

Chiang Mai University

No _____/.....

Chiang Mai, Date 30/Dec/2021

Course Syllabus

1 Program

Title of the study programme: Environmental Science Program and CMU School of Lifelong Education

2 Course details

Course name: Fundamental Ecosystem Restoration

Course code: 213323

Number of credits (hours/week): 3 h per week workload comprises of online lectures and self-study materials. Optional field course (5 days).

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

Prerequisites courses: None

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

Year 1		Year 2	
Semester 1	Semester 2	Semester 1	Semester 2
<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>

3 Responsible unit

3.1 Department: Environmental Science Research Center

Names and affiliations of lecturer(s): Prasit Wangpakapattanawong, Alice Sharp, Dia Shannon, Sutthathorn Chiaruang斯里, Watit Khoktong and Stephen Elliott (All CMU)

4 Course description

This course provides a general introduction to the principles and practices of tropical forest ecosystem restoration, including modern techniques such as the use of drones and online tools. It is aimed at stakeholders involved in developing or implementing restoration projects (e.g., forest officers, NGO staff, community leaders etc.). Participants, who subsequently enrol at CMU, will have the option to transfer credits to their degree program.

The course opens with consideration of the recent upsurge in demand for forest ecosystem restoration and the political and technological needs required to meet expectations. Next, the importance of reference forests is established. The problem of deforestation is defined, along with the values of restoration, as incentives for stakeholders. Core ecological theories—succession, forest dynamics etc. are presented, as the basis for matching appropriate restoration strategies with degradation levels and harnessing natural regenerative mechanisms. This is followed by an in-depth explanation of best practices for all sequential restoration tasks, from seed collection and growing planting stock, to tree planting and maintenance, followed by practical techniques for monitoring biomass, forest structure, biodiversity and ecological functioning. The course concludes by considering broader issues including the socio-economic impacts of restoration,

5 Course objectives

To provide students with basic knowledge and the latest practical skills, needed to implement new forest restoration projects or improve existing ones.

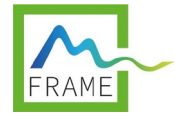
Knowledge: distinctive features of forest types, practical knowledge of forest restoration tasks, ecological succession and forest dynamics, drivers of deforestation, local and global impacts of forest degradation

Skills: identification of deforestation drivers, seed collection & storage, nursery operations, tree planting, maintenance and monitoring tree performance and biodiversity recovery,

Application of theories to practice: planning restoration activities with communities, identifying and developing incentives for restoration, quantifying the socio-economic and environmental benefits of forest restoration

6 Course teaching methods

This open course provides a series of integrated online lectures designed to have the widest possible reach for remote-learners from various backgrounds. It may also be used as an entry-level course by prospective CMU students. The course consists of 2 x 15-20 min online recorded lectures per week for 15 weeks (one semester), with recommended reading materials, homework (self-learning) assignments, and live Q/A sessions every alternate week. The course is designed for learners with different needs as follows.



- **MOOC-Certificate:** A prospective learner who completes all the online lectures, self-study activities, online quizzes, and the term-end assignment with an accumulated score higher than 70 % shall receive a certificate of completion. Study at this level is free of charge.
- **Short Course-Certificate:** For learners who can come to Chiang Mai, an optional 5-day field course is offered at the end of the course, to provide hands-on experience of the practices explained during the course. A registration fee may be applied to cover materials and transport during the field course. Short-course certificates will be awarded to those who score 70% or higher at the end of the field course.
- **Accreditation:** This is for learners who score 70% or higher in the online and field course evaluations and who want to transfer credits to a degree program. An additional fee for accreditation will be applied. Accredited learners will receive a CMU official transcript issued by the registrar. The credit acquired will be stored in the learner’s credit bank.

The platform for online lectures: All recorded lectures and quizzes will be available via CMU School of Lifelong Education (CMU-LE). Prospective learners shall register with the CMU-LE system and enroll for the MOOC course. CMU-LE platform can be accessed at www2.lifelong.cmu.ac.th/, where learners can create a CMU-LE learner’s account and have access to a variety of courses.

Self-study teaching materials: A list of self-study reading materials will be provided after each week's lecture. In addition, 5 activities are included, to acquaint learners with various online restoration tools. Proof of activity completion shall contribute towards the final score.

Modes of communication: Once registered for this course, learners will be contacted via the email provided. Modes of communication will include a LINE Group (for discussion of course materials among learners and lecturers). Activity and assignment reports shall be submitted via email. Live Q/A sessions will be offered periodically via Zoom.

7 Teaching plan

Week	Content	Method/ activity	Time
1	Defining forest ecosystem restoration. The growing global demand for forest ecosystem restoration—climate change and species extinctions. The roles of science and politics.	Online lecture, home study	3h
2	The future of forest restoration - the need for new technologies, policies and programs	"	3h
3	The socio-economic drivers of deforestation and forest degradation and the value of forest recovery – stakeholder involvement. Online tools to track deforestation and forest fires. ACTIVITY: Use Global Forest Watch mapping tool to assess local deforestation.	"	3h
4	Ecological succession—as the theoretical basis for ecosystem restoration.	"	3h
5	Defining goals and locating seed sources—using local forests as reference ecosystems.		3h



Week	Content	Method/ activity	Time
6	Matching interventions with degradation stage — protection, ANR, the framework species and maximum diversity methods, soil amelioration and nurse plantations.	"	3h
7	Site condition determination and landscape-scale considerations (FLR) - using drones to determine forest degradation levels. ACTIVITY: Learn how to recognize restoration opportunities with ROAM.	"	3h
8	The role of phenology, propagule morphology, dispersal and predation	"	3h
9	Tree species selection - use of online aids. ACTIVITY: use an online species selection tool (e.g. D4R). TERM ASSIGNMENT PREP: how to write a restoration plan	"	3h
10	Seed collection and storage – seed banking. Locating seed trees by drone.	"	3h
11	Tree-nursery planning, establishment, practices and production scheduling	"	3h
12	Tree planting, direct seeding, drone-seeding and tree maintenance. ACTIVITY: Explore commercial drone seeding.	"	3h
13	Recovery of biomass, carbon and structural complexity – ground and drone-based survey techniques	"	3h
14	Recovery of indicator species and ecological functioning – camera trapping and bird surveys (McKinnon’s method)	"	3h
15	Socio-economic impact – engaging stakeholders, monetizing forest values, governance and human rights. ACTIVITY: Use restor.eco to register your restoration plots and network	"	3h
			45h
<i>Optional Field Course</i>			
16	Forest-reference Forest structure, recognizing framework tree species, phenology monitoring, seed collection	<i>Field trip</i>	1 day
16	Nursery - seed banking, fruit/seed morphology, seed pre-treatments, germination and dormancy, potting, care and grading, production schedules	<i>Hands-on nursery work</i>	1 day
16	Restoration sites (1) - preparation and planting: rapid site surveys (ground and drone surveys), tree planting, ANR, direct seeding, maintenance techniques	<i>Hands-on field tasks</i>	1 day
16	Restoration sites (2) - monitoring forest recovery (ground and drone surveys), bird and plant communities, and carbon accumulation.	<i>Hands-on field tasks</i>	1 day
16	Classroom - data processing and restoration planning: processing drone imagery, McKinnon's curves (bird diversity) and calculating carbon accumulation. Coaching individual forest restoration plans. Practical Exam	<i>Guided data analysis. Individual/group coaching.</i>	1 day
			5 days

8 Material needs

8.1 Course equipment: AV equipment for online course and drones (for optional short field course)

9 Reading

9.1 Course textbooks

Elliott, S.D., D. Blakesley & K. Hardwick, 2013. Restoring Tropical Forests: a Practical Guide. Royal Botanic Gardens, Kew; 344 pp. (particularly Chapters 3 and 5)
www.forru.org/library/0000152

Elliott, S., S. Chairuang Sri, C. Kuaraksa, S. Sangkum, K. Sinhaseni, D. Shannon, P. Nippanon & B. Manohan. 2019. Collaboration and conflict - developing forest restoration techniques for northern Thailand's upper watersheds whilst meeting the needs of science and communities. *Forests* 10(9): 732; (doi.org/10.3390/f10090732)

Di Sacco, A., K. Hardwick, D. Blakesley, P.H.S. Brancalion, E. Breman, L.C. Rebola, S. Chomba, K. Dixon, S. Elliott, G. Ruyonga, K. Shaw, P. Smith, R.J. Smith & A. Antonelli, 2021. Ten guidelines for tree planting initiatives to optimise carbon sequestration, biodiversity recovery and livelihood benefits. *Global Change Biology* 27:1328-1348. (doi.org/10.1111/gcb.15498)

9.2 Other recommended reading

Elliott, S., G. Gale & M. Robertson (Eds), 2020. Automated Forest Restoration: Could Robots Revive Rain Forests? FORRU-CMU, Chiang Mai Thailand, 2015, 254 pp.
www.forru.org/library/0000099

Elliott, S., P. Navakitbumrung, C. Kuarak, S. Zangkum, V. Anusarnsunthorn & D. Blakesley, 2003. Selecting framework tree species for restoring seasonally dry tropical forests in northern Thailand based on field performance. *Forest Ecology & Management* 184: 177-191
www.forru.org/library/0000056

Elliott, S. & C. Kuaraksa, 2008. Producing Framework Tree Species for Restoring Forest Ecosystems in Northern Thailand. *Small Scale Forestry*: 7, 403-415, www.forru.org/library/0000022

Forest Restoration Research Unit 2005 How to Plant a Forest: The Principles and Practice of Restoring Tropical Forests. Chiang Mai, Thailand: Biology Department, Science Faculty, Chiang Mai University. www.forru.org/library/0000153

Gardner, S., P. Sidisunthorn & V. Anusarnsunthorn, 2007. A Field Guide to Forest Trees of Northern Thailand. Kobfai Publishing Project, Bangkok, Thailand, www.forru.org/library/0000227

Wilkinson K, Landis T, Haase D, Daley B, Dumroese RK. 2014 Tropical nursery manual: A guide to starting and operating a nursery for native & traditional plants. Washington DC, USA: U.S. Department of Agriculture, Forest Service.

10 Assessment of students

10.1 Description of assessment

Online course

Weekly Online Quizzes (15) 3% each – 45%

Small Web-based Assignments (proof of completion sent to teachers) (5 x 6%) – 30%

End-Term Assignment – Forest Restoration Plan – 25%

Field course

Practical assessment – 100 %

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

Chiang Mai, Date ...30...../...Dec/....2021.....