OSU-Cascades HERS Lab

Human and Ecosystem Resiliency and Sustainability Lab

In Cooperation With:

National Park Service

Upper Columbia Basin Network

Monitoring American Pika in Protected Lava Landscapes

2019 Project Background and Results

American pika at Lava Beds National Monument, California. (OSU-Cascades HERS Lab, D. Popp, 2019)

Abstract

Occupancy surveys for American pika were conducted at Crater Lake National Park (CRLA), Craters of the Moon National Monument (CRMO), Lava Beds National Monument (LABE) and Newberry National Volcanic Monument (NEWB) in 2019 as part of a five-year monitoring agreement between NPS and Oregon State University-Cascades. Lassen Volcanic National Park (LAVO), continued long-term pika monitoring as well. Pika were present in all parks.

Fresh pika sign was detected in 71% of plots at CRLA, 15% at CRMO, 36% at LABE, 36% at LAVO and 30% at NEWB. Occupancy rates all fall within the range reported from surveys conducted during 2010-2014.

Background

The American pika (*Ochotona princeps*) is a charismatic species often characterized as a sensitive indicator for species response to climate-change. Some evidence suggests localized extirpations and range contractions for the species have occurred in portions of its range, particularly in the Great Basin (Beever et al. 2010, Beever et al. 2016, Wilkening et al. 2011).

In response to concerns about range-wide population persistence, the Upper Columbia Basin Inventory and Monitoring Network (UCBN) and three parks in the Klamath Inventory and Monitoring Network (KLMN) initiated long term monitoring of American pika in 2010. Monitoring was conducted using a shared protocol (Jeffress et al., 2011) over a five-year period at Craters of the Moon National Monument and Preserve (CRMO), Lava Beds National Monument (LABE), Lassen Volcanic National Park (LAVO) and Crater Lake National Park (CRLA).

Results from the five-year monitoring program (2010-2014) identified factors (e.g., temperature, precipitation, habitat connectivity, topography, etc.) that shape contemporary pika distributions; assessed gene flow and genetic connectivity of pika populations; and evaluated climate change vulnerability of pika populations in each park. At the conclusion of the project, additional five-year monitoring periods were recommended for clearly identifying patterns of habitat occupancy and turnover in these habitats (Rodhouse and Hovland 2015).

This report summarizes the third year of a second five-year monitoring period for American pika at four national park units (CRLA, CRMO, LABE and LAVO) and one national monument administered by the U.S. Forest Service (Newberry National Volcanic Monument [NEWB] in Oregon). The addition of the NEWB low-elevation lava flow study area adds substantially to the ecological context and breadth of this second five-year phase.

The five survey areas covered in this report contain unique ecosystem types worthy of conservation attention (Crist et al. 2005, Piekielek and Hansen 2012). Lava landscapes (CRMO, LABE, NEWB) and talus slopes (CRLA, LAVO) occupied by American pika contain unique microhabitats (subsurface cold-air refugia) that are functionally "decoupled" from changing meso and macro-climate conditions (Varner and Dearing 2014, Shinderman 2015, Ray et al. 2016, Rodhouse et al., 2017). As a result, these areas may be very important for species adaptation to climate change (across multiple taxa), particularly within the interior Pacific Northwest and portions of the Great Basin (Millar et al. 2015).

American pika at Mokst Butte lava flow on Newberry Volcano in Oregon. (OSU-Cascades HERS Lab, D. Popp, 2017)

2019 Pika Surveys

Pika occupancy surveys were conducted in plot locations established during previous surveys (Jeffress et al., 2011). Plots were selected using a spatially-balanced sampling design (Generalized Random Tessellation Stratified or "GRTS"). NEWB plots used the same GRTS order generated for 2011-2012 pika studies (Shinderman 2015) but were renumbered in 2017 for clarity.

Sampling frames varied between NEWB and the four NPS parks based primarily on access and safety issues. Sampling frames in CRLA, CRMO, LABE and LAVO were restricted to habitat areas within 1km of roads or trails. At NEWB, habitat areas within 400 meters of the lava edge were included in the sampling frame due to limited access and hazardous terrain. Pre-surveys of the lava interior at NEWB in 2011 also indicated very low probability of detecting pika beyond 400 meters from the lava edge due to lack of forage.

NEWB and CRMO plot lists: The NEWB plot list at Lava Butte flow was modified in 2019 – ten plots with no vegetation as ranked by ground observers were dropped from the survey. This modification was made to improve synchrony between the GRTS draw for Lava Butte and habitat with equal probability of occupancy. The next ten plots in GRTS order were added to the survey.

In the original 2010-2014 surveys, plots at CRMO were selected from four sample frames based on lava type and average park elevation (~1600 meters): above a'a, below a'a, above pahoehoe and below pahoehoe (Jeffress et al., 2011). No pika scat had been found in the "below a'a" sample frame during seven years of surveys, so that sample frame was dropped in 2019 after consultation with Dr. Rodhouse. All eighty above/below pahoehoe plots and 20 above a'a plots (in GRTS order) were included in the 2019 surveys.

Field surveys: Site occupancy was determined directly when pikas were visually or aurally encountered within plots, and also indirectly when haypiles or pika scat were encountered (Jeffress et al. 2011). Additional survey instruction details in Jeffress et al., (2011) provided for data collection consistency across parks and field crews.

Surveys were conducted between July and October 2019. Field crews navigated with GPS units and georeferenced pdf maps (using the Avenza app on smart phones) to pre-established plot centers and set up 12-m radius circular search areas. Crew members used flashlights (recommended minimum brightness: 1000 lumens) to search under every rock >0.5m in diameter or large crevices for pika sign (haypiles, scat). Surveys took between ten and 30 minutes, occasionally longer, depending on habitat and pika sign present. Pika calls and sightings inside and outside of the plot were also noted.

Ocular estimates of percent cover in plot were recorded for rock, bare ground (including dirt, mineral soil and litter), forb, grass, shrubs and trees. Percent estimates were then converted into modified Daubenmire (1959) cover classes, either in the field (LAVO) or during data entry.

Approximately 100 initial plot surveys and 30 resurveys were conducted in each park (Table 1). Old sign (old pika scat and haypiles), fresh sign (fresh pika scat and haypiles) and pika calls or sightings were recorded for each plot.

Data from the survey datasheets and associated plot notes were stored in the UCBN American pika database at the end of the field season.

Results

Overview: A total of 496 initial surveys and 149 resurveys (645 surveys total) were completed in the five study areas. One hundred surveys and 29 resurveys were completed at CRLA; 96 surveys and 30 resurveys were completed at CRMO; 99 and 30 at LABE; 100 and 30 at LAVO; and 101 and 30 at NEWB, respectively (Table 1, Figures 1-5).

Pika and pika sign were detected in all park units in 2019. The proportion of plots with fresh pika sign (occupancy rates) fell within or near the range reported from surveys conducted during 2010-2014 (Table 2). CRLA's 71% occupancy was equal to the highest occupancy rate reported during the 2010-2014 monitoring period. NEWB had its highest occupancy rate out of the four years during which surveys were conducted at 30%.

Surveys: Fresh pika sign was detected during the initial surveys in 65% of plots at CRLA, 15% in CRMO, 33% in LABE, 32% in LAVO and 26% in NEWB.

Sign of previous pika activity (old scat or haypile) was detected in 12% of plots at CRLA, 21% at CRMO, 36% at LABE, 27% at LAVO and 48% at NEWB.

Resurveys: Fresh pika sign was detected in 62% of resurvey plots at CRLA, 10% at CRMO, 43% at LABE, 37% at LAVO and 30% at NEWB.

Old pika sign was detected at 10% of resurvey plots at CRLA, 37% at CRMO, 33% at LABE, 30% at LAVO and 53% at NEWB.

Pikas Observed: Pikas were heard or seen in 19 plots at CRLA (17 on surveys and two on resurveys) and three at NEWB (two on surveys and one on resurvey). No pikas were seen or heard within plots at CRMO, LABE and LAVO.

Highest Ranked Sign: Results from surveys and resurveys were combined and the highest ranked sign was selected for each plot in order to compare percent occupancy with previous years (Table 2). Using this measure of occupancy, fresh pika sign was detected in 71% of plots at CRLA, 15% at CRMO, 36% at LABE, 36% at LAVO and 30% at NEWB.

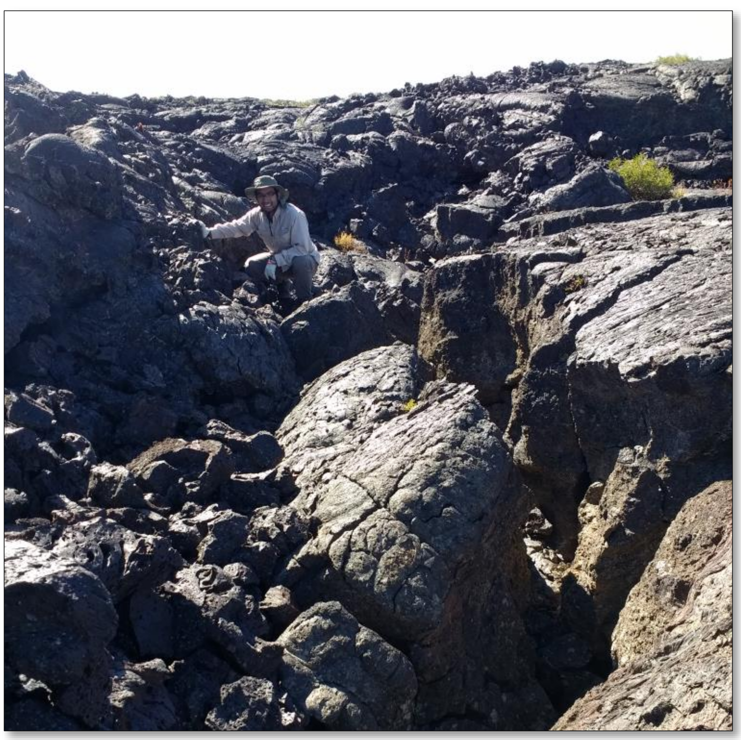
Sign of previous pika activity (old sign) was detected in 8% of CRLA plots, 24% of CRMO, 40% of LABE, 28% in LAVO and 48% in NEWB (Table 1). The highest ranked sign per plot is shown in Figures 1-5.

HERS Lab pika crewmember T. Phillippi setting up a plot at Crater Lake National Park, Oregon. (D. Popp, 2019)

Table 1. Summary results of the 2019 pika occupancy surveys at CRLA, CRMO, LABE, LAVO and NEWB.

Survey	No Sign	Old Sign	Fresh Sign	(Heard/Seen, Included in FreshSign)	Proportion of Sites with Fresh Sign (Occupied)	Total Plots
CRLA	23	12	65	(17)	.65	100
CRMO	62	20	14	(0)	.15	96
LABE	31	36	33	(0)	.33	100
LAVO	40	27	32	(0)	.32	99
NEWB	27	48	26	(2)	.26	101
Resurvey						
CRLA	8	3	18	(2)	.62	29
CRMO	16	11	3	(0)	.10	30
LABE	7	10	13	(0)	.43	30
LAVO	10	9	11	(0)	.37	30
NEWB	5	16	9	(1)	.30	30
Highest Ranked*						
CRLA	21	8	71	(19)	.71	100
CRMO	59	23	14	(0)	.15	96
LABE	24	40	36	(0)	.36	100
LAVO	35	28	36	(0)	.36	99
NEWB	23	48	30	(3)	.30	101

*Highest ranked pika sign of survey and resurvey.



CRMO crew member E. Valeriano during the pika survey at Craters of the Moon National Monument, Idaho. (D. Popp, 2019)

Table 2. Summary of pika survey activity in CRLA, CRMO, LABE, LAVO and NEWB, 2010-2014[1] and 2017-2019.

Total Number of Sites Surveyed

Park	2010	2011	2012	2013	2014	2017	2018[2]	2019
CRLA	85	107	145	100	100	-	95	100
CRMO	56	135	146	103	103	103	99	96
LABE	101	102	100	100	100	98	99	100
LAVO	76	112	75	103	103	101	100	99
NEWB	-	96	76	-	-	100	100	101

Total Number of Sites Resurveyed

Park	2010	2011	2012	2013	2014	2017	2018[2]	2019
CRLA	50	30	30	41	30	-	29	29
CRMO	50	35	30	20	29	29	30	30
LABE	50	-	30	14	50	27	31	30
LAVO	41	30	-	21	20	27	30	30
NEWB	-	-	-	-	-	30	30	30

Proportion of Sites with Fresh Pika Sign[3]

Park	2010	2011	2012	2013	2014	2017	2018[2]	2019
CRLA	.65	.63	.54	.60	.71	-	.58	.71
CRMO	.21	.07	.16	.08	.21	.09	.08	.15
LABE	.24	.29	.40	.45	.61	.22	.35	.36
LAVO	.14	.42	.21	.43	.43	.25	.33	.36
NEWB	-	.21[4]	.18[4]	-	-	.28	.20	.30

[1]From Rodhouse and Hovland (2015) and Shinderman (2015).

[2]Using reclassed fresh sign rankings.

[3]Using highest ranked sign of surveys and resurveys.

[4]Survey data only.

LABE crew member E. Sutphin surveying for pikas at Lava Beds National Monument, California. (D. Popp, 2019)

Figure 1. Distribution and type of pika sign found at Craters Lake National Park in 2019.

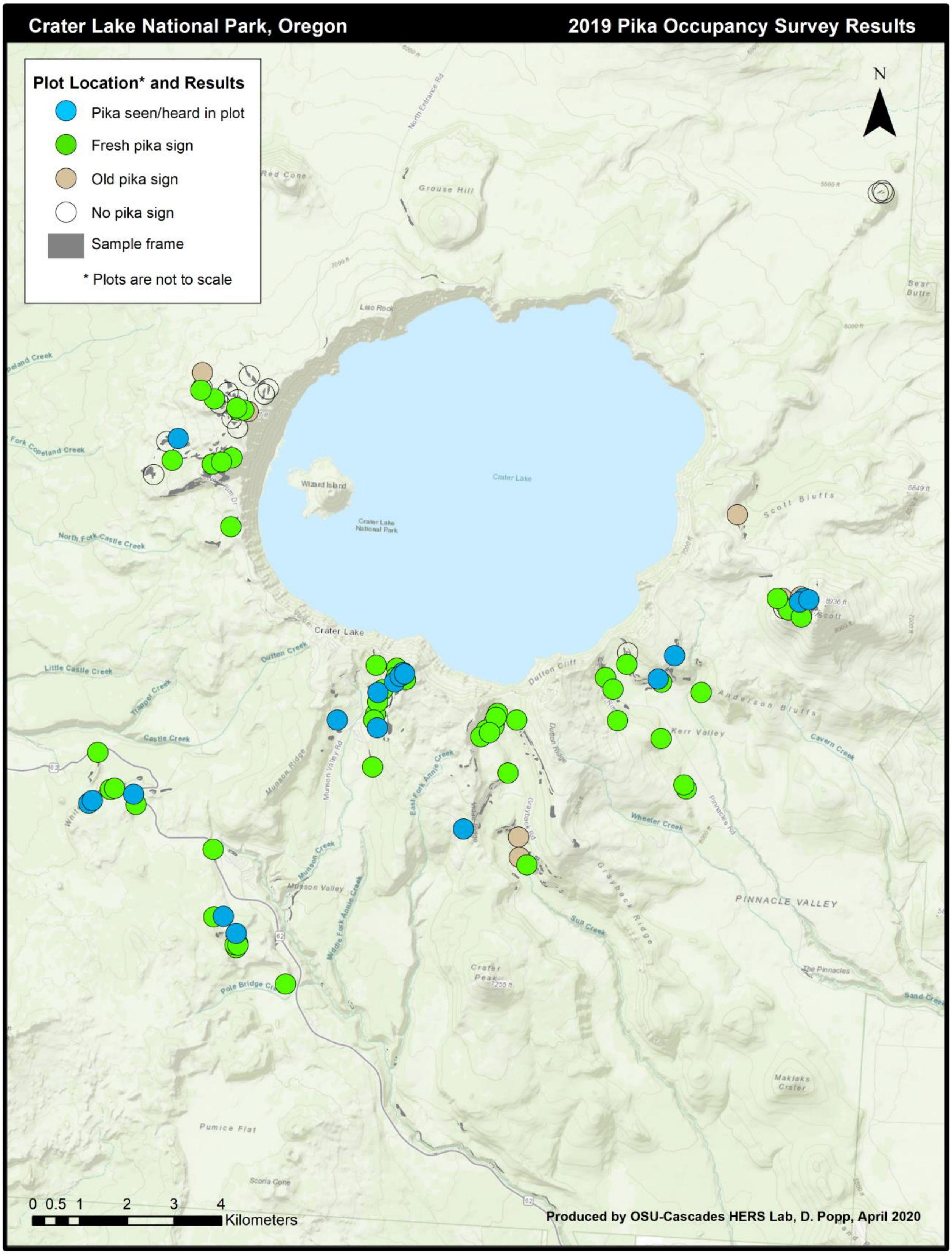


Figure 2. Distribution and type of pika sign found at Craters of the Moon National Monument & Preserve in 2019.

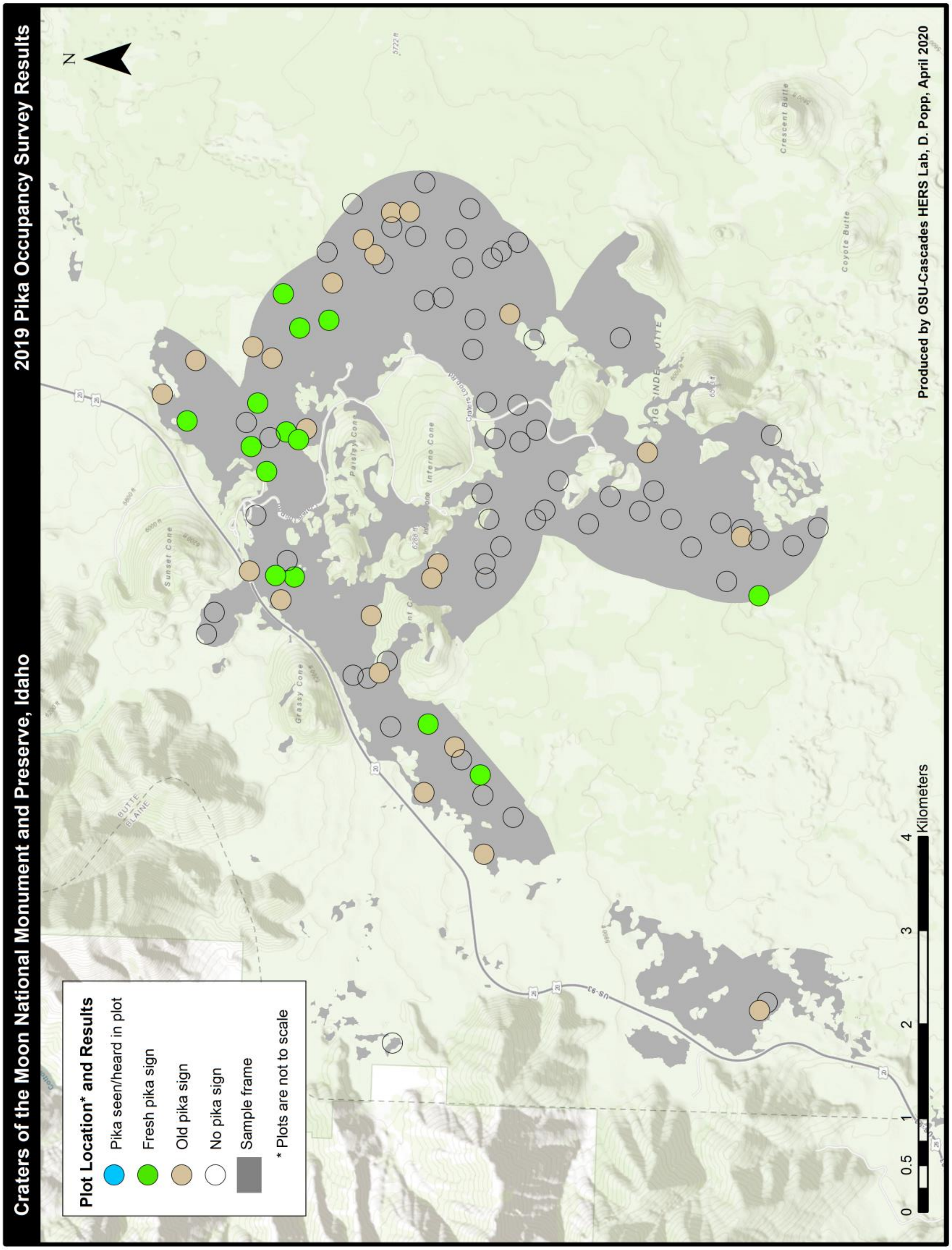


Figure 3. Distribution and type of pika sign found at Lava Beds National Monument in 2019.

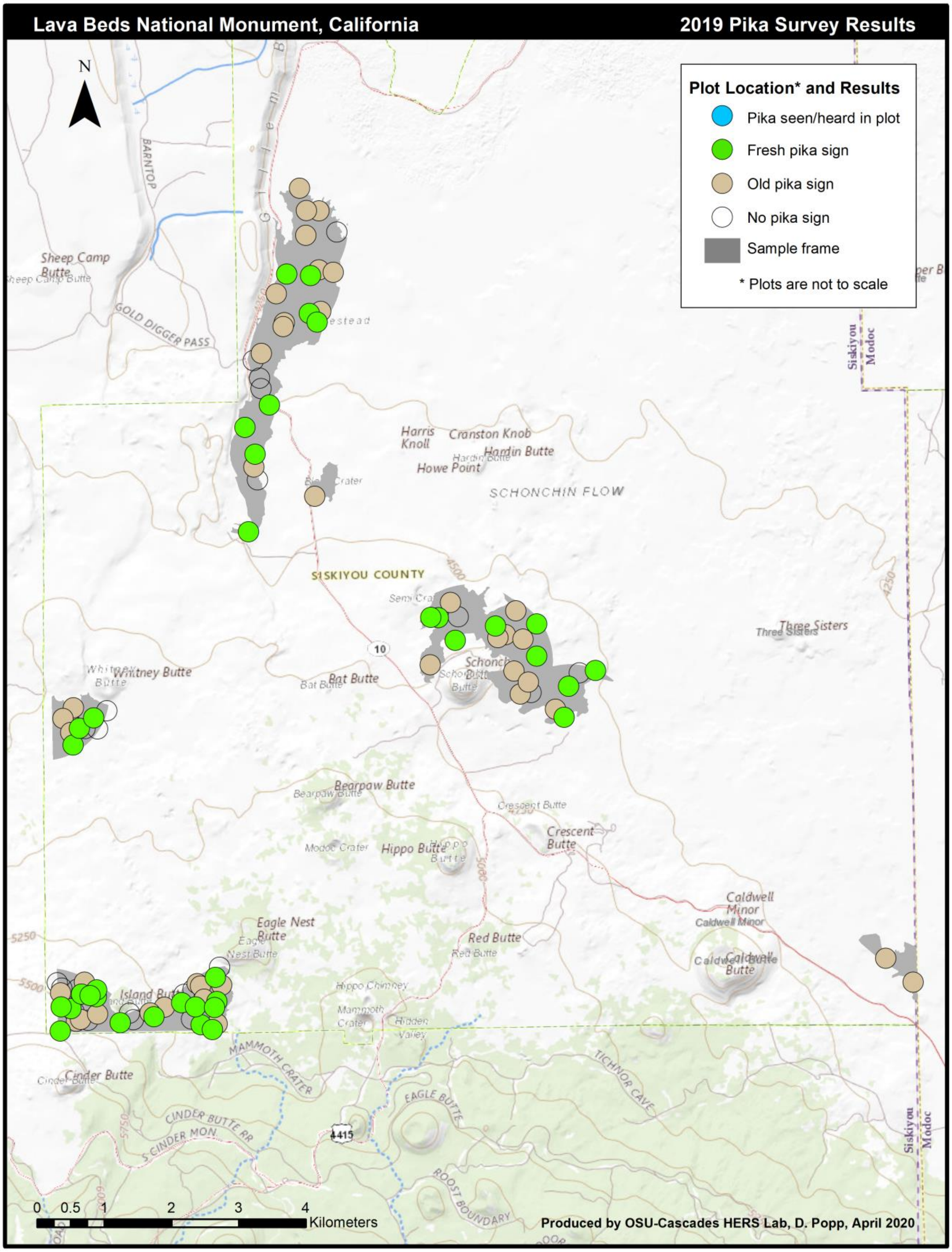


Figure 4. Distribution and type of pika sign found at Lassen Volcanic National Park in 2019.

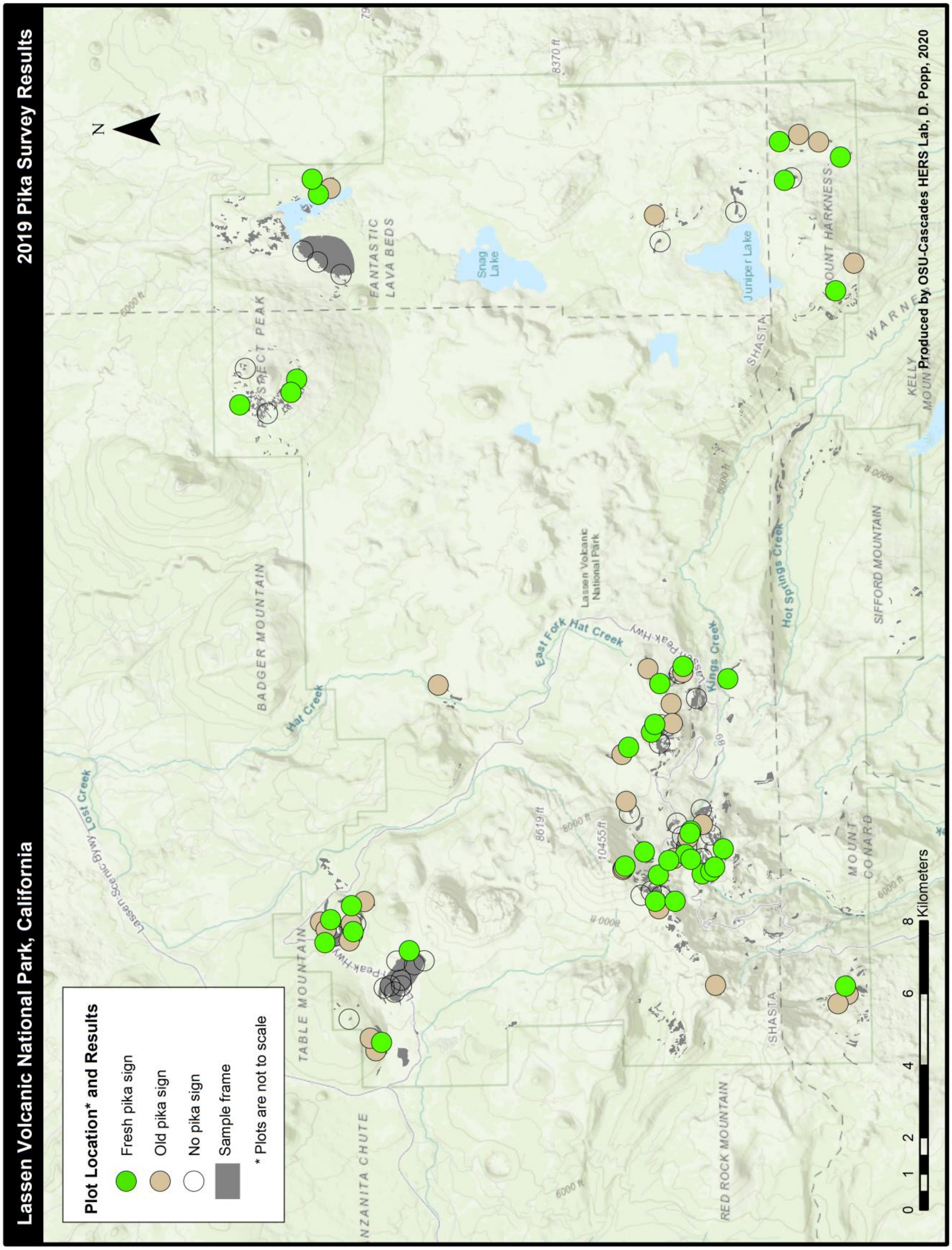
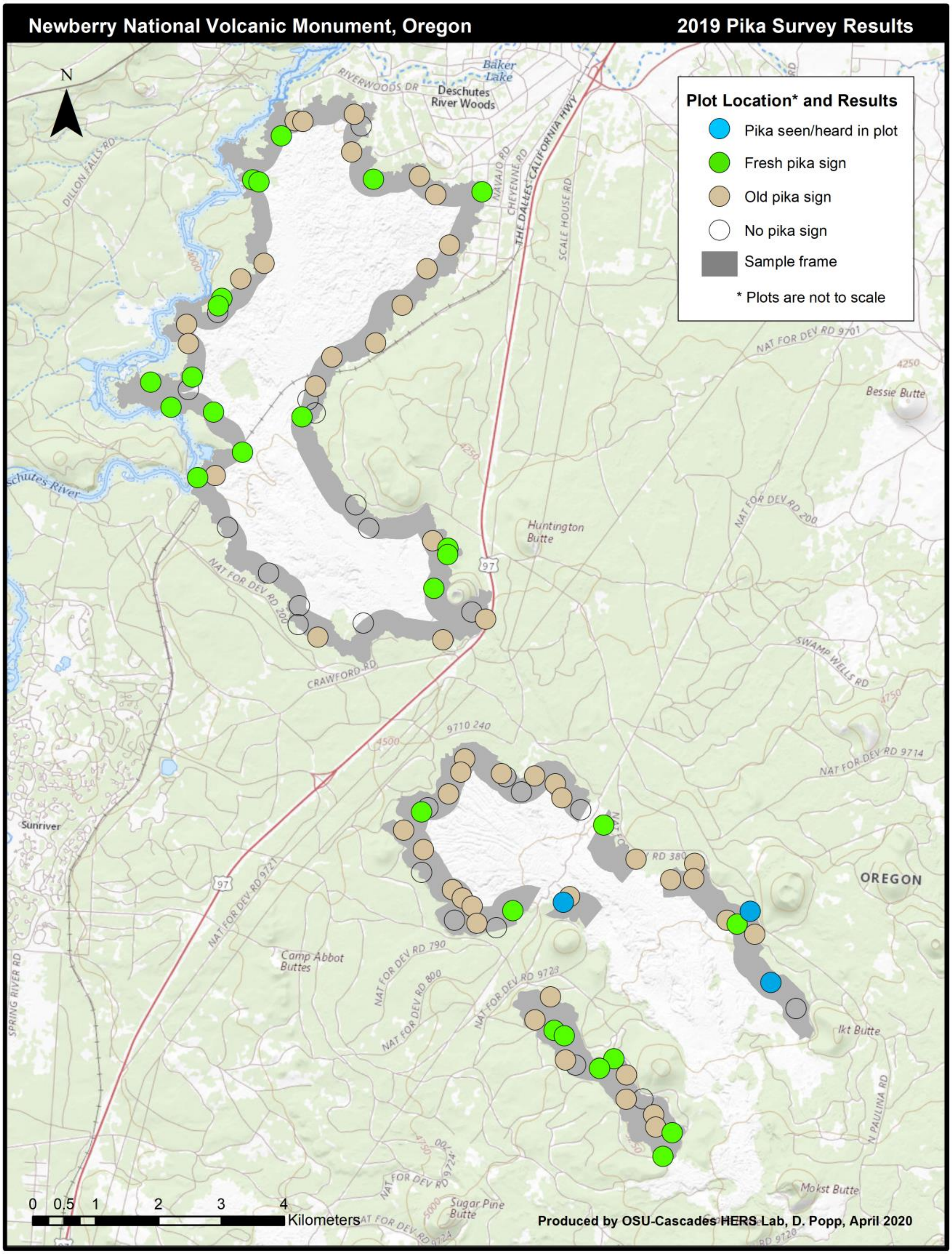


Figure 5. Distribution and type of pika sign found at Newberry National Volcanic Monument in 2019.



Summary and Discussion

Pika occupancy patterns in all five parks continue to vary annually. Trend estimates (based on simple regression) for all parks but CRMO indicate a slight increase in the proportion of occupied sites (Figure 6), and 2019 values were above the park mean for all years at CRLA (.63), CRMO (.12), LAVO (.34) and NEWB (.23). The proportion of occupied sites at LABE, though below the eight-year mean (.38), was within one standard deviation (.12).

Higher than average occupancy reported for CRMO and NEWB in 2019 may be the result of modifications within sampling frames, wherein sites categorized as very poor or non-habitat for pikas were dropped and replaced with new sites following GRTS order. In both cases, replacement should improve the degree to which survey sites fall within habitat with a non-zero probability of being occupied. The proportion of occupied sites tends to be very low at CRMO and only marginally higher at NEWB, which can result in occupancy estimates that under-represent true occupancy within both units.

The apparent declining trend for occupancy at CRMO (Figure 6) is worth noting, and it will be interesting to see if that trend holds after the final two years of data collection are included in forthcoming hierarchical analyses. Mean occupancy (.11) for the most recent three years (2017-2019) is lower than the mean for the 2010-2014 survey period (.15), though all values fall within the previously reported range. If that trend continues through the end of the second monitoring period more focused survey work may be warranted.

Site turnover rates within parks continues to vary year to year, and was greater than 20% for both LABE and LAVO between 2018 and 2019 (Table 3). These values are consistent with turnover reports for the species from other locations and with the range of values reported for these parks during the previous monitoring period (2010-2014).

With the exception of CRLA, the majority (≥90%) of fresh sign recorded is based on indirect sign classification for pika occupancy status at CRMO, LABE, LAVO and NEWB. At CRMO, LABE and NEWB, very few pika are directly observed within established plot locations, though pika are encountered while traveling between plots and during reconnaissance surveys in other areas of each park. Though detection probability has been reported as very high in previous work, detection probability estimates rely heavily on the assumption that indirect sign is an accurate proxy for site occupancy.

As noted in previous reports and recent literature (e.g. Smith et al. 2016, Camp et al. 2020), pika sign varies considerably between parks. Scat color and degree of mounding/sticking is relatively park-specific, such that protocol guidance for scat classification works better in some parks (e.g. CRLA) than others (e.g. CRMO). Pilot studies using camera traps and anecdotal direct observation at NEWB indicate that some sites containing sign classified as “old” are actually occupied, as are sites where no indirect sign was detected. Additionally, haypiles are very infrequently encountered at CRMO, LABE and NEWB. Work to be conducted at NEWB in 2020 should help to elucidate the degree to which both false positive and false negative errors should be accounted for in future occupancy estimates.

Continued field surveys are scheduled through 2022, affording an opportunity to compare occupancy data over another five-year monitoring period. With this long-term data set, collaborators hope to further illuminate occupancy trends and test assumptions about pika habitat usage and patterns of persistence.

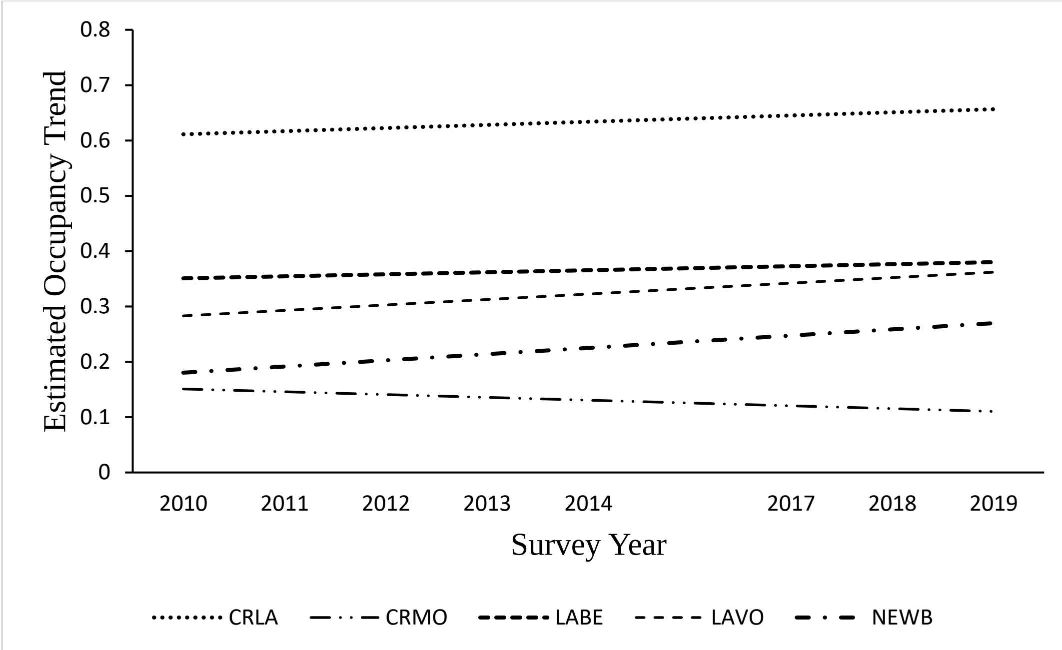


Figure 6. Pika occupancy trends (generated via simple regression) for CRLA, CRMO, LABE, LAVO and NEWB over two monitoring periods (2010-2014 and 2017-2019).

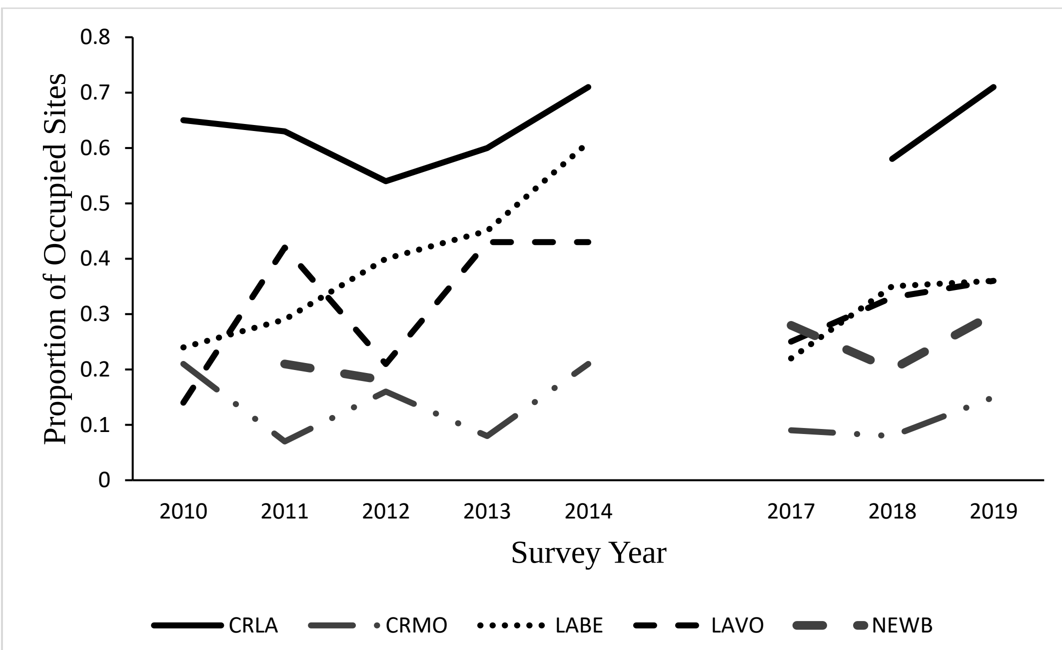


Figure 7. Yearly pika occupancy (proportion of occupied sites) status for CRLA, CRMO, LABE, LAVO and NEWB over two sampling periods (2010-2014 and 2017-2019).

Table 3. Summary of pika occupancy and site turnover (from 2018) for CRLA, CRMO, LABE, LAVO and NEWB in 2019. Site colonization and extinction data include the number and relative proportion of survey sites that changed occupancy status from 2018 to 2019.

Park	Ψ	SE	Site Colonization	Site Extinction	Site Turnover
CRLA	.71	.045	14 (.16)	2 (.02)	18%
CRMO	.15	.036	3 (.06)	2 (.04)	9%
LABE	.36	.048	12 (.12)	11 (.11)	23%
LAVO	.32	.046	14 (.14)	11 (.11)	25%
NEWB	.30	.045	13 (.14)	5 (.05)	19%

*Ψ= proportion of occupied sites

American pika eating rabbitbrush at Lava Beds National Monument, California. (OSU-Cascades HERS Lab, D. Popp, 2019)

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American pika and wildflowers at Crater Lake National Park in Oregon. (OSU-Cascades HERS lab, D. Popp, 2019)

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