ABOVE: Early fall bloom of a yampah (*Perideridia gairdneri* and *P. kelloggii*) dominated prairie at OAEC. With what began as a relatively small patch of yampah over 20 years ago, we have actively expanded its size and density through targeted mowing, weed whipping, hand removal of velvet grass (*Holcus lanatus*), seed collection, and seed sowing. We also distribute seeds to other favorable seasonally saturated wet prairies at OAEC, which previously lacked representation with either yampah species. Photograph by Brock Dolman. • BELOW: Gairdner's yampah (*Perideridia gairdneri)* has delectable seeds and tuberous roots, which were and still are highly coveted by indigenous peoples, and the land stewards at OAEC. The root when eaten raw is nutty, earthy and sweetens up when cooked. The delicious seeds have a spicy flavor reminiscent of coriander. Some of the seeds will be saved for hand dispersal later in the season. Photograph by Brock Dolman.

MENDING THE WILD AT THE OCCIDENTAL ARTS AND ECOLOGY CENTER

by Brock Dolman

For over 20 years, members of the residential community Sowing Circle LLC in collaboration with staff biologists of the non-profit Occidental Arts and Ecology Center (OAEC) have been restoring geophyte habitat on our 70-acre Wildlands Preserve in western Sonoma County using guidelines derived from both indigenous traditional practices and horticultural techniques. Through ecological and observational studies, we have concluded that the geophytes on our land, including yampah (*Perideridia* spp.), bluedicks (*Dichelostemma* spp.), *Triteleia* spp., *Brodiaea* spp., and yellow mariposa lily (*Calochortus luteus*) need management at different scales. First, management has to be

finely tuned to the ecological requirements of the species at the habitat level—the right moisture, light regime, plant associations, and other factors. The geophyte populations that occur on our land are found in coastal prairie. Second, at the scale of the individual—these plants have a reproductive biology that doesn't readily propagate through cloning or seed dispersal without assistance in the form of disturbance: such as small or large mammal digging, eating, and dispersal of cormlets or bulblets, and human dispersal of propagules and seeds.

Taking these requirements into consideration, OAEC designed an active management program through a combination of: collecting native wildflower and grass seeds; reintroducing traditional practices of burning the coastal prairie; active removal of encroaching Douglas fir, coyote brush, Scotch and French brooms; targeted mowing/weed whipping of invasive annual and perennial grasses; sowing the seeds into the burned and unburned areas; and finally monitoring the results. We call this "mending the wild" and it requires active human engagement with the landscape repeatedly with an astute focus on managing for stages of succession optimally conducive to the structure, function and composition of a healthy diverse coastal prairie. From the beginning of our project, we chose to honor and curate our onsite genetic lineage, thus focusing our restoration efforts on working with and expanding our localized native plant populations and the plant communities that house them.

THE HISTORIC LANDSCAPE AND RECENT DEGENERATIVE DISTURBANCE

To understand why we chose these practices, we need to step back and explore the historical ecology of the coastal prairies, recent changes, and the current condition on our land and in the surrounding region. Research in the past 25 years has found that California's coastal prairies are rich in biodiversity (Stromberg et al. 2001).Native perennial grasses often are the dominant form of plant life, with forbs (wildflowers) making up a significant proportion of the species richness of coastal prairies (Hayes and Holl 2003). On our preserve, we currently have roughly seven acres of remnant coastal prairie, and there are native perennial bunchgrasses like blue wildrye (*Elymus glaucus*), California oatgrass (*Danthonia californica*), and purple needlegrass (*Stipa pulchra*), interspersed with the geophytes already mentioned.

In zones with very low frequency of lightning strikes, such as along California's coast, whole ecosystems exist that are clearly fire-dependent, including coastal prairies. Further, ecologists are recognizing that a general decline in biodiversity in coastal areas is likely linked to the absence of indigenous management using digging sticks and propagule replanting combined with the setting of frequent, low intensity fires, because lightning along the coast would have been insufficient (Stuart

Before and after images of a coastal prairie restoration effort at OAEC which initially required a very labor intensive process of removing encroaching coyote brush, Douglas fir and exotic Scotch broom. As can be seen in the after image, the woody slash was burned onsite with the ashes later scattered. Afterwards previously collected native bunch grass and forb seeds were sown into the burn pile areas and places with bare mineral soil created from the removal of the various woody plants. Many of these sites have been restored to prairie, although the capacity of an older stand of Scotch broom, with a significant soil seed bank, should not be underestimated relative to the level of need for ongoing and multi-year follow up! Photographs by Brock Dolman.

and Stephens 2006). Originally these prairies were subjected to grazing pressures exerted over many millennia by Pleistocene megafauna, which are well documented in the regional fossil record (Parkman 2006) and in later times the prairies supported herds of mule deer, pronghorn antelope, and tule elk, also developing under some grazing pressure (Schiffman 2007).

A restored coastal prairie in bloom at OAEC of California oatgrass (*Danthonia californica*) co-mingling with sanicle (*Sanicula* sp.)—several species of which provide important edible tubers to indigenous people, shooting star (*Dodecatheon hendersonii),* and sun cup (*Taraxia ovata)* to name a few. Photograph by Brock Dolman.

In the last 150 years, Euro-Americans heavily influenced OAEC's coastal prairie. In the early 1870s the first Italian homesteaders commenced logging of old growth redwood, and the targeted plowing of all our prairies to plant vineyards, which persisted until their removal during the era of prohibition in the 1920s. Vines were dry farmed on 10' x 10' centers and managed as head-pruned shrubs, which were subsequently maintained with annual plowing between vine rows to a narrow perimeter around the base of each vine. This resulted in an easily observed pattern on the land of hundreds of 1m circular – 10 to 20cm tall mounds, which are the vestiges of the unplowed area at the base of each grapevine. A closer inspection of these mounds show that some of the largest crowns of native bunchgrass we have onsite are often found on the tops of these historically unplowed mounds. Grassland ecologists have documented the capacity for *Stipa pulchra* to live for several hundred years (Hamilton et al. 2002). Based on the large size of some bunchgrass crowns on the mounds, we have inferred that they represent the assumed vegetation community at time of the type conversion to vineyards, and thus offer us "reference" state or quasi-baseline window into the past that inspires our management goals and informs our "mending the wild" activities.

Nearly a century later in the 1960s/70s the land ownership went through several new changes, which came with a different degree of disturbance marked in this case by a significant decrease in active management of the land towards a passive untended approach, although regional fire suppression policies were enforced. We have roughly another five acres of 30+-year-old dense Douglas fir stands, or coyote brush/broom patches along the edges of our existing prairies. Interestingly, when you look at the ground surface below these stands you will also find the telltale pattern of the plowed vineyard mounds. Thus, these areas have recently been encroached by coastal coniferous forest and coastal scrub, a successional pattern that provides evidence for an even greater loss in our overall extent of coastal prairie. Tree and shrub encroachment also appear to be accelerated by the removal of keystone processes, such as lack of frequent, low intensity fire, native herbivore grazing regimes and/or the cessation of wild-tending practices by traditional peoples.

We therefore have come to see some of these historic and modern Euro-American settlement activities as "degenerative disturbances," leaving a legacy of ecological illiteracy expressed in the landscape. As a way forward, our management practices try to mimic the natural disturbances with which coastal prairies have evolved, striving to become agents of regenerative disturbance rather than degenerative disturbance.

REGENERATIVE DISTURBANCE: RESTORING GEOPHYTES AND COASTAL PRAIRIE

Based on the aforementioned impacts of European settlement, our work over the past 22 years has primarily focused on land management practices that favor and strengthen existing native biological assemblages. Recovery from such rapid and extensive changes requires patience and ample adaptive management to re-adjust the species composition, structure and function of ever evolving ecological states.

Our approach recognizes the critical importance of human communities reviving and re-"story"ing our relationship to, and acknowledging our dependency on thriving biologi-

TOP: Using prescribed fire on a cool windless early morning at the Occidental Arts and Ecology Center to restore geophyte habitat in coastal prairie, November 11, 2005. The timing of this fire was in the fall after initial rains had moistened the landscape for general safety concerns. Goals of the burn were to reduce the exotic grass seedlings, and remove extensive dense thatch so as to open up soil space between native bunch grass crowns for onsite collected native geophyte and grass seeds to be thrown and sown, or "shucked and hucked." Photograph by Brock Dolman. • ABOVE LEFT: Yellow mariposa lily (*Calochortus luteus*) flower with red yarn tied on it, which significantly enhances the process of locating the dry pod for seed collection several months later when it blends into the dense standing stalks of various grasses. Photograph by Brock Dolman. • ABOVE RIGHT: Yellow mariposa lily (*C. luteus*) pods and seeds were hand collected, or "shucked" in September. The seeds were stored in paper bags in a cool dark location and subsequently sown several months later with the first rains, after the prescribed burn. Photograph by Jim Coleman.

After burning, native geophyte seeds, such as yellow mariposa lily (*Calochortus luteus*) and perennial native bunch grass seeds were sown into the exposed bare mineral soil, aiming for enhanced seed germination, with the influx of nutrients and reduced competition. Photograph by Jim Coleman.

cally and culturally diverse watershed communities. The results of our work over two decades are markedly heightened patches of diverse native perennial bunchgrasses and wildflowers in our coastal prairie.

As a case study, yellow mariposa lily is one species that receives special attention. It is simply a spectacular flower and has ethnobotanical value in the edible landscape of the indigenous peoples being an important food of tribes as diverse as the Coast Miwok, Pomo, Southern Paiute, and Southern Sierra Mi-Wuk. In 1994, there were only seven individual plants found in one remnant patch on an east-facing slope. Making early note of this, we began a concerted effort to locate the pods each season for seed harvest to be sown later that year. Finding the beautiful yellow flowers in full bloom is not a challenge in late spring, but by late summer, close searching for seedpods amidst a sea of dried brown annual exotic grasses requires one to develop a skilled search image. After several seasons we learned to optimize our chances of re-locating the dried seedpods by tying short lengths of bright red yarn on the blooming flower stalk.

The process of visiting each individual flower in the spring and tying the red yarn on was quite fulfilling knowing that in a few months, we would more easily relocate the mature pod for seed harvest. In late summer/early fall, we collected the seedpods and shucked them by hand to access the small disc-like seeds. Next, we stored the seeds in paper bags in a cool dry indoor location. Prior to the first fall rains we then went out in the field and hucked the *Calochortus luteus* seeds. We call this our "shuck-n-huck" method. Over the years, in order to assure seed contact with bare soil, we either, scattered the seeds in recently burned areas of coastal prairie, or opportunistically flattened the soil mounds of the gophers with our boots, then sprinkled some seeds on the new mineral seedbed—roughing up the surface lightly with our hands to cover the seeds. To optimize our "assisted migration" efforts, we diversified the distribution of seeds on the property by targeted shucking and hucking in all other suitable prairie patches on the property. We are elated to say that after 22 years, in the spring of 2016 we stopped counting flowers/plants at 1,000 individuals in the original source prairie site alone!

The over-arching goals of the OAEC Wildlands Program are to demonstrate, educate, and train communities about the various practices and experiments we use to re-establish a more regenerative relationship with our wildlands and watersheds. Special emphasis is placed upon Traditional Ecological Knowledge (TEK) collaborative trainings with Coast Miwok/Southern Pomo tribal citizens of the Federated Indians of Graton Rancheria. In 2016, OAEC completed a comprehensive Stewardship Plan that details the land history and management goals of our Wildlands Preserve. This 200-page plan and much more information can be found at oaec.org/wildlands.

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Brock Dolman, 15290 Coleman Valley Road, Occidental, CA 95465; Brock@oaec.org