

**TROPICAL BOTANY**  
**BISC 441 (two lecture hours, four laboratory hours)**

**The University of Mississippi**  
**Study Abroad, La Selva OTS Biological Field Station, La Calandria Research Station, Santa Elena**  
**Arenal National Park, Costa Rica**  
**Maymester, May 14-28th**

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**CLASS MEETS DAILY, PLEASE SEE ATTACHED ITINERARY.**

**Emergency Response Plan meeting area \_\_\_\_\_ (to be decided on at La Selva, Arenal and La Calandria orientation).**

**Individual student illness or other emergency, come to Dr. Holland's or Dr. Garrison's room**  
\_\_\_\_\_

**COURSE DESCRIPTION:**

Field Study of plants of tropical ecosystems with discussions regarding tropical plant diversity, ecology, and rain forest dynamics.

**REQUIRED TEXTBOOK:**

*Tropical Plants of Costa Rica: A Guide to Native and Exotic Flora* (2007), Willow Zuchowski, Cornell Press.

**RECOMMENDED TEXTBOOK:**

*Costa Rican Natural History* (1983), Dan Janzen, University of Chicago Press.

Other readings may be assigned from handouts and reference books available at La Selva OTS, La Calandria, and Arenal Park.

**BLACKBOARD:**

Class materials and grades will be posted on the University's Blackboard.

**COURSE OBJECTIVES:**

1. To learn the fundamental principles of tropical plant biology;

**Methods:** Interpretive hikes, individual observation, pollination biology project, assigned readings, informal lectures, bat mist netting demonstration, birding.

**Evaluation:** Class participation, test, pollination biology project, pre session homework

2. To develop and apply skills in the gathering of data about tropical plants;

Methods: Interpretive hikes in different types of preserves, visit to farms, interviews, lecture.

Evaluation: Class participation, sustainable agriculture project, test, pre session homework.

3. To examine the fundamental principles which govern natural and agricultural tropical ecosystems, the basic theories of biological evolutionary change, and the anatomy and physiology of representative tropical plant groups:

Methods: Visit to farms, visit and service within ongoing Costa Rican projects, fair trade lecture, talk informally to farmers, meals at La Calandria of locally grown products, optional participation in selected farm tasks.

Evaluation: Class participation, test, sustainable agriculture assignment.

4. To develop general field and laboratory skills, reporting of results, and independent problem solving.

Methods: Daily activities, service to ongoing research, Spanish lessons, community service, pollination observation; journal notes.

Evaluation: Class participation, pollination biology project, La Selva project; journal.

**GRADING AND EXAMS**: Your grade is based on:

PRE-TRIP HOMEWORK

Part I. 50 points (general questions about Costa Rica)

Part II. 50 points (Questions about plant families)

PARTICIPATION

200 points (observations, comments, questions, service)

JOURNALS

50 points-5 “readings” for 10 points each (daily log of observations)

SUSTAINABLE AGRICULTURE ASSIGNMENT

50 points

EXAM

100 points

POLLINATION BIOLOGY PROJECT

100 points

LA SELVA PROJECT

50 points

59% and below F; 60 - 69% D; 70 - 79% C; 80 - 89% B; 90 - 100% A

**MAKE UP POLICY:** Due to the nature of the class and our activity schedule, it is unfortunately usually not possible for a student to make up an activity that is missed due to illness. The exception is that if a student misses community service at La Calandria due to illness, we might be able to arrange for the student to perform an alternative community service activity. If a student misses a substantial activity such as a day trip due to illness, the student will be permitted to write a paper on the subject of the field trip that was missed. Because of the condensed nature of the class and the fact that there is little time to do make up work, students who have been ill may request an incomplete grade for the class and the work can be made up by the date and in the manner specified by the University of Mississippi, for a letter grade. Making up work or receiving an incomplete for reasons other than illness will not be possible.

**Typical Daily Activities** (weather dependent); please see attached day by day itinerary

7:00 - 8:00 Breakfast

8:00 - 8:30 Daily orientation and announcements

9:00 - 12:00 Hikes, Field trips

12:00 - 1:00 Lunch

1:30 - 3:00 assigned reading, journal writing

3:00 - 5:00 field work, community service

6:00 - 7:00 Dinner

7:30 - 9:00 Evening meetings, lectures, discussions, night walks, games, review

## **COURSE REQUIREMENTS**

**1. PRE TRIP HOMEWORK:** please see separate sheets.

### **2. PARTICIPATION :**

It takes a lot of motivation, and interest to be here! Most college students will be doing an excellent job on the items below naturally, so please forgive me if you are one of those. If you know exactly what is expected, things will run even more smoothly. We are representing the University of Mississippi and the U.S. and we want to be remembered in a good way. We would also like to be welcomed here as a class for years to come.

I will meet individually each day with a different student. We will discuss how the trip is going for you, anything else you would like to discuss, and at that time I will give you informal feedback on your participation.

## **EXCELLENT**

Comes on time to all scheduled events, including meals  
Is prepared: wearing and/or carrying appropriate gear.  
Takes an interest in the material presented, making comments and asking and answering questions.  
Understands that we are here to see animals and plants, so modulates voice and actions accordingly.  
On own, notices things that are different about Costa Rica than at home  
Makes attempt to be friendly with local people even if student does not speak Spanish.  
Respects the local mores concerning dress and demeanor  
Is patient and optimistic, often helping others, and takes a positive view even when things do not go exactly as planned.  
Takes notes.  
Always shows consideration for the well being and feelings of others.  
Voluntarily sits with, talks to, interacts with all members of our group.  
Abides by the guidelines set by La Calandria, La Selva and Arenal Park.  
Takes responsibility for own health and well being by making wise choices in food and drink, not putting themselves or others in danger.  
If going somewhere without the group, leaves note in room as to whereabouts, and expected time of return.

## **POOR**

Comes late or misses scheduled events, meals, or otherwise delays the group  
Is usually dressed inappropriately or missing essential items  
Shows little or no interest in class topics  
Always insists on sitting with certain other person  
Criticizes most people and things  
Takes no notice of surroundings or local people  
Makes lots of noise  
Is easily frustrated and often complains in unexpected situations  
Rude, offensive, self centered  
Ignores guidelines set by La Calandria, La Selva, and Arenal Park.  
Takes unnecessary risks, makes poor decisions concerning one's own health, abuses alcohol.  
Does not leave note in room when away during free time

**MEALS** are an important time for social interaction, and to learn about the culture. Also they are an important part of us staying healthy and especially for staying hydrated. Therefore your participation at meals is an essential part of the course. Meals are considered to be a "scheduled event." I ask that you come to all scheduled meals, even if you do not really feel like eating. Meals are Costa Rican food, consisting of both meat and vegetarian dishes and are almost always delicious. The cooks are local people and were selected in a cooking contest held in the San Luis valley. If you don't like a particular dish, or get tired of a staple, please be polite, and remember that the cook is within earshot!

**3. JOURNAL:** Students will write and/or sketch in their journals each day, recording their impressions, things they have been taught, things they have noticed. A good way to think of your journal is as an articulate and informative letter to a professor, as well as a record for yourself for later.

Each day at our class meetings, I will ask one or more students at random to read from their journal entry of the previous day. (Students will omit reading personal sections of the journal at their discretion.) Each student can expect to read 5 times. Be sure to write something every day, even if it is only a little.

**4. EXAM (100 points):** The exam will be a combination of practical short answer, and short essay. Topics will include material from the assigned readings and discussions, notes taken on field trips, guest lectures, and identification. The test will include, but will not be limited to these topics:

A. Please learn to recognize these birds. See Stiles and Skutch "Birds of Costa Rica"

- American Swallow-tailed Kite
- Groove-billed Ani
- Violet Sabrewing Hummingbird
- Long-tailed Manakin
- Yellow-crowned euphonia
- Yellow-throated Euphonia
- Blue-hooded Euphonia

B. Please be able to identify these plant families, and on sight, in addition to others we may learn.

- Araceae
- Melastomataceae
- Heliconiaceae
- Bromeliaceae
- Acanthaceae
- Piperaceae
- Orchidaceae

\_\_\_\_\_  
\_\_\_\_\_

C. Please be able to discuss these ideas, most of which are covered in "Tropical Plants" by W. Zuchowski and most we will see.

- Adventitious
- Avocado
- Bipinnate
- Cardenolide
- Epiphyte
- Extra-floral nectaries
- Hot lips
- Mimicry
- Parasitism
- Primary producer
- Search image
- Secondary compound
- Species
- Strangler fig
- Sugar cane
- Symbiotic relationship

D. Please be able to write a short essay on sustainable agriculture and fair trade, life histories of different bats, and other topics that we will review.

**5. SUSTAINABLE AGRICULTURE PROJECT (50 points):**

*Provide short answers ( 3-4 sentences ) to each of the following questions:*

- a) (7 points) Describe the history of the banana plantation.
  
- b) (7 points) Describe how bananas are cultivated.
  
- c) (7 points) How much water is needed to raise bananas? To grow coffee?
  
- d) (7 points) What kind of diseases affect bananas? Affect coffee?
  
- e) (7 points) Describe the history of the coffee plantation.
  
- f) (7 points) Describe how coffee is cultivated.
  
- g) (8 points) Which farm appeared to be more sustainable? Why? How could the other farm become more sustainable in the future?

**6. POLLINATION BIOLOGY / LA SELVA and LA CALANDRIA PROJECT (100 points):**

Approximate amount of time required:

How long did you spend on the observation part of this assignment? \_\_\_\_\_

\_\_\_\_2 - 4 hours observation and taking field notes  
(Make your sketch on a separate page to be turned in)

How long did you spend writing?

\_\_\_\_2 hours to write

Select a group of flowers in order to observe pollination. It is best to position yourself comfortably (lawn chair, beach towel?) at a spot where you can easily see many flowers. Choose a population where insects or other animals are actively engaged in visiting and working the flowers. Take a notebook, pencil, and a watch that records seconds.

Know that a bee or wasp, or most other insects, will be completely engaged in their activity, and will not become aggressive unless they are provoked. A sting or bite from a pollinator is extremely unlikely. Birds, bats and others can also be pollinators.

Once you are satisfied that you are in a good spot, make yourself comfortable and make notes.

A) \_\_\_4pts\_\_\_ Describe the setting: location of plants, sun/shade, estimated number of pollinators in sight at any one time, etc.

B) \_\_\_4pts\_\_\_ Describe the plant: Notice, it is not necessary to know the names of plants or pollinators, just to be observant.

\_\_\_4pts\_\_\_ What is the overall size of the plant? (give measurements, not just "large" or "small")

\_\_\_4pts\_\_\_ Is it a herb, shrub, tree, vine or liana?

\_\_\_4pts\_\_\_ Estimate the number of total flowers on the plant.

\_\_\_4pts\_\_\_ Sketch the flowers

C) Describe the flowers:

\_\_\_4pts\_\_\_ Single flower or group of flowers?

\_\_\_4pts\_\_\_ How are they arranged?

\_\_\_4pts\_\_\_ Odor?

\_\_\_4pts\_\_\_ Describe the petals, sepals, stigma, style and ovary and stamens.

\_\_\_4pts\_\_\_ Include colors, odors, shape and

\_\_\_4pts\_\_\_ Other characteristics of your choice. Sometimes it is hard for students to recognize floral parts. *You may discuss this with others.*

D) Describe pollinators and pollination:

\_\_\_2 pt\_\_\_ Crawlers or fliers, description of body,

\_\_\_1 pt\_\_\_ Are they visiting only one species or are they going to several kinds of flowers?

\_\_\_2 pt\_\_\_ What are they doing in the flower?

\_\_\_2 pt\_\_\_ How are they moving?

\_\_\_1 pt\_\_\_ Do they start or land at one part of the flower and consistently move to another floral part?

\_\_\_2 pt\_\_\_ Do they go to the next closest flower or do they move a bit before visiting another flower?

\_\_\_1 pt\_\_\_ Are they gathering nectar?

\_\_\_2 pt\_\_\_ Are they actively engaged in gathering pollen or is the pollen falling on them or being rubbed into them?

\_\_\_1 pt\_\_\_ What part of their body holds the pollen?

\_\_\_1 pt\_\_\_ Is that part smooth or covered with hairs?

\_\_\_1 pt\_\_\_ Is the pollen being carried to another flower?

\_\_\_2 pt\_\_\_ If so, is it being deposited on the stigma?

\_\_\_2 pt\_\_\_ How?

\_\_\_4pts\_\_\_ Include a sketch of pollinators.

\_\_\_4pts\_\_\_ After you have answered these and made any other observations, use your watch to time 5 or 6 pollinator visits. Consistently time some part of the pollination event, and record exactly in your notes.

\_\_\_10pts\_\_\_ Present this data in a graph or table. Example:

<b>Animal</b>	<b>Average time in seconds on each flower</b>	<b># of flowers visited</b>	<b>Time of day</b>	<b>Date</b>
bee	5	10	3:00 p.m.	10 Jan. 2005
unidentified	10	1	3:10 p.m.	
beetle				
hummingbird				

E) Describe

the fruit. Recall that the ovary of the flower becomes the fruit. If pollination is successful, the egg cell will be fertilized, and the fruit will begin to mature. The egg cell in the ovule will become the seed, while the fruit consists of the mature ovary and the seeds - think of the fruit as a "seed container."

\_\_\_2pts\_\_\_ Do you see any signs of developing or mature fruit on your plant? Describe.

\_\_\_2pts\_\_\_ Include a sketch of the developing fruit.

\_\_\_2pts\_\_\_ How do you think the fruit or seeds might be dispersed?

\_\_\_4pts\_\_\_ Describe any other animals on the plant.

F) Conclusions.

\_\_\_4 pts\_\_\_ Try to make some generalizations based on your specific data.

For example: "It appeared to me that pollinators visited the flowers of this plant mainly at dusk. I observed the flowers in the morning, afternoon, at dusk and after dark, and only observed pollinators at 6:00 - 7:00pm."

**7. LA SELVA PROJECT (50 points):**

Q1. What research project did you investigate?

Q2. What was the primary goal of that research project?

Q3. What interested you in this research project?

Q4. What did they find? Results? Conclusions?

Q5. Did this research mean anything to you? Is it important to the greater scientific community?  
Why?

### **Proposed Itinerary (DAY BY DAY)**

**Daily activities may vary according to weather patterns (rainforests tend to get a lot of rain) and situational circumstances that are unavoidable! Central American time schedules unlike the US are very laid back and things will happen on a need to happen basis – so patience, and flexibility are a must!**

#### **May 14<sup>th</sup>**

Depart Memphis/US arrive San Jose, Costa Rica. Stay overnight in a Hotel

#### **May 15<sup>th</sup>**

Depart from San Jose and drive in a 22 passenger van to La Selva ( $\pm$  200km). Arrive Midday / early afternoon: rest of the day spent relaxing getting to know the grounds, renting bikes, meeting researchers, guides etc.

Evening meeting

#### **May 16<sup>th</sup>**

Full Day natural history walk – natural history walk with La Selva guides. This activity with the natural history guides from Sarapiquí is very interesting. They have been in La Selva and Sarapiquí for more than 20 years and know a lot about history, biology, ethobotany/biology and natural history

#### **May 17<sup>th</sup>**

Research Day – groups will split up and observe nature for their respective pollination projects.

Furthermore, groups will investigate a research project underway at La Selva and answer what are they doing? What did they find?

**May 18<sup>th</sup>**

Visit a plantation banana farm and factory. A highlight of the tour is the talk with Carlos Gamboa, he is the Agroecotourism director of DOLE and also is bilingual. He will talk about history, biology, economics of banana farming, crop diseases etc. This day is part one of the sustainable agriculture assignment where you will compare the banana farm to the coffee plantation in Monteverde.

Night Walk for evening activity

**May 19<sup>th</sup>**

River Rafting for the morning activity – raft the sarpiqui!

Afternoon is spent wrapping up assignments, pollination projects, research projects at La Selva etc.

**May 20<sup>th</sup>**

Depart from La Selva for La Calandria, Monteverde – arrive late afternoon (+/- 4.5 hours)

**May 21<sup>st</sup>**

San Luis Waterfall trip – Natural history, botanical identification comparison.

**May 22<sup>nd</sup>**

Trip to the community coffee farm – help out with community service, comparison to banana plantation in La Selva

**May 23<sup>rd</sup>**

Plant identification, entomology with a guide, pollination projects

Night activity – Bat netting at museum

**May 24<sup>th</sup>**

Canopy zipline tours and bridge walks above the tropical rainforest

**May 25<sup>th</sup>**

Completion of research projects (or an extra day in case of heavy rains canceling previous day events/activities)

**May 26<sup>th</sup>**

Final Exam in morning, then

Depart La Calandria and arrive late afternoon at Arenal Hotel

**May 27<sup>th</sup>**

Day spent relaxing and drying out in the Arenal National park

Depart that evening for San Jose (168km), stay overnight in Hotel

**May 28<sup>th</sup>**

Depart San Jose for the United States