Item 19c

MuEuCAP
www.myanmar-edu.org

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

BioCEP-614: Methods in Biodiversity Conservation and Environmental Protection (field /practical)

(3 ECTS, 4 MC)

Course description and syllabus

Basic Information

Type of Course	Lecturer with practical labs/tutorial
Term	1st semester (December – March)
Expected no. of participants	< 20
Language	English
Hours per week in term	4 hr/week for lecture 2 hr/week for practical

Instructors

Prof. Soe Soe Aung	Coordinator
Dr. Kyu Kyu Mar	
Dr. Aung Aung Aye	

Course content

Description	The course will introduce basic principles of methods and design of scientific studies and highlight the importance of statistical criteria during the planning and implementation of research studies. Examples of research studies are used to introduce different aspects of design elements (sampling- and observation design) and to focus on the relevance of proper definitions, planning and interpretation of observational studies and experiments. In this context, aspects of data collection and management as well as the use of models is discussed. A

	further focus of the course is on the careful interpretation of scientific results. Complementary practical exercises with example data and labs are used to introduce specific methods, like data manipulation and basic remote sensing and GIS analysis.
Course objective and learning outcomes	The students should be able to plan and design their own study in empirical research based on statistical principles. The course will familiarize the students with a range of methods and techniques applied to environmental monitoring in the preparation, planning, implementation and analysis phase. The aim of the course is that the students are eventually in the position to carry out their own monitoring projects, and that they have the criteria to judge the quality of monitoring projects in general. Focus is on the target-oriented planning and the definition of the most appropriate sampling design and observation design that guarantees the generation of high-quality information for the decision makers. The students are able to: • identify, implement and critically assess suitable methods for resource inventory and monitoring • identify, implement and critically assess suitable methods for statistical experiments • evaluate the data quality and sources of availability • identify methods of data collection, management and analysis • translate research objectives into research questions and workable hypotheses • assess the usefulness of different data sources and analysis tools for implementation and evaluation of empirical research study
Target Group	Master students with preliminary knowledge about environmental monitoring and basic understanding of statistical sampling.
Grading	Written exam (70%), presentation + practical labs (30%)

Topics

Unit 1. Introduction

- Ecological aspects of biological world (biodiversity and environment)
- Importance and values of sampling methods and monitoring techniques
    - Introduction of three real world examples of environmental studies that are used to demonstrate the character of sampling studies throughout the course

Unit 2. Basic principles of methods and designs

- Planning a research study
    - Formulation of research questions
    - Definition of the population of interest
- Experiments and treatments
    - Differences between “observational studies” and “experiments”
    - How to design experiments
- Research hypotheses
    - Formulation of (testable!) hypotheses
- Designing scheme (elements) for survey and monitoring
    - Sampling-, observation-, and estimation designs
    - Design-based sampling vs. model-based or model assisted
- Typical methods in ecology
    - Observation designs in ecological studies (related to examples of Unit 1)

Unit 3. Sampling designs

- Requirements of a good sample
    - The role of design elements on the interpretability of sampling studies
    - Character of different sampling designs (SRS, Systematic, Cluster, multi-stage, multi-phase)
- Preliminary sampling and prior information
    - Collecting and using prior information in context of planning a research study
    - Determination of sample size
    - Remote sensing integration
    - Stratification
- Planning and field work
    - Field manual and estimation design
    - Considering costs and accessibility
- Data recording and data management
    - Collecting, validating, managing and analyzing research data

Unit 4. Integration of multiple data sources

- Ancillary information from remote sensing
- GIS as tool to integrate spatial data
- Environmental impact studies

Unit 5. Definitions

- Formulation of environmental indicators
    - Definition of complex target variables like “biodiversity”
- Estimation of species diversity
    - Predicting diversity from a limited sample
- Terminology and definitions
    - Defining target variables

Unit 6. Models in ecological research

- Regression models
    - The importance of models and their influence in sampling studies
- Spatially explicit models from remotely sensed data
    - Taking spatial aspects into account
    - Indicator variables derived from remote sensing
    - Model assisted and model-based approaches

Unit 7. Quality assessment and error sources

- Quality measures approaches
- Estimation of error variance
- Standard error

Unit 8. Reporting and presenting scientific results

- Interpretations from data and results
- Converting scientific results into “meaningful information” for decision making

Semester plan

Week	Time	Topic (Adjustments may be necessary)
1	Mon 09-10	1.1 General introduction
	Tue 09-10	1.2 Ecological aspects of biological world (biodiversity and environment)
	Wed 09-10	1.3 Importance and value of sampling methods
	Thu 09-10	1.3 Importance and value of monitoring techniques
2	Mon 09-10	2. Basic principles of methods and designs
	Tue 09-10	2.1 Planning of research studies I
	Wed 09-10	2.1 Planning of research studies II
	Thu 09-10	2.2 Experimental design (general introduction)
	Fri 10-12	Practical/Tutorial (discuss case studies)
3	Mon 09-10	2.2 Treatments and experiments
	Tue 09-10	2.3 Research hypotheses I
	Wed 09-10	2.3 Research hypotheses II
	Thu 09-10	2.4 Designing scheme for survey and monitoring I
	Fri 10-12	Practical/Tutorial (Calculations, introduction to R)
4	Mon 09-10	2.4 Designing scheme for survey and monitoring II
	Tue 09-10	2.5 Typical methods in ecology and nature conservation
	International New Year and Independence Day of Myanmar	
	Thu 09-10	2.5 Ecological methods in monitoring
	Fri 10-12	Practical/Tutorial (Measurements and observations)
5	Mon 09-10	3. Sampling designs I

Week	Time	Topic (Adjustments may be necessary)
	Tue 09-10	3 Sampling designs II
	Wed 09-10	3.1 Requirements of a good sample I
	Thu 09-10	3.2 Requirements of a good sample II
	Fri 10-12	Practical/Tutorial (Introduction to R, calculations)
6	Mon 09-10	3.2 Preliminary sampling I
	Tue 09-10	3.2 Preliminary sampling II
	Wed 09-10	3.4 Planning and field work
	Thu 09-10	3.4 Planning and field work
	Fri 10-12	Practical/Tutorial (Design a field manual)
7	Mon 09-10	3.5 Data management and analysis I
	Tue 09-10	3.5 Data management and analysis II
	Wed 09-10	4. Integration of multiple data sources I (Remote Sensing)
	Thu 09-10	4. Integration of multiple data sources II (GIS)
	Fri 10-12	Practical/Tutorial (analyze case study)
8	Mon 09-10	4.1 Ancillary information from remote sensing (RS)
	Tue 09-10	4.1 GIS as tool to integrate spatial data
	Wed 09-10	4.1 Types of remote sensing imagery (Earth Resource Satellites Operating in the Optical Spectrum)
	Thu 09-10	4.1 Remote sensing analysis
	Fri 10-12	Practical/Tutorial (RS and GIS tutorial)
9	Mon 09-10	4.2 Environmental impact studies I
	Tue 09-10	4.2 Environmental impact studies II
	Wed 09-10	4.2 Environmental impact studies III

Week	Time	Topic (Adjustments may be necessary)
	Thu 09-10	5. Definitions
	Fri 10-12	Practical/Tutorial (Review field manual)
10	Mon 09-10	5.1 Formulation of environmental indicators I
	Tue 09-10	5.1 Formulation of environmental indicators II
	Union Day of Myanmar	
	Thu 09-10	5.2 Estimation of species diversity
	Fri 10-12	Practical/Tutorial (R tutorial on species diversity)
11	Mon 09-10	5.2 Estimation of species diversity
	Tue 09-10	5.3 Definition of target variables
	Wed 09-10	6. Models in ecological research
	Thu 09-10	6.1 Regression models I
	Fri 10-12	Practical/Tutorial (R tutorial on regression)
12	Mon 09-10	6.1 Regression models II
	Tue 09-10	6.2 Spatially explicit models from remotely sensed data
	Wed 09-10	6.2 Spatially explicit models from remotely sensed data
	Thu 09-10	7. Quality assessment and error sources
	Fri 10-12	Practical/Tutorial (QGIS basics)
13	Mon 09-10	7. Quality measures approaches
	Tue 09-10	7.1 Estimation of error variance
	Wed 09-10	7.1 Estimation of error variance (relative efficiency)
	Thu 09-10	7.2 Standard error
	Fri 10-12	Practical/Tutorial (R comparing different estimators)

Week	Time	Topic (Adjustments may be necessary)
14	Mon 09-10	8. Reporting and presenting scientific results I
	Tue 09-10	8. Reporting and presenting scientific results II
	Wed 09-10	8.1 Converting scientific results into "meaningful information" for decision making
	Thu 09-10	8.1 Structure of the report / presentation
	Fri 10-12	8.1 Practical/Tutorial (Short presentations by students)

Recommended reading

Hawksworth, D. 2010. Methods and Practice in Biodiversity Conservation. Springer. 320 pp.

Gregoire, T G and Valentine, H. T. 2008. Sampling strategies for natural resources and the environment. Chapman & Hall/ CRC Press. 496 pp.

Verzani, J. 2005. Using R for Introductory Statistics. Chapman & Hall/ CRC Press. 414 pp.

Petersen, R. G. 1985. Design and Analysis of Experiments. Marcel Dekker Inc. 429 pp.

Gruijter, J., Brus, D., Bierkens, Marc. and Knotters, M. 2006. Sampling for Natural Resource Monitoring. Springer-Verlag Berlin Heidelberg. 332 pp.

Krebs, C. J. 1999. Ecological Methodology. Addison-Wesley Educational Publishers, Inc. 620 pp.

Scheaffer, R. L., Ill, W. M. and Ott, R. L. 2006. Elementary Survey Sampling (Sixth Edition). The Thomson Corporation. 464 pp.

Lohr, S. L. 1999. Sampling: Design and Analysis. Brook/Cole Publishing Company. 494 pp.

Southwood, T. R. E. and Henderson, P. A. 2000. Ecological Methods (Third Edition). Blackwell Publishing. 575 pp.

Kuehl, R. O. 1994. Statistical Principles of Research Design and Analysis. Wadsworth, Inc. 686 pp.

Lillesand, M. T., Kiefer, R. W. and Chipman, J. W. 2008. Remote Sensing and Image Interpretation. John Wiley & Son, Inc. 756 pp.