



Figure 1. One of many presentations by Myanmar staff and students at the needs-assessment workshop in the University of Mawlamyine (10 & 11 July, 2018)

**WP.1.5: Final report on needs assessment for Mandalay, Myeik and Mawlamyine universities and non-academic stakeholders**

incorporating **WP.1.1** Compiling information on existing curricula, human/technical resources

**WP.1.3** Needs Assessment of in environmental protection curriculum

**WP.1.4** Non-academic stakeholder needs assessment in environmental protection competencies

BASED ON THE FOLLOWING WORKSHOPS:

**5-7 July 2018 workshop: University of Mandalay**

**9-10 July 2018: Mawlamyine University**

**12 July 2018: Non-academic stakeholders, Yangon**

**10-14 October 2018 workshop: University of Mandalay**

and EQUIPMENT NEEDS: **11 January, 2019 University of Mandalay**

**7-19 January, 2019: Myeik University**

**1: Work package 1.5 - Results (narrative) (1000 characters)**

Based on workshops in July/October 2018, information was compiled on the existing curricula and human/technical resources in Masters courses relating to environmental protection in three Myanmar universities (Mandalay, Myeik and Mawlamyine) (WP.1.1). A needs assessment of these universities (WP.1.3) and of non-academic partners (WP.1.4) was also undertaken. The latter

comprised biodiversity conservation NGOs and CSOs. The aim was to modernise and improve the modules of the existing curricula (Botany, Geography, Geology, Marine Science and Zoology) for education in environmental protection in each university. The primary outcome of the needs-assessment was that: (1) existing courses and modules seem to be suitable for integration into a new curriculum, thereby reducing the necessity to develop completely new curricula; and (2) a proper combination of enhanced existing courses seems to be a much more efficient route to reach the project goal than developing completely new curricula.

## **2: Anticipated outcome**

- On the basis of WP.1.1, WP.1.3, and WP.1.4, compile a detailed report on all needs, gaps and wishes of the academic and non-academic partners that should be implemented into the enhanced environmental protection curriculum of the three universities (WP.1.5).

**3: Responsible:** Project coordinator, project manager, Myanmar universities contact persons. The tasks of the workshops were coordinated by the European trainers. Information was provided by the Myanmar staff and the report was prepared by European and Myanmar staff.

## **4: Outcomes/outputs reached**

- Baseline information on current curricula, courses and syllabi (MSc) in Mandalay, Myeik, and Mawlamyine universities relating to environmental protection (WP.1.1) (Appendix 1 and 2)
- Database of the needs/gaps in teaching materials in Mandalay, Myeik, and Mawlamyine universities relating to environmental protection (WP.1.3)
- Understanding of the needs/gaps of non-academic partners relating to Master students competencies in environmental protection (WP.1.3)
- Baseline information to assist with the technical up-date of ICT infrastructure and equipment to support equipment delivery in Mandalay, Myeik, and Mawlamyine universities (WP.2.7).

## **5: Remarks**

### **Background on Higher Education Institutions in Myanmar**

Following over half a century of military rule and international isolation, Myanmar has experienced a significant decline in its higher education sector (HES). No national centre of excellence in research or teaching currently exists in the environmental sciences and although zoology/botany departments (equal to faculties) are present in universities throughout the country, none presently delivers interdisciplinary BSc, MSc or PhD degrees dedicated to environmental protection, conservation biology or biodiversity conservation. Nevertheless, biodiversity research or conservation biology in the broadest sense are integrated in several courses in Myeik, Mawlamyine, and Mandalay universities.

Reforms in the higher education sector in Myanmar began in 2011 with the political transition to a largely democratic political system in Myanmar. Major additional reform is anticipated following the National League for Democracy party's win of the national election in November 2015, though the centralized Ministry of Education and several other ministries presently continue to control all aspects of university management, including student enrolment, curriculum structure and content, faculty recruitment and staff transfers. Due to the lack of university autonomy, the curricula of all degrees related to the environmental sciences (e.g. zoology, botany and geography) are standardized between universities and governed by the Board of Studies (BoS). Currently, the University of Mandalay and University of Yangon are transforming from semi-autonomous (i.e. several decisions can be made by the senate or the rector for the university independently of the Ministry of Education) to fully autonomous status (tentatively for 2019).

Under the current system, all MSc degrees in Myanmar comprise two years of study and have an obligatory BSc as entry requirement. The two years of MSc comprise four semesters, the first and second of which are devoted to course work. The third and fourth semesters consists of a research thesis. Semesters 1-2 each consist of four courses, all of which follow the national curriculum set by the BoS. The semester of each year runs from June to September and the second semester from December to March (16 weeks of course work each semester; 1 teaching hour equals 50 minutes per week).

Curricula in Myanmar can be summarised as following traditional approaches and relate mainly to natural history, taxonomy, and in few instances on how land use affects communities. The University of Forestry and Environmental Science (UFES) is an exception, since courses on environmental sciences are offered. However, even in UFES, although a new curriculum is not required, it is necessary to improve the skills of the teachers.

In all universities, currently, most teaching methods tend to be traditional and follow a knowledge-based approach. They do not encourage critical thinking (neither of staff nor students) nor teach modern concepts in environmental protection or ecology. Modern, economically exploitable or cutting-edge science and its teaching is absent. So far, no modern curriculum relating to earth or environmental science (including environmental protection) exists in Myanmar, but several courses are offered with relevance to earth and environmental sciences and protection. The quality and quantity, together with placement in the curricula, learning outcomes and learning aims vary markedly between individual teachers, universities, and departments.

In the current university system, there is a strong focus on theory and knowledge with little focus on transversal skills and competencies. Field trips and laboratory units are typically included, but to a very limited extent. Inter-departmental collaborations within universities to provide interdisciplinary skills' training are absent and there is also little or no culture of collaboration between MUPs and other stakeholders such as the Forest Department (which is under the Ministry of Natural Resources and Conservation). Only few a collaborative programmes and interactions exist with Myanmar-based NGOs/IGOs, such as a loose cooperation between WCS and FFI with Myeik University (to be strengthened through the "Ridge to Reef" GEF funded project starting in the latter part of 2018).

Any deviations from the above system currently require approval from the central education authorities. Syllabi and course contents can be changed or amended without BoS approval, but specifically any change in curriculum (or entire new curriculum) needs approval by the BoS. For example, the BoS for Zoology is centralized at University of Yangon and implemented by all Zoology Departments throughout the country. All higher degree courses in Myanmar are delivered bilingually (with teaching mostly in Myanmar and materials in English) and all examinations and thesis components are undertaken solely in English. English proficiency is a critical impediment in Myanmar because English skills vary largely between individual teachers, departments and universities. English skills amongst students are mostly poor.

The equipment for teaching (including most libraries, laboratories, student work benches, ...) are outdated or entirely absent. Open Society Foundation (OSF) have sponsored eleven libraries of Myanmar universities including University of Mandalay access to thousands of scientific journal including Nature and Science since 2013. ITC equipment is limited and is mostly restricted to a few laptops and LCD projectors, which are present in seminar rooms. They are mainly second hand or affected by the high air humidity. Air-conditioning is restricted to a few seminar rooms. The administrative offices have a few desktop computers and printing facilities. The internet in Myanmar was slow and prone to lengthy interruptions but is rapidly improving with reasonable coverage available in many areas. HEI Servers are not present on campus or not working and hence internet webpages of the universities are hosted elsewhere. Laboratories in environmental sciences are limited to simple work benches and simple chemical analysis. Although in a few cases, there are simple microscopes for students and/or research use, clean spaces and laboratories for

sophisticated chemical/physical analysis are absent. All classrooms have black boards, seats and work benches (partially very old) but white boards and projectors are not yet standard equipment. Laboratories, for example to teach DNA extraction, or other clean spaces are not available in any MUP, although the University of Mandalay is currently setting up one clean space for DNA extraction.

Libraries have a good stock of text books and some online libraries exist already. However, currently no journal in environmental science is available except for those on open access. Textbooks and standard teaching books are outdated or missing. If available, unfavourable climatic conditions to store books challenge the MUPs' efforts to build up a representative library in environmental sciences or any sciences.

The curricula at the 3 Myanmar universities are currently set with very similar prerequisites: students with a BSc degree must complete one year of qualifying studies to begin MSc studies, whereas students with a BSc (Hons) degree bypass this qualifying year to enter MSc studies directly. MSc degrees comprise four semesters (= 2 years) of study, whereby semesters 1 and 2 consist of course work and 3 and 4 of an original research thesis. The first postgraduate semester runs from June to September and the second from December to March. Each is followed by 1 month of examinations. All degree courses at MU are delivered bilingually (with teaching mostly in Myanmar and materials in English) and all examinations and theses are undertaken in English. Full details of BSc, BSc Hons and MSc curricula delivered at the Universities of Mandalay, Myeik and Mawlamyine are given in the Appendices.



Figure 2. Mawlamyine University

### **Mawlamyine University (P5)**

- Rector: Prof. Dr (U) Aung Myat Kyaw Sein
- Pro-rector(s): Prof. Dr (Daw) Mie Mie Sein

Mawlamyine University is the third largest university in Myanmar and the third implemented after Yangon and Mandalay. It is the second largest after Yangon in southern Myanmar. Mawlamyine University offers a curriculum in Botany, Zoology and Marine Science. The latter seems to cut across sectional topics and includes aspects of zoology and botany in coastal zones and the marine realm.

Marine Science focuses on economically important species groups such as seagrass and fisheries, but also includes environmental science aspects in some courses. While true cooperation between the three departments in Mawlamyine University is not (yet) working, there is a slight overlap in interest, which has been identified together during the presentation of courses and syllabi.

Faculty members interviewed (and/or holding a short presentation of their work) included Dr. Mie Mie Sein (currently Pro Rector), Dr. San Tha Tun (Head of Marine Science), Dr. Aye Aye Myint (Associate Professor Zoology Department), Ms Khin Myo Myo Tint (Demonstrator Department of Marine Science), Dr. Hlaing Hlaing Htoon (Assistant Lecture Department of Marine Science), Dr. Naw Zarchi Linn (Assistant Lecturer, Zoology Department), Aung Myo Hsan (Assistant lecturer), and May Thaw Khin and Aye Nyein Soe (both 1<sup>st</sup> year MSc students) at Mawlamyine University. All staff state that they lack specific hard skills such as:

- teaching adequate statistical skills
- modern teaching skills beyond simple knowledge transfer from teacher to student
- how to teach students to develop a research question for their MSc theses.

They also lack transversal skills, such as:

- the ability to adequately present teaching outcomes
- how to present a teaching or research unit for example in pptx.

In addition, they lack equipment and literature, including:

- standard equipment and specific equipment such as SEM (scanning electronic microscope)
- equipment to test water chemistry and physical parameters for marine science.
- text books and access to modern literature, with many reference books over 50 years old.

Mawlamyine University has already incorporated several environmental protection related courses into the curricula, such as environmental ethics, environmental law, ecology, conservation biology and quantitative ecology (which is a technical course in statistics in ecology). Particularly Marine Science offers courses with relevance for environmental protection in marine and costal ecosystems.



Figure 3. The University of Mandalay

#### The University of Mandalay (P6)

- Rector: Prof. Dr (Daw) Thida Win

Mandalay University is the second oldest university nationally (after Yangon) and the largest university in northern Myanmar. It is also the only higher education institution in upper Myanmar that offers PhD degrees, in addition to MSc degrees. Facilities include a University Research Centre

(established in 2013, though work has only begun on Histology to date), central library (established in 2013) and online library (established in 2014). Departments related to the environmental protection include Botany, Zoology, Geography and Geology, whose research areas include "Biodiversity" and "Environmental Science", and also "Ecology" related topics.

The Botany department supports 24 staff (namely: two professors, three associate professors, 12 lecturers, five assistant lecturers and two demonstrators) whose related research efforts include plant anatomy, genetics, plant diversity and environmental sciences. Staff within the Zoology department include >50 PhD holders, and the department accepts >10 PhD candidates per year. Research undertaken by these candidates currently include aquaculture, taxonomy of birds, mammals, and arthropods. Funding for field work in teaching and research poses a major challenge.

Faculty members interviewed (and/or holding a short presentation of their work) included Dr. Thant Zin (Head of Department, Department of Zoology), Dr. Dolly Wilbur (Associate Prof. Department of Zoology), Dr. Sai Sein Lin Oo (Lecturer, Department of Zoology), and Dr Kalayr Lu (Assoc. Prof. Botany). All suggested that the department has the capacity to deliver most of the needed subjects for environmental sciences (particularly the ecology related subjects<sup>1</sup>), with the exception of:

- environmental law
- integrated natural resource management
- geographical information systems
- project cycle management
- protected area management.

However, all existing courses with relevance for environmental protection need much support in updating methods, including: biostatistics, research design implementation, and supervision/mentoring of Master thesis.

Although it was uncertain how many students might enrol in a new environmental protection-orientated MSc, the Zoology Department also voiced its intention to propose a new two-year, full-time MSc in "Biodiversity and Environmental Sciences".

#### **Myeik University (P7)**

- Acting Rector: Prof. Dr (Daw) Ni Ni Oo

Originally founded as Myeik College in 1999 and upgraded in 2004, Myeik University currently hosts over 2500 day students and about 5000 distance education students It has a website at



Figure 4. Myeik University

[http://www.myeikuniversity.edu.mm/?page\\_id=1148](http://www.myeikuniversity.edu.mm/?page_id=1148)). Departments related to biodiversity conservation and environmental protection include Botany, Zoology, Geography and Marine Science. The Marine Science Department closely cooperates with Mawlamyine University's Department of Marine Science on coordinating the curriculum. The BoS of Marine Science in HEI in

---

<sup>1</sup> While EUP assessors agree that specific skills, particularly hard skills in taxonomy and species identification certainly exist at all MUP, the hard skills in up-to-date ecology, evolution, physiology and environmental sciences/earth sciences depend mostly on knowledge of individual staff and varies considerably on –in average– a low level compared to most HEI in Europe.

Myanmar is hosted by Mawlamyine University. Besides the central university library (which caters to the needs of undergraduate students), each department has its own library. The departments support 12-14 staff, of whom a minority undertake active research. Research areas include Botany and Zoology, with a strong emphasis on identification skills and taxonomy (sea grass; small mammals, birds, earthworms, freshwater fish), and Geography, which mainly focuses on land cover.

Unlike the Yangon and Mandalay universities, Myeik University does not offer PhD degrees. Even though all four departments offer MSc degrees, the Botany and Geography MSc programs are new.

Like all other MUPs, Myeik has difficulties in developing and retaining staff expertise due its peripheral geographical location and the national rotation system, but it has addressed this problem by prioritizing staff of local origin for capacity-development support (these being the least likely to request transfer to another university).

Faculty members interviewed (and/or holding a short presentation of their work) included Dr. Ni Ni Oo (Acting Rector), and Dr. Khin Myo Thant (Associate Professor, Botany Department), Dr. Khin Swe Oo and Soe Naing (both Lecturers, Zoology Department), Aung Aung Aye (Assistant Lecturer, Department of Marine Science), and Myat Pwint Yamon (Demonstrator, Botany Department). All reported limited capacity in all of the MSc courses and felt that all were important. They also identified several subjects as priorities for capacity-development with an emphasis on practical applications, namely:

- scientific writing
- data presentation
- research methods and research design
- biostatistics
- ecological field techniques
- project cycle management.

Capacity-development was also identified as being needed for supervision of MSc theses, and support in a step-by-step teaching-approach was suggested.

Myeik University does offer degrees related to biodiversity conservation, including BSc, BSc Hons and MSc degrees in Zoology, Botany, Marine Science and Geography. The number of students graduating with BSc, BSc (Hons) and MSc degrees in these subjects varies considerably per year. Although undergraduate curricula for Zoology, Botany and Marine Science appear to cover the principles of Biology relatively well, the bulk of courses emphasise pure topics with a small minority devoted to conservation biology, biodiversity management or other applied subjects (which typically occur only in final years). As for all 4 MUPs, almost no attention is given to the development of skills for biodiversity surveys and research, quantitative methods, data management, remote sensing analyses and/or geographic information systems, with the latter entirely absent from Zoology and Botany curricula. MSc curricula (which unlike undergraduate degrees include a research thesis) provide slightly greater attention to these, although conservation and protected area management topics remain poorly represented, and the quality of teaching of these courses is substandard. Geography curricula cover a greater variety of disciplines, including several subjects related to biodiversity research (e.g. biodiversity, ethics in environmental conservation, climatology, natural resource management and conservation, statistics, remote sensing and geospatial technology), though protected area management and environmental law are missing.

Previous assessments have revealed MU's limited capacity for delivering interdisciplinary curricula concerning biodiversity conservation, particularly practical aspects and thesis research. This finding was echoed in the present assessment.



Figure 5. Discussing the needs of NGOs and CSOs in relation to the skills of Myanmar Masters students.

### **IGO/NGO/CSO non-academic stakeholder needs assessment for HEI in Myanmar**

Additional to the MUPs, we worked with the non-academic stakeholders to assess the current situation of the HEI sector in Myanmar. We asked these stakeholders about the Master's students that they employ from the Myanmar university sector. We were particularly interested in assessing their view of students' technical skills and their knowledge base. Also of great interest was their view on critical skills that the students were missing since we wish to make the training of Master's students relevant to future employment in NGO/IGO/CSOs. We also asked them (IGO/NGO/CSO) what are the most pressing issues that are currently preventing MUPs teaching students in Myanmar environmental sciences, and that we can seek to adjust through MuEuCAP.

#### **Smithsonian Institution (SCBI Myanmar)**

Smithsonian staff interviewed (skype) included Katie LaJeunesse Connette and Dr. Grant Connette. Smithsonian staff agree that the skills needs for future Myanmar graduates to be employed through projects by the Smithsonian are manifold and include: training in conceptual background, English skills, technical skills (in most fields), how to supervise adequately thesis work (and research projects), how to find and cite literature and literature research skills. They also suggest the need for role models and templates for MSc theses and scientific publications. However, the long-term strategy might be to introduce the concept of critical thinking way before students enter the university and add "critical thinking" as well as "conceptual development" of research into training of the teachers as soon as possible.

#### **WWF, FFI, WCS, MBNS (P8), and Friends of Wildlife**

The non-academic stakeholders and CSO/NGOs/IGOs confirm in principal all the issues and lack of specific skills as identified and raised during the MUP needs assessment (details above), namely:

- Low standard in modern teaching skills and science/research (compared to ASEAN and EU standards)
- Low standard in English/scientific English/teaching capacity in English
- Inflexible structure, high staff turnover (including favourable prospects outside academy)
- A lack of understanding of conceptual background and thinking (and therefore all the correct steps in science/research/thesis supervision are lacking)

The interview with FFI included mainly the coordinator of the southern region, Nay Myo Shwe (FFI Programme Coordinator for southern region Myanmar), a PhD candidate in the Conservation Ecology Programme at King Mongkut's University of Technology Thonburi (KMUTT Thailand). He highly recommended to include the following skills in teaching because these are of low quality or absent in HEI in Myanmar. The skills should be taught as soon as possible to MUP staff and subsequently to Myanmar graduates:

- Basic concept of Environmental Science and Natural resource
- Proposal and Scientific paper writing
- Research methodologies and design
- Wildlife Ecology and Evolution
- Behavioural ecology
- Pollution management
- Statistics (technical skills and concepts) by using open access software such as R
- GIS (ArcGIS/Q) and basic for Remote Sensing
- Paper reading, Seminar practice
- English (for all)

The interview with WCS was joined by representatives of MBNS, Friends of Wildlife, and Smithsonian staff. All these confirm the findings as with WCS (and previous own needs assessments on the topic by Renner, Bates and others). Additional to the hard and soft skills, WCS pointed out that it might be very valuable to teach also components of project management and project cycle management. This should include the ability of graduates to delegate tasks and to know some basics in simple administration of projects (Appendix).

### **Outcomes/outputs reached**

Based on the report and information obtained from WP1.1 (WP1.1: Compile information on existing curricula and human/technical resources), we assessed the needs of the 3 Myanmar universities in education, teaching and scientific skills as well as all other competences relevant for higher education.

### **WP1.1: Documents prepared and circulated**

Digitized (scans) of all documents (including translation) of existing curricula, courses and procedures in Environmental Protection, namely:

- o aims and objectives of course
- o current curriculum, including summarised content of modules
- o number and qualifications of staff
- o availability of technical resources, including ICT
- o language skills
- o student participation, disaggregated by sex, age and where possible social/ethnic background
- o summary of assessment tools and quality assurance

### **WP1.3 Needs Assessment RESULTS HEI partners**

- Results of the needs assessment are very similar for all MUPs.
- The perspective and self-assessment of missing skills of the teachers in the HEI is slightly divergent to the assessment of NGO staff, especially concerning technical skills of staff in MUPs
- Courses are mainly available for environmental protection and can be used in general for a new curriculum. Only few new courses are required and might be developed by splitting off topics (e.g. ecology and biogeography)

- Staff in general have expertise in setting up research projects, but the relevant skills in teaching are missing (e.g., how to teach developing a good research question to students)

#### **WP1.4 Needs Assessment RESULTS non-academic partners**

Results of the need assessment with potential future employers are in some respect different to the needs articulated by the teaching staff. The following aspects were highlighted:

- Critical thinking is almost absent (hierarchy, traditional teaching approach)
- Hard skills missing (R, project set up, didactics, ecology, quantitative ecology, EIA, RS/GIS, any research methodology, publications, ...)
- Soft skills missing (outreach and science communication, statistics, conference organization, ...)
- The following tasks during research are known but cannot be performed in the needed detail to reach the goal of supervising for example a MSc thesis:
  - Apply for additional funding
  - Research question and literature research
  - Testable hypothesis/measurable indicators
  - Planning of analysis & statistics
  - Design of empirical study
  - Preproposal and presentation
  - Sampling/fieldwork
  - Statistical analysis
  - Writing report/paper
  - How to supervise students?

#### **WP2.7 ICT assessment and technical capacity assessment**

ICT at all MUPs is of very low quality and limited quantity. Most seminar rooms have a LCD projector of varying quality and life time. IT communication (LAN network access and infrastructure is absent, own servers are absent, access to "EduRoam" or other internationally standards are not yet available. Access to web of science or any other web-based resources (online libraries, access to scientific journals which are not open access) is only through international co-operation.

#### **New topics to be developed and incorporated into existing courses for the model curriculum**

- Environmental Impact Assessment (EIA)
- Statistics (upgrade or new)
- International conventions and national/international environmental laws
- Research methodology (as part of developing research questions/hypothesis and study design)
- How to organize an international meeting with student participation
- Project setup and management in environmental protection (including project cycles, adaptive management; further details outlined in WWF, FFI, WCS, MBNS (P8), and Friends of Wildlife)
- Data management

#### **Courses which need an upgrading in teaching skills**

- All courses related to statistics and experimental design as well as sampling/field work/experimental setup
- All courses in the broad field of ecology and evolution need an update on concepts
- Adaptive management in conservation and environmental protection
- GIS and remote sensing techniques and CONCEPTS

- All courses need support in rewording (or adding) learning outcomes and examination protocols.

**Further topics related to teaching include training in:**

- How to write a MSc thesis (and how to supervise it with modern teaching techniques), including developing research concepts i.e. the following steps need to be included:
  1. Research question and literature research
  2. Testable hypothesis/measurable indicators
  3. Planning of analysis & statistics
  4. Design of empirical study
  5. Preproposal and presentation
  6. Sampling/fieldwork
  7. Statistical analysis
  8. Writing report/paper
- How to write a scientific report and/or publication (as an outcome to student supervising)
- How to communicate scientific outcomes to a broader non-academic audience of the media, social media, decision makers and the general public
- Didactics, with a special focus on how to prepare learning outcomes and applying modern teaching skills beyond simple lectures
- Awareness of plagiarism and its avoidance - should be delivered in short training units (as stand alone, but also at all other activities...).

**Present and/or Responsible**

WP1.3 Participants at Mandalay University and WP1.3 Participants at Mawlamyine University and Myeik University WP1.4 Participants of non-academic stakeholder needs assessment are listed in the Appendix.

**Remarks**

- UFES's Needs Assessment is not completed because of administrative delays in MONREC and UFES (rescheduled tentatively for January 2019 and subsequently postponed indefinitely).
- Equipment lists are currently being revised based on teaching needs for upgraded/newly established topics within the curricula of the 4 MUPs.



Figure 6. Various examples of the many needs-assessment presentations given in July, 2018 at workshops in the universities of Mandalay and Mawlamyine.

## Appendices

### Appendix 1 – Courses available needing upgrade and training for teaching staff

UM: 1<sup>st</sup> Semester is December to March and 2<sup>nd</sup> semester June-September

University	Type	Course No	Name of Module	Teacher	Level BSc, MSc, PhD	ECTS	Curriculum	Semester	Theory (H/W)	Practical (H/W)	Tutorial (H/W)	Remark
Mandalay	Elective	Bot 1002	Importance of Plants	Soe Soe Aung, NgWar Win	BSc	3	Botany	2	2	2	0	First Year Zoology Specialization
Mandalay	Elective	Bot 5208	Advanced Plant Physiology II	Soe Soe Aung, Hla Myo Aung	BSc (Hons)	3	Botany	2	3	2	0	Third Year Honours Botany Specialization
Mandalay	Core	Bot 623	Plant Biochemistry and Physiology	Soe Soe Aung, Kyaw Kyaw Sann	MSc	4	Botany	2	4	2	0	First Year MSc Botany Specialization
Mandalay	Elective	Geog 1004	Geography of Myanmar	Tin Moe Lwin	BA	3	Geography	2	3	0	1	Geography Minor Specialization
Mandalay	Core	Geog 321	Urban Geography	Tin Moe Lwin	BA	4	Geography	2	4	0	2	First Year Honours Geography Specialization
Mandalay	Core	Geog 714	Remote Sensing (RS), GIS, and Field Training	Tin Moe Lwin	PhD	4	Geography	2	2	2	2	Geography PhD Preliminary

Mandalay	Elective	Geol 2104	Environmental Geology I	Than Than Nu, Hnin Min Soe, Kyi Kyi Mar	BSc	3	Geology	1	2	2	0	Second Year Geology Specialization
Mandalay	Elective	Geol 2108	Environmental Geology II	Than Than Nu, Hnin Min Soe, Kyi Kyi Mar	BSc	3	Geology	2	2	2	0	Second Year Geology Specialization
Mandalay	Elective	Geol 612	Environmental Geology	Than Than Nu, Kyi Kyi Mar	MSc	3	Geology	2	4	2	1	First Year MSc Geology Specialization
Mandalay	Elective	MB 623	Microbiology of Fermented Foods	Soe Soe Aung, Tin Myo Tun	MSc	3	Food Microbiology	2	4	2	1	First Year MSc Microbiology Specialization
Mandalay	Elective	Zool 1001	Ecosystem II	Nang Aye Aye Shein	BSc	3	Environmental Science	2	3	2	n/a	First Year Microbiology Specialization
Mandalay	Core	Zool 2112	Herpetology	Kyaw Htet Kaung, Nyunt Lwin	BSc	4	Zoology	2	3	2	n/a	Second Year Zoology Specialization
Mandalay	Core	Zool 2113	Ornithology I	Nay Myo Hlaing, Nwet Nwet Win	BSc	4	Zoology	2	3	2	n/a	Second Year Zoology Specialization
Mandalay	Core	Zool 2114	Mammalogy I	Nang Aye Aye Shein	BSc	4	Zoology	2	3	2	n/a	Second Year Zoology Specialization
Mandalay	Elective	Zool 3115/3215	Toxicology	Na Dolly Wilbur, Ni Ni Win	BSc, BSc(Hons)	3	Zoology	2	2	2	n/a	Third Year/ First Year BSc (Hons) Zoology Specialization

Mandalay	Core	Zool 621	Animal Physiology and Endocrinology	Khin Mya Mya, Moe Moe Khine	MSc	4	Zoology	2	4	n/a	2	First Year Master Zoology Specialization
Mandalay	Core	Zool 622	Environmental Studies and Conservation Management	Moe Moe Aung, Than Than Swe	MSc	4	Zoology	2	4	n/a	2	First Year Master Zoology Specialization
Mandalay	Core	Zool 623	Evolutionary Biology	Thant Zin	MSc	4	Zoology	2	4	n/a	2	First Year Master Zoology Specialization
Mandalay	Core	Zool 624	Invertebrate Immunology	Naw Dolly Wilbur, Nang Aye Aye Shein, Ni Ni Win	MSc	4	Zoology	2	4	n/a	2	First Year Master Zoology Specialization
Mandalay	Core	Zool 711	Animal Behaviour	Naw Dolly Wilbur	PhD	4	Zoology	2	3	n/a	2	Zoology PhD Preliminary
Mandalay	Core	Zool 714	Biostatistics	Thant Zin	PhD	4	Zoology	2	3	n/a	2	Zoology PhD Preliminary
Myeik		Geol 2104	Environmental Geology I	Ky Ky Maw Myint Swe	BSc	3	Geology	1	2	n/a	2	
Myeik		Geol 2108	Environmental Geology II	Ky Ky Maw Myint Swe	BSc	3	Geology	2	2	n/a	2	
Myeik		Geol 621R	Environmental Geology	Ky Ky Maw Myint Swe	MSc	4	Geology	2	4	n/a	2	
Myeik		Bot 1101	Plant Biology	Khin Moe Moe Myint	BSc	4	Botany	1	4	2	0	
Myeik		Bot 1102	Basic Concept of Applied Botany	Khin Moe Moe Myint	BSc	4	Botany	2	4	2	0	

Myeik		Bot 2104	Ecology	San San Myint	BSc	4	Environmental Science	1	4	2	0	
Myeik		Bot 3104/3204	Environmental Biology	Lae Lae Khaing	BSc, BSc(Hons)	4	Environmental Science	1	4	2	0	
Myeik		Bot 3110/3210	Biodiversity and Conservation	Lae Lae Khaing	BSc, BSc(Hons)	4	Environmental Science	2	4	2	0	
Myeik		Bot 4107/4207	Applied Ecology	Khin Myo Thant	BSc, BSc(Hons)	4	Environmental Science	2	4	2	0	
Myeik		Bot 5211	Ethnobotany	Khin Myo Thant	BSc, BSc(Hons)	4	Botany	2	4	2	0	
Myeik		Bot 5212	Environmental Education and Ethics	Khin Hla Win	BSc, BSc(Hons)	4	Environmental Science	2	4	2	0	
Myeik		Bot 622	Environmental Science	Yadana	MSc	4	Environmental Science	2	4	2	0	
Myeik		MS 624	Estuarine Ecology	Aung Aung Aye	MSc	4	Marine Science	2	4	3	0	
Mawlamyine		MS 714	Marine Resources	San Tha Tun	PhD	4	Marine Science	1, 2	4	2	n/a	
Mawlamyine		MS 1104	Biological Oceanography II	Hlaing Hlaing Htoon	BSc	4	Marine Science	2	3	1	1	
Mawlamyine		MS 2107	Physical Oceanography	Khin Myo Myo Tint	BSc	4	Oceanography	2	0	1	0	

Mawlamyine		MS 2110	Marine Vertebrates	Khin; Myo; Myo Tint	BSc	3	Marine Science	2	0	1	0	
Mawlamyine		MS 4104	Systematics and Ecology of Seagrasses	Aung Myo Hsan	BSc	4	Marine Science	1	3	2	n/a	
Mawlamyine		MS 5208	The Health of the Oceans	Aung Myo Hsan	BSc	4	Environmental Science	2	3	2	n/a	
Mawlamyine		MS 613	Biology of Large Marine Mammals	May Thaw Khin	MSc	n/a	Marine Science	1	n/a	n/a	n/a	
Mawlamyine		MS 624	Estuarine Ecology	May Thaw Khin	MSc	n/a	Marine Science	2	n/a	n/a	n/a	
Mawlamyine		Zool 1102	Life Processes and Homeostasis	Aye Aye Myint	BSc	4	Zoology	2	3	2	n/a	
Mawlamyine		Zool 3115 /3215	Toxicology	Aye Aye Myint	BSc, BSc(Hons)	4	Zoology	2	3	2	n/a	
Mawlamyine		Zool 622	Environmental Studies and Conservation Management	Aye Aye Myint	MSc	4	Zoology	2	4	2	n/a	
Mawlamyine		Zool 5209	Evolution	Aye Aye Myint	BSc, BSc(Hons)	4	Zoology	2	3	2	n/a	
Mawlamyine		Zool 1001	Chemicals of Life and Life Processes	Naw Zarchi Linn	BSc	4	Zoology	2	2	2	n/a	

Mawlamyine		Zool 621	Physiology and Endocrinology	Eaindar Cho	MSc	4	Zoology	2	4	2	n/a	
Mawlamyine		Zool 622	Environmental studies and conservation management		MSc	4	Environmental Science	2	4	2	n/a	
Mawlamyine		Zool 623	Evolutionary biology and animal behavior	Eaindar Cho	MSc	4	Zoology	2	4	2	n/a	
Mawlamyine		Zool 624	Invertebrate Immunology		MSc	4	Zoology	2	4	2	n/a	
Mawlamyine		Zool 621	Physiology and Endocrinology	Aye Nyein Soe	MSc	4	Zoology	2	4	2	n/a	
Mawlamyine		Zool 622	Environmental studies and conservation management	Aye Nyein Soe	MSc	4	Environmental Science	2	4	2	n/a	
Mawlamyine		Zool 623	Evolutionary biology and animal behavior		MSc	4	Zoology	2	4	2	n/a	
Mawlamyine		Zool 624	Invertebrate Immunology		MSc	4	Zoology	2	4	n/a	2	

## Appendix 2 – Learning outcomes and course description

As for the classes listed in Appendix 1.

Course No	Learning Outcomes	Course Description
Bot 1002	Basic knowledge plants and biology; to know the economic importance of plants and their uses for foods, shelters and clothes	How is important of plants in the world; morphological characteristics of useful plants, cereal crops and their nutrient potentials for human being; to know about the knowledge of bioethanol production from plants; to know broadly about plant materials using for cloth, wood, paper, fibres and bamboo; to know nature of earth and their environment; how to function of plants by plant growth hormones
Bot 5208	To understand the advanced concepts of plant physiology; to monitor on plant stress and its conditions; to know very well the concepts of plant stress physiology	Definition and terms of plant stresses; to understand the functions and mechanisms of stress occurrences on plants; to know the interactions of plants stress combinations and plant responses to their environment; to know the detailed about the individual stress occurrences, tolerant, and resistant of plants; how wo survive and adapt the plants under stress conditions and its influencing factors
Bot 623	To know the basic concepts of plant biochemistry and plant physiology and their environment; to obtain the knowledge of biochemical pathways in plants and their physiological process and mechanisms	Definitions and terms of biochemistry and physiology; how is important role of intermediate chemical compounds taking part in plants; how to produce ATP production from plants; to know about the biochemical pathways during photosynthesis, photo-phosphorylation and respiration; plant growth hormones response to plants and environment
Geog 1004	Basic Knowledge of Myanmar, To be familiar with the Physical Geography of Myanmar, To understand the size and shape, the States and Region within Myanmar, To Know Cultural background, Demographic factors, Natural Resources, Economic activities and production, Regional Analysis on the States and Regions	Introduction, Location, Size, and Shape, Paleogeography of Myanmar, Physical bases of Myanmar, Cultural Bases of Myanmar, Demographic factors, Human Resource Development, Economic activities of Myanmar ( Agriculture, Livestock and Fishery, Forestry, Mineral Resources and Exploration, Processing and UMfacturing) Regional analysis on States and Regions of Myanmar (7 States and 7 Regions)
Geog 321	To Know Basic Knowledge of Urban Geography, To understand level of analysis in Urban geography, the global urbanization level, including Developed and Developing Countries, To know urban system	The Scope of Urban Geography, Defining the Urban, Theories of Urban Origins, Urban Characteristics of Place, Early Urban Hearths, Urbanization and Urban Change, Urbanization and Economic Growth, Urban Systems and Urban Structures, Southeast Asian Cities, The Quality of Urban Life, Urban Models,

	and urbanism, urban Places, To understand how to do Sustainable Urban Development, and the relationship between economic development and environmental conditions	
Geog 714	To train the students who are able to understand fundamentals and critical knowledge of Geospatial Technology.; Students are able to Understand: the definition and fundamental concepts of Geospatial Technology, the definition, History and usage of Remote Sensing, the electromagnetic energy, The Electromagnetic Spectrum Interaction of EM energy with other medium types and stages of RS, Information Extraction from Satellite Image and visualization of Image data, Remote Sensing Projects in Various Fields, To get the students who are able to understand fundamentals and practical knowledge of Geospatial Technology especially GIS, To understand some of the case studies related to: Watershed studies, Flood Studies, Health issues, Security and Defence Studies, Urban and Infrastructure Development Studies, Disaster Relief / management	Definition of RS and GIS, Electromagnetic Radiation, Interaction of Earth features with EMR, Interaction with the atmosphere, Spectral characteristics. Components of A GIS, Geographically referenced data, Coordinate system, Data model and data structure, Spatial data model (vector and raster), Spatial analysis, measurement, query, attributes based operation, modelling surface, modelling network, Output generation, map design, map layout, and cartographic symbolization.
Geol 2104	Geology and environmental; geology as a science: Basics and definition.; Understanding the relationship between the natural geological factors and hazards.; Increasing human population as; the number one environmental; problem.; The concept of sustainability and; important factors related to the; Environmental crisis;	Basic knowledge of environmental geology in the fields of natural hazards (Earthquake, Tsunami, Landslide, Volcanic activities, Flooding); The factors required to understand to predict and mitigate the potential impacts from hazards; Case studies
Geol 2108	Basic knowledge of ecology in environmental geology and relationship between ecology and geology by defining a few terms and principles	Basic concepts of ecology and linkages to geology; Water pollution: definition and some of the common water pollutants.; Water pollution problems: cultural eutrophication, acid mine drainage and metal leaching; Some of the important issues

	(species, population, ecological community, habitat); Water and soil pollution: Pollutants (oxygen demanding waste, pathogenic organisms, nutrients, oil, toxic substance); Factors (naturally or human activities) to cause water pollution, to minimize or control the problem, water quality monitoring. Waste disposal: Sanitary landfill, incineration, recycling, toxic waste disposal	related to water quality; standards.; The relationship between waste disposal and pollution (water, soil and air); Factors required to consider for site selection and waste disposal method to mitigate pollution
Geol 612	Understanding the potential environmental problem depends on the nature of geology, lithology, mineralogy and method of mining; Understanding the acid-generating minerals and acid consuming minerals and prevention or minimizing of ARD and metal leaching; Factors to be consider in disposal of mine wastes and tailing storage pond to control or minimize potential environmental problem; Some of the important issues related to; water quality standards; Understanding the processes by which; groundwater may become polluted; and how polluted water may; be treated.	Physical impact of mining activities: changes in landform, water erosion, slope failure and landslide; Chemical impact: Mine wastes (waste rocks, tailings. etc., ); Mine effluent, acid rock drainage (ARD), metal leaching; Water and soil pollution; Mine waste management; tailing management, water management; Environmental impact of dams and roads, etc.; Case studies
MB 623	To know the food safety and food management; how is important of microbial activities of fermented foods and contaminated water; why we should prevent microbial diseases for survival	To know the concepts of water borne diseases and food born diseases; diseases causes of pathogens; food production methods; food spoilage and fermented foods and contaminated water and sewage water; the diagnosis of disease carriers via. Bacteria, fungi and virus; how to make a wine and fermented foods for safety and their management
Zool 1001	Basic knowledge of ecology and ecosystem; Behavioral ecology as required form environments; Concept of an ecosystem	Structure and functions; Producers, consumers and decomposers; Energy flow; Food chains, food webs and ecological pyramids; Forest ecosystem; Grassland ecosystem; Desert ecosystem and aquatic systems
Zool 2112	Understand the nature and biology of diverse herpetofauna species and interpret the ecological	Amphibian, General feature of the class amphibian, Classification of order and suborder, Characteristics of each species ( 3 frogs, 1 toad, salamander and caecilian

	requirements and conservation status of these animals	only one, Reptile, characteristics of class reptilia, Classification of subclass, order and suborder, Morphology and physiology, Characterises of each species (4 snakes, 1 lizard, 1 tortoise, 2turtle and only one crocodilian)
Zool 2113	Understanding basic knowledge of birds, understanding of basic bird groupings, knowledge of higher level classification and basic knowledge of identification, knowledge of birds' external and internal structures.	How birds derived and their characteristics (Evolution of birds and characteristics), different group of birds according to beak and feet types, Classification of Modern birds (True birds) to order and family levels, Structure of and functions of organ systems (Fowl), egg formation and early development of birds
Zool 2114	Mammals are classified with using common features; the integration of form and function in the evolutionary development; Diversity of mammalian forms; the feeding apparatus; focusing on the capturing; processing of Food are learnt; Internal processes are regulated by the nervous and endocrine system; life history features of Mammals are studied.	To know the characteristics of Mammals; To understand the dynamics of locomotors processes in mammals with the arrangement of structures and their functions; To learn the modes of deeding and foraging strategies in mammals; To study some general aspects of two body control systems that are unique to mammals
Zool 3115/3215	Understand a broad set of toxicology knowledge concerning the fundamentals in the basic areas of toxicology, Demonstrate and understanding of legal, regulatory and ethical considerations relating to toxicology within the broader societal context, Obtain knowledge of sources, levels and mechanisms of action for toxic substances, Knowledge of effects of toxic substances on cellular levels, individual health and on natural populations and communities	Toxicology is the scientific study of adverse effects that occur in living organisms due to chemicals. It involves observing and reporting symptoms, mechanisms, detection and treatments of toxic substances, in particular relation to the poisoning of humans. It also includes environmental agents and chemical compounds found in nature as well as pharmaceutical compounds that are synthesized for medical use by humans. These substances may produce toxic effects in living organisms including disturbance in growth patterns discomfort, disease and death.
Zool 621	Integrated understanding of physiological mechanisms, appreciation of how the parts of body are linked into a whole function	What is Physiology Definitions and Introduction; Cellular physiology and Homeodtasis with examples. Physiology of digestion, Physiology of respiration, Physiology of Cardiovascular System, Physiology of Excretion and Osmoregulation, Physiology of muscle contraction, Physiology of Reproduction. Endocrinology Chemical coordination

		endocrinology system; mechanisms of hormone action, Vertebrate endocrine glands and hormones
Zool 622	Apply knowledge to solve problems related to wildlife conservation and management. Implement wildlife conservation and management relates to the economy and environment, both currently and in the future. Critically evaluate current event and public information related to wildlife conservation and management as being scientifically based or opinion based and contributes to the knowledge base of information	Environmental Studies, Environmental Ethics, Earth and Life (Earth system and Resources), water pollution and water related disease and disasters, Earth resources and man, Climate change, environmental hazards and Ecosystems. Definition of the term conservation and biodiversity. Species Dispersal, dispersion and distribution. What is the best ways to conserve biodiversity? Conservation strategies. Biodiversity hotspots. Conservation in practice. Effect of (habitat change and fragmentation, commercial hunting, pest control, competition with introduced species, environmental contaminant). International conservation (IUCN Red Data Books, the role of CITES). Management.
Zool 623	To understand the relation of chemical evolution and biological evolution. To understand the phylogeny and speciation	Evidence of evolution; Speciation through isolation; Patterns in evolution; Five agents of evolutionary change; Biology of evolution
Zool 624	Understanding the immune defences of invertebrate; gain the Knowledge of microbes diversity and their role in the field of Immunology. Concepts and necessary background hypotheses in immunology, biodiversity, managing and efficiency control in nature conservation.	What is animal immunology basics and definitions; Immunology is a science that deals with the immune system and the cell mediated and humoral aspects of immunity and immune response. Mechanism of immune modulation by Fasciolar hepatica: The impact if the innate immune cells on the developing immune response. Neuroendocrine control of immune response. during helminth infection immunomodulation by parasitic Helminths and its therapeutic exploitation
Zool 711	Basic knowledge of Behaviour in the fields of animal ecology and behavioural ecology as required for environmental protection; gain understanding the interaction between humans and animals. Essential concepts in ecology and applying them to current issues. Logic of science is powerful, understandable and beautiful, Understanding monitoring of animals and plants,	What is animal behaviour? Definitions; scientific study of wild and wonderful ways in which animals interact with each other, with other living beings, and with environments, behavioural ecology and evolution. evolution of altruism, evolution of Social behaviour, evolution of communication, avoiding predators and finding food, evolution of reproductive behaviour, Parental care, The developmental basic of behaviour, especially role of genes play as proximate factors underlying animal behaviour. Evolution, nervous systems, and behaviour. evolution of Human behaviour.
Zool 714	To understand the concept and knowledge of biostatistics in the analysis of biological attributes and its related environmental factors, To apply the	Sampling basics and definitions, sampling variation and bias, sampling techniques; Basis of statistical inference; Tests of significance and estimation, large samples, small samples; Linear regression and correlation, correlation coefficient, regression

	statistical tests to solve the biological problems such as similarity or differences of biological parameters within the same species as well as among the different species relation with environmental parameters,	equation; The Chi-square test; Analysis of variance, The F-test, One-way ANOVA, extension to Two-way ANOVA; Nonparametric or distribution free statistical tests
Geol 2104	Understanding and monitoring of the geologic hazards	Geologic Hazards, (Hazards from earthquake, Hazards from volcanic eruption, Hazards from ground failures, Hydrologic Hazards and Coastal Hazards),
Geol 2108	To understand the protection and conservation of natural environment To know the basic knowledge of protection and conservation for pollution	Human Induced Hazards (Waste disposal, Disposing of solid waste and Management of waste disposal). Soil Degradation, Erosion, Desertification and Deforestation Using and Caring for Earth Resources (Environmental impacts of mineral development and using fossil fuels)Pollutions (Water and Air pollution)
Geol 621R	To provide advanced the various geological and human induced hazards · To know solid and liquid wastes disposal · To know disaster management and risk reduction To upgrade the apply knowledge and to solve problems related to conservation and managements of, the natural environments for students,	Nature and Aspects of various geologic Hazards (Hazard from earthquake, volcanic eruption, and ground failures) Ways and means of mitigating these Hazards Geologic condition for proper waste disposal Proper use and care of earth resources ( groundwater and mineral resources, fossil fuel, and soil)Disaster management and risk reduction Impacts of Sedimentation Various Coastal Processes Biodiversity and their ecosystem Managements of waste disposal
Bot 1101	Understand the basic botanical knowledge. Get knowledge of the organization of cell and progressive organization of tissue and organs; followed by the diversity of plants and their relatives, the evolutionary relationship between plant groups. Know broadly about plant physiology or day-to-day functioning of the most complex groups of plants growth, reproduction, heredity and plants and their environment.	Botany as a science, The origin of life, Cell, Tissue and organ, Diversity of plants, Absorption and transport, Plant nutrition, Energy in plants, Plant growth, Plant reproduction, Plant heredity, Plants and their environments
Bot 1102	To know the dependence of human and all animals life on plants (food, medicine, clothing and shelters), to understand the basic concepts of an applied field of botany concerning the plant	Managing a Long Term Seed Stored for Genetic Recourses Conservation, The Determination of Moisture Content and the Number of Seeds in Accession, Characteristics of Seed Dormancy and Factors which Influence it, The Determination of Empty Seed Fraction, The Conduct of Seed Germination Test, Dependence of Human

	hormones, various kinds of biotechnology and bonsai growing technique	and All Animals life on Plants, Early History and Development of Plant Study, Plants and Peoples, Plants as Medicine, Plants for Clothing, Plants Hormones, Introduction to Plant Biotechnology, Fungi Technology, Bonsai
Bot 2104	Understand the meaning of ecology and the relationship between the ecosystem and biosphere. Gain the knowledge of climatic factor, edaphic factor, topographic factor and biotic factor.	Introduction the meaning of ecology, Environment of plants: Climate factor, Environment of plants: Edaphic factor, Environment of plants: Topographic factor, Environment of plants: Biotic factor, Species and population, Ecosystems and living organisms
Bot 3104/3204	To understand the interrelationship among organisms and their surrounding environment and how they symbiosis each other, To gain the knowledge of human population problems, origin of pollution and types of pollutants	To know the Biotic and its Surrounding or Environments, Abiotic environmental Factors, Biotic environmental Factors, Population, Pollution, Natural Resources and Management,
Bot 3110/3210	Understand the current information to biodiversity and able to know why they are important for the whole ecosystem.	Introduction to biological diversity, Threat to biodiversity, The value of biodiversity, Wildlife, Fisheries and Endangered species, Conservation and sustainable development
Bot 4107/4207	To understand deeply about the sustainability. To gain the knowledge of Applied Ecology. To know clearly about the characteristics Pollution. To be able to find good solution to solve the conservation. To get the information for EIA.	Sustainability Exploitation and agriculture, Pollution, Conservation, Introduction of exotic species, The principles of EIA
Bot 5211	Understand the meaning of Ethnobotany and its related subjects. Also understand the disciplines and sub-disciplines related to Ethnobotany and know how they are important for peoples' daily life. Also gain the ethno-medicinal knowledge and environmental conservation knowledge that is related with the Ethnobotany.	Introduction, Ethnobotany: Scope and Status, General Ethnobotanical techniques, Data collection and data compilation, Ethno-medicine, Ethnobotany and conservation, Quantitative ethnobotany, Applied ethnobotany
Bot 5212	To foster clear awareness of, and concern about, economic, social, political and ecological interdependence in urban and rural areas. To	History and Development of Environmental Education, The global Agenda, Perspectives on Theory and Researching in Environmental Education, Environmental

	provide every person with opportunities to acquire the knowledge, values, attitudes commitment and skills needed to protect and improve the environment. To create new patterns of behaviour of individual, groups and society as a whole, towards the environment.	Education: Structure and practice, The Global Scene, Towards progress and Promise in the Twenty-first Century
Bot 622	Understand deeply about the Environmental Science. Gain the knowledge of Environmental Ecology, Know clearly about the characteristics of minerals and natural resources and their values; how they are important for the whole ecosystem. Able to find good solutions to solve the environmental problems. Get the ideas and information for a sustainable plan.	Thinking Critically about the Environment, Environmental Ecology, Natural Resources, Environmental Problems, Planning for sustainable Future
MS 624	(1) Understand habitats in estuaries and the physical processes that contribute to their formation (2) Understand the important ecological processes that operate in estuaries (3) Understand human and natural impacts on estuary ecosystems and how animals and plant respond and adapt to these impacts (4) Synthesis information about assessment of estuary health and management processes in Myeik Estuary Area (5) Engage in informed discussions related to complexity and functioning of soft sediments ecosystems, how science is conducted in these systems, the science behind management/ conservation and possible solutions to the challenges caused by human activities (6) Critically evaluate relevant scientific literature and demonstrate this ability through a written essay and discussions in seminars (7) Design, collect and analyse field data using	1) Introduction to Estuaries 2) Physical and Chemical Characteristics of Estuaries 3) Biological Processes in Estuaries and Marine Ecosystems 4) Ecological Processes of Estuarine 5) Ecological Compartments and Their Interactions 6) Impacts on Estuaries Communities 7) Conservation 8) Recent and Management Issue in Various Myanmar Estuaries

	appropriate techniques (8) Write a scientific report that is integrated with the relevant literature	
MS 714	To understand; The importance of Marine living resources and non-living resources; to know how to use marine resources wisely; to know how to manage marine resources sustainably	Fisheries resources: Scale of the world's fisheries, Fishing methods, overfishing, Fisheries regulation, Fish farming problems. Mineral resources: Terrigenous, Chemogenous, Biogenous deposits, Polymetallic nodules, Polymetallic crusts.
MS 1104	To understand; Ocean terminology; Major taxonomic groups of marine organisms; Concept of food webs and ecological systems	Life history of plankton and benthos; Zonal distribution and migration; food webs and ecological systems; effect of abiotic factors on species and communities; chemical and physical effects of the community on their environment; pollution; exploitation
MS 2107	Have knowledge of general physical properties of ocean	The nature of seawater; Physical properties of ocean water; climate patterns, weather, formation and impacts of El Niño/La Niña on marine environments; renewable sources of energy; ocean circulation; wave characteristics
MS 2110	Knowing about the general characteristics of Chordate	Classification of Chordate; External features of bony fishes; The general characters of Amphibians; The general characters of Reptiles; The general characters of Aves; The general characters of Mammalia
MS 4104	Basic principles of ecology; The important roles and of seagrasses; Conservation and monitoring program	Systematics; Ecological roles; Adaptation to their environment; Productivity; Sampling; Long term monitoring program
MS 5208	Biological and chemical constituents and their pattern of recycle; Knowing specific problems concerned with environment; Values of environment; Methods for the assessment and controlling procedures	Oceans system; Biogeochemical cycles; Pollution in the marine environment; Uses of the marine environment in relation to pollution; Specific problems of regional significance; Methodology for the assessment and control of marine pollution
MS 613	to know the different kinds of marine mammals; to know the conservation needs for marine mammals	Basic knowledge of large marine mammals; Adaptation of swimming and diving mechanism; Behaviour of large marine mammals (Seals, Sea lions, Dugong, Dolphin, Porpoises and Whales); Mechanisms of echolocation; Vocalization and complex behaviour of Cetaceans; Feeding mechanisms; Reproductive behaviour of whales in their natural environment

MS 624	To know estuary is important habitat for euryhaline species; To know how to manage impacts on estuarine communities	The nature, origin and classification of estuaries; Physical characteristics of estuary; Human impacts on estuarine communities
Zool 1102	receive the basic concept on metabolic reaction take part in various organisms	Nutrition; Cellular respiration; Transport, Types of circulatory system; Homeostasis; Adaptations for hot and cold environments
Zool 3115 /3215	obtain knowledge of sources, levels and mechanisms of action for toxic substance; knowledge of effects of toxic substances on cellular levels, individuals health and on natural populations and communities	Definition on toxicology; Basic knowledge of toxicology; Research methodology in toxicology; Acute toxicity, Chronic toxicity, Potential sources of toxicities, Poison prevention and control strategies; Environmental pollution and health effects; Health impact of specific pollutants; Diseases caused by hazardous pesticides; Pesticide toxicity research in Myanmar
Zool 622	get knowledge to solve problem related to wildlife conservation and management; and also have a greater knowledge of how wildlife conservation and management relates to the economy and environment, both currently and in the future students will be able to critically evaluate current events and public information related to wildlife conservation and management	Environmental Ethics; A view on Earth; Protecting resources; Sustainable water management; Earth's Resources and Man; Natural cycles between the spheres; Renewable resources; Global warming; Measuring exposure to environmental hazards; Ecosystems; Value of biodiversity; Conservation Strategies; Value of endangered species; Kinds of managements; Conservation in practice management plan
Zool 5209	Students will be able to understand the relation of chemical evolution and biological evolution, phylogeny and speciation; in addition to obtain the interaction between humans and other animals	Evidence of evolution; Natural selection; The essence of Darwin Theory; Types of selective process; Allele frequencies change; Origin of species; Reproductive isolation; Chromosome change; Fossil record; Rate of evolution
Zool 1001	Understanding the chemical basis of living cells and tissues; Awareness of the importance of the chemical elements in nutrition and health	Variations in vertebrate digestive systems; Accessory organs: secretions of the pancreas; the liver and gallbladder; The actions of insulin and glucagon; Regulatory functions of the liver; Regulatory of blood concentration; Neural and hormonal regulation of digestion; Food energy and energy expenditure; Essential nutrients
Zool 621	gain broad knowledge of animal physiology and endocrinology; understand physiological mechanisms and know fundamental scientific	Cellular physiology and homeostasis; physiology of digestion; chemical coordination endocrine system

	concepts; get an understanding of how the parts of body are linked into a whole function	
Zool 622	know how our environment is important; understanding about wildlife conservation and management and how to solve its problems; about what and how can we do in our daily life to protect our environment; get greater knowledge of the relationship between wildlife conservation management and the economy and environment in the present and future	Environmental studied; Environmental ethics; A view of Earth; Protecting resources; Sustainable water management; Earth resources and man; Climate change; Environmental hazards and ecosystems; Value of biodiversity; Conservation strategies; Value of endangered species; Kinds of management; Conservation in practice management plan
Zool 623	gain knowledge about biology and evolution of organisms; understand the relationship between chemical and biological evolution; know to pay attention on the endangered species in the world; understand how humans and other animals interact with each other	Evidence of evolution; Biology of evolution; Observation and measurement of behaviour; maintenance of behaviour and temporal consideration; Spatial aspects of behaviour; Foraging and antipredator behaviour; Behaviour in social groups; Interaction between human and other animals
Zool 624	know about the nature of microbes and diversity of microbes; get knowledge the role of microbes in immunology field; understand about microbes' immune response	Definition and basic of animal immunology; Fasioler hepatica's mechanism of immune modulation; Neuroendocrine control of immune response; Immunomodulation by parasitic Helminths and its therapeutic exploitation; Evasion of the innate immune system by virus;
Zool 621	Students will be able to an integrated understanding of physiological mechanisms; Students will have an appreciation of how the parts of body are linked into a whole function	Cellular physiology and homeostasis; Definitions and features; Osmosis, metabolism,; Types of digestion; The birth of endocrinology; Nuclear receptors; Hormones of metabolism
Zool 622	Students will be able to apply knowledge to solve problems related to wildlife conservation and management; Students will have greater knowledge of how wildlife conservation and management relates to the economy and environment, both currently and in the future; Students will be able to critically evaluate current	Environmental studies; A view of Earth; Groundwater; Water pollution; Volcanoes; Various spheres; Air pollution; Climate changes; Global warming and acid rain; Biodiversity; Wildlife conservation and management

	events and public information related to wildlife conservation and management as being scientifically bases and contributes to the knowledge base of information	
Zool 623	understand the relation of chemical evolution and biological evolution; Understand the phylogeny and speciation; Gain an understanding the interaction between humans and other animals	Evidence of evolution; Populations can become isolated in several ways; Patterns in evolution; Genetic drift; Natural selection; Science and the study of behaviour; Habitat selection and use; Foraging and antipredator behaviour
Zool 624	The students should be more interested in morphology of microbe; The students should be more understand about immune response of microbe	The immune defences of invertebrates; Mechanisms of immune modulation; Evasion of the innate immune system by virus; Neuroendocrine control of the immune response; Immunomodulation by parasitic helminths and its therapeutic exploitation

### Appendix 3

#### Attendance lists WP1.3 and WP1.4

##### WP1.4

- Dr. Neil Furey, FFI SE Asia, Phnom Pen, Cambodia (through skype call; chat protocol in Fig. 1)
- U Nay Myo Shwe, FFI Myanmar Program, Yangon, Myanmar (through skype; chat protocol attached)
- Ms. Katie LaJeunesse Connette, Smithsonian Conservation Biology Institute, Washington DC, USA (through skype call; chat protocol attached)
- Dr. Grant Connette, Smithsonian Conservation Biology Institute, Washington DC, USA (through skype call; chat protocol attached)
- U Saw Htun, WCS, Yangon, Myanmar
- Mr. Rob Tizzard, WCS, Yangon, Myanmar
- U Myint Aung, Friends of Wildlife, Yangon, Myanmar
- U Thein Aung, MBNS, Yangon, Myanmar
- Dr. Marta Fallola, UEx, Badajoz, Spain
- Ms. Macarena Parejo, UEx, Badajoz, Spain
- Dr. Paul Bates, University of Natural Resources and Natural Sciences, Austria
- Dr. Swen Renner, University of Natural Resources and Natural Sciences, Austria

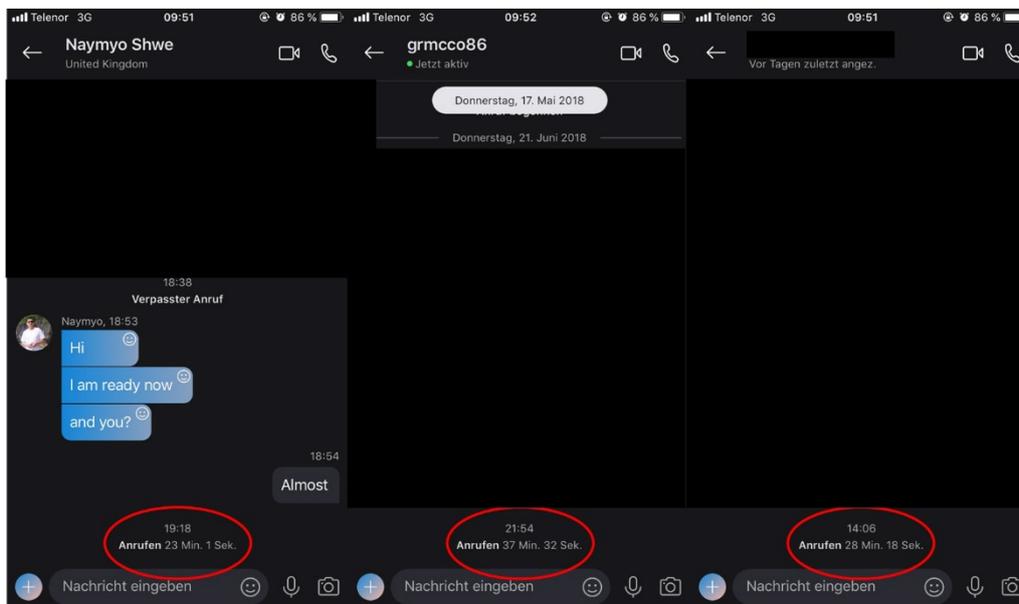


Figure 7. Figure 1: Skype screenshot of WP1. 4 non-academic needs assessment record.