

College of Micronesia – FSM

Course Outline Cover Page

TROPICAL PACIFIC ISLAND

ENVIRONMENTS w Lab

Course Title

SC 117

Department & Number

Course Description:

This course will present ecological principles made relevant by examples from Pacific Island ecosystems and from interactions of humans with our island reefs and forests. It will focus on the close interrelationship between the physical (hydrosphere, lithosphere, atmosphere) and biological (biosphere) environments of tropical Pacific islands and the impact of human colonization. Emphasis will be placed on islands as “closed” systems with limited surface area and resources. Drastic alteration to Pacific island environments by rapid population growth, industrialization and modern technology within the last century will be explored.

Course Prepared by: Alain Bourgoin and Frances Chaine **State:** Pohnpei

	Hours Per Week		No. of Weeks		Total Hours		Semester Hours
Lecture	3	x	16	=	48	=	3
Laboratory	3	x	16	=	48	=	1
Workshop	—		—		—		—
					Total Semester Credits		4

Purpose of Course:

Degree Requirement: X
Degree Elective
Certificate
Remedial
Other

Class Size: No more than 16 per Lab Session (due to transportation problems)

Prerequisite Courses: ESL 089 Reading V and recommended completion of one other college-level Science course and Micronesian History.

Submitted by Frances Chaine, Science Instructor, Pohnpei Campus

Signature, Chair Curriculum Committee

Date

Signature, President, COM-FSM

Date Approved by President

General Objectives

1. Become familiar with the scientific concepts of “environment” and “ecology.”
2. Describe four major Pacific island types and explain their origins.
3. Develop understanding of the past and present impact of humankind on the tropical Pacific island ecosystems.
4. Develop a vocabulary that allows students to discuss environmental realities linked to environmental challenges.
5. Identify “global issues” concerning the world environment and their impact on Tropical Pacific Islands.
6. Understand environmental ethics in relation to traditional or cultural knowledge of the environment.
7. Recognize sustainable patterns in tropical island environments.

Specific Objectives: With 70% mastery students will be able to

1. Explain the concept of “environment”:
 - a) Justify the urgency to develop awareness of island environments and the problems facing them.
 - b) Recognize definitions of the scientific vocabulary associated with tropical Pacific islands and island ecology.
 - c) Keep a mandatory journal (weekly entries) of vocabulary and comment on environmental issues.
2. Describe four Tropical Pacific Island types, including
 - a) Their origins
 - b) Their respective physical and biological environments and
 - c) Their dynamics and environmental fragility.
3. Define and explain the basic concept of “ecology”
 - a) Define “species” and “populations.”
 - b) Explain the concepts of habitat, communities and ecosystems.
 - c) Recognize, analyze and, in some cases, investigate the various biomes throughout the globe and within, or closely linked to, the Tropical Pacific Islands Environment
 - d) Describe the source of energy, its flow, and its interaction with matter within a closed ecological system.
4. Evaluate the impact of humanity on Tropical Pacific Islands ecosystems including
 - a) land resources and their exploitation (deforestation; agriculture, mining)
 - b) freshwater resources and their importance and protection measures.
 - c) saltwater environment, its potential and its overuse.
 - d) human population growth on land and water management and on waste management
5. Develop (and use in journal entries, discussions, exercises and exams) comprehensive vocabulary for discussion of topics linked to various environmental challenges.
 - a) Recognize definitions of the specific vocabulary linked to the respective course topics.
 - b) Use this vocabulary in class discussions.
 - c) Integrate this vocabulary to assignments and journals.
6. Identify the main global issues concerning the world environment and their impact on the Tropical Pacific Islands.
 - a) Define and describe global warming and link it to rising sea levels.

- b) Define and describe the ozone layer, its depletion in the upper atmosphere and the consequences for the Tropical Pacific Island communities.
 - c) Cite examples of various environmental catastrophes that have occurred throughout the world and relate them to direct or indirect effects on the well being of the Tropical Pacific Island communities.
7. Recognize sustainable patterns in tropical island environments
- a) Listen to speakers from various conservation agencies,

Course Content

1. Introduction to the Environmental Sciences
 - 1.1 Definition
 - 1.1.1 Environment
 - 1.1.1.1 Physical Environment (Lithosphere; Hydrosphere; Atmosphere)
 - 1.1.1.2 Biological Environment (Biosphere)
 - 1.1.2 Environmental Sciences
 - 1.2 The Environment as a System
 - 1.2.1 Matter - closed
 - 1.2.1.1 Definition
 - 1.2.1.2 States of matter
 - 1.2.1.3 Matter as a “limited” resource but “recyclable”
 - 1.2.2 Energy - open
 - 1.2.2.1 Definition
 - 1.2.2.2 Source
 - 1.2.2.3 Energy as a “non-recyclable” resource
 - 1.3 Pacific Islands and People
 - 1.3.1 Oceania (Melanesia, Polynesia, Micronesia)
 - 1.3.2 Main categories of islands in the Pacific
 - 1.3.2.1 Volcanic islands
 - 1.3.2.2 Low limestone islands
 - 1.3.2.3 Raised limestone islands
 - 1.3.2.4 Continental islands
 - 1.3.3 People
 - 1.3.3.1 Early human impact
 - 1.3.3.2 Human impacts in modern times
2. Ecology: The Background
 - 2.1 Species and Populations (subspecies or race)
 - 2.2 Habitat, Communities and Ecosystems – the world of “ecology”
 - 2.2.1 Abiotic Factors (Physical-chemical factors --- Light; moisture; salinity; temperature; oxygen; soils...)
 - 2.2.2 Biotic Factors (Biological factors)
 - 2.2.2.1 Competition
 - 2.2.2.2 Predation
 - 2.2.2.3 Symbiosis (mutualism; commensalisms, parasitism)
 - 2.2.3 Limiting Factor
 - 2.2.4 Diversity in Ecosystems
 - 2.2.4.1 Succession and Climax
 - 2.3 Global Habitats ---- Biomes

- 2.3.1 The Relationship of Climate, Soil, and Biomes
 - 2.3.2 World Biomes (Tropical Forest; Savannah and Grassland; Deserts; Temperate Forests; Tundra and Taiga)
 - 2.3.3 Water Habitats
 - 2.3.3.1 Freshwater Habitats (lake, reservoirs; rivers and streams)
 - 2.3.3.2 Estuaries and wetlands (Mangrove swamps)
 - 2.3.3.3 Marine Habitats (Coral Reefs ecosystems)
 - 2.3.4 Tropical Pacific Islands Ecosystems
 - 2.4 Energy Flow and Materials
 - 2.4.1 Trophic levels in Ecosystems
 - 2.4.1.1 Producers
 - 2.4.1.2 Consumers
 - 2.4.1.3 Decomposers
 - 2.4.2 Food Chains and Food webs
 - 2.4.3 Trophic Structure (Trophic pyramid) and Energy Flow
 - 2.4.4 Productivity
 - 2.4.5 Productivity of Marine versus Land Ecosystems
 - 2.5 The Biogeochemical Cycle – recycling of all matter
 - 2.5.1 Recycling of matter and the energy flow
3. Soils, Grasslands, and Forest Ecosystems
- 3.1 Soils
 - 3.1.1 Definition
 - 3.1.2 Soil formation (cycle) --- weathering
 - 3.1.3 Soil structure (profile) – topsoil; subsoil; parent material (bedrock)
 - 3.1.4 Soil erosion
 - 3.1.4.1 Formation of badlands (desertification)
 - 3.2 Grasslands, Savanna and Rangeland (livestock grazing)
 - 3.2.1 Definition
 - 3.2.2 Use and management
 - 3.3 Forest Ecosystems
 - 3.3.1 The tropical forest
 - 3.3.1.1 Richness (biodiversity, medicinal plants...)
 - 3.3.1.2 Deforestation and its impact
 - 3.3.1.3 Conservation of Rain forests (Pohnpei’s watershed plan)
 - 3.4 Desertification
 - 3.4.1 Causes of Desertification (Drought, Overgrazing and Burning of Rangeland, Agriculture, firewood Gathering, Political and Social Factors, Salinization, Groundwater Overuse)
 - 3.4.2 Consequences of Desertification
 - 3.4.3 Halting Desertification
4. Aquatic Habitats and Wetlands
- 4.1 Aquatic ecosystems: overview
 - 4.1.1 Freshwater ecosystems
 - 4.1.1.1 Rivers and streams
 - 4.1.1.2 Lakes and ponds
 - 4.1.2 Uses and abuses of freshwater ecosystem
 - 4.1.2.1 Impact on the water supply for human use

- 4.2 Mangrove ecosystems
 - 4.2.1 Uses and abuses of mangrove ecosystems
- 4.3 Wetlands
 - 4.3.1 Uses and abuses of wetlands
- 5. Coral Reef Ecosystems
 - 5.1 A view of a reef
 - 5.2 The living reef --- its productivity
 - 5.3 Value of coral reefs and threats to their health
 - 5.3.1 Reef fisheries
 - 5.3.2 Nonfood harvests
 - 5.3.3 Tourism and coastal development
 - 5.3.4 Other sources of impact and pollution
 - 5.3.4.1 Ciguatera – A food web poison
 - 5.3.4.2 Crown-of-thorns plagues
 - 5.3.4.3 Coral bleaching
- 6. Island Human Populations
 - 6.1 Human population growth
 - 6.2 The notion of carrying capacity
 - 6.3 Consequences of population growth
 - 6.3.1 For space and resources
 - 6.3.2 On Health and Human Welfare
 - 6.4 Limiting Population Growth in the Pacific Island Populations
- 7. Flora and Fauna of the Tropical Pacific Islands
 - 7.1 The arrival of new species
 - 7.1.1 Flying
 - 7.1.2 “Hitchhiking”
 - 7.1.3 Drifting in air
 - 7.1.4 Swimming and floating
 - 7.1.5 Via humans: introduced species
 - 7.2 Endemic species
 - 7.3 Controlling pests and endangered species
 - 7.3.1 Example of “unwanted species” and their effects
 - 7.3.2 Biological control
 - 7.3.3 Pesticides
 - 7.3.4 Integrated pest management
 - 7.3.5 Endangered species
 - 7.3.5.1 Protecting and management
 - 7.3.6 Biodiversity
 - 7.3.6.1 Importance for the health of the ecosystem
 - 7.3.6.2 Finding solutions: parks and captive breeding
- 8. Sustainability – Wise Use of the Resources
 - 8.1 Definition --- “sustainability”
 - 8.2 Renewable, non-renewable and perpetual resources
 - 8.3 Living wild resources
 - 8.3.1 Fisheries
 - 8.3.1.1 Tuna and other oceanic species

- 8.3.1.2 Turtles
 - 8.3.1.3 Reef fisheries
 - 8.4 Fruit bats and sustainable yield
 - 8.5 Agriculture -- Food Crop Resources
 - 8.5.1 Agricultural dilemmas
 - 8.5.2 Origin and diversity of island crops
 - 8.5.3 Horticulture on high islands and atolls
 - 8.5.4 CEMI agriculture
 - 8.5.5 Sustainable agriculture
 - 8.6 Water
 - 8.6.1 Water on islands
 - 8.6.2 Inland waters as renewable resources
 - 8.6.3 Protecting the freshwater supply
 - 8.6.3.1 Pohnpei's watershed reserve
 - 8.7 Energy and Metals
 - 8.7.1 Energy
 - 8.7.1.1 Sources and use
 - 8.7.2 Minerals and metals
 - 8.7.2.1 Exploitation and environmental impact
 - 8.8 Ecotourism
 - 8.8.1 Developing an industry in a "sustainable manner"
- 9. Dealing with our Wastes
 - 9.1 Sewage disposal
 - 9.1.1 Sewage versus health
 - 9.1.2 Case studies
 - 9.2 Solid Waste Disposal
 - 9.2.1 Litter
 - 9.2.2 Garbage
 - 9.3 Hazardous waste disposal
 - 9.4 Radioactive waste and nuclear testing
- 10. Global Issues
 - 10.1 Global Climate Change
 - 10.1.1 Air Pollution
 - 10.1.2 Greenhouse gases
 - 10.1.3 Global climate system
 - 10.2 Risk for Pacific Islands from global climate change
 - 10.2.1 Water supply
 - 10.2.2 Food supply
 - 10.2.3 Coastal flooding
 - 10.2.4 Ecosystems

Required Textbook

Lobban, S.C. and M. Schefter. *Tropical Pacific Island Environments*. Guam: University of Guam Press. 1997.

Required Materials

Portfolio binder, journal notebook, clipboard, calculator, metric ruler, graph paper, garden/work gloves, collecting containers.

Reference Materials

Cunningham, W. P. and B. W. Saigo. *Environmental Science. A Global Concern*. 6th ed. Boston: McGraw Hill Higher Education. 2001.

Enger E.D. & B.F. Smith. *Environmental Science. A Study of Interrelationships*. 7th ed. New York: McGraw-Hill Higher Education. 2000.

Tyler Miller G. Jr. *Living in the Environment*. 11th ed. New York: Brooks/Cole Publishing Co. 1999.

Field Trips Local marine and terrestrial ecosystems, local environmental agencies

Computer Lab Resources

Internet availability for research during Lab time

Instructional Equipment

TV, VCR, Videos Overhead Projector

Supplies

Transect Tapes	Plastic Bags
PVC Pipe for Transect Squares	Work Gloves
Collecting Nets	Clipboards
Collecting Containers	

Methods of instruction

The course will be taught through lecture, class discussion, oral presentation, speakers and audio-visual materials. Laboratories that compliment the course will include field trips to several terrestrial and marine ecosystems.

Instructional Costs

\$25 Lab Fee

Evaluation

Exams

Assignments (Lab, Journal and homework)

Quizzes

Grade Scale:

89.5 -100%	A	59.5 – 69.4%	D
79.5 – 89.4%	B	below 59.5%	F
69.5 – 79.4%	C		

Credit by Examination

None

Attendance Policy

The COM-FSM attendance policy will be observed.

Sample Course Schedule and Labs:

TROPICAL PACIFIC ISLAND ENVIRONMENTS – SC117

Week 1: Introduction to the Environmental Sciences

LAB A Organization and Expectations
Introduction to Personal Journal

Week 2: Pacific Islands and People

LAB I. Four types of Islands

- Continental; low limestone; high limestone; volcanic
- What renewable vs. non-renewable resources and limits they offer

Week 3: Ecology: The Background

LAB II. People (population) Speaker and Discussion

- Look at the “population demography” of Micronesia on Internet, which gives information on the population pyramid including percent population per age group.
- Explore graphically what will happen to all the “kids” growing up in 20 years time?
- If the population keeps on growing at the present rate, what will happen to the “carrying capacity” of certain islands
 - consequences for space, resources

Week 4: Energy Flow and Materials

Exam 1

LAB III. Waste Management I

- Visit the local dump.
- Pick up garbage on Causeway boat landing, analyze it by type of product (plastics; aluminum etc...) (Garbage Transect).
- Link the impact of garbage on the fisheries resources [plastic chokes animals].

Week 5: Soils, Grasslands, and Forest Ecosystems

Lab IV. Agriculture practices (suggest field visit to sites)

- Impact of deforestation for planting sakau
- Impact of clear-cutting on erosion (land slides...)
- Large-scale production of food products, rather than traditional gardens.

Week 6: Forest Ecosystems

Lab V Deforestation

- Consequences for mangrove forests and coral reefs
- Consequences for local human food supply

- Refer to video --- of Micronesians that visited the Philippines in 1992 to get a better perspective of the consequences of “clear-cutting”

Week 7: Desertification

Lab VI. Mining

- Case Study: Nauru Phosphates ,
 - Consequence for the island ecosystem
- Visit to Kolonia Recycle Center

**Week 8: Mid-term evaluation
Aquatic Habitats and Wetlands**

LAB VII. Waste Management II

- Visit Sewerage Treatment Facilities and explore septic systems

Week 9: Mangrove Ecosystems and Wetlands

Lab VIII. Water Resources – Speaker, exercises

- Pohnpei’s Watershed plan: sponge; potable water
- Problem of deforestation: affect on the water supply in long-term.
- Contamination of water supply: pigs, sanitation measures
- Dependence on streams and rivers for domestic water supply (wash clothes, bodies....)
- Atoll water supplies

Week 10: Coral Reef Ecosystems

LAB IX. Water Resources

- Visit Pohnpei Water Treatment
- Video: on providing Safe Water Supplies for small island environments

Week 11: Island Human Population

Lab X. Biodiversity

- Visit Quarantine Offices/Airport or speaker
- Endemic species
 - Introduction of foreign species ---- impact
 - What could we do about species that have invaded some islands (Kudzu vine, African snail; toads, false sakau...)

Week 12: Exam 3

Flora and Fauna of the Tropical Pacific Islands

Lab XI. Field Trip - Collecting Insects

- Trophic levels

Week 13: Sustainability – Wise Use of the Resources

Lab XII. Development

- Road development --- consequences
- Dredging
- Cities vs rural areas
- Land Use

Week 14 Sustainability – Wise Use of the Resources (continued)

Lab XIII. Energy – Power Plant Visit

- Hydroelectric power (diesel vs hydroelectric dam...)
- Firewood – coconut husk
- What do you do with the vehicle “carcasses”; the batteries; old tires; oil...

Week 15 Dealing with our Wastes

Lab XIV. Use of energy for transportation (cars)

- Consequences of vehicles on the islands ----- building roads (destroys mangroves; creates more access to virgin areas and favors human population settlements in remote areas
- Statistics on the number of vehicles entering the island during last 5 years

Week 16 Global Issues on Island Earth

Lab XV. Global issues

- Video on Greenhouse effect
- Climate change
- Ozone depletion
- Problems of atolls --- flooding....

Week 17 Final Exam

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- 12.4 Energy Flow and Materials
 - 12.4.1 Trophic levels in Ecosystems
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 - 17.3.6.1 Importance for the health of the ecosystem
 - 17.3.6.2 Finding solutions: parks and captive breeding
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 - 18.3.1.3 Reef fisheries
 - 18.4 Fruit bats and sustainable yield
 - 18.5 Agriculture -- Food Crop Resources
 - 18.5.1 Agricultural dilemmas
 - 18.5.2 Origin and diversity of island crops
 - 18.5.3 Horticulture on high islands and atolls

- 18.5.4 CEMI agriculture
- 18.5.5 Sustainable agriculture
- 18.6 Water
 - 18.6.1 Water on islands
 - 18.6.2 Inland waters as renewable resources
 - 18.6.3 Protecting the freshwater supply
 - 18.6.3.1 Pohnpei's watershed reserve
- 18.7 Energy and Metals
 - 18.7.1 Energy
 - 18.7.1.1 Sources and use
 - 18.7.2 Minerals and metals
 - 18.7.2.1 Exploitation and environmental impact
- 18.8 Ecotourism
 - 18.8.1 Developing an industry in a "sustainable manner"
- 19. Dealing with our Wastes
 - 19.1 Sewage disposal
 - 19.1.1 Sewage versus health
 - 19.1.2 Case studies
 - 19.2 Solid Waste Disposal
 - 19.2.1 Litter
 - 19.2.2 Garbage
 - 19.3 Hazardous waste disposal
 - 19.4 Radioactive waste and nuclear testing
- 20. Global Issues
 - 20.1 Global Climate Change
 - 20.1.1 Air Pollution
 - 20.1.2 Greenhouse gases
 - 20.1.3 Global climate system
 - 20.2 Risk for Pacific Islands from global climate change
 - 20.2.1 Water supply
 - 20.2.2 Food supply
 - 20.2.3 Coastal flooding
 - 20.2.4 Ecosystems