Proposal for the Development of a Graduate Program leading to
M.S. and Ph.D. Degrees in

Environmental Systems

University of California, Merced

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1. INTRODUCTION

This proposal is for establishing the Environmental Systems (ES) graduate program leading to M.S. and Ph.D. degrees at the University of California, Merced. UC Merced opened officially in September 2005, but the majority of the current ES graduate group members are Founding Faculty who arrived at UC Merced in 2003. In order to maintain their active research programs, these faculty members began recruiting graduate research assistants for admission to the ES program in Fall 2004. These students were enrolled in the Individual Graduate Program (IGP), which was approved by the Coordinating Committee on Graduate Affairs (CCGA) prior to Fall 2004. Since its inception, the IGP has been established as an interim vehicle to launch interdisciplinary graduate education for high quality students at UC Merced. We believe that the ES program is now ready to emerge from under the IGP umbrella as an official graduate program.

1.1 Program Objectives and Distinct Features

The ES program will equip students with the knowledge and skills necessary to improve the scientific understanding of coupled Earth systems--atmosphere, hydrosphere, lithosphere and biosphere--and to use this understanding to (1) more optimally manage natural resources and (2) engineer the restoration of impaired environments. This improvement in understanding is gained through the systematic study of biological, chemical and physical processes, and through rigorous individualized research programs in natural and engineered environments. Courses are designed to provide the scientific principles underlying the function and sustainability of natural and engineered environmental systems. The ES program places the principles of natural science and engineering in the context of (1) ascertaining fundamental processes and properties of environmental systems, (2) integrating physical, chemical and biological cycles and (3) pollution prevention, treatment and ecosystem restoration.

UC Merced's unique geographical location, its relationship with neighboring institutions and its seemless integration of science and engineering will render the ES program distinct from similar programs in California and elsewhere. In particular, a substantial part of UC Merced's initial development as a research institution has been the structuring of meaningful relationships with the National Park Service and the Lawrence Livermore National Laboratory, with a particular emphasis on coupling scientific enquiry with engineering analysis.

1.2 UC Merced Faculty Strength in the Field

Faculty CVs are attached in Appendix A and point to the groups' research strengths in Earth systems science, ecology, spatial analysis, environmental engineering, geochemistry, solar energy, climatology, hydrology, policy, and economics, including the following specific areas:

- mountain hydrology
- polar ice cores
- water resources management
- climate assessment & applications
- distributed, embedded environmental observations
- environmental spatial analysis
- chemical fate & transport phenomena
- molecular-to-macroscopic aqueous and interfacial geochemistry
- solar energy systems
- biogeochemistry of mountain catchments and ecosystems
- theoretical ecology
- community ecology
- molecular ecology
- environmental policy and economics
- energy policy and economics
- public health

1.3 Program Development: Current and Projected Size

The ES Program (under the IGP) has been admitting students since fall 2004. With minimal formal advertisement the preceding year, and the inaugural pool (14 students) were comprised from a combination of local students and students who accompanied faculty members from their previous institutions. Four additional students admitted and enrolled in Fall 2005 from a pool of 16 applicants (14 domestic, 2 international). One ES student, Daniel Santillano, completed an MS degree in June 2006. In Fall 2006, six students were admitted and five enrolled from a pool of 23 applicants (12 domestic, 11 international). There are currently 25 graduate students in the program (7 MS and 18 PhD). As discussed in the strategic plans of our three schools and the ES group, our goal is to add to the ES group through faculty hires in Engineering, Natural Sciences, and cross-School initiatives (see Section 6. Resources). We have been highly successful in this regard, having added eight new faculty members to the group in October 2006. Assuming a graduate student-to-faculty ratio of 3:1 and an increase in faculty number to 25, we project that the graduate student population will grow to roughly 75 over the next few years. The group is currently considering the addition of a professional MS degree, which might cause this number to increase by an additional 15 to 30 Plan II (coursework-only) MS students.

Table 1. Environmental Systems Faculty Research Groups as of September 2007.

Faculty	MS Students	PhD Students	Postdocs	Research staff
Roger Bales, Professor	1	3	3	1
Martha Conklin, Professor		1	1	
Qinghua Guo, Asst. Professor		2	1	1
Tom Harmon, Professor	4	2	2	

Valerie Lepper, Assoc. Professor		1		
Peggy O'Day, Professor		3	2	1
Sam Traina, Professor		2	2	
Roland Winston, Professor	1.5	1		1
Jeff Wright, Professor	0.5			
Anthony Westerling, Asst. Professor				
Wei-Chin Chun, Asst. Professor				
Benoit Dayrat, Asst. Professor		1		
Lara Kueppers, Asst. Professor				
Yihsu Chen, Asst. Professor				
Carlos Coimbra, Assoc. Professor		1		
Gerardo Diaz, Asst. Professor		1		
Andy Aguilar, Asst. Professor				
TOTALS	**7**	**18**	**11**	**4**

1.4 Relationship to Existing UC Merced Programs and Academic Plans

Most of the members are also active participants in the Sierra Nevada Research Institute, which is directed by ES group member Sam Traina. The Sierra Nevada Research Institute (SNRI) is a key entity that will facilitate the ES program's interdisciplinary approaches to research and graduate education. This Institute provides an important nexus for research and graduate training across the boundaries of the three divisions. The intent in establishing this nascent ORU was to define a structure that would focus on significant problems that are pertinent to life in the Central Valley and adjacent Sierra Nevada, and yet have global implications for the future. The Sierra Nevada Research Institute will carry out research on critical issues that affect humankind's ability to live in an environmentally sustainable way: population growth and development, water and watersheds, air quality, fire ecology, biodiversity, climate change, and resource management and policy. These issues are especially vital to sustaining the natural resources of the San Joaquin Valley and Sierra Nevada. The Sierra Nevada Research Institute bridges the natural sciences, engineering, and policy sciences and provides a broad interdisciplinary experience for graduate students working in association with its faculty.

In addition to research efforts at UC Merced, ES faculty members collaborate with other UC investigators and with scientists at the following institutions: Lawrence Livermore National Laboratory, Lawrence Berkeley National Laboratory, the National Park Service at Yosemite and Sequoia/Kings Canyon Parks, the U.S. Geological Survey and others.

1.5 Interrelationship with other UC or Regional Institution Programs

1.5.1 Other UC Programs in California. There are many environmental science and engineering, and environmentally oriented Earth system science graduate programs in the UC system (see Table 2). The proposed ES program encompasses environmental engineering, Earth system science and ecological content in a manner clearly distinct from the more traditional, discipline-specific environmental engineering and science programs (e.g., programs 4, 8, 13, and 16 in Table 2), and Earth system science programs (3, 5, and 12). Several of the other programs listed incorporate some aspects of the proposed program, but place more emphasis on the social

science component associated ecology and conservation perspectives (6, 11, 15). That is, the programs at other campuses tend to be centered around faculty and students from a single department or school, whereas our aim is to maintain an environmental breadth across multiple schools.

The remaining programs have objectives and content that are similar to the proposed ES program. However, the UCLA Environmental Science & Engineering program and the Bren School MS programs are more professionally oriented. It will benefit the proposed ES graduate group to examine these programs if and when it decides to develop a professional MS degree program. The UCR Environmental Sciences program and, in some respects, its Soil and Water Sciences program, along with the UCSB Bren School's PhD program and a number of the UC Davis graduate group programs all tend to overlap with the proposed program to a large extent in terms of overall philosophy and objectives. Differences amongst these programs are mainly a function of the specific faculty interests and the regional environmental issues that commonly confront students. The healthy enrollment and success of these programs is a good indicator of the demand for a similar effort focusing on problems of California's Central Valley and the Sierra Nevada. In particular, the UCR Environmental Sciences program was established recently (2000), and may serve as the best gauge of the prospects for the proposed program.

Table 2. A tabular list contrasting UC graduate research and professional degree programs conducing research in environmental science and engineering, Earth systems science, and resource management.

Graduate Program	Faculty	Current Enrollment	Areas of Emphasis
1. Environmental Sciences UC Riverside http://ese.ucr.edu/es/about.html	21 fte	14 PhD 3 MS	This is a relatively young interdepartmental program (2000) with 21 fte named in Environmental Sciences, plus 20-25 more participating faculty from various other departments. Program strives for an interdisciplinary research environment, with formal coursework in topics ranging from pollutant transport and fate in soil, water and air, to toxicology, to environmental law and policy.
2. Soil and Water Sciences UC Riverside http://soilwater.ucr.edu/	17 fte 6 adjunct		This program employs many of the same faculty as the newer Environmental Sciences program, and offers training in the chemistry, physics, biology, and ecology of soils, water bodies, and wetlands. Areas of specialization include: soil and aquatic chemistry, watershed and groundwater hydrology, soil and aquatic microbiology, soil-plant relations and biogeochemistry, bioremediation and phytoremediation, soil genesis, mineralogy, geomorphology, and ecotoxicology of soils and sediments

3. Earth Sciences UC Riverside http://www.earthscience.ucr.edu/	14 fte 4 adjunct		This is a science-based program with little or no content related to engineering, policy, and management. Areas of specialization in this program include geochemistry, hydrogeology, and climatology.
4. Environmental Engineering UC Irvine http://www.eng.uci.edu/ene/grad	8 fte		This is an engineering and science-based program emphasizing pollution control technologies and understanding the transport and fate of pollutants in the environment.
5. Earth System Science UC Irvine http://www.ess.uci.edu/	22 fte	33 PhD	This program focuses on the science of the Earth as a system-- global environmental chemistry and climate change along with the underlying chemistry, physics, and biology. At present there is little, if any, activity in solid earth geophysics, geology, petrology, and other more traditional topics. Instead, emphasis is on atmospheric chemistry, climate, and the biogeochemistry of land, ocean, and atmosphere. (note: no terminal MS program at this time)
6. Environmental Studies UC Santa Cruz http://envs.ucsc.edu/graduate/	17 fte	59 PhD	This PhD program draws principally from two areas of knowledge: ecology and social science. Interests in ecology include conservation biology and global change ecology and agroecology. Interests in social science bridge the dimension between environmental policy analysis and political economy of the environment. These all are historically independent fields and this program, which began in 1994, claims to be one of the first to link them.
7. Environmental Science & Engineering UCLA http://www.ph.ucla.edu/ese/	4 fte 21 assoc. fte	40 D.Env.	The interdepartmental program offers a D.Env. degree which is intended as a multidisciplinary, profession doctorate. The program research and training activities are both experimental and analytical in nature, often involving laboratory or field studies but also modeling and policy analysis. Research and instruction recognize the interconnections between soil, air, water and biota, as well as the interdependence of human and ecological health. Equally important, the program emphasizes the interactions and interdependencies between science, engineering, public policy economics and law in the protection of the

			environment and public health.
8. Civil & Environmental Engineering UCLA http://www.cee.ucla.edu/grad/phdee.htm	7 fte 3 adjunct	20 MS 25 PhD	This is an engineering and science-based MS/PhD program emphasizing pollution control technologies and understanding the transport and fate of pollutants in the environment.
9. Bren School of Environmental Science & Management UC Santa Barbara http://www.bren.ucsb.edu/academics/	17 fte 3 adjunct	126 MS 31 PhD	(1) Master's of Environmental Science and Management - a professional Masters (not intermediate degree). Group project is a unique aspect of the program, serving as a thesis. (2) PhD in Env Sci and Management - Specialties include biogeography, hydrology, Earth system science, environmental and resource economics, pollutant fate and transport, ecology, limnology, environmental and ecological restoration, environmental microbiology. (3) PhD in Economics and Environmental Science - Ph.D.-level training in economics *and* a companion area of natural science (climate, hydrology, applied ecology, or marine science)
11. Environmental Science, Policy & Management UC Berkeley http://espm.berkeley.edu/gradprograms/	67 fte	4 MS/217 PhD	M.S. and Ph.D. (primarily) degree program. The three divisions of ESPM are Ecosystem Science, Insect Biology, and Society & Environment. Faculty expertise includes conservation biology, forestry, molecular biology, population ecology, political ecology, entomology, plant ecology, sociology, history, wildlife ecology, political science, and many other fields.
12. Earth & Planetary Science UC Berkeley http://eps.berkeley.edu/education/graduate.php	12 fte (env emphasis)		M.S. and Ph.D. degrees with emphasis in 6 areas, including geochemistry, atmospheric science, and environmental earth science.
13. Environmental Engineering UC Berkeley http://www.ce.berkeley.edu/env/	15 fte	68 MS/PhD	M.S. and Ph.D. degrees; engineering-based research and curriculum addressing complex problems that require innovative solutions to physical, chemical, and ecological issues across all relevant environmental media including air, water, and soil.

14. Atmospheric Science, Hydrologic Science, Soil & Biogeochemistry Graduate Groups UC Davis http://lawr.ucdavis.edu/graduate_sbg.htm	60 fte	120 MS/PhD	3 MS and Ph.D. programs in Atmospheric Science, Soil Science, and Hydrology.
15. Environmental Policy & Management, Ecosystems & Landscape Ecology, Restoration Ecology, Conservation Ecology UC Davis http://ecology.ucdavis.edu/	17 fte	120 MS/PhD	Several multidisciplinary programs within the Graduate Group in Ecology. The program integrates the graduate ecology program with faculty and courses in Agricultural and Resource Economics, Applied Sciences, Civil and Environmental Engineering, Environmental Studies, Political Science, and the School of Law. The result is a program leading to the M.S. and Ph.D. degrees in Ecology that offers students rigorous preparation in policy analysis and quantitative social science.
16. Civil & Environmental Engineering UC Davis http://cee.engr.ucdavis.edu/Student/Prospective/graduate/env.htm	15 fte	81 MS 68 PhD	M.S. and Ph.D. degrees with emphasis in environmental engineering and water resources engineering, including physical, chemical and biological processes in natural and engineered systems, environmental fluid dynamics, resource management and economics, and others.

***1.5.2 Cooperation or Competition with other Institutions*.** UCM ES group recognizes the excellence of our sister campuses and their environmental graduate programs and seeks to complement and extend that excellence. For example, Professors Roger Bales and Tom Harmon are currently members of the UC Davis Hydrologic Sciences graduate group. In the early stages of the ES program, ties such as these will afford UCM graduate students a broader array of coursework and faculty advising expertise than will be available at UCM as a stand-alone institution. These UC ties, along with those to neighboring institutions like CSU-Fresno and CSU-Stanislaus, are also proving to be a good source of graduate student applicants to our nascent program.

While we are excited about cooperative opportunities with our sister campuses and neighboring institutions, we fully expect to compete with them for the best graduate students in the near future. UCM's unique location and relationship with neighboring institutions will help to make its case as a competitive alternative to similar programs. In particular, a substantial part of UCM's initial development as a research institution has been the structuring of meaningful relationships with the National Park Service and the Lawrence Livermore National Laboratory.

As part of the SNRI and ES graduate group focus on the ecosystems of Sierra Nevada and the Central Valley, Director Traina has developed and staffed a field station within Yosemite and is in the advanced stages of developing a field station Sequoia/Kings Canyon National Parks. The leadership of both national parks is firmly committed to developing strong multidimensional

relationships with UCM that will provide important research opportunities for our students. The Park directors have been instrumental in identifying and providing access to on-sight research stations that will facilitate both environmental and cultural research activities within the parks. The Yosemite Fund, a private foundation, has provided support to prepare a field station within the confines of the park that has been turned over to UCM/SNRI for the use of its faculty and students. In addition to the interactions with the most proximate of the National Parks, there is a strong desire on the part of both the National Park Service and UC Merced to develop a long-term working relationship that will be beneficial to both entities and will provide meaningful research, education and employment opportunities for our graduate students.

1.6 Program Administration

The UCM Graduate Council oversees the graduate programs on campus, and it has reviewed and endorsed this proposal (see Appendix B letter of support). The ES program by-laws (see Appendix C) establish program oversight and resource allocation by an elected academic Dean. Jeff Wright, Dean of the School of Engineering, currently holds this position (see Appendix B letter of support). The admissions process is administered by UCM Graduate Division (Sam Traina, Dean of Graduate Studies), with administrative assistance provided by his staff. Administrative support will become an issue as the ES program grows and other UCM graduate programs emerge. Our ES 2005-06 Strategic Plan (see Appendix D) contains a request for a separate administrative staff in support of this program.

The School of Engineering has hired a graduate student affairs person who started work in August 2007. Ms. Tomiko Hales will help students with academic administrative matters as well as with RA and TA paperwork. She will assist the ES Admissions Committee with the admission process and recruiting.

Issues pertaining to ES graduate group membership and day-to-day program administration are described in the by-laws (Appendix C). The current ES Chair is Professor Tom Harmon; the Vice-Chair is Professor Martha Conklin. Current committees are the Executive (EC), Membership (MC), Educational Policy (EPC), Graduate Advising (GAC), and Admissions Committees (ACC). Currently all ES group members are members of the Executive and Membership Committees. We expect this will change as the group size grows. The ES Group meets twice per year formally, and more frequently on an informal basis.

1.7 Program Evaluation Plan

The graduate group structure is meant to instill a culture of interdisciplinary education and research. Given the startup nature of UC Merced, and the limited array of formal graduate course offerings, it will be critical to obtain regular feedback from the students and faculty who participate in the program.

1.7.1 Program Self-Evaluation. Annual surveys and exit interviews of the students will be conducted in order to define problems and to initiate solutions in timely manner. In addition, the development committee will hold an open forum each semester to provide an opportunity for student questions and feedback. Student representation on the development committee will also assure that student issues are brought forth and addressed.

1.7.2 Campus-Wide Evaluation. Graduate Council will review the ES graduate group on a 5-year cycle following standard procedures adopted for program review at UC Merced. Prior to each 5-year review, the ES graduate group will prepare and conduct a self-review culminating in a report to the Graduate Council for use in their review.

2. PROGRAM OF STUDY

The Environmental Systems (ES) graduate program strives to equip students with the knowledge and skills to improve the scientific understanding of the Earth as coupled systems of atmosphere, hydrosphere, lithosphere and biosphere. This understanding is gained through the systematic study of biological, chemical and physical processes. Courses are designed to provide the scientific principles underlying the function and sustainability of natural and engineered environmental systems. The program places the principles of natural science and engineering in the context of (1) pollution prevention, treatment and ecosystem restoration, and (2) integrating physical, chemical and biological cycles. ES program faculty members are affiliated with the Schools of Natural Sciences and Engineering. The ES graduate program leads to M.S. and Ph.D. degrees in Environmental Systems. Programs of study emphasize laboratory, field and modeling studies of the natural and engineered environments from an interdisciplinary perspective.

2.1 Admissions Procedures and Requirements

All students seeking admission to the ES program must make a formal application for admission. We encourage applicants to use the on-line application to streamline the process. Applications are reviewed by the Admissions Committee, which makes recommendations on admission to the Group Chair; the Dean of Graduate Studies makes final decisions on admission. The deadline for receipt of applications is January 15 for enrollment in Fall semester. Enrollment in other semesters will be considered on an individual basis. Applicants are encouraged to contact individual faculty members about their areas of research and teaching interests prior to applying.

Materials to be submitted:

- Official application form
- Application fee
- Official transcripts from all prior university or college attendance
- An official Graduate Record Exam (GRE) score report (only the general tests are required)
- A statement of research interests and career goals
- Three letters of recommendation from instructors or supervisors who can comment on the applicant's scholarly ability and promise as a researcher (letters from faculty are preferred)
- Official score reports from the Test of English as a Foreign Language (TOEFL), if the applicant’s native language or language of instruction is other than English. The Test of Spoken English (TSE) is recommended (not required) for admission, but is required for such applicants who wish to be considered for teaching assistantship (TA) positions.

The minimum requirement for graduate admission to UCM is a bachelor's degree with grade point average for upper division courses of 3.0 or greater on a 4.0 scale. Performance on the GRE, distribution of undergraduate grades, accomplishments in undergraduate research, and letters of recommendation will also be evaluated as important determinants of an applicant's

potential for success in graduate education. Students will be considered for the degree program for which they apply. Students admitted to the M.S. program and later wishing to gain admission to the Ph.D. program must be re-evaluated by the ES Admissions Committee, and should supply the committee with letters of recommendation from the proposed dissertation advisor and two additional members of the ES graduate program.

Students with undergraduate degrees in engineering, physical geography, or natural sciences normally have a background that is well suited to the M.S. and Ph.D. programs in environmental systems. Applicants with other degrees will be examined on a case-by-case basis. Students are expected to have some proficiency in chemistry, physics, and calculus.

2.2 General Requirements for Advanced Degrees

2.2.1 Residency. In accordance with SR 682 and 686, the minimum residency requirement for any advanced degree is two semesters. The minimum residency requirement for the Ph.D. degree is four semesters. Before advancement to candidacy Ph.D. students must be registered in regular University courses as a full-time student for at least two semesters. M.S. students must be registered as a full-time student for at least one semester before advancement to candidacy. M.S. students must, prior to conferral of the degree, be in residency for at least one semester after advancement to candidacy before conferral of the degree. Residency is established by satisfactory completion of at least one upper division or graduate course of four units or more per term.

2.2.2 Scholarship. Graduate students must maintain at least a 3.0 grade point average to be considered in good academic standing or to be awarded an academic graduate degree. A student whose cumulative graduate grade-point average falls below 3.0, or is judged by his or her major professor and degree committee to be making unsatisfactory progress toward the degree , may be placed on academic probation. If academic probation is recommended, then the student has the right to appeal this decision to the Academic Advising Committee (or subset of this committee that does not overlap with the student's degree committee). A student on probation will then be allowed a maximum of two semesters to make up deficiencies and be returned to good academic standing. Otherwise, the student will be dismissed from the graduate program. Specifically:

1) Only courses in the 100 and 200 series in which the student receives grades of "A", "B", and "S" may be counted as satisfying the requirements for advanced degrees. Courses in which a student receives a "C" or lower cannot be used to satisfy the unit requirement for the M.S. degree but will count in determining the grade point average..

2) Courses graded "S/U" will not be counted in determining grade point averages.

3) Candidates must be in good academic standing in order to qualify for advancement to candidacy.

4) Candidates must make satisfactory progress on their programs of study as determined by their major professor and their degree committee.

2.3 Masters Degree (thesis option, Plan I; non-thesis option, Plan II)

The Masters of Science degree is not granted by the University of California merely for the fulfillment of technical requirements, such as residency or completion of fundamental courses. The recipient of a M.S. degree is understood to possess a thorough understanding of a broad field of knowledge and to have given evidence of accomplishment in that field.

There are two options for the Environmental Systems (ES) M.S. degree. The ES M.S. thesis option (Plan I) is designed to educate students to be professionals in environmental systems, both by coursework preparation and completing an independent research project. This program is designed to take two years to complete. The ES M.S. non-thesis option (Plan II) is designed to provide students with the technical expertise to be professionals in environmental systems or as coursework preparation for a doctoral program. This program is designed to take one year to complete.

2.3.1 Requirements. The ES group has established the following requirements for the M.S. degree:

- Complete at least two semesters of full-time academic residence (12 units minimum) at UC Merced;
- Complete coursework as outlined in Coursework Requirements (see below);
- Give an oral presentation in a seminar class or a poster or oral presentation at an approved professional conference;
- Present and successfully defend a M.S. thesis containing an original research (Plan I);
- Pass the comprehensive examination (Plan II).

2.3.2 Selection of a Major Professor. All incoming M.S. students will be assigned an interim major professor during the semester (usually summer) immediately prior to enrollment. We recommend that all M.S. students chose their major professors by the end of their first semester. This is mandatory for Plan II M.S. students. Plan I M.S. students are required to have selected a major professor by the end of their second semester. Major professors must be ladder ranked ES faculty.

For the ES thesis option (Plan I), the heart of this program is the completion of a piece of original scientific research leading to the preparation and defense of a M.S. thesis. To this end, each student should discuss research interests and possible M.S. projects with a broad range of the ES faculty as early as possible, and select a major professor early during the first year of study. Selection of a major professor must occur before the student's degree committee can be constituted. The student and the major professor together will develop a research topic. Research will be expected to occupy a majority of the student's time after the first year of residence. Interdisciplinary projects are highly encouraged, as are research collaborations with faculty or senior scientists outside UC Merced.

For the ES non-thesis option (Plan II), the course program should be determined before the first semester the interim major professor will help the student design his/her program. The major professor will chair the comprehensive examination.

2.3.3 Coursework Requirements. Each student is expected to develop graduate-level competency in ES. Graduate students in the Environmental Systems group are required to submit a program of study to the interim advisor and the Academic Advising Committee upon

enrollment in the program. All program of studies are to be approved by the Academic Advising Committee. Coursework requirements are:

1) Plan I requires completion of at least 24 units of work at the upper division and graduate levels and submission of a thesis. At least 18 of the 24 units required must be strictly graduate work in the major subject.

2) Plan II requires completion of at least 32 units of upper division and graduate courses and satisfactory performance on a comprehensive final examination. At least 24 of the 32 units required must be strictly graduate courses in the major subject. No more than 2 units of research (299 courses or equivalent) may be used in satisfying the 32 unit graduate course requirement.

As there is considerable freedom in the program, each student is expected to assume responsibility for designing his/her program.

2.3.4 Transferring Credit. Though ordinarily all work for the M.S. degree is done in residence, some work taken elsewhere may be credited toward the degree. The normal limit for such transfer work is two courses from another institution or up to one half of the unit requirement from another campus of the University of California, provided the units were not used to satisfy the requirements for another degree. The following regulations apply specifically to the transfer of units toward M.S. degree requirements:

1) Units taken elsewhere than the University of California may not be used to reduce the minimum residence requirement or the minimum requirement in the 200 series courses taken at the University.

2) Requests for transfer credit are to be made prior to or at the time of advancement to candidacy. The major professor should make a request to the Dean specifying the units and courses involved, and provide an official transcript for the course (s).

2.3.5 Faculty Committee for M.S. Degree. Once the M.S. student selects his/her major professor, he/she, in consultation with the major professor and program faculty, forms a degree committee. The role of the degree committee is to advise on and supervise the student's choice of courses, thesis research, serve on examination committees, and/or review and pass upon the merits of the thesis. The degree committee is composed of a minimum of three members, including the major professor; the majority of the committee must be ladder ranked ES faculty. Other committee members may be regular or adjunct faculty from any UC campus, or an individual from outside the University of California who has special expertise and qualifications. In this case, the major professor should submit a brief statement indicating the appointee's affiliation and title and how the prospective appointee has special expertise or qualifications that are not represented on the campus. In addition to the justification letter from the major professor, a curriculum vitae and a letter from the proposed appointee indicating a willingness to serve must be submitted to the Dean of Graduate Studies for review and approval. The committee membership must be approved by the Dean of Graduate Studies.

Reconstitution of the committee may be justified by a substantial change in the student's thesis topic or may be required by the departure of a committee member from the university. Also, if a committee member's absence from campus for an extended period of time makes scheduling of examinations unreasonably difficult, the student may request that the committee be reconstituted.

When membership changes must be made, the major professor in consultation with the student should recommend a new committee member, giving the reason for the change. Changes to the degree committee must be approved by the Dean of Graduate Studies

2.3.6 Advancement to Candidacy. Every student must file an official application for advancement to candidacy after completion of at least one half of the unit requirements for the degree and at least one semester before completion of all degree requirements. The requirements for advancement to candidacy are:

A minimum of one semester of residency

Plan I: Completion of at least 12 units of coursework at the 100/200 level (see Course Requirements)

Plan II: Completion of at least 16 units of coursework at the 100/200 level (see Course Requirements)

Every student must file an official application for advancement to candidacy after completion of at least one half of the unit requirements for the degree and at least one semester before completion of all degree requirements.

Advancement to candidacy is approved by the Dean of Graduate Studies after verification that the student has fulfilled the candidacy requirements. If changes need to be made in a student's program for the degree after advancement to candidacy, the major professor must make recommendations for such changes to the Dean of Graduate Studies.

2.3.7 Plan I: Thesis and Final Examination. The M.S. thesis must be written on a topic approved by the degree committee. The topic should be acceptable to all members of the degree committee, when they agree to serve, and a joint meeting of the committee members and the student should be held at that time.

The M.S. thesis must be the student's independent and creative work that can stand the test of peer review. The expectation is that the material will serve as the basis for publication(s) in a peer-reviewed journal. The student is encouraged to discuss with members of the degree committee both the substance and the preparation of the thesis well in advance of the planned defense date.

The student must provide a copy of the thesis to each member of the degree committee and allow each committee member at least two weeks to read and comment on it. If one or more committee members believe that there are significant errors or shortcomings in the thesis, or that the scope or nature of the work is not adequate, then the student must address these shortcomings before scheduling a defense. Once the committee members are in agreement that the thesis is ready to be defended (even though minor errors or matters of controversy may still exist), the final examination date may be scheduled by the student in consultation with the committee. The date must be reported to the Dean of Graduate Studies, and one copy of the thesis filed, no later than two weeks before the proposed date of the final examination.

The M.S. final examination consists of an open seminar on the M.S. work followed by a closed oral examination by the degree committee. No student should appear for this examination until

after she or he has been advanced to candidacy by the Dean of Graduate Studies. A student must be registered or in current filing fee status when the examination is taken.

Oral thesis examinations may not be longer than three hours. All members of the degree committee must be in attendance for an oral M.S. final examination (connection via videoconferencing is acceptable). An ES faculty member of the degree committee, who is not the major professor, will chair the thesis defense. During the examination, the student is expected to explain the significance of the thesis research, justify the methods employed, and defend the conclusions reached. At the conclusion of the examination, the committee shall vote on whether both the written thesis and the student's performance on the exam are of satisfactory quality to earn a University of California M.S. degree. A simple majority is required for a pass. All members of the degree committee sign the final thesis.

Members of the committee may vote to make conferral of the degree contingent on corrections and/or revisions to the thesis. In this case, the committee will select one member, normally the major professor, who will be responsible for approving the final version of the thesis that is submitted to Dean of Graduate Studies.

If the thesis is regarded as of less than acceptable quality, the student should be given an appropriate period of time, clearly specified by the committee, in which to improve her/his work. If, after that period of time(usually a semester or more), the thesis is still unacceptable to a majority of the committee, the majority may recommend to the Dean of Graduate Studies that the student be disqualified from further graduate study.

2.3.8 Plan II: Comprehensive Examination. The Comprehensive Examination is normally administered at the end of the spring semester and should be taken by students who have completed their Plan II course requirements. No student should appear for this examination until after she or he has been advanced to candidacy by the Dean of Graduate Studies. A student must be registered, or in filing fee status when the examination is taken.

The degree committee conducts the M.S. comprehensive examination. A comprehensive examination in the major subject may be written, oral, or both at the discretion of the degree committee. The format of the comprehensive examination will be determined by the degree committee at the time of advancement to candidacy. All committee members must be present for the oral (portion of the) examination. Oral comprehensive examinations may not be longer than three hours. A unanimous vote is required of the committee to pass a student on the comprehensive examination. If a student does not pass the examination, she/he may be reexamined. Changes in the composition of the committee may be made only for reasons of clear necessity (e.g. the extended absence of a member from the campus). The examination may not be repeated more than once. A student who does not pass on the second attempt is thereby subject to disqualification from further work as a graduate student in this program. The results of all M.S. comprehensive examinations must be reported to Dean of Graduate Studies.

2.4 Doctoral Degree

The Doctor of Philosophy degree is not granted by the University of California merely for the fulfillment of technical requirements, such as residence or the completion of fundamental courses. The recipient of a Ph.D. degree is understood to possess thorough knowledge of a broad

field of learning and to have demonstrated evidence of distinguished accomplishment in that field; the degree is a warrant of critical ability and powers of imaginative synthesis. The degree also signifies that the recipient has presented a doctoral dissertation containing an original contribution to knowledge in his or her chosen field of study.

2.4.1 Requirements. The ES group has established the following requirements for the Ph.D. degree:

- Complete at least four semesters of full-time academic residence (12 units minimum) at UC Merced
- Complete the Environmental Systems course with a letter grade of at least "B"
- Complete a seminar course on current ES topics
- Complete a minimum of 12 units of graded Environmental Systems courses while in residence
- Complete two semesters of the Environmental Systems seminar series as an enrolled student
- Pass the oral Ph.D. qualifying examination
- Complete a research proposal for the doctoral dissertation
- Present an open technical seminar at least once while in residence
- Present and successfully defend a doctoral dissertation containing an original contribution to knowledge in the field.

2.4.2 Selection of a Major Professor. The heart of the Environmental Systems Ph.D. program is the completion of a piece of original scientific research leading to the preparation and defense of a Ph.D. thesis. To this end, each student should discuss research interests and possible Ph.D. projects with all of the faculty in the group as early as possible, and select a faculty research advisor (major professor) by the end of the first year of study. Selection of a major professor must occur before the student's degree committee can be constituted. The student and the major professor together will develop a research topic, and research will normally occupy a majority of the student's time after the first year of residence. Interdisciplinary projects are highly encouraged, as are research collaborations with faculty or senior scientists outside UC Merced. Students will be assigned an interim adviser and an interim advising committee when they first enroll, unless the student already has chosen an adviser.

2.4.3 Coursework Requirements. Students in the Ph.D. program are expected to demonstrate core knowledge in three areas represented by the ES group and equivalent to or surpassing that of the M.S. degree. This requirement may be satisfied by some combination of course work, independent study, and research. Before registering for classes, graduate students in ES, in consultation with their interim advisor and are required to submit a program of study to Academic Advising Committee (AAC) for approval before registering for classes. Later, typically during the student’s second semester, the ES AAC will conduct a formal review to assess student proficiency and specify further course requirements in the student’s program of study. The program of study must then be updated annually until the student advances to candidacy, with any changes approved by the Academic Advising Committee. In addition, there is a coursework requirement of a minimum of 12 graded ES course units in residence. Included in these units is a prescribed course in environmental systems (with a grade of B or higher), if such a course has not been previously completed. Enrollment in at least 2 semesters of a

graduate seminar in current ES topics is also required. As there is considerable amount of freedom in the program, each student is expected to assume responsibility for designing his/her program. Each student is expected to develop graduate-level competency in both their specific area of research as well as in ES.

2.4.4 Faculty Committees for the Ph.D. Degree. All incoming Ph.D. students will be assigned an interim advising committee consisting of three members, including his/her major professor, when selected. After the Ph.D. student selects his/her major professor but before commencing dissertation research, he/she, in consultation with the major professor and program faculty, forms a degree committee to advise on and supervise the student's dissertation research, serve on examination committees, and review and pass upon the merits of the doctoral dissertation. Final approval of the membership on these committees rests with the Dean of Graduate Studies.

Advanced Ph.D. degree committees in the Environmental Systems group consist of a minimum of four members, the majority must be ladder ranked faculty in ES. One committee member must be from outside of the ES group, and may be a regular or adjunct faculty member from any UC campus or an individual from outside the University of California who has special expertise and qualifications. In this case, the major professor should submit a brief statement indicating the appointee's affiliation and title and how the prospective appointee has special expertise or qualifications that are not represented on the campus. In addition to the justification letter from the major professor, a curriculum vitae and a letter from the proposed appointee indicating a willingness to serve must be submitted to the Dean of Graduate Studies for review and approval.

All members of the degree committee must be in attendance for the qualifying and Ph.D. final examinations (connection via videoconferencing is acceptable). An ES ladder ranked faculty member of the degree committee, who is not the major professor, will chair the examinations. If a committee member's absence from campus for an extended period of time makes scheduling of examinations unreasonably difficult, the student may request that the committee be reconstituted. Reconstitution of the committee may also be justified by a substantial change in the student's thesis topic or may be required by the departure of a committee member from the university. When membership changes must be made, the major professor in consultation with the student should recommend a new committee member, giving the reason for the change. Changes in committee membership must be approved by the Dean of Graduate Studies.

2.4.5 Ph.D. Qualifying Examination. All students in the Environmental Systems Ph.D. program are required to pass an oral qualifying examination before advancement to candidacy for the Ph.D. degree. The qualifying examination is normally taken after completion of a majority of formal coursework, but no later than before the end of the fourth semester in residence (excluding summer semesters), unless the student successfully petitions Academic Advising Committee for a later date. The purpose of the exam is to test basic knowledge and the ability to formulate and defend two proposals for original research. The student’s major advisor and other faculty may assist the student in preparing through recommended coursework, reading, or other avenues of investigation. The two proposals for the qualifying examination (five pages each) should present propositions for original research on two substantially different topics and outline a tractable approach for carrying out the research. The intent of this examination is to ascertain the breadth of a student's comprehension of fundamental facts and principles that apply in his or her major field of study, and the student's ability to implement research methods. Both requirements will also determine the student's ability to think critically about the theoretical and

practical aspects of the field. Accordingly, the examination should be focused on the student's field of research but may and should venture into other areas of scholarship that underlie or impinge on the dissertation topic.

Proposal topics must be approved by the members of the student's degree committee. The student must meet with his/her degree committee not less than six weeks in advance of the oral examination for approval of the two proposal topics. Prior to this meeting, the student will submit draft titles of the proposals to the committee members, which will be discussed at the meeting with the student and modified as the committee sees fit. Following the meeting, it is the student's responsibility to develop clear, concise written proposals on the topics approved by the committee. The student will submit his/her proposals to the degree committee not less than two weeks before the oral examination date. Qualifying examinations may not be longer than three hours.

For each proposal, the degree committee will expect the student to identify a valid scientific problem of intrinsic value to the scientific community and to develop a research plan to study the problem. Proposals may take the form of theoretical developments, computations, field and/or laboratory studies, the exploration of a new technique, or combinations of approaches. One proposal may be related to research that the student wishes to pursue for his/her Ph.D. dissertation, but this is not a requirement. The student is also permitted to develop proposals from work previously performed in a seminar or other coursework.

The date of the examination is arranged between the student and the committee members. The committee conducts the examination, and immediately thereafter submits the results of the examination to the Dean of Graduate Studies. Possible outcomes are:

1) Pass (conditions may not be appended to a pass decision)

2) Conditional pass (acceptable conditions include prescribed courses or rewritten proposals)

3) Fail (one re-examination allowed)

The committee members should include in their evaluations of the student such factors as relevant portions of the previous academic record, performance on the examination, and an overall evaluation of the student's performance and potential for scholarly research as indicated during the examination and the research proposals. The committee should strive to reach a unanimous decision. If a unanimous decision is reached, the committee shall inform the student of its decision in one of the forms listed above. If the decision is "Conditional Pass" or "Fail", the chairperson of the committee must include in a report a specific statement, which may include a minority report, explaining its decision and must inform the student of its decision. In the case of a "Conditional Pass" the committee must include in its report a further statement of its terms and inform the student of those terms. In those cases when it is not possible for the members to resolve their differences, the student should be informed of the nature of those differences and each member should submit a detailed assessment of the student's performance to the Graduate Council. The Council will use these individual reports to adjudicate the result.

A student who has failed the examination may repeat the qualifying examination after a preparation time of at least three months. The examination must be held by the same committee except that members may be replaced, with the approval of the major professor, for cause such as

extended absence from the campus. Failure to pass the examination on the second attempt means that the student is subject to disqualification from further study for the doctoral degree. After a second examination, only PASS or FAIL is recognized by the Dean of Graduate Studies.

2.4.6 Research Proposal. After successful completion of their oral examination the student will prepare his/her research proposal in consultation with their major advisor, and will submit the completed proposal to committee members for review. The document (typically five to ten pages) will describe his or her research topic, summarizes progress to date, and outlines what he or she proposes to do, why it is relevant, and what will be learned. The committee will review this document and determine if the student has outlined a project that is appropriate for a Ph.D. Committee members will respond within two weeks of receiving the research proposal. If any committee member has serious reservations regarding proposal content, a meeting of the entire committee with the student will be called to discuss the proposed research. The student is then given a month to rewrite the research plan. After any revisions to the research proposal, the student will submit the final version to committee members for approval. Committee members will indicate their approval of the research proposal by signing the Advancement to Candidacy form.

2.4.7 Advancement to Candidacy. The requirements for advancement to candidacy are:

- A minimum of two semesters of residency
- Completion of the 12 graded ES courses (including ES 200 Environmental Systems) with grade “B” or better
- Passing of the qualifying exam
- Approval of the written research proposal on his or her proposed research topic

The student must fill out an application for advancement to candidacy that is signed by the major professor and the degree committee, the Environmental Systems Chair and submitted to the Dean of Graduate Studies. Upon advancement to candidacy for the degree, the degree committee is then charged to guide the student in research and in the preparation of the dissertation. Advancement to candidacy must occur no later than the sixth semester of residence in the ES program.

2.4.8 Seminars. All students in the Environmental Systems group are required to present an open technical seminar at least once during their residence in the graduate group. The topic of the seminar may be the student's own research or it may be any other topic that falls within the areas of study spanned by the group, broadly defined. The seminar may be presented as part of a regular seminar series or, if necessary, as a special seminar. The open presentation given as part of the Ph.D. defense may be counted as the required seminar.

2.4.9 Dissertation and Final Examination. The Ph.D. dissertation must be creative and independent work that can stand the test of peer review. The expectation is that the material will serve as the basis for publication(s) in a peer-reviewed journal. The work must be the student's, and it must be original and defensible. The student is encouraged to discuss with members of the degree committee both the substance and the preparation of the dissertation well in advance of the planned date of final examination and dissertation defense.

The student must provide a copy of the dissertation to each member of the degree committee and allow each committee member at least three weeks to read and comment on it before scheduling

the date of the final defense. If one or more committee members believe that there are significant errors or shortcomings in the dissertation or that the scope or nature of the work is not adequate, the student must address these shortcomings before scheduling the defense. Once the committee members are in agreement that the dissertation is ready to be defended (although minor errors or matters of controversy may still exist), the final examination date may be scheduled by the student in consultation with the committee. Final examinations may not be longer than three hours. The date must be reported to the Dean of Graduate Studies, and one copy of the dissertation filed, no later than three weeks before the proposed date of the final examination.

The Ph.D. final examination consists of an open seminar on the dissertation work followed by a closed examination by the degree committee. During the examination, the student is expected to explain the significance of the dissertation research, justify the methods employed, and defend the conclusions reached. At the conclusion of the examination, the committee shall vote on whether both the written dissertation and the student's performance on the exam are of satisfactory quality to earn a Ph.D. degree from the University of California. A simple majority is required for a pass. Members of the committee may vote to make conferral of the degree contingent on corrections and/or revisions to the dissertation. In this case, the committee will select one member, normally the major professor, who will be responsible for approving the final version of the dissertation that is submitted to Division of Graduate Studies. All members of the degree committee must sign the final dissertation.

2.5 Nominal Times to M.S. and Ph.D. Degrees

The M.S. and Ph.D. programs, while overlapping in course offerings, promote different career trajectories and the M.S. program is not considered to be a prerequisite for the Ph.D. program. Students who complete the terminal M.S. degree will frequently work professionally in engineering and earth systems science in the context of private consulting firms, government agencies, or non-government organizations. Students completing the Ph.D. program will be equipped for careers in research and teaching.

The nominal time for completion of the M.S. program is 3 semesters (non-thesis plan) and 4 semesters for the thesis plan. The thesis plan often requires that the student work on their research project over the summer. Nominal time for completion of the Ph.D. degree for a student entering the program with an M.S. degree in a relevant field is 4 years. Students entering the program without an M.S. degree typically will require an additional year or more of study to prepare themselves to complete their doctoral research.

In some instances a student may need to withdraw from the Ph.D. program for non-academic reasons. This student may be considered for an M.S. degree through either the thesis or non-thesis plan, and is referred to section 2.3 for the M.S. degree requirements.

3. PROGRAM DEMAND AND JOB PROSPECTS

Healthy enrollment in related UC programs (Table 2) suggests that there is ample student demand for environmental science and engineering graduate programs. Table 3 provides the application and enrollment numbers for the first 3 years of the ES program at UCM. It is worth noting that these numbers were achieved with a minimum of advertisement. Given the startup conditions and extensive administrative demands on UCM faculty, the ES group has initially limited admissions to students needed to staff their research projects. However, we are now

considering admitting larger numbers of students, such as may be associated with professional-type MS programs.

Environmental Systems includes a broad array of research efforts aimed at improving understanding of components of the natural environment through the systematic study of the biological, chemical, and physical processes between and among those components. This research is frequently motivated by a desire to apply science and engineering principles to reduce adverse effects of solid, liquid, and gaseous discharges on the land, and to improve the quality and quantity of surface water, groundwater, and air resources that might be impacted by human activities that threaten those resources. The graduate experience will integrate natural sciences and environmental engineering. Environmental systems research is intended to develop an understanding of the scientific principles underlying the function and sustainability of natural and engineered ecosystems. In many cases, environmental systems research will integrate biological, chemical and physical processes used in conjunction with engineered systems to restore the usefulness of polluted land, water and air resources. Environmental systems research is intended to develop an understanding of the scientific principles required to integrate biological, chemical, and physical processes used in conjunction with engineered systems to restore the usefulness of polluted land, water, and air resources. The program emphasizes science and engineering principles underlying pollution avoidance, as well as pollution treatment and reparation. Advances that might be expected to result from this research include, but are not limited to, ecosystem modeling, improved sensors, innovative production processes, waste reduction and recycling, advanced information systems used for environmental monitoring and assessment, and industrial and agricultural process enhancement. Research may be directed toward ecosystem restoration, predicting ecosystem change, improving the cost-effectiveness of pollution assessment and control as well as developing new principles for pollution avoidance technologies.

Graduates from the proposed program will find jobs in research/academia, government agencies (e.g., state and federal EPA, U.S. Geological Survey, U.S. Bureau of Reclamation, National Park Service, etc.) private consulting firms, and non-government organizations (NGOs). The U.S. Bureau of Labor Statistics is optimistic about career opportunities for environmental scientists, hydrologists and environmental engineers, three job categories which will likely be indicative of the marketability of Environmental Systems graduates (http://www.bls.gov/oco/ocos050.htm). Environmental scientists and hydrologists held about 81,000 jobs in 2004 (not including faculty positions). Environmental scientist jobs are expected to grow by 9 to 17% between 2004 and 2014. The outlook is better for hydrologists (> 26% over the same time), especially in areas where populations is increasing in environmentally sensitive, water-scarce areas, which describes many parts of California and the southwestern U.S. The environmental engineering (49,000 jobs in 2004) job growth rate is projected to be “much faster than average” growth (>26%) between 2004 and 2014.

4. FACULTY AND AFFILIATES

The ES program faculty members are affiliated with the Schools of Natural Sciences (NS), Engineering (SoE), and Social Sciences, Humanities and Arts (SSHA) (click name for faculty websites, or see Appendix A for CVs):

- Andres Aguilar, Assistant Professor of Natural Sciences
- Roger Bales, Professor of Engineering
- Martha Conklin, Professor of Engineering
- Yihsu Chen, Assistant Professor of Engineering and Social Sciences, Humanities and Arts
- Wei-Chun Chin, Assistant Professor of Engineering
- Carlos Coimbra, Acting Associate Professor of Engineering
- Michael Dawson, Assistant Professor of Natural Sciences
- Benoit Dayrat, Assistant Professor of Natural Sciences
- Gerardo Diaz, Assistant Professor of Engineering
- Jessica Green, Assistant Professor of Natural Sciences
- Qinghua Guo, Assistant Professor of Engineering
- Thomas Harmon, Professor of Engineering and Chair of the Environmental Systems Graduate Program
- Lara Kueppers, Assistant Professor of Natural Sciences
- Valerie Leppert, Associate Professor of Engineering
- Monica Medina, Assistant Professor of Natural Sciences
- Peggy O'Day, Professor of Natural Sciences
- Wolfgang Rogge, Associate Professor, School of Engineering
- Samuel Traina, Professor of Natural Sciences and Engineering; Director of the Sierra Nevada Research Institute, Acting Vice-Chancellor of Research and Dean of Graduate Studies
- Anthony Westerling, Assistant Professor of Engineering and Social Sciences, Humanities and Arts
- Roland Winston, Professor of Natural Sciences and Engineering
- Jeff Wright, Professor and Dean of Engineering

Two affiliates are:

- Dr. Philip Duffy (LLNL), Adjunct Professor of Natural Sciences
- Dr. Nigel Quinn (LBNL), Adjunct Research Engineer, School of Engineering

Affiliated research staff are:

- Dr. Eric Berlow (SNRI), Station Manager
- Dr. Liying Zhao, Environmental Analytical Laboratory (EAL) Manager

5. COURSES

Table 3 summarizes potential course offerings in the ES program along with the most recent instructor and other faculty who will teach the course on a rotational basis or as needed (e.g., sabbatical by regular instructor). The table does not reflect teaching assignments. With our starting contingent of graduate students we have been reassessing course offerings on a semester-by-semester basis. As we are now a larger group, and as our undergraduate teaching needs are becoming more clear, we are attempting to revisit our curriculum to converge on a more

definitive plan. As of Fall 2007, the unofficial ES teaching load for its member faculty is as follows:

(1) One co-listed course per year serving upper division undergraduates (biology, environmental engineering, and/or earth systems science majors and entry-level ES graduate students.
(2) One research-oriented graduate course every two years

In addition to these courses, the ES program has offered ES 291 Environmental Systems Seminar since Fall 2004 (the first and longest running seminar series at UC Merced). Graduate research (ES 295), directed group study (ES 298), and directed independent study (ES 299) courses are also used extensively while we continue to add new faculty and expand formal course offerings.

Table 3. Environmental Systems graduate (200-level) courses and relevant undergraduate (100-level) courses.

Course No.	Title (units) - Description	Frequency (last offered)	Instructor(s)	Backup Instructor(s)
ES 200	**Environmental Systems (3) -** This course will explore linkages in environmental systems and tools to evaluate important features of those systems. This will be done by examining the characteristics of different Earth compartments (pedosphere, lithosphere, biosphere, atmosphere and hydrosphere) in terms of mass and energy balance, residence times and interactions.	Annually (F05)	Conklin Traina	All ES faculty
ES 202	**Chemistry and Mineralogy of Soils (3) -** Thermodynamics and kinetics of chemical process in soil systems. Formation and identification of common minerals, adsorption/ desorption, precipitation/dissolution, electro-chemical reactions in soils.	Biannually (Sp06)	Traina	O'Day
ES 203	**Geochemistry of Earth Systems (3) -** Quantitative analysis of Earth systems using principles of thermodynamics, kinetics and isotope geochemistry; solution mineral equilibrium and phase relations; equilibrium and reactive transport approaches to modeling geochemical processes at ambient and elevated temperatures.	Triannually (Spring 2005)	O'Day	Traina
ES 204	**Environmental Organic Chemistry (3) -** Focus on organic chemical reactions in soils and sedimentary environments. Formation and weathering of natural organic matter and reactions of natural organic matter with pollutants.	Biannually	Conklin	O'Day

ES 205	**Watershed Biogeochemistry** (3) **-** Movement, storage and transformations involving water, nutrients and solutes in natural and human impacted watersheds; biological and chemical processes; modeling of biogeochemical processes. Interactions of watersheds with lakes and streams.	As needed	Conklin	Harmon
ES 206	**Instrumental Methods in Environmental Systems (4)**	Biannually	EAL Staff (O'Day)	
ES 207	**Environmental Data Analysis (3) -** The objective of this class is to provide students with probabilistic and statistical methods to analyze environmental data. This class will emphasize on both theoretical and applied aspects of data analysis methods. Topics include: distribution, hypothesis test, linear regression, multiple regression, uncertainty analysis, outlier detection, and sample design.	Biannually	Guo	Chen
ES 208	**Surface and Colloid Chemistry of Earth Materials (3) -** Surface, colloid and interfacial chemistry related to soil, environmental and microbial applications; properties, energetics and reactivity of surfaces and interfaces of earth materials; the role of mineral surfaces in-promoting and catalyzing chemical phenomena at phase boundaries.	Biannually (Fall 2007)	Traina	O'Day
ES 209	**ES 209: Chemistry and Mineralogy of Earth Materials (3) -** Chemical principles, structure and bonding of minerals and Earth materials, including crystallography (symmetry, space groups, group theory), coordination chemistry, bonding models (valence bond, crystal field, and MO theories), and electronic and magnetic properties.	As needed	O'Day	Traina
ES 212	ES 212: Subsurface Hydrology (3) – Hydrology, Prinicples of groundwater flow, well hydraulics, regional groundwater flow, unsaturated zone hydraulics, greophysical techniques, numerical gsoil and groundwater modeling, design project.	Annually	Harmon	TBN
ES 214	**ES 214: Mountain Hydrology of the Western U.S. (4) -** Principles of snow formation, occurrence, and measurement; components of evapotranspiration; runoff generation; ground-water recharge processes; water resource assessments; and resource management.	Biannually	Bales	Harmon

ES 218	**ES 218: Global Change (4) -**Detection of, adaptation to and mitigation of global climate change. Climate-change science, sources, sinks and atmospheric cycling of greenhouse gases. Societal context for implementing engineered responses. Assessment of options for responding to the threat of climate change.	Biannually	Westerling	Duffy
ES 221	**Environmental Microbiology (4) -** Fundamentals of environmental microbiology: physiology, biochemistry, metabolism, growth energetics and kinetics, ecology, pathogenicity and genetics, with application to both engineered and natural environmental systems. Specific applications to water, wastewater and the environmental fate of pollutants.	Biannually	TBN	TBN
ES 224	**Terrestrial Ecosystem Ecology -** Ecosystem ecology is the study of interactions between organisms and their environment. Focus on energy, water and nutrient flows through the living (plants, animals, microbes) and non-living (soils, atmosphere) components of ecosystems. This course examines both natural and human-modified terrestrial ecosystems. Graduate requirements include preparation and peer review of a research proposal.	Annually	Kueppers	TBN
ES 225	**Microbial Ecology (4) -** Advanced course in microbiological systems**,** laboratory and field techniques.	Biannually	TBN	TBN
ES 226	**Environmental Genomics (4) -** Introduction to the principles and methods of genomics as applied to the understanding of ecosystems. Population genetics, adaptation to environmental change, genomic analysis of environmental microbial communities; experimental and computational methods relevant to environmental genomics.	Biannually	TBN	TBN
ES 228	**Ecological Modeling (3) -** Advanced course on modeling population dynamics and the flow of energy and matter in ecosystems.	As needed	TBN	TBN
ES 232	**Climatology (3) -** The global and surface energy balance; the hydrologic cycle; the influence on climate of the atmospheric and oceanic circulation; climate history, sensitivity, modeling, and natural and anthropogenic change.	As needed	Westerling	Bales, Duffy

ES 234	**Air Pollution and Resources [3]** Chemistry and physics of atmospheric pollutants, urban air pollution, visibility, mitigation and resource economics.	Biannually	Rogge	TBN
ES 235 ENGR 135	**Heat Transfer (4) -** Study of conduction, convection and radiation heat transfer, with applications to engineering problems.	Annually (S 07)	Coimbra	Diaz
ES 236 MEAM 236	**Advanced Mass Transfer (4)** Steady and unsteady mass diffusion; mass convection, simultaneous heat and mass transfer; Fick's law in a moving medium; similarity and integral methods in mass transfer; high mass transfer theory; researh project in mass transport.	Biannually	Coimbra	TBN
ES 237 MEAM 251	**Viscous Flows (4)** Study of the Navier-Stokes equations; Stokes' problems; creeping flows; internal and external flows; similarity and integral methods in boundary layer flows; stability and transition to turbulence.	Annually (F 07)	Coimbra	Diaz
ES 240	**Water Resources Planning and Management (3) -** Basic concepts of and issues in water resources management, water resources planning, institutional and policy processes. Quantitative analytical methods in water resources planning and management; introduction to systems analysis, multi-objective planning and risk assessment.	As needed	Wright	TBN
ES 252 (EnvE 152)	**Remote Sensing of the Environment (3) -** Fundamentals of electromagnetic remote sensing, concepts of information extraction and applications pertinent to environmental engineering and Earth systems science. Emphasis on water and other resource management topics.	Annually	Guo	TBN
ES 260 (EnvE 160)	**Sustainable Energy (4) -** Current systems for energy supply and use. Renewable energy resources, transport, storage and transformation technologies. Technological opportunities for improving end-use energy efficiency. Recovery, sequestration and disposal of greenhouse gases from fossil-fuel combustion.	Annually	Winston	TBN

ES 262	**Modeling and Design of Energy Systems (3) -** Concepts and applications of solar thermal processes; applications of solar collectors for water heating; active and passive building heating and cooling; fundamentals and design of wind energy systems; economics of solar energy.	Biannually	Winston	TBN
ES 270 (EnvE 170)	**Contaminant Fate and Transport (3)** Properties and behavior of organic and metal contaminants, in soils, groundwater, surface waters and air. Emphasis on phase transfer and transport for organic compounds; complexation and surface processes for metals. Modeling of environmentally important compounds, photochemical reactions, natural organic matter, sorption phenomena.	Annually	Harmon	Conklin, Traina
ES 291	**Environmental Systems Seminar** (2) – This is a technical seminar series in which invited scholars present to and interact with ES graduate students on research and policy issues.	Each semester (Spr06)	All ES faculty	
ES 292	**Special Topics in Environmental Systems** (2-4) Treatment of a special topic or theme in Environmental Systems.	Annually (Spr06)	All ES faculty	
	Courses under development by new faculty			
ES TBD	**Biodiversity in Environmental Systems**	As needed	Dayrat	TBN
ES TBD	**Application and advances in molecular ecology (TBD)**	Annually	Aguilar	TBN
ES TBD	**Statistical Analysis and Data Visualization**	Annually	Westerling	Guo
ES TBD	**Natural Resources and Environmental Economics**	Biannually (Fall 2008)	Y. Chen	TBN
ES TBD	**Decision Analysis and Theory**	Biannually	Y. Chen	TBN
ES TBD	**Computational Heat Transfer**	Biannually	Diaz	TBN
	Upper division courses of interest to ES graduate students			

EnvE 110	**Hydrology and Climate (4) -** Basics of the hydrological cycle and the global climate system. Fundamentals of surface water hydrology, hydrometeorology, evaporation, precipitation, statistical and probabilistic methods, unit hydrograph and flood routing.	Annually	Bales	Harmon
EnvE/ESS 100	**Environmental Chemistry (4) -** Chemical principles of Earth and environmental systems focusing on environmental processes in water, soil and air. Emphasis on acid-base chemistry, aqueous speciation, mineral and gas solubility, oxidation and reduction, and isotopes.	Annually	O'Day	Conklin
EnvE 130	**Meteorology and Air Pollution (4)** - Basic physics and thermodynamics of the atmosphere; fundamentals of atmospheric sciences important to environmental problems; chemistry and physics of atmospheric pollutants; visibility; air quality modeling; emissions; and air pollution control strategies..	Annually	Rogge	Bales
ESS 141	**Environmental Science and Policy (4)** - In depth-analysis of environmental case studies. Focus on science critical to policy development and implementation, the policy-making process, and policy outcomes. Special emphasis on interaction between scientific information and policy-making. Example topics include Western water resources, biodiversity conservation, and global warming. Emphasis on written and oral communication and critical analysis.	Annually	Kueppers	Westerling
EnvE 180	**Spatial Analysis and Modeling (4) –** Principles of geographic information systems (GIS); applications of GIS to environmental, water and resource management issues; problem solving with GIS; spatial interpolation techniques, model integration.	Annually (F05)	Guo	TBN
EnvE 181	**Field Methods in Snow Hydrology (1-3) -** Properties and measurement of snow. Principles of snow metamorphism and melting. Field workshops.	Annually (Spr05)	Bales	TBN
EnvE 182	**Field Methods in Surface Hydrology (1-3)** Measurement and interpretation of data; stream gauging, hydrography and limnology exercises; evaporation studies; micro-meteorological instruments and methods; discharge measurement; flood plain mapping; preparation of hydrologic reports. Field workshops.	Biannually	Bales	Harmon

EnvE 183	**Field Methods in Subsurface Hydrology** Introduction to fundamental field instruments used for vadose zone and subsurface field investigations.	Biannually (Spr08)	Harmon	Traina
EnvE 184	**Field Methods in Environmental Chemistry (1-3) -** Introduction to the fundamental field instruments used for environmental chemistry field investigations. Air, water and soil sample collection and preservation procedures. Particle separation and analysis, ion selective electrodes, colorimetric assays for nutrients and metallic species, extraction of organic species.	Annually (Spr08)	Conklin	O'Day, Traina

Footnotes:
TBN (to be named): Current priorities in Environmental Systems strategic hiring plan included (i) air pollution engineering/science, (ii) environmental microbiology, (iii) microbial ecology, (iv) ecosystem science, (v) global change ecology, and (vi) sustainability science.

6. RESOURCE REQUIREMENTS

6.1 Faculty FTE

The ES graduate group participated in UCM's strategic planning process during the 2005-06 academic year. The main goal of the group is to become an internationally recognized, premier graduate research program that emphasizes interdisciplinary studies of complex environmental systems. To achieve this status, we plan to (1) hire several key faculty members with direct ties to the ES group, (2) invest ES group effort in several current cross-school hiring initiatives to maximize interdisciplinary opportunities across all schools, and (3) formalize ties with neighboring institutions through adjunct faculty and professional research staff appointments (e.g., Lawrence Livermore National Lab, Lawrence Berkeley National Lab, National Park Service). Each of these activities is discussed further in the following sections.

6.1.1 Key Faculty Hires. UPDATE The ES faculty recognizes that the strength and uniqueness of our program lies in its position at the interface between science and engineering disciplines. As such, an important tenet of our strategic plan for faculty growth is to maintain a complementary balance of faculty in the Schools of Engineering and Natural Sciences, or joint positions, when appropriate, in strategic areas. We have identified the following areas to fill strategic needs in the ES program as either single- or cross-school FTE's towards maintaining this interdisciplinary program-building approach:

Searches in Progress (authorized either from original school allocations or AY '05-'06 cross-unit FTE (1)):

A. <u>Air Pollution Science and Engineering (1) : Search has identified one candidate, senior search is ongoing)</u>. Professor Wolfgang Rogge joined the faculty July 2007. We are seeking an additional person in the area of environmental science and engineering focused on air pollution in order to allow the ES group to better address regional and national air

quality problems. Recognizing California's increasingly poor air quality and the resulting negative impact on human health and the environment this area of research is conspicuously absent at UC Merced. Desirable areas of interest include biogenic emissions, urban and regional aerosols, and atmospheric chemistry, using approaches that may include laboratory or field measurements, or modeling. Ideally, we envision a Natural Science-Engineering joint hire.

B. Microbial Ecology (NS position): This position was allocated from the original 20 in NS. A candidate was identified and approved by CAP. Negotiations will begin once a spousal issue is resolved. This position has a high priority as we currently have no faculty representation in either NS or ENG in the broad area of microbiology of the environment.

C. Ecology/Ecosystem Science (NS position): This position was allocated from the original 20 in NS. A search was conducted last year that was not successful. The position was closed and will be re-advertised. This area has a high priority because of the need to supply missing expertise in ecology and strengthen interdisciplinary links between biological and physio-chemical environmental systems.

D. Ecology/Ecosystems Science (NS position): This position has not yet been detailed, but will be a replacement hire (NS faculty Jessica Green left UCM in July 2007).

NOTE: FTEs for positions B, C and D have been allocated as of August 2007.

Requested positions: AY '06-'07:

E. Sustainability Science. The ES Group sees a need for an FTE working on research in one or more areas of the emerging domain of sustainability. For UC Merced, we envision a interdisciplinary scholar working at the interface of science, engineering, and social problems pertaining to one or more of the critical sectors in sustainability from the perspective of SNRI and globally: water and sanitation, energy, environment and health, agriculture, biodiversity, and sustainable cities. Pertinent subtopics may include climate change and effects (e.g., water resources, biodiversity), global and regional population growth, urbanization, poverty and food production, environmental health, and global economics.

NOTE: **FTE for position E has been ALLOCATED as of AUGUST 2007**.

F. Environmental Microbiology. Environmental microbiologist is seen by the ES Group as another high priority hire if we are to achieve national competitiveness. This individual is necessary both at the graduate and undergraduate level for teaching (environmental microbiology) and expanding the capabilities of the group. This individual would be expected to provide a connection between ES with biosciences. Leading environmental research programs in the nation include a strong core subgroup of environmental microbiology and microbial ecology, typically 2-3 investigators. Engineering successfully identified a senior candidate for this position in 2004-05, but the candidate's current institution successfully retained that individual. The emphasis on this position is engineering microbiology, including the characterization of microbial communities in

both natural and engineered systems. This individual would be expected to team with microbial ecology and ecosystem science faculty from Natural Sciences to give the ES group a strong emphasis in this critical dimension of environmental systems.

G. Spatial Analysis/Earth Surficial Processes. The ES Group has also identified spatial analysis as an area for strategic recruitment. An individual working in the area of surficial processes would be appropriate, including areas such as landform/landscape evolution and forecasting, land surface geochronology, sediment transport, and land use-ecosystem interactions. This candidate might be well-suited for a hire in Natural Sciences, Engineering, or jointly between the schools. The group envisions that a hire in this area would provide the viable research core (along with Assistant Professors Shawn Newman (Computer Scientist) and Qinghua Guo) that would position the group competitively in the rapidly expanding area of research associated with multiscale observations and analyses of environmental patterns and processes through remote sensing, data mining, and feature extraction. Areas of interest to the ES group will depend on hires during the interim, but may include erosion and/or sediment transport, process geomorphology, ecohydrology, and hydrogeology.

6.1.2 Investment in Cross-School Faculty Hiring Initiatives. The ES group will continue to commit substantial effort to the on-going cross-unit searches aimed at identifying scholars who can bridge strategic gaps between UCM's Schools. These searches were identified as a result of UCM's previous strategic plan, and are in the broad areas of (1) environmental economics, (2) environmental policy, (3) chemistry and nanotechnology (with potential environmental applications), (4) materials and energy, and (5) evolutionary biology. In all cases the faculty appointment may reside within a single School, or may be joint between Schools, depending on the specific hire. In each case, the ES group recognizes potential for synergistic appointments although these individuals may not be principally associated with the ES group. For example, the environmental economist's research would address the economics or political economy of resource allocation, including market approaches to resource allocation; human impacts on the environment; economic effects of environmental change; the economic impact and design of environmental regulation; or the economics and finance of regulatory policy or infrastructure related to natural resource allocation. Similarly, the environmental policy candidate may be identified with interests in resource management policy; spatial aspects of environmental change; environmental consequences of urbanism and development; environmental justice; health and the environment; or cultural, political or economic dimensions of environmental policy.

6.1.3 Adjunct Faculty and Research Staff Appointments. At present the ES group has appointed one adjunct professor (Dr. Phil Duffy, LLNL) and one research engineer (Dr. Nigel Quinn, LBNL), all of which have already contributed by way of authoring extramural grants and co-advising UCM graduate students. Professor Traina and ES faculty were awarded a grant by the NSF for technician support for the Environmental Analytical Laboratory (EAL). UC Merced provides matching support for this individual, Dr. Liying Zhao, who started work on September 2006. In additions, Dr. Eric Berlow was appointed in Fall 2006 as the Sierra Nevada Research Institute Station Manager at the SNRI Wawona Station in Yosemite NP.

6.2 Library Acquisition

The UC Merced library opened its doors in 2005 with complete access for students and faculty to the combined collections of all of the University of California Libraries. The combined collection totals approximately 32M bound volumes and millions of items in other formats, including microfilm and sound recordings. Electronic access to extensive on-line information is available to all UC faculty and students through the California Digital Library.

As one of UC Merced's first three academic buildings, the Leo and Dottie Kolligian Library is a university research library of the 21st century, integrating physical and digital collections. The resources and services available are accessible from computers connected to the campus network and to the Internet. Some Library resources will be in either physical or digital mode. The mix of material will ultimately be determined by a faculty committee to guide acquisitions.

Early collection development has focused on the acquisition of gift materials that will support planned research and instructional programs. Volume count to date is in the tens of thousands. Scholarly journals include those in life sciences, geophysics, psychology, sociology, linguistics and public administration. Monograph collections include 750 rare books and brochures, 4,500 volumes about Native Americans and 1,500 volumes of Spanish literature. Materials in other formats include a collection of Asian music recordings and books about Asian music and a complete set of Early American Imprints on microcard. The early Library partnership with the National Park Service and the Ruth and Sherman Lee Institute for Japanese Art are early indicators that digitization of unique material and provision of online access will be a vital strategy for the development of special collections in support of research needs.

6.3 Computing

Academic computing resources are readily available at this stage of UC Merced's development. Several high performance computational clusters have been created by Natural Science and Engineering faculty, and are typically available for computationally intense research topics by ES graduate students and their mentors. A Geographic Information Systems computational lab is vital to the research of several ES faculty, and is currently being developed by Professors Guo and Bales in support of courses (ENGR 180, ES 240, ES 252, etc.).

6.4 Equipment

Professor Traina and ES faculty were awarded a grant by the NSF for technician support for the Environmental Analytical Laboratory (EAL). UC Merced provides matching support for this individual, Dr. Liying Zhao, who started work on September 2006. The EAL, which is dedicated to graduate research for the ES program, is equipped with the following major equipment: Aglient 7500cs inductively coupled plasma-mass spectrometer (ICPMS); Perkin-Elmer Optima 4000 DV inductively coupled plasma-atomic emission spectrometer (ICP-AES); Perkin-Elmer AAnalyst 600 graphite furnace atomic absorption spectrometer; two Dionex ICS 2000 ion chromatographs (one for cations, one for anions) equipped with pulsed electrochemical conductivity detectors; Agilent CP-3800 gas chromatograph coupled to an Agilent Saturn 2200 tandem mass spectrometer (GC-MS-MS); HP 6890 Gas Chromatograph equipped with electron capture and flame ionization detectors; Anton Paar Multiwave 3000 microwave digestion system (for solids digestion) and muffle furnace; Shimadzu TOC-VCSH total organic carbon analyzer

coupled to an AS1-V auto-sampler, a TNM-1 nitrogen module, and a SSM-5000A furnace for the determination of organic C and N in solid and liquid samples; and a Lachat QuikChem-8500 flow injection auto-analyzer. We anticipate adding an HPLC to this compliment of instruments within the next 3 months.
The Imaging and Microscopy Facility (IMF) is the first centralized, recharge-based research facility at UC Merced. This facility houses a FEI Quanta 200 environmental scanning electron microscope (E-SEM) with an EDAX Genesis 2000 EDS system, and a JEOL-2010 high resolution transmission electron microscope (TEM) equipped with a Gatan Image Filter (Gatan Model GIF2002) for electron energy-loss spectroscopy, an energy dispersive spectrometer with an ultra-thin window detector for light-element mapping, and liquid nitrogen cryotransfer holder. The facility is staffed with a full-time laboratory manager, who is responsible for student training and support as well as routine instrument maintenance.

6.5 Space and Capital Facilities

The majority of the ES faculty moved into the newly completed Science and Engineering 1 (SE1) building. SE1 consists of over 100,000 ASF with laboratory and office space for 92 faculty and laboratory desk space for graduate students and postdoctoral students in the laboratories. The space is currently configured in a manner that mixes ES faculty regardless of their school affiliations. This configuration is optimal for the interdisciplinary research mission of the program. The same cannot be said for the graduate student office space in SE1, which is inadequate and fragmented, eliminating opportunities for informal collaborative learning and cross-disciplinary research amongst the students. Another issues is the Environmental Analytical Laboratory (EAL), which remains housed in its original location at the Castle facilities. The EAL is needed by a large number of the ES graduate researchers, staff, and faculty, and this arrangement reduces research efficiency by further fragmenting the efforts of the group. Both of these issues are currently under negotiation between the administration, the ES group, and SNRI.

NOTE: As of May 2007, it was decided that a large portion of the EAL facilities would be moved to campus. Changes in space infrastructure (e.g., electrical) are currently being undertaken to accommodate the move.

7. GRADUATE STUDENT SUPPORT

In principle, our goal is to provide a minimum of four years of stipend support for each graduate student accepted into the doctoral program. Under ideal conditions we would hope that central support would be available for a student's first year or two years in a program. Currently, there is a shortage of teaching assistants (TAs) at UC Merced, and early support for the students is generally available (albeit across a broader spectrum of undergraduate courses than most environmental graduate students would typically experience). This surplus in TA positions is expected to disappear as other graduate programs appear at UC Merced.

At our sister campuses, fellowships (so-called "block grants") are also used to attract and support graduate students in their early years. No fellowship money was available for UC Merced in 2004-05, and approximately $90,000 in fellowship money was made available to UC Merced in 2005-06 (across all disciplines). This level of support is insufficient for a fledgling campus, and projections indicate a substantial deficit in the funds available to fully support the proposed graduate student population at UC Merced. In order for us to close this gap we will need to

capitalize on a wide variety of funding sources and other resources to support graduate education in the earliest years of the campus. ***In the early development phase of the ES program, and UC Merced graduate education as a whole, it is critical that larger block grant allocations be made available for graduate student recruitment and retention. This is especially the case from the perspective of assisting the many junior faculty at UC Merced.***

Beyond early support from special fellowships and TA positions, the ES faculty mentors are assuming responsibility for the stipend and fees of their graduate students. At this stage the faculty have proven that they can successfully compete for large-scope extramural funding in support of our research and training mission, having garnered more than $6M total over the past 2.5 years.

APPENDIX A: CPEC Information

1. **Name of Program: Environmental Systems**
2. **Campus: Merced**
3. **Degree/Certificate: M.S., Ph.D.**
4. **CIP Classification: (to be completed by UCOP) _____**
5. **Date to be started: January 1, 2008**
6. **If modification of existing program, ..: New program**
7. **Purpose (academic or professional training) and distinctive features (how does this program differ from others, if any, offered in California?):**

The proposed Environmental Systems (ES) program includes professional training aspects to equip M.S. graduates with knowledge and skills necessary to enter the work force in a variety of jobs, ranging from private consulting firms, to public agencies, and non-government organizations (NGOs). The Ph.D. program emphasizes academic training to promote careers in college and university teaching and research, as well as mission-oriented research such as for national laboratories and other government and public sector research institutions.

The proposed program strives to be unique, and is probably most similar to UC Berkeley's Environmental Science, Policy & Management (ESPM) program. Like ESPM, the ES program addresses environmental research issues ranging from earth and ecological science to environmental economics and policy. Unlike ESPM, however, the ES program also has strong environmental engineering and hydrologic science components..

8. **Type(s) of students to be served:**

The program will serve a broad array of students including those with background in environmental and other engineering disciplines, physical and biological sciences, such as ecology, geography, and resource management.

9. **If program is not in current campus academic plan, give reason for proposing program now:**

The program is in the UC Merced academic plan.

10. If the program requires approval of a licensure board, what is the status of such approval?

No such approval is required.

11. Please list special features of the program:

All academic requirements are described in sections 2.3 (M.S. program) and 2.4 (Ph.D program) of the proposal.

12. List all new courses required:

All courses are new and tabulated in section 5 of the proposal.

13. List all other require courses:

Not applicable.

14. List UC campuses and other California institutions which now offer or plan to offer this program or closely related programs:

There are numerous environmentally oriented graduate research programs in the UC system. These are summarized in section 1.5 of the proposal. As noted above, the ESPM program at UC Berkeley is probably the most similar to the proposed program. However, the ES program has stronger ties to engineering than the Berkeley program and also has unique regional ties to research topics in the San Joaquin Valley and central Sierra Nevada (including Yosemite, Sequoia, and Kings Canyon National Parks) through its faculty's participation in the Sierra Nevada Research Institute.

15. List any related program offered by the proposing institution and explain the relationship:

There are no similar programs at UC Merced.

16. Summarize employment prospect for graduates of the proposed program. Give results of a job market survey if such has been made:

No survey has been made, but we anticipate excellent job prospects for graduates of this program based on projections by the Bureau of Labor Statistics and Fortune Magazaine (March, 2005 issue). We expect our M.S. graduates will find employment with private engineering and hydrologic science firms, federal agencies such as the U.S. Forest Service, National Park Service, U.S. Enivonmental Protection Agency, as well as state resources agencies, such as the Department of Water Resources, Fish and Game, Water Quality Control Board, and Air Resources Board. Ph.D. graduates will find positions in similar agencies along with research and teaching positions in teaching and research universities.

17. Give an estimated enrollment for the first five years and state the basis for the estimate:

We anticipate an steady enrollment of approximately 25 M.S. students and 50 Ph.D. students within five years. This estimate a faculty of 25 and a student:faculty ratio of 3:1.

18. Give estimates of the additional cost of the program by year for 5 years in each of the following categories:

a. FTE faculty – We expect to hire 3-4 additional faculty in the areas of air quality/atmospheric chemistry (2), environmental microbiology/microbial ecology, and resource management. Searches are on-going for the first 3 position and the fourth position is has been given high priority in the strategic plans of the graduate group. These faculty appointments will be in the Schools of Engineering, Natural Sciences, and Social Science Humanities and Arts; in some cases there will be split-appointments.

b. Library Acquisitions – We anticipate no significant impact here.

c. Computing – Computing resources will be provided by existing University and School of Engineering computing facilities.

d. Other facilities and equipment – Teaching materials (e.g., lab suipplies and equipment) will be provided by the Schools of Engineering and Natural Sciences through co-listed courses offered for upper division undergraduates and ES graduate students. For strictly graduate courses, resources will be provided by the School of Engineering, whose Dean oversees the ES program.

19. How and by what agencies will the program be evaluated.

The ES program will be evaluated by an external review committee of UC faculty on a five year cycle. The Executive Committee will prepare a report for prior review by the committee in accord with UC policy. After reviewing this document, the review committee will make a site visit to meet with ES faculty and students, and review the program.

In order to improve the program from the employer's perspective, and external advisory board will be constituted within one year of the program's approval. Membership for this committee will be sought from the private, NGO, and government sectors.

APPENDIX B: Environmental Systems Faculty CVs

Roger C. Bales

School of Engineering
University of California
Merced, CA 95344-2039
Office: 209-724-4348 Mobile: 209-658-7148
Fax: 209-724-4459 Email: rbalesr@ucmerced.edu
Homepage: http://faculty.ucmerced.edu/rbales

Research Interests

Mountain hydrology and biogeochemistry, polar snow and ice, climate impacts and water resources.

EDUCATION

Ph.D. 1985 Environmental Engineering Science, California Institute of Technology
M.S. 1984 Social Science, California Institute of Technology
M.S. 1975 Civil Engineering, University of California, Berkeley
B.S. 1974 Civil Engineering, Purdue University

EMPLOYMENT

2003-present: School of Engineering, University of California, Merced (Professor and founding faculty member).
1984-2003: Department of Hydrology and Water Resources, University of Arizona, (Assistant Professor 1984-1989, Associate Professor 1989-1995, Professor 1995-2004).
1980-84: Graduate Research Assistant, California Institute of Technology.
1975-80: Project Manager and Project Engineer, Brown and Caldwell, Pasadena, California

REGISTRATION

Civil Engineer 27677, California

OTHER APPOINTMENTS

2004-present. Member, Hydrology Graduate Group, University of California, Davis.
2000-2003: Deputy Director NSF, Center for the Sustainability of Semi-Arid Hydrology and Riparian Areas, University of Arizona
2000-2003: Member, Committee on Remote Sensing and Spatial Analysis, University of Arizona.
1999-2003: Director, Regional Earth Science Applications Center, University of Arizona
1997-1999: Director, Institute for the Study of Planet Earth, University of Arizona
1994-2003: Member, Interdisciplinary Committee for Global Change, University of Arizona. Chair, 1994-1997.
1994-2000: Investigator, Center for Toxicology, University of Arizona.
1994-1995: Visiting Fellow, Udall Center for Studies in Public Policy, University of Arizona.
1989-93: Associate Researcher, Department of Geography, University of California, Santa Barbara.

PROFESSIONAL SOCIETIES

American Geophysical Union (Fellow), American Society for the Advancement of Science (Fellow), American Meteorological Society (Fellow), American Society of Civil Engineers, American Chemical Society, Association of Environmental Engineering Professors.

PROFESSIONAL ACTIVITIES

2004-present. Member, Committee on Integrated Hydrologic Observations, Water Science and Technology Board, National Research Council.

2003-2005: Member, Committee on Metrics for Global Change Research, National Research Council.

2002-2004: Member, Committee on Geophysical and Environmental Data, National Research Council.

2001-present: Member Representative, Consortium of Universities for the Advancement of Hydrologic Science, Inc. 2001-2004 Member, Board of Directors. 2001-2003 Member, Executive Committee. 2000-2001 Chair, steering committee to form consortium and PI on grant that funded the consortium.

2000-present: Steering Committee Chair and Science Coordination Office Director, Summit Greenland Environmental Observatory.

1999-2000, Chair, Steering Committee, Southwest Regional Assessment, U.C. Global Change Research Program; Member, Regional Assessment Team.

2000-2002: Member, Advisory Committee, Geosciences Directorate, National Science Foundation.

2000-2002, Steering Committee, Eos, Transactions, American Geophysical Union. Hydrology Editor, 1997-2001.

1999-2002: Member, Committee on Hydrologic Sciences, National Research Council.

1999-2001: Chair, Ice Core Working Group. Member, 1997-1999.

1999-2000: Member, Water Cycle Study Group, U.S. Global Change Research Program.

1994-1996: Hydrology section secretary, American Geophysical Union.

1992-1996: Associate editor, Water Resources Research.

1992-1996: Member, Committee on Glaciology, National Research Council.

1991-1996: U.S. representative, International Commission on Water Quality, International Association of Hydrologic Sciences.

1991-1995: Chair, Snow-Atmosphere Chemical Exchange Working Group, International Commission for Snow and Ice.

1990-1993: Fall meeting program chair, Hydrology Section, American Geophysical Union.

1987-1990: Steering Committee, Snow Chemistry Working Group, International Commission for Snow and Ice.

1985-1990: Water Quality Committee, Hydrology Section, American Geophysical Union.

1989-1991: Coagulation Research Committee, American Water Works Association.

Five relevant publications

N.P.Molotch,R.C. Bales, M. Colee, J. Dozier, Estimating the spatial distribution of snow water equivalent in an alpine basin using binary regression tree models: the impact of digital elevation data and independent variable selection, *Hydrol. Proc., 19: 1459-1479, 2005.*

T. Meixner, J.R. Shaw, R.C. Bales**,** Temporal and spatial variability of cation and silica export in an alpine watershed, Emerald Lake, California. *Hydrol. Proc.* 18(10): 1759-1776, 2004.

A.K. Huth, A. Leydecker, J.O. Sickman, R.C. Bales, A two-component hydrograph separation for three high-elevation catchments in the Sierra Nevada, California, *Hydrol. Proc.* 18 (9):1721-1733, 2004.

J.A. Rohrbough, D.R. Davis, R.C. Bales, Spatial variability of snow chemistry in an alpine snowpack, southern Wyoming, *Water Resour. Res.*, 39(7): 1190-1201,2003.

S.R. Fassnacht, K.A. Dressler, R.C. Bales, Snow water equivalent interpolation for the Colorado River Basin from snow telemetry (SNOTEL) data, *Water Resour. Res.*, 39(8): 1208-1217, 2003.

Five other publications

R.C. Bales, D.M. Liverman, B.J. Morehouse. Integrated assessment as a step toward reducing climate vulnerability in the southwestern United States, *Bull. Am. Met. Society*, 85: 1727–1734, 2004.

J.F. Burkhart, M.H. Hutterli, R.C. Bales J.R. McConnell, Seasonal accumulation timing and preservation of nitrate in firn at Summit, Greenland, *J. Geophys. Res.*, D19302, 2004

M.A. Hutterli, J.R. McConnell, G. Chen, R.C. Bales, D.D. Davis, D.H. Lenschow, Formaldehyde and hydrogen peroxide in air, snow and interstitial air at South Pole, *Atmos. Environ*. 38:5439-5450, 2004.

H.W. Jacobi, R.C. Bales, R.E. Honrath, M.C. Peterson, J. E. Dibb, A.L. Swanson, M. R. Albert, Reactive trace gases measured in the interstitial air of surface snow at Summit,Greenland, *Atmos. Environ*., 38: 1687-97, 2004.

T. Meixner, R.C. Bales, Hydrochemical modeling of coupled C and N cycling in high-elevation catchments: Importance of snow cover, *Biogeochemistry*, 62(3): 289-308, 2003.

CURRENT STUDENTS AND POSTDOCS

Ph.D. Ricardo Cisneros, Markus Frey.
M.S. Sarah Martin.
Postdoctoral. F. Liu, R. Rice

FORMER STUDENTS AND POSTDOCS

M. S.: J. F. Burkhart, B. J. Cadle, S. M. Carroll, J. Clemmons, S. Hinkle, D. Hunter, A. Kramer-Huth, D. G. Kebler, T. Kinoshita, A. Klein, T. W. Kroeger, D. Lawler, P. W. Lawson, D. McCaulou, K. L. McClellen, P. A. Noppe, C. Peters, C. E. Petersen, J.A. Rohrbough, J.R. Shaw, D. A. Stanley, K. Stocking, P. Whitaker, T. W. Whitehead, J. R. Winterle, B. D. Wolaver.

Ph. D.: J. Burkhart, Z. K. Chowdhury, K. Dressler, R. Harrington, A. Kramer-Huth, S. Li, R. A. Matzner, J. R. McConnell, T. Meixner, N. Molotch, D. L. Pardieck, R. H. Galarraga-Sanchez, J. E. Szecsody, M. P. Valdez, R. A. Wolford.

Postdoctoral: M. Anklin, C. Brown-Mitic, D. W. Cline, S. R. Fassnacht, M. Glueck, M. Hutterli, H. W. Jacobi, J. Morrill, A. Seth,

OTHER INFORMATION

Current Research Collaborators*:* M. Albert, C. Anastasio, T. Cahill, J. Dibb, J. Dozier, J. Frew, G. Huey, J. Kahl, B. Lefer, J. McConnell, N. Miller, A. Nolin, T. Painter, R. Shetter, R. Stewart, D. Tanner.

Graduate Advisor*:* J. J. Morgan.

Wei-Chun Chin, Assistant Professor of Engineering

EDUCATION/TRAINING

INSTITUTION AND LOCATION	DEGREE	YEAR(s)	FIELD OF STUDY
National Tsing-Hua University (Taiwan)	B.S.	1987	Chemical Engineering
National Tsing-Hua University (Taiwan)	M.S.	1989	Chemical Engineering
The University of Washington	M.S.E.	1996	Bioengineering
The University of Washington	Ph.D.	2000	Bioengineering
Johns Hopkins University	Post-doc	2001	Biomedical Engineering

A. Positions and Honors:

Positions and Employment

1991-1992	Laboratory Technician, Academia Sinica, Taiwan
1992-2000	Research Assistant, University of Washington
2000-2001	Postdoctoral Fellow, Biomedical Engineering, Johns Hopkins University
2001-2004	Visiting Assistant Professor, Chemical & Biomedical Engineering, Florida State University
2004-2005	Assistant Professor, Chemical & Biomedical Engineering, Florida State University
2005-	Assistant Professor, School of Engineering, University of California, Merced

Honors and Fellowships:

1985-1986	Book Coupon Awards
1988-1989	Department of Education Fellowship
1989	Phi Tau Phi (Taiwan)
1999	Nomination for Harold M. Weintraub Awards
1998-2000	Nanotechnology Fellowship (University of Washington)
2002	First-Year Assistant Professor Award

B. Publications:

1. Chin W-C, Orellana MV, Verdugo P. Spontaneous assembly of marine dissolved organic matter into polymer gels. Nature 1998. 391:568-572.

2. Nguyen T*, Chin W-C*, Verdugo P. Role of Ca^{2+}/K^{+} ion exchange in intracellular storage and release of Ca^{2+}. Nature 1998. 395:908-912.
   *These authors contributed equally to this work.

3. Dabrowski M J, Chen JP, Shi HQ, Chin W-C, Atkins WM. Strategies for protein-based nanofabrication: Ni^{2+}-NTA as a chemical mask to control biologically imposed symmetry. Chem. Biol.1998. 5:689-697.

4. Nguyen T, Chin W-C, O'Brien JA, Verdugo P, Berger AJ. Intracellular regulatory pathways of rat ependymocytes. J. Physiol. (London) 2001. 531:131-140.

5. Quesada I, Chin W-C, Steed J, Campos-Bedolla P, Verdugo P. Mouse mast cell secretory granules can function as intracellular ionic oscillators. Biophys. J. 2001. 80:2133-2139.

6. Chin W-C, Quesada I, Nugyen T, Verdugo P. Oscillations of pH inside the secretory granule control the gain of Ca^{2+} release for signal transduction in goblet cells exocytosis. Novartis Foundation (Ciba Foundation) Symposium, 2002, 248: 132-141.

7. Quesada I, Chin W-C, Verdugo P. ATP-independent lumenal oscillations and release of Ca^{2+} and H^{+} from mast cell secretory granules: implications for signal transduction. Biophys. J. 2003. 85: 963-970.

8. Orellana MV, Lessard EJ, Dycus E, Chin W-C, Foy MS, Verdugo P. Development of a high specificity ELISA assay to trace the source and fate of biopolymers in seawater. Mar. Chem. 2003. 83: 89-99.

9. Chin W-C, Orellana MV, Quesada I, Verdugo P. Secretion in unicellular marine phytoplankton: demonstration of regulated exocytosis in *Phaeocystis globosa.* Plant Cell Physiol**.** 2004. 45(5): 535-542.

10. Chin W-C, Quesada I, Steed J, Verdugo P. Modeling Ca-polyanion crosslinking in secretory networks. Assessment of charge density and bond affinity in polyanionic secretory network. Macromol. Symp. 2005. 227: 89-96.

11. Quesada I, Chin W-C, Verdugo P. Mechanisms of signal transduction in photo-stimulated secretion in *Phaeocystis globosa*. FEBS Lett. 2006. 580: 2201-2206.

12. Zheng J, Chin W-C, Khijniak E, Khijniak E Jr, Pollack GH. Surfaces and interfacial water: Evidence that hydrophilic surfaces have long-range impact. Adv. Colloid. Interface Sci. (in press).

Martha H. Conklin

School of Engineering
University of California, Merced
Merced, California 9530

Telephone: 209-724-4349 Internet: mconklin@ucmerced.edu
Fax: 209-724-4459 System: 209-724-4400

RESEARCH INTERESTS

Metal transport in natural waters, surface water/shallow groundwater interactions, biogeochemistry, organic chemical distribution in soil and ground water, chemical processes in snow, K-12 environmental education.

EDUCATION

Ph.D. 1986 Environmental Engineering Science, California Institute of Technology
M.S. 1980 Environmental Engineering Science, California Institute of Technology
A.B. 1976 Physics, Mount Holyoke College

EMPLOYMENT

2003-present: Professor, School of Engineering, University of California, Merced
1987-2003: Department of Hydrology and Water Resources, University of Arizona (Assistant Research Hydrologist 1987-89, Research Assistant Professor 1989-90, Assistant Professor 1990-1996, Associate Professor 1996-2002, Professor 2002-2003).
1986-87: Associate Engineer, Environ Corp., Washington, D.C.
1979-86: Graduate Research Assistant, California Institute of Technology.
1976-79: Air Quality Scientist, Environmental Research & Technology, Concord, Massachusetts.

OTHER APPOINTMENTS

1998-1999: Fellow, Udall Center for Studies in Public Policy, University of Arizona.
1994-2003: Investigator, Center for Toxicology, University of Arizona.

1994-2003: Member, Interdisciplinary Committee for Global Change, University of Arizona.

PROFESSIONAL SOCIETIES

American Geophysical Union, American Society of Limnology and Oceanography, Association of Enivironmental Engineering and Science Professors, American Chemical Society, American Society for the Advancement of Science, American Water Resources Association.

SELECTED PUBLICATIONS

Relevant and Recent Refereed Journal Papers

Morrill, J.C., R.C. Bales and M.H. Conklin, Estimating Stream Temperature from Air Temperature: Implications for Future Water Quality, *Journal of Environmental Engineering*, 131, 139, 2005.

J.W. Harvey, M.H. Conklin and R.S. Koelsch. Predicting changes in hydrologic retention in an evolving semi-arid alluvial stream, *Advances in Water Resources*, **26**, 939-950, 2003.

J.E. Villinski, J.E. Saiers and M.H. Conklin, The effects of reaction-product formation on the reductive dissolution of MnO_2 by Fe(II). *Environmental Science and Technology*, **37**, 5589-5596, 2003.

N. Melitas, M. Conklin and J. Farrell. Electrochemical study of arsenate and water reduction on iron media used for arsenic removal from potable water. *Environmental Science and Technology*,36, 3188-3193, 2002.

J.A.K. Silva, R. G. Bruant and M.H. Conklin. Equilibrium partitioning of chlorinated solvents in vadose zone: Low f_{oc} geomedia, *Environmental Science and Technology*, 36, 1613-1619, 2002.

J. Villinski, P.A. O'Day, T.L. Corley and M.H. Conklin. In situ spectroscopic and solution analyses of the reductive dissolution of MnO_2 by Fe(II). *Environmental Science Technology*. 35, 1157-1163, 2001.

J.T. Kay, M. H. Conklin, C.C. Fuller and P.A. O'Day. Processes of nickel and cobalt uptake by a manganese oxide forming sediment in Pinal Creek, Globe Mining District, Arizona. *Environmental Science and Technology*, 35, 4719-4725, 2001.

J. Choi, J.W. Harvey and M.H. Conklin. Characterizing multiple timescales of stream and storage zone interaction that affect solute fate and transport in drainage basins. *Water Resources Research*, 36(6), 1511-1518, 2000.

R.G. Bruant, Jr., and M.H. Conklin. Adsorption of trichloroethene at the air/water interface. *Environmental Science & Technology*, 35(2), 362-364, 2001.

R.G. Bruant, Jr., and M.H. Conklin. Dynamic determination of vapor/water interface adsorption for volatile organic compounds (VHOCs) using axisymmetric drop shape analysis: Procedure and analysis of benzene adsorption. *The Journal of Physical Chemistry B*, 104(47), 11146-11152, 2000.

J. Choi, M.H. Conklin, R.C. Bales, R.A. Sommerfeld. Experimental investigation of SO_2 uptake in snow. *Atmospheric Environment*, 34: 793-801, 2000

CURRENT STUDENTS

Ph.D.: Glenn Shaw (University of California, Merced.

CURRENT POSTDOCTORAL FELLOWS

Sarah May, Fengjing Liu

FORMER POSTDOCTORAL FELLOWS

Jean Morrill, John Villinski

FORMER PHD STUDENTS

Robert Bruant, Chunming Yu, Ingrid Padilla, Jungyill Choi, David Quanrud, John Villinski.

COLLABORATORS

Michael Hoffman (dissertation advisor), Christopher Fuller (USGS), G. Bryant Hudson (LLNL), Jean Moran (LLNL), Gregory Nims (LLNL), Roger Bales (UCM), David Goodrich (USDA ARS)

QINGHUA GUO, Assistant Professor of Engineering

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Email: qguo@ucmerced.edu Phone: (209) 724-2911, Fax: (209) 724-2912

EDUCATION

Institution	***Major***	***Degree & Year***
University of California at Berkeley	Environmental Sciences	Ph.D. 2005
Peking University, China	GIS and Remote Sensing	M.S. 1999
Peking University, China	Environmental Sciences	B.S. 1996

APPOINTMENTS

2005 - Present	Assistant professor, University of California at Merced
1999 - 2005	Research assistant, University of California at Berkeley
1996 - 1999	Research assistant, Peking University, China

PUBLICATIONS

Guo, Q., Kelly, M., Graham, C. 2005. Support vector machines for predicting distribution of Sudden Oak Death in California. *Ecological Modelling.* 182: 75-90.

Guo, Q., Kelly, M. 2004. Interpretation of scale in paired quadrat variance methods. *Journal of Vegetation Science*. 15: 763-770.

Liu D., P. Gong, M. Kelly, **Q. Guo**, In press. Automatic registration of airborne images by combining area-based methods with local transformation models. *Photogrammetric Engineering and Remote Sensing*.

Kim, J., **Guo, Q.**, Baldocchi, D., Xu, L., Leclerc, M. In Press. Upscaling CO_2 fluxes from tower to landscape: overlaying tower flux footprint calculations on high resolution (IKONOS) vegetation density images. *Agricultural and Forest Meteorology*.

Wieczorek,J., **Guo, Q.**, Hijmans, R. 2004. The Point-Radius method for georeferencing locality and calculating associated uncertainty. *International Journal of Geographical Information Science*. 18: 745-767

Kelly, M., Sharri, D., **Guo, Q.**, Liu, D. 2004. A comparison of standard and hybrid classifier methods for mapping hardwood mortality in areas affected by "sudden oak death". *Photogrammetric Engineering and Remote Sensing*. 70: 1229-1239.

Piao, S., Fang, J., Ji, W., **Guo, Q.**, Ke, J., Tao, S. 2004. Variation in a satellite-based vegetation index in relation to climate in China. *Journal of Vegetation Science.* 15: 219-226.

Fang, J., Piao, S., Field, C., Pan, Y., **Guo, Q.**, et. al. 2003. Increasing net primary production in China from 1982 to 1999. *Frontiers in Ecology and the Environment*. 1: 293-297.

Piao, S., Fang, J., Zhou, L., **Guo, Q.**, et. al. 2003. Interannual variation of monthly and seasonal normalized difference vegetation index (NDVI) in China from 1982 to 1999. *Journal of Geophysical Research*. 108(D14), 10.1029/2002JD002848.

Piao, S., Fang, J., **Guo, Q**. 2001. Terrestrial net primary production and its spatio-temporal patterns in China during 1982—1999. *Acta Scientiarum Naturalium Universitatis Pekinensis* (in Chinese). 37: 536-569.

Piao, S., Fang, J., **Guo, Q**. 2001. Estimation of net primary production in China. *Acta Phytoecologica Sinica* (in Chinese). 25: 603-609.

Zeng, H. Yu, H., **Guo, Q.** 2000. Simulation of urban growth based on a Cellular Automata model in Longhua Town, ShenZhen city. *Acta Ecologica Sinica* (in Chinese). 20: 545-551.

Guo, Q., Yu, H., Cao, Y., Zhang, Z. 1999. The remote sensing study on the characteristics of Forest-Steppe Ecotone. *Univesitatis Pekinensis* (in Chinese). 35: 550-557.

Fang, J. **Guo, Q.**, Liu, G. 1999. Distribution pattern of Chinese Beech (*Fagus L.*) species in relation to topology. *Acta Botanica Sinica* (in Chinese). 41: 766-774.

Zeng, H., **Guo, Q.**, Yu, H. 1999. Spatial analysis of landscape human transforming in Fenggang Town, Dongguan City. *Acta Ecological Sinica* (in Chinese). 19: 298-303.

Zeng, H., Shao, N., **Guo, Q.** 1999. A Study of landscape heterogeneity in the Eastern Pearl River Delta. *Acta Geographica Sinica* (in Chinese). 54: 255-262.

Zeng, H., Tan, J., **Guo, Q.** 1999. Landscape change in Eastern Pearl River Delta—a case study of ChangPing Town, Dongguan City. *Scientia Geographica Sinica* (in Chinese). 19, 73-77.

Zeng, H., **Guo, Q.**, Liu, X. 1998. Effects of spatial resolution on landscape pattern –a case study of Eastern Pearl River Delta. *Univesitatis Pekinensis* (in Chinese). 34: 820-826.

Zeng, H., Tan, J., **Guo, Q.** 1998. A landscape study of element transferring pattern and changing of ChangPing Town in Eastern Part of Pearl River Delta. *Journal of Basic Science and Engineer* (in Chinese). 6: 562-567.

Zeng, H., **Guo, Q**., Liu, J. 1997. Analyses of landscape ecological-changing characteristics of Dongguan City. *China Environmental Sciences* (in Chinese). 17: 422-425.

AWARDS

2004	Student Honors Paper Competition (2nd Place): Remote Sensing Specialty Group, 100th Annual Meeting of the Association of American Geographers
2001-2002	Carolyn Meek Scholarship: UC Berkeley
2001	NASA-MSU Professional Enhancement Award: US-International Association for Landscape Ecology
1998-1999	Jiu Ding-Xuan Scholarship: Peking Univ.
1997-1998	Outstanding Youth Scientist Award: Peking Univ.
1994-1995	Excellent Academic Scholarship: Peking Univ.
1992-1993	Excellent Social Work Award: Peking Univ.

PROFESSIONAL SERVICE

Reviewer

International Journal of Remote Sensing, Remote Sensing of Environment
Data Knowledge and Engineering, Acta Ecological Sinica
Journal of Spatial Hydrology, ASPRS 2006 Annual Conference

Society Membership

Association of American Geographers (AAG)
American Geophysical Union (AGU)
American Society for Photogrammetry and Remote Sensing (ASPRS)

JESSICA L. GREEN, Assistant Professor of Natural Sciences
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PROFESSIONAL PREPARATION

Education

University of California, Los Angeles	Civil and Environmental Engineering	B.S.	1992
University of California, Berkeley	Civil and Environmental Engineering	M.S.	1994
University of California, Berkeley	Nuclear Engineering	Ph.D.	2001

Postdoctoral Institutions

Rocky Mountain Biological Laboratory, Colorado	2001
Macquarie and Sydney University, Australia	2002 - 2003
University of California, Davis	2003 - 2004

APPOINTMENTS

- July 2004 – present **Assistant Professor**. School of Natural Sciences, University of California, Merced, California.
- 2002 – 2004 **NSF Bioinformatics Postdoctoral Fellow**. *Bioinformatics analysis of the effects of spatial scale and phylogenetic resolution on biodiversity theory: tests in a microbial landscape* DEB/DBI-0107555.
- 2004 **Affiliated Faculty**. Complex Systems Summer School, Santa Fe Institute.
- 2000-2001 **Graduate Fellow**. University of California President's Dissertation-Year Fellowship.
- 2000 **Graduate Fellow**. Phi Beta Kappa Northern California Association Graduate Fellowship.
- 1999-2000 **Graduate Fellow**. UC Toxics Research and Teaching Fellowship Program.

5 MOST RELEVANT PUBLICATIONS

Green, J.L., B. Bohannan. *In press.* Spatial scaling of microbial biodiversity. Trends in Ecology and Evolution.

Green, J.L., Hastings, A., Arzberger, P., Ayala, F., Cottingham, L., Cuddington, K., Davis, F., Dunne, J., Fortin, M.J., Gerber, L., Neubert, M. Complexity in ecology and conservation: mathematical, statistical, and computational challenges. Bioscience 55: 501-510.

Green, J.L., Holmes, A.J., Westoby, M., Oliver, I., Briscoe, D., Dangerfield, M., Gillings, M., Beattie, A. 2004. Spatial scaling of microbial eukaryote diversity. Nature 432: 747-750.

Green. J.L., Harte, J., Ostling, A. 2003. Species richness, endemism and abundance patterns: tests of two fractal models in a serpentine grassland. Ecology Letters 6: 919-928.

Green, J.L., A. Ostling. 2003. Endemics-area relationships: the influence of species dominance and spatial aggregation. Ecology 84: 3090-3097.

FIVE OTHER PUBLICATIONS

Hughes, J.B., Bohannan, B.J.M., Brown, J.H., Colwell, R.K., Fuhrman, J., **Green, J.L.**, Horner-Devine, M.C., Kange, J.A., Krumins, J.A., Kuske, C., Morin, P., Naeem, S., Øvereas, L., Reysenback, A-L., Smith, V., Staley, J. 2006. Microbial biogeography: putting microbes on the map. Nature Reviews Microbiology: 4: 102 – 112.

Harte, J., Ostling, A., **Green, J.L.**, A. Kinzig. 2004. Climate change and extinction. Nature 430: 145-148

Green, J.L., Harte, J., Ostling, A., 2001. Climate change and biodiversity loss, in B*iotic Homogenization: the Loss of Diversity Through Invasion and Extinction*. Edited by J. L. Lockwood and M. McKinney, Kluwer Academic/Plenum Publishers, New York.

Banavar, J.R., **Green, J.L.**, Harte, J., Maritan, A., 1999. Finite size scaling in ecology. Physical Review Letters 83: 4212-4214.

Harte, J., Kinzig, A., **Green, J.**, 1999. Self-similarity in the distribution and abundance of species. Science 284: 334-336

GRANTS

Green, J.L. (PI) and B. J. M. Bohannan. Spatial scaling of bacterial biodiversity. NSF: DEB. $480,000. 3/1/2006 – 2/28/2008.

Green, J.L. Spatial scaling of microbial diversity in the environment: biostatistical challenges. NSF: MCB- 0500124. $49, 425. 11/1/05 – 10/31/06.

SYNERGISTIC ACTIVITIES

- Founding faculty at the University of California at Merced, the tenth campus in the University of California and the first American research university to be built in the 21st century.
- Serve on the Smithsonian Institution Biodiversity Science and Education Initiative Task Force
- Chair of Santa Fe Institute working group "Unifying Current Theories of Ecology", October 2006. Co-organizers: Drew Allen, Steve Hubbell, Pablo Marquet.
- Actively working to engage K-12 students in quantitative environmental problem solving in Merced County School District.
- Member of working group at NCEAS addressing *Patterns in Microbial Biodiversity*, April 2005. The group of 20 was organized by Brendan Bohannan of Stanford University.

ADVISORS

Masters: Lisa Alvarez-Cohen (University of California, Berkeley)
Ph.D.: John Harte and William Kastenberg (University of California, Berkeley)
Postdoc: Alan Hastings (University of California, Davis), Mark Westoby (Macquarie University, Australia), Andrew Holmes (University of Sydney, Australia)

CURRENT ADVISING

Postdoctoral Assistants

- Hélène Morlon (Center for Computational Biology UCM)
- Ethan White (NSF Postdoctoral Fellowship in Biological Informatics). *Jessica Green and ecologist Brian Enquist (University of Arizona) are the co-sponsors for White's 2-year fellowship.*

Graduate Students

- Jeanie Hinds (1st year Environmental Systems PhD student).
- Daniel Santillano (2nd year Environmental Systems Master's student - Genomics Fellowship from the Society for Advancement of Chicanos and Native Americans in Science (SACNAS))

Research Assistants

- Jessica Bryant (B.S. UC Santa Cruz 2005).

Thomas C. Harmon, Professor of Engineering

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EDUCATION

The Johns Hopkins University	B.S. Civil Engineering	1985
Stanford University	M.S. Civil & Environ. Engineering	1986
Stanford University	Ph.D. Civil & Environ. Engineering	1992

APPOINTMENTS

July 2005-present	Professor and Founding Faculty Member, School of Engineering, University of California, Merced
July 2003-2005	Associate Professor and Founding Faculty Member, School of Engineering, University of California, Merced
July 1999- 2003	Associate Professor, Department of Civil & Environmental Engineering, University of California, Los Angeles
July 1992- 1999	Assistant Professor, Department of Civil & Environmental Engineering, University of California, Los Angeles

PROFESSIONAL AFFILIATIONS:

Association of Environmental Engineering Scientists & Professors (AEESP), American Geophysical Union (AGU), American Chemical Society (ACS), American Society of Civil Engineers (ASCE)

RECENT PUBLICATIONS

Bendikov, T.A. and Harmon, T.C. Long-lived solid state perchlorate ion selective sensor based on doped poly(3,4-ethylenedioxythiophene) (PEDOT) films, *Analytica Chimica Acta*, 551, 30-36, 2005.

Bendikov, T.A., Kim, J. and Harmon, T.C., Development and Environmental Application of a Nitrate Selective Microsensor Based on Doped Polypyrrole Films, *Sensors and Actuators B: Chemical*, 106(2), 512-517, 2005.

Kim, J., Y. Park and T. C. Harmon, Real-Time Model Parameter Estimation in Support of Analyzing Transport in Porous Media, *Groundwater Monitoring and Remediation*, 25(2), 1-9, 2005.

Bendikov, T.A. and T.C. Harmon. A Sensitive and Highly Selective Nitrate Ion Selective Electrode from a Pencil Lead: An Analytical Laboratory Experiment, *Journal of Chemical Education*, 82(3), 439-442, 2005.

Sciortino, A., T.C. Harmon and Yeh W. W-G., Experimental Design and Model Parameter Estimation for Locating a Dissolving DNAPL Pool in Groundwater, *Water Resources Research*, 38(5), U290-U298, 2002.

Saez, J.A. and T.C. Harmon, Optimal two-stage ground water pump-and-treat subject to slowly desorbing and persisting sources, in press *Ground Water*, January 2006.

Shih, T., Y. Rong, T. Harmon and M. Suffet. Evaluation of the Impact of Fuel Hydrocarbons and Oxygenates on Groundwater Resources, *Environmental Science and Technology*, 38(1), 42-48, 2004.

Khachikian, C S. and Harmon, T.C., Long-Term Studies of the Effects of NVOCs on the Surface Areas of Porous Media, *Journal of Environmental Quality*, 31(4), 1309-1315, 2002.
Burks, G.A. and Harmon, T.C., Volatilization of Solid Phase PAH Mixtures, *Journal of Chemical & Engineering Data*, 46, 944-949, 2001.
Harmon, T.C., Burks, G.A., Aycaguer, A-C., and Jackson, K. Thermally Enhanced Vapor Extraction for Removing PAHs from Lampblack-Contaminated Soil, *Journal of Environmental Engineering*, 127(11), 986-993, 2001.

SYNERGISTIC ACTIVITIES

Thomas Harmon (PI) is Harmon is currently collaborating on the science and technology ***Center for Embedded Networked Sensing*** (CENS) (#CCR-012077, 8/02-7/07, $20M), where he is directing the contaminant assessment and management applications research thrust areas. He is also a member of the CENS Research Executive Committee. One doctoral student and one postdoctoral scholar are currently receiving training on this project. To date three journal articles are in press [Ben05a, Ben05b; Kim05]. He is currently one of 5 co-PIs on the NSF ***ITR Networked Infomechanical Systems (NIMS*)**, funded at a level of $7.5M from 10/2003 to 9/2008; one of 5 co-PIs on the ***Biocomplexity Award Automated-Minirhizotron and Arrayed Rhizosphere Soil Sensors (10/04-9/09; $2M);*** and PI of a ***CLEANER Planning Grant (8/04-7/05, $86K) Embedded Networked Sensing in Support of a CLEANER California Water Cycle.*** Prof. Harmon was previously PI of a ***CAREER Award (BES 9502170, 1995-2000) Phase Equilibria and Mass Transfer Characteristics of Nonvolatile Organic Chemicals in Unsaturated Soils***. This project resulted in 6 journal papers [Yu99, Kha00a,b, Bur01, Har01, Kha02] and 3 PhDs, and 3 undergraduates received research experience on the project. He was also PI of a ***Combined Research-Curriculum Development Award (1998-2002) Virtual Reality in the Environmental Engineering Curriculum***. Several undergraduate programmers and two graduate students received pedagogical development experience on this project, which results in to educational research journal articles [Chu01; Har02].

COLLABORATORS AND OTHER AFFILIATIONS (past 4 years)

William Yeh, Phil Rundel, Jennifer Jay, Steve Margulis, Deborah Estrin, Greg Pottie, Jack Judy, Chih-Ming Ho, William Sandoval, Mani Srivastava, Richard Ambrose, William Kaiser, Eva Baker, John Villasensor (all UCLA), Janet Hering, Yu-Chong Tai (Caltech), Michael Allen, Edith Allen, Michael Hamilton (all UC-Riverside), Ari Requicha, Ramesh Govindan, Gaurav Sukhatme David Caron (U. Southern Cal.), John Gamon, Tina Salmassi, Fred Daneshgaran (Cal. State LA), Roger Bales, Sam Traina, Peggy O'Day, Martha Conklin, Jeff Wright, Christopher Viney, Valerie Leppert (UC Merced), Nigel Quinn, Norm Miller (Lawrence Berkeley National Lab), Andy Thompson, Reed Maxwell (Lawrence Livermore National Lab), Charlie Kratzer, Joe Domalgalski (USGS Sacremento)

Former Doctoral Students: Dung Kong, Los Angeles Co. Sanitation District, Brian Dela Barre (TetraTech/EMI), Antonella Sciortino (Cal. State Long Beach), Crist Khachikian (Cal. State Los Angeles), Glenn Burks (ERI Consultants), Priti Bhrama (NOAA), Moises Carvalho (2003), J. Saez (2004), Jason Fisher (2005).

Current graduate students: Masood Hosseini, Yeonjeong Park, John Ewart

Former Postdoctoral Scholars: Tatyana Bendikov (Weizmann Institute), Kevin Jackson (Uniroyal Tires), Hyung-Shin Sun (Bookman-Edmonston Constultants)

Current Postdoctoral Scholars: Jason Fisher, Alex Ratko

Valerie J. Leppert, Associate Professor of Engineering

Professional Preparation

Sonoma State University	Biology	B.A.	1986
Sonoma State University	Physics/Chemistry	B.A. (**with distinction**)	1987
Northwestern University	Mater. Sci. and Eng.	Ph.D.	1994

Appointments

07/04 - present	Founding Director, Imaging and Microscopy Facility, University of California at Merced, School of Engineering
07/04 - present	Founding Director, Foster Family Center for Engineering Service Learning, University of California at Merced, School of Engineering
07/05 - present	Associate Professor, Founding Faculty, University of California at Merced, School of Engineering 07/05 - present
07/03 - 07/05	Assistant Professor, Founding Faculty, University of California at Merced, School of Engineering
07/03 - 07/05	Visiting Assistant Professor, University of California at Davis, Department of Chemical Engineering and Materials Science
08/01 – 07/03	Assistant Professional Researcher, University of California at Davis, Department of Chemical Engineering and Materials Science
11/99 – 08/01	Assistant Adjunct Professor, University of California at Davis, Department of Chemical Engineering and Materials Science
03/95 – 11/99	Lecturer and Post-Graduate Researcher, University of California at Davis, Department of Chemical Engineering and Materials Science
09/87 – 12/93	Research Assistant, Northwestern University, Department of Materials Science and Engineering
12/84 – 09/96	Biologist, Anatec Laboratories, Santa Rosa, CA

Five Publications

1. A. Harvey, B. Guo, I. Kennedy, S. Risbud, and V. Leppert, "A Systematic Study of the Oxygen K-edge in the Cubic and Less Common Monoclinic Phases of the Rare Earth Oxides (Ho, Er, Tm, Yb) by Electron Energy Loss Spectroscopy", *J. Phys. Condens. Matter*, **18**:1 (2006)
2. J. Jasinski, I.M. Kennedy, K.E. Pinkerton, and V.J. Leppert, "Surface Oxidation State of Combustion-Synthesized γ-Fe_2O_3 Nanoparticles Determined by Electron Energy-Loss Spectroscopy in the Transmission Electron Microscope", *Sensors and Actuators B: Chemical*, **109**:19 (2005)
3. Y.M. Zhou, A. Aust, I.M. Kennedy, V.J. Leppert, S.V. Teague, and K.E. Pinkerton, "Reduced Lung Cell Proliferation Following Short-Term Exposure to Ultrafine Soot and Iron Particles in Neonatal Rats: Key to Impaired Lung Growth?", *Inhal. Toxic*. **16**:1 (2004)
4. Madewell, B.R., S.M. Griffey, M.C. McEntee, V.J. Leppert, and R.J. Munn, “Feline Vaccine-associated Fibrosarcoma: An Ultrastructural Study of 20 Tumors (1996-1999),” *Vet. Path.* **38**:196 (2001)
5. Yang, Y., V.J. Leppert, S.H. Risbud, B. Twamley, P.P. Power, and H.W.H. Lee, "Blue Luminescence from Amorphous GaN Nanoparticles Synthesized *In Situ* in a Polymer,” *Appl. Phys. Lett*. **74**, 2262 (1999)

Five Other Publications

1. Zhou, Y.M., C.Y. Zhong, I.M. Kennedy, V.J. Leppert, and K.E. Pinkerton, "Oxidative Stress and Activation of NF_KB in the Lungs of Healthy Adult Rats: A Synergistic Interaction Between Soot and Transition Metal Iron Particles," *Toxic. and Appl. Pharm.* **190:**157 (2003)
2. Leppert, V.J., A.K. Murali, S.H. Risbud, M. Stender, P.P. Power, C. Nelson, P. Banerjee, and A.M. Mayes, "Microscopy and Microanalysis of Ordered Arrays of Size-controlled Ga-Nitride Nanoclusters in a Block Copolymer Matrix," *Phil. Mag. B* **82**:1047 (2002)
3. Leppert, V.J., C.J. Zhang, H.W.H Lee, I.M. Kennedy, and S.H. Risbud, "Observation of Quantum Confined Excited States of GaN Nanocrystals," *Appl. Phys. Lett.* **72:**3035 (1998)
4. Leppert, V.J., S. Mahamuni, N.R. Kumbhojkar, and S.H. Risbud, "Structural and Optical Characteristics of ZnSe Nanocrystals Synthesized in the Presence of a Polymer Capping Agent," *Mater. Sci. Eng. B* **52**:89 (1998)
5. Leppert, V.J., S.H. Risbud, and M.J. Fendorf, "High-resolution Electron Microscopy and Microanalysis of ZnSe Quantum Dots in Glass Matrices," *Phil. Mag. L.* **75**:29 (1997)

Synergistic Activities

1. Research Facility Development: Founding Director for UC Merced Imaging and Microscopy Facility, Co-Founder of Electron Microscopy Materials Science Central Facilities at UC Davis.
2. Curriculum Innovation: Director of Engineering Service Learning and PI for UC Merced EPICS (Engineering Projects in Community Service) grant through Purdue University, funded by NSF CLC program. Chair of Engineering Service Learning Committee. UC Merced EPICS service learning mentor for students who constructed a physics exhibit for the Castle Science and Technology Center in Atwater, CA.
3. Professional Activities: Poster Session I chair, NSF International Workshop on Nanomaterials, September 30 – October 2, 2002, Brasov, Romania; Nanocomposite Symposium co-chair, 9th International Conference on Composites Engineering, July 1-6, 2002, San Diego, CA; NSF Panel Reviewer, Instrumentation Development for Biological Research, 2001-2005; NSF Mail-In Reviewer, Electrochemistry and Surface Chemistry, Ceramics, and Metals Programs, 2001-2005.

Honors and Awards

2005 Research Fellowship, International Center for Young Scientists, Japan National Institute of Materials Science
2004 Invited Participant, National Academy of Engineering 10th Annual Symposium on Frontiers of Engineering
2003 Finalist, UC Davis Academic Federation Award for Excellence in Research
2002 NSF Advance Fellows Award - Electron Microscopy of Nanomaterials
1992 Alpha Sigma Mu - National Metallurgical and Materials Engineering Honor Society
1987 Graduation with Distinction in Chemistry, SSU

Organizations

Materials Research Society
American Physical Society
Microscopy Society of America Soc. of Women Engineers
Northern California Society for Microscopy

***Ph.D. Advisor*:** R.P.H. Chang, Northwestern U.
***Postdoctoral Advisor*:** S.H. Risbud, UC Davis
***Students*:** Graduate - Rebecca Chacon (M.S., 12/04), Ashley Harvey (Ph.D., 1/06), Geoff McCool (M.S., 6/04), Undergraduate - Christina Zhang, Bridget Bonner, John Tseng, Cameron Shelton, Derek Shon, Jack Ostrowski, Paul Sherrill, Ben Sherrill, Anthony Hayes, Ryan Dewitt, Kip Hensley, Nathan Graves, Matthew Nelson, Cameron Hoyle

MÓNICA MEDINA

University of California, Merced
Merced, CA 95344
tel: (209) 724-4309
e-mail: mmedina@ucmerced.edu

Current position:
Assistant Professor
School of Natural Sciences

EDUCATION

Ph.D. 1998. Marine Biology and Fisheries (MBF). Rosenstiel School of Marine and Atmospheric Science. University of Miami. *Molecular Systematics and Population Genetics of Sea Hares (Gastropoda: Opisthobranchia: Anaspidea).*
B.S. 1989. Biology. Universidad de Los Andes. Bogotá, Colombia.

PROFESSIONAL EXPERIENCE

Assistant professor. July 2005-current. University of California, Merced. School of Natural Sciences.
Research scientist. (2000 - 2005). Lawrence Berkeley National Laboratory - DOE Joint Genome Institute. Walnut Creek, CA. Comparative and functional genomics.
Research associate (2001 - Present). California Academy of Sciences (CAS). Invertebrate Zoology and Geology Department.
Postdoctoral research fellow. (2000). California Academy of Sciences (CAS). San Francisco, CA. Nudibranch systematics.
Postdoctoral research fellow. (1998-2000). Marine Biological Laboratory (MBL). Woods Hole, MA. Eukaryotic and metazoan evolution. P.I. Mitchell Sogin.

Teaching Experience

Assistant professor. (present). Evolution, Evolution and Development & Genome Biology. UC Merced.
Invited visiting professor. (2003). Introduction to Genome Science. Universidad Nacional. Bogotá. Colombia.
Invited visiting professor. (2002). Graduate course on molecular phylogenetics. Universidad de Cadiz. Spain.

HONORS

2005. Elected fellow of the California Academy of Sciences. San Francisco, CA.

2000. Sigma-Xi associate member.

RECENT PUBLICATIONS

Concepcion, G.T., **M. Medina** and R.J. Toonen (*in press*). Non-coding mitochondrial loci for corals. *Molecular Ecology Notes*.

Tyler, B.M., S. Tripathy, X. Zhang, P. Dehal, R. Jiang, A. Aerts, C.M.B. Damasceno, D Dou, I. Dubchak, M. Gijzen, S. Gordon, F. Govers, N. Grunwald, W. Huang, K. Ivors, S. Kamoun, K. Krampis, Kurt Lamour, W. H. McDonald, **M. Medina**, H. Meijer, E. Nordberg, M.D. Ospina-Giraldo, P. Morris, N. Putnam, S. Rash, J. K.C. Rose,[5] Y. Sakihama, A. Salamov, A. Savidor, B. Smith, J. Smith, B. W. S. Sobral, A. Terry, T. Torto-Alalibo, J. Win, H. Zhang, I. Grigoriev, D. Rokhsar,

and J. Boore. (*2006*) *Phytophthora* Genome Sequences Uncover Evolutionary Origins and Mechanisms of Pathogenesis. *Science* 313(5791):1261-1266.

Medina, M., A. Collins, T. Takaoka, J. Kuehl, and J. Boore. *(2006)*. Naked corals: Skeleton Loss in Scleractinia. *Proceedings of the National Academy of Sciences US.* 103(24):9096-9100.

Pola, M, Y. Valles and **M. Medina,** and T. Gosliner. (*2006*) Taxonomic status of *Tambja abdere* and *Tambja fusca* based on morphological and molecular evidence, with comments on the phylogeny of the subfamily Nembrothinae (Nudibranchia, Polyceridae*). Annales Zoologici Fennici* 43:52-64.

Collins, A.G., P. Schuchert, A.C. Marques, T. Jankowski, **M. Medina** and B. Schierwater (*2006*). Cnidarian Phylogeny and Character Evolution Clarified by New Large and Small Subunit rDNA Data and an Assessment of the Utility of Phylogenetic Mixture Models. *Systematic Biology* 55(1):97-115.

Medina, M., T.M. Collins, and P.J. Walsh. (2005). Phylogeny of the sea hares in the *Aplysia* clade based on mitochondrial DNA sequence data. *Bulletin of Marine Science* 76(3):691-698.

Medina, M. (2005) Genomes, Phylogeny and Evolutionary Systems Biology. *Proceedings of the National Academy of Sciences USA.* 102:6630-6635.

Armbrust, E. V., J.A. Berges, C. Bowler, B.R. Green, D. Martinez, N.H. Putnam, S. Zhou, A.E. Allen, K.E. Apt, M. Bechner, M.A. Brzezinski, B.K. Chaal, A. Chiovitti, A.K. Davis, M.S. Demarest, J. C. Detter, T. Glavina, D. Goodstein, M. Z. Hadi, U. Hellsten, M. Hildebrand, B.D. Jenkins, J. Jurka, V.V. Kapitonov, N. Kröger, W.W.Y. Lau, T.W. Lane, F.W. Larimer, J.C. Lippmeier, S. Lucas, **M. Medina**, A. Montsant, M. Obornik, M. Schnitzler Parker, B. Palenik, G.J. Pazour, P.M. Richardson, T.A. Rynearson, M.A. Saito, D.C. Schwartz, K. Thamatrakoln, K. Valentin, A. Vardi, F.P. Wilkerson, D. S. Rokhsar. (2004). The genome of the diatom *Thalassiosira pseudonana*: ecology, evolution, and metabolism. *Science* 301:79-86. **(Selected by Faculty of 1000).**

Boore, JL, **M. Medina**, and L.A. Rosenberg. (2004). Complete sequences of two highly rearranged molluscan mitochondrial genomes, those of the scaphopod *Graptacme eborea* and of the bivalve *Mytilus edulis. Molecular Biology and Evolution.* 21(8):1492-15003.

Medina, M., **A. Collins, J. Taylor, J.W. Valentine, J. Lipps, L. Amaral-Zettler, and M.L. Sogin. (2003). Phylogeny of Opisthokonta and the evolution of multicellularity and complexity in Fungi and Metazoa. *International Journal of Astrobiology* 2:203-211.**

Walsh, P.J., G.D. Meyer, **M. Medina**, M.L. Bernstein, J. Barimo, and T. Mommsen. (2003). A second glutamine synthetase gene with expression in the gills of the ureotelic gulf toadfish (*Opsanus beta*). *Journal of Experimental Biology* 206:1523-1533.

Dehal P, Satou Y, Campbell RK, Chapman J, Degnan B, De Tomaso A, Davidson B, Di Gregorio A, Gelpke M, Goodstein DM, Harafuji N, Hastings KE, Ho I, Hotta K, Huang W, Kawashima T, Lemaire P, Martinez D, Meinertzhagen IA, Necula S, Nonaka M, Putnam N, Rash S, Saiga H, Satake M, Terry A, Yamada L, Wang HG, Awazu S, Azumi K, Boore J, Branno M, Chin-Bow S, DeSantis R, Doyle S, Francino P, Keys DN, Haga S, Hayashi H, Hino K, Imai KS, Inaba K, Kano S, Kobayashi K, Kobayashi M, Lee BI, Makabe KW, Manohar C, Matassi G, **Medina M**, Mochizuki Y, Mount S, Morishita T, Miura S, Nakayama A, Nishizaka S, Nomoto H, Ohta F, Oishi K, Rigoutsos I, Sano M, Sasaki A, Sasakura Y, Shoguchi E, Shin-i T, Spagnuolo A, Stainier D, Suzuki MM, Tassy O, Takatori N, Tokuoka M, Yagi K, Yoshizaki F, Wada S, Zhang C, Hyatt PD, Larimer F, Detter C, Doggett N, Glavina T, Hawkins T, Richardson P, Lucas S, Kohara Y, Levine M, Satoh N, Rokhsar DS. (2002). The draft genome of *Ciona intestinalis*: Insights into chordate and vertebrate origins. *Science* 298:2157-2167. **(Selected by Faculty of 1000).**

Medina. M., T.M. Collins, and P.J. Walsh. (2001). MtDNA ribosomal gene phylogeny of sea hares in the genus *Aplysia* (Gastropoda, Opisthobranchia, Anaspidea): Implications for comparative neurobiology. *Systematic Biology* 50(5):676-688.

Peggy A. O'Day

Professor, School of Natural Sciences, University of California, Merced

Education	1992	Ph.D., Stanford University, Stanford, CA, Applied Earth Sciences
	1984	M.S., Cornell University, Ithaca, NY, Geological Sciences
	1981	B.S., University of California, Davis, CA, Geology, *with Honors*

Professional Experience
2005-present: Professor & Founding Faculty, University of California, Merced
2003-2005: Associate Professor & Founding Faculty, University of California, Merced
2002-2003: Department of Chemistry & Biochemistry, Arizona State University, 50% position
2000-2003: Associate Professor, Department of Geological Sciences, Arizona State University
2000-2001: Visiting Scholar, Lawrence Livermore National Laboratory, Livermore, CA
1994-2000: Assistant Professor, Geology Department, Arizona State University
1992-1994: Post-Doctoral Research Fellow, University of California, Berkeley
1987-1992: Ph.D. Candidate, Applied Earth Sciences, Stanford University
1986-1987: Research Assistant, Environmental Science & Engineering, Rice University

Professional Activities and Awards
Gast Lecturer, Goldschmidt Conference, Geochemical Society, Copenhagen DK, 2004
Associate Editor, *Geochimica et Cosmochimica Acta*, 2001-present
Panel Review Member, NSF-EAR Instrumentation and Facilities Program, 2003-2006
American Chemical Society, Geochemistry Division, Program Chair, 2001; Chair, 2002
Mineral & Rock Physics Committee Member, American Geophysical Union, 2000-2002
GeoSync Society, American Geophysical Union, Chair, 2000-2001
National Science Foundation, Faculty Early Career Award, 1996-2000
Mineralogical Society of America, National Visiting Lecturer, 1995-1996
National Science Foundation, Post-Doctoral Research Fellow, Earth Sciences, 1992-1994

Experience and Research Interests
Mineral-aqueous interface geochemistry; chemistry and mobility of contaminants in the environment; geochemical and biogeochemical applications of spectroscopy and microscopy, in particular synchrotron X-ray methods; inorganic, organic, and microbial chemistry at ambient and hydrothermal conditions.

Synergistic Activities
Participant, Sally Ride Science Festival, Arizona State University, 2003
Participant, *DSV Alvin/Atlantis* Cruise Extreme 2002, 9°N East Pacific Rise
Participant, *DSV Alvin/Atlantis* Cruise Extreme 2001, 9°N East Pacific Rise
Participant, Interdisciplinary Workshop on Nanogeoscience, 2002
Faculty Participant, ASU "Down-to-Earth" K-12 Education and Outreach Program, 2000-2003
Faculty Participant, NSF-IGERT Program in Urban Ecology, 2000-2003

Five Publications Related to the Proposed Research

1. O'Day, P. A., Vlassopoulos, D., Meng, X. and Benning, L. G., Editors, (2005) *Advances in Arsenic Research: Integration of Experimental and Observational Studies and Implications for Mitigation*, American Chemical Society Symposium Series **915**, 433 pp.
2. O'Day, P. A., Vlassopoulos, D., Root, R., and Rivera, N. (2004) The influence of sulfur and iron on dissolved arsenic concentrations in the shallow subsurface under changing redox conditions, *Proc. Nat. Acad. Sciences* **101**, 13703-13708.

3. O'Day, P. A., Rivera, N., Root, R., and Carroll, S. A. (2004) X-ray absorption spectroscopic study of iron reference compounds for the analysis of natural sediments, *Am. Miner.* **89**, 572-585.
4. Kneebone, P. E., O'Day, P. A., Jones, N., and Hering, J. G. (2002) Deposition and fate of arsenic in iron-and arsenic-enriched sediments, *Environ. Sci. Tech.* **36**, 381-386.
5. Carroll, S. A., O'Day, P. A., Esser, B., and Randall, S. (2002) Speciation and fate of trace metals in estuarine sediments under reduced and oxidized conditions, Seaplane Lagoon, Alameda Naval Air Station (USA), *Geochem. Trans.* **3**(10), 81-101.

Five Other Publications

1. McCliment, E.A., Voglesonger, K. M., O'Day, P. A., Dunn, E. E., Holloway, J. R., and Cary, S. C. (2006) Colonization of nascent, deep-sea hydrothermal vents by a novel Archaeal and Nanoarchaeotal assemblage, *Environ. Microbiology* (**8**(1), 114-125).
2. Savage, K. S., Bird, D. K., and O'Day, P. A. (2005) Arsenic speciation in synthetic jarosite, *Chem. Geol.* **215**, 473-498.
3. Vlassopoulos, D., O'Day, P. A., Rivera, N., Rafferty, M. T., and Andrews, C. B. (2005) Arsenic removal by granular iron: A field-based study of rates, mechanisms and long-term performance, in *Advances in Arsenic Research: Integration of Experimental and Observational Studies and Implications for Mitigation*, O'Day et al. (Eds.), ACS Symposium Series **915**, 344-360.
4. O'Day, P. A., Carroll, S. A., Randall, S., Martinelli, R. E., Anderson, S. L., Knezovich, J. P., and Jelinski, J. (2000) Metal speciation and toxicity in contaminated estuary sediments, Alameda Naval Air Station, California, *Environ. Sci. Tech.* **34**, 3665-3673.
5. O'Day, P. A. (1999) Molecular environmental geochemistry, *Rev. Geophys.* **37**, 249-274.

Collaborators (last 36 months)

D.K. Bird (Stanford), S.C. Cary (Univ. Delaware), S.A. Carroll (LLNL), J. Chorover (Univ. Arizona), L. Criscenti (Sandia), C.C. Fuller (USGS), F. Garrido (CSIS, Madrid, Spain), L. Garvie (Arizona State), J.G. Hering (Caltech), R. Hervig (Arizona State), J.R. Holloway (Arizona State), K. Mueller (Penn State), K.S. Savage (Vanderbilt Univ.), J. Serne (PNNL), E. Shock (Arizona State), C. Steefel (LBNL), G.A. Waychunas (LBNL), D. Vlassopoulos (SSPA)

Graduate Student Advisees

UC Merced Nelson Rivera (Ph.D.) Robert Root (Ph.D.) Dorothy Beals (Ph.D.)

Arizona State University

Lara Heister (M.S. '97)
Katherine Geiger (M.S. '99)
Jill Best (M.S. '02)
Nelson Rivera (M.S. '04)
Dawn Ashbridge (M.S. '02)
Robert Root (M.S. '03)
Ken Voglesonger (Ph.D. '04)

Post-Doctoral Scholars *(current):* Virginia Illera Ramon; Sunkyung Choi
Previous: Nita Sahai (Univ. of Wisconsin)

Graduate Advisors: George A. Parks, Gordon E. Brown, Jr. (Stanford University)

Post-graduate Sponsor: Harold C. Helgeson (UC Berkeley)

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Education: **B.S., Soil Science, 1978, University of California, Berkeley; Ph.D., Soil Chemistry, 1983, University of California, Berkeley.**

Professional Experience: Postdoctoral Scientist, Department of Soil and Environmental Sciences, University of California, Riverside (1983-1984); Assistant Research Professor, Department of Soil and Environmental Sciences, University of California, Riverside (1984-1985); Assistant Professor, Department of Agronomy, Assistant Professor, Environmental Biology, The Ohio State University, (1985-1991); Associate Professor, Department of Agronomy, Associate Professor, Environmental Science, The Ohio State University (1991-1994); Associate Professor, School of Natural Resources, Associate Professor, Environmental Science, Associate Professor, Department of Geological Science, The Ohio State University, (1994-1997); Director of the Graduate Program in Environmental Science, The Ohio State University, (1995-1998); Professor, School of Natural Resources, Professor, Environmental Science and Professor, Department of Geological Science, The Ohio State University, (1997–present); Cox Visiting Professor of Earth Sciences, Stanford University (1998). Co-Director, The Ohio State University EMSI (2000-July 1, 2002), Adjunct Professor, OSU, (2002- present). Professor of Natural Science, Professor of Engineering, University of California, Merced; Founding Director, Sierra Nevada Research Institute, University of California, Merced (7/1/02 - present).

Professional Service: Review of DOE Subsurface Science Program, Deep Microbiology and Co-contaminants Programs (1994); US EPA, Exploratory Research Program, Panel Member (1994); USDA, National Research Initiative, Panel Member (1994); USDA National Research Initiative. Panel Chair (1996); DOE, ER-NABIR Program, Panel Member (1996); DOE, ER-NABIR Program, Biogeochemical Dynamics Group, Panel Chair (1997); National Academy of Science/National Research Council Panel on Remediation of Naval Weapons Sites, Panel Member (1997-1998); DOE, OS-ER-EMSP, Hydrogeology Panel Chair (1999); Clay Minerals Society Technical Program Chair (1999); Chair of Clarke Medal Committee, The Geochemistry Society (1999). DOE-EMSP Chemistry Panel Member (2001). Panel Review of Heavy Element Chemistry Group, Los Alamos National Laboratory (2001), Panel Review of Earth Science Division of LBL (2003). DOE- ERD subcommittee of BERAC, 2003-present

Honors: Distinguished Graduate Teaching Award, UC Berkeley, 1981. Distinguished Research Award, Ohio Agricultural Research and Development Center, 1990; Multidisciplinary Team Research Award, Ohio Agricultural Research and Development Center, 1998; Cox Visiting Professor, School of Earth Sciences, Stanford University, 1998. Fellow Soil Science Society of America, 2001, Jackson Award, Clay Minerals Society, 2005.

Research Interests: Environmental chemistry, soil chemistry and geochemistry of organic and inorganic contaminants in terrestrial and aquatic environments; thermodynamic, kinetic and spectroscopic studies of contaminant solution and surface chemistry; remediation of contaminants in soils, sediments and aquatic systems. Spectroscopic studies of contaminant-surface interactions.

Five Relevant Publications:

He, Y. Thomas, Chen, Chia-Chen and Traina, Samuel J. 2004. Inhibited Cr(VI) reduction by aqueous Fe(II) under hyper-alkaline conditions. Environ. Sci. Tech. 38:5535-5539.

Klupinski, Theodore P.; Chin, Yu-Ping; Traina, Samuel J. 2004. Abiotic Degradation of Pentachloronitrobenzene by Fe(II): Reactions on Goethite and Iron Oxide Nanoparticles. Environ. Sci. Tech. 38:4353-4360.

Zachara, John M.; Ainsworth, Calvin C.; Brown, Gordon E.; Catalano, Jeffrey G.; McKinley, James P.; Qafoku, Odeta; Smith, Steven C.; Szecsody, James E.; Traina, Sam J.; Warner, Jeffrey A. Chromium speciation and mobility in a high level nuclear waste vadose zone plume. 2004. Geochimica et Cosmochimica Acta 68(1), 13-30.

He, Y.T., and S.J. Traina. 2005. Cr(VI) reduction and immobilization by magnetite under alkaline pH conditions: the role of passivation. Environ. Sci. Technol. 2005 39(12)4499-4504.

He, Y.T., J.M. Bigham, and S.J. Traina. 2005. Biotite dissolution and Cr(VI) reduction at elevated pH and ionic strength. Geochim. Cosmochim. Acta 2005 34(2) 676-686.

Five Other Publications:

Templeton, A.S., T.P. Trainor, S.J. Traina, A.M. Spromann and G.E. Brown, Jr. 2001 Pb(II) distributions at biofilm-metal oxide interfaces. Proceed Nation. Acad. Sci. 98(21), 11897-11902.

Traina, S.J., N. Fendinger, and D. McAvoy. 2002. Fate of polydimethylsilicone in biosolids-amended field plots. J. Environ. Qual. 31:247-255.

Adhiya, J., X. Cai, R.T. Sayre, S.J. Traina. 2002. Binding of aqueous cadmium by the lyophilized biomass of *Chlamydomonas reinhardtii*. Colloids Surf. A: Physico. Engin . Asp. 210:1-11.

Williams, D.J., J.M. Bigham, C.A. Cravotta, S.J. Traina, J.E. Anderson and J.G. Lyon. 2002. Assessing mine drainage water quality from the color and spectral reflectance of chemical precipitates. Appl. Geochem. 17:1273-1286

Siripornadulsil, S., S. Traina, D.P. S. Verma, and R.T. Sayre. 2002. Molecular mechanisms of proline-mediated tolerance to heavy metals in transgenic microalgae. Plant Cell. 14:2837-2847.

Ph.D. Advisor: Harvey Doner, University of California, Berkeley
Post-Doctoral Advisor: Garrison Sposito, University of California, Riverside

APPENDIX C: Environmental Systems Letters of Support

APPENDIX D: Environmental Systems Administrative Bylaws

UC Merced Graduate Group in Environmental Systems

BYLAWS

Article I: Objective

The graduate emphasis in Environmental Systems is organized to establish and administer a program of instruction and research leading to the M.S. and Ph.D. in conformance with the regulations of the Graduate Council and the Division of Graduate Studies at the University of California, Merced. The Graduate Group is responsible for establishing standards and requirements for the M.S. and Ph.D. degrees and certifying satisfactory completion by candidates.

The Group function is to provide a focus for graduate training in Environmental Systems by facilitating the research interactions among and between graduate students and faculty. By its very nature the study of environmental systems is multifaceted and draws on the expertise of the Natural Sciences, and Engineering disciplines, as well as those within the Social and Behavioral Sciences, and Management. The principal focal areas of the Group include, but are not limited to Atmospheric Sciences, Earth Systems Science, Ecology, Environmental Geochemistry, Hydrology and Water Resources Management, and Environmental Engineering; this is not intended to preclude the growth into other areas. As the breadth of faculty expertise grows in the coming years there is expected to be broad faculty representation in this group from across the University.

Article II: Membership

Membership shall be opened to faculty who are actively involved in scientific inquiry and scholarship in the broad realms of environmental science, ecology and environmental engineering. Membership is not limited to UC Merced ladder faculty and may include ladder faculty members from other UC campuses. Voting privileges on ES Group policy and by-law matters are restricted to UC Merced ES Group members who are ladder faculty.

Members of the University faculty wishing to be appointed to the graduate faculty in the Group must submit a written request to the Chair indicating their interest in participating in the group. This should be accompanied by a current c.v. Materials will be evaluated by the Executive Committee for the appropriateness of the appointment to the Graduate Group faculty. At the Executive Committee's discretion an ad hoc committee may be appointed to solicit input from the graduate group and provide a recommendation. Applicants will be admitted to the group if their application receives a majority vote of the Executive Committee.

Faculty will be expected to participate actively in the program. The faculty member is responsible for providing the Executive Committee with appropriate documentation of performance. The Committee will conduct a review of the membership on a periodic basis of four years using the following metrics: 1) An active research program indicated by significant publication in the principal peer-reviewed journals of the field during the past three years. 2) A significant contribution to graduate mentorship and training by either advising a student in their laboratory or by formal graduate teaching through research seminars and courses. 3) General contribution to graduate research training through participation in the management of the

graduate program through service on the Graduate Council or one of the standing committees of the group.

Article III: Organization and Administration

All policy and procedure issues will be developed through the Executive Committee (EC) which will consist of five members,. including the Graduate Group Chair and Vice-Chair. All EC members have voting rights. The Graduate Group Chair will chair the EC. It is the responsibility of the Chair and the Vice-Chair to voice the results of EC deliberations to pertinent academic and research administrative units, and to the Dean providing oversight and resources to the Group. EC. . Election procedures and specific duties of the Graduate Group Chair, Vice-Chair and Executive Committee are discussed in the following articles.

Article IV: Academic Dean

The Dean providing oversight and resources for the ES Graduate Group will be elected by a simple majority vote of the group members. This appointment must be renewed by vote every five years or less. [By Unanimous vote Jeff Wright (Dean, School of Engineering) was named ES Graduate Group Academic Dean starting July 1, 2005]

Article V: Graduate Group Chair

The Executive Committee (EC) will solicit the names of nominees for the Group Chair. The EC will then present a list of at least two nominees willing to serve to the group's faculty for vote. All votes will remain confidential. In the event that no candidate obtains a simple majority of votes, a run-off vote will be conducted between the top two candidates from the initial vote. Once a majority candidate has been identified, the EC will forward the name to the Dean of Graduate Studies. The normal term of appointment will be three years.

The Chair's responsibilities are:

1) Calling and presiding over the Group meetings in the Fall and Spring semesters 2) Calling and presiding over meetings of the Executive Committee, and 3) Acting on behalf of the EC as the administrative liaison between the Group and the relevant academic Dean, the Graduate Council, the Division of Graduate Studies, and other campus units.

Article VI: Graduate Group Vice-Chair

The Executive Committee (EC) will solicit the names of nominees for the Group Vice-Chair. The EC will then present a list of at least two nominees willing to serve to the group's faculty for vote. All votes will remain confidential. In the event that no candidate obtains a simple majority of votes, a run-off vote will be conducted between the top two candidates from the initial vote. Once a majority candidate has been identified, the EC will forward the name to the Dean of Graduate Studies. The normal term of appointment will be three years.

The Vice-Chair's responsibilities are:

1) Presiding over the Group and EC meetings in the Chair's absence 2) Acting, along with the Chair, and on behalf of the EC, as the administrative liaison between the Group and the relevant

academic Dean, the Graduate Council, the Division of Graduate Studies, and other campus units.
3) Serving as Chair of the Educational Policy Committee

Article VII: Committees

The EC will appoint members to the following standing committees at the beginning of Fall term. The Executive Committee may choose to not constitute a particular committee as a separate body, in which case the EC will assume the responsibilities of that committee. Committee formation and appointments will be reviewed on an annual basis.

1) Executive Committee (EC)

The EC shall, in consultation with the faculty, determine and implement policy for the good of the Group, establish and guide the educational requirements of the Group, and represent the interests of the Group to University and other agencies.

The EC shall consist of five elected members (3 EC members plus the Group Chair and Vice-Chair) who will serve a term of three years. Committee memberships will be staggered by one year to maintain a range of experience across the committee. Membership may be extended for one year beyond the three-year term by a majority vote of the Group faculty.

It will be the responsibility of the Executive Committee to prepare an annual slate of nominees to be put before the membership for election to serve on the Executive Committee in subsequent years, assuming one or more members has completed his/her term.

The Executive Committee will make appointments to the standing committees of the Group. The term of service in each group will be three years. Extensions beyond the three-year term require a majority vote of the Executive Committee for each year of the extension.

The Executive Committee will approve faculty appointments to the Group based on recommendations from the Membership Committee. These approvals will require a simple majority of the Committee.

2) Membership Committee

The Membership Committee will be responsible for reviewing applications from faculty who wish to be part of the Group. In addition, the Committee will review the membership of the Group every three years. The Membership committee will recommend approval or denials for membership to the Executive Committee. This committee will be constituted by at least three Group members appointed by the EC. The term of service is two years, and appointments are renewable.

3) Educational Policy Committee

The Educational Policy Committee (EPC) is responsible for establishing and guiding the educational programs of the Group. The Group Vice-Chair will chair the EPC. The EPC is charged with establishing and maintaining documentation on the ES curriculum, and committee will periodically prepare for system reviews of the ES program, including the five-year review. The EPC, in consultation with the group faculty, will coordinate and document changes in programmatic requirements of the ES program, and present proposed changes to the voting body.

This committee will be constituted by at least two Group members appointed by the EC, and the Group Vice-Chair, who will preside over the EPC. The term of service will two years for the regular members, and appointments are renewable.

4) Graduate Advising Committee

Members of the Advising committee will be responsible for advising students on initial enrollment, serving as interim major professors as needed, assisting students in identifying their major professor(s), approving programs of study, and monitoring the progress toward degree. The advising committee, together with the major professor, is charged with reviewing previous coursework of incoming students and recommending a program of study that considers both the policies of ES and the student's goals. This committee will be constituted by at least three Group members appointed by the EC. The term of service is two years, and appointments are renewable.

Student grievances requiring adjudication may stem from disputed examination results, GSR appointment termination, or other issues. Students have the right to pursue grievances with the Advising Committee, which will assemble, review pertinent information, and provide a written summary to the Executive Committee within 30 calendar days of the student grievance. Extensions may be granted in writing by the Group Chair when warranted by key parties on either side of the grievance (e.g., extended travel obligations, illness). Advising and Executive Committee members who are members of the examination committee will recuse themselves from the review process, but may be interviewed by the remaining committee members. The Executive Committee will rule on the case. Students have the right to appeal this ruling to the Dean of Graduate Studies within 30 calendar days. The Graduate Dean may request that the graduate program's Lead Dean and/or other appropriate parties investigate the student's concerns or grievances and determine appropriate resolutions. Ultimately, the final resolution of all disputes lies with the Dean of the Graduate Division as described in UC Merced's Graduate Advisors Handbook. In the event that the dispute involves the Graduate Dean in her/his role as a faculty member, then the final resolution of all disputes resides with the Executive Vice Chancellor.

5) Admissions Committee

The Admissions committee is charged with the development of recruiting materials for the Group, reviewing applications for admissions, making recommendations for admissions to the Dean of Graduate Studies, exploring graduate student support mechanisms, and allocating intramural financial assistance. This committee will be constituted by at least three Group members appointed by the EC. The term of service is two years, and appointments are renewable.

Article VIII: Student Representative

A student representative will be included in all deliberations that revolve around issues having to do with educational policy and curriculum. The student representative will be elected by the current graduate students in the enrolled in the ES Graduate Group. The student representative will serve a one-year term and may be re-elected for a second term.

Article IX: Meetings

The membership of the Group should meet each fall and spring term. The Group chair is responsible for calling all regular and special meetings of the membership. The EC should meet on a bi-monthly basis, or more frequently as necessary.

Article X: Quorum

Issues that require a vote of the membership need to have a 50% quorum present. Group decisions will be determined by simple majority of those voting.

Article XI: Amendments

Amendments to the By-Laws require approval by two-thirds of the voting members of the group. Written notice of the proposed amendment shall be sent to each member prior to the meeting at which the amendment is to be discussed. All amendments must also be submitted to Graduate Council for review and final approval.

APPENDIX E: Environmental Systems November 2005 Short-Term Strategic Plan

UNIVERSITY OF CALIFORNIA Merced

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November 3, 2005

To: **Keith Alley, Vice-Chancellor for Research/Dean of Graduate Studies**

From: **Tom Harmon, Chair, Environmental Systems Graduate Program**

Subject: **Short-Term Strategic Plan**

This memorandum outlines the short-term strategic plan for the Environmental Systems (ES) Graduate Group. This document is the result of discussions amongst the ES faculty and non-ES faculty associated with the on-going and prospective faculty searched discussed below. Six of the nine ES faculty provided input and endorsed the plan. Others were unable to respond within the time frame for this memo, but have provided input in the past.

The overriding goal of the Environmental Systems graduate group is to become an internationally recognized, premier graduate research program that emphasizes interdisciplinary studies of complex environmental systems. To achieve this status, we plan to (1) hire several key faculty members with direct ties to the ES group, (2) invest ES group effort in several current cross-school hiring initiatives to maximize interdisciplinary opportunities across all schools, (3) enhance our existing graduate degree program, and (4) successfully compete for large-scope extramural funding in support of our research and training mission by (i) attracting top graduate students, postdoctoral researchers and research scientists, and (ii) increasing the involvement of adjunct researchers in activities of the group. Each of these activities is discussed further in the following sections.

(1) Key Faculty Hires. The ES faculty recognize that the strength and uniqueness of our program lies in its position at the interface between science and engineering desciplines. As such, an important tenet of our strategic plan for faculty growth is to maintain a complementary balance of

faculty in the Schools of Engineering and Natural Sciences, or joint positions, when appropriate, in strategic areas. We have identified the following areas to fill strategic needs in the ES program as either single- or cross-school FTE's towards maintaining this interdisciplinary program-building approach:

Searches in Progress (authorized either from original school allocations or AY '05-'06 cross-unit FTE (1)):

H. Air Pollution Science and Engineering (2) : ENG position in negotiations; ENG or NS in progress). We are seeking an open-rank professor in the area of environmental science and engineering focused on air pollution in order to allow the ES group to better address regional and national air quality problems. This position is in addition to the recently concluded search for a senior air resources engineering person as an inaugural faculty hire (candidate was identified and negotiations are on-going). Recognizing California's increasingly poor air quality and the resulting negative impact on human health and the environment this area of research is conspicuously absent at UC Merced. Desirable areas of interest include biogenic emissions, urban and regional aerosols, and atmospheric chemistry, using approaches that may include laboratory or field measurements, or modeling. Ideally, we envision a Natural Science-Engineering joint hire.

I. Microbial Ecology (NS position): This position was allocated from the original 20 in NS. A candidate was identified and approved by CAP. Negotiations will begin once a spousal issue is resolved. This position has a high priority as we currently have no faculty representation in either NS or ENG in the broad area of microbiology of the environment.

J. Ecology/Ecosystem Science (NS position): This position was allocated from the original 20 in NS. A search was conducted last year that was not successful. The position was closed and re-opened this fall; applications at the assistant professor level are currently being accepted. This area has a high priority because of the need to supply missing expertise in ecology and strengthen interdisciplinary links between biological and physio-chemical environmental systems.

Requested positions: AY '06-'07:

K. Environmental Microbiology. Environmental microbiologist is seen by the ES Group as another high priority hire if we are to achieve national competitiveness. This individual is necessary both at the graduate and undergraduate level for teaching (environmental microbiology) and expanding the capabilities of the group. This individual would be expected to provide a connection between ES with biosciences. Leading environmental research programs in the nation include a strong core subgroup of environmental microbiology and microbial ecology, typically 2-3 investigators. Engineering successfully identified a senior candidate for this position in 2004-05, but the candidate's current institution successfully retained that individual. The emphasis on this position is engineering microbiology, including the characterization of microbial communities in both natural and engineered systems. This individual would be expected to team with microbial ecology and ecosystem science faculty from Natural Sciences (Asst. Professor Jessica Green, a senior hire currently in negotiation, and mid-career hire in progress) to give the ES group a strong emphasis in this critical dimension of environmental systems.

L. Spatial Analysis/Earth Surficial Processes. The ES Group has also identified spatial analysis as an area for strategic recruitment. An individual working in the area of surficial processes would be appropriate, including areas such as landform/landscape evolution and forecasting, land surface geochronology, sediment transport, and land use-ecosystem interactions. This candidate might be well-suited for a hire in Natural Sciences, Engineering, or jointly between the schools. The group envisions that a hire in this area would provide the viable research core (along with Assistant Professors Shawn Newman and Qinghua Guo) that would position the group competitively in the rapidly expanding area of research associated with multiscale observations and analyses of environmental patterns and processes through remote sensing, data mining, and feature extraction. Areas of interest to the ES group will depend on hires during the interim, but may include erosion and/or sediment transport, process geomorphology, ecohydrology, and hydrogeology.

(2) Investment in Cross-School Faculty Hiring Initiatives. The ES group will continue to commit substantial effort to the on-going cross-unit searches aimed at identifying scholars who can bridge strategic gaps between UCM's Schools. These searches were identified as a result of UCM's previous strategic plan, and are in the broad areas of (1) environmental economics, (2) environmental policy, (3) chemistry and nanotechnology (with potential environmental applications), (4) materials and energy, and (5) evolutionary biology. In all cases the faculty appointment may reside within a single School, or may be joint between Schools, depending on the specific hire. In each case, the ES group recognizes potential for synergistic appointments although these individuals may not be principally associated with the ES group. For example, the environmental economist's research would address the economics or political economy of resource allocation, including market approaches to resource allocation; human impacts on the environment; economic effects of environmental change; the economic impact and design of environmental regulation; or the economics and finance of regulatory policy or infrastructure related to natural resource allocation. Similarly, the environmental policy candidate may be identified with interests in resource management policy; spatial aspects of environmental change; environmental consequences of urbanism and development; environmental justice; health and the environment; or cultural, political or economic dimensions of environmental policy.

(3) Graduate Degree Program. A vigorous graduate degree program underlies all successful academic research programs, and the successful development of such programs will be the cornerstone of UCM's legacy as a research institution. Our short-term goal is to increase our graduate enrollment of high quality domestic and international graduate students in the ES program by (1) increasing our recruiting efforts in terms of both Web-based presence and extramural recruiting materials and presence, and by (2) solidifying and expanding (contingent on additional faculty hires) our graduate and co-listed course offerings to attract a larger number of M.S. students focused on career development (professional M.S. degree).

To attract quality graduate students consistently, we recognize that the ES group will need to offer a reasonable number of fundamental/core and advanced research-level courses on a consistent basis. We are currently exploring the best plan for such course offerings. Regardless, it is clear that such a plan will impact the number of undergraduate courses that ES faculty are able to offer. For example, one reasonable plan might see a typical ES faculty member alternating between 2 undergraduate plus 1 graduate course in year 1, followed by 2 graduate courses and 1 undergraduate

course in year 2, and so on. In order to develop nationally recognized professional M.S. programs that consistently attract top quality students, we need sufficient faculty in key areas to balance teaching load with research, and complementary faculty associated with the School of Management. We envision several areas that would be popular M.S. professional programs, e.g., Environmental systems engineering; water resources engineering and management; geospatial analysis; public lands conservation and management.

Maintaining a graduate program requires that we have a repository for student files, administrative help in creating forms, maintaining files, scheduling meetings, handling course requests, particularly as we expand program offerings at the M.S. level. In a traditional university, these were handled on the department level. Currently we have no such support. We anticipate needing someone 0.25 time in the incoming year and increasing this support as the graduate program grows. In addition, we recommend naming an Assistant Dean of Graduate Studies to assist Graduate Dean Alley in overseeing the graduate curricula before the number of programs increases.

4) Extramural Support for Research. The ES group has already enjoyed enormous success in acquiring extramural funding in support of its laboratory facilities and field research (more than $6M total over the past 2.5 years!). Funding aside, however, there is a sentiment that we are currently supporting as many students as we can personally handle given the high administrative overhead taxing faculty at UCM, and by the lack of research space for personnel, laboratory experiments, and equipment. As the ES group grows to a critical mass by making the types of interdisciplinary hires noted above, we expect the administrative load to normalize. We are then in a strong position to become nationally competitive for major research grants and centers. We have already begun to lay the foundation for such efforts in the context of our interactions with large-scale hydrologic and environmental engineering observatory initiatives, consistently successful grant proposals to the NSF's Major Research Instrumentation (MRI) program, and numerous individual investigator awards. Furthermore, expansion of research in the context of larger centers, initiatives, or centralized laboratory facilities requires adequate research space for a variety of research activities (offices, wet labs, computing labs, equipment).

At this point the 9 ES faculty are building active research groups (Table 1). The current census includes 6 M.S. and 12 Ph.D. students, as well as 11 postdocs and 3 staff researchers (e.g., programmers, lab technicians. As the number of graduate students is expected to continue to increase, a high priority need is to hire a full-time laboratory manager for the environmental analytical laboratory. This need will be met in the current year, in part, through an NSF grant. It is important to make this a continuing, sustainable position. With growth of the extramural research program it will become necessary to provide additional continuity in some of the long-term research activities through professional researchers affiliated with the group. This is being explored with some of the current postdocs.

At present there are 2 adjunct researchers (Duffy, Quinn) affiliated with the ES group, and have already contributed by way of authoring successful extramural grants and co-advising UCM graduate students. Four additional government scientists have expressed interest in being involved with supervising graduate students, teaching, or being Co-PI's on grants. Over the next year we expect to affiliate at least two more government scientists with the Environmental Systems Group.

Table 1. Environmental Systems Faculty Research Groups as of December 2005.

	Under-	MS	PhD	Postdocs	Research

Faculty	Grads	Students	Students		staff
Roger Bales, Professor	1	1	2	3	1
Martha Conklin, Professor			1	1	
Jessica Green, Asst. Professor			2	1	1
Qinghua Guo, Asst. Professor					
Tom Harmon, Professor	1	2	2	2	
Peggy O'Day, Professor		1	2	2	
Sam Traina, Professor			2	2	
Roland Winston, Professor		1.5	1		1
Jeff Wright, Professor	2	0.5			
TOTALS	**4**	**6**	**12**	**11**	**3**