

# Robert J. Bernard Field Station 2014-15 Annual Report



**Activities at Bernard Field Station during the 2014-2015 academic year.** Upper Left: Maddi Cowen holding a western scrub jay. Upper Right: Katie Barton and Nola Shi setting up a motion sensitive camera to inventory mammals. Lower Left: Vian Zada measuring base of burned shrub that failed to resprout and Jeffrey Allen taking GPS data. Lower Right: Sycamore Elementary School student surveying birds.

# Executive Summary

The 2014-15 academic year marked another successful year for the Bernard Field Station (BFS).

- **Use monitoring and Claremont Colleges course use.** Our first complete year of use monitoring recorded 6,644 user days, indicating that on average >18 people use the BFS each day of the year. Much of this use is by students and researchers from the Claremont Colleges. For example, 24 courses used the BFS this year providing 710 opportunities for students to have hands-on educational experiences.
- **Claremont Colleges research.** Twenty-six research projects were conducted at the BFS, including at least 6 senior thesis projects. Two of these senior projects are currently being edited prior to submission for publication.
- **Educational opportunities for local K-12 students.** The Leadership in Environmental Education Partnership (LEEP), run through Pitzer College since 1996, has provided the primary link in recent years between the BFS and local K-12 students (~140 K-12 students every year). This year, however, marked the beginning of a new K-12 program. A pilot program was run with Sycamore Elementary Students with the goal of providing opportunities for every fourth grader in the Claremont School District to visit the BFS and learn about the ecology of their town during the 2015-16 academic year.
- **Engaging the greater Claremont community.** This year we held our second annual BFS Earth Day Event with over 100 people from the community taking part in various tours and activities that highlighted local biodiversity and the diverse research conducted at the BFS. Community members also participated in the BFS volunteer program.
- **Research and academic use by institutions outside the Claremont Colleges.** This year, we hosted researchers from California Polytechnic University Pomona, California State University Fullerton, University of California at Riverside, University of California at Davis, and Arizona State University. We also hosted two workshops focused on effectively monitoring biodiversity in endangered sage scrub habitats with attendees from multiple institutions throughout southern California.

This first annual report aims to compile a complete list of uses for the BFS during the 2014-15 academic year and highlight the critical role the BFS plays at the Colleges and in the greater Claremont and southern California Community.

## Use of the BFS

In total, we recorded **6,644 user days** at the BFS during the 2014-15 academic year. This is a conservative estimate that does not include use associated with our active volunteer program, the director's use, the LEEP program open house, or the 2015 BFS Earth Day Events. Below are some pictures highlighting different uses of the BFS:



**Additional activities at Bernard Field Station during the 2014-2015 academic year.** Upper Left: Professor Matina Donaldson-Matasci (HMC) and Tessa Finley count flowers on a buckwheat shrub to quantify the resources available to bees. Upper Right: Rickie Cleere and Tessa Adams monitoring ecological succession following the 2013 BFS fire as part of Pomona's Fire Ecology course. Lower Left: Volunteers removing overgrown cattails from pHake Lake. Lower Right: Children from the Claremont community participating in the 2015 BFS Earth Day Events.

# Course Use by the Claremont Colleges

**Twenty-four courses** from throughout the Claremont Colleges used the BFS this year, providing **710 opportunities** for students to have hands-on educational experiences. Courses include:

## Harvey Mudd College

- BIOL 052: Introduction to Biology
- BIOL 110: Experimental Ecology
- HM CL 57.1: Field Ecology of Lizards
- BIOL 108: Ecology and Environmental Biology

## Pomona College

- BIOL 132: Vertebrate Biology
- Workshop (1-day): Intro to Designing Inquiry Based Experiences
- EA 030: Science and Environment
- EA 173 L: Ecology of Inland Waters
- BIOL 41E: Ecological and Evolutionary Biology
- BIOL 180: Microbial Ecology
- BIOL 189B: Fire Ecology

## Pitzer College

- EA 199: Envisioning Southern CA Sustainability
- Art 180: Art and Animals
- ARHI 186B: Environmental Robotics
- EA 146: Theory and Practice of Environmental Education

## Keck Science (Pitzer, Scripps and Claremont-McKenna Colleges)

- HHMI SScIP: Howard Hughes Summer immersion program
- BIOL 154 L: Animal Behavior Lab
- EA 030 L (two semesters): Science and the Environment
- ASTR 066: Astronomy
- EA 103: Soils and Society
- BIOL 135 L: Field Biology
- BIOL 044 L: Introductory Biology
- AISS: Accelerated Integrated Science Sequence

# Research

## Research Use by the Claremont Colleges

Claremont Colleges faculty and students conducted **26 research projects** at the BFS this academic year, including **7** senior thesis projects, two of which are currently being edited for publication. During the 2014-15 academic year, one peer-reviewed article from the BFS was published, and another was accepted for publication. In addition, because this is the inaugural annual report for the BFS, we would like to mention another publication that was accepted for publication just prior to the start of this academic year. Senior theses and publications are listed below.

In addition, to senior research projects, research was conducted by many students (> 40) from throughout the Claremont Colleges. Most notably, the Director of the Bernard Field Station hired 18 students using BFS funds, funds from the Henry David Thoreau Foundation and funds from the Schenk family.

## Use by Non-Claremont Institutions

The BFS also attracts users from outside the Claremont Colleges because it can provide biological resources or habitats that may not be available at the home institution and can also serve as a useful site for inclusion in studies that examine gradients (e.g., nitrogen or temperature) over a large geographic area. Research and academic use by institutions outside the Claremont Colleges has, in fact, been expanding. This year, we supported researchers from California Polytechnic University Pomona, California State University Fullerton, University of California at Riverside, University of California at Davis, and Arizona State University. Faculty and staff from multiple southern California institutions also participated in two BFS-hosted workshops focused on effectively monitoring biodiversity in endangered sage scrub habitats (see below).

## Publications

### Senior Theses:

Dipman, Madison (2015) Factors driving early decomposition processes in low elevation habitat types of southern California. Bachelor of Arts, Pomona College, Biology. Advisor: Wallace Meyer.

Gormally, Brenna (2015) Comparing corticosterone concentrations in male *Sceloporus occidentalis* from urban and protected habitats. Bachelor of Arts, Pomona College, Biology. Advisor: Kristine Kaiser.

Hackenberger, Benjamin C. (2015). The San Antonio Wash: Addressing the gap between Claremont and Upland. Bachelor of Arts, Pomona College, Environmental Analysis. Readers: Char Miller, Lance Neckar, and John Bohn

Hernandez, Jessica (2015) The effects of urbanization on circulating testosterone levels in male *Sceloporus occidentalis* across urban and protected areas in the Los Angeles basin. Bachelor of Arts, Pomona College, Biology. Advisor: Kristine Kaiser.

Nuffer, Alex (2015) Relationship between soil nutrients and vegetation communities at the Robert J. Bernard Biological Field Station. Bachelor of Arts, Keck Science, Environmental Analysis. Advisor: Colin Robins.

Osborne, Rose (2015) Behavioral and physiological adaptations to avoid desiccation, starvation, and lethally high temperatures during estivation in the land snail *Helminthoglypta tudiculata*. Bachelor of Arts, Pomona College, Biology. Advisor: Jonathan Wright.

Stroutsos, Mia (2015) Environmental education curricula in the Inland Empire: ethnographic accounts of innovative schooling. Bachelor of Arts, Pitzer College, Anthropology and Environmental Analysis. Advisor: Claudia Strauss.

### **PhD Dissertation:**

Hollowell, Amanda C. (2015) Drivers of Genotypic Abundance and Spatial Spread in Wild *Bradyrhizobium*. Doctor of Philosophy, University of California Riverside, Genetics, Genomics and Bioinformatics. Advisor: Joel Sachs.

### **Peer-Reviewed Publications:**

Lin, Y., H. Kastein, T. Peterson, C. White, C. G. Lowe, and C. M. Clark. 2014. A multi-AUV state estimator for determining the 3D position of tagged fish. *Proceedings of the 2014 IEEE/RSJ International Conference on Intelligent Robots and Systems (IROS 2014)*: 3469-3475.

Regus, J. U., K. A. Gano, A. C. Hollowell, and J. L. Sachs. 2014. Efficiency of partner choice and sanctions in *Lotus* is not altered by nitrogen fertilization. *Proceedings of the Royal Society B: Biological Sciences* 281: 20132587

Staubus, W. J., E. S. Boyd, T. A. Adams, D. M. Spear, M. M. Dipman and W. M. Meyer III. *In Press*. Ant communities in native sage scrub, non-native grassland, and suburban habitats in Los Angeles County, USA: conservation implications. *Journal of Insect Conservation*

## K-12 Programs

The BFS has two K-12 programs:

The **Leadership in Environmental Education Partnership (LEEP)**, through Pitzer College, has provided the primary link between the BFS and K-12 students. This flagship program is run through a Pitzer College class offered most years titled, *“Theory and Practice in Environmental Education”*. This course teaches ~25 college students environmental/ecological pedagogy and curriculum development. Then it provides an opportunity for these students to teach elementary school children (~140) from diverse backgrounds (> 70% of the students qualify for the free or reduced lunch program) about environmental concerns in our community.



**K-12 activities at Bernard Field Station during the 2014-2015 academic year.** Left: Brenna Gormally assisting Sycamore Elementary students with a survey of plant diversity and leaf structure at the BFS; Right: Sycamore Elementary student surveying arthropod (e.g., insect, millipede, spider) diversity at the BFS.

This year marked the beginning of a **new K-12 program at the BFS**. This program will provide an additional link between the BFS and K-12 students complimenting efforts of the LEEP program. During the 2014-15 academic year, inquiry based curriculum was developed and implemented in three classes at Sycamore Elementary School. The educational objective is to provide students a more accurate sense of place (i.e., understand that the California Sage Scrub ecosystem is extremely diverse, unique and in critical need of conservation) and develop a community with a stronger commitment to environmental stewardship. With support from the Henry David Thoreau Foundation, we plan to expand this program to provide access to all fourth graders in the Claremont Unified School District.

# 2015 BFS Earth Day Events

This year, the BFS held its second annual BFS Earth Day events, which provides the primary opportunity for the greater Claremont Community to participate in various tours and learn about the research being conducted at the BFS. Unfortunately, this year, heavy rains also attended the event forcing us to cancel the extremely popular Night Family Tour.

**Bernard Field Station (BFS) Earth Day Events – Saturday, April 25, 2015**

In celebration of Earth Day, the BFS is hosting a variety of tours for the Claremont community. To reserve your spot, please visit: [bfs.claremont.edu/events/earthday.html](http://bfs.claremont.edu/events/earthday.html)

**List of Tours**

1. Bird Watching Tour – 7-9 AM (10 spots)
2. Intro to BFS 8-9 AM (12 spots)
3. Wildflower Tour – 9-11 AM (12 spots)
4. Native Plants for your Garden – 9:30-10:30 AM (12 spots)
5. Family Science Tour – 3-5:30 PM (50 spots)
6. Night Family Tour – 7:30-9 PM (30 spots)

*Everyone under 18 must be accompanied by a parent or legal guardian*

Photo: Lotus Hairstreak on Deerweed



**BFS Earth Day Events.** Top: Poster announcement of the event. Lower Left: Professor Paul Stapp (Cal State Fullerton) introducing the native mammals living at the BFS. Lower Right: Children learning about the various lizards that inhabit the BFS and Claremont.

# Bio-Monitoring Program

The BFS is currently leading a multi-institutional effort with National Science Foundation support to set up long-term bio-monitoring programs in California sage scrub fragments throughout southern California. In July 2014, bio-monitoring protocols were developed to document and assess changes in diversity and phenology of four distinct taxonomic groups: plants, invertebrates, birds, and mammals. Protocols were developed based on two criteria: (1) that they collect data in a way that can reveal changes in the biota at both the patch and regional levels; and (2) that they are practical (i.e., they could be implemented with the resources at most institutions). In January 2014, implementation of bio-monitoring protocols began at the BFS.

Prior to this effort, the BFS Director implemented a bio-monitoring program to assess ground-dwelling invertebrate diversity. Implementation began in March 2013 and continues today as part of the laboratory curriculum in Pomona College's 41E Ecological and Evolutionary Biology.



**Bio-monitoring efforts at the BFS during the 2014-15 academic year.** Left: From left to right: Ken Halama (UC Riverside), Jonathan Wright (Pomona) Joan Leong (Cal Poly Pomona), Robin Ikeda (Chaffey College), and the arm of Erin Oplinger (San Bernardino County) participating in a workshop aimed at monitoring bio-diversity in the endangered sage scrub ecosystem. Right: Students from Pomona's BIOL 41E: Ecological and Evolutionary Biology course continuing pitfall trap sampling at the BFS.

# Volunteer Program

Our very successful volunteer program continued in 2014-2015, with workdays scheduled for the first and third morning of each month during the academic year. Ninety-two volunteers participated in the program, including 59 college and high school students (from Harvey Mudd, Pomona, Scripps, and Citrus Colleges, University of California Riverside, Claremont High School, and one home-schooled student), 9 faculty members, 14 children, and 10 community members.

We held 15 Saturday morning workdays. (Four of the 18 scheduled workdays were canceled because of fire danger, West Nile virus threat, rain, or extreme heat; one was made up.) An average of 13 volunteers participated in each workday for a total of 390 volunteer hours.

Plant removal comprised the bulk of the work (290 volunteer-hours) and included removal of cattails, invasive thistles, and non-native mustard. Volunteers also weeded experimental plots in the burn area, and prepared and planted a teaching garden.



**Volunteers at the BFS during the 2014-15 academic year.** Upper Left: A young volunteer grunts while pulling a Sahara Mustard plant. Upper Right: Volunteers weed an experimental plot in the burn area. Lower Left: Volunteers remove Maltese Star Thistles and non-native mustard. Lower right: Volunteers plant the teaching garden.

## BFS Web Resources

Over the past year, we have continued to improve the BFS web resources, which provide useful information to Claremont College students and faculty as well as outside researchers and the general public. Among our main web resources are the constantly updated lists of flora and fauna at the BFS, with links to many photographs of the species taken at the BFS.

This year, through a combination of regular surveys and findings from research projects, we added 12 new plants, one new mammal to the BFS species list, and 169 new invertebrate taxa. The extensiveness of our invertebrate list is fairly unique, and it will be featured in a forthcoming publication on insect diversity in Southern California. We have also recorded some unusual species. Our documentation of a Desert Black Swallowtail at the BFS this year marks only the second time this species has been reported in Los Angeles County.

Photographs posted on the BFS website – in addition to providing useful resources for students have been included in a number of outside publications and projects, including an University of Arizona extension service publication, a Arizona State/Cornell collaborative project on computerized moth identification, Back to Natives Restoration information on native pollinators, “Bird Watching” magazine, and the new edition of *Insects of the Los Angeles Basin*.

In addition, we collaborated with the Field Museum, Chicago, who developed the Rapid Color Guide format to produce a Rapid Color Guide of Butterflies of the Bernard Field Station. The Guide is available as a PDF from both the BFS and Field Museum web sites.



**Some new additions to the BFS species lists.** Left: *Whispering Bells* (*Emmenanthe penduliflora* var. *penduliflora*). Right: *Desert Black Swallowtail* (*Papilio polyxenes coloro*).

# BFS Director Achievements

## **Publications (only those associated with the BFS are listed)**

Staubus, W. J., E. S. Boyd, T. A. Adams, D. M. Spear, M. M. Dipman and W. M. Meyer III. *In Press*. Ant communities in native sage scrub, non-native grassland, and suburban habitats in Los Angeles County, USA: conservation implications. *Journal of Insect Conservation*

Wheeler, M. M., M. M. Dipman, T. A. Adams, A. V. Ruina, C. R. Robins and W.M. Meyer III. *In Review*. Carbon and nitrogen storage in California sage scrub and non-native grassland habitats. *Soil Biology and Biochemistry*.

- Two other manuscripts are in preparation. One examines spider community changes associated with fire and plant succession. The other paper examines the factors that influence decomposition processes and how habitat modification influences this critical ecosystem process. I expect these will be submitted and published during the 2015-16 academic year.

## **Presentations**

Meyer, W. M., III. Invited Oral Presentation. Carbon storage and biodiversity in low elevation Southern California habitat types: perspectives for a sustainable future. Urban Soil Carbon Water Summit, February 2015. (<https://www.youtube.com/watch?v=x1hr5Y4A5Qg>)

Meyer, W. M., III, W. J. Staubus, M. Wheeler, M. Dipman, D. M. Spear. Oral Presentation. Conservation importance of native coastal sage scrub and non-native grassland habitat patches in urban/suburban Los Angeles County, California, USA. 99<sup>th</sup> Annual Ecological Society of America Meeting, August 2014.

## **Bio-monitoring**

I hosted three workshops focused on developing and implementing a bio-monitoring program in the endangered sage scrub ecosystem. In addition, I drafted the bio-monitoring protocol document and implemented the BFS bio-monitoring program which monitors plant, mammal, arthropod, and bird diversity and phenology. During the 2015-16 academic year, I will continue bio-monitoring implementation and work on developing the appropriate data management approach for this multi-institutional effort.

## **Research**

Generous grants from the Henry David Thoreau Foundation and the Schenk Fund along with research funds from the BFS allowed the director to hire and support 18 student researchers.

# **BFS Director Achievements (continued)**

## **Grants**

### Received

Henry David Thoreau Foundation, Grant for Student Research – 2015 (\$31,000)

### Administered

Henry David Thoreau Foundation, Grant for Student Research – 2014 (\$25,000)

National Science Foundation, Field Station Planning Grant (DEB, FSML) – 2013 (\$23, 897)

Schenk Fund, Grant for Research on Plants – (\$3,500)

## **K-12 Programs**

I hired three student education interns and mentored them in developing environmental curriculum for fourth graders in the Claremont Unified School District. Curriculum was developed and implemented in three classes at Sycamore Elementary School. Expansion of this program during the 2015-16 academic year will provide opportunities for all fourth graders in the district.

## **Community Outreach**

I organized and oversaw the 2015 BFS Earth Day Events. In 2016, we will continue the BFS Earth Day program. Expansion of community programs is not planned, and would require additional resources.