

# Symposium Abstracts 2008

## *Oral Presentations:*

- **Anderson, K. Evolution of some pretty cloud forest bugs.**

I will present (if completed) a phylogeny of a genus of Andean butterflies, and apply information about their evolution to questions about their range limits and species distributions.

- **Bowles, C. Alternate states, stability, disturbance and positive feedbacks in Central California soft-sediments.**

Ecological systems can be modified by many factors including habitat modification, eutrophication, species introductions and fishing. A natural system may withstand such disturbances until a threshold is reached, and the state switches to a distinct alternate state. Alternate stable state theory may be important for understanding community dynamics and managing ecological systems, but experimental evidence is limited and controversial. To persist, alternate stable states must have positive feedback mechanisms which promote both the existing community state at the expense of outsiders and recovery from disturbance (resilience).

*Boccardia proboscidea*, a native polychaete worm, has recently formed dense patches in Bodega Harbor mudflats adjacent to habitat dominated by venerid clams and phoronids. By monitoring the biological, physical and chemical characteristics of the *Boccardia* and phoronid states, I have demonstrated that these represent two distinct community states with discrete biological assemblages and physical characteristics. I experimentally manipulated *Boccardia* and phoronid communities using reciprocal transplants, removal of invertebrates (defaunation), and disturbances to study community structure, stability and recovery. Experimental and monitoring data show some evidence for stability, including community persistence and resilience. *Boccardia* is able to colonize empty habitat and alter the physical environment, which suggests ecosystem engineering as a positive feedback mechanism maintaining the *Boccardia* state.

- **Cobb, R.C., and D.M. Rizzo. Apparent competition among host species and feedbacks on disease severity in the sudden oak death pathosystem.**

Apparent competition can arise when an outside actor such as a predator or pathogen alters the interaction between two species. Generalist pathogens are likely to cause apparent competition when infection and mortality are selective. The arising pathogen mediated competition has been shown to alter competitive interactions and radically transform community structure. *Phytophthora ramorum*, the causative agent of sudden oak death, has a broad host range but is highly virulent to only a few species. In California redwood forests, susceptibility to foliar *P. ramorum* infection varies from high in California bay laurel (*Umbellularia californica*) to low in redwood (*Sequoia sempervirens*) but neither species suffers mortality. In contrast, tanoak (*Lithocarpus densiflorus*), an important component of these forests, is highly susceptible but suffers extensive mortality due to stem cankers. We hypothesize that differing susceptibility among host species to *P. ramorum* results in apparent competition among hosts and causes feedback between removal of tanoak and disease intensification. Because high amounts of pathogen sporulation occurs on leaves of bay laurel, increased survival of this species is likely to increase disease severity in tanoak. Conversely, increased survival of redwood is likely to decrease inoculum load because redwood is much less susceptible and supports minimal sporulation. Over the course of six years, we monitored survival of 5769 trees spanning the current geographic distribution of *P. ramorum* in California to estimate effects of *P. ramorum* on competitive interactions and host survival. Effects of apparent competition were evaluated

by reconstructing pre-disease vegetation structure and interactions from initial plot surveys. Pre-disease vegetation structure was regressed on per-capita infection and mortality rates. Before the arrival of sudden oak death species relationships were orthogonal and influenced by edaphic factors such as topographic moisture index, aspect, and soil texture. Tanoak mortality was positively related to pre-disease tanoak and bay laurel basal area suggesting that inoculum pressure is an important driver of mortality. Post-disease bay laurel-tanoak correlations were negative as would be expected if these species were competing for resources. In conjunction, these observations indicate that *P. ramorum* infection results in negative effects of bay laurel on tanoak. Logistic regression showed increased survival of infected redwood and bay laurel compared to uninfected trees in small size classes suggesting that infection may increase survival of these hosts, presumably through reduced competition for resources. Long-term changes in community structure are likely to increase disease intensity in stands with edaphic conditions favoring bay laurel and decrease disease intensity in those with edaphic conditions favoring redwood.

- **Dolanc, C. Current and potential vegetation shifts in subalpine vegetation of the Sierra Nevada, USA.**

Despite the attention climate change research has given arctic ecosystems, high-elevation ecosystem are also early, sensitive indicators of change. It is likely that many montane species will need to undergo an upslope migration to remain in appropriate habitat but it is unclear how easy that process will be for most species. Climatologists are predicting unprecedented rates of change and migration will be challenging in the heterogeneous, disjunct terrain of most mountain ranges. The objective of my study is to determine whether subalpine vegetation of the Sierra Nevada is already experiencing shifts in response to changing climate, and how continued change is likely to shape those shifts. Currently, I am approaching this objective from three angles: (1) I am re-sampling Wieslander Vegetation Type Mapping (VTM) plots that were originally sampled in the early 1930s. Modern plot data will be compared to historic data to look for differences in stand structure and composition that might be indicative of a climate shift. (2) I am coring trees of all sizes and species to determine whether growth increment has increased in recent years. Tree rings will be analyzed and correlated with weather data from nearby stations in the Sierra to look for factors driving 'good' years of growth. (3) I will initiate a study this spring that manipulates timing of snowmelt and follow seedling survival and recruitment in patches of earlier snowmelt versus controls. A more thorough understanding of how vegetation is responding to our changing climate and potential future climate will help land managers and conservation scientists create understand what and where subalpine vegetation will be 50-100 years from now.

- **Forrester, T., and D. Hankins<sup>1</sup>. Indigenous Prescribed Fire and Breeding Songbirds: A Possibility for Restoration.**

The Californian indigenous peoples have used prescribed fire as a deliberate management tool for thousands of years. This extensive history of anthropogenic burning in California, including the Central Valley, shows potential for using indigenous prescribed fire to manage and restore rare habitats, such as riparian valley oak (*Quercus lobata*). This presentation will briefly describe historical California Indian prescribed burning and detail a collaborative study that is beginning to examine the effects of indigenous prescribed fire on vegetation and breeding songbirds in the Central Valley. The study will use a participatory research approach, involving the local California Native American and land manager communities in the implementation and monitoring of the study, and the results will be presented to both communities at the conclusion

of the research. Prescribed burns will be conducted in riparian valley oak communities in the Central Valley of California, using both traditional ecological knowledge and scientific methodologies. Breeding songbird abundance, richness, and breeding success will be monitored on control and burned plots and analyzed to determine effects of prescribed fire. The results will address the relevance of indigenous management techniques in contemporary conservation, applied questions of songbird community viability under historic disturbance regimes, and theoretical considerations of niche modeling and source sink dynamics.

<sup>1</sup>CSU, Chico.

- **Hettinger, A. Hanging by a thread: Effects of ocean acidification on a calcifying marine foundation species.**

Global warming and climate change are perhaps the biggest environmental issues facing the planet today. Potential consequences of increases in atmospheric CO<sub>2</sub> concentrations and subsequent reductions in seawater pH (ocean acidification) are receiving greater awareness. An accompanying effect of ocean acidification is declining carbonate ion concentrations, which disrupts precipitation of calcium carbonate by calcifying organisms. Habitat-modifying foundation species, such as the California mussel, *Mytilus californianus*, could be compromised in significant ways by ocean acidification through direct and indirect impacts on their calcium carbonate shells and proteinaceous byssal thread holdfasts. This research will determine effects of ocean acidification on several ecologically relevant, mechanical properties of mussels to increase our knowledge of this important species that forms the basis on which the entire rocky intertidal habitat is built.

- **Hillis, V., M. Zimmerman, B. Beheim, A. Bell, C. Boyko, R. Boyko, M. Lubell, R. McElreath, P. Richerson, P. Smaldinho, K. Smith. When does copying pay? An agent-based simulation of social learning.**

Social learning is common to many species, but particularly important to humans, who display a fine-tuned capacity for imitation and teaching that underlies the generation of cumulative culture. We constructed an agent-based simulation to compare the performance of social and individual learning strategies in a complex and changing environment. We tested agents that employed different amounts of individual and social learning while manipulating the frequency of environmental change and the accuracy of social learning. Preliminary results indicate that strategies relying on social learning perform best when the frequency of environmental change is low and the accuracy of social learning is high. Overall, the best performing strategies employed a mix of both social and individual learning. The findings inform our understanding of the selective use of social learning in a complex and changing environment.

- **Ketchum, J.<sup>1</sup>, A. Hearn<sup>2</sup>, A.P. Klimley<sup>1</sup>. Movement patterns, connectivity, and residency of scalloped hammerhead sharks (*Sphyrna lewini*) in the Galapagos Islands: implications in the design of marine reserves and seascapes**

Marine predators such as sharks exhibit a whole range of behaviors and habitat uses, reflected in their movements occurring at different spatial and temporal scales. However, this movement patterns are far from understood, particularly in the case of highly mobile shark species like the scalloped hammerhead. The Galapagos Archipelago is one of the last outposts where large numbers of sharks still linger in the eastern Pacific, but alternatives to conserve and manage them are lacking. The Galapagos Marine Reserve offers some protection; however, the original design did not consider large marine predators, limiting its effectiveness. We intend to alleviate this management problem by incorporating shark movement in the design of the marine reserve. Our studies at the Galapagos show movements of scalloped hammerhead sharks at different

spatial scales: insular (< 30 km), inter-island (30-400 km), and oceanic (> 500 km). Insular movements are associated to 'hotspots' around islands, inter-island ones appear as less directional movements within the archipelago, whereas oceanic ones are more directional to other islands and/or seamounts away from the archipelago. This implies connectivity and a high degree of use of different areas within the archipelago, and the likelihood of migratory corridors between the Galapagos and islands and seamounts of the tropical eastern Pacific. Our findings have strong implications in the design of the Galapagos Marine Reserve and the Eastern Tropical Pacific Seascape. <sup>1</sup>Biotelemetry Laboratory, Department of Wildlife, Fish, and Conservation Biology. University of California, Davis, CA, USA. <sup>2</sup>Department of Marine Research and Conservation. Charles Darwin Foundation, Galapagos, Ecuador.

- **Nickols, K., B. Gaylord, and J. Largier. The California Coastal Boundary Layer: Lowering the speed limit for nearshore dispersers.**

Nearshore flow is one of the most important and understudied issues in marine ecology. The movement of ocean waters near the coast has important implications for larval recruitment and other ecological processes. Of particular interest are velocity gradients caused by the interactions of the coastline and alongshore flow, referred to as the Coastal Boundary Layer (CBL). Here, we examine the presence of a CBL at multiple sites on the South and Central California coast. We deployed Acoustic Doppler Current Profilers in transects perpendicular to the shore to measure velocity gradients in the nearshore waters. Data indicate the presence of a CBL whose characteristics reflect interactions of flow with the shoreline and the shallow seabed nearshore. A universal relationship describing these dynamics is also found, which may be used in nearshore dispersal models. Slower flows nearshore due to the presence of a CBL may be responsible for decreased alongshore transport and increased local retention of larvae and pollutants.

- **Prager, K. Investigating the ecology of infectious canid pathogens in African carnivores.**

Infectious canid pathogens such as rabies and canine distemper virus (CDV) have been implicated in significant mortality events and population declines in the highly endangered African wild dog (*Lycaon pictus*); thus, an understanding of the ecology of these pathogens is critical to wild dog conservation. A key issue in understanding the dynamics of these and other multi-host pathogens in an ecosystem is the identification of the pathogen reservoir. In Africa, domestic dogs (*Canis familiaris*) have traditionally been thought to be the reservoir of canid pathogens; however, other wild African carnivores, such as the black-backed jackal (*Canis mesomelas*), the spotted hyena (*Crocuta crocuta*) and the striped hyena (*Hyaena hyaena*) may play an important role in transmission dynamics and possibly as reservoirs. Identification of pathogen reservoirs becomes especially important when transmission of these pathogens to endangered species may increase their risk of extinction. The goal of this project is to gain a better understanding of the ecology of rabies, CDV and other common canid pathogens in the carnivores of sub-Saharan Africa. This improved understanding is critical for at least three reasons: (I) to aid in understanding extinction risks to wild dogs; (II) to aid in making effective conservation management decisions directed at wild dogs, other wild African carnivore populations and domestic dogs; and (III) in the case of zoonotic pathogens such as rabies, to aid in the development of effective public health management decisions.

- **Vaughn, K., and T. Young. Contingent conclusions; year effects influence the results of ecological field experiments, but temporal replication is rare.**

Interannual variations in experimental field conditions produce variability in the results of experiments conducted in different years, termed year effects. Since the outcome of an

experiment is highly dependent on the experimental conditions, the answers to fundamental ecological problems may depend on the year in which the question is asked. Examination of year effects requires initiating identical experiments in multiple years. Here we report results from a literature review covering more than 1800 articles published in six journals over the last 40 years. Only 5.4% of ecological field studies initiated experiments in multiple years. In contrast, 48% of field studies published in an agronomy journal tested results across years, perhaps because of the annual nature of agronomic crops. Despite their rarity, 71% of ecological experiments that were initiated in multiple years found at least one change in treatment effect significance in different years. Furthermore, 79% of studies that reported treatment by year interactions found significant interactions that eliminated or reversed treatment effects in different years. Thus, the conclusions drawn from these studies differed dramatically, depending on the year the experiment was initiated. We conclude that the results of ecological field experiments are largely contingent on the year in which they are implemented, despite widespread neglect of this contingency in experimental design. This is sobering news for field ecology, but also provides a strong impetus to test the generality of ecological findings across interannual variation.

- **Xu, W., W.S. Leal, Y. Ishida, Z. Syed, F. Zalom, and M. Johnson. Scent of beetle could save orchards.**

The ten-lined June beetle (TLJB) is a chronic problem in orchards where it occurs. TLJB grubs feed on the roots of several commercial trees including almonds. Although adults cause no economic damage, this life stage is amenable to control strategies as they emerge out of the soil in summer. Over the last three years, we have been observing the mating behavior of the TLJB. During the flight season, mating takes place at dusk for a very short period of time (<3 min) and soon after that females returned to the soil. If insecticides were to be applied, there is a very short window of mating activity (less than 90 min after dusk) when both males and females could be directly exposed to the treatment. Females start attracting males while emerging from the soil and in innumerable occasions mating took place while the female's head was still buried (in the soil). We commonly observed a large number of males searching in a certain area from where a female emerged later. In fact, this male behavior guided us in our search for females in the field. Pheromones and other attractants are important tools for monitoring and/or controlling insect populations. To identify the sex pheromone of the TLJB, airborne volatile collections and whole body extracts from field-collected females were analyzed with a gas chromatograph linked to an electroantennographic detector (GC-EAD). Males responded with remarkable sensitivity to compounds that were below the detection limits of the gas chromatograph.

#### *Poster Presentations:*

- **Drauch, A, J. Rodzen, J. Banks, and B. May. Using genetic techniques to resolve critical uncertainties in white sturgeon ecology and management.**

Several critical uncertainties about white sturgeon ecology may inhibit our ability to make informed management decisions for the species, including a lack of information about population structure, dispersal behavior, and recruitment success. To address some of these uncertainties, we will combine genetic and demographic data to examine the status of white sturgeon populations across the species range. First, we will examine population structure of white sturgeon within and among the Sacramento, Columbia, Snake, Kootenai, and Fraser Rivers. Knowledge of the extent of genetic variation in this species may be used in wildlife forensics and law enforcement to identify the sources of poached materials. Second, we will use mixed stock analysis to evaluate dispersal of white sturgeon among large west coast estuaries.

Exploitation of white sturgeon occurs primarily in estuaries and if white sturgeon from different spawning populations are found to mix in estuary habitats, interjurisdictional management may be warranted. Finally, we will examine the relationship between spawning stock size and recruitment in the Sacramento River by constructing full-sib progeny arrays of downmigrating juvenile white sturgeon. The ability to estimate the number of adults spawning each year will allow managers to better understand annual population trends and make more accurate projections of future white sturgeon abundance.

- **Vaughn, K. Competition and Indirect Facilitation in California Valley Oak Grasslands.**

The restoration of California grasslands is bound by two related principles: 1) the successful establishment of native perennial grasses requires exotic annual grass control and long-term control of exotic annual grasses can be achieved by the successful establishment of perennial grasses. In addition, oak seedling establishment is low in exotic annual dominated grasslands. Native grassland restoration may indirectly facilitate the establishment of oak seedlings through the suppression of exotic annual grass competitors. By experimentally manipulating exotic annual and native perennial grass cover, I examined direct and indirect competitive interactions in a California Grassland restoration context. I found 1) high annual grass cover decreased native perennial grass cover, 2) established perennial grasses decreased annual grass cover and 3) high annual grass cover decreased mean oak seedling height. However, while oak seedlings grew taller in plots with high perennial cover, no significant effect was detected.

- **Santos, M.J. E.L. Hestir, S. Khanna, N. Noujdina, J. Greenberg and S.L. Ustin. Weeding out the invaders: lessons learned from 5 years of hyperspectral weed detection in a highly altered estuary.**

Invasive aquatic weeds negatively affect biodiversity, fluvial dynamics, water quality and availability. California's Sacramento-San Joaquin River Delta, part of the largest estuary in the Western United States, has undergone long-term changes in ecosystem function and is currently the focus of a massive, coordinated rehabilitation and restoration program. This program includes monitoring submerged, floating and emergent plant communities, and controlling Brazilian waterweed (*Egeria densa*) and water hyacinth (*Eichhornia crassipes*). Since 2003 we have performed an annual survey of the distribution and dynamics of invasive aquatic weeds in the Sacramento-San Joaquin Delta, CA, using hyperspectral imagery. Covering over 2,500 km<sup>2</sup> and a base image dataset of over 130 GB per year, this project is one of the largest hyperspectral monitoring efforts ever conducted. Major considerations for accurate mapping of these communities include: (1) sensor choice, (2) flight planning, (3) radiometric correction, (4) geometric correction, (5) submerged species detection, which is complicated by water conditions (turbidity, depth and specular reflection) and confusion with tree shadows, and (6) species differentiation complicated by intra-specific phenological heterogeneity and spectrally similar species. We discuss methods and results from the 2003-2007 efforts to classify the aquatic plant communities with a focus on lessons learned and future remote sensing research goals for an improved description of the state and dynamics of aquatic vegetation.