

Table of Contents

FORWARD by <i>Michael G. Barbour</i>	iii
INTRODUCTION	v
 SECTION I. Past and Present Distribution, and Physical and Biological Considerations	
Characterization and Global Distribution of Vernal Pools	
<i>Jon E. Keeley and Paul H. Zedler</i>	1
Vernal Pool-Soil-Landform Relationships in the Central Valley, California	
<i>David W. Smith and Wayne L. Verrill</i>	15
Soil Forming Processes in Vernal Pools of Northern California, Chico Area	
<i>William A. Hobson and Randy A. Dahlgren</i>	24
Hydrology of Vernal Pools on Non-Volcanic Soils in the Sacramento Valley	
<i>Toby Hanes and Larry Stromberg</i>	38
The Hydrogeomorphic Approach and Its Use in Vernal Pool Functional Assessment	
<i>Mary Butterwick</i>	50
Current Distribution and Historical Extent of Vernal Pools in Southern California and Northern Baja California, Mexico	
<i>Ellen T. Bauder and Scott McMillan</i>	56
Great Valley Vernal Pool Distribution, Photorevised 1996	
<i>Robert F. Holland</i>	71
 SECTION II. The Plants, Animals, and Ecosystems – Ecology and Systematics, Status and Trends	
Evolution of Amphibious Vernal Pool Specialist Annuals: Putative Vernal Pool Adaptive Traits in <i>Navarretia</i> (Polemoniaceae)	
<i>Stanley C. Spencer and Loren H. Reiseberg</i>	76
Pool Duration Influences Age and Body Mass at Metamorphosis in the Western Spadefoot Toad: Implications for Vernal Pool Conservation	
<i>Steven R. Morey</i>	86
Avian Uses of Vernal Pools and Implications for Conservation Practice	
<i>Joseph G. Silveira</i>	92
Crustacean Biodiversity and Endemism in California’s Ephemeral Wetlands	
<i>Marie A. Simovich</i>	107
Loss of Diversity as a Consequence of Habitat Destruction in California Vernal Pools	
<i>Jamie L. King</i>	119
Biogeography of Eight Large Branchiopods Endemic to California	
<i>Brent P. Helm</i>	124
<i>Branchinecta</i> of North America: Population Structure and Its Implications for Conservation Practice	
<i>Michael Fugate</i>	140
Global Status and Trends in Ephemeral Pool Invertebrate Conservation: Implications for Californian Fairy Shrimp	
<i>Denton Belk</i>	147
Patterns of Vernal Pool Biodiversity at Beale Air Force Base	
<i>Gerrit A. J. Platenkamp</i>	151
Patterns in Time and Space for Rare Macroinvertebrates and Vascular Plants in Vernal Pool Ecosystems at the Vina Plains Preserve, and Implications for Pool Landscape Management	
<i>Douglas G. Alexander and Robert A. Schlising</i>	161
Specialist Bee Pollinators of Showy Vernal Pool Flowers	
<i>Robbin W. Thorp and Joan M. Leong</i>	169
Population Genetics of Vernal Pool Plants: Theory, Data and Conservation Implications	
<i>Diane R. Elam</i>	180

SECTION III. CONSERVATION AND MANAGEMENT

Vernal Pool Creation in the Sacramento Valley: A Review of the Issues Surrounding Its Role as a Conservation Tool
Greg Sutter and Robert Francisco 190

An Overview of 15 Years of Vernal Pool Restoration and Conservation Activities in San Diego County, California
Charles Black and Paul H. Zedler 195

Review of Ten Years of Vernal Pool Restoration and Creation in Santa Barbara, California
Wayne R. Ferren Jr., David M. Hubbard, Sheila Wiseman, Anuja K. Parikh and Nathan Gale 206

Vernal Pool Construction Monitoring Methods and Habitat Replacement Values
June M. De Weese 217

Aquatic Macroinvertebrate Occurrences and Population Trends in Constructed and Natural Vernal Pools in Folsom, California
D. Christopher Rogers 224

Managing the Sacramento Vernal Pool Landscape to Sustain Native Flora
Sheila J. Barry 236

The Use of Prescribed Fire to Control Invasive Exotic Weeds at Jepson Prairie Preserve
Oren Pollak and Tamara Kan 241

Management Considerations for Small Vernal Pool Preserves – The Phoenix Vernal Pools
George M. Clark, Terry J. Roscoe, M. Josephine van Ess and Nancy Wymer 250

Planning Sustainable Conservation Projects: Large and Small-Scale Vernal Pool Preserves
Sherry Teresa and Brenda C. Pace 255

Toward an Ecosystem Approach to Vernal Pool Compensation and Conservation
Robert A. Leidy and Elizabeth G. White 263

Determination of Available Credits and Service Areas for ESA Vernal Pool Preservation Banks
Deborah L. Mead 274

GENERAL INDEX 282

ACKNOWLEDGEMENTS 284

Forward

This written record of the conference can only convey a portion of the excitement, expectations, and synergy which permeated and characterized the meeting. Although the conference's name might seem to restrict contributions and conversations to vernal pool ecosystems, the breadth of presentations in these proceedings make it clear that the conference was about progress in—and plans for—conservation of California's landscapes in general.

It was not so long ago, at the start of this century, that conservation meant the management of a natural resource in such a way that the resource's availability for use was prolonged for as lengthy a period of time as possible. Then, by the middle of this century, conservation began to be defined as the preservation of something. Conservation management, under this view, would prolong the presence (not the use) of that something for as lengthy a period of time as possible. Since use was no longer the focus, conservation began to be applied to ecosystems, airsheds, watersheds, and non-commercial biota. Wilderness, rather than certain commercially valuable resources, came to exemplify the target for this version of conservation.

Now, late in the century, a new conservation movement has been building. Its focus is not on the conservation of people-less wilderness in mountain meadow, desert bajada, backwater bayou, or arctic tundra. It has become clear that while we have striven to purchase, protect, and visit wild places with breathtaking vistas and profound solitude, we continued to absent-mindedly degrade the places where we live. The new conservation movement highlights the places where we live. This type of conservation, sometimes referred to as "bioregionalism" or "environmental justice," addresses landscapes that have already been modified by humans, including the grassland-vernal pool landscape of the Great Central Valley, with its urban centers, intensive cattle grazing, fragmentation by agriculture, modified wildfire regime, and dominance by exotic plant species.

These half-natural, half-modified ecosystems are the homes we live in, not the wildlands far away. These are the landscapes that form the more continuous matrix of cover over the earth's surface. As we continue to protect and preserve undisturbed areas, we must strive to restore and enhance the far larger disturbed areas. According to poet-naturalist Gary Snyder, in his recent book *A PLACE IN SPACE*, we need to center our life and our economy in the bioregion around us, because in so doing we become "inhabitants." Inhabitants have a long-term commitment to a place and a view of resource use that approaches the ideal of ecosystem sustainability.

Sustainability is an often-used term today. Intuitively, sustainable management implies that the "green-ness" of a particular landscape will remain unchanged over some considerable period of time. We can be more precise and measure that green-ness by counting species, weighing the biomass, tallying the number of grazing animals, or assessing the yield and vitality of crops. Numbers would let us meet more technical definitions of sustainability, which require data showing no loss of genetic diversity or productivity over time.

Is the achievement of sustainable management for vernal pools or any other landscape or resource a reasonable near-future objective? Our history, as a species, of attaining sustainable management is dismal. A few years ago the ecologist Donald Ludwig, of the University of British Columbia, wrote an essay entitled "Environmental sustainability: magic, science, and religion in natural resource management." His historical review of human failure to achieve sustainability even in the ecosystems humans know best—forests, farms, fisheries—led him to rhetorically ask how we can now think that sustainable management of less well-known ecosystems is within our grasp. "Science is founded upon the conviction that experience, effort, and reason are valid; magic on the belief that hope cannot fail nor desire deceive." He concluded that our current expectation of achieving sustainable resource management is based more in magic than it is in science.

Like the biota in any ecosystem, vernal pool plants, animals, and microbes have co-evolved with each other and in relation to narrow environmental conditions. The complex result is rather difficult to imitate in humanly created pools. Our attempts to move and create vernal pool ecosystems have only been partially successful, as presentations in this conference attest, and even this measure of success is based on short-term observations of half a dozen years or less. The successful retention of a diverse suite of organisms can probably best be judged by monitoring over a time period long enough to include the historic, natural range of environmental variability (drought years, wet years, cold years, warm years). For vernal pools, this period of time might well exceed a decade. For ecosystem types which have longer-lived woody plants or vertebrate animals, the necessary period of monitoring might well exceed several decades and even approach a century. The US Forest Service, in fact, was formally requested to develop a management plan in the Pacific Northwest that would sustain spotted owl populations for 100 years into the future. Is such long-term monitoring and management possible? Do we have the kind of social infrastructure that could maintain consistent policy and monitoring plans for that length of time? Do we, as a species, have decade-long to century-long attention spans?

I personally imagine that the answers to those questions are “no.” Until the answers can be “yes,” the prudent, conservative policy should be to retain as many vernal pools and as much of the natural landscape as we can, while attempting mitigation, enhancement, and restoration activities at the same time. As the late George Clark once said at a meeting when conservation action was being criticized, “Dammit, the plants need us!” George had an inhibitory outlook.

MICHAEL G. BARBOUR

Environmental Horticulture
Nature and Culture Program
University of California
Davis, CA 95616

Introduction

Vernal pools have long attracted botanists and plant lovers. Their showy splash of color is a magnet to those who appreciate California's diverse and often unusual flora. Relatively little has been published to date on vernal pools and much of the material is from privately financed studies that are not widely distributed. The three previous symposia held on California vernal pool issues have largely focused on the flora, plant community associations, and rare plants of this unique ecosystem. The first two, sponsored by the University of California, Institute of Ecology, occurred in 1976 and 1981. The more recent conference, sponsored by the Pacific Section of the Botanical Society of America, was in 1989.

In the intervening years since the most recent symposium, other biologists and naturalists have become increasingly interested in vernal pool ecosystems. In addition to the ongoing interest in the unique – and often rare – plants associated with vernal pools, several researchers have begun to document an equally unique and highly endemic fauna – particularly invertebrates – also associated with vernal pools. Several species of invertebrates endemic to vernal pools were listed as threatened or endangered under the Federal Endangered Species Act in 1994. Since that time, numerous other species of plants and animals associated with vernal pools have been listed or proposed for listing, and vernal pool conservation has become a major environmental issue at the federal, state and local level.

The Conference on the Ecology, Conservation, and Management of Vernal Pool Ecosystems was jointly sponsored by the California Native Plant Society, the Western Section of The Wildlife Society, and the California Chapter of the Society for Ecological Restoration. The three day symposium was intended to provide current information to biologists, land use planners, environmental agency personnel, and others who are concerned about vernal pools. Speakers from a broad range of disciplines were invited to present papers at the conference providing a forum for discussion of issues relating to the unique natural communities associated with vernal pools.

Participation and attendance at the Conference exceeded the expectations of the planners and organizers. In addition to the multitude of governmental and regulatory agency personnel and biological consultants, the conference was well attended by citizens interested in the unique natural heritage of vernal pools. The interdisciplinary nature of the conference allowed many individuals and groups who might not otherwise cross paths to share their ideas and insights on ecology as well as conservation and long term preservation of both species and habitats.

The papers in this proceedings are organized into subject areas patterned after the conference. I am very pleased to report that 81% of the papers presented at the conference are included in this proceedings. I wish to thank each and every author who submitted a paper and then took the time to respond to both peer review and editorial comment. Numerous other individuals and organizations contributed to the success of the conference and the publication of this proceedings and have been listed in the acknowledgements section.

CAROL W. WITHAM

California Native Plant Society
1722 J Street, Suite 17
Sacramento, CA 95814