

# Management Considerations for Small Vernal Pool Preserves – The Phoenix Vernal Pools

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**ABSTRACT.** The two small Phoenix vernal pool preserves differ with respect to public access, which ultimately defines management strategies for the two areas. The preserves are subject to a variety of impacts, including bicycle and foot traffic, plant collection, exposure to herbicides, watershed alterations, littering and vandalism, out-of-season water runoff, invasive exotic plants, and feral animals. Proximity of local residential areas precludes the use of standard grassland management practices such as burning and grazing. Management options to enhance the prospects for the preserves' long term viability are limited to mowing, selective weeding, fencing, and providing adequate buffer areas to minimize impacts concentrated at the preserves' perimeter.

**CITATION.** Pages 250-254 *in*: C.W. Witham, E.T Bauder, D. Belk, W.R. Ferren Jr., and R. Ornduff (Editors). Ecology, Conservation, and Management of Vernal Pool Ecosystems – Proceedings from a 1996 Conference. California Native Plant Society, Sacramento, CA. 1998.

## INTRODUCTION

To achieve wide public understanding of the biologic diversity and uniqueness of California's vernal pools, preserves which are accessible to the general public are possibly the best educational tool available. The Phoenix Park Vernal Pool Preserve (PPVPP) in Sacramento County, managed by the Fair Oaks Recreation and Park District (FORPD), occupies fourteen acres. The park district has recently installed an interpretive kiosk at the site that includes photographs and descriptions of some of the more common plants with information about the pools and their ecology.

A few hundred yards to the northeast of the PPVPP is an even smaller, eight acre vernal pool preserve managed by the California Department of Fish and Game (CDFG). This preserve, called Phoenix Field Ecological Reserve (PFER), was estab-

lished in 1979 as mitigation for a nearby development. Its purpose was to protect a population of Sacramento County's only known endemic species, Sacramento or Sticky Orcutt-grass (*Orcuttia viscida*). Both preserves have very large perimeters relative to their size, and have no buffer from surrounding residential and recreational areas. "Edge effect" impacts from these areas include changes in hydrology from water runoff, herbicide input, increased foot traffic, and introduction of exotic species. The purpose of this paper is to suggest management options to minimize these impacts and increase the prospects for the long term viability of the preserves.

## SITE CHARACTERIZATION

The Phoenix vernal pool preserves are located approximately 20 miles east of the City of Sacramento. The PPVPP is managed as a natural area within the larger Phoenix Park, which

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includes exercise areas, baseball diamonds, soccer fields, and parking lots. The preserve is bounded by a roadway, a parking lot, baseball diamonds, and residential housing. The area is open to the public at all times. Post and cable fencing surrounds the preserve. However, trails are available for foot traffic.

The PFER was established as an ecological reserve in order to protect the Sacramento Orcutt-grass, as well as the Pincushion Navarretia (*Navarretia myersii*) which was described from the site. The preserve is fenced and authorized access is limited to researchers, students, and supervised volunteers.

The area in which the preserve is located receives an average of 20 inches of rain annually. Precipitation usually occurs from November through March. The elevation of the preserves ranges from 271 to 280 feet above sea level.

The preserves occur on Red Bluff-Reading Complex soils (USDASCS, 1993), a cobbly loam with low relief deposited by the ancestral American River. The terrain varies from shallow, intermittent drainages and depressions to high terraces. The soil is moderately well drained with a hardpan occurring at 40 to 60 inches below the surface. The surface layer typically consists of eight inches of brown loam. The upper subsoil is yellowish red loam and gravelly loam. The lower subsoil is clay loam about 17 inches thick that is above a very gravelly clay loam with an underlying hardpan. Water perches above the hardpan after heavy rainfall. Soil inclusions are found in the vernal pools and swales. Surrounding upland areas have a much deeper soil.

#### MANAGEMENT CONSIDERATIONS

An extensive literature addresses the difficulty of managing small preserves (cited in Shafer, 1995), although the work to date focuses largely on considerations of fauna, not flora. The two preserves under discussion have experienced a variety of impacts which are ultimately detrimental to their long term viability.

The Phoenix preserves differ somewhat from each other in the management problems encountered because of their differing public accessibility and surrounding land use. The PPVPP is very accessible and is situated adjacent to high use areas (sport fields). The PFER has no public access and remains locked at all times.

*Off-Road Motorized Vehicles.* Both sites historically have experienced off-road vehicle traffic. This use is still evidenced by well compacted roadways and trails which traverse the sites, and occasionally cross through vernal swales. After the PFER was fenced, it has been slowly recovering from vehicular impacts. It is interesting to note that although vegetative cover is still markedly less in the roadway, the species composition does not differ significantly from that of undisturbed portion of the

swale (Roscoe, 1994). While the post and cable fencing has eliminated vehicle traffic from the PPVPP, foot traffic frequently follows the historic roadways, and continues to prevent revegetation of these areas.

*Foot, Horse and Bicycle Traffic.* Foot traffic continues to impact the heavily visited PPVPP, particularly in spring when the vernal pool plants are flowering and moist soil is easily compacted. Where trails come close to pools, soil compaction and heavy traffic have eliminated vegetation cover. A footbridge was installed in 1991 across the main drainage of the PPVPP, and this has reduced foot traffic within the pool. The limited foot traffic within the PFER has not impacted the area beyond the immediate proximity of the access gate.

Bicycles and horses are occasionally a problem at the PPVPP. The muddy pool bottoms are attractive to children. Bicycles as well as horses create new trails, changing the microtopography of the pool's bottom, and crushing pool vegetation. Long-term effects of this impact have not been quantified.

*Plant and Animal Collection.* Because the PPVPP is a widely known wildflower viewing site, many visitors are attracted to the preserve every spring. Visitors frequently collect bouquets of wildflowers and may collect tadpoles as well. The result is the removal of the more showy plants every year, particularly near well-established trails. It is possible that this practice is altering species composition with displacement of native species by exotics (Crawley, 1983; Putnam, 1986; Stechman, 1986). This possibility needs further investigation.

*Herbicides.* Both preserves are affected by various levels of herbicide application in nearby areas. County roadsides are commonly treated in spring with a combination contact (glyphosphate) and pre-emergent (diuron and simazine) herbicide mixture. The PPVPP is bordered by Sunset Avenue on the north. The effects of the spraying on the vernal pool vegetation was noticed in spring 1992, when heavy rains resulted in herbicide contaminated runoff entering the nearby vernal pools. The majority of plants were either killed or the seeds prevented from germinating in the pools during that spring. The Sacramento County Department of Public Works has ceased spraying the roadside adjacent to the preserve in favor of mowing. Although no pre-treatment data were available for relative cover or species composition for the affected pools, data show that the seed bank was adequate to revegetate the affected pools in following years (unpublished report, N. Wymer). In other areas of Sacramento County, which continuously experience annual spraying, pools within close proximity of the road are devoid of vegetation (Roscoe, 1996).

*Changes in Hydrology.* Summer water runoff is a substantial problem facing vernal pool preserves adjacent to developed or irrigated lands. Several of the vernal pools at both preserves are

located along the preserve perimeter, where they experience summer runoff from adjacent irrigated lawns or playing fields. Runoff from residential lawns and playing fields may also contain significant amounts of fertilizer. Since the quality and quantity of water received could substantially influence the flora and fauna of the pool (Holland and Jain, 1973; Ferren and Gervitz, 1990), it is important to consider potential impacts to vernal pools from modifications to their watershed (Stromberg and Hecht, 1991).

The drainage patterns of both preserves have been altered somewhat by human intervention. The PFER has been altered by historic off-road vehicle use and by trenches constructed to study pool hydrology. The PPVPP's main drainage may have been a series of pools which have been artificially connected to facilitate drainage. The PFER has been historically impacted by increased runoff from the adjacent Phoenix Field Airstrip, which was active until the early 1980's. The hydrology of the PFER has been studied in some detail by analyzing the potential impacts from development of the lands which lie east and north of the preserve (Hanes et al., 1990). The study concluded, in part, that the removal of runoff from the proposed development (roughly removing five acres of watershed) would result in a substantial negative impact on the hydrology of the vernal pools within the Reserve. Additionally, there were concerns regarding summer runoff from the residences adjacent to the PFER. The developer provided a drainage system along the eastern boundary of the Reserve to intercept water runoff from the residences, and convey it to the storm drain. This system has proven successful at the PFER and has been duplicated at the PPVPP where a similar condition exists.

However, in perimeter areas not afforded protection by a drainage system, water runoff continues to affect the nearby vernal pool vegetation at both preserves. The residential lots along the northern boundary of the PFER continue to spill summer runoff into the preserve, transforming the adjacent vernal pools into seasonal wetlands. Although CDFG has plans to install a drain system along the northern boundary, funding has not been available to date.

**Litter.** Litter has been a nuisance at both preserves. Landscapers continually dump lawn and landscape clippings, leaves and debris along the preserves' perimeter. The more remote location of the PFER led to trash dumping for many years. Litter may accumulate within the vernal pools to the extent that the pool micro topography is altered, and the existing vegetation is smothered. Dumping of landscape clippings has also introduced many exotic species into the preserve, as well as creating a fire hazard. Annual clean-up of the preserve, prior to fire season, is required by local fire ordinances.

**Invasive Exotic Plants.** The upland and vernal pool floras of both preserves contain a number of exotic plant species. Dur-

ing dry years these exotic plant species occur in substantial numbers in the vernal pools (Holland and Jain, 1973). To date, relatively few exotic plant species have become problems within the preserves. One is the recently introduced Manna Grass (*Glyceria declinata*) (Baad, 1976; McDonald, 1976; Webster et al., 1987; Holland, 1988). This grass is spreading in the pools where native Orcutt-grass occurs. It is likely that the manna grass will eventually dominate these pools, threatening the long-term viability of Orcutt-grass at the preserve. The perimeter of PFER is experiencing incursions of a number of invasive landscape plants such as Star Jasmine and Calla Lily, which are further supported by summer water as runoff from the adjacent residences. An invasion of Big Quaking Grass (*Briza maxima*) has occurred in the upland areas of the PFER, apparently introduced at the entrance gate, from which it is spreading. The lands within the immediate vicinity of the vernal pools are heavily populated by Hawkbit (*Leontodon taraxacoides* ssp. *taraxacoides*). It is suspected that the introduction of non-native annual plants may impact the type and number of vernal pool plant pollinators by displacing their host plants (Thorpe, 1976; 1990).

**Feral and Domestic Animals.** Feral animals are occasionally observed at both preserves. Bird use (nesting and foraging) is specifically affected by domestic and feral cats (Jurek, 1993). These animals prey on the ecosystem's small mammal, reptile, and amphibian populations; however, it is not known whether this predation exceeds historic predation by native carnivores.

**Vegetation Management.** As is common in ungrazed grasslands dominated by exotic grass species, vegetation biomass has been continuously accumulating at both preserves. Fire could act as a management tool, however, the preserves are relatively small, and are separated from local residences by a wooden fence. The proximity of the residences, as well as the wooden fence preclude the use of fire as a management tool. In fact, a fire break must be created each summer as required by the local fire ordinance. Until recently, this was done by clearing all vegetation inside the preserve, within the thirty feet of the wooden fence. This provided a disturbed substrate which favored the establishment of exotic plant species, and disturbed the vernal pools which extended into the firebreak. Mowing has proven to be an effective management tool, without the unwanted impacts of ground clearing. It is interesting to note that the only Valley Oak (*Quercus lobata*) regeneration occurring the PFER is within the annually mowed buffer area. Grazing could be effectively used to reduce the residual dry matter and control exotic weedy species. However, the preserves' small size, lack of adequate fencing and water make grazing a problematic management tool.

**Vandalism.** Fences have been cut to allow unauthorized and destructive access at the more remote PFER. The more visible PPVPP has an interpretive kiosk and fencing which has received

little intentional human damage. Visibility and access, usually associated with degree of remoteness, appear to be the greatest variables in determining vandalism potential.

#### CONCLUSIONS AND RECOMMENDATIONS

The long term effects of the impacts outlined above are complex and difficult to assess; however, recent observations have shown that the ecology of each preserve is changing and this can be directly related to the preserves' size and degree of public access. These impacts will ultimately affect the long term viability of the preserves. The above-mentioned problems associated with creation of small, isolated vernal pool preserves should be seriously considered prior to and during any planning effort affecting this vernal pool resource. Management plans, including preproject biological surveys of the flora and fauna, should address the problems outlined in this paper. Potential changes in hydrology, including but not limited to unseasonal runoff, should be evaluated and addressed prior to establishment of the preserve.

*Fencing.* Fencing needs will be determined by public use goals for the area. Habitats for special status species should be protected from foot traffic and off-road vehicles. Fencing should also be used to "guide" visitors around vernal pools. If grazing is considered as a management tool, fencing should be designed with consideration of the grazing strategy (ie. animal movement and water access). If fire is to be used as a management tool, fencing should be fireproof.

*Access.* Access points (for humans as well as grazing animals) should be well marked and planned to avoid foot traffic in sensitive areas. They should be well monitored and more intensively managed, because access points provide an area of increased soil compaction, littering and pest plant introduction.

*Enforcement.* Ideally, preserves should be patrolled to prevent vandalism, littering and unauthorized use. In the absence of patrolling, interpretive signs should explain the location of open and closed (more sensitive) areas, and appropriate activities for the preserve.

*Hydrology.* Most small preserves should receive an evaluation of historic, existing and potential impacts to on-site hydrology. A well engineered hydrologic plan should be required which would include provisions for eliminating unseasonal runoff, while providing the historic hydrology of the vernal pools. Buffers and perimeter drainage systems are recommended.

*Pollutants.* The preserve should be evaluated for the potential impacts from herbicide, fertilizer and road runoff. Local agencies managing road runoff should be contacted to develop a plan which addresses the vegetation management needs of all parties. Nearby homeowners should be educated regarding the

importance of the preserve, and methods of preventing runoff from entering the preserve. Mowing or selective hand weeding would be preferred over proximal herbicide use. Buffers and drainage swales can be used to successfully divert road runoff and fertilizer drift from entering the preserve.

*Exotic plant invasion.* The preserve should be protected from invasive pest plant species. Management tools may include selective weeding, controlled herbicide use, grazing, fire, and limiting access to prevent dumping of refuse. Monitoring should occur to detect pest plant encroachment as early as possible. Maintaining the area's historic hydrology also helps maintain the preserve's endemic flora.

*Management Endowments.* Funding mechanisms should be established to provide adequate management of the preserve, including patrolling and monitoring in perpetuity.

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