Biology 3634.03: Agroforestry - Syllabus (Seaside, 2013)

Instructor: Rajesh Rajaselvam

Lectures: Monday through Saturday, 0935-1225, and 1325-1605
Field research/Labs:
*(at **Point Pleasant Park**, Halifax, **LaHave Forests**, near Lunenburg, and **Christmas Tree Research Centre**, Truro).*

The economic and environmental challenges to agricultural and forestry sectors force these sectors to consider new ways of operating. By combining the strengths of agriculture and forestry, agroforestry opens up promising new prospects for the future of rural communities.

Agroforestry is a land-use systems in which trees or shrubs are grown in association with agricultural crops, pastures or livestock, and in which there are both ecological and economic interactions between the trees and other components. It has the combinations of trees with plants or animals thus result interactions between the tree and non-tree parts of the system. Agroforestry systems provide numerous ecological, environmental and economic advantages. They protect crops, livestock, soil and watercourses, stimulate biodiversity, contribute to carbon sequestration and even mitigate the effects of climate change. Furthermore, they create jobs, improve practices of agriculture and forestry, enhance the landscape and generate additional farm revenues.

While agroforestry principles and practices have long been recognized and applied in tropical countries, temperate countries have lagged behind in this regard. The desire for more environmentally responsible agricultural practices and systems has provided an ideal context for developing and implementing agroforestry in temperate regions. Understanding the scientific concepts of agroforestry and implementing the practical approach is vital to protect the environment and promote sustainability in both agricultural and forestry sectors. This field intensive course facilitate students to have a strong foundation of this traditional practice now becomes popular in North America.

Format: Lecture, Lab and Field Research

Prerequisites: Introduction to Ecology (BIOL 2060.03 from Dalhousie's Biology Dept or BIOL 3001 or AGRI 1000from Dalhousie's Faculty of Agriculture or an equivalent class) or permission of instructor. An additional class on the biology, ecology, diversity or physiology of plants is recommended.

Text-book: 'Agroforestry' custom made (from various resources in North America and around the world)

Learning outcomes:

1. To understand the need of agroforestry and the involved biophysical processes
2. To study the role of agroforestry systems in soil fertility and nutrient cycling

3. To examine the positive and negative tree-crops-soil interactions (for light, water and nutrients)

4. To be familiar with environmental conservation and international conventions, in particular the Convention on Climate Change, and the Convention on Biological Diversity, and how they relate to agroforestry systems.

5. To be aware of opportunities for employment and cash income through agroforestry systems

6. To appreciate how agroforestry innovations can make positive impact on economy and environment

7. To get a field experience in agroforestry and evaluate some multipurpose tree species

Evaluation of Student Performance

Assignment, Exam, or Presentation	Marks %	
Oral Presentation (group presentation)	10	
Brief Report *(Tree-plant interaction)*	10	
Special Report *(An AF system/MPTS)*	10	
Field Report *(LaHave Forest)*	20	
Quiz	10	
Written Exam	40	
Total	**100**	

Grading Scale: The grading scale is the same as used in the Biology core classes at Dalhousie:

90-100 **A+**	70-74 **B**	53-55 **C-**
85-89 **A**	65-69 **B-**	50-52 **D**
80-84 **A-**	60-64 **C+**	<50 **F**
75-79 **B+**	56-59 **C**	

Tentative Outline:

1. Introduction to Agroforestry (Course Introduction: 1 hour, Lectures; 2 hours, Slideshow or Movie: 1 hour, Discussion on "Need, potential and benefits of Agroforestry": 1 hour)
   - What is Agroforestry?
   - Types of Agroforestry
   - Importance of Agroforestry in North America

2. Practical Applications of Agroforestry: Group discussion based on the handouts (by USDA) provided: 1 hour

   - Wind breaks and shelterbelts
   - Riparian buffers

- Alley cropping
- Silvopasture systems
- Understory crops
- Apisilviculture
- Aquaforestry
- Woody crops

3. Soil Conservation and Agroforestry (Lectures; 2 hours, Slideshow/Movie: 1 hour, Group discussion: 1hour)
   - Agroforestry for Control of Soil Erosion
   - (Experimental evidence, Agroforestry practices for erosion control)
   - Agroforestry for Maintenance of Soil Fertility
   - (Soil fertility, Effects of trees on soils, Soil organic matter and plant nutrients, The role of roots, Agroforestry practices for soil fertility and improvement)

4. Agroforestry services (Lectures:1 hour, group discussion: 1hour)
   - Ecosystem services and environmental benefits
   - Economic services
   - Social services
   - Land-use services
   - Cultural services

5. Successful Agroforestry Approaches in Canada (Lecture/Slide-show by a visiting Scientist from the AF industry in Canada: 1 hour)
   -Advancing Agroforestry practices (including intercropping with nut trees, establishment and management of shelter belts and riparian buffers)

6. Multipurpose Tree Species in Agroforestry: Tropical and Temperate Tree Species and Current Research Activities (Lecture/Slide-show/Movie: 3 hours)

7. Agroforestry and the Future (Lecture; 1 hour, Group discussion: 1hour, Quiz 2: 1 hour)

Field visit 1: Half a day field observation and data collection at Point Pleasant Park on "Tree-Plant Interactions"

a. Abiotic factors (light intensity, Soil temperature, soil moisture content, pH, Soil nutrients)

b. Biotic factors (shoot/root growth patterns, diversity)

(A two page brief report/question and answer format on the hand out provided should be submitted after the lab)

Soil analysis will be done at the university lab

Field visit 2: 2-day field research at "Lahave forests" near Lunenburg (including 1-night stay) to study:

a. Modern Silvicultural practices towards sustainability (Agroforestry concepts)

b. Different Multipurpose Tree Species and their contribution to soil fertility

c. The amount of CO_2 sequestered in different tree species

After collecting and analyzing the data, a five page field report should be submitted for evaluation.

Format: Introduction, Research objective, Method/materials, Results, Conclusions and Discussions

(A notebook will be necessary for use in the field and field station to include notes on procedures, hypotheses, and findings. This will be an invaluable resource in writing field reports)

Soil analysis will be done at the university lab

Field visit 3: A day trip to "Christmas tree research centre" in Truro to experience some hands on activities in Multi-Purpose Tree research followed by a lecture by an expert in Silviculture.

(No written report is expected, the practical knowledge is necessary for the quiz)

Monograph on a Multipurpose Tree Species

A two page monograph (description, distribution, uses and special purpose in agroforestry) on a Multipurpose Tree Species should be submitted at the end of the course. Students are expected to do a 10 minute power point presentation on their chosen multipurpose tree species.

Evaluation rubric	MARKS				
Evaluate the presentation by checking the grade the student achieved in the following categories:					
The presentation was well organized.	5	4	3	2	1
The topic was covered in a clear and understandable fashion.	5	4	3	2	1
The presentation was very well timed.	5	4	3	2	1
Audio-visual resources were incorporated and used effectively.	5	4	3	2	1
The student responded effectively to questions posed by the audience.	5	4	3	2	1
Main points were effectively summarized at the end of the presentation.	5	4	3	2	1
Overall grade: Total (out of 30) is reduced to out of 10					

Computer use and communications

Computer use will be necessary for this field oriented class including oral presentations and field reports. We will also rely on email for communication among students and between students and teaching staff (instructor and teaching assistant) via BBL. Field reports and presentations will require the use of Excel (spreadsheets/graphs), Word and Power-point.

Tentative Schedule

Day	Activity
Day 1	<u>Morning session</u> 1. Introduction to Agroforestry 2. Practical Applications of Agroforestry <u>Afternoon session</u> 3. Soil conservation and Agroforestry
Day 2	<u>Morning session</u> 4. Agroforestry services 5. Successful Agroforestry approaches in Canada <u>Afternoon session;Field Trip to Point Pleasant Park</u> Tree-Plant Interaction/Data collection *This field session ends at 6:00pm*
Day 3	<u>Morning session</u> 6. Multipurpose Tree Species in Agroforestry *Brief Introduction on Field report and presentation* <u>Afternoon session</u> *Introduction to field work at Lahave forests and preparations*

Day 4 (Lahave Forests)	At 8:05 am: Departure from Dalhousie
	    10:30 am: Field-work/research
	    12:30 pm- 1:00 pm Lunch/Snack
	     1:00 pm- 4:00 pm Fieldwork/research
	     6:00 pm- 7:00 pm Dinner

Day 5 (Lahave Forests)	8:00 am- 8:30 am Breakfast
	    8:30 am- 11:30 am Fieldwork/research
	At 12:05 pm: Departure from Lahave Forests
	                (can go to Lunenburg and have lunch)
	    4:30 pm: Back to Dalhousie, Halifax

Day 6	<u>Morning session</u> 7. Agroforestry and the future <u>Afternoon session</u> Soil analysis at the Dalhousie laboratory (using test kit) *Point pleasant park and LaHave Forest soil samples will be analysed using test kit*
Day 7 Christmas Tree Centre /NSAC	At 9:05 am: Departure from Dalhousie 10:30 am- 12:30 pm Field work 12:30 pm- 1:30 pm Lunch 1:30 pm- 3:00pm (Lecture followed by discussion) At 3:30 pm: Departure from NSAC
Day 8	Morning session only: Exam Preview/Preparation session *Quiz (9:35 to 12:35 am)*

Day 9	Study leave (No classes)
Day 10	Written Exam: 3 hours (9:35 am- 12:35 pm)
Day 11	Students' Oral Presentations (9:35 am- 10:35 am)
Day 12	Deadline to submit; (9:35 am to 10:35 am) a. Brief report on ''Tree-plant interaction'' (Point pleasant park) b. Field report (LaHave forest) c. Special report on the oral presentation (chosen AF system/Multi-Purpose Tree Species Marks/Feed-back on Exam (11:00 am- 12:25 pm)

Morning session: 9:35am to 12:25 pm

Afternoon session: 1:25 pm to 4:05 pm

Items needed for field and research experiments

1. pH meter
2. Photo meter (to measure the light intensity)
3. Soil tools (augur or shovel) and nutrient testing kits
4. Tape measure
5. Hand-lenses
6. Paper/Polythene bags (small and medium sizes)
7. Marker pens
8. Tags or labels
9. Field notebook
10. Ropes
11. Outdoor thermometer
12. Binoculars
13. Field guide (any flora of NS identification book)
14. Digital camera

Items 1 - 11 Provided at the field station
Items 12- 13 Students can bring their own Items; Four different guides with colour pictures will be uploaded on the course website/OWL

During field research: Items needed/recommended for students
1. Clipboard & notebook paper
2. Pens & pencils
3. Daypack or shoulder bag to carry your things
4. Sneakers/ hiking boots
5. Windproof jacket/rain jacket and pants
6. Sunscreen
7. Insect repellent
8. Sunglass

9. Hat and gloves

At the field station: Required personal items
1. Sleeping bag/blankets
2. Water bottle
3. Alarm clock
4. Flashlight with extra batteries
5. Appropriate clothing
6. Boots/Rain-boots
7. Personal toiletries (tooth brush, tooth paste, soap, shampoo and a bath towel)
8. Prescription drugs
9. Basic snack food
10. Cash (for emergency purchases)
11. Portable audio device (optional)
12. Laptop (optional, your responsibility)

Office : LSC 5238
Email: rajesh.rajaselvam@dal.ca
Phone: (902) 494-2831