



THE SCHOOL  
FOR FIELD STUDIES

# Techniques in Wildlife Management

## SFS 3710

### Syllabus

The School for Field Studies (SFS)  
Center for Wildlife Management Studies (CWMS)  
Karatu, Tanzania

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 CONTENT SUBJECT TO CHANGE

***Please note that this is a copy of a recent syllabus. A final syllabus will be provided to students on the first day of academic programming.***

SFS programs are different from other travel or study abroad programs. Each iteration of a program is unique and often cannot be implemented exactly as planned for a variety of reasons. There are factors which, although monitored closely, are beyond our control. For example:

- Changes in access to or expiration or change in terms of permits to the highly regulated and sensitive environments in which we work;
- Changes in social/political conditions or tenuous weather situations/natural disasters may require changes to sites or plans, often with little notice;
- Some aspects of programs depend on the current faculty team as well as the goodwill and generosity of individuals, communities, and institutions which lend support.

Please be advised that these or other variables may require changes before or during the program. Part of the SFS experience is adapting to changing conditions and overcoming the obstacles that may be present. In other words, the elephants are not always where we want them to be, so be flexible!

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## Course Overview

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This course involves learning about the interface of ecology and wildlife management. It uses scientific principles as well as human dimensions to explain current strategies/techniques for managing natural resources. A good example is how principles of resource selection by wild animals are used not only to manage habitat interactions with wildlife, but also to guide tourism and management activities in a protected area. The other example is how local communities and land use activities influence wildlife dispersal in critical migration corridors and the implications of this on a landscape level. This course then carefully blends field and laboratory (computer) techniques to examine field collected data, using analytical techniques - core skills a wildlife manager needs to have when managing natural resources in a protected area.

The course encourages and promotes field-based learning with or without the faculty. Techniques in large wild mammal identification and counting, and natural history assessment, including social organization and interactions among large mammals, will be taught throughout the semester.

Field trips will be made to Lake Manyara National Park, Ngorongoro Crater and Manyara Ranch (both areas combine pastoralism with wildlife conservation), a multiple-day expedition to Tarangire national park and an expedition to Serengeti National Park and to selected protected areas in Kenya. There will be travelling lectures that provide students with the opportunity to observe and synthesize, analyze and discuss key environmental, land use, conservation and community livelihood issues in the Tarangire-Manyara ecosystem (TME) and the Amboseli ecosystem in Kenya. These trips to protected areas offer additional opportunities for students to learn core issues in ecology and management of natural resources in East Africa.

Data collected in the field will be used in laboratory analyses of estimating animal densities, habitat preferences and species diversity. The students will also examine the wildlife conservation/management philosophy, its evolution and application in the real world situation. In East Africa, the majority of protected areas follow the Park Model (Category II of IUCN classification) that was pioneered in Yellowstone National Park in 1870s. However, following international agreements on diversifying strategies and conservation models to conserve as much representative diversity (inside or outside) protected areas as possible, other models of conservation, their characteristics and management styles have been proposed. It is imperative to appreciate and examine the alternative conservation models because they are critical in expanding a network of protected areas for biodiversity conservation and also in ameliorating some of the emerging challenges of the widely applied Park Model.

Finally, the course will offer discussion forums that examine other alternative approaches in mitigating threats to environmental and wildlife conservation. Issues such as wildlife utilization and conservation strategies used in Tanzania and Kenya will be considered.

## Learning Objectives

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The overall objective of the course is to equip students with adequate knowledge on various wildlife management and conservation issues in Tanzania and Kenya. These issues will be used to identify conservation/management (actual & potential) problems that will then form the basis for directed research projects for the students. The course therefore has the following specific objectives:

1. To examine basic wildlife management and research techniques
2. To identify and study common large wild African mammals

3. To examine different conservation approaches
4. To study wildlife-human interactions
5. To examine the challenges facing wildlife conservation in East Africa

## Case Study

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### Overview

The grasslands of northern Tanzania (Maasai steppe) comprise extensive areas of land, which is home to the Maasai community. The area is characterized by a diversity of landscapes and habitats used by migratory wildlife species from Lake Manyara and Tarangire national parks. Apart from a few scattered permanent rivers and springs, most of this region is largely arid or semi-arid, with mean annual rainfall in the range of 300-800 mm. The landscape has been used traditionally by the Maasai pastoral community to graze livestock on a communal basis, but this has rapidly changed in the last decades. There has been a steady shift in land use from purely pastoral to mixed agro-pastoral systems driven by multiple factors, including changing demographics, emerging economic opportunities, increasing tourism demands, and access to markets. Land use changes in the wildlife dispersal areas between protected areas compromises the ecological and environmental integrity and quality as habitats for a wide variety of wildlife species, especially large mammals like the African elephant, generally posing a serious challenge to conservation of biodiversity in this region. The current scenario in the region has generated some antagonism between the dual goals of promoting local livelihoods and conservation.

The issues affecting and influencing wildlife conservation, local livelihoods and co-existence of humans and wildlife in the Maasai steppe of Tanzania present a showcase for students and SFS faculty to explore the best strategy of promoting wildlife conservation whilst improving local livelihoods. We will use multiple learning approaches, including conducting research on specific issues that have a bearing on the drivers of changes in these biodiversity rich landscapes, and their impacts on local livelihoods, wildlife and other critical natural resources. The SFS-CWMS (Tanzania) program is geared towards preparing students to answer the following case study question:

*How can changes in land use and resource availability in the Maasai Steppe of Tanzania be managed in such a way as to foster the well-being of local communities whilst safeguarding and promoting biodiversity conservation?*

### Case Study Background in Tanzania: The Tarangire-Manyara Ecosystem

The Tarangire-Manyara Ecosystem (TME) is one of the key wildlife conservation areas in Tanzania, and part of the Northern tourist circuit including the famous national parks of Serengeti, Lake Manyara, Tarangire, Arusha and Mt. Kilimanjaro, and the Ngorongoro conservation area. TME is estimated to comprise about 35,000 km<sup>2</sup>. Tarangire and Lake Manyara national parks are the core protected areas in the TME exclusively designated for photographic tourism. Other forms of protected areas in TME include Wildlife Management Areas (WMA) managed by local communities for tourism investment, game controlled areas (GCAs) and game reserves (GRs) managed by the Wildlife Division in which consumptive utilization such as trophy hunting is allowed. Consumptive utilization is also allowed in open areas that fall under the village lands designated as hunting blocks. All protected areas in TME have porous boundaries, thus, wildlife migrate freely between protected areas and dispersal areas in community village land. This leads to high levels of human-wildlife interactions and the ensuing human-wildlife conflicts. For many decades, the primary inhabitants of TME have been pastoralist Maasai communities with low human population density. However, over the past three decades there has been a rapid increase in human population mainly due to immigration with consequent changes in land use leading

to expansion of agriculture and human settlement. This has resulted into blockage of migratory wildlife routes (such as into Simanjiro plains and to Lake Manyara through Kwakuchinja Corridor) and habitat fragmentation, and has created more opportunities for human-wildlife conflicts. This poses increasing threats to environmental and wildlife conservation in the TME. Tarangire/Lake Manyara ecosystem in the Maasai steppes of northern Tanzania is also faced with multiple threats ranging from land use changes, tourism proliferation, human population increase and general ecological changes. The parks are renowned for their biodiversity in a relatively dry landscape, but their future is in jeopardy due to insularization. There are growing land use changes, such as large scale farming, unplanned settlements and increase in human population in the dispersal areas, migratory routes and corridors, which are necessary for the free movement of large mammalian species. Moreover, uncontrolled tourist activities and accommodation (such as camp sites and curio shops) around the parks create more insularization of the parks. Uncontrolled hunting of wildlife in the dispersal and game control areas outside the parks is prevalent, hence endangering critical wildlife species. Human-wildlife conflict is equally rampant, further compromising the future of wildlife conservation, local livelihoods and harmonious co-existence between locals and wildlife.

Other challenges in the TME include tourism impacts, ecological changes, rampant poaching of wildlife due to inadequate law enforcement, and overall wildlife population declines. Unplanned settlements and increase in human population lead to insularization of Tarangire and Lake Manyara national parks. Unplanned development of tourist accommodation facilities (such as camp sites and lodges) around the parks, although benefiting the local communities, exert a high demand on water, reducing quantity of water discharge into Lake Manyara, reducing water quality due to potential pollution from sewerage and domestic effluents. Poorly regulated hunting of wildlife in dispersal and game control areas outside the parks threaten populations of critical wildlife species. Expanding irrigation in nearby rice farms in Mto wa Mbu town, heavy siltation, pesticide application, pollution caused by erosion and depletion of vegetation due to farming in the highland catchment areas affect the ecology and biodiversity of Lake Manyara and the adjacent wetlands. This is compounded by an increase in the human population in the catchment areas. Student projects will focus on providing comparative assessments of wildlife in different conservation areas, critical analysis and investigation with the aim of providing information to contribute towards sustainable environment and natural resource management, promote wildlife conservation and livelihood improvement for local communities.

The Tanzanian case study will be complemented by excursions to the Tsavo-Amboseli ecosystem in southern Kenya. This will allow students to give a comparative outlook on wildlife conservation and natural resource management issues and policies in two countries. In Kenya, students will visit Amboseli National Park, Tsavo West National Park, Chulu Hills National Park, Kimana Sanctuary.

## Assessment

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| No.   | Assessment Item   | Value (%)  |
|-------|---|------------|
| WM 04 | African Large Mammal Identification (Quiz)                                  | 12         |
| WM 11 | Large Mammal Assessment (Written poster)                                    | 26         |
| WM 05 | Comparative assessment of wildlife-based conservation models in East Africa | 12         |
|       | WM Examination  | 50         |
|       | <b>TOTAL</b>  | <b>100</b> |

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## 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

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**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

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

| <i>Type and Time</i>    | <i>Title and Description</i>   | <i>Readings</i>  |
|-------------------------|--|--|
| WM01<br>(L, 2 hrs)      | <b>An overview of wildlife management and conservation issues in Tarangire-Manyara ecosystem</b><br>This lecture will set the case for the current status of environmental and conservation reality in the ecosystem and elaborate on issues that need to be addressed for wildlife and other resource conservation and environmental health in the area.                              | Msoffe, F. et al. 2011. Spatial correlates of land-use change in the Maasai-Steppe of Tanzania: Implications for conservation and environmental planning. <i>International Journal of Biodiversity and Conservation</i> 3, 280-290. <b>(Required)</b>  |
| WM02<br>(L, 1.0 hr)     | <b>Introduction to Wildlife Management</b><br>This lecture will trace the origins of wildlife management from Game Management to current conservation issues, and will give a general outline of the course.   | Kiffner, C. et al. 2017. Long-term population dynamics in a multi-species assemblage of large herbivores in East Africa. <i>Ecosphere</i> 8:e02027 <b>(Required)</b>   |
| WM 03<br>(L, 1.5 hrs)   | <b>Introduction to classification of African Large Mammals</b><br>This lecture will explore basic taxonomy for most common large mammals that will be seen in the field, and highlight radiation of species, especially within the family bovidae.   | Estes, R. D. 1991. Behavioral Guide to African Mammals including Hoofed Mammals, Carnivores and Primates. Awake Forest Studium Book. Russel Friedman Books Publishers. South Africa. 611pp <b>(Required; Book in Library)</b><br>Kingdon, J. 1997. The Kingdon Field Guide to African Mammals. A.P., London <b>(Required; Book in Library)</b> |
| WM04a<br>(L, 1.0 hr)    | <b>Social organization, behavior and conservation</b><br>This lecture will teach students how to identify common large mammals, distinguish (where possible) between male and female of each species in the field, and observe and document various social organizations and associations of common large mammals and highlight links between animal behavior and conservation issues. | Kiffner et al. 2014. Seasonal patterns of mixed species groups in large East African Mammals. <i>PloS ONE</i> 9(12): e113446 <b>(Required)</b><br>Kingdon, J. 1997. The Kingdon Field Guide to African Mammals. A.P., London <b>(Required)</b>   |
| WM04b<br>(FEX, 3.0 hrs) | <b>African Large Mammal Identification, and Social organization (Practice)</b><br>This exercise will enable students to be able to: identify common large mammals in the African savannahs; distinguish between male and female of each species in the field.  | Estes, R. D. 1991. Behavioral Guide to African Mammals including Hoofed Mammals, Carnivores and Primates. Awake Forest Studium Book. Russel Friedman Books Publishers. South Africa. 611pp <b>(Required)</b><br>Kingdon, J. 1997. The Kingdon Field  |

| <b>Type and Time</b>                  | <b>Title and Description</b>  | <b>Readings</b>  |
|---------------------------------------|---|--|
|                                       |   | Guide to African Mammals. A.P., London <b>(Required)</b>   |
| WM05<br>a,b,c<br><b>(FL, 9.0 hrs)</b> | <b>Conservation models in East Africa</b><br>These field lectures explore the limitation of the park model, and presents other approaches and challenges to conservation in East Africa.  | Caro et al. 2009. Assessing the effectiveness of protected areas: paradoxes call for pluralism in evaluating conservation performance. Diversity and Distributions, 15, 178-182. <b>(Required)</b> |
| WM06<br><b>(L, 1.5 hrs)</b>           | <b>Techniques for estimating species diversity</b><br>This topic will explore large mammal species diversity, local extinctions, and common metrics how to describe animal communities.   | Msuha et al. 2012. Conserving biodiversity in a changing world: land use change and species richness in northern Tanzania, Biodiversity and Conservation, 21, 2747-2759 <b>(required)</b>          |
| WM07<br><b>(L, 1.5 hrs)</b>           | <b>Techniques for estimating animal density</b><br>This lecture will teach students how to plan, prepare and conduct a sample road count in a national park using distance sampling.  | Thomas et al. 2010. Distance software: design and analysis of distance sampling surveys for estimating population size. Journal of Applied Ecology, 47, 5-14 <b>(Required)</b> .                   |
| WM08<br><b>(FL, 1.5 hrs)</b>          | <b>African lion conservation in the Tarangire-Manyara ecosystem, Tanzania.</b><br>This lecture will explore conservation issues of the African lion and highlight issues of field research on large carnivores.   | Kissui, B.M. 2008. Livestock predation by lions, leopards, spotted hyenas, and their vulnerability to retaliatory killing in the Maasai steppe, Tanzania <b>(Required)</b>                         |
| WM09<br><b>(L, 1.5 hrs)</b>           | <b>Techniques for assessing resource selection</b><br>This lecture will teach students the difference between resource usage and selection, and introduce key concepts for measuring habitat preferences.   | Jacobs J. 1974. Quantitative Measurement of food selection: A modification of the forage ratio and Ivlev's electivity index. Oecologia, 14, 413-417. <b>(Required)</b>                             |
| WM10<br><b>(L, 1.5 hrs)</b>           | <b>Large mammal count techniques</b><br>This lecture will introduce students to common techniques of counting large mammals in Africa. A follow up exercise for counting large mammals will be done in protected areas and using that data, large mammal population density and diversity will be determined. | Sinclair, A.R.E., Fryxell, J.M., & Caughley, G. 2006. Wildlife Ecology, Conservation, and Management. Chapter 13 <b>(Required)</b>   |
| WM 11a, b, c<br><b>(FEX, 9.0 hrs)</b> | <b>Large mammal Assessment (Practice)</b><br>During these exercises students will conduct actual wildlife counts in protected areas of Tanzania and Kenya. The students, in groups, will learn practically how to count animals, and determine age, sex, behavior and habitat                                 | Kingdon, J. 1997. The Kingdon Field Guide to African Mammals. A.P., London <b>(Required)</b>   |

| <i>Type and Time</i>      | <i>Title and Description</i>  | <i>Readings</i>  |
|---------------------------|---|--|
|                           | usage of large mammal species during the censuses.  |  |
| WM12<br>(L, 1.0 hr)       | <b>Wildlife Field Research</b><br>This guest lecture will give insights into a field research project in northern Tanzania  | No reading   |
| WM13<br>(FL, 4.0 hrs)     | <b>Wildlife Management areas</b><br>This field lecture will explore the history, challenges and opportunities for community based wildlife management in the TME.   | Wilfred, P. 2010. Towards sustainable wildlife management areas in Tanzania. <i>Tropical Conservation Science</i> 3: 103-116.  |
| WM14<br>(Lab, 3.0 hrs)    | <b>Estimating habitat preferences and diversity indices</b><br>This laboratory exercise will teach students how to summarize, analyze & interpret animal population data, & to estimate the density and diversity of large mammals from actual count data from protected areas They will estimate standard parameters for describing habitat preferences and mammal diversity in diverse animal communities of different protected areas. Students will acquire quantitative skills in determining habitat preferences and species diversity & density within conservation areas. | Jacobs J. 1974. Quantitative Measurement of food selection: A modification of the forage ratio and Ivlev's electivity index. <i>Oecologia</i> , 14, 413-417. <b>(Required)</b>           |
| WM15<br>(FL/FEX, 3.0 hrs) | <b>Human Wildlife conflict</b><br>This field lecture will examine interactions between wildlife and humans and means to prevent human-wildlife conflict   | Changa'a et al. (2016) Scaling up the use of chili fences for reducing human-elephant conflict across landscapes in Tanzania. <i>Tropical Conservation Science</i> 9(2), 921-930         |
| WM16<br>(Lab, 3.0 hrs)    | <b>Estimating animal density</b><br>Estimate animal density of different mammal species across time and space using distance sampling. Results will be combined with those from WM 10, and each student will prepare a graded poster.   | Thomas et al. 2010. Distance software: design and analysis of distance sampling surveys for estimating population size. <i>Journal of Applied Ecology</i> , 47, 5-14 <b>(Required)</b> . |
| WM17<br>(L, 1.0 hrs)      | <b>Introduction to scientific poster presentation</b><br>The main objective is to introduce Power point as a tool to create concise and visually appealing scientific posters using information from analyses on actual count and habitat data from protected areas.  | None. The Faculty will give guidelines on how to write the poster, and discuss example posters   |
| WM18<br>(FL, 3 hrs)       | <b>Wildlife Management challenges within National Parks</b><br>These lectures will highlight the history, significance and management challenges of national parks in East Africa.  | No reading   |

| <b>Type and Time</b> | <b>Title and Description</b>   | <b>Readings</b>  |
|----------------------|--|--|
| WM 19 (L, 1 hrs)     | <b>Bird count and identification methods:</b><br>Students will learn the main major bird identification and census methods.  | No reading   |
| WM 20 (FEX, 2 hrs)   | <b>Birding and waterfowl count in Amboseli National Park:</b> This is a part of long-term waterfowl monitoring program. It is a way for students to appreciate the role of birding as a tourism product. | No reading   |
| WM 21 (FL, 2 hrs)    | <b>Endangered species management.</b> The case of Black Rhino in Kenya. Students will learn about the use of sanctuaries in endangered species management.   | 1. BBC 2018. Northern white rhino: New hopes for IVF rescue - BBC News.<br><a href="https://www.bbc.com/news/science-environment-46109393">https://www.bbc.com/news/science-environment-46109393</a><br>2. <i>Scientific American: RIP Sudan, the Last Male Northern White Rhino;</i><br><a href="https://blogs.scientificamerican.com/extinction-countdown/rip-sudan-the-last-male-northern-white-rhino/">https://blogs.scientificamerican.com/extinction-countdown/rip-sudan-the-last-male-northern-white-rhino/</a> |
| WM 22 (FEX, 3 hrs)   | <b>Tourism and wildlife.</b> In this field exercise, students will assess tourist behavior towards different wildlife species in Serengeti National Park and assess tourist facilities in Kenya.         | No reading   |
| <b>60.0</b>          | <b>TOTAL CONTACT HOURS</b>   |  |

## Reading List

\*Readings in **Bold** are required. Readings are listed in the order in which they appear in the above table.

- Msoffe**, F. et al. 2011. Spatial correlates of land-use change in the Maasai-Steppe of Tanzania: Implications for conservation and environmental planning. *International Journal of Biodiversity and Conservation* 3, 280-290.
- Kiffner**, C. et al. 2017. Long-term population dynamics in a multi-species assemblage of large herbivores in East Africa. *Ecosphere* 8:e02027
- Estes**, R. D. 1991. Behavioral Guide to African Mammals including Hoofed Mammals, Carnivores and Primates. Awake Forest Studium Book. Russel Friedman Books Publishers. South Africa. 611pp (Book in Library)
- Kingdon**, J. 1997. The Kingdon Field Guide to African Mammals. A.P., London (Book in Library)
- Kiffner** et al. 2014. Seasonal patterns of mixed species groups in large East African Mammals. *PloS ONE* 9(12): e113446
- Kingdon**, J. 1997. The Kingdon Field Guide to African Mammals. A.P., London
- Estes**, R. D. 1991. Behavioral Guide to African Mammals including Hoofed Mammals, Carnivores and Primates. Awake Forest Studium Book. Russel Friedman Books Publishers. South Africa. 611pp
- Kingdon**, J. 1997. The Kingdon Field Guide to African Mammals. A.P., London
- McNaughton**, S.J. & Georgiadis, N.J. 1986. Ecology of African Grazing and Browsing Mammals. *Annual Review of Ecological Systematics* 17: 39 – 65
- Caro** et al. 2009. Assessing the effectiveness of protected areas: paradoxes call for pluralism in evaluating conservation performance. *Diversity and Distributions*, 15, 178-182.

- Msuha** et al. 2012. Conserving biodiversity in a changing world: land use change and species richness in northern Tanzania, *Biodiversity and Conservation*, 21, 2747-2759
- Thomas** et al. 2010. Distance software: design and analysis of distance sampling surveys for estimating population size. *Journal of Applied Ecology*, 47, 5-14
- Hanby, J.P., Bygott, J.D. & Packer, C. 1995. Ecology, demography and behaviour of lions in two contrasting habitats: Ngorongoro Crater and the Serengeti Plains. In *Serengeti II. Dynamics, Management and Conservation of an Ecosystem*
- Packer, C., Scheel, A., Pusey, A 1990. Why lions form groups: food is not enough? *American Naturalist* 136 (1): 1-19
- Kissui**, B.M. 2008. Livestock predation by lions, leopards, spotted hyenas, and their vulnerability to retaliatory killing in the Maasai steppe, Tanzania
- Jacobs** J. 1974. Quantitative Measurement of food selection: A modification of the forage ratio and Ivlev's electivity index. *Oecologia*, 14, 413-417.
- Sinclair**, A.R.E., Fryxell, J.M., & Caughley, G. 2006. *Wildlife Ecology, Conservation, and Management*. Chapter 13
- Kingdon**, J. 1997. *The Kingdon Field Guide to African Mammals*. A.P., London
- Wilfred**, P. 2010. Towards sustainable wildlife management areas in Tanzania. *Tropical Conservation Science* 3: 103-116.
- Jacobs** J. 1974. Quantitative Measurement of food selection: A modification of the forage ratio and Ivlev's electivity index. *Oecologia*, 14, 413-417.
- Thomas** et al. 2010. Distance software: design and analysis of distance sampling surveys for estimating population size. *Journal of Applied Ecology*, 47, 5-14.