Conservation Science and
Habitat Protection at
Audubon Canyon Ranch

THE ARDEID

- herons and egrets
- **beyond the bay area**
- invasive species
- **rapid response**
- avian richness
- **first surveys**
- Modini Ingalls
- Ecological Preserve
- **serpentine mysteries**

2011

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Cover: *Mountain Quail—an iconic bird species found at Modini Ingalls Ecological Preserve. Photo by Brian Small.*
Ardeid masthead: *Great Blue Heron ink wash painting by Claudia Chapline.*

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The Watch

Volunteers for ACR research or habitat restoration projects since *The Ardeid* 2010. Please call (415) 663-8203 if your name should have been included. ♦ **Project Classifications** ♦**B**—Bouverie Stewards ♦ **C**—Coastal Colonial Waterbirds Survey ♦ **G**—Project GROW ♦ **H**—Heron and Egret Project ♦ **M**—Modini Ingalls Ecological Preserve projects ♦ **MG**—Martin Griffin Preserve Stewards ♦ **N**—Newt Monitoring ♦ **S**—Tomales Bay Shorebird Census ♦ **W**—Tomales Bay Waterbird Census

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Beyond the Bay Area

Mapping Heronries in Coastal California

by Emiko Condeso and John Sterling

At the end of the nesting season, as packet after packet of carefully summarized observations of heron and egret behavior begin to fill the Cypress Grove Research Center mailbox, it is easy to assume that the San Francisco Bay Area is the center of the wading bird universe. Every spring, approximately 70 volunteers monitor about 60 nesting colony sites in the northern San Francisco Bay Area. A concurrent effort, coordinated by the San Francisco Bay Bird Observatory (SFBBO), gathers a similarly sized data set from the Bay Area counties south of the Golden Gate Bridge. Together, these data contribute to the Heron and Egret Project—a regional, long-term effort to monitor the distribution, abundance, and productivity of nesting herons and egrets. Data from this project form a powerful basis for conservation—to protect both our nesting wading birds and the wetlands upon which they depend.

Inventory and monitoring projects such as this one, that document population status and identify trends, are widely recognized as essential for conservation and management of natural resources. Before any threats to wildlife can be assessed, or management decisions made, the current state of the population must be known. Although the Bay Area is well established as an important area for nesting herons and egrets, relatively little is known about heron and egret breeding distribution beyond the Bay Area to support decision-making at a larger scale. No comprehensive statewide survey or monitoring effort exists, even though it is widely recognized that many parts of California provide important habitat for wading birds.

In response to this lack of statewide data, and evidence that some colonial waterbird populations are declining (potentially at risk) while others may be increasing and causing management concerns (Cattle Egrets and Black-crowned Night-Herons prey on the nests of Tricolored Blackbirds, a top-priority Species of Special Concern in California), the United States Fish and Wildlife Service (USFWS) has initiated a survey of colonial waterbirds in 11 western states (Table 1). When complete, this effort will provide a record of active and historical (currently inactive, but previously documented) colonies in one all-inclusive document: Coordinated Colonial Waterbird Inventory and Monitoring in the Western United States: Comprehensive Breeding Season Surveys.

The results of the colonial waterbird inventory will provide important baseline data and a basis for future monitoring to track changes in population size and distribution of colonial waterbirds in the western United States. Audubon Canyon Ranch, in collaboration with PRBO Conservation Science (PRBO), participated in this effort

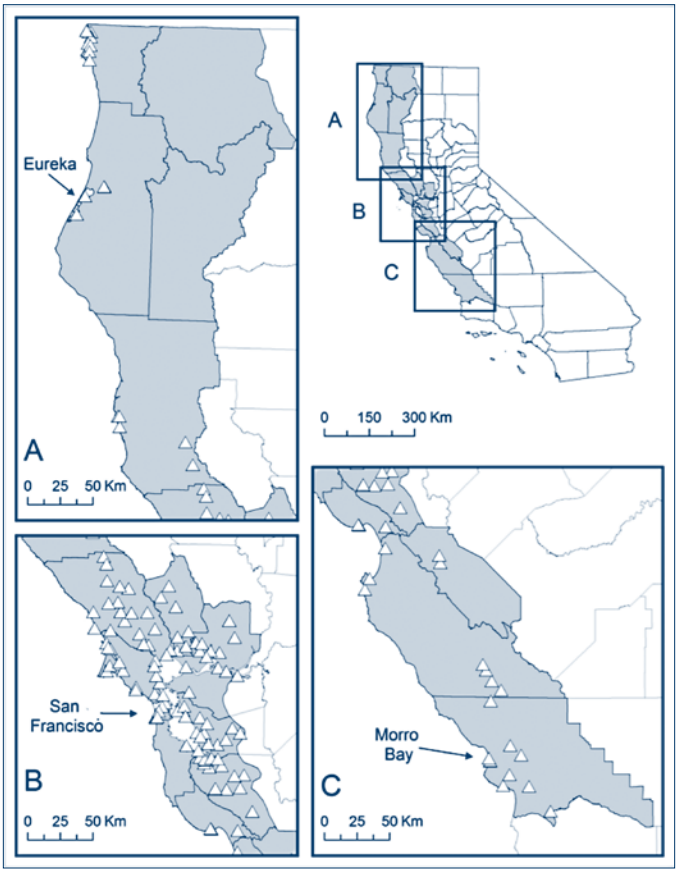

Figure 1. Preliminary map of active colony sites identified in the coastal survey area (shaded area) in 2011, including the northern coastal counties of Del Norte, western Siskiyou, Humboldt, Trinity, and Mendocino (inset A), the Heron and Egret Project study area (inset B), and the north-central coastal counties of Santa Cruz, Monterey, San Benito, and San Luis Obispo (inset C).

Table 1. Focal species for the coordinated colonial waterbird inventory and monitoring in the western United States (excerpted from the United States Fish and Wildlife Service Western Colonial Waterbird Survey Protocols, 2008).

Island nesters	Tree nesters	Marsh nesters
American White Pelican	Black-crowned Night Heron	Black Tern
Double-crested Cormorant[a]	Great Blue Heron	Forster's Tern
Common Tern	Snowy Egret	White-faced Ibis
Caspian Tern	Great Egret	Franklin's Gull
Ring-billed Gull	Cattle Egret	
California Gull	Neotropic Cormorant	
Western Grebe		
Clark's Grebe		
Eared Grebe		

[a]Double-crested Cormorants are also tree nesters.

by organizing a survey focusing on Great Blue Herons, Great Egrets, Snowy Egrets, Cattle Egrets, Black-crowned Night-Herons, and Double-crested Cormorants in northern and central California. The area surveyed includes all coastal counties north of Santa Barbara County, including the San Francisco Bay Area, as well as the interior counties of the Central Valley north of Stanislaus County, excluding the Great Basin and Sierran regions of northeastern California. We report here on the results of the survey of the coastal counties, which was coordinated by ACR (Figure 1).

The surveys of nesting colonies along the northern California coast were carried out primarily by highly skilled volunteer birders under the direction of several county coordinators. We timed the surveys to coincide with the peak of breeding activity (April and May), when nest sites were most detectable. Where access was available, colonies were surveyed from land using spotting scopes and binoculars; inaccessible areas were surveyed by boat or aircraft. We excluded Double-crested Cormorant colonies on offshore rocks and on bridges from the survey, because those sites were previously documented by other studies. Volunteers prioritized search areas by first visiting previously documented sites, then searching the nearby surroundings for new sites. When active sites were identified, the observers counted and mapped the nests of each species. When nests could not be seen, observers counted the number of adult birds that were present. We compiled historical colony records from local birders, breeding bird atlases, government agencies, PRBO, and the California Natural Diversity Database. We also identified additional priority survey areas by their proximity to assumed high-quality foraging areas, such as the riparian corridors of the Eel, Russian, and Salinas rivers.

Importance of the Bay Area

The results of this survey are preliminary at the time of this writing, as data compilation is still underway. However, so far we have identified 171 active nesting sites in the coastal survey area (Figure 1). The majority of these sites (127) were located in the San Francisco Bay Area, and all of these were already being monitored monthly by ACR and SFBBO. Outside of the San Francisco Bay Area, we detected 44 sites across eight counties. The majority of these sites were previously known or strongly suspected to exist prior to the survey.

TOM GREY / WWW.TGREYBIRDS.COM

Great Egret twig presentation during nest building.

As in the Bay Area, most of the heron and egret colonies in the northern and southern coastal areas were found in either blue gum eucalyptus *(Eucalyptus globules)* or Monterey cypress *(Cupressus macrocarpa)* trees, although in the riparian areas along the Salinas River Valley, valley oak *(Quercus lobata)* and western sycamore *(Platanus racemosa)* were common nest substrates. On coastal Prince Island near the Oregon border, birds nested in large elderberry "trees" (*Sambucus* sp.). Very few sites were found in low-growing marsh vegetation such as rushes and sedges. Throughout the coastal survey area (including the Bay Area counties), Great Blue Heron colonies were found in both riparian and estuarine areas, where birds are likely foraging in both salt marshes and freshwater wetlands. Great Egret, Snowy Egret, and Black-crowned Night-Heron colonies tended to be located near estuaries; however, several important sites were also found in inland, freshwater-influenced areas such as the Laguna de Santa Rosa in Sonoma County.

Great Blue Herons nested in all of the counties surveyed except for Trinity County, and they were most abundant in Sonoma, Solano, Marin, Napa, and Monterey counties (Table 2). Throughout the survey area, Great Blue Herons tended to nest in small colonies of fewer than 10 nests. Notable exceptions were large colonies of 28 (Contra Costa), 26 (Monterey), 23 (Sonoma), and 21 (San Mateo) nests.

We found Great Blue Heron colonies in all of the counties surveyed except for Trinity County. Unlike Great Blue Herons, most Great Egrets nested in colonies that were larger than 10 nests, with the largest Great Egret colonies numbering 197, 110, and 108 nests each (Solano County). Snowy Egrets and Black-crowned Night-Herons were distributed similarly to Great Egrets, although they nested in fewer counties (absent from Contra Costa, Sacramento, and Santa Cruz counties). Additionally, nesting Snowy Egrets were not found in Monterey County. Notably, large Black-crowned Night-Heron and Snowy Egret colonies were found in Solano, Sonoma, Marin, Monterey, Napa, Alameda, and San Francisco counties. Cattle Egrets were found nesting only at two sites in the survey area, one in Sonoma and one in Solano County.

Double-crested Cormorants were found nesting in all counties except Contra Costa, Sacramento, Humboldt, Trinity, San Benito, and Monterey. However, cormorants that may have been nesting on offshore rocks and bridges throughout the survey area were not censused.

Preliminary results suggest that relatively few herons and egrets nest in the coastal counties north of Mendocino, compared to the rest of the survey area. However, we suspect that our estimates of nest abundance in these counties are lower than the actual number of nests, given that many potentially suitable nesting areas were difficult to access. The steep, wooded terrain in Trinity and Siskiyou counties, in particular, made surveys difficult. In addition, large amounts of late spring/early summer rainfall interfered with the survey effort, reducing the detectability of nesting birds

Table 2. Preliminary numbers of nesting pairs in the coastal California survey area in 2011, by county. Western Siskiyou County was not surveyed due to weather constraints.

County	Great Blue Heron	Great Egret	Snowy Egret	Cattle Egret	Black-crowned Night-Heron	Double-crested Cormorant[c]
SF Bay Area						
Sonoma	109	146	111	40	197	31
Napa	69	70	95	0	90	43
Solano	78	521	276	145	111	263
Marin	78	200	89	0	48	548
Contra Costa	28	16	0	0	0	0
Alameda	56	75	186[a]	0	24[a]	110
San Francisco	16	0	83	0	50	129
San Mateo	24	0	0	0	0	187
Santa Clara	31	66	27	0	44	179
Sacramento[b]	14	1	0	0	0	0
North Coast						
Del Norte	18	8	30[a]	0	30	4
W. Siskiyou	–	–	–	–	–	–
Humboldt	17	111	2	0	30	0
Trinity	0	0	0	0	0	0
Mendocino	24	0	0	0	0	12
South Coast						
Santa Cruz	10	11	0	0	0	208
San Benito	13	0	0	0	0	0
Monterey[a]	72	23	0	0	92	0
San Luis Obispo	47	8	18	0	37	263

[a] Counts of nestlings were used to estimate number of nesting pairs at some colonies.
[b] Only a small fraction of Sacramento County was included in the survey.
[c] Double-crested Cormorants on offshore rocks and bridges were not counted.

and colonies throughout the survey area. Western Siskiyou County, in particular, was not surveyed due to constraints imposed by weather.

Colonial waterbirds, by definition, concentrate in particular places during the nesting season, and this behavior makes them vulnerable to chance events involving weather, pollution, or other disturbances, and to changes in human land use (Kushlan et al. 2002). Because of this vulnerability, information on the size and distribution of the breeding populations is critical for effective management. Like ACR's Heron and Egret Project, the USFWS Colonial Waterbird Survey will help to identify important nesting habitat for a number of species in California and help guide decisions made by land managers and conservation planners.

Future objectives of the USFWS survey include development of a monitoring program that will provide repeated estimates of breeding population size and distribution. Such effort is important because colony sizes and locations can change dramatically between years (Kelly et al. 2007). The unseasonably wet spring of 2011, combined with the large geographic area, also made colony detection difficult, and subsequent surveys will be required to determine if the results are accurate or stable. For example, future surveys are needed to confirm whether the higher nesting densities in the nine-county Bay Area contrast as strongly with lower nesting densities along the rest of the northern California Coast as the survey results suggest.

Future work by ACR will help to elucidate regional differences in heron and egret nesting abundance, by comparing foraging habitat associations among coastal areas or between heron and egret "hotspots" such as the Sacramento Valley and San Francisco Bay (Kelly et al. 2008). With this landscape perspective on the needs of nesting herons and egrets, ACR is expanding the focus of colonial waterbird conservation from protecting individual colonies to protecting wetlands, one of the most endangered habitats in California.

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Emiko Condeso is an Ecologist and GIS Specialist at Cypress Grove Research Center.

John Sterling, a Research Associate of Audubon Canyon Ranch, coordinated the coastal inventory of heronries outside the San Francisco Bay Area.

Medical models point the way to effective invasive species treatment

Early Detection and Rapid Response

by Matthew Danielcyzk

Populations of invasive species are far easier to manage when they are still small than after they become well established. In the case of plants, we may be able to simply pull a few small individuals out of the ground and score a local victory for biodiversity conservation. Toward that end, Audubon Canyon Ranch is adopting a fairly new paradigm in invasive species management: "early detection and rapid response," or EDRR for short. Early detection is potentially critical for preventive care, in both medicine and the protection of natural areas.

The two greatest threats to biodiversity are (1) habitat loss and fragmentation, and (2) invasive species, and both are likely to intensify with climate change (Higgins et al. 1999, Conservation Biology 13: 303-313; Dukes and Mooney 1999, Trends in Ecology and Evolution 14: 135-139). ACR is addressing the former by protecting nearly 2,500 acres as sanctuaries for native plants and animals, as well as working to manage and protect additional lands in Marin and Sonoma counties. However, effective protection of these lands requires a continuing effort to avoid the threats of invasive species.

Invasive species harm biodiversity by out-competing native plant and animal species or altering habitat conditions needed to sustain native assemblages. Examples of invasive species that have negatively impacted native flora and fauna include: the brown tree snake *(Boiga irregularis)* on the island of Guam, which has extirpated most of the forest-dwelling vertebrate species on the island (Fritts and Leaseman-Tanner 2001, www.fort.usgs.gov/resources/education/bts/bts_home.asp); kudzu *(Pueraria montana* var. *lobata)* in the American South, which has infested nearly 7.5 million acres, severely impacting biodiversity where it forms a monocultural stand (Boyette et al. 2001, Biological Science and Technology 12:75-82); and the pathogen that causes sudden oak death *(Phytophthora ramorum),* which is altering the composition and structure of redwood forests and oak woodlands in northern California and on ACR lands (See The Ardeid 2002). Other invasive species on ACR properties, such as Cape Ivy *(Delairea odorata;* Figure 1) and panic veldt grass *(Ehrharta erecta),* are displacing native vegetation and altering food webs. Managing dense or extensive infestations of such species is difficult, time consuming, and expensive.

EDRR is the most time- and cost-effective tool we have for combating the spread of invasive plants (Di Tomaso et al. 2007, in Stromberg et al., California Grasslands: Ecology and Management, UC Press, Berkeley). Early detection has been an effective medical tool for combating infectious disease outbreaks in humans, and in 2003, the National Invasive Species Council, composed of secretaries and administrators from several federal agencies, endorsed EDRR for all invasive species, plants, animals, pathogens, etc. The general idea is to detect a small population of invasive species before it becomes a large population—saving time and money but, more importantly, preventing the loss of biodiversity that accompanies the spread of many invasive plants.

In practice, early detection involves hiking—something many people often do. However, crucial to a successful early-detection hike are some basic plant identification skills. It's difficult to know all 10,000 or so species of plants that occur in California, in addition to new invaders from

Table 1. Partial list of early-detection species on ACR-managed preserves, with management recommendations.

Species	Common Name	Preserve	Population	Ideal Treatment Month	Notes
Helichrysum petiolare	licorice plant	MGP	Bourne Ridge	April	single individual pulled 2011, keep under surveillance
Helichrysum petiolare	licorice plant	MGP	Garden Club Canyon	April	several individuals pulled, probable retreatment required in 2012
Hypericum canariense	Canary Island St. John's wort	MGP	Hwy 1 parking lot	May	patch pullled February 2011, dug May 2011
Hypericum canariense	Canary Island St. John's wort	MGP	Crum House	May	patch pulled February 2011, dug May 2011
Dittrichia graveolens	stinkwort	MMAS Pump Station	Mayacamas	June; flame in May?	hand-pulled in 2010, primary impact in road, threatens reveg project. In hard-packed road, pulling ineffective

LEN BLUMIN

Figure 1. Cape ivy covering riparian forest floor at Martin Griffin Preserve; EDRR can check such invasions before they reach this stage.

other parts of the world, so it's important to report suspected invasive species to experts to ensure certainty in the diagnosis. ACR's Resident Biologists, Resource Ecologists, and Vegetation Management Specialist are on the front lines of identifying and acting on the discovery of invasive species when spotted by an alert volunteer. Sometimes we are stumped and need to send a specimen to colleagues in the Marin-Sonoma Weed Management Area (MSWMA), the Bay Area Early Detection Network (BAEDN, co-founded by ACR's Daniel Gluesenkamp), the California Department of Food and Agriculture's Botany Laboratory, or to the County Agricultural Commissioner. Once a new observation of an early detection target is confirmed, it is usually treated by hand-pulling or digging. If the infestation is too large to control by manual methods, it is no longer in the early-detection stage of invasion.

It's very difficult to hike every square meter of the 5,000 acres of natural areas managed by ACR , so we must prioritize where to hike. Our highest priorities are the areas where we're most likely to find invasive plants—roads and trails being of foremost concern. Invasive plant seeds move in via tire treads, vehicle undercarriages, boot treads, socks, and other clothing, and they sometimes hitch a ride on animal fur. Since ACR staff and volunteers regularly hike the trails, why not map invasive plants at the same time? Such an approach could be powerful if enough people make it a routine. Another common route for invasions is along stream corridors, including the cut-banks and slide areas within them. Many seeds travel downstream and grow well in moist, disturbed soils. Lastly, the property boundaries are important to inspect to see if anything is moving in from adjacent properties.

ACR staff has had leadership roles in the MSWMA and BAEDN because of the importance of communicating with our neighbors about the locations of invasive plants near our preserves. For example, licorice plant *(Helichrysum petiolare)* is a highly invasive viny shrub that is little known in California, except for Marin County. The Golden Gate National Recreation Area and Mount Tamalpais State Park, not far from ACR's Martin Griffin Preserve (MGP), have populations of licorice plant, so we have been vigilant about monitoring its distribution. State Parks is doing the best it can to treat licorice plant infestations, but with limited State funding, they are hard-pressed to keep up with it. We have encountered a few individuals at MGP, and when I get a report, I confirm it, map it, and remove it as soon as I can—it becomes my highest priority at MGP.

BAEDN has acquired funding to compile a regional list of invasive species to target for early detection. Entries on the list include Canary Island St. John's wort *(Hypericum canariense)* and hairy wallby grass *(Danthonia pilosa),* both of which occur at MGP. Stinkwort *(Dittrichia graveolens)* is a species that is too abundant regionally to be considered an early-detection target by BAEDN, but it is on ACR's early-detection list. This species was found at the Mayacamas Mountains Audubon Sanctuary, which is managed by ACR, and it is well worth our time to keep it from establishing in the area.

ACR's list of early-detection target species (Table 1) is quite small compared to the long list of invasive plants that occur on ACR preserves and in the Bay Area. This small list of targets is by design. To be effective, we must focus our efforts where they will provide the greatest return on our time, money, and energy. What then do we do about those invasive plants that have progressed beyond the early-detection phase? Plants like rosy sandcrocus *(Romulea rosea),* waxy mannagrass *(Glyceria declinata),* or yellow glandweed *(Parentucellia viscosa)* are all invasive at Bouverie Preserve, but are too well-established to qualify as early-detection targets. For these weeds, we are prioritizing management actions based on how invasive they are, the degree of ecological impact they cause, the ease and cost of treatment, and the sensitivity of the natural resources they threaten. For example, waxy manna-grass out-competes rare native vernal pool plants at Bouverie Preserve, so it's a higher priority for management than rosy sand-crocus or yellow glandweed, which occupy already-disturbed grasslands and are not terribly harmful at low densities.

We are working our way down the priority list for fighting invasive species infestations on ACR lands. Someday, hope-fully, we will have controlled or eliminated all the major infestations and can focus exclusively on EDRR as new plant species appear on our preserves. In the meantime, because resources available to manage natural areas are typically limited, EDRR is the best tool we have to maximize our ability to fight invasive species.

Early detection hikes are a lot of fun, and volunteer help is always needed. To get involved in EDRR work at ACR, please call ACR or email me at matthew@egret.org.

Matthew Danielcyzk is ACR's Vegetation Management Specialist.

Documenting the avian richness of the Modini Ingalls Ecological Preserve

First Surveys

by John P. Kelly

KEN WILSON / TALON TOURS

Figure 1. An adult Warbling Vireo feeds its fledgling. Warbling Vireos sing conspicuously throughout the day, often from high in the canopy of broad-leaf trees..

If you make it all the way up to High Valley, near the ridgeline of the Mayacamas Mountains in northern Sonoma County, you will experience a dramatic transition. As you make your way into this remote area, some of the most isolated forests in the Mayacamas, rooted into some of the steepest slopes, quickly drop away with the fading songs of Warbling Vireos (Figure 1) and Western Tanagers. A vast landscape of chamise *(Adenostoma fasciculatum)* and knobcone pine *(Pinus attenuata),* swept with occasional meadows and swales, opens across a table of gentler, drier slopes. The light, the movement of air, and the acoustics are all different. For adept field observers documenting the breeding status of local birds for Audubon Canyon Ranch, this realm is marked by an even subtler ambiance: the intuitive possibility of a Greater Roadrunner or other unusual breeding bird species pushing over the ridge from the arid interior of the Coast Range—and by the ubiquitous, bell-like calls of Mountain Quail.

On a deeper level, other boundaries are crossed as one connects personally with this place. For birders, each new set of habitat conditions reveals not only an interesting new assemblage of nesting species, but also a personal sense of discovery and connection with the landscape. Eventually, this area will become the Modini Ingalls Ecological Preserve (MIEP) of Audubon Canyon Ranch, and the MIEP Breeding Bird Assessment will provide a way for others to appreciate and help protect the beautiful and wild landscape of the central Mayacamas Mountains.

In 2009, Audubon Canyon Ranch biologist Sherry Adams launched a broad effort to evaluate the ecological values of the Modini Ranch. Jim and Shirley Modini provided crucial financial support needed for this work, following a collaborative, planned-giving arrangement to establish a new ACR sanctuary for native plants and animals. This landscape is rich with bird life, so an assessment of breeding bird use and associated habitat values is a key objective in delineating its ecological character. In 2010, Emiko Condeso and I initiated a pilot effort, with a select team of talented Sonoma County birders, to determine the most effective way to measure nesting bird use in this rugged landscape. We launched a full effort in 2011, and the first surveys of the multiyear breeding bird assessment are confirming the extraordinary avian richness of MIEP.

The MIEP Breeding Bird Assessment seeks to measure the nesting status, distribution, and abundance of each locally nesting species and to use the results to evaluate avian habitat values on the property. In addition, the discovery of nesting by rare or special-status species could influence conservation priorities. We are using two different survey methods to determine the status and distribution of the nesting birds: timed searches to document evidence of nesting and "fixed-radius point counts" to estimate breeding bird abundances. To thoroughly assess nesting bird use, we visit the property six times annually, during April and May, and will continue the effort for two or three more years.

This project contributes to a more extensive (but less intensive) countywide effort to update the Sonoma County Breeding Bird Atlas (Burridge 1995, http://audubon.sonoma.net/birding/scbba1995.pdf). Together with the Breeding Bird Atlas and previous bird surveys conducted on neighboring lands (Payne and Morrison 2003, Checklist of Birds of Pine Flat Road and the Mayacamas Mountains Audubon Sanctuary, Madrone Audubon Society), our results will provide the basis for an evaluation of avian habitat values and associated implications for conservation throughout the central Mayacamas Mountains.

continued on page 8

Table 1. Preliminary results of the Breeding Bird Assessment across all survey areas of the Modini Ingalls Ecological Preserve, 2010 and 2011, based on evidence (n = 8 survey days) for confirmed (CO), probable (PR), or possible (PO) nesting, or observed only (OB), and on breeding bird densities (birds/km2, standard error, calculated from detections within 50 m of point-count stations; n = 70 station-counts).

Species Name	Evidence	Birds/km^2	(SE)
Acorn Woodpecker	CO	78.0	(16.42)
American Kestrel	CO	7.3	(3.75)
Anna's Hummingbird	CO	20.0	(4.10)
Black Phoebe	CO	1.8	(1.34)
Black-headed Grosbeak	CO	9.1	(2.90)
Brewer's Blackbird	CO	5.4	(2.97)
Bushtit	CO	10.9	(3.69)
California Towhee	CO	20.0	(4.91)
Cassin's Vireo	CO	10.9	(3.69)
Dark-eyed Junco	CO	36.3	(6.64)
European Starling	CO	14.5	(4.48)
Hairy Woodpecker	CO	5.4	(2.28)
House Wren	CO	88.9	(9.78)
Lazuli Bunting	CO	21.8	(4.65)
Nuttall's Woodpecker	CO	12.7	(3.38)
Oak Titmouse	CO	36.3	(6.64)
Orange-crowned Warbler	CO	47.2	(7.17)
Pacific-slope Flycatcher	CO	38.1	(7.46)
Purple Finch	CO	3.6	(2.67)
Rufous-crowned Sparrow	CO	5.4	(2.28)
Spotted Towhee	CO	36.3	(8.33)
Violet-green Swallow	CO	30.8	(10.85)
Warbling Vireo	CO	16.3	(5.01)
Western Bluebird	CO	9.1	(2.90)
Western Screech Owl	CO	0.0	(0.00)
White-breasted Nuthatch	CO	10.9	(4.15)
White-tailed Kite	CO	0.0	(0.00)
Wrentit	CO	20.0	(5.26)
American Crow	PR	9.1	(3.96)
Ash-throated Flycatcher	PR	0.0	(0.00)
Bewick's Wren	PR	20.0	(4.52)
Blue-gray Gnatcatcher	PR	12.7	(4.32)
Brown-headed Cowbird	PR	5.4	(2.97)
California Quail	PR	9.1	(3.96)
Chipping Sparrow	PR	3.6	(1.88)
Common Merganser	PR	0.0	(0.00)
Common Raven	PR	7.3	(2.62)
Eurasian Collared-Dove	PR	0.0	(0.00)
House Finch	PR	1.8	(1.34)
Hutton's Vireo	PR	5.4	(2.97)
Lesser Goldfinch	PR	30.8	(8.18)
Mourning Dove	PR	9.1	(3.96)
Pileated Woodpecker	PR	3.6	(1.88)
Red-shouldered Hawk	PR	0.0	(0.00)
Red-tailed Hawk	PR	0.0	(0.00)
Red-winged Blackbird	PR	1.8	(1.34)
Steller's Jay	PR	27.2	(6.57)
Townsend's Warbler	PR	1.8	(1.34
Western Kingbird	PR	0.0	(0.00)
Western Meadowlark	PR	9.1	(3.96)
Western Scrub-Jay	PR	1.8	(1.34)
Wild Turkey	PR	0.0	(0.00)
American Robin	PO	1.8	(1.34)
Belted Kingfisher	PO	0.0	(0.00)
Black-throated Gray Warbler	PO	9.1	(4.39)
Brown Creeper	PO	5.4	(2.28)
Bullock's Oriole	PO	1.8	(1.34)
California Thrasher	PO	3.6	(1.88)
Chestnut-backed Chickadee	PO	3.6	(1.88)
Cooper's Hawk	PO	0.0	(0.00)
Downy Woodpecker	PO	0.0	(0.00)
Golden Eagle	PO	0.0	(0.00)
Hermit Warbler	PO	0.0	(0.00)
Lawrence's Goldfinch	PO	1.8	(1.34)
Mountain Quail	PO	3.6	(1.88)
Northern Flicker	PO	1.8	(1.34)
Northern Pygmy-Owl	PO	0.0	(0.00)
Olive-sided Flycatcher	PO	0.0	(0.00)
Peregrine Falcon	PO	0.0	(0.00)
Purple Martin	PO	0.0	(0.00)
Red-breasted Sapsucker	PO	0.0	(0.00)
Song Sparrow	PO	0.0	(0.00)
Swainson's Thrush	PO	0.0	(0.00)
Tree Swallow	PO	0.0	(0.00)
Turkey Vulture	PO	1.8	(1.34)
Western Tanager	PO	7.3	(2.62)
Western Wood-Pewee	PO	0.0	(0.00)
White-throated Swift	PO	0.0	(0.00)
Wilson's Warbler	PO	10.9	(3.69)
Winter Wren	PO	1.8	(1.34)
Yellow Warbler	PO	3.6	(1.88)
Yellow-rumped Warbler	PO	1.8	(1.34)
Band-tailed Pigeon	OB	0.0	(0.00)
Cedar Waxwing	OB	14.5	(10.70)
Empidonax flycatcher sp.	OB	0.0	(0.00)
Golden-crowned Sparrow	OB	5.4	(2.28)
Nashville Warbler	OB	0.0	(0.00)
Pine Siskin	OB	1.8	(1.34)
Ruby-crowned Kinglet	OB	0.0	(0.00)
Selasphorous hummingbird sp.	OB	1.8	(1.34)
White-crowned Sparrow	OB	1.8	(1.34)

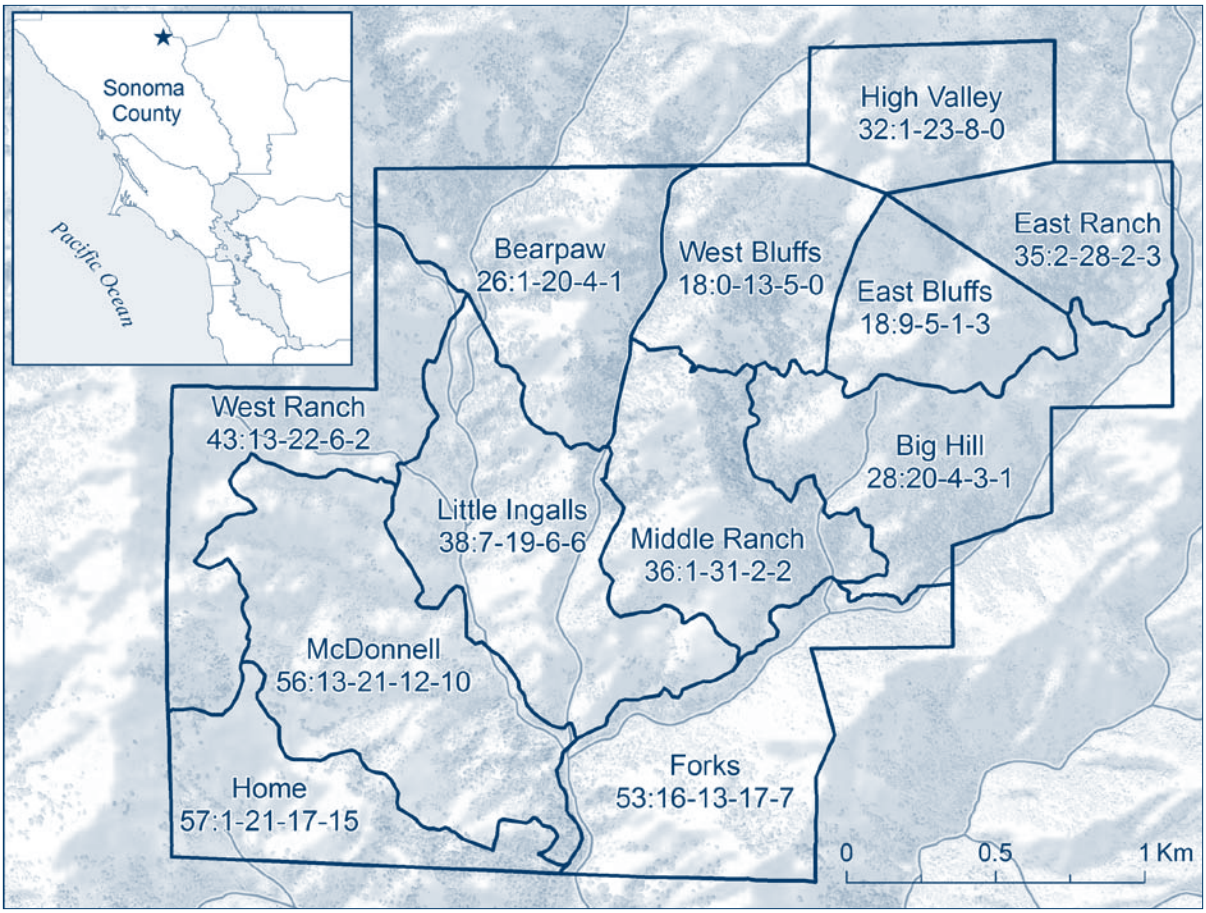

Figure 2. Map of Breeding Bird Assessment areas at the Modini Ingalls Ecological Preserve (areas do not exactly follow preserve boundaries). The numbers under each survey area name indicate preliminary (2010-2011) counts of species recorded for each level of nesting evidence (total species: "observed"–"possible"–"probable"–"confirmed").

Breeding evidence

The MIEP Breeding Bird Assessment is rigorous and ambitious. This process involves intensive field work within each of 12 partitions of the property designed to reflect areas of management interest, such as particular slopes, drainages, or contiguous habitat areas (Figure 2). In each survey area, we are classifying each bird species encountered according to four levels of nesting evidence (see below). Preliminary results reveal a rich breeding bird community (Table 1, see page 7). The initial results also suggest good progress toward our Breeding Bird Assessment goal of documenting "confirmed" or "probable" nesting by at least 90% of the breeding species during the next 2–3 years, estimated by declining (flat-lined) rates of new evidence (Figure 3).

Appropriate levels of breeding evidence are substantiated by numerous criteria, standardized by the North American Ornithological Atlas Committee (www.bsc-eoc.org/norac), to gauge the strength of evidence for just about every observable aspect of avian nesting behavior. For example, a singing male in suitable nesting habitat during its breeding season provides evidence of "possible" breeding. "Probable" breeding can be revealed by courtship behavior, territorial behavior, nest building by wrens (male wrens may build "dummy" nests when they are merely "hopeful"), or other criteria. Breeding can be "confirmed" by observing an adult carrying food or a fecal sac (excreted by nestlings), dependent young incapable of sustained flight, or other evidence needed to verify actual nesting. By applying such effort within each survey area, we hope to develop a fine-scaled understanding of how bird use varies across the MIEP watershed.

Searching for breeding evidence involves focused, high-interest birding. To avoid altering the natural nesting behaviors of birds, observers must minimize their intrusiveness. Patiently, they watch the routine activities of birds and investigate, very cautiously, any suspicious "nesting" activities. Nest predation rates are often high, so observers must be especially cautious when investigating suspected nest sites, without leaving trails or other habitat disturbance that might lead a discerning predator to a nest. In many cases, we do not need to approach a nest site because breeding

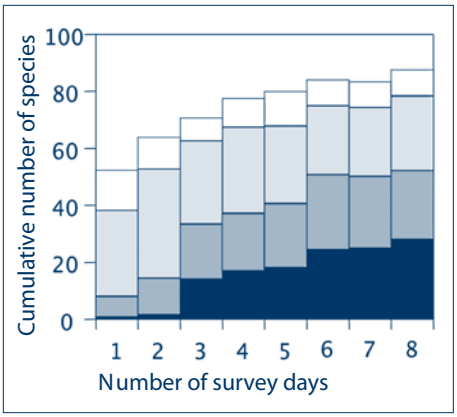

Figure 3. Preliminary accrual of breeding evidence for birds at Modini Ingalls Ecological Preserve, 2010-2011, has documented "Confirmed" or "Probable" nesting by 52 species; additional nesting species are expected. Evidence levels: "confirmed" (black), "probable" (dark gray), "possible" (light gray), species "observed" (white).

Table 2. Criteria for priority species in the Breeding Bird Assessment at Modini Ingalls Ecological Preserve; target species satisfy one or more of these criteria.

● Rare in Sonoma County and a potential spring resident based on field observations in the surrounding landscape (e.g., American Dipper)
● Common breeder in Sonoma County, but rare or uncommon spring resident at MIEP (e.g., Allen's Hummingbird)
● Rare spring resident, within its known breeding range, in the surrounding landscape (e.g., Dusky Flycatcher)
● Known to breed currently or historically in surrounding landscape, but likely to require targeted effort to confirm at MIEP (e.g., Sage Sparrow)
● Uncommon or rare breeder in Sonoma County (e.g., Hermit Warbler)

activity can be confirmed from a remote location. For example, an Orange-crowned Warbler disappears into a knot of foliage and, immediately, the faint begging calls of hungry nestlings are heard... breeding confirmed!

Gathering observations about local breeding bird activity seems simple enough at first, but it can become a serious challenge. Although some survey-area boundaries follow creeks, roads, fences, or ridges, documenting bird use within particular areas that are not otherwise marked in the field is like navigating in the dark (Figure 2). So, observers use maps, aerial photos, compasses, and GPS units to guide their work. Such effort depends on building a fine-scaled familiarity with the land, highlighted by configurations of trees, rocks, and other landmarks. As experienced birders, the field observers are pre-adapted for such familiarity: they share a practical knowledge of how species occurrences reflect subtle differences in the substance and architecture of preferred habitat.

On the very first day, we learned that a thorough assessment of breeding birds at MIEP involves relatively little leisurely "bird-watching." The rugged off-trail conditions can impose a serious challenge to one's physical endurance, often demanding pioneer drive—pushing through thick vegetation and climbing nearly vertical slopes—to find new birds. Fortunately, the rewards are great: finding the "secret" nest of a Rufous-crowned Sparrow deep inside a thicket of woody shrubs, in a ridiculously high and "inaccessible" place, can inspire a profoundly personal connection with nature. And, of course, a thorough assessment of avian habitat values requires us to connect with every part of the landscape.

Documenting all "possible" breeding activity depends on auditory detections of all singing males, who could be tending nesting territories. Ultimately, however, confirmation of local nesting requires visual evidence, which can be extremely difficult and time-consuming to obtain. To maximize our efficiency, we established several criteria to prioritize efforts targeting rare and secretive species, reducing time spent on common species likely to be confirmed by serendipitous encounters (Table 2). Obviously, this approach also makes the field work more interesting!

We also plan to conduct additional ad hoc surveys, inside or outside the April–May survey period, to target suspected nesting by rare breeding species. For example, repeated sightings of Lawrence's Goldfinches or Red Crossbills could inspire such effort! Overnight visits will target owls, Poorwills, or other species known to be secretive or active primarily during twilight or nocturnal periods. Our planned owling effort this year was unexpectedly rained out, so we have yet to actively seek owls. However, we did confirm local nesting by Western Screech Owl, by finding a nestling owlet that was apparently a victim of predation. With occasional patches of yellow pine *(Pinus ponderosa)* in and near the study area, the extremely unlikely possibility of finding a Flammulated Owl entices our birding effort— Flammulateds are well-documented in similar open and broken conifer woodlands of the coastal California mountains to the north.

Nesting abundances

Documenting whether a bird species nests in a particular area is only one aspect of its nesting status. As in measuring the status of wildflowers, it is helpful to know how many! To estimate breeding-season bird abundances, we are conducting 8-minute, 50-m, fixed-radius point counts at 36 standardized locations (Ralph et al. 1995, USFS Tech Rpt. PW-GTR-149). During each count, observers record all birds detected, mostly by song or call, within and beyond a 50-m radius (using laser range finders to gauge the distance). The number of individuals detected within 50 m is used to estimate breeding bird densities; birds detected farther away provide more general information on bird abundance.

One difficulty in conducting point counts is that auditory detections of birds are strongly influenced by acoustics. In estimating the distance of each singing or calling bird—a challenging task in itself—observers must adjust for the differential effects of vegetation or other habitat features on the transmission or scattering of sound frequencies. In addition, many birds "throw" their voices in different directions by turning their heads as they sing, and they may alter their volume, sounding far away even if they are nearby. Such behaviors may allow birds to adaptively target receivers or confuse potential predators or competitors—and birders!

The standardized point-count stations are distributed in proportions that match the relative extents of avian habitats—grassland, shrub, oak woodland, mixed evergreen forest, and open-canopy, gray-pine *(Pinus sambiniana)* woodland—estimated from the MIEP vegetation map created by Sherry Adams. Such proportional samples roughly estimate overall abundances across the landscape. Ultimately, we will evaluate how bird densities vary in relation to on-the-ground habitat conditions at each count station.

These first breeding bird surveys at the Modini Ingalls Ecological Preserve are fueling a growing love and appreciation for the living landscape of the central Mayacamas Mountains. The importance of the MIEP Breeding Bird Assessment in guiding local stewardship is enhanced by its potentially critical value in regional conservation. Once completed, the results will establish a foundation for documenting avian habitat values and associated implications for conservation throughout the central Mayacamas.

John Kelly is ACR's Director of Conservation Science.

Investigations of a special habitat at Modini Ingalls Ecological Preserve

Serpentine Mysteries

by Sherry Adams

As with grasslands across California, a typical grassland at the Modini Ingalls Ecological Preserve (MIEP) is dominated by wild oats *(Avena barbata),* rattlesnake grass *(Briza maxima),* ripgut brome *(Bromus diandrus),* false brome *(Brachypodium distachyon),* Italian thistle *(Carduus pycnocephalus),* and other plants that humans have introduced from other continents. Interspersed with these dominants are quite a few of our native grassland species, albeit in low abundance in most spots. These include long-lived bunch grasses like California brome *(Bromus carinatus),* California oatgrass *(Danthonia californica),* and purple needlegrass *(Stipa pulchra),* each with roots that go down several feet below the soil surface. Adding color to the landscape are many wildflowers such as Sonoma clarkia *(Clarkia gracilis* ssp. *sonomensis),* tomcat clover *(Trifolium willdenovii),* mariposa lilies *(Calochortus* spp.*)* and tarweeds *(Madia* spp. and others*).*

If your travels at MIEP take you to Ingalls Ridge however, prepare yourself for a completely different visage. Shiny green outcrops of serpentine, our state rock, are surrounded by the typical grassland described above. The serpentine outcrops range in size from a few hundred square feet up to about eight acres. Poking up from the broken shimmering rocks is a variety of wildflowers, many which grow only in this other-worldly environment.

Casual observation of this archipelago of outcrops reveals very little soil development, resulting in low water-holding capacity. Occasionally, a gray pine *(Pinus sambiniana)* may provide some shade, but mostly these locations get full sun. While these factors clearly create harsh conditions for many species, there is even more than meets the eye. Ecologists typically use the term "serpentine" broadly, referring to the habitat described above and the plants found therein. Geologists use a stricter sense of the term "serpentine," referring solely to minerals found in the parent material of some ultramafic rocks. "Mafic" is derived from the symbols for magnesium and iron and indeed these ultramafic parent materials give rise to soils that have very high levels of heavy metals, toxic to many plants. In addition, these locations typically have very low levels of key plant nutrients.

Conservation International recognizes the California Floristic Province (which encompasses most of the state) as one of the 34 biodiversity hotspots in the world, indicating a high level of endemism coupled with significant natural habitat loss. Within California, serpentine environments are particularly rich in uncommon and endemic plants. While less than 2% of California's land mass is serpentine, 13% of California endemic plants are restricted to serpentine, and 15% of all plants listed as threatened or endangered in the state show some degree of association with serpentine (Safford et al. 2005).

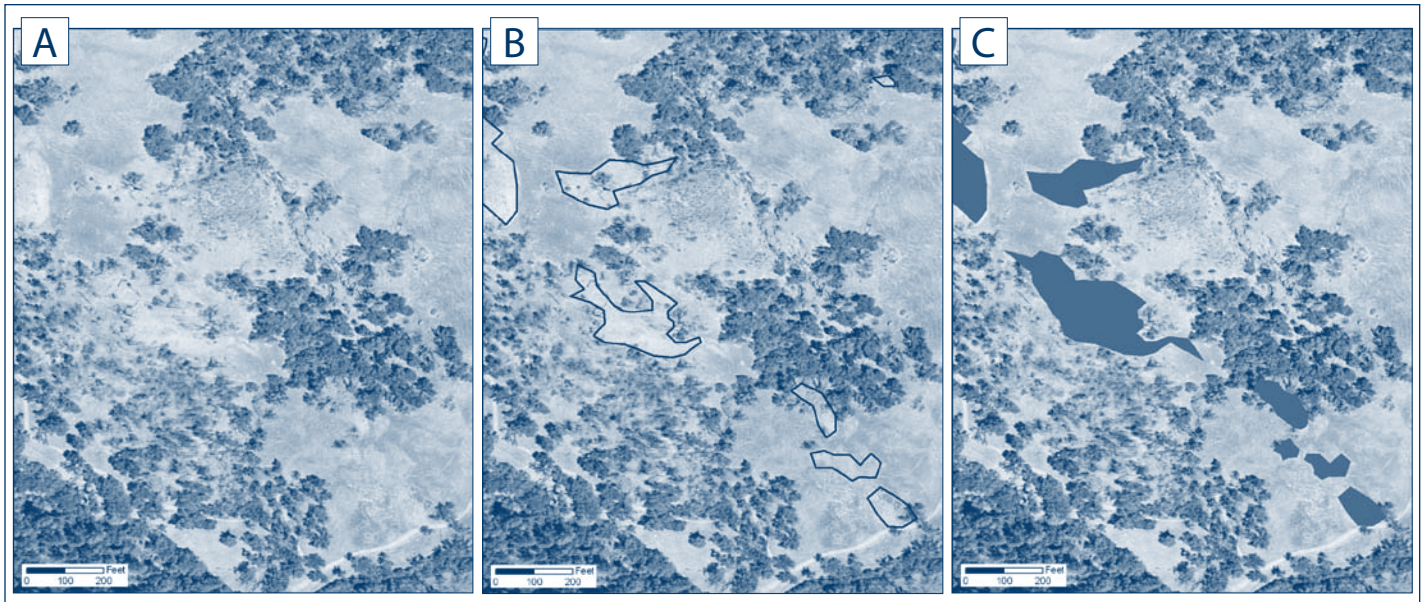

Figure 1. Using GIS to map serpentine outcrops on Modini Ingalls Ecological Preserve. (A) We began with high resolution aerial photos. (B) In the office, we delineated areas that appeared to be serpentine outcrops. (C) On-the-ground validation showed the preliminary boundaries to be a good start, with some adjustments needed.

Figure 2. Experts disagree on whether this Jewelflower is a unique rare subspecies with a very limited range *(Streptanthus glandulosus* ssp *arkii)* or a local version of a highly variable subspecies *(S. glandulosus* ssp *glandulosus;* Meyer & Beseda 2010). Although the species is not limited to serpentine outcrops, at MIEP it occurs primarily on serpentine. Many closely related species (genus *Streptanthus,* the jewelflowers) are limited to serpentine outcrops.

Figure 3. St. Helena fawnlilly *(Erythronium helenae),* a plant of very limited distribution on the California Native Plant Society's Watch List (List 4.2), growing at MIEP.

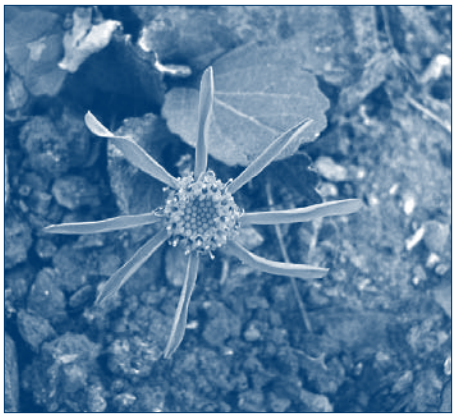

Figure 4. Flame butterweed *(Packera greenei)* is found on serpentine outcrops of the North Coast Range and at MIEP. The bright orange flowers contrast sharply to the leaves which blend in with the surrounding soil.

The North Coast Ranges, which include MIEP, have more serpentine endemic plants than any other region of the state (about 120 taxa; Safford et al. 2005). Many of these groups of plants have a very limited distribution. For example, two plants found at MIEP, the St. Helena fawn lily *(Erythronium helenae)* and the Mount Saint Helena morning-glory *(Calystegia collina* ssp. *oxyphylla),* are both present in only a small area which includes MIEP.

In many disciplines, serpentine is an exciting locus of research, with some scientists suggesting that learning about serpentine leverages our research investment by teaching us about much more than just the serpentine outcrop itself (Harrison and Rajakaruna, 2011). We now know that terrestrial serpentine outcrops tend to be found in bands along the boundaries of tectonic plates. For geologists, serpentine outcrops helped to shine light on the plate tectonics model, since they are often composed of material that is either scraped to the continental surface where two plates collide, or that emerges under the ocean where new oceanic crust is being formed at spreading centers. NASA has done research on serpentine microbial life (an example of "extremophiles"), because they think it may provide a model for life elsewhere in the solar system. Where ultramafic rocks surface under the ocean, an exothermic (energy-producing) chemical reaction supports a microbial community, even deep inside the rock, expanding our understanding of the parameters that support life on earth.

Serpentine inventory at MIEP

In 2010, with assistance from volunteers and other ACR staff, I initiated an inventory of the plants of the serpentine outcrops at MIEP. We began by using high-resolution aerial photography to identify possible serpentine outcrops, followed by field work to validate and revise the results (Figure 1).

We are targeting the serpentine outcrops because it is an efficient way to find many of the rare plants of MIEP. If we consider a list of the species of a given place, a few are abundant, but most are uncommon. In other words, these uncommon species, including many of the plants on MIEP's serpentine outcrops, are the backbone of biodiversity. Further, the persistence of a species that is limited to a few isolated patches is naturally precarious, because an event that eliminates the plants on a patch may significantly reduce the genetic diversity of the species. Keeping an eye on these uncommon plants is a way for us to monitor the most sensitive elements of biodiversity.

One of the intriguing aspects of serpentine outcrops is that each has a different assemblage of species. For example sickle leaf onion *(Allium falcifolium)*, a serpentine plant found in California and Oregon, is found at MIEP but only on one of the 30+ outcrops. Jepson ceanothus *(Ceanothus jepsonii* var. *albiflorus),* a low shrub limited to serpentine soils in the North Coast Ranges, is found on two of the serpentine patches at MIEP, but they are not near each other and there are many serpentine patches in between that do not have the species. Likewise, several other plants are found on one or a few serpentine outcrops but are absent from seemingly similar outcrops elsewhere at MIEP. We have been collecting some basic data from the serpentine outcrops to see if this can shed some light on the distribution of these plants. While competition for light, water, and nutrients is fierce in the surrounding grassland, in the open environment of serpentine outcrops such biotic factors may be less important than abiotic factors (such as aspect, slope, and soil depth) or chance dispersal events.

A few early observations

Another reason to conduct scientific investigations of the serpentine outcrops of MIEP is to gain enough knowledge about their condition to ensure that we are able to protect them from threats. This spring while conducting the inventory I found a small patch of barbed goatgrass *(Aegilops triuncinalis)* on only one of the outcrops and so far nowhere else on MIEP. While finding an introduced plant in California grasslands sounds like an old story, a number of experts have raised concerns that this grass is particularly problematic. Like some other invasive pest plants, it can come to

dominate a grassland and is unpalatable to cattle and wildlife. However, of particular conservation concern is the fact that goatgrass can spread rapidly in serpentine areas, one of the last refuges of native plants in California grasslands. There is evidence to suggest that this species can be an ecosystem engineer, which is to say that it changes the physical or biological structure of a place so much that, even after removal, its impacts may continue to be felt. In this case, such secondary impact can occur in the form of changed soil-microbial community (Batten et al. 2006), or accumulation of undecomposed litter (Drenovsky and Batten 2006). The patch of barbed goatgrass I found was still small enough that I was able to hand-pull and remove all plants, and it was early enough in the season that they had not distributed their seeds yet. By the time you are reading this I will have visited all known serpentine outcrops on MIEP, and barbed goatgrass is one thing I'll be looking for.

Jewelflowers *(Streptanthus* spp.*)* are a group of unusual flowers in the mustard family (Brassicaceae), many of which are specially adapted to growing in serpentine. Because serpentine outcrops can be distributed patchily across the landscape, populations have often been separated for long periods of time. As a result of such separation, the plants in one patch may look a bit different from the plants in another patch, even if they are very closely related and considered the same species. This may be due to genetic drift, which is genetic changes in small isolated populations due to chance. One outcome is disagreement and constant revision by taxonomic experts who work to determine what qualifies as a separate species or subspecies in a group that appears to be undergoing speciation before our eyes. Additionally, it is no easy task to compile a simple list of the jewelflowers found at MIEP! Even consulting with experts has not always clarified the identity of a plant.

While our inventory is not complete, a few things are already clear. Serpentine outcrops are a storehouse and refuge for native plants at the Modini Ingalls Ecological Preserve. Of the 179 species so far found on these outcrops, 149 are native, and they are the plants that dominate these patches. Over 40 of them are documented in the scientific literature to be associated specifically with serpentine soils. This includes some that are strict endemics, meaning they are only found on serpentine outcrops. Quite a few are also regional endemics, only found in the North Coast Ranges of California. ACR, with our partners the Modinis and the county open space district, have a commitment to the conservation of this property and the natural heritage of the central Mayacamas Mountains. The serpentine habitats of MIEP, a special and unique botanic treasure, are one example of what inspires that commitment.

Thank you to ACR volunteers Denny Fujita and Diana Ruiz for assistance in collecting data for the serpentine inventory at MIEP, and to Emiko Condeso for GIS assistance.

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Sherry Adams is the Biologist and Preserve Manager of the Modini Ingalls Ecological Preserve and the Mayacamas Mountains Audubon Sanctuary.

Visiting investigators

Audubon Canyon Ranch hosts graduate students and visiting scientists who rely on the undisturbed, natural conditions of our sanctuaries to conduct investigations in conservation science.

Carbon addition and mowing as restoration measures in a coastal California grassland. Brody Sandel, UC Berkeley.

Long-term monitoring of the Giacomini wetland. Lorraine Parsons, Point Reyes National Seashore.

Analysis of sedimentation in natural and restored marshes. Lorraine Parsons, Point Reyes National Seashore.

A camera trap survey of mammals and birds at Audubon Canyon Ranch. Rich Tenaza, University of the Pacific, and Chris Wemmer, California Academy of Sciences.

Functional trait distribution in California plant communities. Susan Harrison, Brian Anacker, Barbara Going, and Andrew Kleinhasselink, UC Davis.

Assessing impairment of Tomales Bay due to mercury: Risk to invertivores at the Walker Creek Delta. Kat Ridolfi, San Francisco Estuary Institute.

Development of macroalgal assessment framework to diagnose eutrophication in estuaries. Lauri Green, UC Los Angeles.

In Progress: project updates

Current projects by Audubon Canyon Ranch focus on the stewardship of sanctuaries, ecological restoration, and issues in conservation science.

Picher Canyon Heron and Egret Project ◗ The fates of all nesting attempts at ACR's Picher Canyon heronry have been monitored annually since 1967, to track long-term variation in nesting behavior and reproduction.

Tomales Bay Shorebird Census. ◗ Since 1989, we have conducted annual shorebird censuses on Tomales Bay. Each census involves six baywide winter counts and one baywide count each in August and April migration periods. The data are used to investigate winter population patterns, local habitat values, and implications for shorebird conservation. We are currently measuring benefits of the Giacomini Wetlands Restoration Project to shorebirds using Tomales Bay.

Tomales Bay Waterbird Census. ◗ Since the winter of 1989–90, teams of observers have conducted winter waterbird censuses from survey boats on Tomales Bay. The results provide information on habitat values and conservation needs of more than 50 species.

North Bay Counties Heron and Egret Project. ◗ Annual monitoring of reproductive activities at all known heron and egret nesting colonies in five northern Bay Area counties began in 1990. ACR's 250-page Annotated Atlas and Implications for the Conservation of Heron and Egret Nesting Colonies in the San Francisco Bay Area is available online (www. egret. org/atlas. html), along with a reference that uses Google Earth to show the locations and status of individual heronries (www. egret.org/googleearth2.html). We are currently working on the effects of climate change on regional nesting abundances, the effects of colony site disturbance on nesting distributions, and seasonal heron and egret use of Bolinas Lagoon.

California Watershed Assessment Framework. ◗ ACR collaborated with PRBO Conservation Science on a contribution to the State Water Resources Watershed Assessment Framework. We evaluated the use of avian indicators, including nesting abundance and reproductive success in tidal marsh birds, herons and egrets, and waterfowl, to measure the health of estuaries and watersheds.

The State of Birds of San Francisco Bay. ◗ ACR collaborated on a report on the State of Birds of San Francisco Bay, providing an analysis of the status and conservation of herons and egrets. The purpose of the report, produced by PRBO Conservation Science, is to improve bird conservation by influencing policy, raising awareness about the status of birds, and recommending actions for habitat restoration and management.

Four Canyons Project. ◗ We are restoring native vegetation in the lower reaches of four canyons at ACR's Martin Griffin Preserve, eradicating or controlling invasive plant species and using locally collected and propagated plant materials to repair disturbed sites.

Monitoring and Control of Non-Native Crayfish. ◗ Jeanne Wirka and others are studying the distribution of non-native signal crayfish *(Pacifastucus leniusculus)* in Stuart Creek at Bouverie Preserve and investigating the use of barriers and traps to control the impacts of crayfish on native amphibians and other species.

Plant Species Inventory. ◗ Resident biologists maintain inventories of plant species known to occur on ACR's Tomales Bay properties and at the Bouverie and Martin Griffin preserves.

Annual Surveys and Removal of Non-Native *Spartina* and Hybrids. ◗ In collaboration with the San Francisco Estuary Invasive Spartina Project, Emiko Condeso and Gwen Heistand coordinate and conduct field surveys for invasive, non-native *Spartina* in the shoreline marshes of Tomales Bay and Bolinas Lagoon.

Monitoring and Eradication of Perennial Pepperweed in Tomales Bay. ◗ We are removing isolated infestations of invasive, non-native pepperweed *(Lepidium latifolium),* known to quickly cover floodplains and estuarine wetlands, compete with native species, and alter habitat values.

Saltmarsh Ice Plant Removal. ◗ We have eradicated nonnative ice plant from marshes and upland edges at Toms Point on Tomales Bay, although management to remove resprouts and new patches continues.

Eradication of *Elytrigia pontica* ssp. *Pontica*. ◗ At Bouverie Preserve, we are removing a patch of *Elytrigia,* an invasive, non-native perennial grass that forms dense populations in seasonal wetlands.

Nest Boxes. ◗ Tony Gilbert maintains several Western Bluebird nest boxes in the Cypress Grove grasslands. In addition, Jennifer Potts and Jeanne Wirka are monitoring nest box use, by bluebirds and other species, to help in monitoring the restoration of oak woodlands at Bouverie Preserve (see Project Grow).

Removal of *Ammophila arenaria* in Coastal Dunes. ◗ Removal of invasive dune grass *(Ammophila arenaria)* at ACR's Toms Point is helping to restore and protect native species that depend on mobile dune ecosystems.

Vernal Pool Restoration and Reintroduction of Imperiled Plants. ◗ In the vernal pools at Bouverie Preserve, we are removing invasive plants and re-establishing the federally listed Sonoma sunshine *(Blennosperma bakeri)* and the California species of conservation concern, dwarf downingia *(Downingia pusilla)*. The work involves manual effort by volunteers, propagation and planting of native plants, use of prescribed fire, cattle grazing, and monitoring of vegetation and hydrology.

Yellow Starthistle at Modini Ingalls Ecological Preserve (MIEP). ◗ Sherry Adams conducted an inventory of yellow starthistle *(Centaurea solstitialis),* established a monitoring program, and developed guidelines to reduce the spread of this invasive plant.

Serpentine and Rare Plant Survey at MIEP. ◗ Sherry Adams and volunteers are identifying and mapping unique plant assemblages associated with serpentine outcrops to help understand their status in the central Mayacamas Mountains.

Breeding Bird Assessment at MIEP. ◗ Using breeding-bird atlas and point-count methods, we are assessing the breeding status, abundance, and distribution of each bird species at MIEP. This work will contribute to an understanding of regional bird use in the central Mayacamas Mountains.

Project GROW. ◗ Gathering to Restore Oak Woodlands (GROW) is a partnership between ACR and the Southern Sonoma County Resource Conservation District to restore eight acres of oak woodlands at the Bouverie Preserve. Community members and Sonoma Valley High School students helped plant several species of oak trees and other species. Habitat enhancements include planting native grasses and installing brush piles and nest boxes to support wildlife.

Coastal Survey of Colonial Waterbird Colonies. ◗ ACR conducted a coastal survey of heron, egret, and Double-crested Cormorant nesting colonies, from San Luis Obispo County northward to the Oregon border. Surveys beyond the San Francisco Bay area were coordinated by ACR Research Associate John Sterling. The results contribute to a statewide inventory of waterbird colonies by PRBO Conservation Science and underscore the importance of the San Francisco Bay area to heron and egret populations.

Audubon Canyon Ranch
4900 Shoreline Highway One
Stinson Beach, CA 94970
Cypress Grove Research Center
P.O. Box 808
Marshall, CA 94940
(415) 663-8203

THE ARDEID

Ardeid (Ar-DEE-id), N., refers to any member of the family Ardeidae, which includes herons, egrets, and bitterns.

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Birds-eye gilia *(Gilia tricolor)* grows on a serpentine outcrop at Modini Ingalls Ecological Preserve

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Serpentine Mysteries see page 10