

*The third article is by Dr. Richard E. MacMillen, University of California–Irvine, and Dr. Frank L. Powell, Director of the White Mountain Research Station, University of California–San Diego. Those of us involved in creating and developing curricula will find a real gold mine of ideas in this article about the development of an Ecology Supercourse. With the ideas and information from this article, all you need is an administrator willing to work at creative ways to fund such a great idea.—Ed.*

## THE ECOLOGY SUPERCOURSE CONCEPT

### Introduction

During the late 1960s and early 1970s the University of California undergraduate campuses were simultaneously experiencing burgeoning enrollments of “Baby Boomers,” students clamoring for environmental education, and progressive curtailment of education funding (which continues today). In the University of California, Irvine, Department of Population and Environmental Biology (now the Department of Ecology and Evolutionary Biology), we ecologists were faced with the dilemmas of undergraduates eager for hands-on field experiences in ecology, pressures to teach ever-expanding enrollments in ecology courses that precluded meaningful field experiences, and a budget-driven administrative mentality that favored the large classes with limited field experience. The problem was exacerbated further by the temporal demands of other courses in a demanding major that competed for student time. Also at this time, field experimentation and longer-term studies became increasingly popular and important to ecologists. It was apparent to us that the most critical and important educational needs of undergraduates aiming at future careers in ecological sciences simply could not be met in a large-class/limited-field environment. Thus, in 1972, was developed the first UCI Terrestrial Field Ecology Supercourse for undergraduates.

### The campus-based Supercourse

Since three of us at UCI were already offering upper-division ecology courses in the Spring Quarter, it was a logistically simple matter to combine these with an additional component of undergraduate research, to comprise the entire course loads of the enrolled students for that academic term. In this way the students were basically freed from any other academic distractions, and the calendar became wide open and flexible. Our initial offering combined four-unit courses in Field Botany (Pete Atsatt), Physiological Plant Ecology (Phil Rundel), Physiological Animal Ecology (Dick MacMillen), and Independent Research (all three of us), with enrollment restricted to 20 students. In this manner the roll books showed that three professors were teaching, collectively, 80 students. Although enrollment was restricted perhaps to fewer students than the individual courses might have attracted when offered alone, the operational costs were reduced by pooling several educational resources, including Teaching Assistants, transportation, and nearly all on-campus residential overhead costs. With an open calendar we could spend alternate weeks in the field, and then come back to campus for more formal lecturing, data extraction and analysis, and such simple necessities as showers and laundry. Field work concentrated on several of the University of California’s Nature Reserves (UC Natural Reserve System), representing much of the state’s natural diversity, from coastal valleys to deserts to alpine mountains. All field work entailed camping on-site, so that informal lecturing and demonstration, species collection and identification, field experimentation and monitoring, camp cooking and cleanup, and recreation were all parts of daily life. This initial offering was wildly successful, both from an academic and social perspective. The communal living experience was an education in itself, providing students with an early introduction to self-reliance and interdependence at the same time. Several returning students from

this initial Supercourse offering competed successfully for an NSF Student Originated Studies Grant, returning to the desert site for a summer study of the impacts of human recreational use on desert biodiversity. Most of these students went on to higher degrees in Environmental Biology, with at least two attaining Ph.D.s, and enviable professional positions.

The proof was in the pudding that this was an extremely effective and innovative educational undertaking that brought the classroom to Ecology, rather than the traditional approach of bringing Ecology to the classroom. So successful was the program that UCI’s marine biologists developed a Marine Biology Supercourse that alternated annually with the Terrestrial Ecology Supercourse during Spring term, and with equal effectiveness. During the 1980s the Terrestrial Supercourse was expanded to an intercampus offering, with enrollment open both to students from UCI and UC San Diego, with Ted Case participating as faculty representative from the latter campus. This intercampus venture proved equally effective, and it continued for a decade, drawing upon several terrestrial courses that cycled through that period (e.g., Insect Ecology, Community Ecology, Animal Physiological Ecology, Plant Physiological Ecology, Field Botany), to distribute the demanding but rewarding teaching commitment more equitably over the department.

### The field station-based Supercourse

*History.*—By the 1990s the stage was set to apply the Supercourse concept to a truly systemwide enrollment that would be available to each of the eight undergraduate University of California campuses. Several events combined to make feasible such an application, which involved instruction at a field station during the academic year: (1) MacMillen and Powell had served for several years as members of the UC President’s Advisory Committee for the White Mountain Research Station (WMRS)

in Bishop, eastern California, where they had independently conducted research. Both had discussed the possibility of a Supercourse at the Station, and received enthusiastic endorsement from the rest of the committee, representing each of the UC campuses; (2) Powell was appointed Director of the White Mountain Research Station in 1995, and pledged to bring more of a year-around academic presence to a field station that previously had focused most of its activities on the three summer months; and (3) The University of California Office of the President, in an attempt to encourage more intercampus educational activities, made funding available on a competitive basis from an Intercampus Academic Program Incentive Fund (IAPIF).

Basing the Supercourse at WMRS offered several advantages in this UC funding competition, leading to the conclusion that the field station environment might provide logistical advantages for Supercourse development, obviating on-campus constraints. An important justification for the WMRS Supercourse was that it relied on UC systemwide faculty and student participation at a time when demanding research expectations of junior faculty and early retirement of seniors reduced teaching flexibility, and students were being directed progressively into locked-in curricula with fewer options; thus on any one campus there were fewer faculty and students available for unusual educational options. In addition, WMRS had, over the years, developed a community of dedicated teacher-researchers representing nearly all of the UC Campuses, and they enthusiastically supported the Supercourse idea, and many pledged to contribute a week of instruction as well as to enlist students.

Our proposal to develop a WMRS undergraduate Supercourse in Environmental Biology was funded by a matching grant from IAPIF, with the expectation that WMRS would assume sole fiscal responsibility for the course after the first or second year of operation. The initial offering was in the Spring Quarter 1996, attracting 12

Table 1. Syllabus and schedule for the Spring 1997 Supercourse in Environmental Biology, offered at the University of California White Mountain Research Station, Bishop, California.

---



---

Week 1. Orientation to the Owens and Mono Basins, from Mono Lake (Mono County) to Owens Lake (Inyo County): Local experts in fish and game management..
Week 2. Applied Conservation Biology: Water and Land Management Los Angeles Department of Water and Power, and local cattle rancher.
Week 3. Field Ecology: Terrestrial Ecosystems and Communities. Faculty from UC Irvine, UC San Diego.
Week 4. Applied Conservation Biology: Water and Land Management. Experts from BLM, Inyo County Water Department, California Attorney General's Office.
Week 5. Field Ecology: Aquatic Ecosystems and Communities. Faculty from UC Irvine, Claremont Colleges (Emeritus).
Week 6. Applied Conservation Biology: Mono and Owens Lakes. Experts from U.C. Sierra Nevada Aquatic Research Laboratory, and Great Basin Air Pollution Control District. Black Toad and Bat Census, WMRS staff.
Week 7. Physiological Ecology: Regulation. Energy, Temperature, Nitrogen, Water. Faculty from UC Riverside, UC Irvine.
Week 8. Physiological Ecology: Respiration of Aquatic and Terrestrial Animals. Faculty from UC Irvine, UC San Diego.
Week 9. Independent Research Projects. WMRS staff.
Week 10. Independent Research Projects, and Poster Session. WMRS staff.

---

highly motivated students, but representing only two campuses (UC Irvine, UC San Diego). At present (May 1997) we are approaching the end of our second offering, with a similar number of students representing five campuses (UC Irvine, UC San Diego, UC Santa Barbara, UC Davis, UC Santa Cruz). These two Supercourses, like the previous campus-based offerings, have been extremely effective from an academic perspective, and from that of the field station. We believe that it is entirely feasible for other field stations to develop successful Supercourses based on our model either in Ecology, or in other disciplines and interdisciplines.

*Logistics.*—As in the earlier campus-based Supercourses, the WMRS version consists of four, four-unit courses, comprising the full-term academic commitment of each student. The courses are: Field Ecology, Physiological Ecology, Applied Conservation Biology, and Independent Research. A syllabus of the 1997

Supercourse, currently in session, is in Table 1. All students are in residence at the field station for the entire 10 weeks, with weekends generally free. Essential to the operation and integration of the four courses is a full-time Coordinator; MacMillen served in this capacity during 1996 and 1997. Each course is divided into two, week-long segments, often alternating with other course segments (Table 1). For the Field Ecology and Physiological Ecology Segments, each week is instructed by a team of two faculty from one or more of the UC campuses, who are in residence at the station for their week; occasionally an emeritus from a non-UC campus will be invited to fill in. The Applied Conservation Biology course depends entirely upon instruction by local Owens Valley land managers, representing both the public and private sector; this course revolves around the issue of water as a critical resource in this desert setting, a resource whose demands are exacerbated by export of both riparian and

groundwater to the City of Los Angeles, 480 km away.

About equal time is spent in the classroom, with lectures and demonstrations, and in the laboratory and/or field, learning and applying experimental techniques (Table 1). In this manner students may learn about theoretical aspects of environmental biology in the morning, and apply tests of those theories the same day with local systems, either in the laboratory or field. With its unique setting at the ecotones of Mojave and Great Basin Deserts, and montane ecosystems, the Owens Valley offers unusual opportunities for studies of Environmental Biology. Because the nearby Sierra Nevada Range and the White-Inyo mountain ranges are snow-laden often into summer, the courses concentrate on Owens Valley studies out of the WMRS Owens Valley Laboratory (elevation 1234 m), but the last segment of the Physiological Ecology course is able to conduct altitude-related experiments in the White Mountains at the WMRS Crooked Creek Laboratory at 3094 m, and, conditions permitting, at least a visit to the Barcroft Laboratory at 3800 m.

It was interesting to note in two recent Ecology 101 articles (D'Avanzo 1996, Zedler and Callaway 1997) endorsement of hands-on laboratory instruction, using a succession of approaches that emphasize progressive independence of student research effort; these include carefully "guided" research projects with teacher control, followed by "teacher-collaborative" research where the teacher is a co-researcher, to "open-ended research," where the teacher merely serves as mentor to students who control the progress and outcome of the project. We intuitively developed this approach in the evolution of the Supercourses, at first leading students through projects with known outcomes, with a gradual weaning process through the term, toward nearly complete independence at the end. Like previous offerings, the WMRS Supercourse culminates in an intensive 2-week period of independent research in Environmental

Biology (topic chosen by student), requiring a publication-style manuscript and presentation of a judged poster at the WMRS Annual Meeting of Western Physiological Ecologists.

The development of this System-wide Supercourse has not been without logistic difficulties. While we would like to cap enrollment at 16 students, we have been unable to attract more than 12 during the first two years, although we have expanded from two to five campuses represented during that period. In part this is due to difficulties in advertising the course on all campuses, and reaching the potential feeder courses. In addition, each campus has its own registration peculiarities, and seems ill-equipped to deal with unusual enrollment requests. For the first year, the Supercourse used an experimental program that enabled students to receive credit on their own campus for taking courses approved on another. Our courses were approved at UCI, and the UCSD students received their credit through this program. However, other UC campuses were reluctant to use this experimental program in the second year. To overcome this, we are in the process of listing each course through the appropriate campus and departmental curricular channels. Another stumbling block is that Berkeley is on the semester system, while all other UC campuses are on the quarter system, making it difficult for both scheduling and credit transfer.

Except for rather modest honoraria, we have been unable to provide salary support for any except soft-moned faculty participants. But we have been elated that faculty have thus far voluntarily and readily contributed their time for a week of instruction, rewarded only by a chance to interact with a small number of highly motivated students. And the response from the Owens Valley land management community has been overwhelmingly positive, asking to be included each ensuing year, whether it be from private consultants, local cattle ranchers, City of Los Angeles Department of Water and Power, Inyo County Water Depart-

ment, Great Basin Air Pollution Control District, or the Bureau of Land Management. Because of these selfless contributions, we have been able to expose our dozen students to 20 or more expert practitioners of Environmental Biology over the 10-week period.

Funding of future Supercourses poses a challenge with the expiration of the IAPIF award. White Mountain Research Station will continue to provide a stipend, room, and board for the course Coordinator, and honoraria for soft-moned faculty. The Station also provides a scholarship for each student, amounting to one-third of the meal costs, with the students paying the balance. We are exploring, unsuccessfully to date, an avenue by which a portion of each student's campus enrollment fees are redirected to the Station, to help offset operating costs. The only overhead costs Supercourse students represent to their home campuses are those related to registration, which should be minimal.

From the students' perspective there are logistic difficulties with registration as described above, but these should be minor. More difficult problems are those related to curricular planning, so that the students can afford a quarter off campus without jeopardizing completion of a three-quarter course sequence, and still graduate in a timely manner. An additional student difficulty is arranging for vacating on- or near-campus living arrangements, if there is a 9-month residency expectation. But none of these logistic problems is insurmountable to the highly motivated student, the kind we hope to attract to such a course.

## Conclusions

We view the Ecology Supercourse, either on-campus or at a field station, as an exceptional educational opportunity for highly motivated undergraduates wishing to explore, if not pursue, professional careers in the ecological sciences. Our program has been developed over the past 25 years, culminating in the present field station offering. Through it we have seen students blossom from mere

amateurs to young, competent ecologists, all in a 10-week period, progressing much more rapidly in the realms of academics, self-reliance, social compatibility, and maturation than in any conventional course setting that we (or at least one of us) has witnessed during 37 years of college/university instruction. It represents a modest luxury which we need to afford during this period of factory training of tomorrow's scientists. The probability of its continuing success is reflected in the words of a current student: "This is an absolutely wonderful course, and I am extremely grateful to have been an active part of it. If there is anything I can do to help keep this program and programs like this alive, please let me know."

### **Acknowledgments**

We thank the many students and faculty who devoted their time, energy, and skills to the development of the Supercourse concept, and to the University of California Office of the President for the confidence it showed in aiding our successful application of the concept to a field station setting.

### **Literature cited**

- D'Avanzo, C. 1996. Three ways to teach labs by inquiry: guided, open-ended, and teacher collaborative. *ESA Bulletin* 77:92-93.
- Zedler, J. B., and J. C. Callaway. 1997. Restoration ecology. Combining the teaching of principles with group experiments and native

plant restoration on the SDSU campus. *ESA Bulletin* 78:67-69.

*Richard E. MacMillen  
Professor Emeritus of  
Biological Sciences  
University of California, Irvine, and  
Coordinator, WMRS Supercourse in  
Environmental Biology  
Bishop, CA  
Present address: 705 Foss Road  
Talent, OR 97540  
E-mail: bidmac@jeffnet.org*

*Frank L. Powell, Director  
White Mountain Research Station  
University of California, San Diego  
La Jolla, CA 92093*