

PROPOSAL TO OFFER A NEW ACADEMIC PROGRAM/ MAJOR IN FALL 2002  
(LONG FORM)


Proposed Name of Degree:	<u>Bachelor of Science in Environmental</u>
Options/ Emphases in the	<u>Science and Resource Management</u>
Degree:	<u>Environmental Science Emphasis</u>
	<u>Resource Management Emphasis</u>
Faculty Proposing New	<u>William Adams, Ph.D.</u>
Program:	<u>Philip Hampton, Ph.D.</u>
	<u>Jacquelyn Kilpatrick, Ph.D.</u>
	<u>Dennis Muraoka, Ph.D.</u>
	<u>Ching-Hua Wang, M.D., Ph.D.</u>

**Review and Approval:**

**1. Curriculum Committee Approval:**

Curriculum Chair:  Date: 12/11/01

**2. Academic Senate Approval:**

Chair, Academic Senate:  Date: 12/11/01

**3. Administration Approval:**

President (or designee):  Date: 12/17/01

## **PROCEDURE FOR SUBMITTING PROPOSALS FOR NEW DEGREE MAJOR PROGRAMS**

A campus, in accordance with its approved academic master plan, submits detailed proposals for new degree major programs to the Office of Academic Program Planning for review and approval in the academic year preceding projected implementation. Approval of any degree major program is subject to campus assurances that financial support, qualified faculty, physical facilities and library holdings sufficient to establish and maintain the program will be available within current budgetary support levels. The proposal must follow the format below, and four copies should be sent to Academic Program Planning, Office of the Chancellor.

### **1. Definition of the Proposed Degree Major Program**

- a. Name of the campus submitting the request, the full and exact designation (degree terminology) for the proposed degree major program, and academic year of intended implementation.

California State University Channel Islands  
Bachelor of Science in Environmental Science and Resource Management  
Fall 2002 Implementation

- b. Name of the department, departments, division or other unit of the campus that would offer the proposed degree major program. Identify the unit that will have primary responsibility.

Academic Affairs

- c. Name, title, and rank of the individual(s) primarily responsible for drafting the proposed degree major program.

Darwin Hall, Ph.D.  
Professor, Environmental Science, CSULB

William Adams, Ph.D.  
Associate Professor, Anthropology

Philip Hampton, Ph.D.  
Associate Professor, Chemistry

Jacquelyn Kilpatrick, Ph.D.  
Associate Professor, English

Dennis Muraoka, Ph.D.  
Professor, Economics

Ching-Hua Wang, M.D., Ph.D.  
Professor, Biology

- d. Objectives of the proposed degree major program.

Today's environmental problems call for people who are educated in more than one discipline, highly trained in technical skills, and aware of the political, economic, scientific, cultural, humanistic and social dimensions of environmental decisions. The Bachelor of Science degree in Environmental Science and Resource Management

provides solid training in basic physical, biological, and social sciences, and application of management principles to reduce adverse impacts of human activity on the environment and to maximize the benefits that accrue from environmental resources. This curriculum prepares students for professional careers in Environmental Science and Resource Management and for subsequent graduate study.

In the narrowest sense, environmental science is the study of the *impact* of human systems on physical and biological systems, and the *dependence* on natural resources by human systems. In a broader sense, environmental science is the study of the interaction and co-evolution of human, physical, and biological systems. Natural Science is the study of physical and biological systems. Social science is the study of human systems – economic systems, political systems, human perceptions, and human interactions. Environmental science requires knowledge of both natural and social science. Resource management is concerned with the most effective means of avoiding damage to environmental assets and extracting beneficial uses of environmental resources. Effective resource management considers benefits and costs, uncertainties and risks, limits of knowledge, institutional constraints, and social and political forces. This program prepares graduates specializing in environmental science who understand basic principles of resource management, and graduates specializing in resource management who understand basic principles of environmental science.

- e. Total number of units required for the major. List of all courses, by catalog number, title, and units of credit, to be specifically required for a major under the proposed degree program. Identify those new courses that are (1) needed to initiate the program and (2) needed during the first two years after implementation. Include proposed catalog descriptions of all new courses.

120 units in the degree; 80 units in the major.

Since CSUCI will only begin admitting students in Fall 2002, all courses are new and will be needed to initiate the program. These courses will be offered during the first two years (and subsequent years) after program implementation. See the following pages for Courses and Catalog Descriptions.

#### LOWER DIVISION REQUIRED COURSES (36 units):

BIOL 200 Principles of Organismal and Population Biology (4)  
BIOL 201 Principles of Cell and Molecular Biology (4)  
CHEM 121 General Chemistry I and Laboratory (4)  
CHEM 122 General Chemistry II and Laboratory (4)  
ECON 110 Principles of Microeconomics (3)  
ECON 111 Principles of Macroeconomics (3)  
MATH 150 Calculus I (4) [MATH 151, Calculus II (4) recommended]

One of the following courses:

ANTH 102 Cultural Anthropology (3)  
ANTH 103 Human Beginnings: Biological and Cultural Evolution (3)  
ANTH 120 The World Eaters: Co-evolution of Human and Natural Systems (3)  
ANTH 322 World Cultures: North America (3)

One of the following courses:

GEOL 121 Physical Geology and Laboratory (4)

**PHYS 200 General Physics I (4)**

One of the following courses:

**MATH 202 Biostatistics (3)**

**MATH 340 Statistics for Business and Economics (3)**

**MATH 342 Probability and Statistics (3)**

**UPPER DIVISION REQUIRED COURSES (35 units):**

**BIOL 330 Ecology and the Environment (4)**

**ECON 362 Introduction to Environmental Economics (3)**

**ENGL 330 Writing in the Disciplines (3)**

**ENGL 337 Literature of the Environment (3)**

**ESRM 328 Introduction to Geographical Information Systems (3)**

**ESRM 330 Environmental Institutions, Law, & Regulation (3)**

**ESRM 499 Capstone (3)**

**GEOL 321 Environmental Geology (3)**

One of the following courses:

**ECON 310 Intermediate Microeconomics (3)**

**ECON 329 Managerial Economics (3)**

## **COURSE DESCRIPTIONS**

### **Anthropology**

**ANTH 102. Cultural Anthropology (3)**

The study of recent and modern societies using a cross-cultural perspective, to gain an understanding on the range of human expression in culture and society. Issues discussed include ethnicity, gender, family structure, kinship, sex and marriage, socio-economic class, religion and the supernatural, language and culture, economics, political and social organization, art, and culture change. [History and Social Science Domain 1: Multiple Subject Teaching]

**ANTH 103. Human Beginnings: Biological and Cultural Evolution (3)**

Human biological and cultural evolution from 5 million years ago to the present using archaeological and physical anthropology. How and when did we become human? What physical and cultural adaptations were necessary as we spread across the Earth? How did hunters and gatherers become sedentary horticulturalists and pastoralists? What role did humans play in the domestication of plants and animals? [History and Social Science Domain 1: Multiple Subject Teaching]

**ANTH 120. The World Eaters: Co-evolution of Human and Natural Systems (3)**

Are natural systems real, or have humans so altered the Earth to meet our needs that no purely natural systems survive? This course examines the human impact on the environment from the discovery of fire to the present, using case studies from throughout the world, including fire farming in Australia, deforestation in Africa, Asia, and America; human role in faunal and floral extinctions through time. Same as ESRM 120. Meets General Education Category B2 and D.

**ANTH 322. World Cultures: North America (3)**

This course examines the development of Native American peoples and cultures as they adapted to their environments. The environmental history of the last glacial and post-glacial periods will be examined to provide a backdrop for human history. Using archaeological, historical, and ethnographic sources, the culture history of these peoples will be traced from antiquity to the present, to provide the student with a broad context for understanding the region.

## **Biology**

### **BIOL 200. Principles Of Organismal And Population Biology (4)**

An introduction to organismal biology, including the diversity, comparative structure, organ system function, development, phylogeny, taxonomy and systematics of prokaryotes, protists, fungi, plants, and animals. Discussion of the principles of evolution including speciation and natural selection, the environmental impact and ecosystem interaction of plants and animals, the behavior of animals, population genetics and population biology. Weekly three-hour lectures and three-hour laboratories. A standard lab fee is required.

### **BIOL 201. Principles Of Cell And Molecular Biology (4)**

Prerequisite: CHEM 121; BIOL 200 with "C" or better grade for biology majors. (No prerequisite for students in Liberal Studies, Teaching and Learning Option.)

This course will cover principles and applications of basic chemistry, biological macromolecules, prokaryotic and eucaryotic cell structure and function, homeostasis, metabolism including both respiration and photosynthesis, cell cycling, signal transduction, Mendelian genetics, molecular genetics including transcription and translation, and a brief introduction to virology and immunology. The philosophy of science, scientific method and experimental design are foundational to the course. Weekly three-hour lectures and three-hour laboratories. A standard lab fee is required.

### **BIOL 202 Biostatistics (3)**

Use of probability and statistics in the description and analysis of biological data collected from laboratory and/or field experiments. Weekly three-hour laboratory instruction and exercise. (Same as MATH 202)

### **BIOL 330. Ecology And The Environment (4)**

Ecological characteristics of natural ecosystems and basic effects of human society upon those systems. Plant and animal distribution patterns in relation to past and present physical and biotic factors. Issues of resource management, population, food production, global environmental problems will be emphasized to explore future directions. Weekly three-hour lectures and three-hour laboratories, including periodic field trips. A standard lab fee is required. (Same as ANTH 330)

## **Chemistry**

### **CHEM 121. General Chemistry I and Laboratory (4)**

Prerequisite: A passing score on the Chemistry Placement Examination or credit in CHEM 150 within the preceding year. One year of high school chemistry is strongly recommended. An introductory chemistry course which provides an overview of the chemical and physical behavior of matter with a focus on qualitative and quantitative general inorganic, physical, and analytical chemistry. Three hours of lecture and one

three-hour laboratory each week. Laboratory fee required. Meets General Education Category B1.

**CHEM 122. General Chemistry II and Laboratory (4)**

Prerequisites: Chem 121 with a grade of C or better.

An introductory chemistry course which provides an overview of the chemical and physical behavior of matter with a focus on quantitative general inorganic, physical, and analytical chemistry including kinetics and thermodynamics of reactions, gas phase and solution equilibria, and qualitative aspects of radiochemistry, organic chemistry, and polymer chemistry. Three hours of lecture and three hours of laboratory each week. Laboratory fee required. Meets General Education Category B1.

## **Economics**

**ECON 110. Principles of Microeconomics (3)**

The application of economic reasoning to the decisions of consumers and producers.

Topics include opportunity cost, resource allocation, the price system, the organization of industry, market failures, distribution of income, public sector economics.

**ECON 111. Principles of Macroeconomics (3)**

Study of the workings of the economy. Topics include national income accounting, business cycles, employment and unemployment, inflation, economic growth, financial institutions, fiscal and monetary policy, international trade.

**ECON 310. Intermediate Microeconomics (3)**

Prerequisites: ECON 110, 111 and either MATH 140 or 150. Economic analysis of the decisions of consumers and producers. Emphasis on the theory of consumer behavior, the theory of the firm, price and output determination in various market structures, factor markets and externalities.

**ECON 329. Managerial Economics (3)**

Prerequisites: ECON 110, 111 and either MATH 140 or 150. Development of the tools of marginalist analysis and their application to managerial decisions and planning. Topics include demand analysis, production and cost, pricing and output decisions under different market structures. Product and factor markets will be analyzed.

**ECON 362. Introduction to Environmental Economics (3)**

Prerequisites: ECON 110 and 111. Economic analysis of environmental problems and policy. Market failures due to externalities, public goods, and common property resources will be examined. Private (market) and public (governmental) solutions to environmental problems are examined.

## **English**

**ENGL 330. Writing in the Disciplines (3)**

Fulfills upper-division writing requirement.

Prerequisite: Completion of lower division writing requirement. Individual and collaborative writing in a variety of styles and forms. Students will learn writing and research techniques of various types, with special emphasis on writing for their chosen majors. Oral presentations form a portion of the course. Meets General Education Category A1 and A2.

### **ENGL 337. Literature of the Environment (3)**

Literature of the Environment is structured to involve the student in many forms of dialogue on issues pertinent to humanity's relationship with Earth. By reading works by writers from diverse fields and by writing in response, the student will gain a better understanding of our planet, its needs, and a better control of writing in response to learning. Meets General Education Category A3 and C2.

## **Environmental Science And Resource Management**

### **ESRM 328. Introduction to Geographical Information Systems (3)**

Introduction to fundamental concepts and techniques of geographic information systems, including problems of acquiring and processing machine-readable map data. Traditional grading only. (Seminar 2 hours, Laboratory 2 hours).

### **ESRM 330 . Environmental Institutions, Law & Regulation (3)**

Political institutions, property rights, federal and state roles in decision-making, and challenges for environmental policy. Decision-making is examined in the context of the rights and limits of both private parties and the broad public interest. Emphasis is on the use of science in decision-making, choices between regulations and incentives, and the role of bureaucracy in resource policy. Examples of legal principles as applied to environmental regulation by federal and state governments. Case studies from air pollution, water pollution, land development, wetlands and coastal management. (2 hrs lecture, 1 hr discussion). Meets General Education Category D.

### **ESRM 335. Population and Resource Constraints (3) (cross-listed as ANTH 332)**

This human ecology course places humans into the environment in historical and global contexts. Discusses systems theory as it applies to human adaptation to the environment. Studies the relations between political power, ideology, and resources, integrating concepts from ecology with those from social sciences. Theories and forecasts of human population growth and migration among regions and cultures. Social and environmental impacts of population and age distribution. Natural resource constraints on growth. Topics from land development, resource planning, environmental quality, politics, economic growth, conflicts and wars.

### **ESRM 499. Capstone (3)**

Prerequisites: Upper Division Required Courses in ESRM.

This course consists of an interdisciplinary evaluation of the physical, biological, social, economic, and legal dimensions of environmental decision-making. The instructor will select from Southern California ecosystems – and decisions with associated environmental impacts – for evaluation and analysis. Examples include decisions to reduce, control, or treat surface water run-off, establishing or changing the management of marine protected areas, dredging in harbors, and permits for coastal development. Students will transmit results to appropriate national, state, or local agencies for consideration and deliberation in administrative decisions. (2 hrs lecture, 1 hr discussion, and field trips).

## **Geology**

### **GEOL 101. Physical Geology (3)**

This course examines the basic composition of the Earth and the dynamic forces which

have altered the Earth's surface through time, including sedimentation, erosion, volcanism, earthquakes, plate tectonics, and mountain-building. Students will gain an appreciation for the immense processes affecting their environment.

#### **GEOL 321. Environmental Geology (3)**

Interrelationships between human and natural geologic hazards: tsunami, earthquakes, landslides, subsidence, volcanoes. Explores environmental impact of resource extraction and usage. Importance of understanding the geologic processes and landscape in land use planning. Means of using geology to minimize conflicts in resource management and disaster preparation.

### **Mathematics**

#### **MATH 150. Calculus I (4)**

A course in analytic geometry and calculus. Elementary and transcendental functions are introduced, their properties studied; limits, derivatives, integrals and mathematical modeling used in problem-solving in sciences.

#### **MATH 202 Biostatistics (3)**

Use of probability and statistics in the description and analysis of biological data collected from laboratory and/or field experiments. Weekly three-hour laboratory instruction and exercise. (Same as BIOL 202)

#### **MATH 340. Statistics for Business & Economics (3)**

Prerequisite: MATH 140 or 150

Introduction to modern statistical methods used in business analysis and economics, especially in experimental data evaluation and decision-making contexts. Topics include: sampling, probability, various distributions, correlation and regression, statistical inferences, hypothesis testing, problem solving and the consequences to underlying economical systems. Includes a project in the community.

#### **MATH 342. Probability and Statistics (3)**

Prerequisite: MATH 151. Data gathering, analysis and display. Validity of sampling methods and statistical conclusions. Probability, conditional probability, Bayes' Theorem, discrete and continuous random variables and their distribution (e.g., binomial, Poisson, hypergeometric, negative binomial, normal, exponential, gamma), moments, bivariate distributions, transformations of random variables, central and other limit theorems. Bayesian estimates, tests of hypotheses, nonparametric tests, decision theory. Modern computer software applications in statistics.

### **Physics**

#### **PHYS 200. General Physics I (4)**

Prerequisites: MATH 150

An introduction to the properties of matter, classical mechanics, wave motion and thermal physics. Three hours of lecture and three hours of laboratory each week. Laboratory fee.

#### **PHYS 201. General Physics II (4)**

Prerequisites: PHYS 200



An introduction to electromagnetic theory, light, and atomic and nuclear physics. Three hours of lecture and three hours of laboratory each week. Laboratory fee.

- f. List of elective courses, by catalog number, title, and units of credit, that can be used to satisfy requirements for the major. Identify those new courses that are (1) needed to initiate the program and (2) needed during the first two years after implementation. Include proposed catalog descriptions of all new courses.

Environmental Science and Resource Management majors must complete either the emphasis in Environmental Science or the emphasis in Resource Management, both of which contain nine units of electives taken from the lists in 1g. An additional nineteen units can be taken as general university electives.

- g. If any formal options, concentrations, or special emphases are planned under the proposed major, explain fully.

This degree program has two emphases: environmental science and resource management. The program prepares graduates specializing in environmental science who understand basic principles of resource management, and graduates specializing in resource management who understand basic principles of environmental science.

The proposed degree is "Environmental Science and Resource Management," not "Environmental Sciences" isolated from resource management, nor natural sciences in isolation from human systems (ecology). Thus, both emphases have substantial required course work in natural and social sciences.

Environmental decision-making inhabits a space at the intersection of the natural sciences, the social sciences, law, and politics. Just as surely as we need persons that are able to apply the natural sciences to the analysis of environmental problems, we need persons who are able to effectively interface between these natural scientists and the politicians who set environmental policy through law. The major has a rigorous core in natural science and resource management, plus emphases to develop disciplinary skills and applications.

#### **ENVIRONMENTAL SCIENCE EMPHASIS:**

All three of the below classes:

BIOL 432 Principles of Epidemiology and Environmental Health (3)

CHEM 250 Quantitative Analysis (2 units)

CHEM 251 Quantitative Analysis Laboratory (2 units)

A total of nine units from the following list of courses:

BIOL 301 Microbiology (4)

BIOL 310 Animal Biology and Ecology (4)

BIOL 311 Plant Biology and Ecology (4)

BIOL 312 Marine Biology (4)

BIOL 331 Biotechnology in the 21st Century (2)

BIOL 333 Emerging Public Health Issues (2)

BIOL 402 Toxicology (3)

BIOL 427 Developmental Biology (3)

BIOL 428 Biology of Cancer (2)  
CHEM 311 & 312 Organic Chemistry I & Lab (4)  
CHEM 314 & 315 Organic Chemistry II & Lab (4)  
CHEM 318 Biological Chemistry (3)  
CHEM 344 Energy and Society (3)  
ESRM 481 Topics in Environmental Pollution (3)  
MATH 430 Scientific Experimental Design and Data Analysis (3)

#### **RESOURCE MANAGEMENT EMPHASIS:**

Both of the below classes:

ECON 486 Introduction to Econometrics (3)  
ECON 488 Quantitative Methods in Environmental Economics (4)

A total of nine units from the following list of courses:

ECON 443 Capital Theory (3)  
ECON 462 Environmental Economics (3)  
ECON 464 Natural Resource Economics (3)  
ECON 463 Energy Economics (3)  
ESRM 332 Population & Resource Constraints (3)  
ESRM 430 Environmental Impact Analysis (3)  
ESRM 482 Topics Environmental Planning & Resource Management (3)  
ESRM 483 Topics in Global Resource Management (3)  
MGT 307 Management of Organizations (3)  
MGT 428 Management for Scientific/Technology Organizations (3)

#### **COURSE DESCRIPTIONS**

##### **Biology**

###### **BIOL 301. Microbiology (4)**

Prerequisites: CHEM 121; BIOL 201 with "C" or better grades.

Study of microorganisms of the environment, including disease-causing organisms, their structures and functions and their interactions to their host animals and the environment. Weekly three-hour lectures and two one-and-a-half hour laboratories. A standard lab fee is required.

###### **BIOL 310. Animal Biology And Ecology (4)**

Prerequisites: BIOL 100 or BIOL 201.

Animal adaptation and diversity and their relationship to the development of evolutionary theory and the environment. Identification of common invertebrate and vertebrate animals. No credit given toward the biology major. Weekly three-hour lectures and three-hour laboratories with periodic field trips in local ecosystem and its animals. A standard lab fee is required.

###### **BIOL 311. Plant Biology And Ecology (4)**

Prerequisite: BIOL 100 or BIOL 201.

A general introduction of diverse structures and functions of plants and their relationship to the environment. Identification of common, local native plants and plant communities, uses of native plants by Native Americans, and human and environmental

impacts on native plant communities. No credit given toward the biology major. Weekly three-hour lecture and three-hour laboratories with periodic field trips. A standard lab fee is required.

**BIOL 312. Marine Biology (4)**

Prerequisite: BIOL 201.

Overview of complexity of marine life including marine plants and animals and the processes that underlie their distribution and abundance in open oceans, coastal regions, estuaries, and wetlands. Diverse interactions of organisms in the intertidal zone, over the continental shelves and in the open oceans. Weekly three-hour lectures and three-hour laboratories with periodic field trips. A standard lab fee is required.

**BIOL 331. Biotechnology In The Twenty- First Century (2)**

Presentation of recent advances in biotechnology and discussion of societal implications. Topics include applications in basic research, medicine, agriculture, consumer products and warfare. No credit given toward the biology major. Weekly two-hour lectures.

**BIOL 333. Emerging Public Health Issues (2)**

Discussion of emerging infectious diseases and other health related issues with global concerns such as AIDS, tuberculosis, sexually transmitted diseases, cardiovascular diseases, animal and bird diseases which may be transmitted to people, food and blood safety issues, environmental public health hazards, immigration and public health issues, potential biological weapons and their impact on human and animal populations in the world and the ecosystem. Weekly two-hour lectures.

**BIOL 402. Toxicology (3)**

Prerequisites: CHEM 122; BIOL 201 with "C" or better grades.

An in depth study of toxic chemicals and their interactions within the ecosystems. Topics include the origin, fate, chemical and biological detection, and quantification of pollutants and toxins and their impact on organisms at the molecular, biochemical, cellular, physiological, organismal, and community levels of organization. Basic toxicology, genetic toxicology, environmental mutagenesis and the molecular basis of mutation induction will be covered. Weekly three-hour lectures.

**BIOL 427. Developmental Biology (3)**

Prerequisites: CHEM 122; BIOL 300 with "C" or better grades.

Studies in human developmental sequences from fertilization to adolescence and examine how the developmental processes can be altered due to genetic, drug or other environmental factors. Other animal systems (fly, frog, chick, mouse) will also be studied to aid in understanding anatomical, physiological, genetic and molecular mechanisms operating during gametogenesis, fertilization, cleavage, gastrulation and organogenesis. Weekly three-hour lectures.

**BIOL 428. Biology Of Cancer (2)**

Prerequisites: CHEM 122; BIOL 300 with "C" or better grades.

Principles of oncology are examined. Included are mechanisms of oncogenesis at cellular and molecular levels, characteristics of cancer, advantages and disadvantages of various therapies of cancer treatment. Weekly two-hour lectures.

**BIOL 432. Principles Of Epidemiology And Environmental Health (3)**

Prerequisites: CHEM 122; BIOL 201 with "C" or better grades.

Distribution and dynamics of human health problems and principles and procedures used to determine circumstances under which disease occurs or health prevails and to aid in managing and planning health and environmental systems. The broadened scope of epidemiology is examined through case studies and community and environmental health approach. Weekly three-hour lectures.

**Chemistry****CHEM 250. Quantitative Analysis (2)**

Prerequisites: CHEM 122 with a grade of C or better.

An examination of the theory and techniques involved in the quantification of inorganic, organic, and biological species from samples with an emphasis on the environmental,

biological, and medical applications of the analysis techniques. Two hours of lecture each week. Must be taken concurrently with CHEM 251.

**CHEM 251. Quantitative Analysis Laboratory (2)**

Co-requisite: CHEM 250.

A laboratory course designed to provide students with an exposure to the techniques used in the quantification of inorganic, organic, and biological species from samples using gravimetric and volumetric analyses, potentiometric titrations, atomic absorption spectrometry, UV-visible spectroscopy, GC, and GC/MS. Two three-hour laboratories each week. Must be taken concurrently with CHEM 250. Laboratory fee required.

**CHEM 311. Organic Chemistry I (3)**

Prerequisites: CHEM 122 with a grade of C or better.

The structure and reactions of simple organic molecules and spectroscopic techniques (NMR, GC-MS, IR, and UV-visible) used to characterize molecules. Students interested in pre-professional programs (pre-medical, pre-veterinary, pre-dental, and pre-pharmacy) should take this course. Three hours of lecture each week.

**CHEM 312. Organic Chemistry I Laboratory (1)**

Co-requisite: CHEM 311.

This course trains students in the use of common organic laboratory techniques and instrumentation (NMR, GC-MS, IR, and UV-visible) used to characterize organic molecules. Three hours of laboratory each week. A lab fee is required.

**CHEM 314. Organic Chemistry II (3)**

Prerequisites: CHEM 311 with a grade of C or better.

An examination of the structure, reactions, and spectroscopy of organic compounds containing one or more functional groups, and the structures and reactions of biologically relevant molecules. Students interested in pre-professional programs (pre-medical, pre-veterinary, pre-dental, and pre-pharmacy) or a obtaining a minor in Chemistry should take this course. A minor in Chemistry can be obtained by taking CHEM 314 and 315 instead of CHEM 318 (Biological Chemistry) and an additional four units of electives on the 300 or 400 level. Three hours of lecture each week.

**CHEM 315. Organic Chemistry II Laboratory (1)**

Prerequisites: CHEM 321 with a grade of C or better.

This course provides students with experience in the synthesis and characterization of the products of organic reactions including multi-step syntheses. Three hours of laboratory each week. A lab fee is required.

**CHEM 318. Biological Chemistry (3)**

Prerequisites: CHEM 322 (or equivalent) with a grade of C or better.

An integrated Organic Chemistry II and Biochemistry course for biology students. The topics covered in this course include: the structure and synthesis of sugars, amino acids, DNA, RNA, proteins; enzyme catalysis and inhibition; and the reactions involved in biosynthetic and metabolic pathways. Students who are interested in pre-professional programs (pre-medical, pre-veterinary, pre-dental) or Biology majors interested in obtaining a minor in Chemistry should take CHEM 314. Three hours of lecture each week.

**CHEM 344. Energy and Society (3)**

Survey of the physical, chemical, and engineering principles involved in the production of energy from current and potential sources and the economical, environmental, and political issues surrounding energy production. The course will also examine factors that influence worldwide energy policy. Examples of topics that may be included in this course include fossil fuels, solar energy, biomass, fuel cells, and nuclear (fission and fusion) processes. Three hours of lecture each week. *Intended for the non-chemistry major.* Meets General Education Category B1.

## **Economics**

### **ECON 343. Capital Theory (3) (cross-listed as FIN 343)**

Intertemporal choice and decision-making under uncertainty in our personal and financial lives. Topics include multiperiod consumption, multiperiod production, capital budgeting, modern portfolio theory and financial management.

### **ECON 462. Environmental Economics (3)**

Prerequisites: ECON 310 or 329, 362, 486 or 488 (may be taken concurrently).

The measurement of market and non-market benefits with application in measuring environmental benefits. Theory of consumer choice: indirect utility functions, expenditure functions, consumer surplus, willingness-to-pay and willingness-to-accept. Theory of measurement: hedonic models, recreation demand, contingent valuation, economy-ecosystem interactions, valuing human morbidity and mortality.

### **ECON 463. Energy Economics (3)**

Prerequisite: ECON 310 or 329. Application of economic analysis to energy problems and policies. Representative topics include macroeconomic effects of energy price shocks, international financial fragility, OPEC pricing strategies, determinants of demand and supply, industrial organization and finance, investor and publicly owned utilities, domestic and international policies.

### **ECON 464. Natural Resource Economics (3)**

Prerequisite: ECON 310 or 329. Microeconomic and capital theory applied to problems of conserving and managing natural resources. Analysis of public policies affecting renewable and nonrenewable resources including price controls, taxation and leasing. Representative topics include: forestry, energy, water, and mineral economics.

### **ECON 486. Introduction to Econometrics (3)**

Prerequisites: ECON 310 or 329, 311, MATH 340. Development and application of econometric tools.

### **ECON 488. Quantitative Methods in Environmental Economics (4)**

Prerequisites: ECON 310 or 329, 362; MATH 150, BIOL 202 or MATH 340.

Economic and social impacts of environmental regulations. Applications of input-output analysis and computable general equilibrium models to measure economic consequences to employment and the economy from environmental regulations.

## **Environmental Science and Resource Management**

### **ESRM 332. Population & Resource Constraints (3). (cross-listed as ANTH 332)**

Theories and forecasts of human population growth and migration among regions and cultures. Social and environmental impacts of population and age distribution. Natural

resource constraints on growth. Topics from land development, resource planning, environmental quality, politics, economic growth, conflicts and wars.

**ESRM 430. Environmental Impact Analysis (3)**

Prerequisites: BIO 330, ECON 362, ESRM 330, GEOG 350.

Required components of environmental impact reports and assessments, and the processes involved in preparation and approval. Problems related to environmental impacts, mitigation, alternatives, benefits, costs, and consequences.

**ESRM 481. Topics in Environmental Pollution (3)**

(may be repeated for credit, with permission)

Prerequisites: BIO 330 and 432, and CHEM 250 and 251.

Analysis of pollution transformation and transport. Impacts on human and natural systems. Examples from tropospheric air pollution, water pollution, soil pollution, climate change.

**ESRM 482. Topics in Environmental Planning & Resource Management (3)**

(may be repeated for credit, with permission)

Prerequisites: BIO 330, ECON 362, ESRM 330.

Topics from land use planning and urban development, forest management, integrated water resource planning and demand-side management, surface water run-off, air quality management, coastal development and planning, marine protected area planning and management, preservation of cultural and natural heritage, recycling and waste management, and power plant siting.

**ESRM 483. Topics in Global Resource Management (3)**

(may be repeated for credit, with permission)

Prerequisites: BIO 330, ECON 362, ESRM 330.

International pollution and resource use. Topics from climate change, ocean resources, tropospheric air pollution, ozone depletion, water pollution, and water use.

## **Math**

**MATH 430. Scientific Experimental Design and Data Analysis (3)**

Discussion on experimental design, sampling methods, data collection, and methods of data analysis related to scientific fields. Meets General Education Category B1 and B3. (Same as BIOL 430 and CHEM 430)

- h. Course prerequisites and other criteria for admission of students to the proposed degree major program, and for their continuation in it.

Course prerequisites are listed under the individual course descriptions. Students must have declared themselves as Environmental Science and Resource Management Majors and remain in good academic standing throughout their enrollment at CSUCI.

Explanation of special characteristics of the proposed degree major program, e.g., in terminology, units of credit required, types of course work, etc.

The program implements the distinguishing characteristics of all CSUCI programs: an interdisciplinary and service learning approach to higher education.

- j. For undergraduate programs, provisions for articulation of the proposed major with community college programs.

These courses are articulated with other CSU campuses. CSUCI will apply for articulation using the California Articulation Numbers (CAN) system. The following required and elective courses in the major are listed by other CSU campuses with CAN numbers:



ANTH 102 Cultural Anthropology  
 ANTH 103 Human Beginnings: Biological & Cultural Evolution  
 BIOL 200 Principles of Organismal and Population Biology  
 BIOL 201 Principles of Cell and Molecular Biology  
 CHEM 121 General Chemistry I and Laboratory  
 CHEM 122 General Chemistry II and Laboratory  
 CHEM 250 Quantitative Analysis  
 CHEM 251 Quantitative Analysis Laboratory  
 ECON 110 Principles of Microeconomics  
 ECON 111 Principles of Macroeconomics  
 GEOL 121 Physical Geology and Laboratory  
 PHYS 200 General Physics I  
 MATH 150 Calculus I  
 MATH 202 Biostatistics, or  
 MATH 340 Statistics for Business and Economics,

- k. Provision for meeting accreditation requirements, where applicable, and anticipated date of accreditation request.

N.A.

## 2. Need for the Proposed Degree Major Program

List of other California State University campuses currently offering or projecting the proposed degree major program; list of neighboring institutions, public and private, currently offering the proposed degree major program.

The Bachelor of Science in Environmental Science and Resource Management is unique in the CSU system, and within the state of California, both public and private universities. There is a Ph.D. program at UC Santa Barbara in Environmental Science and Resource Management, but that is complementary, not competitive. This places the proposed program in a unique niche.

There are BS degree programs in Environmental Science and there are BA degree programs in Environmental Studies, within the CSU system and in other public and private universities. The Environmental Science programs typically emphasize natural sciences (for example San Diego State University), while Environmental Studies programs emphasize social sciences, not integrating the knowledge necessary for good decision-making, with few existing exceptions. The exceptions are the programs at UC Berkeley (B.S. in Environmental Science with the social science emphasis, and B.S. in Conservation and Resource Studies which is unique in that the degree is a bachelor of science rather than bachelor of arts), and the proposed B.A. and B.S. programs in Environmental Science and Policy at CSU Long Beach.

The B.S. in Environmental Science and Resource Management will prepare students for graduate programs in either Environmental Science or Resource Management. For example, students could pursue a Ph.D. in Environmental Science at UCLA or in Environmental Science and Policy at U.C. Santa Barbara.

- b. Differences between the proposed program and programs listed in Section 2a above.

The San Diego State University program, a typical Environmental Science program, has no required social science courses (except geography courses that emphasize natural science). The UC Berkeley degrees both contain substantial natural and social science requirements, and the CSU Channel Islands degree compares favorably in required natural and social science courses, as well as courses in modeling (statistics, computer applications, quantitative methods).

**f. Professional uses of the proposed degree major program.**

For graduates completing the rigorous program of study required for our proposed BS degree, there are ample career opportunities working on environmental problems in industry, government, and non-profit organizations.

**References:**

- a. See Cook, John R. Jr., Kevin Doyle, Sam Heizmann, Tanya Stubbs, Meryl Brott, and Dylan Murray, 1999, The Complete Guide to Environmental Careers in the 21<sup>st</sup> Century, The Environmental Careers Organization, Washington DC: Island Press. ISBN 1-55963-585-1.
- b. Also see Makower, Joel, 1995, Good Green Jobs: How Business is Putting the Environment to Work for California, California Department of Conservation, Washington DC: Tilden Press, Inc. ISBN 0-9605750-6-5.

**g. The expected number of majors in the year of initiation and three years and five years thereafter. The expected number of graduates in the year of initiation and three years and five years thereafter.**

	<u>Number of Majors*</u>	<u>Number of Graduates*</u>
Initiation Year	31	7
Third year	56	15
Fifth year	69	22

\*Data extrapolated from "CSUN at CI/CSUCI FTES Enrollment Transition Plan, February 2001."

**3. Existing Support Resources for the Proposed Degree Major Program**

Faculty members, with rank, appointment status, highest degree earned, date and field of highest degree, and professional experience (including publications if the proposal is for a graduate degree), who would teach in the program.

William H. Adams  
Associate Professor of Anthropology  
Ph.D. in Anthropology, 1976  
Anthropology Professor since 1976  
Extensive experience teaching anthropology and conducting anthropological research in eight countries since 1971.

William P. Cordeiro  
Professor of Management

Ph.D. in Executive Management, 1986

CSU Professor since 1988

Extensive experience as employee and consultant in private and public organizations since 1969.

Ivona Grzegorzcyk

Associate Professor of Mathematics

Ph.D. in Mathematics, 1990

Mathematics Professor since 1992

Extensive experience in mathematics and its applications and mathematics education since 1982.

N. Jacquelyn Kilpatrick

Associate Professor of English

Ph.D. in English, 1996

English Professor since 1981

Extensive experience in British Literature, American Literature, and Integrative Studies, with a specialty in Native American Literature and Cultures.

Philip Hampton

Associate Professor of Chemistry

Ph.D. in Chemistry, 1989

Chemistry Professor since 1991

Extensive experience in research and education in organic chemistry.

Louise H. Lutze-Mann

Associate Professor of Biology

Ph.D. in Biology, 1983

Extensive experience in biochemistry, physiology, cancer biology, and molecular biology

Dennis Muraoka

Professor of Economics

Ph.D. in Economics, 1981

CSU Professor since 1982

Extensive as employee and consultant in private and public sectors since 1975. Research speciality in natural resource and environmental economics.

Ching-Hua Wang

Professor

Ph.D., 1986; M.D., 1978

CSU professor since 1990

Extensive experience in the areas of immunology, virology, infectious diseases, and microbiology.

At least one and possibly more full-time faculty are anticipated for Fall 2002. In addition, other faculty searches are being conducted that may result in faculty from other disciplines that may have teaching or research expertise in environmental science and resource management.

This program will require classroom space, library materials, library electronic databases and the use of Information Technology (IT) resources. The IT requirements will not be

extensive - mainly PCs for faculty and student use, PC Lab and "smart classroom" wired for PCs screen projections and Web-based instruction. The Capstone course requires a dedicated PC and high-speed printer. The laboratory needs of courses will be satisfied by the science laboratories available in the new science building (completed Fall 2003) and temporary laboratory space used for the 2002-2003 academic year.

The program assumes the development of campus resources for students, faculty and staff: parking, offices, food service, health services and key academic support resources (admission, advising, records, etc.).

**4. Additional Support Resources Required**

- b. Any special characteristics of the additional faculty or staff support positions needed to implement the proposed program.

Faculty should have experience working cooperatively across the boundaries between natural and social sciences. Natural scientists should have experience in public policy and social scientists should have experience working cooperatively with natural scientists.

- c. The amount of additional lecture and/or laboratory space required to initiate and sustain the program over the next five years. Indicate any additional special facilities that will be required. If the space is under construction, what is the projected occupancy date? If the space is planned, indicate campus-wide priority of the facility, capital outlay program priority, and projected date of occupancy.

The program will use the existing classroom space being used for "CSUN @ CI" as enrollments shift to CSUCI students. In addition, the program will use classroom space being developed during the growth of the CSUCI campus.

A computer laboratory is needed for students taking ECON 488, Quantitative Methods Environmental Economics and ESRM 328, Geographical Information Systems.

- d. Additional library resources needed. Indicate the commitment of the campus to purchase or borrow through interlibrary loan these additional resources.

No additional library resources needed above the existing CSUCI Library acquisition program. The faculty is working with the Library staff to assure an appropriate level and subject distribution of library resources.

- e. Additional equipment or specialized materials that will be (1) needed to implement the program and (2) needed during the first two years after initiation. Indicate the source of funds and priority to secure these resource needs.

No new needs beyond those planned during the development of the campus facilities.

**5. Abstract of the Proposal and Proposed Catalog Description**

Attach an abstract of the foregoing proposal, not to exceed two pages, and a complete proposed catalog description, including admission and degree requirements.

(see the following catalog copy)

## ENVIRONMENTAL SCIENCE AND RESOURCE MANAGEMENT

Today's environmental problems call for individuals who are educated in more than one discipline, highly trained in technical skills, and aware of the political, economic, and social dimensions of environmental decisions. The Bachelor of Science in Environmental Science and Resource Management provides solid training in basic physical, biological, and social sciences, and application of management science to reduce adverse impacts of human activity on the environment and to maximize the benefits that accrue from environmental resources. This curriculum prepares students for professional careers in Environmental Science and Resource Management and for subsequent graduate study.

In the narrowest sense, environmental science is the study of the impact of human systems on physical and biological systems, and the dependence on natural resources by human systems. In a broader sense, environmental science is the study of the interaction and co-evolution of human, physical, and biological systems. Natural science is the study of physical and biological systems. Social science is the study of human systems – economic systems, political systems, human perceptions, and human interactions. Environmental science requires integral knowledge of both natural and social science. Resource management is concerned with the most effective means of avoiding damage to environmental assets and extracting beneficial uses of environmental resources, within the context of social institutions. Effective resource management considers benefits and costs, uncertainties and risks, limits of knowledge, institutional constraints, and social and political forces.

The B.S. program has two emphases: environmental science and resource management. This program prepares graduates specializing in environmental science who understand basic principles of resource management, and graduates specializing in resource management who understand basic principles of environmental science. Most required courses are those offered in related disciplines. The curriculum fosters cross-disciplinary communication in the several required courses common to both degree programs and particularly in the Environmental Science and Resource Management courses.

### DEGREES OFFERED

Bachelor of Science in Environmental Science and Resource Management  
Emphasis in Environmental Science  
Emphasis in Resource Management

### CONTACT INFORMATION

#### Resource Management Emphasis

Dennis Muraoka, Ph.D.  
Professor of Economics  
Phone: (805)437-8861  
FAX: (805)437-8864  
Web Page: <http://www.csuci.edu>  
Email: [Dennis.Muraoka@csuci.edu](mailto:Dennis.Muraoka@csuci.edu)

#### Environmental Science Emphasis

Philip Hampton, Ph.D.  
Associate Professor of Chemistry

Phone: (805)437-8869  
FAX: (805)437-8864  
Web Page: <http://www.csuci.edu>  
Email: [phampton@csuci.edu](mailto:phampton@csuci.edu)

## **PROPOSED COURSE OF STUDY**

### **FRESHMAN YEAR (31 Units)**

BIOL 200 Principles of Organismal and Population Biology (4)  
BIOL 201 Principles of Cell and Molecular Biology (4)  
CHEM 121 General Chemistry I (4)  
CHEM 122 General Chemistry II (4)  
ECON 110 Principles of Microeconomics (3)  
ECON 111 Principles of Macroeconomics (3)  
ENGL 100 Composition and Rhetoric I (3)  
History, Title V (3)  
GE course (3)

### **SOPHOMORE YEAR (29 Units)**

MATH 150 Calculus I (4)  
Anthropology course: ANTH 102, 103, or 120 (3)  
History, Title V (3)  
Physical science requirement: GEOL 121 or PHYS 200 (4)  
Statistics course: MATH 202, MATH 340, or MATH 342 (3)  
Elective (3)  
Elective (3)  
Elective (3)  
GE course (3)

### **JUNIOR YEAR (31 Units)**

BIOL 330 Ecology and the Environment (4)  
ESRM 328 Introduction to Geographical Information Systems (3)  
ENGL 330 Writing in the Disciplines (3)  
ENGL 337 Literature of the Environment (3)  
ESRM 330 Environmental Institutions, Law and Regulation (3)  
Economics course: ECON 310 or 329 (3)  
Elective in the emphasis (3)  
Elective (3)  
GE course (3)  
GE course (3)

### **SENIOR YEAR (29 Units)**

ESRM 499 Capstone (3)  
ECON 362 Introduction to Environmental Economics (3)  
GEOL 321 Environmental Geology (3)

Required course in the emphasis (3)  
 Required course in the emphasis (4 or 2+2)  
 Elective (4)  
 Elective in the emphasis (3)  
 Elective in the emphasis (3)  
 Elective (3)

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## **REQUIREMENTS FOR THE BACHELOR OF SCIENCE IN ENVIRONMENTAL SCIENCE AND RESOURCE MANAGEMENT**

Lower Division Required	36
Upper Division Required	44
General Education (GE)	15
Title V	6
<u>Electives</u>	<u>19</u>
<b>Total</b>	<b>120</b>

### **LOWER DIVISION REQUIRED COURSES (36 UNITS) Semester Units**

<b>BIOL 200</b>	<b>Principles of Organismal and Population Biology</b>	<b>4</b>
<b>BIOL 201</b>	<b>Principles of Cell and Molecular Biology</b>	<b>4</b>
<b>CHEM 121</b>	<b>General Chemistry I and Laboratory</b>	<b>4</b>
<b>CHEM 122</b>	<b>General Chemistry II and Laboratory</b>	<b>4</b>
<b>ECON 110</b>	<b>Principles of Microeconomics</b>	<b>3</b>
<b>ECON 111</b>	<b>Principles of Macroeconomics</b>	<b>3</b>
<b>MATH 150</b>	<b>Calculus I</b>	<b>4</b>
<b>(MATH 151</b>	<b>Calculus II is also recommended)</b>	

Select one course from each of the following sets of courses:

<b>ANTH 102</b>	<b>Cultural Anthropology, or</b>	<b>3</b>
<b>ANTH 103</b>	<b>Human Beginnings: Biological and Cultural Evolution, or</b>	
<b>ANTH 120</b>	<b>The World Eaters: Co-evolution of Human and Natural Systems, or</b>	
<b>ANTH 322</b>	<b>World Cultures: North American</b>	
<b>GEOL 121</b>	<b>Physical Geology, or</b>	<b>4</b>
<b>PHYS 200</b>	<b>General Physics I</b>	
<b>(PHYS 201</b>	<b>General Physics II is also recommended)</b>	
<b>MATH 202</b>	<b>Biostatistics, or</b>	<b>3</b>
<b>MATH 340</b>	<b>Statistics for Business and Economics, or</b>	
<b>MATH 342</b>	<b>Probability and Statistics</b>	



<b>UPPER DIVISION REQUIRED COURSES (44 UNITS)</b>	<b>Semester Units</b>
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BIOL 330	Ecology and the Environment	4
ECON 362	Introduction to Environmental Economics	3
GEOL 321	Environmental Geology	3
ENGL 337	Literature of the Environment	3
ENGL 330	Writing in the Disciplines	3
ESRM 328	Introduction to Geographical Information Systems	3
ESRM 330	Environmental Institutions, Law, and Regulation	3
ESRM 499	Capstone	3

Select one of the following economics courses:

ECON 310	Intermediate Microeconomics, or	3
ECON 329	Managerial Economics	

***ALL STUDENTS MUST SELECT EITHER THE ENVIRONMENTAL SCIENCE EMPHASIS OR THE RESOURCE MANAGEMENT EMPHASIS AND TAKE THE ASSOCIATED COURSEWORK.***

<b>ENVIRONMENTAL SCIENCE EMPHASIS</b>	<b>Semester Units</b>
---------------------------------------	-----------------------

All three of the following courses:

BIOL 432	Principles of Epidemiology and Environmental Health	3
CHEM 250	Quantitative Analysis	2
CHEM 251	Quantitative Analysis Laboratory	2

A total of nine units from the following set of courses:

BIOL 301	Microbiology	4
BIOL 310	Animal Biology and Ecology	4
BIOL 311	Plant Biology and Ecology	4
BIOL 312	Marine Biology	4
BIOL 331	Biotechnology in the 21st Century	2
BIOL 333	Emerging Public Health Issues	2
BIOL 402	Toxicology	3
BIOL 427	Developmental Biology	3
BIOL 428	Biology of Cancer	2
CHEM 311	Organic Chemistry I	3
CHEM 312	Organic Chemistry I Laboratory	1
CHEM 314	Organic Chemistry II	3

CHEM 315	Organic Chemistry II Laboratory	1
CHEM 318	Biological Chemistry	3
CHEM 333	Energy and Society	3
ESRM 481	Topics in Environmental Pollution	3
PHYS 201	General Physics II	4
MATH 430	Scientific Experimental Design and Data Analysis	3

**RESOURCE MANAGEMENT EMPHASIS****Semester Units**

Both of the following courses:

ECON 486	Introduction to Econometrics	3
ECON 488	Quantitative Methods in Environmental Economics	4

A total of nine units from the following set of courses:

ECON 443	Capital Theory	3
ECON 462	Environmental Economics	3
ECON 463	Energy Economics	3
ECON 464	Natural Resource Economics	3
ESRM 332	Population and Resource Constraints	3
ESRM 410	Environmental Impact Analysis	3
ESRM 482	Topics in Env. Planning and Resource Management	3
ESRM 483	Topics in Global Resource Management	3
MGT 307	Management of Organizations	3
MGT 428	Management for Science/ Technology Organizations	3

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**COURSE LIST:**

From above descriptions

# Summary Sheet

## Bachelor of Science in Environmental Science and Resource Management

California State University Channel Islands

### I. Lower Division Required Courses (36 units) GE

BIOL 200	Principles of Organismal and Population Biology (4)	B-1
BIOL 201	Principles of Cell and Molecular Biology (4)	
CHEM 121	General Chemistry I and Laboratory (4)	
CHEM 122	General Chemistry II and Laboratory (4)	
ECON 110	Principles of Microeconomics (3)	D
ECON 111	Principles of Macroeconomics (3)	
MATH 150	Calculus I (4)	B-3
(MATH 151	Calculus II is also recommended)	

Select one course from each of the following sets of courses:

#### (a) Anthropology:

ANTH 102	Cultural Anthropology (3)	D
OR		
ANTH 103	Human Beginnings: Biological and Cultural Evolution (3)	
OR		
ANTH 120	The World Eaters: Co-evolution of Human and Natural Systems (3)	
OR		
ANTH 322	World Cultures: North American (3)	

#### (b) Physical Science:

GEOL 121	Physical Geology (4)	B-2
OR		
PHYS 200	General Physics I (4)	
(PHYS 201	General Physics II is also recommended)	

#### (c) Statistics:

MATH 202	Biostatistics (3)	A-3
OR		
MATH 340	Statistics for Business and Economics (3)	
OR		
MATH 342	Probability and Statistics (3)	

### II. Upper Division Required Courses (44 units) GE

BIOL 330	Ecology and the Environment (4)	B-1
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ECON 362	Introduction to Environmental Economics (3)	
GEOL 321	Environmental Geology (3)	
ENGL 330	Writing in the Disciplines (3)	A-2
ENGL 337	Literature of the Environment (3)	C-2
ESRM 328	Introduction to Geographical Information Systems (3)	
ESRM 330	Environmental Institutions, Law, and Regulation (3)	D
ESRM 499	Capstone (3)	

Select one of the following economics courses:

ECON 310 Intermediate Microeconomics (3)  
OR  
ECON 329 Managerial Economics (3)

*All students must select either the Environmental Science Emphasis or the Resource Management Emphasis and take the associated coursework:*

Environmental Science Emphasis:

All three of the following courses:

BIOL 432 Principles of Epidemiology and Environmental Health (3)  
CHEM 250 Quantitative Analysis (2)  
CHEM 251 Quantitative Analysis Laboratory (2)

A total of nine units from the following set of courses:

BIOL 301 Microbiology (4)  
BIOL 310 Animal Biology and Ecology (4)  
BIOL 311 Plant Biology and Ecology (4)  
BIOL 312 Marine Biology (4)  
BIOL 331 Biotechnology in the 21st Century (2)  
BIOL 333 Emerging Public Health Issues (2)  
BIOL 402 Toxicology (3)  
BIOL 427 Developmental Biology (3)  
BIOL 428 Biology of Cancer (2)  
CHEM 311 Organic Chemistry I (3)  
CHEM 312 Organic Chemistry I Laboratory (1)  
CHEM 314 Organic Chemistry II (3)  
CHEM 315 Organic Chemistry II Laboratory (1)  
CHEM 318 Biological Chemistry (3)  
CHEM 333 Energy and Society (3)  
ESRM 481 Topics in Environmental Pollution (3)  
PHYS 201 General Physics II (4)

Resource Management Emphasis:

Both of the following courses:

ECON 486 Introduction to Econometrics (3)  
ECON 488 Quantitative Methods in Environmental Economics (4)

A total of nine units from the following set of courses.

ECON 443	Capital Theory (3)
ECON 462	Environmental Economics (3)
ECON 463	Energy Economics
ECON 464	Natural Resource Economics (3)
ESRM 332	Population and Resource Constraints (3)
ESRM 410	Environmental Impact Analysis (3)
ESRM 482	Topics in Environmental Planning and Resource Management (3)
ESRM 483	Topics in Global Resource Management (3)
MGT 307	Management of Organizations (3)
MGT 428	Management for Science/ Technology Organizations (3)

### III. General Education (15 units outside the major, 48 units total)

The following General Education categories are satisfied through double counting of courses in the ES&RM major resulting in a total of 33 units of General Education double-counted in the major.

#### *A: English, Communication, and Critical Thinking (9 units)*

- |                                 |                                 |
|---------------------------------|---------------------------------|
| 1. Written English (3 units)    | --                              |
| 2. Oral Communication (3 units) | ENGL 330                        |
| 3. Critical Thinking (3 units)  | MATH 202, MATH 340, or MATH 342 |

#### *B: Mathematics and Sciences (12 units)*

- |                                |                      |
|--------------------------------|----------------------|
| 1. Life Sciences (3 units)     | BIOL 200 or CHEM 121 |
| 2. Physical Sciences (3 units) | GEOL 121 or PHYS 200 |
| 3. Mathematics (3 units)       | MATH 150             |

#### *C: Fine Arts, Literature, Languages and Cultures (12 units)*

- |                                   |                                 |
|-----------------------------------|---------------------------------|
| 1. Fine Arts (3 units)            | --                              |
| 2. Literature (3 units)           | ENGL 337                        |
| 3. Language and Culture (3 units) | ANTH 103, ANTH 120, or ANTH 322 |

#### *D: Social Perspectives (12 units)*

- |                                       |   |
|---------------------------------------|---|
| Economics (3 units)                   | ECON 486 or ECON 488  |
| Anthropology (3 units)                | ANTH 103, ANTH 120, or ANTH 322<br>(Note: if not used for category C) |
| Env. Science and Res. Mgmt. (3 units) | ESRM 330  |

#### *E: Human Psychological and Physiological Perspectives (3 units)*

#### Upper-Division Interdisciplinary General Education Requirement

Six of the required nine units of interdisciplinary upper-division general education courses can be satisfied by BIOL 330, ENGL 330, ESRM 330, MATH 340, and MATH 342. An additional 3 units of an interdisciplinary course must be taken outside the major. ENGL 330 also satisfies the upper-division writing requirement.

### IV. Title V (6 units)

**V. Electives (19 units)**

**TOTAL UNITS FOR GRADUATION**

I. Lower Division Required	36
II. Upper Division Required	44
III. General Education (GE)	15
IV. Title V	6
V. Electives	19
<b>Total</b>	<b>120</b>