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Sierra Nevada Bird Observatory

2015 WILLOW FLYCATCHER SURVEYS IN THE TAHOE NATIONAL FOREST

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Above: Willows occupied by a singing willow flycatcher during the June 14, 2015 survey at Little Truckee Boyington Mill

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Above: Surveyor Stephen Strohm Hein watching a singing willow flycatcher during the June 14, 2015 survey at Little Truckee Boyington Mill

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INTRODUCTION

In June and July 2015, The Institute for Bird Populations (IBP) surveyed for Willow Flycatchers at eight meadow systems on the Tahoe National Forest. These surveys used the Bombay *et al.* (2003a) protocol, in compliance with USFS Region 5 Forest Plan Amendments (Powell and Blackwell 2003).

The goals of these surveys were to:

- 1) determine whether Willow Flycatchers were present or absent at these sites;
- 2) estimate the number and locations of Willow Flycatcher breeding territories at each site, if present; and
- 3) provide a species list of the avian community at each site.

METHODS

Eight meadow systems were surveyed, across three Tahoe National Forest Ranger Districts. These sites are known to have been previously occupied by Willow Flycatchers (Mathewson *et al.* 2011, 2012, Loffland *et al.* 2013). However, this species was not detected at these sites during focused surveys in 2014 (Loffland and Siegel 2014). Meadows surveyed in 2015 include five Sierraville Ranger District (SV) sites (Carman Knuthson, Lewis Mill, Little Perazzo, Little Truckee 3, and Saddle Meadow); two Truckee Ranger District (TR) sites (Little Truckee Boyington Mill and Sagehen Creek); and one site (Loney Meadow) in the Yuba River Ranger District (YR). Appendix A of this document illustrates the survey meadow locations on a regional scale, shown by Ranger District. These maps were provided to IBP by the Tahoe National Forest.

Within each meadow, survey points were distributed 30-50m apart throughout all areas of potentially suitable habitat (i.e., containing willow or alder cover). These points were previously delineated for Willow Flycatcher surveys in 2014 using GIS ArcMap 10.1 and 2012 natural color NAIP imagery (ESRI 2011), and were field-verified by the 2014 survey crew (Loffland and Siegel 2014). The 2015 surveys revisited the 2014 survey points (located in the field by GPS and 50m pacing) and again verified that all areas of potentially suitable habitat were covered. Appendix B includes site-specific aerial photographs with survey points overlaid to illustrate the locations of each survey point on each meadow. The latitude and longitude of each survey point are included in site-specific tables that follow each meadow map.

The Willow Flycatcher survey protocol requires two survey visits to each site, with one occurring during the June 15-25 period when Willow Flycatcher singing is typically most frequent and the presence of passage migrants is least likely (Bombay *et al.* 2003a). The two surveys must be more than 5 days apart, and the second survey must occur either between June 1-14 or June 26-July 15. We surveyed all eight sites once within the mandatory June 15-25 window. We performed the additional survey at five sites within the June 1-14 period, choosing these early dates because of the early leafing out of willows in this drought year. Rain during this period prevented us from completing all eight sites between June 1-14, however, so we performed the second survey at the remaining three sites during the June 26-July 15 period.

All surveys were completed between first light and 10:00 am, and followed the Bombay *et al.* (2003a) protocol. Surveys began with a 10-minute period of listening for any Willow Flycatchers that may have been detectable on site prior to broadcasting recorded Willow Flycatcher vocalizations. Following the initial listening period, a series of active broadcasts, listening and observing was performed for 6 minutes at each survey point.

If a Willow Flycatcher was observed during a survey and its identity confirmed by detection of its “fitz-bew” song, we recorded the approximate distance and bearing of the bird from the survey point. After completing the protocol at the meadow’s remaining survey points, the observer returned to the detection location for a few hours and mapped the flycatcher’s movements, recording as many GPS locations as possible for observed singing perches, foraging perches, and other used locations. The observer also looked for color identification bands in case the Willow Flycatcher had been banded during the Mathewson *et al.* demography study (2011), and looked for evidence of breeding activity (carrying nesting material, carrying food or fecal sac, or interacting with possible mates). General descriptions of the hydrology, vegetation and overall meadow habitat were also completed per protocol requirements (Bombay *et al.* 2003a).

The strong bird identification skills of our field observers provided reliable Willow Flycatcher survey results. Our familiarity with the songs and calls of all Sierra bird species allowed us to quickly and accurately distinguish other species from Willow Flycatchers, including similar species such as the more common dusky flycatchers and western wood-pewees. As an additional indicator of habitat conditions, we documented a list of all bird species seen or heard during each survey visit, including both the focal meadow and its surrounding uplands (within hearing range of the meadow, typically about 150m from the meadow edge).

All surveys were performed in compliance with the Training Plan, Survey Plan, and Quality Control Plan that were developed by the Institute for Bird Populations in May 2015. These three plans were also vetted by Tahoe National Forest staff prior to the beginning of the survey season.

RESULTS

A total of 411 survey points were visited across the eight meadow sites in 2015. Survey dates are presented in Table 1. In order to complete all survey points by 10:00am as required by the Bombay *et al.* (2003a) protocol, larger sites were completed over 2-3 consecutive days, or with two observers, or both.

Two Willow Flycatchers were detected during the 2015 surveys, one at Little Truckee Boyington Mill on June 14 and one at Little Truckee 3 on June 15 (Table 1). Neither of these two flycatchers remained on site for the second survey date (June 21 and June 27). Color bands were not observed on either of the two Willow Flycatchers, and neither was observed interacting with mates or performing other nesting-related behaviors such as carrying nesting material or fecal sacs.

Table 1. Survey sites, visit dates, and Willow Flycatcher detections.					
Site Name	Number of Survey Points	First Survey Date(s)	Number of Willow Flycatchers Detected	Second Survey Date(s)	Number of Willow Flycatchers Detected
Carman Knuthson	49	June 7	0	June 19	0
Lewis Mill	31	June 20	0	July 8	0
Little Perazzo	40	June 1-2	0	June 16	0
Little Truckee 3	54	June 15	1	June 27	0
Little Truckee Boyington Mill	101	June 13-14	1	June 21-22	0
Loney Meadow	37	June 17	0	June 28	0
Saddle Meadow	28	June 3	0	June 24	0
Sagehen Creek	71	June 8-9, 12	0	June 23	0

The exact locations in which each of the two 2015 Willow Flycatchers were observed are mapped in Figures 1 and 2, with GPS coordinates listed in Table 2. The Willow Flycatcher at Little Truckee 3 was presumed to be a migrant passing through the site, as he was heard voicing only two “fitz-bews” at one location before flying off, after which he remained undetected during several hours of territory mapping attempts over the next few days. The Willow Flycatcher at Little Truckee Boyington Mill, however, appeared to be establishing a territory, as he sang unceasingly throughout the morning and well into the afternoon, while observers mapped him flying between seven consistently-repeated singing perches.

Table 2. GPS coordinates of the two Willow Flycatchers observed during 2015 surveys (UTM, NAD83).			
Site	Date	Easting	Northing
Little Truckee Boyington Mill	June 14	749964	4369592
Little Truckee Boyington Mill	June 14	749987	4369578
Little Truckee Boyington Mill	June 14	749984	4369594
Little Truckee Boyington Mill	June 14	749931	4369580
Little Truckee Boyington Mill	June 14	749917	4369583
Little Truckee Boyington Mill	June 14	749903	4369565
Little Truckee Boyington Mill	June 14	749860	4369587
Little Truckee 3	June 15	729948	4375232

Figure 1. Map of singing perches used by the Willow Flycatcher observed at Little Truckee Boyington Mill on June 14, 2015.

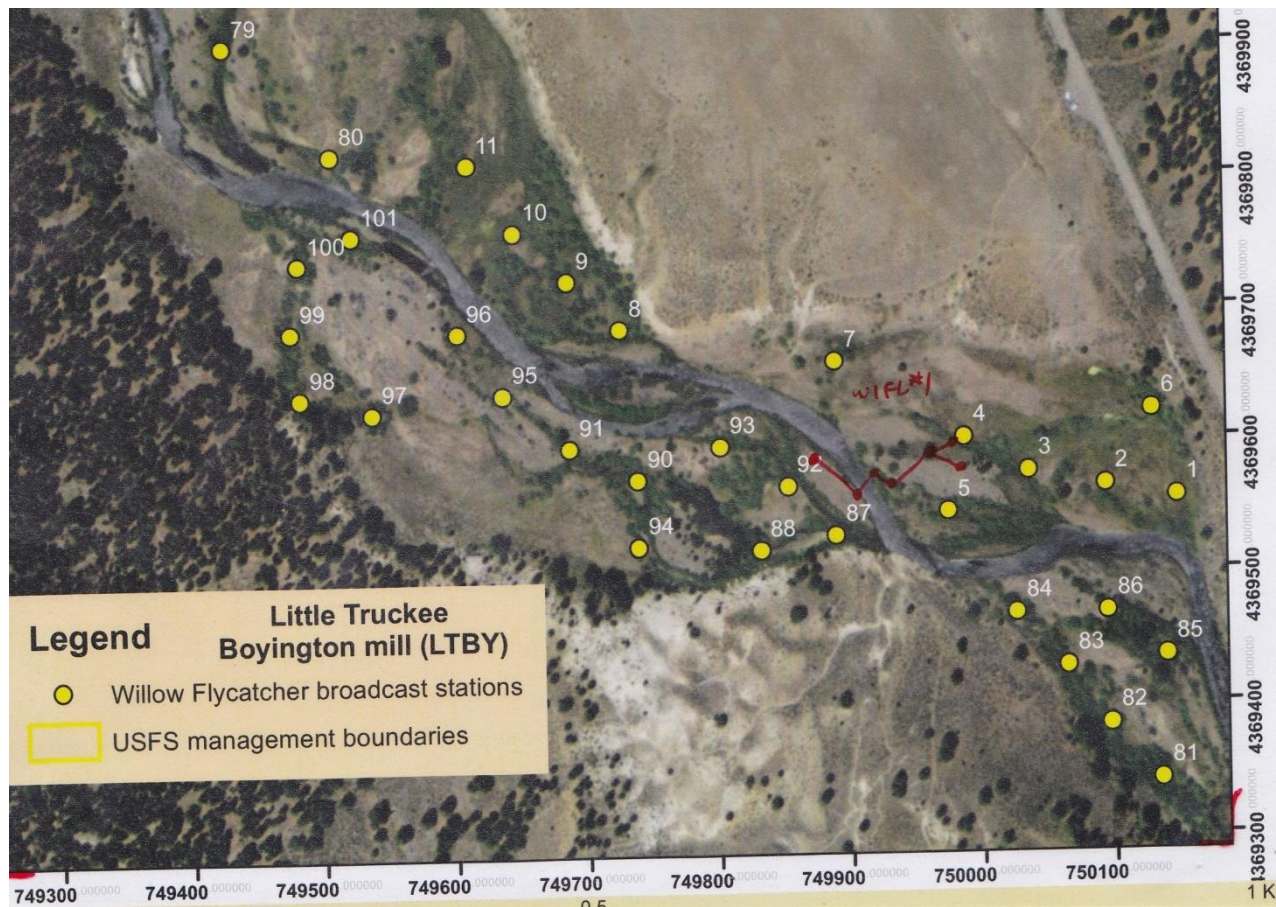
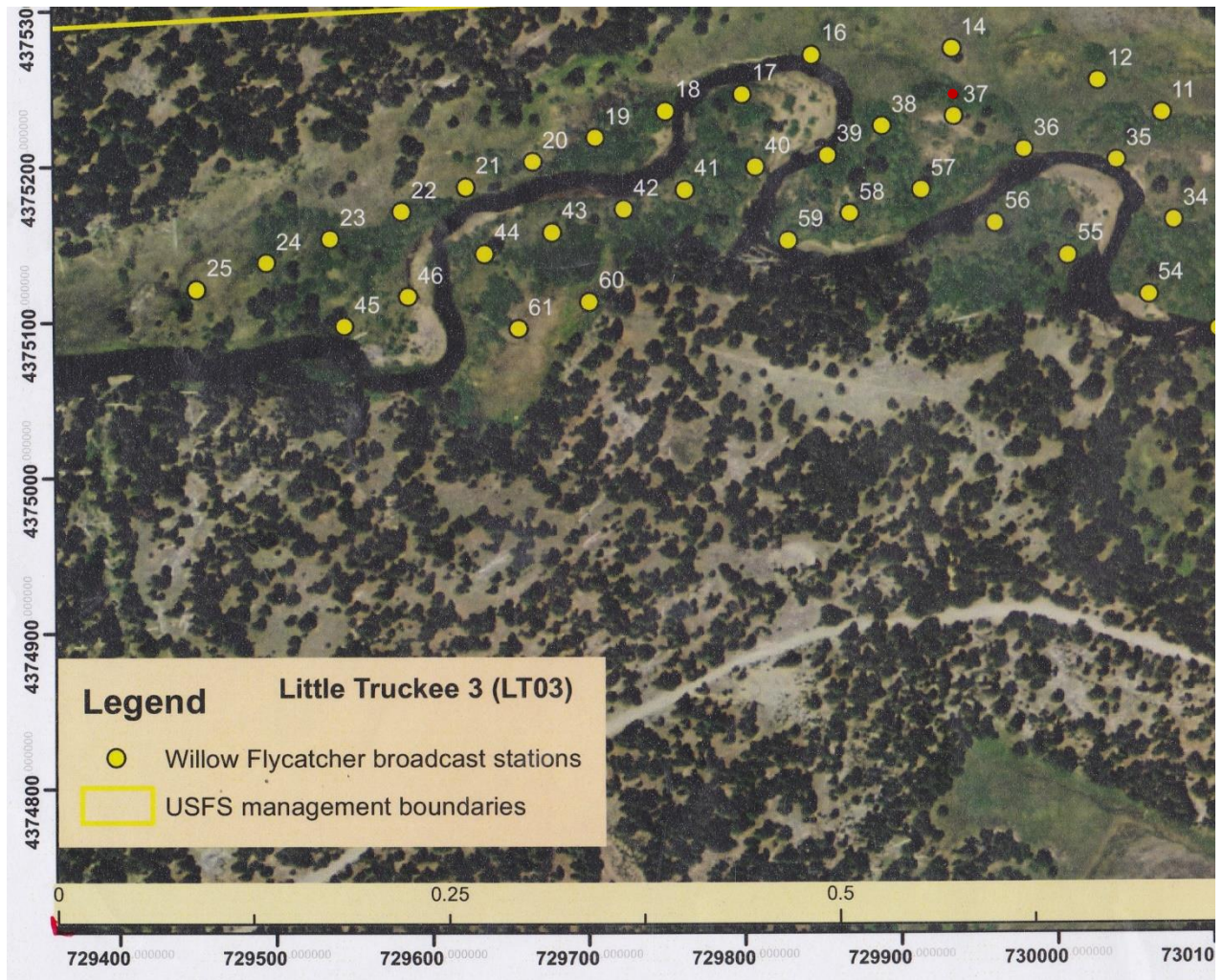


Figure 2. Location of the singing Willow Flycatcher observed at Little Truckee 3 on June 15, 2015.



A total of 100 bird species were detected incidentally during the 2015 Willow Flycatcher surveys (Table 3). Sixteen of these (including Willow Flycatchers) were designated as meadow focal species by Loffland *et al.* (2011a), species strongly associated with meadow habitats and likely to respond to meadow restoration efforts. These sixteen species are noted with a * in Table 3.

Table 3. List of all bird species detected at each surveyed meadow (including uplands within 150m hearing distance of the meadow).									
Species	Carman Knuthson	Lewis Mill	Little Perazzo	Little Truckee 3	Little Truckee Boyington Mill	Loney Meadow	Saddle Meadow	Sagehen Creek	Total Number of Sites per Species
American Goldfinch		X							1
American Kestrel	X								1
American Robin	X	X	X	X	X	X	X	X	8 (all)
American White Pelican			X						1
Anna's Hummingbird						X			1
Barn Swallow	X								1
Band-tailed Pigeon								X	1
Belted Kingfisher				X	X		X	X	4
Black-headed Grosbeak	X	X			X	X	X		5
Brewer's Blackbird	X	X	X	X	X	X	X	X	8 (all)
Brewer's Sparrow			X		X		X		3
Brown Creeper	X	X	X	X		X	X	X	7
Brown-headed Cowbird * (Invasive)	X	X	X	X	X	X	X	X	8 (all)
Bushtit					X				1
California Gull					X				1
California Quail			X	X	X				3
Calliope Hummingbird	X	X	X	X	X	X	X	X	8 (all)
Canada Goose			X		X		X		3
Cassin's Finch	X	X	X	X	X	X	X	X	8 (all)
Cassin's Vireo	X	X	X	X	X	X	X	X	8 (all)
Chipping Sparrow	X	X	X	X	X	X	X	X	8 (all)
Clark's Nutcracker	X	X	X	X	X	X	X	X	8 (all)
Cliff Swallow					X				1
Common Merganser				X	X		X	X	4
Common Nighthawk	X	X			X	X		X	5
Common Poorwill		X							1
Common Raven	X	X	X	X	X		X	X	7

Table 3. List of all bird species detected at each surveyed meadow (including uplands within 150m hearing distance of the meadow).									
Species	Carman Knuthson	Lewis Mill	Little Perazzo	Little Truckee 3	Little Truckee Boyington Mill	Loney Meadow	Saddle Meadow	Sagehen Creek	Total Number of Sites per Species
Dark-eyed Junco	X	X	X	X	X	X	X	X	8 (all)
Double-crested Cormorant					X				1
Downy Woodpecker			X					X	2
Dusky Flycatcher	X	X	X	X	X	X	X	X	8 (all)
Eurasian Collared Dove (Invasive)	X								1
European Starling (Invasive)	X								1
Fox Sparrow	X	X	X	X	X	X	X	X	8 (all)
Gadwall					X			X	2
Gray Flycatcher	X								1
Great Horned Owl	X			X	X				3
Golden-crowned Kinglet		X	X			X	X	X	5
Green-tailed Towhee		X	X	X	X	X	X	X	7
Hairy Woodpecker	X	X	X	X	X	X	X	X	8 (all)
Hammond's Flycatcher				X	X				2
Hermit Thrush			X					X	2
Hermit Warbler	X			X	X	X	X	X	6
Horned Lark					X				1
House Wren	X	X	X	X	X	X	X	X	8 (all)
Killdeer					X				1
Lesser Goldfinch	X	X			X				3
Lincoln's Sparrow *	X	X	X	X	X	X	X	X	8 (all)
MacGillivray's Warbler *	X	X	X	X	X	X	X	X	8 (all)
Mallard	X			X	X		X		4
Mountain Bluebird	X	X	X				X		4
Mountain Chickadee	X	X	X	X	X	X	X	X	8 (all)
Mountain Quail	X	X	X	X	X	X	X		7
Mourning Dove	X	X		X	X				4
Nashville Warbler		X		X	X	X		X	5
Northern Flicker	X	X	X	X	X	X	X	X	8 (all)
Northern Rough-winged Swallow					X				1
Olive-sided Flycatcher		X	X		X	X	X		5
Orange-crowned Warbler	X	X	X	X	X	X	X	X	8 (all)
Osprey		X		X	X	X	X		5

Table 3. List of all bird species detected at each surveyed meadow (including uplands within 150m hearing distance of the meadow).									
Species	Carman Knuthson	Lewis Mill	Little Perazzo	Little Truckee 3	Little Truckee Boyington Mill	Loney Meadow	Saddle Meadow	Sagehen Creek	Total Number of Sites per Species
Pied-billed Grebe	X				X				2
Pileated Woodpecker						X			1
Pine Siskin		X	X	X	X		X	X	6
Purple Finch	X								1
Pygmy Nuthatch		X							1
Red Crossbill		X			X		X	X	4
Red-breasted Nuthatch	X	X	X	X	X	X	X	X	8 (all)
Red-breasted Sapsucker *	X	X	X	X	X	X	X	X	8 (all)
Red-tailed Hawk	X				X	X	X	X	5
Red-winged Blackbird	X		X	X	X	X			5
Ruby-crowned Kinglet			X						1
Rufous Hummingbird		X		X					2
Sandhill Crane *	X		X						2
Savannah Sparrow			X	X	X				3
Song Sparrow *	X	X	X	X	X	X	X	X	8 (all)
Sooty Grouse						X	X	X	3
Sora *	X								1
Spotted Sandpiper *				X	X			X	3
Steller's Jay	X	X	X	X	X	X	X	X	8 (all)
Swainson's Thrush *			X						1
Townsend's Solitaire	X	X	X	X	X	X	X	X	8 (all)
Tree Swallow	X	X	X	X	X		X		6
Turkey Vulture			X		X	X			3
Vesper Sparrow					X				1
Virginia Rail *	X				X				2
Warbling Vireo *	X	X	X	X	X	X	X	X	8 (all)
Western Bluebird	X	X			X		X	X	5
Western Meadowlark	X				X				2
Western Tanager	X	X	X	X	X	X	X	X	8 (all)
Western Wood-Pewee	X	X	X	X	X	X	X	X	8 (all)
White-breasted Nuthatch	X	X	X		X		X		5
White-crowned Sparrow *	X		X	X	X		X		5
White-headed Woodpecker	X		X			X		X	4

Table 3. List of all bird species detected at each surveyed meadow (including uplands within 150m hearing distance of the meadow).									
Species	Carman Knuthson	Lewis Mill	Little Perazzo	Little Truckee 3	Little Truckee Boyington Mill	Loney Meadow	Saddle Meadow	Sagehen Creek	Total Number of Sites per Species
Willow Flycatcher *				X	X				2
Wilson's Snipe *			X	X		X			3
Wilson's Warbler *	X	X	X	X	X	X	X	X	8 (all)
Wood Duck	X								1
Yellow Warbler *	X	X	X	X	X	X	X	X	8 (all)
Yellow-breasted Chat *					X				1
Yellow-rumped Warbler	X	X	X	X	X	X	X	X	8 (all)
Total Number of Species per Site	59	51	54	52	73	47	52	49	
Total Number of Species Observed this Season, Across All Sites									100
* Designated as meadow focal species by Loffland <i>et al.</i> (2011a).									

DISCUSSION

Within the previous 10 years, Willow Flycatchers had been detected at four of the eight sites surveyed in 2015 (Table 4). At each of these sites, the number of Willow Flycatcher observations has been lower in the past two years than in previous years, although the overall number of observations are too low (no more than four individuals per site per year) to perform a statistical analysis of site-specific population trends.

Table 4. Comparison of 2015 survey results to prior results from the last 10 years (2005-2014).									
Site Name	2005	2006	2007	2008	2009	2010	2012	2014	2015
Carman Knuthson	0	0	1	0	0	0		0	0
Lewis Mill	0							0	0
Little Perazzo	2	1	1	1	1	1		0	0
Little Truckee 3	3	4	3	1	2	2	0	0	1
Little Truckee Boyington Mill						0	0	0	1
Loney Meadow						0	1		0
Saddle Meadow	0	0	0	0	0	0		0	0
Sagehen Creek	0		0					0	0
Sources: 2005-2010 data from Mathewson <i>et al.</i> (2011) except Little Truckee Boyington Mill data from Loffland <i>et al.</i> (2011b) and Loney Meadow data from Loffland <i>et al.</i> (2011c). 2012 data from Loffland <i>et al.</i> (2013). 2014 data from Loffland and Siegel (2014).									

Past research has described the habitat characteristics associated with Willow Flycatcher meadow occupancy, relative abundance, nest site selection, and nest survival. Bombay *et al.* (2003b) demonstrated that meadows are more likely to be occupied by Willow Flycatchers if they possess a greater percent cover of riparian shrubs (especially willows), greater total area of riparian shrubs, and lower percent cover of understory forbs (an indicator of meadow wetness and disturbance). Among occupied meadows, Willow Flycatcher abundance is higher in meadows with greater percent cover of riparian shrubs, greater shrub height, and lower percent cover of overstory trees. Within occupied meadows, Willow Flycatchers are more likely to occupy breeding territories in the portions of the meadows with the greatest percent cover of riparian shrubs, and are similarly more likely to nest in the portions of those territories with the greatest percent cover of riparian shrubs. Willow Flycatcher nests are more likely to survive and successfully fledge at greater distances from overstory trees (Bombay *et al.* 2003b), perhaps because this maintains a greater distance from tree-associated predators and nest parasites, and perhaps because overstory trees are also linked to meadow wetness. Nesting areas are generally characterized by extensive surface water (Harris *et al.* 1988, Sanders and Flett 1989), at least in the early part of the breeding season. Cain *et al.* (2003) found that standing water around nests is a deterrent to predation by mammalian predators, and Green *et al.* (2003) suggested that high rates of nest predation have resulted from meadow desiccation. The Tahoe National Forest has engaged in successful meadow habitat restoration at several sites throughout the region, including sites where Willow Flycatchers were observed during Loffland and Siegel's 2014 surveys. Benefits to Willow Flycatchers are likely to increase over time as the post-restoration habitat continues to mature, and further surveys will be helpful to document restoration effects and future population trends.

In addition to site-specific habitat conditions, Willow Flycatcher populations at individual meadows are likely affected by metapopulation dynamics, which are influenced by the occupancy, survival, reproduction, site fidelity, and dispersal of Willow Flycatchers at other meadows in the Sierra/Cascades region (Siegel *et al.* 2008), as well as conditions on their migratory routes and wintering grounds. It is possible that Allee effects are influencing the recovery of this species in our region. As relatively low numbers of young fledge within the region each year and return to breed the following spring, returning Willow Flycatchers may have difficulty finding mates and establishing new nesting territories in suitable but unoccupied meadows. This issue may have affected the two singing Willow Flycatcher males detected in this study, who were not observed interacting with mates or performing other breeding-related behaviors such as carrying nesting material or carrying fecal sacs. Future research planned by the Institute for Bird Populations will examine the potential effects of social attraction by experimentally broadcasting recordings of Willow Flycatcher songs at several restored meadows where the habitat quality is deemed suitable for nesting. If successful, this technique may be repeated in conjunction with additional habitat restoration to help attract migrating Willow Flycatchers to high-quality habitat and to each other.

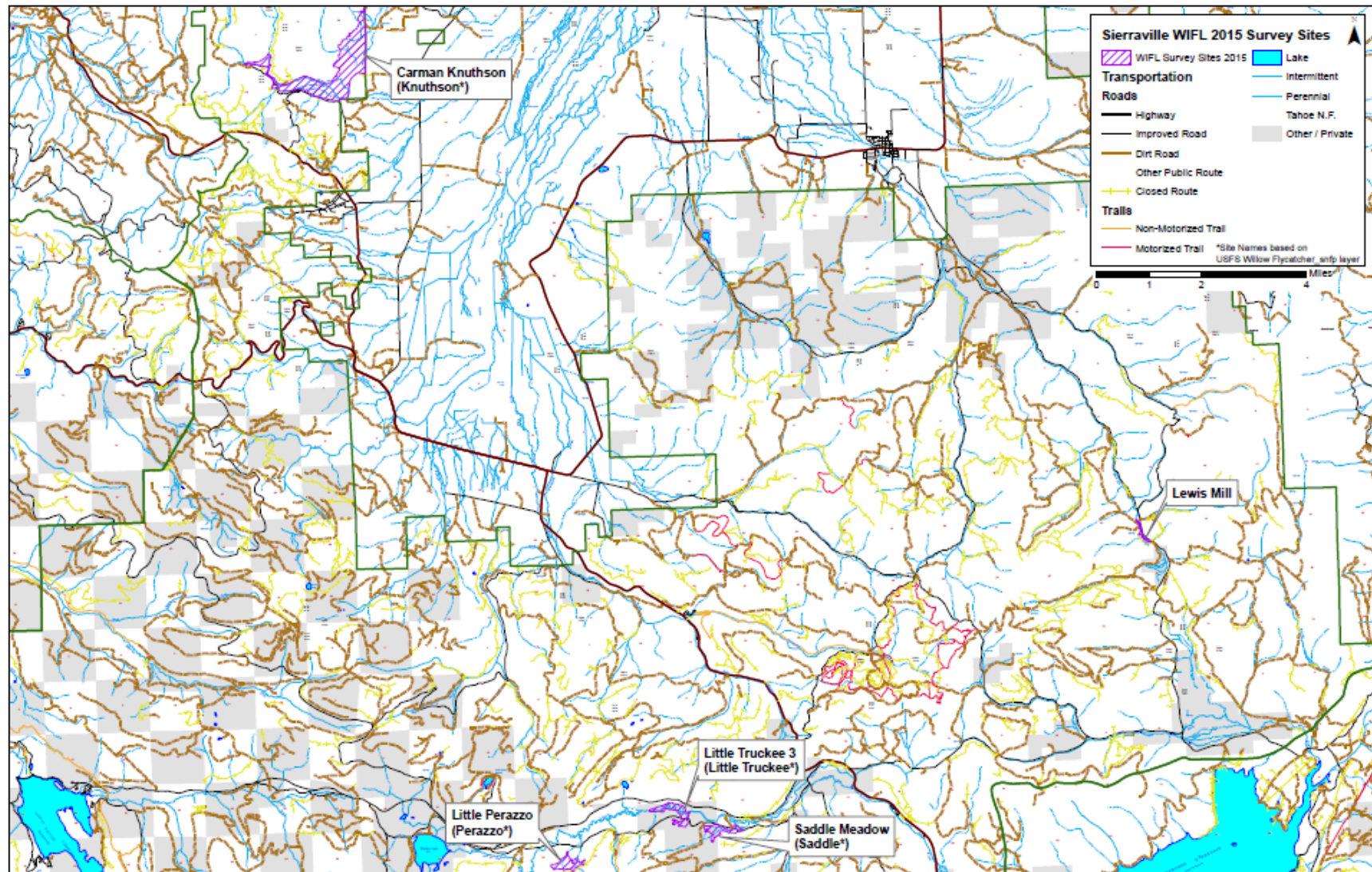
ACKNOWLEDGMENTS

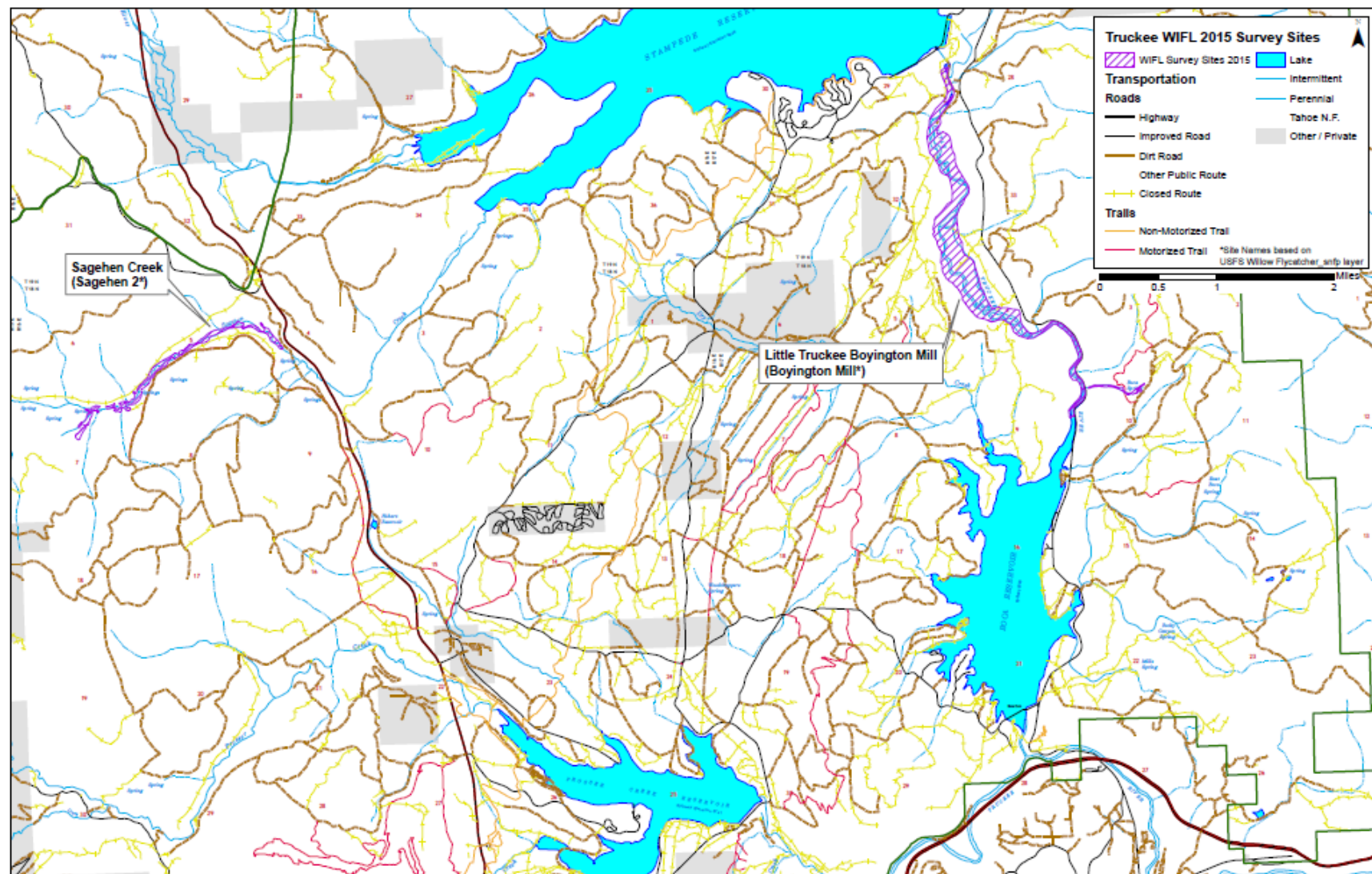
Valuable contributions in staff time were provided by personnel at the US Forest Service Pacific Tahoe National Forest, especially Kris Boatner, Craig Wilson, Ashly Kula and Tina Mark. UC Berkeley's Sagehen Field Station provided access and support for surveys at Sagehen Creek. Field data were collected by Stephen Strohm Hein and Kristen Hein Strohm (crew leader). This project was conducted by The Institute for Bird Populations' Sierra Nevada Bird Observatory. This is Contribution No. 514 of The Institute for Bird Populations.

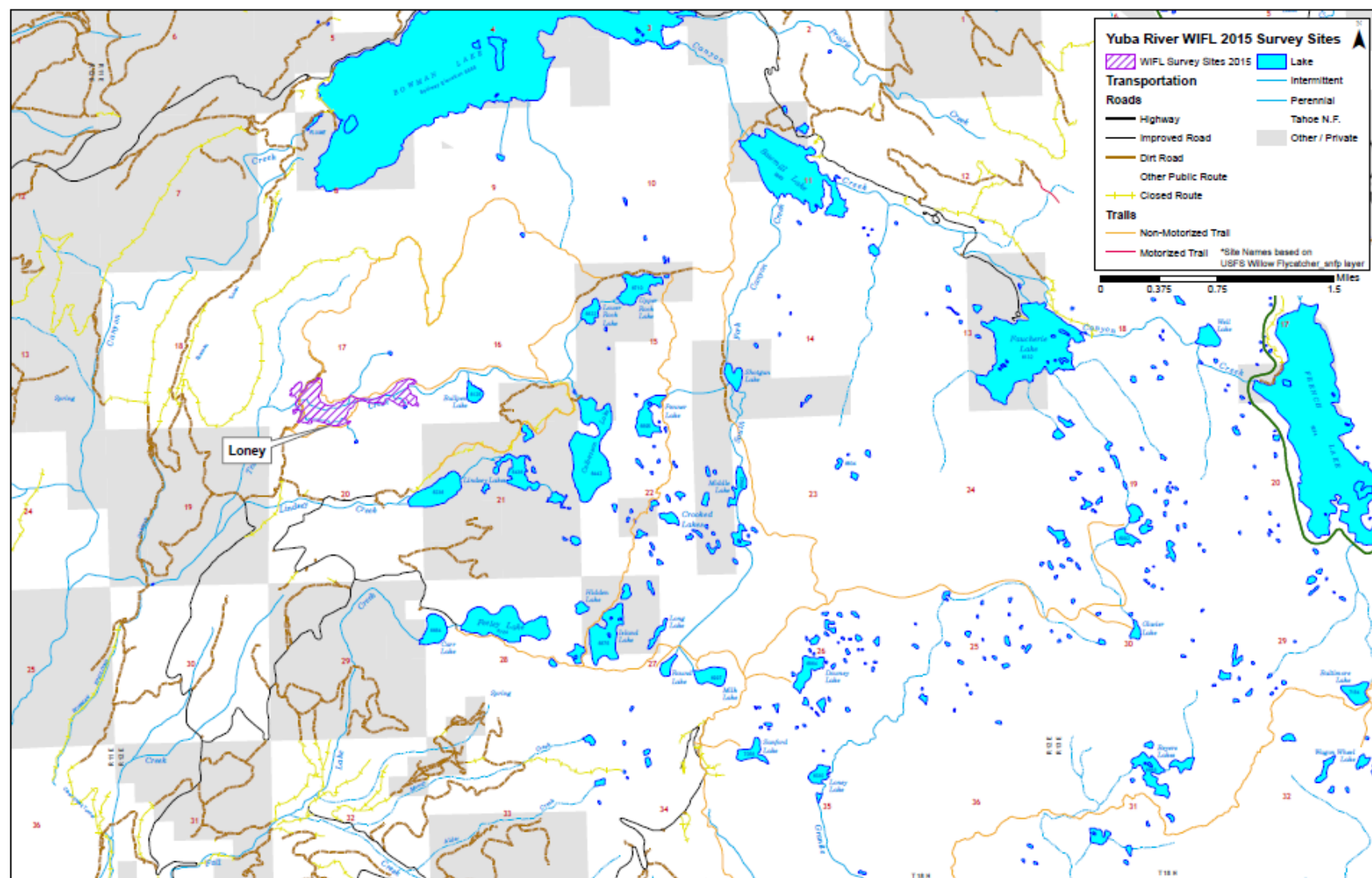
LITERATURE CITED

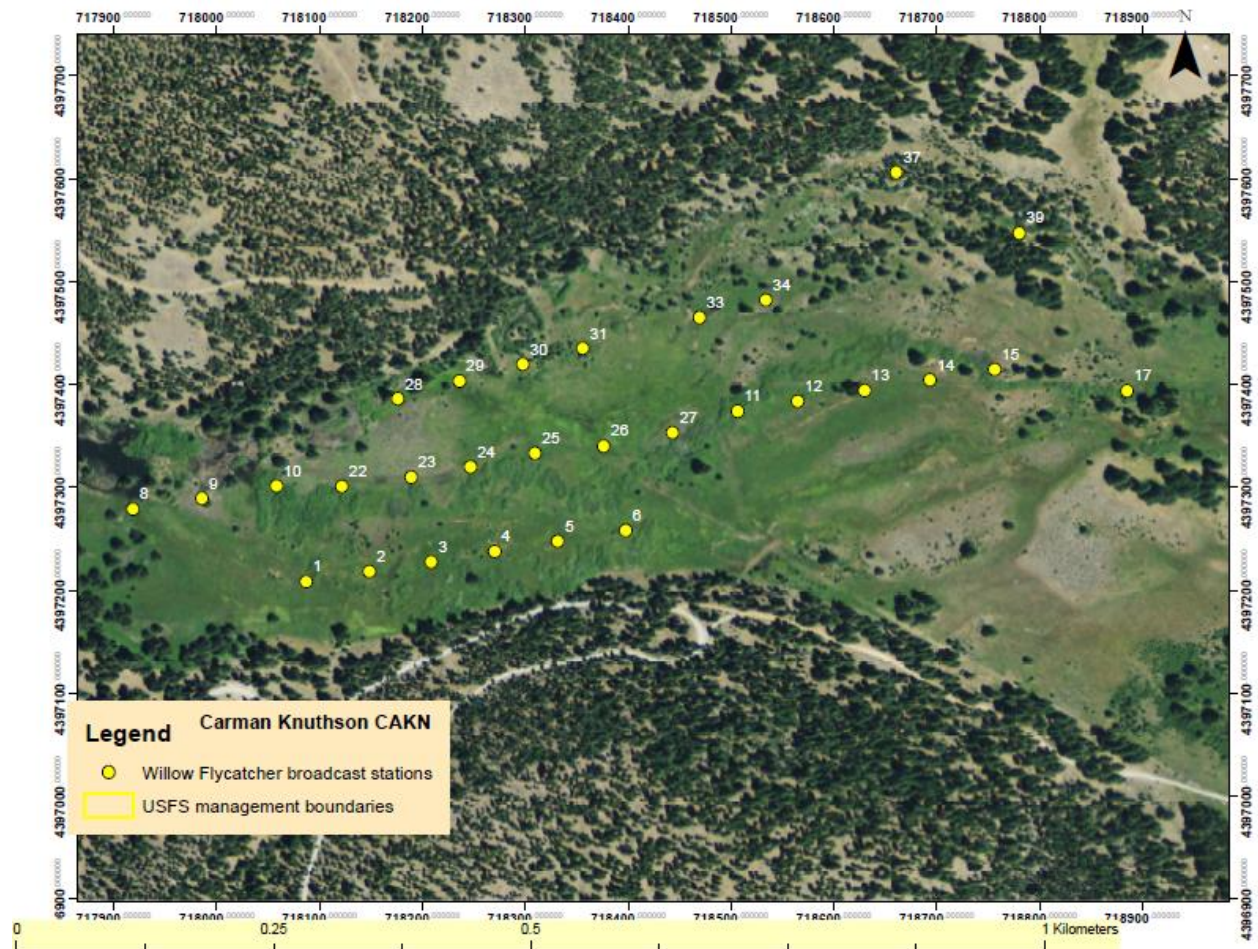
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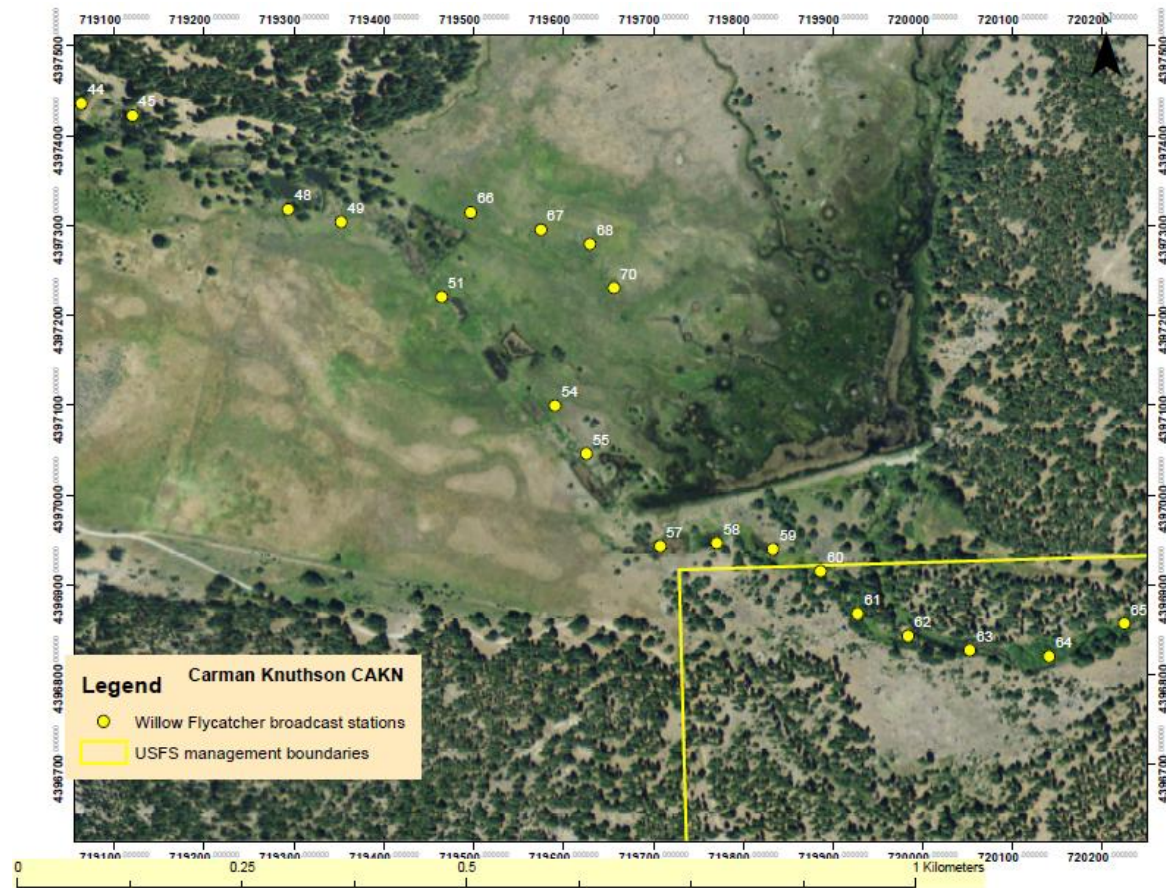
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Appendix A. Maps of Surveyed Meadows within each Ranger District



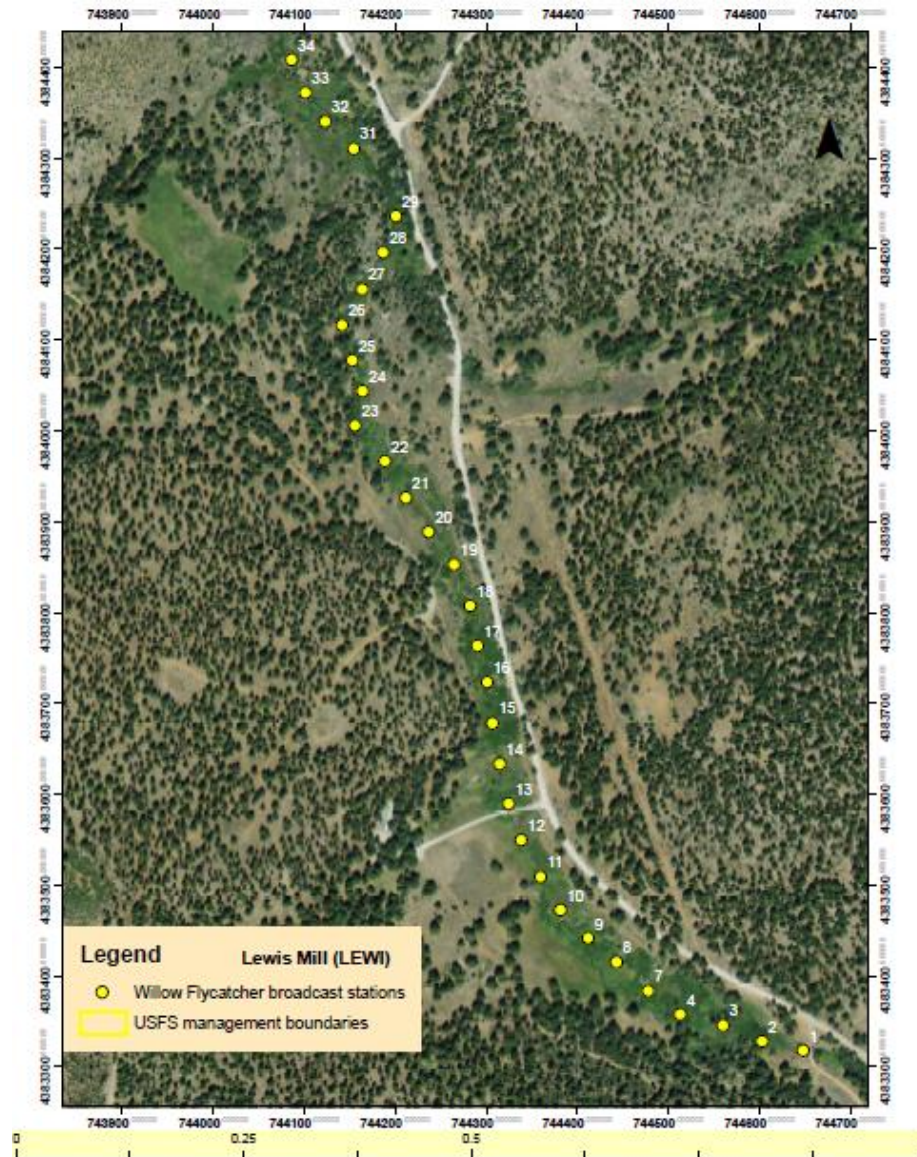


Appendix B. Maps and Coordinates of Surveyed Points within each Meadow



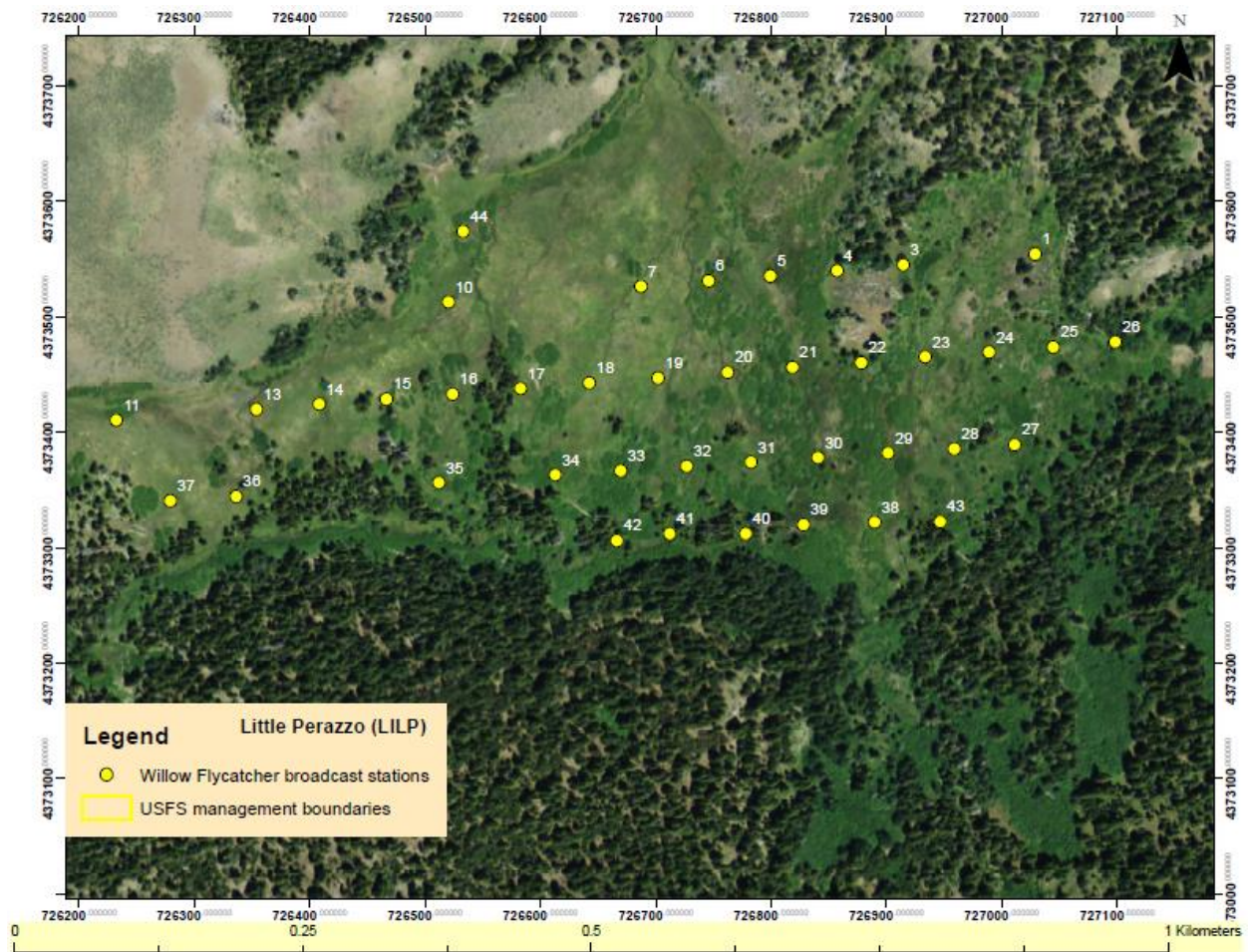
Carman Knuthson Survey Points		
Station	Longitude	Latitude
1	-120.456446	39.696881
2	-120.455727	39.696954
3	-120.455022	39.697025
4	-120.454301	39.697098
5	-120.453581	39.697171
6	-120.452812	39.697249
8	-120.458388	39.697558
9	-120.457601	39.697639
10	-120.456754	39.697726
11	-120.451503	39.698266
12	-120.450819	39.698336
13	-120.450058	39.698415
14	-120.449314	39.698491
15	-120.448579	39.698567
17	-120.447084	39.698349
22	-120.456013	39.697707
23	-120.455225	39.697772
24	-120.454551	39.697844
25	-120.453812	39.697948
26	-120.453032	39.697994
27	-120.452246	39.698092
28	-120.455347	39.698458
29	-120.454648	39.698598

30	-120.453922	39.698730
31	-120.453238	39.698853
33	-120.451906	39.699094
34	-120.451148	39.699231
37	-120.449629	39.700315
39	-120.448254	39.699754
44	-120.444997	39.698682
45	-120.444341	39.698543
48	-120.442354	39.697557
49	-120.441673	39.697418
51	-120.440397	39.696637
54	-120.438965	39.695513
55	-120.438576	39.695027
57	-120.437654	39.694077
58	-120.436917	39.694087
59	-120.436192	39.694012
60	-120.435582	39.693776
61	-120.435115	39.693341
62	-120.434472	39.693104
63	-120.433673	39.692943
64	-120.432643	39.692861
65	-120.431658	39.693166
66	-120.439985	39.697479
67	-120.439086	39.697282
68	-120.438448	39.697124
70	-120.438159	39.696680



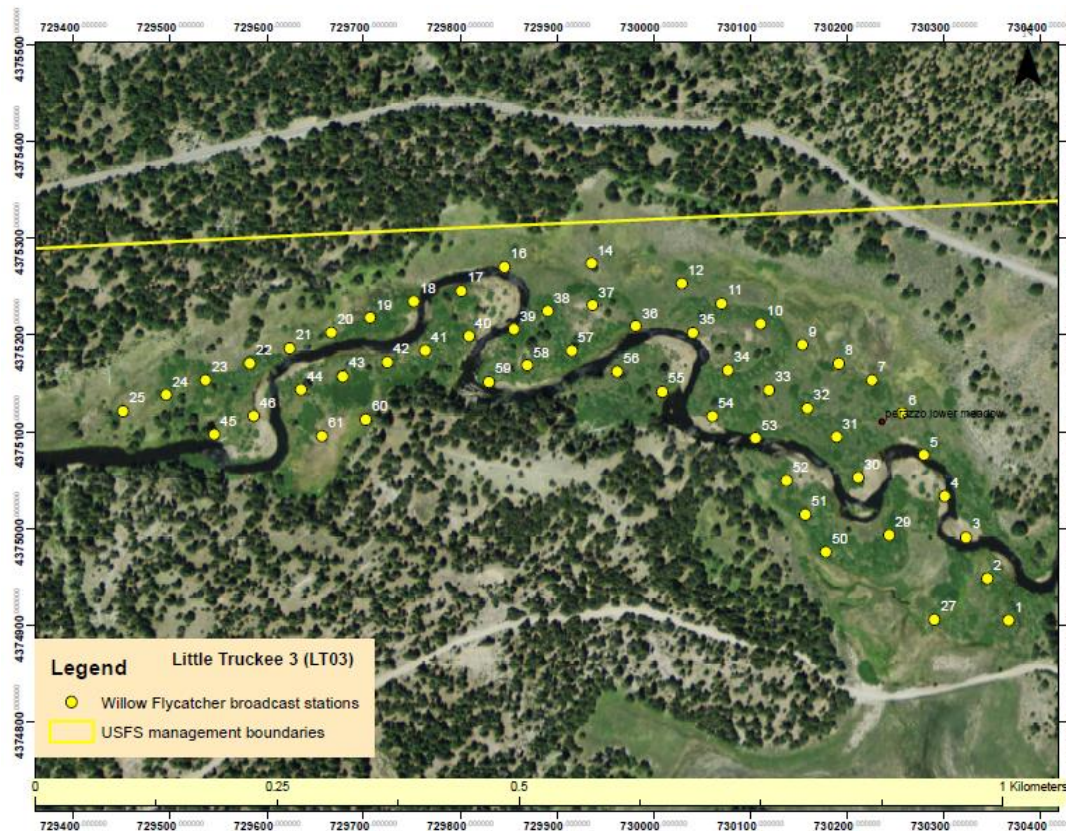
Station	Longitude	Latitude
1	-120.152138	39.564683
2	-120.152657	39.564785
3	-120.153151	39.564958
4	-120.153692	39.565078
7	-120.154091	39.565321
8	-120.154487	39.565616
9	-120.154838	39.565863
10	-120.155181	39.566152
11	-120.155421	39.566485
12	-120.155652	39.566855
13	-120.155799	39.567222
14	-120.155898	39.567617
15	-120.155974	39.568024
16	-120.156027	39.568431

17	-120.156135	39.568797
18	-120.156211	39.569192
19	-120.156402	39.569608
20	-120.156712	39.569937
21	-120.156990	39.570284
22	-120.157245	39.570653
23	-120.157607	39.571014
24	-120.157501	39.571357
25	-120.157619	39.571664
26	-120.157736	39.572012
27	-120.157467	39.572363
28	-120.157183	39.572720
29	-120.157007	39.573079
31	-120.157518	39.573759
32	-120.157869	39.574035
33	-120.158111	39.574327
34	-120.158274	39.574659



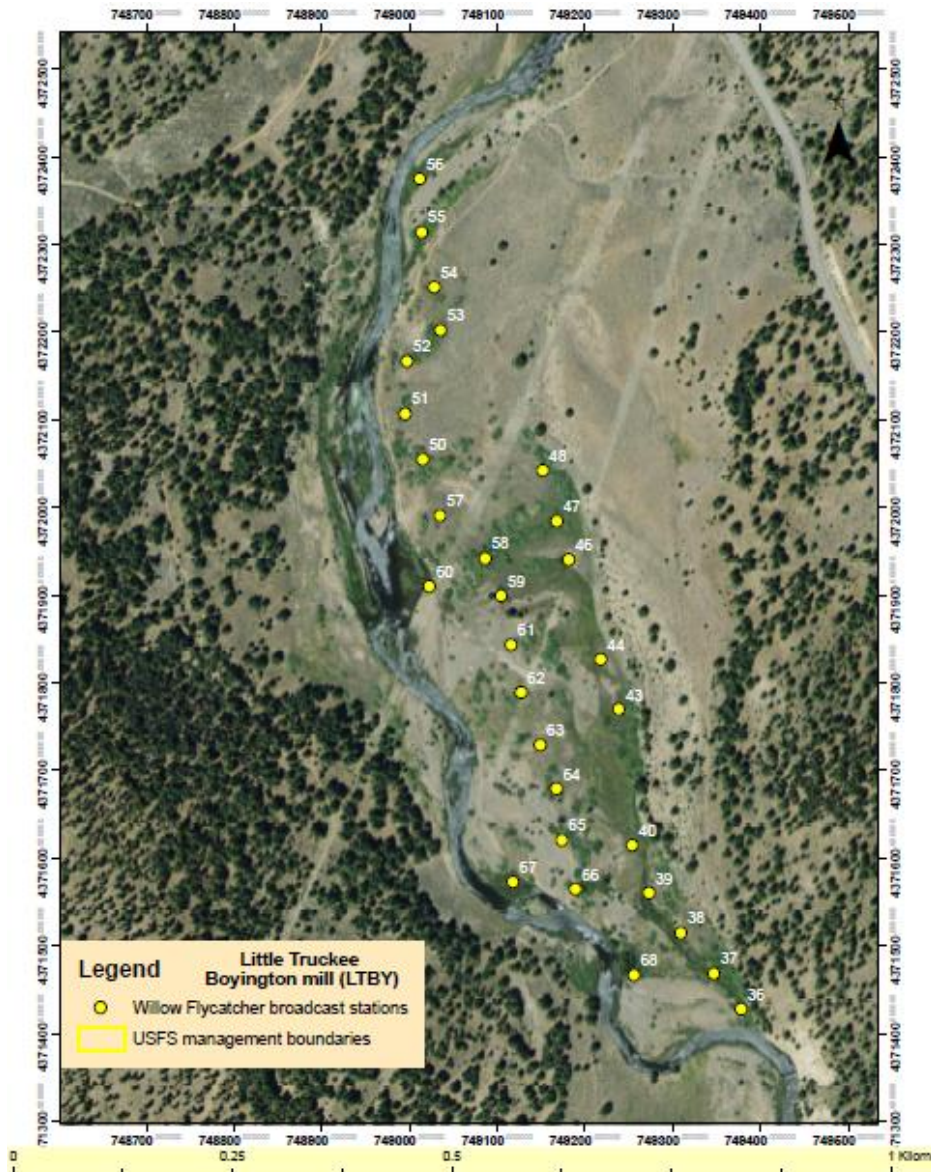
Little Perazzo Survey Points		
Station	Longitude	Latitude
1	-120.360358	39.481646
3	-120.361689	39.481593
4	-120.362359	39.481562
5	-120.363031	39.481539
6	-120.363657	39.481513
7	-120.364336	39.481486
10	-120.366282	39.481408
11	-120.369660	39.480563
13	-120.368246	39.480616
14	-120.367616	39.480640
15	-120.366936	39.480665
16	-120.366266	39.480691
17	-120.365581	39.480716
18	-120.364884	39.480743
19	-120.364192	39.480769
20	-120.363488	39.480795
21	-120.362835	39.480820
22	-120.362143	39.480840
23	-120.361495	39.480870

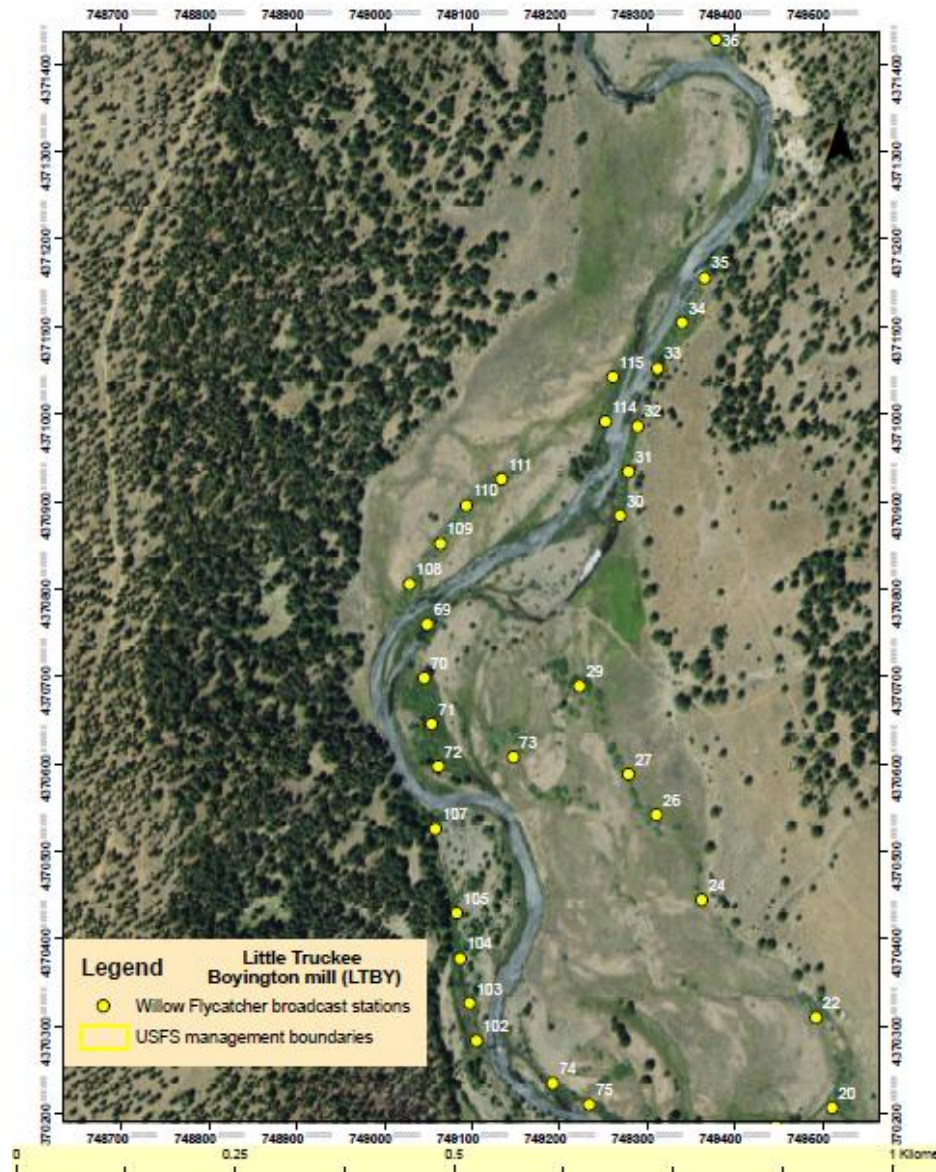
24	-120.360853	39.480895
25	-120.360202	39.480919
26	-120.359578	39.480943
27	-120.360620	39.480166
28	-120.361230	39.480148
29	-120.361898	39.480129
30	-120.362605	39.480109
31	-120.363279	39.480090
32	-120.363930	39.480071
33	-120.364598	39.480052
34	-120.365257	39.480034
35	-120.36643	39.480000
36	-120.368477	39.479941
37	-120.369142	39.479922
38	-120.362056	39.479594
39	-120.362771	39.479592
40	-120.363356	39.479533
41	-120.364118	39.479552
42	-120.364658	39.479510
43	-120.361395	39.479581
44	-120.366111	39.481956

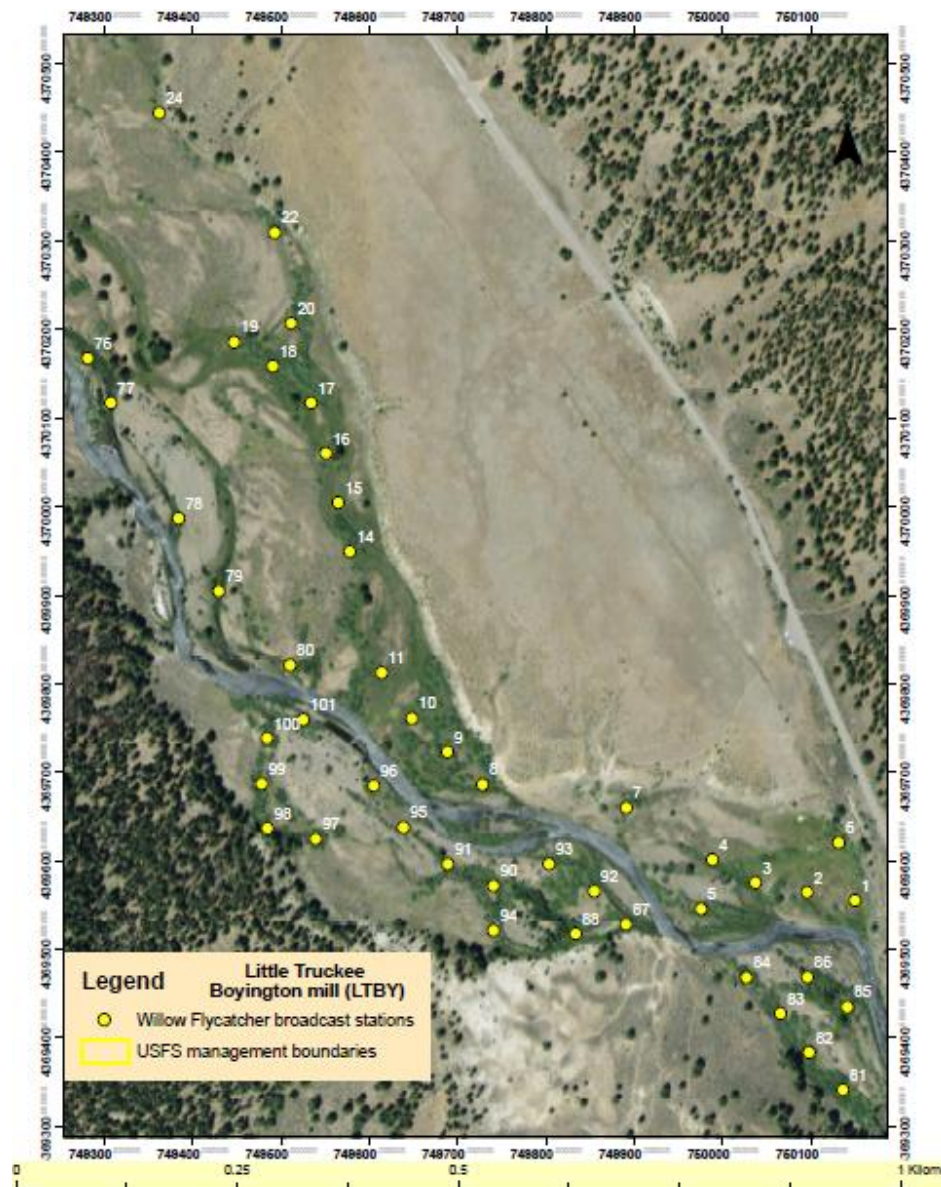


Little Truckee 3 Survey Points		
Station	Longitude	Latitude
1	-120.321120	39.492914
2	-120.321364	39.493310
3	-120.321601	39.493698
4	-120.321842	39.494090
5	-120.322078	39.494475
6	-120.322322	39.494872
7	-120.322677	39.495186
8	-120.323069	39.495353
9	-120.323500	39.495536
10	-120.323992	39.495744
11	-120.324459	39.495942
12	-120.324926	39.496140
14	-120.326004	39.496352
16	-120.327047	39.496345
17	-120.327577	39.496130
18	-120.328154	39.496049
19	-120.328683	39.495908
20	-120.329153	39.495782
21	-120.329655	39.495647
22	-120.330142	39.495517
23	-120.330681	39.495373
24	-120.331159	39.495245
25	-120.331681	39.495105
27	-120.322012	39.492942
29	-120.322527	39.493742
30	-120.322876	39.494285

31	-120.323123	39.494669
32	-120.323462	39.494943
33	-120.323918	39.495125
34	-120.324404	39.495320
35	-120.324810	39.495679
36	-120.325493	39.495756
37	-120.326007	39.495962
38	-120.326545	39.495920
39	-120.326960	39.495764
40	-120.327500	39.495708
41	-120.328032	39.495590
42	-120.328491	39.495489
43	-120.329031	39.495369
44	-120.329536	39.495257
45	-120.330594	39.494864
46	-120.330117	39.495023
50	-120.323292	39.493601
51	-120.323526	39.493956
52	-120.323739	39.494278
53	-120.324097	39.494681
54	-120.324608	39.494895
55	-120.325200	39.495139
56	-120.325730	39.495340
57	-120.326271	39.495545
58	-120.326812	39.495421
59	-120.327279	39.495277
60	-120.328770	39.494962
61	-120.329304	39.494817

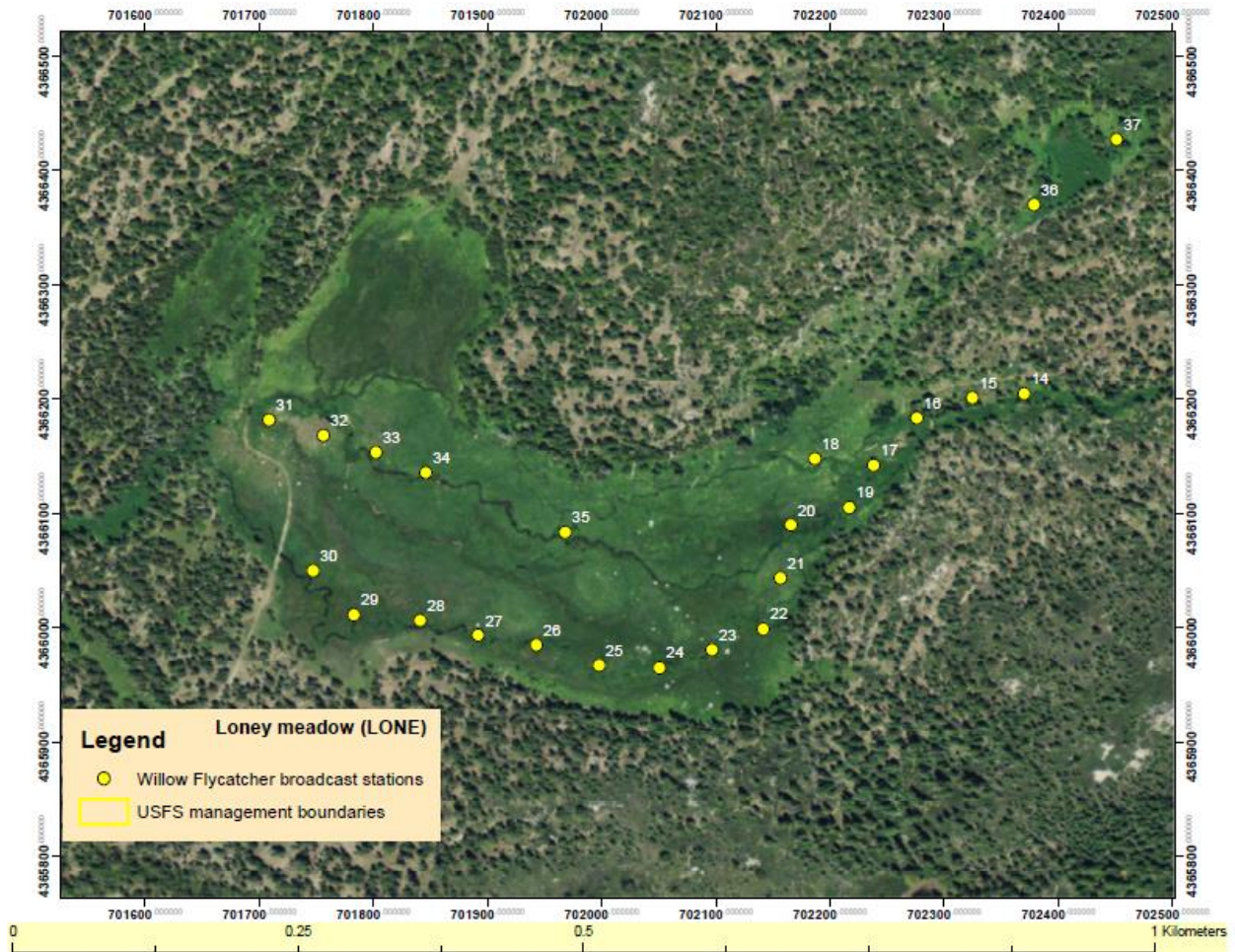


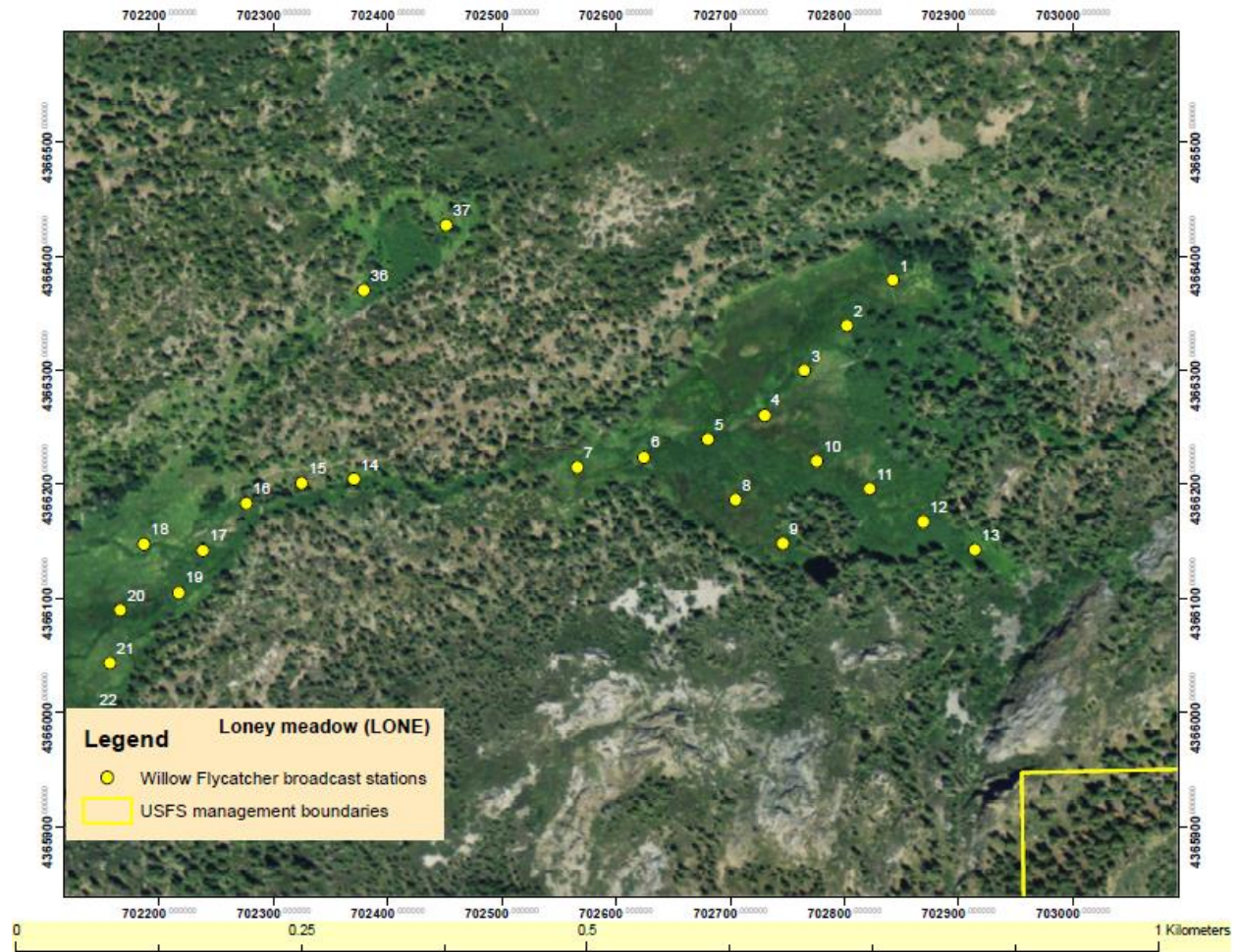




Little Truckee Boyington Mill Survey Points		
Station	Longitude	Latitude
1	-120.093344	39.439246
2	-120.093970	39.439345
3	-120.094641	39.439463
4	-120.095199	39.439710
5	-120.095366	39.439207
6	-120.093534	39.439841
7	-120.096306	39.440262
8	-120.098185	39.440547
9	-120.098632	39.440892
10	-120.099086	39.441243
11	-120.099466	39.441717
14	-120.099829	39.442960
15	-120.099962	39.443463
16	-120.100102	39.443967
17	-120.100281	39.444484
18	-120.100764	39.444872
19	-120.101261	39.445128
20	-120.100508	39.445300
22	-120.100685	39.446228
24	-120.102147	39.447480
26	-120.102709	39.448370
27	-120.103068	39.448796
29	-120.103676	39.449717
30	-120.103066	39.451460
31	-120.102939	39.451910
32	-120.102797	39.452371
33	-120.102504	39.452959
34	-120.102162	39.453422
35	-120.101843	39.453873
36	-120.101596	39.456321
37	-120.101941	39.456693
38	-120.102362	39.457121
39	-120.102767	39.457542
40	-120.102970	39.458036
43	-120.103088	39.459439
44	-120.103305	39.459957
46	-120.103685	39.460991
47	-120.103830	39.461394
48	-120.103992	39.461917
50	-120.105577	39.462069
51	-120.105788	39.462545
52	-120.105743	39.463081
53	-120.105284	39.463391
54	-120.105350	39.463833
55	-120.105496	39.464403
56	-120.105496	39.464951
57	-120.105367	39.461486
58	-120.104794	39.461031
59	-120.104595	39.460645
60	-120.105543	39.460764
61	-120.104485	39.460135
62	-120.104375	39.459644

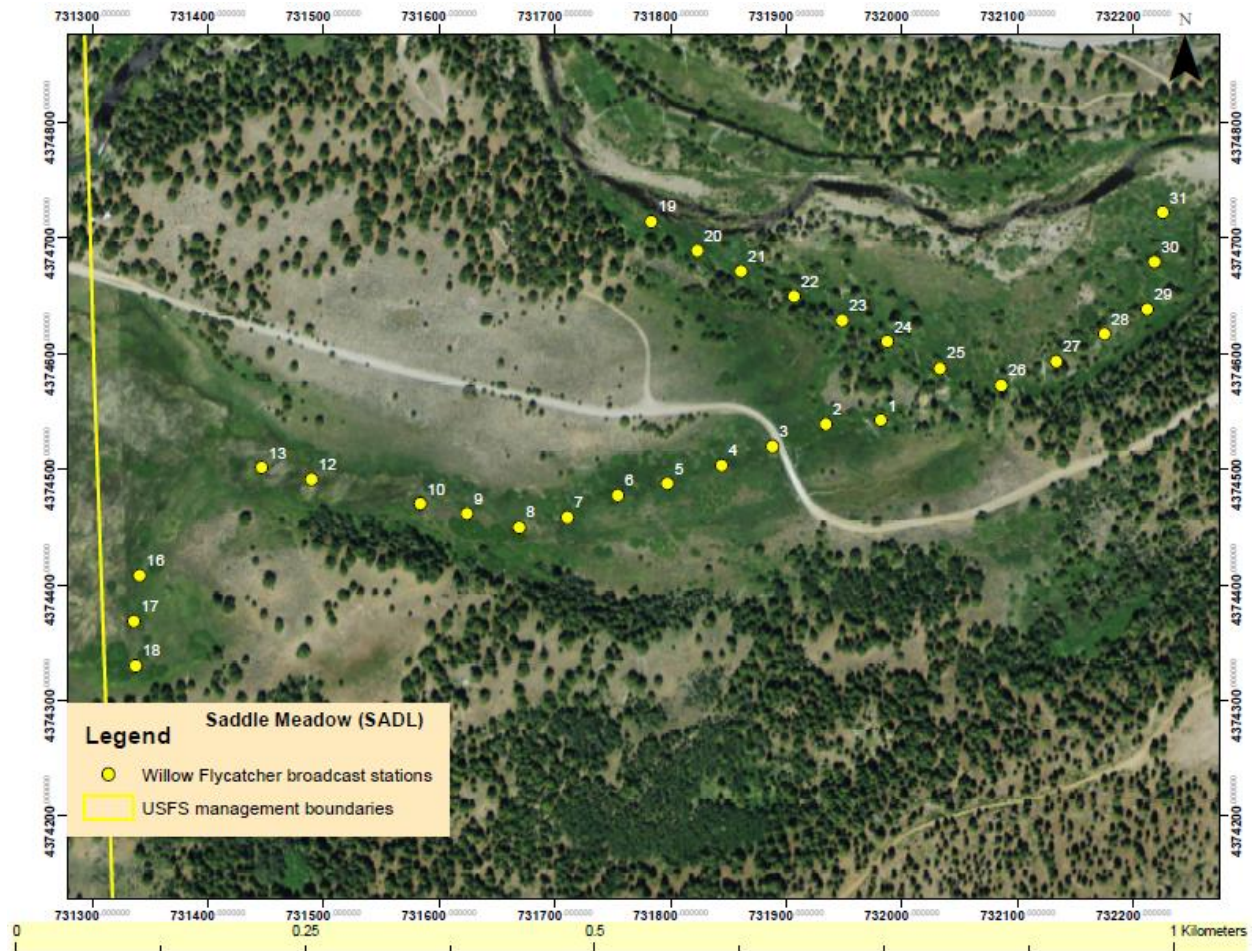
63	-120.104144	39.459096
64	-120.103947	39.458644
65	-120.103893	39.458113
66	-120.103737	39.457608
67	-120.104563	39.457700
68	-120.102998	39.456702
69	-120.105673	39.450405
70	-120.105734	39.449852
71	-120.105654	39.449379
72	-120.105587	39.448937
73	-120.104585	39.449013
74	-120.104202	39.445643
75	-120.103728	39.445410
76	-120.103191	39.445010
77	-120.102910	39.444550
78	-120.102068	39.443355
79	-120.101569	39.442598
80	-120.100664	39.441824
81	-120.093581	39.437327
82	-120.094010	39.437719
83	-120.094370	39.438122
84	-120.094800	39.438496
85	-120.093492	39.438165
86	-120.094002	39.438482
87	-120.096359	39.439077
88	-120.097031	39.438999
90	-120.098086	39.439514
91	-120.098675	39.439749
92	-120.096767	39.439427
93	-120.097347	39.439716
94	-120.098104	39.439061
95	-120.099243	39.440138
96	-120.099617	39.440571
97	-120.100400	39.440048
98	-120.101030	39.440172
99	-120.101090	39.440625
100	-120.100994	39.441088
101	-120.100510	39.441266
102	-120.105198	39.446103
103	-120.105267	39.446492
104	-120.105378	39.446953
105	-120.105404	39.447425
107	-120.105650	39.448294
108	-120.105886	39.450821
109	-120.105462	39.451228
110	-120.105100	39.451612
111	-120.104620	39.451874
114	-120.103221	39.452429
115	-120.103103	39.452885





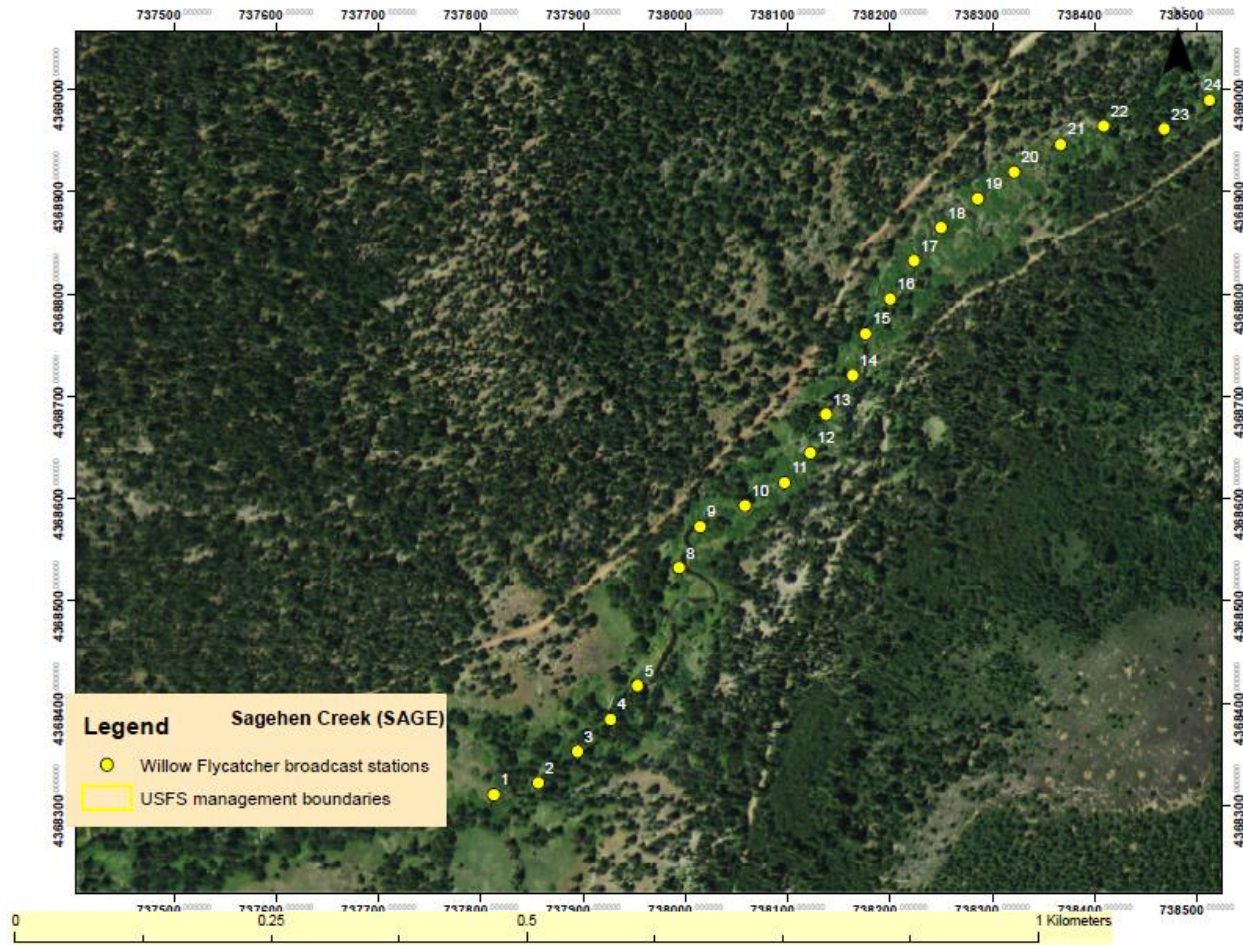
Loney Meadow Survey Points		
Station	Longitude	Latitude
1	-120.643517	39.423088
2	-120.643996	39.422738
3	-120.644438	39.422394
4	-120.644855	39.422050
5	-120.645439	39.421871
6	-120.646095	39.421741
7	-120.646773	39.421679
8	-120.645172	39.421389
9	-120.644705	39.421036
10	-120.644339	39.421677
11	-120.643806	39.421447
12	-120.643274	39.421179
13	-120.642751	39.420945
14	-120.649049	39.421629
15	-120.649578	39.421611
16	-120.650149	39.421461
17	-120.650603	39.421098
18	-120.651199	39.421162

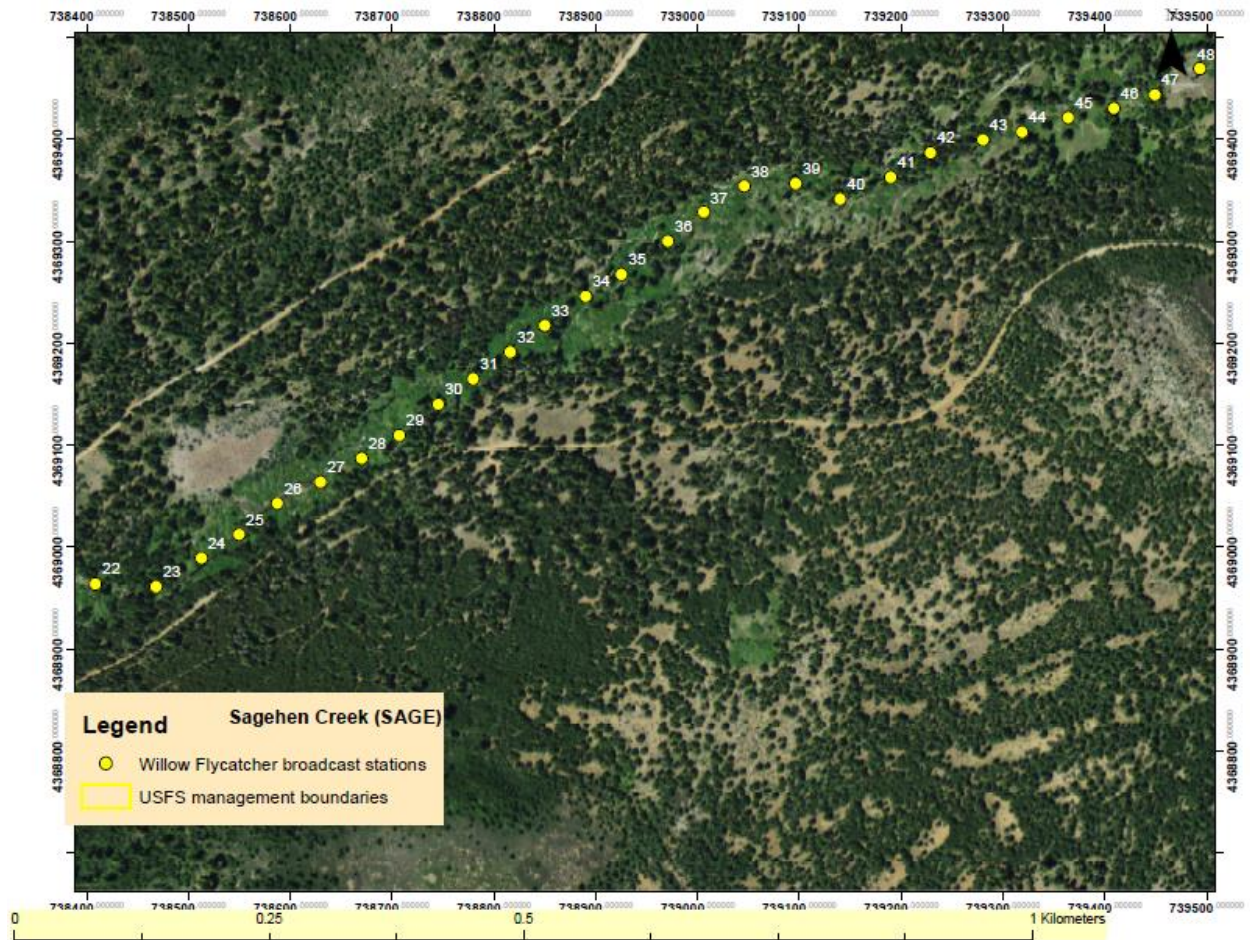
19	-120.650860	39.420770
20	-120.651458	39.420643
21	-120.651579	39.420227
22	-120.651767	39.419829
23	-120.652293	39.419675
24	-120.652832	39.419547
25	-120.653448	39.419576
26	-120.654078	39.419751
27	-120.654667	39.419839
28	-120.655255	39.419967
29	-120.655924	39.420026
30	-120.656329	39.420382
31	-120.656738	39.421577
32	-120.656189	39.421445
33	-120.655660	39.421303
34	-120.655158	39.421131
35	-120.653755	39.420633
36	-120.648900	39.423120
37	-120.648044	39.423613

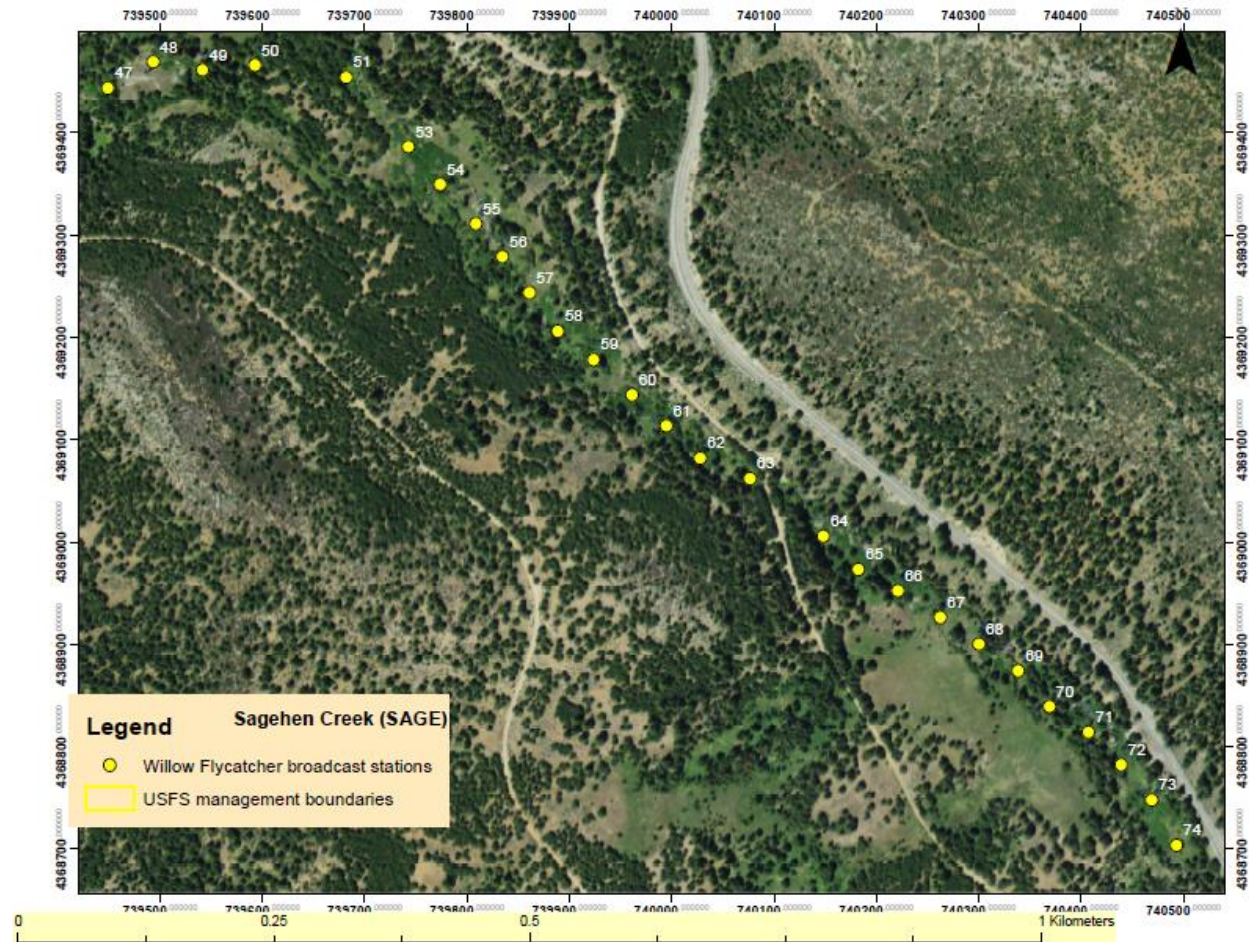


Saddle Meadow Survey Points		
Station	Longitude	Latitude
1	-120.302487	39.489218
2	-120.303041	39.489201
3	-120.303586	39.489041
4	-120.304099	39.488903
5	-120.304650	39.488773
6	-120.305152	39.488695
7	-120.305666	39.488535
8	-120.306153	39.488468
9	-120.306672	39.488588
10	-120.307137	39.488676
12	-120.308221	39.488892
13	-120.308717	39.488993
16	-120.309979	39.488182

17	-120.310046	39.487826
18	-120.310044	39.487480
19	-120.304732	39.490819
20	-120.304280	39.490582
21	-120.303848	39.490411
22	-120.303325	39.490202
23	-120.302849	39.490007
24	-120.302402	39.489829
25	-120.301880	39.489609
26	-120.301270	39.489463
27	-120.300710	39.489635
28	-120.300217	39.489838
29	-120.299780	39.490019
30	-120.299696	39.490386
31	-120.299597	39.490771







Sagehen Creek Survey Points		
Station	Longitude	Latitude
1	-120.236978	39.431539
2	-120.236468	39.431628
3	-120.236011	39.431897
4	-120.235624	39.432168
5	-120.235305	39.432458
8	-120.234796	39.433483
9	-120.234544	39.433840
10	-120.234030	39.434013
11	-120.233569	39.434205
12	-120.233267	39.434460
13	-120.233077	39.434795
14	-120.232756	39.435133
15	-120.232596	39.435492
16	-120.232307	39.435795
17	-120.232025	39.436122
18	-120.231707	39.436407
19	-120.231282	39.436653
20	-120.230858	39.436875
21	-120.230319	39.437107
22	-120.229829	39.437256
23	-120.229139	39.437215
24	-120.228614	39.437453
25	-120.228176	39.437651
26	-120.227728	39.437915
27	-120.227229	39.438094
28	-120.226752	39.438291
29	-120.226314	39.438483
30	-120.225858	39.438746
31	-120.225450	39.438963
32	-120.225018	39.439191
33	-120.224617	39.439414
34	-120.224139	39.439658
35	-120.223724	39.439845
36	-120.223183	39.440124
37	-120.222766	39.440370

38	-120.222288	39.440591
39	-120.221704	39.440601
40	-120.221202	39.440452
41	-120.220619	39.440629
42	-120.220157	39.440833
43	-120.219554	39.440931
44	-120.219106	39.440992
45	-120.218571	39.441104
46	-120.218046	39.441175
47	-120.217580	39.441283
48	-120.217057	39.441503
49	-120.216499	39.441418
50	-120.215906	39.441446
51	-120.214874	39.441314
53	-120.214192	39.440684
54	-120.213844	39.440348
55	-120.213451	39.439993
56	-120.213163	39.439694
57	-120.212869	39.439371
58	-120.212560	39.439024
59	-120.212163	39.438764
60	-120.211745	39.438444
61	-120.211365	39.438161
62	-120.210992	39.437866
63	-120.210431	39.437674
64	-120.209622	39.437148
65	-120.209235	39.436847
66	-120.208797	39.436645
67	-120.208323	39.436402
68	-120.207895	39.436153
69	-120.207459	39.435910
70	-120.207118	39.435586
71	-120.206682	39.435349
72	-120.206325	39.435054
73	-120.205992	39.434737
74	-120.205724	39.434331