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Integration of Environmental and Sustainable[1] Development into Agricultural Educational Programe

Pongsak Angkasith[2]

Abstract : In the past three decades, agricultural productivity has increased remarkably in many parts of the world, including Thailand, with the application of modern technologies and with public and research policies supporting the Green Revolution. Thailand's policies have encouraged farmers to grow crops and raise livestock for sale as exports. Cash crops of rice, maize, mungbean, soybean and longan have changed land-use patterns and made Thailand the world's leading exporter of rice.

This success has entailed negative consequence, including overproduction and low market prices, overdependence on external inputs and associated risks, degradation of soil and water resources, and toxicity to farm workers and other living organisms. Problems in marketing agricultural exports have become increasingly serious. Farmers have incurred high debts to make the capital investment needed to shift to high-production agriculture.

Deforestation and land degradation have become critical. In some parts of the country (particularly the ecologically more fragile Northeast), farmers notice a greater tendency for drought in the wake of deforestation, and problems due to soil depletion and salinization. In the North, farmers have noticed an increase in health problems due to agricultural chemicals. Community organization concerned by the dwindling flow of local rivers have launched campaigns to protect their watersheds. Government, private, and religious organizations particularly non governmental organizations (NGOs) have organized campaigns and seminars to raise public awareness of environmental problems. Many Thai universities, including the Faculty of Agriculture, Chiang Mai University (CMU), are also working in this area.

The objective of the Faculty of Agriculture, CMU, is to provide students with the concepts and tools of an interdisciplinary approach for analyzing the function and development of agricultural systems in order to dewign, implement, and evaluate sustainable alternatives. Student learn the fundamentals in basic courses, followed by more indepth studies in specific majors like Land Resource Management, Agroforestry, and Agricultural Systems. The programme prepares students for careers in extension, development and research.

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[1] Case Study from Consultation Meeting in ROME, 30 November - 4 December 1993.

[2] Associate Professor in Agricultural Extension Education and Dean, Faculty of Agriculture, Chiang Mai University, Thailand.

The Faculty's research directly related to sustainable agriculture has included M.S. thesis research on sustainable systems of agriculture; ongoing research on alternative agroforestry systems for ethnic minorities in Northern Thailand; and international collaborative research on the Sustainability of Agricultural Systems of Southeast Asia, involving other researchers in the Southeast Asian Universities Agroecosystems Network (SUAN). The Faculty is also closely involved in a number of development projects.

From its experience, the Faculty of Agriculture, CMU, has found that its structure provides a firm foundation for providing interdiscriplinary learning of agricultural systems for sustainable development. Interdisciplinary approaches can be especially well integrated in programmes at the postgraduate level, where students already have a basic understanding of fundamentals, and administrative cooperation among departments is more easily arranged. Its research and outreach through involvement with development programmes add real-world elements to student experience and preparation of careers.

The process of addressing Faculty programmes on the envrionment and sustainable agriculture can proceed best through the sharing of experiences among insititutions. This can involve collaborative research, seminars and expert consultations (such as the recent consultation on Agroforestry curricular hosted by CMU and organized by FAO), and short-term exchange of students and Faculty staff.

Other Thai universities also playing important roles in education, research, and extension of sustainable agricultural practices, include : the Faculty of Agriculture, Khon Kaen University (Northeastern Thailand), the Faculty of Agriculture, Kasetsart University (Bangkok), and the Faculty of Natural Resource Management, Prince of Songkhla University (Southern Thailand). At Khon Kaen University, the interdisciplinary approach has developed through its strong programmes in agroecosystems research and farming systems research. At Prince of Songkhla University, sustainable agriculture through natural resource management has become a required course for agriculture students.

All these programmes in Thailand generally share constraints that can be met through the provision of:

- resource persons who can join in both teaching and research
- teaching materials and more sophisticated equipment for measuring environmental effects
- scholarships
- information dissemination assistance

At the Faculty of Agriculture, CMU, these needed inputs could build on the interdisciplinary foundation and help the Faculty provide leadership forimproved research and education that comprehensively addresses key issues emerging in environmental degradation and sustainable agricultural development, for the benefit of the people in Thailand and othercountries with similar agroclimatic conditions.

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บทคัดย่อ : ในสามทศวรรษที่ผ่านมา ผลผลิตทางการเกษตรในภูมิภาคต่าง ๆ ของโลก เพิ่มขึ้นอย่างยิ่งซึ่งรวมถึงประเทศไทยด้วย ซึ่งเป็นผลของการพัฒนาเทคโนโลยีสมัยใหม่จากงานวิจัย และเป็นการสนับสนุนนโยบายการปฏิวัติเขียว (Green Revolution) ประเทศไทย ได้กำหนดนโยบายในการส่งเสริมให้เกษตรกรปลูกพืชและเลี้ยงสัตว์เพื่อการส่งออก พืชเงินสดหลายอย่างเช่น ข้าว ข้าวโพด ถั่วเขียว ถั่วเหลือง และไม้ผล เช่น ลำไย สร้างความเปลี่ยนแปลงรูปแบบของการใช้ที่ดินเป็นอันมาก และเป็นผลให้ประเทศไทยเป็นประเทศผู้นำในการส่งออกผลผลิตข้าวอีกด้วย

แต่ความสำเร็จในด้านการผลิตเพื่อการส่งออกดังกล่าว สร้างผลกระทบในทางลบหลายประการ เช่น ผลผลิตล้นตลาด ราคาพืชผลตกต่ำ การพึ่งพาทรัพยากรการผลิตจากภายนอกเป็นอย่างมากมาย และยังสร้างความเสี่ยงมากขึ้น เกิดความเสื่อมคุณภาพของดินและแหล่งน้ำ และสร้างมลพิษต่อเกษตรกรผู้ผลิต และมวลชีวิตโดยรอบฟาร์ม ปัญหาการตลาดเพื่อการส่งออกของผลผลิตทางเกษตร เป็นปัญหาวิกฤตที่เพิ่มขึ้นตลอดเวลาเกษตรกรสร้างภาวะหนี้สินจากการกู้เงินลงทุนเพื่อการผลิตอย่างมากมาย

การทำลายป่าไม้ และการเสื่อมคุณภาพของดินนั้น นับเป็นปัญหาวิกฤตสูงขึ้นเป็นลำดับ ในภูมิภาคบางแห่งของประเทศ (โดยเฉพาะในภาคตะวันออกเฉียงเหนือ) เกษตรกรพบกับปัญหาของความแห้งแล้งจากผลของการทำลายป่าไม้ และยังเป็นผลต่อการเกิดสภาพความเป็นเกลือของดินด้วย ส่วนในภาคเหนือนั้นเกษตรกรพบกับปัญหาด้านสุขภาพอันเกิดจากการใช้สารเคมีที่เกินกว่ากำหนด และไม่เหมาะสม องค์กรในชุมชนต่างก็แสดงความเป็นห่วงใยต่อสภาพการพังทะลายของดินตามแม่น้ำ จึงได้จัดให้มีการรณรงค์เพื่ออนุรักษ์ พื้นดิน น้ำ และลุ่มน้ำ องค์กรของรัฐ เอกชนและศาสนา โดยเฉพาะองค์กรพัฒนาเอกชนได้ดำเนินการจัดให้มีการรณรงค์และจัดการสัมมนาอภิปราย เพื่อสร้างความตระหนักแก่สาธารณชนต่อปัญหาสิ่งแวดล้อม

มหาวิทยาลัยในประเทศไทยหลายแห่ง รวมถึงคณะเกษตรศาสตร์ มหาวิทยาลัยเชียงใหม่ ได้มีส่วนในการดำเนินการดังกล่าวด้วย

วัตถุประสงค์และเป้าหมายของคณะเกษตรศาสตร์ มหาวิทยาลัยเชียงใหม่ คือ การถ่ายทอดความรู้ในสิ่งต่าง ๆ เหล่านั้นแก่นักศึกษา เพื่อเป็นการเรียนรู้และแสดงความคิดและเป็นเสมือนเครื่องมือในระบบการศึกษาแบบสหสาขาวิชา ซึ่งจะเป็นแนวทางในการวิเคราะห์บทบาทและการพัฒนาการของระบบการเกษตร เพื่อจะเป็นแนวทางในการกำหนดรูปแบบ การปฏิบัติ และการประเมินผล เพื่อแสวงหาทางเลือกที่สร้างความยั่งยืนได้ นักศึกษาจะศึกษาเกี่ยวกับวิชาพื้นฐานการเกษตรและการศึกษาที่ลึกเฉพาะทาง เช่น การจัดการทรัพยากรดิน ระบบวนเกษตร และระบบเกษตร โปรแกรมการศึกษามุ่งที่จะผลิตบัณฑิต เพื่อประกอบอาชีพในด้านการส่งเสริมพัฒนาและการวิจัย

งานวิจัยของคณะเกษตรศาสตร์ จะเกี่ยวข้องโดยตรงต่อการพัฒนาเกษตรกรที่ยั่งยืน ซึ่งกำหนดไว้ในหลักสูตรมหาบัณฑิตโดยได้รวมงานวิจัยระบบการเกษตรยั่งยืน การวิจัยต่อเนื่องเกี่ยวกับระบบวนเกษตรเพื่อเป็นทางเลือกสำหรับชนกลุ่มน้อยชาวเขาในภาคเหนือของประเทศไทย และโครงการวิจัยร่วมกับสถาบันต่าง ๆ ในเรื่องเกี่ยวกับระบบเกษตรที่ยั่งยืนในเอเชียอาคเนย์ ซึ่งเป็นโครงการวิจัยร่วมของนักวิจัยอื่น ๆ ในเครือข่ายระบบวนเกษตร

ของมหาวิทยาลัยในเอเชียอาคเนย์ (SUAN) คณะเกษตรศาสตร์ ยังเป็นสถาบันที่ทำงานวิจัยและพัฒนาใกล้ชิดกับโครงการพัฒนาเกษตร และชนบทหลายโครงการ ในภาคเหนืออีกด้วย

จากประสบการณ์ดังกล่าวแล้ว เป็นผลทำให้คณะเกษตรศาสตร์ มหาวิทยาลัยเชียงใหม่ มีโครงสร้างที่ดีและมีความมั่นใจ ในการให้การศึกษาระบบสหสาขาวิชาในระบบเกษตรเพื่อการพัฒนาที่ยั่งยืน ระบบสหสาขาวิชานับเป็นแนวทางของการศึกษาที่สามารถรวมวิชาการต่างๆ เข้าด้วยกัน เป็นผลดีต่อการศึกษาในระดับบัณฑิตศึกษา ซึ่งนักศึกษาที่มีความเข้าใจพื้นฐานสามารถนำมาดำเนินการจัดการผสมผสาน วิชาการในสาขาวิชาต่าง ๆได้ง่าย และมีประสิทธิภาพ งานวิจัยและการปฏิบัติพัฒนาในระดับฟาร์มสามารถสร้างความรู้ความเข้าใจและประสบการณ์ในสถานการณ์ที่เป็นจริงได้อย่างดียิ่ง

การดำเนินการโครงการศึกษา เกี่ยวกับสิ่งแวดล้อม และการพัฒนาการเกษตรที่ยั่งยืนของคณะเกษตรศาสตร์ สามารถดำเนินการได้อย่างดียิ่ง เนื่องจากความร่วมมือของสถาบันต่าง ๆ ซึ่งหมายรวมถึง โครงการวิจัยร่วม การจัดสัมมนาทางวิชาการเกษตรและการให้คำปรึกษาของผู้เชี่ยวชาญ (อาทิ เช่น การให้คำปรึกษาของผู้เชี่ยวชาญ FAO ต่อการสัมมนาหลักสูตรวนเกษตรที่ผ่านไปไม่นานมานี้) และโครงการแลกเปลี่ยนนักศึกษา และคณาจารย์ เป็นต้น

ในส่วนมหาวิทยาลัยอื่น ๆ ในประเทศไทย ก็ได้แสดงบทบาทสำคัญในการศึกษาวิจัยและพัฒนาในความคิดเห็นเกี่ยวกับพัฒนาที่ยั่งยืนในการเกษตร เช่น คณะเกษตรศาสตร์ มหาวิทยาลัยขอนแก่น (ภาคตะวันออกเฉียงเหนือ) คณะเกษตร มหาวิทยาลัยเกษตรศาสตร์ (กรุงเทพฯ) และคณะทรัพยากรธรรมชาติ มหาวิทยาลัยสงขลานครินทร์ (ภาคใต้) มหาวิทยาลัยขอนแก่น มีการศึกษาตามระบบสหสาขาวิชา โดยดำเนินการตามโครงการวิจัยด้านสิ่งแวดล้อมเกษตร และระบบการจัดการฟาร์ม และมหาวิทยาลัย สงขลานครินทร์ ก็เช่นเดียวกัน มีการศึกษาวิจัยการเกษตรที่ยั่งยืนดำเนินการตามโครงการวิจัยการจัดการทรัพยากรธรรมชาติ และยังจัดให้เป็นวิชาบังคับพื้นฐานสำหรับนักศึกษาด้วย

จากโครงการศึกษาวิชาการเกษตรยั่งยืนดังกล่าวของประเทศไทย สามารถจะวิเคราะห์ ปัญหาข้อขัดข้องทั่วไปร่วมกันในด้านต่างๆ ได้ดังนี้.-

- ทรัพยากรบุคคล ผู้ที่สามารถทำงานทั้งด้านการสอนและงานวิจัย
- อุปกรณ์ประกอบการสอนและอุปกรณ์วิทยาศาสตร์ที่ซับซ้อนในการวัดผลกระทบของสิ่งแวดล้อม
- ทุนสนับสนุนการวิจัย
- การสนับสนุนข้อมูล

คณะเกษตรศาสตร์ มหาวิทยาลัยเชียงใหม่ มีความต้องการทรัพยากรดังกล่าวเพื่อพัฒนาการศึกษาวิจัย เพื่อสร้างการเป็นผู้นำในการพัฒนางานวิจัยและการศึกษาอันสามารถแสดงถึงความรับผิดชอบต่อปัญหาสำคัญที่เกิดจากผลของความเสื่อมโทรมของสิ่งแวดล้อม และการพัฒนาเพื่อความยั่งยืนในด้านการเกษตร อันจะเป็นผลประโยชน์ต่อประชาชนคนไทยและประเทศอื่นๆ ที่มีความคล้ายคลึงในพื้นฐานด้าน ภูมิศาสตร์ได้ในที่สุด

Introduction

In the past three decades, agricultural productivity has increased remarkably in many parts of the world with application of modern technologies and with public and research policies supporting the Green Revolution. Modern agriculture is generally associated with inputs of chemical pesticides and inorganic fertilizers, and sometimes with mechanized monoculture. Its greatest vitues are the increased production of food and fiber to satisfy a growing world population, and greater income for a number of farmers.

The practice of modern agriculture, however, has had other consequences, including overproduction and resultant low market prices, overdependence on external inputs and associated risks, degradation of soil and water resources, toxicity to living organisms, and other forms of environmental pollution.

The growing evidence and public awareness of these problems suggest the need to consider potential alternatives to modern agriculture for encuring economic and ecological sustainability. Such alternative systems both indigenous and recently developed exist and can provide a foundation for further improvement. They include many variations of integrated agriculture, low-energy, low-chemical-based production, and natural farming. These systems often have the advantages of less dependence on chemical and other external inputs and greater diversity of economic activites and biological components. The practice of alternative agriculture could lead to greater long-term development by shifting the focus from maximum production to a goal of reduced production costs and risks, controlled pest and disease problems, improved farm income, and minimal adverse affects to the environmental system. At this juncture, it is important to identify, assess, and modify existing sustainable agriculture systems for more beneficial and wider practice.

As the regional university for northern Thailand, Chiang Mai University's Faculty of Agriculture is committed to playing a key role in this shift toward sustainable agricultural development through its three main functions of education, research, and extension. The mountainous region's wealth includes forest and water resources as well as potentially sustainable indigenous systems of agriculture.

Purpose of This Case Study

This case study examines the roles of the Faculty of Agriculture at Chiang Mai University (CMU) in promoting sustainable agriculture through its present activities and future plans in research, education, and extension, particularly as they reflect and support the FAO policy and UN General Assembly Resolution No. 42/168. In particular, this study will :

1. Examine the activites of the Faculty of Agriculture, CMU, in environmental and sustainable agriculture.
2. Identify roles, strategies, and appropriate approaches through which the Faculty can contribute to and implementation of Agenda 21 of the UN Conference on Environment and Development (UNCED)
3. Suggest a line of action and policies to strengthen the contribution of the Faculty of Agriculture, CMU, to agricultural education and training in environmental management and sustainable agricultural and rural development.

Methodology

This case study was prepared through documentation of discussions and interviews concerning the environment and sustainable development with lecturers, professors and researchers involved in the Faculty's educational programs (both degree and non-degree programs), research programs, and outreach (or extension) campaign activities. A database was also complied and statistically analyzed.

Scope of the Study

This study is limited to the roles and activites of the Faculty of Agriculture, CMU, and related institution involved in education, research and extension in agriculture for sustainable development.

The Case Study Context

For a long time, Thailand was well known as an agricultural country where the fertile land could grow every kind of crop and could support every kind of livestock. Major agricultural exports are rice (ranked number 1 in the world), maize, cassava, and and sugar cane. Table 1 shows the structure and area coverage of agricultural holdings in each of the country's four regions.Table 2 shows the breakdown of the country's land area among the five land-use categories of rice, field/ vegetable crops, permanent crops, forest and pasture, and other areas.

Thailand's policies have encouraged farmers to grow crops and raise livestock for sale as exports. Five major crops are grown for export and have essentially changed the land-use patterns (Table 3). Among livestock farms, five types of livestock provided farmers with good income (Table 4).

About 58.19% of the total Thai population is engaged in agriculture, composed of 52.61% males and 47.33% females.

Thai farmers organized their own associations by 1949, with legal recognition in 1972. Farmers associations, mainly involving male farmers, became active in agricultural promotion and technology transfer. Some associations proved more sucessful than others.

Table 1. Agricultural situation in Thailand (Data on Agricultural structure by province)

Number and area of Holdings by size of holding

Area (rai) Region and province	Size of holding (rai)[1/]											
	All size		Under 6		6-9.9		10-39.9		40-139.9		140 and over	
	Number	Area	Number	Area	Number	Area	Number	Area	Number	Area	Number	Area
Whole Kingdom	4,877,424	109,149,504	703,047	2,738,475	602,157	4,589,767	910,845	59,593,583	639,318	36,227,705	22,057	5,999,974
Central Region	542,495	23,288,797	106,987	388,954	79,021	593,628	489,517	10,318,599	158,319	9,496,653	8,654	2,493,163
Northeastern Region	2,179,562	49,425,853	157,201	605,967	224,634	1,615,019	1,493,807	29,727,883	296,549	15,648,779	7,371	1,828,225
Southern Region	647,723	13,972,879	110,710	523,200	105,390	942,597	373,034	8,312,762	58,854	3,571,324	1,735	622,996
Northern Region	1,207,644	22,461,975	328,152	1,222,354	103,112	1,438,523	554,487	11,234,559	127,598	7,510,949	4,297	1,055,590

Number and area of holdings by land-use class

Area (rai) Region and province	Total area of holding	Land-use class													
		Agricultural land										Forest		Building and others	
		Arable land						Permanent crops		Pasture					
		Rice		Field crops		Vegetable crops									
		Number	Area	Number	Area	Number	Area	Number	Area	Number	Area	Number	Area	Number	Area
Whole Kingdom	109,149,504	3,797,169	62,921,633	1,715,825	24,854,144	472,639	836,634	1,242,181	13,776,882	131,480	945,277	245,974	2,325,028	1,927,048	3,489,906
Central Region	23,288,797	518,970	11,604,797	283,536	7,349,797	69,422	299,823	249,442	2,760,702	16,114	165,175	27,195	321,496	306,797	787,007
Northeastern Region	49,425,853	1,877,134	33,943,908	899,523	10,920,128	279,583	245,769	248,878	807,793	94,624	635,773	139,622	1,246,951	986,364	1,625,531
Southern Region	13,972,879	392,664	3,294,888	26,053	82,522	29,024	49,757	524,667	9,421,037	10,766	49,653	47,239	489,898	264,284	585,124
Northern Region	22,461,975	1,010,401	14,078,040	506,713	6,501,697	94,610	241,285	219,394	787,350	9,976	94,676	31,918	266,683	369,603	492,244

Source : National Statistical Office

[1/] 6.25 rai = 1 Hectar

Farm housewives were also a target clientele of activities by the Department of Agricultural Extension, under the Ministry of Agriculture and Cooperatives, designed to assist farmers in agriculture, home economics, and other activities involved with farm management. Farm housewives were encouraged to set up their own associations, which became even more effective than many of the farmer associations to which their husbands belonged.

The Department of Agricultural Extension's programs with children began in 1953 with activities in elementary schools. Later, youth programs were promoted in selected areas, and eventually at the national level. Now, national conferences of youth groups are held annually. Youth organizations and 4-H clubs have had verying levels of success in some provinces.

These three types of organizations of men farmers, farm housewives, and young people have become the channels for agricultural and rural development in Thailand today.

Thai agriculture for a long time pursued monoculture in its traditional agriculture systems, as they could be supported by the existion conditions of rainfall, soil, seed, etc. As the development of agriculture worldwide has involved more advance technologies for increased production. Thailand incorporated these advanced inputs to keep place.

Thai extension services promoted chemical fertilizer, insecticide use and mechanized farm operations throughtout the country. Due to competition in the agricultural export market this campaign for high-technology agriculture provided Thai farmers with a high return. Farmers followed the experts' recommendations and invested in more chemicals in order to increase their operations year-round, with at least two crops per year on average. This promotional campaign an adoption by Thai farmers make Thailand the world's leading exporter of rice.

This system, however, led to over-production in some years. Problems in marketing agricultural exports were in some cases caused by the world market and in others by the country's export system. More recently, marketing problems have become more serious, affection rice, cassava, maize, coffee, and livestick crops. Thai authorities have reconsidered the role of high-technology systems and the country's agriculture development plans in view of this continuing complex problem and its political consequences.

Besides the problem of market, other problems have emerged with physical, social and economic dimensions. Agricultural industries have grown up to support and exploit the monoculture-based system of cash crop production, and farmers now face social conflicts as they struggle to gain negotiating leverage with these agri-businesses for better farmgate prices for their crops. Farmers also face help levels of debt incurred by the

capital investiments needed to shift to high-input, high-production agriculture.

Environmental problems have become more serious. In some parts of the country (particularly the ecologically fragile Northeast), farmers are recognizing symptoms of climatic change invoving drought and soil salinitization.

The Concern of Thai government and educational institutions with these problems of imbalance in natural resource use and pollution led them to be cited in the country's Plan for Economic and Social Development in two of the plan's three main purposes :

1. To accelerate human resource development concerning quality of life, environment, and natural resources, and
2. To promote greater income generation and distribution at the regional and local levels.

For the plans, agricultural development sector, it defined the objectives and targets of :

1. Accelerated increase in production and rationalization of this agricultural expan sion to consider market demand, promotion of appropriate land uses, clarification of policies on irrigation and water use, fertilizer promotion, and private sector promotion
2. Specific area agricultural development, mainly for the rural poor and their land use and quality of life.
3. Greater income and fairness to farmers from their agricultural products.

Table 2. Area of holding by land use

Land use	Area of holding			Percentage		
	1987	1983	1988	1987	1983	1988
Total area of holding	19,942,423	21,625,953	22,461,975	100.0 .	100.0	100.0
Rice	13,261,569	13,847,152	14,078,040	66.5	64.0	62.7
Field/vegetable crops	5,690,070	6,521,544	6,742,982	28.5	30.2	30.0
Permanent crops	451,381	633,767	787,350	2.3	2.9	3.5
Forest and pasture	346,267	319,505	361,359	1.7	1.5	1.6
Other areas	193,136[1/]	303,985[2/]	492,244[2/]	1.0	1.4	2.2

1/ Including area 400 m^2, and over occupied by buildings

2/ Including all area occupied by buildings

Table 3. Major crops by name of crops

Item	Number			Percentage of change	
	1978	1983	1988	1983/78	1988/83
Rice					
No. of holdings reporting	823,296	937,873	1,000,638	+13.9	+7.7
Planted area	13,329,318	13,715,716	14,644,657	+2.9	+6.8
Maize					
No. of holdings reporting	229,774	325,587	345,934	+41.7	+6.3
Planted area	3,503,723	4,619,385	4,992,520	+31.8	+8.1
Mung bean					
No. of holdings reporting	152,134	194,395	159,100	+27.8	-18.2
Planted area	2,139,678	2,028,645	1,795,728	+5.2	-11.5
Soybean					
No. of holdings reporting	66,412	86,293	162,402	+29.9	+88.2
Planted area	440,349	624,699	1,317,133	+41.9	+110.8
Longan					
No. of holdings reporting	20,653	55,310	138,680	+167.8	+150.7
Total no. of trees	903,403	1,559,275	3,643,196	+72.6	+133.7

Source : National Statistical Office

Besides agricultural policy and plans, the Seventh Economic and Social Development Plan pinpoints policies that concern the environment and natural resource development.

1. Environmental policy which will promote the knowledge and campaign on pollution of the environment by chemical substances, including agricultural chemicals.
2. Natural resource development policy that addresses appropriated use and conservation of forest, mining land and water resources

Thailand's national legistation governing the environment was revised in 1991. The Ministry of Science, Technology and Environment became responsible for environmental control, conserva-

tion, development and promotion. For environmental concerns, the Ministry has established a Committee for National Environmental, which addresses problems involving pollution of water, soil, air and other resources that are caused by favorites vehicles and misuse of agricultural products.

According to the legistation. the Thai government established policy at the national and local levels for development of the environment, particularly the nation's agricultural land. The Thai Plan for Economic and Social Development in two of the plan's three main purposes :government is government is aware that the use of advanced technologies can also cause problems for the consumer of agricultural products and aims to address these through prevention and protection. To promote awareness of environmental problems, many organizations both governmental and pri-

Table 4. Livestock and type of livestock

Item	Number			Percentage of change	
	1978	1983	1988	1983/78	1988/83
Cattle					
No. of holdings reporting	219,667	171,745	170,788	-21.8	-0.6
No. of cattle	989,108	900,004	1,222,699	-9.0	+35.9
Buffalo					
No. of holdings reporting	382,624	309,529	185,730	-19.1	-40.0
No. of buffaloes	1,214,400	906,516	627,709	-25.4	-30.8
Pig					
No. of holdings reporting	418,468	282,900	301,174	-32.4	+6.4
No. of pigs	1,422,361	794,963	1,150,091	-44.1	+44.7
Chicken					
No. of holdings reporting	726,333	1,117,326	899,257	+53.8	-19.5
No. of chickens	13,565,962	16,935,692	19,550,379	+24.8	+15.4
Duck					
No. of holdings reporting	124,008	154,347	135,190	+24.5	-12.4
No. of ducks	1,548,920	2,228,790	1,240,898	+43.9	-44.3

Source : National Statistical Office

vate, particularty non-governmental organizations (NGOs) have organized campaigns, seminars, roundtable discussions, and other forums for delivering information to the public. Many universities are also working on research and training in this area. Their educational programs also include sustainable agriculture and environmental education in their curricula for B.S. and M.S. degree.

Faculty of Agriculture, Chiang Mai University

The Faculty of Agriculture was established in 1967, and became the fifth faculty of Chiang mai University, the first "regional university" in Thailand. The Faculty grown steadily over the last two decades, in quality and quantity.

The Faculty is committed to three majors functions : instruction, research and extension. The Faculty of Agriculture strongly believes that, for greatest impact, its functions should not be pursued behind closed doors. In its pursuit of excellence and relevance in teaching, research and extension, the faculty vigorously promotes collaboration with relevant institutions within and outside the country. However, the decision to establish an institutional linkage normally considers the symbiotic nature of the forementioned trilogy of functions. It also considers the potential for optimum utilization of available resources and expertise to contribute to the progress and development of the beneficiaries to whom the institutions are accountable.

In 1993, the Faculty of Agriculture had an enrollment of 804 in eight bachelor-degree programmes : Agriculture Economics, Agricultural Extension, Agronomy, Animal Science, Entomology, Horticulture, Plant Pathology and Soil Science and Conservation. The Faculty also offers seven Master's degree programmes, with a current enrollment of 233 in graduate studies : Agricultural Extension, Agricultural Systems, Agronomy, Animal Science, Entomology, Horticulture and Soil Science and Conservation.

As of June 1993, a total of 2,857 students have graduate and 188 Master'sdegrees have been conferred

The academic year is devided into two semesters. Each semester is approximate 18 week long. There is also a summer session, which runs for 8 weeks.

The Faculty offers courses along individual academic disciplines and evaluates the amount of credits each student may take per semester. A one-credit course requires one hour of lecture or two-three hours of laboratory work each week for the regular session. A three credit course requires three hours of lectures per week throughout a semester.

Current Roles and Activities of the Faculty of Agriculture in Promotion of Sound Environmental Practices, Sustainably Agriculture, and Rural Development

Mandate

Covering substantive educational programs and development project, the Faculty's mandate can be broadly classified into four main categories of activites and objectives:

- to produce graduates in agricultural fields of high academic standard, who are endowed with a high sense of morality and creativity
- to act as an information center extending and disseminating proper and advanced agricultural knowledge and technology to farming communities, particularly in the North of Thailand.
- to cooperate and to coordinate with other international institutes and organizations for the economic improvement of the Southeast Asian people

The Faculty's current course of teaching and research related to the environment and sustainable agriculture is indicated in following two tables.

Interdisciplinary research has been practiced at the Faculty's Multiple Cropping Center since 1970, and developed into the postgraduate program in Agricultural System in 1984. Field research can be accomodated by four highland research stations, apart from numorous stations operated by the Department of Agriculture (DOA) and Royal Forest Department (RFD) in northern Thailand. On-farm research and watershed studies can be conducted in cooperation with many government and non-government projects. The project sites cover a broad spectrum of ecological and socioeconomic conditions representing many part of tropical and subtropical areas.

Articles and papers produced through the Faculty's research program share the findings with colleagues in the academic and official community. Recent and current research directly related to sustainable agriculture includes :

- M.S. Thesis research studied Sustainability of Forestry Production Systems (1990)
- Ongoing research on Developing Alternative Agroforestry Systems for Ethnic minorities in Northern Thailand is building on the more sustainable systems practiced by Karen and Lisu minorities in the area.
- Ongoing research on the Sustainability of Agricultural Systems of Southeast Asia, involving collaborators in the Southeast Asian Universities Agroecosystems Network (SUAN), is examing the shifting cultivation systems of southern China, cassava production in Northeast Thailand and other systems in Southeast Asia to develop a methodology for comparing features and indentifying technological and/or policy interventions.

Awareness of appropriate approaches for environmental development and sustainable agriculture are promoted in the Faculty's interdisciplinary system in which a student learns through basic courses (general education) and more in-depth studies in specific majors like land resource management, agroforestry and agricultural systems.

This system aims to produce graduates with applied skills and an analytical framework for determining appropriate agricultural system components in a given agro-environment for more sustainable production.

The Faculty of Agriculture raises public awareness of environmental problems through arange of channels, including :

- two radio programs : the University station (FM 100 MHz) and the Royal army station (AM 73.8 MHz)
- two newspaper : Northern Region, Thai News.
- campaigns involving participation by students and the public for tree growing and garbage collection
- seminar and workshops on specific topics, like proper use of insecticides, chemical fertilizers and botanical pesticides

In its outreach programs, the Faculty of Agriculture conducts community service training courses for farmers in areas related to use of botanical pesticides, chemical insecticides, and pesticides. Training topics are determined by emerging problems in the nearby farming community.

In addition, the Faculty is closely involved in a number of development projects in the northem region, including Royal Projects and Special Development projects launched under the patronage of H.R.H. King Bhumibhol.

As mentioned earlier, the Faculty aims to create students' awareness of environmental problems arising from inappropriate agricultural practices, and provide students with tools for assessing appropriate adaptations to suit the local environment and development goals. Within the Faculty, the general assessment of the constraints that limit impact in this areas are :

- lack of up-date teaching materials
- lack of support for long-term research
- inadequate experience with on-farm research

The Faculty hopes that future integrations of its program can better educate students in environmental problems related to agriculture and effective design of sustainable agricultural systems for the people of northern Thailand and similar agroclimatic areas.

Environmental Content/Message

The Faculty of Agriculture, CMU, has been involved with information campaigns on environmental protection in agriculture through educational research and community service. Messages have included :

1. the danger of accumulated insecticides and pesticides in vegetable production and the need for farmers to use these chemicals with caution.
2. the nature of soil and water pollution caused by agricultural chemicals and the advantages of organic fertilizers
3. the negative effect of deforestation and reduced forest cover on local rainfall pat terns and climate.

These messages have been conveyed through many media, including training courses, seminar, information campaigns and articles in newspapers and radio programs.

Faculty staff impart knowledge and prac tices of conservation for the local farm environment and/or natural resource management through the following subject areas :

- Soil Science and Conservation (about 9 courses)
- Plant Protection both Entomology and Plant Phatology, including biological con trol, integrated pest management taught at B.S. and M.S. levels (about 7 courses)
- Cropping Systems and Agricultural System taught in an international program (8 courses taught)
- Land Resource and Natural Resource management (to be offered to M.S. students in 1995)
- Agroforestry curriculum for M.S. students (to be offered in 1994)

In its community extension program, the faculty raises public awareness through mass media and training.

Scope and Extent of Integration of Environmental Elements

It the national level, almost all tertiary educational institutions in Thailand offer programmes for students related to the environment, following the policy outlined in the Seventh National Economic and Social Development Plan, which includes an Educational Development Plan.

According to survey estimates, about 80% of the country's student receive exposure to environmental information considered to be basic knowledge for awareness of environmental problems, through all media. Only about 40% of the country's students however are enrolled in educational programmes that actively teach environmental issues.

Among B-S-level students at the Faculty of Agriculture, CMU, about 90% receive general information concerning environmental problems and about

45% of B.S.-level students are involved in courses that teach methods for assessing environmental problems and sustainable Agriculture (by gender, about 60% male and 40% female).

At the M.S. level, however, all student receive at least general information on environmental issues and sustainable agriculture and 60% receive such knowledge through classroom teaching

Table 5. Research activities related to environmental and sustainable agriculture

	Research area	No. of studies	Percentage of total
1.	Crop production (Agronomy, Horticulture)	3	4.22
2.	Agricultural systems	30	42.26
3.	Entomology	5	7.04
4.	Soil Science and conservation	6	8.45
5.	Socio-economics	7	7.04
6.	Forest Ecology and agroforestry	4	5.64
7.	Resource restoration, maintenances and conservation	7	9.86
8.	On-Farm research	2	2.82
9.	Extension and rural development	6	4.85
10.	Joint research	3	4.22
	Total	71	100.00

Table 6. Activities concerning environmental and sustainable agriculture

Area of activites	Amount (time)	Percentage
Training	6	17.14
Special lecture	5	14.28
Seminar	14	40.00
Workshop	10	28.58
Total	35	100.00

and research (70% male, 30% female) M.S. students are in the specializations of Agricultural Systems, Soil Science, Entomology Agricultural Extension, Agronomy, Horticulture and Animal Science (calculation base on enrollment and information distribution).

The Faculty of Agriculture's interdisciplinary approach to agriculture and rural development proves particularly conductive for integrating elements of environmental assessment. Key areas in the general educational programme where this integration is taking place are the fields of Biological Control, Soil Conservation, and Forest Resources. The fields of specialization most closely involved with sustainability issues are Forest Resources and Soil Science at the B.S. level, and Agricultural Systems and Agroforestry at the M.S. level.

Table 7 shows the proportion of programmes and courses offered, both in the Faculty of Agriculture and more widely in Chiang Mai University, that concern the environment and sustainable agriculture.

Concerning the number and proportion of Faculty staff with experience in environmental and natural resource management studies, and the total time allocated for teaching and research in these areas: the Faculty has 66 staff involved in research and instruction in these areas, out of its total 117 staff. Calculated on the basis of teaching and research workload, this figures to be 198 hours per week, out of 1,218 total hours per week, or about 16.25%.

Regarding government budget support, of the total US$ 3.88 million in 1993, an estimated US$ 1.16 million is allocated to environmental education research and promotion. This amount is divided between **capital investment** for land, buildings and equipment and **operation costs** for teaching materials, salaries, utilities and other.

There remains great scope for further integration of environmental issues into existing courses and new courses in the Faculty of Agriculture, in view of staff interest in related problems evident in Northern Thailand, such as increasingly scarce water resources, climate change, abuse of agricultural chemicals (for example, in tobacco cultivation), and socioeconomic effects on agricultural production. In the North and elsewhere in Thailand, the environment has become a "hot" issue and is widely featured in media articles and even advertisements, and the Faculty has responded both though revising its offering of courses and involvement with various development projects in the areas.

Still, in making the Faculty's programme in environmental issues and sustainable agriculture more comprehensive, the following must be addressed :

- A policy statement should clarify what is maint by sustainable agriculture,

particulary as it affects students' career opportunities after graduation.

- Staff experience and expertise in these fields must be enhanced.
- Support for long-term research (especially critical in environmental fields where changes and trends are gradual) is needed to reinforce the Faculty's teaching programme.
- More up-to-date teaching materials and equipment must be obtained.

In addressing these needs, the Faculty welcomes support from international organizations and donor countries in terms of :

- resource persons who can join in both teaching and research
- teaching materials and more sophisticated equipment for measuring environmental effects
- scholarships
- information dissemination

If these needs are addressed and the holistic, interdisciplinary foundation of the Faculty's structure is further built upon, the Faculty of Agriculture can help provide leadership, both in Thailand and more widely in the Asia-Pacific region, for improved research and education that comprehensively addresses the key issues emerging in environmental degradation and agricultural development.

Table 7. Proportion of course work related to environmental development and sustainable agriculture

	B.S. Programme			M.S. Programme		
	Total courses	related	(%)	Total courses	related	(%)
Chiang Mai University (overall)	3024	69	2.28	1483	92	6.20
Faculty of Agriculture	253	29	11.46	153	37	24.18
Ratio		1:2.38			1:2.49	

Table 8. Number of staff and proportion of Faculty time devoted to environmental development and sustainable agriculture

	B.S. Programme			M.S. Programme		
	Total courses	related	(%)	Total courses	related	(%)
Faculty teaching staff	117	29	24.78	109	37	33.94
Time allocated (hour)	355	90	25.35	154	114	74.02
Ratio	1:3.1			1:3.8		

Process of Integration the Environment into Course Offerings by the Faculty of Agriculture

Since the approval of the Seventh National Economic and Social Development Plan for the period 1992-1996 the Plan's component Educational Development Plan has also been implemented to make Thailand's university program responsive to the changing development condi-tions in the country. Agricultural education at the tertiary level was revised according to society's changing needs. As a result the Faculty of Agriculture, CMU, is introducing several new programmes : Forest Resources, Agroforestry, Landscape Design, and Land Resource Management.

The process by which new course offerings are proposed, determined and prepared consists of two parts : policy and planning and academic curriculum development.

Policy and Planning Level

1. Change in Social Needs and Biophysical Situation, local and global changes **(Department Committee : Judgment of Value)**

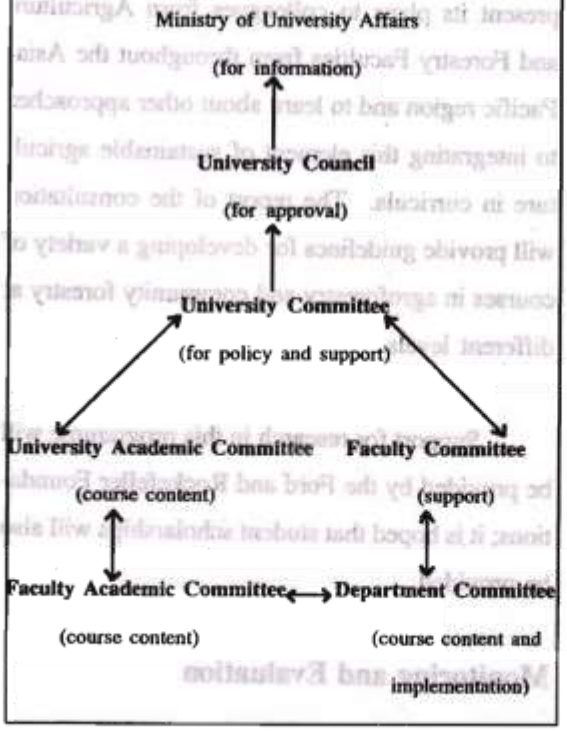
2. Value and Benefit to Society **(Faculty Committee : Support)**

3. Value and Benefit of Society **(University Committed : Policy and Support)**

4. Value **(University Council : Approval of Policy)**

Academic Process of Curriculum Development

After the policy has been approved by the University Council the development of a curriculum proceeds as follows:



The Faculty's process starts at the department level, from which the proposed change goes to the Faculty Committee for a judgment of the proposal's value and determination of support. The Faculty Committee presents its determination to the University Committee for and assessment of policy, plans and support. From there it is passed to the University Council, the top policy body in the University.

If policy support is given at this level the University sends the proposal back to the Faculty for formulation of course content which is done mostly by the Department Committee. Their formulation is reviewed by the Faculty's Academic Committee before it is presented for detailed consideration by the University Academic Committee for approval. The result is reported to the University Committee and the University Council for final consideration and approval.

At the national level new courses are reported to the Ministry of University Affairs. Then new courses in environment and sustainable agriculture are offered to the students. Lecturers and professors who have been involved in the process since preparation of the course outline and content then prepare the teaching materials, with assistance from technicians both in terms of subject matter and in preparation of audiovisual aids. Text books, articles and other publications are prepared based on research recommendations and researchers' experience.

Integration of environmental issues into the educational programme has proceeded in this manner, following and initial assessment of emerging social needs at the local and national levels. Farmers' difficulties with cash-crop agriculture and awareness of related environmental problems have emerged more or less simultuaneously in Northern Thailand and elsewhere in the country.

At present, the Faculty of Agriculture, CMU

was introduced aspects of environmental development and sustainable agriculture through the programmes of Soil Conservation, Integrated Pest Management, Biological Control, and others.

New programmes to be introduced in the next two to three years include, at the B.S. level Forest Resourced and Landscape Design, and Agroforestry and Land Resource Management at the M.S. level.

The Faculty staff has also included environmental education into its work of outreach and information dissemination using mass media and professional journals. Faculty continues to improve their knowledge and skills through academic meetings, seminars and workshops. Some receive specialized training and the national and/or international levels. Independent research for indepth study further develops the knowledge area and thus the educational offering.

Example : Development of the Agroforestry Programme

The Faculty's recent addition of a study programme in Agroforestry, to be offered to students in 1994 illustrates the openness of the integration process at Chiang Mai University.

Based on perceived needs for agroforesty in the environment of Northern Thailand and interest at the Faculty level the outline of an M.S. programme in Agroforestry was developed. This process was supported by the FAO-implemented Asia-Pacific Agroforestry Network (APAN), which organized a regional expert consultation on Curriculum Development in Agroforestry, hosted by Chiang Mai University with the Royal Forest Department in June 1993. The consultation provided the opportunity for the Faculty of Agriculture to present its plans to colleagues from Agriculture and Forestry Faculties from throughout the Asia-Pacific region and to learn about other approaches to integrating this element of sustainable agriculture in curricula. The report of the consultation will provide guidelines for developing a variety of courses in agroforestry and community forestry at different levels.

Support for research in this programme will be provided by the Ford and Rockefeller Foundations; it is hoped that student scholarships will also be provided.

Monitoring and Evaluation

For further improvement in the environmental aspects of the Faculty's programme the Faculty arranges an Academic Committee for monitoring and follow-up and to provide guidance to new programmes. Program evaluations take place every three years, involving former students and outside experts.

At the Faculty of Agriculture the needs of the society of Northern Thailand and the interest from Faculty staff combine to offer great poten-

tial for creating a model of integration of sustainable agriculture aspects in a Faculty of Agriculture programme.

Summary of Lessons Learned

From its experience in addressing the issues of environment and sustainable agriculture in its programmes, the Faculty of Agriculture, CMU, has identified the following lessons :

1. Regarding interdisciplinary relationships, the Faculty has found that its internal structure including the Multiple Cropping Center, provides a firm foundation for providing interdisciplinary learning. Interdisciplinary approaches can be particularly well integrated in programmes at the postgraduate level; at that level students already have a basic understanding of fundamentals, and administrative cooperation among deparments is more easily arranged.

2. Regarding its role in education on the environment and sustainable agriculture the Faculty tries to prepare students for a range of careers in research development policy and education by developing their understanding of system dynamics and of how to assess the impact of changes and interventions in a given system.

3. The Faculty has found that its research and outreach through involvement with government and non-government development programmes (for example with the Royal Forest Department in developing local capacity for watershed management) helps to add real-world elements to its experience and education. This channel can to be more fully developed.

4. Regarding coverage of environment-related educational programmes in the student body and community growing interest in Northern Thailand due to immediate problems provides perhaps the best catalyst for development appropriate responses by the Faculty in its offerings to students.

5. In terms of interagency collaboration in multidisciplinary programmes the Faculty's experience has been positive with government agencies such as the Royal Forest Department. Great scope remains to develop interagency cooperation with other parts of the university. For example the Faculty plans to pursue this with the Faculty of Social Science's Resource Management and Development Center through the focus of an exchange programme with the University of Wisconsin (Madison) in the United States.

6. In terms of integrating biophysical aspects of environmental processes with the socioeconomic aspects of environmental management the Faculty's approach through systems analysis is very supportive. The Faculty's experiences with Farming Systems Research and with Agroforestry reinforce this style of integration in new programmes.

7. Socioeconomic trade-offs must be faced in the development of sustainable agricultural systems; these trade-offs and methods of assess-

ing them must be conveyed to students. It is not always possible to both increase and sustain food production and income. For example among hill-tribe minorites in northern Thailand the Faculty's research shows that introduction of a market-based cash-shop system for income generation not always the best way for socioeconomic advancement. In these fragile ecosystems certain communities have developed subsistence systems, in these cases, introduction of only one or two marketable components such as coffee trees, can supplement the system for appropriate development.

8. Developing new Faculty programmes can proceed most efficiently, in terms of institutional learning through the sharing of experiences among institutions. The Faculty of Agriculture's collaborative research with other SUAN researchers on sustainable agricultural systems in Southeast Asia illustrates the research avenue for this exchange. Seminars and expert consultations that examine experience with curricula and teaching such as the recent consultation on Agroforestry curricula hosted by CMU and organized by FAO offers a second approach. Shortterm exchange of students and Faculty staff offer a third channel for exchange and development.

Acknowledge

Auther wish to express his gratitude and thanks to FAO Regional Office in Bangkok who supporting this study and consultation meeting at FAO Head Quater in ROME. And hope this study will be the convincing knowledge of the intregration of Environmental and Sustainable Development into Agriculture Educational and Extension Programme in any agricultural universities in the world.

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