NATURAL RESOURCE MANAGEMENT PROGRAM

The Natural Resource Management Programe was established in 1994 at the School of Bioresources and Technology to be responsible for graduate programmes, research and development. This was in response to the importance of natural resource develpment to the region, and the need to create an edcuational and research base that enables multidisciplinary. Due to differences in topography, and social/ cultural needs of different regions, exchanging knowledge on a research basis with local people will be also encouraged. Furthermore, the program emphasizes science and scientific understanding of the systems that we are trying to manage and the application of scientific concepts and technologies for problem solving and decision-making in order to use, conserve, and manage natural resources.

In line with the government policy to improve the relationship between Thailand and its neighbours, KMITT is willing to assist Thailand`s neighbours to develop human capabilities including training and technical exchange. To do this, the Natural Resource Management program is being conducted in English and will accept students from Indochina, ASEAN and other regional countries. Students will be encouraged to do work in which the research activities are motivated by problems in their countries to satisfy their country needs.

The Master's Degree Program consists of at least 25 credits of course work and at least 12 credits of thesis work. To complete the program, graduate students are required to take core courses, compulsory courses and to select elective(s) in related areas to enhance their knowledge within their field of interest. The research thesis will give students the opportunity to carry out research under the guidance of an advisor.

Selected research fields are as follows:

1. Agricultural Technology adaptation and rural development
2. Community resources management
3. Waste management
4. Ecology and Systematics

Master of Engineering Program in Natural Resource Management Master of Science Program in Natural Resource Management

CURRICULUM

Total program credits **37 credits**
Curriculum Component

A. Core Courses	10 credits
B. Compulsory Courses	9 credits
B. Elective Courses	6 credits
C. Thesis	12 credits

1. Core Courses 10 credits

NRM	601	Natural Resource Management	3(2-3)
NRM	691	Seminar	1(0-2)
NRM	692	Special problem	3(0-6)
JEE	613	Research Methodology	3(3-0)

2. Compulsory courses 9 credits

Students can select compulsory courses offered by the program with the consent of their advisors.

2.1 Ecology and Systematics

NRM	648	Ecological System	3(3-0)
NRM	694	Selected topics in Crop science and Forestry	3(3-0)

2.2 Sustainable Agriculture

NRM	623	Soil Management	3(3-0)
NRM	636	Crop and the Changing Environment	3(3-0)
NRM	697	Selected topics in Crop science and Forestry	3(3-0)

2.3 Community Resource Management

NRM	606	Community Resources Management	3(3-0)
NRM	671	Man and Social Science	3(3-0)
NRM	672	Integration of Social sciences, Science and Technology	3(3-0)
NRM	681	Science and Technology for Community Management	3(3-0)

3. Elective Courses 6 credits

Elective courses can be selected from the Natural Resources Management Division or related programs.

3.1 Natural Resource Administration, Policy and Law

NRM	602	Natural Resource Administration, Policy and Law	3(3-0)
NRM	603	Natural Resource Planning and Evaluation	3(3-0)
NRM	604	Economics of Natural Resource Management	3(2-3)
NRM	605	Economics of Land and Water Resource Management	3(3-0)
NRM	693	Selected Topics in Economics and Management	3(3-0)

3.2 Data and Information Technology

NRM	613	Introduction to Remote Sensing	3(2-3)
NRM	614	Introduction to Geographic Information System	3(2-3)
NRM	615	Digital Analysis of Remote Sensed Data	3(2-3)
NRM	616	Data Based and Information System	3(2-3)

NRM	617	Application of Remote Sensing in NRM	3(2-3)
NRM	694	Selected Topics in Data and Information Technology	3(2-3)

3.3 Agricultural Resources, Soil and Water

NRM	622	Soil Classification and Land Use	3(3-0)
NRM	623	Soil Management I	3(2-3)
NRM	624	Soil Management II	3(3-0)
NRM	625	Land Resource Management	3(2-3)
NRM	626	Waster Resource Management and Hydrology	3(2-3)
NRM	695	Selected Topics in Soil and Water Management	3(3-0)

3.4 Crop and Forestry

NRM	635	Crop Ecology	3(3-0)
NRM	636	Crop and the Changing Environment	3(2-3)
NRM	637	Sustainable Agriculture	3(3-0)
NRM	638	Integrated Pest Management	3(2-3)
NRM	639	Agroforestry and Management	3(2-3)
NRM	645	Forest Management	3(3-0)
NRM	648	Ecological Systems	3(3-0)
NRM	697	Selected Topics in Crop Science and Forestry	3(3-0)

3.5 Environmental Science

EV	520	Wastewater treatment	3(3-0)
EV	621	Water Quality	3(3-0)
EV	623	Advanced Wastewater Treatment	3(3-0)
EV	632	Treatment and Utilization of Solid Waste	3(3-0)
EV	635	Waste Minimization and Clean Technology	3(3-0)
EV	641	Environmental Impact & Assessment	3(3-0)
EV	642	Environmental Quality Management	3(3-0)

3.6 System Analysis and Operations Research

NRM	667	Agriculture Systems Analysis and Design	3(3-0)
NRM	668	Operations Research for Resource Management	3(3-0)

3.7 Biotechnology Science

BIT	611	Biodeterioration and Biodegradation	3(3-0)
BIT	641	Treatment and Utilization of Biological Waste	3(3-0)

4. Thesis — 12 credits

NRM	699	Thesis	12(0-24)

STUDY PLAN

◆ First Year
First Semester

NRM	601	Natural Resource Management	3(2-3)
JEE	613	Research Methodology	3(3-0)
XXX	XXX	Elective	3(x-x)
XXX	XXX	Elective	3(x-x)
		Total	**12 (5+x-3+x)**

Second Semester

NRM	691	Seminar	1(0-2)
NRM	692	Special problem	3(0-6)
XXX	XXX	Elective	3(x-x)
XXX	XXX	Elective	3(x-x)
		Total	**10 (x-8+x)**

◆ Second Year
First Semester

NRM	699	Thesis	6(0-12)
XXX	XXX	Elective	3(x-x)
		Total	**9 (x-12+x)**

Second Semester

NRM	699	Thesis	6(0-12)
		Total	**6 (0-12)**

COURSE DESCRIPTIONS

NRM 601 Natural Resources Management 3 (2-3)
Prerequisite: none
Major issues and methods used in the study of the earth's environment integrated concepts from many disciplines (such as natural resource conservation, ecology, economics, law, geography, philosophy, as well as others) for natural resource management problems from Thailand as well as other countries. Current conservation and management policies enacted in Thailand, their effectiveness, and possible improvements to these policies. Case studies and excursion.

NRM 602 Natural Resource Administration, Policy and Law 3 (3-0)
Prerequisite : none
Constitutional, legal and administrative framework for resource development. Resource law; concepts and problem in resource development, management and conservation. International resource issues.
Sustainable development paradigm, policy component of sustainable development, integrated planning for resource management and regional economic development.
Planning policy in relation to good specification and decision making.
National and local administration for water, forest and land resources. Natural resource administration and social dimension; cultural and social perception of natural resources; administrative, legal, economic and social environment.

NRM 603 Natural Resource Planning and Evaluation 3 (3-0)
Prerequisite : none
Concepts in resource planning and management. Emphasized on the management of renewable natural resources and the agricultural development process. Systems approach to planning, design and management. Problem formulation, data requirements, resource inventory parameter identification. Land evaluation and land use planning. Water resource planning and evaluation. Identification and evaluation of alternatives. Environmental impact assessment and risk analysis. Case studies in comprehensive, multiple resource public planning and single resource private planning.

NRM 604 Economics of Natural Resource Management 3 (2-3)
Prerequisite : none
Principles and concept of economics, scarcity, choices, trade-off and resource allocation. The allocation of renewable resource flows. Demand and supply and the role of prices. Theories of consumers and producers. Economic efficiency and welfare. Cost and benefit analysis. Ecological economic including systematic approaches, depletion of renewable natural resources and the mechanism of discounting. Property right and problems of resources and environment depletion. Relationship between man and use of natural resources and environment systems. Application of economic principle to resource allocation and utilization. Analyzing natural resource problems and policies to improve economic efficiency and equality. Case studies and excursion.

NRM 605 Economics of Land and Water Resource Management 3 (3-0)
Prerequisite : NRM 604 Economics of Natural Resource Management or consent of the instructor
Description of various characteristics and alternative uses of land and water resources. Concepts of resource evaluation, market and non-market pricing, optimization and public/private resource management. Institutional aspects of land and water resources in the context of ownership, tenureship and implication for efficient and equitable use. Analysis of population growth, technology and development on the quantity, quality and supply of land and water resources.

The inter-relationship between land/water resources, human populations and agricultural systems in the light of alternative development. Field trip.

NRM 606 Community resource Management 3 (2-9)
Prerequisite: none
This subject provides understanding of the concepts of natural resources and environmental management at the local community level. Learning how to connect with and the principles of understanding a local community such as conducting a public hearing, or community action plan. Student can study the way of life, as well as local or folk knowledge of natural resources management. This will also guide them as to how to develop projects that could be investigated in the community as well as guiding the community to be utilized as a "community lab" for further research. It would also guide students and local people to select and develop appropriate technologies for these communities.

NRM 613 Introduction to Remote Sensing 3 (2-3)
Prerequisite: none
Principles and techniques used in remote sensing, the earth observation satellites and the sensors, data used in remote sensing, image interpretation and image processing. An overview of the application of remotely sensed data to provide current information for natural resource management in Thailand and this region. Lab based and hands on.

NRM 614 Introduction to Geographic Information Systems (GIS) 3 (2-3)
Prerequisite : none
Fundamental principles of GIS. Application of GIS in natural resources management. Emphasized on Lab-based and “hands on”. Discuss papers from international journals.

NRM 615 Digital Analysis of Remotely Sensed Data 3 (2-3)
Prerequisite : NRM 611 Introduction to Remote Sensing
Fundamental principles and techniques of digital image processing; using computer to enhance information from remotely sensed images, especially multispectral scanner data. Both image enhancement and classification covered in some details including basic background on computer hardware and software concepts. Laboratory work covers computer familiarization and image analysis exercises using a variety of different computer systems.

NRM 616 Data Base and Information Systems 3 (2-3)
Prerequisite : Consent of the instructor
Information systems and data base concepts, information output formats, flowchart, data base architecture and structure, inductor systems analysis, fundamental principles and use of Geographic Information System (GIS), computer assisted cartography and microcomputer technology, capabilities, application and use of GIS for resource management. First-hand experience gained through practice on a simple grid-based GIS.

NRM 617 Application of Remote Sensing in NRM 3 (2-3)
Prerequisite: NRM 611 Introduction to Remote Sensing
An introduction to the interpretation of remote sensing data and applications to natural resources. Course topics include a discussion of types of remote sensing data and product displays, the advantages and limitations of data types, and techniques of data interpretation for various natural resources problems. Application of aerospace digital remotely sensed data to provide current information for management and basic spectral response and ground measurement research to develop and validate concepts for potential use in aerospace remote sensing. Emphasis is based on geographic inventory and environmental monitoring. Application of remotely sensed data to natural resource.

NRM 622 Soil Classification and Land Use 3 (3-0)
Prerequisite : none
Genesis, morphology and classification of soil. Nature and properties of tropical soils. How soil properties affect their use, management and conservation. Land classification for various purposes. Use of soil data and interpretation in land use and environmental decision.

NRM 623 Soil Management I 3 (2-3)
Prerequisite : Consent of the instructor
Soil formation, soil characterization, soil survey interpretations and land use planning. Nutrients for plant growth and fertilizer management. Some problems of land use in Thailand such as soil pollution and saline soil and their management. New techniques for soil monitoring. For example molecular and recombinant DNA techniques. Case studies focusing on current problems of soil in Thailand as well as soil monitoring.

NRM 624 Soil Management II 3 (3-0)
Prerequisite : Consent of the instructor
Soil dynamics : energy and movement of water in soils, soil water balance, irrigation and drainage, principles and practice.
Trillage and soil compaction. Soil mechanical properties, interaction of soil with tillage implements and wheels. Mechanical amelioration of degraded soils, soil structure measurements. Surface flow and erosion. Measurement of soil water and run-off. Universal soil loss evaluation. Methods of erosion control and conservation, wind and water erosion, causes and effects, control and reclamation. Managing soil to maintain or increase crop productivity while minimizing soil loss from wind and water erosion. Excursion.

NRM 625 Land Resource Management 3 (2-3)
Prerequisite : none
Land evaluation. Use and problems of land resource. Approaches to soil, water crop and mineral resource management. Integrated approach to land management. Policy and project management related to land resource, utilization ways to solve the environmental problems of land resources. Case studies and field trip.

NRM 626 Water Resource Management and Hydrology 3 (2-3)
Prerequisite : none
Science and management of water resources; quantitative approach to hydrological cycle and introduction to the problems of water use and management. Transfer of water within the hydrological cycle including both surface and groundwater hydrology. Water quality focuses on physical, chemical, microbiological and biological properties of water and wastewater. Water and wastewater Treatment. Water quality index. Utilization of wastewater. Waste minimization. Case studies focusing on water resource management, wastewater utilization and waste minimization in food industry.

NRM 635 Crop Ecology 3 (3-0)
Prerequisite : Consent of the instructor
Concepts and factors affecting adaptation and distribution of crop plants and ecosystems. Microclimate and crop response to environmental factors with modifications of microclimate by agricultural operations. Interactions among crop plants and between weeds and crop plants under field conditions.

NRM 636 Crop and the Changing Environment 3 (2-3)
Prerequisite : Consent of the instructor
The basis of current and future changes in the climate and atmosphere. Implication of environmental change for crops: mechanism which plants respond and adapt to their environment including carbon dioxide, ultraviolet-visible infrared radiation, water, temperature, air pollution and mineral nutrition. Monitoring and analysis of crop microclimate. Case studies and excursion.

NRM 637 Sustainable Agriculture 3 (3-0)
Prerequisite : Consent of the instructor
Basic agricultural crop production including cultural practices, postharvest handling, marketing, and utilization of high potential crops. Crop protection using biological control and natural substances. Decrease the chemical usage in agricultural sectors involved in both fertilizer and pesticide. Develop no tillage production, multiple cropping systems, natural agriculture, and soil and water conservation for better environmental conditions. Applied agricultural sustainable techniques suitable for agriculture in Thailand.

NRM 638 Integrated Pest Management 3 (2-3)
Prerequisite : Consent of the instructor
Nature and scope of pest problems, identification and biology of pest. Study of pest management based on the interaction of pest biology and ecology data with cultural, physiological and pesticidal control. Pesticide toxicity and selectivity. Case studies and excursion.

NRM 639 Agroforestry and Management 3 (2-3)
Prerequisites : Consent of the instructor
Relationship and Interaction among plants especially crops, soil, and geographical climate. Landuse Management system. Factors related to combining agricultural crops management with forestry and wildlife management. Evolution of wildlife and plant communities, including economics crops. Eco-physiological interaction among plant community. Environmental impact of agricultural system. Landuse management for maximum benefit with regard to ecological factor, socio - economical factor, and soil maintenance using techniques of land preparation and combined crops schemes accordingly. Case studies and excursion.

NRM 645 Forest Management 3 (3-0)
Prerequisites : Consent of the instructor
Forest planning; the rational planning process applied to single and multiple use management of forest. Forest models for predicting and regulating forest production and generating management options. Application of operations research to forest management problems.
Plantation management; maintenance of long-team productivity under intensive forest cropping. Cost and benefits of particular initial escapement and pruning as silvilcultural options. Stand management regimes; selecting thinning and felling regimes to suit local conditions. Non-merchantable and merchantable thinning, the length of the rotation, the use of models to aid decision-making. Factors of the environment influencing silvilcultural practice; pests, erosion control, and particularly wind. Forest administration; aspects of personal and organization management. Forest management in developing countries; special problem and community forest.

NRM 648 Ecological Systems 3 (3-0)
Prerequisite : none
Overview of ecological systems. The function of ecological systems with particular emphasis on ecological sampling and analysis of ecological data. Field and indoors Labs. Read and discuss papers form international journals, emphasizing understanding and the enhancement of critical thinking skills.

NRM 667 Agricultural Systems Analysis and Design 3 (3-0)
Prerequisite : MTH 574 Operations Research
Application of system analysis to agricultural and biologically related problems; computer modeling and use of operations research methods.

NRM 668 Operations Research for Resource Management 3 (3-0)
Prerequisite : MTH 574 Operations Research
MTH 371 Statistic, MTH 572 Statistical analysis
or consent of the instructor
Concepts and problems of operations research for resource management. Production and inventory system. Input-output analysis, stimulation technique for economic application, linear programming, simple method, integer programming, dynamic programming, critical path method analysis, Queuing theory. Use of game theory in planning and decision-making of natural resource management for non-marketing system. Methods of assessment and decision-making under risk and uncertainty.

NRM 671 Man and Society 3(2-9)
Prerequisite : none
This course will focus on the principles of social science focusing on behavior and participation both at the local and national levels, analyzing local people's opinions about managing their resources, factors that influence their participation in their community, culture, tradition, religion & faith, and local knowledge concerning community resources management.

NRM 672 Integration of Social Sciences, Science and Technology 1 (0-2)
Prerequisite : none
The course will introduce the concept of socioeconomic issues concerning resources management, e.g. human ecology, cultural geography, diversity of social systems and cultures both temporally and spatially, behavior and participation of people both at the micro and macro scale; and factors that influence participation at the community level. This will also provide methods of how to analyze the relationships between cultural-social and economic as well as the effect of technology on development both at local and national levels. Students will learn how to manage and build up the potential of natural resources by using science & technology. They can also learn how to predict the future trend which both threaten and give opportunities to local communities by reviewing case studies and the literature.

NRM 681 Science and Technology for Community Management 3 (2-9)
Prerequisite : none
To provide principles of science and technology concerning natural resources management such as genetics, nano-technology, environmental technology, energy resources technology, agricultural and industrial technology. Students will learn to review and analyze scientific reports and articles, as well as other phenomena by using scientific concepts to increase their knowledge and understanding of science and technology, which are important for resources management, and for understanding the thought processes used in the development of science and technology.

NRM 691 Seminar 1 (0-2)
Prerequisite : none
Preparation, presentation and discussion of the selected topics of interest literature, techniques and research pertaining to natural resource and environment.

NRM 692 Special Problems 3 (0-6)
Prerequisite : Consent of the advisor or graduate committee
Individual student research and study related to the technology development and technology adaptation for natural resource management. Natural resource problem from Thailand as well as other countries. Planning of natural resources. Tropical ecosystems emphasized on relationship between plants and microorganisms as well as the effect of environmental factors and human activities on the changing of ecosystem. Biodiversity. Pest management water and soil management. Otherwise topics which depended on the direction of school or division.

NRM 693 Selected Topic in Economic and Management 3 (3-0)
Prerequisite : Approval of department
Discussion and lectures on special issues of economic management. Check departmental announcement for topics offered any given semester or contact instructor for information.

NRM 694 Selected Topics in Data and Information Technology 3 (3-0)
Prerequisite : Approval of department
Discussion and lectures on special aspects or advanced topics of current interest in data and information technology. Check departmental announcement for topics offered any given semester or contact instructor for information.

NRM 695 Selected Topics in Soil and Water Management 3 (3-0)
Prerequisite : Approval of department
Discussion and lectures on special aspects or advanced topics of current interest in soil and water management, and management technology. Check departmental announcement for topics offered any given semester or contact instructor for information.

NRM 697 Selected Topics in Crop Science and Forestry 3 (3-0)
Prerequisite : Approval of department
Discussion and lectures on special aspects or advanced topics of current interest in crop science or forestry. Check departmental announcement for topics offered any given semester or contact instructor for information.

NRM 699 Thesis 12 (0-24)
Prerequisite : none
Experimental Research to generate technologies or synthesize technologies that can be applied to manage our local natural resources for conservation and sustainable country development Otherwise experimental research which depended on the direction of school or division.

BIT 611 Biodeterioration and Biodegradation 3 (3-0)
Prerequisite : none
Biodeterioration and materials, their causes, effects and prevention. The activity of different organisms in the decay of a wide range of organic and inorganic materials including metals. Organisms for biodeterioration testing, the techniques used in assessing the extent and cause of deterioration. Biodeterioration of timber in aquatic environments, petroleum products, synthetic polymers, tobacco and rubber in contact with water and sewage. Methods for testing wrapping and coatings for susceptibility to microbial attack. The microbial spoilage of pharmaceutical products, the detection of microorganism. The microbial degradation of preservatives and antimicrobial agents. Product resistance to microbial attack, the microbial breakdowns for pesticides. Structural factors influencing biodegradability.

BIT 641 Treatment and Utilization of Biological waste 3 (3-0)
Prerequisite : none
Parameters of water pollution. Ecology of waste disposal. Treatment and use of water in food processing and other biological industries. Generation of solid wastes, sources, types and composition. Onsite handling, storage and processing. Collection systems, equipment, transfer and transport. Processing techniques and equipment. Volume and size reduction. Component separation. Drying and denaturing. Disposal of solid waste and residual matter. Site selection. Landfilling methods and operation. Design of landfills. Process in waste utilization. Recovery of resources, chemical and biological conversion products. Recovery of energy from conversion products. Future of waste utilization.

EV 520 Wastewater Treatment 3 (3-0)
Prerequisite : none
Properties, structures and functions of bacteria, algae, fungi and protozoa. Growth and metabolism of microbes. Sterilization and analysis of water quality. Activated sludge process. Sludge drying bed. Anaerobic digestion. Planning, feasibility assessment and site selection for water treatment by natural processes. Basic process responses and interactions. Fundamentals of waste water treatment by natural processes such as stabilization ponds, land treatment systems, wastewater reuse, etc.

EV 621 Water Quality 3 (3-0)
Prerequisite : none
Physical, chemical and biological properties of water and wastewater. Pollutants and their effects upon ecosystems. Various methods of treatment. Water quality criteria and uses. Analytical techniques.

EV 623 Advanced Wastewater Treatment 3 (3-0)
Prerequisite : none
Chemical constituents and their effects in wastewater. Nitrogen and phosphorus removal. Design criteria of biological process. Design of removal processes of refractory organics, dissolved inorganic substances; carbon adsorption, ion exchange, ultrafiltration, electrodialysis. Utilization of disposal of concentrated contaminants resulting from advanced wastewater treatment.

EV 631 Hazardous Materials & Safe Disposal of Hazardous Wastes 3 (3-0)
Prerequisite : none
Basic principles of hazardous materials, atomic structure and chemical reactivity, combustion mechanisms of reactive materials, gas law governing temperature, pressure, and volume, behavior of compressed and cryogenic gases, explosive mechanism, shock waves, toxicity of materials, corrosive materials, radioactive materials.

EV 635 Waste Minimization and Clean Technology 3 (3-0)
Prerequisite : none
Introduction of sustainable waste management aims at pollution prevention through waste minimization. Waste minimization techniques focus on using clean technology in production processes cleaner and recycling. Waste management strategy, waste monitoring and characterization, process formulations, reuse of waste and cleaner technologies for selected sectors to minimize waste generation. Case study of some interesting industries such as chemical and food industries.

EV 641 Environmental Impact & Assessment 3 (3-0)
Prerequisite : none
Various elements of environmental impact statements and environmental impact assessment of air, water, noise, biological, culture resources, socio-economic and other relevant projects. Systems approach to energy and environment. Analytical tools and techniques and their applications on the environmental impact measurement of various projects both beneficial and adverse are discussed. Case studies.

EV 642 Environmental Quality Management 3 (3-0)
Prerequisite : none
Setting of environmental standards, data management and translation to standards. Procedure and methodology of environmental impact assessment. Planning of measurement and environmental quality, monitoring, establishment and organization of control agencies. Industrialization and urbanization management, resource conservation.

JEE 613 Research Methodology
Prerequisite : none
Introduction to modern data acquisition. Research project management and analysis. Theories and practices of various experimental techniques necessary for research including physical and chemical methods of analysis. Concepts in resource planning and management. System approach to planning, design and management. Problem formulation and data requirements. Identification and evaluation of alternatives. The course will not attempt to give the particular techniques needed in special subject areas because these techniques will be different for each student, and they will be given by other parties or divisions of JGSEE.