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Biodiversity and Conservation

ENVI-3000 (3 credits)

Madagascar: Biodiversity and Natural Resource Management

This syllabus is representative of a typical semester. Because courses develop and change over time to take advantage of unique learning opportunities, actual course content varies from semester to semester.

Course Description

Biodiversity in Madagascar is closely linked to the well-being of local communities and the availability of natural resources. However, competition for these resources is increasing due to climate change, drought, poverty, habitat loss, and human development. Also, given practical constraints, conserving all aspects of biodiversity and natural features is not feasible. Our seminar on the conservation of biodiversity will introduce students to the science of biodiversity and to the ecological underpinnings of species extinction and conservation. This background will provide an understanding of methods for protecting and enhancing biodiversity, particularly the use of protected areas.

Learning Outcomes

Upon completion of the course, students will be able to:

- Describe the range of Madagascar's main terrestrial, coastal and marine ecosystems and their key features.
- Acquire a solid understanding of the fundamental concepts related to ecological and evolutionary processes in Madagascar.
- Assess the significance, methodologies, and scientific underpinnings of conservation and management efforts within Madagascar.
- Gain proficiency in research methodologies and techniques.
- Propose strategies for tropical biodiversity conservation.
- Undertake a research project to address significant, unresolved inquiries (during ISP).

Language of Instruction

This course is taught in English, but students will be exposed to vocabulary related to course content through in-country expert lectures and field visits in a wide range of venues and regional locales.

Instructional Methods

SIT's teaching and learning philosophy is grounded in the experiential learning theory developed by Kolb (1984; 2015) and informed by various scholars, such as Dewey, Piaget,

Lewin, among others. Experiential learning theory recognizes that learning is an active process that is not confined to the formal curriculum; “knowledge is created through the transformation of experience” (Kolb, 2015, p. 49). Learning involves both content and process. Learning is holistic and happens through various life experiences upon which students draw to generate new ways of knowing and being. Learning involves a community and is a lifelong endeavor. Learning is transformational. The suggested four step-cycle of a *concrete experience*, *reflective observation*, *abstract conceptualization*, and *active experimentation* embedded in the experiential learning model is not linear and might not always happen in that specific order, as any learning is highly context dependent. These stages of taking part in a shared experience; reflecting on that experience by describing and interpreting it; challenging their own assumptions and beliefs to generate new knowledge; and ultimately applying new knowledge, awareness, skills, and attitudes in a variety of situations and contexts are important for students to engage in to become empowered lifelong learners.

Assignments and Evaluation

Assignment Descriptions and Grading Criteria

1) Botanical Methods Study (20%)
Students work with Malagasy counterparts from the *L’Universite de l’Itasy* to gain practical field experience in collecting botanical data. Methods focus on species discovery and minimum area, inventories using Gentry plots, Point Center Quarter (PCQ) for habitat and species association, vertical forest structure using Gauthier’s method, and herbarium collection methods. Feedback given on an oral presentation in English or French on analysis performed on data collected is incorporated into the written report.

2) Lemur Ecology Study (20%)
Students work with Malagasy counterparts from the *L’Universite de l’Itasy* to gain practical field experience in collecting botanical data. Each group will perform population density estimates, habitat use, and time allocation of *Indri indri* and *Prolemur simus* during field study in Andasibe. Students present their analyses orally in English or French. Feedback is then incorporated into the written report.

3) Natural Resource Issues Portfolio (30%)
Each student investigates and develops a theme of their choice over the first six weeks of the program. The goal is to use a variety of field techniques, including participant observation, structured and key stakeholder surveys, and Participatory Rural Appraisal methods to gather information on a chosen natural resource in urban and rural settings. The value of each technique is assessed in the process of weaving together pertinent facts about Madagascar’s peoples and environments that optimizes academic and experiential learning from seminar classes, field excursions, the village stay, homestay, interviews, and publications. Students present findings in a carefully constructed analysis paper backed by appropriate literature.

4) Student-led Discussion (20%)

Students work in groups to facilitate discussion on contemporary resource issues. The goal of the assignment is for students to understand, appreciate and critically reflect on pressing issues in marine resources management and conservation. Context and scale are critical to examining themes involving multiple stakeholders. A synthesis of issues and questions is presented in French, followed by a discussion in English penetrating into issues that also draw from students' practical experiences over the first two months of the semester.

5) Participation (10%)
This includes active involvement in lectures, readings, discussions and excursions using the following criteria:

- Attendance - promptness to class and positive presence in class.
- Active Listening - paying attention in class and during field excursions, asking appropriate questions, showing interest and enthusiasm (this includes body language), entertaining contradictory perspectives, taking notes.
- Involvement in Class Discussions - either in small or large groups, sharing knowledge. This means challenging yourself to speak up if you usually don't, and also means allowing others to speak if you are a person who tends to dominate class discussions.
- Group Accountability – positive participation in the group during field excursions and classes; not keeping others waiting.
- Displaying Respect – culturally appropriate interaction with hosts, SIT program staff, SIT lecturers and communities.

Assessment

Botanical Methods Study	20%
Lemur Ecology Study	20%
Student-Led Discussion	20%
Natural Resource Issues Portfolio	30%
Effort and participation	10%

Attendance and Participation
Due to the nature of SIT Study Abroad programs, and the importance of student and instructor contributions in each and every class session, attendance at all classes and for all program excursions is required. Criteria for evaluation of student performance include attendance and participation in program activities. Students must fully participate in all program components and courses. Students may not voluntarily opt out of required program activities. Valid reasons for absence – such as illness – must be discussed with the academic director or other designated staff person. Absences impact academic performance, may impact grades, and could result in dismissal from the program.

Late Assignments
SIT Study Abroad programs integrate traditional classroom lectures and discussion with field-based experiences, site visits and debriefs. The curriculum is designed to build on itself and progress to the culmination (projects, ISP, case studies, internship, etc.). It is critical

that students complete assignments in a timely manner to continue to benefit from the sequences in assignments, reflections and experiences throughout the program.
Example: Students may request a justified extension for one paper/assignment during the semester. Requests must be made in writing and at least 12 hours before the posted due date and time. If reason for request is accepted, an extension of up to one week may be granted at that time. Any further requests for extensions will not be granted. Students who fail to submit the assignment within the extension period will receive an 'F' for the assignment.

Grading Scale

94-100%	A
90-93%	A-
87-89%	B+
84-86%	B
80-83%	B-
77-79%	C+
74-76%	C
70-73%	C-
67-69%	D+
64-66%	D
below 64	F

Program Expectations

- Show up prepared. Be on time, have your readings completed and points in mind for discussion or clarification. Complying with these elements raises the level of class discussion for everyone.
- Have assignments completed on schedule, printed, and done accordingly to the specified requirements. This will help ensure that your assignments are returned in a timely manner.
- Ask questions in class. Engage the lecturer. These are often very busy professionals who are doing us an honor by coming to speak.
- Comply with academic integrity policies (no plagiarism or cheating, nothing unethical).
- Respect differences of opinion (classmates', lecturers, local constituents engaged with on the visits). You are not expected to agree with everything you hear, but you are expected to listen across difference and consider other perspectives with respect.

SIT Policies and Resources

Please refer to the SIT Study Abroad Handbook and the Policies section of the SIT website for all academic and student affairs policies. Students are accountable for complying with all published policies. Of particular relevance to this course are the policies regarding: academic integrity, Family Educational Rights and Privacy Act (FERPA), research and ethics in field study and internships, late assignments, academic status, academic appeals, diversity and disability, sexual harassment and misconduct, and the student code of conduct.

Please refer to the SIT Study Abroad Handbook and SIT website for information on important resources and services provided through our central administration in Vermont, such as Library resources and research support, Disability Services, Counseling Services, Title IX information, and Equity, Diversity, and Inclusion resources.

Course Schedule

**Please be aware that topics and excursions may vary to take advantage of any emerging events, to accommodate changes in our lecturers' availability, and to respect any changes that would affect student safety. Students will be notified if this occurs*

Module 1: Understanding Madagascar's Biodiversity and Monitoring It

This module provides students with an understanding of Madagascar's unique and endemic flora and fauna. Considering unique biogeography and evolutionary processes, students learn theories of evolution and how they led to diverse habitats and species forming in different parts of Madagascar. New evidence of early human settlement, extinctions and genetic evidence for natural fragmentation of populations provide a fascinating lens through which students explore Madagascar's unique flora and fauna. A field course on the collection of botanical and plant community ecology provides students with the opportunity to understand the data collection protocols and context for the monitoring and management of biodiversity rich littoral forests.

Excursions: Forest of Andasibe and Ankafobe

Readings:

Antonelli, A., Smith, R. J., Perrigo, A. L., Crottini, A., Hackel, J., Testo, W., Farooq, H., Torres Jiménez, M. F., Andela, N., Andermann, T., Andriamanohera, A. M., Andriambololonera, S., Bachman, S. P., Bacon, C. D., Baker, W. J., Belluardo, F., Birkinshaw, C., Borrell, J. S., Cable, S., & Canales, N. A. (2022). Madagascar's extraordinary biodiversity: Evolution, distribution, and use. *Science*, 378(6623). https://doi.org/10.1126/science.abf0869

Ganzhorn, J., Wilme , L., & Mercier , J-L. (2014). Explaining Madagascar's biodiversity. In *Conservation and Environmental Management in Madagascar* (pp. 17–43). Earthscan.

Goodman, S. M., & Jungers, W. L. (2014). *Extinct Madagascar: picturing the island's past*. The University of Chicago Press.

Quemere E et al. (2012). Genetic data suggest a natural prehumen origin of open habitats in northern Madagascar and question the deforestation narrative in this region, *Proceedings of the National Academy of Sciences*, Vol 109 (32): 13028-13033.

Dewar, R. (2014). Early human settlers and their impacts on Madagascar's landscapes. In *Conservation and Environmental Management in Madagascar* (pp. 44–64). Earthscan.

Module 2: People and Plants: Ethnobotany, Bioprospecting

The relationships between people and plants in Madagascar are extremely diverse and complex. This module introduces students to a range of the human uses of plants in Madagascar across scales, habitat types and management systems. Topics covered include traditional medicine, subsistence agriculture and cash cropping, construction, and fuelwood as well as the search for pharmaceutical products from nature. Students are encouraged to maintain a critical perspective when considering human uses of plants, understanding the significance of local livelihoods, and governance and management of plants as well as the potential for exploitative and neocolonial uses of Malagasy plants through forms such as land grabbing and biopiracy.

Excursions: *Centre National d'Application des Recherches Pharmaceutiques* (CNARP)

Readings:

Golden, C. D. et al. (2012). Rainforest Pharmacopeia in Madagascar Provides High Value for Current Local and Prospective Global Uses. *PLoS ONE*, *7*(7), e41221. https://doi.org/10.1371/journal.pone.0041221

Martin, G. (1995). *Ethnobotany: A Methods Manual*. Chapman and Hall.

Neimark, B., and Tilghman, L. (2014). Bioprospecting in a biodiversity hotspot: The political economy of natural products drug discovery for conservation goals in Madagascar. In *Conservation and Environmental Management in Madagascar* (pp. 271–298). Earthscan.

Module 3: Marine Biodiversity: Coastal Ecology and Management

This module complements the content already covered by the fisheries and marine policies unit. Madagascar is important within the western Indian Ocean region in term of its marine biodiversity, while traditionally the terrestrial fauna and flora received much focus from the conservation community, the last decade has seen a remarkable growth in marine conservation programs with the establishment of new marine protected areas and a great deal of attention from researchers and NGOs. Lectures, readings, and site visits initiate students in the diversity of marine species from the mangrove, intertidal and coral reef zones, as well as the trends and systems established for their monitoring and management. A special focus is placed on learning about the community based marine protected areas being established by NGOs and local communities in the Tulear area and how these interact with Malagasy customs and local livelihood and governance systems.

Excursions: Mangily, Tulear

Readings:

Gildas , A., & Gardner, C. J. (2010). L'utilisation du *dina* comme outil de gouvernance des ressources naturelles : leçons tirés de Velondriake, sud-ouest de Madagascar. *Tropical Conservation Science*, *3*(4), 447–472. https://doi.org/10.1177/194008291000300409

Cooke, A. (2012.) *Madagascar: A Guide to Marine Biodiversity*, Wildlife Conservation Society.

Harris, A. (2009). "To live with the Sea": Development of the Velondriake Community - Managed Protected Area Network, Southwest Madagascar. *Madagascar Conservation & Development*, *2*(1). https://doi.org/10.4314/mcd.v2i1.44129

Module 4: Lemurs of Madagascar: Evolution, Ecology and Conservation

The lemurs are undoubtedly emblematic of the uniquely adapted and endemic fauna of the island. There are currently 111 recognized species of lemur, many of them found only in small, isolated forests. The ecological niches and roles as pollinators, seed dispersers, indicators and flagship species for conservation are explored through lectures and a lemur ecology field course. The evolutionary history of lemurs and contestation of the true diversity of lemurs and their unique adaptations are also covered. The course introduces students to a series of fundamental methods used in the study and monitoring of lemurs: The development of ethograms and behavioral study, the study of lemur home range and habitat preferences and the use of population census activities through transect walks provides students with insights into key methods used by primatologists and conservation biologists. Students meet and discuss with local stakeholders to understand traditional beliefs and taboos about lemurs, as well as the roles, costs, and benefits of local actors in managing protected areas.

Site Visits: Andasibe.

Readings

Schwitzer C, Mittermeier RA, Davies N, Johnson S, Ratsimbazafy J, Razafindramanana J, Louis Jr. EE, Rajaobelina S (eds). (2013) Lemurs of Madagascar: A Strategy for Their Conservation 2013–2016. Bristol, UK:IUCN SSC Primate Specialist Group, Bristol Conservation and Science Foundation, and Conservation International.

Sterling, E., Bynum, N., & Blair, M. (2013). *Primate Ecology and Conservation: A Handbook of Techniques*. Oxford University Press.

Mittermeier, R. A., & Nash, S. D et al. (2010). *Lemurs of Madagascar* (3rd ed.). Conservation International.

Muldoon, K. M., & Goodman, S. M. (2015). Primates as Predictors of Mammal Community Diversity in the Forest Ecosystems of Madagascar. *PLoS ONE*, *10*(9), e0136787. https://doi.org/10.1371/journal.pone.0136787

Ballhorn, D. J., Rakotoarivelo, F. P., & Kautz, S. (2016). Coevolution of Cyanogenic Bamboos and Bamboo Lemurs on Madagascar. *PLoS ONE*, *11*(8), e0158935. https://doi.org/10.1371/journal.pone.0158935

Tattersall, I. (2013). Understanding species-level primate diversity in Madagascar. *Madagascar Conservation & Development*, *8*(1). https://doi.org/10.4314/mcd.v8i1.2

