This symposium is supported by the Kenneth S. Norris Endowment Fund for the California Environment provided to the Natural Reserve System by the David and Lucile Packard Foundation.
Breakfasts will be served in the Dining Room in the housing area (green circle). All other symposium activities will be at the Laboratory (red circle).
Patricia A. Holden
Professor
Bren School of Environmental Science & Management, UC Santa Barbara
PhD UC Berkeley
Microbes are the most abundant and metabolically diverse life forms on Earth. They catalyze most nutrient cycling reactions, including pollutant biodegradation; some also cause disease in humans, and thus are public health concerns. My research regards microbes in the environment: where are they, what do they do, and what controls their processes? Our work spans the dual roles of microbes, i.e. as either transformation agents or as contaminants, with a substantial focus on bacteria.

Patrick O’Grady
Associate Professor
Environmental Science, Policy and Management, UC Berkeley
PhD University of Arizona
My work takes advantage of the spectacular diversity of Drosophilidae present in the Hawaiian Islands and a wealth of genomic tools available in the genus Drosophila to understand how species form and persist through evolutionary time. These questions are becoming especially critical now that we are facing a global biodiversity crisis and species are disappearing at an unprecedented rate. Comprehensive taxonomic revisions provide a framework that my laboratory employs to examine phylogenetic and biogeographic patterns in the Hawaiian Drosophilidae, including both historical patterns across older lineages and within recently divergent species. The combination of the two approaches yields a highly detailed view of evolutionary change at the point of species formation while providing the historical context in which species are forming.

Chelsea Specht
Associate Professor
Plant Biology, UC Berkeley
PhD New York University
The evolution and diversification of plants is characterized by a continuous origin of morphological and biochemical novelties that underlie an astounding richness of species diversity. My research focuses on investigating the genetic and genomic processes that drive plant diversification, particularly relating to the evolution of innovations in plant form and function. Our models include floral developmental evolution in the tropical gingers (Zingiberales), the gain and loss of carnivory in the Caryophyllales (flytraps, Nepenthes, sundews), and the evolution of thermogenesis associated with cycad pollination.
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<tr>
<th>Time</th>
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<tr>
<td>12:00-1:20 p.m.</td>
<td><strong>Lunch</strong> <em>(Food service 12:00-12:45 p.m.)</em></td>
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| 1:30-2:15 p.m. | **Opening remarks**  
Peggy Fiedler, Director, UC Natural Reserve System  
*Introduction to Bodega Marine Laboratory and Reserve*  
Suzanne Olyarnik, Manager, Bodega Marine Reserve |                                                                                 |
| 2:15-2:40 p.m. | **Believing is Seeing: A photographic index of the University of California Natural Reserve System**  
Christopher Woodcock, Department of Art (Studio)  
University of California, Davis |                                                                                 |
| 2:40-3:05 p.m. | **Quantifying the meadow “sponge”: Impact of drainage on high elevation meadow water holding capacity**  
Chelsea Arnold, School of Engineering  
University of California, Merced |                                                                                 |
| 3:05-3:25 p.m. | **Break**                                                           |                                                                                 |
| 3:25-3:50 p.m. | **Shrub encroachment into the alpine. An uphill battle?**  
Christopher Kopp, Department of Biology  
University of California, San Diego |                                                                                 |
| 3:50-4:15 p.m. | **Scale-dependence of pollinator responses to floral resource density**  
Carla J. Essenberg, Department of Biology  
University of California, Riverside |                                                                                 |
| 4:15-4:30 p.m. | **Break**                                                           |                                                                                 |
| 4:30-6:00 p.m. | **Tour of the laboratory**  
Suzanne Olyarnik and Jackie Sones |                                                                                 |
| 6:15-7:40 p.m. | **Dinner** *(Food service 6:15-7:00 p.m.)*                          |                                                                                 |
| 7:45-8:45 p.m. | **LECTURE:** Aquatic insect diversity in northern California’s rivers: developing metrics for evaluating water quality and sustainability in natural ecosystems.  
Patrick O'Grady  
Associate Professor of Environmental Science, Policy and Management  
University of California, Berkeley |                                                                                 |
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<td><strong>Constraints on biological nitrogen fixation across geological time</strong></td>
<td>Joy Cookingham, Graduate Group in Ecology, Land Air and Water Resources</td>
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<td><strong>Zooplankton prey delivery to intertidal suspension feeders in turbulent and wavy flow</strong></td>
<td>H. Eve Robinson, Department of Integrative Biology</td>
<td>University of California, Berkeley</td>
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<td>9:50-10:15 a.m.</td>
<td><strong>Mutualist-mediated niche expansion and differentiation in a newly discovered grass-fungal endophyte symbiosis</strong></td>
<td>Michelle E. Afkhami, Department of Evolution and Ecology</td>
<td>University of California, Davis</td>
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<td>10:15-10:35 a.m.</td>
<td><strong>Break</strong></td>
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<tr>
<td>10:35-11:00 a.m.</td>
<td><strong>Understanding the relationship between conifers and bacterial endophytes</strong></td>
<td>Emily C. Wilson, School of Natural Sciences</td>
<td>University of California, Merced</td>
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<td>11:00-11:25 a.m.</td>
<td><strong>Mines, mycorrhizae, and management: Effects of topsoil depth and soil inoculation at a mine restoration site</strong></td>
<td>Taraneh Emam, Graduate Group in Ecology, Plant Sciences</td>
<td>University of California, Davis</td>
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<td>11:25-11:50 a.m.</td>
<td><strong>Tidepools are scary: seastar predators benefit tidepool algae by scaring snail prey</strong></td>
<td>Sarah Gravem, Graduate Group in Ecology, Environmental Science and Policy</td>
<td>University of California, Davis</td>
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| 1:30-3:30 p.m. | **Tour of the reserve**  
Suzanne Olyarnik, Jackie Sones, and Michelle Cooper |
| 3:30-3:45 p.m. | **Break**                                                            |
| 3:45-4:10 p.m. | **Impacts of biological diversity on sediment transport in streams**  
Lindsey K. Albertson, Department of Ecology, Evolution, and Marine Biology  
University of California, Santa Barbara |
| 4:10-4:35 p.m. | **Infestation of wild birds with *Ixodes pacificus*, the tick vector of *Borrelia burgdorferi* and *Anaplasma phagocytophilum***  
Regina J. Dingler, Veterinary Medicine and Epidemiology  
University of California, Davis |
| 4:35-5:00 p.m. | **Does antioxidant physiology mediate sexual pigmentation and alternative reproductive strategies in yellow warblers?**  
Andrea Grunst, Department of Evolution, Ecology, and Organismal Biology  
University of California, Riverside |
| 6:15-7:30 p.m. | **Dinner** (Food service 6:15-7:00 p.m.)                             |
| 7:45-8:45 p.m. | **LECTURE: Ecological implications of engineered nanomaterials**  
Patricia Holden, Professor of Environmental Microbiology  
University of California, Santa Barbara |
## Sunday morning

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<td><strong>A multi-level approach to describing connectivity in</strong> <em>Acacia greggii A Gray</em>&lt;br&gt;Keith Gaddis, Department of Ecology and Evolutionary Biology&lt;br&gt;University of California, Los Angeles</td>
</tr>
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<td>9:25-9:50 a.m.</td>
<td><strong>Stream temperature and cues from exotic trout interact to alter insect behavior</strong>&lt;br&gt;Bruce Hammock, Graduate Group in Ecology&lt;br&gt;University of California, Davis</td>
</tr>
<tr>
<td>9:50-10:15 a.m.</td>
<td><strong>Spiders in the grass: Do non-native grasses change trophic cascades?</strong>&lt;br&gt;Kirsten E. Hill, Department of Environmental Science, Policy, and Management&lt;br&gt;University of California, Berkeley</td>
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<td>10:15-10:35 a.m.</td>
<td><strong>Break</strong></td>
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<td>10:35-11:00 a.m.</td>
<td><strong>Size variation and reproductive strategies in the sand wasp</strong> <em>Steniolia nigripes</em>&lt;br&gt;Gilene M. Young, Department of Ecology and Evolutionary Biology&lt;br&gt;University of California, Los Angeles</td>
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<td>11:00-11:25 a.m.</td>
<td><strong>Adaptive plasticity in reproductive behavior and mediation by the adrenocortical stress response</strong>&lt;br&gt;Melissa Grunst, Department of Evolution, Ecology, and Organismal Biology&lt;br&gt;University of California, Riverside</td>
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<td>11:25-11:50 a.m.</td>
<td><strong>Q&amp;A – Life after graduate school</strong>&lt;br&gt;Holden, Specht, O’Grady and Fiedler</td>
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Believing is Seeing: A photographic index of the University of California Natural Reserve System
Christopher Woodcock, Department of Art (Studio)
University of California, Davis
The University of California Natural Reserve System (NRS) is the largest university-administered system dedicated to providing and protecting the natural landscapes of California for research. Education is often thought of as an endeavor that occurs within the confines of a classroom, but the 37 NRS sites provide a unique opportunity to study and conduct research in habitats unavailable in a classroom setting. Located throughout California, the forty-five-year-old NRS consists of a mosaic of native ecological and topographical diversity endemic to the state. At a time when every resource at the University of California is being questioned and critiqued for its particular value, I sought to use landscape photography to visually index the scale and importance of the NRS. My Mathias Grant is the culmination of over 6 weeks of field research and more than 4,000 miles traversing the state of California with a 5x7-inch field camera. The resulting body of work is a series of four 5x7-inch images captured at each reserve. Standing alone, the images are meant to summarize the reserves’ various ecotones. Taken at dawn or dusk, the exposures last from seconds to minutes in the rapidly changing crepuscular light. During the presentation I will discuss the virtues of conducting such a large and extensive project, describe my first-hand research while showing a selection of images, and elaborate on the tools and techniques that I employed. The resulting body of work is a photographic portrait of the University of California Natural Reserve System.

Quantifying the meadow “sponge”: Impact of drainage on high elevation meadow water holding capacity
Chelsea Arnold, School of Engineering
University of California, Merced
Meadow degradation is a critical problem facing a variety of environments, including high elevation ecosystems of the Sierra Nevada, California, and has become a focus of major research and restoration efforts. A meadow experiences degradation when the hydrologic regime is altered by lowering of the water table due to incision of stream channels. Consequently, pivotal to the restoration efforts in degraded meadows has been returning a high water table to the meadows. While this approach creates conditions conducive to the re-establishment of traditional meadow vegetation, it does not take into account the long and short-term impacts of aerobic decomposition of soil organic matter (SOM) and consolidation of meadow soils that occur when the water level is low. Within the historic range of water level in a meadow, it is hypothesized that a meadow will retain its water holding capacity and resiliency. However, if the water table drops below a historic level, the processes of soil consolidation and aerobic decomposition will influence the resiliency of the meadow through a) irreversible plastic deformation of the soil pores and b) changes in SOM chemistry and distribution. The subsequent change in soil structure results in decreased porosity, increased bulk density, and a reduction in permeability of the meadow. Such changes can adversely impact the overall water holding capacity of the meadow. The research presented here utilizes a modified triaxial system to quantify the historic limit of dryness experienced in a high elevation meadow and degree of consolidation the meadow would experience if that limit was exceeded.
Shrub encroachment into the alpine. An uphill battle?
Christopher Kopp, Department of Biology
University of California, San Diego
Shifting range distributions observed worldwide provide some of the best evidence of species responses to increasing global temperatures over the past century. Many predictions of species range shifts are based on the climate envelope approach, with the null prediction that species ranges will shift poleward and upward in elevation to track suitable climate. However, observed rates of range alteration vary widely among species, potentially due to both differential dispersal rates and species interactions. In 2010 we conducted a re-survey of plant species distribution and abundance in eastern California’s White Mountains, in areas originally surveyed by Harold Mooney in 1961. Species presence and abundance data were collected along line transects between elevations of 2,900 m and 4,000 m. We found that A. arbuscula increased its elevational range margin on granitic soils as much as 150 m from the original 1961 survey, and this upward range expansion coincided with significant declines in abundances of three alpine cushion plants: Trifolium andersonii, Phlox condensata, and Eriogonum ovalifolium. There were, however, smaller but significant declines in these species at higher elevations and on soil types where A. arbuscula had already become abundant. Together these results suggest that rising temperatures may be negatively impacting these alpine plant communities via both direct and indirect mechanisms, increasing the likelihood of local extinctions as compared with predictions from a simple climate envelope approach. Based on these results we have established an experiment that tests the effects of shading, warming, and presence of A. arbuscula on alpine plant species in the White Mountains.

Scale-dependence of pollinator responses to floral resource density
Carla J. Essenberg, Department of Biology
University of California, Riverside
Many studies have found effects of flower or plant density on pollinator visitation rates at local scales. Much less is known about effects at larger scales, in spite of the potential importance of those effects for plant population and community dynamics. Here I present data from an observational study in which I measured the effects of floral resource density on per-flower visitation rates and visitor species composition at both local (4 m²) and large (12.5 ha) spatial scales, using the annual plant Holocarpha virgata at the UC McLaughlin Reserve. Responses were scale-dependent. Both the total per-flowerhead visitation rate and visitation by the most common visitor, the eucerine bee Melissodes lupina, were positively correlated with large-scale floral resource density as it changed through the season. However, local flowerhead density had no effect on total visitation rates and had a negative effect on visitation by M. lupina. In addition, the species composition of visitors changed with local flowerhead density: visitation by M. lupina declined and visitation by honeybees increased with local density. Because of variation in pollinator quality, shifts in species composition such as those I observed could lead to unexpected changes in pollination success with flower density. The scale-dependence of the effects of floral resource density means that data collected at local scales cannot safely be applied to larger-scale contexts.
**Constraints on biological nitrogen fixation across geological time**

Joy Cookingham, Graduate Group in Ecology, Land, Air and Water Resources
University of California, Davis

Biological nitrogen (N) fixation—the conversion of atmospheric di-nitrogen (N$_2$) into bio-available ammonium—is a process of significant ecological importance. N limits plant productivity and carbon exchange at the global scale, yet our understanding of the rates and controls of this process are limited, especially for aymbiotic N fixation during litter decomposition. In ecosystems lacking large numbers of symbiotic N$_2$-fixing plants, aymbiotic N fixation has the potential to represent a substantial N input. My study takes advantage of a natural ecological staircase located in Mendocino County, California, composed of five wave-cut terraces each 100,000 years older than the one below. The sequence represents an extreme gradient in nutrient availability, with a nutrient poor pygmy forest at the oldest site and a relatively nutrient rich bishop pine forest at the youngest site. Using the Ecological Staircase as a natural experiment in nutrient limitation, I will examine the response of aymbiotic N fixation during litter decomposition at each terrace. In order to address possible mechanisms responsible for observed patterns, I will conduct two field experiments. First, I will examine the response of N-fixation across terraces in response to fertilization by elements potentially limiting the activity of this process. Second, I will conduct a decomposition experiment with reciprocal transplant of litter from each terrace. This experiment will examine the relative importance of litter quality (i.e. concentration of polyphenols) versus site conditions (i.e. nutrient availability) on N fixation during litter decomposition. This study will provide estimates of N fixation rates with variations in nutrient availability and address possible mechanisms responsible for observed patterns.

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**Zooplankton prey delivery to intertidal suspension feeders in turbulent and wavy flow**

H. Eve Robinson, Department of Integrative Biology
University of California, Berkeley

Benthic suspension feeders play a key role in transporting material from planktonic to bottom-dwelling communities by preying upon particles and small organisms suspended in the water column. Variations in the flow environment affect food availability and prey capture by sessile suspension feeders. Turbulence and waves impact zooplankton by increasing encounter rates with predators and limiting swimming behavior or escape responses. Turbulence can also affect the predator by impacting their ability to successfully retain and ingest prey. To address how the fluid environment affects predator-prey interactions in suspension feeding, I characterized the flow environment above a bed of aggregating sea anemones, *Anthopleura elegansissima*, at two rocky intertidal sites on Bodega Head (Sonoma Coast, California), and measured plankton availability. One site was directly exposed to waves; the other site was located in a harbor, relatively sheltered from incoming swell. The localized flow measurements were also compared to offshore buoy observations and nearshore instruments that measured waves to look for energetic linkages between large-scale and small-scale flow variations. These data will be used to re-create in a laboratory flume the range of flow velocities, turbulence, and waves observed over sea anemones to study small-scale predator-prey interactions between zooplankton prey and benthic suspension feeders.
Mutualist-mediated niche expansion and differentiation in a newly discovered grass-fungal endophyte symbiosis
Michelle E. Afkhami, Department of Evolution and Ecology
University of California, Davis
Niche theory has led to important advancements in the understanding of species coexistence, community assembly, and speciation. Researchers have focused on niche reduction caused by negative species interactions, but the effects of positive interactions (e.g. mutualism and facilitation) have been virtually ignored. Unlike competition/predation, positive interactions can expand the realized niche of a species, even beyond the fundamental niche, by conferring benefits that ameliorate (a)biotic stresses. Partner-generated niche shifts could also cause intra-specific niche differentiation, if individuals that associate with partners have different niches from those that do not. I examined how a fungal endophyte (Neotyphodium sp.) affects the niche of its native grass host, Bromus laevipes, via modeling and experimental approaches. Ecological niche models using survey and climate data indicate that endophyte expands the host niche across its entire range and that differentiation associated with the endophyte is comparable to that observed among species. Five common gardens were also set up at UC Natural Reserves throughout northern/central California to test for niche effects and whether the interaction can be mutualistic. I manipulated endophyte levels in plants from 11 populations prior to planting. Over the last three years, I have found that across all five gardens, plants with high levels of endophyte experienced higher fitness than plants with low levels or no endophyte. The fitness increase was large: ~40% more stems and leaves, ~80% more flowering, and 25% lower mortality for plants with endophyte. Plants with high endophyte levels also receive less natural enemy damage, suggesting an underlying mechanism of endophyte-conferred natural enemy deterrence.

Understanding the relationship between conifers and bacterial endophytes
Emily C. Wilson, School of Natural Sciences
University of California, Merced
With increasing population growth and the predicted consequences of global climate change, renewable approaches to agriculture and forestry are important areas of research. To understand factors that contribute to successful and productive plants we need a better understanding of symbionts such as endophytes — bacteria and fungi inside healthy plant tissue — which can play a role in plant stress protection and growth promotion. Application of these bacteria could drive future efforts in sustainable crops and forestry, however much remains to be studied concerning plant-endophyte relationships and the complex communities of endophytes. Studies of single-endophyte isolates from agricultural plants have demonstrated that bacterial endophytes have beneficial effects on their plant host but little is known about the role of bacterial endophytes in natural ecosystems. Further study is needed concerning the mode of endophyte transmission, the specificity of plant-endophyte relationships, and variability of bacterial endophyte communities throughout host tissues, species, and geographic locations over time. The central hypothesis directing the course of this project is that plants form specific symbioses with host-adapted bacterial endophytes. This hypothesis will be tested in a seasonal study of conifer endophytes isolated from Pinus contorta growing in Tuolumne Meadows, California.
Mines, mycorrhizae, and management: Effects of topsoil depth and soil inoculation at a mine restoration site
Taraneh Emam, University of California, Davis
Mine sites can be particularly challenging to restore, as topsoil is often lost, severely disturbed, or contaminated. I applied two treatments used in mine restoration, topsoil addition and soil inoculation, to a waste disposal site at the former Knoxville mercury mine on McLaughlin Natural Reserve. Depths of stockpiled topsoil from 2 – 50 cm were placed atop mine tailings to simulate possible reclamation practices and to vary the levels of stress experienced by plants. Subplots containing the topsoil depth gradient were then inoculated with either arbuscular mycorrhizal (AM) inoculum from a commercial source, rhizosphere soil from nearby native grassland, or were left uninoculated as a control. Plots were seeded with a mixture of native grasses and non-native species recruited from adjacent areas. Contrary to my hypotheses, non-native grass biomass was more responsive to inoculation than native grass biomass. In control plots, biomass of non-native and native grass was similar. In rhizosphere soil treated plots, biomass of non-native grasses was approximately 2.5 times higher in than in controls, while native grass was unaffected. Commercial AM inoculum had no significant effect on either native or non-native grass biomass. Deeper topsoil resulted in higher native grass biomass, and AM colonization of the native grass selected for analysis (Vulpia microstachys) was highest in both shallow and deep extremes of topsoil depth, but there was no interaction between depth and inoculation treatment. These results indicate that while soil inoculation may increase plant biomass in mined areas, it could disproportionately increase growth of less desirable species; thus caution should be used when implementing an inoculation treatment.

Tidepools are scary: seastar predators benefit tidepool algae by scaring snail prey
Sarah Gravem, Graduate Group in Ecology, Environmental Science and Policy University of California, Davis
The presence of predators in communities can have cascading effects on lower trophic levels, and recent evidence suggests cascades are often caused by changes in prey behavior rather than actual consumption of prey (non-consumptive indirect effects, NCIE). However, natural field-based studies showing this are rare. Using natural densities and allowing free movement of predators and prey in the field, I demonstrated an NCIE where the predatory seastar Leptasterias hexactis indirectly positively affect microalgae in tidepools by altering the behavior of the herbivorous snail Chlorostoma (Tegula) funebralis. Laboratory and field experiments also show that individual snail states, including increased size, increased hunger level, and high densities of conspecifics, mitigate the fear response of the snail, and may weaken the strength of this NCIE. This result, where phenotypic plasticity alters the strength of an NCIE, has not been demonstrated in other studies. Further, I plan to study how these snail states alter NCIE in the natural tidepool system, and how Leptasterias may exert “remote control” over algae in Chlorostoma’s refuge habitat.
Impacts of biological diversity on sediment transport in streams
Lindsey K. Albertson, Department of Ecology, Evolution, and Marine Biology
University of California, Santa Barbara
An increasing number of studies have shown that organisms modify physical processes by
constructing biological structures (e.g. plant roots, biofilms). However, most of these studies have
investigated a single, dominant organism and have rarely investigated the impacts of biological
structures from multiple, coexisting species. Here, I ask whether we must account for variation
among species that, because of niche differences, each exert a unique influence on physical processes.
I use a model system to test how the diversity of benthic, net-spinning caddisflies (Trichoptera)
impacts sediment transport in streams. I extend the results of previous studies showing that silk nets
of a single species of caddisfly can reduce sediment mobility by asking whether two species have a
greater impact than one. In studies conducted in laboratory flumes and experimental stream channels
at the Sierra Nevada Aquatic Research Laboratory, I found that the critical shear stress required to
initiate sediment movement was significantly higher in streams containing two caddisfly species. The
increase in stability appeared to result from spatial partitioning of larvae among pore spaces, with a
larger species (Arctopsyche californica) that produces relatively stronger silk building nets at the
benthic surface and a smaller species (Ceratopsyche oslari) that produces relatively weaker silk building
nets in the subsurface. These results suggest that a quantitative merger of biology and
geomorphology may require that we specifically account for variation among species.

Infestation of wild birds with Ixodes pacificus, the tick vector of Borrelia burgdorferi and
Anaplasma phagocytophilum
Regina J. Dingler, Veterinary Medicine and Epidemiology
University of California, Davis
Lyme borreliosis (LB), caused by Borrelia burgdorferi, and human granulocytic anaplasmosis (HGA),
caused by Anaplasma phagocytophilum, are the most common tick-borne diseases in the United States.
In California, the bacterial pathogens may be transmitted to humans and/or domesticated animals by
Ixodes pacificus, the western black-legged tick. Avian mist nets were opened for 80 hours over a
period of 19 weeks at two sites in central California: Quail Ridge Reserve (Napa, California) and
Cache Creek Canyon Regional Park (Yolo, California). 143 birds, representing 28 species, were
captured. Ticks were removed from 48 birds, yielding 240 larval and 53 nymphal ticks. Quail Ridge
was more diverse in terms of avian richness and abundance. Additionally, more ticks, both larval and
nymphal, were collected at Quail Ridge (n=272) compared with Cache Creek (n=21). Ectoparasites and avian blood samples were analyzed for B. burgdorferi and A. phagocytophilum
infection and previous exposure. This study demonstrates that although these pathogens are likely
maintained by rodent reservoirs, birds serve as hosts for subadult I. pacificus. For instance, a juvenile
wild turkey captured at Quail Ridge Reserve was heavily infested with nymphal ticks, and supports
the hypothesis that ground foraging birds may be important hosts for maintaining tick populations.
Further, since nymphal ticks may acquire infections as larvae, birds at these two sites are potentially
carrying and/or dispersing infected ticks. Therefore, understanding the seasonality of tick life stages
in relation to bird foraging behavior and migratory patterns may help clarify the disease ecology of
these two pathogens.
Does antioxidant physiology mediate sexual pigmentation and alternative reproductive strategies in yellow warblers?
Andrea Grunst, Department of Evolution, Ecology, and Organismal Biology
University of California, Riverside

Tradeoffs between self-maintenance and reproduction are theorized to constrain alternative life histories and reproductive strategies, and may also constrain expression of expensive sexual ornaments. However, researchers have only recently begun to study sexual ornaments as life history investments. There is a trade-off between the development of these ornaments and other allocation alternatives. In yellow warblers (*Setophaga petechia*), I am investigating the hypothesis that males with high levels of sexual pigmentation invest in pigmentation and mating effort at the expense of oxidative status and paternal care. Development of pigment ornaments and intense male-male mating competition may generate oxidative costs by expending molecules with antioxidant potential and increasing metabolic rate and production of pro-oxidants. Increased time devoted to mating effort and declines in body condition and oxidative status may in turn reduce paternal performance. On the other hand, I am also exploring the possibility that highly pigmented males invest in mating over paternal care only in certain environments or stages of the breeding cycle, such as when territory disputes are intense. To address my hypotheses, I capture warblers early in the season and measure pigmentation using digital photographs and reflectance spectra obtained from feathers. I also obtain blood samples to measure oxidative status. Throughout the season, I video-record nests to determine song and paternal provisioning rates. Further, I present a model territorial intruder near nestling-stage nests to assess territoriality and whether territorial challenge differentially affects paternal effort in males differing in pigmentation. Results provide support for hypotheses, but additional work including a pigment manipulation will solidify interpretation.
A multi-level approach to describing connectivity in *Acacia greggii* A Gray
Keith Gaddis, Department of Ecology and Evolutionary Biology
University of California, Los Angeles
In the face of human-driven environmental change, ecology and conservation biology are increasingly concerned with factors influencing population dynamics. Species distributed among patches may be particularly sensitive to change due to constraint by niche limitations or resource competition. Increasing distance between patches due to environmental damage could lead to a decline in recolonization probability, resulting in decreased local stability. Areas like the American southwest are currently at an increased risk, as multiple climate models have predicted increasing aridity over the next 50 years and large areas are now slated for development of solar power plants, destroying huge areas of preserved land and cutting off remaining populations. In this environment, we have used *Acacia greggii* A Gray as a model of limitations to reproduction and gene flow in both a historical and contemporary context. We are investigating the mechanisms that maintain dispersal across such a heterogeneous landscape where populations are separated by mountain ranges and dry valleys. Using molecular techniques, we have documented a history of widespread gene flow in this species over the range of the preserve, but identified a more limited movement currently. We are quantifying the influence of dry washes on connectivity patterns in this species. It is possible that monsoon events in this region have driven rapid movement and new establishment of *A. greggii*. This analysis will inform us as to how this and other species will respond to a future of increasingly infrequent rainfall patterns.

Stream temperature and cues from exotic trout interact to alter insect behavior
Bruce Hammock, Graduate Group in Ecology
University of California, Davis
Determining how environmental problems interact with one another to affect ecosystems is a first step toward mitigation. Streams in the Sierra Nevada Mountains are subjected to ongoing climate change and are heavily invaded by exotic trout. Because trout metabolism will likely increase as alpine streams warm, the effect of trout on community structure and function may increase in response to climate change. We asked how an ecosystem function, the daytime drift of a stream mayfly, responds to changes in water temperature, and whether that response varied between streams invaded and uninvaded by trout. Specifically, we show that the daytime drift of *Baetis tricaudatus* exhibits a strong, negative correlation with water temperature in a fish-bearing stream, and demonstrate experimentally that water temperature was a probable driver for this correlation. Then, in an experiment replicated at the catchment scale, we show that water temperature and fish presence strongly interact to affect the daytime drift of *Baetis bicaudatus*. In fishless streams, daytime drift increased with water temperature, while in fish-bearing streams, daytime drift decreased with water temperature. Our results suggest that the anticipated increase in stream temperature due to climate change may escalate observed divergence in community structure and function between invaded and uninvaded streams, and that managers could reduce the effects of climate change by removing exotic trout.
Spiders in the grass: Do non-native grasses change trophic cascades?
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Predators can play a critical role in the structure and function of ecosystems through trophic cascades. In California’s introduced annual grasslands, arthropod predators’ ability to forage may be altered by non-native grasses that have different life forms than the formerly dominant native perennial grass. Land managers challenged to restore and maintain these systems have a task complicated by the inherent unpredictability of the indirect interactions found in trophic cascades. It is unknown if habitats dominated by non-native grasses reduce the abundance and diversity of arthropods. I hypothesized that senescent, non-native annual grasses create a hot, dry landscape, inducing herbivorous arthropods to switch from non-native to native food plants and reducing spider survival and foraging when compared to spiders in native perennial habitats. Using diurnal observational surveys and pitfall trapping along 30 m meadow boundary to interior transects, I found a significant positive correlation (r = .786) between the percent of native plant species and the abundance of arthropods present. Total spiders captured in pitfall traps was also significantly correlated (r = .881) with an increasing percent of native plant species. A significant positive effect was found with the proportion of native grass and distance from shaded meadow boundary on total spiders captured in pitfall traps for distances of 0, 15, 20, and 30 m from meadow boundary, with more spiders in native grasses. Knowledge from this study will benefit not only researchers but also land managers and planners who together face the daunting challenge of trying to keep and restore our remaining grasslands.

Size variation and reproductive strategies in the sand wasp Steniolia nigripes
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Differences in reproductive tactics and phenotypes are most often explained in the adaptive context of frequency-dependent and condition-dependent selection. However, traditional theories relating ecology and mating systems do not account for the effects that the behavior of one sex can have on the fitness of the other. Sand wasps (Crabronidae: Bembicinae) present a unique opportunity to study the importance of phenotypic variation in sexual interactions, because there is variability in sexual dimorphism and mating behavior across species. In particular, Steniolia nigripes shows reversed sexual size dimorphism and aggressive male defense of food resources visited by females, a behavior previously undescribed in the Bembicinae. Males are larger than females, but body size varies significantly within both sexes. If body size mediates the success of reproductive tactics, several patterns should be evident: (1) Large body size contributes to individual success in obtaining high quality territory or prey items; (2) the relative value and local distribution of body size vary with changes in resource availability; and (3) females and/or males demonstrate preferences in mating that correlate to either the size of the chooser or the size of the potential mate. My data indicate that male aggression level and success in territory holding are highly related to body size, confirming the first prediction. Body size may be a critical factor in determining the outcome of intrasexual competition, mate choice, and conflict between male and female reproductive behaviors in S. nigripes.
Adaptive plasticity in reproductive behavior and mediation by the adrenocortical stress response
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Adjustment of physiological mechanisms in response to external or internal cues allows for adaptive behavior. One physiological mechanism that mediates optimal balance of the survival-reproduction tradeoff is release of steroid hormones, glucocorticoids, via the adrenocortical stress response. Glucocorticoids act adaptively to promote glucose metabolism and flight-fight responses, but also have costs including muscle wasting and suppressed reproductive function. Indeed, down-regulation of the stress response facilitates energetic investment into reproduction by preventing cessation of reproductive activity despite potential survival threats. Down-regulation of the stress response during the breeding season is well documented among vertebrate taxa. However, despite profound fitness implications, intraspecific variation in stress hormones within the breeding season rarely has been studied. My research examines whether song sparrows (Melospiza melodia) display intraspecific differences in stress physiology that reflect variation in the value of the reproductive attempt, and which translate into differences in reproductive effort and responses to offspring- and adult-directed threats. To address this question, I am capturing sparrows using conspecific playback and measuring the stress response via serial blood sampling. I am also measuring variables that influence the value of the reproductive attempt including clutch size, time in the breeding season, and male quality (reflected by repertoire size). Finally, I am measuring reproductive effort by video-recording incubation attentiveness and nestling provisioning rates, in the presence and absence of nest and adult predator decoys. Preliminary results regarding effects of hormone levels on reproductive behavior are inconclusive, but suggest that male quality is an important factor influencing female reproductive effort.
1 – Oolok
2 – Lodge
3 – Dining hall
4 – Barracks
5 – Miwok
6 – Tokau
7 – Cottage
8 – Primrose
9 – Heron

To the town of Bodega Bay

To the Bodega Marine Lab