

GENERAL CAMPUS ORU POLICIES AND PROCEDURES

1998 WMRS ANNUAL REPORT

The 1998 annual report for the White Mountain Research Station (WMRS) MRU covers fiscal year 1997/98. However as in previous reports, data related to station use is reported for the 1998 calendar year, which correlates more closely with the main research season from June through September at the station. The report is organized according to the January 8, 1998 General Campus ORU policies and Procedures. According to the 1982 UC Policy on ORU and MRU reports, it is being submitted to the Chair of the Advisory Committee the President (*via* the Provost and Senior Vice-President for Academic Affairs) and the Vice Chancellor for Research with copies to the Chancellor.

1. SUMMARY OF MAJOR ACTIVITIES IN 1998

a. Research and educational “use” of a field station is one of the most valuable measures of its success. WMRS tracks the total number of users, the total number of “user nights” (requiring room and or board) and “user days” (*e.g.* classroom use for teaching or a conference), and the institutions and disciplines represented by the users for the *calendar year*. The calendar year corresponds more closely to the research season, which peaks between April and October and straddles the fiscal year.

- In 1998, there were a total of 1,626 users and 7,604 user nights (all sites), representing 66 institutions. These numbers indicate a 22% increase in the length of stay of approximately the same number of users in comparison to 1997. UC usage continues to increase from 25% in 1996 to 52% in 1998.
- The campus most represented at WMRS is UCSD.
- Earth and Biological Sciences are equally represented with 43% and 42% respectively. Interestingly, the majority of Earth Science users are non-UC and the majority of Biological Science users are UC. Medical use was 6% followed by Other (4%), Environmental (3%), and Space (1%). In 1998 there were no Social Science users.
- The Owens Valley Laboratory and Bishop facilities receive the most use.
- Researchers comprise 29% of the user nights and educational programs comprise 65%. These absolute number of users in these categories represent a 12% and 27% increase, respectively, from 1997.
- The large increase in publications from 1996 (44 pubs) to 1997 (71 pubs) continued to hold in 1998 (89 pubs). The 1998 publications included: 69 research articles (23 in the Hall Symposium special volume), 4 Masters and 3 Ph.D. thesis. Of the total of 89 publications, 30 are WMRS publications (For listing see #7).

b. Summary of 1998 WMRS research grant awards. WMRS scientists submitted 18 proposals in 1998 and 6 were funded. Funded proposals included:

1. “**Graduate Course Modules and Research Proposal Workshops at the WMRS Eastern Sierra Institute**”; UCOP MRU grant (\$29,598, F.L. Powell and C.O. Qualset, co-PI’s). This was a competitive renewal of our MRU grant for the “Eastern Sierra Institute at WMRS” in 1997 (\$68,325, F.L. Powell, PI). During the first year, a GIS laboratory was established at

WMRS (hardware, software, and 33% computer specialist) and an academic coordinator (33%) was funded to develop educational programs under the Eastern Sierra Institute (ESI) banner. The second phase is to actually run the educational programs for three years (see 1.c.3. below).

2. **“Eastern Sierra Geospatial Data Clearinghouse and Metadata Workshop”**; USGS grant (\$40,000, S. Szewczak, PI). This grant supported the Academic Coordinator (25%), and computer specialist (50%) to establish a Geospatial Data Clearinghouse internet node at WMRS which now includes 41 sets of metadata. For detailed results of the grant see: <http://www.wmrs.edu/clearinghouse/finalreport>. This grant was used with the Eastern Sierra Institute grant to build the new GIS laboratory at WMRS, which is being used for new research and educational programs.
3. **“Comparative Demography of Selected Mountain Sheep Populations in High Mountains and the Mojave Desert of California”**, Cal Department of Fish and Game grant (\$134,635 for 1997-2000), J. Wehausen, PI). J. Wehausen is in the third decade of long-term research on comparative demography of mountain sheep populations in the Sierra Nevada, White Mountains, and eastern Mojave Desert of California. This work focuses on demography at three levels: (1) actual patterns of dynamics of population sizes; (2) the relative importance of variation in adult survivorship vs. recruitment in these dynamics; and (3) the factors underlying variation in adult survivorship and recruitment, including predation, diseases, weather, age structure, pregnancy rates, and population density. This research tests basic theoretical models of ungulate population dynamics that serve as the foundation for wildlife conservation approaches.
4. **“Society for Integrative and Comparative Biology Symposium: Phenotypic and Genotypic Strategies to Chronic Hypoxia”**, NSF (\$2,920, F.L. Powell, PI). This symposium was organized by Powell and J.W. Hicks (UC Irvine) at the request of the SICB Division of Comparative Physiology and Biochemistry at the 1999 meeting in Denver. The goal of the symposium was to bring together scientists from the many areas that study hypoxia, including medical researchers, zoologists and evolutionary biologists. The speakers (from U. Nevada, U. Chicago, U. Colorado and UC) compared and contrasted the biological responses to hypoxic stresses of different duration—from minutes to generations—in the animal kingdom. The speakers started planning new interdisciplinary research projects to study interactions between physiological acclimatization and genetic adaptation to the environmental stress of hypoxia.. The next step in this process will be a workshop at WMRS in Spring 1999 to identify the best animal models for studying adaptation to hypoxia.
5. **“Summer Internship Program”**, Berger Foundation (\$27,600, S. Szewczak, PI). Funding provided support for field supervisors, staff, and supplies for undergraduate interns (see 1.c.2)
6. **“Forestry Research”**, USFS (\$52,965, S. Szewczak, PI). This funding allowed for the development a Forest Health Monitoring and Research Program at WMRS based on lichen assessment in the Western US. It provided funding for two researchers and a variety of subcontracting field staff.

c. WMRS Educational Programs:

1. UC Intercampus Supercourse in Environmental Biology at WMRS. In Spring 1998, 16 students from UCD, UCI, UCR, UCSB, UCSC and UCSD enrolled in the WMRS Supercourse in Environmental Biology. The supercourse was taught by faculty from UCI, UCR and UCSD and 8 other institutions and local agencies. The biggest challenges with this intercampus course remained recruitment and enrollment from multiple UC campuses. WMRS used flyers, faculty and student contacts, student affairs offices and campus list servers to advertise the course. For 1998/99, the Academic Coordinator is working closely with the individual campuses and currently, 7 different registration procedures are listed on the web site for the 7 different campuses.

To further improve the advertising process while efficiently using staff time, we will attempt to increase the visibility of WMRS through improved access to WMRS program descriptions. Working with individual campus departments, we will develop higher visibility advertising such as the Bodega Bay description at the top of the BioScience listings in the UC Davis course catalog:

http://registrar.ucdavis.edu/UCDWebCatalog/WebCatCrs/gc_bis.htm#bmlprog

In addition, we will attempt to formalize contacts for the updating of campus catalogs. Without a designated contact at every campus, WMRS listings are frequently omitted from the catalogs when updates are made. Therefore, in the absence of system-wide procedures, WMRS will attempt to join individual campus listservers for updating course catalogs, much like we currently do nationally with the Undergraduate Internship. The success of this intercampus course depends on our ability to establish procedures that do not need to be developed over every year.

Finally, stable funding for this course will be pursued with the support of the Office of Research at UCOP, based on the involvement of undergraduates in research.

A new supercourse in earth sciences is being planned for the Fall of 1999, with the support of the Eastern Sierra Institute MRU grant.

2. WMRS Undergraduate Internship Program. The 1998 WMRS Summer Internship Program ran from June 21-August 25. There were 21 participants: 5 were advanced interns and 16 were on the Interagency Resource Teams (IRT), four of whom were high school students. Universities and High Schools represented include, Cornell, Harvard, Middlebury, Bates, St. Joseph's, UCD, UCI, UCLA, UCSD, U of Colorado, Antelope Valley Community College, Bishop Union High School, and Lone Pine High School. The summer program generated an income of \$41,560, including \$12,123 for room and board fees and \$3,151 for support of the WMRS GIS laboratory.

Interagency Resource Teams Projects included:

- Sensitive Plant Monitoring (USFS)
- Macroinvertebrate Monitoring (UCSB),
- Kern Plateau Stream Survey (USFS)

- Noxious Weed Monitoring (BLM, USFS, DWP, Inyo County Water Department)
- Eastern Sierra Riparian Vegetation Survey (Point Reyes Bird Observatory, USFS, BLM)
- Soil Survey (UCB)
- Stream Condition Inventory (USFS)
- Yosemite Toad Survey (USFS)
- Willow Flycatcher Monitoring (USFS)
- Ponds Invertebrate and Amphibian Surveys at Devils Postpile National Monument (CDFG and NPS)
- Columbine Speciation Project (UCSB)
- Archeological Inventory of the Eastern Escarpment of the Sierra Nevada (USFS).

Advanced Internships: We completed a successful summer of the Advanced Student Internship, which was started in 1997 as a pilot project. The three projects completed under this program were: Eastern Sierra Riparian Vegetation Survey (Point Reyes Bird Observatory, USFS, BLM), Aquatic Invertebrate Ecology (UCB), Aquatic Resources Inventory of Devils Postpile National Monument and Surrounding Area (CDFG, NPS).

In 1998-99, WMRS ran a pilot winter internship with 5 interns. Projects included: Stream assessment and construction of a fish barrier on the Kern Plateau (USFS), GIS mapping of Death Valley surface geology (WMRS, USGS), Mule Deer tracking (CDFG), GIS mapping of historic vegetation in the Owens Valley (Inyo Co Water Department), GIS mapping in Mono County (Mono County Planning Department). This was a very successful program that provided researchers and resource specialists with critical assistance, offered students excellent educational opportunities in research and real-world resource management problems, and enhanced the academic environment at WMRS during the winter months.

3. Eastern Sierra Institute (ESI) symposia and advanced course modules. In 1998, additional funding was secured and planning was done for the first ESI program for the summer of 1999. In collaboration with the University of California *Ad hoc* Committee for Intercampus Activity in Conservation Biology (CIACB), WMRS applied for a renewal of the MRU grant we received last year to develop the ESI. We used the original grant to develop the GIS laboratory infrastructure that will be necessary for the institute program. This second phase of the project is devoted to developing the institute curriculum around the foundation of a UC symposium in Conservation Biology. The symposium will be held at the WMRS Crooked Creek facilities. The first three years of the program are designed to provide opportunities for faculty and students to interact with agency personnel and explore theories and technologies critical to conservation biology. Topics are: The Scientific Basis of Conservation Planning (1999), Application of Molecular Data to Conservation Planning (2000) and Application of Geospatial Data to Conservation Planning (2001). Participants will analyze real-world conservation planning and use new technologies to enhance faculty and graduate student participation in, and contribution to, this critical process. Advanced course modules will be programmed as satellites before and after the main conservation symposium for graduate students and professionals needing training in new experimental or analytical methods in environmental sciences. Research opportunities identified by faculty and participants in these modules will lead to subsequent

workshops to develop multicampus, interdisciplinary research projects at WMRS. The education modules and research workshops are designed to be self-sustaining through course fees and research funding by 2001. We are attempting to integrate the advanced training and research program at WMRS with K-12 teacher and student outreach programs run by the Inyo County Department of Education under the ESI banner also.

4. 1998 WMRS Public Lecture Series

The WMRS Lecture Series are evening public lectures at the Owens Valley Laboratories that was started in 1982. Since that time, the annual series has attracted thousands of attendees, who come to hear about the scientific work by researchers in the region. In addition to an evening lecture, the speakers generally stay at the Station to interact with WMRS students, faculty and local agency scientists.

The 1998 lectures included:

- “Remote Sensing and Geology in the White-Inyo Range”, Gary Ernst, Dept. of Geology, Stanford University, CA. March 26, 1998
- “New Insights into the Mechanisms of Pulmonary Edema”, Marlowe Eldridge, Dept. of Pediatrics-Critical Care, University of California Davis. April 2, 1998
- “Bishop: 500,000,000 BP”, Katherine Bergk, Depart. Of Geology, University of California Davis. April 9, 1998.
- “Active Faults in the Owens Valley and Environs”, Jeff Lee, Institute for Crustal Studies, University of California Santa Barbara. April 16, 1998.
- “Biological Indicators of Great Basin Spring-fed Wetland Conditions”, Don Sada, Environmental Studies Program, University of Nevada. April 23, 1998.
- “California Public Lands, Wild and Beautiful”, Allan Schoener, Division of Natural Sciences, Fullerton College. April 30, 1998.

d. University-industry Activities. The United States Department of Energy and other funding agencies recognize hydrogen as a viable option for clean, renewable energy and have initiated research efforts for its development. WMRS staff member Rick Masters has promoted WMRS as an ideal site for hydrogen energy R&D. His efforts have stimulated serious interest in members of the nascent hydrogen energy industry to integrate WMRS into their research plans. Out of this grew the concept of a Hydrogen Energy Technologies Integration Center (HETIC) at WMRS.

In September, the vice president of Stuart Energy Systems, Matthew Fairlie, visited the WMRS upper stations and endorsed the concept. Stuart was awarded \$5.8M (US) in February 1999 by the Canadian government for hydrogen refueling stations in Vancouver. Also in September, WMRS joined the non-profit California Hydrogen Business Council (CHBC) and Rick Masters constructed a website for the CHBC to help promote hydrogen energy:

<http://www.wmrs.edu/ricksweb/ch2bcweb/index.htm>

In November, the Chairman of DCH Technology, David Haberman, with his Chief Scientist and Technical Advisors, spent two days inspecting the WMRS facilities and developing the details of converting to a hydrogen power system. In December, Dr. Jay O. Keller, Hydrogen Program

Manager of Sandia National Laboratory at LLNL presented a Powerpoint presentation on the HETIC concept [<http://www.wmrs.edu/hydrogen/>] to the department heads of the Department of Energy at the Hydrogen Clusters and Corridors meeting in Florida. Following the H₂CC meeting, David Haberman of DCHT discussed the HETIC proposal with members of Congress at the Hydrogen Technical Advisory Panel meeting (established by the Hydrogen Future Act to advise Congress on hydrogen energy technologies) and received a "very positive response." At this point, the collaboration of interested parties is currently working through researchers at UN-Reno's Desert Research Institute and are investigating possible UC researchers to lead HETIC.

e. McAfee Meadows RNA: As reported last year, the US Forest Service (USFS) is pursuing the formal establishment of the McAfee Meadows Research Natural Area (RNA). This RNA is intended to preserve a representative example of alpine fell field. Located near the Barcroft facilities, the boundaries of the McAfee Meadows RNA could greatly impact on the WMRS research program. In contrast to the 1951 Cooperative Agreement between UC and USFS to restrict traffic in the WMRS Scientific Area, which was intended to minimize interference with scientific research projects in the area, an RNA is established to preserve undisturbed habitat and it prohibits any manipulative research in the environment. Some of the candidate boundaries proposed for the McAfee Meadow RNA completely surrounded the Barcroft and White Mountain Summit facilities operated by WMRS, and were therefore unacceptable for our research mission. In cooperation with the USFS, WMRS interns collected data on the history and value of research in the area, and wrote a draft proposal to establish the RNA, as part of the NEPA process.

This collaboration was successful in producing an entirely unique proposal for an RNA with a core non-manipulative zone, over the critical alpine fell-fields, and a larger buffer zone around the core, in which manipulative research will be permitted. The Barcroft facilities are in the manipulative zone and the entire boundaries exclude the WMRS Summit facilities. WMRS will collaborate with the USFS on the processing of special use permits for research in the manipulative zone of the McAfee Meadow RNA, just as we do now for research permits in the area. The regional USFS offices have endorsed this proposal and the final establishment is expected in 1999.

2. ADVISORY COMMITTEE MEMBERS

The Advisory Committee that was in place when the new Director was appointed in 1995 continued to serve, except for Clemens A. Nelson (Member-at-large, UCLA Emeritus) who retired 1998.

- Phillip E. Bickler, Department of Anesthesiology, UC San Francisco
- Diane Campbell, Department of Ecology and Evol. Biology, UC Irvine
- Ted Case, Department of Biology, UC San Diego
- Mark A. Chappell, Department of Biology, UC Riverside
- Martin L. Cody, Department of Biology, UC Los Angeles
- Gary Ernst, Member-at-large, Dept. Geological & Environmental. Science, Stanford University

- Sally Holbrook, Department of Biological Sciences, UC Santa Barbara, Committee Chairperson
- Mathias Kondolf, Department of Environmental Planning, UC Berkeley
- Jeffrey Mount, Department of Geology, UC Davis
- Edwin P. (Phil) Pister, Member-at-large, Calif. Dept. of Fish and Game Emeritus
- John Smiley, Division of Natural Sciences, UC Santa Cruz and Landells Hill Big Creek Reserve
- Steven J. Wickler, Member at large, Dept. of Animal & Veterinary Science, Cal Poly Pomona.

The structure and function of the Advisory Committee will be reviewed at the 1999 annual meeting.

3. ACTIVE WMRS FACULTY MEMBERS

a. U.C. Faculty. In 1997/98, four faculty from four UC campuses are receiving WMRS support:

1. Peter A. Bowler, Assoc. Adj. Prof. of Ecology & Evolutionary Biology, Course Coordinator for 1998 Environmental Biology Supercourse.
2. Kimberly A. Hammond, Asst. Prof. of Biology, UCR - WMRS Assistant Research Scientist.
3. Scott A. Hodges, Asst. Prof. of Ecology, Evolution and Marine Biology, UCSB - WMRS Assistant Research Scientist.
4. Frank L. Powell, Prof. of Medicine, UCSD - WMRS Director.

b. U.C. Professional Researchers:

In 1998, three professional researchers were based at the station:

1. Joseph M. Szewczak, Ph.D. - Assistant Research Physiologist, Dept. of Medicine, UCSD
2. Susan M. Szewczak, Ph.D. - WMRS Academic Coordinator
3. John D. Wehausen, Ph.D. - WMRS Associate Research Scientist

Appointments for three more WMRS researchers are pending external funding for their salaries:

1. Eric Berlow, Ph.D. - WMRS Assistant Research Scientist, pending NSF funding 4/1/99.
2. Angela Jayko, Ph.D. - Associate Research Scientist, pending USDA funding 4/1/99.
3. Rob Roy Ramey, Ph.D. - WMRS Project Scientist, pending NSF funding 6/1/99

4. GRADUATE STUDENTS AND POSTDOCTORAL RESEARCHERS

a. Postdoctoral trainees were not officially supported by WMRS, although several trainees worked with UC and non-UC researchers using the facilities. In 1997/98, Petra Schmitt, D.V.M was appointed as a PGR through WMRS. She is supported by a Deutsche Forschungs

Gemeinschaft fellowship to study “Respiratory Gas Exchange in Birds Exercising at High Altitude” (Advisor: F.L Powell, UCSD).

b. WMRS graduate student Fellowships. Graduate student research proposals were reviewed by the Advisory Committee. In 1998, twelve awards were made for a total of \$19,020 including awards carried forward from 1997. \$6,040 was given as a cash award and \$12,980 was given as credit vouchers for room and board at the station or travel to WMRS. The awards were:

- Bauer, Kenneth, (UC Berkeley): “Context-Dependent dynamics of Sagebrush and herbaceous species in Sierra Nevada Meadows”, (James Bartolome, Advisor).
- Gerard, Andre B., (UC San Diego): “The effect of oxygen enrichment of cognitive function following rapid ascent to high altitude”, (John B. West, Advisor).
- Gustaven-Unger, Mike, (Rice University): “Three dimensional strain and displacement analysis in the Sierra Nevada batholith”, (Basil Tikoff, Advisor).
- Kennedy, Theodore, (University of Minnesota): “The impacts of a Salt *Cedar* (*Tamarix ramosissima*) invasion on biotic communities and ecosystem processes in riparian corridors of the Owen’s”, (Shahid Naeem, Advisor).
- McElroy, Michele K., (UC San Diego): “The effect of oxygen enrichment of room air on sleep, arterial oxygen saturation and control of ventilation after rapid ascent to high altitude” (John B. West, Advisor).
- Meyers, Marilyn, (UC Berkeley): “Aquatic invertebrates in springs of the great Basin”, (V. Resh, Advisor).
- Nowak, Nathan, (University of Michigan): “Kin selection and alarm calling in yellow-bellied marmots (*Marmota flaviventris*)”, (Brian Hazlett, Advisor).
- Rourke, Bryan, (UC Irvine): “Geographic and altitudinal variation in water balance in the lesser migratory grasshopper, *Melanoplus sanguinipes*”, (Allen Gibbs, Advisor).
- Smeltzer, Matthew W., (UC Berkeley): “Historical geomorphological analysis for the restoration of aquatic and riparian habitat in the Owens River Gorge, California”, (G.M. Kondolf, Advisor).
- Stallman, Elizabeth, (University of Michigan): “Nutritional, ecological, and social factors affecting fertility in female yellow bellied marmots (*Marmota flaviventris*)”, (Warren Holmes, Advisor).
- Vines, John A., (VA Polytech): “Emplacement history of the Paiute Monument pluton, east-central California: relationships between emplacement mechanisms and their wall”, (Richard D. Law, Advisor).
- Wenner, Jennifer, (Boston University): “The role of high-silica granites in the Sierra Nevada as end members in a mixing process that generates average continental crust”, (Drew S. Coleman, Advisor).

c. **Graduate Students Involved in the Unit's work.** Eric Porter (Dept. of Ecology and Evolutionary Biology, UCI) was the Teaching Assistant for the WMRS Supercourse in Environmental Biology.

5. STUDENT AND FACULTY PARTICIPATION FROM OTHER CAMPUSES OR UNIVERSITIES

In 1998, the total number of non-UC “user nights” at all sites increased to 3,612 (from 3,318 in 1997) but the use by UC increased more (3,992 in 1998 vs. 2,920 in 1997). Hence, the percentage of non-UC users decreased (see table below). Use by UC faculty and students has increased from 1,150 in 1995, which explains the decrease in percent usage by non-UC percentage. The *absolute number of non-UC users has remained constant* at approximately 3,500 per year since 1993.

User nights by institution

	1994	1995	1996	1997	1998
UC	31%	24%	25%	47%	52%
non-UC	69%	76%	75%	53%	48%

There were 29 non-UC field classes, field trips, and workshops for a total of 3,331 user nights. There were 10 field classes or trips for a total of 2,132 user nights from UCB, UCD, UCLA, UCR and UCSB. There were 5 extension classes from UCB, UCR, UCSB and UCSD for a total of 469 user nights.

**6. NUMBERS AND FTE OF ACADEMIC RESEARCH PERSONNEL, TECHNICAL STAFF
AND ADMINISTRATIVE PERSONNEL¹**

		FTE
Director		
Powell, Frank	Director	0.50
Asst. Res. Sci. 11-mos²		
Bowler, Peter	Supercourse Coord.	0.33
Hammond, Kim	Res. Scientist	0.33
Hodges, Scott	Res. Scientist	0.33
Academic Subtotal (Sub 00)		1.50
Campus Office Staff		
Fager, Barbara	Admin. Specialist	1.00
Jamous, Cecilia	Admin. Asst. I	0.50
Campus Subtotal (Sub 01)		1.50
Station Staff		
Hetzler, Scott	Lead Groundskeeper	1.00
Masters, Richard	Auto. Mechanic	0.75
Patrick, Cecil	Principal Cook III	1.00
Shinn, Donna	Admin. Asst. III	1.00
Trydahl, David	Sr. Super. of PPS	1.00
Station Subtotal (Sub 01)		4.75
Total FTE		7.75

¹ Casual employees; office help, seasonal cooks carpenters, building maintenance workers, laborers are essential for support during heavy research use in the summer season.

² The Assistant Research Scientist FTE is an unfilled position used for rotating support of UC faculty to seed long-term research programs at WMRS.

³ The Principal Cook is currently funded at only 75% but is anticipated to increase to 100% with funding support from increased use and recharge income.

7. PUBLICATIONS

Research at WMRS resulted in 89 publications in 1998 including 7 MS, MA and Ph.D. theses based on research at the Station. Also included are 23 peer-reviewed articles in the Geological Society of America volume titled "*Integrated Earth and Environmental Evolution of the Southwestern United States*". This publication collected papers presented at the September 13-15, 1997 symposium of the same name at WMRS. W.G. Ernst and C.A. Nelson organized the symposium and edited the volume in honor of Clarence A. Hall Jr., the previous Director of WMRS. WMRS spent \$1,200 on editorial expenses for this publication. The articles in this volume and the masters and doctoral theses are listed below. The full list of WMRS-related publications is being organized in a searchable database that will be available on our web site.

1. Atwater, T., and Stock, J., 1998, Pacific-north American plate tectonics of the Neogene southwestern United States: An update: in Ernst, W. G., and Nelson, C. A., eds., *Integrated Earth and Environmental Evolution of the Southwestern United States*, Geological Society of America International Book Series, p. 393-420.
2. Axelrod, D.I., 1998, Paleoelevation estimated from Tertiary Floras: in Ernst, W. G., and Nelson, C. A., eds., *Integrated Earth and Environmental Evolution of the Southwestern United States*, Geological Society of America International Book Series, p. 70-79.
3. Axen, G.J., and Fletcher, J.M., 1998, Late Miocene-Pleistocene extensional faulting, northern gulf of California, Mexico and Salton Trough, California: in Ernst, W. G., and Nelson, C. A., eds., *Integrated Earth and Environmental Evolution of the Southwestern United States*, Geological Society of America International Book Series, p. 365-392.
4. Burchfiel, B.C., Cameron, C.S., and Royden, L.H., 1998, Geology of the Wilson Cliffs-Potosi Mountain Area, southern Nevada: in Ernst, W. G., and Nelson, C. A., eds., *Integrated Earth and Environmental Evolution of the Southwestern United States*, Geological Society of America International Book Series, p. 203-227.
5. Cliff, S.S. Oxygen Isotopic Studies of Atmospheric Nitrous Oxide. UCSD. 1998 Ph.D. Thesis.
6. Coleman, D. S., and Glazner, A. F., 1998, The Sierra crest magmatic event: rapid formation of juvenile crust during the Late Cretaceous in California: in Ernst, W. G., and Nelson, C. A., eds., *Integrated Earth and Environmental Evolution of the Southwestern United States*, Geological Society of America International Book Series, p. 253-272.
7. Ducea, M., and Saleeby, J.B., 1998, A case for delamination of the deep batholithic crust beneath the Sierra Nevada, California: in Ernst, W. G., and Nelson, C. A., eds., *Integrated Earth and Environmental Evolution of the Southwestern United States*, Geological Society of America International Book Series, p. 273-288.
8. Fritsche, A.E., Miocene paleogeography of southwestern California and its implications regarding basin terminology: in Ernst, W. G., and Nelson, C. A., eds., *Integrated Earth and Environmental Evolution of the Southwestern United States*, Geological Society of America International Book Series, p. 484-502.
9. Greene, H.M. High Altitude effects (3800M) on respiratory gases, acid-base balance, and pulmonary artery pressures in equids. 1998. CSU Pomona. MA Thesis

10. Hagadorn, J.W. Restriction of a late Neoproterozoic Biotope. USC 1998 Ph.D. Thesis.
11. Hamilton, W.B., 1998, Archean tectonics and magmatism: in Ernst, W. G., and Nelson, C. A., eds., *Integrated Earth and Environmental Evolution of the Southwestern United States*, Geological Society of America International Book Series, p. 5-43.
12. Hetzner, S., Richter, M., Rien, M., Spengler, T., and Verleger, K., 1998, Climatic-ecological aspects of the arid American southwest, with special emphasis on the White Mountains, California: in Ernst, W. G., and Nelson, C. A., eds., *Integrated Earth and Environmental Evolution of the Southwestern United States*, Geological Society of America International Book Series, p. 228-250.
13. Koch, A.K. The effects of high altitude and exercise on fluid balance in equids. CSU Pomona. 1998. MA Thesis.
14. Ingersoll, R.V., 1998, Phanerozoic tectonic evolution of central California and environs: in Ernst, W. G., and Nelson, C. A., eds., *Integrated Earth and Environmental Evolution of the Southwestern United States*, Geological Society of America International Book Series, p. 349-364.
15. Knesel, K.M., and Davidson, J.P., 1998, The origin and evolution of large-volume silicic magma systems: Long Valley Caldera: in Ernst, W. G., and Nelson, C. A., eds., *Integrated Earth and Environmental Evolution of the Southwestern United States*, Geological Society of America International Book Series, p. 326-345.
16. Krauskopf, K.B., 1998, Ten plutons revisited: A retrospective view: in Ernst, W. G., and Nelson, C. A., eds., *Integrated Earth and Environmental Evolution of the Southwestern United States*, Geological Society of America International Book Series, p. 173-174.
17. Mayo, D.P., Anderson, J.L., and Wooden, J.L., 1998, Isotopic constraints on the petrogenesis of Jurassic plutons, southeastern California: in Ernst, W. G., and Nelson, C. A., eds., *Integrated Earth and Environmental Evolution of the Southwestern United States*, Geological Society of America International Book Series, p. 421-442.
18. Miller, D.E., and Ernst, W.G., 1998, Deformation and metamorphism of the Marble Mountain and Pony Camp areas, western Triassic and Paleozoic Belt, central Klamath Mountains, northwestern California: in Ernst, W. G., and Nelson, C. A., eds., *Integrated Earth and Environmental Evolution of the Southwestern United States*, Geological Society of America International Book Series, p. 443-483.
19. Miltenberger, T.L. Metabolic changes in the horse with ascent to high altitude. CSU Pomona 1998. MA Thesis
20. Moores, E.M., 1998, Ophiolites, the Sierra Nevada, "Cordillera," and Orogeny along the Pacific and Caribbean Margins of North and South America: in Ernst, W. G., and Nelson, C. A., eds., *Integrated Earth and Environmental Evolution of the Southwestern United States*, Geological Society of America International Book Series, p. 44-58.
21. Morgan, S.S., and Law, R.D., 1998, An overview of paleozoic-mesozoic structures developed in the Central White-Inyo Range, eastern California: in Ernst, W. G., and Nelson, C. A., eds., *Integrated Earth and Environmental Evolution of the Southwestern United States*, Geological Society of America International Book Series, p. 161-172.

22. Mount, J.F., and Bergk, K.J., 1998, Depositional sequence stratigraphy of Lower Cambrian Grand Cycles, southern Great Basin, U.S.A.: in Ernst, W. G., and Nelson, C. A., eds., Integrated Earth and Environmental Evolution of the Southwestern United States, Geological Society of America International Book Series, p. 180-202.
23. Nelson, C.A., 1998, The Beer Creek-Cottonwood igneous contact, southern White Mountains, California: in Ernst, W. G., and Nelson, C. A., eds., Integrated Earth and Environmental Evolution of the Southwestern United States, Geological Society of America International Book Series, p. 175-179.
24. Smith, T.R. Altitude, but not exercise, increases erythropoietin in the horse. CSU Fullerton. 1998. MA Thesis.
25. Stevens, C.H., Stone, P., Dunne, G.C., Green, D.C., Walker, J.D., and Swanson, B.J., 1998, Paleozoic and Mesozoic evolution of East-Central California: in Ernst, W. G., and Nelson, C. A., eds., Integrated Earth and Environmental Evolution of the Southwestern United States, Geological Society of America International Book Series, p. 119-160.
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8. INCOME

The table below shows the WMRS budget for fiscal year 1997/98. Not included are the federal and state contracts and grants awarded to individual investigators using WMRS. The 1998 annual total for these awards was \$1.81M. This includes \$425,000 to UC faculty and \$518,000 to non-UC faculty for research directly involving WMRS (*i.e.* the work would be impossible without the Station)

INCOME	1997/98
1. Fed/State contracts & grants	\$86,919
2a. Recharge income	146,910
2b. Gifts and endowments	8,022
3a. UC appropriation	679,715
3b. UC grants	44,428
TOTAL	\$965,994

9. EXPENDITURES

Expenditure directly related to research includes 1. Academic Personnel (listed in section 3. Active WMRS Faculty), 2. Graduate Student Fellowships, and expenses under 7. Operations and Supplies covered by Income through Federal/State contracts and grants (see 1. on Income table above). Administrative and physical plant expenses account for the rest of the expenditures. This includes 3. Station Staff and 4. Campus Staff (shown on Table 6. above) plus temporary office help and seasonal cooks, carpenters, building maintenance workers and laborers who are essential during heavy research use in the summer season. 5. Benefits are lumped for all personnel. Other support costs are grouped into “fixed” and “variable” costs. 6. Utilities, facility improvements and equipment includes “fixed” infrastructure costs including utilities, insurance, leases, inventoried equipment, in addition to station office expenses. 7. Operations and Supplies includes “variable” expenses related to station use, such as food, linens, non-inventoried equipment, physical plant and vehicle maintenance.

b. EXPENDITURES	
1. Academic pers. (sub 0)	\$154,001
2. Grad. Fellows/TAs	8,040
3. Station Staff (sub 1 & 2)	381,273
4. Campus Staff (sub 1 & 2)	53,998
5. Benefits (sub 6)	82,249
6. Utilities, equip, & improvements	157,203
7. Operations & supplies	125,181
TOTAL	\$961,935

This budget left a balance of \$4,059. For 1998/99 a deficit is projected to finish the construction at the Crooked Creek facilities and it will be covered by opportunity funds obtained for these improvements. However, the costs of this development exceeded the original budget set by the previous administration and we may have to deplete the \$100,000 contingency fund to finish construction in the 1998/99 fiscal year. This contingency fund has been viewed as essential for the safe and continuous operation of WMRS facilities, given the remote and hostile nature of the high altitude mountain environment.

10. SPACE

The WMRS office at UCSD (11.1 m²) is provided by the Dept. of Medicine in the Medical Teaching Facility. The Station's main facilities are located near Bishop, CA on land leased from the Los Angeles Dept. of Water and Power, or used under a special use permit from the U.S. Forest Service. The Station consists of 4 facilities located over a 3,100 m (>10,000 foot) vertical transect from the floor of the Owens Valley to the summit of White Mountain.

Owens Valley Facility (1,235 m): Owens Valley facility consists of a 230 m² office-kitchen-dining building and 2 classrooms (80 and 87 m²). A 116 m² machine/vehicle shop is housed in what was once a helicopter hanger. Three dormitories and 7 trailers provide the bulk of the living quarters and bathroom facilities (393 m²) for approximately 60 persons. One long-term research residence suitable for a family is also on site. Camping areas are available in overflow times (May-September). Open storage and storage units account for another 269 m² of space. Kitchen facilities for large groups are separated from a small kitchen set aside for individual users of the Station. **The Manis Laboratory** is divided into two rooms and has an attached animal facility (22 m²). The main room currently has 11 m of wetbench space, propane gas and vacuum, plumbing for compressed gases, microscopes, dissecting microscopes, chemical reagents, balances, glassware, spectrophotometer, and drying ovens. The other room in the Manis laboratory is currently occupied by Dr. Joe Szewczak for respiratory physiology research. This includes respiratory physiology equipment to measure ventilation, metabolism, and blood gases in small animals; physiological recorders and computers for A-D data collection and analysis. **The GIS Laboratory** consists of 5 client PC workstations, a high-end Internet-GIS server, and 2 internet linked Macintosh computers, laser printers, a color scanner, digitizer, and plotter. Software packages allow for complete GIS capability to provide GIS maps and query capabilities through a USGS/SDI clearinghouse web site. Remote Sensing Applications are supported by Erdas Imagine software. **The Herbarium and Library** are housed in a trailer (37 m²). The library includes approximately 800 scientific books and another 700 scientific research articles. Over 1,200 more specimens are contained in the Bishop herbarium. **The Deepest Valley Native Plant Propagation Center** is a collaborative project with the University of California, Bureau of Land Management, US Forest Service and the Los Angeles Department of Water and Power includes a greenhouse and shadehouse for native seed propagation. This facility allows researchers to germinate and propagate native plant under controlled conditions.

Crooked Creek Facility (3,094 m altitude): The renovated Crooked Creek facility consists of housing for approximately 60 researchers and students in the two-story Clarence A. Hall Jr., Lodge and four smaller cabins. Each cabin has two rooms and a bathroom, and can sleep 8 people. Two cabins have kitchenettes, and are suitable for use by long-term researchers with

families. The Lodge consists of a dormitory and an adjoining common facility that has a kitchen, dining and assembly room, large meeting room and housing for staff and several researchers. Partially covered outdoor patio/decking provides an additional 279 m² of space. The existing original structures (kitchen, dining, two bedrooms, and two baths) were converted into a new research laboratory (121 m²) separated into three rooms for research, teaching and animal housing. Furthermore, researchers have access to a fully equipped shop (90 m²). Fully automated weather data acquisition equipment is located at this facility. Foundations are in place and logs have already been purchased for the construction of two more cabins when there is sufficient user demand.

Barcroft Facility (3,801 m altitude): The Barcroft facility consists of main laboratory building (Nello Pace Laboratory) is a two story Quonset hut (1300 m²) that contains living quarters (for approximately 50 researchers), kitchen, shop, dining area, storage area, an office and three laboratories and includes a room in which the oxygen environment can be controlled to simulate altitudes from 3,000-5,500 m. Other buildings include a remodeled animal building (44 m²), a separate laboratory (36 m²), and two cement block/Quonset buildings (total of 62 m²) used for storage and garages. Fully automated weather data acquisition equipment is located at this facility also.

Summit Facility (4343 m altitude): This 42 m² laboratory consists of living quarters for four and a small laboratory area. The living quarters are stocked and maintained at all times. It is supplied by the Barcroft Facility, 8 km to the south and powered by generators or solar power as necessary.