

Course Syllabus for EcoFS' 2019-20

Caribbean Ecosystem Field Studies

A marine field course developed by Professor Steve Johnson
Affiliate Faculty of the University of Montana Environmental Studies Program



A 3-WEEK, COLLEGE-ACCREDITED, HANDS-ON SCIENTIFIC ANALYSIS OF THE WONDROUS CARIBBEAN ECOSYSTEM

LOCATION: Xpu-Ha Beach, Mexico – 1-hour south of Cancun along the safe & beautiful Riviera Maya Coast.

COURSE CREDITS: ENST 391-Caribbean Ecosystem Field Studies for 3 undergraduate semester transfer credits through the University of Montana, Environmental Studies Program & is **open to students from *any* university or major**.

While over 180 universities have accepted EcoFS courses for transfer credit, students must confirm with their department or advisor exactly how these credits transfer for their specific degree.

DATES: December 27, 2019 – January 16, 2020

(this class will also be offered over summer-break, tentative dates are late May to mid June)

CLASS SIZE: 18-22 Students

Xpu-Ha Beach offers an exceptional opportunity to study a healthy & diverse Caribbean ecosystem. Daily snorkels, SCUBA dives, hikes, and hands-on scientific investigations provide incredible coral reef & coastal academic learning experiences. Students will synthesize & apply information they have gained from their classroom & textbook context while actively studying & exploring a spectacular ocean environment.

To learn more & **APPLY**- visit

www.ecofs.org



ECOSYSTEM Field Studies

Caribbean Ecosystem Field Studies is a hands-on, 21-day field class that provides incredible academic opportunities for experiential investigation of marine ecosystems. Ecological concepts & field methods that pertain to the Caribbean coral reef are examined in the greatest detail yet the knowledge & techniques gained are applicable to any ecosystem. Instruction is delivered with inquiry-based activities incorporating observation & data collection, small working groups, lecture, focused exploration through daily SCUBA dives/snorkels, hikes, guest speakers & off-site trips. During the second half of the course students create and implement an original ecosystem field research project. Upcoming summer-break students have the exciting opportunity for participation in sea-turtle nest monitoring.

Course Objectives:

Students will...

- Achieve a deep knowledge base of the structure & functioning of coral reef & coastal ecosystems of the Caribbean.
- Gain expertise in utilizing a variety of ecosystem field tools & techniques.
- Learn rigorous scientific research skills including observation, hypothesis formation, sampling, mapping, modeling & data analysis.
- Build proficiency in SCUBA diving/snorkeling skills & the ability to conduct basic ocean/reef research.
- Participate positively in a safe, rewarding & challenging group educational experience.

Course Location

Xpu-Ha Beach, Caribbean coast of Mexico

Xpu-Ha (pronounced Eshpoo-Ha and is a Mayan word for morning dew) is a small beach community along the tourist friendly Riviera Maya coast of Mexico approximately 50 miles south of Cancun, between Playa del Carmen and Tulum on an easy 1-hour drive. Xpu-Ha consists of a mile-long spectacular white sandy beach within a sheltered bay bordered by rocky points and with a vibrant coral reef directly offshore. The relatively undeveloped beach is an important nesting ground for green and loggerhead sea turtles. Xpu-Ha is a very quiet and safe location providing exceptional field learning opportunities.

The Caribbean EcoFS field site is on the private property of the La Playa Xpu-Ha Beach Club (www.laplayaxpuha.com). The course uses the Beach Club's comfortable bungalow rooms and beach campground for our accommodations. The Xpu-Ha-EcoFS Field Research Cabaña serves as our central meeting & studying area. Our classroom is the spectacular beach, coastline, coral reef and ocean just steps away.

A Typical Day...

Instruction days begin with an exciting, academically focused SCUBA dive or snorkel

Our dives and snorkels involve a scientific focus that includes data collection with underwater slates and research equipment. We then savor an all-you-can-eat brunch buffet at the La Playa Xpu-Ha Beach Club. We'll finish the morning with analysis of our amazing marine and reef observations, typically in small group discussions. Lunch is typical American style fare and prepared by our group out of our Field Research Cabaña. Afternoons include lecture on ecosystem concepts and activities that we investigate with hands-on field work and data collection. Typically, afternoons include snorkels, 1-2-mile coastal walks, field investigations and labs. There are 3-4 off-site visits to other amazing ecosystem locations such as coastal lagoons, Akumal Bay to study green sea turtles, cenotes/caves.

Our academic day ends at 5:30 pm and dinner is prepared by a fantastic local chef and enjoyed oceanside. The remainder of the day is for homework, independent study, and personal time. Independent study is phased in during the second half of the course & individual research projects become the academic focus. Days are very full and academic expectations are high so there is minimal "vacation-like" time. EcoFS' accommodations at Xpu-Ha are in beach bungalow double occupancy rooms with full beds, air conditioning, showers *or* in our beautiful beach campground under the palm trees in spacious tents with access to showers and the cabana. Wi-Fi is available, and all accommodations and facilities are steps from beautiful Xpu-Ha beach & ocean.

A few words regarding safety

The Xpu-Ha area and the Riviera Maya is an extremely safe & friendly place for tourists. There is a major medical clinic & United States Department of State Embassy office in Playa del Carmen (15 minutes from Xpu-Ha) and a major hospital in Cancun (1 hour from Xpu-Ha). This course has a Family Physician on call in the United States for phone and/or internet video consultation. All students are covered with a comprehensive international health/medical insurance through the University of Montana. EcoFS has safely taught this class in this area 12 times in the past 6 years.

*This is Where Your
Classroom Education
Comes to Life!*



Course Schedule of Topics & Activities:

Each day runs 8:00 am to 5:30 pm

Day 1- Fri 12/27: Arrival & Introduction

Fly to Cancun!

Flights arranged by students -must land by 4 pm

EcoFS staff meets students at airport -approximate 1-hour highway drive south along Riviera Maya coast in private shuttle

Arrive in Xpu-Ha

Settle into accommodations, orientation to facilities

Evening -Group introductions

Day 2- Sat 12/28: Xpu-Ha Bay Snorkel & Caribbean Overview

Lecture/discussion topics:

Course introduction -syllabus, educational approach, safety, emergency procedures, Mexico travel concerns

SCUBA/snorkel training -safety, swimming & buoyancy, equipment overview & check, communication & navigation, boat safety

Ecosystem data collection- scientific observations

Climatology -global climate processes, coastal weather factors, measurement

Field Activities:

AM- Snorkel in Xpu-Ha Bay -snorkel skills overview, reef investigation

PM- Weather data collection -measure climatologic variables including air & ground temperature/humidity, cloud cover/type, wind speed/direction, ocean/sand temperature, wave height, tides. Compare various locations.

Day 3- Sun 12/29: Yucatan Geography & Oceanography

Lecture/discussion topics:

Geographic overview -Caribbean Sea, Yucatan Peninsula, Xpu-Ha topography

Oceanic features -currents, tides, waves, beaches

Reef topography- types of reef, reef formation, bathymetry, rugosity, field measurement techniques

Field Activities:

AM- SCUBA dive/snorkel -skill reviews, reef observation

PM- Xpu-Ha beach walk- investigate beach topography

Beach survey -conduct geographic survey of Xpu-Ha beach including measurement of layout, profile, slope, angle, aspect, composition, current

Day 4- Mon 12/30: Reef Structure & Water Quality

Lecture/discussion topics:

Geologic overview -processes, geologic features, Yucatan Peninsula

Water quality -chemical & physical properties, unique Yucatan hydrology, human influence, impacts to reef

Stony corals -ecological role for reefs, physiology & ecology, Caribbean species of interest, ecosystem impacts to corals & reefs, identification skills

Field Activities:

AM- SCUBA dive/snorkel -assess reef structure & topography

PM- Coastal hike -geologic investigation of limestone coast, rock & fossil analysis, intertidal zone community exploration

Water quality field & analysis -perform chemical/physical tests of ocean, brackish & tidepool water. Measure temperature, ph, salinity in various locations.

Day 5- Tue 12/31: Stony Corals & Cenote Exploration

Lecture/discussion topics:

Fish -identification, Caribbean species of interest, importance to reefs, behavior opportunities, species interactions, research methods

Cenotes -geologic/hydrologic formation & features

Field Activities:

AM- SCUBA dive/snorkel -stony coral analysis, identify and describe stony coral species, analyze distribution & health

PM- Cenote/cave exploration -hike & swim through a dry cave & cenote, analyze underground hydrogeology, explore Yucatan jungle



SCUBA & Snorkel

SCUBA & snorkel are key features of this course that provide exceptional marine & coral reef study opportunities.

Students choose a SCUBA & Snorkel option or a Snorkel-only option for the course. All SCUBA & snorkel activities are beginner level and no prior experience is required.

All info related to SCUBA & snorkel, such as certification, can be found on the SCUBA/Snorkel page of the EcoFS website.



Day 6- Wed 1/1: Reef Fish & Sea Turtles

Lecture/discussion topics:

Animal Behavior- animal observation skills, pros & cons of behavioral studies, ethogram usage

Coastal communities- Yucatan ecosystems

Field Activities:

AM- Green sea turtle investigation in Akumal Bay -conduct population & behavioral observations

PM- SCUBA dive/snorkel -fish observationidentification

Day 7- Thu 1/2: Animal Behavior & Coastal Lagoon

Investigation

Lecture/discussion topics:

Sea Turtles- ecology, behavior, population status, & conservation efforts

Populations - basic concepts of age, size, reproduction, distribution, niche, habitat

Animal Behavior- animal observation skills, pros & cons of behavioral studies, ethogram usage

Field Activities:

PM- Yal-Ku Lagoon snorkel & study-investigate mangrove community ecology, analyze water quality parameters, observe fish populations

PM- SCUBA dive/snorkel -animal behavior observation & analysis, create and utilize ethograms

Nighttime throughout course:

Sea turtle nest monitoring. Assist in patrols of beach, collect data for nesting Green and Loggerhead sea turtles, relocate nests to hatchery, if necessary

Day 8- Fri 1/3: Soft Corals & Soil/Sand Analysis

Lecture/discussion topics:

Soft corals -difference between hard & soft corals, identification groups, major species of Caribbean, interactions with other species

Soli/Sand -formation, composition, classification, ecosystem importance & connection to reef & coastal organisms

Field Activities:

AM- SCUBA dive/snorkel -soft coral focused analysis. Identify physiological groups & soft coral relationship with abiotic factors & other organisms, observe polyp behaviors

PM- Soil/sand field & lab analysis -dig soil/sand pits, identify horizons, measure infiltration rate, moisture, temperature. Classify soil/sand type, sorting, composition & perform chemical tests for ph.

Day 9- Sat 1/4: Research Design & Night Snorkel

Lecture/discussion topics:

Convene at 1:30pm -How to Do Ecology Book discussion activity. Application to course research projects.

Evening:

Night snorkel -shallow reef in Xpu-Ha Bay using lights, investigate nocturnal species

Day 10- Sun 1/5: Sponges & Other Incredible Invertebrates

Lecture/discussion topics:

Invertebrates -major relevant phyla, Caribbean species of interest, observation skills, research methods, diversity.

Sponges -taxonomy, physiology, ecology, research methods

Field Activities:

AM- SCUBA dive/snorkel -invertebrate diversity investigation

PM- invertebrate diversity study in intertidal zone, calculate species richness and abundance

Day 11- Mon 1/6: Marine Algae & Reef Health

Lecture/discussion topics:

Macro Algae – types, role in ecosystem, interactions with corals & other reef organisms, phase shift towards macro-algae dominated reefs

Reef Monitoring- health parameters, conservation efforts

Field Activities:

AM- SCUBA dive/snorkel -algae types and coverage assessment, algae vs. living coral analysis, species of concern

PM- Independent Study Preparation

Assignments

& Percentage of Overall Grade

- * 35% = Daily homework assignments (Homework is given nightly for the first half of course to synthesize & apply data & observations from the day.)
- * 15% = 10-minute presentation on the research topic & project
- * 30% = 10-page written paper expanding on the field research project (Due two weeks after course ends)
- * 10% = Course participation
- * 10% = Final (take home) written exam (Due one week after course ends)

Readings

How to Do Ecology- A Concise Handbook, Karban & Huntzinger, 2nd ed., 2014

Reef Coral Identification: Florida, Caribbean, Bahamas, Humann & DeLoach- 3rd ed., 2013

Reef Creature Identification: Florida, Caribbean, Bahamas, Humann & DeLoach, 3rd ed., 2013

Reef Fish Identification: Florida, Caribbean, Bahamas, Humann & DeLoach, 4th ed., 2014



Day 12- Tue 1/7: Sampling Methods

Lecture/discussion topics:

Sampling methods- transects/quadrats, randomization & replication, GPS/GIS application

Maps -types, scientific research uses, Google Earth utilization

Field Activities:

AM- SCUBA dive/snorkel - sampling techniques, practice & use with a variety of tools such as GPS, transects, quadrats, compass.

PM- Independent research- process scientific observations, devise hypotheses, create initial methodology & research design

GPS use- basic research utilization, collect waypoints & record tracks

Individual consultations-advisement for research projects

Day 13- Wed 1/8: Independent Research Prep

Field Activities:

AM/PM- Dive/snorkel/land research option

Independent research- process observations, refine hypotheses & experimental design, begin data collection

Individual consultations-advisement for research

Day 14- Thu 1/9: Independent Research

Field Activities:

AM/PM- Dive/Snorkel/land research option

Independent research - intensive data collection

Day 15- Fri 1/10: Night Dive/Snorkel

Lecture/discussion topics:

Night diving/snorkeling overview

Field Activities:

AM/PM- Dive/snorkel/land research option

Independent research - intensive data collection

Evening:

Night Dive/Snorkel- shallow reef dive using lights to observe incredible nocturnal reef species

Day 16- Sat 1/11: Ecological Data Analysis

Lecture/discussion topics:

Data analysis -basic analysis methods, statistics overview

Field Activities:

AM/PM- Dive/snorkel/land research option

Independent research - intensive data collection

Day 17- Sun 1/12: Independent Research

Lecture/discussion topics:

Presentation techniques -effective public speaking & presentations

Field Activities:

AM/PM- Dive/snorkel/land research option

Independent research -final data collection, data analysis

Day 18- Mon 1/13: Presentation Prep

Field Activities:

AM/PM- Dive/snorkel/land research option

Independent research -data analysis, presentation prep

Day 19- Tue 1/14: Student Presentations

Lecture/discussion topics:

Student presentation of field research projects

Day 20- Wed 1/15: Student Presentations & Caribbean Restoration Ecology

Lecture/discussion topics:

AM- Presentations (continued)

PM- Ecosystem restoration -goals & method

Field Activities:

PM - Coastal trash clean-up

Evening: Closing & farewell dinner

Day 21- Thu 1/16: Departures

Shuttles to airport throughout day

COURSE END

Research Project

The culminating assignment is a field research project & presentation. Students develop an original research project based upon scientific field observations they perform. In their project students will process observations, formulate hypotheses, design an experimental methodology, conduct background research, & collect & analyze field data. A culminating class presentation outlines the research project & expands on key concepts. Finally, post course, students complete a written scientific research paper that encapsulates the project.

Examples of past research topics:

- *Fish diversity in relation to lionfish presence*
- *Ph levels of water & sediment at various depths*
- *Octopi camouflage response mechanisms*
- *Evaluating the effects of coral community diversity on disease prevalence*
- *Sand sorting in relation to wave energy*
- *Effect of turbidity on stingray abundance*
- *Damselfish aggression levels in relation to varying habitats*
- *Yellow band disease prevalence in star corals*
- *Coconut palm tree growth patterns in relation to beach slope*
- *Sea urchin density as an indicator of reef health*
- *Soft coral poly response time to disturbance*
- *Sea fan growth pattern in relation to dominant current*
- *Snail abundance & diversity as a function of tidepool depth*
- *Comparison of parasitic flatworm prevalence on hosts at varying depths*



For all further course info including details on costs, credits & application please visit:

www.ecofs.org