ANP 304 Spring 2015

Ecology: Linking People and Nature
with emphasis on the Turkana Basin

This module will introduce students to the present-day flora, fauna and ecology of the Lake Turkana Basin. The module will include a mixture of fieldwork, lectures, seminars and readings. The fundamental principles and techniques of basic field ecology will be demonstrated in the context of the modern East African Lake Turkana environment. This will be presented in the context of the evolution of the various taxa and the general principles of evolutionary biology. Emphasis will be on identification of common and important species around and near the Turkana Basin Institute (TBI) at Turkwel as well as recognizing important evolutionary and ecological patterns and issues.

Fieldwork will focus on plants and insects and generate useful baseline data for longer-term studies. Students will be introduced to some basic ecological monitoring methods for plant and insect communities. Plant studies will include transects, quadrats and understanding community dynamics including identification of common plant species, restoration ecology and invasive species. Insect fieldwork will focus on survival in drylands and be linked to topics including mutualism, phenology, invasive species, epidemiology and restoration ecology. We will be looking closely at some aspects of the biology of vectors around TBI as part of this module (Fall 2014).

Students will be exposed to a variety of habitats including the riverine forests and dryland grassland areas around the Turkana Basin Institute as well as the rich freshwater and island systems of Lake Turkana.

Several short excursions are planned as part of this module. Field trips will take the students into the habitats discussed in the course and include coverage of field methods. Shorter trips to look at birds, plants and insects will also be planned during the module. Field trips will typically take place in the mornings, with occasional evening/afternoon activities. We will return to TBI around 11 am each morning for lectures, discussion and seminar sessions. Students should be prepared to spend time outdoors for this module and have adequate packs for carrying notebooks, water and other supplies.

Instructor: Dr. Dino J. Martins dino@turkanabasin.org
Office & Phone: +254 733 673 493
Will be generally available to students for office hours during the module.

Teaching Assistants: There will be one graduate student TA and one undergraduate student TA available at the facility for the duration of the semester.

Text: There is no assigned textbook for this course; assigned readings will be given digitally to the students at the beginning of the course. The readings will be useful for clarifying concepts discussed in class and for supplying additional examples from those presented in lecture. Students will find that reading the material before attending lecture will make the lecture easier to follow. Other documents, review sheets, class announcements, etc, will be downloadable from the class Blackboard site (https://blackboard.stonybrook.edu).

Class Meetings: Monday - Saturday, 8:00 am - 12:00 pm, and 2:30 - 5:30 pm

Week	Day	Lecture	Seminar	Recitation	Lab	Field	Other	Total
1	Mon	3			3			6
1	Tues	3			3			6
1	Wed	3			3			6
1	Thur	3			3			6
1	Fri	3			3			6
1	Sat				3	3		6
2	Mon	3			3			6
2	Tues				3	3		6
2	Wed	3			3			6
2	Thur		3				3 exm	6
2	Fri		6					6
2	Sat					6		6
Total Hours		21	9		27	12	N/A	72
Contact Hours		21	9		13.5	4		**47.5**

COURSE LEARNING OBJECTIVES

The objectives of this course are to teach you to:

- Understand the application of the scientific method (i.e., how to construct and test a hypothesis).
- Be able to summarize and describe simple quantitative and qualitative observations and react to such observations critically
- Understand the theory of evolution at both the molecular and organismal levels.
- Examine the interconnectedness between climate, environment, organismal evolution, and human life history and behavior.

This course satisfies the following requirements of the **DEC**:
Category E- Natural Sciences

This course satisfies the following requirements of the **SBC**:
Study the Natural World (SNW):

1. Understand the methods scientists use to explore natural phenomena including observation, hypothesis development, measurement and data collection, experimentation, and evaluation

of evidence.
2. Understand the natural world and the major principles and concepts that form the basis of knowledge in the natural sciences.
3. Assess scientific information and understand the application of scientific data, concepts, and models in the natural sciences.
4. Make informed decisions on contemporary issues involving scientific information.

-In this class, via field practicals and lab experiments (see details below), students will have hands-on practice with the methods scientists use to explore natural phenomena, will gain direct understanding of the natural world and the major principles and concepts that form the basis of knowledge in the natural sciences, learn how to Assess scientific information and understand the application of scientific data, concepts, and models, such that at the end of the module they will be able to make informed decisions on contemporary issues involving scientific information.

and

Write Effectively within One's Discipline (WRTD):

1. Collect the most pertinent evidence, draw appropriate disciplinary inferences, organize effectively for one's intended audience, and write in a confident voice using correct grammar and punctuation.

-Each student will prepare a paper that uses data to address an ecological issue. Over the course of the module, the instructor will issue feedback on paper's topic, logical structure, detailed outline, and rough drafts, so that students become proficient in constructing and writing papers on scientific topics.

PREREQUISITES

This course is part of a 5-course themed cluster (field school) and there are no prerequisites except permission from the instructor and/or study abroad office. Lectures will cover the basic concepts that are required to understand the material. A science background is not necessary for the successful completion of the course.

COURSE REQUIREMENTS

Grades will be based on participation in class, practicals and preparing a paper accompanied by a short discussion/presentation on a particular topic. This can be done in groups of 2-3, but each student must write their own paper. Potential topics will be discussed at the beginning of the module.

Students will also be required to keep a notebook/journal into which they will record general natural history and ecology notes and drawings over the duration of the course. There will be short exam at the end of the module. Practical field-based investigation will be emphasized and students will be expected to explore and report on specific aspects of ecology.

A short paper and presentation will be developed on this topic chosen by the student. Students may work in groups on a particular topic, but must prepare their own papers. Students can choose to write/present on a topic such as a particular approach to conservation or management/exploitation of biodiversity as well as on broader topics in ecology, epidemiology and other areas.

Practicals will develop the following key elements of the scientific process:

1. Identifying a valid question.
2. Developing a research plan
3. Conducting ecological field research, collecting appropriate data

4. Analyzing the data
5. Synthesizing the information into a written project, paper or presentation

Grading:

-Participation	20%
-Practicals	25%
-Paper/presentation	30%
-Journal/notebook	15%
-Exam	10%

COURSE POLICES

Classroom etiquette:

While students are in class, they are expected to give their full attention to the lecture. Reading, talking, eating, texting or browsing on cell phones, leaving or packing up to leave before the professor has dismissed the class are inappropriate classroom behaviors and disruptive to other students. Also, please make sure that your watch alarms, pagers, and cell phones do not go off during class.

Attendance and preparation of assignments:

Students are expected to attend all classes; if you expect to miss one or two classes, please email your TA, who will inform to me. Unexcused absences will lower your grade. Computer glitches (such as computers that die, hard disks that crash, flash drives that are lost, etc) will not be accepted as excuses for failure to do assignments on time, to study for exams, etc.

Policy Regarding Missed Exams:

Generally, makeup examinations are not given (and the score for the missed exam is entered as zero "0"). If you would like to be considered for a makeup examination, the following conditions must be met: 1. You should have a legitimate excuse for having missed the original exam, e.g., illness, family emergency. 2. You must inform me within 48 hrs before or after the scheduled exam date that you cannot take the exam. If the above conditions apply, then you will be allowed to do a makeup exam.

Americans with Disabilities Act:

If you have a physical, psychiatric/emotional, medical or learning disability that may impact on your ability to carry out assigned course work, please contact the Disability Support Services office in the Educational Communications Center (ECC) Building, room 128 (632-6748). DSS will review your concerns and determine, with you, what accommodations are necessary and appropriate. All information and documentation of disability is confidential.

Academic Integrity:

Each student must pursue his or her academic goals honestly and be personally accountable for all submitted work. Representing another person's work as your own is always wrong. Faculty are required to report any suspected instances of academic dishonesty to the Academic Judiciary. Faculty in the Health Sciences Center (School of Health Technology & Management, Nursing, Social Welfare, Dental Medicine) and School of Medicine are required to follow their school-specific procedures. For more comprehensive information on academic integrity, including categories of academic dishonesty, please refer to the academic judiciary website at http://www.stonybrook.edu/uaa/academicjudiciary/

Critical Incident Management:
Stony Brook University expects students to respect the rights, privileges, and property of other people. Faculty are required to report to the Office of Judicial Affairs any disruptive behavior that interrupts their ability to teach, compromises the safety of the learning environment, or inhibits students' ability to learn. Faculty in the HSC Schools and the School of Medicine are required to follow their school-specific procedures.

Syllabus

Day 1- Arrival and Orientation
Morning: Travel to Mpala Research Centre campsite
Afternoon: Game drive and walk.

Day 2- Introduction to Ecology
Morning: Ecology and Evolution Overview
Afternoon: The African Savannah – Overview of ecosystems and habitats; Discussion of student topics for papers

Day 3- Introduction to Modern Africa Savannah Ecology
Morning: Introduction to Modern Africa Savannah Ecology
Afternoon: Plant density, patterns, reproduction

Day 4- TRAVEL DAY-
Afternoon: Orientation at the Turkana Basin Institute

Day 5- Life on the Edge – Adaptations to Heat and Drought
Morning: Strategies of plants and strategies of animals
Afternoon: *Practical* – Adaptations of plants to drought and heat

Day 6- Vectors and Disease Ecology I
Morning: Introduction
Afternoon: *Practical* – life history of selected vectors

Day 7- Biodiversity of African Drylands
Morning: Linking People and Nature- bees and pollination
Afternoon: *Practical* – Sampling dryland insect diversity

Day 8- Field Trip to Kerio Delta
Morning: Restoration of African Drylands, Invasive Species, Charcoal
Afternoon: *Practical* – Biodiversity associated with invasive *Prosopis*

Day 9- Linking People and Nature – Agrobiodiversity in Turkana Pastoralism
Morning: Agrobiodiversity in Turkana Pastoralism and a changing landscape
Afternoon: *Practical* – Visit to pilot farming project and livestock bomas

Day 10- Rest Day - Field Trip to Napedet Hills

Day 11- Vectors and Disease Ecology II
Morning: Biology of Malaria
Afternoon: *Practical* – life history of selected vectors

Day 12- Lake Turkana Freshwater Ecology
Morning: *Practical* – Identifying common birds, insects
Insect behaviour (dragonflies, mosquitoes)
Afternoon: Life on the edge – the littoral zone, freshwater stream systems
Practical – A simple food chain on the banks of the Turkwel

Day 13- Linking People and Nature – Turkana Freshwater Ecology
Morning: Freshwater ecology; health and disease in a changing world
Afternoon: Student research projects.

Day 14- Showing What You Learned
Morning & Afternoon: Writing of student papers; Individual meetings with Dr. Martins/review projects

Day 15- Showing What You Learned
Morning: Exam
Afternoon: Presentation/Discussion of student papers

Day 16- Class Over: Rest Day Before Next Module

Details of main topics to be covered:

Introduction – The Lake Turkana Ecosystem
Ecosystems and habitats of the Lake Turkana Ecosystem
Overview of species diversity across the region
People, culture and political development of the region – in a context relevant to understanding biodiversity and ecology
Practicals for this topic will include basic introductory exercises in taxonomy, natural history and vegetation studies

The African Savannah – Ecosystems and Habitats
Species, populations, niche and ecosystem – understanding ecology
Biodiversity – What is it, what does it mean?
Soils, climate and geology – How physical traits of the landscape shape habitats
Practicals will include and introduction to the vegetation and identifying plants and preparation of plant specimens

The African Savannah – Changing Landscapes
Current vegetation patterns around TBI. Why does it look the way it does?
Plants in drylands – adaptations to drought survival, herbivory, grazing.

Practical on monitoring vegetation and analysing data, continued identification of plants

Life in hot climates – Strategies for survival
Foraging patterns of desert ants
Adaptations to extremes of heat and aridity by plants and insects
Practical on insects adapted to extreme heat and aridity
Practicals will look at plants and insects around TBI, make basic measurements and carry out some experimental manipulation

Restoration of African drylands
The need for restoration ecology – The Acacia tortilis woodlands
What does it mean for African drylands?
Practical on monitoring vegetation and analysing data for ecological work

Invasive species
Invasive species - Why do they matter?
Distribution and biology of Prosopis at Lake Turkana
Practical on identifying species associated with Prosopis

Lake Turkana Freshwater Ecology
The abiotic environment – the conditions of life in water
Overview of East African freshwater lakes diversity – fish, birds, mammals, molluscs, insects and other invertebrates, and vegetation.
The food-web of Lake Turkana – from sunlight to giant perch and crocodile
Practical on observing and identifying dragonflies

Linking People and Nature
People and nature – biodiversity conservation in Africa today
Bees in African drylands: evolutionary history, diversity and ecology
Practical on biology of vectors in Turkana.
Biology, life-histories and role of vectors in the epidemiology and ecology of the environment around TBI.

Readings

Readings for individual lectures will be distributed as PDFs/photocopies before or at the beginning of the module. Students are expected to have read the papers before the day that topic is covered and come prepared with questions for discussion sessions.

Introduction – The Lake Turkana Ecosystem:
Martins, D. J. (2013). Lake Turkana. In *Biomes and Ecosystems: an Encyclopaedia*. Salem Press, University of Georgia.

Bobe, R. (2006). The evolution of arid ecosystems in eastern Africa. *Journal of Arid Environments*, 66(3), 564-584.

The African Savannah – Ecosystems and Habitats

Reid, R. S., & Ellis, J. E. (1995). Impacts of pastoralists on woodlands in South Turkana, Kenya: livestock-mediated tree recruitment. *Ecological Applications*, 978-992.

Cumming, D. H. M. (1982). The influence of large herbivores on savanna structure in Africa. In *Ecology of tropical savannas* (pp. 217-245). Springer Berlin Heidelberg.

Scholes, R. J., & Archer, S. R. (1997). Tree-grass interactions in savannas. *Annual review of Ecology and Systematics*, 517-544.

The African Savannah – Changing Landscapes

McCabe, J. T. (1990). Turkana pastoralism: A case against the tragedy of the commons. *Human Ecology*, *18*(1), 81-103.

Coughenour, M. B., & Ellis, J. E. (1993). Landscape and climatic control of woody vegetation in a dry tropical ecosystem: Turkana District, Kenya. *Journal of Biogeography*, 383-398.

Adams, W. M. (1989). Dam construction and the degradation of floodplain forest on the Turkwel River, Kenya. *Land Degradation & Development*, *1*(3), 189-198.

Vector Biology:

Martens, W. J., Niessen, L. W., Rotmans, J., Jetten, T. H., & McMichael, A. J. (1995). Potential impact of global climate change on malaria risk. *Environmental health perspectives*, *103*(5), 458.

Hopkins, D. R. (2013). Disease eradication. *New England Journal of Medicine*, *368*(1), 54-63.

Bayoh, M. N., Akhwale, W., Ombok, M., Sang, D., Engoki, S. C., Koros, D., & Hamel, M. J. (2011). Malaria in Kakuma refugee camp, Turkana, Kenya: facilitation of *Anopheles arabiensis* vector populations by installed water distribution and catchment systems. *Malar J*, *10*(149), 10-1186.

Patz, J. A., Campbell-Lendrum, D., Holloway, T., & Foley, J. A. (2005). Impact of regional climate change on human health. *Nature*, *438*(7066), 310-317.

Life in hot climates – Strategies for survival

Moseley, P. L. (1997). Heat shock proteins and heat adaptation of the whole organism. *Journal of applied physiology*, *83*(5), 1413-1417.

Newman, R. W. (1970). Why man is such a sweaty and thirsty naked animal: a speculative review. *Human Biology*, 12-27.

Berry, J., & Bjorkman, O. (1980). Photosynthetic response and adaptation to temperature in higher plants. *Annual Review of Plant Physiology*, *31*(1), 491-543.

Wahid, A., Gelani, S., Ashraf, M., & Foolad, M. R. (2007). Heat tolerance in plants: an overview. *Environmental and Experimental Botany*, *61*(3), 199-223.

Restoration of African drylands:

Ellis, J. E., Coppock, D. L., McCabe, J. T., Galvin, K., & Wienpahl, J. (1984). Aspects of energy consumption in a pastoral ecosystem: wood use by the South Turkana. *Wood, energy and households: perspectives on rural Kenya. Beijer Institute and the Scandinavian Institute of African Studies*.

Invasive species:

Mwangi, E., & Swallow, B. (2005). Invasion of *Prosopis juliflora* and local livelihoods: Case study from the lake Baringo area of Kenya. *World of Agroforestry Centre (ICRAF). Nairobi, Kenya*.

Andersson, S. (2005). Spread of the introduced tree species *Prosopis juliflora* (Sw.) DC in the Lake Baringo area, Kenya. *Institutionen for Skoglig vegetationsekologi. ISSN*, 1652-4918.

Pringle, R. M. (2005). The origins of the Nile perch in Lake Victoria. *BioScience*, *55*(9), 780-787.

Lake Turkana Freshwater Ecology:

Campbell, L. M., Osano, O., Hecky, R. E., & Dixon, D. G. (2003). Mercury in fish from three rift valley lakes (Turkana, Naivasha and Baringo), Kenya, East Africa. *Environmental Pollution*, *125*(2), 281-286.

Kolding, J. (1989). *The fish resources of Lake Turkana and their environment*. University of Bergen, Department of Fisheries Biology.

Linking People and Nature:

Martins, D. J. (2014). Butterfly Pollination of the Dryland Wildflower *Gloriosa minor*. *Journal of East African Natural History*, *103*(1), 25-30.

Martins, D. J. (2013). People, Plants and Pollinators: Uniting Conservation, Food Security, and Sustainable Agriculture in East Africa. In *Conservation Biology: Voices from the Tropics, 1st edn.(edited by NS Sodhi, L. Gibson and PH Raven). John Wiley and Sons Ltd, New York*, 233-238.