HSU Academic Program Criteria
Academic Program in Environmental Systems Graduate

I. The Vision for Humboldt State University (Limit: 2 +1.5 pages) [15%]

Describe up to 5 curricular or co-curricular features of the program that are consistent with the Vision of HSU, and indicate which aspect(s) of the Vision align with that particular feature. Please provide sufficient information such that an individual unfamiliar with your program will clearly understand the feature's relevance.

The Master of Science degree in Environmental Systems is intended to provide graduate education in the scientific study, preservation, and/or management of the environment. It is an interdisciplinary program with four major options: Environmental Resources Engineering (ERE), Geology, Mathematical Modeling, and Energy, Environment, and Society (EES). The EES option is a new option that began Fall 2007 and replaced the International Development Technology option. The curriculum normally requires two years for completion with the second year focusing on advanced techniques applied to a specific environmental or resource topic and culminating in a thesis or, in the case of the EES option, a bound project report.

The very nature of this program is tightly aligned with HSU's Vision statement. The culminating experience (thesis or bound project) requires the student to add to the scientific community's understanding of an environmental topic and/or implement a change for the benefit of the environment and humanity. Thus, the culminating experience strongly supports the first and forth points of the Vision Statement in that it *requires* the students to work on theses or projects that directly or indirectly "improve the human condition and our environment." These efforts add to HSU's prominence as a center for "for social and environmental responsibility and action." For example projects in the EES program include the study of solar, wind, and biogas technologies, as well as their implementation locally and in the developing world. Recent theses in the mathematical modeling option have addressed aspects of the global carbon cycle, invasive species spread, management of endangered species, and automated technology for land mine clearing. Theses in the environmental resources engineering option focus on the application of quantitative methods and operations research techniques to the management of environmental resources, particularly ground water, waste water, environmental pollutants, and renewable energy resources. In the geology option most students concentrate on geologic analysis or modeling and measurement of geomorphic processes with particular emphasis on neotectonics,

uplift, and seismic hazard or on hill slope erosion, sediment transport, and channel stability. As you will see in the reminder of this document, many of these theses and projects have lead to peer-reviewed publications in international journals, as well as scholarly awards at the local, state, and international levels.

The Environmental Systems program is defined by "the interdisciplinary study of the environment and its natural resources," hence it strongly supports the second point of the Vision Statement. The core curriculum for the environmental systems program requires that students from all options participate in a common colloquium series; a common seminar on environmental and natural resource management problems, a social science component which emphasizes the social, political, and economic aspects of environmental questions and their solution; and a statistic research methods component emphasizing interdisciplinary group projects in experimental design, data collection, and analysis. Faculty from seven distinct departments across all three colleges of the university are affiliated with this program, and faculty from several other departments have served as thesis committee members. Many of the culminating projects are interdisciplinary in nature. To encourage interdisciplinary work, the Mathematical Modeling option requires that at least one committee member be from outside the mathematics department. The EES option is interdisciplinary by design; students in the option work with faculty from a number of departments in all three of HSU's colleges.

In support of the Vision Statement's seventh point, the Environmental Systems program partners with local and international communities to achieve its goals. Joint research and projects as well as student employment and volunteerism form the bulk of these partnerships. See II D. 1 of this document for details of these partnerships.

II. Demand (Limit: 1.5 pages per option, not including tables) [20%]

A. Internal demand for the degree program and courses in the degree program

1. Headcount Data

Major Academic Year (Fall/Spring) Average Headcount Summary Majors_overview_ESER report generated: 16-APR-08									
Major Code	**Major Description**	**AY 00/01**	**AY 01/02**	**AY 02/03**	**AY 03/04**	**AY 04/05**	**AY 05/06**	**AY 06/07**	**AY 07/08**
ESER	Environmental Systems (Engr)-Grad	4	1	4	4	4	7	10	8
Total		**4**	**1**	**4**	**4**	**4**	**7**	**10**	**8**

Major Academic Year (Fall/Spring) Average Headcount Summary Majors_overview_ESES report generated: 16-APR-08									
Major Code	**Major Description**	**AY 00/01**	**AY 01/02**	**AY 02/03**	**AY 03/04**	**AY 04/05**	**AY 05/06**	**AY 06/07**	**AY 07/08**
ESES	Env Systems(Enrgy,Envrn & Soc)-Grad	0	0	0	0	0	0	0	4
Total		**0**	**0**	**0**	**0**	**0**	**0**	**0**	**4**

Major Academic Year (Fall/Spring) Average Headcount Summary Majors_overview_ESID report generated: 16-APR-08									
Major Code	**Major Description**	**AY 00/01**	**AY 01/02**	**AY 02/03**	**AY 03/04**	**AY 04/05**	**AY 05/06**	**AY 06/07**	**AY 07/08**
ESID	Env Systems (Intl Dev Tech)-Grad	12	16	18	11	13	16	14	7
Total		**12**	**16**	**18**	**11**	**13**	**16**	**14**	**7**

Major Academic Year (Fall/Spring) Average Headcount Summary Majors_overview_ESGE report generated: 16-APR-08									
Major Code	**Major Description**	**AY 00/01**	**AY 01/02**	**AY 02/03**	**AY 03/04**	**AY 04/05**	**AY 05/06**	**AY 06/07**	**AY 07/08**
ESGE	Environmental Systems (Geol)-Grad	13	10	13	11	11	12	9	5
Total		**13**	**10**	**13**	**11**	**11**	**12**	**9**	**5**

Major Academic Year (Fall/Spring) Average Headcount Summary Majors_overview_ESMM report generated: 16-APR-08									
Major Code	**Major Description**	**AY 00/01**	**AY 01/02**	**AY 02/03**	**AY 03/04**	**AY 04/05**	**AY 05/06**	**AY 06/07**	**AY 07/08**
ESMM	Env Systems (Math Modeling)-Grad	12	14	16	18	18	19	18	18
Total		**12**	**14**	**16**	**18**	**18**	**19**	**18**	**18**

Majors by Sex and Ethnicity Majors_overview_ESER report generated: 16-APR-08									
SEX	**Ethnicity**	**AY 00/01**	**AY 01/02**	**AY 02/03**	**AY 03/04**	**AY 04/05**	**AY 05/06**	**AY 06/07**	**AY 07/08**
Female	Hispanic	0	0	0	0	0	1	1	1
	White	2	0	1	2	1	0	1	1
Sum		**2**	**0**	**1**	**2**	**1**	**1**	**2**	**2**
Male	Asian	0	1	1	1	2	2	2	1
	Hispanic	0	0	0	0	0	1	0	0
	White	2	1	1	1	0	2	4	4
	Unknown	0	0	1	1	2	2	2	1
sum		**2**	**1**	**3**	**3**	**3**	**6**	**8**	**6**

Majors by Sex and Ethnicity Majors_overview_ESES report generated: 16-APR-08									
SEX	**Ethnicity**	**AY 00/01**	**AY 01/02**	**AY 02/03**	**AY 03/04**	**AY 04/05**	**AY 05/06**	**AY 06/07**	**AY 07/08**
Female	Other	0	0	0	0	0	0	0	1
	Unknown	0	0	0	0	0	0	0	1
sum		**0**	**0**	**0**	**0**	**0**	**0**	**0**	**2**
Male	Asian	0	0	0	0	0	0	0	1
	Unknown	0	0	0	0	0	0	0	1
sum		**0**	**0**	**0**	**0**	**0**	**0**	**0**	**2**

Majors by Sex and Ethnicity Majors_overview_ESID report generated: 16-APR-08									
SEX	**Ethnicity**	**AY 00/01**	**AY 01/02**	**AY 02/03**	**AY 03/04**	**AY 04/05**	**AY 05/06**	**AY 06/07**	**AY 07/08**
Female	Hispanic	1	1	0	0	1	1	1	0
	Native Amer	0	1	1	1	1	1	1	0
	White	5	3	2	1	4	5	4	2
	Other	0	0	0	0	0	1	0	0
	Unknown	1	1	1	3	2	3	1	1

sum		7	6	4	4	7	10	7	3
Male	Hispanic	0	2	2	0	0	0	0	0
	White	4	7	9	6	5	5	4	2
	Other	1	0	1	1	0	0	1	1
	Unknown	0	1	2	1	1	1	3	2
sum		**5**	**10**	**14**	**8**	**6**	**6**	**8**	**5**

Majors by Sex and Ethnicity **Majors_overview_ESGE report generated: 16-APR-08**									
SEX	**Ethnicity**	**AY 00/01**	**AY 01/02**	**AY 02/03**	**AY 03/04**	**AY 04/05**	**AY 05/06**	**AY 06/07**	**AY 07/08**
Female	Hispanic	0	0	0	0	1	1	1	0
	White	4	3	3	2	3	3	2	2
	Other	0	0	0	0	1	1	1	0
	Unknown	2	1	1	1	1	2	1	1
sum		**6**	**4**	**4**	**3**	**6**	**6**	**4**	**2**
Male	White	7	5	6	5	4	4	3	3
	Other	0	0	0	0	1	1	1	1
	Unknown	1	2	3	3	1	1	1	0
sum		**8**	**7**	**9**	**8**	**5**	**6**	**5**	**3**

Majors by Sex and Ethnicity Majors_overview_ESMM report generated: 16-APR-08									
SEX	**Ethnicity**	**AY 00/01**	**AY 01/02**	**AY 02/03**	**AY 03/04**	**AY 04/05**	**AY 05/06**	**AY 06/07**	**AY 07/08**
Female	Asian	0	0	0	0	0	0	1	1
	Hispanic	1	1	0	0	0	0	0	0
	White	4	4	3	3	3	3	4	3
	Other	1	1	1	1	0	1	1	2
	Unknown	0	0	0	0	0	0	0	2
sum		**5**	**5**	**4**	**4**	**3**	**4**	**6**	**8**
Male	Asian	1	1	0	0	0	1	1	1
	Hispanic	0	0	0	0	0	1	1	1
	White	5	5	9	13	14	11	7	5
	Other	0	1	1	2	1	1	1	2
	Unknown	2	2	2	0	1	2	2	2
sum		**7**	**9**	**12**	**14**	**16**	**16**	**12**	**10**

Environmental Systems (Engr)-Grad (with options) Degrees Awarded (incl. primary and second majors) degrees_awarded_M_ESER report generated: 25-JUN-08								
MAJOR	**AY 99/00**	**AY 00/01**	**AY 01/02**	**AY 02/03**	**AY 03/04**	**AY 04/05**	**AY 05/06**	**AY 06/07**
Environmental Systems (Engr)-Grad	3	1	2	0	1	0	1	0
sum	**3**	**1**	**2**	**0**	**1**	**0**	**1**	**0**

Env Systems (Intl Dev Tech)-Grad (with options) Degrees Awarded (incl. primary and second majors) degrees_awarded_M_ESID report generated: 21-AUG-06								
MAJOR	**AY 98/99**	**AY 99/00**	**AY 00/01**	**AY 01/02**	**AY 02/03**	**AY 03/04**	**AY 04/05**	**AY 05/06**
Env Systems (Intl Dev Tech)-Grad	6	7	4	6	3	8	4	4
sum	**6**	**7**	**4**	**6**	**3**	**8**	**4**	**4**

Environmental Systems (Geol)-Grad (with options) Degrees Awarded (incl. primary and second majors) degrees_awarded_M_ESGE report generated: 25-JUN-08								
MAJOR	**AY 99/00**	**AY 00/01**	**AY 01/02**	**AY 02/03**	**AY 03/04**	**AY 04/05**	**AY 05/06**	**AY 06/07**
Environmental Systems (Geol)-Grad	5	1	3	3	7	6	1	4
sum	**5**	**1**	**3**	**3**	**7**	**6**	**1**	**4**

Env Systems (Math Modeling)-Grad (with options) Degrees Awarded (incl. primary and second majors) degrees_awarded_M_ESMM report generated: 25-JUN-08								
MAJOR	**AY 99/00**	**AY 00/01**	**AY 01/02**	**AY 02/03**	**AY 03/04**	**AY 04/05**	**AY 05/06**	**AY 06/07**
Env Systems (Math Modeling)-Grad	3	1	1	2	3	1	6	4
sum	**3**	**1**	**1**	**2**	**3**	**1**	**6**	**4**

Environmental Systems (Engr)-Grad Degrees Awarded by Sex and Ethnicity (incl. primary and second majors) degrees_awarded_M_ESER report generated: 25-JUN-08									
SEX	**Ethnicity**	**AY 99/00**	**AY 00/01**	**AY 01/02**	**AY 02/03**	**AY 03/04**	**AY 04/05**	**AY 05/06**	**AY 06/07**
Female	White	0	1	0	0	0	0	0	0
sum		**0**	**1**	**0**	**0**	**0**	**0**	**0**	**0**
Male	Asian	0	0	0	0	0	0	1	0
	White	2	0	2	0	0	0	0	0
	Unknown	1	0	0	0	1	0	0	0
sum		**3**	**0**	**2**	**0**	**1**	**0**	**1**	**0**

Env Systems (Intl Dev Tech)-Grad Degrees Awarded by Sex and Ethnicity (incl. primary and second majors) degrees_awarded_M_ESID report generated: 21-AUG-06									
SEX	**Ethnicity**	**AY 98/99**	**AY 99/00**	**AY 00/01**	**AY 01/02**	**AY 02/03**	**AY 03/04**	**AY 04/05**	**AY 05/06**
Female	Hispanic	0	0	0	1	0	0	0	0
	White	1	1	2	4	2	1	0	0
	Other	1	1	0	0	0	0	0	0
	Unknown	0	0	0	0	0	0	1	0
sum		**2**	**2**	**2**	**5**	**2**	**1**	**1**	**0**
Male	Asian	1	0	0	0	0	0	0	0
	Hispanic	0	0	1	0	0	0	2	1
	Native Amer	0	0	1	0	0	0	0	0
	White	2	5	0	1	1	5	1	2
	Other	1	0	0	0	0	1	0	0
	Unknown	0	0	0	0	0	1	0	1
sum		**4**	**5**	**2**	**1**	**1**	**7**	**3**	**4**

Environmental Systems (Geol)-Grad Degrees Awarded by Sex and Ethnicity (incl. primary and second majors) degrees_awarded_M_ESGE report generated: 25-JUN-08									
SEX	**Ethnicity**	**AY 99/00**	**AY 00/01**	**AY 01/02**	**AY 02/03**	**AY 03/04**	**AY 04/05**	**AY 05/06**	**AY 06/07**
Female	White	4	0	0	1	0	1	1	2
	Unknown	0	0	0	0	1	1	0	0
sum		**4**	**0**	**0**	**1**	**1**	**2**	**1**	**2**
Male	White	1	1	3	2	4	2	0	2
	Unknown	0	0	0	0	2	2	0	0
sum		**1**	**1**	**3**	**2**	**6**	**4**	**0**	**2**

Env Systems (Math Modeling)-Grad Degrees Awarded by Sex and Ethnicity (incl. primary and second majors) degrees_awarded_M_ESMM report generated: 25-JUN-08									
SEX	**Ethnicity**	**AY 99/00**	**AY 00/01**	**AY 01/02**	**AY 02/03**	**AY 03/04**	**AY 04/05**	**AY 05/06**	**AY 06/07**
Female	White	0	1	1	0	0	0	1	1
sum		**0**	**1**	**1**	**0**	**0**	**0**	**1**	**1**
Male	Asian	1	0	0	0	0	0	0	0
	White	2	0	0	1	2	1	5	3
	Unknown	0	0	0	1	1	0	0	0
sum		**3**	**0**	**0**	**2**	**3**	**1**	**5**	**3**

2. FTES by Course Code

FTES taken in Engineering classes by Majors (AY 02/03 - AY 07/08) course_ftes_smry_ENGR report generated: 30-JUN-08									
SUBJ	**Course level**	**Student Major**	**AY 02/03**	**AY 03/04**	**AY 04/05**	**AY 05/06**	**AY 06/07**	**AY 07/08**
	Graduate	Env Systems (Intl Dev Tech)-Grad	7.7	2.7	5.6	3.1	3.5	1.8
		Environmental Systems (Engr)-Grad	1.0	1.3	.4	1.5	2.2	1.6
		Social Science-Grad	.0	.1	.5	.0	.1	1.3
		Environmental Resources Engr	1.9	.9	1.8	.5	.4	.8
		Env Systems(Enrgy,Envrn & Soc)-Grad	.0	.0	.0	.0	.0	.5
	Sub-total		**11.5**	**5.3**	**8.8**	**5.1**	**6.6**	**6.0**

FTES taken in Geology classes by Majors (AY 02/03 - AY 07/08) course_ftes_smry_GEOL report generated: 30-JUN-08								
SUBJ	**Course level**	**Student Major**	**AY 02/03**	**AY 03/04**	**AY 04/05**	**AY 05/06**	**AY 06/07**	**AY 07/08**
	Graduate	Geology	2.7	5.4	2.1	1.9	2.0	3.7
		Environmental Systems (Geol)-Grad	4.6	5.9	3.8	6.2	3.4	1.8
		Undeclared	.3	.4	.4	.5	.4	.3
		Forestry	.0	.5	.0	.0	.0	.3
		Botany	.0	.0	.0	.0	.0	.2
		Nat Resources (Range & Soils)-Grad	.0	.3	.0	.0	.0	.2
	Sub-total		**9.5**	**14.6**	**8.0**	**9.1**	**6.7**	**6.9**

FTES taken in Mathematics classes by Majors (AY 02/03 - AY 07/08) course_ftes_smry_MATH report generated: 30-JUN-08								
SUBJ	**Course level**	**Student Major**	**AY 02/03**	**AY 03/04**	**AY 04/05**	**AY 05/06**	**AY 06/07**	**AY 07/08**
	Graduate	Env Systems (Math Modeling)-Grad	5.3	7.3	6.4	7.3	6.8	7.0
		Mathematics	.9	.3	.2	.0	.7	.1
		Undeclared	.0	.0	.0	.0	.0	.1
		Environmental Resources Engr	.2	.0	.1	.0	.1	.1
	Sub-total		**6.9**	**8.1**	**6.8**	**8.4**	**7.9**	**7.5**

FTES taken in Science classes by Majors (AY 02/03 - AY 07/08) course_ftes_smry_SCI report generated: 30-JUN-08								
SUBJ	**Course level**	**Student Major**	**AY 02/03**	**AY 03/04**	**AY 04/05**	**AY 05/06**	**AY 06/07**	**AY 07/08**
SCI	Graduate	Env Systems (Math Modeling)-Grad	1.3	.8	2.0	1.8	1.4	1.3
		Environmental Systems (Engr)-Grad	1.0	.3	.2	.5	1.2	.8
		Env Systems (Intl Dev Tech)-Grad	2.0	.5	1.5	1.0	1.0	.4
		Env Systems(Enrgy,Envrn & Soc)-Grad	.0	.0	.0	.0	.0	.3
		Environmental Systems (Geol)-Grad	.8	.8	1.5	1.1	.1	.3
	Sub-total		**5.1**	**2.4**	**6.6**	**4.9**	**3.9**	**3.1**

3. Service to other HSU program/options

Document other HSU programs/options (including, GE) with required coursework from your program

Other HSU program/option name	Courses required List course number and units	Restricted elective courses List number and units
Environment and Community Master's Program in Social Science	Not applicable	ENGR 532: Energy, Environment, and Society (4 units)
Fisheries Biology	Not applicable	GEOL 550: Geology (3 units)
Oceanography Minor	Not applicable	GEOL 561: Geology (3 units)

4. Comment on the internal demand **FOR EACH OPTION** of the Major. Explain any significant changes in internal program demand over past 7 years. Provide any additional relevant information of internal demand.

Env Systems (Engr) - Grad

After many years with 4 to 5 students, enrollment in the Environmental Engineering (Engr) graduate program option has increased to about 10 students in the last few years. During this period, the number of applicants has increased somewhat, but the primary reason for the increase in enrollment is the increase in faculty available to work with graduate students. In the past, a number of applicants have not been recommended for admission due to limited facility and staff resources. With the addition of two new facility positions three years ago, we have increased the fraction of qualified applicants recommended for admission. In addition, we have revised the curriculum of the ERE option in order to support expanded faculty involvement in the engineering department. Expanded faculty involvement is expected to translate into an increase in the number of graduate students in the program.

Env Systems (Enrgy, Envrn, & Soc) - Grad

The EES option of the Environmental Systems Graduate Program was launched in the fall of 2007. This new option replaces the International Development Technology (IDT) option. The EES program was designed specifically to attract high quality graduate students with an interest to contribute to solutions to key social and environmental problems related to the production and use of energy. The curriculum of the EES option includes a strong focus on climate change mitigation, renewable energy technology, and energy policy. As described below in subsequent sections, increased interest, grant funding, and employment opportunities in these areas provide the option with strong potential for growth.

The data presented in the tables above for internal demand for the EES option (major code ESES) do not reflect current student numbers, as the majority of the remaining IDT students intend to transfer to the EES option prior to graduation. Currently, there are 11 graduate students who are active in the EES option, including six women, five men, and one international student from an Asian country.

Env Systems (Geol) - Grad

For most of the last decade, the geology MS program enrolled 3-4 new graduate students per year, which kept our headcount at a steady state of 10-12 active graduate students per year. In the past two years the number of new students has dropped to 1-2 per year, and the number of

active students to 5 –7. This reflects four factors: 1) the "hot" job market for geologists causing graduates to take professional jobs rather than going to grad school; 2) the disability of Dr. Burke (he is unable to do field work), who was one of the major draws in our department; 3) inability to provide financial support comparable to competing institutions (e.g., no TA's); and 4) inability to hire new young faculty who would open up new research opportunities and help to draw students. Only one of our faculty members is under 50.

The percentage of female students has ranged from 22% to 62%, averaging 44% over the past 5 years. Currently women make up 35 –40% of geology MS students nationwide, so we are slightly ahead of the curve.

Env Systems (Math Modeling)

The headcount in the Math Modeling saw an increase from around 14 students per year during 2000-2003 to around 18 students in the most recent 5 years. This program has had a favorable portion of female graduate students when compared to other math graduate programs across the US. A 2006 report from the American Mathematical Society showed that the percentage of female graduate students was essentially a constant 30% from 1997-2006[1]. The Mathematical Modeling option has had on average 29% female graduate students of the 8 years listed in this report and has increased to 39% in the most recent two years. The sample size is too low to make any conclusions about trends in the number of minority students. The graduation rate was quite low (about 2 on average) from 99-05, but has significantly increased in the 05-07 years (5 on average).

B. External demand for "graduates" from the program

> Imagine you are answering a parent's question about job prospects and the demand for graduates of your program/option. Describe evidence of external demand for this program. Evidence may be cited from one of the following sources: the State of California http://www.labormarketinfo.edd.ca.gov/, the US Department of Labor http://www.bls.gov/OCO/, the National Association of Colleges and Employers, http://naceweb.org. Evidence may be cited from an additional source from, for example, a professional society relevant to your discipline.

Env Systems (ERE) - Grad

[1] http://www.ams.org/employment/2006Survey-Graduate-Students.pdf

Projected demand for environmental resources engineering is very high over the next decade. The State of California labor analysis estimates that positions will increase 25% from 2006-2016 with an average of 260 job openings per year[2]. The State of California predictions are consistent with those of the US Department of Labor. Nationally, environmental engineering is predicted to grow much faster than average (25%) over the 2006-2016 projection decade[3]. In addition, ERE graduate students working in areas related to renewable energy and climate change mitigation will be well positioned to obtain employment in these fast moving fields. See notes on the external demand for the EES option, below, for additional details.

Env Systems (EES) – Grad

The EES option is well positioned to grow in the coming years. The curriculum of the option is designed to provide students with tools to pursue opportunities in fast growing job markets associated with clean energy technology and climate change mitigation. Employment opportunities, which are already strong in these areas, are set to expand rapidly over the next 15-20 years. For example, annual growth in the global solar and wind energy sectors has averaged a phenomenal 25-30% over the past decade, and growth trends in other clean energy fields have also been very positive. Here in California, The California Climate Action Team, an expert group assembled by Governor Schwarzenegger, estimated that over 80,000 new jobs would be created in the state by 2020 in fields related to clean energy technology and climate change mitigation.[4] Job creation is expected to be especially rapid in this area following implementation of the California Global Warming Solutions Act of 2006 (AB-32). Key provisions of the Act that would further stimulate such job creation go into effect in 2011. Beyond California, our graduates have similarly positive possibilities. Seventeen other U.S. states, including Oregon and Washington, have also adopted climate change mitigation legislation that is expected to result in significant clean energy job growth trends in the coming years.[5] Humboldt State University is in a strong position to train professionals for work in this rapidly expanding area,

[2] http://www.labormarketinfo.edd.ca.gov/
[3] http://stats.bls.gov/oco/ocos027.htm#outlook
[4] http://www.climatechange.ca.gov/climate_action_team/reports/2006report/2006-04-03_FINAL_CAT_REPORT_EXECSUMMARY.PDF
[5] http://www.pewclimate.org/what_s_being_done/in_the_states/emissionstargets_map.cfm

and the EES and ERE options of the Environmental Systems Graduate Program are set to play a leading role in this effort.

Env Systems (Geol) - Grad

Statistical overview for geologists/geoscientists and hydrologists:

For the California labor market only[6]

Occupation	Years	Employment Estimated 2006	Employment Projected 2016	Employment Change Number	Employment Change Percent	Annual Avg Openings
Geologist	2006 - 2016	3,900	4,900	1,000	25.6	200
Hydrologist	2006 - 2016	1,000	1,300	300	30.0	60

For the national labor market[7]

Occupation	Years	Employment Estimated 2006	Employment Projected 2016	Employment Change Number	Employment Change Percent
Geologist	2006 -2016	31,000	38,000	6,800	22
Hydrologist	2006 -2016	8,300	10,000	2,000	24

According to the Bureau of Labor Statistics, median annual earnings of geoscientists were $72,660 in May 2006. The middle 50 percent earned between $51,860 and $100,650; the lowest 10 percent earned less than $39,740, the highest 10 percent more than $135,950.

Three recent articles document the rapidly growing demand for geoscience graduates.[8,9,10] The number of geoscience jobs in industry is expected to grow by 22% between 2006 and 2016, significantly outpacing the projected 10% increase in all occupations, according to the U.S. Bureau of Labor Statistics[8].

Additional evidence for the high demand for geoscientists is the Keynote Session scheduled for October 5, 2008 at the Geological Society of America Annual Meeting, (a meeting

[6] http://www.labormarketinfo.edd.ca.gov/
[7] http://www.bls.gov/OCO/
[8] Gramling, C., "In the geosciences, business is booming", p. 856-857
[9] Laursen, L., "Geoscientists in high demand in the oil industry", p. 857-859
[10] Coontz, R., "Hydrogeologists tap into demand for an irreplaceable resource", p.858-859 in: Science, vol. 321, August 8, 2008.

that generally draws 5,000 - 7,000 registrants) titled "Perspectives on an emerging workforce crisis in geology". The session description reads: "The recent and rapid increase in demand for geologists has yet to foster a comparable surge in enrollment. Industries served by geology are scrambling for available graduates. Academia's response is hampered by competing priorities and limited resources. This session assembles diverse perspectives to assess the existence, intensity, and best response to this perceived "workforce crisis" in geology."[11]

Geoscience graduates have multidisciplinary training that qualifies them for jobs both in geology and in a spectrum of related fields. Employment opportunities for geoscientists range from petroleum (43%) and mining (12%) to government (18%), academia (17%) and environmental firms (8%) [8]. The strong demand for geoscience graduates is reflected in rising salaries. According to the American Geological Institute, the average starting salary for a geoscientist in industry, academia or government was $74,000 in 2005, (a 9.7% increase over 2004), and the average salary for career scientists with 20 years' experience was $139,000 in 2005 (a 23% increase over the previous year)[8].

Env Systems (Math Modeling)

Our Mathematical Modeling program can be best appreciated in the context of a broad national movement toward interdisciplinary training in biology. There is an increasing need for quantitatively trained interdisciplinary scientists who are well-versed not only in analytical techniques but have strong science backgrounds.[12] In fact, it has been proposed by many sources in recent years[13,14,15] that advanced interdisciplinary training in mathematical biology holds an enormous potential for the future. Our well-established Mathematical Modeling program has been providing such training for decades. Furthermore, several areas of mathematical biology (population biology, theoretical ecology and population genetics) are central to the quantitative understanding and analysis of the pressing scientific challenge of global climate change and its

[11] GSA Today, 2008, vol.19, No.9, p.18.

[12] J. Austin and C. Castillo-Chavez: "Math and Biology: Careers at the Interface", Science Careers, Feb. 2006
[13] Cohen JE: (2004) “Mathematics Is Biology's Next Microscope, Only Better; Biology Is Mathematics' Next Physics, Only Better”, **PLoS Biol,** 2(12)
[14] Hastings A, Palmer, MA: (2003) “A Bright Future for Biologists and Mathematicians?” **Science**,Vol. 299, Issue 5615
[15] Bio 2010: Transforming Undergraduate Education for Future Research Biologists, (2003), National Research Council Report published by The National Academies Press

impact on human and wildlife populations. These areas are well represented among our faculty's fields of expertise and are an important part of our curriculum.

Furthermore, aside from the relevance of the specific interdisciplinary training, according to the 2007 California State Labor Market analysis[16], mathematics is a common skill needed across disciplines. The rigorous mathematical coursework that emphasizes applications of mathematical techniques in various settings provides a strong foundation for our students to enter the workforce.

Finally, our program provides training for future community college instructors. Most of our students are supported through their graduate studies by working as part-time instructors at HSU and at College of the Redwoods, and many of them continue to work at various community colleges upon graduation. Although it is not a requirement of our program, most of our graduate students do participate in the College Faculty Preparation Program. This certificate program and the significant teaching experience of our graduates makes them successful candidates in their further teaching careers. Of the graduates from this program in the last three years approximately 65% are currently teaching at the community college level, while the reminder are currently in PhD programs or have careers in industry or research related to mathematics.

[16] http://www.calmis.ca.gov/specialreports/Labor-Market-Economic-Analysis-2007.pdf

III. Program Quality (Limit: 6 pages, not including tables) [30%]

A. Students

1. For graduate and post-baccalaureate professional programs

Total Fall Confirmations received appsXmajFall report generated: 29-JUL-08						
General major	**2003**	**2004**	**2005**	**2006**	**2007**	**2008**
Env Systems (Intl Dev Tech)-Grad	3	4	5	6	0	0
Env Systems (Math Modeling)-Grad	7	6	8	4	6	4
Env Systems(Enrgy,Envrn & Soc)-Grad	0	0	0	0	3	3
Environmental Systems (Engr)-Grad	0	2	4	4	0	2
Environmental Systems (Geol)-Grad	3	4	3	1	2	1

Total Fall Applicants who enrolled appsXmajFall report generated: 29-JUL-08						
General major	**2003**	**2004**	**2005**	**2006**	**2007**	**2008**
Env Systems (Intl Dev Tech)-Grad[3]	3	4	3	3	0	0
Env Systems (Math Modeling)-Grad	7	6	8	3	6	4
Env Systems(Enrgy,Envrn & Soc)-Grad[17]	0	0	0	0	3	3
Environmental Systems (Engr)-Grad	0	2	4	4	0	2
Environmental Systems (Geol)-Grad	3	4	3	1	2	1

Provide an explanation of the above data, if necessary, and/or provide additional evidence indicative of program quality related to student achievement.

While the number of students in the Environmental Systems Graduate Program has been modest in recent years, the quality of many of the students has been very high. Students in the Math Modeling and Geology options have won the Patricia O. McConkey Outstanding Thesis Award in four of the last five years, and one student won the Western Association of Graduate Schools Distinguished Master's Thesis Award. Two EES students in the last two years were awarded the prestigious Switzer Environmental Fellowship, which provides $15,000 in funding.[18] A recent Math Modeling student and his adviser Ken Owens were awarded the Intel Environment award worth $50,000 for their research on landmine-clearing robots. In recent years students in this

[17] The zeros in the Energy, Environment, and Society (EES) and International Development Technology (IDT) programs reflect the fact that EES replaced IDT Fall 2007.
[18] http://www.switzernetwork.org/

option also have been awarded the Graduate Equity Fellowship, the Rotary Graduate Scholarship, the Patel Scholarship, and the Rumble Award for Excellence in Botany. Additionally, in order to continue to attract high quality students the Schatz Energy Research Center established a $10,000 per year fellowship that is awarded to one incoming ERE or EES student each year and is renewable for up to two years.

The Environmental Systems graduate students are active scholars. In the past five years Geology graduate students had, while in residence at least 10 presentations with faculty or independently at large national and regional meetings, and at least three peer-reviewed publications in professional journals (this does not include thesis-related publications after they left HSU). In the most recent three years 15 talks or posters have been presented by Mathematical Modeling students at regional or national conferences. Approximately 25 % of our Geology and Mathematical Modeling graduates go on to earn a doctorate, mostly from prestigious Research 1 institutions.

While the quality of our students is high, the number of students enrolled has not been high. The Mathematical Modeling option has had fewer faculty and has sought to increase the quality of graduate students by raising the standards for acceptance, which has resulted in slightly lower enrollment numbers for the last three years. See II. A. 4. for an explanation of the low enrollments in the geology program. Low number of new students in the ERE option in the last two years appear to be related to a reduction in funded research projects outside of the energy field that offer stipends for the students. Faculty members are working hard to increase funding opportunities to ensure that exceptional applicants are not “outbid” by other universities in the future. The EES program is new and there is a great potential for growth (See IV).

B. Faculty

1. Provide evidence of teaching effectiveness and commitment to continuous improvement of teaching. Include, for example, engagement in professional development for teaching (including around campus themes on learning outcomes and diversity, and on accessibility training), program approaches to ensure quality, and/or recognitions, honors, and awards for excellence in the classroom as appropriate for your program.

The Environmental Systems program has a very solid set of faculty members who are deeply committed to teaching excellence. The group includes three HSU Outstanding Professors of the

Year (Raymond "Bud" Burke (Geology) 1997/98, Charles Chamberlin (ERE/EES) 1994/95, and John Longshore (Geology) 1983/84), five HSU Scholars of the Year (Lori Dengler 2008, Steve Hackett (EES) 2005, Peter Lehman (ERE) 2002, Gary Carver (Geology) 1995, and Ken Aalto (Geology) 1987), and one winner of HSU's WASC Making a Difference Award (Arne Jacobson (EES) 2008).

Members of the faculty in this group have worked to improve their teaching through midsemester evaluations and a number of professional development activities. For example, Environmental Systems faculty have participated in workshops at HSU on writing across the curriculum, large lectures, Accessibility, WASC and assessment, and attended courses on technology. They have also participated actively in HSU conferences and meetings such as the Diversity Conference, the Campus Dialogue on Race, the Social Justice Summit, International Education Week, and attended seminars on encouraging diversity in the sciences. Beyond HSU, faculty have recently attended and lead sessions related to pedagogy at national conferences.

2. Evidence of faculty engagement in scholarship/creative activities and service. (Express as a percentage of full-time or FERP faculty members **affiliated with the program**. For example, if 9 of 10 faculty affiliated with your program gave a paper at a professional meeting in 04/05, then enter 9/10 = 90%.) This table is to be completed by the department.

Scholarship/Creative Activities/Service EES Option[19]	**05/06**	**06/07**	**07/08**
At least one peer-reviewed publication or creative product	57%	57%	71%
At least one funded grant or contract related to scholarship	71%	86%	86%
Invited participant or leader of workshops, expert panels, or task forces	71%	86%	86%
At least one presentation (paper, poster, exhibition, etc.) given at a professional society meeting	100%	57%	57%
Professional service activities at a regional or national level	86%	86%	71%
Service on at least one university or college-level committee (at least 1 hour/wk avg.)	71%	71%	71%

[19] The EES faculty include Dr. Charles Chamberlin (Engineering), Dr. Sarah Goldthwait (Oceanography), Dr. Steve Hackett (Economics), Dr. Arne Jacobson (Engineering; EES option coordinator), Dr. Peter Lehman (Engineering), Dr. Llyn Smith (Anthropology), and Dr. Noah Zerbe (Politics).

Scholarship/Creative Activities/Service ERE Option	05/06	06/07	07/08
At least one peer-reviewed publication or creative product	53%	53%	53%
At least one funded grant or contract related to scholarship	84%	74%	53%
Invited participant or leader of workshops, expert panels, or task forces	53%	63%	53%
At least one presentation (paper, poster, exhibition, etc.) given at a professional society meeting	63%	74%	63%
Professional service activities at a regional or national level	74%	53%	84%
Service on at least one university or college-level committee (at least 1 hour/wk avg.)	53%	63%	53%

Scholarship/Creative Activities/Service Geology Option	05/06	06/07	07/08
At least one peer-reviewed publication or creative product	71%	86%	86%
At least one funded grant or contract related to scholarship	57%	57%	57%
Invited participant or leader of workshops, expert panels, or task forces	14%	14%	57%
At least one presentation (paper, poster, exhibition, etc.) given at a professional society meeting	86%	86%	71%
Professional service activities at a regional or national level	43%	43%	43%
Service on at least one university or college-level committee (at least 1 hour/wk avg.)	29%	29%	29%

Scholarship/Creative Activities/Service Mathematical Modeling Option[20]	05/06	06/07	07/08
At least one peer-reviewed publication or creative product	67%	50%	67%
At least one funded grant or contract related to scholarship	50%	67%	67%
Invited participant or leader of workshops, expert panels, or task forces	17%	50%	17%
At least one presentation (paper, poster, exhibition, etc.) given at a professional society meeting	50%	50%	50%
Professional service activities at a regional or national level	83%	83%	83%
Service on at least one university or college-level committee (at least 1 hour/wk avg.)	50%	67%	67%

3. Provide explanations of the data above and/or descriptions of the patterns of faculty engagement in scholarly and/or creative activities and service as appropriate for your program.

The above tables reflect a high level of scholarly activity across all options. Our faculty have also been successful in securing grants (see IV A. 5.). It is particularly notable that faculty in the EES option have served as Principal Investigators for projects totaling more than $1.75M from AY 05/06 to AY 07/08. This represents approximately 6% of all grants and contracts managed by the Humboldt State University Sponsored Programs Foundation during the period. Five faculty from the Environmental Systems program have been awarded Scholar of the Year (see III B. 1.).

4. Provide evidence for faculty mentoring of students. Include, for example, approaches to advising, directed study or research, and/or clubs or student professional chapters that involve faculty mentorship.

Faculty in the Environmental Systems program mentor graduate students in the context of academic advising, thesis and bound project development, funded research efforts, proposal writing, directed studies, club and volunteer project activities, and other professional development opportunities. Faculty encourage graduate student involvement in their research, present papers with them, and co-author publications with them. EES coordinator Arne Jacobson

[20] The math faculty affiliated with graduate program are: Mazzag, Dugaw, Van Kirk, Brown, Owens, and Rizzardi

is the advisor for the Renewable Energy Student (See IV C. 5.). Geology Faculty involve students in a local professional organization (Humboldt Friends of Geology) and accompany them on regional professional field excursions and to professional meetings. Students who participate in the California Faculty Preparation Program[21] get help in preparing their CV and practicing their job interviewing skills as part of the coursework they take.

5. Other evidence of quality indicators related to faculty that may not be listed elsewhere, including, for example, faculty diversity within the program.

The EES faculty includes members from five departments in all three of HSU's colleges. It is, therefore, one of the few programs on campus where faculty from a range of disciplines, including engineering, physical sciences, natural sciences, and social sciences, work together to teach and mentor students.

The Mathematical Modeling option has two female faculty members associated with it (Brown and Mazzag), so 30% of our faculty is female. This is quite rare among Mathematics programs. Since 1979 the Geology department has had two women faculty – approximately 30% of the department. They were hired at a time when women were uncommon in geology. Even today women comprise only 13-17% of earth science faculty nationwide.

C. Curriculum (differentiate by option, if appropriate)

1. Writing and oral communication learning outcomes
Describe how written and oral communication skills are included in your program.

Included in our 2004/2005 program review is the learning outcome that students will be able to demonstrate "The ability to clearly articulate an understanding of and solutions to environmental and resource management problems." We address this outcome throughout the curriculum beginning with Science 698 where each student is required to make a presentation and to develop a poster related to a current environmental problem, continuing with their option course work where they are expected to write papers and make oral presentations, and finally culminating with their thesis or project. In the Math Modeling option, every required core course has a project, which involves a written and oral presentation. We also regularly offer a course in proposal and thesis writing that helps students improve their ability to communicate in writing.

[21] Coordinated by math professor Sharon Brown prior to her leave of absence this year.

2. Assessment
   [Data on program progress with assessment tasks will be provided from the Faculty Associate for Assessment]
   Provide 2 examples of how you have used results of assessment of your program's student learning outcomes to adapt, enhance, or affirm your program's curriculum.

Our program has not been asked to conduct any formal assessments of our student learning outcomes, however we recognize the importance of assessment. Our last program review conducted in the 2004/2005 defined several learning outcomes that can all be assessed using the culminating experience. Every student in our program produces a thesis or bound project that must be signed be at least three committee members and the graduate coordinator, which indicates that they met the learning outcomes. However, there are different degrees of achievement and we will strive to have all of our students meet the learner outcomes at the highest level. To measure this we plan to begin assessment.

Although we have not formally performed assessments, we have made changes to our curriculum in response to our program review. These changes were designed to help students attain the learner outcomes. We now offer the thesis and proposal writing course described in III C. 1., above, to improve communication.

3. Accreditation (if applicable)
   If the program is accredited, describe the need for this accreditation and its impact on the quality and composition of the curriculum of the program.

   Not applicable.

4. Relevance and innovation
   Provide evidence through examples that demonstrate a curriculum that is relevant, innovative, forward looking, responsive to changing trends, and equips students to function in a diverse, global context.

The tasks of addressing global climate change while simultaneously reducing world poverty and social inequity provide some of the greatest challenges of the coming century. There is a growing need for professionals in the energy field who can combine technical and natural scientific expertise with public policy skills and the capacity to analyze and interpret the economic and social dimensions of these problems. The EES program is designed to prepare students to work as professionals, researchers, and academics in this growing field. The

curriculum for this option, which is the first of its kind in the CSU system, has already generated considerable interest. In the first year of its existence, we received 22 applications for admission (approximately twice the historic average for the IDT program). We expect an even larger number of applicants this year.

The Mathematical Modeling program is fulfilling the crucial role of providing rigorous theoretical and computation training to students interested in interdisciplinary work. As discussed above (II. B.), there is a nationally recognized need for training mathematical biologists and scientists who are well-trained in mathematics and computation. In our courses, we build on modern mathematical ideas (such as qualitative analysis of systems of differential equations using dynamical systems concepts) and show how they apply to problems in biology (and in some cases physics or engineering). Some of the courses, (such as Mathematical Ecology – Math 580) the mathematical content is driven by the particular applications investigated.

5. Interactions between graduate and undergraduate programs (if applicable)
   If this is a graduate program, what opportunities for undergraduates result (or are lost) by virtue of the graduate program.

Undergraduate math and engineering majors commonly take graduate math courses, typically one student per graduate course. The vast majority of our remedial courses are taught by math graduate student TA's; EES and ERE graduate teach undergraduate courses. Most ERE graduate students take at least four undergraduate engineering courses during their time at HSU. These students serve as role models for the undergraduates, and are a valuable addition to the undergraduate classroom environment.

EES and ERE graduate students play an important role in the Renewable Energy Student Union, which has many undergraduate members. The graduate students bring a higher level of expertise and experience to these clubs. Due in large part to graduate student leadership, students in the clubs have been involved in successful efforts over the past three years such as the installation of a $55,000 renewable energy system operated by the Smith River Alliance, the development and operation of a Solar Radiation Monitoring Station that is part of the U.S. Department of Energy's National Solar Radiation Database, and the assessment of Humboldt County's wind energy resources through an EPA funded project. Students in the club have also written successful proposals for projects exceeding $100,000, including the first two projects funded under the Humboldt Energy Independence Fund (HEIF). The practical learning

associated with participation in these projects has enhanced the educational experience of dozens of students, undergraduate and graduate alike.

The Geology option provides opportunities for undergraduate involvement in graduate student research and mentoring as well as a greater variety of specialization courses for advanced undergraduates. Undergraduates comprise one-quarter to one-third of geology graduate courses.

6. Program uniqueness
   If your program provides unique educational opportunities or course content that is found at few or no other CSU institutions, please describe this uniqueness.

Env Systems (EES): The EES option is the first of its kind in the CSU system. See II. C. 4. A. for a discussion of the innovative nature of this program

Env Systems (ERE) : The Environmental Engineering option offers an academic program that is unique in the CSU system. Traditional environmental engineering is focused on pollution control and prevention. The program at HSU has an emphasis on engineering applied to natural resources. For example, our program explores uses of constructed wetlands for waste treatment, engineering measures to assist in river and watershed restoration, engineering designs to aid is passage of fish through culverts, design and applications of renewable energy systems. None of these topics are found in any other engineering program in the CSU system.

Env Systems (Geol): The geology option is unique in its emphasis on environmental geomorphology: Quaternary stratigraphy and tectonics and hillslope and fluvial processes. These make our students desired by consulting and environmental firms, and by government agencies. The HSU campus is located in the middle of this dynamic geologic system. All of these features are located within close proximity to the department, thus providing a field laboratory that is unmatched by any other geologic department in the state and arguably in the nation. The rural, undeveloped setting of the area provides access to unmodified geologic conditions that cannot be found in more urban areas.

Env Systems (Math Modeling): The Mathematical Modeling option is a unique program in the state of California as it is the only applied math masters program that is part of an interdisciplinary program and one of only four applied math masters in the CSU system.

7. Opportunities for undergraduate scholarship/creative activities/service

Estimate the percentage of your undergraduate majors that participate in scholarship/creative activities/professionally-related service, and provide some illustrative examples of such activities. Can students receive academic credit for these activities and have them counted toward undergraduate major requirements?

Not applicable.

D. Affiliations/Equipment/Facilities/Environment

1. Affiliations
   Some academic programs are affiliated with on-campus or off-campus centers, units or institutes that bring important benefits to programs. For any such center/unit/institute, please provide (1) the name of such center/unit/institute, and very brief descriptions of (2) the purpose of the center/unit/institute, (3) the nature of your program's affiliation with the center/unit/institute, and (4) the benefits accruing to your program/major from your affiliation with this center/unit/institute. Units/centers/institutes may be public (HSU, CSU, local, state, federal) or private.

Faculty and students in the Environmental Systems program have collaborated with over 20 different organizations in recent years. Due to space limitations we cannot list all of the details of the many affiliated organizations, but we have included details of select few.

Redwood Sciences Lab (RSL): RSL is operated by the USDA Forest Service, located next to the HSU campus, houses research scientists, technicians, and support personnel who are conducting watershed, wildlife, and fisheries research applicable to the region. There is a history of collaborative research between RSL scientists and faculty in the Geology and Math Modeling options, and RSL currently employs a Math Modeling student. The lab and the geology department lend each other field equipment and share access to lab facilities, to the benefit of both. Two RSL lab members are geology adjunct faculty who have served as thesis supervisors or committee members of several graduate students and have funded the research of at least 6 of the geology graduate students.

Schatz Energy Research Center (SERC): SERC is an internationally recognized research laboratory that has a twenty-year history of groundbreaking work in renewable energy and hydrogen technologies. SERC is affiliated with the engineering department and co-directed three engineering professors. The Center has an $8M endowment and has attracted substantial funding from federal, state, and business organizations, as well as a number of private foundations. The Center is in the process of developing a new 6,500 ft^2 facility on the HSU

campus. Students from the EES and ERE options of the Environmental Systems Graduate Program hold paid research positions at SERC.

Lawrence Berkeley National Laboratory (LBNL): LBNL is a Department of Energy laboratory based in Berkeley, California. Arne Jacobson works in close collaboration with Dr. Evan Mills of LBNL on a research effort focused on the development of improved lighting services for low-income homes and businesses in Sub Saharan Africa that currently use fuel based lighting. This past summer, one ERE and one EES student traveled with Jacobson to Kenya for fieldwork associated with the project.

Yurok Tribe: The Schatz Energy Research Center (SERC) has worked with the Yurok Tribe on a number of renewable energy and energy efficiency related projects over the past decade. Four engineering faculty have worked along with the SERC staff to build and maintain the relationship over time. Over the past year, two graduate students (one EES and one ERE) have worked on energy projects with the Yurok Tribe.

Other HSU Departments: Professors and students in the Environmental Systems program regularly interact with faculty and students in other HSU departments. Students in the Math Modeling program are required to have a member of their committee from outside their department. Faculty in the ES program also serve on committees of other department's graduate students. Shared research and grants with outside faculty are also common among our faculty. Departments that have regular interaction with ES faculty and students include: Biology, Natural Resources and Sciences, Fisheries, Forestry, Oceanography, Politics, Economics, Anthropology, and Wildlife, Watershed Management, and Wildland Soils.

Other Affiliations

Research Centers and/or Institutions: Center for Integrative Coastal Observation, Research and Education (CICORE), Center for Advanced Materials Characterization at the University of Oregon, California State University Program for Education and Research in Biotechnology at UC Davis, and the Energy and Resources Group at UC Berkeley

Municipalities, government, and corporations*:* City of Arcata, Fremont-Madison Irrigation District, Humboldt Waste Management Authority, Idaho Department of Fish and Game, US Bureau of Reclamation, US Fish and Wildlife Service, US Environmental Protection Agency,

US Department of Agriculture – Rural Development, and the International Finance Corporation of the World Bank Group.

***Nonprofit Organizations**:* Friends of the Teton River, Henry's Fork Foundation, Henry's Fork Watershed Council, Smith River Alliance, Salmon Forever, and the Natural Resources Defense Council.

2. Facilities and resources
   Provide a brief listing of your most important facilities, equipment and information/library resources, and describe the degree to which the current facilities, equipment and information/library resources affect program quality.

The library collection of book, print, and electronic journals are invaluable resources for graduate research. Math Modeling and ERE graduate students rely on computing resources for model simulation and analysis. The ERE sediment transport flume is a valuable resources for ERE graduates investigating projects on streambank restoration and fish passage through road culverts. The Schatz Energy Research Center has excellent facilities for conducting clean energy research in topic areas related to hydrogen energy, fuel cells, solar energy, biomass energy, and off-grid lighting for developing countries (See III. D. 1.) Geology students depend on the X-ray fluorescence Spectrometer and the X-ray diffractometer (Fifteen years old, but in good shape and used by graduate students and faculty for research. The chief problem is lack of funds for maintenance); the Experimental Petrology Lab which provides equipment to perform high temperature-pressure experiments on geologic materials; the GIS computer lab, and the soil analysis lab.

3. Unique local and regional environment
   Describe how the program takes advantage of the unique local or regional social, cultural and/or natural environment available to students and faculty at HSU. (Do not include items listed under D1.)

The rich local natural and social environment provides an ideal location for an Environmental System program. Many masters' theses address the important local biological, environmental, and geological systems via scientific research and mathematical modeling. The environmentally aware and social progressive community provides an ideal environ for Energy, Environment, and Society students.

IV. Investments, Revenues, and Efficiencies (Response Limit: 2 +1.5 pages of narrative, not including tables) [20%]

A. Program Investments

1. Program Investment – Degree Requirements

Enter the total number of required course units (as listed in the catalog) for this academic program, and then the number of required course units for this academic program that are from the primary course code associated with your program. Provide a total for each option if appropriate.

Student Units

EES

Total required Program SCUs	30	Required Program SCUs in the primary Course Code	12

ERE

Total required Program SCUs	30	Required Program SCUs in the primary Course Code	9

Geology

Total required Program SCUs	30	Required Program SCUs in the primary Course Code	19

Mathematical Modeling

Total required Program SCUs	30	Required Program SCUs in the primary Course Code	21

Weighted Teaching Units (WTU's)

Total the number of WTUs required to teach 1 section of each of the required courses in the program. If there are lists of restricted electives (e.g., take 1 of the following 3 courses), then choose a representative course from the list. For required S-factor

courses, estimate the typical number of WTU's assigned to a faculty member who teaches the course. Again, differentiate by option if appropriate.

EES

Total Required Program WTUs	31.8	Required Program WTUs in the primary Course Code	12.5

ERE

Total Required Program WTUs	30	Required Program WTUs in the primary Course Code	12

Geology

Total Required Program WTUs	33.3	Required Program WTUs in the primary Course Code	21

Mathematical Modeling

Total Required Program WTUs	28.3	Required Program WTUs in the primary Course Code	18

2. Program investment – by Minimum Weighted Teaching Units required to offer coursework so students can make reasonable progress toward their degree.

Complete the table below using the definitions that follow. Include additional columns as needed for additional options.

Total WTU in Course Code	WTU for GE and service to other academic Programs	WTU for EES	WTU for ERE	WTU for Geology	WTU for Mathematical Modeling
Not Applicable	Not Applicable	30.3	10	36	35

Total WTU in Course Code: Sum up the total number of WTU that were used to teach courses in the primary course code associated with your academic program ***over the past two academic years****. Exclude remedial courses.*

Service to GE and other Academic Programs: Enter the total number of WTU that were used ***over the past 2 years*** *to meet service demands imposed by students outside the major. (In other word, if 8 sections of Egyptology 301 have been offered over the past 2 years, but if 2 sections over the past 2 years would have been sufficient for the Egyptology majors, then count 6 sections of Egyptology, and the associated WTU, in this category.)*

WTU for Major Option (s): Sum up the non-service WTU for the set of courses in the course code associated with your program that you would need to offer ***over a two year period*** *to accommodate progress toward degree for your program students.*

Notes: 1) In programs with multiple options, courses common to the multiple options should be included in all options. Hence the entries to the right of the "Total" entry will not sum to the total. 2) Do not pro-rate WTU's by the percentage of students in a particular section of a course that are majors. Include the course in the count if it must be offered during a 2-year period for students to make progress toward their degree. The 4-year major plan for Freshmen may be useful.

3. Program Investments – by staff allocations.

Estimate the percent of departmental expenditures for staff positions that can be attributed to this academic program. Provide an explanation, as appropriate.

	ENGR & EES	GEOL	MATH
Percent of Staff FTE	5%	2%	3%

Staff FTE

	1/31/2004		1/31/2005		1/31/2006		1/31/2007		1/31/2008	
ENGINEERING	**Count**	**Sum**	**Count**	**Sum**	**Count**	**Sum**	**Count**	**Sum**	**Count**	**Sum**
R05									1	0.50
R07	1	1.00	1	1.00	1	1.00	1	1.00	1	1.00
R09	1	1.00	1	1.00	1	1.00	1	1.00	1	1.00
Total	2	2.00	2	2.00	2	2.00	2	2.00	3	2.50

	1/31/2004		1/31/2005		1/31/2006		1/31/2007		1/31/2008	
GEOLOGY	**Count**	**Sum**	**Count**	**Sum**	**Count**	**Sum**	**Count**	**Sum**	**Count**	**Sum**
R07	1	1.00	1	1.00	1	1.00	1	1.00	1	1.00
R09	2	1.50	2	1.50	1	1.00	1	1.00	1	1.00
Total	3	2.50	3	2.50	2	2.00	2	2.00	2	2.00

	1/31/2004		1/31/2005		1/31/2006		1/31/2007		1/31/2008	
MATH	**Count**	**Sum**	**Count**	**Sum**	**Count**	**Sum**	**Count**	**Sum**	**Count**	**Sum**
R07	2	1.50	2	1.50	2	1.50	2	1.50	3	1.40
Total	2	1.50	2	1.50	2	1.50	2	1.50	3	1.40

The staff support for this program is minimal. Most of the administrative work is done by the graduate coordinator. A small fraction of the departmental secretary's time is spent supporting graduate coursework. The College of Natural Resources and Sciences dean's office as well as the graduate studies office also provide some support to this program. The EES and ERE options are housed in the Environmental Resources Engineering Department. The staff time data listed above under Engineering apply to both of these options.

4. Program Investments – Other annual costs.

Provide dollar estimates for other program costs by the following categories. Annualize periodic costs (equipment purchases or facilities upgrades) as necessary. Include an explanation, if appropriate. Do not include costs for commonly used items (smart classrooms, faculty workstations, etc.).

Category	**Estimated Cost**
Equipment (including maintenance)	0
Instructional Supplies	$50
Temporary Help (graders, lab assistants, GA's, etc.)	0

5. Program Investments – accreditation [if applicable]

If this program is accredited, describe how this accreditation effects program costs.

Not applicable

B. Gross Revenues

Revenue DEPARTMENTS COMPLETE THIS SECTION	05/06	06/07	07/08
Fundraising/donations[22]	$77,495	$65,842	$17,270
Extended Education	NA	NA	NA
Student fees	NA	NA	NA
Instructionally Related Activities (IRA)	NA	NA	NA
Instructionally-related grants	---	---	---
Grants and contracts to P.I.s (EES)	$286,250	$529,932	$887,438
Grants and contracts to P.I.s (ERE)	$305,248	$1,063,213	$908,775
Grants and contracts to P.I.s (Geology)	$216,539	$44,500	$141,136
Grants and contracts to P.I.s (Math Modelong)	$99,975	$153,271	$6,500
Other revenues	NA	NA	NA

Provide an explanation for how these revenues support the academic program.

In the geology program fundraising/donations have been critical in providing equipment necessary to maintain and modernize our program. Field vehicles have been largely purchased with donations. The geology laptop lab, GIS lab, and dual-monitor earthquake information display were all acquired through private donations. Student fees and extended education monies are used to replace items that are gradually worn out or depleted in classroom instruction: e.g., topographic maps, rock and mineral samples, tapes, surveying rods, repair of surveying equipment, etc. P.I. grants and contracts help to replace consumables used in preparing reports and presentations (e.g., inks, paper, toner) and occasionally equipment that can also be used by the department in research or instruction (e.g., LCD projector, soil augers.)

The Environmental Resources Engineering undergraduate program would have faded away many years ago without the continual infusion of revenue from donations, grants, and contracts. Each year, a significant fraction of the department's operating supplies is derived from "donated" PI funds, equipment purchased from grants that is used in instruction, and student research assistants who are funded from grant revenues. CSU provided revenue is not adequate to support even a marginally successful undergraduate or graduate program in engineering, and external

[22] This represents the total fundraising and donations to the Geology and Engineering Departments.

funds are required to provide the necessary resources for the exceptional program we are determined to provide.

C. Efficiency

1. Efficiency – By SFR for course code
   Not applicable

2. Efficiency – Other views.

   The Prioritization Task Force will examine the data given under section IV.A and B in terms of the overall production (e.g. number of majors, number of graduates) in the program. Please comment if appropriate.

Other than the WTUs associated with teaching required graduate courses and the 6 WTUs of release time per year for coordination, the costs associated with the program are negligible. Additionally, the WTU associated with S-factor courses are typically taken as overload by faculty. These courses make up the bulk of the difference between the data reported in IV A. 1. and IV A. 2. There is very little staff support for this program.

D. Budget cut impacts

Indicate how your program has been affected by recent (since 2002-2003) budget cuts that have directly affected resources for your program (faculty, staff, operating expense) and course offerings (class size, reduced course offerings or options for the major.) Refer to the data included under section IV. E. or in the departmental report as appropriate.

A number of changes have been made to our options in response to the recent budget cuts. The ERE option has made significant changes to its curriculum to improve efficiency and to facilitate greater levels of faculty participation in the program. The changes include allowing greater flexibility for students in selection of graduate level courses and cross listing nearly all of their courses with undergraduate courses (graduate students have extra assignments and different grading standards) to increase the opportunity for larger class sizes and increased educational experience for undergraduate students.

The mathematical modeling program has gone to alternate year offerings of all but one of the core courses. This has resulted in larger class sizes. The transition to alternate year

offerings has just become complete this fall semester and so the data in part E. below do not reflect the reduction in distinct course offerings.

Due to budget cuts the Geology has suffered the retirement of 2 faculty with no replacement and the elimination of all part-time/temporary faculty. Also Geology had to significantly reduce the variety and frequency of offerings of upper-division and graduate-level specialization courses, which handicaps us in recruitment, retention, and professional/career development of both undergraduate and graduate students. (5-7/year reduced to 2-3/yr).

E. Additional Data

Distinct Courses Enrolled in Engineering by Level (AY 00/01 - AY 07/08) **class_offerings_ENGR report generated: 27-JUN-08**								
Course Level	**AY 00/01**	**AY 01/02**	**AY 02/03**	**AY 03/04**	**AY 04/05**	**AY 05/06**	**AY 06/07**	**AY 07/08**
Graduate	4	3	5	4	4	4	3	2
Avg Section Enrollment in Engineering by Level (AY 00/01 - AY 07/08) **class_offerings_ENGR report generated: 27-JUN-08**								
Graduate	8	9	10	5	8	4	5	7

Distinct Courses Enrolled in Geology by Level (AY 00/01 - AY 07/08) **class_offerings_GEOL report generated: 27-JUN-08**								
Course Level	**AY 00/01**	**AY 01/02**	**AY 02/03**	**AY 03/04**	**AY 04/05**	**AY 05/06**	**AY 06/07**	**AY 07/08**
Graduate	5	6	5	6	5	5	4	4
Avg Section Enrollment in Geology by Level (AY 00/01 - AY 07/08) **class_offerings_GEOL report generated: 27-JUN-08**								
Graduate	8	11	10	10	10	7	11	12

Distinct Courses Enrolled in Mathematics by Level (AY 00/01 - AY 07/08) class_offerings_MATH report generated: 27-JUN-08								
Course Level	**AY 00/01**	**AY 01/02**	**AY 02/03**	**AY 03/04**	**AY 04/05**	**AY 05/06**	**AY 06/07**	**AY 07/08**
Graduate	5	5	5	4	5	6	5	5
Avg Section Enrollment in Mathematics by Level (AY 00/01 - AY 07/08) **class_offerings_MATH report generated: 27-JUN-08**								
Graduate	6	5	6	7	4	4	5	5

Distinct Courses Enrolled in Science by Level (AY 00/01 - AY 07/08) class_offerings_SCI report generated: 27-JUN-08								
Course Level	**AY 00/01**	**AY 01/02**	**AY 02/03**	**AY 03/04**	**AY 04/05**	**AY 05/06**	**AY 06/07**	**AY 07/08**
Graduate	3	2	2	2	3	2	2	2
Avg Section Enrollment in Science by Level (AY 00/01 - AY 07/08) **class_offerings_SCI report generated: 27-JUN-08**								
Course Level	**AY 00/01**	**AY 01/02**	**AY 02/03**	**AY 03/04**	**AY 04/05**	**AY 05/06**	**AY 06/07**	**AY 07/08**
Graduate	14	17	16	10	14	15	15	11

V. Potential (EES. Limit: 2 pages per option) [15%]

A. Program capacity with existing resources:

1. What is your program's maximum capacity with current resources? Use two metrics to define "capacity": The number of graduates per year, and the number of FTES generated by courses that are unique to this option, per year.

EES Option	Graduates per year	FTES in the major option per year
Existing	n/a[23]	11 [24]
Maximum capacity with existing resources	5-7	12-16

3. If your program is at maximum capacity, proceed to question 2. If you have capacity to grow with existing resources, what steps have been taken to increase enrollment? What have been the effects of these steps, and what results are still anticipated?

Faculty in the EES option have worked hard to raise awareness about the program and to recruit high quality graduate students. The primary recruiting tool is a new website for the program, which was launched in the summer of 2007. In addition, EES faculty members have contacted colleagues at other universities and colleges around the country to introduce them to the new option. Faculty members have also promoted the program in the context of work related trips to places such as the Bay Area, Sacramento, Washington, DC, Kenya, and Bhutan. Our work has begun to pay off. In the spring of last year, the EES option received nearly twice as many applications (22) as the historical average for the IDT option that it replaced. Based on inquiries to date, we expect an even larger number of applications this year. EES is simultaneously working to expand the number of faculty members involved in the option. Greater faculty involvement will allow us to support a larger number of students.

B. Opportunities for future growth or substantial curricular changes

1. What opportunity does the program have for future expansion? Provide evidence for your response.

Growing interest, grant funding, and employment opportunities in fields related to renewable energy and climate change mitigation all provide the EES option with very strong opportunities for growth. As noted above, the state of California expects that over 80,000 new jobs will be

[23] The EES program does not have a historical record of graduation rates, as it was launched in the Fall of 2007.
[24] This number is a combined value for students in the EES and IDT options. The IDT students include a number who intend to transfer to the EES option prior to graduation, but have not yet filed the necessary paperwork.

created in the state by 2020 in fields related to climate change mitigation (see II.B). Employment opportunities are also expected to expand in a number of other states – including Washington and Oregon - that have enacted legislation related to climate change mitigation. Grant opportunities for research related to renewable energy and climate change have also grown rapidly in recent years. These opportunities can be used to create a solid base of funding that can be used to support graduate students in the EES *and* ERE options.

2. Describe the curricular changes and/or staffing increases required to accomplish such an expansion?

The EES option would benefit greatly from an increase in the number of faculty on campus with an interest to work with EES graduate students and expertise in fields related to energy technology, energy policy, climate change, and associated topics. These faculty could be placed in a number of departments, including (but not limited to) Environmental Resources Engineering, Environmental Science, Economics, Politics, Business, and others.

C. Impact of augmented resources
Suppose that your program were ranked in a category that recommended augmentation of resources. What would be the impact of augmented resources? (Answer for a 10% augmentation and a 20% augmentation.)

An augmentation of 10% could support the cost of administering the program; this is currently carried out on a volunteer/overload basis. This would enable the development of a better recruiting system, greater coordination among faculty members, and better support for students. An augmentation of 20% would further support increased course offerings, which would make the program even more attractive to prospective students.

D. Impact of reduced resources
Suppose that your program were ranked in a category that recommended reduction of resources. What would be the impact of reduced resources? (Answer for a 10% reduction and a 20% reduction.)

Given the very limited resources currently allocated to the EES option, reductions of 10% or 20% would likely result in elimination of current course offerings. The option would not be viable at levels below current levels, so such cuts would effectively result in elimination of the option.

E. Impact of program elimination

Suppose that your program were recommended to be discontinued. What would be the impact of program elimination?

Elimination of the EES option would have negative repercussions for the Environmental Resources Engineering Department (including undergraduate and graduate programs), the Schatz Energy Research Center, and the University. Elimination of EES could impact the ERE Department's ability to recruit and retain faculty, as some of the most active faculty members are interested to work with graduate students. Elimination of the option would also reduce SERC's ability to conduct research and raise funds, as high quality graduate students associated with the EES and ERE options are a critical element of the Center's work. ERE undergraduate students would lose access to important graduate-undergraduate mentorship opportunities that take place in the context of senior level engineering courses and club activities carried out by groups such as the Renewable Energy Student Union.

V. Potential (ERE. Limit: 2 pages per option) [15%]

A. Program capacity with existing resources:

1. What is your program's maximum capacity with current resources? Use two metrics to define "capacity": The number of graduates per year, and the number of FTES generated by courses that are unique to this option, per year.

ERE Option	Graduates per year	FTES in the major option per year
Existing	1-2	3
Maximum capacity with existing resources	3-4	6-8

2. If your program is at maximum capacity, proceed to question 2. If you have capacity to grow with existing resources, what steps have been taken to increase enrollment? What have been the effects of these steps, and what results are still anticipated?

We revised the curriculum of the ERE option in order to facilitate participation by a greater fraction of the engineering faculty. Including involvement by more faculty members will, in turn, allow the option to support a greater number of students. In addition, a new web site has been completed for the graduate program, and a significant number of requests for information from prospective students have occurred. However, without funds to offer students as stipends or research assistantships, attracting good students is difficult. Faculty active in the graduate program have increased their efforts to obtain grant funding to support research activities and students. Several additional funded graduate student positions will be available next term due to this effort.

B. Opportunities for future growth or substantial curricular changes

1. What opportunity does the program have for future expansion? Provide evidence for your response.

As cited earlier in this report, the job market for environmental engineers is very strong, and is expected to remain strong for the next decade. The professional engineering society is formalizing plans to change the definition of the terminal degree requirement for professional registration to include 30 units of instruction beyond a B.S. degree. These two conditions suggest that demand for graduate education in environmental engineering will increase. In

addition, as cited previously, growing interest, funding possibilities, and employment opportunities in fields related to renewable energy and climate change mitigation also provide strong possibilities for expansion of the ERE option. The range of expertise of the faculty in the graduate program could easily support 8 graduating students per year, which matches the approximant number of applicants received each year. Achieving this level of growth in students accepted into the program would however require an increase in resources (see next two questions).

2. Describe the curricular changes and/or staffing increases required to accomplish such an expansion?

   The addition of one new faculty member and one additional course offering per term.

C. Impact of augmented resources
Suppose that your program were ranked in a category that recommended augmentation of resources. What would be the impact of augmented resources? (Answer for a 10% augmentation and a 20% augmentation.)

10% Augmentation

- Allow an additional graduate level course to be taught each year, increasing the range of topics of interest available to prospective students, and helping active students move through the degree program more quickly.
- Provide a student teaching assistantship position which would increase the likelihood of increasing enrollment by at least one student.

20% Augmentation

- Allow two additional graduate level courses to be taught each year, increasing the range of topics of interest available to prospective students, and helping active students move through the degree program more quickly.
- Provide an additional faculty position to help cover the course load of existing faculty. This would allow more time for developing research proposals that would bring additional revenue to HSU and funds for graduate assistantships.
- Provide funds to purchase equipment and supplies necessary to support some course offerings in the graduate program that currently are not able to offer realistic laboratory exercises. The improvement in the laboratory capabilities

for students will result in an improved academic experience for graduate students and may result in increased enrollment.

D. Impact of reduced resources
Suppose that your program were ranked in a category that recommended reduction of resources. What would be the impact of reduced resources? (Answer for a 10% reduction and a 20% reduction.)

10% or 20 %Reduction; Termination of the program.

E. Impact of program elimination
Suppose that your program were recommended to be discontinued. What would be the impact of program elimination?

- Loss of several faculty members from the department that would not stay without an opportunity to work with graduate students. This would have great harm on the undergraduate engineering program.
- Loss of research opportunities for existing undergraduate students that often are involved in graduate research projects.
- Loss of $500,000/year (averaged over the last 5 years) in research funds that are tied to either faculty that would leave, or are conditioned on having graduate students available to work on the projects.

V. Potential (Geology. Limit: 2 pages per option) [15%]

A. Program capacity with existing resources:

1. What is your program's maximum capacity with current resources? Use two metrics to define "capacity": The number of graduates per year, and the number of FTES generated by courses that are unique to this option, per year.

Geology Option	Graduates per year	FTES in the major option per year
Existing	4	8
Maximum capacity with existing resources	6	12

2. If your program is at maximum capacity, proceed to question 2. If you have capacity to grow with existing resources, what steps have been taken to increase enrollment? What have been the effects of these steps, and what results are still anticipated?

• Sending out advertising fliers, improving website somewhat.

Effects have been minimal, probably because of 1) good job market, 2) our inability to offer competitive financial support, and 3) lack of resources to redesign website and make it effective. Currently we have only 1-2 incoming students/yr.

B. Opportunities for future growth or substantial curricular changes

1. What opportunity does the program have for future expansion? Provide evidence for your response.

• There is currently a great increase in demand for earth scientists (cf. II.B)

• ESGE is piggy-backed on the undergraduate program, and its growth cannot really be separated from that of the undergraduate program. Any faculty hired would have 80- 90% undergraduate responsibilities.

• ESGE can expand to handle at least 4 incoming students/year, 12 in residence at any time, because program has done that in past, albeit with larger faculty. Six incoming per year is pushing the envelope, would require existing faculty members to have 3-4 graduate students each. Adding a faculty member would ease this.

2. Describe the curricular changes and/or staffing increases required to accomplish such an expansion?

C. Impact of augmented resources

Suppose that your program were ranked in a category that recommended augmentation of resources. What would be the impact of augmented resources? (Answer for a 10% augmentation and a 20% augmentation.)

10% augmentation

- Allow hiring of part-time faculty to teach introductory classes, freeing faculty to teach more sections of most important class sequences and graduate classes
- Increase offerings of specialization courses, making program more attractive
- Allows modest growth of program

20% augmentation

- Hire engineering geologist/groundwater position with GIS and field skills (identified as important in program review and assessment)
- Enlarge GIS capacity, incorporate GIS into regular instruction and research
- Allows significant growth of program
- Enhanced program would better serve needs of watershed, soils, engineering, geography students

D. Impact of reduced resources

Suppose that your program were ranked in a category that recommended reduction of resources. What would be the impact of reduced resources? (Answer for a 10% reduction and a 20% reduction.)

10% reduction

- Further reduction in offering of geology specialization and graduate courses, which reduces appeal of program to prospective students and employers.
- Fewer graduate students can be supervised

20% reduction

- Geology graduate curriculum reduced to bare-bones offering of only the minimum courses required for graduation.
- Appeal of program to prospective students and employers reduced due to reduction in specialization courses
- Number of graduate/advanced undergraduate students may decline sufficiently that necessary classes cannot be offered
- Probable elimination of part-time stockroom technician, causing reduced maintenance of equipment used in teaching and much poorer inventory control, as stockroom would be staffed only by part-time undergraduate assistants

E. Impact of program elimination
Suppose that your program were recommended to be discontinued. What would be the impact of program elimination?

Effects on Geology undergraduate program

- Loss of younger faculty who will leave because we no longer have a graduate program
- Inability to hire competitively as existing faculty retire. High-quality faculty expect that graduate students will be available for their research.
- Great reduction in specialization courses available to undergraduates (required as part of the major), diminishing appeal of program to prospective students and employers
- Loss of opportunities for undergraduates to participate in graduate student research and mentoring

Effects on other programs:

- Elimination of support courses for 2 other programs (see Table II.A.3)
- Potential loss of faculty expertise drawn on by other CNRS programs, especially in soils, watershed, and fisheries

Effects on the University and larger community

- Loss of community outreach and service:

  --Landslide, flood, sediment transport, gravel mining and geomorphic education for the general public and advising for agencies (Lehre, Burke)

- Reduction of supply of skilled geologists to consulting firms and government agencies

V. Potential (Mathematical Modeling Limit: 2 pages per option) [15%]

A. Program capacity with existing resources:

1. What is your program's maximum capacity with current resources? Use two metrics to define "capacity": The number of graduates per year, and the number of FTES generated by courses that are unique to this option, per year.

Mathematical Modeling Option	Graduates per year	FTES in the major option per year
Existing	5	8
Maximum capacity with existing resources	8	9

2. If your program is at maximum capacity, proceed to question 2. If you have capacity to grow with existing resources, what steps have been taken to increase enrollment? What have been the effects of these steps, and what results are still anticipated?

The Math Modeling option is near the advising capacity of the faculty. Thesis advising is very time consuming and without more faculty we cannot take on many more students. However, there is significant room for improvement in the number of graduates per year. We have already implemented significant changes, which are reflected in the higher number of graduates in recent years (See II A. 1.) We now assign all incoming students a preliminary advisor to help students with finding a thesis topic. We encourage our students to take the thesis/proposal writing course in their second semester. We have initiated efforts to increase recruitment, so we can attract a larger applicant pool. This will allow us to enroll higher quality students who will complete their degrees in a timely manner.

B. Opportunities for future growth or substantial curricular changes

1. What opportunity does the program have for future expansion? Provide evidence for your response.

One of the greatest potentials for our program is to reach out and advertise to a wider audience, as discussed above. Simultaneously, our program can enhance its vibrancy by putting more emphasis on the job placement/employment or further academic career of our students. Helping students to prepare for specific careers could be facilitated in a number of ways. (1) Strengthening existing ties to academic and institutions locally and regionally; (2) creating

internships; (3) developing connections with local industry to find out more about job opportunities and the skills required for them.

Within the current context of our option, there are several opportunities to enhance the interdisciplinary nature of the program. The hire of Prof. Van Kirk who has research in fisheries and watershed management will strengthen connections between Mathematics and several other departments. Prof Owens has had collaborations with the Schatz Center and has worked on establishing connections between academia and local industry. These projects could lead to new directions for the option. Finally, our option may grow to include other areas of mathematical biology. There are campus initiatives to launch a new undergraduate Bioinformatics Certificate Program, with long-term goals of establishing a major and a graduate program in this field. Many of the mathematical and computational methods used and taught by our faculty are equally valuable in these other biological applications.

2. Describe the curricular changes and/or staffing increases required to accomplish such an expansion?

More specialized cross-disciplinary courses are needed to improve the interdisciplinary aspects of the program. Such courses may include smaller, special topics courses focusing on a faculty member's or faculty group's area of expertise. Short intensive courses could also be team-taught by faculty from different disciplines to introduce different disciplinary perspectives on a topic. Such courses could be offered on topics that are in the intersection of several faculty and graduate students – i.e. Individual-based models with applications from fisheries and wildlife or Metapopulation models and the role of migration with applications to insect populations.

C. Impact of augmented resources
Suppose that your program were ranked in a category that recommended augmentation of resources. What would be the impact of augmented resources? (Answer for a 10% augmentation and a 20% augmentation.)

The Math Modeling option is housed in the Mathematics Department, and it does not operate on separate budget. The only resources directly associated with the program are faculty salaries. Below, we assume that each semester approximately 15 units of WTU are directed toward teaching graduate courses (10 WTU in teaching the core courses and 5 WTU in S-factor courses.)

Augmented resources would allow the program to (1) add new, specialized courses curriculum, possibly interdisciplinary courses team-taught by math faculty and faculty from other departments; (10% increase: 3 WTU per year; 20%: 6 WTU per year); (2) advertise the program more broadly – nationally and regionally; (10 % augmentation) (2) offer stipends or scholarships to successful graduate students (20 % augmentation).

D. Impact of reduced resources

Suppose that your program were ranked in a category that recommended reduction of resources. What would be the impact of reduced resources? (Answer for a 10% reduction and a 20% reduction.)

As the core courses are already offered on an alternate-year schedule, cutting further course offerings is not possible. Some courses could be cross-listed as undergraduate and graduate courses. This possibility has been discussed by the Graduate Committee, and the general consensus has been that cross-listing courses may easily lead to lower standards and a decline in program quality. Similarly, some faculty in the program already advise graduate students as an overload, but this may be even more wide-spread as a result of reduced resources.

<u>10% Reduction</u>

1.5 WTU of faculty effort would be diverted from the program each semester. This could be achieved by cross-listing one of the core courses in the curriculum.

<u>20% Reduction</u>

3 WTU of faculty effort would be diverted from the program, or two of the core-classes to be cross-listed as undergraduate/graduate courses.

E. Impact of program elimination

Suppose that your program were recommended to be discontinued. What would be the impact of program elimination?

Program elimination would negatively impact the cost-effectiveness of the Mathematics Department because the instruction of remedial courses would fall on adjunct and tenure-track faculty. Some of this cost may be recovered if the faculty currently teaching graduate courses taught undergraduate courses and, as a result part-time positions were eliminated.

VI. Additional Information (Limit: 1 + 1.5 pages) [up to 5 extra credit points may be assigned to the overall score]

Provide crucial information that is not provided under the previous categories.

The Environmental Systems graduate is an important part of the University. Graduate education is a hallmark of an institution with an active research program. Many of the faculty members that are affiliated with this program rely on graduate students to help conduct research. The research conducted with graduate students helps bring in grant funding, and increase the visibility of HSU in the local community and broader academic community through community involvement, research publications, presentations, and awards. Environmental Systems is a unique program that draws in students that we would not usually get at HSU both from out of state and internationally.

Our program provides training for students in areas of need for the state and the region. Graduate students contribute positively to the skilled labor-force of the area, and the region. Our students go on to be professional engineers, geologists, consultants, community college instructors, and university professors (Professors Brown and Van Kirk are two such examples.) The EES program will produce graduates that will work in an area of critical need: alternative energy and energy independence.

Graduate students enhance the undergraduate experience through interaction between students. Graduate students in the mathematics department contribute to teaching remedial courses and course support through teaching assistantships and working in the Math Tutorial Lab. Without the graduate program it would be difficult for the math department to find instructors for these courses.

Faculty members Arne Jacobson and Peter Lehman have played a central role in co-organizing and co-sponsoring the Sustainable Futures: Energy, Environment and Society Speaker Series. This series, which is conducted jointly with the Environment and Community Master's Program in Social Science, has been the largest and most consistent university-wide series on campus in recent years. The series focuses on themes of sustainability, environmental protection, resource management, and social justice. Since the spring of 2005, a total of 32 speakers have presented in the series. Attendance at the presentations typically ranges between 50 and 100 people, and a few events have drawn as many as 150-200 participants. The series

provides students, faculty, and interested community members with an opportunity to engage with leading experts and academics in a number of fields and disciplines. Frequent exposure to new ideas and viewpoints is important on any university campus. Given our geographic isolation, here at HSU we must work especially hard to bring in outside perspectives.

This gradate program is helps departments recruit and retain faculty. The university has recent made a shift towards a greater emphasis on research, and a graduate program is an important tool to help attract active scholars. The Environmental Systems program is very interdisciplinary and therefore benefits many departments in this regard. Furthermore the Schatz Energy Research Center is dependent on students in this program. It would likely not continue to exist if it weren't for the Environmental Systems Program.

APPENDIX

HSU *Vision* Statement

1. Humboldt State University will be the campus of choice for individuals who seek above all else to improve the human condition and our environment.

2. We will be the premier center for the interdisciplinary study of the environment and its natural resources.

3. We will be a regional center for the arts.

4. We will be renowned for social and environmental responsibility and action.

5. We believe the key to our common future will be the individual citizen who acts in good conscience and engages in informed action.

6. We will commit to increasing our diversity of people and perspectives.

7. We will be exemplary partners with our communities, including tribal nations.

8. We will be stewards of learning to make a positive difference.