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Ash Bathing by Western Gray Squirrels and Wild Turkeys in an Oak Forest of California

Ryan Meadows, Francesca Rubino[1], Kailyn Lozano, Austin Roy, and Janet Foley

Department of Medicine and Epidemiology, School of Veterinary Medicine, University of California, Davis, One Shields Avenue, Davis, California 95616
[1]Corresponding author, e-mail: firubino@ucdavis.edu

***Abstract.*—Dust bathing, including in ash, is a common behavior thought to help animals remove ectoparasites like ticks that transmit harmful pathogens. The acaricidal efficacy of bathing in ash depends on the innate properties of ash and willingness of animals to use it. California is ideal for studying this phenomenon given widespread tick infestations on many wildlife species as well as frequent wildfires and controlled burns producing wood ash. We investigated the ash bathing preferences of California wildlife in a predominantly Blue Oak (*Quercus douglasii*) Forest for three common local tree species: Coast Redwood (*Sequoia sempervirens*), California Bay Laurel (*Umbellularia californica*), and Tasmanian Blue Gum Eucalyptus (*Eucalyptus globulus*), which have been evaluated previously for their effects on local tick species. Remote cameras recorded 1,674 independent wildlife visits to piles of ash placed *in situ* over 5 mo. Among the 45 detected ash bathing events, the primary bathers were Western Gray Squirrels (*Sciurus griseus*), which used all three types of ash, and Wild Turkeys (*Meleagris gallopavo*), which used Coast Redwood and Tasmanian Blue Gum Eucalyptus ash. Dark-Eyed Juncos (*Junco hyemalis*), although frequently observed near all ash types, were only observed bathing once in California Bay Laurel. Our findings suggest that some wildlife tick-hosts actively bathe in ash with known acaricidal properties, but we did not detect a significant preference among ash types. Wildfires and controlled burns could contribute to tick control by providing wildlife with natural acaricides. Prioritizing controlled burning of plant species with acaricidal properties could enhance the potential of wildfire management to contribute to tick-borne disease mitigation.**

Key Words.—behavior; dust bathing; ectoparasite; fire; *Meleagris gallopavo*; *Sciurus griseus*; squirrel; tick-borne disease; turkey.

Introduction

Dust bathing, widely practiced by numerous mammals and birds, is thought to aid in ectoparasite removal, cleaning, thermoregulation, and scent marking (Eisenberg 1963; Branch 1993; Rees 2002; Clayton et al. 2010). Among the many species of wildlife that are known to dust bath, published descriptions of dust bathing in the Western Gray Squirrel (*Sciurus griseus*) are limited, though other squirrel species have been observed using dust baths including the American Red Squirrel (*Tamiasciurus hudsonicus*; Ferron 1976), chipmunks (Sciuridae; Johnston 1998), and several species of ground squirrels (Sciuridae; Steiner 1974; Long and Smith 2023). Wild Turkeys (*Meleagris gallopavo*) also have also been documented dust bathing (Buchholz 1995; Miller 2018). During this process, animals lay down and roll in dust composed of naturally occurring substrates, such as soil, sand, or ash; however, the substrate preferences for dust bathing among wildlife remain largely undocumented, limiting our understanding of how these materials might be used and their potential role in ectoparasite removal.

For domestic animals, ash is specifically provided for dust bathing and used to control ectoparasites (Hakbijl 2002; Banjo et al. 2009; Gabanakgosi et al. 2012; Moyo et al. 2015; Wanzala 2017). Rubino (2024) noted that fine particles of ash may abrade arthropod exoskeletons, block respiratory spiracles, or induce chemical toxicity, ultimately leading to parasite death. The study also experimentally showed that ash from California Bay Laurel (*Umbellularia californica*) and Tasmanian Blue Gum Eucalyptus (*Eucalyptus globulus*) could successfully kill the Western Black-legged Tick (*Ixodes pacificus*), the primary vector of the pathogens that cause Lyme disease (*Borrelia burgdorferi*) and granulocytic anaplasmosis (*Anaplasma phagocytophilum*) in the western U.S. In contrast, ash from Coast Redwood (*Sequoia sempervirens*) was ineffective.

Wildfires and controlled burns are both common in California. These fires can kill ticks outright, reduce habitat for ticks and their hosts, and generate ash that could provide wildlife with a natural acaricide (Gallagher et al. 2022; Brown et al. 2023). Specific ash bathing preferences of wildlife are unknown, however, including whether wildlife seek ash from tree species with higher acaricidal properties. This knowledge could guide prioritization of tree species during controlled burns, highlighting the potential for controlled burns to simultaneously support ecosystem health while aiding in disease control. We aimed to identify patterns in ash bathing among wildlife species and how environmental factors (vegetation composition, canopy cover) influence these patterns. We expected that wildlife, when provided these same three types of ash, would exhibit preferences for more acaricidal ashes, particularly those produced from California Bay Laurel and Tasmanian Blue Gum Eucalyptus over those produced from Coast Redwood.

Methods

Study site.—We conducted our study at the Quail Ridge Reserve in Napa County, California (38°49′04″N, 122°14′28″W). The reserve supports roughly 18 mammal, 130 bird, and 20 reptile and amphibian species (UC Davis

Natural Reserve System. 2004. Natural History of Quail Ridge. Available from https://naturalreserves.ucdavis.edu/quail-ridge-reserve/natural-history-of-quail-ridge [Accessed 20 January 2025]). The mean temperature in 2024 was 15.6° C, with summer highs frequently exceeding 32.2° C (112 d), and annual precipitation totaling 839 mm (www.ncdc.noaa.gov). We selected four study sites in Decker Canyon (Fig. 1), a dominantly Blue Oak woodland within the most mesophytic habitat of the reserve, influenced by its proximity to a marina and low elevation (UC Davis Natural Reserve System. 2004. *op. cit.*). Scattered California Bay Laurel is found in the Canyon, whereas Tasmanian Blue Gum Eucalyptus and Coast Redwood are absent, no Eucalyptus or Coast Redwood forests occur nearby.

Ash production.—We produced ash off-site in a cleared 100 m^2 area of bare earth using a kiln made from stacked concrete and bricks. We rinsed the kiln between burns to reduce residues from previously burned vegetation. We obtained wood used to produce ash from fallen branches of California Bay Laurel, Tasmanian Blue Gum Eucalyptus, and Coast Redwood within Alameda, Yolo, and Sonoma counties. After burning, we crushed the ash into powder with a rubber mallet to ensure consistency in textural properties.

Experimental design.—Within Decker Canyon, we non-randomly selected four sampling sites (A-D) consisting of 10-m diameter plots containing at least three oak trees for mounting cameras spaced a minimum of 3 m apart and at least three 1 m^2 areas of clear ground. At each site, we used these clear areas to establish ash piles (one for each ash type), so that all three ash types were simultaneously represented at each site. Each site was at least 100 m from the others. We deployed three camera (Hyperfire 2; Reconyx, Holmen, Wisconsin, USA) traps per site 20 June 2024 at Sites A, B, and C, and 2 July 2024 at site D. The cameras were installed on oak trees at least 3 m apart (Fig. 2) to minimize the likelihood of capturing the same animal ash bathing in one ash pile in the adjacent camera. We mounted cameras approximately 0.5 m off the ground using wire and mounting straps on the north side of trees to prevent glare from the rising and setting sun. We angled each camera downward 70° to aim at a single ash pile approximately 2 m from the camera. Ash piles consisted of 470 mL of finely ground ash spread in an approximate diameter of 0.6 m and a height of < 1 cm. We replaced the ash every 12 to 28 d (mean = 17 d), rotating the ash type in front of each camera every 4 weeks by sweeping away old ash residues before depositing a different ash type.

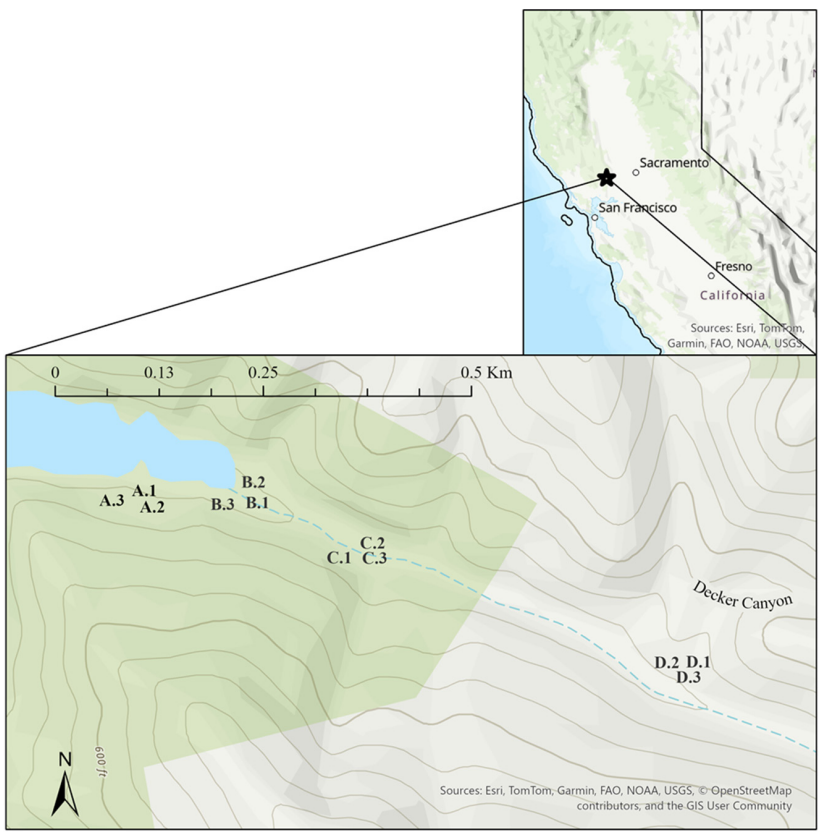

Figure 1. Locations of sites A, B, C, D at Quail Ridge Reserve, California, where camera trapping surveys of wildlife activity were conducted June-October 2024. The grouped letters (e.g. A.1, A.2, A.3) give the locations of mounted cameras. Star in inset map shows reserve location within California.

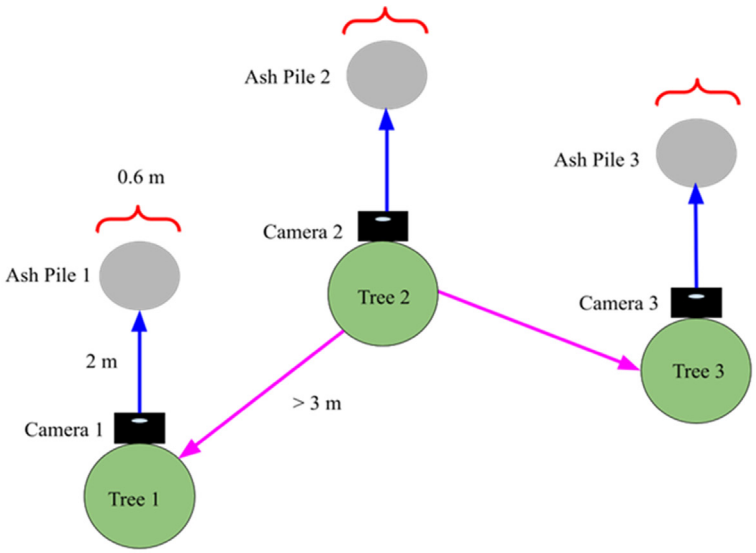

Figure 2. Representative layout of camera-traps deployed at sites A, B, C, and D, at Quail Ridge Reserve, California, for detection of wildlife behaviors at ash piles from June-October 2024.

Trapping methods.—After being deployed in June and July, cameras remained active until 20 October 2024 ahead of rain, which typically starts in the fall in the area we studied (https://www.wunderground.com/history/monthly/us/ca/sacramento/KSMF/date/2024-10). We programmed each camera to take motion-activated pictures instead of video footage due to memory constraints, with detection sensitivity set to high to record animal movement. Each camera took five photographs when triggered, with no delay between triggers. To avoid overexposed photos, we placed green masking tape over half of the LED lights on each camera. Additionally, we trimmed back vegetation within the visual range of each camera to minimize false camera triggers. Minimal trimming was required because our sites had relatively sparse understory vegetation.

Vegetation assessment.—On 19 March 2025, we collected vegetation data at each camera site. We assessed tree density by identifying to species and counting all trees with a diameter > 7.62 cm (3 in) that were within 2 m of each camera trap. We quantified canopy cover from digital photographs taken facing upward 1 m above each ash pile and analyzed using ImageJ software (Schneider et al. 2012). In ImageJ, photographs were first converted to grayscale, then a brightness threshold was applied to distinguish canopy pixels from sky pixels. We calculated the proportion of pixels classified as canopy relative to the total pixels in the image to determine percentage canopy cover (Goodenough and Goodenough 2012). We further recorded key habitat features such as hip level vegetation density, leaf litter abundance, and proximity to roads and water.

Statistical analyses.—For each camera image, we recorded location, date and time, and animal species and behavior including: (1) animals bathing in the ash; (2) animals otherwise interacting with the ash; or (3) moving near the camera without interacting with the ash. We defined ash bathing as rolling, lying prone, or feather-fluffing in the ash (Eisenberg 1963; Joubert 1972; Van Liere and Bokma 1987). Non-bathing behaviors were categorized as: (1) walking on (visible leg movement across consecutive frames); (2) standing on; (3) sitting on; (4) foraging on; or (5) no ash interaction.

We considered visits occurring > 15 min apart from other visits to be independent (Rendall et al. 2014). We excluded prey animals that were brought to ash sites by their predators, such as a Bobcat (*Lynx rufus*) carrying a living California Vole (*Microtus californicus*) onto an ash pile. If multiple species appeared in a single image, we recorded the presence of each species as a distinct visit. In the 146 visits in which species differentiation was not possible, we classified animals as precisely as possible to genus, family, or order.

We calculated odds ratios (ORs) and 95% confidence intervals and used a two-tailed Fisher's Exact Test to determine whether animals showed a bathing preference for each ash type. To account for multiple comparisons, we adjusted P values using the Benjamini-Hochberg correction, considering $P \leq 0.05$ as the threshold for significance. In addition to ash type, we examined whether ash bathing preferences varied by site using a two-tailed Fisher's Exact Test. We also assessed whether ash-bathing behavior changed over time since ash deployment by fitting Logistic Regression models with time since deployment as a predictor and including an interaction with species to account for potential species-specific differences in temporal response. We used R version 4.3.2 (R Core Team, 2024) for all statistical analyses.

Results

Wildlife visits.—There were 1,674 wildlife visits across 1,437 camera days (Appendix Table 1). Among the 27 species we identified, the most common visitors were Dark-eyed Juncos (*Junco hyemalis*), which we found at all four sites (386 visits, 23.1% of all animal visits; Appendix Table 2), Western Gray Squirrels (334 visits, 20.0% of all animal visits), and Wild Turkeys (325 visits, 19.4% of all animal visits). These three species together accounted for 62.4% of all site visits by animals.

Ash bathing.—We observed 45 independent ash bathing events. Western Gray Squirrels bathed in ash 31 times (9.6% of the 334 total Western Gray Squirrel visits), Wild Turkey 10 times (3.1% of the 325 Wild Turkey visits), and there was one event each by a Coyote (*Canis latrans*; 1.6% of the 62 Coyote visits), Striped Skunk (*Mephitis mephitis;* 1.6% of 63 Skunk visits), Dark-eyed Junco (0.3% of 386 Dark-eyed Junco visits), and Mourning Dove (*Zenaida macroura*; 11.1% of 9 Mourning Dove visits).

Of 334 total visits to ash by Western Gray Squirrels, 124 (37.1%) were to California Bay Laurel, 110 were to Coast Redwood (32.9%), and 100 were to Tasmanian Blue Gum Eucalyptus (29.9%). Squirrels were observed bathing in Coast Redwood ash (12, 10.9% of visits to Coast Redwood), Tasmanian Blue Gum Eucalyptus (10, 10.0% of visits to Tasmanian Blue Gum Eucalyptus), and California Bay Laurel (9, 7.3% of visits to California Bay Laurel; Fig. 3). These differences were not significant, however (Table 1), and there was no clear preference for a specific ash type.

Table 1. Pairwise comparisons of ash-bathing preferences among Western Gray Squirrel (*Sciurus griseus*) and Wild Turkey (*Meleagris gallopavo*) visits, with adjusted (Adj.) *P* values using the Hochberg correction for multiple comparisons. None of the comparisons were significant. Plant comparisons for each animal species are CBL = California Bay Laurel (*Umbellularia californica*), TBGE = Tasmanian Blue Gum Eucalyptus (*Eucalyptus globulus*), CR = Coast Redwood (*Sequoia sempervirens*). The abbreviation CI = confidence interval.

Comparison	Odds Ratio (95% CI)	Adj. *P* value
Western Gray Squirrels		
CBL / TBGE	0.71 (0.24–2.02)	0.960
CBL / CR	0.64 (0.23-1.74)	0.960
TBGE / CR	0.91 (0.33–2.42)	1.000
Wild Turkeys		
CBL / TBGE	0.00 (0.00–1.08)	0.110
CBL / CR	0.00 (0.00–1.69)	0.248
TBGE / CR	0.76 (0.15–3.30)	0.755

Of 325 visits to ash by Wild Turkeys, 123 were to Coast Redwood (37.8%), 107 to Tasmanian Blue Gum Eucalyptus (32.9%), 95 to California Bay Laurel (29.2%). They were observed ash bathing in Coast Redwood (6, 4.9% of visits to Coast Redwood) and in Tasmanian Blue Gum Eucalyptus (4, 3.7% of visits to Tasmanian Blue Gum Eucalyptus), but not in California Bay Laurel (Fig. 3). Overall, type of ash was not a significant factor (Table 1).

While all 12 cameras observed at least one instance of ash bathing, there were differences in how *many animals* engaged in ash bathing across sites. There were 517 total visits at Site A, 315 at Site B, 373 at Site C, and 469 at

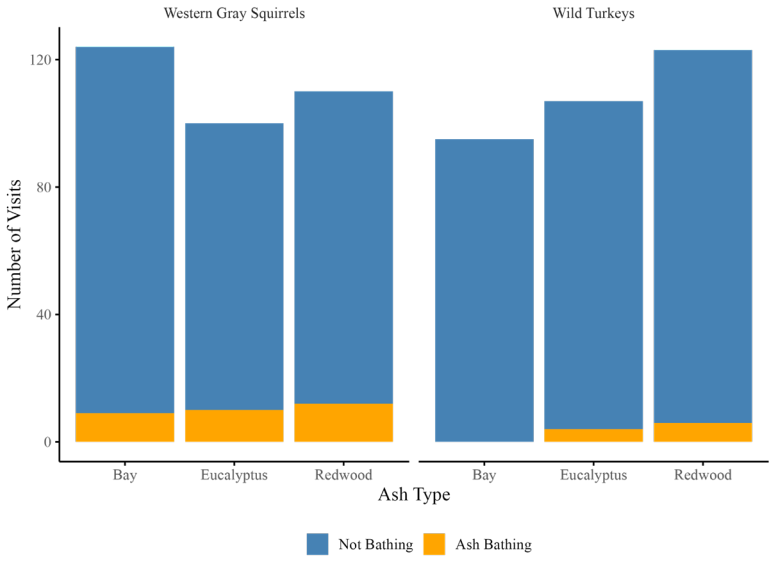

Figure 3. Independent visits by Western Gray Squirrels (*Sciurus griseus*) and Wild Turkeys (*Meleagris gallopavo*) at ash piles of three tree species at Quail Ridge Reserve, California from June-October 2024. Abbreviations are Bay = California Bay Laurel (*Umbellularia californica*), Eucalyptus = Tasmanian Blue Gum Eucalyptus (*Eucalyptus globulus*), and Redwood = Coast Redwood (*Sequoia sempervirens*). No significant difference in visit frequency to ash piles from the different tree species was detected ($P > 0.05$).

Table 2. Site characteristics where camera trapping surveys of wildlife activity were conducted June-October 2024. Tree count reflects number of trees > 7.6 cm (3.0 inches) diameter at breast height within 2 m of the camera.

Camera	Tree Count	Dominant Oak Species	Canopy Coverage	Notes
Site A				
1	4	Live Oak	38.38%	Near marina; low tree density and canopy cover
2	1			
3	1			
Site B				
1	2	Black Oak	60.56%	Site bisected by road; closest to water; relatively dense leaf litter
2	1			
3	1			
Site C				
1	4	Live Oak	63.17%	Dense understory with hip-level vegetation; wild grapes and berry-producing plants present; abundant coarse woody debris; located in floodplain with moist-soil species; high acorn density and squirrel caching activity
2	2			
3	2			
Site D				
1	3	Live Oak	55.32%	Sparse shrub layer; evidence of historical road disturbance; grape vines present
2	5			
3	1			

Site D. Of all ash-bathing events, 42.2% occurred at Site C, 26.7% at Site A, 24.4% at Site D, and 6.7% at Site B. Metrics of habitat quality varied between sites, with Site C featuring the highest tree canopy coverage and highest density of hip-level vegetation (Table 2). Western Gray Squirrels bathed during 13.5% of visits at Site C (13/96), 7.1% at Site D (7/98), 9.2% at Site A (11/119), and never at Site B (0/21). These differences were not significant (P = 0.629 in all comparisons). Wild Turkeys bathed during 7.7% of visits at Site C (6/78), 4.4% at Site D (3/69), 1.0% at Site A (1/97), and never at Site B (0/81). There were no significant preferences of one site over another (Table 3). Visual inspection of the 45 ash-bathing events did not suggest any temporal variation in bathing behavior (Fig. 4). Time since deployment was not a significant predictor of bathing probability for Wild Turkeys and Western Gray Squirrels ($F_{1,657}$ = 0.174, P = 0.679). Including an interaction between time and species to assess species-specific trends also showed no significant effect ($F_{1,655}$ < 0.001, P = 0.993), indicating that temporal trends were similar across both species.

Table 3. Adjusted pairwise Fisher's Exact Test P values comparing Wild Turkey (*Meleagris gallopavo*) ash bathing preferences between sites.

	Site B	Site C	Site D
Site C	0.076	–	–
Site D	0.380	1.000	–
Site A	1.000	0.229	0.926

Discussion

Our study provides the first systematic documentation of ash bathing behavior in free-ranging Western Gray Squirrels and Wild Turkeys and reveals previously undescribed patterns in both the frequency and context of this behavior. Among 23 vertebrate species detected across four study sites, only six were observed engaging in ash bathing, with Western Gray Squirrels and Wild Turkeys accounting for the majority of these events. In fact, Western Gray Squirrels bathed in ash during nearly 10% of their site visits. We did not observe any preferences among Western Gray Squirrels or Wild Turkeys for the three ash types offered. Prior

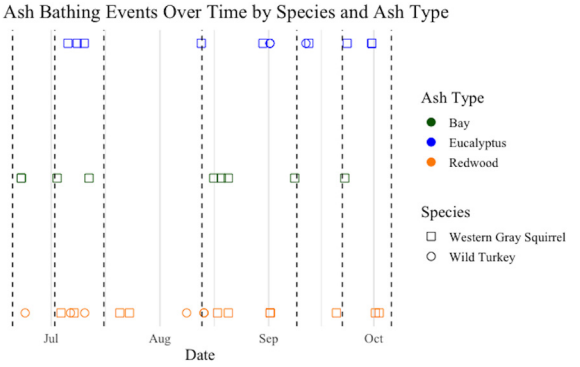

Figure 4. Timing of ash bathing events among dominant ash-bathing species following ash deployment (indicated by dashed vertical lines). Points represent individual bathing events, colored by ash type and shaped by species.

studies have shown that substrate preferences for dust bathing in Wild Turkeys and other Galliformes are variable, though fine, dry, loose particles like sand are often preferred (Olsson and Keeling 2005; de Jong et al. 2007; Wang 2018; Monckton 2020). Most accounts for squirrel species describe the use of dust or sand (Steiner 1974; Long and Smith 2023); however, chipmunks have been reported bathing in fine bark debris from Giant Sequoia (*Sequoiadendron giganteum*; Johnston 1998). All three ash types offered in our study had similar consistency, having been crushed into a powder and dried before deployment.

Both Western Gray Squirrels and Wild Turkeys serve as hosts for the Western Blacklegged Tick, the primary vector of *Borrelia burgdorferi*, the bacterium the causes Lyme disease (Lane et al. 2006; Salkeld et al. 2008), and *Anaplasma phagocytophilum*, the agent of granulocytic anaplasmosis (Rejmanek et al. 2011). Western Gray Squirrels, in particular, are key reservoir hosts for both pathogens (Lane et al. 2005; Salkeld et al. 2008; Nieto and Foley 2008; Foley et al. 2008; Rejmanek et al. 2011). Their demonstrated willingness to bathe in Tasmanian Blue Gum Eucalyptus ash, and in the case of squirrels, also California Bay Laurel ash, shows that these hosts engage in ash bathing with ash types that have known acaricidal effects against the Western Blacklegged Tick (Rubino 2024), though we did not observe a preference for one type of ash over another. In laboratory trials, the majority of adult ticks died within 48 h when exposed to these ash types. The question of whether this behavior effectively reduces tick burdens in wild populations should be addressed in the future.

We did not observe ash bathing in other wildlife hosts present in the study area that serve as primary hosts for tick species, such as Mule Deer (*Odocoileus hemionus*; Castro and Wright 2007). An anecdote about deer (*Odocoileus* sp.) bathing in ash is available (Street Roots. 2020. Native land management could save us from wildfires, experts say. Available from https://www.streetroots.org [Accessed 20 January 2025]), however, and Mule Deer frequently visited our camera sites, where they were observed sniffing the ash. We suspect that the ash piles may have been too small for deer to use for bathing.

Habitat characteristics appeared to influence ash bathing behavior. The highest frequency of ash bathing was observed at Site C, which was situated on a floodplain, with abundant hip-level vegetation and visible squirrel activity zones including caching areas and abundant acorns (pers. obs.). Squirrels sometimes use dust bathing in chemical communication (Steiner 1974; Long and Smith 2023). Although Site C did not have the highest overall squirrel visitation, its high caching and foraging activity may have influenced how squirrels used the site, including the possibility that ash bathing served a communicative function related to territoriality or resource marking. This site also had the highest average canopy cover and densest vegetation of all the sites. While limited research is available on Wild Turkeys, other Galliformes have similarly shown a preference for dust bathing in areas with dense tree cover that offer more concealment from predators (Hein 1970; Wang et al. 2018).

Ash is produced naturally in wildfires and deliberately through controlled burns. These burns may provide an opportunity to integrate tick control by creating ash that is both acaricidal and attractive to wildlife, which can be placed at sites where key hosts are likely to bathe. This approach echoes ethnoveterinary practices in which ash bathing is used to manage ectoparasites in domestic animals (Banjo et al. 2009; Moreki 2013; Wanzala 2017), suggesting that traditional knowledge could inform strategies to enhance acaricidal efficacy in wild populations.

We recognize that our study had several limitations. Although conducted in an oak forest, we did not evaluate wildlife use of oak ash due to safety concerns regarding its carcinogenic potential (Maciejewska et al. 1993), though this remains a relevant future research avenue. Additional work in other forest types, such as Coast Redwood and Douglas Fir (*Pseudotsuga menziesii*), would help determine whether the behaviors observed here can be generalized beyond our study system. Predator scent marking, particularly by coyotes, may have influenced visitation rates and ash bathing behavior by prey species in our study (Mahr and Hoi 2018). Finally, we rotated the ash piles at each site so that every site had every type of ash. This rotation helps account for differences not due to ash type but to location and ensures that observed ash-bathing patterns reflect ash type rather than site-specific effects. Residual ash could, however, have caused cross-contamination. Nevertheless, our findings, paired with existing evidence of ash toxicity to ticks, reveal a promising intersection between wildlife behavior, vector ecology, and fire management. Although no significant preference for ash types was detected, the willingness of key tick hosts to engage in ash bathing nonetheless highlights an important avenue for future research on wildlife-mediated ectoparasite control. Future research should explore whether the strategic use of specific ash-producing vegetation in controlled burns can help suppress tick populations and reduce pathogen transmission in natural systems.

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Ryan Meadows is a Ph.D. student in the Entomology and Nematology program at the University of California, Davis. His research focus is on the use of insects in organic waste management and bioconversion. He earned a B.S. in Entomology from the same institution, where he contributed to research in several labs, studying arthropods in agriculture, ecology, and vector control. (Photographed by Ryan Meadows).

Francesca Rubino is a Disease Ecologist who uses statistical modeling as well as quantitative field and laboratory studies to investigate the ecology and epidemiology of tick-borne diseases. She earned her B.S. in Conservation and Resource Studies and a M.S.P.H. in Global Health and the Environment from the University of California, Berkeley, and her Ph.D. in Epidemiology from the University of California, Davis. Francesca aims to apply her work to integrate public health and ecological conservation efforts to promote healthier ecosystems and communities. (Photographed by Anthony Parker).

Kailyn Lozano is a Ph.D. graduate student in the interdisciplinary Comparative Health Sciences program, administered by the Carlson College of Veterinary Medicine at Oregon State University, Corvallis. Her current research focuses on disease ecology, particularly Crimean-Congo hemorrhagic fever and Foot-and-Mouth disease. Kailyn earned a B.A. in Evolution, Ecology, and Biodiversity, with a minor in Global Disease Biology from the University of California, Davis. While there, she contributed to research in an Infectious Disease Ecology Lab, studying the ecology of tick-borne diseases. (Photographed by Drew Morganstein).

Austin Roy is a Small Mammal Ecologist who studies how wildlife interact with their environment and shape ecosystems and seeks to understand how species management affects these interactions. He earned his B.S. in Wildlife from Humboldt State University in Arcata, California, and his Ph.D. in Ecology and Evolutionary Biology from the University of Texas at El Paso. Austin aims to apply his expertise to the conservation of wildlife and natural resources for the benefit of the public. (Photographed by Austin Roy).

Janet Foley is a Professor and Researcher for the Department of Veterinary Medicine and Epidemiology in the School of Veterinary Medicine at the University of California, Davis. She studies the ecology and epidemiology of infectious diseases in complex communities. Research in her lab aims to understand how community complexity contributes to disease persistence and emergence, and how driving factors are affected by anthropogenic change. (Unknown photographer).

Appendix

Appendix Table 1. Behaviorally categorized independent visits by wildlife species to in front of camera stations at Quail Ridge Reserve in Napa County, California, from June-October 2024. Abbreviations are Bay = California Bay Laurel (*Umbellularia californica*), Eucalyptus = Tasmanian Blue Gum Eucalyptus (*Eucalyptus globulus*), and Redwood = Coast Redwood (*Sequoia sempervirens*).

Behavior Category	Species	Scientific name	Bay	Eucalyptus	Redwood	Total
Bathing in ash	Coyote	*Canis latrans*	1			1
	Dark-eyed Junco	*Junco hyemalis*	1			1
	Mourning Dove	*Zenaida macroura*			1	1
	Striped Skunk	*Mephitis mephitis*		1		1
	Western Gray Squirrel	*Sciurus griseus*	9	10	12	31
	Wild Turkey	*Meleagris gallopavo*		4	6	10
	Bathing Total		11	15	19	45
Foraging on ash	Bobcat	*Lynx rufus*	1		2	3
	Coyote	*Canis latrans*	15	5	5	25
	Dark-eyed Junco	*Junco hyemalis*	9	6	4	19
	Mule Deer	*Odocoileus hemionus*	16	15	15	46
	Gray Fox	*Urocyon cinereoargenteus*	4	3	3	10
	Mourning Dove	*Zenaida macroura*			1	1
	Mouse spp.	*Mus* spp.			1	1
	California Quail	*Callipepla californica*			1	1
	Striped Skunk	*Mephitis mephitis*	5		2	7
	Western Gray Squirrel	*Sciurus griseus*	23	15	16	54
	Wild Turkey	*Meleagris gallopavo*	9	13	10	32
	Unidentified Passerine	—		3	2	5
	Foraging on Ash Total		82	60	62	204
No Ash Interaction	Bobcat	*Lynx rufus*	2	4	4	10
	Canada Goose	*Branta canadensis*	1	1		2
	Coyote	*Canis latrans*	13	5	6	24
	Dark-eyed Junco	*Junco hyemalis*	94	95	99	288
	Mule Deer	*Odocoileus hemionus*	41	43	30	114
	Domestic Dog	*Canis lupus familiaris*		1		1
	Gray Fox	*Urocyon cinereoargenteus*	15	18	9	42
	Frog spp.	—		1	2	3
	Botta Pocket Gopher	*Thomomys bottae*		1		1
	House Finch	*Haemorhous mexicanus*		2	1	3
	Magpie spp.	*Pica* spp.			1	1
	Mountain Lion	*Puma concolor*	1		1	2
	Mourning Dove	*Zenaida macroura*	1	3	2	6
	Mouse spp.	*Mus* spp.	3	4	7	14
	Virginia Opossum	*Didelphis virginiana*		2	4	6
	California Quail	*Callipepla californica*	1	1	2	4
	Red Shouldered Hawk	*Buteo lineatus*		1		1
	Striped Skunk	*Mephitis mephitis*	12	13	16	41
	Spotted Towhee	*Pipilo maculatus*	2	2	3	7
	Western Gray Squirrel	*Sciurus griseus*	70	66	65	201

Appendix Table 1 (continued). Behaviorally categorized independent visits by wildlife species to in front of camera stations at Quail Ridge Reserve in Napa County, California, from June-October 2024. Abbreviations are Bay = California Bay Laurel (*Umbellularia californica*), Eucalyptus = Tasmanian Blue Gum Eucalyptus (*Eucalyptus globulus*), and Redwood = Coast Redwood (*Sequoia sempervirens*).

Behavior Category	Species	Scientific name	Bay	Eucalyptus	Redwood	Total
	Hermit Thrush	*Catharus guttatus*	5	11	7	23
	Wild Turkey	*Meleagris gallopavo*	60	68	72	200
	Unidentified Passerine	—	17	29	21	67
	California Vole	*Microtus californicus*	2	2	2	6
	Western Bluebird	*Sialia mexicana*	2	1		3
	Western Fence Lizard	*Sceloporus occidentalis*	1	1	3	5
	Western Screech Owl	*Megascops kennicottii*		3	2	5
	Western Wood Pewee	*Contopus sordidulus*			1	1
	White Breasted Nuthatch	*Sitta carolinensis*			1	1
	No Ash Interaction Total			378	361	1082
Sitting on ash	Bobcat	*Lynx rufus*	2		2	4
	Dark-eyed Junco	*Junco hyemalis*	1		1	2
	Gray Fox	*Urocyon cinereoargenteus*		1		1
	Western Gray Squirrel	*Sciurus griseus*			2	2
	Wild Turkey	*Meleagris gallopavo*	1	1		2
	Sitting on Ash Total		4	2	5	11
Standing on ash	Cooper's Hawk	*Accipiter cooperii*		1	1	2
	Dark-eyed Junco	*Junco hyemalis*	4	3	9	16
	Mule Deer	*Odocoileus hemionus*	3		2	5
	Domestic Dog	*Canis lupus familiaris*			1	1
	Gray Fox	*Urocyon cinereoargenteus*	2	1	2	5
	Spotted Towhee	*Pipilo maculatus*			1	1
	Western Gray Squirrel	*Sciurus griseus*	2	1	2	5
	Hermit Thrush	*Catharus guttatus*	2			2
	Wild Turkey	*Meleagris gallopavo*	3			3
	Unidentified Passerine	—	2	2		4
	Standing on Ash Total		18	8	18	44
Walking on ash	Bobcat	*Lynx rufus*	1	1		2
	Canada Goose	*Branta canadensis*		1		1
	Coyote	*Canis latrans*	10		2	12
	Dark-eyed Junco	*Junco hyemalis*	18	12	30	60
	Mule Deer	*Odocoileus hemionus*	7	3	16	26
	Domestic Dog	*Canis lupus familiaris*	1			1
	Gray Fox	*Urocyon cinereoargenteus*	6	9	6	21
	Frog spp.	—		1		1
	House Finch	*Haemorhous mexicanus*			1	1
	Mountain Lion	*Puma concolor*	1			1
	Mourning Dove	*Zenaida macroura*			1	1
	Mouse spp.	*Mus* spp.	1	3	1	5
	Virginia Opossum	*Didelphis virginiana*		1	1	2
	California Quail	*Callipepla californica*			3	3
	Striped Skunk	*Mephitis mephitis*	5	6	3	14
	Spotted Towhee	*Pipilo maculatus*	2		1	3

Appendix Table 1 (continued). Behaviorally categorized independent visits by wildlife species to in front of camera stations at Quail Ridge Reserve in Napa County, California, from June-October 2024. Abbreviations are Bay = California Bay Laurel (*Umbellularia californica*), Eucalyptus = Tasmanian Blue Gum Eucalyptus (*Eucalyptus globulus*), and Redwood = Coast Redwood (*Sequoia sempervirens*).

Behavior Category	Species	Scientific name	Bay	Eucalyptus	Redwood	Total
	Western Gray Squirrel	*Sciurus griseus*	20	8	13	41
	Hermit Thrush	*Catharus guttatus*	1			1
	Wild Turkey	*Meleagris gallopavo*	22	21	35	78
	Unidentified Passerine	—		5	6	11
	Western Bluebird	*Sialia mexicana*	1			1
	Dusky-footed Woodrat	*Neotoma fuscipes*		1	1	2
	Walking on Ash Total		96	72	120	288
	Total		554	535	585	1,674

Appendix Table 2. Totaled independent visits by wildlife species to tree ash deposited in front of camera stations at Quail Ridge Reserve in Napa County, California from June-October 2024. Bay = California Bay Laurel, Eucalyptus = Tasmanian Blue Gum Eucalyptus, and Redwood = Coast Redwood. Scientific names are given in Appendix Table 1.

Species	Bay	Eucalyptus	Redwood	Grand Total	% of Total Visits
Dark-eyed Junco	127	116	143	386	23.06
Western Gray Squirrel	124	100	110	334	19.95
Wild Turkey	95	107	123	325	19.41
Mule Deer	67	61	63	191	11.41
Gray Fox	27	32	20	79	4.72
Striped Skunk	22	20	21	63	3.76
Coyote	39	10	13	62	3.7
Hermit Thrush	8	11	7	26	1.55
Mouse spp.	4	7	9	20	1.19
Bobcat	6	5	8	19	1.14
Spotted Towhee	4	2	5	11	0.66
Mourning Dove	1	3	5	9	0.54
Virginia Opossum		3	5	8	0.48
California Quail	1	1	6	8	0.48
California Vole	2	2	2	6	0.36
Western Fence Lizard	1	1	3	5	0.3
Western Screech Owl		3	2	5	0.3
Western Bluebird	3	1		4	0.24
Frog spp.		2	2	4	0.24
House Finch		2	2	4	0.24
Mountain Lion	2		1	3	0.18
Canada Goose	1	2		3	0.18
Domestic Dog	1	1	1	3	0.18
Cooper's Hawk		1	1	2	0.12
Dusky-footed Woodrat		1	1	2	0.12
Botta Pocket Gopher		1		1	0.06
Magpie spp.			1	1	0.06
Red Shouldered Hawk		1		1	0.06
Western Wood Pewee			1	1	0.06
White Breasted Nuthatch			1	1	0.06
Unidentified Passerine	19	39	29	87	5.2
Grand Total	554	535	585	1,674	