

CONSERVATION AND COMMUNITY AMONG THE SANTA ROSA PLAIN VERNAL POOLS

by Michelle Jensen and Nancy C. Emery

Nestled within the rolling grasslands of the Santa Rosa Plain in Sonoma County are shallow topographic depressions where water, soil, and sunshine mingle. Each year the sprinkling of seasonal precipitation over a landscape lined with a soil hardpan cause vernal pool wetlands to swell, triggering a remarkable cascade of biological events.

In response to the onset of rain in the late fall, terrestrial plant species begin to germinate while salamanders, copepods (a group of small crustaceans), and fairy shrimp wake

from their hot weather dormancy among the loamy soils. Months later, as the days warm signaling the onset of spring, rapidly unfurling floral displays entice native solitary bees and pollinators to produce future generations before the water table recedes and the summer sun laps the last few molecules of standing water into the sky.

Ephemeral vernal pool wetlands are rare in the state of California and the Santa Rosa Plain is one of the few coastal regions containing relicts of this biodiverse ecosystem. It is theorized that northern hardpan pools on the Plain were developed through the scouring activity of creeks and rivers. This action shaped the hummocky (ridge-like) uplands of Wright clay loam that encircle shallow depressions, or meander scars (abandoned portions of a channel) where vernal pools are commonly found (Norwick 1991).

The pools are botanically intriguing in that they represent a diverse oasis of native annuals that are adapted to the harsh fluctuations of full inundation in winter and complete aridity in summer. Species found amidst these "islands among the grasses" include downingia (*Downingia concolor*), smooth or rayless goldfields (*Lasthenia glaberima*), California semaphore grass (*Pleuropogon californicus*), Douglas's beardstyle (*Pogogyne douglasii*), and the delicate Lobb's aquatic buttercup (*Ranunculus lobbii*).

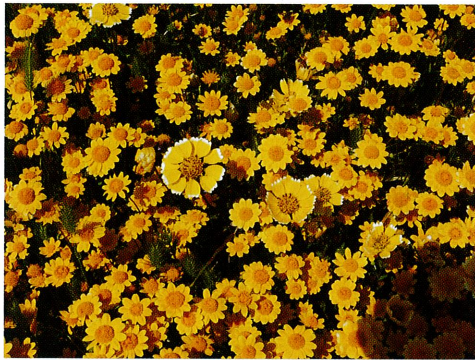
The pools may also contain three endangered plant species that are largely endemic to Sonoma County:

Burke's goldfields (*Lasthenia burkei*), Sebastopol meadowfoam (*Limnanthes vinculans*), and Sonoma sunshine (*Blennosperma bakeri*), all CNPS List 1B.1 species. All three have been substantially impacted through a history of pressures from development and land conversion, and have spurred an intensive conservation movement to preserve the few populations that remain today (e.g., see CH2M Hill 1995). Considering that California has now lost up to 95% of its vernal pool habitat (Holland 1978; Holland 1998), each remnant of this unique ecosystem represents a last-standing refuge for many endemic and endangered species.

HISTORY ON THE PLAIN

Between 1970 and 1990 Sonoma County experienced a major population boom, resulting in an escalation of urban development that encroached onto the Plain and into vernal pool habitat. During this period, species of concern became protected under Federal and State Endangered Species Acts, triggering the implementation of mitigation projects as a means to address the loss of wetland habitat.

Mitigation on the Plain primarily involved the creation of artificial vernal pool habitat at alternative sites using heavy equipment to contour the soils. Seed (or scraped soils containing seeds) from destroyed or donor pools was then used to "inoculate" the created pools. Oftentimes seed was transported in larger quantities, at greater distances,



ABOVE LEFT: One of the most vibrant of endangered vernal pool species on the Santa Rosa Plain, Burke's goldfields (*Lasthenia burkei*) has experienced a decline in population size over the last 25 years. Photograph by D. Ackerly. • LEFT: Sebastopol meadowfoam (*Limnanthes vinculans*), another species endemic to the Plain, is also threatened by development. Photograph by M. Jensen.



Created vernal pool in winter on mitigation property in Sonoma County with a staff gauge for monitoring pool hydrology in the center. Large Valley oak trees (*Quercus lobata*), as seen in the background, are often found scattered among the wet meadows of the Plain. Photograph by M. Jensen.

and deposited in ways that did not reflect natural patterns of seed dispersal. Furthermore, seeds were often sown haphazardly across pools, without regard to subtle differences in elevation (microtopography). This can have dramatic influences on plant germination and survival, as small changes in elevation within pools is often associated with vastly different hydrological conditions, soil types, and plant community composition.

Regardless of the onset of mitigation practices and their intention to reduce impacts to endangered species, incessant pressures from urban encroachment and land use on the Plain continued well into the new millennium. Recognition that these demands needed to be addressed resulted in a collaboration of stakeholders who developed the Santa Rosa Plain Conservation Strategy in 2005 (Goude et al. 2005). Instead of dealing with land conversion on a project-by-project basis, this guid-

ing document advocated setting aside *contiguous* conservation areas associated with projected urban growth boundaries. However, at the time of its inception, many natural vernal pools remained scattered on private lands and beyond the jurisdiction of the Strategy.

WHERE ARE WE NOW?

When a vernal pool specialist is asked about the state of the pools on the Plain, they most often reply with concern. The role and “success” of mitigation in the conservation of endangered plant species is contentious, and we still don’t understand how past seed translocation activities are affecting these populations. Despite strong opposition from CNPS (Hubbart et al. 2001) and various conservation scientists (Elam 1998; Howald 1996), seed translocation practices are still utilized to this day.

Unfortunately, a majority of the

remaining vernal pools on the Plain are heavily degraded or unmanaged, leaving populations vulnerable to changes in environmental or land-use conditions. Properly managing these landscapes can be an expensive and daunting task, demanding a fundamental understanding of the complexities associated with vernal pool systems and their annual fluctuations.

Presently we are at a point where development and land conversion has temporarily declined in the region, thereby giving pause for stakeholders to engage in the acquisition, management, and conservation of the remaining vernal pools. We can also reflect upon what we have learned over the last 25 years, considering our past mistakes and achievements in preparation for the next set of challenges.

Instead of approaching the circumstances on the Plain with reservation, we can reevaluate our position and recognize the Plain as a



Volunteers learning to identify Sebastopol meadowfoam, one of the three endangered species monitored annually through the Adopt a Vernal Pool citizen science program. Photograph by H. Brown.

case study of mitigation. Adopting this perspective opens up many opportunities for local botanists, ecologists, naturalists, and students, as well as land managers and policymakers, to explore a system that has been tampered with yet still requires active long-term management. Given that population growth in California is inevitable, we must learn how to best conserve and manage our treasured flora, regardless of site history.

RESEARCH ACTIVITIES

A growing awareness of the uncertain future facing vernal pools throughout California has led to a recent surge of research activity on the endangered plant species found on the Santa Rosa Plain. Armed with contemporary scientific techniques that are increasingly accessible, local researchers are exploring the conservation ecology, evolution, and genetics of vernal pool plant species. The list of research possibilities seems endless, covering everything from grazing regimes to the effects of hydrologic connectivity between neighboring pools and

swales on seed dispersal. Some of the current research projects related to vernal pools that are taking place on the Plain include:

- comparisons of local pollinator communities observed in created and natural pools (Kandis Gilmore, Sonoma State University);
- genetic diversity and structure across endangered plant species' ranges, as well as within individual pools (Dr. Christina Sloop, San Francisco Bay Joint Venture; Michelle Jensen and Dr. Nancy C. Emery, Purdue University; see Ayres and Sloop 2008);
- the effects of soil compaction on plant growth and morphology (Michelle Jensen and Dr. Nancy C. Emery, Purdue University); and
- vernal pool seed bank dynamics (Hattie Brown, Laguna de Santa Rosa Foundation; and Dr. Christina Sloop, San Francisco Bay Joint Venture).

It is the goal of many of these research projects to establish an up-to-date baseline dataset that will enhance our knowledge of vernal pool species to assist conservation efforts.

BECOMING INVOLVED

There are now many opportunities for members of the public to participate in research activities on the Plain. One is the Adopt a Vernal Pool (AVP) citizen science monitoring program, which was initiated in 2007 through the collaborative efforts of the California Native Plant Society's Milo Baker Chapter and the Laguna de Santa Rosa Foundation. The AVP program currently consists of over 50 volunteers that annually monitor endangered vernal pool plant populations across the Plain. Standardized data collections are annually compiled in a publicly accessible database available at www.citizen-science.org.

In the last three years, AVP volunteers have increased our understanding of vernal pool dynamics and have brought attention to a recent threat of invasive plant species infiltrating vernal pool habitat, including the notorious pennyroyal mint (*Mentha pulegium*). Through these observations, land managers have been alerted and are beginning to coordinate their efforts to eradicate this threat before it takes root.

This exemplary program has engaged public participants from all backgrounds. With direction from AVP, they have been able to develop a connection with the pools they watch over, increasing their knowledge of the flora and scientific data collection methods, while becoming part of a growing local conservation community.

FUTURE PROSPECTS

As stewards of the landscape, we must adapt to new challenges, much like the plant species occupying these unusual ephemeral wetlands. Tomorrow may bring new, unanticipated biological threats, and changes in weather patterns or political climates. Attempting to conserve the remnant pools on the Santa Rosa Plain—no matter how de-

graded they may be—is a daunting task. The contributions of everyone, from academics to backyard naturalists, are essential for improving our research and management efforts. Searching for clues among our past activities on the Plain will assist policymakers, landowners, and managers statewide to make better-informed decisions about how best to conserve our valued vernal pool habitat. By looking back on the Plain through the lens of collaborative understanding, we can begin to move forward.

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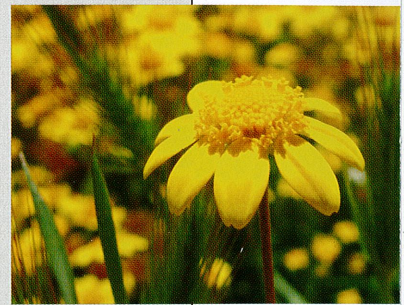
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ENDANGERED PLANT SPECIES OF THE SANTA ROSA PLAIN

- ▶ **Burke's goldfields** (*Lasthenia burkei*) (RIGHT) *L. burkei* may possibly be the most threatened of the three endangered plant species found on the Plain. A member of the sunflower family (Asteraceae), *L. burkei* is noted for its golden composite inflorescence made up of both ray and disk flowers. Photograph by D. Ackerly:
- ▶ **Sebastopol meadowfoam** (*Limnanthes vinculans*) (MIDDLE) *L. vinculans* was originally discovered and described by Robert Ornduff in 1969. There are approximately 30 known populations found in a variety of wet meadows, swales, and vernal pools. The seeds of meadowfoam plants are called nutlets and have identifying ridges, or tubercles, on the seed coat. Some speculate that these ridges may assist seed dispersal by increasing seed buoyancy. Photograph by M. Jensen.
- ▶ **Sonoma sunshine** (*Blennosperma bakeri*) (BOTTOM) Also known as Baker's stickyseed, *B. bakeri* is an early bloomer on the Plain with flowers signaling the approach of spring in early March. This lovely species is found only within Sonoma County. The specific epithet of the scientific name, *bakeri*, refers to the historic botanist for whom the local CNPS chapter is named: Milo Baker. Photograph by K. Gilmore.



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Michelle Jensen, Department of Botany and Plant Pathology, Purdue University, 915 West State Street, West Lafayette, IN 47907, pollywog.mmj@gmail.com; Nancy C. Emery, Department of Biological Sciences, Purdue University, 915 West State Street, West Lafayette, IN 47907, nemery@purdue.edu