ConCord

PINE HILL PRESERVE

CASE STUDY



Pacific Northwest NATIONAL LABORATORY

U.S. DEPARTMENT of ENERGY

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Pine Hill Preserve Case Study

Managing Land and Vegetation to Reduce Wildfire Risk and Conserve Rare Plants

April 2026

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Cover Page: Transmission infrastructure and right-of-way in the Pine Hill Preserve (Photo by Anne-Marie Patterson).

Summary

The Sacramento Municipal Utility District (SMUD), a municipal utility that serves most of Sacramento, California and the surrounding areas, operates a transmission line that passes through the Pine Hill Preserve. The powerlines transmit power from SMUD's Upper American River Project, a hydroelectric system in the Sierras west of Lake Tahoe, to SMUD's service territory. The Preserve features unique and biodiverse ecosystems, and is dominated by chaparral, oak woodlands, and grassland ecotypes. There are eight rare plant species that inhabit the Preserve, and four of these species are only found within the Preserve. The region's gabbro soils that are high in iron and magnesium are what make this environment suitable for these rare plant species.

Fire suppression is a high priority for SMUD in managing their transmission corridors. This is especially true for their rights-of-way (ROW) in the Pine Hill Preserve given the area's high fire risk levels. Vegetation management is critical to wildfire mitigation in transmission ROWs, as uncontrolled vegetation can act as fuel if a transmission line sparks an ignition. Given the unique landscape and abundance of rare species in the Pine Hill Preserve, SMUD found that vegetation management efforts intended to mitigate wildfire risk could offer an additional benefit of supporting a thriving, resilient native ecosystem.

SMUD employs integrated vegetation management (IVM) approaches at the site, which provide dual benefits of wildfire risk mitigation and improvements to habitat. The first major effort that SMUD implemented at the site was site mastication (i.e., manual removal of plants in the transmission ROW). After this took place, there was selective herbicide application to effectively eradicate invasive plants with minimal impacts on native species or the surrounding soils. Historically, the U.S. Bureau of Land Management (BLM), the land manager of the Preserve, has not allowed herbicides to be used at preserve sites. SMUD worked with BLM, the U.S. Fish and Wildlife Service (USFWS), the California Department of Fish and Wildlife (CDFW), and others to develop a plan for selective herbicide applications at Pine Hill Preserve in 2022. This combined IVM approach has allowed the utility to effectively minimize the growth of plants that can act as fuel during a fire, thus reducing wildfire risk, while also enhancing area biodiversity by encouraging the growth of native plants and their associated pollinators.

The Pine Hill Preserve transmission corridor highlights successes associated with combining wildfire mitigation with other goals, as well as effective interagency collaboration to support the biodiversity of a jointly managed area. SMUD has made preserving and encouraging native species in transmission corridors a priority, as they are adapted to local climate and conditions. Native plants are more resilient and are less dependent on water and fertilizers when compared to many non-native species (Persad and Brown 2025). In addition, native plants in the Pine Hill Preserve (as in other parts of California) are less likely to act as unwanted fuel for wildfire, since they tend to be slower-growing, low-profile, and adapted to thrive in fire-prone landscapes.

The Pine Hill Preserve case study was developed by compiling and analyzing publicly available information and validated through semi-structured interviews with key informants affiliated with the project. These interviews added valuable interpretation, expertise, and nuance to the public documents analysis, ultimately providing deeper insights than secondary research alone can provide.

Acronyms and Abbreviations

ACEC – Areas of Critical Environmental Concern
BLM – Bureau of Land Management
CEQA – California Environmental Quality Act
CDFW – California Department of Fish and Wildlife
CPUC – California Public Utility Commission
EPRI – Electric Power Research Institute
FERC – Federal Energy Regulatory Commission
IVM – Integrated Vegetation Management
NAPPC – North American Pollinator Protection Campaign
NEPA – National Environmental Policy Act
ROW – Right(s)-of-Way
SMUD – Sacramento Municipal Utility District
UARP – Upper American River Project
USFWS – United States Fish and Wildlife Service
WMP – Wildfire Mitigation Plan

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1.0 Connecting Transmission Corridors Initiative

The Connecting Transmission Corridors (ConCord) Initiative seeks to characterize the benefits of multifunctional transmission corridors, with a specific focus on recreation, conservation and restoration, and wildfire mitigation. This initiative outlines options and identifies best practices for providing public benefits in transmission corridors while also identifying models, tools, and resources for evaluating benefits in existing and future transmission infrastructure and transmission planning paradigms.

Case studies serve as informative examples of multifunctional transmission corridors and provide valuable lessons learned on land and vegetation management. The Pine Hill Preserve Case Study is one of several completed within the ConCord Initiative to highlight and characterize existing efforts within transmission corridors. These case studies focus on land and/or vegetation management to enhance ecosystem services as well as recreation and the development of multi-use trails within transmission corridors. Each case study was developed through a combination of desk-based research and interviews with key informants affiliated with the project. In the following sections, background information on the Pine Hill Preserve is presented, as well as details on project development and key takeaways. There are also three appendices that detail the measures implemented, the spatial scale, and timeline for the project.

2.0 Pine Hill Preserve Project

2.1 Background and Context

The Pine Hill Preserve is situated in a rural area of western El Dorado County, California, between Folsom Lake and the Lake Tahoe region. The Pine Hill Area of Critical Environmental Concern within the Preserve, where the project is located, is public land managed by the Bureau of Land Management (BLM) (Figure 1). Areas of Critical Environmental Concern (ACECs) require special management by the BLM to protect important natural resources, such as wildlife habitat and scenic landscapes or to protect people and property from hazards (Bureau of Land Management 2024). This unique BLM land designation arose from the Federal Land Policy and Management Act (U.S. Department of the Interior, Bureau of Land Management 2016).

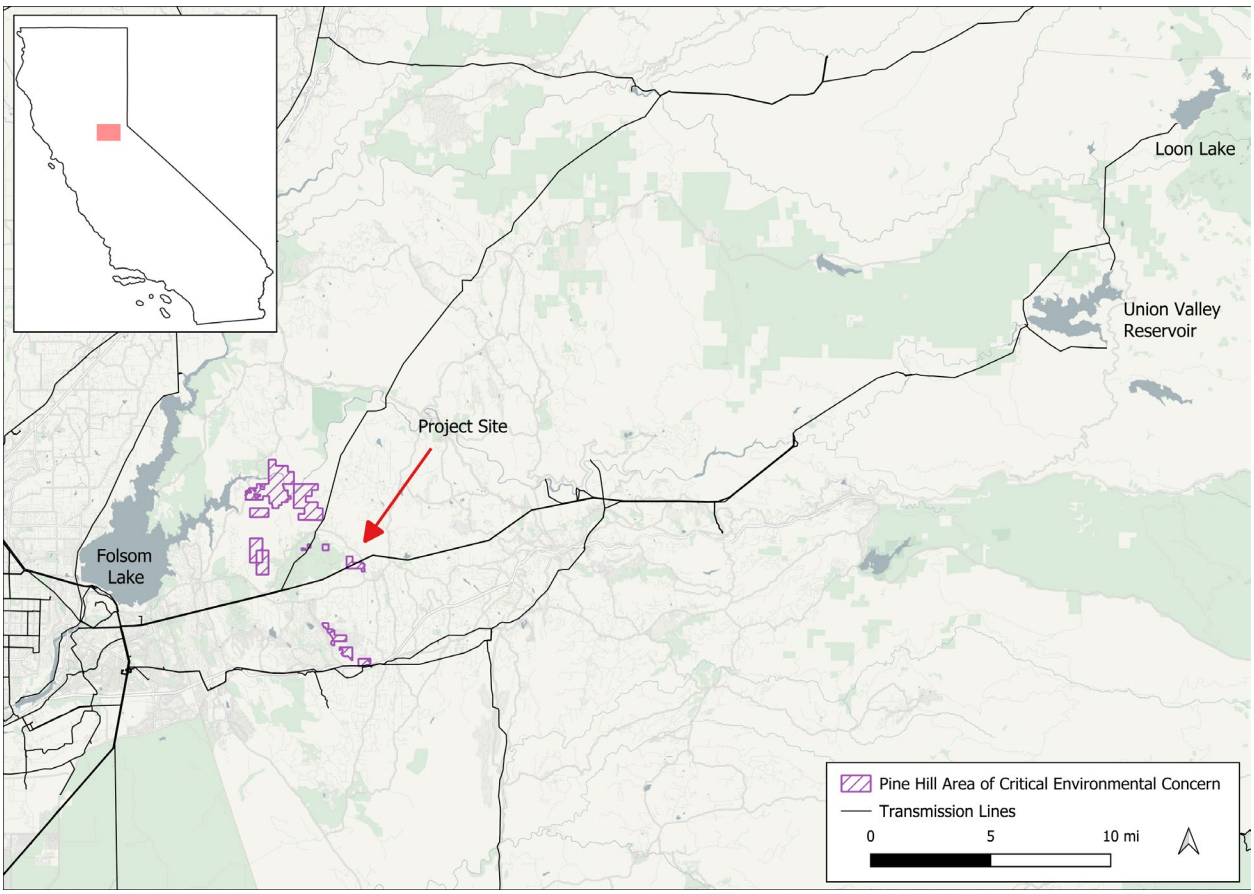

Figure 1. The Pine Hill Area of Critical Environmental Concern represents the federally designated protected area within the Pine Hill Preserve (Bureau of Land Management 2024). The project site within the Preserve refers to the specific stretch of transmission ROW where the project is located.

The Pine Hill Preserve is managed under a cooperative conservation effort between a coalition of ten cross-jurisdictional agencies and organizations to protect rare plant species. The entire Preserve, as well as the adjacent Kanaka Valley (Figure 2), spans 4,940 acres and is jointly managed by federal, state, and county governments (Bureau of Land Management 2025). While Kanaka Valley is not part of the Preserve, it serves as an important wildlife corridor that

connects state and federally managed lands. The agencies and organizations responsible for managing the Preserve include three federal agencies, which are the BLM, the U.S. Fish and Wildlife Service (USFWS), and the U.S. Bureau of Reclamation; two state agencies, the California Department of Fish and Wildlife (CDFW) and the California Department of Forestry and Fire Protection; three local agencies, which are the government of El Dorado County, the El Dorado County Water Agency, and the El Dorado Irrigation District; and two nonprofit conservation organizations, the American River Conservancy and the California Native Plant Society.

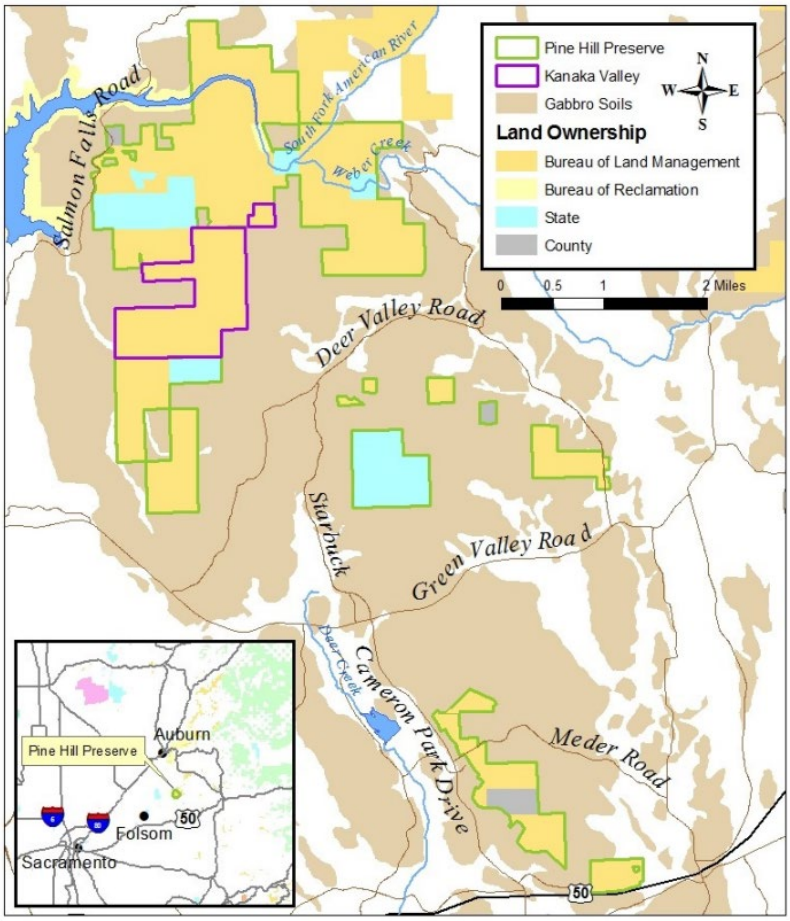

Figure 2. The Pine Hill Preserve in El Dorado County is managed by multiple entities, including federal, state, and county agencies. Map is courtesy of the BLM.

The Preserve, although covering a small area, hosts around 10% of California's native plant populations (interview, October 2nd, 2025). This makes the Preserve an ecologically significant site. The Preserve is home to eight rare plant species, four of which are endemic to the area (Persad and Brown 2025). Five of these plant species are federally listed, with four being endangered and one being threatened (Table 1, Figure 3). These rare plant communities are associated with the area's unique gabbro soils of the Rescue series, named after the unincorporated community of Rescue located near the Preserve (Bureau of Land Management 2025).

Table 1. The rare plant species inhabiting the Pine Hill Preserve. These species are designated as rare, threatened, or endangered on the California Native Plant Society list.

Common Name	Scientific Name	Federal Status	State Status
Stebbins' morning glory	*Calystegia stebbinsii*	Endangered	Endangered
Pine Hill ceanothus	*Ceanothus roderickii*	Endangered	Rare
Pine Hill flannelbush	*Fremontodendron decumbens*	Endangered	Rare
El Dorado bedstraw	*Galium californicum ssp. sierrae*	Endangered	Rare
Layne's butterweed	*Packera layneae*	Threatened	Rare
El Dorado mule-ears	*Wyethia reticulata*	Species of Concern BLM Sensitive	-
Red Hills soaproot	*Chlorogalum grandiflorum*	BLM Sensitive	-
Bisbee Peak rush-rose	*Crocanthemum suffrutescens*	-	-



Figure 3. The four federally endangered plant species endemic to the Pine Hill Preserve. Clockwise from top left: Stebbins' morning glory, Pine Hill ceanothus, El Dorado bedstraw, and Pine Hill flannelbush. Photos are courtesy of USFWS.

Like much of California, the region where the Preserve is situated has a Mediterranean climate, with warm, dry summers and mild winters. With these conditions, especially during periods of reduced precipitation, there's a greater risk of wildfire, which is becoming an increasing threat to utilities in the state. Electric utility infrastructure, particularly transmission lines, can pose a high

risk of ignition if corridors are not effectively managed to mitigate fire risk. The California Public Utility Commission (CPUC) has designated the area surrounding Pine Hill Preserve as “Tier 3 – Extreme Fire Threat,” which indicates the highest risk of utility-caused wildfire out of three possible risk tiers (Figure 4). The maps indicating which locations fall into which risk tier are required to be updated every ten years and were last released in 2017 (CPUC n.d.). Similarly, the state of California has designated the area as a “Very High” Fire Hazard Severity Zone, which is the highest possible hazard designation for overall wildfire risk. This means that the region faces significant likelihood of experiencing wildfires if mitigation measures are not taken. These risk maps are updated via a separate process from the CPUC maps and cover all state lands; they are updated every five years and were last updated in 2024 (Office of the State Fire Marshall n.d.).

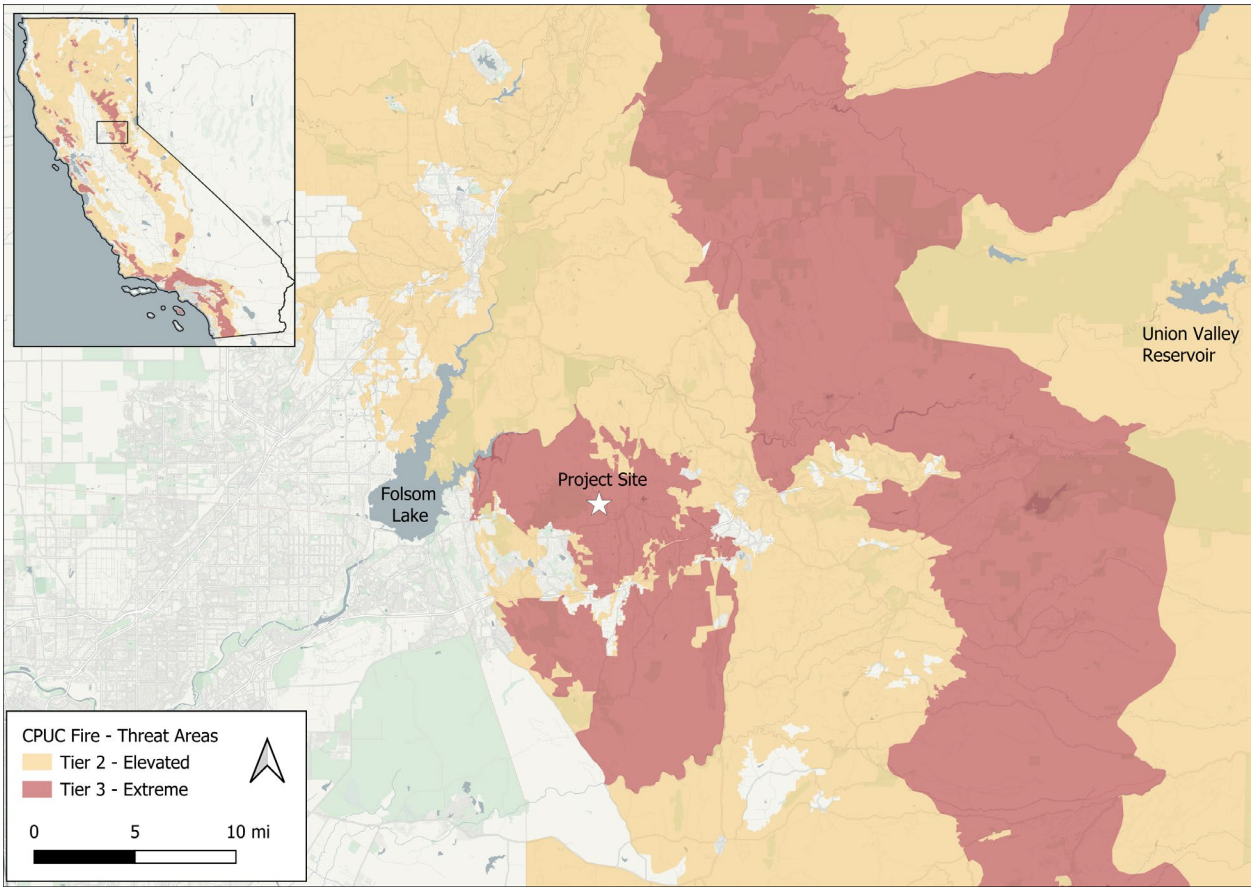

Figure 4. The project site and much of the Preserve are located within an area experiencing extreme fire threat. Data on fire threat are from CPUC (CPUC n.d.).

California regulations require enhanced wildfire mitigation activities for utility infrastructure located in “Tier 3” fire risk areas according to the CPUC map. This includes increased clearances between vegetation and power lines and between wires, as well as robust annual inspections. These requirements apply to the SMUD transmission line that crosses through the Pine Hill Preserve. This line is one of SMUD’s high-voltage transmission lines associated with the Upper American River Project, a hydroelectric system that provides power to SMUD customers in the greater Sacramento area.

The transmission lines were first installed in the 1960s. From the 1960s through 2019, the ROW was managed using traditional vegetation management approaches. More active efforts to reduce wildfire risk were taken in 2020 when site mastication of the corridor—a term referring to a process of clearing vegetation in a transmission ROW and converting it into mulch— took place. This was the first major action at the site and presented a blank slate that informed subsequent actions to control incompatible vegetation using selective herbicide application. While wildfire risk mitigation was an important driver for this effort, another driver was evaluating which IVM practices were most beneficial to the plants and to research how IVM impacts pollinators.

2.2 Objectives and Scope

SMUD's objectives for the Pine Hill Preserve project were to reduce wildfire risk by adopting IVM practices recommended by the BLM while simultaneously encouraging the protection and growth of rare native plant species. IVM can be effective at reducing the presence of potential vegetation fuel in corridors in an environmentally sensitive, cost-effective way. Additional goals of the project included maintaining line clearance to ensure system reliability and documenting best management practices to inform future IVM strategies. Given the high wildfire risk in the area, efforts to mitigate the likelihood of the transmission lines igniting a wildfire have been prioritized. At the same time, SMUD has had to ensure that these wildfire mitigation activities do not threaten the Preserve's unique biodiversity.

SMUD began efforts to manage their transmission ROW in the Pine Hill Preserve for wildfire mitigation, alongside similar efforts in other parts of El Dorado County where SMUD has transmission lines and practiced IVM (interview, October 2nd, 2025). Reducing wildfire ignition risk in transmission line corridors requires routine check-ins and maintenance to keep plants low-growing. Targeted removal of invasive plant species is also critical as it removes fuel sources that are disruptive to the local ecosystem and its resilience to fire. SMUD's wildfire mitigation plans (WMPs) identify IVM approaches in transmission corridors as risk reduction steps and indicate that various IVM approaches are already being implemented in ROWs across their network of transmission lines (SMUD 2023).

To summarize, SMUD's primary goal with their Pine Hill Preserve project was to document which IVM practices were most effective for mitigating wildfire risk and supporting the area's rare plants to be able to thrive. Additionally, maintenance of the corridor offered an opportunity to research how different vegetation management approaches impact pollinators (interview, October 2nd, 2025). There was also an interest in understanding how other wildlife, including larger mammals, were using the ROW, especially since the location was at a rural-urban interface.

2.3 Governance and Setting

SMUD is a municipal utility that is owned by the customers in its service territory and is governed by a seven-member Board of Directors elected by those customers (SMUD 2025a). Its service territory extends over approximately 900 square miles around Sacramento, serving most of Sacramento County and small parts of neighboring Placer and Yolo Counties (SMUD 2025b). The project site in the Pine Hill Preserve is located outside of SMUD's service territory. The transmission line that crosses the Preserve delivers power into the Sacramento area from the Upper American River Project (UARP), which refers collectively to several hydroelectric

reservoirs owned and operated by SMUD in and around the El Dorado National Forest (SMUD 2025d).

The Pine Hill Preserve is jointly managed by ten agencies at the federal, state, and local level. Much of the federal land in the area is managed by BLM, including the parcel of land through which this stretch of corridor sits (Figure 5). BLM makes recommendations on IVM practices to mitigate wildfire risk for the region, and SMUD follows this guidance in their utility easements, where they are responsible for maintenance and liability of the corridor (interview, October 2nd, 2025). The utility works with two types of contractors that are responsible for different types of vegetation management. The tree contractors support the bigger jobs, such as mastication, whereas the IVM contractors support other needs, such as herbicide application.

As a transmission line owner, SMUD is subject to regulation by the Federal Energy Regulatory Commission (FERC). These requirements include regular site surveys and reporting. Additionally, as protected land is home to rare and endangered species at both the state and federal levels, work on the site to maintain SMUD's transmission corridor is sometimes subject to environmental review processes under the National Environmental Policy Act (NEPA) and the California Environmental Quality Act (CEQA).

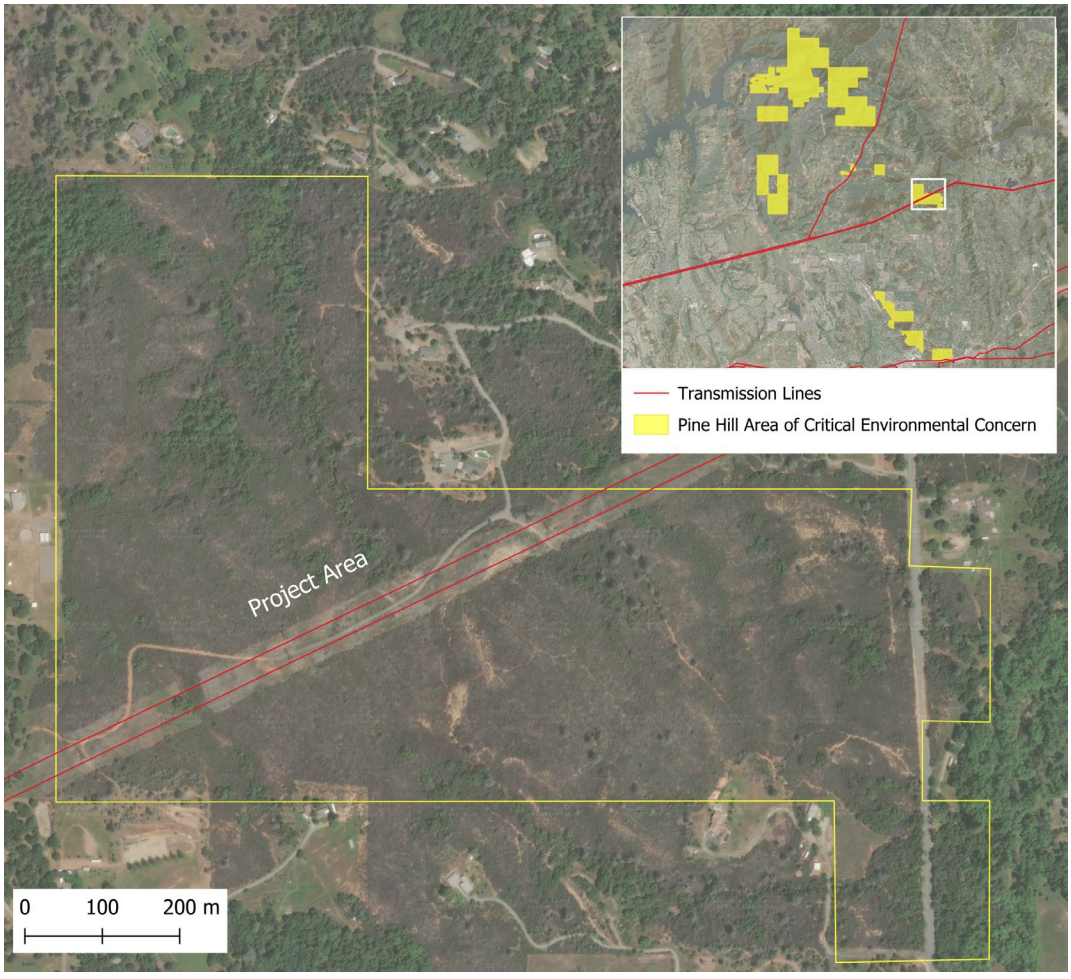

Figure 5. The project area is located within a stretch of transmission corridor located within a parcel of land owned by BLM in the Pine Hill Preserve.

2.4 Project Development

As this project was born out of wildfire mitigation, the project kicked off with site mastication to clear the land and remove invasive plant species, especially those that are fire prone. When invasive plants such as fire-tolerant grasses spread through an area, they may increase the likelihood of wildfire spreading and serve as more of a fuel source than patches of native vegetation adapted to wildfire-impacted landscapes. The mastication process entailed clearing vegetation that could act as wildfire fuel using equipment that grinds that vegetation into mulch and distributes that mulch around the corridor (interview, October 2nd, 2025). This process created valuable early successional habitat and opportunities for native vegetation to become better established. Figure 6 depicts this change over time, showing the corridor before and after site mastication occurred.



Figure 6. Before and after aerial view of the ROW where mastication took place. Left side shows the ROW before the land was cleared (June 2020). Right side shows the ROW after mastication took place (November 2021).

Once the vegetation was cleared, the utility implemented selective herbicide applications to keep the invasive and incompatible plants at bay. Selective herbicide application involves targeted treatment of invasive plants and has been shown to be an effective tool to eradicate invasive species at the root with minimal disturbance to other plants or surrounding soil (PennState Extension 2024). Since BLM did not allow herbicides to be applied in the Preserve, extra effort had to be taken by SMUD to work with BLM and other agencies to develop an acceptable plan for the application of herbicides to control incompatible vegetation. For Pine Hill Preserve, efforts to mitigate wildfire risk through vegetation management benefited native plant species recovery as well, fostering a resilient native ecosystem.

As part of the FERC license to operate their transmission line, SMUD must conduct surveys on vegetation and wildlife (interview, October 2nd, 2025). SMUD has extensive historical data from past surveys and does continuous monitoring, which allows the utility to track trends in

vegetation growth and outcomes of management approaches (interview, October 2nd, 2025). More recently, the level of research involved in these surveys has expanded to include more detailed vegetation mapping and work focused on pollinators and other species. As part of a partnership with the Electric Power Research Institute (EPRI), SMUD has deployed additional monitoring efforts to track trends in wildlife usage of the area (Pollinator Partnership 2025). Wildlife camera traps capture images of animals passing through the area (Figure 7).

SMUD is fully responsible for maintenance and liability of the site (interview, October 2nd, 2025). Relatively straightforward site access has aided the project. The utility has an existing easement, which allows SMUD to access the site without requiring permission from neighbors ahead of each visit, as can be the case under other land use agreements. However, the utility still communicates proactively with some neighboring landowners ahead of any work on the site in order to maintain good working relationships. SMUD installed a gate that prohibits public access to the site, which the utility reported that the neighbors support since it blocks unauthorized access to the neighbors' properties as well as to the ROW. Since the previous gate did not fully block unauthorized access to the site, there were concerns about the introduction of seeds of invasive species via visitors' shoes and physical disturbance to plants from people walking around (interview, October 2nd, 2025).

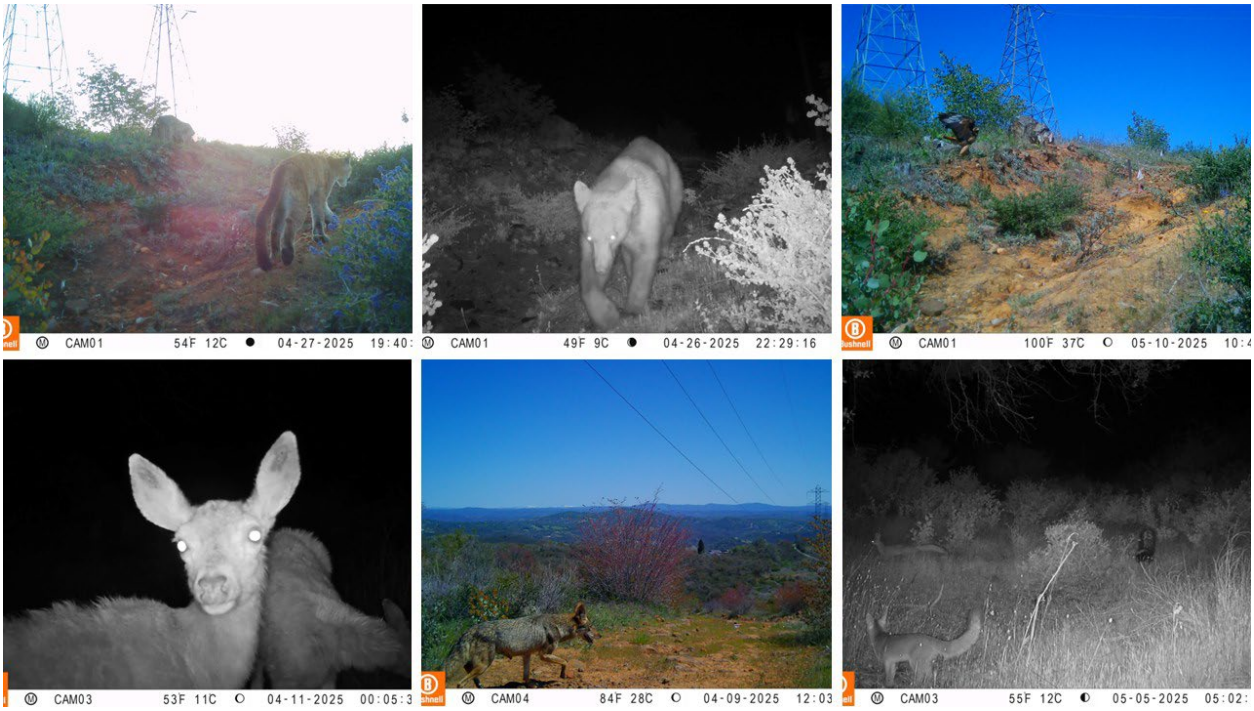

Figure 7. Animals observed passing near wildlife camera traps within the ROW in Pine Hill Preserve. Photo courtesy of SMUD.

3.0 Barriers and Constraints

One of the main challenges facing SMUD's management of the Pine Hill Preserve corridor is navigating the regulatory landscape intended to protect the rare and federally protected species present in the Preserve. For example, SMUD must have other contractors come out to flag protected species before any work is done (interview, October 2nd, 2025). In order to minimize impacts to listed species and comply with all regulations, any maintenance work in the corridor must be done slowly using equipment such as shields.

SMUD elected to incorporate selective herbicide application into their IVM approach for the Pine Hill corridor. However, herbicides were not permitted at the Preserve, and herbicide usage was not included in SMUD's original license for managing the transmission corridor there. BLM requires site-specific pesticide use plans and environmental assessments through NEPA for any additional pesticide use and approval on public lands. SMUD was therefore required to apply for a license update, which required them go through a biological evaluation process, which evaluates how a project may impact listed species in the project area, as required by NEPA (interview, October 2nd, 2025). This process took a few years to complete. Currently, since the project has an approved pesticide use portfolio, it is difficult for the utility to adjust their herbicide use as new invasive species emerge (interview, October 2nd, 2025).

Additionally, the IVM work is subjective in nature, since SMUD is exercising some discretion in deciding which native populations to leave alone and which to change. Their goal is to create a mosaic habitat with the highest possible diversity and lowest possible fire risk. Achieving this goal requires selecting contractors with specialized expertise. These contractors must be willing to fine tune maintenance and management practices in response to data and to be able to adapt to site-specific challenges (interview, October 2nd, 2025).

The utility has noted that there can be an added layer of optics when there are multiple public-facing agencies (the utility and the BLM) involved in managing an area or project, and that this adds some difficulty in coordinating public-facing communication. To enhance credibility to the public and other stakeholders, SMUD has made efforts to incorporate more third-party, academic research into their IVM efforts. This has added some minor complications, such as needing to evaluate any student-led research efforts. SMUD has considered memorandums of understanding that detail risks in partnerships with universities to facilitate student research (interview, October 2nd, 2025).

4.0 Outcomes and Impacts

The efficacy of individual mitigation measures in preventing a wildfire is difficult to prove, but poorly managed vegetation in ROWs has contributed to the exacerbation of utility-caused wildfires elsewhere, and vegetation management in transmission corridors is widely recognized as a critical component of wildfire mitigation efforts (Rohrer 2023). While there was one small fire in 2002 in the nearby El Dorado Hills, that fire was not utility-caused, and there have been no documented fires in the immediate area since, and no recorded wildfires within the Pine Hill Preserve (California Department of Forestry and Fire Protection 2025).

SMUD's IVM work at the Pine Hill Preserve project has effectively encouraged native plant growth and supported the biodiversity of the area (Figure 8). The data from the surveys the utility collects regularly allow SMUD to measure the growth of native plants and pollinators, track invasive species, and adjust IVM approaches as needed to continue to achieve the project's goals. SMUD is a member of EPRI's "Power-in-Pollinators Initiative," and shares data and tools from their work in Pine Hill and other corridors to support knowledge-sharing among other utilities interested in combining ROW management with pollinator conservation (SMUD 2025c). In November 2025, SMUD was recognized with a national award from the North American Pollinator Protection Campaign for their sustainable land management approach at Pine Hill Preserve (Ciampoli 2025).

The project also offers a successful example of interagency collaboration in a complex area. Since Pine Hill Preserve is jointly managed by several state and federal agencies, SMUD's ROW work has involved extensive collaboration with BLM and other agencies involved in managing the land. Given that the project is in a rural area, there are few neighbors to coordinate with; however, maintaining good relationships and keeping landowners in the loop about project work and any updates is important. For example, sharing outcomes from surveys and evaluations with local landowners helps people in the community stay aware of the benefits and outcomes of a project.



Figure 8. IVM approaches within this transmission corridor have focused on the conservation of rare plant species endemic to the area. There is a clear difference between the project area where IVM and restoration of rare plant species is occurring and the area outside of that. The red line marks this distinction.

5.0 Key Takeaways

Integrated vegetation management in ROWs can meet multiple objectives, including wildfire mitigation. SMUD's work in the Pine Hill Preserve demonstrates that vegetation management activities undertaken by utilities in transmission corridors can lead to multiple beneficial outcomes. Restoring native plants, such as Stebbins' morning-glory, El Dorado bedstraw, Pine Hill ceanothus, and the Pine Hill flannelbush, and selectively removing invasive plant species supports wildfire mitigation, since the native plants are more resilient to fire and less likely to act as fuel. Meanwhile, encouraging the growth of native plants while eradicating invasive species is an investment in ecosystem health and a biodiverse landscape.

Continuous investment in data and surveying facilitated better site outcomes, effective permitting, and partnerships. The utility's approach has included regular data collection and surveying, which has supported research and analysis of the local ecosystem and has allowed the utility to use data to effectively iterate on their IVM approaches. SMUD's IVM approach at Pine Hill Preserve has included several tools, including site mastication, where vegetation is physically removed and spread as mulch over an area, and selective herbicide application, which has allowed the utility to perform a targeted eradication of selected invasive species. Allowing the application of herbicides in a federally protected area required an extensive environmental review process and collaboration with BLM, the landowner.

A team of utility specialists worked together across different divisions of the utility to complete this work. This includes people with high levels of expertise and experience, including specialized contractors and researchers working with SMUD to manage and monitor the Pine Hill Preserve ecosystem. Project managers have been critical for keeping all entities engaged, and this has necessitated significant investment in planning as well as consistent check-ins to ensure clear and regular communication between all parties. Communication between all stakeholders involved or impacted, including different agencies and neighboring landowners, has been crucial to effective long-term transmission corridor management (interview, October 2nd, 2025).

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Appendix A – Measures Implemented

Table 2. Measures implemented at Pine Hill Preserve to mitigate wildfire risk and restore rare and endangered native plant species.

ID	Measure	Description
M1	Site mastication	Fuel-reduction approach to mitigate wildfire risk in transmission corridors where vegetation is removed, ground to mulch, and spread around the area to discourage future fuel growth
M2	Selective herbicide application	Application of approved herbicides to root systems of invasive species to effectively eradicate them with minimal disturbance to other plants or soil.
M3	Regular site surveying	Contractor-led monitoring of vegetation growth and trends throughout the ROW to mitigate wildfire risk and measure trends in area biodiversity
M4	Wildlife monitoring	Monitoring of trends in wildlife usage of site via specialized tracking equipment in order to gain additional data on biodiversity and pollinator habitat.

Appendix B – Scale Table

Table 3. Project footprint and context on adjacent infrastructure. (Linear corridor length and the extent of restoration is not specified in project materials and is estimated based on the project footprint within the BLM parcel.)

Item	Value
Corridor length affected	~0.51 miles: Approximate based on project footprint within BLM parcel; exact linear measurement not specified in available sources
Habitat restored	~12.5 acres: Approximate based on project footprint within BLM parcel;
Key assets affected	High-voltage transmission facilities; access roads/gates

Appendix C – Timeline Table

Table 4. Timeline of key milestones for the Pine Hill Preserve right-of-way project.

Milestone	Date	Attribution
Implementation start	2020	The initial step taken was site mastication to clear vegetation from the land.
Major phase(s)	2023	First round of herbicide treatments to remove invasive plant species and reduce their competition with rare and endangered native plant species
	2024	Second round of herbicide treatments to remove invasive plant species and reduce their competition with rare and endangered native plant species
Current status	2025	Received a national award from the North American Pollinator Protection Campaign (NAPPC) for their sustainable land management approach at Pine Hill Preserve SMUD is conducting pilot wildlife surveys to collect data on what types of wildlife use the habitat. This includes tracking pollinators so that they can learn the best ways for expanding pollinator habitat.

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