Executive Summary

Cartographic Design and Multi-Criteria GIS Analysis for Conservation Easement and Stewardship Project Management for Siskiyou Land Trust in Siskiyou County, California

by

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Siskiyou Land Trust (SLT) is a nonprofit land conservation organization located in Mount Shasta, California. Established in 1993 by volunteers who recognized the value of Siskiyou County lands, SLT's goals were to preserve the natural resources within a variety of land uses in Siskiyou County by way of long-term stewardship. Siskiyou County is the fifth largest county in California by area, comprising over 444,000-acres of wilderness, and with a population just over 44,000.

Situated in the northernmost part of California (*Figure 1*) it is adjacent to the Oregon State border inside the Shasta Cascade region. The County itself sits within a rugged wilderness, with towering mountains, an abundance of rivers and waterways, and a large portion of flat valley lands that are historically used for ranching and farming.

The highest point in Siskiyou County is Mount Shasta volcano, a potentially active 14,162-foot compound stratovolcano with designation as one of the largest and tallest volcanoes in the Cascades (*Figure 2*). Having six national forests and seven wilderness areas within the county, one of SLT's goals is connecting existing conserved/protected lands for wildlife corridors. Another goal and reason for GIS analysis for acquisition potential, is to preserve and in some cases, restore cold water streams for Coho and Chinook spawning and rearing habitat.

Figure 1. Siskiyou County, California Regional Locator Map.

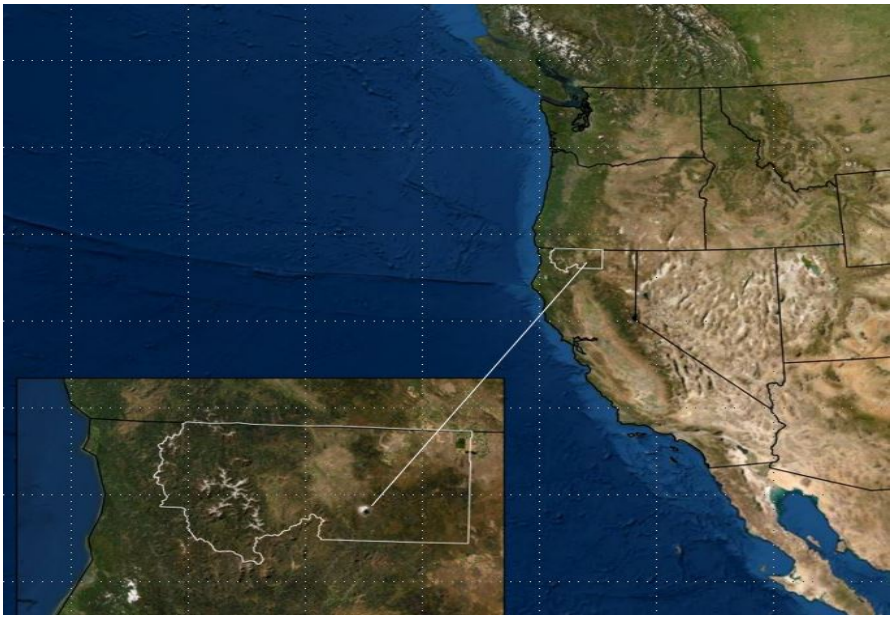
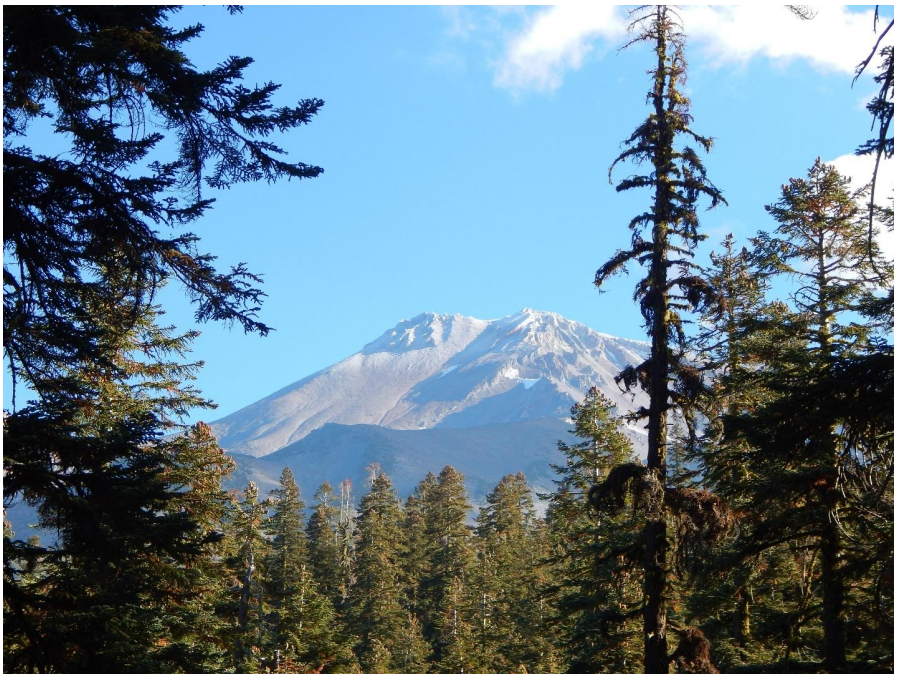


Figure 2. Mount Shasta Volcano from Sand Flat, August 2020.



SLT's main goal is to help landowners and communities in Siskiyou County achieve preservation goals for forest and wild lands, open spaces, wetlands, scenic viewsheds, agricultural lands, and natural resources. They accomplish this through Conservation Easements (CE's) and fee title holdings.

Conservation easements are legal agreements set by a landowner or proprietor that specify future protections that either leave a property in private ownership or allow public agencies and nonprofit organizations like Siskiyou Land Trust to hold the lands while limiting development, in perpetuity. A fee title is a property that an organization acquires either by direct purchase, donation, or combination of the two, that they want to protect.

Target values for CE's and fee title properties are established during the first stages of procurement and preparation strategies. Values may be related to different ecological and economic factors, contingent on the geographic location and ecological opportunity of the property. Each of SLT's CE's and fee title holdings (*Table 1*) represent preservation values with different motives including: natural or undisturbed lands with a high focus on watershed and river life; lands that support rare or unique ecosystems; lands with scenic viewsheds; and lands with cultural and economic properties such as long-term family ranches and farms producing agriculture and harvesting timber.

Table 1. SLT Fee Title Holdings & Conservation Easements.

Holding Name	Acreage & Location	Price/Donation	Year Completed	Intent of Preservation
Trinity River	70 acres Salt Flat, Trinity County	Private donation by Ward family	1998	Open space, prehistoric cultural resources, salmon & steelhead spawning areas & wildlife habitat (SLT agreed to hold due to no land trust in Trinity co)
Sisson Meadow Wetlands & Trails	7.5 acres Mount Shasta	$410,000	2003	Enhancement of freshwater wetlands & public trail
Hammond Pond	67 acres Mount Eddy	Private donation by Dwight Hammond	2007	Scenic values & wildlife habitat including migrating Canada geese

Scott Valley CE's	5,680 acres Scott Valley (Fort Jones, Etna, Callahan)	Whipple & Plank No financial info available	2010	Rangeland & open space conservation Agricultural CE's (These are not in fee-title status- these CE's are managed by SLT and held by a multitude of private ownership entities)
Garden Share	City lot 0.5 acres	No financial info available	2010	Public garden space used by Boys & Girls club & Mount Shasta locals
Kingston Road	5 acres Mount Shasta	City donation for public use	2014	Multi-use trail linkages, stream & wetlands, open-space, urban storm-water runoff, public access
Garden Greenway	2.89 acres Mount Shasta	150,000 in a six-month local fundraising event	2014	Wetlands protection, wildlife habitat, scenic views, public green space
Rainbow Ridge: Wherrit Forest House	600 acres Mount Shasta	Bequest by Thamar Wherrit	2018	Working forest, wildlife habitat, scenic, non-industrial timber harvest plan, public hiking trail access
Scott River Headwaters: Wildcat, Whiskey, Bouvier properties in partnership with Western Rivers Conservancy & Ecotrust Forest Management	28,548 acres (Four forest tracts total, one in process & not listed) Scott Valley	EFM & WRC owned, SLT monitoring in partnership. No financial info available.	2020	Headwaters protection, Wilderness connectivity, Freshwater fish habitat and riparian corridors
Spencer Ranch	320 acres Scott Valley Adjacent to Plank & Whipple	In process/funded	2020	Family ranch, riparian corridor, fish and wildlife habitat
Thompson Creek In partnership with The Nature Conservancy	67 acres Happy Camp	TNC owned by bequest and SLT joined in on the project in 2020 for monitoring.	2020	Headwaters protection, wilderness connectivity, wildlife habitat, Coho & Chinook salmon habitat

I completed my required Professional Science Master's degree internship with Siskiyou Land Trust as a Geographic Information Systems (GIS) intern. My responsibilities as GIS intern were two-fold. 1) Create resource assessment maps for conservation easement parcels that were not yet funded that clearly conveyed the ideas and needs associated with established values in order for SLT to secure grants.

2) Determine the potential value of land tracts in Siskiyou County based on SLT criteria to support land acquisition decisions using GIS analysis.

Along with creating maps that assisted in the funding process for multiple CE's *(e.g., Figures 3 & 4)* I focused on improving file organization, data flow, and map design issues during my internship. To construct maps and models that utilized raster and vector datasets for visualization, I used ArcGIS Pro (https://pro.arcgis.com/en/pro-app/2.8/get-started/get-started/htm) which is a desktop application with contextual tabs and layers that allow the user to utilize and store map items, layouts, tables, charts, and informational data (metadata) in one place termed a project.

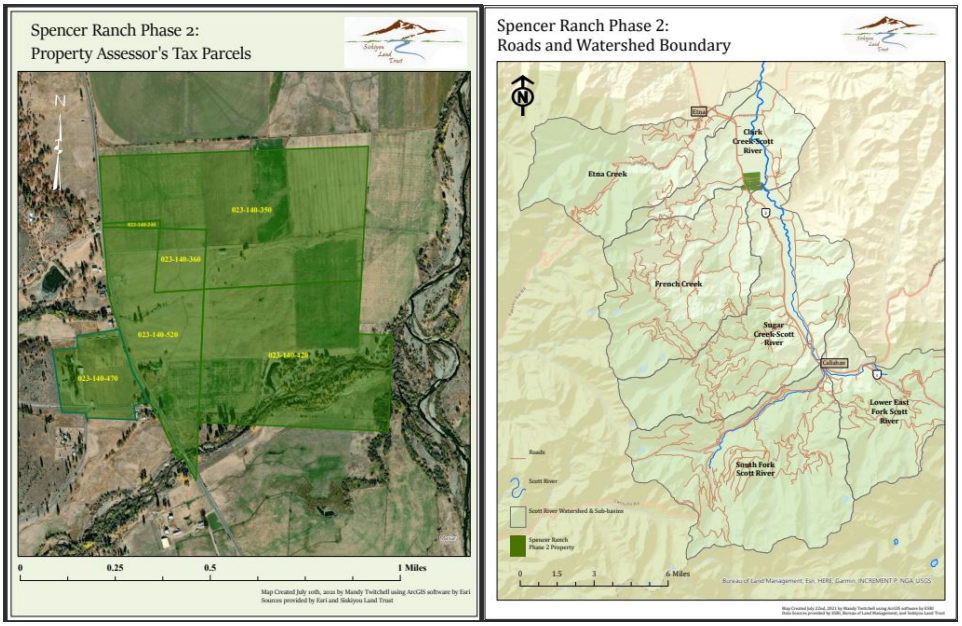


Figure 3: Spencer Ranch APN's; Figure 4: Spencer Ranch Roads & Watershed Boundary

ArcGIS Pro was used to exemplify visual assessment of spatial distribution for three project phases including (1) existing conserved land parcels that have been funded and are part of SLT's fee title holdings, (2) in-process acquisition projects that have not yet been funded, and (3) parcels that fall within SLT's criteria for potential acquisition inquiries. For fee title holdings and in-process projects, tax assessor's parcels, acreage, land use, and soil maps were created. For potential acquisition inquiries, maps were created after the suitability criteria were determined and confirmed.

The study area for GIS analysis is in the Scott and Shasta River watersheds (*Figure 5*).

Figure 5. Scott River & Shasta River Watershed in Siskiyou County, California. Mount Shasta volcano is located on the southeastern edge of Shasta River watershed.

The Scott and Shasta River watersheds are home to the listed Coho and Chinook salmon and are considered high ecologically valuable to SLT. The analysis parameters focused on parcels that were equal or greater to 500 acres, within or near riparian zones with 100-ft buffer, and adjacent to or within close proximity (1-2 miles) to existing protected lands (EPL's). Delineating a riparian corridor based on ecological variables including ground surface, atmospheric, vegetation, and soil factors was beyond the scope of this study. For GIS analysis, I used a 100-foot buffer for first- through third-order streams or headwater streams which are waterways within the upper reaches of the watershed.

Twelve maps created during my internship were used for securing funding and ongoing project management. A total of 38 maps were produced over the course of the internship. Table 2 shows results of specific ranking criteria used to identify land parcels suitable for conservation easement acquisition by SLT.

Table 2. Suitability Analysis Criteria Ranking Outcome.

Criteria	Ranking Score	Number of Parcels	Acquisition Potential (Low, Medium, High)
Riparian corridor	All parcels fall in range	5,945	N/A
Riparian corridor, privately owned	All parcels fall in range	3,068	N/A
Riparian corridor, privately owned, desired ownership attributes	All parcels fall in range	2,700	N/A
>500 acres, not in proximity to EPL's	1 of 3	65	Low
>500 acres, in proximity to EPL's, but outside of watershed boundary	2 of 3 *Ranking of EPL's is higher than watershed boundary limitations	30	Medium
>500 acres, in proximity to EPL's, within watershed boundary	3 of 3	25	High

A total of 53,665 parcels were analyzed. Of those, 5,945 fell within the riparian corridor. Of those, 3,068 were designated as privately owned. Of those, 2,700 had desired attributes and were included in the final suitability analysis. 25 high value parcels were identified for potential acquisition meeting all SLT criteria.

External communication is of the utmost importance to these small nonprofit organizations because one of their most imperative goals is to convince funders of their value. Maps are one way to tell the story, and I was able to build on the cartographic work I completed to show how additional GIS analysis and mapwork can be used to help guide decisions that determine the allocation of scarce resources. In addition to the initial maps and cartographic design scheme I delivered to SLT during my internship, the multiple variable criteria suitability analysis I conducted for potential land acquisition sites for conservation will, in fact, help prioritize their future expenditures.

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