Jasper Ridge Biological Preserve

Annual Report 2004–05

STANFORD

School of
Humanities and Sciences

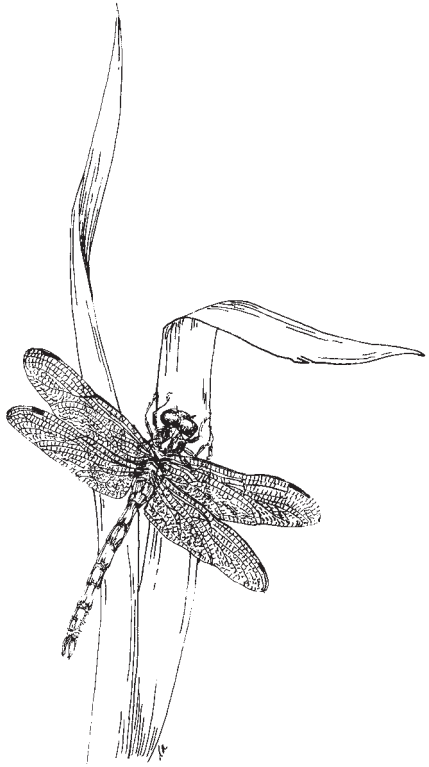
The mission of Jasper Ridge Biological Preserve

is to contribute to the understanding of the Earth's natural systems through research, education, and protection of the preserve's resources.

From the Faculty Director

Chris Field

This is the beginning of a new era for me and for Jasper Ridge. 2006 is the start of my fourth decade of association with the preserve. For 30 years, Jasper Ridge has been the place that taught me most about the natural world and about being a scientist.



Over the past decades at Jasper Ridge, I have measured the temperature and photosynthesis of thousands of leaves, sorted millions of roots, and walked every trail in the dark for pre-dawn water potentials. Jasper Ridge has given me the opportunity to explore a wide range of questions, collaborate with a wonderful community of colleagues, train a brilliant and dedicated group of students and post-docs, and thoroughly enjoy myself. Now, I am excited to have the chance to give something back to the place that has given me so much. As the first faculty director of the preserve, I am joining the JRBP community in a new way, helping assure the success of ongoing efforts and set the course for the future.

I have always been more or less connected with Jasper Ridge issues, but I gained a new appreciation for their diversity and complexity while chairing the Jasper Ridge strategic planning effort (2003–2005). A core theme of the strategic plan[1] is that the long-term success of the preserve depends on the effectiveness of its integration with the university and surrounding communities. We are undertaking a number of steps to enhance this integration. Central to this effort is the

decision by Stanford University's Sharon Long, the Vernon R. and Lysbeth Warren Anderson Dean of Humanities and Sciences, to allocate the resources for creating a faculty director position and implementing other key elements of the strategic plan. These actions substantially upgrade the profile of Jasper Ridge, moving it closer to the university's core academic and decision-making activities.

The timing could not be better. Stanford has a major new initiative focusing on the environment. The environment initiative encompasses a broad range of topics and disciplines. I hope Jasper Ridge will be a centerpiece. As a living laboratory on the edge of campus, the preserve can contribute to this venture in a variety of ways. Some of these are discussed in the strategic plan. Others need to be developed, with input from the Jasper Ridge community. The new Jasper Ridge Advisory Committee brings a wealth of experience and creativity to the challenge of integrating the preserve and the environment initiative. I expect to see a series of vibrant partnerships linking JRBP with other parts of the university. Look for results of these new partnerships in teaching, research, and restoration.

In parallel with the higher profile JRBP will have in the university, we are also upgrading interactions with surrounding communities and resource-management agencies. The new coordinating council is vital to this effort. Other new investments will address effective communication of JRBP science, improved K–12 outreach, and meaningful experiences for all the visitors who encounter the preserve.

These are exciting times for Jasper Ridge. With a superb staff and wonderfully engaged students, researchers, and community members, I am confident that we are well positioned to take advantage of the full sweep of upcoming opportunities. Jasper Ridge has always been fortunate to have enthusiastic support inside and outside the university. Over the past couple of years, the inputs of members of two advisory committees have been especially important. The preserve owes a lasting debt to all the members of the Strategic Planning Committee: Philippe Cohen, who initiated the effort, plus Irene Brown, Nona Chiariello, Will Cornwell, David Freyberg, Bill Gomez, Deborah Gordon, Lisa Moore, Kären Nagy, and Jeanne Sedgwick; and the External Review Committee: Rosina Bierbaum (chair), Steve Burgess, Jerry Franklin, Alex Glazer, and Mary Price.

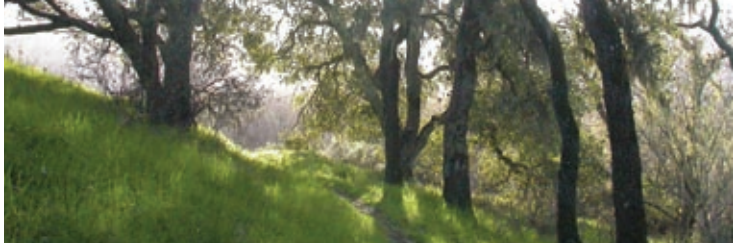
Chris Field is a professor of biological sciences at Stanford and director of the Carnegie Institution's Department of Global Ecology.

December 1997

September 1998

October 2005

One visible example of change at Jasper Ridge: the increasing sedimentation of Searsville Lake, as viewed from the causeway bridge at the south end.



From the Administrative Director

Philippe S. Cohen

My years at Jasper Ridge have been marked by two important, and at first glance, opposing characteristics: a sense of place and the certainty of change. For me, the hallmarks of this place and the sense that it engenders are particular majestic oak trees, a couple of snags, the early morning mist that rises from Searsville Lake, and the community of people with whom I interact. During the winter months, another scene emerges that captures my sense of Jasper Ridge—sunrise over the global change experiment, with its juxtaposition of dewy grasses, long light, and high-tech equipment. This scene perfectly frames the reasons I find my work so meaningful—in this place, an amazing group of scientists endeavors to understand the natural systems that extend beyond a bright horizon. While the oaks and views feel like an enduring part of Jasper Ridge, they are inexorably changing. Change both complements and challenges my "sense of place." I struggle with this tension at many levels, from the invasive species that threaten to change the character of the preserve, to the turnover in students and researchers.

Some of you have heard me comment that there is only one thing we know for sure about the future of Searsville Lake and Dam: the status quo is not an option. This is also true for the preserve as a whole. Ecological processes and human activities are continually altering the face of Jasper Ridge. So the big questions facing us are: which changes do we accommodate and adapt to, and which ones do we resist? Indeed, when I first proposed engaging in a strategic planning process, I was motivated by my own sense that Jasper Ridge would need to change how it operated in order to meet the many future challenges that I could see on the horizon.

Accordingly, the Jasper Ridge strategic plan aimed to map out a strategy to better adapt the management of the preserve to new opportunities and challenges while integrating these activities into its programmatic mission. This past year has demonstrated that the document was not just a nice sounding set of platitudes collecting dust on a shelf. Instead, the strategic plan has already led to several important events, and more are forthcoming. As you have seen in the statement preceding this one, Chris Field has become Jasper Ridge's first faculty director. Creating this position

Land Management

Philippe S. Cohen

This past year has seen two important land management–related activities. The first involves a proposed boundary change that will increase the size of the preserve. The second activity is the continued coordination with the local mosquito abatement district. In both cases, it is clear that Jasper Ridge's position at the urban/wildland interface is increasingly shaping how its land and resources are managed.

While the land management challenges of an urban/wildland context present significant challenges, they also come with opportunities. One such opportunity is the availability of Stanford land that had been occupied for several decades by Boething Treeland Nursery. The addition of these 39 adjacent acres will increase Jasper Ridge's total area to 1,228 acres (497.17 hectares). Unlike the rest of Jasper Ridge, this land has been heavily altered by years of intensive nursery operations (see the aerial photo on the following page). One measure of the degree of impact is the inventory of plants conducted by Jasper Ridge docents Toni Corelli, Ann Lambrecht, John Rawlings, and Carol Zabel: out of a documented 109 plant species on the property, 75 are non-native and 34 are native.

Although this land is heavily disturbed, its very disturbance provides some potential benefits. For one, the area provides a location for manipulative experiments that would otherwise not be allowed or would be more difficult on the preserve. Already, there are the beginnings of a new research project. In May, the Stanford Institute for the Environment awarded a grant to fund a "Feasibility Study: Re-introduction of the Bay Checkerspot Butterfly to Stanford University Lands."[3] As you may know, the Bay checkerspot butterfly (*Euphydryas editha bayensis*) has been extinct from the preserve since the late 1990s. This extinction, likely due to

regional loss of habitat and inter-annual rainfall variability, presents an opportunity to assess the feasibility of reintroducing a very well studied species. See the research highlights section for further information.

Other benefits I can envision for the new area include opportunities for restoration research and for providing an increased buffer to the more intact habitats in the core of the preserve.

We have already been engaged in several important management activities in the Boething acreage that reflect these benefits. We have worked with the equestrian community, especially the Woodside Trail Club (and Rick DeBenedetti), the Stanford Management Company (Leonie Batkin), and other adjacent landowners/lessees to relocate horse trails out of and away from San Francisquito Creek. As part of this arrangement, the preserve has relocated existing fences and installed additional fencing. These changes should significantly enhance riparian habitat and water quality, as well as reduce bank erosion.

We have also tried to reduce erosion in other areas of the property. Thanks to the efforts of Jasper Ridge staff Leonard Robinson and Cary Tronson, we have attempted to re-establish the original drainage across the land, and have abandoned the use of some existing ditches and culverts that were causing significant erosion and bank failure. We'll find out this winter how successful our efforts have been.

The other major development this past year was a negotiated Memorandum of Understanding (MOU) with the San Mateo County Mosquito Abatement District, particularly James Counts (field operation supervisor) and Chindi Peavey (vector ecologist). With the arrival of West Nile Virus, mosquito control has taken on new urgency. The MOU was developed to help clarify communication and decision-making protocols for existing and future abatement activities. Specifically, the MOU describes monitoring and surveillance strategies, treatment protocols, materials used to control mosquito populations, scheduling of treatments, and public notification.

With the MOU in place for this past mosquito season, abatement involved the use of a helicopter to

spray Searsville Lake and associated wetlands habitat every three weeks from late June through October. The agents sprayed were either a bacterial agent, *Bacillus sphaericus*, which primarily targets mosquito larvae, or methoprene, a growth inhibitor. The latter treatment is used to minimize the potential for mosquito larvae to develop resistance to larvicidal treatment. In addition, docents and staff have conducted dip-netting every two weeks to help monitor mosquito larvae.

Given that the need for mosquito abatement has become a public health issue, it is likely to be a continuing part of Jasper Ridge land management for the foreseeable future. The long-term implications of this management beyond the control of mosquitoes are as yet unclear, but the fiscal impact on preserve operations is substantial, accounting for about 5% of the preserve's annual operating budget.

Both the Boething land addition and the mosquito abatement efforts reflect the growing reality that faces Jasper Ridge: the need to maneuver nimbly and creatively as we try to manage existing natural systems within a setting increasingly affected by human activities.

Left: *The 2005 true color mosaic aerial photo shows the existing and proposed boundary change for JRBP. When looking at this photo, one of the striking features is the clearly discernible difference in land uses inside and outside of the preserve's existing boundaries. For more information about the aerial photo, see the technical notes section (page 13).*

Below left: *Leonard Robinson and Cary Tronson working to re-establish natural drainage and reduce erosion on the property that was formerly the Boething Treeland Nursery.*

Below: *The American Institute of Architects (AIA) and its Committee on the Environment (COTE) selected the Leslie Shao-Ming Sun Field Station as one of eight examples of architectural and "green" design solutions that protect and enhance the environment.[4] The Sun Field Station was Stanford's first green building, and is now viewed by the campus as an important display of leadership that makes a statement about the importance of conserving natural resources.*

was one of the key recommendations of the strategic plan—to assure that JRBP is properly integrated into the academic programming of the university. We are fortunate that Chris is so intimately familiar with the details, history, and promise of the preserve.

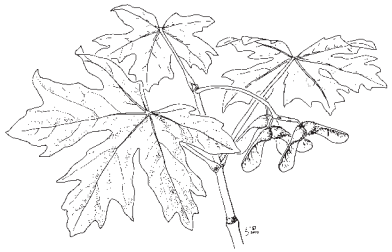
I'm delighted to note that Chris has already moved forward on implementing two other strategic plan recommendations: 1) beginning to conduct an assessment of the "state of the preserve" to establish important baselines for future assessments and research, and to act as a guidepost for future management strategies; 2) enhancing and expanding the role of the Jasper Ridge Advisory Committee by broadening its membership within the university so that the preserve is better integrated into Stanford University programs, such as the interdisciplinary Stanford Institute for the Environment.[2]

Likewise, I will be creating the Jasper Ridge Coordinating Committee (JRCC) as recommended in the plan. This group is designed to provide a forum for various stakeholders, including neighbors, agency representatives, local officials, community leaders, docents, and university officials. The JRCC will help clarify management issues facing the preserve, act as an important conduit for information on land management and community issues, and coordinate responses to land management opportunities and challenges.

The goals of the strategic plan, while ambitious, provide an essential and realistic vision for what JRBP needs to achieve in the coming years. If Jasper Ridge is to continue as a premier biological field station, it must find effective linkages between human-induced changes and natural systems. Human activities outside the preserve's boundaries can and will alter ecological and hydrologic processes in complex, cumulative, and often permanent ways. These external effects can range from increased fuel management activities that reduce fire risk for the growing number of homes on our boundary, to the possible arrival of sudden oak death. Understanding these effects and determining how to manage them while promoting research and education is a non-trivial undertaking. Decisions we make today and in the coming years are destined to become historical events whose residual effects will constrain and control many of Jasper Ridge's ecological patterns and processes.

Finding an effective balance or linkage between human and natural systems is the overarching challenge facing the preserve and all open space/natural systems around the world. In many ways, the scope and impact of human activities means we are charting unknown territory in managing the preserve.

The strategic plan provides a solid framework for navigating the known and unknown challenges that lie ahead. It will help us maintain the "sense of place" that makes Jasper Ridge unique, while adapting to the change that will inevitably come. Thanks to the strategic planning effort and the many people who contributed to it, along with the leadership that Chris Field brings as the inaugural faculty director, a remarkable staff, and a supportive community and university, I am more confident than ever that the preserve is positioned to navigate the future successfully.



Trevor Hébert and Léo Laporte join birder Gary Nielsen in a training session for the Jasper Ridge bird monitoring program.

Research Highlights

Nona Chiariello

If one theme describes the 65 scientific studies at JRBP this past year, it is their potential to contribute meaningfully to the strategic plan's goal of greater integration among research, conservation, and education. Ongoing studies reported new results on topics ranging from the diversity of life, to controls on biological invasions, to the future of grassland ecosystems. Work also began on 11 new studies, two of which involve novel collaborations outside the traditional field sciences. In their objectives and execution, the preserve's studies shared a common goal of contributing to fundamental knowledge through carefully designed experiments that have minimal impact to JRBP but broad impact scientifically. Beyond their immediate objectives, there is added significance to the year's studies as they help set the stage for a state of the preserve assessment, one of the strategic plan's key recommendations for strengthening research and building integration across JRBP's missions.

In total, this year's research involved 52 scientists and 27 students from Stanford University and 19 other institutions (appendix 1). Stanford researchers were affiliated with nine departments and programs in four schools at Stanford: humanities and sciences, earth sciences, engineering, and law. This represents a new record for the breadth of Stanford participation in research at Jasper Ridge.

Research this year was significant and scientifically productive. Five studies were supported by the National Science Foundation (NSF), and 30 research papers were published or accepted for publication in 2004 and 2005 (appendix 2). In addition, during the 2004–05 academic year, three PhD dissertations and one master's thesis brought to fruition the hard work of four Stanford graduate students. We profile these students in a new section (page 16). During their studies, three of the four students received grants from the joint A.W. Mellon Foundation/Stanford University program for student research at Jasper Ridge. This year, two new grants were awarded to Claire Lunch and Ron Yeh.

The impact of research extends beyond the academic literature. Several studies are using web sites, the news media, and educational programs to communicate with a wider audience. This year Trevor Hébert and I started to facilitate this outreach with a new online database that provides non-technical research summaries, new research findings, and maps.[5] It is also a quick way to link to web sites developed by individual researchers.

Throughout the past year, implementation of the strategic plan was a consistent underpinning of our research activity and planning. The following discussion highlights some of the year's research and its significance to major themes of the strategic plan.

Global Change

The Jasper Ridge global change experiment (JRGCE) completed its eighth year of studying grassland responses to four global environmental changes: elevated levels of CO_2, nitrogen, water, and heat. The study is funded by NSF and directed by Chris Field and five other professors: Shauna Somerville, Brendan Bohannan, Hal Mooney, Peter Vitousek, and Jim Tiedje. More than 25 collaborating faculty, students, postdocs, and technicians from seven institutions participated.

The year was marked by several significant developments. As results from diverse studies coalesced into a new hypothesis about responses in the Jasper Ridge grassland, a companion experiment was launched to test the hypothesis. Two dissertations representing major parts of the study were completed by Lisa Moore and Elsa Cleland. In addition, there were some important new findings, including the discovery of a group of microbes previously unknown in this ecosystem.

A growing focus this year was to understand why a doubling of the atmospheric CO_2 concentration (the level expected by the century's end) has not consistently stimulated plant growth in the experiment, and has actually decreased plant production in some years or in combination with some treatments. The result is surprising because the JRGCE treatments increase, directly or indirectly, one or more resources required by plants for their growth. Several lines of evidence led the team to hypothesize that as the treatments relieved some limitations to growth, the plants became limited by a factor that had been near-limiting previously, most likely phosphorus. The group

also identified ways the global change treatments could exacerbate phosphorus limitation, further lowering plant production.

Several results support the hypothesis. Elsa Cleland found chemical changes in plants and litter consistent with phosphorus deficiency, and Lisa Moore's mathematical models reproduced the multi-year growth pattern when phosphorus limitation was built into the model but overestimated plant growth when phosphorus was assumed to be sufficient. These findings parallel Hugh Henry's conclusion that higher plant growth following a wildfire in 2003 coincided with higher phosphorus availability. Although these results are very suggestive, the team decided to explicitly test the hypothesis with a new experiment. They will grow plant communities in pots with factorial resource additions and see if phosphorus addition enhances the response of plant growth to elevated levels of CO_2 and/or nitrogen. Todd Tobeck, Alison Appling, and Yuka Estrada constructed the experiment this summer.

Soil microbes influence most components of global change and are a major area of research in the JRGCE. For example, this year Joey Blankinship found that elevated CO_2, water, and temperature affect the capacity of soil bacteria to consume atmospheric methane, a potent greenhouse gas, and that treatments interact in their effects. These results show that methane-oxidizing bacteria are sensitive to global changes and confirm that soils can participate in feedbacks to global warming. Parallels between Joey's results and work on microbial diversity by Brendan Bohannan's lab suggest that changes in the activity of methane-oxidizing bacteria can be associated with changes in the community structure of these bacteria.

A major surprise in the links between microbial physiology and diversity was discovered this year. In analyzing the JRGCE soils, the labs of Brendan Bohannan and Chris Francis detected more than a dozen types of ammonia oxidase genes belonging to organisms classified within the Crenarchaeota. The Crenarchaeota are considered "extremophiles" because until recently they were known only from hot springs, deep sea hydrothermal vents, or frigid ocean waters. They constitute a kingdom within the Archaea, one of the three domains of life. Understanding the properties of the newly discovered mesophilic Crenarchaeota in the JRGCE may reveal even stronger relationships between soil processes and microbial communities.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In the last year, several broadly synthetic papers in widely distributed journals have extended the JRGCE results to larger scales and other ecosystems. These efforts reflect both the maturity of the study and its relevance to climate policy. Bruce Hungate and other JRGCE scientists challenged global predictions that the biosphere will be able to store increasing quantities of carbon. Their calculations show that at the global scale, plant growth will be progressively limited by nitrogen, and where atmospheric deposition of nitrogen relieves this limitation, it is likely that some other nutrient will become a constraint. Another important trend in the last year is that studies of other ecosystems have begun observing little or no response by plant growth to elevated CO_2, in parallel with the JRGCE. These results underscore the limited capacity of the biosphere to counter the rising CO_2 concentration and its consequences for global climate.

Biological Invasions

The arrival and spread of invasive species has been one of the most pervasive and significant changes in the biotic communities of Jasper Ridge, and will undoubtedly loom large in the state of the preserve assessment. A major theme of this year's research was the degree to which two well-studied invasives, Argentine ants (*Linepithema humile*) and yellow star-thistle (*Centaurea solstitialis*), are held in check by other organisms.

Professor Deborah Gordon's group conducted their twelfth year of studying the Argentine ant invasion. Two graduate students whose studies were highlighted in previous annual reports, Nicole Heller and Patrick Hsieh, finished their degrees this year (see page 16). Nicole's dissertation included new results on the facilitating role of coyote brush (*Baccharis pilularis*), a native shrub that invades open grassland. Her studies suggest that cover provided by coyote brush tempers micro-environmental extremes in the grassland, and that aphids feeding on the shrubs provide nutritious secretions. It appears that as coyote brush invades grassland, the ameliorated conditions may allow Argentine ants to follow.

This year, PhD student Jessica Shors took over the preserve-wide survey of Argentine ants, and also began examining butterflies and their larval food plants. Jessica is studying whether, as Argentine ants drive out other species of ants, they replace the displaced ants in coevolved mutualisms that were assumed to be very exclusive, such as tending butterfly larvae.

JRBP's other well-studied invasive, yellow star-thistle, was the subject of four research projects. Claire Lunch and professor Jeff Dukes tested whether herbivory by slugs and snails accounts for the distribution of yellow star-thistle. Their study was inspired by Jeff's earlier work, which showed that star-thistle seedlings could not be grown in the global change experiment without netting to protect the seedlings from slugs and snails. Claire and Jeff planted star-thistle seedlings in pairs of protected and unprotected plots in a dozen patches of grassland, both invaded and uninvaded. The result was baffling—a near absence of herbivory in all plots.

In yellow star-thistle's native habitats in Eurasia, larvae of some weevils and small flies consume the plant's flower structures, including the developing seeds. A half dozen of these

1. Hugh Henry ferrying solutions for a final "wet-up" study of microbial activity in soils of the JRGCE, before leaving to become a professor at the University of Western Ontario.

2. Chris Lilgeberg testing a new power-driven soil-coring device designed for the JRGCE by Todd Tobeck, who observes its performance.

3. Kris Hulvey securing cylinders of screening so seeds from her star-thistle experiment will self-sow for a second year of studies.

4. Paul H. Arnaud, Jr., curator emeritus of entomology at the California Academy of Sciences, attaching a collection funnel to a Malaise trap for insects near the marsh.

insect species have been introduced as biocontrol agents in California, but never at Jasper Ridge. Undergraduate Anna Lee and master's student Caroline Lee systematically surveyed Jasper Ridge to see whether the biocontrols are present nonetheless. They sampled each 25-hectare sector of JRBP, sweep-netting and examining flower heads. Yellow star-thistle was present in nearly all sectors, and one or more biocontrol species was present in every stand. In addition, Italian thistle (*Carduus pycnocephalus*) was commonly infected with its own biocontrol weevil, making a total of five species of non-native biocontrols. Studies next summer will examine the impact the biocontrols are having.

Two PhD students from UC Santa Cruz are also studying star-thistle at JRBP. Kris Hulvey began a study of competition between yellow star-thistle and a native tarweed. Results to date suggest that at sufficiently high tarweed *(Hemizonia congesta)* densities, star-thistle plants are disproportionately suppressed, apparently because they become poorer competitors for water. Krikor Andonian conducted greenhouse experiments in preparation for a Jasper Ridge field study that will test whether soil fungi, especially arbuscular mycorrhizal networks, facilitate or suppress star-thistle invasion.

Collectively, these studies have important conservation value. Controls on invasion may vary in importance from year to year or site to site, so we cannot assess a measure's success in short-term studies. The preserve's size and location make it as accessible to biocontrol organisms as it is to the invasives themselves. And finally, other species, including natives, may hinder or facilitate the success of invasives.


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Bay Checkerspot Studies

A new collaboration brought together Stanford professors from biology, history, soil science, and law to explore the extinction history and reintroduction possibilities of the Bay checkerspot butterfly (*Euphydryas editha bayensis*), a locally extinct subspecies that is federally listed as threatened. Decades of study by professor Paul Ehrlich's lab made the Bay checkerspot a model system in population biology and conservation. This new study extends that legacy by examining diverse but fundamental issues in restoring any extinct species or lost habitat. The project is directed by Paul Ehrlich and Carol Boggs, and is funded by the Stanford Institute for the Environment. Professors Scott Fendorf, Chris Field, Buzz Thompson, and Richard White are coinvestigators.

Work began this year on four goals. One is a regional look at historical changes in the ownership, management, and condition of the butterfly's habitat, serpentine grasslands. Jon Christensen is a PhD candidate working with Richard White on this aspect. A second goal is to analyze the regulatory framework for endangered species and how changes to regulations might aid recovery efforts for species like the Bay checkerspot. A third aim is to analyze the DNA of Bay checkerspot specimens in research collections and possible donor populations, in order to characterize the genetics of these populations as a basis for reintroductions. Finally, a fourth goal is to test several methods for creating suitable new habitat for the checkerspot. All of these goals involve JRBP in some way, but the last goal entails an experiment within the preserve.

The site for the study is the former Boething nursery, where existing conditions allow experiments that are too disruptive for other areas. With treatments ranging from scraping away topsoil to tweaking soil chemistry, the project will see whether the substrate can be altered easily and sufficiently for serpentine plants,

5. Caroline Lee and Anna Lee examining their catch after sweep-netting for biocontrol insects in a stand of yellow star-thistle.

6. Will Cornwell driving a soil corer in one of 35 plots he is comparing for habitat properties such as soil moisture.

7. Krikor Andonian and Kendra Hauser hand-pollinating grasses grown from seed collected in the JRGCE, as part of professor Erika Zavaleta's experiment testing whether evolution in some key traits occurred under the global change treatments. Seeds from these grasses will have known parentage and can be grown to determine if changes in the traits are heritable.

including food plants of the Bay checkerspot larvae, to persist. Success will be determined by whether the experimental plots are more similar to natural serpentine grassland than to non-serpentine grassland. This study is critical in determining whether and how to attempt a reintroduction of Bay checkerspots to Stanford lands in the future.

BioACT

Another first for the preserve is a collaboration between computer scientists and biologists called "BioACT." This project focuses on acquiring, curating, and transferring biodiversity data, both present and past, through new technologies. Andreas Paepcke directs the NSF-funded project.

Two studies within BioACT involved Jasper Ridge directly this year. One was Ron Yeh's dissertation research on new technologies that modernize a tool still considered indispensable to most biologists, the humble field/lab notebook. Ron developed software to work with a commercially available auto-digitizing pen. Together these tools allow researchers to return from the field and rapidly see an entire day's work on a computer, with handwritten field notes, digital photos, and other data all assembled into a single digital scrapbook.[6] Fourteen people tested Ron's prototype in a controlled study this year.

A second major thread is a camera trapping study led by professor Rodolfo Dirzo. This project represents a dual advance in that it is both the first systematic, preserve-wide survey of mammal activity at JRBP, and it includes a direct comparison of traditional film-based systems and professional-quality digital cameras. Rodolfo will use the photos to study the activity patterns of mammals and to estimate animal abundance using statistical models.

Nearly nine months of work went into finding the overall best combination of camera and sensor across twelve stations in diverse vegetation types. This effort was led by docent Bill Gomez. The diversity in both vegetation structure and animal size created a very challenging range of operating conditions and cues for any single system. Bill's optimum configuration consists of two posts 10 meters apart; each is mounted with a camera, infrared beam, and detector, all facing the opposite post. An animal crossing between the posts interrupts one or both beams, which are at different heights, and either beam triggers both cameras. The setup has performed consistently, yielding stunning photos of deer, bobcats, raccoons, owls, and jays.

If the camera traps work as hoped, the results will provide important information on questions ranging from the role of herbivores in shaping the vegetation at JRBP, to the conservation status of predators, to the behavior of species that are vectors of disease. As one example, the hourglass shape of many young oaks is conspicuous evidence of heavy browsing by deer; the camera trap study will help us estimate deer abundance and how much they move around the preserve. An important goal of the state of the preserve assessment will be to coordinate other types of monitoring with the camera traps, so we can begin to link patterns in vegetation, mammals, birds, aspects of the physical environment, etc.

Searsville Lake and Watershed

Under its current management regime, every year Searsville Lake gets noticeably closer to the end of its "useful" lifespan, as silt continues to fill the basin and willows establish on newly formed shorelines. Professor David Freyberg's research and a new NSF-funded study by PhD student Chris Heppner are aimed at

8. Tom Mudd at the bat station with Kris Cheng, Eren Bilir, and Rici Mooney, who monitored daily insect collections for relating bat activity to insect abundance.

9. Bill Graves examining a newly flowering *Dirca* plant in one of several JRBP study sites that differ in microenvironment.

understanding how the hydrologic environment is changing and what the impacts will be. This year David's group expanded their network of instruments (piezometers) that measure ground water storage and movement; they now have piezometers in a dozen different locations.

Chris Heppner's study adapts a comprehensive watershed model to simulate streamflow, runoff, and sediment transport through the 14-square-mile watershed of Searsville Lake. Chris is tailoring the model with existing data and also new measurements, such as infiltration properties of soils and retention of sediments by the lake. One can imagine his model as a mesh draped over the watershed, with the hydrologic processes in each cell interacting with those of neighboring cells. The goal of Chris's research is to examine the effects of Searsville Dam and its possible removal on upstream areas, including the wetland on the southern end of the lake.

Open water habitat is critical to many organisms. The most detailed study addressing this is Tom Mudd's work on the relationships among bat activity, insect abundance above the surface of the lake, and weather. Suspecting that the lake alters the local microenvironment, Tom added weather sensors to the bat station this summer to supplement those on the weather station 150 meters away. Since 2001, the bat station has logged over eight million bat calls.

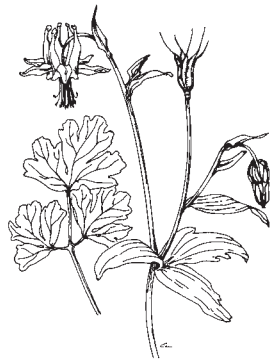
Dirca occidentalis

One of the botanical treasures of Jasper Ridge is its large population of western leatherwood (*Dirca occidentalis*), a Bay Area endemic whose yellow flowers brighten the start of winter. *Dirca* is one of the best-mapped plant species at Jasper Ridge, thanks to work by John Kriewall and other docents. This year professor Bill Graves visited from Iowa State University for six months to explore *Dirca's* regional distribution, reproduction, and similarity to *Dirca palustris* of eastern North America. Bill found significant genetic differentiation among geographically separated populations of *Dirca* within the Bay Area but relatively little variation within populations, and he confirmed the capacity of *Dirca* to reproduce asexually as well as by seeds.

Dirca presents a rare opportunity to study a species that is strongly restricted in distribution yet abundant enough at Jasper Ridge that it can be investigated in detail without putting it at risk. Bill will return this year to pursue his hypothesis that low winter temperatures in certain sites limit seed production.

As recognized in the strategic plan, research at Jasper Ridge is strong, diverse, and significant. It consists of investigator-initiated studies asking fundamental questions about the environment. Such studies have the potential to explain patterns at Jasper Ridge and, at the same time, provide model systems for understanding other environments. Our online database is a good starting point for more information on the studies described here, as well as others.

The future impact of Jasper Ridge research will be shaped by the strategic plan and by the questions posed by researchers. The studies discussed here suggest some subtle but important trends. One is an increased focus on finding solutions to problems, whether through re-establishing Bay checkerspot habitat, managing the lake, or maintaining sensitive species. The second is the importance of new collaborations and tools that broaden our perspectives and abilities. Both trends will contribute to and strengthen the state of the preserve assessment, our conservation efforts, and the way we communicate the value of research.



Technical Notes Trevor Hébert

Information technology is playing an increasingly important role in research activities and day-to-day operations at Jasper Ridge Biological Preserve, from the mapping of research sites with hand-held global positioning system (GPS) units to providing online access to research databases. During the 2004–05 academic year I continued to make improvements and additions to the preserve's data resources and capabilities, both expanding the availability of information to the JRBP community and reducing costs by increasing the efficiency of data management and dissemination systems. We have also continued to use geographic information systems (GIS) effectively in support of management and research activities at the preserve.

One of this year's highlights is the addition of a new set of aerial photographs covering the entire preserve and adjacent lands. The photos were taken in mid-May at a 1:4800 scale, then scanned at high resolution and orthorectified. Orthorectification is the process of accurately registering the images to a real-world projection system, which I did in-house using sophisticated software for remote sensing (RSI ENVI) and mapping (ESRI ArcGIS). The final result is a projected, map-accurate photographic mosaic of the entire preserve and surrounding lands (see page 4). This mosaic can now be used as the basis for new maps or for detecting changes in land use or physical features over time by comparing it with aerial photos from previous years. Funds permitting, we try to take photos every year, alternating between spring and late autumn.

Another noteworthy development in the area of GIS was the establishment of a more formal training program for the preserve's Trimble GPS equipment. GPS allows a researcher to record the coordinates of a physical feature or sample site with relatively high precision so that it can be displayed accurately on a map. To better train students, staff, and researchers, I attended Trimble's intensive GPS trainer course and passed their skills test to become a certified GPS instructor. Certified instructors have access to a wealth of free training materials and technical support from Trimble's certified trainers web site. GPS training courses will be held at least once per quarter at Jasper Ridge, with students learning through both hands-on computer experience and field work with the GPS units. Both classes held this spring were well attended, mostly by Stanford graduate students.

One of the most visible accomplishments of academic year 2004–05 was the redesign of the JRBP web site.[7] Former publications coordinator Justin Holl and I worked with staff to create new content and graphic design for the site, and I did the HTML coding and server side scripting to rebuild the site on Stanford's departmental web servers. Launched in time for the new school year in September 2004, the site features a more consistent, user-friendly navigation structure, improved security, effective use of photos, and stronger identification with Stanford University. This initial redesign forms a strong foundation from which many more improvements and upgrades can be made in the future, including more sophisticated database applications. Some prototype online databases are already up and running, including the JRBP herbarium plant list and research projects databases. Both offer keyword searches and have links to color photographs of individual plants and research project sites and systems.

Above: *Detail of JRBP 2005 aerial photos showing the area around the Sun Field Station and a portion of Searsville Lake.* ***Below:*** *David Fedor using one of the preserve's three GPS units to record the location of a soil pit for the field studies class.*

Looking forward, my goal is to continue to enhance and maintain state-of-the-art information systems infrastructure at Jasper Ridge, supporting a variety of researcher, staff, and student needs. While it is challenging to keep up with all the latest information systems and equipment, it is also very rewarding when technological solutions succeed in increasing efficiency, productivity, and ease-of-use while at the same time lowering costs. Effectively collecting, archiving, and disseminating information is critical to fulfilling the JRBP strategic plan's mandate to "build a knowledge base for long-term research and management."

Education and Docent Program Highlights

Cynthia J. Wilber

During academic year 2004–05, the Sun Field Station was the starting point for classes, lectures, workshops, community outreach, and both formal and informal educational opportunities, all taking advantage of the preserve's inspiring 1,200-acre classroom. Stanford classes included the Jasper Ridge Docent Training class; Field Studies in Earth Systems; Core Experimental Laboratory for Ecology; Science of Soils; Introduction to Earth Systems; Sophomore College; Quest Scholars Program; Ecosystems of California; Floods and Droughts, Dams and Aqueducts; General Botany; and many others.

Jasper Ridge affiliates participated in a broad range of educational opportunities that included field trips to the UC Berkeley Sagehen Creek Field Station, the Fitzgerald Marine Reserve, and Coyote Ridge/Kirby Canyon. Affiliates also taught, both in the field and in the classroom, greatly enriching the education program at the preserve. Léo Laporte, a docent and professor emeritus of earth systems at UC Santa Cruz, lent his teaching expertise to Biology 96 and Earth Systems 189 classes and led multiple geology field reviews within the preserve. Working together with docent Bill Gomez, Léo also helped produce an explanatory guide to the Jasper Ridge global change experiment (JRGCE). Professional illustrator and docent Judy Mason taught a course in botanical drawing, with emphasis on both classroom and field drawing skills. Also contributing to an exciting and productive educational year at the preserve were teacher workshops, visits by international conservation groups, and numerous science outreach programs. For a complete list of instructional use of the preserve, see appendix 3.

JRBP's monthly brown bag lunch lecture series hosted speakers that included Jasper Ridge researchers, Stanford faculty members, and Bay Area ecologists. In addition to this series, Bill Graves of Iowa State University spoke on his *Dirca occidentalis* research at the preserve and throughout the Bay Area. A list of all speakers may be found on page 27.

Collaboration has been the key element in the expansion of the education program in recent years and has made possible unique and new opportunities for teaching and learning. In the past year, partnerships within the university, both with the Stanford Teacher Education Program (STEP) and the Office of Science Outreach, produced two Jasper Ridge based teacher education workshops. In November of 2004, STEP faculty, teachers, and students, as well as Stanford graduate students in the Department of Biological Sciences, came together at Jasper Ridge for a one-day workshop and training in the utilization of Vernier technology in the high-school science classroom. In August of 2005, Bay Area teachers participating in the Industry Initiative for Science and Math Education (IISME) summer program at Stanford spent a day at the preserve. This program included an archaeological field methods workshop with campus archaeologist Laura Jones, soil temperature data collection and analysis, and a classroom-based activity exploring the mysteries of plant reproductive strategies with docent Bill Korbholz.

Last year the trend of community partnerships continued. Jasper Ridge brought together high-school students and faculty from Eastside College Prep and Woodside Priory School to collect, analyze, and compare water quality data from the San Francisquito Creek watershed. continued on page 18 >

Profiles

academic milestones and accomplishments

Lisa Moore

A big unknown concerning the global climate is whether Earth's ecosystems will take up and store increasing quantities of the greenhouse gas carbon dioxide (CO_2), a possibility that could slow the rate of atmospheric warming. This is the topic Lisa Moore pursued for her PhD, working with Chris Field and other members of the global change experiment. She found that in an elevated CO_2 background, the ecosystem appeared to lose carbon when rainfall increased, store carbon when nitrogen was added, and maintain a tenuous equilibrium when temperatures were increased. Lisa's results demonstrate an important tenet of the JRGCE—that a realistic understanding of climate change must account for multiple global changes that are occurring. As down-to-earth as the roots she studied, Lisa also contributed beyond the JRGCE, serving as a member of the strategic planning committee and the Stanford Center for Teaching and Learning. She is now in New York City on a one-year fellowship with Environmental Defense, writing about climate change science and policy.

2005 Docent Class

The Jasper Ridge Biological Preserve docent class of 2005 in the field studying grasses with John Rawlings. The class of 2005 includes new docents Kali Albright, Nidia Bañuelos, Leonie Batkin, Laura Bloomfield, Ross Bright, Eva Dehlinger, Terry Donovan, Lynne Emery, Erin Gaines, Jolie Glaser, Jeremy Hartje, Bill Korbholz, Jacqui Martin, Laura Nugent, Tess Pierce, and Ron Yeh.

Elsa Cleland

Elsa Cleland sought to solve a number of problems during her PhD, studying multiple plant responses to the treatments of the global change experiment in order to understand how the vegetation and ecosystem would be altered. For the elevated CO_2 treatment, Elsa found that grasses were less likely to be eaten by slugs, had delayed flowering, and decomposed more slowly, and these responses helped explain changes in biodiversity and nutrient cycling. While working on her PhD, Elsa also contributed to a study that found that across nine North American ecosystems, added nitrogen disproportionately eliminated rare plant species over common ones. She is now a postdoctoral fellow at the National Center for Ecological Analysis and Synthesis focusing on the use of plant traits to predict species responses to environmental change, as well as their use in restoration.

Geranium dissectum, *one of Elsa's study species, flowers earlier in warmed plots.*

Prenolepis imparis *ants on flowers of vetch.*

Patrick Hsieh

Hundreds of Stanford students visit and get a taste of JRBP each year, but Patrick Hsieh feasted on almost every opportunity the preserve offers. He participated in Deborah Gordon's study of the Argentine ant invasion, became a docent, took the field studies course, served as a teaching assistant for the docent class, and completed a co-terminal master's thesis. Insects, and especially ants, were a unifying theme in all of this. Patrick's thesis is a pioneering survey of the ants of Jasper Ridge and Stanford campus to see if they harbor a specific type of microorganism, *Wolbachia,* which is capable of tinkering with its host's reproduction. In some arthropods, infection with *Wolbachia* leads to all-female offspring or feminized males, but almost nothing is known of its effects in ants. Patrick mastered the molecular techniques necessary to screen ants for *Wolbachia*, and discovered it was present in the ant *Formica moki*, both at Jasper Ridge and on campus.

Nicole Heller

Even before she came to Stanford, Nicole Heller began pondering the global spread of Argentine ants as she studied their impact on the Santa Cruz Islands. This year she finished her PhD working with Deborah Gordon. Her dissertation challenges prevailing but overly simplistic ideas about the reasons for the Argentine ants' success. Researchers have long argued that Argentine ants in California are successful because they have lost a tendency toward infighting, which in their native habitat limits their dominance over other species. But Nicole traveled to Argentina and found they were just as likely to be cooperative there as they are in California. Her work also shows that Argentine ant "supercolonies" thought to span thousands of kilometers actually consist of colonies, which are related groups of nests on the scale of hundreds of meters. Nicole is now living in Russia with her family and volunteering in a study of the biodiversity of forests surrounding St. Petersburg.

Brendan Bohannan

Microbial ecologist Brendan Bohannan was promoted this year to associate professor with tenure in the Department of Biological Sciences at Stanford. Brendan and his lab group have conducted ground-breaking studies that use microbial communities, both in natural environments and in experimental settings, to understand fundamental principles in biodiversity. They were the first to show that bacteria conform to a well-known pattern in plants and animals—an increase in the number of species encountered as a sampling area gets larger, known as the "species-area relationship." Brendan's work with others has also shown that some experimental conditions, and perhaps most microbial environments, are like a rock-paper-scissors game in which different types of bacteria coexist because each is superior to some competitors but inferior to others. Work by Brendan's lab within the global change experiment has shown important changes in microbial communities in response to the global change treatments.


1


2


3

The watershed drains through or near the two campuses, and is a natural, physical link connecting the schools as well as Santa Clara and San Mateo Counties. Water quality data included pH, conductivity (total dissolved salts), turbidity, dissolved oxygen, and temperature. Students compared and analyzed data from sites located in Portola Valley (upper watershed), Jasper Ridge Biological Preserve, and East Palo Alto (lower watershed). The water quality monitoring project provided a science-based, real world context for the two student groups to work together on a project of mutual concern.

The JRGCE also continued its outreach education partnership with Woodside High School this past year. The program, which began in 2002, brings together climate change researchers and high-school ecology students, and was profiled at the annual meeting of the American Geophysical Union by docent Bill Gomez. Bill presented a poster on high-school and undergraduate participation in the JRGCE in a session titled "Communicating climate change science: conundrum or creative challenge?" The session included presentations and posters on the challenges, opportunities, success stories and case study insights on teaching climate change to students and other non-technical audiences.

Five high-school students also worked with JRBP researchers in 2005. During the summer, Astasia Myers volunteered almost full-time on a project with the JRGCE, and Eren Bilir, Kris Cheng, and Rici Mooney worked with docent and bat researcher Tom Mudd. Matt Prior continued his work with Ted Mill of SRI in a study of Searsville Lake.

Eastside Field Studies at Jasper Ridge, now in its seventh year, stands out as a source of meaningful ecology education experiences both for the Eastside School students and for their Stanford student teachers. In spring quarter, 21 Eastside sixth graders collected and analyzed data in multiple ecosystems and presented their results to classmates and staff in June of 2005. Jasper Ridge docents Kali Albright, Mollie Chapman, Laura McClendon, Jacqui Marten, Laura Nugent, and Tim Varga led the ecosystem groups, developed curriculum, and taught class sections.

As in previous years, Jasper Ridge affiliates were responsible for maintaining the Oakmead Herbarium, conducting bird and plant censuses, leading tours and classes, removing exotic species, assisting with research, and a myriad of other services. In the 2004–05 academic year more than 5,300 people visited the preserve and left with a broader understanding of our mission thanks to the generous efforts of the Jasper Ridge docent community.

1. Campus biologist Alan Launer discussing the San Francisquito watershed with participants of the Center for Venture Philanthropy's Venture Van tour.

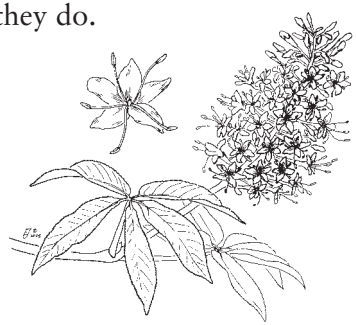
2. Professor Pam Matson and senior Christa Horn sampling from chambers to measure trace gas production by soils during the Earth Systems 189 class.

3. Professor Rodolfo Dirzo working with Biology 96 students Tess Pierce, Nidia Bañuelos, and Jolie Glaser to determine the plant species composition of a plot that excludes both large and small mammals.

4. Stanford undergraduate and JR docent Kali Albright assisting an Eastside School sixth grader with data collection in the marsh.

5. Jeff Brown, the resident manager at the UC Berkeley Sagehen Creek Field Station, talks to Jasper Ridge docents during the annual field trip to a biological field station.

The wisdom of seeking and utilizing sustainable, renewable resources is perhaps best demonstrated within the Jasper Ridge community itself—an invaluable source of energy, talent, and camaraderie. The preserve's multifaceted community of researchers, educators, docents, rangers, and students work together to produce an energy supply that builds upon itself. It is this rich energy resource that powers education at the preserve, supporting programs, fostering innovation, and stimulating inquiry. Education at the preserve is quite literally built on the talents and generosity of the JRBP community and we are thankful for all that they do.



Left: The Stanford Institute for the Environment hosted the Fourth Annual Sustainability Days Conference. The first day's activities included dinner and a tour of research at JRBP, including an after-dinner talk and panel featuring Andrew Revkin, an environmental reporter for *The New York Times*. The title of the panel discussion was "Academics reaching the public: what is responsible popularization and advocacy?"

Appendix 1: Research Projects

Project	Principal Investigator(s)	Department or Division	Institution
Comparative ecology and life history of chaparral shrub species	Ackerly, David	Fac, Integrative Biology	UC Berkeley
Functional diversity of California woody plant communities	Cornwell, Will	GS, Biological Sciences	Stanford University
Relationship of post-fire ecological strategy and plant flammability	Cowan, Peter	GS, Integrative Biology	UC Berkeley
Transition from the understory to the canopy by *Prunus ilicifolia*	Tirado, Reyes	PD, Integrative Biology	UC Berkeley
Mycorrhizal networks and invasion by yellow star-thistle	Andonian, Krikor	GS, Ecol. and Evol. Biol.	UC Santa Cruz
Biosystematics of Hilara, Medetera, and Tachinidae	Arnaud, Paul	SS, Entomology	Cal. Academy of Sciences
Carbon burial and preservation in Searsville and other lake environments	Berhe, Asmeret Asefaw	GS, Env. Sci., Policy & Mgmt.	UC Berkeley
Broadband seismic monitoring	Beroza, Greg	Fac, Geophysics	Stanford University
	Karavas, Bill	SS, Berkeley Digital Seismic Net.	UC Berkeley
Population biology of the butterfly *Euphydryas chalcedona*	Brown, Irene	Ind, JRBP	
Evolution of edaphic races in *Lasthenia californica*	Choe, Gina	GS, Botany	Univ. of British Columbia
Mammalian herbivores as mediators of community structure and soil fertility	Cushman, Hall	Fac, Biology	Sonoma State Univ.
Experimental test of gastropod control of star-thistle distribution	Dukes, Jeff	Fac, Biology	Univ. of Massachusetts, Boston
	Lunch, Claire	GS, Biol. Sci. & Global Ecol.	Stanford Univ. & Carnegie Inst.
Long-term studies of *Euphydryas editha bayensis* and feasibility of reintroduction	Ehrlich, Paul	Fac, Biol. Sci.	Stanford University
	Boggs, Carol	Fac, Ctr. Cons. Biology	Stanford University
	Fendorf, Scott	Fac, Geol. & Environmental Sci.	Stanford University
	Field, Christopher	Fac, Global Ecology	Carnegie Institution
	Thompson, Barton	Fac, Law School	Stanford University
	White, Richard; Christensen, Jon	Fac; GS, History	Stanford University

Key to abbreviations used:

Fac = faculty
SS = senior scientist or senior scholar
RA = research associate
Ind = independent researcher
PD = postdoc
GS = graduate student
UG = undergrad
Doc = docent

Front and back views of a bobcat, captured simultaneously by two cameras in the testing phase of the camera trapping project.

Project	Principal Investigator(s)	Department or Division	Institution
Long-term monitoring of ecosystem processes by eddy flux	Field, Christopher; Berry, Joe	Fac; Fac, Global Ecology	Carnegie Institution
Simulation of ecosystem responses to global change	Wang, Ying Ping	Fac, Atmospheric Research	CSIRO (Australia)
Jasper Ridge global change experiment	Field, Christopher	Fac, Global Ecology	Carnegie Institution
	Bohannan, Brendan; Mooney, Harold; Vitousek, Peter	Fac, Biological Sciences	Stanford University
	Somerville, Shauna	Fac, Plant Biology	Carnegie Institution
	Tiedje, James	Fac, Ctr. for Microbial Ecology	Michigan State Univ.
Response of soil bacterial communities to global change	Avrahami, Sharon	PD, Biological Sciences	Stanford University
Impacts of global change on soil microbial community	Balser, Teri; Mentzer, Jessica	Fac; GS, Soil Science	Univ. of Wisconsin, Madison
Effects of global change on methane oxidation	Blankinship, Joey	GS, Biological Sciences	Northern Arizona Univ.
Biochemical indices of leaf and canopy responses to global changes	Boelman, Natalie	PD, Global Ecology	Carnegie Institution
Spectral measurement of aboveground vegetation dynamics	Chiariello, Nona	RA, Biological Sciences	Stanford University
Population and species effects on biogeochemistry	Cleland, Elsa	GS, Biol. Sci. & Global Ecol.	Stanford Univ. & Carnegie Inst.
Trace gas fluxes under simulated global changes	Dijkstra, Paul	RA, Biological Sciences	Northern Arizona Univ.
Microbial diversity and breakdown of polyaromatic compounds in soil	Gantner, Stephan	PD, Center for Microbial Ecol.	Michigan State Univ.
Changes in nitrogen cycling in response to global change treatments	Gurwick, Noel	GS, Biol. Sci. & Global Ecol.	Stanford Univ. & Carnegie Inst.
Plant organic compounds and microbial functional diversity	Henry, Hugh	PD, Biol. Sci. & Global Ecol.	Stanford Univ. & Carnegie Inst.
Effects of global change on soil nitrogen cycling	Hungate, Bruce	Fac, Biological Sciences	Northern Arizona Univ.
Responses of soil carbon to global change	Juarez, John	GS, Earth Sys. & Global Ecol.	Stanford Univ. & Carnegie Inst.
Nitrification and denitrification under altered climate	Leadley, Paul; Niboyet, Audrey	Fac; GS, Ecol., Systém, & Evol.	University of Paris at Orsay
Whole-system gas exchange of the JRGCE	Lunch, Claire	GS, Biol. Sci. & Global Ecol.	Stanford Univ. & Carnegie Inst.
Belowground effects of multiple global changes	Moore, Lisa	GS, Biol. Sci. & Global Ecol.	Stanford Univ. & Carnegie Inst.
Chemical profile of soil organic matter responses to global change	Raab, Ted	SS, Biological Sciences	Stanford University
	Gurwick, Noel	PD, Global Ecology	Carnegie Institution
Changes in gene expression in *Geranium dissectum* and *Avena barbata*	Thayer, Sue; St. Clair, Sam	RA; PD, Plant Biology	Carnegie Institution
Rapid evolution in response to global climate and atmospheric change	Zavaleta, Erika	Fac, Environ. Studies	UC Santa Cruz
Surface- and ground-water interactions in the Searsville Reservoir sediments	Freyberg, David	Fac, Civil & Envir. Engineering	Stanford University
Numerical modeling of subsurface water flow in Searsville sediments	Chui, May	UG, Civil & Envir. Engineering	Stanford University
Ground water flow in lake sediments and lake–ground-water exchange	Kim, Donghyun	GS, Civil & Envir. Engineering	Stanford University
Climate data synthesis for hydrologic modeling	Li, Michael	UG, Civil & Envir. Engineering	Stanford University
Argentine ant *(Linepithema humile)* invasion and the response of native ants	Gordon, Deborah	Fac, Biological Sciences	Stanford University
Population dynamics of the Argentine ant in JRBP	Heller, Nicole	GS, Biological Sciences	Stanford University
Survey of ants for bacterium *Wolbachia* and effects on reproduction	Hsieh, Patrick	GS, Biological Sciences	Stanford University
Interactions among butterflies, their larval foodplants, and Argentine ants	Shors, Jessica	GS, Biological Sciences	Stanford University
Determinants of the distribution and reproductive success of *Dirca occidentalis*	Graves, William	Fac, Horticulture	Iowa State Univ.

Project	Principal Investigator(s)	Department or Division	Institution
Monitoring of water flow and quality	Hecht, Barry; Owens, Jonathan; White, Chris		Balance Hydrologics, Inc.
Simulation of the upstream effects of dams and dam removal on hydrologic response and sediment transport	Heppner, Christopher	GS, Geol. & Environmental Sci.	Stanford University
Fate of perfluorochemicals in lake sediments	Higgins, Christopher	GS, Civil & Envir. Engineering	Stanford University
Effects of rainfall variability and gopher removal on serpentine grassland	Hobbs, Richard	Fac, Wildlife & Ecol.	CSIRO (Australia)
Native species as a control on grassland invasion by yellow star-thistle	Hulvey, Kris	GS, Ecol. and Evol. Biology	UC Santa Cruz
GPS mapping for the San Francisquito archaeological research project GIS	Jones, Laura	SS	Carnegie Foundation for the Advancement of Teaching
Earthquake prediction from precursory electromagnetic anomalies	Klemperer, Simon McPhee, Darcy; Glen, Jonathan Bijor, Sheila	Fac, Geophysics RA; RA, Geophysical Unit, Menlo Park UG, Electrical Engineering	Stanford University U.S. Geological Survey Stanford University
Regional surveys of annual acorn production and phenology	Koenig, Walter Carmen, William	Fac, Hastings Natural Hist. Res.	UC Berkeley Ctr. for Environ. Citizenship
Survey of San Francisquito Creek and removal of exotics	Launer, Alan	RA, Ctr. for Conservation Biol.	Stanford University
Biocontrol insects of thistles and their distribution at JRBP	Lee, Caroline; Lee, Anna	GS; UG, Biological Sciences	Stanford University
Intercomparison of Ameriflux eddy covariance studies	Loescher, Henry	RA, Forest Science	Oregon State Univ.
Germination traits of CA native forbs in invaded grasslands	Mayfield, Margie	PD, Ecol., Evol. & Biol.	UC Santa Barbara
Photochemical changes in natural organics in Searsville Lake water	Mill, Theodore	SS, Chemistry	SRI International
World herbivory project	Moles, Angela Cornwell, Will	PD, Biological Sciences GS, Biological Sciences	Macquarie Univ. (Australia) Stanford University
Long-term acoustical monitoring of bat activity	Mudd, Thomas	Ind, JRBP	
Computing support for acquisition, collaborative curation, and dissemination in biodiversity research (BioACT)	Paepcke, Andreas	SS, Computer Sciences	Stanford University
Camera-trap monitoring of mammals	Dirzo, Rodolfo Gomez, William	Fac, Biological Sciences Doc, JRBP	Stanford University
Larval host plant preference and development rates in the ringlet butterfly *(Coenonympha tullia)*	Peters, Halton Stamberger, Jeanne	PD, Biol. Sci. & Global Ecol. GS, Biological Sciences	Stanford Univ. & Carnegie Inst. Stanford University
Energy performance of the Leslie Shao-ming Sun Field Station	Scofield, John	Fac, Physics & Astronomy	Oberlin College
Passive cumulative monitoring of nitrogenous atmospheric pollutants & ozone	Weiss, Stuart	Ind	Creekside Center for Earth Observations

Appendix 2: Publications

Ackerly, D.D. (2004) Adaptation, niche conservatism, and convergence: comparative studies of leaf evolution in the California chaparral. American Naturalist 163: 654–671.

Ackerly, D.D. (2004) Functional traits of chaparral shrubs in relation to seasonal water deficit and disturbance. Ecological Monographs 74: 25–44.

Cleland, Elsa Eleanor (2005) The influence of multiple interacting global changes on the structure and function of a California annual grassland ecosystem. PhD Dissertation, Department of Biological Sciences, Stanford University.

Cleland, E.E., Peters, H.A., Mooney, H.A., and Field, C.B. Gastropod herbivory in response to elevated CO_2 and N deposition: impacts on plant community composition. Ecology (in press).

Coleman, R.G. (2004) Geologic nature of the Jasper Ridge Biological Preserve, San Francisco Peninsula, California. International Geology Review 46: 629–637.

Dukes, J.S., and Mooney, H.A. (2004) Disruption of ecosystem processes in western North America by invasive species. Revista Chilena de Historia Natural 77: 411–437.

Dukes, J.S., Chiariello, N.R., Cleland, E.E., Moore, L.A., Shaw, M.R., Thayer, S., Tobeck, T., Mooney, H.A., and Field, C.B. (2005) Responses of grassland production to single and multiple global environmental changes. PLoS Biology 3(10): e319.

Ehrlich, P.R., and Hanksi, I., eds. (2004) On the Wings of Checkerspots: A Model System for Population Biology. Oxford University Press.

Enge, P., Akos, D., Do, J., Simoneau, J.B., Pearson, L.W., Seetharam, V., and Oria, A. J. (2004) Measurements of Man-Made Spectrum Noise Floor. Report to NASA Center for AeroSpace Information (CASI): NASA/CR-2004-213551, 20041101; November 2004.

Evelyn, M., Stiles, D., and Young, R. (2004) Conservation of bats in suburban landscapes: roost selection by *Myotis yumanensis* in a residential area in California. Biological Conservation 115: 463–473.

Graves, W.R. Distribution and reproduction of *Dirca occidentalis* (Western Leatherwood). The Four Seasons (in press).

Heller, Nicole E. (2005) Colony structure, climate and spread in invasive Argentine ants. PhD Dissertation, Department of Biological Sciences, Stanford University.

Heller, N.E. (2004) Colony structure in introduced and native populations of the invasive Argentine ant, *Linepithema humile*. Insectes Sociaux 51: 378–386.



Heller, N.E., Sanders, N.J., and Gordon, D.M. Linking temporal and spatial scales in the study of an Argentine ant invasion. Biological Invasions (in press).

Henry, H.A.L., Chiariello, N.R., Vitousek, P.M., Mooney, H.A., and Field, C.B. Interactive effects of fire, elevated CO_2, and N deposition on a California annual grassland. Ecosystems (in press).

Henry, H.A.L., Cleland, E.E., Field, C.B., and Vitousek, P.M. (2005) Interactive effects of elevated CO_2, N deposition and climate change on plant litter quality in a California annual grassland. Oecologia 142: 465–473.

Henry, H.A.L., Juarez, J.D., Field, C.B., and Vitousek, P.M. (2005) Interactive effects of elevated CO_2, N deposition and climate change on extracellular enzyme activity and soil density fractionation in a California annual grassland. Global Change Biology 11: 1–8.

Horz, H.-P., Barbrook, A., Field, C., and Bohannan, B.J.M. (2004) Ammonia-oxidizing bacteria respond to multifactorial global change. Proceedings of the National Academy of Sciences (USA) 101: 15136–15141.

Horz, H.-P., Rich, V., Avrahami, S., and Bohannan, B.J.M. (2005) Methane-oxidizing bacteria in a Californian upland grassland: diversity and response to simulated global change. Applied and Environmental Microbiology 71: 2642–2652.

Huxman, T.E., Smith, M.D., Fay, P.A., Knapp, A.K., Shaw, M.R., Loik, M.E., Smith, S.D., Tissue, D.T., Zak, J.C., Weltzin, J.F., Pockman, W.T., Sala, O.E., Haddad, B.M., Harte, J., Koch, G.W., Schwinning, S., Small, E.E., and Williams, D.G. (2004) Convergence across biomes to a common rain-use efficiency. Nature 429: 651–654.

Hsieh, Patrick (2005) The presence and possible effects of the bacterial endosymbiont *Wolbachia* on a common ant of northern California: *Formica moki*. Master's Thesis, Earth Systems Program, Stanford University.

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Luo, Y.Q., Su, B., Currie, W.S., Dukes, J.S., Finzi, A., Hartwig, U., Hungate, B., McMurtrie, R.E., Oren, R., Parton, W.J., Pataki, D.E., Shaw, M.R., Zak, D.R., and Field, C.B. (2004) Progressive nitrogen limitation of ecosystem responses to rising atmospheric carbon dioxide. BioScience 54: 731–739.

Moore, Lisa A. (2005) Effects of global change on a California annual grassland: empirical and modeling approaches. PhD Dissertation, Department of Biological Sciences, Stanford University.

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Appendix 3: Docent Tours & Educational Use

Stanford University Classes (1217*)

ANSI 003	Introduction to Prehistoric Archaeology (Rick)
ANSI 141	Hunters and Gatherers in Archaeological Perspective (Truncer)
Bio 12	Wildflower Families of the Bay Area (Corelli)
Bio 44Y	Core Experimental Laboratory for Ecology (Malladi, Yelton)
Bio 47	Native Shrubs, Trees, and Vines of the Santa Cruz Mountains (Corelli)
Bio 96A/B	Jasper Ridge Docent Training (Wilber)
Bio 101	Ecology (Vitousek, Bohannan)
Bio 117	Biology of Global Change (Mooney, Vitousek)
Bio 120	General Botany (Preston)
Bio 125	Ecosystems of California (Mooney)
Bio 127	Ecology of Microorganisms (Bohannan)
CEE 266B	Floods and Droughts, Dams and Aqueducts (Freyberg)
CEE 299	Independent Study in Civil Engineering (Freyberg)
Esys 10	Introduction to Earth Systems (Ernst)
Esys 189	Field Studies in Earth Systems (Chiariello et al)
GES 175	Science of Soils (Fendorf)
GP 25	Planetary Habitability (Sleep)
ME 222	Beyond Green Theory (Chapin, McPherson)
SophColl 10SC	Green Buildings (Masters)
SophColl 11SC	Biology of Invasions (Gordon)

Non–Stanford University Classes (446*)

California College of the Arts: Green Building Design (Lehrer)
California College of the Arts: Ecology of Research (Franceschini)
California Polytechnic State University, San Luis Obispo:
Art, Architecture and Ecology in the California Landscape (McDonald)
Cañada College: Native Plants and Wildflowers (Steiner)
De Anza College: Natural History of the Bay Area (West-Bourke)
JRBP: Botanical Drawing (Mason)

Stanford Organizations (1016*)

Alpha Omicron Pi
Bechtel International Center
Branner Hall
Catholic Community at Stanford
Center for Advanced Study in the
Behavioral Sciences
Center for Integrated Facility Engineering
Chinese Mayors
Controller's Office
Department of Biological Sciences
Edward L. Ginzton Laboratory
Engineers for a Sustainable World
Escondido Village
Forum for American/Chinese Exchange at Stanford
Graduate School of Business
Hawaiian, Maori and Alaska Native
Conservation Group
Hopkins Marine Station: Miller Library of
Marine Biology
International Sustainability Conference
Master of Liberal Arts Alumni
Medical School Alumni Association
Office of Development
Office of Undergraduate Admission
Potter College
Quest Scholars Program
Rains Graduate Residence
Robinson House
Roble Hall
School of Education
School of Humanities & Sciences: Administrators
School of Humanities & Sciences: Dean's Office
Sigma Chi Fraternity Alumni

Stanford Alumni Association
Stanford Club of Palo Alto
Stanford Facilities and Operations, Zone Management Administration
Stanford Institute for the Environment
Stanford in Germany Reunion Group
Stanford Queer Engineers & Scientists
Stanford Singles
Stanford Teacher Education Program
Students for a Sustainable Stanford
Twain Dorm

Other Organizations (2680*)

American Geophysical Union
Buchanan Partners
California Garden Historical Society
California Lichen Society
California Native Plant Society
Canopy
Castilleja School
Center for Science & Engineering Education, Lawrence Berkeley National Laboratory
Center for Venture Philanthropy
Christ Church Episcopal, Portola Valley and Woodside
City of Palo Alto
City of San Francisco Department of Environment
Committee for Green Foothills
Conservation Strategy Fund
David and Lucile Packard Foundation Conservation and Science Program
East Palo Alto High School
Eastside College Prep
Environmental Volunteers
Foundation for a Global Community
Grand Canyon Gals
HP Labs
Hidden Villa
Hillsborough Garden Club
Holy Trinity Episcopal Church
Insight Meditation Center of the Mid-Peninsula
Joint Powers Authority
Jewish Community Center Super Active Seniors
Los Altos Sunset Rotary Club
Mountain School
Oakland Museum of California: Natural Science Docents
Ohlone School Parent Teacher Association
Peninsula School
Phi Beta Kappa
Portola Valley Town Council
Rocky Mountain Biological Laboratory
San Francisco Watershed Council
San Mateo County Environmental Health Division
San Mateo County Fire Safe Committee
Santa Clara Valley Audubon Society
Santa Cruz Mountains Trails Association
Stanford Catholic Community
The Balance Center
The Sequoias Retirement Community
The William and Flora Hewlett Foundation Building Project
Town of Portola Valley
Wild Bird Center of Los Gatos
Wild Bird Center of San Carlos
Woodside-Atherton Garden Club
Woodside High School
Woodside Priory School
Woodside Priory School Board of Trustees

*Number of visits. One visit = one person entering preserve on one day. These numbers represent an underestimate; they do not include informal use or research use.

2004–05 Brown Bag Lunch Lectures

October: **Rodolfo Dirzo**
Bing Professor in Environmental Science, Stanford University
"Defaunation in the tropics: plant-mammal interactions and tropical forest floristic diversity and structure"

November: **David Victor**
Director, Program on Energy and Sustainable Development, Center for Environmental Sciences and Policy
"International policy and global climate change"

December: **Chris Field**
Director, Department of Global Ecology, Carnegie Institution of Washington
"Carnegie global ecology and plant biology—organization and programs"

January: **Christina Swanson**
Fisheries biologist, The Bay Institute
"Restoring freshwater flow to the massively degraded San Francisco Bay and Sacramento–San Joaquin watershed"

February: **Kris Hulvey**
Graduate student, Department of Environmental Studies, UC Santa Cruz
"Tying together patterns of extinction and invasion in California grasslands"

March: **Buzz Thompson** and **Jeffrey Koseff**
Co-directors, Stanford Institute for the Environment; Robert E. Paradise Professor of Natural Resources Law and Professor of Civil & Environmental Engineering, respectively
"The Stanford Institute for the Environment (SIE)"

April: **Elizabeth Hadly**
Associate professor, Department of Biological Sciences, Stanford University
"Mammalian response to global warming: what have we learned from the prehistoric past?"

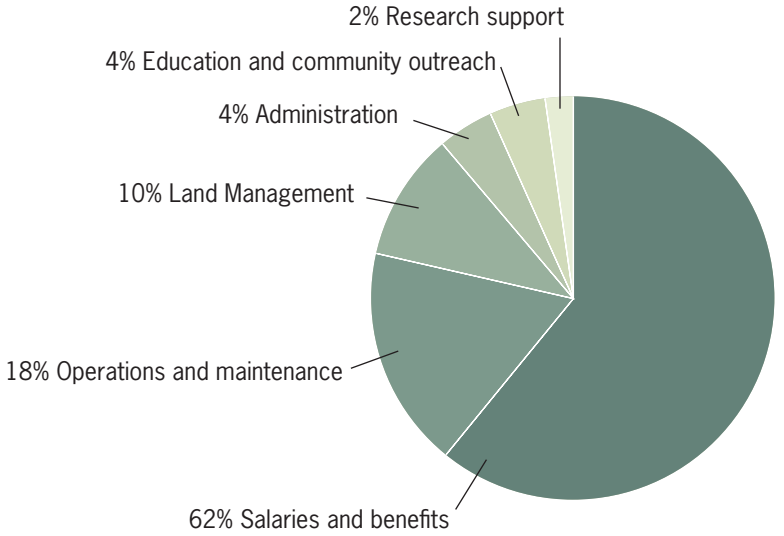
May: **Stephen Palumbi**
Professor, Department of Biological Sciences, Hopkins Marine Station
"The history and work of Hopkins Marine Station"

Appendix 4: 2004–05 Financial Summary

Expense Summary

Salaries and benefits	$455,134
Operations and maintenance	134,037
Land management	76,463
Administration	33,184
Education and community outreach	33,277
Research support	17,365
Total	**$749,460**

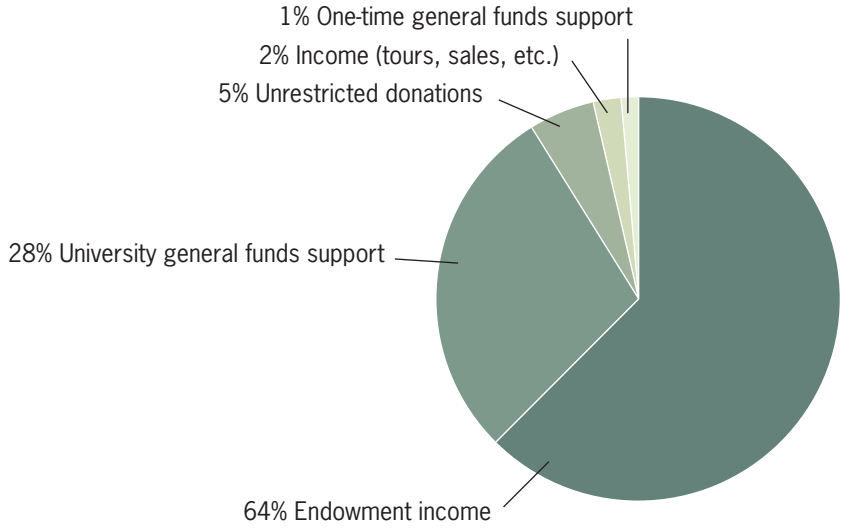
This past year expenses exceeded revenues primarily due to land management expenses. Specifically, mosquito abatement to reduce potential exposure to West Nile virus ($28,645) and activities associated with the addition of the Boething property ($23,433).



Revenue Summary

Endowment income	$440,506
University general funds support	200,086
Unrestricted donations	36,941
Income (tours, sales, etc.)	16,071
One-time general funds support	9,700
Total	**$703,304**

The shortfall between expenses and revenue was covered by unrestricted donor account reserves. One-time general funds support were matching funds for fencing around the Boething property.



Appendix 5: Donors

Unrestricted Gifts,
September 1, 2004–August 31, 2005

Nancy C. and Carlos Aguilar
James B. and E. Anne Allen
Amber Foundation
Paul H. and Madeline L. Arnaud, Jr.
Richard K. and Mary Blair Arnold
Leonie Batkin
Monika and Olle Björkman
Mary B. Blume
Irene and Robert Brown
Robert R. Buell
Eugene and Mary A. Bulf
John Caldwell, Jr.
Susan M. and Stephen R. Carpenter
Jack Chin
Hedy N. Chang
Bill and Jean Clark
Betsy B. Clebsch
Robert L. and Patricia R. Dengler
Joan M. and Robert M. Desky
Mary H. and Robert Dodge
John L. and Judith A. Doyle
Frances E. Escherich
Ed and Virginia Fryer
Mr. and Mrs. Theodore H. Geballe
Natalie S. Graham
Carol and Dexter Hake
Benjamin C. and Ruth Hammett
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Pauline Heyneker
Bruce Hinchlife
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Leo M. and Florence Holub
Mary Page Hufty
Charles N. and Donna E. Huggins
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William and Katherine Korbholz
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Edward S. Mocarski
John R. Page, Jr.
Susan N. Peterson
Charles and Dana Quinn
John Rawlings
Lenore L. Roberts
Deborah H. Rohan
Rajpal Sandhu Foundation
Earl F. and Patricia Schmidt
Sandra L. Swanlund
Colleen and Geoff Tate
Sara Timby
Donn J. and Margaret V. Wells
Sueko and Gustav R. Williges
Paul B. and Jennefer L. Wineman
Eleanor J. Wood
Woodside-Atherton Garden Club
John W. Working
Sunia Yang
Richard I. Yankwich
Lisa Zimmerman

Appendix 6: The JRBP Community

David Ackerly
Ann Akey
Kali Albright
Carolina Altamirano
Sean Anderson
Krikor Andonian
Chris Andrews
Alison Appling
Paul Arnaud
Ron Arps
Greg Asner
Marianne Austin
Sharon Avrahami
Monya Baker
Clare Baldwin
Teri Balser
Nidia Bañuelos
Mary Baron
Leonie Batkin
Nancy Bavor
Erin Beller
Kathleen Bennett
Asmeret Asefaw Berhe
Eren Bilir
Monika Björkman
Joey Blankinship
Tom Bleier
Laura Bloomfield
Karina Boege
Natalie Boelman
Carol Boggs
Brendan Bohannan
Timothy Bonebrake
Kate Brauman
Sharon Brauman
Ross Bright
Kathleen Brizgys
Bill Brown
Irene Brown
Jamie Brown
Andrew Buck
Bob Buell
Gene Bulf
Ruth Buneman
Boyce Burge
Al Butner
Kim Cahill
Kim Carlson
William Carmen
Charles Carter
Lacy Caruthers
Nicholas Casey
Sally Casey
Gerhard Casper
Cristina Castanha
Ted Chandik
Zoe Chandik
Andrew Chang
Audrey Chang
Mollie Chapman
Carl Cheney
Kris Cheng
Lily Cheng
Nona Chiariello
Jack Chin
Gina Choe
Jon Christensen
Ting Fong Chui
Hovey Clark
Jean Clark
William Clark
Betsy Clebsch
Elsa Cleland
Philippe Cohen
Robert Coleman
Toni Corelli
Will Cornwell
Peter Cowan
Jenny Creelman
Rig Currie
Hall Cushman
Gretchen Daily
Marge De Staebler
Rick DeBenedetti
Eva Dehlinger
Fran Delagi
Marge DeStaebler
Paul Dijkstra
Rodolfo Dirzo
Juyong Do
Bob Dodge
Janet Doell
Ted Dolton
Kim Dongkyun
Terry Donovan
Jeff Dukes
Edwin Ehmke
Lisa Ehrlich
Paul Ehrlich
Linda Elkind
Claire Elliot
Lynne Emery
Gary Ernst
Irene Estelle
Yuka Estrada
Brooke Fabricant
Natasha Fabricant
Ron Fark
David Fedor
Scott Fendorf
Christopher Field
Harris Fienberg
Susan Finlayson
Kathryn Fitzgibbons
Erica Fleishman
Cedric Frenette
David Freyberg
Zoë Friedman-Cohen
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Carol Graham
Ben Graves
William Graves
Margaret Green
Hannah Griego
Alan Grundmann
Nico Grundmann
Noel Gurwick
Elizabeth Hadly
Carol Hake
Dexter Hake
Tim Hall
Jennifer Harden
Jeremy Hartje
Stephen Hass
Trevor Hébert
Barry Hecht
Nicole Heller
Hugh Henry
Christopher Heppner
Joe Herzog
Chris Higgins
Michael Hipolito
Richard Hobbs
Justin Holl
Leo Holub
Whitney Hopkins
Rebecca Hopkinson
Christa Horn
Shelley Hou
Patrick Hsieh
Mary Hufty
Kris Hulvey
Bruce Hungate
Peter Jacke
Debi Jamison
Richard Jeffers
Gerry Jennings
Eliza Jewett
Laura Jones
John Juarez
Tamara Juarez
Bill Karavas
Megan Keely
Marcia Keimer
Donald Kennedy
Gary Kittleson
Simon Klemperer
Walter Koenig
Bill Korbholz
Robert Kovach
Margaret Krebs
John Kriewall
David Kroodsma
Maneesh Kumar
Ann Lambrecht
Jean Lane
Léo Laporte
Peter LaTourrette
Alan Launer
Anna Lee
Caroline Lee
Kathleen Lee
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Cynthia Bradford Lencioni
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Chirs Lilgeberg
Targe Lindsay
Tom Lindsay
Henry Loescher
Sara Lopus
Claire Lunch
Nancy Lund
Karen Martell
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Jacquie Martin
Don Mason
Judy Mason
Pam Matson
Christie May
Margaret Mayfield
Laura McLendon
Ann McMillan
Darcy McPhee
Laura McVittie
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Betsy Meehan
Jessica Mentzer
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Tom Merigan
Deanna Messinger
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Jed Mitchell
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Harold Mooney
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Melissa Morelos
Lincoln Moses
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Kären Nagy
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Dahlia Naveh
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Judith Wagner
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Richard White
Erik Whitehorn
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Sunia Yang
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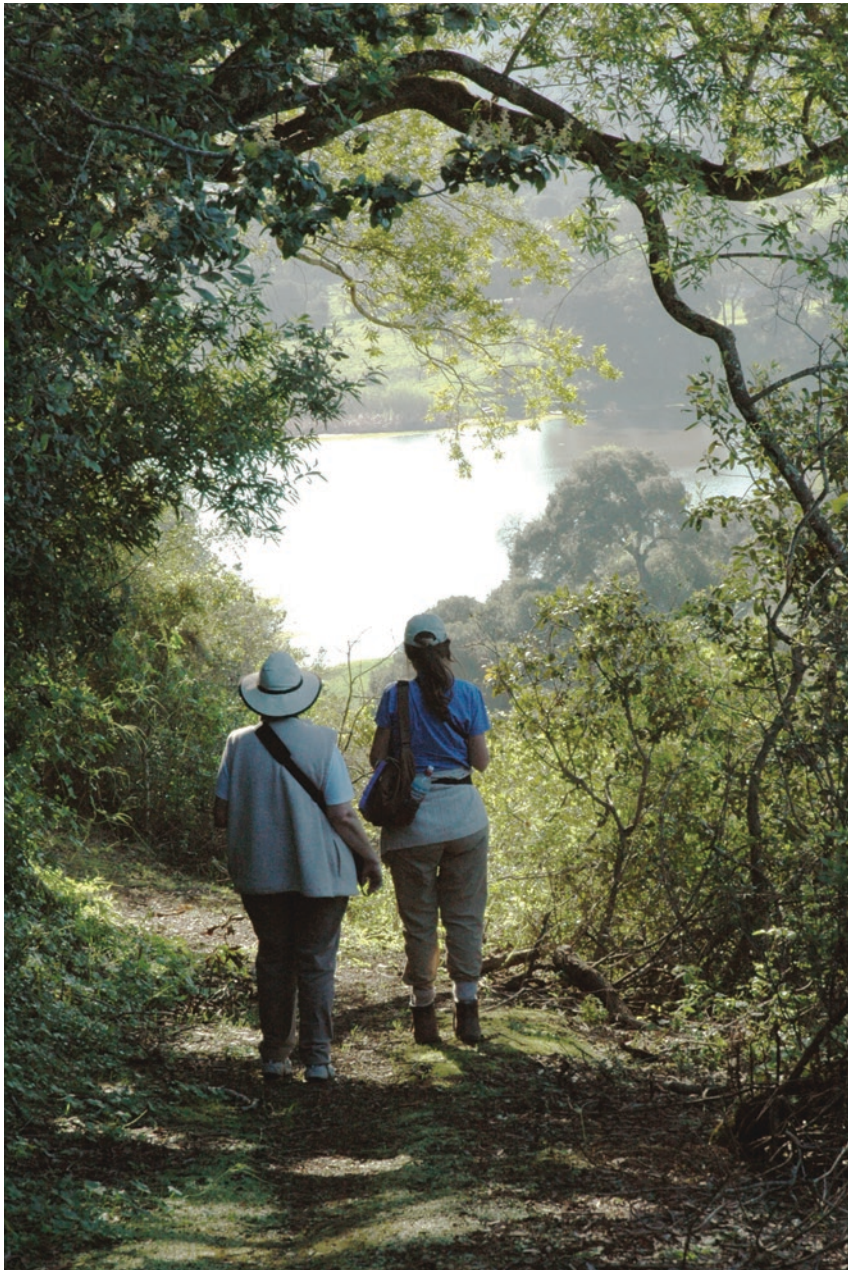

JRBP Staff

Left to right in above photo:
Chris Field, PhD, faculty director
Alison Rountree, administrative assistant
Philippe Cohen, PhD, administrative director
Trevor Hébert, GIS and data manager
Leonard Robinson, resident caretaker
Cary Tronson, operations steward
Cindy Wilber, education coordinator
Brooke Fabricant, resident ranger
Nona Chiariello, PhD, research coordinator
Not pictured:
Deanna Messinger, resident ranger
Justin Holl, publications coordinator (through March 2005)
Joy Wagner, financial associate (through May 2005)

Endnotes: Web Sites

1. Jasper Ridge strategic plan: http://jasper1.stanford.edu/home/stratplan.html
2. Stanford Institute for the Environment (SIE): http://environment.stanford.edu/index.html
3. SIE grants: http://environment.stanford.edu/grants/grant2005_butterfly.html
4. "Green" design award: http://www.aia.org/cote_2005greenprojects
5. JRBP research projects: http://jasper1.stanford.edu/projects
6. Computer science tools for field research: http://hci.stanford.edu/research/biology
7. JRBP home page: http://jasper1.stanford.edu

For more information about Jasper Ridge Biological Preserve

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Stanford University
Stanford, CA 94305-5020
Email: philippe.cohen@stanford.edu
Web site: http://jasper1.stanford.edu/
Phone: (650) 851-6814
Fax: (650) 851-7334

If you would like to make a gift of support to Jasper Ridge Biological Preserve, please call Gift Processing at (650) 725-4360 or visit http://givingtostanford.stanford.edu.

Photographs

Nona Chiariello: 4 (lower left), 6, 7, 8, 9, 10, 11, 12 (left), 13 (bottom), 16 (top, bottom right), 17 (middle, right), 18 (2), 20 (top), 24 (right)
Philippe Cohen: 1, 2, 5, 19 (bottom right), 23, 25 (middle), 29 (top), 30
Geocadd Surveys, Fremont, California (orthorectification by Trevor Hébert): 4 (top left), 13 (top)
Bill Gomez: 20 (bottom)
Scott Haefner: 29
Justin Holl: 12 (right)
Patrick Hsieh: 17 (top left)
Don Mason: cover, inside front cover, 3, 14, 15, 16 (bottom left), 17 (far left), 18 (1, 3), 19 (5), 24 (left, middle), 25 (left, right), 26, 28, 31, 32, inside back cover, back cover
Cindy Wilber: 19 (4)

Illustrations

Chris Andrews: 1, 2, 12
Eliza Jewett: 5, 19

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In Memoriam

Byron "Bill" Brown 1930–2004

Emeritus Stanford Professor of Biostatistics, Byron "Bill" Brown, Jr., died November 30, 2004. He was 74. Recruited from the University of Minnesota faculty, Bill joined Stanford's statistics department in 1968, serving for a number of years as chair of health research and policy. A kind, thoughtful, and modest man, Bill worked mainly as a consulting statistician in the design of clinical trials and assessment of new medical technologies for their effectiveness and safety. A colleague said, "Bill was constantly teaching how to seek the truth while warning us of how difficult it was." Author of numerous journal articles and several books, he was nationally recognized and honored. He retired in 1998. After retiring, Bill became a valuable JRBP birding affiliate, and was a regular on monthly counts until his death. He is missed.

Edward Fryer 1916–2005

As an educator, Ed felt strongly that great professors should not only teach, but also inspire their students. He spent 20 years in academia teaching physics and believed passionately in liberal arts education and excellence in undergraduate education. A Jasper Ridge docent since 1984, Ed loved the preserve and was as comfortable teaching on the trail as he was in the physics classroom. A rock, a twig, a feather, the spring wildflowers, or a view of the lake were often starting points for teaching and certainly for life-long learning. All of us at Jasper Ridge are deeply saddened by the death of our long-time friend and docent. We shall remain ever grateful for his generosity, sage wisdom, extraordinary knowledge, and sweet inspiration.

Jasper Ridge Biological Preserve
Stanford University
Stanford, CA 94305-5020

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