

2000 WMRS ANNUAL REPORT

The 2000 annual report for the White Mountain Research Station (WMRS) MRU covers fiscal year 1999/2000. However as in previous reports, data related to station use is reported for the 2000 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, this is submitted by the Chair of the Advisory Committee to (1) the President, *via* the Provost and Senior Vice-President for Academic Affairs, and (2) the Vice Chancellor for Research with copies to the Chancellor on the Director's home campus.

1. SUMMARY OF MAJOR ACTIVITIES IN

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. The notable features of these data for last year are:

| <u>Summary of Usage for Calendar Year</u> | 2000 | 1999 |
|--|---------------------|----------------------|
| Number of users | 4,007 | 2,097 |
| Number of user nights, all sites | 7,544 | 8,832 |
| Number of institutions represented | 87 | 79 |
| Research user nights | 2,824 (37%) | 2,589 |
| Education user nights | 3,421 (45%) | 5,193 |
| Other user nights | 1,299 (17%) | 1,050 |
| Total User Nights | 7,544 | 8,332 |
| UC User Nights | 4,238 (56%) | 3,524 |
| Non UC User Nights | 3,306 (44%) | 5,308 |
| Owens Valley Laboratory user nights | 5,584 (74%) | 5,869 |
| Crooked Creek user nights | 1,327 (18%) | 2,126 |
| Barcroft user nights | 633 (8%) | 837 |
| Campus most represented: | UCD (1,337) | UCSD (1,569) |
| Discipline most represented: | Bio. (3,205) | Earth (4,038) |

- Increases in absolute numbers of research users and users from the University of California compared to 1999.
- A decrease in total number of users compared to 1999. This difference is explained mainly by the University of North Carolina Geology Supercourse that was held at WMRS Fall 1999 but was not repeated in 2000.

b. WMRS Research Programs. WMRS scientists submitted 14 proposals in 2000 and 7 received external funding. Funded proposals for this year included:

1. **Comparative Demography of Selected Mountain Sheep Populations in High Mountains and the Mojave Desert of California** (California Department of Fish and Game (\$583,041 1/00-12/02), J.Wehausen, PI and R. Ramey, Co-PI). Wehausen is in the third decade of 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 uses molecular genetics and fieldwork to test basic theoretical models of ungulate population dynamics that serve as the foundation for wildlife conservation approaches.
2. **Context-Dependent Constraints of Sagebrush-Herb Dynamics** (NSF grant, \$145,370 4/99-12/01, Eric Berlow, PI). Like many other areas of the western United States, large montane meadows in the eastern Sierra Nevada of California have changed dramatically in their vegetative cover since the introduction of livestock grazing earlier this century. The most obvious changes include large-scale expansion of sagebrush, reduction in cover of herbaceous species, and an apparent aridification of these habitats. Currently there is great interest in restoring these meadows to a condition where herbaceous species are dominant, yet little is known about the processes governing the interaction of sagebrush and herbaceous species in these sites, or about the role of temporal and spatial heterogeneity in influencing species interactions and vegetation change. The large montane meadows of the Golden Trout Wilderness in the southern Sierra Nevada are an ideal system to explore what regulates context-dependency in the dynamics of sagebrush-herb interactions because: (1) several large cattle enclosures exist in four different meadows within the regions, (2) variability in the patterns of shrub expansion and herb recovery occurs over relatively small scales that are experimentally tractable, 3) a series of at least 15 geologically similar meadow exist within this large plateau, and 4) meadow restoration plans are in their initial stages of development and ecological information and a conceptual framework for understanding constraints on restoration are badly needed. Using a combination of experimental and observational studies, this research addresses the following questions: (1) Within the mesic terraces, where patches of shrubs and herbs vary across constant water table depth, what factors control vegetation patterns and dynamics? (2) If restoration efforts increase water availability in xeric terraces, will other processes characteristic of mesic terraces inhibit the recovery of herbaceous species? (3) How do the patterns of meadow terracing vary within and among meadows and over time? We will focus on testing hypotheses about the role of current vegetation in inhibiting establishment of species that could otherwise exist in these patches and the roles of spatial variation in soils and temporal variation in water availability in determining the outcome of species interactions. This potential variability in sagebrush-herb interactions is typical of the challenges faced by many restoration efforts in systems so it also addresses the more widespread problem of tailoring general ecological theory to site-specific management issues.
3. **The Forest Health Monitoring/Forest Inventory and Analysis Programs** (USFS Coop Agreement, \$77,361, S.M. Szewczak, PI). FHM/FIA is a interagency-university research

team charged with assessing the condition and trends of the nation's forest resources. The program is comprehensive in scale, using a nationwide, intensive assessment grid including thousands of plots and covering every forested ecosystem in the country. FHM/FIA currently works in 32 states (including California) and is slated by Congress for expansion into all remaining states over the next three years. The program includes such indicators as lichen communities, foliar damage, ozone, soils, and crown mensuration/transparency, and involves a collaboration of approximately 20 research institutions and several agencies. FIA's current annual budget for these indicators is approximately \$2 million, with matching funds from other agencies and universities for several million in addition. Epiphytic lichen communities have been chosen as a core indicator of the program because they directly address such key assessment questions as air quality trends, effects of air quality on biodiversity, long-term climate change, and sustainability of forest resources. Lichen communities provide not only a measure of air pollution impacts upon lichens, but also on aspects of forest health that are difficult to measure directly (*e.g.* forage for numerous mammals, habitat for arthropods, and nitrogen fixation).

The Lichen Indicator's research plan for the coming year includes a mixture of modeling and assessment activities including: (1) Production of air quality and climate gradient models for the Pacific Northwest, (2) a special study of air quality bioeffects downwind of two large-scale coal-fired power plants near Craig, Colorado is nearing release, (3) establishment of physical/chemical monitoring-to-lichen communities model using the National Acid Deposition Program's national plot network, (4) detection monitoring operations in Washington, Oregon, California, Arizona, Idaho and Colorado. Future research priorities include (1) development of lichen community air/climate gradient models for remaining floristic regions, (2) development of gradient models to assess forest management issues such harvest levels, levels of spatial and age class heterogeneity, patch dynamics, and relationship of assessment grid to structurally-chosen "reference stands" and (3) collaboration with geospatial modeling groups (*e.g.*, UCSB) to link lichen indicator findings to large-scale data sets. (see <http://www.wmrs.edu/lichen>)

- 4. Don't Duck Metadata** (USGS, \$8,200, S.M. Szewczak, PI and James Quinn (UC Davis Information Center for the Environment, co-PI). When the Eastern Sierra Geospatial Data Clearinghouse (ESGDC) was established as a node of the National Geospatial Data Clearinghouse in 1998, WMRS showed that interns from the natural resource internship program could efficiently create FGDC-compliant metadata. New funding supports (1) summer interns to develop 25 metadata datasets in collaboration with UC Davis ICE and (2) the WMRS Data Manager to index metadata to conform to the standards of the Z39.50 protocol for the National Geospatial Data Clearinghouse. Metadata to be created in this project will allow the Eastern Sierra Geospatial Data Clearinghouse to expand its holdings to become an ecoregional node for the western Great Basin. Metadata to be created pertain to both biological as well as geophysical data. In 1999, the ESGDC was registered as a node of the NBII Metadata Clearinghouse. The project will thus enlarge the holdings of both the National Geospatial Data Clearinghouse as well as the NBII Metadata Clearinghouse and create 1 target datasets regarding invasive species. ICE is developing a proposal to the NBII and NSF to improve Federal information facilities in California and create an NBII thematic node to focus on invasive species. This issue will be used as a test case for the development of improved ecological data management systems as part of national and international

initiative. Metadata to be developed in our Don't Duck Metadata proposal will support these much broader-scale efforts.

5. **Major Laboratory and Telecommunications Improvements for WMRS** (NSF Field Stations and Marine Laboratory Improvements, \$99,670, F.L. Powell, PI). This is a revised proposal from White Mountain Research Station (WMRS) to (1) improve laboratory resources for modern biological research and (2) establish voice and data telecommunications links between its high altitude laboratories and the rest of the world. WMRS is uniquely poised on the western edge of the Great Basin with four laboratories spanning an elevation transect that exceeds 3100 m in just 20 kilometers. WMRS lies in the heart of a region possessing rich topographic and biologic diversity with an area that is larger than the state of Connecticut and is accessible to research because 97% of this land is publicly owned. Although use of WMRS has increased dramatically over the last decade, the basic laboratory and communication capabilities have changed little the 1960's. We will make two major improvements to provide the essential tools for WMRS to make important contributions to field biology in the new century: (1) Develop a modern biology laboratory at the Owens Valley Laboratories (at 1,235m above sea level), which operate year-round as the Station headquarters in Bishop, CA. This involves improving the existing Manis Laboratory and installing a new modular laboratory. This is not intended to duplicate facilities at an investigator's home campus. Rather, the objective is to provide the essential tools for conducting field research and stabilizing biological samples for transport to a campus-based laboratory for analysis with more specialized instrumentation. (2) Establish telecommunication links between the high altitude laboratories (Barcroft at 3,801m and Crooked Creek at 3,094m) and the Owens Valley Laboratories (1,235m) where there is a dedicated connection to the internet. The proposed system will (a) provide a transparent extension of the Owens Valley Laboratories local area network to Barcroft and Crooked Creek using a combination of wireless and cable data transmission, and (b) provide internet and telephone connectivity between the high altitude laboratories and the outside world.
6. **Cooperative Agreement Data Collection for Ecological Assessment of Wilderness Plan** (USGS, \$23,810K, E. Berlow, PI; S.M. Szewczak, Co-PI). The U.S. Forest Service (USFS) is in the process of developing a new management plan for areas designated as Wilderness in the Inyo National Forest (INF). To date there have been few restrictions on recreational use within the Wilderness other than trailhead quotas, domestic pet restraint or prohibition, pack animal access and restraint, campfire prohibition, local confinement to trails, and regulation of campsite proximity to water bodies. The current management plan proposes different zoning alternatives to regulate the number of visitors in different areas of the Wilderness. An important goal of the new plan is to balance the recreational and aesthetic needs of human visitors with the need to protect the forest's floral and fauna. Yet there are major uncertainties in the ecological and economic impacts of potential changes in the plan. This project integrates ecological, social, and economic concerns to facilitate the development of a new plan, and to use adaptive management in the new plan in response to temporal changes in environmental and social conditions. Since this approach is flexible, it can also be easily tailored to management of other systems. Specific objectives are to (1) facilitate public commentary of the plans, and (2) compare the USFS studies of visitor values deduced from current patterns of use with actual visitor priorities. The public will be able to make comments on the plans by accessing GIS information on a web site and clicking on a spot

and attaching, in effect, an electronic 'post-it' note. To further define public opinions and values, we will develop a presurvey process for public values. Together, this feedback will allow us to assess better the degree to which current zoning plans actually satisfy the visitor needs; which, are independent of the ecological protections that need to be incorporated in the zoning.

7. **Acid-Base State of Small Mammals** (NSF SGER 7/00-6/01, \$61,896, J.M. Szewczak, PI) A fundamental principle of physiology is that organ systems function to defend the internal environment that bathes all cells and much of physiological regulation is dedicated toward maintaining the cellular acid-base state within a stringent tolerance. Warm-blooded animals are known to maintain this acid-base environment at pH 7.4, as measured from arterial blood. However, recent results in Dr. Szewczak's laboratory indicate that mammals less than 50 g regulate their arterial pH at 7.3 and less. This represents a significant departure from what we consider to be the mammalian norm, and is of particular interest because the earliest known mammals from the Triassic Period are estimated to have weighed 20-30 grams. Dr. Szewczak will measure the acid-base state in a variety of mammals as small as 7 grams to begin investigating whether this is a general adaptive strategy of mammals at this scale

We also received funding from the University of California Multicampus Research Incentive Fund (MRIF) for a "**Program to Study Adaptation to hypoxia Using Animal Models at WMRS**" (\$19,891 July 2000-June 2001, F.L. Powell, PI). This program was a follow-up to an NSF sponsored symposium organized by WMRS at the 1999 Society for Integrative and Comparative Biology meetings in 1999, titled "Phenotypic and Genotypic Strategies to Chronic Hypoxia" and a workshop sponsored at WMRS in 1999. A scientific theme was identified for pursuit of external funding, namely determining mechanisms of genotypic and phenotypic responses to chronic hypoxia with human and animal studies. Participants include faculty from four UC campuses and Johns Hopkins University. WMRS will provide a central focal point for these studies through its physical resources (e.g. high altitude laboratories, computer support for on-line preparation of collaborative grants) and administrative support (e.g. contract and grant preparation).

c. WMRS Educational Programs:

1. **UC Intercampus Supercourse in Environmental Biology.** In Spring 2000, 10 students from UCD, UCI and UCSD enrolled in the WMRS Environmental Biology Supercourse and were in residence at WMRS for the 10 week quarter. Faculty teaching in the Supercourse were from UCI, UCSD and local and government and scientific agencies. Prof. Peter Bowler (UCI) was the resident Course Coordinator and completed several research projects (for posters at national meetings or publications in preparation) with some students as part of their independent research.
(see <http://www.wmrs.edu/supercourse/2000yearbook/2000yearbook.htm>)
2. **UC Summer Symposium in Conservation Biology** for graduate students was held for the second time August 13-18, 2000 at the Crooked Creek facilities. Over 50 people participated in the symposium, including UC faculty, graduate students from all eight non-medical UC campuses, government (USDA, CDF&G) and non-profit agencies (Wilderness Society, Sierra Nevada Bighorn Foundation, California Native Plant Society) and the press (Sacramento Bee). The evaluations collected from participants indicates it was very successful and the most common benefit (90%) was meeting other UC students, faculty or

staff who may be valuable contacts in future research or conservation activities. The symposium will be held a third time in 2001 to complete the current funding cycle for the program (**Graduate Course Modules and Research Proposal Workshops at the WMRS Eastern Sierra Institute**; UCOP, \$29,598 per year, 1998-2001, F.L. Powell and C.O. Qualset, Genetics Resource Conservation Program, co-PI's). The activity will be evaluated at the 2001 annual meeting of the Conservation Biology Workgroup to decide on future plans.

3. **Fluvial Geomorphology: Principles and Applications** was an advanced short course offered by M. Kondolf (UCB) September 25-29, 2000 at WMRS, also as part of the continuing funding for the Eastern Sierra Institute (**Graduate Course Modules and Research Proposal Workshops at the WMRS Eastern Sierra Institute**; UCOP, \$29,598 per year, 1998-2001, F.L. Powell and C.O. Qualset, Genetics Resource Conservation Program, co-PI's). The workshop was organized around classroom discussion, current research techniques using data from local monitoring stations, and hands-on field experiences for riverine restoration. With the success of the 2000 program, Dr. Kondolf will be offering the course again in fall of 2001.
4. **WMRS Undergraduate Internship Program.** There were 19 undergraduate and 4 high school participants in the 2000 program. This year we introduced new technology to the IRT program with generous funding from the Berger Foundation. This included the interface between satellite orientation with Global Positioning Systems (GPS) and computer-aided mapping with Geographical Information Systems (GIS) and web publishing using Photoshop to manipulate images, and Front Page to build the web sites. As a result, the students each developed web pages that incorporated this new technology in addition to the standard published reports. This process was extremely successful and results in some great web pages (see <http://www.wmrs.edu/interns-2000/>). The Interns completed 12 projects:
 - Research on Sagebrush Invasion, Eric Berlow, UCB
 - Relationship of Vegetation to Maternal Bat Roosts, Joe Szewczak, WMRS
 - Riparian Songbird and Vegetation Monitoring, Sacha Heath, PRBO
 - Sensitive Plant Monitoring on the Kern Plateau, Kathleen Nelson and Sue Weis, USFS
 - ??XX of *Marmota flaviventris* ??, Elizabeth Stallman, Ph.D. candidate, UM
 - Use of Biological Water Quality Monitoring Criteria for Mono Lake, David Herbst, UCSB/SNARL
 - Identification of Bats Using Sonobat, Joe Szewczak, WMRS
 - Nearest Neighbor Analysis of Alpine Plants on Rock Substrates, Elizabeth Wenk, Ph.D. candidate, UCB
 - Mountain Yellow-Legged Frog Habitat Rehabilitation in Big Pine Basin, Phil Kiddoo, DFG
 - Stream Ecosystem Educational Outreach at the Paiute Instructional Center, Susan Szewczak, WMRS

- Monitoring Effects of Dams on Fish Populations in Rush and Lee Vining Creeks, Don Sada, UNR.
- Examination of the Adaptive Significance of Genetic Variation in Natural Populations of Montane Leaf Beetles, Nathan Rank, CSU Sonoma, Elizabeth Dalhoff, Santa Clara College

5. Advanced Internships. We completed 11 Advanced Student Internships in summer 2000. We expanded the number of projects from last year to evaluate the effects of an increased number of research projects on the Internship. In addition to the Berger Foundation and resource agency funding, we are developing a proposal for the DOE Learning Anywhere, Anytime program to provide further funding for the technological component of the Internship for 2002. Proposals have been submitted for other advanced interns in collaboration with USFS, BLM, CDFG, and USGS.

- Collaborative Weed Outreach and Control Project, Brian Cashore, ICWD
- Determination of Reference Genealogy of Big Horn Sheep, John Wehausen, WMRS
- Ancient Bristlecone Pine Forest Interpretation, John Louth, USFS
- Eastern Sierra Native Seed Assessment and Test Garden Project, Anne Halford, BLM
- Mapping Uncertainty in Wilderness Management. Eric Berlow, UCB; Richard Bernknopf, and Angela Jayko, USGS
- Invasive Weeds in Mineral Material Sites, Anne Halford, BLM
- Investigation into Small Mammal Acid/Base Regulation, Joe Szewczak, WMRS
- Biological Monitoring of Springs in the Owens Valley, Don Sada, UNR
- Impacts of Cattle Grazing on Archaeological Sites in the Eastern Sierra, Kirk Halford, BLM

d. WMRS Outreach Programs

1. 2000 WMRS Public Lecture Series. The WMRS lecture Series is a quarter-long series of public lectures at the Owens Valley Facility 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 new “Friends of WMRS” organization hosted many of the talks. They also invited some local citizens to dinner with speakers at the station before the lectures.

- February 10 – Ray Gray, “Recent Volcanism Along the Eastern Sierra”
- February 24 – Dr. Angela Jayco, “Topography, Mountain Belts, and Plate Tectonics”
- March 2 – Dr. Don Sada, “Death Valley Pupfish”
- March 16 – LeRoy Johnson, “The Trunk is Bunk”
- March 30 – Dr. Tony Phillips, “An Historic Alignment of the Planets in May”
- April 13 – Dr. Aaron Steinward (Inyo County Water Dept.), “Owens Valley Soils, the Earth Beneath Your Feet.”

- April 27 – Dr. Bob Harrington (Inyo County Water Dept.), “Owens Valley Hydrogeology, Hydrology, and Water Resources”
 - May 11 – Doug Powell, Slides of the geography and beauties of our mountains
 - June 1 – Hal Kleiforth (Desert Research Institute, UN), “A Half-Century Exploring Atmospheric Events, Climatic Features, and Varied Landscapes of the Inyo-Mono Region”
2. **The Eastern Sierra Geological Society (ESGS) Academic Lecture Series.** Clem Nelson (Emeritus Professor, UCLA), working with a group of local geologists in Bishop, developed a new academic geological organization known as the Eastern Sierra Geological Society (ESGS). They have held a series of academic talks and field trips. Further information is available from the ESGS membership coordinator, Paul Hancock (pack@QNET.COM). In addition to their academic talks, ESGS will be organizing several public lectures in geology for the Winter and Fall to further support WMRS outreach into the local community.
 3. **The Eastern Sierra Education Forum.** The Education Forum was originally developed in 1994 by Elizabeth Phillips, then office manager at WMRS and Susan Szewczak, current Academic Coordinator to provide a link between the academic and research community of WMRS and the local k-12 educational community. The original mission statement adopted in 1994 states that "The Education Forum, facilitated by University of California, White Mountain Research Station, brings together teachers, post-secondary faculty, administrators, parents, governmental agency personnel and other interested individual in an effort to pool and share resources, facilities and expertise. By fostering communication and support, the Education Forum seeks to build consortiums which empower all potential participants, in order to develop creative and cost-effective ways to meet the wide variety of needs of the students in the rural communities of the Eastern Sierra."

In 2000, the Education Forum has begun to explore how to connect the vast resources of the Eastern Sierra into a nationally recognized outdoor science education program. WMRS has been facilitating collaboration with other UC organizations, including the UC, Office of the President MESA and MSTAR programs as well as UC Merced and its flagship research unit, the Sierra Nevada Research Institute. The goal is to share resources and experience in the development of K-12 outdoor science education programs that can link students from both the east and west sides of the Sierra Nevada to the wonder of these mountains as they improve their understanding of math, science, and technology. In collaboration with the UCOP MESA program, WMRS has submitted a Rural Systemic Initiative Proposal to NSF for funding of teacher development regarding science and math education for k-8 students who traditionally are underrepresented in the math and science professions. In addition, the Education Forum is developing a pilot Scientist-in-the-Classroom/Students-in-the-Field Program. This program will draw on the needs of the local k-12 educational districts, research resources of WMRS, and volunteer support groups in the Bishop Paiute Tribe, the Senior Center, and the Friends of WMRS. The Berger Foundation and the Eastern Sierra Institute for Collaborative Education are funding a pilot project for Spring of 2001.

Participating organizations in the Education Forum are Bishop Elementary, Bishop High School, Big Pine, Independence, and Round Valley School Districts, Inyo County Office of Education, UC WMRS, Cal Tech Owens Valley Radio Observatory, Cerro Coso Community

College, Bishop Paiute Tribe, Inyo-Mono Senior Association, Inyo County Library, Inyo County Head Start Program, US Forest Service, Bureau and Land Management, California Department of Fish and Game, Friends of White Mountain Research Station.

- 4. Friends of White Mountain Research Station.** The Friends of White Mountain is officially recognized as a Campus Support Group at UCSD. The purposes of this organization are (1) to help the station enhance its community outreach activities and (2) provide support to WMRS rural community education needs programs. Activities include annual open house, lecture series, adult-education workshops, teacher training, K-12 activities, and other interpretive activities for general public. Significant activities in 2000 included hosting over 500 visitors at the annual WMRS Open House over Labor Day weekend.

d. WMRS Laboratory Activity:

- 1. Manis Laboratory.** The Manis Laboratory is being upgraded for modern molecular biology. This is part of a laboratory modernization program for which we are receiving NSF support. Equipment upgrades for 2000 included a Barnstead water purification system this fall, a new microwave for gel preparation, and a class 100 clean hood. Much of this equipment was made possible by Dr. John Wehausen's contract with California Department of fish and game to study the genetics of the Sierra Bighorn Sheep. This equipment has also been critical for research by Profs. Elizabeth Dalhoff (Santa Clara College) and Nathan Rank (CSU Humboldt). Their current studies build on data collected on predator-prey interactions between willow beetles and host plants with chemical defenses by Dr. John Smiley (UCSC) at WMRS in the 1980s. The data are showing molecular mechanisms of evolution to drought in the late 1980s and subsequent recovery that isolated different populations of the willow beetles in the eastern Sierra Nevadas.
- 2. Geographical Information System/ Computer Labs.** Use of the computer/GIS lab increased again in 2000. Activities in 2000 included
 - Adding query capabilities to the databases for publications and weather on the WMRS website.
 - Working with UC Davis summer geology class to set up its own local area network and provide internet access through WMRS' frame relay connection. This effectively doubled the WMRS computing facility and allowed the large group of Davis students to have computer and internet access during the peak summer usage period without impacting other users
 - Acquisition of high-resolution digital orthophoto quads for most of the Eastern Sierra. These images will be of interest to virtually every researcher doing fieldwork in the Whites and Inyo Mountains, Owens Valley, and central Sierra Nevada.
 - Installation of ArcIMS interactive web-based GIS that gives many GIS capabilities to web-clients through their web-browsers. We implemented a prototype project for the Inyo National Forest using maps of its proposed wilderness management plan.
 - **Researcher Support and data assistance**_for researchers, faculty and students from Great Basin Unified Air Pollution Control District, SNARL, Inyo County Water Department, BLM, Inyo National Forest, Mono County Collaborative Planning Team,USGS, National Park Service, CSU Sonoma, UC Berkeley, UC Davis, UC Santa

Barbara , Evergreen State, University of North Carolina, Rancho Santa Anna, Brown University, DRI, Arizona Department of Environmental Quality.

- **Instruction** for WMRS Environmental Biology Supercourse, WMRS Internship Program
 - **Websites.** Developed SW Great Basin website (in collaboration with Connie Millar) and supported development of Forest Health Monitoring website (Peter and Linda XX)
3. **Deepest Valley Native Plant Propagation Center.** Deepest Valley Native Plant Propagation Center. On-going research included the Eastern Sierra Native Seed Zone Project (S. Szewczak, PI) to determine the amount of ecotypic variation in native perennial bunch grass species and facilitate the development of seed collection zones for on-going and future revegetation projects. Preliminary results should be available by summer of 2001. Fish Slough milk-vetch (*Astragalus lentiginosus var. piscinensis*) a federally threatened species, is being propagated as part of cooperative study between the U.S. Fish and Wildlife Service, the University of Montana, Missoula, MT (P.I's. Kevin Murray and Anna Sala), the BLM, Bishop Field Office, California Native Plant Society and WMRS. The study focuses on the ecophysiological effects of flooding on plant survivorship specifically, how soil inundation affects the establishment of mycorrhizal and Rhizobium symbionts on plant physiological performance and is scheduled to finish in 2002. Finally, from 1999 to 2000 the Deepest Valley Cooperative Native Plant Propagation Center has been used to propagate over 50 different species of eastern Sierra native plants grown that have not been grown in a horticultural setting before. Information on germination treatments and cultivation are being recorded in a database to track successes and failures as well as to add to the broader understanding of Mojave, Sierran and Great Basin native plant propagation. The Bristlecone Chapter of the California Native Plant Society grew approximately 1200 of these plants for their successful native plant sale and Inyo National Forest grew plants for revegetation projects.

2. ADVISORY COMMITTEE

A new representative from UC Santa Cruz was added this year. Previously, John Smiley represented the UCSC campus and the Natural Reserve System on the Advisory Committee.

- Robert S. Anderson, Department of Earth Sciences, UC, Santa
- Phillip E. Bickler, Department of Anesthesiology, UC San Francisco, **Committee Chair**
- Diane Campbell, Department of Ecology and Evolutionary Biology, UC Irvine
- Mary Droser, Department of Biology, UC Riverside
- Gary Ernst, Member-at-large, Department Geological & Environmental. Science, Stanford University
- Joshua Kohn, Department of Biology, UC San Diego
- Mathias Kondolf, Department of Environmental Planning, UC Berkeley
- James McClain, Geology, UC Davis
- Kenneth A. Nagy, Organismic Biology, Ecology and Evolution, UC Los Angeles
- Edwin P. (Phil) Pister, Member-at-large, Calif. Dept. of Fish and Game, Emeritus

- O. J. Reichman, NCEAS/Dept. of Ecology, Evolution & Marine Biology, UC Santa Barbara
- John Smiley, Landells Hill Big Creek Reserve
- Steven J. Wickler, Member at large, Dept. of Animal & Veterinary Science, Cal Poly Pomona.
- *ex officio* Cathy Magowan, Science and Technology Research Coordinator, UCOP
- *ex officio* Carol McClain, Director, Multicampus Research Planning & Programs, UCOP
- *ex officio* Frank L. Powell, Director, WMRS

3. ACTIVE WMRS FACULTY MEMBERS

a. U.C. Faculty. In 1999/00, four faculty from three UC campuses received WMRS support:

1. Peter A. Bowler, Assoc. Adj. Prof. of Ecology & Evolutionary Biology, Course Coordinator for 2000 Environmental Biology Supercourse.
2. Arthur C. Gibson, Prof. of Biology, UCLA - WMRS Research Scientist.
3. Philip W. Rundel, Prof. of Biology, UCLA, - WMRS Research Scientist.
4. Frank L. Powell, Prof. of Medicine, UCSD - WMRS Director.

b. U.C. Professional Researchers:

In 2000, five professional researchers were based at the station:

1. Eric L. Berlow, Ph.D. – WMRS Assistant Research Scientist
2. Joseph M. Szewczak, Ph.D. - WMRS Assistant Research Physiologist
3. Susan M. Szewczak, Ph.D. - WMRS Academic Coordinator
4. Rob R. Ramey, Ph.D. – WMRS Assistant Project Scientist
5. John D. Wehausen, Ph.D. - WMRS Associate Research Scientist

In addition, appointment papers for two more WMRS researchers were begun pending external funding for their salaries:

1. Michael Morrison, Ph.D. Associate Research Scientist, pending USN funding 3/1/01.
2. Jeff Holmquist, Ph.D. Associate Research Scientist, pending Yosemite funding 3/1/01.

c. Visiting Reserachers:

1. Angela Jayko, Ph.D. (USGS) maintained her field station office at WMRS in 2000

4. GRADUATE STUDENTS AND POSTDOCTORAL RESEARCHERS

a. Postdoctoral trainees. Nancy Aguilar, Ph.D. received a NSF Postdoctoral Research Fellowship with Professor James Hicks from UCI and Frank Powell as co-mentors. Her primary appointment is in WMRS to study the effects of hypoxia on gene expression in fishes adapted to

different patterns of environmental hypoxia. She is working on physiological studies at UCI and molecular regulatory studies at WMRS.

b. WMRS graduate student Fellowships. Graduate student research proposals were reviewed by the Advisory Committee. In 2000, sixteen awards were made for a total of \$22,674. \$ 5,219 was given as a cash award for travel and \$ 17,455 was given as credit vouchers for room and board at the station

The Committee awarded support to the following applicants:

- **Karrin Alstad, Northern Arizona University**, \$2,000, "Water use assesment of riparian woody species relative to a altered instream flow regime. Part I: Historic water-use patterns of Populua species relative to instream flow pattens using tree ring isotopic indicators. Part II: Seasonal water use patterns of five riparian woody species along a diverted and a non-diverted reach.", (Dr. Stephen C. Hart -Advisor).
- **Steven Bacon, Humboldt State**, \$605, "Latest Quaternary Owens Valley pluvial lake stratigraphy and Paleoseismic Investigations on the Owens Valley Fault Zone near Lone Pine, California: Paleo-climate implications, seismogenic behavior, and fault mechanics.", (Dr. Bud Burke, Dr. Silvio Pezzopane, Dr. John Longshore - Advisor).
- **Andrew Elmore, Brown University**, \$1,370, "Semi-arid plant community response to drought and land-use at the regional scale", (Dr. John F. Mustard-Advisor).
- **Dave Grow, University of Arizona**, \$450, "Site selection analysis of long Bristlecone Pine chronologies"(Dr. Tom Swetnam-Advisor)
- **Catherine Kleier, UCLA**, \$1,860, "Determination of plant morphology in *Chrysothamus viscidiflorus* ssp. *viscidiflorus*: population level adaptation or phylogenetic carryover.", (Dr. Phil Rundel - Advisor).
- **Brendan Larson, UC Riverside**, \$1,650 "Pollination syndromes vs. habitat preferences as isolating mechanisms in *Aquilegia*" (Dr. Scott Hodges - Advisor).
- **Alan Levy, UCLA**, \$1,000 "Cosmology Measurements at WMRS - Measuring the Polarization and Anisotropy of the CMB" (Dr. Phil Lubin - Advisor)
- **Erin Lutrick, UC Berkeley**, \$850, "A comparison of pre-diversion and post-diversion geomorphology of vegetation in the Owens River Gorge", (Dr. G. Mathias Kondolf - Advisor).
- **Rosemarie McKeon, UC San Diego**, \$2,000, "Computer curricular framework for supporting WMRS internship programs", (Dr. Fred Lonidier -Advisor).
- **Karen Michelsen, Virginia Tech**, \$2,000, "Internal structure and emplacement of the Mount Barcroft Pluton, White Mountains, California", (Dr. R.D. Law - Advisor).
- **Gary Neargarder, Sonoma State University**, \$1,325, "Thermal tolerance of a montane leaf beetle (*Chrysomela aeneicollis*)", (Dr. Nathan Rank - Advisor).
- **Shane Parendras, UCLA**, \$1,000 "Cosmology Measurements at WMRS - Measuring the Polarization and Anisotropy of the CMB" (Dr. Phil Lubin - Advisor)
- **Elizabeth Stallman, University of Michigan**, \$3,195, "Ecological causes and reproductive consequences of female-female competition in yellow-bellied marmots", (Dr. Warren G. Holmes - Advisor).
- **Ryan Taylor, University of North Carolina**, \$1,080, "May Lake interpluton screen and its bearing on pluton emplacement", (Dr. Allen Glazner - Advisor).

- **Christopher Van de Ven, Stanford University, \$935**, "The White-Inyo Mountains, Eastern California: influence of bedrock and altitude on soil development and botanical cover", (Dr. W.G. Ernst - Advisor).
- **Elizabeth Wenk, UC Berkeley, \$1,354**, "The functional ecology and evolutionary origin of nutrient and water uptake mechanisms in the alpine flora of the Sierra Nevada and the White Mountains, California.", (Dr. Todd Dawson - Advisor).

5. STUDENT AND FACULTY PARTICIPATION FROM OTHER CAMPUSES OR UNIVERSITIES

In 2000, WMRS hosted 7544 “user nights” at all sites, including 4,238 from the University of California and 3,306 from other institutions. 87 different institutions used WMRS in 2000. The actual numbers of user nights from outside the University of California decreased in 2000, from an all-time high of 5,308 in 1999. As explained earlier, this is largely a function of the University of North Carolina not repeating their Geology Supercourse in the Fall of 2000 so the number of non-UC users in 2000 equaled the average number of users from 1995 through 1998.

User nights by institution

| | 1995 | 1996 | 1997 | 1998 | 1999 | 2000 |
|---------------|-------------|-------------|-------------|-------------|-------------|-------------|
| UC | 24% | 25% | 47% | 52% | 40% | 56% |
| non-UC | 76% | 75% | 53% | 48% | 60% | 44% |

There were 24 classes, field trips, symposia and workshops from institutions other than the University of California, compared to 11 from UCD, UCLA, UCR, UCSB and UCSD, 6 extension classes from UCB, UCI, UCLA, UCR, and UCSC and 6 WMRS sponsored programs.

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

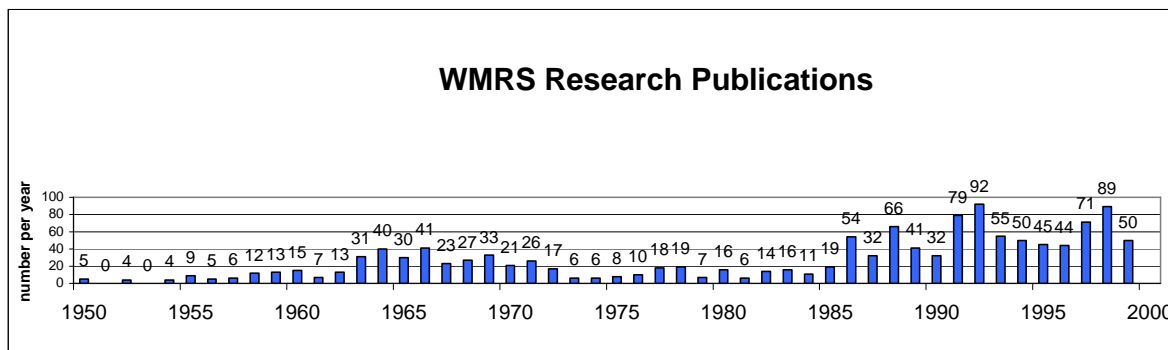
| | | FTE |
|---|-----------------------|-------------|
| Director | | |
| Powell, Frank | Director | 0.50 |
| Asst. Res. Sci. 11-mos² | | |
| Bowler, Peter | Supercourse Coord. | 0.33 |
| Rundel, Phil | Res. Scientist | 0.33 |
| Hodges, Scott Szewczak, Joseph | Res. Scientist | 0.33 |
| Academic Subtotal (Sub 00) | | 1.50 |
| | | |
| Campus Office Staff | | |
| Fager, Barbara | MSO | 1.00 |
| Jamous, Cecilia ³ | Admin. Asst. II | 0.53 |
| Campus Subtotal (Sub 01) | | 1.53 |
| Station Staff | | |
| Hetzler, Scott | Lead Groundskeeper | 1.00 |
| Masters, Richard | Auto. Mechanic Senior | 0.75 |
| Patrick, Cecil | Principal Cook | 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 | | 7.78 |

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 (1) FTE is an unfilled position used for rotating support of UC faculty to seed long-term research programs at WMRS.

7. PUBLICATIONS

Publications based on research done at a field station are a traditional measure of research productivity. The WMRS bibliography includes 1,338 publications from its inception in 1950 through 1999. This number includes 81 Master or Doctoral theses, 177 papers or chapters from WMRS Symposia and over 850 original research articles or book chapters. 819 publications have been added over the last 15 years with 300 just since 1995. This bibliography is currently being updated as a searchable database that will be available on the WMRS web site. When this bibliography is finished, users will be sent a list of their publications in the WMRS bibliographic database, with a request to update the list.



8. INCOME

The table below shows the WMRS budget for fiscal year 1999/00. Not included are the federal and state contracts and grants awarded to individual investigators using WMRS. The 2000 annual total for such WMRS-related awards was \$1,787,111. This includes \$584,845 to UC faculty and \$1,202,266 to non-UC faculty for research directly involving WMRS (*i.e.* the work would be impossible without the Station).

| INCOME | 1999/00 |
|--|--------------------|
| 1. Fed/State contracts & grants (includes carry forward FY99/00) | \$286,612 |
| 2a. Recharge income | \$250,233 |
| 2b. Gifts and endowments | \$6,135 |
| 3a. UC appropriation | \$713,586 |
| 3b. UC grants | \$44,598 |
| 3c. Carry forward | \$256,193 |
| TOTAL | \$1,555,737 |

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. 6. Other support costs are grouped Campus supplies, equipment, and travel costs and 7. Station operations and supplies: this includes “fixed expenses” for running four separate operations for utilities, facility improvements, vehicle maintenance, insurance, land leases, 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.

| b. EXPENDITURES | |
|---|--------------------|
| 1. Academic pers. (sub 0) | \$274,944 |
| 2. Grad. Fellows/TAs | 5,018 |
| 3. Station Staff (sub 1 & 2) | 326,797 |
| 4. Campus Staff (sub 1 & 2) | 60,151 |
| 5. Benefits (sub 6) | 152,798 |
| 6. Campus Supplies, Equipment & Travel | 15,595 |
| 7. Station Supplies, Equipment & Travel | 385,447 |
| TOTAL | \$1,220,750 |

The budget in 1999/2000 actually increases our Carry forward to \$336, 597. This includes restricted gifts and endowments, contract and grant funds covering periods of performance that do not coincide with the UC fiscal year (*e.g.* \$61,379 in 1999/2000) and a \$100,000 emergency fund, which is essential for the safe and continuous operation of WMRS facilities, given the remote and hostile nature of the high altitude mountain environment.

10. SPACE

No new space was added in 2000. Progress was made on improving the Manis laboratory, finishing more of the buildings at Crooked Creek and relocating portions of the library in Owens Valley Laboratory.

| Owens Valley Laboratories | Square Feet |
|----------------------------------|--------------------|
| Dining/office | 2,475 |
| Sleeping dorms | 4,231 |
| Manis lab | 716 |
| Classroom | 864 |
| Library | 400 |
| Shop | 1,250 |
| Lecture hall | 960 |
| Classroom & computer lab | 960 |
| Caretaker's housing | 900 |
| Bathroom | 320 |
| Temporary housing | 1,695 |
| Long term housing | 1,440 |
| <i>subtotal</i> | <i>16,211</i> |
| Crooked Creek | |
| Hall lodge | 6,600 |
| 4 Cabins | 3,200 |
| Quanset/Storage | 1260 |
| Bathroom | 320 |
| Shop | 960 |
| Lab | 1,300 |
| <i>subtotal (square feet)</i> | <i>13,640</i> |
| Barcroft | |
| Pace lab | 9,400 |
| Quonset/Storage huts | 300 |
| Animal lab | 476 |
| Outer lab | 392 |
| Garage/Shop | 672 |
| <i>subtotal</i> | <i>11,240</i> |
| Summit Laboratory | |
| <i>subtotal</i> | <i>450</i> |
| TOTAL | 41,541 |