



Monitoring Vegetation Composition, Structure, and Function in Whiskeytown National Recreation Area and Lassen Volcanic National Park

Fiscal Year 2012 Annual Report

Natural Resource Data Series NPS/KLMN/NRDS—2014/628



ON THE COVER

Sampling at Whiskeytown National Recreation Area
Photograph by: Sean B. Smith, Klamath Network

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February

U.S. Department of the Interior
National Park Service
Natural Resource Stewardship and Science
Fort Collins, Colorado

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All manuscripts in the series receive the appropriate level of peer review to ensure that the information is scientifically credible, technically accurate, appropriately written for the intended audience, and designed and published in a professional manner. Data in this report were collected and analyzed using methods based on established, peer-reviewed protocols and were analyzed and interpreted within the guidelines of the protocols.

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Please cite this publication as:

Smith, S. B., and D. Sarr. 2014. Monitoring vegetation composition, structure, and function in Whiskeytown National Recreation Area and Lassen Volcanic National Park: Fiscal year 2012 annual report. Natural Resource Data Series NPS/KLMN/NRDS—2014/628. National Park Service, Fort Collins, Colorado.

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Abstract

This report describes the results of the second year of implementing the Klamath Network's Vegetation Monitoring Protocol. At Whiskeytown National Recreation Area we monumented and read 21 matrix, 15 riparian, and 10 high elevation plots. At Lassen Volcanic National Park we monumented and read 18 matrix and 14 riparian, and 10 high elevation sites. Data from these plots are summarized below in a format that provides a template for future annual vegetation monitoring reports. Some minor changes to the protocol have been made at the request of park staff and due to some unexpected situations that occurred, not specifically addressed in the original Standard Operating Procedures (SOPs).

Introduction

In 2012, the Klamath Network Inventory and Monitoring Program (KLMN) implemented the second season of its vegetation monitoring protocol (Odion et al. 2011) at Whiskeytown National Recreation Area (WHIS, or Whiskeytown) and Lassen Volcanic National Park (LAVO, or Lassen). The protocol measures vegetation composition, structure, and function across on selected sampling frames in each of six parks of the network every three years. The data will be summarized in annual reports for each year of sampling in a given set of parks, with more complex analysis and synthesis reports at less frequent intervals.

The main objectives for the Fiscal Year (FY) 2012 field season were to monument and read 25 matrix, 26 riparian, and 20 high elevation sites at Whiskeytown and 30 matrix, 26 riparian, and 26 high elevation sites at Lassen. After the 2011 season, when we met 80% of our goals, we realized the goals for monumenting and reading plots in the Vegetation Monitoring Protocol (Odion et al. 2011) were very likely going to be too high to consistently meet. Results are described here in the format the KLMN proposes to use in the future for annual reporting of the vegetation monitoring. Annual reports are intended for park staff and partners and will summarize the work completed in a given field season and the status of vegetation composition, structure and function based on the data collected. The analyses and data summaries are selected to convey basic descriptive information in an easily interpreted format. More complex analyses and syntheses will be conducted every third year as outlined in the vegetation monitoring protocol (Odion et al. 2011).

Methods

Complete methods for site selection, data collection, data management and analysis are described in Odion et al. (2011), which provide detailed guidance for sampling in each park. This methodological summary is an abbreviated overview to provide context for this report.

Site Selection

The monitoring sampling frame used was constrained for safety and logistical reasons to exclude areas with slopes greater than 30 degrees, and locations less than 100 m or more than 1 km from a road or trail. An exception occurred at WHIS: due to safety issues regarding illegal cannabis cultivation in the park, all sites (except high elevation) were <150m from a road or trail. Across all parks, three types of sampling frames are recognized: 1) Riparian (areas within 20 m horizontally of a perennial stream), 2) High Elevation (elevations above a specific elevation limit in each park), and 3) Matrix (remaining areas).

At both Whiskeytown and Lassen, the park landscapes were divided into matrix, riparian, and high elevation sampling frames. For each sampling frame, we set target sample sizes following the Vegetation Monitoring Protocol (Odion et al. 2011), which were 25 matrix, 26 riparian, and 20 high elevation plots at Whiskeytown, and 30 matrix, 26 riparian, and 20 high elevation plots at Lassen. Where possible, we aimed to co-locate our plots with Stream, Landbird, or Whitebark Pine Monitoring sites. Sampling at Whiskeytown occurred between June 4 and August 29. Sampling at Lassen occurred between June 20 and September 21st.

Training and Logistics

Three NPS crew members began work on May 21st to assist the Crew Lead with site sampling. In addition to the four NPS positions, two Southern Oregon University (SOU) alumni were hired through a cooperative agreement with SOU to assist with sampling, one beginning May 21st and the other July 1st. Initial training occurred during the first work week. Training consisted of protocol and SOP review, safety and Job Hazard Analysis (JHA) discussions in the office, and field procedure training at a nearby green space. During the second work week, the group made a site visit to Whiskeytown for species familiarization and hands-on instruction of protocol procedures. After training as a group for two work weeks, the team split into two crews and sampling was conducted by one two-person crew, and one three-person crew until July 1st. After July 1st, we sampled mostly as two three-person crews. Crews worked an 8 10-hour workday field schedule; an 8-day work week is referred to hereafter as a 'hitch'.

Field Sampling

A 20 x 50 m plot was used for sampling matrix sites (Figure 1); a 10 x100 m or two 10x50 m plots was used for riparian sites, plot shape depended on the sinuosity of the stream channel (Figures 2a and b). The 10 m wide riparian plots were used to avoid going too far into the upland habitat type, and the varying angles (plots were not strictly linear) allowed us to capture more of the streamside vegetation. Site diagrams were drawn in the field for all riparian sites. Each plot, regardless of

sampling frame, consisted of ten 10 x 10 m modules, four of which were sampled intensively for species, ground cover, and seedling and sapling data.

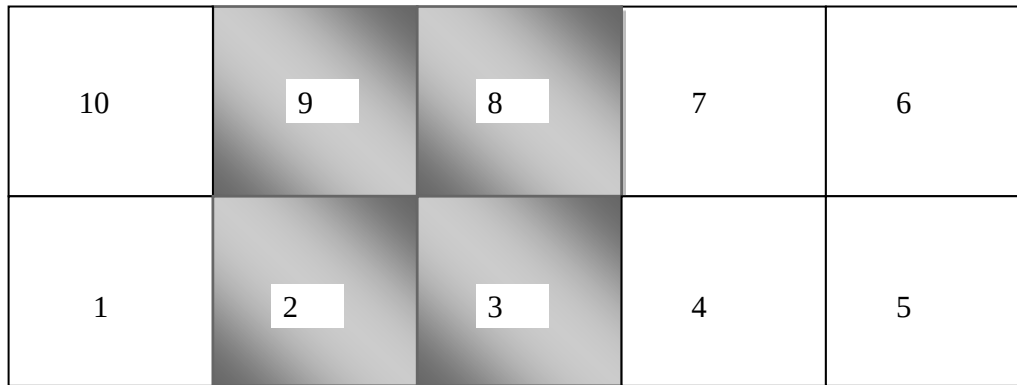


Figure 1. The 20 x 50 m matrix and high elevation site layout. Each numbered square is 10 x 10 m. Shaded squares are the four intensive modules.

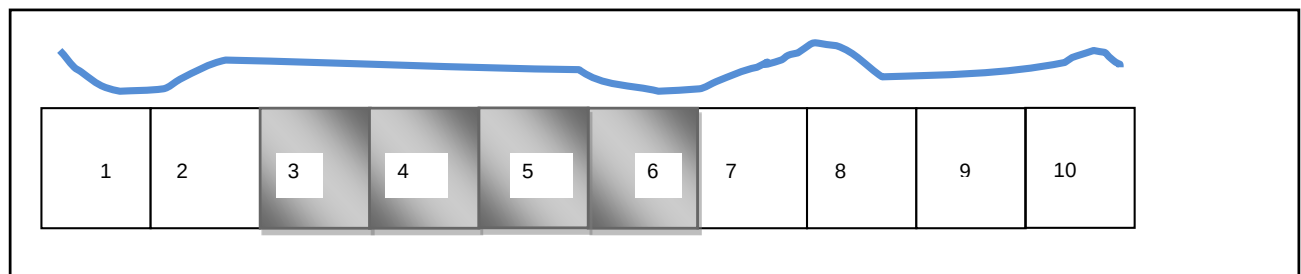


Figure 2a. Ten x 100 m riparian plot layout. Each numbered square is a 10 x10 m module. Shaded squares are the four intensive modules.

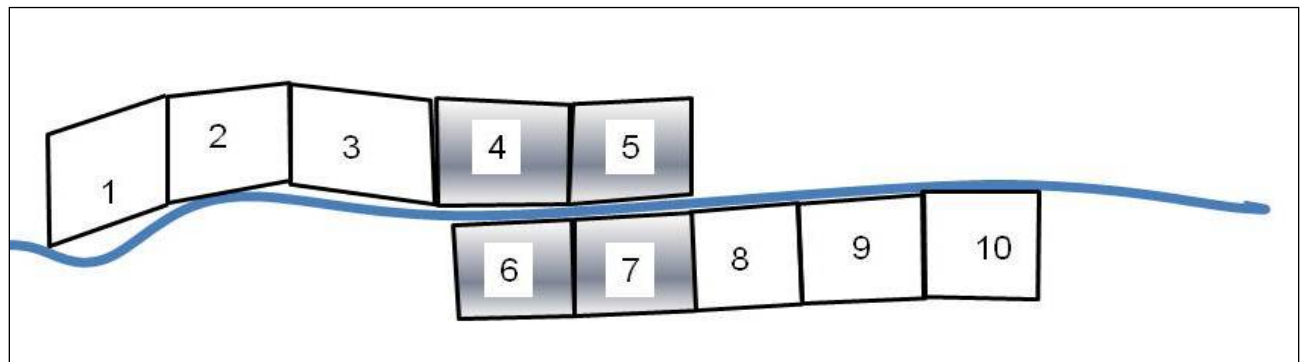


Figure 2b. Ten x 50 m riparian site layout. Each numbered square is 10 x10 m. Shaded squares are the four intensive modules.

Standard Operating Procedures 6-9 of the Vegetation Monitoring Protocol (Odion et al. 2011), provide details on the collection in each plot of measurements of the following parameters, which are sampled in the field:

1. Slope

2. Aspect
3. Elevation
4. Microtopography
5. Macrotopography
6. Vascular plant cover by species and height strata (S1 = (<.75m), S2 = (0.75-2.5 m), S3 = (2.6-5 m), and S4 = (>5 m))
7. Ground cover
8. Tree seedlings
9. Tree saplings by size class
10. Small trees by size class
11. Live trees (diameter at breast height [dbh], canopy position and condition)
12. Dead trees (dbh, decay class)
13. Fine wood (<7.6 cm diameter)
14. Coarse wood (>7.6 cm in diameter, size and decay class)
15. Litter and duff: (depth/thickness)

Data Management, Analysis and Presentation

All data management followed the procedures outlined in Standard Operating Procedure 12 of the Vegetation Monitoring Protocol (Odion et al. 2011). Field data were collected on tablet computers in the field, with nightly or weekly downloads to a secure computer. Verification of specimens and validation of data occurred throughout the field season and was finalized at the end of the field season, led by the field Crew Lead (Smith).

General data summaries were conducted to provide descriptive statistics of the park vegetation. These included measures of central tendency (mean, median) and variance (range, standard deviation) for each parameter. Data are presented in tabular form, and where suitable, in a user-friendly graphical format to aid in the visualization of data distribution or geographic variation across the sampling frame. A procedure for producing bubble maps was created for use in the future. Depending on data collected in future monitoring of the parks, annual reports may show different statistics, but will use the same general families of analysis and similar tables and illustrations.

Due to database constraints, the vascular plant taxonomy used in the study is a combination of The Jepson Manual 1st edition (Hickman et al. 1993) and United States Department of Agriculture (USDA) Plants Database (USDA, NRCS 2012).

Woody debris tons/acre was calculated using FFI (FEAT/FIREMON Integrated Database; Lutes et al. 2009) fuel constants. We did not calculate weighted averages.

Results

Here we summarize selected data most relevant to our monitoring objectives. Appendix A provides a more comprehensive summary of the environmental data collected at each site.

Whiskeytown

At Whiskeytown, we established 21 matrix sites, all co-located with Bird Community monitoring routes (Stephens et al. 2010); 15 riparian sites, 13 co-located with Stream Monitoring sites (Dinger et al. 2011); and 10 high elevation sites. Figure 3 shows the site locations. For reasons we are not sure of, one riparian site, WT125, was missing two subplots of data (substrate and vascular plant cover, shrub heights, and species present in the rest of the plot).

Lassen Volcanic

At Lassen, we established 18 matrix sites; 14 riparian sites, all co-located with Stream Monitoring sites (Dinger et al. 2011); and 10 high elevation sites, all co-located with Whitebark Pine Monitoring sites (McKinney et al. 2012). Figure 4 shows the site locations. Riparian site 122 was missing a site diagram.

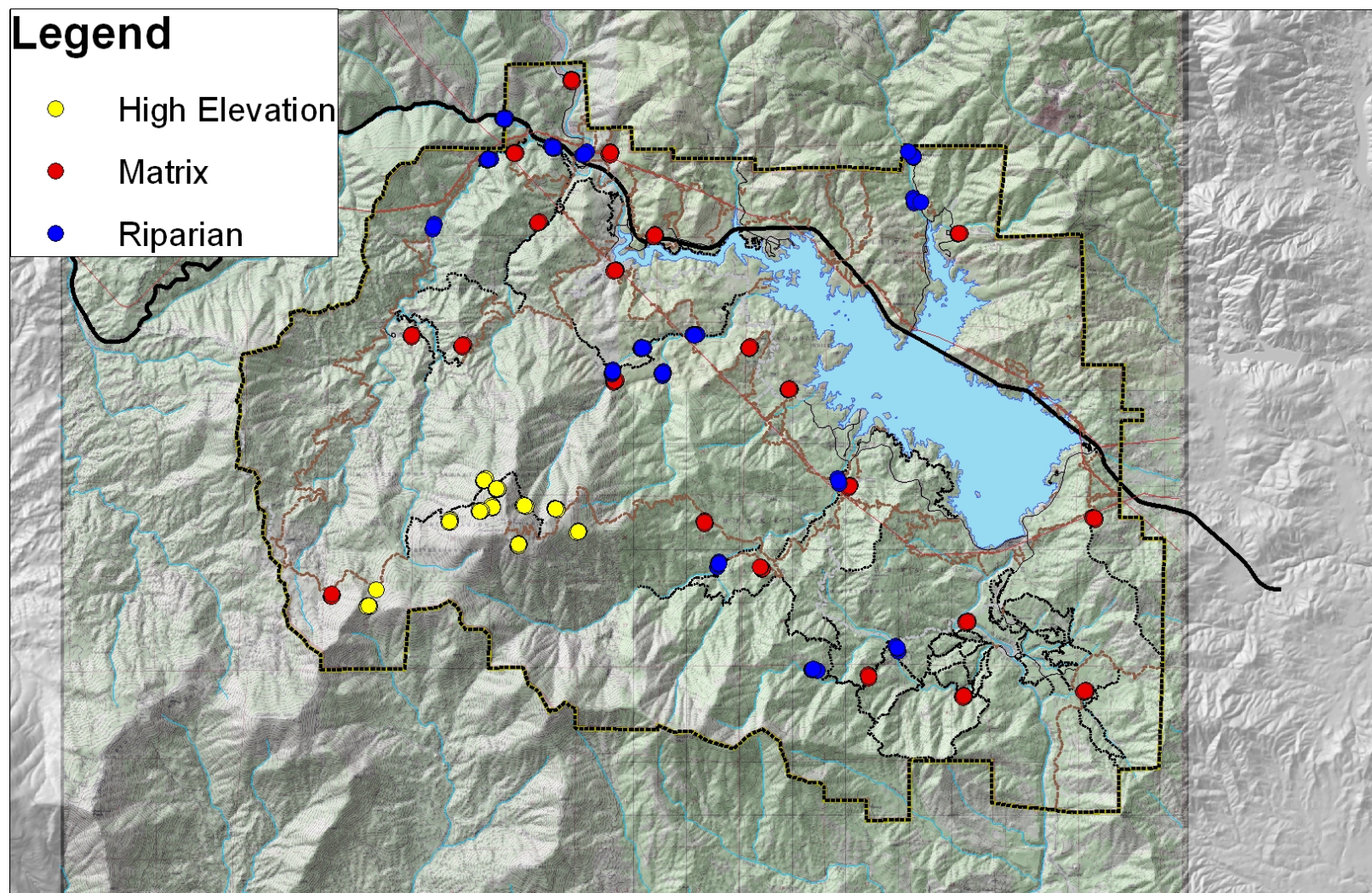


Figure 3. Location of 2012 Vegetation Monitoring plots at Whiskeytown National Recreation Area.

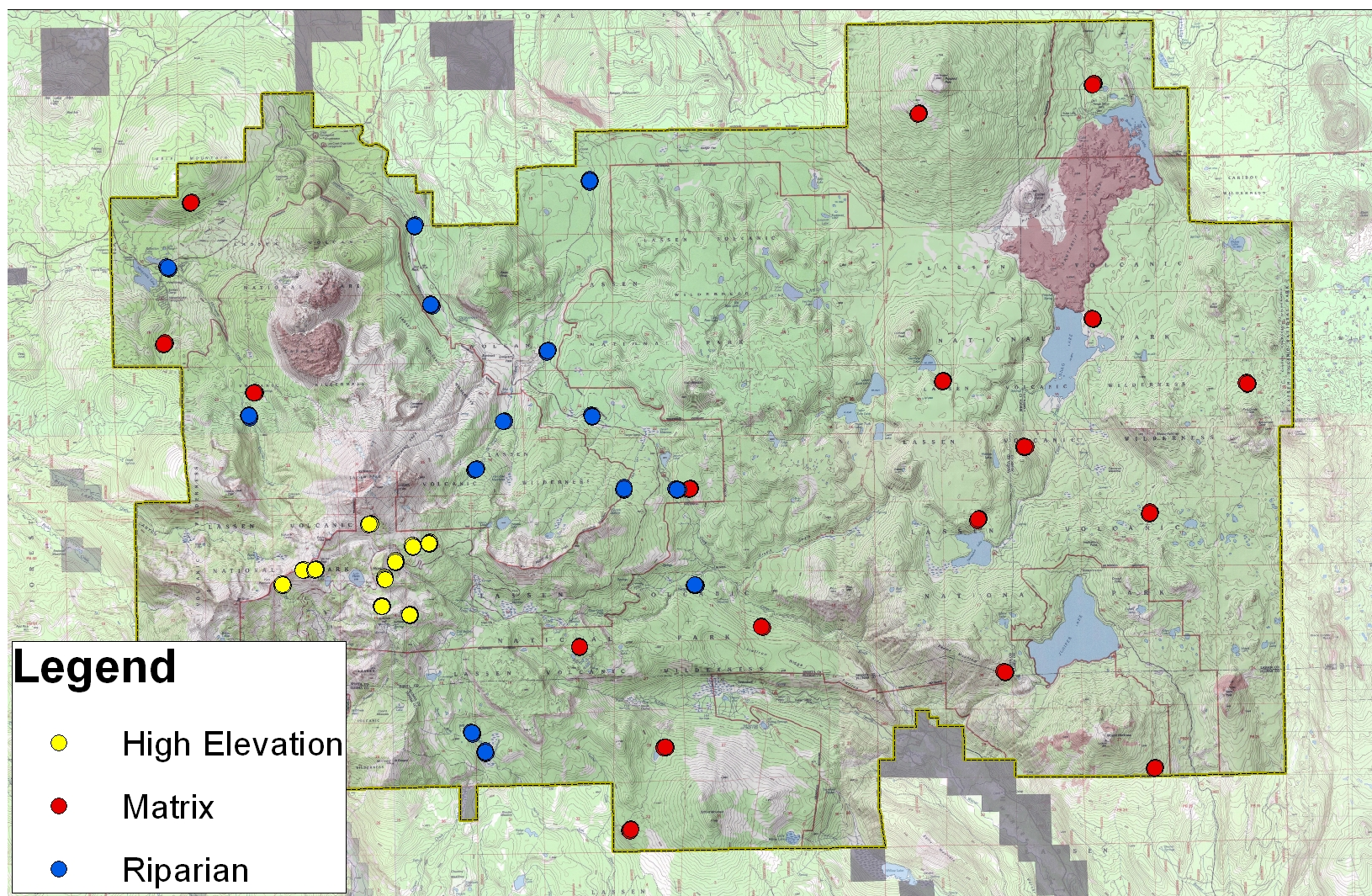


Figure 4. Location of 2012 Vegetation Monitoring sites at Lassen Volcanic National Park.

Vegetation Composition

Whiskeytown

Vascular plant species richness for the 0.1 ha sampling plot at Whiskeytown ranged from 9 to 81 species for matrix, 36 to 96 species for riparian, and 10 to 48 species for high elevation sites (Figure 5, Table1). For all matrix plots, 216 species were recorded (234 when counting unknowns). For all riparian plots, 247 species were recorded (269 when counting unknowns). For all high elevation plots, 78 species were recorded (81 when counting unknowns). The most frequently occurring understory species by sampling frame are shown in Tables 2, 3, and 4. Non-native species composition at the plot level ranged from 0-22 % for matrix; 0-32 % for riparian; and was 0 % for all high elevation sites (Figure 5). A total of 21 non-native species were observed in the matrix frame and 37 in the riparian, with the most frequently occurring noted in Table 2. Tree species composition at Whiskeytown consisted of 18 species. Eleven tree species were found in the matrix, 13 trees in the riparian, and four in the high elevation. Only Ponderosa pine (*Pinus ponderosa*) occurred in all three sampling frames. Figure 6 shows tree basal area composition percentage by site.

We found and vouchered seven species previously absent from the Whiskeytown vascular plant species list. None of the species represent significant range extensions or are considered rare. They are: *Melica subulata*, *Silene lemmonii*, *Sorbus californica*, *Thelypteris nevadensis*, *Trautvetteria caroliniensis* var. *occidentalis*, *Vaccinium parvifolium* (observed on way to a site, but not collected at a site) and *Woodsia scopulina*. Six species currently on the Whiskeytown vascular plant list but lacking vouchers were observed and collected: *Agrostis idahoensis*, *Bromus hordeaceus*, *Elymus stebbinsi*, *Malus sylvestris*, *Melica aristata*, and *Vaccinium membranaceum*.

We collected two specimens which should be reviewed by taxa experts. The first and potentially most interesting is a specimen closely resembling *Calamagrostis foliosa* but which does not match all morphological characteristics perfectly. If the specimen turns out to be *Calamagrostis foliosa*, this would be a noteworthy collection as this would be a range extension inland from the coastal habitat of the species. The second specimen keys to *Carex deweyana* ssp. *leptopoda*, but closer examination suggests this may be the newly separated taxon *Carex infirmivervia*.

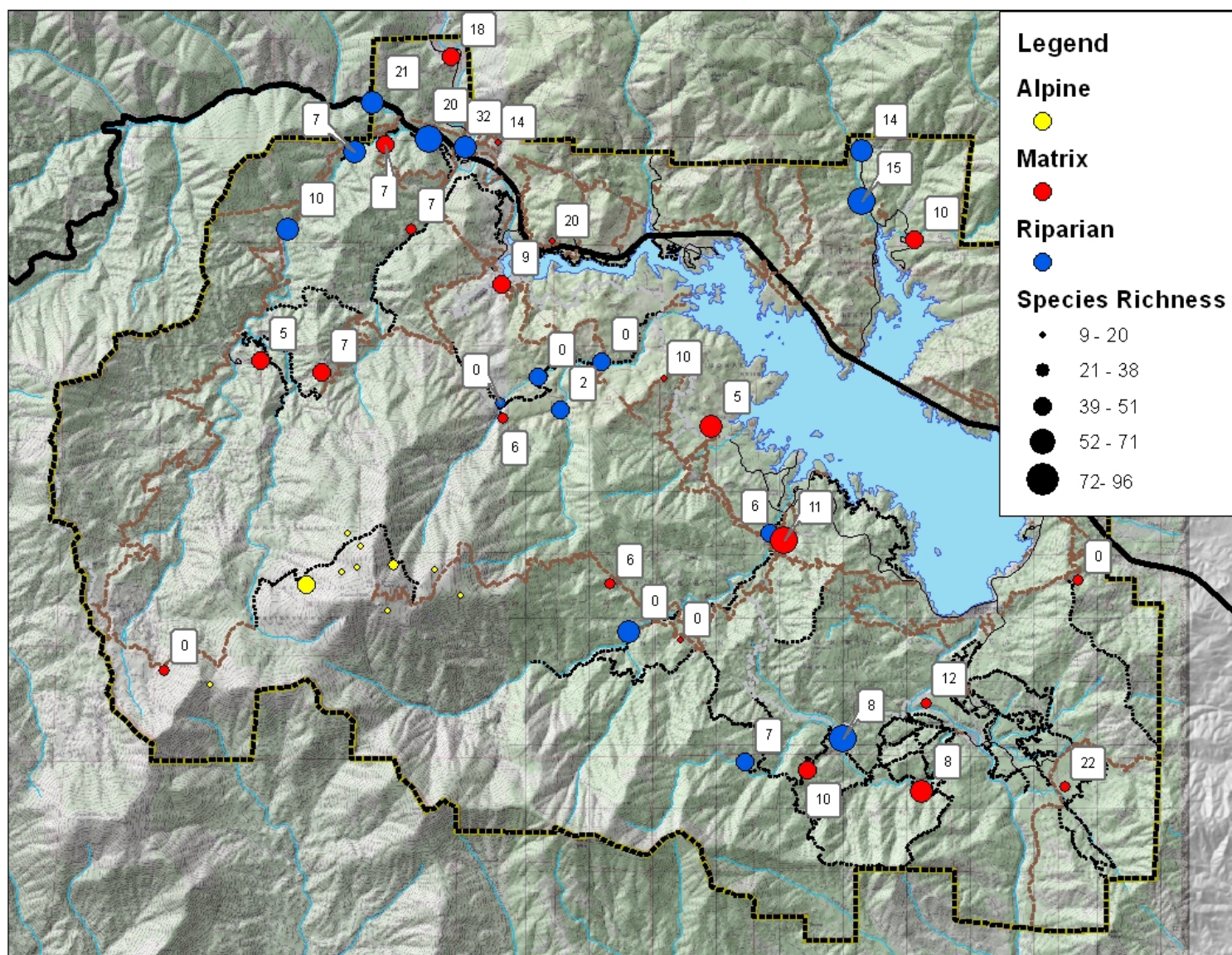


Figure 5. Whiskeytown site species richness from each sampling frame. White labels show percentage of species that are non-native. No high elevation sites had any non-native species, and labels are excluded.

Table 1. Species richness minimum, maximum, mean, and sample frame total from the 2012 Vegetation Monitoring plots.

Park	Sample Frame	SR Min	SR Max	SR Mean	Sample Frame Total
WHIS	High Elevation	10	48	18	78
WHIS	Matrix	9	81	38	234
WHIS	Riparian	36	96	60	267
LAVO	High Elevation	6	23	14	52
LAVO	Matrix	4	29	17	113
LAVO	Riparian	47	93	67	311

Table 2. Most frequently occurring understory species at Whiskeytown matrix sites. Number indicates constancy (% of plots species occurred in) (* indicates non-native species).

Herbs		Herbs	
<i>Galium porrigens</i> var. <i>tenu</i>	86	<i>Achnatherum lemmonii</i>	38
<i>Aira caryophylla</i>	62	<i>Calystegia occidentalis</i>	38
<i>Collomia heterophylla</i>	57	<i>Madia exigua</i>	38
<i>Carex multicaulis</i>	52	<i>Phlox speciosa</i> ssp. <i>occidentalis</i>	38
<i>Melica harfordii</i>	52	<i>Apocynum androsaemifolium</i>	33
<i>Comandra umbellata</i> ssp. <i>californica</i>	48	<i>Cynoglossum grande</i>	33
<i>Hieracium albiflorum</i>	48	<i>Elymus glaucus</i>	33
<i>Hypericum concinnum</i>	48	Shrubs	
<i>Hypericum perforatum</i> *	48	<i>Toxicodendron diversilobum</i>	95
<i>Lonicera interrupta</i>	48	<i>Heteromeles arbutifolia</i>	71
<i>Luzula comosa</i>	48	<i>Arctostaphylos viscida</i>	67
<i>Polygala cornuta</i>	43	<i>Ceanothus lemmonii</i>	48
<i>Torilis arvensis</i> *	43	<i>Rhamnus rubra</i>	38
<i>Vulpia myuros</i> var. <i>myuros</i> *	43	<i>Styrax officinalis</i> var. <i>redivivus</i>	38

Table 3. Most frequently occurring understory species at Whiskeytown riparian sites. Number indicates constancy (% of plots species occurred in) (* indicates non-native species).

Herbs		Herbs	
<i>Darmera peltata</i>	87	<i>Aruncus dioicus</i> var. <i>pubescens</i>	53
<i>Pteridium aquilinum</i> var. <i>pubescens</i>	87	<i>Lilium pardalinum</i>	53
<i>Rubus ursinus</i>	87	<i>Lonicera interrupta</i>	53
<i>Trientalis latifolia</i>	87	<i>Polygala cornuta</i> var. <i>cornuta</i>	53
<i>Elymus glaucus</i>	80	<i>Polystichum imbricans</i>	53
<i>Melica harfordii</i>	80	<i>Equisetum arvense</i>	47
<i>Osmorhiza chilensis</i>	80	<i>Galium porrigens</i> var. <i>tenue</i>	47
<i>Aralia californica</i>	73	Shrubs	
<i>Carex nudata</i>	73	<i>Vitis californica</i>	93
<i>Festuca occidentalis</i>	73	<i>Philadelphus lewisii</i>	87
<i>Montia parviflora</i>	73	<i>Toxicodendron diversilobum</i>	87
<i>Woodwardia fimbriata</i>	73	<i>Calycanthus occidentalis</i>	73
<i>Agrostis exarata</i>	67	<i>Salix lasiolepis</i>	60
<i>Carex deweyana</i> ssp. <i>leptopoda</i>	67	<i>Smilax californica</i>	60
<i>Galium triflorum</i>	67	<i>Aesculus californica</i>	53
<i>Polystichum munitum</i>	67	<i>Cornus sessilis</i>	53
<i>Torilis arvensis</i>	67	<i>Rubus armeniacus</i> *	47
<i>Deschampsia danthonioides</i>	60	<i>Cornus glabrata</i>	40
<i>Aristolochia californica</i>	53	<i>Styrax officinalis</i> var. <i>redivivus</i>	40

Table 4. Most frequently occurring understory species at Whiskeytown high elevation sites. Number indicates constancy (% of plots species occurred in) (* indicates non-native species).

Herbs		Herbs	
<i>Carex rossii</i>	95	<i>Arctostaphylos patula</i>	57
<i>Apocynum androsaemifolium</i>	90	<i>Chrysolepis sempervirens</i>	57
<i>Chimaphila menziesii</i>	90	<i>Ceanothus prostratus</i>	52
<i>Lotus crassifolius</i> var. <i>crassifolius</i>	90	<i>Symphoricarpos mollis</i>	52
<i>Achnatherum occidentale</i> ssp. <i>californicum</i>	86	<i>Holodiscus microphyllus</i> var. <i>microphyllus</i>	48
<i>Gayophytum heterozygum</i>	81	<i>Quercus vacciniifolia</i>	48
<i>Pyrola picta</i>	76	<i>Acer glabrum</i> var. <i>torreyi</i>	48
Shrubs	76	<i>Amelanchier alnifolia</i> var. <i>pumila</i>	
<i>Lithocarpus densiflorus</i> var. <i>echinoides</i>	76	<i>Ribes lobbii</i>	95
<i>Arctostaphylos nevadensis</i>	57		

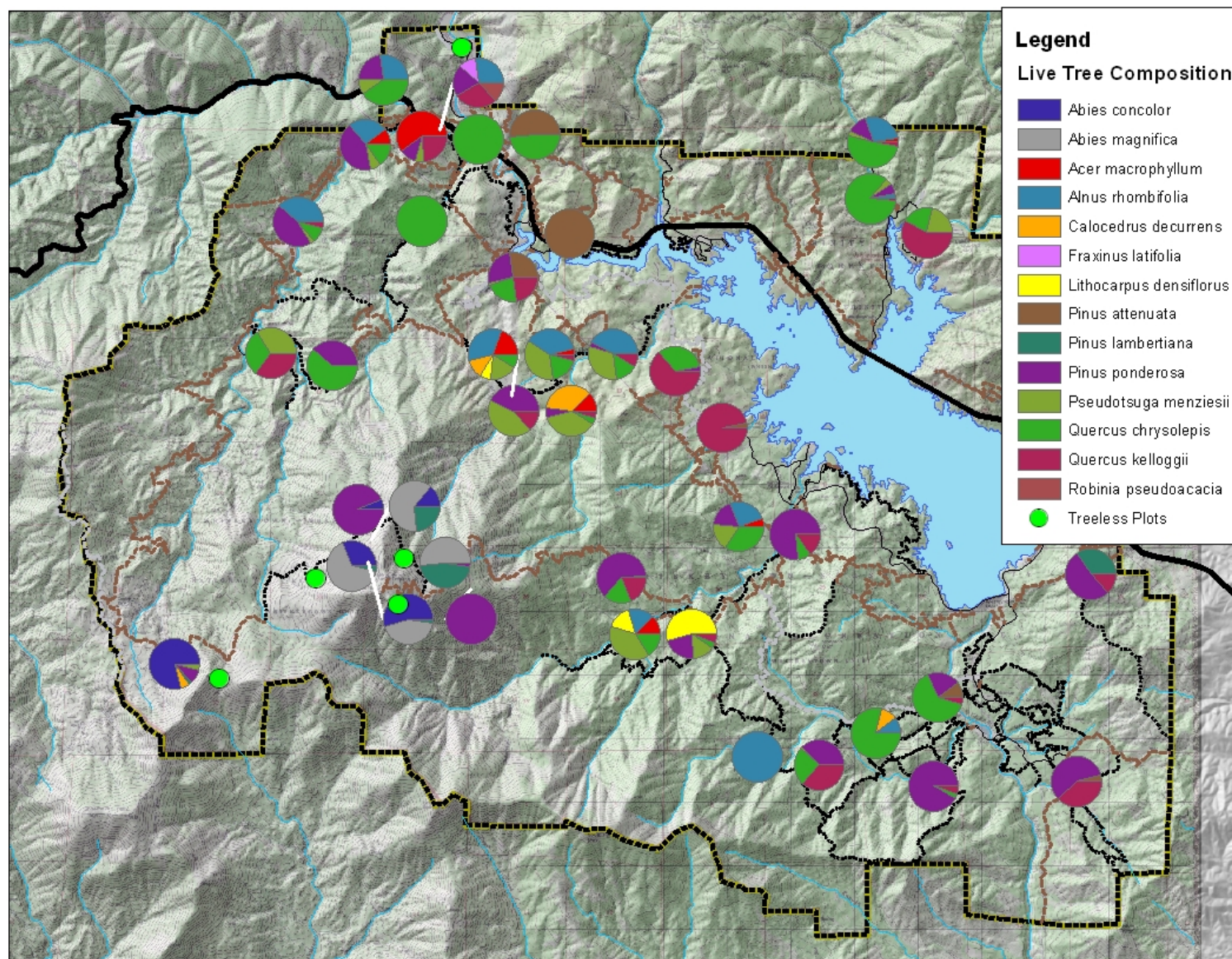


Figure 6. Individual tree (>15cm dbh) basal area composition of Whiskeytown sites. Four species were left off map legend as they are a very small percentage of the basal area and not visible in the pie charts: *Cornus nuttallii*, *Malus sylvestris*, *Quercus agrifolia*, and *Salix lasiolepis*.

Lassen

Species richness in the Lassen matrix sampling frame ranged from 4-29 species per 0.1 ha sampling plot (Figure 7, Table 1). Across all matrix plots sampled, 111 species (113 when counting unknowns) were observed. The riparian sampling frame proved to be very diverse; species richness at the plot level ranged from 47-93 species, with 302 species observed (311 when counting unknowns). Species richness in the high elevation frame ranged from 6-23, with 52 species observed. The most frequently occurring understory species for each sampling frame are shown in Tables 5, 6, and 7. Non-native species composition ranged from 0-6 % in matrix sites, 0-4 % in riparian sites, and 0 % for all sites in the high elevation frame (Figure 7). We observed one non-native species in the matrix sampling frame and four in the riparian. Only dandelion (*Taraxacum officinale*) was observed with notable frequency in the riparian sampling frame (Table 6). Ten tree species were observed; eight occurred in the matrix sampling frame, seven in the riparian frame, and four in the high elevation frame. Tree basal area composition by site is shown in Figure 8.

No new species were observed at Lassen.

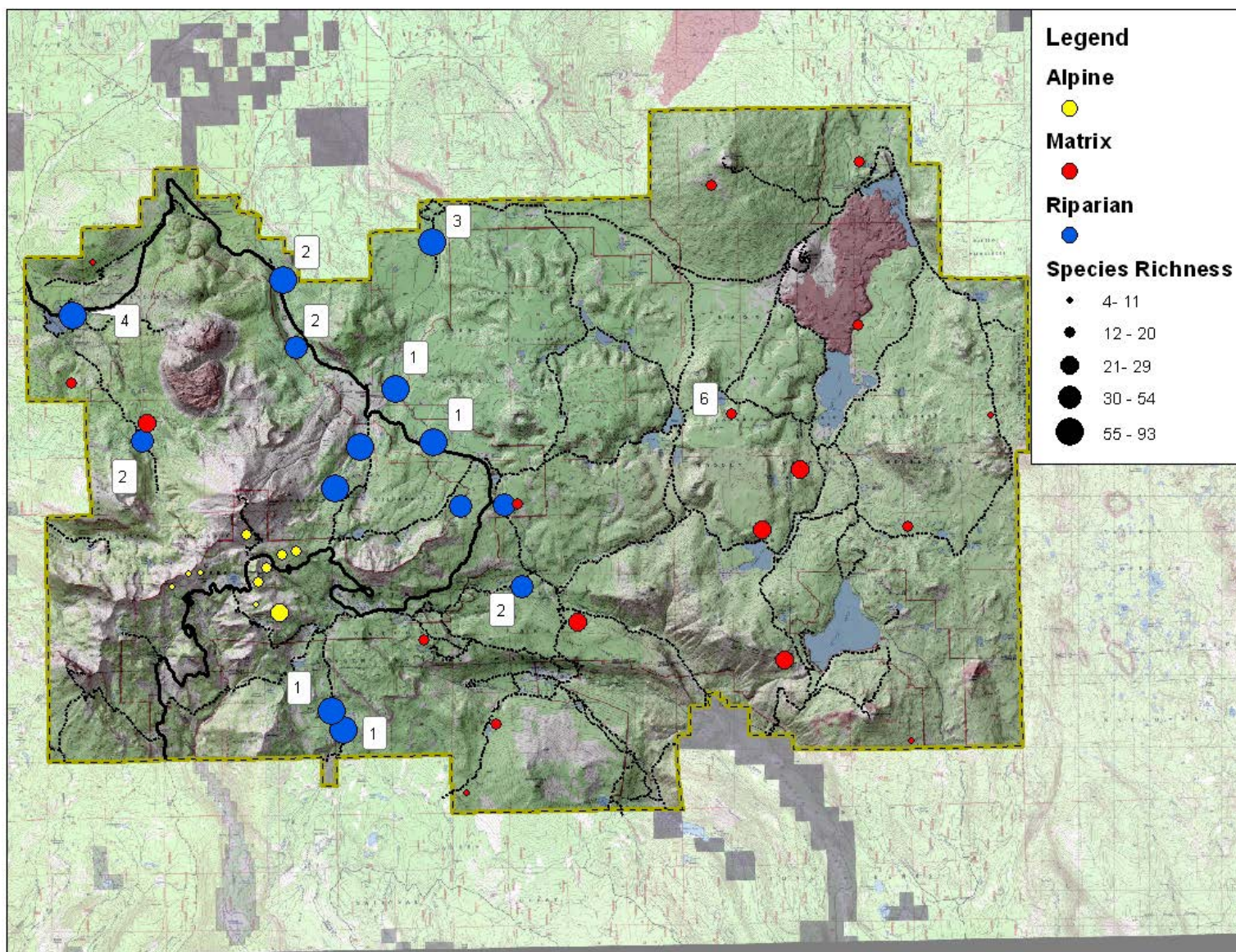


Figure 7. Lassen site species richness from each sampling frame. White labels show percentage of species that are non-native. Sites with no non-native species are not labeled.

Table 5. Most frequently occurring understory species at Lassen matrix sites. Number indicates constancy (% of plots species occurred in) (* indicates non-native species).

Herbs		Herbs	
<i>Carex rossii</i>	67	<i>Bromus suksdorfii</i>	22
<i>Elymus elymoides</i> ssp. <i>californicus</i>	56	<i>Elymus glaucus</i> ssp. <i>glaucus</i>	22
<i>Achnatherum occidentale</i> ssp. <i>californicum</i>	44	<i>Penstemon heterodoxus</i> var. <i>shastensis</i>	22
<i>Gayophytum diffusum</i> ssp. <i>parviflorum</i>	44	<i>Pedicularis semibarbata</i>	22
<i>Achnatherum occidentale</i> ssp. <i>occidentale</i>	39	Shrubs	
<i>Arabis platysperma</i> var. <i>platysperma</i>	39	<i>Arctostaphylos nevadensis</i>	56
<i>Carex brainerdii</i>	39	<i>Chrysolepis sempervirens</i>	44
<i>Monardella odoratissima</i> ssp. <i>pallida</i>	39	<i>Arctostaphylos patula</i>	22
<i>Pyrola picta</i>	39	<i>Ceanothus velutinus</i> var. <i>velutinus</i>	22
<i>Achnatherum lemmonii</i>	28		

Table 6. Most frequently occurring understory species at Lassen riparian sites. Number indicates constancy (% of plots species occurred in) (* indicates non-native species).

Herbs		Herbs	
<i>Carex nervina</i>	93	<i>Veronica wormskjoldii</i>	71
<i>Senecio triangularis</i>	93	<i>Carex rossii</i>	64
<i>Achillea millefolium</i>	71	<i>Equisetum arvense</i>	64
<i>Calamagrostis canadensis</i>	71	<i>Hieracium albiflorum</i>	64
<i>Elymus glaucus</i> ssp. <i>glaucus</i>	71	<i>Monardella odoratissima</i> ssp. <i>pallida</i>	64
<i>Galium triflorum</i>	71	<i>Osmorhiza chilensis</i>	64
<i>Ligusticum grayi</i>	71	<i>Viola glabella</i>	64
<i>Luzula comosa</i>	71	Shrubs	
<i>Lupinus polyphyllus</i> var. <i>burkei</i>	71	<i>Ribes montigenum</i>	64
<i>Mimulus guttatus</i>	71	<i>Alnus incana</i> ssp. <i>tenuifolia</i>	57
<i>Taraxacum officinale</i> *	71		

Table 7. Most frequently occurring understory species at Lassen high elevation sites. Number indicates constancy (% of plots species occurred in) (* indicates non-native species).

Herbs		Herbs	
<i>Eriogonum marifolium</i>	90	<i>Penstemon davidsonii</i> var. <i>davidsonii</i>	30
<i>Lupinus obtusilobus</i>	90	<i>Polygonum shastense</i>	30
<i>Polygonum davisiae</i>	80	<i>Streptanthus tortuosus</i> var. <i>orbiculatus</i>	30
<i>Calyptridium umbellatum</i>	70	<i>Arabis platysperma</i> var. <i>howellii</i>	20
<i>Carex breweri</i> var. <i>breweri</i>	50	<i>Arabis platysperma</i> var. <i>platysperma</i>	20
<i>Carex rossii</i>	50	<i>Carex preslii</i>	20
<i>Elymus elymoides</i> ssp. <i>californicus</i>	50	<i>Luzula divaricata</i>	20
<i>Juncus parryi</i>	50	<i>Trisetum spicatum</i>	20
<i>Eriogonum pyrolifolium</i>	40	Shrubs	
<i>Achnatherum occidentale</i> ssp. <i>occidentale</i>	30	<i>Phyllodoce breweri</i>	30
<i>Carex stramineiformis</i>	30	<i>Holodiscus microphyllus</i> var. <i>glabrescens</i>	20
<i>Monardella odoratissima</i> ssp. <i>pallida</i>	30		

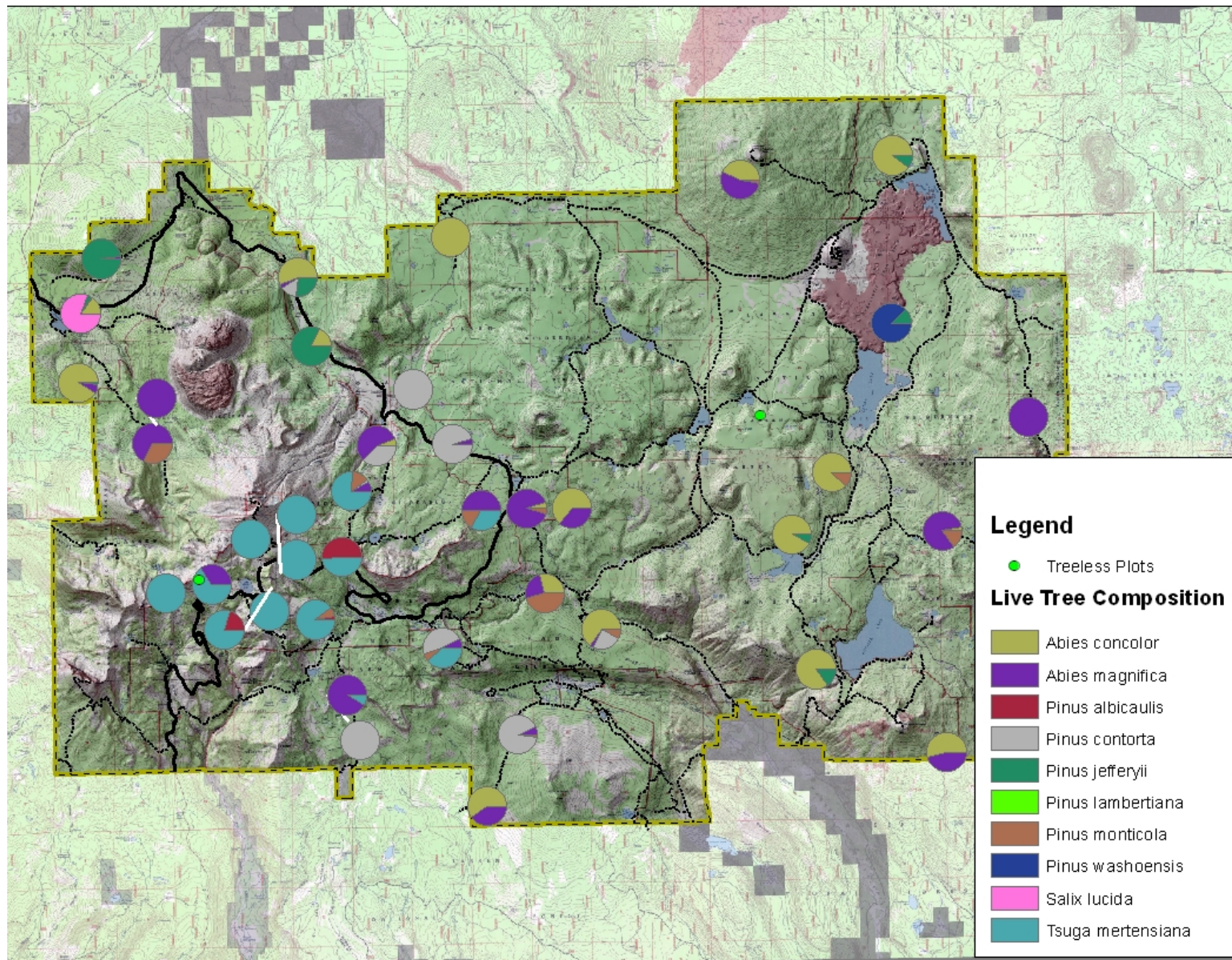


Figure 8. Individual tree (>15cm dbh) species basal area composition of Lassen sites.

Vegetation Structure

Whiskeytown National Recreation Area

Both the matrix and riparian sampling frames had the same pattern of vegetation cover with the stratum 3 having the lowest percent cover followed by, in increasing order, strata 1, 2, and 4. Relative mean cover in each riparian frame stratum was higher than the corresponding matrix stratum (Table 8). The majority of the vegetation cover in the high elevation sampling frame occurred in strata 1 and 2 (Table 8.).

Table 8. Summary of vegetation cover (%) by stratum for Whiskeytown by sampling frame.

Frame	Stratum 1				Stratum 2			
	Min	Max	Mean	S.D.	Min	Max	Mean	S.D.
High Elevation	0.7	78.0	27.1	24.0	8.3	68.8	27.3	23.4
Matrix	0.8	55.1	12.2	11.5	0.0	86.1	16.6	20.6
Riparian	6.2	72.5	28.0	18.0	9.2	125.5	34.5	27.9

Frame	Stratum 3				Stratum 4			
	Min	Max	Mean	S.D.	Min	Max	Mean	S.D.
High Elevation	0.0	11.8	2.5	3.9	0.0	38.3	17.1	16.5
Matrix	0.0	53.5	11.3	14.6	0.0	104.1	53.3	30.3
Riparian	7.5	50.0	27.6	13.9	0.0	124.5	71.4	33.5

Mean plot basal area for the matrix sampling frame was 23.4 m²/ha for live trees and 0.3m²/ha for snags. Only one of 21 matrix plots lacked trees >15cm dbh. Mean plot basal area for the riparian sampling frame was 36.7 m²/ha for live trees and 0.2 m²/ha for snags. All riparian plots had trees >15cm dbh. Of all three sampling frames, the high elevation sites had the lowest basal area for live trees (18.7 m²/ha) and snags (0.18 m²/ha). Table 9 shows tree basal area summary for all sampling frames. Tree density followed the same pattern as basal area with riparian sites being the most dense (325 trees/ha), followed by matrix sites (293 trees/ha), and, lastly, high elevation sites (165 trees/ha). Mean snag density was highest in the matrix sampling frame (34 trees/ha) (Table 9). Tree height and height to crown are shown in Table 10; snag heights are presented in Table 11.

Table 9. Live tree and snag basal area (BA) minimum, maximum, mean, and standard deviation for sampling frames at Whiskeytown. Units are m²/ha.

Frame	Min BA	Max BA	Mean BA	S.D.
High Elevation	0.00	67.54	18.70	22.64
Matrix	0.00	71.70	23.37	17.55
Riparian	3.68	87.19	36.66	22.48

Frame	Min Snag BA	Max Snag BA	Mean Snag BA	S.D.
High Elevation	0.00	0.95	0.18	0.31
Matrix	0.00	1.35	0.33	0.42
Riparian	0.02	0.70	0.21	0.25

Table 10. Whiskeytown mean live tree density (stems/ha), height (m), height to crown (m), and maximum tree height (m). Standard deviations shown in parentheses.

Frame	Mean Tree Density	Mean Tree Height	Mean Height to Crown	Max Tree Height
High Elevation	165 (196)	14 (6)	5 (3)	33
Matrix	293 (174)	16 (8)	7 (5)	51
Riparian	325 (125)	18 (9)	7 (5)	52

Table 11. Whiskeytown mean snag density (stems/ha) and height (m). Standard deviations shown in parentheses.

Frame	Mean Snag Density	Avg Snag Height
High Elevation	17 (18)	11 (6)
Matrix	34 (51)	12 (7)
Riparian	16 (20)	9 (6)

Woody debris lag class values for the high elevation and riparian sampling frames both had the pattern of lowest bulk density for the 1hr class, increasing bulk density for the 10hr, 100hr, and 1000hr rotten classes, and a maximum bulk density in the 1000hr sound class (Table 12). The matrix sampling frame did not display such a pattern; the largest bulk density value was in the 1000hr sound class and second largest was in the 100hr class.

Table 12. Whiskeytown summary of woody debris time lag classes (tons per acre, standard deviations in parentheses).

Frame	1hr	10hr	100hr	1000hr Rotten	1000hr Sound
High Elevation	0.15 (0.13)	1.05 (0.66)	1.13 (1.05)	3.03 (9.58)	4.30 (7.85)
Matrix	0.28 (0.25)	1.55 (1.16)	3.21 (2.61)	1.35 (2.89)	6.25 (15.31)
Riparian	0.29 (0.30)	1.22 (0.66)	1.45 (1.22)	2.66 (6.18)	6.88 (7.03)

Mean shrub heights were approximately 1m for all sampling frames, with high elevation at 0.8 m, matrix at 1.0 m, and riparian at 1.3 m.

Fine wood/litter dominated the ground cover for all three sampling frames. A ground cover summary is shown in Table 13.

Table 13. Whiskeytown ground cover/substrate mean percent cover. Standard deviations shown in parentheses.

Frame	Bare Soil	Bryophytes	Coarse Wood	Fine Wood / Litter	Rock	Water
High Elevation	5.7 (7.3)	0.3 (0.4)	3.7 (3.8)	78.9 (11.9)	11.2 (8.9)	0.0 (0)
Matrix	3.9 (6.9)	2.4 (3.3)	3.9 (5.7)	84.4 (13.5)	2.5 (3.1)	0.0 (0)
Riparian	2.9 (1.7)	10.0 (7.6)	3.3 (1.9)	59.6 (14.3)	16.4 (8.6)	1.3 (1.1)

Litter depths were very similar for the high elevation and matrix sampling frames, at 2.3 and 2.8 cm, respectively. Mean litter depth in the riparian frame was 4.0 cm. Mean duff depths were comparable between sampling frames, with the lowest in the high elevation at 0.6 cm and 1.2 cm for both the riparian and matrix sampling frames. Table 14 shows the litter and duff depth summary.

Table 14. Whiskeytown litter and duff minimum, maximum, and mean depth. Units are cm, standard deviations shown in parentheses.

Frame	Litter Depth Mean	Litter Depth Min	Litter Depth Max	Duff Depth Mean	Duff Depth Min	Duff Depth Max
High Elevation	2.3 (1.3)	0.1	4.6	0.6 (0.8)	0.0	2.5
Matrix	2.8 (1.4)	0.3	6.6	1.2 (1.1)	0.0	3.2
Riparian	4.0 (2.0)	1.3	10.0	1.2 (1.2)	0.0	3.8

Lassen

Highest values for vegetation cover were largely found in strata 1 and 4. Mean vegetation percent cover in both the high elevation and riparian sampling frames was highest in stratum 1 (Table 15). The matrix sampling frame mean vegetation percent cover was highest in stratum 4 (32.1%), and second highest in stratum 1 (15.7%). Maximum vegetation percent cover values for all sampling frames were highest in stratum 1.

Table 15. Summary of vegetation cover (%) by stratum for Lassen by sampling frame.

Frame	Stratum 1				Stratum 2			
	Min	Max	Mean	S.D.	Min	Max	Mean	S.D.
High Elevation	3.2	73.9	21.4	21.9	0.0	7.8	1.9	2.2
Matrix	0.4	79.0	15.7	21.1	0.0	8.6	2.8	2.6
Riparian	6.6	110.7	36.6	28.9	3.4	33.8	10.7	8.8

Frame	Stratum 3				Stratum 4			
	Min	Max	Mean	S.D.	Min	Max	Mean	S.D.
High Elevation	0.0	14.0	4.7	4.0	0.0	23.3	5.9	8.5
Matrix	0.0	10.5	4.1	3.3	0.0	69.0	32.1	20.0
Riparian	2.5	67.0	13.1	17.6	3.3	48.3	21.6	11.5

Mean live tree basal area at Lassen was highest in the matrix (43.54 m²/ha), second highest in the riparian (30.97 m²/ha), and lowest in the high elevation (20.68 m²/ha) sampling frames. Snag basal area was much lower than live tree basal area (Table 16). One matrix and one high elevation plot lacked trees. Matrix site mean tree density (342 trees/ha) was higher than for both high elevation (253 trees/ha) and riparian (244 trees/ha) sites. Matrix site mean snag density (103 trees/ha) was highest, followed by riparian (62 trees/ha), and lastly high elevation (13 trees/ha) sites. Tree height and height to crown data are also shown in Table 17; snag heights are presented in Table 18.

Table 16. Live tree and snag basal area (BA) minimum, maximum, mean, and standard deviation for sampling frames at Lassen. Units are m²/ha.

Frame	Min BA	Max BA	Mean BA	S.D.
High Elevation	0.00	64.53	20.68	26.33
Matrix	0.00	105.58	43.54	27.51
Riparian	1.26	66.85	30.97	22.08
Frame	Min Snag BA	Max Snag BA	Mean Snag BA	S.D.
High Elevation	0.13	0.62	0.34	0.26
Matrix	0.02	3.42	1.32	1.16
Riparian	0.07	2.82	0.89	0.92

Table 17. Lassen mean live tree density (stems/ha), height (m), height to crown (m), and maximum tree height (m). Standard deviations shown in parentheses.

Frame	Mean Tree Density	Mean Tree Height	Mean Height to Crown	Max Tree Height
High Elevation	253 (247)	8 (3)	2 (2)	19
Matrix	342 (286)	18 (8)	7 (4)	48
Riparian	244 (170)	17 (9)	6 (9)	50

Table 18. Lassen mean snag density (stems/ha) and height (m). Standard deviations shown in parentheses.

Frame	Mean Snag Density	Avg Snag Height
High Elevation	13 (23)	4 (2)
Matrix	103 (127)	14 (8)
Riparian	62 (90)	13 (8)

Dead and down woody debris data are shown in Table 19. In the high elevation sampling frame, the 1000hr rotten wood lag class was surprisingly low (0.08 tons/acre), and lower than the 1hr class (0.10 tons/acre). The matrix and riparian sites down woody debris values were similar, with the exception that the 1000hr rotten woody debris value for matrix sites (7.35 tons/acre) was about half that of the value for riparian sites (16.08 tons/acre).

Table 19. Lassen summary of woody debris time lag classes (tons per acre, standard deviations in parentheses).

Frame	1hr	10hr	100hr	1000hr Rotten	1000hr Sound
High Elevation	0.10 (0.09)	0.33 (0.41)	0.35 (0.58)	0.08 (0.27)	1.30 (2.90)
Matrix	0.59 (0.42)	2.15 (1.18)	2.68 (2.07)	7.35 (11.76)	14.76 (13.00)
Riparian	0.30 (0.22)	1.33 (0.86)	2.40 (2.00)	16.08 (29.75)	14.01 (14.47)

Mean shrub heights were low in all sampling frames, with high elevation sites at 0.02 m, matrix sites at 0.14 m, and riparian sites at 0.52 m. The riparian sampling frame had a maximum shrub height of 2.15 m while the other two sampling frames were both less than 0.5 m.

Litter was the dominant ground cover in all three sampling frames. In the high elevation sampling frame, while fine wood/litter was highest (39.6%), rock (37.4%) and bare soil (21.9%) were also substantial components. The ground cover summary is presented in Table 20.

Table 20. Lassen ground cover/substrate mean percent cover. Standard deviations shown in parentheses. ** Bryophytes were found in one high elevation plot, cover percentage too low to report in this format.

Frame	Bare Soil	Bryophytes	Coarse Wood	Fine Wood / Litter	Rock	Water
High Elevation	21.9 (29.5)	**	1.2 (1.7)	39.6 (28.3)	37.4 (24.0)	0 (0)
Matrix	4.8 (7.0)	0.3 (0.5)	9.5 (6.5)	76.3 (14.7)	7.2 (10.4)	0 (0)
Riparian	6.3 (9.8)	2.0 (2.4)	6.7 (7.7)	76.0 (10.6)	6.6 (5.1)	1.6 (1.6)

Mean litter and duff depths were greatest for the matrix sampling frame. Table 21 shows the litter and duff depth summary.

Table 21. Lassen litter and duff minimum, maximum, and mean depth. Units are cm, standard deviations shown in parentheses.

Frame	Litter Depth Mean	Litter Depth Min	Litter Depth Max	Duff Depth Mean	Duff Depth Min	Duff Depth Max
High Elevation	0.9 (1.0)	0	2.78	0.3 (0.5)	0	1.41
Matrix	3.5 (1.8)	0.89	8.29	2.7 (2.7)	0	9.04
Riparian	2.5 (1.2)	1.15	4.65	1.4 (1.0)	0	2.85

Vegetation Function (Regeneration)

Whiskeytown

The most abundant regenerating tree species in the matrix sampling frame >15cm tall height class was *Quercus kelloggii*. *Quercus chrysolepis* was the most abundant species in all other size classes. The two smallest size classes in the riparian sampling frame were also dominated by *Quercus chrysolepis*. In the third size class, *Quercus chrysolepis* and *Alnus rhombifolia* were tied, and *Alnus rhombifolia* was the dominant species in the largest two size classes. The most abundant regenerating tree species in the high elevation sampling frame was *Abies magnifica* in all classes except in the >15cm tall and <2.54 cm dbh class, where *Abies concolor* was the most abundant. Mean regeneration counts for all tree species combined are shown in Table 22.

Table 22. Whiskeytown regeneration by size class for all live tree species by sampling frame. Units are trees/ha, standard deviations shown in parentheses.

Frame	<15cm Tall	>15cm Tall- <2.54cm dbh	>15cm Tall >2.54 - <5cm dbh	>15cm Tall >5 - <10cm dbh	>15cm Tall >10 - <15cm dbh
High Elevation	500 (577)	150 (269)	78 (172)	115 (187)	58 (103)
Matrix	4476 (6674)	2988 (5332)	94 (116)	168 (165)	102 (111)
Riparian	2983 (3887)	6150 (6545)	162 (175)	160 (161)	85 (99)

Lassen Volcanic

In the matrix sampling frame, *Abies magnifica* was the most abundant regenerating tree species in the smallest size class, and *Abies concolor* was the most abundant in all other size classes. In the riparian sampling frame, *Abies magnifica* was the most abundant regenerating tree species in the smallest three classes; *Pinus contorta* was the most abundant regenerating tree species in the largest two size classes. In the high elevation sampling frame, *Tsuga mertensiana* dominated all size classes. Mean regeneration counts for all tree species combined are shown in Table 23.

Table 23. Lassen regeneration by size class for all live tree species by sampling frame. Units are trees/ha, standard deviations shown in parentheses.

Frame	<15cm Tall	>15cm Tall- <2.54cm dbh	>15cm Tall >2.54 - <5cm dbh	>15cm Tall >5 - <10cm dbh	>15cm Tall >10 - <15cm dbh
High Elevation	75 (169)	1075 (1803)	118 (185)	220 (269)	83 (92)
Matrix	4931 (8084)	1458 (1551)	110 (151)	149 (165)	85 (89)
Riparian	3946 (2904)	3054 (5019)	220 (229)	189 (206)	80 (59)

Discussion

Early on in the 2012 field season we realized our initial goals of monumenting and reading sites was unfeasible. After completing the 21 matrix sites at Whiskeytown, we agreed upon a revised target number of 20 riparian and 10 high elevation sites, and at Lassen, we targeted 20 matrix, 20 riparian, and 10 high elevation sites. Despite these revised number of target sites, we unfortunately still fell short.

At Whiskeytown, we surveyed 100% of matrix, 75% of riparian, and 100% of high elevation target sites. We encountered only minor logistical challenges while sampling at Whiskeytown. Off trail travel was more straightforward than expected because sites were all <150 m from a road or trail. Very few sites were rejected due to accessibility or safety issues (matrix=0, riparian=3, high elevation=1). We attribute the failure to reach all the target sites to an injury sustained by our most botanically experienced seasonal crew member during time off. This injury resulted in us only having one crew for one hitch because only the crew lead was experienced enough to identify all species at the plot with confidence. We feel confident that, barring the injury, we would have reached our revised (20 matrix, 20 riparian, and 10 high elevation sites) goals. We realize the need to have more built in resiliency among crew members, in particular, having members with strong botanical skills with the ability to identify most vascular plants we encounter to species-level, and at minimum, genus-level. We should strive to have two seasonal crew members (in addition to the Crew Lead) with these skills.

Our completions percentages at Lassen were less than that of Whiskeytown: we surveyed 90% of matrix, 70% of riparian, and 100% of high elevation target sites. Reasons for not meeting our goals at Lassen were beyond our control. The Reading Fire started on July 23rd (near Reading Peak within Lassen) and burned 16,993 acres in the north central portion of the park. Anything inside the perimeter of the Reading Fire was inaccessible, even after the fire was controlled, which included six matrix sites and seven riparian sites. Fires both in the park (Reading Fire) and outside the park boundary slowed our work and prevented us from getting to several sites altogether. Without the issues caused by the fires, we feel confident we would have completed our 20 matrix, 20 riparian, and 10 high elevation targeted sites.

Timing of sampling at Whiskeytown was good for most sites. Field notes indicate four sites that should be visited earlier (for phenological reasons) than they were in 2012: matrix WT10 and riparian WT121, 101, and 125. Riparian site 125 was missing vegetation data for two subplots. We are not sure how this loss of data occurred. In 2013, we plan on revisiting the site and recollecting data from all four subplots, not just from the two with missing data. Timing at Lassen seemed appropriate at all sites. Riparian site 122 was missing a site diagram. When we revisit the site in 2015, we will draw another diagram as we set up the site. Photographs taken at the site show a mostly open meadow habitat, and relocating permanent rebar should be relatively easy.

Species overlap between the two parks was 71 species. This is a much greater overlap in species composition than observed during the 2011 field season, when Redwood National and State Parks (Redwoods) and Lava Beds National Monument (Lava Beds) had only four species of overlap (Smith

and Sarr 2013). Only two species are consistent among all four parks: *Achillea millefolium* and *Galium aparine*.

We were pleasantly surprised with how many new species we vouchered for Whiskeytown. Our addition of seven new species to the park list and seven new specimens of species previously on the list but not yet vouchered greatly exceed the results from Lassen, and from Redwoods and Lavabeds during the 2011 field season. Only one new species was observed during the 2011 field season at Redwoods, and none were observed at Lassen. The difference in the number of new species at Whiskeytown verses the other three parks in which we installed long-term vegetation monitoring plots is likely two fold. First, the other parks have had much more botanical work done at them, both Lassen and Lava Beds have had Floras prepared, and Redwoods, while lacking a Flora, is near Humboldt State University and has three botanists on staff (Whiskeytown has none). Second, the diverse topography at Whiskeytown discourages cross country navigation and exploration. Whiskeytown Falls, a 400 foot waterfall, was rumored to exist in the park but was not formally documented until 2003 (National Geographic 2005). Given the relative recentness of such a large discovery, it is entirely plausible further intensive botanical exploration of Whiskeytown would produce more new species.

Changes to protocol or potential future logistical issues

Through this year's sampling, we realized a number of possible improvements to the protocol. These were evaluated with Klamath Network staff, and the following changes were made:

- Craggs Campground is scheduled to be turned into a youth camp by next season and will no longer be available to our crews for free camping. The alternative is to camp at another campground and pay a fee. Reservations for the other campgrounds are made through ReserveAmerica.com.
- At the start of the Whiskeytown sampling effort, we camped at either Brandy Creek or Peltier Bridge Campground, depending on proximity to our field sites. However, a theft of our personal items from Brandy Creek while we were out working forced us to find other accommodations. Park personnel were able to negotiate for us to stay at WHIS Quarters 200, the WHIS Fire Use Module office. This worked well as the WHIS Fire Use Module was on assignment. For future visits to Whiskeytown, it is recommended the crews do not camp in Whiskeytown campgrounds but instead in a more secure location, like WHIS Quarters 200.
- We will not count suckers coming from tree bases that are visibly attached to the tree. Only if a seedling is visibly not connected to the mother tree will it be counted as a seedling.
- We modified the site naming convention. Matrix sites are two digit (e.g., 25), riparian sites are three digit, with first digit being 1 (e.g., 125), and high elevation are three digit, with first digit being 2 (e.g., 225).
- In an effort to reduce the amount of rebar at sites co-located with the Whitebark Pine Monitoring protocol, we modified the placement of rebar (Figure 9).

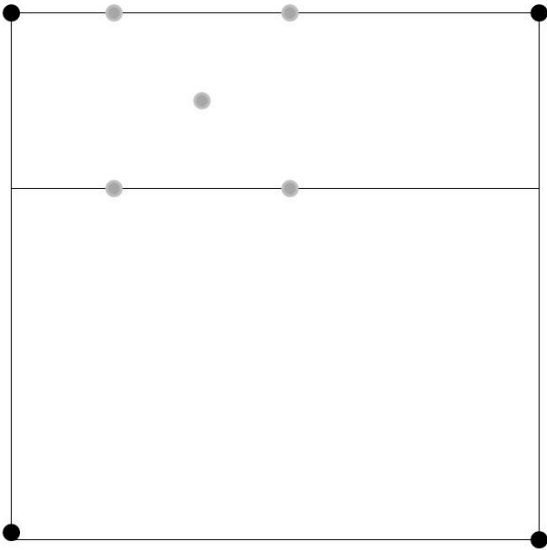


Figure 9. Fifty x 50 m Whitebark Pine Monitoring site with 20 x 50m Vegetation Monitoring plot nested in upper 1/3rd. Back dots are Whitebark Pine Monitoring rebar locations and grey dots are Vegetation Monitoring rebar locations.

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Appendix A. Environmental Variables at Sites.

Table A.1. Site data and environmental parameters collected at Whiskeytown high elevation plots in 2012.

Park	Site	Frame	Monument Date	Easting	Northing	Macro Position	Slope Shape	Elevation	Avg Slope	Avg Aspect
WHIS	WT202	High Elevation	7/21/12	529090	4495510	MACPOS 2	Straight	1610	16	319
WHIS	WT203	High Elevation	8/29/12	528435	4494734	MACPOS 2	Concave	1534	23	279
WHIS	WT205	High Elevation	7/22/12	529842	4495027	MACPOS 2	Straight	1651	8	26
WHIS	WT209	High Elevation	8/29/12	529326	4495341	MACPOS 2	Concave	1717	21	339
WHIS	WT210	High Elevation	7/19/12	529735	4494293	MACPOS 3	Straight	1813	14	144
WHIS	WT212	High Elevation	8/28/12	526909	4493138	MACPOS 2	Concave	1548	21	0
WHIS	WT213	High Elevation	7/20/12	529238	4495001	MACPOS 3	Straight	1747	19	238
WHIS	WT214	High Elevation	8/27/12	530858	4494536	MACPOS 2	Undulating	1547	14	135
WHIS	WT218	High Elevation	7/21/12	530442	4494965	MACPOS 3	Straight	1617	18	33
WHIS	WT219	High Elevation	7/20/12	529013	4494924	MACPOS 3	Straight	1703	17	341

Table A.2. Site data and environmental parameters collected at Whiskeytown matrix plots in 2012.

Park	Site	Frame	Monument Date	Easting	Northing	Macro Position	Slope Shape	Elevation	Avg Slope	Avg Aspect
WHIS	WT10	Matrix	6/6/12	532303	4500125	MACPOS 4	Straight	438	16	129
WHIS	WT11	Matrix	6/7/12	530732	4503044	MACPOS 3	Straight	426	21	77
WHIS	WT13	Matrix	6/4/12	538040	4500158	MACPOS 4	Straight	418	4	357
WHIS	WT14	Matrix	6/23/12	528680	4498046	MACPOS 1	Undulating	879	17	156
WHIS	WT15	Matrix	6/21/12	529662	4501665	MACPOS 4	Convex	426	23	4
WHIS	WT16	Matrix	6/7/12	535974	4495400	MACPOS 4	Undulating	396	8	75
WHIS	WT17	Matrix	6/10/12	533252	4494707	MACPOS 3	Straight	737	22	248
WHIS	WT19	Matrix	6/19/12	536341	4491810	MACPOS 3	Undulating	575	17	71
WHIS	WT21	Matrix	6/6/12	540595	4494786	MACPOS 3	Straight	550	21	36
WHIS	WT22	Matrix	6/8/12	538131	4491435	MACPOS 4	Convex	406	8	77
WHIS	WT23	Matrix	6/10/12	531553	4497374	MACPOS 4	Straight	699	10	3
WHIS	WT25	Matrix	6/5/12	534834	4497227	MACPOS 3	Concave	401	12	349
WHIS	WT27	Matrix	6/22/12	530190	4500359	MACPOS 3	Straight	451	18	142
WHIS	WT29	Matrix	7/3/12	526207	4493383	MACPOS 3	Undulating	1313	11	316
WHIS	WT4	Matrix	6/9/12	531557	4499462	MACPOS 3	Undulating	379	10	151
WHIS	WT5	Matrix	6/20/12	527723	4498237	MACPOS 2	Undulating	762	22	297
WHIS	WT55	Matrix	6/11/12	531460	4501676	MACPOS 3	Straight	415	20	116
WHIS	WT6	Matrix	5/5/12	534321	4493847	MACPOS 2	Convex	639	19	272
WHIS	WT7	Matrix	5/30/12	540405	4491507	MACPOS 3	Convex	311	5	341
WHIS	WT8	Matrix	6/9/12	534088	4498002	MACPOS 1	Convex	549	11	359
WHIS	WT9	Matrix	6/8/12	538195	4492838	MACPOS 2	Undulating	288	16	73

Table A.3. Site data and environmental parameters collected at Whiskeytown riparian plots in 2012. *Average aspect is problematic to report as sites are often either flat or the 10 x 50 m belts are on opposite sides of a stream, i.e. opposite aspects.

Park	Site	Frame	Monument Date	Easting	Northing	Macro Position	Slope Shape	Elevation	Avg Slope	Avg Aspect*
WHIS	WT101	Riparian	7/3/12	529469	4502317	MACPOS 5	Undulating	383	15	----
WHIS	WT108	Riparian	7/6/12	536879	4492343	MACPOS 5	Undulating	479	18	----
WHIS	WT112	Riparian	7/5/12	533516	4493937	MACPOS 5	Undulating	644	31	----
WHIS	WT115	Riparian	7/7/12	528131	4500280	MACPOS 5	Undulating	483	9	----
WHIS	WT117	Riparian	7/8/12	531516	4497554	MACPOS 5	Undulating	690	7	----
WHIS	WT118	Riparian	7/16/12	535774	4495496	MACPOS 5	Undulating	412	12	----
WHIS	WT121	Riparian	7/2/12	530385	4501784	MACPOS 5	Straight	389	0	----
WHIS	WT122	Riparian	6/6/12	532457	4497517	MACPOS 5	Straight	574	14	----
WHIS	WT125	Riparian	6/25/12	530980	4501652	MACPOS 5	Concave	351	0	----
WHIS	WT126	Riparian	7/4/12	537205	4500730	MACPOS 5	Undulating	374	16	----
WHIS	WT128	Riparian	6/24/12	535292	4491943	MACPOS 5	Undulating	714	16	----
WHIS	WT130	Riparian	7/4/12	533056	4498244	MACPOS 5	Concave	486	14	----
WHIS	WT133	Riparian	7/7/12	532063	4497993	MACPOS 5	Undulating	577	5	----
WHIS	WT155	Riparian	7/17/12	537177	4501607	MACPOS 5	Undulating	289	14	----
WHIS	WT158	Riparian	7/18/12	529168	4501553	MACPOS 5	Straight	433	17	----

Table A.4. Site data and environmental parameters collected at Lassen high elevation sites plots in 2012.

Park	Site	Frame	Monument Date	Easting	Northing	Macro Position	Slope Shape	Elevation	Avg Slope	Avg Aspect
LAVO	LV203	High Elevation	08/17/12	627562	4479954	MACPOS 2	Undulating	2598	8	127
LAVO	LV205	High Elevation	09/04/12	625028	4481023	MACPOS 1	Straight	2629	19	176
LAVO	LV206	High Elevation	08/02/12	626956	4480825	MACPOS 1	Straight	2650	16	234
LAVO	LV207	High Elevation	07/30/12	627233	4481220	MACPOS 2	Straight	2560	14	79
LAVO	LV208	High Elevation	08/03/12	628020	4481655	MACPOS 2	Undulating	2581	5	313
LAVO	LV209	High Elevation	08/05/12	624539	4480669	MACPOS 2	Straight	2501	8	123
LAVO	LV210	High Elevation	08/14/12	625321	4481035	MACPOS 3	Straight	2627	26	158
LAVO	LV211	High Elevation	08/16/12	626604	4482116	MACPOS 3	Straight	2790	23	199
LAVO	LV212	High Elevation	08/14/12	627626	4481584	MACPOS 2	Undulating	2601	8	153
LAVO	LV214	High Elevation	08/17/12	626898	4480167	MACPOS 2	Concave	2584	10	170

Table A.5. Site data and environmental parameters collected at Lassen matrix plots in 2012.

Park	Site	Frame	Monument Date	Easting	Northing	Macro Position	Slope Shape	Elevation	Avg Slope	Avg Aspect
LAVO	LV01	Matrix	08/18/12	633620	4476817	MACPOS 2	Undulating	1949	2	5
LAVO	LV02	Matrix	07/21/12	623861	4485232	MACPOS 3	Undulating	1998	8	344
LAVO	LV04	Matrix	08/31/12	642050	4482231	MACPOS 3	Straight	2048	25	158
LAVO	LV05	Matrix	07/31/12	634204	4482949	MACPOS 1	Undulating	2076	0	-----
LAVO	LV06	Matrix	07/20/12	622356	4489744	MACPOS 2	Undulating	1946	10	137
LAVO	LV07	Matrix	09/11/12	639638	4491852	MACPOS 2	Straight	2382	15	154
LAVO	LV08	Matrix	08/31/12	641680	4478607	MACPOS 3	Straight	2067	24	225
LAVO	LV11	Matrix	09/12/12	643759	4487983	MACPOS 3	Straight	1868	8	22
LAVO	LV14	Matrix	09/05/12	643771	4492544	MACPOS 3	Straight	1882	0	-----
LAVO	LV15	Matrix	09/16/12	647425	4485453	MACPOS 2	Undulating	2252	15	253
LAVO	LV16	Matrix	09/15/12	645123	4482372	MACPOS 2	Straight	2105	6	289
LAVO	LV17	Matrix	08/19/12	632801	4474870	MACPOS 2	Straight	1978	23	125
LAVO	LV18	Matrix	07/20/12	621733	4486383	MACPOS 3	Straight	1863	10	291
LAVO	LV20	Matrix	09/14/12	642150	4483952	MACPOS 3	Convex	1974	19	209
LAVO	LV23	Matrix	09/13/12	640214	4485507	MACPOS 2	Convex	2080	11	306
LAVO	LV24	Matrix	09/01/12	635905	4479676	MACPOS 3	Straight	1861	12	15
LAVO	LV25	Matrix	08/16/12	631582	4479194	MACPOS 2	Undulating	2192	12	277
LAVO	LV28	Matrix	08/30/12	645237	4476334	MACPOS 3	Straight	2110	17	146

Table A.6. Site data and environmental parameters collected at Lassen riparian plots in 2012. *Average aspect is problematic to report as sites are often either flat or the 10 x 50 m belts are on opposite sides of a stream, i.e. opposite aspects.

Park	Site	Frame	Monument Date	Easting	Northing	Macro Position	Slope Shape	Elevation	Avg Slope	Avg Aspect*
LAVO	LV101	Riparian	08/02/12	632638	4482945	MACPOS 5	Concave	2123	8	-----
LAVO	LV104	Riparian	09/05/12	628059	4487318	MACPOS 5	Straight	1891	0	-----
LAVO	LV105	Riparian	08/01/12	631886	4484672	MACPOS 5	Concave	2003	11	-----
LAVO	LV108	Riparian	08/03/12	631818	4490257	MACPOS 5	Concave	1867	3	-----
LAVO	LV109	Riparian	08/04/12	629773	4484552	MACPOS 5	Concave	1978	10	-----
LAVO	LV110	Riparian	08/01/12	629038	4477155	MACPOS 5	Convex	2077	7	-----
LAVO	LV112	Riparian	07/22/12	630819	4486219	MACPOS 5	Concave	1944	0	-----
LAVO	LV113	Riparian	07/31/12	633902	4482933	MACPOS 5	Concave	2022	23	-----
LAVO	LV120	Riparian	07/31/12	627662	4489183	MACPOS 5	Concave	1844	22	-----
LAVO	LV121	Riparian	08/04/12	629120	4483417	MACPOS 5	Concave	2263	13	-----
LAVO	LV122	Riparian	08/15/12	629349	4476696	MACPOS 5	Straight	2039	0	-----
LAVO	LV123	Riparian	07/21/12	623745	4484679	MACPOS 5	Undulating	2039	23	-----
LAVO	LV125	Riparian	09/06/12	634319	4480676	MACPOS 5	Undulating	1893	0	-----
LAVO	LV127	Riparian	07/30/12	621819	4488195	MACPOS 5	Straight	1798	2	-----