest one is Whitney Glacier, in 1987 it was approximately 2 miles long and covered an area from 13,700' down to around 9,500'. In 2014 it was around 1.86 miles long and losing around 3 feet per year. The glacier averaged a depth of 80 feet deep and was approximately 320 acres (AGU 2014). In 2021 Whitney Glacier was fully exposed after the winter's snowpack completely melted, it began to break down into multiple segments but slightly recovered when the 2022 snowfall was well above average. However, when the glaciers do not retain their snowpack year-round, long term impacts are felt. Since 2005 the Whitney Glacier has retreated over 3,000' and a 50% reduction in area has been observed by remote sensing (Smith 2021; AGU 2022). As the glaciers have moved and melted slowly over the years they have left behind different deposits of rocks, helping form the unique shape of the stratovolcano. Avalanche Gulch and the old Ski Bowl on Mt. Shasta are the result of these different deposits left by glaciers that once covered the area. Those glaciers melted sometime between 15,000 and 30,000 years ago during the same time as the Tioga Glaciation of the Sierra Nevada Range (Christiansen et al 2017). The current glaciers within the Mt. Shasta Wilderness along with the different ecosystems are heavily impacted by changing

climates and precipitation patterns; those impacts descend into the lower elevations through several different biotic zones.

Mt. Shasta Wilderness spans elevations from 4,400' to 14,179', encompassing 5 unique biotic zones. Topographic variations drastically affect the weather patterns on Mt. Shasta, which determines the different types of life that can be supported in these zones. In the Alpine Biotic Zone, 10,000' and above, most flora and fauna cannot survive the extreme weather and freezing temperatures. (Loidi et al 2022) The only signs of life here are usually humans or birds passing through. Permanent snowfields and glaciers form their own type of life zone, they become a source of water for the ecosystems and their inhabitants below. Melting snowpack seeps into the Headwater Spring in Mt. Shasta City Park, the headwaters for the Upper Sacramento River (MSREC n/a). Between 8,500' & 10,000' is the Sub-Alpine Zone, vegetation here tends to consist of wildflowers, grasses, lichen, and moss (Loidi et al 2022). Winds can reach up to 100 mph in this area and the temperatures are colder which only allow for a short growing season (MSAC n/). The only permanent residents of Mt. Shasta Wilderness are a wide variety of flora and fauna, and they reside in the lower biotic zones.

As the elevation decreases into a slightly warmer climate known as the Upper Montane Zone, the trees, vegetation, and wildlife are presented with a more hospitable environment. This zone is typically below 8,500' and is commonly referred to as the Tree Line. These forests are generally drier and warmer, hosting mixed conifers such as Douglas Fir, Ponderosa Pine, Mountain Hemlock, and Whitebark Pine. Black bears, mountain lions, mule deer, snowshoe hare, and the American badger can all be found in the lower elevations. (Loidi et al 2022; STNF n/a) The Trailheads that provide access to the alpine zones are in the Woodlands and Lower Montane Zones, typically lush forests that cover the lower elevations from around 1,500' to 6,000' (Loidi et al 2022; UC Merced 2023). The variations in elevation provide a wide range of temperatures and precipitation patterns. Coupled with a history of volcanic eruptions and nutrient-rich soils, several different ecosystems thrive here. The different biotic zones in the Mt. Shasta Wilderness

showcase many different physical features and forces of nature, which some humans of course, have a history of exploiting.

For thousands of years, before Mt. Shasta Wilderness was protected and surrounded by what is now known as the Shasta-Trinity National Forest, several different Native American Tribes called the surrounding area home, and the volcano was considered a sacred place. Many tribes viewed and still view it today as the place where their ancestors descended from, the origin of fire, and a resting place for the Great Spirit (Jackson 2015). While there is no specific historical data of people living on Mt. Shasta itself, many of the tribes lived nearby and would take spiritual journeys up the massive mountain. Sometime before 1848, logging by European settlers was already taking place in the Montane Forests surrounding Mt. Shasta. When some of those settlers discovered gold in the region, the timber industry was born. By the mid 1850's the Native Tribes were violently forced out of their lands, and by the late 1860's the US Army took complete control of the area (Smith 2013; PRT n/a). While the Native Tribes of the region left mostly footprints, the European settlers left clear cut swaths of land. Today no logging is allowed in the designated Wilderness, but it still takes place in the surrounding category VI area, The Shasta-Trinity National Forest. The United States Department of Agriculture's (USDA) Forest Service (FS) recognizes, protects, maintains, and manages access to the Mt. Shasta Wilderness area.

Under the Transfer Act of 1905, President Theodore Roosevelt established the Shasta National Forest. In 1954 the Shasta and Trinity National Forests were merged to be managed as one. Initially this was done to mitigate resource conflicts regarding timber for the ever-expanding American West. Today there are many different divisions of management that reduce conflict. Some of these divisions include resource management, recreation, fire suppression & prevention, trail maintenance, and of course law enforcement (STNF n/a). However, other types of conflicts have existed between ecological and cultural aspects of the area. The native tribes of the area still consider Mt. Shasta a spiritual place and some of their practices, like building sweat lodges or altars do not adhere to the Wilderness Act regulations (Fernandez-

Jimenez 1992). While this specific conflict may have more validity than others, this area will only be able to enforce these regulations if they remain in a protected status and are funded appropriately.

Funding for Mt. Shasta Wilderness comes from various sources, permit fees make up a small portion, non-governmental organizations help too, but the majority is budgeted by the Federal Government each year. The US Congress determines the budget for the USDA, and they determine and disperse funds to the Forest Service. The Wilderness Society, a non-profit that started conservation efforts in 1935, leads the effort in advocating for appropriate funding for the conservation of Wilderness areas, including Mt. Shasta Wilderness (USDAFS 2022; TWS n/a). In recent years, droughts and massive wildfires have consumed larger and larger portions of the annual budget. In 2023 the budget for the FS was \$9 billion, nearly \$4.9 billion of that was used in fire suppression and prevention (USDAFS 2022). While the protection status of this area would not be possible without Federal funding, collecting fees for summit permits allows for the recreation of all the different physical features found in this majestic wilderness.

The Mt. Shasta Wilderness requires a permit to access any of the trails or natural features. The wilderness permits are free and can usually be obtained by self-issue at any of the trail heads, they can also be picked up at the Mt. Shasta or McCloud Ranger Stations nearby. Anyone going above 10,000' is required by law to purchase a 3-day summit pass for \$25.00, or an annual summit pass for \$30.00. There are a few different base camps in the wilderness, all of which are free to camp at, except Horse Camp which charges a \$5 fee per tent. (STNF n/a) Considering on average only between 5,000 and 6,500 people purchase summit passes, it's a good thing the Shasta-Trinity National Forest does not depend on those sales for managing the Wilderness (Thomas 2021). Due to the remoteness of the area, the physical exertion it takes to summit, and the different life-threatening hazards presented on the trek up, Mt. Shasta's visitors need to have a wide variety of gear, physical, and mental abilities.

Once a visitor picks up their wilderness and / or summit permits, they must be fully self sufficient when they leave their vehicle behind at the trailhead. The nearest shops and gear stores in town are

approximately 1 hour away, so having enough food, water, and essential backcountry gear is crucial for a safe experience. However, venturing above 10,000' the FS mandates the following gear: helmet, crampons, ice axe, and what is known as a pack out bag... for human waste. (STNF 2015; MSAC n/a) Hiking thousands of vertical feet while carrying 20-40 pounds of water and gear limits the accessibility and requires not only the physical ability but also a special mindset. Organic material, such as human feces, takes a very long time to decompose in an Alpine Biotic Zone, therefore the FS developed a system to ensure you carry your own waste out. At all the trailheads little bags full of saw dust can be found for free and they are required by law to be above 10,000'. When nature calls that special mindset will help when you must relieve yourself into a bag and then find a place for it, in your pack. Considering the icy and hazardous nature found in the Alpine Zone, knowledge of proper crampon and ice axe use is a must. Fortunately, there are several different private tour guide businesses in the surrounding area to help guide you safely through the glacier covered volcano (STNF 2015; MSAC n/a). The guides can be hired for hiking, mountaineering, ski touring, spiritual quests, and just about any other reason you would want to climb the volcano.

The physical features and different biotic zones offer a unique experience for anyone who can traverse the rugged terrain; however, recreation here depends largely on the climate. The best time to safely make the trek is between April and early July (MSAC n/a). The weather is generally better during these times and the daylight hours are longer. Falling rock hazards are lower as they are still frozen in place, typically the avalanche risk is lower as well. Ice climbing would be better earlier in the season, while bird watching depends on the migratory patterns, but this all depends on precipitation patterns, the snowpack, and the climate. (STNF 2015; MSAC n/a) Historically Mt. Shasta had snowpack year-round, which allowed for a more dependable recreation experience. But, in recent years the white patches on the mountains you could see in August or September were the exposed glaciers, not snow. In 2021, Lake Shasta, which is fed by the snowpack, reflected its lowest point in 44 years. The lack of snow and warming temperatures cause other issues that the region has not regularly experienced in the past; wildfires, mudslides, and debris flows

(Sahagun 2021). All the biotic zones, glaciers, and physical features of the Mt. Shasta Wilderness will continue to reflect the impacts of the warming climate.

The global temperature increases we are experiencing today positively correlate with the changing patterns of precipitation (IPCC 2021). The Headwaters of the Upper Sacramento River depend largely on precipitation and snowpack within the Mt. Shasta Wilderness. From 2019 – 2022, the rapid decline of the water line in Lake Shasta, fed by the Sacramento River, showcased a preview of the potential future results from climate change. With surface temperatures rising, the intensity and frequency of heat waves will also increase, melting the snowpack and glaciers on Mt. Shasta at an even faster rate than we are experiencing today (Sahagun 2021; IPCC 2021). These shifting patterns will alter the different biotic zones in the wilderness and that will affect the vegetation, wildlife, water resources, recreation opportunities, cultural significance, and of course the management practices of the protected area. While the warmer climate may allow for vegetation to grow in higher elevations, the changing habitats can alter the way species interact with different ecosystems (EPA 2017) The effects of these changes are hard to predict, and we all depend on the water resources the area provides.

The protection of Mt. Shasta Wilderness is largely dependent on the preservation of the ecological beauty found here. Visitors may come for a chance to hike and ski a volcano scattered with iconic glaciers, or maybe to track and research migratory birds along one of the major migratory flyways of North America. The stratovolcanoes diverse biotic zones and cultural heritage provide an amazing site for human interaction with a wide range of natural and spiritual elements. The continued coexistence of these elements will depend on the climate of the region. So, the next time you are flying or driving past the enormous mountain protruding from the landscape, let it be a reminder of the responsibility we all have, to protect and preserve the environment so it can be experienced by future generations. By continuing to study, recreate, and protect the Mt. Shasta Wilderness area we can ensure that its geological, ecological, and cultural significance continues to offer the endless opportunities that it offers today.

References

- British Geological Survey (BGS) Date: n/a. Types of Volcanoes <https://www.bgs.ac.uk/discovering-geology/earth-hazards/volcanoes/how-volcanoes-form> Date Accessed 11/20/2023
- Christiansen, R.L., Calvert, A.T., and Grove T.L., 2017, Geologic field-trip guide to Mount Shasta volcano, northern California: *U.S. Geological Survey Scientific Investigations Report 2017-5022-K3*, 33 p., <https://doi.org/10.3133/sir20175022K3>. Date Accessed: 11/15/2023.
- Christiansen, R.L., Calvert, A.T., Champion, D.E., Gardner, C.A., Fierstein, J.E., and Vazquez, J.A., 2020, The remarkable volcanism of Shastina, a stratocone segment of Mount Shasta, California: *Geosphere*, v. 16, no. 5, p. 1153–1178, <https://doi.org/10.1130/GES02080.1> Date Accessed: 11/15/2023.
- Environmental Protection Agency (EPA) Jan. 19th, 2017. (Description: Climate change impacts on ecosystems.) https://19january2017snapshot.epa.gov/climate-impacts/climate-impacts-ecosystems_.html Date Accessed 12/1/2023.
- Fernandez-Gimenez, Maria. Lynn Huntsinger, Catherine Phillips, Barbara Allen-Diaz, 1992 *USDA Forest Service Gen. Tech. Rep. PSW-132. Conflicting Values: Spirituality and Wilderness at Mt. Shasta.* <https://www.fs.usda.gov/research/treesearch/28050> Date Accessed: 11/28/2023.
- Intergovernmental Panel on Climate Change (IPCC), 2021: Summary for Policymakers. In: *Climate Change 2021: The Physical Science Basis. Contribution of Working Group I to the Sixth Assessment Report of the Intergovernmental Panel on Climate Change* [Masson-Delmotte, V., P. Zhai, A. Pirani, S.L. Connors, C. Péan, S. Berger, N. Caud, Y. Chen, L. Goldfarb, M.I. Gomis, M. Huang, K. Leitzell, E. Lonnoy, J.B.R. Matthews, T.K. Maycock, T. Waterfield, O. Yelekçi, R. Yu, and B. Zhou (eds.)]. Cambridge University Press, Cambridge, United Kingdom and New York, NY, USA, pp. 3–32, doi:10.1017/9781009157896.001.
- Jackson, Steven, *National Public Radio*, June 7th, 2015. (Description: Native spiritual & cultural significance of Mt. Shasta) www.npr.org/2015/06/07/412098380/a-mountain-of-many-legends-draws-spiritual-seekers-from-around-the-globe Accessed 11/25/2023.
- Mt. Shasta Avalanche Center (MSAC) Date: n/a. (Description: Climbing, hiking, hazards, information on Mt. Shasta) <https://www.shastaavalanche.org/#/all> Date Accessed: 11/25/2023.
- Mt. Shasta Recreation & Parks District (MSREC) date: n/a (Description: Info on Headwater Spring) www.msrec.org/mt-shasta-city-park Date Accessed: 11/22/2022.
- National Geographic (NatGeo) October 19th, 2023 (Description: Basic information on Pacific Ring of Fire) <https://education.nationalgeographic.org/resource/ring-fire/> Date Accessed: 11/20/2023.
- National Park Service (NPS) 2020, Plate Tectonics & Our National Parks, Convergent Plate Boundaries, Subduction Zones <https://www.nps.gov/subjects/geology/plate-tectonics-subduction-zones.htm> Date Accessed: 11/20/2023
- Pelto, Mauri, *American Geophysical Union (AGU)* Sept. 30th, 2014. Whitney Glacier Retreat and Thinning, Mount Shasta, California. <https://blogs.agu.org/fromaglaciersperspective/2014/09/30/whitney-glacier-retreat-and-thinning-mount-shasta-california/> Date Accessed: 11/20/2023.

References (continued)

- Pelto, Mauri, *American Geophysical Union (AGU)* August 26th, 2022. Whitney Glacier, Mount Shasta snow free again in 2022 <https://blogs.agu.org/fromaglaciersperspective/2022/08/26/whitney-glacier-mount-shasta-snow-free-again-in-2022/> Date Accessed: 11/30/2023
- Sahagun, Louis, *Los Angeles Times*. Sept. 8th, 2021, First the snow vanished, then the mudslides began: Mt. Shasta's summer of pain. <https://www.latimes.com/environment/story/2021-09-08/mt-shasta-snow-vanished-replaced-by-mudflows> Date Accessed 11/22/2023.
- Shasta-Trinity National Forest (STNF) July 2015, *Forest Service Pacific Southwest Region* So you want to climb Mt. Shasta (Description: Information on climbing Mt. Shasta, permits, routes, gear, etc.) https://www.fs.usda.gov/Internet/FSE_DOCUMENTS/fsm9_008138.pdf Date Accessed: 11/15/2023.
- Shasta-Trinity National Forest (STNF) Date: n/a History & Culture (Description: First people, merging of two forests, lakes) <https://www.fs.usda.gov/main/stnf/learning/history-culture> Date Accessed: 11/15/2023
- Smith, Kristen Nov. 5th, 2021. *Outside Magazine* (Description: Glaciers retreating and changing snowpacks) <https://www.backpacker.com/news-and-events/mt-shastas-glaciers-are-disappearing/> Date Accessed: 11/25/2023.
- Smith, Dottie, *Redding Record Searchlight* May 9th, 2013. Travelin' in Time: Logging helped Shape Early Shasta County history (Description: Early logging operations in Shasta County) <https://archive.redding.com/lifestyle/travelin-in-time-logging-helped-shape-early-shasta-county-history-ep-299667563-353914541.html/> Accessed 11/25/2023.
- The Wilderness Society (TWS) Date: n/a. (Description: NGO Involvement in Conservation in Washington D.C) <https://www.wilderness.org/articles/article/national-forest-service-budget> Date Accessed: 11/20/2023.
- Thomas, Gregory, *San Francisco Chronicle*. May 23rd, 2021 (Description: Visitor counts and hazards) <https://www.sfchronicle.com/culture/travel/article/It-s-now-easier-than-ever-to-hike-to-the-summit-16195577.php> Date Accessed: 11/30/2023
- United States Department of Agriculture, Forest Service (USDAFS) Fiscal Year 2023 Budget Justification, 2023 USDA Explanatory Notes – Forest Service. 2022 <https://www.fs.usda.gov/about-agency/budget-performance> Date Accessed: 11/28/2023.
- University of California, Merced (UC Merced) July 17th, 2023. Yosemite Field Station, Life Zones (Description: Biotic Zones of mountainous regions) <https://snrs.ucmerced.edu/natural-history/life-zones> Date Accessed: 11/20/2023.