THE SCHOOL FOR FIELD STUDIES

Elephant Ecology and Conservation in Kenya
SFS 3252

Syllabus
4 credits

The School for Field Studies (SFS)
Center for Wildlife and Human Dimensions of Conservation (CWHDC)
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.

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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 they may present. In other words, this is a field program, and the field can change.

Course Overview

The African elephant (Loxodonta africana) is an important keystone species in Africa and has profound influence on the structure and dynamics of landscapes where it co-exists with other species. It's one of the most charismatic and charming species but its conservation and population status has continued to attract a lot of concern within and beyond Africa. A key worry is that it's conservation is increasingly becoming uncertain across the entire African continent as due illegal poaching, landscape fragmentation and retaliatory attacks by local communities due to prevalence of human-elephant conflicts. At the beginning of the 20th century, there were several millions of elephants roaming across Africa (Douglas-Hamilton 1979), but today, they have declined rapidly, and are estimated to be nearly 450,000 - 700,000 (Stephenson, 2007).

Illegal poaching has been and remains the biggest threat to the survival of elephants, and this threat is rampant throughout the entire continent (Douglas-Hamilton et al. 1992). Habitat loss, associated with anthropogenic effects is the second biggest threat to the future conservation of the species, and in the last century, large swathes of elephant natural habitats have been converted into human dominated landscapes (Esikuri 1998). This not only leads to loss, reduction, and degradation of elephant prime habitats, but curtails their free movement, reduces their home range, blocks their movement corridors and routes but increases conflicts with humans (Spinage 1990). Collectively, this matrix creates a very inhabitable and hostile environment for elephant survival and conservation programs in all its range in Africa.

Since the advent of wildlife-based tourism in Africa, the African elephant has remained one of the species highly sought by tourists as a member of the big five large mammals which include the rhinoceros, cape buffalo, leopard, and the lion (Okello et al. 2005). Consequently, it plays a key role in the tourism industry across the entire continent, and in this regard, most countries have enhanced their protection and conservation efforts all geared towards saving elephants. In the same breath, and given that the species doubles as a flagship and keystone species, its successful conservation is viewed by conservationists as a testimony of how humans can effectively protect other biodiversity types, and their commitment to co-exist with wildlife. The elephant is also an umbrella species which depends on securing large tracks of ecologically connected landscapes and ecosystems, and therefore serves the objective of wider biodiversity conservation (Litoroh et al. 2012).

The spatial-temporal distribution of elephants in Africa is influenced by multiple factors. These include intensity and prevalence of poaching and conflicts with humans, availability of suitable habitats and associated resources especially food and water, human population density and land use changes (Spinage, 1990; Croze and Moss, 2011). For instance, food requirements has been found to be a major determinant of wet and dry season habitat occupancy for the Amboseli elephants, and hostile encounters with local Maasai have been documented to force elephants to avoid local Maasai homesteads (Kangwana, 1993). Similarly, prevalence of poaching in 1970s and 1980s forced elephants to spend more time inside Amboseli National Park for safety reason (Croze and Moss, 2011), and this phenomenon was observed in most parts of Africa in response to surge in the menace.

Elephants are mega-herbivores, consuming vast quantities of food, and are known as 'wasteful feeders' (Kerley et al., 2008). They are a savanna keystone species (Western, 1989; Laws, 1970), meaning that their presence ecologically benefits other wildlife species and due to its ecological role in an ecosystem

(Twine et al., 2008), they are important in nutrient recycling and seed dispersal, and elicit plant defense and growth responses (Kerley et al., 2008). Elephants and fire are regarded as drivers of alternate states in ecosystems (Kerley et al., 2008). It is sometimes difficult to disentangle the relative roles of elephant, fire, drought, disease, and other browsers in tree population patterns because they often affect the vegetation in combination (Kerley et al., 2008).

As bulky feeders, elephants include low-quality plant matter in their diets (Owen-Smith, 1988). However, to maximize their energy intake there should be a trade-off between selection for scarce, high-quality resources and the utilization of lower quality resources that are presumably more abundant (Illius, 2006). For elephants, nutritional constraints are pronounced as the dry season progresses. In theory, elephants are therefore expected to increase the size of their home range during the dry season to include the resources otherwise available during the wet season. Most often, elephants tend to concentrate their foraging activities in areas close to water during the dry season (Osborn and Parker, 2003) and they then conceivably depend on lower quality food (Owen-Smith, 1988). The restriction imposed by the distribution of water, presence of human infrastructure and presence may therefore coincide with selection for areas with higher food resource availability within the landscape, which may consequently determine the location of elephant home ranges (Damschen et al., 2006).

Few wild animals elicit drastic and different human emotions, as elephants do. They capture the imagination and unswerving affection of many people worldwide, but also inspire animosity and fear among those sharing land and resources with these mega-herbivores. Two factors have a large effect on determining the numbers and distribution of elephants in Kenya, and elsewhere in Africa. These are poaching and conversion of land by people. Therefore, there has been a steady decrease in elephant habitats over many decades throughout Africa wherever human populations have increased. Thus, there is a linear, negative relationship between human population size and elephant density. However, coexistence is possible at low human densities, while loss of habitat occurs at a critical threshold level of roughly 15 people per km2. Apart from the widespread habitat loss that is facing elephant populations across the African continent, illegal poaching can eliminate populations, even when human land use would otherwise allow coexistence.

Numerous studies across Africa have extensively reported local community's antipathy to elephants beyond that expressed for any other wildlife species. Communities surrounding forest reserves and conservation areas engage in small-scale subsistence and cash-crop farming. Those farms close to the boundary are vulnerable to elephant crop raids and damage, which is most intense during the food crop-harvesting season, but also occurs to a lesser extent throughout the year. In the process, elephants jeopardize communities' food security and livelihoods and communities' attitudes towards elephants are consequently and consistently negative in all elephant ranges in Africa.

Resolving human-elephant conflicts has become critical to the improvement of the livelihoods of rural communities co-existing with elephants and conservation of elephants. Resolution of direct conflict between humans and elephants in Africa has become a serious local socio-economic and political issue in recent years, and a continental conservation problem. Many studies have therefore shown that elephant causes diverse damage types including crop depredation, property damage and even threat to human life. About eighty percent (80%) of the African elephant's range lies outside formally protected areas, and inadequate management of the conflicts with humans is frequently a pre-cursor to further decline in the numbers and distribution of elephants**.**

Learning Objectives

In this course students will learn and examine diverse and critical aspects of African elephants in Africa, Kenya, and in the Amboseli and Maasai-mara landscapes. This learning process will be achieved through interactive classroom learning sessions, experiential field activities, class discussions and lectures by Faculty and various guests.

The specific objectives of the course are:

1. Discuss the status of elephants as an endangered species, its role as a keystone and flagship species.
2. Use quantitative and qualitative research methods and techniques in studying elephant ecology, management, and conservation dynamics.
3. Examine elephant ecology and social organization, and implications on their conservation in Kenya.
4. Evaluate key constraints to elephants' conservation in light of ongoing land tenure transformations in Kenya and the Amboseli Ecosystem
5. Appraise current approaches, techniques and innovations that are used to enhance elephant conservation in a rapidly changing world.
6. Produce educational materials that can be used to promote elephant conservation.

Assessment

Assessment Item	Value (%)
Film on conservation of African elephants	20
Elephant photobook	15
Human-elephant conflict	10
Elephant counts	15
Participation	10
Final exam	30
TOTAL	**100**

Film on conservation of African elephants (20%)

The assignment requires students to work in groups to develop a short film of 10 minutes to create public awareness about African elephants, their conservation challenges, and opportunities. Each group will be given a theme by faculty on which to focus their story. Students will use open-source video editing software of their choice. The idea is to combine knowledge gathered during the course, including field exercises and the Maasai Mara expedition, and storytelling skills. The videos will be considered for use in SFS- Kenya social media platforms.

Elephant Photobook (15%)

This exercise will be done in Amboseli National Park and in Maasai Mara National Reserve. The assignment will involve students working in groups that are based on elephant age sets. For each group, students will collect data on dental formula of the elephant, identification of two/three individual elephants using body characteristics and unique behavioral characteristics. A photo book of the identified elephants will be created.

Human-elephant Conflict (10%)

Students will use an already developed questionnaire to conduct a survey with farmers on the nature and scope of HECs. They will understand the trends of HECs, the driving factors, consequences, and mitigation measures. Students will analyze the data and write a report of between 4-5 pages for grading.

Elephant Counts (15%)

Counting endangered wildlife species helps evaluate whether their population is growing, or they are likely to become extinct. Knowledge of the decline and surges in population for mega herbivores like elephants helps conservationists and managers plan conflict and habitat related conservation measures. This elephant count exercise will be done in Amboseli National Park, a core concentration area for Amboseli ecosystem elephants. Students will work in groups to count elephants in allocated blocks of the park. Data will be collated from all the groups for synthesis and each student will then write an individual report using the guideline given by the faculty for grading.

Participation (10%)

Both faculties shall work together to evaluate students on their participation throughout the course. A grading rubric shall be provided to students at the beginning of the program.

Final Exam (30%)

There will be a written exam that accounts for 30% of the overall course grade and will comprise of short answer questions. Students will be expected to demonstrate an understanding of various competences and knowledge of conservation issues in the Amboseli and Maasai-mara Ecosystems. Each faculty shall set 3 questions. Question 1 set by each faculty shall constitute 5 points and shall be compulsory. Students shall answer any of the two questions (question 2 and 3) from each faculty. The exam shall last 2 hours.

Grading Scheme

A	95.00 - 100.00%	B+	86.00 - 89.99%	C+	76.00 - 79.99%	D	60.00 - 69.99%
A-	90.00 - 94.99%	B	83.00 - 85.99%	C	73.00 - 75.99%	F	0.00 - 59.99%
		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 and material of others without giving due credit is cheating and will not be tolerated. A grade of zero will be assigned if anyone is caught cheating or aiding another person to cheat 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% deducted. 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 your experience and that of your classmates have while at CWWS. Therefore, it is important that you are prompt for all course activities.

Course Content

Type- L: Lecture, **F:** Film, **FL:** Field Lecture, **GL:** Guest Lecture, **FEX:** Field Exercise, **D:** Discussion, **Lab:** Classroom lab/workshop

***Required readings are in bold**

No	*Title and outline*	*Type*	*Time (hrs)*	*Readings*
1	**Course overview** Lecture provides a broad scope on elephants and wildlife conservation topics in the Amboseli Ecosystem	L	2 hours	**Okello, M. et al., (2009).**
2	**Introduction to conservation issues in the Kimana area and their intersection with elephants** A drive through field lecture in the former Kimana Group Ranch during which Faculty will make strategic stops to demonstrate to the students the following: manifestations of land uses, abstraction of water resources, general state of the ecosystem/landscape environment, community conservation initiatives, elephant habitats fragmentation and loss of landscape ecological connectivity.	FL	2 hours 30 min	**Okello and D'Amour (2008). Okello M. (2009).**
3	**Elephant ecology and social organization** This lecture will examine key ecological and social aspects of African elephants and how they influence conservation	L	1 hour 40 min	**Estes, R. D. (1991). Douglas (1972).**
4	**Land tenure regimes in Kenya, Land Use Changes and their impacts on conservation of endangered species** In Kenya land and resource tenure is still at its nascent stage. This classroom lecture will trace land tenure transformation in Kenya, since the colonial times to current situation, and how these changes in land tenure impinge on the conservation of species of concern.	L	1 hour 40 min	**Groom and Western (2013). Mwangi & Ostrom (2009).** Kantai (2007). Pas, A., Watson, E. E., & Butt, B. (2023).
5	**Environmental Education as strategy in conservation** The faculty introduces the importance of conservation education as a strategy in conserving elephants in Kenya. Students are thereafter divided into three groups in which	L	50 mins	**Green, S. J., Grorud-Colvert, K., & Mannix, H. (2018).**

No	*Title and outline*	*Type*	*Time (hrs)*	*Readings*
	they work as a team a create a short video (10 minutes) to be used for educating various populations e.g. youth, tourists and farmers about elephants and promote elephant conservation.			De Groot, W. T., & Zwaal, N. (2007).
6	**Aging and sexing in African elephants: theory and field exercise preparation** Lecture will provide elephant features that are typically used to age and sex them.	L	1 hour 40 min	**Shrader et al., (2006).**
7	**Aging and sexing in African elephants** In this **f**ield exercise students will learn how to age and sex elephants in Amboseli National Park	FEX	2 hours 30 mins	
8	**Elephant count methods and preparation for field exercise** This lecture will examine the rationale for counting elephants, how to conduct sample and total counts using elephant signs and actual sighting and the underlying considerations.	L	1 hour 40 min	**Whitehouse, A. M. et al., (2001). Okello, M. et al., (2016).**
9	**Prep for aging and sexing of elephants** This class will prepare students on field identification criteria as well as use of the field equipment.	L	50 Min	
10	**Elephant counts in Amboseli National Park** This field exercise will be done in Amboseli N. Park, a core concentration area for the Amboseli Ecosystem elephants. Students will conduct elephant counts using ground count method, and use the data to determine the population, density, and habitat associations of elephants in the park.	FEX	2 hours 30 mins	
11	**Elephant counts in AE(Lab)** In this lab session, students will synthesis and analysis data collected during field exercise. They will also learn how to interpret the results obtained. Each group of students will write a report for grading.	LAB	2 hours	
12	**Preparatory class for elephant age photo book** This class will prepare students to learn the dental formula and individual identification of elephants using body characteristics**.**	L	50 Mins	**Berg, J. K. (1983). Stansfield, F. J. (2015).**
13	**Field elephant individual identification photo book** Students will be grouped according to elephant age sets to identify elephants in ANP. Additionally, students will identify the dental formula of elephants based on ages.	FEX	1 hour 40 min	
14	**Genealogy of the Amboseli Elephant (Prep)** This is a short preparatory lecture for a field exercise. The faculty will explain to students the role that genealogical studies in wildlife could enhance their conservation.	L	50 mins	

No	*Title and outline*	*Type*	*Time (hrs)*	*Readings*
15	**Genealogy of Amboseli Elephants from long term research** This FEX provides an opportunity for students to engage with long term research of the Amboseli Elephant Trust. Students will be given data on family relations of selected Elephants. Students will analyze the data to produce genealogical charts or family trees and discuss as per the questions provided. e.g. which elephants are related and how? Are there cases of inbreeding? What is the status of the identified elephants? What conservation information can we draw from genealogical data?	FEX	1 hour 40 min	
16	**Elephant behavior and communication** Lecture will be based on long-term studies on Amboseli elephants. It will focus on key behavioral attributes of African elephants and how they communicate	L	1 hour 40 min	**Langbauer Jr, W. R. (2000).** Berg, J. K. (1983).
17	**Elephant crimes, investigations and prosecution** In this guest lecture by KWS law enforcement officer, students learn about wildlife conservation law and policy in Kenya, especially those that are related to elephant conservation. The speaker will talk about the common crimes that elephants face in Kenya, how these crimes are reported and investigated, as well as the prosecution of suspects. The speaker will talk about some challenges they face in their daily work of investigations and prosecution.	L	1 hour 40 min	
18	**Visit to cultural Manyatta** A critical analysis of Maasai Manyattas as ecotourism enterprises and/or cultural entities: Students will visit a Maasai cultural Manyatta, discuss with residents and examine the role played by manyattas in cultural tourism and conservation in the Amboseli region.	FEX	1 hour 40 min	
19	**Introduction to human-elephant conflicts in Kenya** This lecture will be centered on the intricacies of human-elephant conflicts in Kenya. Trends, driving factors, consequences and mitigation measures are discussed. In the second part of the lecture, the faculty shall prepare students for a field exercise.	L	1 hour 40 min	**Evans. L and Adams (2018). Shaffer et. al. (2019).**
20	**Preparation for a FEX on human-elephant conflicts in former Mbirikani Group Ranch** The faculty will explain the tasks that students will be undertaking during the field exercise. Also, students will be talking though the digitized survey that will be used to collect the data. Faculty will use this time to establish the modalities that the students will use to collect the data.	L	50 mins	
21	**Assessing the scope and nature of human-elephant conflicts (HECs) in the former Kimana group ranch**. Students will assess the typology of HECs among smaller	FEX	3 hours	

No	Title and outline	Type	Time (hrs)	Readings
	scale farmers, their causes, patterns, impacts and mitigation. Students will conduct in-depth interviews with farmers in the former Kimana group ranch. Students use predesigned tools for the interviews.			
22	**Human elephant conflicts in the Mbirikani group ranch** In this lab, faculty will show the students how to analyze qualitative data from the in-depth interviews and write a short report.	LAB	1 hour 40 min	
23	**The political economy of elephant ivory trade** In this lecture students will learn about factors that mediate elephant poaching and ivory trade. Local and international trade networks for Ivory will be explored and how these markets are sustained and linked with other forms of cross-border crimes e.g. money laundering, terrorism, drug trafficking etc. Rationalities of commodification e.g. conservation gains of trophy hunting, infatuations with eastern medicines and alternative medicines, fame and class will be discussed. (At KBC)	L	1 hour 40 min	**Brennan, A. J., & Kalsi, J. K. (2015). Anderson, B., & Jooste, J. (2014).**
24	**Application of forensics science in the conservation of African elephants in Kenya** This lecture will be given by a wildlife forensics analyst at the KWS headquarters in Nairobi. Students will learn the historical development of wildlife forensics, the theory and practice of forensics science in wildlife conservation, how forensics science is used to detect elephant crimes and ivory trafficking; how forensics science is used to manage elephant meta-populations; achievements and limitations for wildlife forensics in conserving elephants in Kenya.	L	1 hour 30 min	Kanthaswamy, S. (2024). Bell, L. S. (2011).
25	**Visit to forensics science laboratory at KWS headquarters** Students will visit, in groups, the Wildlife Forensics Laboratory at the KWS headquarters (the only one in East and Central Africa). Students will be taken through the process of stages and departments where forensic samples are processed in the Laboratory and have an opportunity to understand some of the techniques used in the lab**.**	FL	1 hour 30 min	
	Population status and trends of the African elephant: a continental perspective Lecture will examine trends in the population of African elephant in Africa. It will also examine the causes for the observed population trends of the species and challenges.	L	1 hour 30 min	ACOF, 2016
	Technology and innovations in elephant conservation In this lecture, the guest will expose students to some of the state-of-the art technologies used in elephant conservation and associated crimes. These innovations	L	1 hour 30 min	

No	Title and outline	Type	Time (hrs)	Readings
	include amongst others; collaring and geofencing, Ranger App, drones, forensics			
	Photobook Class presentation and discussion Student groups will present their photo book exercise to the faculty.	D	1 hour 30 min	
	Community-based conservation and its role in conserving elephants in the Maasai Mara ecosystem In this guest lecture, a manager of a community conservancy in the Maasai Mara ecosystem will talk about how the conservancy model helps in creating conservation space for giraffes within the context of changing land tenure. In addition, the lecture will also explore modalities of engaging communities in giraffe conservation.	L	1 hour 30 min	**Fisher, Keely A.; Donnelly, Marc R.; and Adams, Collin (2021). Liang, W., Linxiu, Z., Min, W., Erustus, K., & Cong, D. (2018).**
	Review of Storytelling Videos Students show their films to stakeholders and peers.	D	2 hours	
	Course overview and Exam Review Overall review or recap of the course, highlighting main themes and messages, and outline topics that students should put more effort into and focus on for the exam. Students will have a chance to seek further clarifications on course topics and practical as well as administrative matters of the exam.	D	50 mins	
	Total		50	
	UMN Instructional Hours*		60	

**UMN defines* an instructional hour as a 50-minute block. SFS syllabi are written in full 60-minute hours for programming purposes. Therefore 50 full hours = 60 UMN instructional hours (for four credit courses) and 25 full hours = 30 UMN instructional hours (for two credit courses).*

Reading List

1. ACOF, (2016). Elephants in the Dust – The African Elephant Crisis. A Rapid Response Assessment. United Nations Environment Programme, GRID-Arendal
2. Bell, L. S. (2011). Forensic science in support of wildlife conservation efforts Morphological and chemical approaches (global trends). *Forensic Sci Rev*, *23*(1), 30-36.
3. Berg, J. K. (1983). Vocalizations and associated behaviors of the African elephant (Loxodonta africana) in captivity. *Zeitschrift für Tierpsychologie*, *63*(1), 63-79.
4. Brennan, A. J., & Kalsi, J. K. (2015). Elephant poaching & ivory trafficking problems in Sub-Saharan Africa: An application of O'Hara's principles of political economy. Ecological Economics, 120, 312-337.
5. De Groot, W. T., & Zwaal, N. (2007). Storytelling as a medium for balanced dialogue on conservation in Cameroon. *Environmental conservation*, *34*(1), 45-54.
6. Douglas-Hamilton, Iain.,1972. "On the ecology and behaviour of the African elephant." PhD diss., University of Oxford.
7. Estes, R. D. 1991. The behavioral guide to African mammals including hoofed mammals, carnivores, and primates. Awake Forest Studium Book. Russel Friedman Books Publishers, South Africa
8. Evans, L. A., & Adams, W. M. (2018). Elephants as actors in the political ecology of human–elephant conflict. *Transactions of the Institute of British Geographers*, 43(4), 630-645.

9. Fisher, Keely A.; Donnelly, Marc R.; and Adams, Collin (2021) "The Rise of Community Based Natural Resource Management Strategies as Explained by Transaction Costs," Undergraduate Economic Review: Vol. 18: Iss. 1 , Article 5.
10. Green, S. J., Grorud-Colvert, K., & Mannix, H. (2018). Uniting science and stories: perspectives on the value of storytelling for communicating science. Facets, 3(1), 164-173.
11. Groom and Western (2013). Impact of land subdivision and sedentarization on wildlife in Kenya's Southern Rangelands Rangeland Ecology & Management, 66(1):1-9.
12. Kanthaswamy, S. (2024). Wildlife forensic genetics—Biological evidence, DNA markers, analytical approaches, and challenges. *Animal Genetics*, *55*(2), 177-192.
13. Kantai (2007). In the grip of a vampire state: Maasai land struggles in Kenyan politics.
14. Langbauer Jr, W. R. (2000). Elephant communication. *Zoo Biology: published in affiliation with the American Zoo and Aquarium Association*, *19*(5), 425-445.
15. Liang, W., Linxiu, Z., Min, W., Erustus, K., & Cong, D. (2018). The Development of Wildlife Community Conservancies in Kenya: A Preliminary Review. Journal of Resources and Ecology, 9(3), 250-256.
16. Mwangi & Ostrom (2009). A century of institutions and ecology in East Africa's rangelands.
17. Ngene, S. *et al.*, (2017). Home range sizes and space use of African elephants (Loxodonta africana) in the Southern Kenya and Northern Tanzania borderland landscape. *International Journal of Biodiversity and Conservation*, *9*(1), 9-26.
18. Okello M. (2009). Contraction of Wildlife Dispersal Area and Displacement by Human Activities in Kimana Group Ranch Near Amboseli National Park, Kenya.The Open Conservation Biology Journal, 3:49-56.
19. Okello and D'Amour (2008). Agricultural expansion within Kimana electric fences and implications for natural resource conservation around Amboseli National Park, Kenya. Journal of Arid Environments, 72: 2179–2192
20. Okello, M. et al., (2016). Population density of elephants and other key large herbivores in the Amboseli ecosystem of Kenya in relation to droughts. *Journal of Arid Environments*, *135*, 64-74.
21. Okello M. *et al.,* (2015). Habitat use and preference by the African elephant outside of the protected area, and management implications in the Amboseli Landscape, Kenya. *International Journal of Biodiversity and Conservation*, *7*(3), 211-226.
22. Okello, M. *et al.,* 2009. Reconciling peoples' livelihoods and environmental conservation in the rural landscapes in Kenya: Opportunities and challenges in the Amboseli landscapes. *Natural Resources Forum* 33:123 - 133.
23. Pas, A., Watson, E. E., & Butt, B. (2023). Land tenure transformation: The case of community conservancies in northern Kenya. Political Geography, 106, 102950.
24. Shaffer, L. J., Khadka, K. K., Van Den Hoek, J., & Naithani, K. J. (2019). Human-elephant conflict: A review of current management strategies and future directions. *Frontiers in Ecology and Evolution*, 6, 235.
25. Shrader, A. M., Ferreira, S. M., McElveen, M. E., Lee, P. C., Moss, C. J., & Van Aarde, R. J. (2006). Growth and age determination of African savanna elephants. *Journal of Zoology*, *270*(1), 40-48.
26. Stansfield, F. J. (2015). A novel objective method of estimating the age of mandibles from African elephants (Loxodonta africana africana). *PLoS One*, *10*(5), e0124980.
27. Whitehouse, A. M., Hall-Martin, A. J., & Knight, M. H. (2001). A comparison of methods used to count the elephant population of the Addo Elephant National Park, South Africa. *African Journal of Ecology*, *39*(2), 140-145.