



THE SCHOOL
FOR FIELD STUDIES

Techniques in Natural Resource Management SFS 3751

Syllabus, Spring 2019

John Kioko, PhD

Resident Lecturer in Techniques in Natural Resource Management

The School for Field Studies (SFS)
Center for Water and Wildlife Studies (CWWS)
Kilimanjaro Bush Camp, Kimana, Kenya

This syllabus may develop or change over time based on local conditions, learning opportunities, and faculty expertise.
Course content may vary from semester to semester.



Course Overview

This course involves students learning about principles and techniques of natural resource management. The course will introduce the ongoing discourse and the underlying scientific principles on natural resource management as well explain the current techniques being applied in managing natural resources. The course will in particular emphasis on water resources as a core resource for humans and wildlife. In order to enhance a broad understanding of natural resource management, the course will be taught through a juxtaposition of field based experiential learning through hands on activities and interactions with expert persons. The training emphasizes self-learning with guidance from a resident faculty.

Student learning activities will be centered within the socially and ecologically unique environment within Amboseli-Tsavo Ecosystem (ATE) of southern Kenya and in the Tarangire-Manyara Ecosystem (TME), Ngorongoro-Serengeti ecosystem (NSE) of northern Tanzania. The broad objective of the course is to expose students to the realm of biodiversity conservation in East Africa in context of the status, management strategies and the challenges. This will be achieved through a case study approach in ATE, TME and NSE. While much of the learning will be done in Kenya, Tanzania offers a chance for comparison of management policies and approaches in two countries.

Specific courses are designed to offer students knowledge on; *natural resource assessments, monitoring, planning and management, and strategies for sustainable natural resource management*. The mode of field learning will include classes at base camp, field exercises and self or guided lab sections.

Learning Objectives

The overall objective of the course is to equip students with knowledge on techniques for managing natural resources. The case study dwells on water as a focal natural resource due to its vital role in sustaining other natural resources and humans. The specific objectives are to help students;

1. Gain knowledge on water resource planning, management and monitoring process
2. Learn the techniques for assessment of water quality and quantity in wild places and adjacent to human communities
3. Understand the role of water in shaping wildlife dynamics within diverse ecosystems
4. Understand the local, regional, and national strategies and policies for sustainable water resource conservation

Case Studies

Overview

Natural resource management is broad and requires a multi-faceted approach. This is necessary because most natural resources face enormous pressure from multiple direct and indirect human effects, often with deleterious consequences for human and natural life. This requires sustainable management as most natural resources are limited or fragile. Most parts of East Africa face severe water stress due to the seasonal and low rainfall regime. In the ATE, TME and NSE wetlands are the lifeline of the entire ecosystem. Apart from a few scattered permanent rivers and springs, most of the region is largely arid or

semi-arid, with mean annual rainfall of 300-800 mm. The wildlife ecological dynamics are entirely dependent on these wetlands. The wetlands are the predominant dry season dispersal areas as water and forage elsewhere diminishes. Consequently management of water resources is a major conservation and livelihood issue. While water quality and availability are underlying issues, of significance are the consequences are the conflicts associated with water use for humans and wildlife. Reconciling those conflicts is a major preoccupation of wildlife managers in the area. In a nutshell, the challenges facing natural resource conservation in ATE entail reconciling rural development with wildlife and water conservation.

In this course, we apply a case study approach. The approach is ideal for studying complex interrelated issues within ecosystems. It presents students with an opportunity to analyze broad issues using a systematic and interactive approach. Here students will be able to analyze the interplay between development and natural resource conservation. In order to focus our learning, this case study focusses on water resources due to their paramount influence on humans and wildlife resources in the case study areas. While the key case study area is ATE in Kenya, TME and NSE in Tanzania provides comparison due to differences in social-ecological contexts across the ecosystem. Within fall and spring semesters, learning will revolve around a case study question that will be answered through learning based on class room lectures, field exercises, and interactive sessions with field experts and analysis of some of the data collected. The case study question will be:

“How can water resources be sustainable managed so as to safeguard wildlife resources and livelihoods in the ATE?”

Case Study Background in Kenya

The basis for this case study is Ecosystem approach. This approach appreciates the spatial-temporal nature of natural resource interrelationships. Student learning will be largely done in the Amboseli-Tsavo Ecosystem in southern Kenya. This will be enriched by a two week long field trip to TME and SNE in northern Tanzania.

The Amboseli -Tsavo Ecosystem (ATE), Kenya

ATE comprises of several protected areas (Amboseli, Tsavo West and Chyulu hills National parks, and several wildlife sanctuaries/conservancies) and the adjacent community lands. These areas are hot spots for biodiversity conservation in southern Kenya, hosting the “big five” large mammal species (buffalo, rhino, elephants, lions and leopards), and a rich abundance and diversity of other wildlife. The adjacent communities use the area mainly for livestock keeping and agriculture. The areas outside the core protected areas face intense interactions between human and wildlife, mostly inform of human wildlife conflicts and, competition for pasture and water. While water is uniquely scarce due to the semi-arid nature of ATE, it is arguably the most important natural resource as it supports most life systems including humans. The major sources of water in ATE are perennial and semi-perennial wetlands, mostly associated with Mt. Kilimanjaro. These wetlands have undergone immense pressure with effects on water quality and quantity due to combined direct human use and climate change. This has had deleterious effects on wildlife in the area, particularly the migratory species and the species directly dependent on water. Agricultural activities within the core wetlands have led to water over-abstraction and degradation. These activities coupled with severe climatic changes have contributed to drying or reduced water in most of the wetlands. The outcome has been a growing human-wildlife and livestock-agriculturists conflicts, leading to a water crisis, particularly in the dry season.

The Tarangire Manyara Ecosystem (TME) and Ngorongoro-Serengeti Ecosystems (NSE), Tanzania

Northern Tanzania region hosts some of the world's most renowned protected areas. These protected areas are found within the The Tarangire-Manyara Ecosystem (TME) and Ngorongoro Serengeti Ecosystem. These include Serengeti, Ngorongoro and Lake Manyara, Tarangire, which together with Arusha and Mt. Kilimanjaro make the Northern tourism circuit. The northern circuit is a major tourist hub in East Africa. Except, Mt. climbing on Mt Kilimanjaro, much of the tourism activities involve game viewing and photography. Like the case of ATE, all the protected areas have open boundaries, thus wildlife move freely in and out of the protected areas into the adjacent community village lands.

Similar to ATE, the region was traditionally occupied by the Maasai people, who are mostly pastoralists. The area is however currently inhabited by numerous other communities. This has led to expansion of agricultural activities and a rapid spread of peri-urban areas. Due to these changes in land tenure and land use, the area now faces daunting conservation challenges. These challenges are inform of loss of wildlife habitat due to habitat fragmentation, blockage of wildlife corridors and the ensuing human wildlife conflicts.

Of interest will be conservation of Lake Manyara National Park, like most soda water lakes, the lake is rich in bicarbonate and carbonate nutrients, and thus highly productive natural ecosystems. Those nutrients support a rich concentration of phytoplankton food for massive population of flamingoes. However due to the closed and shallow nature of the lake, they are prone to small changes in water quality and quantity. These changes affect the abundance and composition of phytoplankton and zooplankton, and the subsequently the health and number of flamingoes and other aquatic life forms. The catchment for Lake Manyara is area of intense farming, thus, making conservation of wildlife associated with the lake huge challenge due to due to incompatible land use resulting to alterations in the hydrological regime of the catchment, contamination from pesticide and heavy metals.

In Tarangire and Serengeti National Parks, and Ngorongoro Conservation Area, student learning will focus on the effects of water on ecosystem wide wildlife dynamics, focusing on large migratory species such as wildebeest and elephants.

Assessment

| No. | Assessment Item | Due Date | Value (%) |
|------------|---|-----------------|------------------|
| NRM 4 | Poster on influence of water on wildlife numbers and distribution in Amboseli National Park | XX | 15 |
| NRM 6 | Report on water quality assessment for Kimana Swamp | XX | 20 |
| NRM 9 | Mechanisms for coping with heat stress in African elephants: implications for managing elephants in water scarce environments | XX | 20 |
| NRM 12 | Resolving water use and ownership Conflicts in Kimana area | XX | 15 |

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| | NRM Examination | | 30 |
| | | TOTAL | 100 |

Grading Scheme

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|----|-----------------|----|----------------|----|----------------|---|----------------|
| A | 95.00 – 100.00% | B+ | 86.00 – 89.99% | C+ | 76.00 – 79.99% | D | 60.00 - 69.00% |
| A- | 90.00 – 94.99% | B | 83.00 – 85.99% | C | 73.00 – 75.99% | F | 59.99 - 0.00% |
| | | B- | 80.00 – 82.99% | C- | 70.00 – 72.99% | | |

General Reminders

Readings: Assigned readings and hand outs (exercises/assignments) will be available prior to the scheduled activities. Course readings must be read and clarification on issues sought where necessary since ideas and concepts contained in them will be expected to be used and cited appropriately in assigned course essays and research papers.

Plagiarism: using the ideas or material of others without giving due credit – is cheating and will not be tolerated. A grade of zero will be assigned for anyone caught cheating or aiding another person to cheat either actively or passively (e.g. allowing someone to look at your exam).

Deadlines: Deadlines for written field exercises and other assignments are posted to promote equity among students and to allow faculty ample time to review and return assignments in good time. As such, deadlines are firm and extensions will only be considered under the most extreme circumstances. Late assignments will incur a 10% penalty for each hour that they are late. This means an assignment that is five minutes late will have 10% removed an assignment that is one hour and five minutes late will have 20% of the grade deducted.

Participation: Since we offer a program that is likely more intensive than you might be used to at your home institution, missing even one lecture can have a proportionally greater effect on your final grade simply because there is little room to make up for lost time. Participation in all components of the program is mandatory because your actions can significantly affect the experience you and your classmates have while at CWMS. Therefore, it is important that you are prompt for all course activities.

Course Content

Instructor: John Kioko

Type- L: Classroom lecture, **FL:** Field lecture, **FEX:** Field Exercise, **D:** Class discussions, **Lab:** Lab exercise, **SP:** Students Presentation

*Readings in **Bold** are required

| <i>Course Title and Description</i> | <i>Instructor</i> | <i>Type</i> | <i>Time (hrs)</i> | <i>Readings</i> |
|--|-------------------|-------------|-------------------|------------------|
| NRM 1: Introduction to natural resource | JK | L | 1.5 | Natural Resource |

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| <p>principles and management approaches. This will help students learn the scope of natural resources and the dynamic nature of their management. The lecture will dwell on the difference approaches for managing natural resources, and the underlying argument for application of each principle and approach.</p> | | | | Management Ministerial Council. (April, 2010). |
| <p>NRM 2: Evolution of land tenure and land use changes in ATE: Implications of for water resource management. A theoretical background of land tenure and land use changes and their influence on water resources in ATE will be explored.</p> | JK/Guest | L | 1 | (Nyamasyo, K.S. & Kihima, B.O., 2014). |
| <p>NRM 3: Use of large wildlife counts in understudying the influence of surface water availability on wildlife movement I. This lecture will introduce to students the common techniques of counting large mammals.</p> | JK | FE | 4 | Ashiagbor, G., & Danquah, E. (2017). |
| <p>NRM 4: Use of large wildlife counts in understudying the influence of surface water availability on wildlife numbers and distribution. A field exercises on counting large mammals will be done in protected areas and the data used to analyse trends in specific species population dynamics in ATE. In the long term, the data will be use to infer to the role of water in short and long term wildlife movements, and the implications for managing large management. Information from the counts will be presented inform of a poster for grading.</p> | JK | FE | 4 | |
| <p>NRM 5: Water quality assessment techniques.– A lecture on water quality assessment field procedures and tools will be undertake as an introduction to the field work (NRM 6) on water quality assessment.</p> | JK | L | 1 | (GLOWS-FIU, 2007) |
| <p>NRM 6: Water quality assessment techniques in ATE. A follow -up field exercise on water quality assessment techniques will be undertaken in order for students to have a hand on experience in assessment of quality of water resources. Students will prepare a report on status of water quality in ATE.</p> | JK | L | 4 | (GLOWS-FIU, 2007) |

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| <p>NRM 7: Monitoring and evaluation in natural resource conservation. Monitoring and Evaluation (M&E) is a process that helps improve performance and achieve results. Its goal is to improve current and future management of outputs, outcomes and impact. The lecture focusses on teaching students on the evaluation and monitoring tools and process to track the performance of ongoing initiatives for managing various natural resources within ATE.</p> | JK | L | 1 | (Kusek, J.Z. & R. C. Rist, 2004). |
| <p>NRM 8: Monitoring and evaluation of water resource conservation initiatives in ATE. A follow up field visit in form of travelling lectures will aim to expose students to the ongoing projects, where they will be able to track their performance/impacts by way of field observations and discussion with the stakeholders.</p> | JK/Guest | FE | 4 | |
| <p>NRM 9a: Water dynamics and wildlife movement. This lecture will discuss how different water dynamics across landscapes and over time impact animal behavior with a discussion on the direct and indirect of climate change on large mammals</p> | JK | L | 2 | |
| <p>NRM 9b: Mechanisms for coping with heat stress in African elephants: implications for managing elephants in water scarce environments Behavioral observations on thermoregulatory behavior will be undertaken. Students will gain an understanding of how they can monitor water stress within habitats through animal behavior.</p> | JK | FE | 4 | (Adams. Martha., 2018). |
| <p>NRM 10: Techniques for resolving conflict in natural resource management: Use and ownership of natural resources often involves tensions from different social levels (individuals, families, villages, communities, organizations, religions to states). Student will go through a step wise process on how to resolve these conflicts.</p> | JK | L | 1 | (FAO, January 2007). |
| <p>NRM 12: Managing water use conflicts in ATE: Students will visit a water use conflict hot zone in ATE and discuss with community members the nature, extent and actors in</p> | JK | FL | 4 | (Wither, Emily, 2011). |

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| the conflict. There after students will write a discussion paper on possible ways how the conflict can be resolved. | | | | |
| NRM 13: Techniques for monitoring wetland resources: Case of water fowl counts: A lecture on the techniques for monitoring bird populations will be undertaken with a bias on the common methods used in monitoring waterfowl. | JK | L | 1 | (Dale A. Z, Donald A. T, & David J. P., 1996). |
| NRM 14: Wetland monitoring: Avian counts in Amboseli National Park: A field exercise will be undertaken as part of long term monitoring of waterfowl in Amboseli National Park. This will be undertaken in collaboration with the Nature Kenya and the Ornithology department of national museum Kenya, and management of Amboseli National Park, with whom we will share the data. | JK | FE | 4 | (Dale A. Z, Donald A. T, & David J. P., 1996). |
| NRM 15: Resource Management Planning process This lecture topic deals with the role of habitat management in water conservation areas. Habitat management entails taking steps towards reclaiming, rehabilitation and restoration of habitats. | JK | L | 2 | Fallding, Martin. (2008). |
| NRM 16: Resource Management Planning process (Practice): Students will assess the status of specific wetland and propose measures for managing it to meet certain social-ecological goals e.g for aquatic bird conservation, sustainable farming. | JK | FE | 4 | |
| NRM 18: Role of Kenyan women in soil and water conservation: Case of women groups: Women groups in form of self-help groups are an important organizational set up for women in most rural areas in Africa. In Kenya in particular, they have become a major tool for social economic development, with potential to play a major contribution in natural resource conservation. In this field exercise students will learn the role women play in natural resource conservation, and further explore the challenges they face. This will be done through an open forum discussion with members of a women group in ATE. | JK | FL | 4 | Gathaara, N.V., et al. (2011). |

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| NRM 19: Sustaining Lake Manyara National Park: Challenges facing management of Lake Manyara National Park: This will be a travelling lecture focusing on the challenges and initiatives towards managing Lake Manyara. | JK | FL | 4 | (Xinhua, 2018). |
| NRM 20: The dynamics of an ecosystem: Influence of water on large scale wildebeest movement and the challenges to wildebeest migration in NSE. This will be a video show on ecology of wildebeest migration focusing on water and the conservation of Mau forest in Kenya. The forest is the main catchment for Mara river which is a focal point for the wildebeest migration. | Guest | FL | 1.5 | Sayagie, George. (March 2018). (Kiplagat, Robert, 2018). |
| NRM 21: Managing water for wildlife and livestock. Cost of managing water resource in multiple use areas. This will be a travelling lecture focusing on Manyara Ranch. Students will get exposed to real life example of how water use for divergent uses can be managed in multiple use areas. | JK/Guest | FL | 5 | (Simpson, N. O. Stewart, K. M., and Bleich, V. C, 2011). |
| Natural resource conservation leadership dialogue. In this section students will get a chance to engage and ask questions to practitioners and decision makers in order to broaden their understanding of current issues in natural resource conservation in Kenya. In this interactive student led program is meant to enhance student skills in conservation communication across diverse environments. | JK/Guest | FL | 2 | (Black, Simon, A., Groombridge, Jim. J. & Jones , C. G, 2011). |
| TOTAL CONTACT HOURS | | | 57.5 | |

Reading List

*Readings in **Bold** are required

Adams, Martha. (2018). How an Elephant's Ears Help Control Its Temperature. *Mom.me*. Web.
<https://animals.mom.me/elephants-ears-control-its-temperature-7483.html>

Ashiagbor, G., & Danquah, E. (2017). Seasonal habitat use by Elephants (*Loxodonta africana*) in the Mole National Park of Ghana. *Ecology and Evolution*, 7(11), 3784–3795.

Black, Simon, A., Groombridge, Jim. J. & Jones , C. G. (2011). Leadership and conservation effectiveness: finding a better way to lead. *Conservation Letters*, 329–339.

- Dale A. Z., Donald A. T., and David J. P., (1996).** Birds of Kenya and Northern Tanzania. Helm Field Guides.
- Gathaara, N.V., et al. (2011).** Gender, soil and water conservation in Machakos district, Kenya. *African Crop Science Conference Proceedings*: (10), 319 – 322.
- GLOWS-FIU. (2007). Water Quality Baseline Assessment Report, Mara River Basin, Kenya/Tanzania. *Global Water for Sustainability Program*. 61 pp.
- Fallding, Martin. (2008).** What makes a good natural resource management plan? *Ecological Management and Restoration* 1(3):185 - 194
- Kiplagat, Robert. (2018). Over 300 Families Evicted from Maasai Mau Forest. *Kenya News Agency*. Web. <http://www.kenyanews.go.ke/over-300-families-evicted-from-maasai-mau-forest/>
- Kusek, J.Z. & R. C. Rist. (2004).** Ten Steps to a Results-Based Monitoring and Evaluation System. *The World Bank*. Washington, D.C.
- Natural Resource Management Ministerial Council. (April, 2010). Principles for Sustainable Resource Management in the Rangelands. *Commonwealth of Australia*.
- Nyamasyo, K.S. & Kihima, B.O. (2014). Changing Land Use Patterns and Their Impacts on Wild Ungulates in Kimana Wetland Ecosystem, Kenya. *International Journal of Biodiversity*.
- Simpson, N. O. Stewart, K. M., and Bleich, V. C. (2011). What have we learned about water developments for wildlife? Not enough! *California Fish and Game* 97(4):190-209.
- Sayagie, George. (March 2018). Wildlife in major game reserves face threat as Mara River dry. *Daily Nation*. Web. <https://www.nation.co.ke/counties/narok/Drying-Mara-River-doom-for-wildlife/1183318-4327792-format-xhtml-amolre/index.html>
- The Food and Agriculture Organization (FAO).** (January, 2007). Negotiation and mediation techniques for natural resource management: Case Studies and Lessons Learned. FAO.
- Wither, Emily. (September, 2011). Elephants and livestock battle for water in East Africa. *CNN*. Web. <https://www.cnn.com/2011/09/09/world/africa/drought-elephant-human-conflict/index.html>
- Xinhua. (2018). Tanzania says Lake Manyara "drying up," threatening flamingo, hippo habitat. Xinhuanet.com. Web. http://www.xinhuanet.com/english/2018-03/05/c_137016019.htm