# Edaphic Features within Vernal Pools of the Laguna de Santa Rosa
# Effects on Global and Local Ecosystems

## ABSTRACT


**Part I – John Krafft**

Vernal pools have long been a part of the natural environment, providing essential functions within local and global cycles. The carbon cycle is the most talked about area of concern in recent years as climate change has become widely accepted. Wetlands sequester carbon within soils at greater rates than non-wetland areas; vernal pools are no different. In this study I demonstrate, on a fine scale, the difference in carbon sequestration between soils with the most anaerobic conditions in vernal pools compared with the soils that are more aerobic just outside vernal pools. The loss of seasonal wetlands not only degrades the intrinsic value of our environment, I propose that it also contributes to the changes in climate we have seen due to increasing $CO_2$ in our atmosphere.

**Part II – Karen Kassebohm-Hancock**

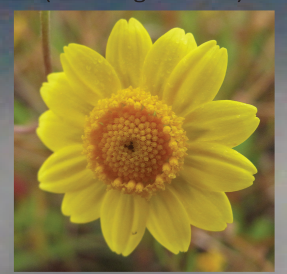
The Santa Rosa Plain Vernal Pool Ecosystem is a unique microtopography that hosts endangered and endemic plant species. This study looks at whether edaphic, soil related factors may influence the geographic distribution of California endemic flora within the vernal pool system. To address this question, vernal pools from six different sites were surveyed using a laser rangefinder to locate the perimeters of the vernal pools and the target plant's population within the pool. The Sonoma County Soil Survey was used to reference soil types. Field observations for color, texture and redoximorphic features of the soils were used to ground truth these locations. pH analysis of the soil samples was measured at the Sonoma State University Soils lab. This study identifies a clear relationship between edaphic factors and plant species and should be considered in the preservation of natural and translocated populations of *Blennosperma bakeri, Limnanthes vinculans* and *Lasthenia burkei* to help ensure long term survival.

*Part I and Part II are two seperate papers which have been combined for the purpose of this poster presentation. Both Authors helped with each projects research, however the author for each original paper is listed next to their section in the abstract.*


***Blennosperma bakeri***
(Sonoma sunshine)

***Limnanthes vinculans***
(Sebastopol meadowfoam)

***Lasthenia burkei***
(Burke's goldfields)



## METHODS

**Part I** - Three soil cores with a depth of at least 200 centimeters below the surface were taken from two vernal pools. Both pools share the same soil type per the soils survey of 1972 conducted by Vernon Miller. At each pool one core was taken at the high point in the local topography which represents the more aerobic soil conditions. One core was taken at the perimeter of each pool and one core was taken at the lowest point within the vernal pool which represents the more anaerobic soil conditions. Each core was extracted by use of a hand held soil auger where detailed descriptions of color, structure and texture were recorded. Further analysis of carbon sequestration was calculated through incineration of 10g soil samples. Each 10g sample was dried at 100° Celsius for 24 hours to ensure loss of water content would not skew results, once cool samples were incinerated at 425° Celsius for 4 hours. Using the following formula percent of weight loss was calculated. Results were recorded as organic percent lost on ignition.

$$\%\ \text{loss-on-ignition} = [(w_1 - w_2)/w_1]*100$$

**Where $w_1$ = net oven-dry weight of sample before combustion**
**$w_2$ = net oven-dry weight of sample after combustion**

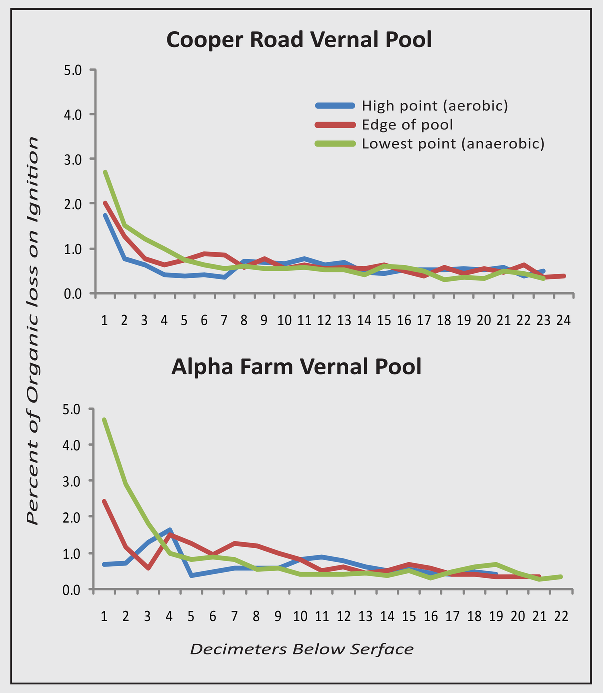
**Part II** - Field surveying and mapping techniques were employed by using an Impulse laser rangefinder and a handheld Global Positioning System by Trimble to determine perimeters of vernal pools and the extent of the target plant species distribution within each pool. This data was put into a Geographic Information System to create digital maps of the pools. A soils layer was then overlaid to determine soil type and cross referenced with the Sonoma County Soils Survey of 1972 by Vernon Miller. Finally, aerial photographs were embedded to give context as to the current vegetation patterns near the vernal pools. The sites were then ground-truthed by field observations. Core samples were taken from the known target plant species location within the vernal pools with a shallow soil probe, 40 cm long, manufactured by Oakfield Apparatus Company. The cores were then evaluated in the field, for color, texture and redoximorphic (mottling) features, following the methods of similar studies in vernal pools of the Central Valley. A sample from the core approximately 15 centimeters from the surface was bagged on site and taken to the Sonoma State University soils lab, where reaction to pH was determined. The pH measurement method was a 1:1 suspension of soil to distilled water, following the method of Peach. A pHep +, pocket-sized pH meter with automatic temperature compensation by Hanna Instruments was used to test the pH of the suspension.

## RESULTS

Although nearly twice as much organic weight was lost on ignition at the Alpha Farm site, both sites do show the more anaerobic cores sequestering more carbon than the aerobic cores. Differences between sites such as bioturbation, vegetation mater, historical land use or a large variety of other factors will play a role in soil carbon content.

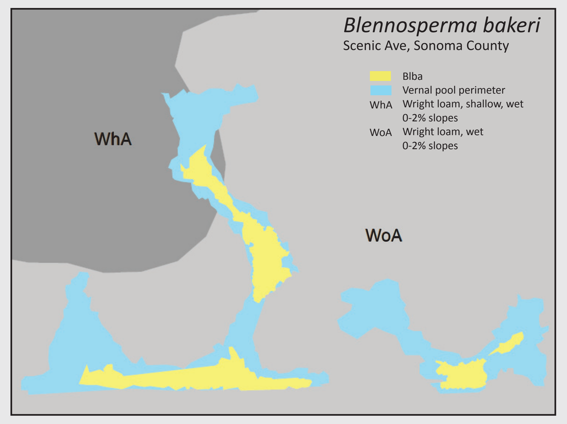
Samples After Incineration


| Site | Species | Soil Phase |
|---|---|---|
| | | |
| Wood-Fulton | *Lasthenia burkei* | Htc, HuB |
| YCP | *Blennosperma bakeri* | HtC |
| Wilkinson | *Lasthenia burkei* | WhA |
| Balletto | *Limnanthes vinculans* | CfA |
| Scenic | *Blennosperma bakeri* | WoA, WhA |
| Hessel | *Limnanthes vinculans* | CtC, BcA |




| Alpha Farm - Anaerobic | | |
|---|---|---|
| Centimeters Below Surface | | |
| From | To | % loss |
| 0 | 13 | 4.6981 |
| 13 | 22 | 2.9080 |
| 22 | 30 | 1.8110 |
| 30 | 50 | 1.0023 |
| 50 | 61 | 0.8075 |
| 61 | 71 | 0.9000 |
| 71 | 77 | 0.8189 |
| 77 | 82 | 0.5618 |
| 82 | 91 | 0.5767 |
| 91 | 102 | 0.4192 |
| 102 | 114 | 0.4006 |
| 114 | 123 | 0.4116 |
| 123 | 127 | 0.4328 |
| 127 | 137 | 0.3611 |
| 137 | 150 | 0.5023 |
| 150 | 161 | 0.3105 |
| 161 | 170 | 0.4851 |
| 170 | 178 | 0.5989 |
| 178 | 186 | 0.6753 |
| 186 | 197 | 0.4321 |
| 197 | 210 | 0.2628 |
| 210 | 221 | 0.3373 |

| Series | Family | Subgroup | Order |
|---|---|---|---|
| | | | |
| Blucher | Course-loamy over clayey, mixed, noncalcareous, mesic | Typic Haplaquolls | Mollisols |
| Clear Lake | Fine, montmorillonitic, thermic | Typic Pelloxererts | Vertisols |
| Cotati | Clayey, montmorillonitic, mesic | Typic Haploxerults | Ultisols |
| Huichica | Fine,montmorillonitic, thermic | Abruptic, Haplic, Durixeralfs | Alfisols |
| Wright | Fine, mixed, mesic | Typic Albaqualfs | Alfisols |




| Site | Soil Phase | Munsell Color | Redox | Perme-ability | Moisture Retention | Available Water Capacity | Reaction |
|---|---|---|---|---|---|---|---|
| | | moist | | inches/hour | at 15 atmoshperes% | inches/inch of soil | pH value |
| Wood-Fulton | HtC | 10YR 4/3 | Yes | 0.63-2.0 | 5.1 | 0.16-0.18 | 5.5 |
| Wood-Fulton | HuB | 10YR 4/3 | Yes | <0.06 | 5.1 | 0.04-0.06 | 5.5 |
| YCP | HtC | 10YR 4/3 | Yes | 0.63-2.0 | 5.1 | 0.16-0.18 | 5.5 |
| Wilkinson | WhA | 10YR 3/2 | Yes | 0.63-2.0 | 21.9 | 0.16-0.18 | 6.2 |
| Balletto | CfA | 10YR 3/1 | Yes | 0.06-0.2 | 21.9 | 0.13-0.16 | 5.3 |
| Scenic | WhA | 10YR 6/2 | Yes | 0.63-0.2 | 5.2 | 0.16-0.18 | 6.2 |
| Scenic | WoA | 10YR 6/2 | Yes | 0.63-0.2 | 5.2 | 0.16-0.18 | 6.2 |
| Hessel | BcA | 10YR 2/2 | No | 0.63-2.0 | - | 0.14-0.18 | 7 |
| Hessel | CtC | 10YR 4/2 | No | 2.0-6.3 | - | 0.13-0.15 | 5.3 |

Sonoma sunshine and Burke's goldfields in the vernal pools of the study sites, were on related or associated soils with the parent material being mixed sedimentary and volcanic ash.

Sebastopol meadowfoam occurred on soils that the parent material was made up of the Wilson Grove Formation, marine sand and gravel.

## CONCLUSIONS

From these studies a relation can be drawn showing how soils of the Santa Rosa plain are helpful to local and global ecosystems. As ecosystem service providers, vernal pools and the edaphic features within support endemic species along with playing a vital role in our global carbon budget.

To focus on just the endemic species that depend on vernal pool habitat we see how digital soils and species maps are essential for conservation planning. Focusing more on the carbon cycle using the more aerobic core as a proxy for converted seasonal wetlands, we can see how changes to these systems reduce the amount of carbon sequestration on a global scale. Today only about 10 percent of vernal pools remain throughout California. With the severe reduction of seasonal wetlands on a global scale we can understand the impact this is having on endemic species in vernal pools as well as the carbon budget.

## PURPOSE

Vernal pools should be protected not only for their intrinsic value but for the services they provide and support in the environment.

**Actions steps:**

- Get involved with local organizations
- Become educated in how your actions interact with the environment
- Restrict development in areas of importance
- Land managment plans

The following web sites contain helpful information on vernal pools, plant species and how someone can get involved.

**http://www.lagunadesantarosa.org**

**http://www.cnps.org**

**http://www.vernalpools.org**

**Something to think about with soils:**

- How do soils effect our water quality?
- What about the air we breath?
- What about run off from soils treated with chemicals?
- How long does it take for soils to form?
- With urbanization what happens to soils?
- With the degradation or sealing of soils what is to happen to the crucial services soils perform?
- What about climate and weather patterns?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