Co-funded by the Erasmus+ Programme of the European Union

Forest Restoration Research Unit (FORRU) No _____/.....

Chiang Mai University, Chiang Mai, Thailand Chiang Mai, Thailand

Date ___8_/_3__/_22__

Course Syllabus

1 Program

Title of the study programme: Master of Science in Biology, and Master of Science in Environmental Science

2 Course details

Course name: Forest Restoration Science and Research

Course code: BIOL 202877

Number of credits (hours/week): 3 (Lecture: 2 hours/week, Laboratory: 3 hours/week)

Course type (tick the appropriate box): ☐ Required, ☒ Elective, ☐ Other, if other please explain:

Prerequisites courses: 213323 (Fundamental Ecosystem Restoration) or instructor's consent

Semester, in which the course is taught: *tick the appropriate box below*

Year 1		Year 2	
Semester 1	**Semester 2**	**Semester 1**	**Semester 2**
☒	☐	☒	☐

3 Responsible unit

3.1 Department: Biology Department, Faculty of Science

Names and affiliations of lecturer(s):

Staff members of the Biology Department, as follows:

1) Asst. Prof. Dr. Pimonrat Tiansawat

2) Dr. Watit Khokthong

3) Assoc. Prof. Dr. Stephen Elliott

4 Course description

This course is aimed at graduate students planning to perform scientific research for their dissertation on restoration-related topics. It provides such students with the skills needed to design, execute, analyse and interpret the results of scientific research to develop effective techniques to restore tropical forest ecosystems. It assists students to develop research proposals within a framework of current restoration concepts: reference ecosystems, restoration site positioning among other landscape components (forest landscape restoration, FLR), and matching restoration approach to degradation level. The rest of the course deals with learning research skills specific to forest ecosystem restoration: from phenology studies in reference forest, to nursery experiments and field trials. Field sessions contrast conventional ground survey techniques with aerial surveys by drone. Computer lab sessions teach students how to analyse both numerical data and drone imagery to plan restoration and assess its ecological outcomes whilst also considering its socio-economic impact.

5 Course objectives

Knowledge: forest restoration principles , best practices and implications

Skills: experimental design, execution, drone piloting, analysis of both numerical data and drone imagery, GIS mapping

Application of theories to practice: using scientific methods to compile effective restoration strategies and protocols

Social knowledge and skills: analysis of the socio-economic impact of restoration

5.1 Learning objectives of particular modules

If the course is divided into sections or modules, please state the learning objectives for the specific sections/modules taught within the course

6 Course teaching methods

Specify teaching methods used throughout the course

6.1 Lectures – PowerPoints, interactive discussions, and follow-up home assignments. Home assignments will familiarize students with the many online tools now available for assisting with restoration research, such as plant databases, online satellite imagery (Google Earth), forest fire monitoring etc. and FORRU-CMU's own web-based resources.

6.2 Labs – hands-on data collection, hands-on skills learning, drone piloting and drone-based monitoring, computerized data and image analysis.

7 Teaching plan

Specify the teaching plan for each week of the course, including the methods used to relay information to the students and the number of hours spent on the subjects

Lectures = 30 hours

Week	Content	Method/activity	Hours
1	Principle concepts of restoration ecology, with specific reference to tropical forest ecosystems	Lectures	2
2	Understanding the reference-forest concept and using it to define restoration objectives, both ecological and socio-economic. Working with international guidelines.	Lectures	2
3-4	Restoration-site selection: positioning and FLR. How to implement and analyse rapid site assessments and collaborative costing.	Lectures, follow-up home **assignment**	4
5-6	Methods for restoring forest ecosystems - protection, natural regeneration, tree planting and dealing with soil degradation.	Lectures	4
7-8	Research in the reference forest ecosystem: phenology and quantifying restoration goals in terms of biomass, structural complexity, biodiversity and ecological functioning.	Lecture, follow-up home **assignment**	4
9-10	Research in the nursery: experimental design and execution: germination trials and seedling growth experiments, testing treatments and comparing	Lectures	4

	species. Randomized complete-block design (RCBD) and analysis of variance (ANOVA).		
11-12	Research in restoration sites: replication, controls. Comparing tree species and silvicultural treatments; tree planting vs aerial or direct seeding. RCBD and ANOVA.	Lecture, follow-up home **assignment**	4
13	Monitoring recovery of carbon and biodiversity	Lecture	2
14	Compiling and utilizing research results: species selection and restoration planning	Lecture, follow-up home **assignment**	2
15	Analysing the socio-economic impact of restoration	Lecture	2

Labs = 45 hours

Week	Content	Method/activity	Hours
1	Phenology data collection - finding seed trees by drone	Demo and hands-on data collection skills in reference forest ecosystem	3
2	Phenology data analysis - constructing species pheno-profiles and analysing them for optimum seed collection time	Demo and hands-on data analysis in computer lab. Lab **report**: phenology	3
3-4	Setting up nursery experiments - germination trials and seedling growth experiments - applying treatments, data collection.	Demo and hands-on research work in a tree nursery. Lab **report**: nursery experiments	6
5-7	Rapid site assessment (RSA) - ground survey and drone survey **Mid-term exam**	Ground/drone surveys at sites varying in degradation levels	9
8	Analysis of RSA data - ground surveys and drone image analysis	Demo and hands-on data analysis in computer lab. Lab **report**: RSA	3
9-12	Monitoring of species performance and the effects of silvicultural treatments - by ground and drone surveys	Ground/drone surveys at restoration sites of various ages	12
13	Analysing field data - numerical and drone imagery	Demo and hands-on data analysis in computer lab.	3

14-15	Monitoring birds and mammals as biodiversity indicators - McKinnon's curves and camera traps	Bird data collection - demo of camera traps. Lab **report**: restoration monitoring	6

8 Material needs

8.1 Course equipment: *link to equipment needs/purchases as part of the project*

Drones, tablets, notebook computers, desktop computers, photogrammetry software, handheld-GPS

9 References

9.1 Compulsory reading list

The Forest Restoration Research Unit, 2008. Research for Restoring Tropical Forest Ecosystems: A Practical Guide. Chiang Mai University, Forest Restoration Research Unit, Thailand. 144 pp.

Elliott S., G, Gale & M. Robertson (Eds), 2020. Automated Forest Restoration: Could Robots Revive Rain Forests?

Lamb, D., 2011. Regreening the Bare Hills: Tropical Forest Restoration in the Asia-Pacific Region. World Forests, Volume 8, Springer, 2011. Hardcover, 547 pp. ISBN: 9789048198702.

Weblink: Global Forest Watch — https://www.globalforestwatch.org/

9.2 Suggested reading list

Blakesley, D., K. Hardwick, and S. Elliott, 2002. Research needs for restoring tropical forests in Southeast Asia for wildlife conservation: framework species selection and seed propagation. New Forests 24 (3): 165-174.

Elliott, S., J. Kerby, D. Blakesley, K. Hardwick, K. Woods & V. Anusarnsunthorn (Eds), 2000. Forest Restoration for Wildlife Conservation. International Tropical Timber Organization and the Forest Restoration Research Unit, Chiang Mai University. 440 pp.

Elliott, S., C. Kuaraksa, P. Tunjai, T. Toktang, K. Boonsai, S. Sangkum, S. Suwanaratanna & D. Blakesley, 2012. Integrating scientific research with community needs to restore a forest landscape in northern Thailand: a case study of Ban Mae Sa Mai. Pp 149-152 in Stanturf, J., P. Madsen & D. Lamb (Eds), A Goal-Oriented Approach to Forest Landscape Restoration, Springer. DOI 10.1007/978-94-007-5338-9_7

Elliott, S. D., Blakesley, D., & Hardwick, K, 2013. Restoring Tropical Forests: a practical guide. Royal Botanic Gardens, Kew.

Hardwick, K., J. R. Healey, S. Elliott & D. Blakesley, 2004. Research needs for restoring tropical forests in Southeast Asia for wildlife conservation: accelerated natural regeneration. New Forests 27 (3): 285-302.

10 Assessment of students

10.1 Description of assessment

Objectives	Assessments
1. Demonstrate understand of restoration research concepts	Two examinations (50%) (mid-term 25%, final 25%, based on lectures and labs)
2. Application of knowledge to research design and implementation	Lab reports: 4x 10% each. Term paper 10% (research plan).

10.2 Grade distribution and student assessment

Grading scale

Grade		Total score	Scale
Symbol	Verbal grade		
A	Excellent	80-100	4.00
B+	Very good	75-79	3.50
B	Good	70-74	3.00
C+	Fairly good	65-69	2.50
C	Fair	60-64	2.00
D+	Poor	55-59	1.50
D	Very poor	50-54	1.00
F	Failed	<50	0.00

Place, Date ...../...../.....