USF
UNIVERSITY of SAN FRANCISCO

COLLEGE OF ARTS AND SCIENCES

Department of Environmental Science

Self- Study

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1. INTRODUCTION

The Department of Environmental Science is the newest of the science departments at the University of San Francisco (USF), being formally constituted in 1996. Currently, there are 9 full-time and 1 term faculty member serving 20 undergraduates in Environmental Science and 82 graduate students in Environmental Management. At the present time, the department has responsibility for an undergraduate major and minor in Environmental Science and a master's program in Environmental Management (delivered both locally and internationally). It is also inextricably tied to an undergraduate major and minor in Environmental Studies and to one of the tracks in the undergraduate International Studies major.

While the Department is young, the teaching of environmental science and, in particular, environmental management at USF has a much longer history. Since this is the Department's first self-study, we believe it is important to provide an overview of the history as background and context for the present status of the Department. Knowledge of how the Department has evolved and is still evolving as a function of the various programs and initiatives that it has been involved with is important to appreciating the structure of its current programs and future directions.

It should be noted that the graduate program in Environmental Management predates the introduction of undergraduate major in Environmental Science, but for the purposes of this self-study the latter will be addressed first.

1.1. Department Mission

In keeping with the University's mission – "Educating Minds and Hearts to Change the World" – the primary mission of the Department of Environmental Science is to educate, to train and to advise students in the theory and practice of Environmental Science and Environmental Management within the context of a Jesuit liberal arts university.

1.2. History of Environmental Science

The undergraduate Bachelor of Environmental Science major commenced prior to the creation of the Department of Environmental Science and until that time was taught out of the Department of Biology. There were three specific courses offered in environmental science (Environmental Science 110, 210 and 310); otherwise the requirements for the major reflected those of the Biology major, with some variation in the acceptable senior electives. The 110, 210, and 310 courses corresponded roughly to the current 210, 212, and 410 courses, respectively. A capstone course for seniors at the time was an internship, which had an Environmental Science 498 designation at the time.

When the Department was created, some curricular changes occurred, but these were minor. For all intents and purposes, the status quo remained until 1998, when the appointment of additional faculty allowed for continued development of the undergraduate programs and a subsequent thorough reworking of the degree. Notable changes were the reduction in unit requirements for the major, from 75 to 52 units, the offering of more electives for the junior and senior year, and a general increase in the sense of continuity in the degree structure. Requirements for the minor were also revised

to conform to college standards. It should be noted that much of this change was driven by the need to make the degree more attractive to students entering USF, since the numbers entering the major declined once it was formally separated from Biology.

In addition, the University introduced Bachelor of Arts degrees in Environmental Studies (2001) and in International Studies (2004) and, as noted immediately below, the Department is also involved in delivery of these. (Note: Since neither Environmental Studies nor International Studies is under review at this time the information about these programs is provided only to show these as activities in which the Department expends considerable effort.)

1.3. History of Environmental Management

1.3.1. San Francisco Program

The Master of Science in Environmental Management (MSEM) program was first offered in San Francisco in 1977. It is a two-year program designed specifically to accommodate working professionals by being taught primarily on Saturdays, with occasional weekday courses.

For all intents and purposes, this program was created by the late Dr. J. Petulla who was also its director for many years. In its first incarnation, the program consisted of a series of core and elective courses, and a master's thesis; it was taught out of the College of Professional Studies. Staffing of the program was almost entirely by part-time faculty. This worked successfully for a long time, but it was not without problems; in particular the consistency in quality of some courses, and the fact that there was little academic continuity. As part of USF's realignment and approach to the re-accreditation process, the decision was made in 1994 to move the program under the umbrella of the College of Arts and Sciences and to begin to involve more full-time faculty. This was possible, in part because of the decision to create a Department of Environmental Science, and in part with the appointment of new full-time tenure track faculty with professional as well as academic experience.

From the time this program change occurred until 1998, the MSEM program effectively remained in its original format albeit with some course additions and deletions to reflect changes in the environmental management arena. The first substantive change occurred in 1998 when the decision was made to replace the thesis requirement with a 'master's project' and additional course work requirements. The primary reason for this action was the change in character of students coming into the program, specifically students whose employment did not allow them time to carry out original research. The master's project has worked well and gives students some of the critical experience necessary in the field. The project requires application of the scientific method, critical thinking, the development of a research question, and the production of a professional level final document as well as the delivery of a conference style platform presentation; however, it does not require original research.

The next significant program changes were a direct result of a decision to start offering the program in Orange County (OC) in Southern California. To accommodate this with the available faculty members, the program was redesigned with two 16-week semesters per year (no summer session). The 3-unit courses were recast into 2-unit courses each

consisting of 24 lecture-hours taught in blocks of six hours on four alternating Saturdays with faculty commuting between San Francisco (SF) and OC. In each semester, students would typically take 8 units per semester, with the semester being divided into two 8-week sessions. The one exception is the master's project course, which is semester-long and now a 4-unit course. This remains the current format for the MSEM program in San Francisco.

The Department has also been involved in delivering the MSEM program internationally. The delivery format of the international programs was adapted from the local program, but these modifications did not affect the format of the local program.

In overview, the San Francisco MSEM program has been and remains highly successful as evidenced by its longevity and the success of its graduates. It has been progressively updated and although enrollments have fluctuated over the years, it remains a viable and healthy program. At the present time, the program is delivered by both full-time and part-time faculty and is administered by the Department.

1.3.2. Southern California - Orange County Program

The MSEM program was first offered in OC in 2000. The program was a mirror of the one offered in SF, although with little or no choice of electives. As noted above, the delivery format of the SF program was adapted to allow for delivery of the OC program by the same academic staff members. Class sizes were small, and student feedback was generally very positive with the small class size being seen as a distinct advantage. Unfortunately, the small class sizes meant that the program was economically unsustainable. After much consideration of economic feasibility as well as impacts on faculty teaching loads in the Department, a decision to cancel the program was made in 2004.

1.3.3. Development of International Programs

The venture into the international arena was driven by a number of considerations, and some of these are as follows. At the present time, there is clearly a world wide need for better environmental management practices that are based firmly on a science-based yet holistic and integrated view of the environment. USF has a long history of success in its MSEM program. Distance education has been a growing phenomenon with universities in developed countries reaching out to less-developed places. The MSEM program, taking the first point into account, was directly in line with USF's mission statement and therefore a logical launching pad for increasing its international presence. The international experience would potentially provide new opportunities for interaction of USF staff and students in the various programs allowing for a potential international network for improving environmental management practices.

1.3.3.1. Hungary - Budapest Program

The Budapest MSEM program arose from a direct request from Pazmany Peter Katolikus Egyetem (PPKE) in Hungary to develop a joint program to address the need for improved environmental management practices in Hungary. The curriculum was based on the SF program, with USF responsible for delivery of half the courses (the science and

engineering based courses) and PPKE for the other half. The first intake of students was in 2001.

Since USF faculty traveled to Budapest to deliver their courses, the delivery format was again modified such that absences from USF would be for reasonable periods. Thus, the courses were truncated into 16 to 18 hours of face-to-face instruction delivered over a 5 to 7 day period. Follow-up based on additional readings, homework assignments, test and exams, etc. was facilitated by an on-site tutor, who was specifically appointed for the program. The tutor worked closely with the instructor while the course was presented and by email once the instructor returned to the United States.

Again, while the students who undertook the program benefited greatly from it, as with the OC program, the low student numbers and lower tuition rates negotiated between the university administrations meant the program was financially unsustainable. The decision to cancel it was made in 2004 with an anticipated end date for the currently enrolled students of mid-2006.

1.3.3.2. Thailand - Bangkok Program

Along the same lines as the Budapest program, a joint degree MSEM program was negotiated with the environmental science faculty at Mahidol University (Salaya Campus) in Thailand. However, for similar reasons as with the Hungarian programs, the Bangkok program which started in 2001 was also cancelled, in this case in 2003.

1.3.3.3. Philippines - Manila Program

The Manila MSEM program was developed in a partnership with Ateneo de Manila University, one of the premier institutions in the Philippines. The curriculum in this case, while based on the USF program, was modified in line with the expertise of the staff at Ateneo and the needs of the students there. The delivery aspects were also modified as the courses are semester long. USF faculty participate in this program by co-teaching selected classes, and have done so since fall semester 2002. The USF instructor visits Ateneo for one to two weeks and presents material in a series of intensive classes. The USF faculty member then works closely with a member of the Ateneo staff who presents the rest of the course material. This works well, and the USF faculty who have taught in this program have found it to be an excellent experience, with motivated students and a partner unquestionably committed to a high quality program. Unfortunately, as with the Budapest and Bangkok programs, revenue is insufficient to sustain it. The last intake of students occurred this year, and the program will end in 2008.

1.3.3.4. China - Xiamen Program

The Xiamen MSEM program is a partnership with Xiamen University in China. Teaching into this program started in 2004. Whereas this program looks financially viable given tuition rate and the large number of current and projected enrollments, it has also been the subject of ongoing debate within the Department. In particular, and in contrast to the other programs, the general feeling is that the potential for involvement of full-time faculty is very limited and that the Department does not have adequate academic input into or control over the way the program is being conducted. After much debate, a recommendation was put forward to the Dean's Office strongly recommending

discontinuance of this program under the current operating guidelines. The outcome of this is not known at the time of this writing.

1.3.4. Some Other General Comments Regarding the International Programs

While it is unfortunate that these programs have had to be terminated or are in the process of being terminated, the experience has been an interesting one, with much benefit and professional growth being gained on all sides – staff and students alike. In some cases, students from our international programs have taken a course at USF, and some USF MSEM students have spent a semester abroad. Certainly, the faculty members from the Department of Environmental Science who have taught into these programs have invested a huge amount of time and effort in creating and re-working courses, adapting to different cultural situations and the like, and have done this with great success. It is a great pity that education as a social responsibility cannot be disconnected from financial reality.

1.4. Other Initiatives

1.4.1. Environmental Studies

The Bachelor of Arts in Environmental Studies is a multidisciplinary major with 40 units of required courses and 8 units of electives. The Department played a key role in the development of this major. A minor in Environmental Studies is also offered. Brochures outlining the requirements for the major and minor in Environmental Studies are given in Appendix 1.

1.4.2. International Studies

The Bachelor of Arts in International Studies is also a new major that was recently introduced at USF involving a unique collaboration between multiple departments across the University. It is structured with three required courses and a series of five options or functional tracks. One of these tracks is titled "Environment and Development" where students are required to take two of three core environmental science courses (0209-110, Understanding our Environment; 0209-210, Ecology and Human Impacts; 0209-212, Air and Water) along with an additional 8 units of electives. Currently electives from the Department include 0209-366, Environmental Policy; and 0209-230, Environmental Impacts and Economic Decision Making.

1.4.3. EnVision

EnVision is the USF student environmental club that was initiated in 2000 by faculty and students in the Department of Environmental Science to provide for a greater degree of social and cultural exchanges on environmental issues. The group is self-described as: "EnVision, a student-run environmental organization committed to bring environmental awareness and change to the USF community and beyond." EnVision is a member of the Associated Students of the USF Peace and Justice Coalition. The current focus of the club is to promote campus issues related to sustainability. EnVision sponsors speakers on campus, represents the student body on the USF Sustainability Committee, holds a very a successful annual event (the Great Plate Campaign) to increase student awareness of waste and recycling at the university's food service, hosts an annual Earth Day Fair on

campus and actively engages in a variety of other environmental education and service projects. In addition, as with all USF student groups, a faculty member serves as a mentor.

1.4.4. Environmental Residential Learning Community

In line with trends in other institutions of higher learning, the University of San Francisco supports several living learning communities. The most recent to be established, in the 2004/2005 academic year, as an initiative from the Department of Environmental Science is the Environmental Residential Learning Community (ERLC). This was formulated as a freshman program with an environmental focus. The feedback from the first group of ERLC students was positive. However, enrolments (7 dropping to 5 in 2004/2005 and 10 dropping to 9 in 2005/2006) have not been up to our original expectations. This has been disappointing. Certainly some students who were interested in the ERLC could not join because timetabling clashes and some others felt the work load was too great. Never the less, the number impacted by these considerations is relatively small and would not have brought us up to our ideal class size of about 20.

The Department's view is that the ERLC is an important initiative, and there is a commitment both from the Department and from the Dean's Office to continue with it. We have been reviewing the program, and as a result of our experience with enrollments to-date we have decided to recast the program in 2006/2007 as a freshman/sophomore program, and with a new name - "Scholars for a Sustainable Society". This mix of students will change the dynamics of both the academic and residential components of the program and the new name will give it a better focus.

With regard to the academic component, there are two courses (one delivered in the fall semester and the other in the spring) dedicated to the students in this program and taught by environmental science faculty. The first course (0209-111 "Living in Our Environment") parallels the 0209-110 and satisfies the part of the university's core (B2) science requirements. It also satisfies the university's service learning requirements. This year the second course focuses on the interpretation of environmental data and satisfies the university's core science (B1) requirements. That the ERLC courses satisfy both core and service learning requirements was seen as a recruiting plus for the program.

A copy of the current ERLC brochure, which was sent to all incoming freshmen in 2003/2004 and 2004/2005, is included in Appendix 2.

1.4.5. Brazilian Connection

Environmental Science faculty members (Benning, Lendvay) are in the second year of a four-year FIPSE grant to support a study abroad program with an environmental science focus in Brazil. "The Science of Degraded Versus Unspoiled Environments: The Cultural Differences of Conservation and Reclamation Emphasized in Multidisciplinary Undergraduate Education" is an exchange program designed specifically for science students in the consortium institutions of Regis University, Gonzaga University and USF in the United States, along with Brazilian partners, the Universidade Federal de Minas Gerais and Universidade Federal de Alagoas. Student exchanges amongst consortium institutions will begin in the fall of 2006 and continue through the fall of 2008. Students will participate in a multidisciplinary environmental science curriculum at their host

institution and all students will enroll in a commonly developed research methods class. The goal of this program is to provide environmentally focused science students with the opportunity to participate in a study abroad experience which will not delay completion of their science degrees. Brochures for the program are provided in Appendix 2.

1.5. The Challenges Facing Us

The greatest challenge in the immediate future is how to increase and stabilize the undergraduate student numbers. Much effort has been expended, and some in-roads have been made, as detailed in Section 5, but this remains an ongoing concern.

At the present time, the numbers in the graduate program are excellent, as is discussed in Section 6. The challenge here is to keep the numbers at this level, since experience has shown that they can fluctuate quite dramatically. Promotion and advertising of the program requires constant attention, and the Department needs to be provided with the adequate resources to do this.

The above two considerations underpin another set of challenges for the Department – specifically how to stabilize specific teaching commitments for individual faculty members, how to make best use of their specialist expertise, and how to balance teaching loads between the various programs. The variety of courses that we can offer is clearly a function of student numbers along with student interest in particular subject areas and this has to be balanced against an administrative mandate of minimum class size. That a newly developed senior level course may be cancelled at the 11th hour because of low enrollments is a major source of stress to the faculty member involved and Department chair. In addition, it also penalizes students who try to enroll in advance. However, that being said, it should also be pointed out that in both our undergraduate and graduate programs we have successfully increased the number and variety of course offerings and these have been well received by our students.

A further challenge, implicit but not overtly stated above, is the balancing of demands of all of the programs with which the Department is involved from an administrative point of view. From the time of establishment of the Department until recently one person served as both Department Chair and Graduate Program Director. This turned out to be an impossible situation and in 2003, several years after it was first requested by the Department, the Administration agreed that the positions be split. This has proved to be a far better situation and the challenge now is one of communication within the Department to ensure that the needs of all programs and faculty are met. An ongoing challenge is to have the Administration recognize the efforts that all of the above requires and to provide appropriate levels of release time for faculty who serve in these positions.

Given the variety of courses we now offer and the range of expertise of the faculty, the Department of Environmental Science is ideally placed to interact with other departments, both science and non-science, within the university. Such interaction has the potential to enrich the educational experience of both those being educated and the educators, and is clearly in line with the mission of a Jesuit liberal arts education as well as the interdisciplinary nature of the Environmental Science and Environmental Management field. Some interaction has occurred but, with the exception of the establishment of Environmental Studies and International Studies, it has been minimal.

The challenge here is to come up with innovative ways to promote and increase interaction across the university, and especially with other science departments. The Administration has the potential to play a key role in facilitation of such interactions, in particular with rationalizing senior level course offerings across the college.

1.6. Department Personnel

1.6.1. Academic Staff

The Department is currently staffed by seven tenured, two tenure-track and one term faculty. Of the three full professors in the Department, two (Brown, Karentz) have joint appointments with Biology. In addition, two faculty (Karney, Toia) have joint appointments with Chemistry but primarily for research purposes. The joint appointments with Biology are problematic in that teaching workload is rarely split between departments and overall have this arrangement has not fostered the cooperation that might have been hoped for with the Biology Department. In contrast, the joint appointments with Chemistry have fostered positive interactions between the two departments especially in terms of access to laboratories and instrumentation. Overall, the Department has a wide range of expertise covering a large part of what commonly falls under the umbrella of Environmental Science and Environmental Management.

Academic staff details are summarized in Table 1 and are followed by short biographical sketches. In addition, curriculum vitae are provided in Appendix 3.

Table 1: Summary of Details for Academic Staff, Department of Environmental Science.

NAME	YEAR OF APPOINTMENT	ACADEMIC RANK & STATUS	DEGREES	SPECIALTY	GENERAL TEACHING DUTIES
Tracy L. Benning	2002	Assistant Professor, Tenure Track	B.A., 1987, Univ. of Nebraska at Omaha; M.A., 1989, Univ. of Nebraska at Omaha; Ph.D., 1993, Univ. of Colorado at Boulder	Ecosystem/Landscape Ecology	Introductory ENVS, Ecology, Resource Management, Remote Sensing & GIS
R. James Brown	1970	Professor, Tenured	B.A., 1964, Ottawa University; M.A. , 1967, Univ. of California, Davis; Ph.D. 1970, Univ. of California, Davis	Biology, Zoology	Vertebrate Zoology, Evolution, Embryology and Systematics, Introductory ENVS, Monitoring, Ecoscience
John Callaway	1999	Associate Professor, Tenured	B.A., 1985, Univ. of California, Berkeley; M.A., 1990, San Francisco State Univ.; Ph.D., 1994, Louisiana State Univ.	Wetland and Restoration Ecology	Introductory ENVS, Ecology electives Ecology, Restoration Ecology, Wetlands Ecology, capstone practicum for ENVA majors, Ecoscience, Applied Ecology

NAME	YEAR OF APPOINTMENT	ACADEMIC RANK & STATUS	DEGREES	SPECIALTY	GENERAL TEACHING DUTIES
James D. Fine	2003	Assistant Professor, non-Tenure Track	B.S., 1989, Univ. of Pennsylvania; M.S., 1998, Univ. of California, Berkeley; Ph.D., 2003, Univ. of California, Berkeley	Environmental Policy; Environmental Planning	Environ. Economics, Air Quality Assessment & Mgmt, Introductory ENVS, capstone practicum for ENVA majors
Deneb Karentz	1992	Professor, Tenured	B.S., 1982, Univ. of Rhode Island; M.S., 1976, Oregon State Univ.; Ph.D., 1973, Univ. of Rhode Island	Marine Biology (UV photobiology)	Biology- Lower division biology; Upper division biology; Graduate level Environmental Management
William L. Karney	1997	Associate Professor, Tenured	B.A., 1986, Haverford College; Ph.D., 1994, Univ. of California, Los Angeles	Physical Organic Chemistry	Environmental Chemistry, Organic Chemistry
John M. Lendvay	1999	Associate Professor, Tenured	B.A., 1983, Hiram College; M.S.E., 1994, Univ. of Michigan; Ph.D., 1999, Univ. of Michigan	Water Quality Assessment & Remediation	Introductory ENVS, Water Resources, Water Quality

NAME	YEAR OF APPOINTMENT	ACADEMIC RANK & STATUS	DEGREES	SPECIALTY	GENERAL TEACHING DUTIES
Tom MacDonald	1996	Associate Professor, Tenured	B.S., 1989, Brown Univ.; M.S., 1990, Stanford Univ.; Ph.D. 1995, Stanford Univ.	Environmental Modeling, Hazardous Waste Treatment	Engineering, Waste Management, Environmental Modeling and Data Analysis
Stephanie Ohshita	2003	Assistant Professor, Tenure Track	S.B., 1988, Massachusetts Institute of Technology; M.S., 1996, Stanford Univ.; Ph.D., 2003, Stanford Univ.	Air Quality, Climate Change Mitigation, Environmental Policy, Technology Transfer, Risk Assessment and Management	Quantitative Analysis, Air And Water, Energy and Environment, Climate Change Mitigation, Risk Assessment and Management
Robert Toia	1995	Professor, Tenured	B.Sc.(Honors), 1973, Univ. of Western Australia; Ph.D. 1977, Univ. of Western Australia	Environmental Chemistry and Toxicology	General Environmental Science, Environmental Chemistry, Toxicology, Environmental Health, Sustainability

1.6.1.1. Faculty Achievements

As is evident from the Table 1, above, the expertise of the faculty is very broad allowing for a wide range of specialty topic areas to be developed and taught in both the undergraduate and graduate programs, in addition to the more general environmental science courses. In terms of research and other activities, collectively the faculty has published 105 articles in peer reviewed journals and has made over 90 research presentations at scientific meetings in the past 10 years. Detailed information about funded research can be found in the faculty CV's in Appendix 3; however, in general, faculty in the department have been very successful at obtaining funds to support research. Some of the funding includes external research grants from NSF, NASA, Andrew Mellon Foundation, ACS Petroleum Research Fund, California Coastal Conservancy, CALFED, Bay Area Air Quality Management District, EPA, and California Sea Grant Program. In addition to the outside research grants, faculty has also enjoyed good success in competing for internal monies made available by USF. There have been grants from the Lily Drake Cancer Fund, Jesuit Foundation, McCarthy Center for Public Service and Common Good as well as grants obtained from the Faculty Development Fund.

Several faculty members have received University wide honors for research, teaching and service. Two faculty members (Brown, Karentz) have received the Distinguished Research Award, two faculty members (Brown, MacDonald) have received the Distinguished Teaching Award and one faculty member has received the Distinguished Service Award (Brown) and Sarlo Prize (Lendvay). Additional individual honors are listed in faculty CV's in Appendix 3.

1.6.1.2. Biographical Sketches

Tracy Benning is an ecosystem ecologist with expertise in remote sensing and Geographic Information Systems (GIS) applications in landscape ecology. She received her Ph.D. in Environmental, Population and Organismic Biology from the University of Colorado at Boulder in 1993. She was previously an assistant professor in the Department of Environmental Science, Policy and Management at the University of California at Berkeley before joining the faculty at USF in 2002. Her current research interests include riparian ecosystem ecology and management, development of landscape metrics and methodology for assessment of ecosystem processes and spatially explicit modeling of ecosystem dynamics. Her current research activities are focused in Kruger National Park, South Africa where she is investigating the role of riparian habitats within the larger savanna landscape.

James Brown brings many years of experience in university teaching and research to the Environmental Management program. His interests include in the effects of geothermal development in areas of vertebrate and aquatic ecology. His current research focuses on coastal streams in California.

John Callaway is an ecologist with expertise in wetland plants and soils, focusing primarily on restoration issues. He joined the Environmental Science Department in 1999. Previously he served as Associate Director of the Pacific Estuarine Research Laboratory (PERL) at San Diego State University. He has a Ph.D. in Oceanography and

Coastal Sciences from Louisiana State University with an emphasis in wetland ecology. His recent research projects include evaluating the relationship between plant diversity and ecosystem function in restored coastal wetlands, assessing impacts of sedimentation on coastal wetlands, evaluating the importance of tidal creek networks for the development of restored wetlands, and assessing the success of wetland mitigation efforts. His research includes projects in San Francisco Bay and Tijuana Estuary and has been funded by the National Science Foundation, the Environmental Protection Agency, California State Water Resources Control Board, CALFED, and other agencies. He served as editor of Madroño, the journal of the California Botanical Society, from 2002-2004 and now serves as a member of the board of editors of Ecological Applications, published by the Ecological Society of America. In addition, he serves on a number of regional and state panels on wetland management issues.

Jamie Fine joined USF in 2003 as an interdisciplinary policy scientist after completing his Masters of Science and Doctorate in the Energy and Resources Group at the University of California at Berkeley. He also holds a Bachelor of Science in Economics from the University of Pennsylvania's Wharton School of Business. With core strengths in modeling, economics, market-based policy and air quality, Jamie's instruction is local, contemporary, case-based, and engages students in service learning, professional practice and community-based research. He developed and implemented as USF's environmental studies capstone course, Student Science Advisors for the Environment (SSAFE) that deploys student teams to community environmental benefits groups as research liaisons. SSAFE is also one of several undergraduate and graduate courses and seminars that Jamie developed over the past three years as an Assistant Professor at USF.

In addition to teaching and developing SSAFE, Jamie conducts interdisciplinary research in environmental policy, economics and planning issues, and he also serves on the coordinating team of the West Oakland Environmental Indicators Project and on the community task for the Bay Area Air Quality Management's Community Air Risk Evaluation project.

Deneb Karentz is a marine biologist with expertise in plankton ecology and ultraviolet (UV) photobiology. She has an MS from Oregon State University and a PhD from the University of Rhode Island. Her graduate work focused on the physiological ecology of phytoplankton and this research initiated an interest in the use of molecular techniques to study ecological questions. She completed post-doctoral training in molecular biology at the University of California San Francisco Medical Center working on the molecular genetics of an inherited human disorder in DNA repair relative to exposure to UV radiation. Her current research activities include investigations on biological responses of marine organisms to ozone depletion in Antarctica and continuation of work on understanding the molecular basis of DNA repair in the context of human disease. Deneb came to USF in 1992 and has a joint appoint with Biology.

William L. Karney earned his B.A. from Haverford College in 1986 and his Ph.D. in organic chemistry from the University of California, Los Angeles in 1994. Following postdoctoral work and teaching at the University of Washington and the University of California, Berkeley, he joined the faculty at USF in 1997, where he holds a joint appointment in the Environmental Science and Chemistry Departments. His research in physical organic chemistry involves the use of theoretical and computational chemistry to

study reactive intermediates and reaction mechanisms, with a focus on Moebius aromaticity and dynamic processes in annulenes. William teaches primarily environmental and organic chemistry.

Jack Lendvay is an environmental engineer with expertise in water quality assessment and remediation (particularly bioremediation). He joined the Environmental Science Department in 1999. He has a Ph.D. in Environmental and Water Resources Engineering from the University of Michigan. He is also a licensed Civil Engineer in the state of California. His current research focuses on community based assessment of water quality with an emphasis on environmental justice issues.

Tom MacDonald is an environmental engineer with expertise in modeling, hazardous waste treatment (particularly bioremediation), hydrogeology, and data analysis. He joined the Environmental Science Department in 1996. He worked previously at ENVIRON, an environmental consulting firm. He has a Ph.D. in Civil Engineering from Stanford University. His recent research projects include evaluating environmental risk policy in the face of uncertainty and changing states of knowledge.

Stephanie Ohshita is an Assistant Professor of Environmental Science and Management. Venturing forth from the great woods of Wisconsin, Stephanie earned an SB in Chemical Engineering at MIT, and then headed to the Tokyo Institute of Technology to conduct atmospheric dispersion modeling and research on the environmental health risks of mercury. She subsequently worked for 5 years in the San Francisco Bay Area as a consultant to government and industry in the areas of air quality management, risk management, and pollution prevention. Returning to graduate school, she earned an MS and Ph.D. in environmental engineering and policy from Stanford. She currently teaches courses on energy, climate change mitigation, environmental risk assessment and management, and related topics. Combining engineering with tools from political economy and organizational theory, her research centers on energy-based solutions to multiple environmental problems, from local air pollution to global climate change. Currently, Stephanie is working with colleagues from Japan, China, Norway, and California to develop a new framework for East Asian energy efficiency and conservation cooperation, to address energy, economic, and climate change concerns in the region.

Robert Toia is an organic chemist whose research interests have been wide ranging – from studies on natural products, marine organoarsenicals, insect secretions, and mechanistic aspects of organophosphorus chemistry to research in environmental toxicology. He has held postdoctoral appointments at the University of California's Berkeley and Riverside campuses and a University Research Fellowship at the University of Western Australia. Prior to being appointed to USF in 1995 he held appointments as senior lecturer in organic chemistry at the University of New South Wales, as Co-Director of the Pesticide Chemistry and Toxicology Laboratory at UC Berkeley, and as Research Director at PTRL-West. At USF, in keeping with the nature of the programs run out of the Department his interests expanded and he has taught a variety of courses in both the undergraduate and graduate programs. These range from first year environmental science to environmental monitoring, environmental health, environmental toxicology, environmental chemistry, ecoscience, and industrial ecology and sustainability. He has also worked with many undergraduate students on research projects as well as Master's thesis and project students. Between 2001 and 2003 Robert

was on leave from USF, as Head of the School of Environmental and Life Sciences, University of Newcastle. During that time he successfully incorporated the disciplines of biology, chemistry, environmental science, human and physical geography, and geology into a single school, laid the foundations for the Asia Pacific Institute for the Environment, and was instrumental in establishing a degree program in Environmental and Occupational Health and Safety in Singapore.

1.6.2. Support Staff

The department is also supported by a full-time program assistant (Marie Markon-Edel) and a part time (0.25) student-assistant. Partial technical support is provided by Mr. Andy Huang and Mr. Jeff Oda who are both housed in Chemistry but who have college-wide responsibilities. Ms. Charmaine Qiu also housed in Chemistry has recently joined the support to staff to focus on Environmental Health and Safety issues across the college. Department computer support is provided by Mr. Cody Nivens, the system administrator for the sciences in addition to the normal ITS technical assistance.

2. DEPARTMENT GOVERNANCE

The department currently has two faculty-staffed administrative positions which each carry three units of release time per semester – the Department Chair and the Graduate Program Director (GDP). The Department Chair is elected and functions in accordance with the USFFA-USF Collective Bargaining Agreement; the GDP is appointed by the Dean who, to date, has taken the departmental recommendation. Both the Chair and GPD serve for a three-year term. Given the administrative complexities facing the department as a result of its many undertakings, the Chair handles all matters associated with the undergraduate programs and the GPD the graduate programs.

2.1. Department Chair

The Department Chair is responsible for the smooth running of the department and interfacing with the Dean's Office as the representative of the department. The Chair administers the undergraduate component of the budget. Together with the Graduate Program Director, the Chair has oversight of Program Assistant and student employees, part-time faculty selection, workload distribution, course-scheduling problems, etc. The Chair coordinates department meetings once or twice per month. The Chair also attends the monthly meetings of College Council and COSEC (The College of Science Executive Council) and sits on the committee that evaluates science courses proposed for the University's "Core B" requirements.

It is worth noting that because we are a unionized faculty the position of Chair does not carry the same level of authority as it does in many other universities. At USF, in most situations the Chair makes recommendations to the Dean or Associate Dean who may then choose to take action or otherwise. This can create some problems, particularly with regard to the supervision of support staff. Specifically, the Chair is in direct contact with the Program Assistant on a daily basis and conducts the associated job performance reviews. However, the Chair has no direct authority to ensure that expectations are met, and the Dean's Office is simply too far removed to provide the necessary oversight.

2.2. Graduate Program Director

The GPD supervises the operations of the graduate program, from recruitment through graduation and the extensive work in between including the management of budget activities. The GPD is also responsible for locating from a few up to ten qualified part-time instructors to provide relevant courses to the students that cannot be provided by the full-time faculty (in terms of either expertise or available teaching load). The GPD is heavily involved in marketing and admissions for the program. The GPD designs the scheduling of courses according to instructor availability and curricular needs. The GPD basically has the same responsibilities for the graduate programs as the Chair does for the undergraduate programs including supervision and evaluation of support staff.

3. WORKLOAD

Full-time tenured or tenure track faculty are required to teach 36 workload units over a two-year period; full-time term faculty are required to teach 12 workload units per semester, or 48 units over the same two-year period.

3.1. Undergraduate Courses

A spreadsheet typical of that used for making course workload decisions is included in Appendix 4. All undergraduate courses in ENVS are currently 4-unit courses, matching the course model recently adopted by the College of Arts and Sciences. Lecture only courses are credited as 4 units of faculty workload. However, since courses that also have laboratory or field components require a higher level of effort and time commitment, these courses constitute a 6-unit workload equivalent.

3.2. Graduate Courses

All current courses in the MSEM programs, with the exception of the Master's Project and Thesis classes are 2 units. In the San Francisco program the number of workload units is equivalent to the course units; when taught in Orange County a 1.5x loading was applied (i.e., a 2 unit course carried 3 units of workload) and when taught internationally, a 2x loading. The loading was to compensate for travel time, time away, etc. The original goal of the administration in developing the international programs was to have two programs in the same region, so that a faculty member could teach in both locations in one trip. The workload agreement for this case was double for the first location and single for the second location. Unfortunately, the dual-location system never materialized. Most recently, the decision was taken by the university to not count international teaching as part of workload, but rather to use casual staff or pay full-time faculty wishing to be involved on an overload basis. This has raised some concern regarding the academic integrity of these programs and involvement of full-time faculty in delivery of course content. In addition, the pay rate for these programs is currently under discussion.

4. DEPARTMENT BUDGET

4.1. Organization and Historical Context

Prior to 2003 there were no distinct budgets for the various programs run out of the Department. Rather, monies were allocated by the Dean's Office on a "need basis". This approach worked up to a point, particularly as we were in a developmental stage for so many programs, and it was difficult to predict budget requirements. However, this approach precluded forward financial planning.

In May 2003, when the positions of Chair and GDP were split and new university-wide accounting practices were put in place, specific budgets were created for each program. These are now managed separately by the Chair or GDP as a function of their respective responsibilities. The specific budgets have identified the serious budget deficiencies for obligatory Departmental programs to the administration. As a result, there has been a substantial undergraduate budget increase for the 2004 fiscal year (Figure 1). A further increase of 4% was provided this year (2005) based on the CPI. Budget increases have also occurred in the MSEM program (see section 4.3).

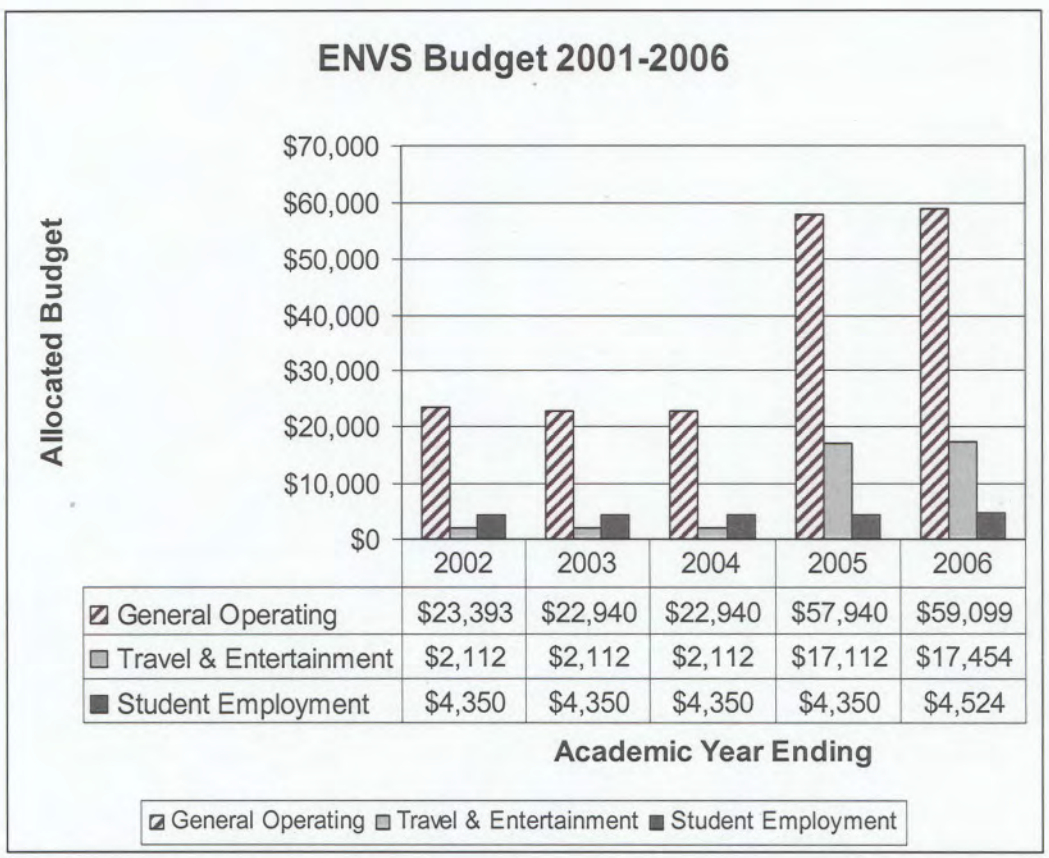

Figure 1: The Environmental Science budget over the most recent 5 fiscal years. The fiscal year corresponds to the academic year and is from June 1 to May 31.

4.2. Undergraduate Budget

The budget for the undergraduate Environmental Science is divided into three general categories: (1) General Operating, (2) Instructional Travel and Entertainment, and (3) Student Employment

Figure 1 shows the undergraduate Environmental Science budget from 2001 through 2005. With a dedicated budget, money is now spent on the program for which it was intended. This has allowed the department to vastly improve our support of undergraduate teaching, especially in so far as laboratory materials and equipment are concerned.

4.2.1. General Operating

The General Operating Expenses for the June 1, 2005 –May 31, 2006 fiscal year are $59,099 and are adequate for departmental needs. These monies are allocated to capital equipment, repair and maintenance costs for equipment, office supplies, instructional materials including materials to support the teaching labs, all duplicating expenses, freight and postage, telephone charges for research laboratories, interlibrary loan charges, honoraria, and student awards.

4.2.2. Academic Travel & Entertainment

Entertainment was budgeted at $2,371 for this fiscal year, and this is also adequate. These funds sponsor (1) periodic luncheons (usually once per semester) hosted by the department to bring together ENVS faculty and students to discuss a particular topic; (2) periodic (approximately bimonthly) late afternoon social events with students; most recently we are hosting these jointly with another department to also foster collegiality. We are also currently considering use of these funds to also support student awards for academic achievement.

The bulk of this line item, $15,083, is provided for academic travel to support courses; these funds are not intended for or used to support conference or research travel. The budget is adequate to support costs associated with use of university vehicles and for bus charter service. These funds support transportation so that we may utilize the field as a laboratory for many of our courses.

4.2.3. Student Employment

The monies allotted for student employment are currently $4,524. The majority of this money provides for a student assistant for the department office. Some funds are used provide limited assistance to laboratory courses on a demonstrated need basis.

4.3. Graduate Program Budget

4.3.1. Program Budget Allocations and Actual Budget Expenditures

One of the key concerns with regard to the MSEM budget is that we have never had enough funding to do anything more than a minimally maintain the program. The resources and infrastructure (software, films, field equipment, computer resources and library materials) are becoming progressively outdated at a time when the student body is

becoming ever more demanding and critical. With a recent reassignment of the advertising budget for this program from the Department to a College-wide office, the program operating budget will now be more readily monitored, and hopefully the funds should be sufficient to cover basic program expenses. Figure 2 shows a graph of allocated budgets versus actual expenses for the most recent budget years. The current fiscal year operating budget has been increased greatly over past levels; experience this year will indicate whether that budget meets the program needs.

4.3.2. Program Marketing Budget

Marketing is essential to the continuing success of this program. As with the overall MSEM budget, the past marketing budget had no relation to real expenditures (Figure 3), and was insufficient to properly advertise the program.

A new approach with the marketing budget for graduate programs is to control it in a central college-wide office. We believe that this centralized approach could be just as effective as the previous system, but there still needs to be a recognition in this approach of the real needs for the MSEM program (relative to all other graduate programs handled by the central office). Because of the centralized control of the advertising budget, it is incumbent upon the GPD to work with the administration to adequately fund our

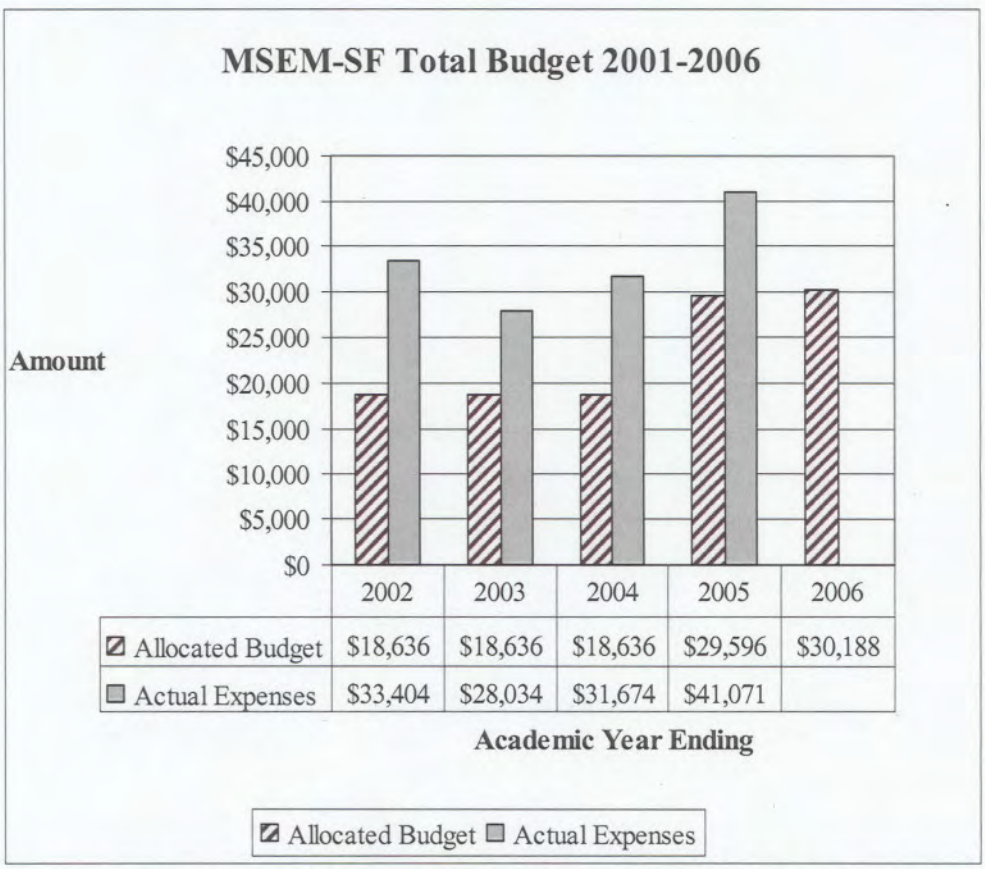

Figure 2: MSEM-SF advertising budget allocations and expenditures for the most recent 5 academic years.

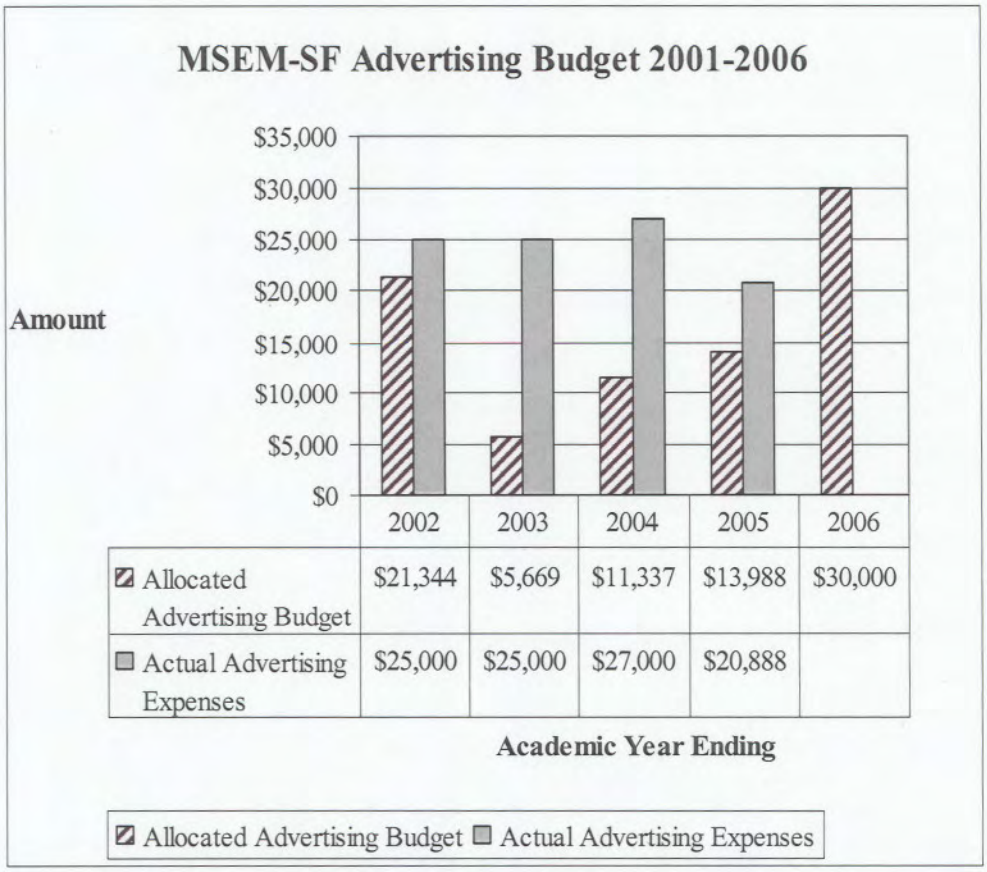

Figure 3: MSEM-SF advertising budget allocations and expenditures for the most recent 5 academic years.

advertising needs.

4.3.3. Allocated Budget Relationship with Student Numbers

Unfortunately, past budget allocations were not based on changing dynamics. As a result, there is no relationship between the number of students served in the program and program budget size. The lack of a correlation between these otherwise linked entities could be a disservice to the program. Budgeting in this manner could result in a negative feedback system, which not only does not encourage improvement and growth, but discourages it. If we are able to recruit larger numbers of students and budget allocations remain stagnant, then there may be insufficient resources available to serve the increased number of students. This would result in a less than positive experience for students and reflect badly on our program reputation. Since the environmental community in the Bay Area is so tightly interlinked, "word" of inadequate funding of this program would greatly hamper our efforts to recruit.

4.3.4. Merit Units

In addition to the budget allocations shown above, the distribution of Merit Scholarship units has also reflected the recent increase in student numbers without a comparable

increase in funding. Merit units can be used to attract good students. Often a unit or two can make the difference between a student enrolling in the program or not. Given that the average student enrolls in 15 units of classes per year, providing 2 units at no cost to the most deserving students does not significantly impact tuition revenue. While financial issues are very important to the university, intangible benefits that result in long-term success and continued profitability must be considered in this analysis. By being able to recruit excellent students, the reputation of the program grows due to the quality of our graduates in the workplace. In addition, it results in students with a wider range of backgrounds, which enhances the education provided by the program. However, even with important intangibles aside, the merit scholarship units make financial sense.

Unfortunately, the number of units that the MSEM program has received has not been linked to the number of students in the program. Our student numbers have increased, but the merit numbers has not kept pace (Figure 4).

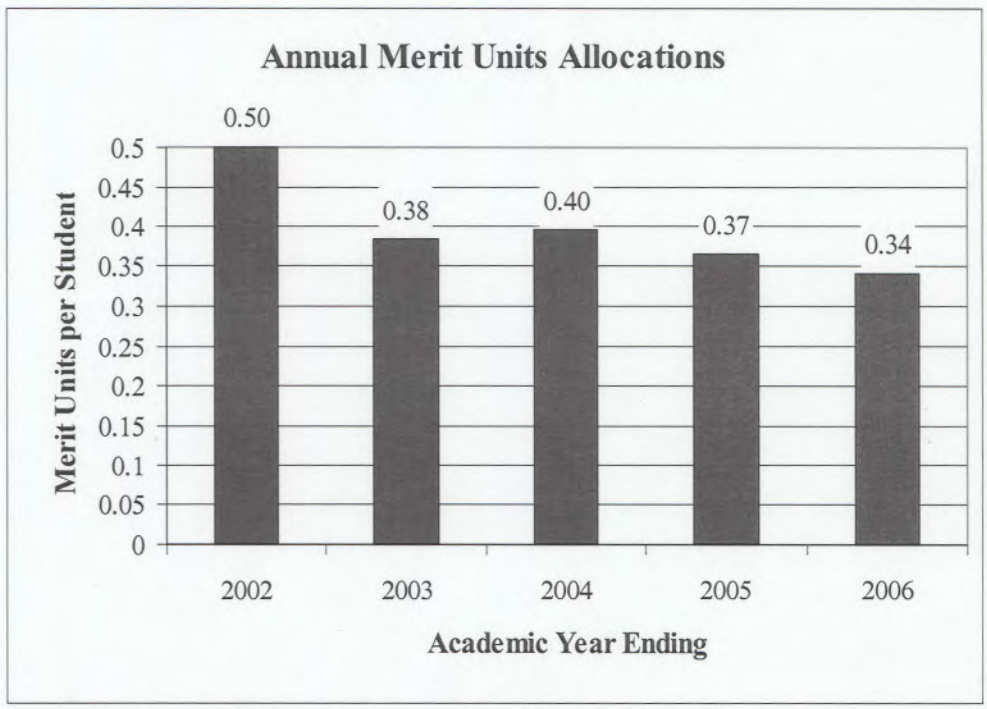

Figure 4: Merit unit allocations per MSEM student.

5. UNDERGRADUATE PROGRAMS – ACADEMIC CONSIDERATIONS, STUDENT NUMBERS AND ACHIEVEMENTS

As noted in section 1.2 of this document the department offers a Bachelor of Science in Environmental Science (ENVS), and it supports two Bachelor of Arts degrees, one in Environmental Studies (ENVA) and the other in International Studies (BAIS). Minors are also offered in ENVS and ENVA.

Table 2 summarizes our current degree options and their attendant unit requirements. ENVS majors must also take 20 additional science units from Biology, Chemistry, and Physics to meet degree requirements.

5.1. ENVS Student Learning Outcomes

To develop a clear understanding of our degree program, the department has developed program learning outcomes. These state that upon completion of the major requirements, the students should have met the following program learning outcomes:

- Demonstrate knowledge and integration of the natural sciences as applied to the complexities of environmental protection and sustainability.
- Critically analyze impacts, both actual and potential, of human activity on the environment and their prevention and mitigation.
- Demonstrate a working knowledge of the scientific method to identify, evaluate and recommend solutions to environmental problems.
- Communicate skillfully through written reports and oral presentations of scientific findings.
- Display an increased awareness of environmental conditions locally, regionally, nationally and globally so as to promote active participation and social justice in future environmental decisions through science outreach and community engagement.

5.2. Undergraduate Curriculum Development Since 2002

In 2002, the college mandated that all departments modify their curriculum to transition from a 3-unit to a 4-unit model. The department used this opportunity to reevaluate our major program and make long desired changes to strengthen it. In particular, we focused on development of student learning outcomes for the major (Section 5.1) and proposed changes that supported the realization of these outcomes. In this process several significant issues were addressed, and positive outcomes were the result.

- Within the ENVS major, course offerings from the department were increased from 16 out of 55 units to 32 out of 52 units. This provided for a substantially greater and concerted focus on environmental science topics.
- We instituted upper division "specialty" courses as part of the degree program (12 units out of 52) requiring students to further develop their scientific abilities on environmental issues. This change also provided faculty members the opportunity to teach courses within their research emphasis. The result was that the reformulated degree took better advantage of faculty expertise and broadened the array of courses offered.

Table 2: Course listings for undergraduate degrees supported by Environmental Science. Courses labeled with an "X" are required for the degree while courses labeled with an "E" are elective courses from which students may choose to count toward their degree.

USF ENVS Courses	Semester Units	ENVS B.S.	ENVA B.A.	ENVS Minor	ENVA Minor	BAIS B.A.	University Core Course
110 (Understanding our Environment w/ Lab) OR 111 (Living in our Environment w/ Lab)	4	X	X	X	X	X	Laboratory Science
210 (Ecology and Human Impacts w/ Lab)	4	X	X	X	E	X OR 212	-
212 (Air and Water w/ Lab)	4	X	X	X	E	X OR 210	-
230 (Environmental Issues and Economic Decision Making)	4	-	E	E	E	-	-
250 (Environmental Data Analysis)	4	X	X	E	E	-	Quantitative Science
312 (Water Resource Analysis w/Lab)	4	E	E	E	E	-	-
320 (Restoration Ecology w/ Lab)	4	E	E	E	E	-	-
321 (Wetland Ecology w/ Lab)	4	E	E	E	E	-	-
331 (Environmental Health – A Toxicological Perspective)	4	E	E	E	E	-	-
350 (Energy and Environment)	4	E	E	E	E	-	-
360 (Climate Change: Science and Policy)	4	E	E	E	E	-	-
370 (Environmental Remote Sensing and GIS w/ Lab)	4	E	E	E	E	-	-
410 (Methods of Environmental Monitoring w/Lab)	4	X	E	E	E	-	Service Learning
498 (Research for Advanced Undergraduates)	1-4	E	E	E	E	-	Service Learning
6xx (MSEM Courses)	2	E	-	-	-	-	-
Total units required in Environmental Science		**32**	**24-28**	**20**	**4-16**	**8-12**	

- We successfully made the case to have the Understanding our Environment introductory course accepted as part of the University Core Curriculum (laboratory science). Similarly, the Environmental Data Analysis course was accepted as part of the Core (quantitative science). In fall 2004, we were further successful in adding the Living in our Environment course to the Core (laboratory science).
- Finally, the department was successful in having three courses added to the Core Service Learning requirement. They are Methods of Environmental Monitoring, Research for Advanced Undergraduates, and in 2004 Living in our Environment.

Combined, these changes dramatically altered the nature of the ENVS degree program. Specifically, we now provide students with a program designed from the "ground up" and based on intended outcomes rather than one based on a miscellany of available courses in other departments that might be construed as environmental science without any underlying connectedness.

5.3. Major Required Courses Offered

The course descriptions listed in this section are for those courses that are required of all majors and provide for a solid foundation in environmental science.

110 - Understanding Our Environment w/ Lab (4) – a laboratory science Core Curriculum course

This course serves as an introduction to and covers broad aspects of environmental science and environmental studies. For all cases, the resulting environmental impacts are studied in detail. Specifically, this course examines the risks associated with growth in a developing world; environmental impact of population growth on natural resources; mineral and resource extraction; water resource uses; and renewable and non-renewable sources for power generation. Emphasis is placed on a holistic approach to environmental science using laboratory exercises, environmental surveys, and class discussions to reinforce scientific principles.

111 - Living in Our Environment w/Lab (4) – a laboratory science and Service Learning Core Curriculum course

This course is specifically designed for students who are participating in the Environmental Residential Learning Community at USF. The course serves as an introduction to environmental science and environmental studies with a focus on sustainability. Topics include the use of basic scientific concepts and tools for environmental problems; human population growth; cycles of carbon, water, and other matter; weather and climate; and the use of natural resources, in particular water and energy. The course will evaluate natural environmental processes, as well as human impacts to these processes. Students will consider sustainability issues in general, campus sustainability, and individuals' contributions toward environmental sustainability. The laboratory component of the course will include field trips, discussions, and in-lab activities.

210 - Ecology and Human Impacts w/Lab (4)

Prerequisite: ENVS - 110. This course introduces students to biological and ecological aspects of environmental science. The course includes lectures, laboratory, and field exercises that emphasize basic ecology principles. The goal of the course is to give the student an overview of basic ecology, ecological management issues, and ecosystem policy with special emphasis on local issues in the San Francisco Bay Area.

212 - Air and Water w/Lab (4)

Prerequisite: ENVS - 110. This course covers broad physical and chemical aspects of the atmosphere and water resources. Specifically, this course considers atmospheric composition, weather processes, and air pollution; water resources, regulations, and defining water quality based on intended use. For all cases, the resulting environmental impacts are studied in detail. Emphasis is placed on a holistic approach to environmental science using field trips and sampling exercises, laboratory exercises, environmental surveys, and class discussion to reinforce scientific principles.

250 - Environmental Data Analysis (4) – a quantitative science Core Curriculum course

This course provides students with foundations in quantitative analysis methods used to analyze environmental data. These methods are applied to real-world cases, and students conduct a full analysis and prepare a professional report as part of a group process.

410 - Methods of Environmental Monitoring w/Lab (4) – a Service Learning Core Curriculum course

Prerequisites: ENVS - 210, ENVS - 212 and ENVS - 250. This course is a senior-level environmental science methodology class that presents a hands-on approach to environmental field sampling, laboratory analyses, data analyses and data presentation in the context of environmental monitoring. Students work in teams to study and collect data on selected physical, chemical and biological features of a watershed. Students learn to analyze and interpret the data and present results in a final written report.

5.4. Recently Developed Elective Courses (2002 – present)

As previously stated, we used the program changes of 2002 to increase our upper division course offerings. The courses listed in this section are designed to provide for diverse elective courses for our students. In general, the department offers 1-2 of these courses per semester but offers any one of these courses no more than once in a 2-year period.

312 - Water Resource Analysis w/Lab (4)

Prerequisite: ENVS - 212. This course explores two primary aspects of water resource availability: surface water hydrology and water quality. Process analyses of environmental problems are used throughout this course to aid in the development of scientific knowledge and environmental impacts on water.

320 - Restoration Ecology w/Lab (4)

Prerequisite: ENVS - 210. An overview of concepts and practices in restoration ecology. Emphasis is on the application of ecological principles to restoration design, implementation, and monitoring. Two lectures and one laboratory session each week.

With an increase in student and expanded faculty interest in such courses we then developed the following courses between 2002 and 2005:

321 - Wetland Ecology w/Lab (4)

Prerequisite: ENVS - 210 or permission of instructor. This upper-division lecture and laboratory course reviews basic concepts of ecology as they apply to wetland ecosystems. Major course topics include: wetland hydrology and soils, wetland biota and their adaptations, wetland types, and policies for wetland management.

331 - Environmental Health -- A Toxicological Perspective (4)

Prerequisites: CHEM - 111, CHEM - 113 Recommended: CHEM - 236. Environmental health is concerned with effects the environment can have on the general health and well being of humans. Environmental toxicology investigates the impacts pollutants have on the structure and function of ecosystems. Major topics include toxicological aspects of water and air pollution, biological contaminants, heavy metals, and pesticides and other toxins as they relate to environmental health.

350 - Energy and Environment (4)

Prerequisites: ENVS - 212 and ENVS - 250. In this course, students examine energy production and consumption as an underlying cause of multiple environmental problems. Beginning with an overview of energy-environment connections, the course covers major fuel types and energy sources--from coal and natural gas to solar and advanced energy carriers and storage systems (e.g., hydrogen and fuel cells).

360 - Climate Change: Science and Policy (4)

Prerequisites: ENVS - 210, ENVS - 212 and ENVS - 250. In this course, students develop a deeper understanding of the greenhouse effect and human influences on the Earth's climate. Building on this scientific base, the course emphasizes climate change mitigation--options for changing human activities and reducing emissions of greenhouse gases to avert negative climate change impacts.

370 - Environmental Remote Sensing and GIS w/Lab (4)

Prerequisites: ENVS - 110, ENVS - 210 OR ENVS - 110 and PHYS - 100. This course serves as an introduction to environmental remote sensing and Geographic Information Systems (GIS). It is designed to provide students with basic concepts, principles and applications of remote sensing and GIS and their use in natural resource management. This course has a co-requisite laboratory.

In addition to the courses listed above, the department is also teaching an upper division special topic courses called "Sustainable Development – Problems, Progress and Prospects", spring 2006. This course will be added to our curriculum following curriculum review.

5.5. Service Courses That Satisfy the University Core Curriculum Requirements

As described in Table 2, the ENVS department offers one quantitative science core course and two laboratory science Core Curriculum courses. Additionally, three courses meet the service learning requirement of the Core Curriculum.

5.6. Student Credit Hours (SCHs)

Environmental Science Department's SCHs (Figure 5) have increased substantially in recent years for a number of reasons. First, and most significantly, in 2001 the college administration allowed for science departments to develop and teach a variety of science Core Curriculum courses. Realizing that this could provide for a supply of SCHs and also a resource for potential majors, the Department reworked the first year class – Understanding our Environment w/Lab (ENVS-110) into a suitable format that met Core requirements. ENVS 110 thus serves as the introductory course for our majors as well as science Core Curriculum course for non majors. This made good sense given the current state of the global environment and the need for increasing environmental awareness in all our graduates. Since fall 2001, ENVS-110 enrollments have continued to grow.

- 2001-2002 AY .....45 students .....1 lecture and 1 lab section
- 2002-2003 AY .....65 students .....2 lecture and 2 lab sections
- 2003-2004 AY .....122 students .....3 lecture and 5 lab sections
- 2004-2005 AY .....142 students .....3 lecture and 5 lab sections

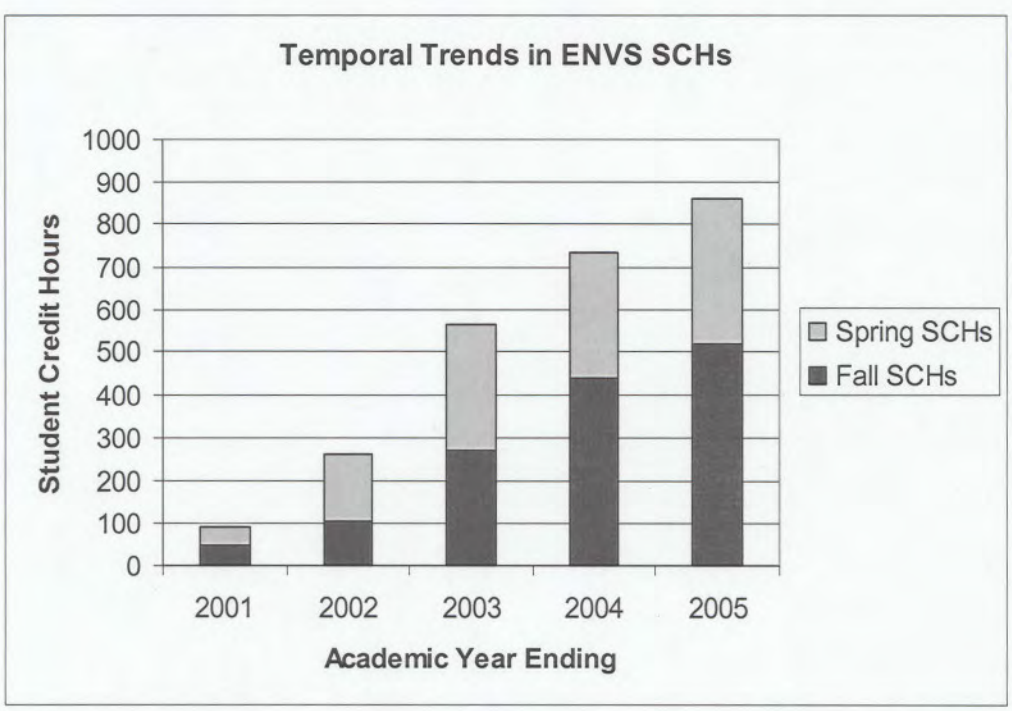

Figure 5: Student credit hours for the ENVS department over the past 5 years.

- 2005-2006 AY .....148 students .....3 lecture and 6 lab sections

A second, less dramatic reason for the increase in SCHs is the increase in total number of declared ENVS majors. Obviously, if more students are enrolled in the major program more will take our courses and increase SCHs.

As implicit in the above discussion, the majority (ca. 90%) of our SCHs come from lower division courses and in particular from ENVS-110. For example representative typical enrollments of lower division courses are shown below (numbers are annual averages over a 2-year period (S2004-F2005) :

- Understanding Our Environment.....137 students (3 sections)
- Ecology and Human Impacts.....10 students (1 section)
- Air and Water .....7 students (1 section)
- Environmental Data Analysis .....9 students (1 section)

Because the student enrollments for the last three classes listed are relatively low, all are cross listed with Environmental Studies courses. Since the inception of the ENVA program in 2001, the department has found it necessary to cross list these courses as all are required for both degrees. This effectively doubles the student numbers in each class but those are accounted for under the ENVA program SCHs and not the ENVS department SCHs. While this tactic limits the ability of instructors to focus the curriculum for a scientific student audience, there are advantages. First, the courses are consistently taught on an annual cycle and do not get cancelled due to low enrollments. Second, an interaction develops between the ENVA and ENVS students that provides for a broader understanding of each degree and a greater awareness by the students of issues associated with the environment outside their area of focus. For example, an ENVS student may see environment issue from a more social or political view; or ENVA students may better understand the science associated with environmental problems they are considering.

5.7. The Undergraduate Student

Between fall 1995 and spring 2005, 61 environmental science majors graduated from USF (Figure 6 shows recent trends). In addition, since the inception of Environmental Studies in 2002, an additional 14 students have earned degrees supported by our department bringing our total to 75 students. This number compares favorably with several other science departments (e.g. Chemistry/biochemistry- 88, Math-61, Physics-29).

Figure 7 presents the number of declared environmental science majors in a given year (i.e., the sum of all students, freshmen through senior) for the last 5 years. While there has been considerable fluctuation to this number, our current total numbers are relatively strong.

The academic quality of our majors has been uneven. Some have difficulty passing through the program while others show a remarkable aptitude for the course material. However, the quality of our top end students is excellent. This is indicated by the following list of student achievements:

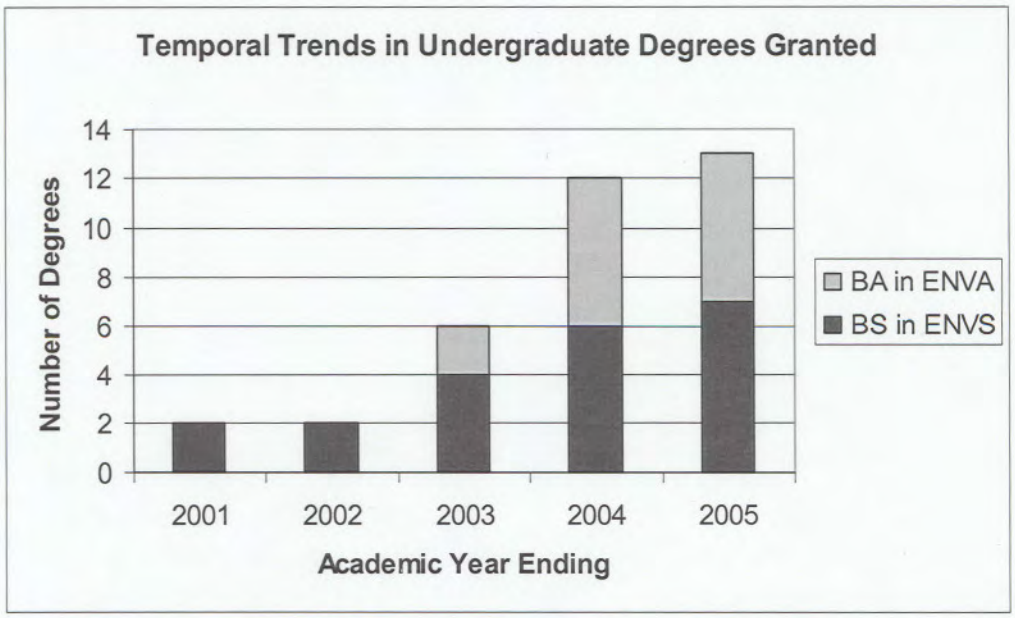

Figure 6: Total number of ENVS and ENVA students graduating for the past 5 academic years.

- 4 Students received competitive scholarships (e.g. ARCS, Barry Goldwater Scholar, etc.)
- 2 Students accepted for competitive internships (e.g. REU)
- 4 peer-reviewed papers with undergraduate student co-authors;
- Acceptance of students into excellent graduate schools or professional programs (UC Berkeley, University of Washington, Stanford, Yale, etc).
- Recent graduates are working as environmental scientists on a range of issues with local environmental consulting firms, with the US EPA, and with California Department of Environmental Health.

The Department carefully tracks the performance of its students. Those who do not meet the 2.0 GPA major requirements are notified, both orally and in writing, that the Department is concerned about their ability to graduate in environmental science. Students who do not seem to have the academic strength to complete the program successfully are encouraged to find a different major program. Faculty members also personally encourage students to engage in research through our advising process, through opportunities advertised by other universities and formally in our own laboratories in the form of independent study (ENVS 498). As a result, each year there are a number of our majors participating in supervised research projects.

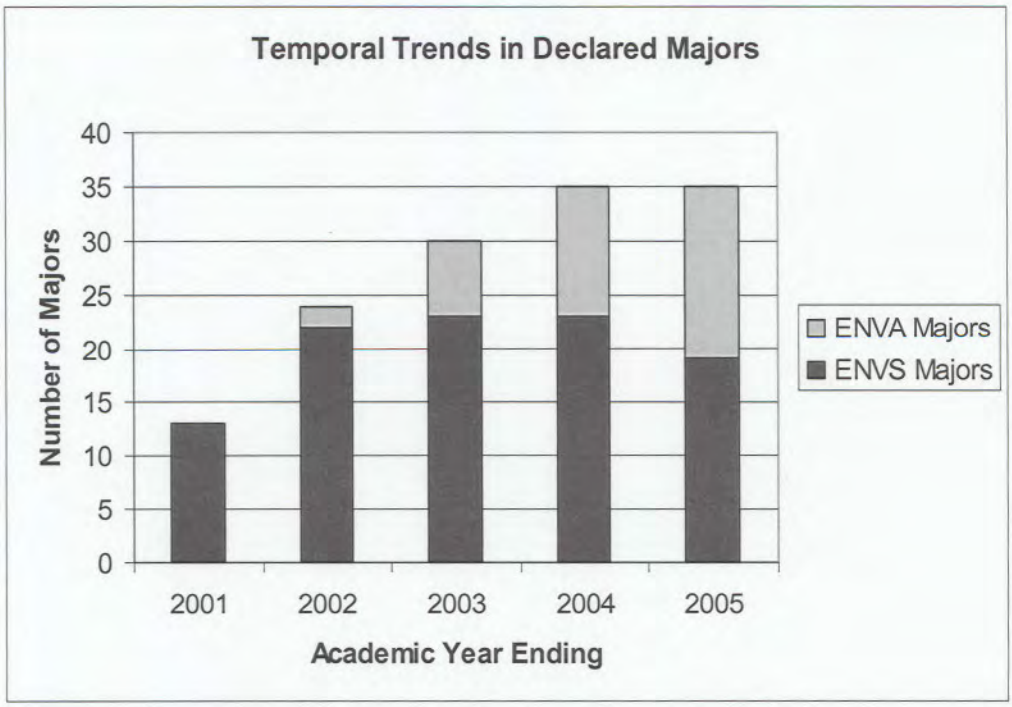

Figure 7: The number of declared majors in a given year (includes all undergraduate students) for the last 5 years.

5.8. Maintaining Undergraduate Student Numbers

Since 2001, the department received an average of only two declared ENVS students starting as a freshman, and an additional two transfer students each year. Clearly, these numbers cannot sustain our programs. To address this issue, the department has committed extensive energy toward recruiting students into the major. These efforts focus on two different populations of students, those already attending USF but not declared as an ENVS major and those who have been accepted to USF but have not declared ENVS as a major and are listed as undeclared science majors. Some examples of our efforts are (1) mailing departmental letters to all declared ENVS and undeclared science students who are admitted to the university so that they may consider what we have to offer prior to the deadline for tuition deposits in May; (2) mailing of postcards during the summer to all incoming 1st and 2nd year students advertising our core course offerings; (3) active recruiting of students from our core classes; (4) representation of our programs at admissions events and at the major/minor fair every time they are scheduled; and (5) delivery of "Do Not Disturb the Environment" door knob hangers during intersession to all students in the residence halls advertising our core offerings for spring semester. In addition to these efforts, the department has worked extensively with the admissions counselors to inform them of our programs and provide information they need to positively represent our programs to prospective students. Moreover, the department is currently working with transfer admissions to sign contracts with several local community colleges for 2+2 programs – programs where students study their first two years at a local community or city college and then their last two years at USF, completing their ENVS degree within these 2 years. This final effort could help to

increase student numbers particularly in our upper division courses where it is most needed.

While the number of incoming students who enter USF having already declared ENVS as their intended major is small, the department is successful in recruiting students from within USF. Our focus is predominantly on students who enter the university not having declared any major. The results of our efforts are most evident when considering our retention statistics. Only two departments in the sciences graduate a greater number of students than enter declared in the major, Chemistry and Environmental Science. In 2005, ENVS graduated 1.75 students for every 1 student that entered 4 years earlier as a declared ENVS major. Over the past 5 years, this ratio has steadily grown steadily (Figure 8). This trend would suggest that the recent changes to our program make the ENVS degree attractive to USF students.

While our efforts to increase student interest and enrollment in ENVS are substantial, it appears that we are meeting with modest success and the department will continue these efforts as needed.

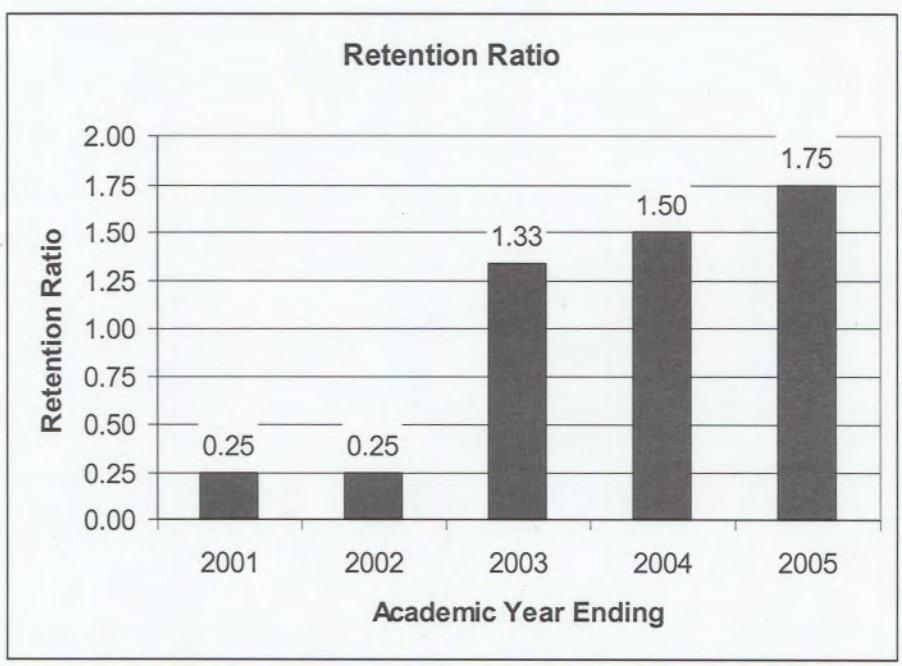

Figure 8: Retention ratio of ENVS majors for the past 5 academic years. The ratio is the number of students graduating versus the number entering as a declared major 4 years prior.

6. GRADUATE PROGRAMS – ACADEMIC CONSIDERATIONS, STUDENT NUMBERS AND ACHIEVEMENTS

6.1. Graduate Program Description

As noted in Section 1.3, the Department offers a Master of Science in Environmental Management (MSEM) degree. We currently have a program in San Francisco, as well as joint programs with universities in Manila, The Philippines, and Xiamen, China. The curriculum in each location is somewhat different due to the collaborative aspects of the program and the need importance of satisfying local needs.

6.1.1. San Francisco MSEM Program

The Master of Science in Environmental Management is designed for graduate students and working professionals who seek or hold careers in the environmental field. The goal of this science-based management program is to enhance and broaden the skills and knowledge necessary to meet the demands and changes of the environmental marketplace-in industry, in public agencies and government bodies, and in the consulting sector. Graduates from the program have established a wide variety of environmental careers and organizations in the United States and throughout the world since its inception in 1977.

The Environmental Management program at USF has two components – a substantial amount of course work and a "capstone" master's project. A thesis option is also available but this will not be elaborated here.

Courses, which cover the scientific, technical, regulatory, and public policy knowledge related to problems of air and water quality, solid and hazardous waste, resource use, and human and ecological health issues, provide the essential knowledge and foundations of environmental management. With the wide variety currently on offer a student can tailor their program to meet their particular interests and career goals.

The Master's Project hones the skills essential to environmental management: problem identification and definition; review, organization, and analysis of relevant literature and research; and presentation of justifiable recommendations. The Master's Project is developed with a faculty advisor and in a seminar-style discussion group with fellow graduate students and therefore also emphasizes communication and scientific writing skills.

Since the program is designed for full-time working professionals, classes meet primarily on Saturdays over four semesters in a two-year period. Some courses are also taught during the week.

Experience in the environmental management field is an important part of the MSEM graduate program. Most students currently hold positions in the field. For those students who do not hold a position, it is strongly recommended that they endeavor to find a paid position or internship.

6.1.2. MSEM Learning Outcomes

The Master of Science in Environmental Management Program is designed not only for practicing environmental specialists but also for other interested professionals who wish to enhance, broaden, and update their skills and knowledge to meet the demands of industry and government, as well as society in general. The Master of Science in Environmental Management degree is designed to provide students with a comprehensive professional education in environmental management. It aims to provide its graduates with an understanding and appreciation of the global environment as well as details pertinent to environmental management at the local and national levels. Students who complete the degree requirements will:

- Demonstrate an understanding of an interdisciplinary approach to the study of the relationships and interactions of human beings with the natural world
- Utilize principles and processes of the natural sciences, social sciences and the humanities to provide both theoretical and applied understanding of managing environmental issues
- Demonstrate understanding of environmental management tools, techniques, and technologies designed to meet the demands of industry, government, and the consulting sector regarding the protection of the environment and the fulfillment of environmental regulations
- Communicate skillfully through written reports and oral presentations of environmental management issues
- Critically analyze impacts, both actual and potential, of human activity on the environment and their prevention and mitigation

6.2. Degree Requirements

The program consists of 30 graduate units; twenty-six course-work units (13 courses) and four of Master's Project. Students must achieve a minimum grade point average of 3.0 to graduate.

6.3. Admission Requirements

The field of environmental management is extremely broad with subject areas ranging from ecology to chemistry to hazardous waste to human health to policy to ethics to law. This breadth makes it difficult to specify uniform requirements for all incoming students but we do require one semester of college chemistry and additional background in the physical and biological sciences and mathematics is recommended.

6.4. MSEM Curriculum

Each course in the curriculum is 2 units. Each course lasts for 8 weeks, meeting on four Saturdays for six hours per meeting (24 hours total). There are two eight-week sessions in a semester, making the graduate program semester one week longer than the undergraduate semester of 15 weeks. Courses are typically offered once every two years but this is under review.

Since students may not be able to take all the courses they want during their time in the program, graduates are generally allowed the benefit of auditing any class for the rest of their lives, *gratis*. This also allows for graduate to update their knowledge, gain background in new areas as their careers change, explore new areas of interest, and remain engaged with the program.

6.4.1. Changes to the Curriculum

The last ten years have seen enormous changes to the MSEM curriculum in San Francisco, both in terms of course offerings and in terms of structure. Ten years ago, the program required a total of 26 units including a research thesis (19 units of classes and 7 units for the thesis). The classes were 3 units each, 15 weeks long, and offered in a trimester system (fall, spring, and summer). Students took a required course on Saturday morning from 9:00 to 12:00, followed by an elective class (chosen from three courses) in the afternoon from 12:30 to 3:30. The semester-long classes allowed more depth to be covered in each course. However, they also allowed students to sample from fewer disciplines. In terms of hiring adjunct faculty experts, it was much more difficult to find faculty willing to work 15 Saturdays than the current 4 Saturdays. In practical terms, this difference also made it difficult to provide as rich a selection of courses. With the recent changes to shorter course modules and the change to require more class units, the students are exposed to more subjects.

However, the biggest change was from the required research thesis to the current Masters Project with an option for doing a research thesis. Previously, approximately 45 percent of students were not able to complete the program, because they were not able to complete their theses. Our student population of working students (typically 40-60 hours per week) left them little time to perform original research on their own with occasional personal meetings and email contact with a research advisor. It became clear that requiring a research thesis of students who were not full-time was not working properly. Since the program is designed for working professional rather than for preparing students for PhD studies, we concluded that students might benefit more from an in depth critical assessment of an environmental issue of interest to them (Masters Project) rather than performing new research that the world has never seen before. This change has been positive.

A difficulty we faced with the change to shorter course modules was the loss of depth in some courses. We have been addressing this issue by designing course sequences with prerequisites and by allowing new students to enter the program only in the fall semester. That has allowed sequences to occur over an entire year, as will occur in 2006-2007 academic year, when the Engineering I-Engineering II-Risk I-Risk II sequence will occur for the first time, and the subject matter will build over the entire year.

6.5. Environmental Management Course Descriptions

601 - Environmental Chemistry (2)

A survey of the chemistry involved in environmental processes.

605 - Environmental Ethics (2)

A survey of the ethical issues facing the global/environmental community. Review of the foundations of ethical and environmental thought, and application of these perspectives to a wide range of topics. Topics include environmental justice, corporate responsibility, the shaping of a global community, valuing non-human species and biodiversity.

606 - Environmental Philosophy and Ethics (2)

A critical analysis of values and traditions of environmental thought. The philosophy of environmental policy issues and ethical systems related to environmental thought.

608 - Introduction to Environmental Politics and Policies (2)

A brief introduction to the institutions and forces which combine to make and implement environmental policy in the United States. An important underlying theme of the course is the role that democracy has, for better or worse, on policy making.

611 - Ecoscience (2)

Examines basic principles of environmental science and evaluates large-scale human impacts to the global ecosystem.

613 - Environmental Law (2)

A survey of the requirements of state and federal laws dealing with impacts on the natural environment and human health. Legal theory and case applications are reviewed.

614 - Environmental Economics (2)

A survey of the principles of economics as they apply to environmental management. The principles of cost-benefit analysis are applied to evaluating the impacts of sustained growth and development.

620 - Applied Ecology (2)

An introduction to basic ecological concepts through their application to environmental management problems. The course will evaluate a series of case studies and scientific literature covering ecosystem management, watersheds, habitat restoration, endangered species, and other topics.

621 - Restoration Ecology (2)

Prerequisite: ENVS - 620 - An overview of concepts and practices in restoration ecology. Emphasis will be on the application of ecological principles to restoration design, implementation, and monitoring.

622 - Restoration Ecology Lab (2)

Prerequisite: ENVS - 620 - Corequisite: ENVS - 621 - This laboratory course is a companion to ENVS 621 and will emphasize field and laboratory analyses of restoration projects, involving one lab meeting per week.

624 - Environmental Planning (2)

This course provides an overview of the principles and practices of environmental planning at the federal, state and local level. Course work focuses on planning theory, case studies, and applicable analytical methods.

630 - Hydrogeology (2)

Hydrogeology introduces students to ground water flow and related environmental applications. There is an emphasis on gaining intuitive insight through quantitative understanding and practice examples. Some particular topics include Darcy's Law, field assessment techniques, and ground water resource management.

631 - Water Quality Assessment and Management (2)

This course covers broad aspects of water quality in freshwater environments. The principle goal of this course is to provide students with the necessary understanding of water resources, uses, impacts on quality, and regulations so that they may manage water use policies by considering planned uses and interpretation of water quality data.

633 - Air Quality Assessment and Management (2)

This course aims to introduce students to air quality management and some of the challenges involved. The course looks at the framework for air quality management, including current challenges, regulations, and meteorological and topographic impacts. It then examines various air pollution control strategies for managing air pollution.

634 - Environmental Permitting (2)

The environmental permitting process requires this understanding of how the laws and regulations evolved. This course will examine the permitting process with the different environmental media. The interaction between industry, the public, and government agencies will be addressed as well. By taking this course, the student will obtain a firm understanding of how our current regulations were developed and how permitting and enforcement provides for the adherence to these regulations

636 - Resource Management (2)

Provides an overview of the mechanisms for incorporating resource assessment data into resource management decisions within the regulatory framework.

637 - Accelerated Introduction to GIS for Environmental Science

This course serves as an introduction to Geographic Information Systems (GIS). It is designed to provide students with basic concepts, principles and applications of GIS and their use in the decision-making process, pertaining to natural resource management. Students will perform practical exercises using ESRI's ArcGIS software, the industry standard in GIS applications.

641 Environmental Health and Safety Management (2)

This course will provide the student with an understanding of the complex array of interacting, overlapping and sometimes conflicting laws, regulations, safety programs and compliance issues as they are translated into practical application within the work

environment. Emphasis is placed on identifying regulatory programs, their major elements for implementation, as well as the compliance issues typically encountered.

644 - Environmental Toxicology (2)

This course investigates the impacts pollutants have on the structure and function of ecosystems and human health. The conceptual framework of environmental toxicology will be used as a basis for probing various aspects of environmental health. Some of the fundamentals to be covered include environmental chemodynamics, abiotic- and bio-transformations, and distribution (toxicokinetics), and intoxication mechanisms and the expression of toxic action (toxicodynamics).

645 - Environmental Health and Epidemiology (2)

The focus of the course is on the study of chemical, bacteriological and viral agents found in the environment and that affect human populations. Students will gain applied knowledge of the basis of environmental health and epidemiology in a unified way.

646 - Resource Assessment (2)

Provides an overview of the mechanisms for incorporating resource assessment data into resource management decisions within the regulatory framework.

647 - Environmental Risk Management (2)

Examines the use of risk analysis to make decisions in the face of uncertain adverse events. Beginning with a brief overview of social theories of risk, the course will cover project-based risk management, environmental risk considerations in policy making, and risk communication.

648 - Environmental Risk Assessment (2)

Covers the principles and methods used in evaluating human health risks from environmental hazards, including quantitative and qualitative aspects of hazard identification, dose-response assessment, exposure assessment, and risk characterization.

649 - Probabilistic Risk Assessment: Quantitative Methods (2)

Covers the relevant statistical and quantitative methods for calculating risks associated with engineered and other human activities and natural adverse events.

650 - Industrial Ecology and Sustainability (2)

This course serves as an introduction to the topics of industrial ecology and sustainability. Students gain an understanding of industrial ecology through life-cycle assessment to explore sustainable resource management, and evaluate the impact of external factors on these processes.

651 - Energy Resources and Environment (2)

This course examines present and potential future energy trends. Energy usage and it impact on the environment are emphasized, as well as economic, technical, and political issues.

653 - Management of Chemical and Hazardous Waste Materials (2)

Practical aspects of hazardous material and waste management in industry and other components of society, and resource recovery of hazardous waste streams.

654 - Environmental Engineering I: Contaminant Transport in Surface Water and Air (2)

Engineering principles are used to examine and understand pollutant transport in surface water and the atmosphere.

655 - Environmental Engineering II: Contaminant Transport in Ground Water (2)

Prerequisite: ENVS - 654 - Engineering principles and techniques from ENVS 654 are expanded and used to examine and understand pollutant transport in groundwater.

656 - Engineering Aspects of Hazardous Waste Management (2)

Physical, chemical, and biological control technologies of solid and hazardous waste generation, transport and siting.

661 - Environmental Accounting (2)

This course is an introduction to both financial and managerial accounting concepts as currently practiced in American business. The emphasis is on how environmental issues are reflected in the annual report and in internal decision-making.

680 - Special Topics (2)

A variety of specialty courses are provided to meet students' professional needs and address current environmental issues.

688 - Thesis Research (2)

Development of research problem and literature searches of research area.

689 - Thesis Design (2)

Prerequisite: ENVS - 688 - Planning and methodologies of research design.

690 - Thesis Writing (2)

Prerequisite: ENVS - 688 - Effective presentation of research results.

691 - Directed Study (2)

Students complete a focused research project under the supervision of a faculty member. A completed report must be filed.

698 - Master's Project (4)

This course is the capstone portion of the curriculum and is designed to give the student an opportunity to develop an in-depth study of a specific area within the broader discipline of Environmental Management. The project includes a detailed synthesis of the literature on a question of interest, as well as a professional presentation on this topic.

6.6. Recent New Course Offerings

Recently, with the addition of new full-time and adjunct faculty, we have had the opportunity to add some exciting new classes to the program. The College dean's office

has been very supportive of these additions, and the program and College have been greatly rewarded. New classes are first added to the program as Special Topics classes numbered 680. Before the classes are offered a second time, they experience review in the College Curriculum Review Committee, and if acceptable, are given other 600-level course numbers. Below is a list of recent Special Topics classes.

- Natural Resource Economics and Development Policy
- Market-Based Environmental Policy
- Environmental Compliance and Auditing
- Restoration Ecology
- Sustainability and Society: Ecological Footprints
- Environmental Site Characterization, Sampling and Analysis
- Wildlife and Human Environment
- Urban Ecosystem Management I
- Urban Ecosystem Management II
- Modeling and Environmental Planning
- Renewable Energy and Sustainability
- Watershed Management
- Riparian Ecology
- Environmental Policy Implementation and Design
- Communications for Environmental Professionals
- Climate Change Policy
- Managing Contaminated Sites: Soil Treatment Science & Technology
- Advanced Environmental GIS
- Energy and Environment

Several recent courses have passed through curriculum review and now have their own numbers. These courses include:

- Climate Change: Global Processes and Ecological Perspectives
- Accelerated Introduction to Environmental GIS
- Environmental Accounting
- Wetlands Ecology
- Wetlands Ecology Laboratory

6.7. Student Enrollment

Student enrollment over the last ten years has fluctuated. Over the last five years, with changes in curriculum, addition of new faculty, and changes in marketing strategy, student numbers have been increasing (Figure 9). With this increase in student numbers, we have been able to offer more course diversity. The course diversity has allowed us to examine new possibilities for curriculum development, including areas of emphasis and core classes.

6.8. The Graduate Student

The MSEM program in San Francisco serves our graduate students in several different ways. For most students, the program provides them with further education, which allows them to compete better for promotion or other improved career opportunities. For a significant number of other students, they enroll in the program to serve as a springboard for a career change. For example, we have had a number of students in the banking and finance arena making career changes to the environmental field through our program. For all students, and especially those looking for a career change, the program allows them many opportunities to learn about other career options in the field and of specific job openings. Because of the work experience of students in the environmental field, the students bring valuable insights and examples to discussions in class. Few of our students go on to Ph.D. programs.

Because of the nature of our students working during the week, we are not able to employ them as TAs for our undergraduate classes. Ideally, we would have administrative support for a number of students to work in this capacity while performing research with

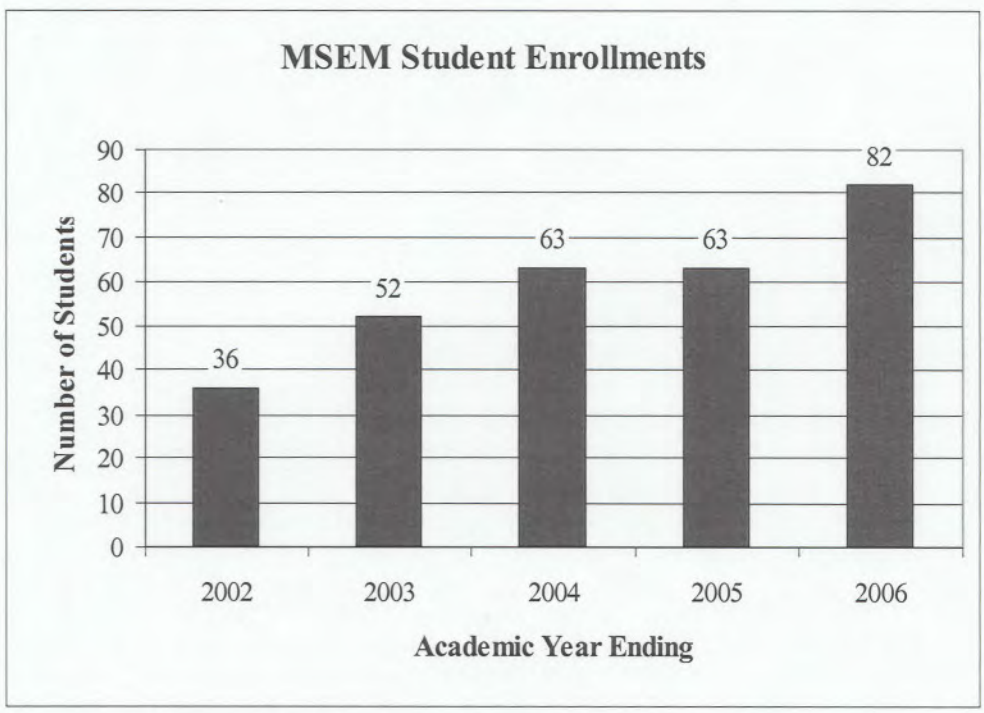

Figure 9: MSEM-SF student enrollments for the past 5 years.

an advisor (i.e., a traditional graduate student). However, the cost of such an arrangement is considered too much for the university administration. The students could still be of help to our undergraduate program through guest talks about career options, case studies, and field trips to their work sites. We have been able to take some advantage of this for our undergraduates, but our alumni outreach mechanism is nonexistent to take full advantage of this great resource (30 years of environmental professional alumni). We are currently trying to set up such an alumni outreach system, but there is little support from the administration in terms of time or money to do this.

The professional background and academic quality of our majors has been uneven. Some just barely pass through the program; others show a remarkable aptitude for the course material. The current population of students is quite strong academically and professionally. Recently, the demographics of our student population have shifted slightly. The students are generally younger (and so have less work experience in the field), but have stronger academic backgrounds from stronger undergraduate institutions. One of the problems the program faces is continuing to recruit more students with the professional experience and academic skills to succeed in our program.

The Department together with the Associate Dean of Students carefully tracks the performance of its students. Those who do not meet the 3.0 GPA major requirements in any given semester are notified in writing that the Department and College is concerned about their ability to graduate. The student is warned that if their academic performance does not improve to at least a 3.0 GPA in courses the next semester, their enrollment will be terminated. This procedure allows students to make it through one poor semester, but prevents students with little to no chance of graduation from continuing to waste their time and money.

7. SPACE, EQUIPMENT AND OTHER CONSIDERATIONS

Unlike most departments, the ENVS faculty are located on three different floors of the science building. This is one factor leading to a general sense that there is no particular *location* that is viewed as "the department". Another factor is the lack of dedicated teaching space- especially lab space. The latter also hinders the effective development of our curriculum. These points are described in more detail below.

7.1. Space

7.1.1. Faculty Offices

The 5th floor of Harney Science Center houses two-thirds of the offices of the Environmental Science faculty. One member (joint with Chemistry) has an office on the 4th floor and two members (including one joint with Biology) are located on the 3rd (Biology) floor. The Computer Science Department is also located on the 5th floor. In short, having more of our faculty located on the same floor would promote greater interaction within the Department.

7.1.2. Classrooms

There are several classrooms on the 5th floor, which are used by a wide variety of departments. In addition, the department uses Harney 103 (located on the 1st floor)

heavily for teaching. A few faculty in the department depend heavily on the availability of "smart classrooms" for teaching lecture-based courses. These rooms have built-in projectors, along with computers and Internet connections. The shortage of these rooms on campus means that obtaining one for a class is always uncertain. As this affects many departments, the administration is aware of the issue and is working to address it on a campus-wide basis.

7.1.3. Laboratories

One of the most pressing needs in the department is for more adequate lab space for teaching. Currently one of our labs (ENVS 212) is taught each year in one of the Chemistry Department laboratories. The one room that is devoted exclusively to Environmental Science teaching is Harney 103. It is also used for lecture sections in the department, and for the lab portions of ENVS 110 (Understanding Our Environment), ENVS 210 (Ecology and Human Impacts), some 300 level lab courses, and ENVS 410 (Methods of Environmental Monitoring). One consequence of this is that it leads to scheduling difficulties, since numerous ENVS lab classes use a single room, and the department must also avoid schedule conflicts between ENVS courses and supporting courses that our majors are also required to take (e.g. Biology, Chemistry, Physics).

More importantly, the design of Harney 103 severely limits the types of experiments that can be conducted in the lab courses that use that room. Despite the input of substantial departmental resources (to reconfigure lights, relocate storage, improve sight lines, etc.), the fact remains that Harney 103 is configured as a physics laboratory. Having inadequate ventilation and no hood space, it is not suitable for many wet lab experiments. Many experiments that we might like to incorporate are simply not feasible. Thus, the substandard nature of this space consequently hinders our efforts to develop our laboratory curriculum.

In large part due to the absence of departmental teaching lab space, the department has little permanent storage space for equipment used in teaching labs. As a result, we rely heavily on numerous cabinets in the 5th floor hallway, as well as limited storage space in faculty research labs.

Thus, the department feels a clear need for more teaching lab space appropriate for the courses we teach. This would include rooms that are more flexible than Harney 103. Such labs would be equipped, for example, with sinks and fume hoods for processing field samples and performing wet chemical experiments, with safety showers and eye washes to insure the safety of students conducting labs, with proper chemical storage facilities, with infrastructure to accommodate bench-top analytical instrumentation, and/or with facilities for adequately cleaning and drying equipment after field use.

Computational resources used for teaching by the department vary. One of our faculty (Benning) makes her computational research lab available for use in teaching GIS courses, though the small size of the lab (six computers) severely limits the size of those courses. Students in ENVS 212 use a computer lab in the Chemistry Department for modeling and processing of experimental data. These and other courses (e.g. ENVS 250, ENVS 110) would benefit from a departmental computer lab or access to college-wide computer labs.

The department has access to a greenhouse, which is used in ENVS 210. While we are fortunate to have such a resource, the greenhouse is in disrepair, and its location on the roof of Harney makes access problematic for safety reasons.

7.1.4. Communal Space

To facilitate interactions among ENVS majors, and between students and faculty outside the classroom, it would be helpful to have a communal room in the Department. This would be a place where students could gather for group study sessions and EnVision club meetings, and could serve as a hub for departmental social events. It would also be a place where faculty could hold office hours for larger groups of students. Such a room would greatly enhance the feeling of community within the Department. The University is in the midst of a capital campaign, one of the goals of which is to fund an expansion of Harney Science Center, as well as the renovation of the existing space. This will hopefully address some of the needs expressed above, though the planned construction is still several years in the future.

7.2. Equipment

Major equipment in the department (much of which is faculty research equipment that is also used for teaching) includes a Hach UV-Vis spectrophotometer, several multi-parameter data sondes for water quality measurements, and two electronic flow meters for stream-flow measurements. For field measurements we have several Hach handheld colorimeters and pH/conductivity/dissolved oxygen meters. Some of these instruments have been purchased by faculty using research funds, and are made available for use in teaching labs.

We also have access to some of the instrumentation in the Chemistry Department, including two gas chromatographs with flame ionization detection, a GC/MS, a flame atomic absorption spectrophotometer, UV-Vis spectrophotometers, an FTIR spectrometer, and a microwave digestion oven. These are used extensively in the lab portion of ENVS 212.

As a result of incorporating the abovementioned equipment into courses, our students gain hands-on experience with a wide range of lab-based and field-based methods and instrumentation. Currently, however, there are certain areas in our lab-based courses where experiments are simplified due to the lack of necessary equipment. Along these lines, major instrumentation needs include an ion chromatograph, air sampling equipment, and a dedicated gas chromatograph with columns and detectors suitable for the analysis of environmental samples.

8. Strategic Planning and Goals

Given the range of programmatic and budgetary issues the department has faced in the past, as outlined in earlier parts of this document, it should be clear that much effort was focused on maintenance of the programs with many of the decisions being reactive rather than the result of forward planning. However, as we are gaining stability, we are also gaining the ability to plan proactively. We do recognize the need to develop a strategic plan with long term goals and preliminary discussions have identified some initial areas

for attention, as introduced below. However, we also recognize that these are by no means definitive and a more detailed strategic plan will be developed over time.

First, we must increase the number of students who are declared as ENVS majors. Second, the department has a strong desire to increase its interactions with other science departments and we need to establish the necessary dialog to achieve this. And third, we must continuously update our degree programs based on changes occurring in the discipline and on the knowledge-base and skill-sets required by our undergraduate and graduate students. With regard to the first point, student enrollments have been discussed in detail in section 5.8 and will not be further elaborated here other than to say we give this item constant attention.

In terms of interdepartmental interactions, we feel we are ideally placed to interact with the Chemistry and Biology departments. For example, an undergraduate elective course in environmental chemistry could serve Environmental Science majors as well as Chemistry major and minors and would fill an important curricular gap in both departments. The large pool of potential students for such a course would increase the chances for healthy enrollment, something that is often difficult to achieve within a single department. An extension of this could be the development of a joint Environmental Chemistry program.

With regard to the Biology Department, the current interaction is complex. For example, the ENVS major allows students to take one upper division biology course as a normal part of their degree. However, because of prerequisites and the large number of biology majors who need to enroll in the limited number of courses offered by Biology, ENVS students are unable, in practice, to take these courses. Conversely, there are some upper division ENVS courses that are appropriate for biology majors but Biology only permits enrollment when all biology course sections are full and no other options are available to fulfill their degree requirements. If the biology degree matrix was to include a limited number of appropriate ENVS courses it is likely that some biology students would enroll in them. A further area to explore would be the development of an Environmental Biology degree administered and taught by both departments.

While we have implemented significant changes to the environmental science degree since 2001, the Department recognizes that the field of environmental science undergoes rapid evolution. We also recognize the need to be proactive and forward thinking in our curriculum design, including the incorporation of the necessary interdisciplinary aspects. This is critical in providing students with the necessary training to succeed in both the workplace and graduate school programs.

With regard to the MSEM program, the progressive divestment of many of the external programs means we can now direct our attention to the parent program in San Francisco. This is timely since the student numbers are healthy and can support a wide range of offerings. In particular, we need to address the general structure and format of the courses. We also need to consider links between the courses and to provide defined tracks where possible to provide more structure and definition to the program. In the past we have considered how to involve our alumni in the program and we need to provide a plan for this.

In summary, we are optimistic about the future of the ENVS and MSEM programs. We believe that our current programs are solid and provide the necessary foundation for future development. We have a committed faculty with the necessary resolve to move these programs forward.

Appendices will be included for the following:

1) ENVS, ENVA major and minor requirements
2) Brochures for ERLC and Brazil Program
3) Faculty CV's
4) Examples of Undergraduate and Graduate Workload
5) Graduate Information- Brochures etc.