Development of Graduate and Undergraduate Programs in Agroforestry at Virginia Tech

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Abstract

Graduate and undergraduate study of agroforestry is offered in a new program at Virginia Tech. This is integrated with a developing program of research, extension, and public service. The program is strongly interdisciplinary and provides opportunities to emphasize agroforestry from the perspective of any of its basic disciplines.

Undergraduate study is designed to present and teach the principles and practice of agroforestry systems and technologies so that students can: 1) define the role of agroforestry in meeting the food, fuel, fiber, material and economic needs of people; 2) determine both traditional and innovative agroforestry approaches and strategies for a variety of situations; 3) identify the economic, social, and cultural impacts of agroforestry; 4) integrate agroforestry technologies in the context of social and community forestry; 5) relate agroforestry to its basic disciplines in order to interpret advances in those disciplines and apply them to agroforestry situations; 6) conduct training and technology transfer activities in agroforestry; and 7) follow developments in agroforestry through the literature and other media.

Master's and Ph.D. degrees may be earned through multidisciplinary graduate programs centered in the College of Forestry and Wildlife Resources and the Department of Crop and Soil Environmental Sciences of the College of Agriculture and Life Sciences. An array of courses in 24 departments of the university provide a diverse basis for developing a soundly conceived graduate program from a variety of disciplinary foundations. In depth courses are offered in specialities related to the components of agroforestry. Requirements vary depending on the student's background of study and experience.

Introduction

Agroforestry is the youngest of the land-use sciences. It may be regarded as the study and exploitation of the interactions between trees and crops, and of both with animals when placed together on the same unit of land (Wood, 1990). It simply means the technology of using trees on farms, or the activities of farmers in forests. It is becoming an element to be considered in both international and domestic programs of forestry and agriculture.

The Center for International Forestry Research (CIFOR), the newest member of the Consultative Group of International Agricultural Research (CGIAR) systems, has recently been established, and will be giving particular emphasis to community and farm level forestry in the developing world. The greatly increased role for international forestry research speaks to the need for well trained scientists who clearly undestand both process-oriented basic research (answering the why and how questions about trees, crops, forests, and forested ecosystems), and the animals and people that inhabit and rely on these resources. Concurrently, there is a need for individuals who can link this work to application to deal with all the myriad and differing problems and unique needs faced by each developing country.

Currently, many U. S. universities are striving to enhance their international programs. Matters of global concern frequently involve forests and agriculture, e.g., deforestation, global warming, water quality, loss of biodiversity, sustainable development, fuelwood crises, soil erosion, sediment problems, destruction of watersheds, and large scale flooding. To help bridge the widening gap between cutting edge research and the basic needs of developing countries, much stronger and more relevant international programs must be woven into the fabric of our traditional teaching, research, and extension programs (Gold, 1993). To prepare our students for the global community, there is a great deal of discussion directed at improvement of international programs in U. S. Land Grant Universities. The disciplines of forestry, crop, and animal science offer opportunities to address this issue. The 1980's have been called the "Lost Development Decade" because of the international debt crisis. Hundreds of millions of people are worse off today than they were a decade ago (IDRC, 1992). In the future our students will enter a global setting more dependent on a strong knowledge of international issues than ever before. Forestry and agriculture colleges, schools, and departments must make sincere efforts to modify and increase their teaching, research, and extension programs to respond to these challenges.

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One Approach

Making broad proclamations that commit our institutions to "internationalize" our teaching, research, and extension programs is easily accomplished. Implementation of meaningful change is a much more difficult and long-term commitment on behalf of the university, its faculty, staff, students, alumni, state legislatures and all who are integral part of universities (Gold, 1993). This article presents an example of intercollegiate and interdepartmental efforts to develop both an undergraduate/graduate course offering in agroforestry and a graduate concentration in agroforestry. This example is offered to suggest one method to address the commitment to internationalize curriculum.

This commitment also has important benefits domestically. Agroforestry systems are being given increased attention by temperate zone foresters, farmers, planners, and community leaders as a means to make effective use of land, tree, and animal resources.

Development of agroforestry programs at Virginia Tech is guided by an interdisciplinary Agroforestry Task Force. That group includes faculty from 14 departments and 5 colleges who meet regularly during the school year to make plans, review progress, and bring a broad perspective to the subject through seminars and informal discussion.

A New Creation

The first step in developing an agroforestry emphasis was the creation of a senior/graduate level course in agroforestry. The intercollegiate, interdepartmental effort brought forestry, crop and soil environmental sciences, animal science, agriculture and applied economics, wildlife, and sociology together. An overview of this new course follows:

Principles and practices of agroforestry systems

Course Description: Biological, social, economic and technical aspects of agroforestry systems, training and technology transfer techniques, and intergration and applications from forestry, agriculture, animal sciences. Farmer and community involvement in planning and implementation of agroforestry products.

Objectives: To present and teach the principles and practice of agroforestry systems and technologies so that students can:

- define the role of agroforestry in meeting the food, fuel, fiber, material, and economic needs of people in developing countries
- determine both traditional and innovative agroforestry approaches and strategies for a variety of situations
- identify the economic, social, and cultural impacts of agroforestry
- integrate agroforestry technologies in the context of social and community forestry
- relate agroforestry to its basic disciplines in order to interpret advances in those disciplines and apply them to agroforestry situations
- conduct training and technology transfer activities in agroforestry and
- follow developments in agroforestry through the literature and other media.

Staffing: The principal coordinators and instructors are: Drs. Ruth D. Harris, Robert L. Youngs, James A. Burger, and James R. McKenna. Additional instructors from related departments were recruited as needed.

Format: The course is run as an integrated series of self-contained topic areas taught by the various instructors in their respective areas of expertise. This approach provides the students with the most current information possible, utilizing the great diversity and experience of the instructors. The class meets twice each week for 1½ hours. Class period are split between lecture and discussion. Class text is a series of readings submitted by the instructor team. Students *are required* to prepare a brief outline of each reading to be submitted on class days. Also, each student is responsible for one discussion question each class period.

Group Project: Projects provide students with an opportunity to read, present, and discuss various facets of agroforestry systems relevant to their design and subsequent development of agroforestry projects. The purpose of the group project is to suggest ways in which a particular farming/land use system in a particular agroecological zone (to be assigned) might (or might not) be improved through the use of agroforestry. The class is divided into groups and presented with instructions and a set of background materials. Drawing on material from the lecture, readings, and data gathered independently, the groups discuss and present their systems design and development to their colleagues at the end of the term.

Term paper: Students electing to write a term paper research a selected topic of interest. This paper can be prepared in lieu of the final exam.

Grading: Two grading options are available. Students must elect which option they will choose by the end of the fourth week of class. Option #1 will be the final exam. Option #2 will be a term paper on a selected research topic of interest. A detailed outline of the paper must be handed in by the end of the sixth week of class. If no outline is received by that time, the students must default back to option #1. Credit will be allocated as follows:

Option #1:

Exam I	20%
Exam II	20%
Reading Response Questions/Summaries	10%
Group Project	20%
Final Exam	30%

Option #2:

Exam I	20%
Exam II	20%
Reading Response Questions/Summaries	10%
Group Project	20%
Term Paper	30%

The second task was to develop M.S. and Ph.D. concentrations in agroforestry in both the College of Forestry and Wildlife and the Department of Crop and Soil Environmental Sciences within the College of Agriculture and Life Sciences. Again, a multicollegiate, multidepartmental committee met to recommend an appropriate course of graduate study. A brief description of the program follows.

Multidisciplinary Graduate Programs in Agroforestry

Masters Degree Program: Graduate requirements for an M.S. degree include successful completion of a program of study approved by a guidance committee comprised of the major professor and two core faculty members affiliated with the program representing different academic disciplines. The program of study must include at least 30 post-baccalaureate semester credits for a Master Degree.

Foreign language competency equivalent to FSI[1] level 2 is required, advanced-placement language waivers are possible for students with strong language backgrounds.

Both Thesis and Nonthesis Masters options would be available.

Thesis—course work, thesis, and oral exam; a maximum of 8 credits in thesis research may be included in the 30 credits.

Nonthesis—course work; research paper (which may earn up to 4 credits), and oral exam.

GPA Requirement: Students must maintain a 3.0 GPA. Removal from the program is automatic if there are 3 course grades below "B", an accumulation of 9 credits below "B", or if the GPA is below 3.0 for two terms.

Ph.D. Program Options: The Doctor of Philosophy degree program with a major in Forestry/CSES and specialization in agroforestry is open to nonforesters as well as foresters. Specialities related to agroforestry are studied in depth. Requirements vary depending on the student's background of study and experience. In all cases, the student must complete an acceptable dissertation incorporating the results of original research. Foreign language competency equivalent to FSI level 3 is required, advanced-placement language waivers are possible for students with strong language backgrounds.

[1] FSI is the Foreign Service Institute's standard evaluation system to rate an individual's language skills. FSI level 2 indicates professional competency in a foreign language for which you will be expected to follow work-related discussion or meetings, even though you may wish to intervene in another official language. You will be expected to participate in simple conversations, use the telephone, read, and understand work-related texts, and to write simple communications, etc.

Area	Course Title	Semester
FORESTRY/FOREST PRODUCTS		
For 4334	**Agroforestry Prin. & Pract.**	(F)
Wood 3784+	**World Forestry**	(S)
For 5984	**Social Forestry**	(S)e
For 4364	Advanced Silviculture and Forest Veget. Mgt.	(S)
For 5334	Plant Water Relations	(F)
For 5354	Advanced Forest Soils	(S)
For 5374	Advanced Forest Ecology	(S)e
For 5415/16	Advanced Forest Resource Management & Econ.	(F)
For 5494	Nat. Res. Research Proc.	(S)
For (Wood) 4614	**Econ. of For. Prod. Marketing**	(S)
Wood 5614	For. Prod. Mkt. & Mgmt. Srat.	(S)
For 4114	Computer Application in Nat. Res.	(F)
For 5224	Forest Biometry	(F)
For 5254	**Remote Sens. of Natural Res.**	(S)
For 3215/6+@	Forest Measurements/Lab	(F/S)
For 3364+@	Survey of For. Ecology and Management	(F)
For 3324/34+@	Silviculture/Silvic. Lab	(S)
For 3424/34+@	Forest Resource Economics/Lab	(F)
For 5984	**Advanced Agroforestry**	(?)
AGRICULTURAL ECONOMICS		
AgEc 4304	Natural Resource Economics	(S)
AgEc 5144	Resource and Environmental Economics	(S)
AgEc 5154	International Agric. Development and Trade	(F)
AgEc 5244	Rural Development	(S)
AGRICULTURAL ENGINEERING		
AgE (CE) 5144	Knowledge-Based Expert System	(S)
AgE 5204	Environmental Control for Animals and Plants	(S)
AGRICULTURE AND LIFE SCIENCES		
ALS 5274	Advanced Topics in Ruminant Nutrition	(F)
ANIMAL SCIENCE		
AnSc (ALS) 5204	Animal Nutrition Experimentation	(F)e
DaSc 5474	Dairy Management Decisions	(F)e
BIOCHEMISTRY AND NUTRITION		
BioN (PPWS) 5324	Plant Metabolism	(F)
BIOLOGY		
Biol 5034	Ecosystem Dynamics	(F)
Biol (PPWS) 5304	Plant Stress Physiology	(S)
Biol 4684/94	Soil Microbiology/Lab	(S)
CIVIL ENGINEERING		
CE 5104	Environmental Chemistry	(F)
CE 5134	Engineering Aspects of Water Quality	(S)
CE 5324	Advanced Hydrology	(F)

CROP AND SOIL ENVIRONMENTAL SCIENCES

CSES 3444+	World Cropping Systems	(S)
CSES 4214	Soil Fertility and Management	(S)
CSES 4224	Soil Fertility and Management Lab	(S)
CSES 4334	Principles and Practices of Agroforestry	(F)
CSES 4344	Crop Physiology and Ecology	(S)
CSES 4444	**Advanced Cropping Systems**	(S)
CSES 4544	Forage Crop Ecology	(S)
CSES 4984	Soil Taxonomy	(S)
CSES 5034	Soil Interpretation	(S)o
CSES 5214	Soil-Plant Relationships	(S)o
CSES 5364	Microenvironment and Crop Growth	(F)o
CSES 5544	**Soil-Plant-Animal Interrelationships in Grasslands**	(S)o
CSES 5634	Soil Chemistry	(F)
CSES	Soil Biophysics (forthcoming)	

ECONOMICS

Econ 4014	Environmental Economics	(F)
Econ 4124	Growth and Development	(S)
Econ 6054	Economic Development	(F)

EDUCATION

EdCi 6034	Education and Anthropology	(F)
EdCi 6534**	Ethnogr. Methods in Education Res.	(S)
EdVt 6694	**Vocational and Technical Educ. for Developing Countries**	(F)

ENTOMOLOGY

Ent 5264	Biol. Control of Arthropod Pests and Weeds	(S)
Ent 6254	Population Models of Insect Systems	(S)
Ent 4224	Integrated Pest Management	(?)

FISHERIES AND WILDLIFE

FIW 5414	Endangered Species Management	(F)o
FIW 5984	Conservation Genetics	(F)
FIW 5984	(Directed study)	

GEOGRAPHY

GEOG/UAP 5204	Geography of Third World Development	(S)
GEOG 4204	Geography of Resources	(F)

HORTICULTURE

HORT 5504	Nutrition of Horticulture Crops	(F)o
HORT 5604	Physiology of Crop Plants	(S)o

HUMAN NUTRITION AND FOODS

HNF 4024	Intern. Nutrition in Developing countries	(F)

INTERNATIONAL STUDIES

IS/Comm 4044	International Communication	(F)

LANDSCAPE ARCHITECTURE

LAR 4044	Land Analysis and Evaluation	(S)
LAR 4134	Ecosystems, Dynamics and Vegetation Management	(S)e

PLANT PATHOLOGY, PHYSIOLOGY, AND WEED SCIENCE

PPWS 4754	Weed Science: Principles and Practices	(F)
PPWS 5654	Plant Growth and Development	(F)

POLITICAL SCIENCE

PSci 5434	Politics of Developing Areas	(S)

SOCIOLOGY

Soc 4514	Rural Sociology	(F)o
Soc 5504	Population Processes and Policies	(S)
Soc/UAP 5524	International Development	(S)
Soc 4784	Women in World Development (Special Studies)	(S)
Soc/PAPA 5204*	Data Analysis	(S)
Soc 6204**	Survey Research Methods	(F)

STATISTICS

STAT 4204*	**Experimental Designs**	(F)
STAT 5605/6*	Biometry sequence	(F/S)
STAT 5615/16	**Statistics in Research**	(F/S)

URBAN AFFAIRS AND PLANNING

UAP 4374	Land Use and Environment: Planning & Policy	(S)
UAP/Geog/ Soc 4764	**Third World Development**	(F)
UAP 5304	Land Use Planning	(S)
UAP 5374	Plan Implementation in Developing Countries	(S)e
UAP 5394	Seminar in Third World Development Planning	(F)
UAP 5414	Natural Resources Planning	(F)
UAP 5474	Program Evaluation	(F)
UAP 5484**	**Advanced Research Methods**	(F)

Courses highlighted in boldface type are core courses for the M.S. program. At least four core courses are required, core course selection may vary depending on background of student.

*Statistics and Experimental Design Courses: Students will be required to take either STAT 5605/6 or 5615/6. STAT 4204 is required in all cases.

**Methods courses.

+Courses can be taken for graduate credit as special problems.

@Courses may be required for graduate students without prior backgrund in forestry.

(S) or (F)e = A course taught Spring or Fall semester, even numbered years only.

(S) or (F)o = A course taught Spring or Fall semester, odd numbered years only.

Summary

In general, faculty have become increasingly distanced from current realities in many developing countries. Cutting edge research in forestry and agriculture does not address existing basic needs of rural peoples for trees, crops, animals, forests, or the myriad products derived from tree and forest resources, produced in association with crop and animal systems (Gold, 1993). As a result, we are less able to properly train international students in ways that enable them to be meaningfully productive within their own countries (Cashman and Persons, 1989).

We must not overlook the value of simple technologies and culturally sensitive solutions to solve development problems. Examples of simple innovations that have had profound influence include the LORENA wood stove and modifications to the bicycle for human powered locomotion (Gold, 1993). In tropical forestry, success has been created through modification of existing "indigenous" agroforestry technologies and social forestry programs that emphasis household and community involvement (Ganguli, 1992). The principles developed here also have important applications in effective use of domestic soil and forest resources at the individual farm and community level.

This initiative at Virginia Tech is presented as an example of one institution's effort to address this need. Given the interdisciplinary nature of agroforestry, significant interaction and input across colleges was necessary for the development and implementation of this graduate and undergraduate program in agroforestry. The article presents this as a starting point for others interested in agroforestry in the curriculum, and in no way assumes to be the complete answer in addressing the training of domestic and international students.

Literature Cited

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