

1975

## Vegetation Zonation in a Vernal Marsh on the Santa Rosa Plateau of Riverside County, California

Kathleen J. P. Kopecko  
*Loma Linda University*

Earl W. Lathrop  
*Loma Linda University*

Follow this and additional works at: <http://scholarship.claremont.edu/aliso>



Part of the [Botany Commons](#)

---

### Recommended Citation

Kopecko, Kathleen J. P. and Lathrop, Earl W. (1975) "Vegetation Zonation in a Vernal Marsh on the Santa Rosa Plateau of Riverside County, California," *Aliso: A Journal of Systematic and Evolutionary Botany*: Vol. 8: Iss. 3, Article 8.  
Available at: <http://scholarship.claremont.edu/aliso/vol8/iss3/8>

## VEGETATION ZONATION IN A VERNAL MARSH ON THE SANTA ROSA PLATEAU OF RIVERSIDE COUNTY, CALIFORNIA

KATHLEEN J. P. KOPECKO AND EARL W. LATHROP  
*Loma Linda University, Riverside, California*

### INTRODUCTION

A series of four vernal marshes, ranging in size from 2 to 30 acres, occurs on the top of the lava-capped Mesa de Colorado of Rancho California, approximately 5 miles west of Murrieta, on the Santa Rosa Plateau. The marshes are located less than a mile west of the Santa Rosa Ranch headquarters as indicated on the vegetation map of a florula of the Santa Rosa Plateau (Lathrop and Thorne, 1968, Fig. 2). The location of the marshes is also shown in aerial photographs of a floristic survey of the marshes (Thorne and Lathrop, 1969, Figs. 1, 2). Brief descriptions of the soils, underlying rock strata, rainfall, seasonal appearance, zonation, etc. of the marshes are also included in the previous article. Additional plant species appearing in the marshes following the survey listed above were reported in a subsequent article (Thorne and Lathrop, 1970).

To the previous floristic knowledge of this unusual habitat, the authors propose to add quantitative measurements of the vegetation. Field work was conducted at the vernal marsh sites by one or both of the authors twice weekly between February 14 and July 8, 1974. The nomenclature of plant species encountered in measurements at the sample sites (TABLE 1A-E) largely follows that of Munz (1974), and the species are listed, along with their habitat or habitats, in the vernal marsh articles cited previously.

### METHODS

A margin 45 m wide encircling the largest vernal marsh was arbitrarily established and subjectively divided into three approximately equal zones; criteria used were homogeneity of vegetation and physiognomic appearance in each zone (Kleiner and Harper, 1972).

An additional zone 15 m wide was selected within the marsh border for the purpose of sampling in the shallow standing water of the marsh and in the dry marsh bed following dessication of the marsh.

The vegetation was sampled in each of the zones for density, dominance, and frequency. Six and two thirds  $0.3 \times 1.8$ -m belt transects, marked off into 15 cm<sup>2</sup> quadrats, were placed in the sample sites where the growth seemed to be representative of the community for that date (Bernard, 1974).

Density, relative density, frequency, and relative frequency were determined from counts of species and individuals occurring within the total of 160 quadrats in each zone following standard formulas for these measurements as outlined in Cox (1972).

Dominance, as determined from foliage cover, was measured by the use of the point frame (Heady and Rader, 1958). The frame was placed at 50 sites in each of the marsh zones following the same criteria as were used for placement of the belt transects in the same zones. The point frame held 10 sampling pins, making a total of 500 sample points taken in each zone. Total species dominance (percent foliage cover) and relative dominance were determined for each zone following dominance calculations by the point-frame method (Phillipps, 1955; Cox, 1972; and Whitman and Siggeirsson, 1954).

Relative density, relative frequency, and relative dominance values were totaled to determine an importance value (I.V.) for each species within a particular marsh zone.

### VEGETATION ZONATION

Relative dominance and importance values (I.V.) of each plant species sampled in each of the marsh zones are shown in Table 1A-E. The outermost zone of dry grassland is in the southern California grassland community (Thorne, 1975), which along with southern oak woodland (Thorne, 1975), are the dominant communities on the Santa Rosa Plateau. The next zone inward toward the marsh center is a zone of grassland influenced by the presence of the marsh, the vernal moist zone. The moist muddy margin of the marsh made up the third terrestrial zone sampled for vegetation. The shallow standing water adjacent to the muddy margin of the marsh and the dry marsh bed, resulting from desiccation of the marsh, make up the last two vegetation zones (Figs. 1 and 2).

Each of the five vegetation zones sampled had similar foliage cover, 82, 84, 81, 70 and 71 percent respectively from the outermost dry grassland zone through the dry marsh bed. The species composition, however, is significantly different in each zone.

The dominant species in the dry grassland zone, in order of their I.V. (Table 1A), were *Bromus mollis* L., *Avena barbata* Brot., and *Erodium cicutarium* (L.) L'Her. These species, along with the subdominants (Table 1A), are characteristic of southern California grassland, indicating that this zone is probably not influenced by the presence of the marsh.

The next zone inward, the vernal moist zone (Table 1B), is also dominated by grass species, *Bromus mollis* and *Festuca megalura* Nutt. However, the presence of two typical wet-area species in this zone, *Eleocharis macro-*

→

Fig. 1 (above). View across the vegetation zones of the large vernal marsh from east to west. Southern California grassland and southern oak woodland can be seen in the background. The foreground shows the standing water, muddy margin and vernal moist zones respectively. Photograph taken in late March, 1974, by Earl W. Lathrop.



Fig. 2 (below). The desiccated marsh bed with a sparse covering of badly trodden and heavily grazed spike-rushes (*Eleocharis* spp.). Characteristic outcropping boulders of basaltic lava (Thorne and Lathrop, 1969) are conspicuous in the shallow basin of the marsh. Photograph taken in July, 1974, by Earl W. Lathrop.

TABLE 1. *Relative dominance and importance value of vascular plant species in vegetation zones of vernal marsh communities of the Santa Rosa Plateau, Riverside County, California.*

Species	Relative dominance	Importance value
A. DRY GRASSLAND ZONE		
<i>Avena barbata</i> Brot.	20.29	43.63
<i>Bromus mollis</i> L.	18.09	75.41
<i>Bromus diandrus</i> Roth	2.44	13.58
<i>Bromus rubens</i> L.	5.60	7.50
<i>Cerastium glomeratum</i> Thuill.	1.95	3.00
<i>Deschampsia danthonioides</i> (Trin.) Munro var. <i>gracilis</i> (Vasey) Munz	6.60	7.62
<i>Erodium cicutarium</i> (L.) L'Her.	6.60	31.88
<i>Festuca megalura</i> Nutt.	9.04	17.68
<i>Hemizonia paniculata</i> Gray	2.20	15.30
<i>Hypochoeris glabra</i> L.	4.88	22.99
<i>Lasthenia chrysostoma</i> (F. & M.) Greene	0.73	0.98
<i>Lepidium nitidum</i> Nutt.	2.20	3.32
<i>Lupinus bicolor</i> Lindl. ssp. <i>marginatus</i> D. Dunn.	1.46	1.68
<i>Lythrum hyssopifolium</i> L.	3.66	4.42
<i>Medicago hispida</i> Gaertn.	1.71	4.08
<i>Microseris linearifolia</i> (DC.) Sch.-Bip.	3.91	7.20
<i>Muilla maritimi</i> (Torr.) Wats.	0.97	1.87
<i>Orthocarpus densiflorus</i> Benth.	1.46	2.99
<i>Plagiobothrys nothofulvus</i> (Gray) Gray	3.66	4.56
<i>Plantago bigelovii</i> Gray ssp. <i>californica</i> (Greene) Bassett.	1.22	22.00
<i>Trifolium amplexens</i> T. & G. var. <i>truncatum</i> (Greene) Jeps.	1.95	8.97
B. VERNALLY MOIST ZONE		
<i>Anagallis minima</i> (L.) E. H. L. Krause	1.17	3.17
<i>Avena barbata</i> Brot.	12.73	16.98
<i>Bromus mollis</i> L.	19.81	93.13
<i>Bromus diandrus</i> Roth	4.24	4.74
<i>Deschampsia danthonioides</i> (Trin.) Munro var. <i>gracilis</i> (Vasey) Munz	3.06	5.13
<i>Eleocharis macrostachya</i> Britt.	4.24	5.52
<i>Erodium cicutarium</i> (L.) L'Her.	6.36	16.38
<i>Festuca megalura</i> Nutt.	14.85	71.41
<i>Hemizonia paniculata</i> A. Gray	7.07	20.15
<i>Hypochoeris glabra</i> L.	6.83	16.40
<i>Lasthenia chrysostoma</i> (F. & M.) Greene	1.41	2.16
<i>Lepidium nitidum</i> Nutt.	4.95	8.07
<i>Medicago hispida</i> Gaertn.	5.66	11.91
<i>Microseris linearifolia</i> (Nutt.) Sch.-Bip.	2.82	7.10
<i>Plagiobothrys undulatus</i> (Piper) Jtn.	1.65	5.11
<i>Trifolium amplexens</i> T. & G. var. <i>truncatum</i> (Greene) Jeps.	3.06	10.28

TABLE 1. *Continued.*

Species	Relative dominance	Importance value
C. MUDDY MARGIN ZONE		
<i>Alopecurus howellii</i> Vasey	1.24	3.91
<i>Anagallis minima</i> (L.) E. H. L. Krause	2.47	3.84
<i>Callitriche marginata</i> Torr.	2.47	25.27
<i>Cotula coronopifolia</i> L.	4.94	5.28
<i>Crassula aquatica</i> (L.) Schoenl.	12.35	49.59
<i>Deschampsia danthonioides</i> (Trin.) Munro var. <i>gracilis</i> (Vasey) Munz	1.24	5.29
<i>Downingia cuspidata</i> (Greene) Greene	4.94	13.14
<i>Elatine californica</i> Gray	4.94	14.40
<i>Elatine chilensis</i> Gay	1.24	5.13
<i>Eleocharis acicularis</i> (L.) R. & S.	8.64	27.53
<i>Eleocharis macrostachya</i> Britt.	8.64	12.43
<i>Eleocharis parishii</i> Britt.	4.94	7.29
<i>Hypochoeris glabra</i> L.	2.32	2.93
<i>Isoetes howellii</i> Engelm.	1.24	5.45
<i>Isoetes orcuttii</i> A. A. Eat.	1.24	4.38
<i>Juncus bufonius</i> L.	1.24	16.11
<i>Lilaea scilloides</i> (Poir.) Haum.	2.47	8.32
<i>Lythrum hyssopifolium</i> L.	4.94	13.64
<i>Marsilea vestita</i> Hook. & Grev.	4.94	12.48
<i>Pilularia americana</i> A. Br.	7.41	17.13
<i>Plagiobothrys undulatus</i> (Piper) Jtn.	9.88	33.03
<i>Psilocarpus brevissimus</i> Nutt.	2.47	5.60
<i>Trifolium amplexens</i> T. & G. var. <i>truncatum</i> (Greene) Jeps.	3.70	7.69
D. STANDING WATER ZONE		
<i>Callitriche longipedunculata</i> Morong.	11.43	36.97
<i>Callitriche marginata</i> Torr.	1.43	12.48
<i>Downingia cuspidata</i> (Greene) Greene	5.71	24.75
<i>Elatine californica</i> Gray	4.29	31.98
<i>Elatine chilensis</i> Gay	7.14	18.07
<i>Eleocharis acicularis</i> (L.) R. & S.	5.71	13.48
<i>Eleocharis macrostachya</i> Britt.	11.42	35.76
<i>Eleocharis parishii</i> Britt.	2.85	11.45
<i>Isoetes howellii</i> Engelm.	2.86	13.58
<i>Isoetes orcuttii</i> A. A. Eat.	18.57	27.34
<i>Lilaea scilloides</i> (Poir.) Haum.	2.86	18.22
<i>Marsilea vestita</i> Hook. & Grev.	1.43	3.16
<i>Pilularia americana</i> A. Br.	2.86	14.09
<i>Plagiobothrys undulatus</i> (Piper) Jtn.	15.71	24.19
<i>Ranunculus aquatilis</i> L. var. <i>capillaceus</i> (Thuill.) DC.	5.71	13.83

TABLE 1. *Continued.*

E. DRY MARSH BED ZONE		
<i>Alopecurus howellii</i> Vasey	3.30	13.42
<i>Bromus mollis</i> L.	3.03	7.63
<i>Crassula aquatica</i> (L.) Schoenl.	3.03	9.57
<i>Deschampsia danthonioides</i> (Trin.) Munro var. <i>gracilis</i> (Vasey) Munz	4.68	9.55
<i>Downingia cuspidata</i> (Greene) Greene	4.95	12.56
<i>Eleocharis acicularis</i> (L.) R. & S.	3.58	8.14
<i>Eleocharis macrostachya</i> Britt.	7.43	14.16
<i>Eleocharis parishii</i> Britt.	5.50	10.68
<i>Eryngium aristulatum</i> Jeps. var. <i>parishii</i> (Coult. & Rose) Math. & Const.	12.39	33.04
<i>Festuca megalura</i> Nutt.	1.92	6.55
<i>Hemizonia paniculata</i> Gray	1.10	7.56
<i>Hordeum californicum</i> Covas & Steb.	3.85	13.55
<i>Isoetes howellii</i> Engelm.	4.68	9.07
<i>Isoetes orcuttii</i> A. A. Eat.	4.13	9.23
<i>Juncus bufonius</i> L.	1.92	3.06
<i>Lythrum hyssopifolium</i> L.	3.58	28.15
<i>Marsilea vestita</i> Hook. & Grev.	3.03	10.22
<i>Navaretia prostrata</i> (Gray) Greene	15.42	43.64
<i>Orcuttia californica</i> Vasey	3.03	8.19
<i>Psilocarpus brevissimus</i> Nutt.	9.36	41.68

*stachya* Britt. and *Plagiobothrys undulatus* (Piper) Jtn. (Table 1B), indicates influence by the vernal marsh.

Semiaquatics dominated in the muddy margin zone including, in order of abundance based on their I.V. (Table 1C), *Crassula aquatica* (L.) Schoenl., *Plagiobothrys undulatus*, *Callitriche marginata* Torr., *Eleocharis acicularis* (L.) R. & S., *Pilularia americana* A. Br., *Juncus bufonius* L., *Elatine californica* Gray, and *Downingia cuspidata* (Greene) Greene.

There were also several species present in this zone which are more typical of shallow water but were present here due, evidently, to the recently receded water along the edge of the marsh. Among these aquatic species (Table 1C) were *Marsilea vestita* Hook. & Grev., *Isoetes howellii* Engelm., *I. orcuttii* A. A. Eat., and *Elatine chilensis* Gray.

Species receiving the highest I.V.'s in the standing water zone (Table 1D) were two ephemeral aquatics, *Callitriche longipedunculata* Morong. and *Elatine californica*, and an abundant perennial spike rush, *Eleocharis macrostachya*. Other characteristic aquatic ephemerals growing abundantly in the water included *Isoetes orcuttii*, *Downingia cuspidata*, *Plagiobothrys undulatus*, *Lilaea scilloides* (Poir.) Haum., and *Elatine chilensis*.

The vegetation of the dry marsh bed was sampled in one of the smaller vernal marshes on the mesa following desiccation in early July. The dominant species in this zone included perennials which mature much later than

the rest of the aquatic vegetation, some persistent semiaquatics and several scattered grasses (Table 1E).

The most abundant semiaquatics to persist in the desiccated marsh bed were *Psilocarpus brevissimus* Nutt., *Eleocharis macrostachya*, and *Downingia cuspidata* (see also Table 1C). The later-blooming perennials included *Navarretia prostrata* (Gray) Greene, *Eryngium aristulatum* Jeps. var. *parishii* (Coul. & Rose) Math. & Const., and *Lythrum hyssopifolium* L. The light cover of grass species in the dry marsh bed included *Deschampsia danthonioides* (Trin.) Munro ex Benth. var. *gracilis* (Vasey) Munz, *Alopecurus howellii* Vasey, the small rare vernal pool and marsh grass *Orcuttia californica* Vasey, and two weedy invaders, *Hordeum californicum* Covas & Steb. and *Bromus mollis*.

#### ACKNOWLEDGMENTS

We wish to take this opportunity to thank the management of the Rancho California, and in particular, O. Max Sloan, Bill Hamon, John Mekeel, and Lynne Mall, for their continued support of our survey efforts on the Santa Rosa Plateau. Dr. Robert F. Thorne of Rancho Santa Ana Botanic Garden has been most helpful in giving taxonomic and ecological guidance in this project. We are also grateful to him for helpful suggestions and reading the manuscript.

#### SUMMARY

The vernal marshes on Mesa de Colorado showed distinct vegetative zonation based on floristic composition sampled during the vernal marsh season. Each zone had its characteristic flora and included many species which are specifically adapted to the extremes of desiccation and vernal moisture, which perhaps accounts for some of the rare and interesting plants found there.

#### LITERATURE CITED

- Bernard, J. M. 1974. Seasonal changes in standing crop and primary production in a sedge wetland and an adjacent dry old-field in central Minnesota. *Ecology* 55: 350-359.
- Cox, G. W. 1972. *Laboratory Manual of General Ecology*. William C. Brown Co. Publishers. Dubuque.
- Heady, H. F., and L. Rader. 1958. Modifications of the point frame. *J. Range Management* 11(2):95-96.
- Kleiner, E. F., and K. T. Harper. 1972. Environment and community organization in grasslands of Canyonlands National Park. *Ecology* 53: 299-309.
- Lathrop, E. W., and R. F. Thorne. 1968. Flora of the Santa Rosa Plateau of the Santa Ana Mountains, California. *Aliso* 6: 17-40.
- Munz, P. A. 1974. *A Flora of Southern California*. University of California Press. Berkeley. 1086 p.
- Phillipps, E. A. 1955. *Methods of Vegetation Study*. Henry Holt and Company, Inc. New York.
- Thorne, R. F. 1975. The vascular plant communities of southern California. In J. Latting [ed.], *Proceedings of the "Plant Communities of Southern California" Symposium*, Fullerton, Calif., May 4, 1974. Southern California Botanists Chapter of the California Native Plant Society. Riverside, Calif. (In press.)



- , and E. W. Lathrop. 1969. A vernal marsh on the Santa Rosa Plateau of Riverside County, California. *Aliso* 7: 85-95.
- , and ———. 1970. *Pitularia americana* on the Santa Rosa Plateau, Riverside County, California. *Aliso* 7: 149-155.
- Whitman, W. C., and E. E. Siggeirsson. 1954. Comparison of line interception and point contact methods in the analysis of mixed grass range vegetation. *Ecology* 35: 431-436.