AMBOSELI TRUST FOR ELEPHANTS

Amboseli Trust for Elephants

Annual Research Report 2019

MISSION STATEMENT FOR ATE SCIENCE AND RESEARCH: *The Amboseli Elephant Research Project is trailblazing and the world's longest continuous elephant research programme. At ATE we contribute to knowledge of large mammal socioecology, provide a basis for public understanding and concern for elephants and their ecosystems, and communicate information enhancing conservation in the Amboseli ecosystem and for regional and global elephant populations.*

Introduction

Our annual report for 2019, as we enter our 48th year of study, aims to provide background information for all our ecosystem partners on the health and status of the Amboseli elephant population, derived from long-term monitoring of individual elephants over their lifespan. We continue to work closely with our ecosystem partners, Kenya Wildlife Service, the Group Ranches and Community Conservancies, Amboseli Ecosystem Trust and Big Life Foundation, to support them with science and knowledge about elephants, their habitats and elephant lives. We thank all our partners, collaborators and donors for their sustained interest in our research results and for protecting the elephants and ecosystem of the Amboseli Basin.

Using our individual IDs, we now have information on the life histories of 3515 elephants, of which 1666 (727 males and 938 females) were alive at the end of 2019. These life histories allow us and our ecosystem partners to understand and predict the population dynamics of elephants in Amboseli, as well as comparatively across the rest of Africa. AERP's contribution to understanding population dynamics results from the relatively undisturbed, well-protected nature of this intensively monitored population.

I. Long-Term Monitoring

(a) Background environmental context

The context of our project is evolving as the ecosystem faces challenges of habitat conversion and climate change. Only with long-term studies can we assess the responses of a long-lived and threatened species, such as elephants, to these changes and predict those biological, behavioural and cognitive factors that might make elephants resilient to change. Behavioural elements have started to be recognised more widely as a significant aspect of conservation for many species, including for elephants, based at least in part on ATE's long-term studies.

Photo, right: We regularly monitor vegetation adding to our continuous dataset to assess vegetation dynamics in conjunction with rainfall and satellite-based remote sensing.

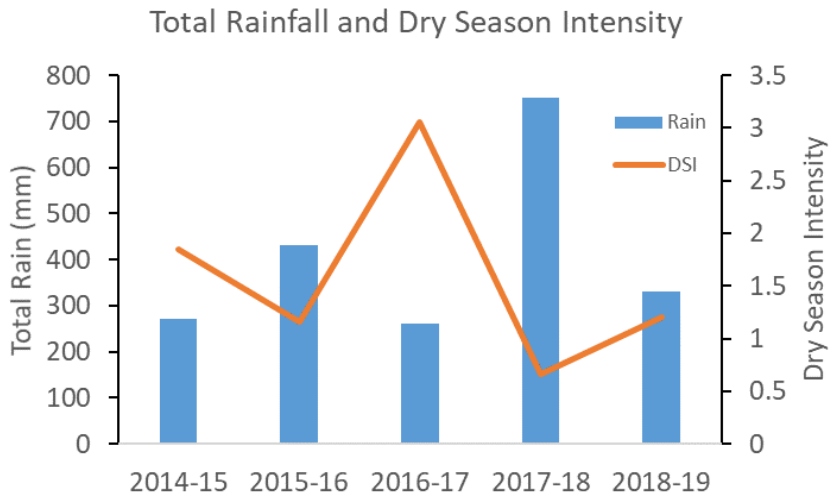


Figure 1. *Mean monthly rainfall (mm) for the last 5 years along with the dry season intensity index (number of consecutive months with <20mm rainfall, divided by total annual rainfall *100), an indicator of drought intensity.*

Change was a feature of 2019, with uneven but abundant rainfall (Figure 1). Following an exceptionally wet 2018, we have now had two years of high food availability for elephants and other grazers, as well as flooded landscapes. Both these factors have contributed to dynamic distributions of the elephants throughout the ecosystem.

B) *Elephant range and habitat use*

AERP has been monitoring how elephants use vegetation and habitats for the past 45 years. Elephant movements respond to rainfall, and the subsequent availability of vegetation and water, with a socially learned component defining when and how far females and families move on a daily, monthly and seasonal basis. A number of Amboseli families now disperse far from the central basin while others remain and concentrate on the swamps as illustrated (Figure 2).

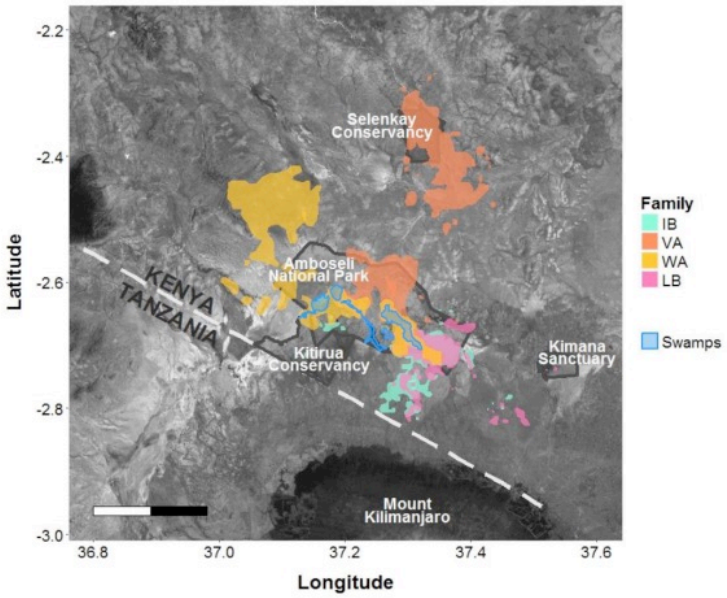


Figure 2. *Map of area of use for four families (95% kernels) showing their ranging within the central basin and outside in community conservancies and group ranch areas (From Boult, 2018).*

The use of these areas is strongly seasonal, related to shifts in rainfall and vegetation growth, as illustrated in Figures 2 and 3.

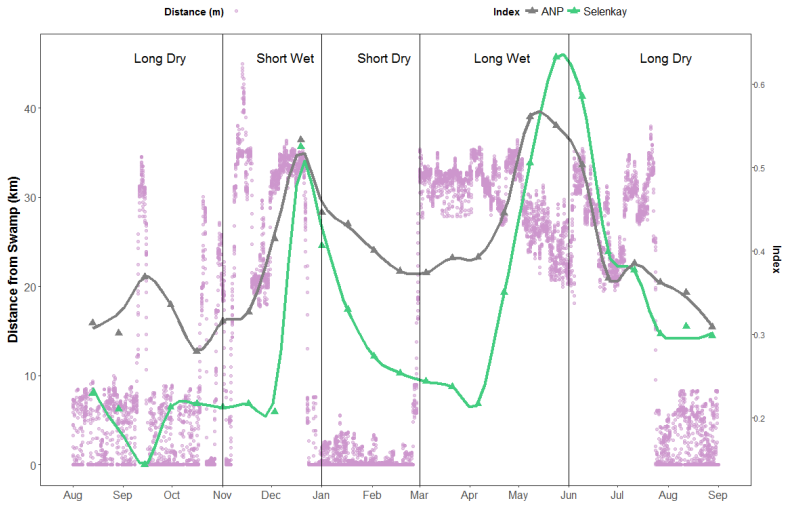


Figure 3. *Monthly and Seasonal NDVI or satellite greenness index (green and grey lines) in relation to the movements of one collared elephant (Vicky) elephant movements to and from swamps (1hr fixes for satellite collar). ANP = Amboseli National Park, Selenkay = dispersal area in the conservancy (from Boult, 2018).*

Elephants are sexually segregated at the landscape scale; within the central study area, both males and females use similar habitats in proportion to their availability, which may be a function of patch size, competition with livestock or habitat quality. Some sex differences are however clear; females (both families and mixed groups) tend to be observed more at swamp edges, while males are seen more in woodlands and wet swamps (Figure 4). This dependence on water is probably linked to females' greater need to drink every day in order to maintain milk production, while males are using areas of lower quality foods, such as wet swamps and woodlands.

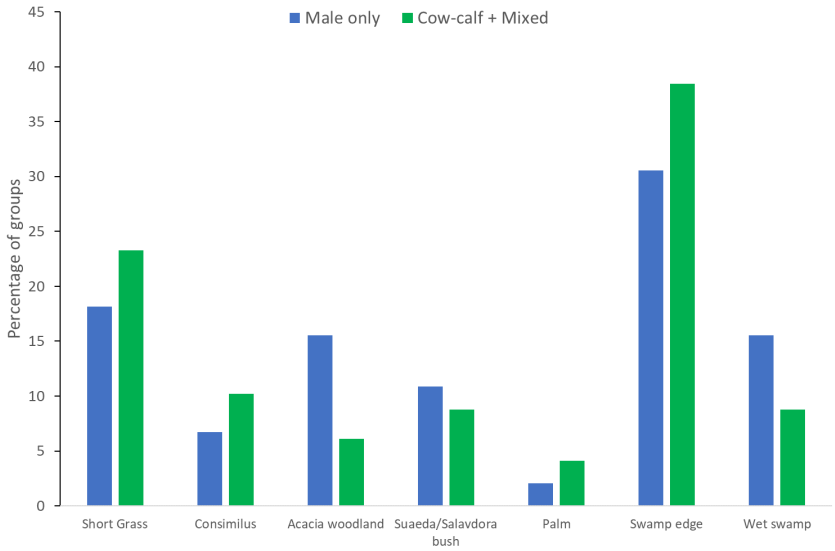


Figure 4. *Percentage of observations of groups in the different Amboseli basin habitats in 2019. Male n = 193, female n = 705.*

Elephants, both male and female, make decisions about where to go and when to move based on social factors as well as food, aggregating in large groups to seek mates and learn from others or breaking into smaller groups to avoid competition. How elephants use their landscape reveals when and how they make these decisions and how important their social choices are. As a result of differing social and ecological strategies, males and females find themselves in groups of markedly different sizes (Figure 5).

The most common group size for females in 2019 was 20.5 elephants, while that for males in male-only groups was 2.24. As is typical for elephants in Amboseli and elsewhere in Africa, males

are more social than they are solitary. This high sociality of males is an important part of their strategy to manage risks, especially those caused by humans.

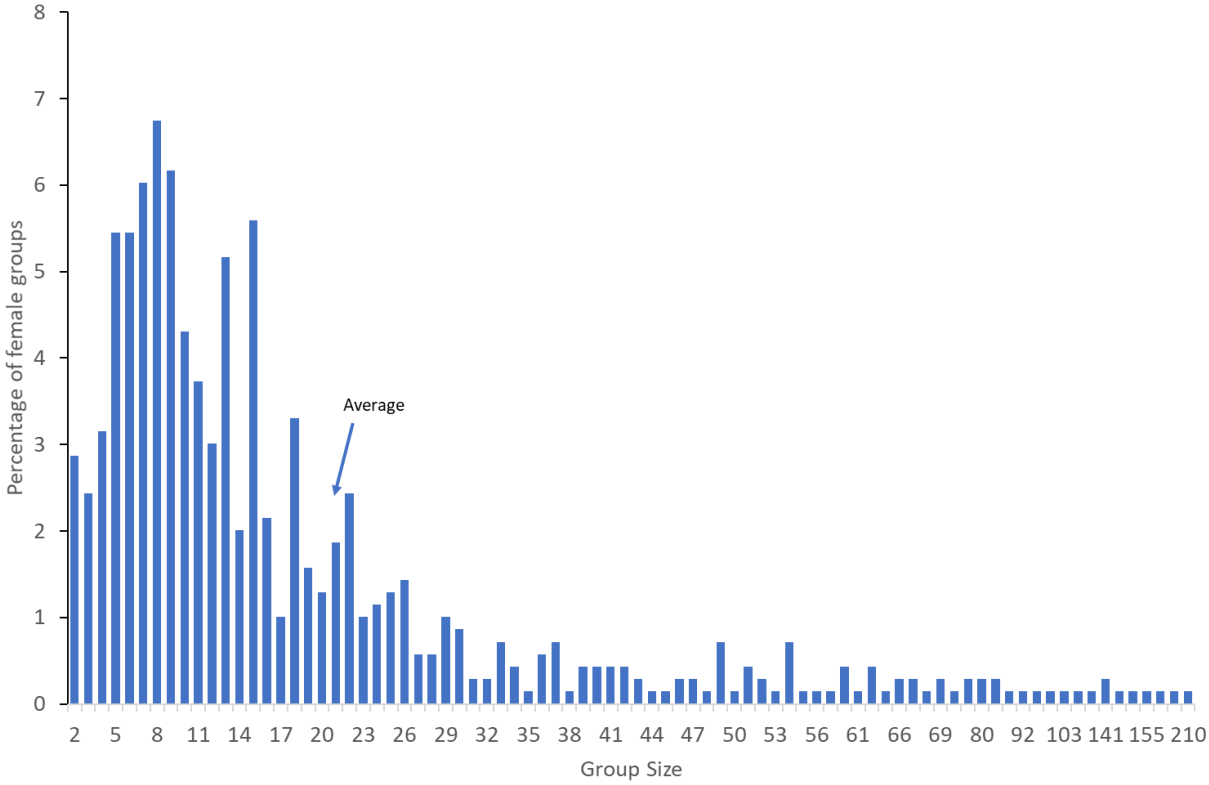


Figure 5. *Distribution of group sizes for female-only and mixed-sex groups in 2019. Largest group seen was 370 elephants.*

Common habitats, short grass plains and swamp edge, were used more than the rarer habitats like *Phoenix* palm or *Consimilis* grassland (see Fig. 4), but Amboseli elephants were found in small, medium and large groups in both common and rare habitats (Figure 6). For females (both female-only and mixed sex groups, Figure 6A), large groups were slightly more likely to be seen in areas with short grass, where females aggregated before splitting up into smaller units to drink and forage at the edges of and in the swamps. Small groups were also seen more than expected in *Phoenix* palm woods, which are rare habitats across the ecosystem. For males (Figure 6B), the patterns were slightly different: lone males were sighted most in short grass plains and swamp edges. Large groups of males were seen in most habitats, although there were fewer large male groups seen in *Consimilis* grasslands or *Phoenix* palms within the central basin.

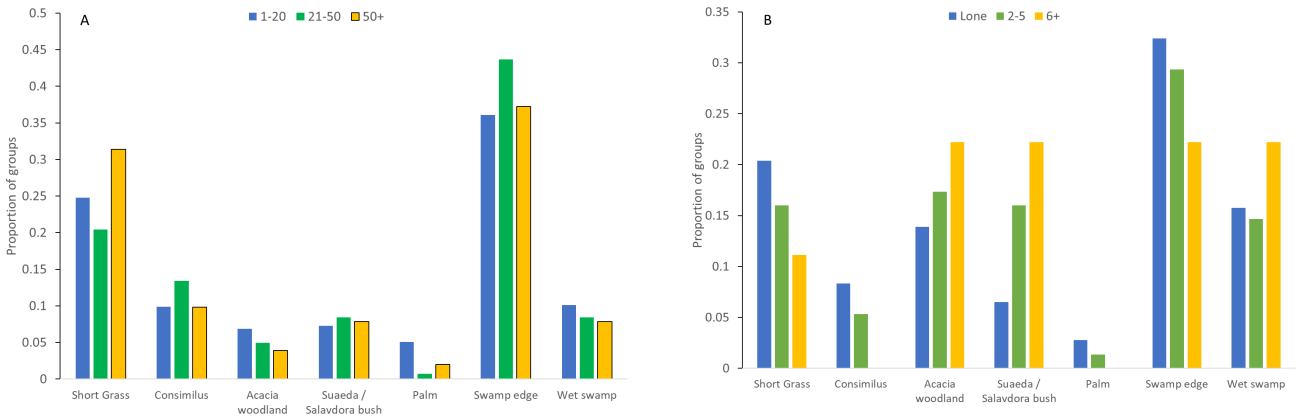


Figure 6. *Total Habitat occupancy (proportion of sightings within habitats) of (A) female groups by size category of average, large, and very large; (B) male groups by size category of lone, small and large.*

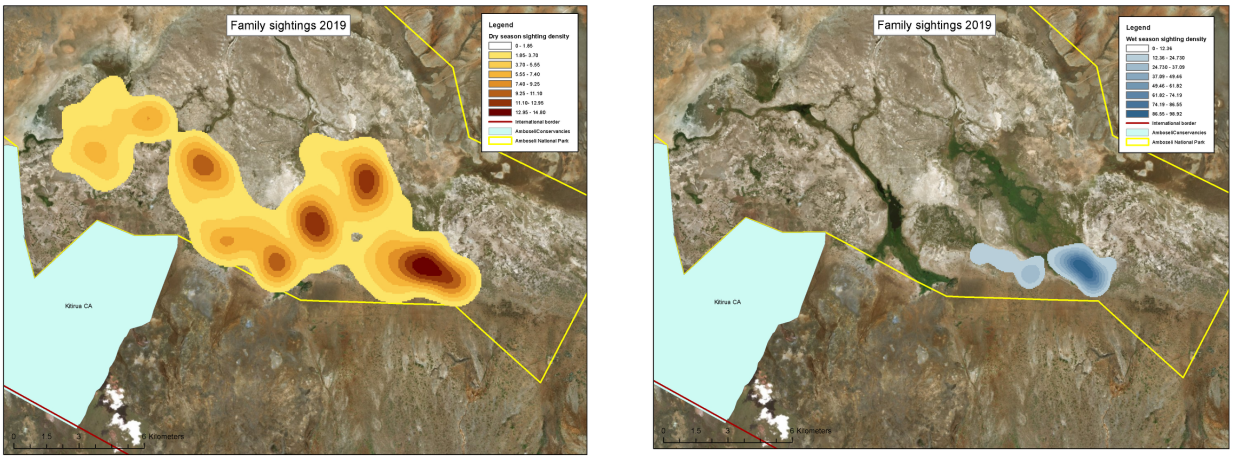


Figure 7. *Sightings of family units during the Dry (yellow, L) and Wet (Blue, R) in the central protected area of Amboseli during 2019. The occupancy of the park is strongly related to water availability, with considerable dispersal during wet period.*

(C) Elephant population dynamics

There were only 9 deaths recorded in 2019, following 2018 which also had very few deaths (total = 10). Of these deaths none was directly attributed to human-elephant hostility, illustrating the importance of the actions of our ecosystem partners, Kenya Wildlife Service, Big Life Foundation, and local communities and ranger/scout organisations (e.g. Olgulului Community Wildlife Rangers), in effectively managing human-elephant coexistence.

There were only 17 births in 2019 because there were very few females without a calf under two years of age: 202 calves had been produced in the previous two years from 541 females over the age of 9 years (youngest age at first reproduction). Most females won't be able to conceive until their calf is 2 years old, and with a 22-month gestation, this means that most females simply are not ready to become pregnant or give birth again for another year at least. Historically, most females give birth to their next calf between 4 and 5 years after the previous calf. Interbirth intervals (IBI) between surviving calves have been low in recent years (Figure 8); we have yet to be able to determine the current intervals since so few females have given birth to their next calf since 2016.

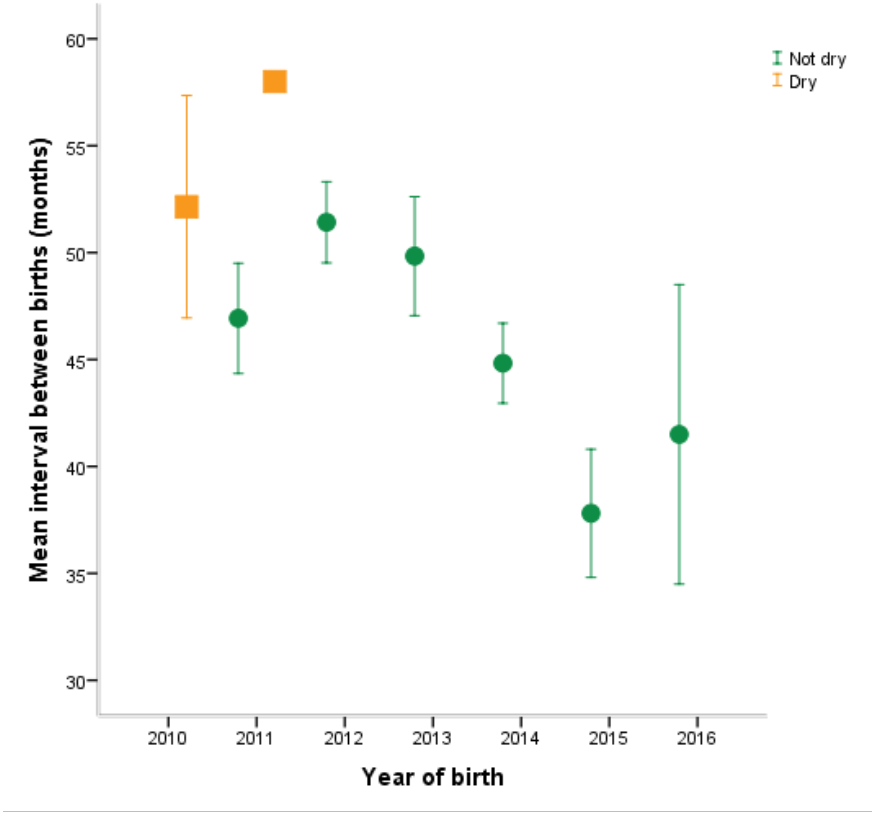


Figure 8. *The interbirth intervals – time between successive births to the same mother – showing the effect of dry years and the short intervals for wet years.*

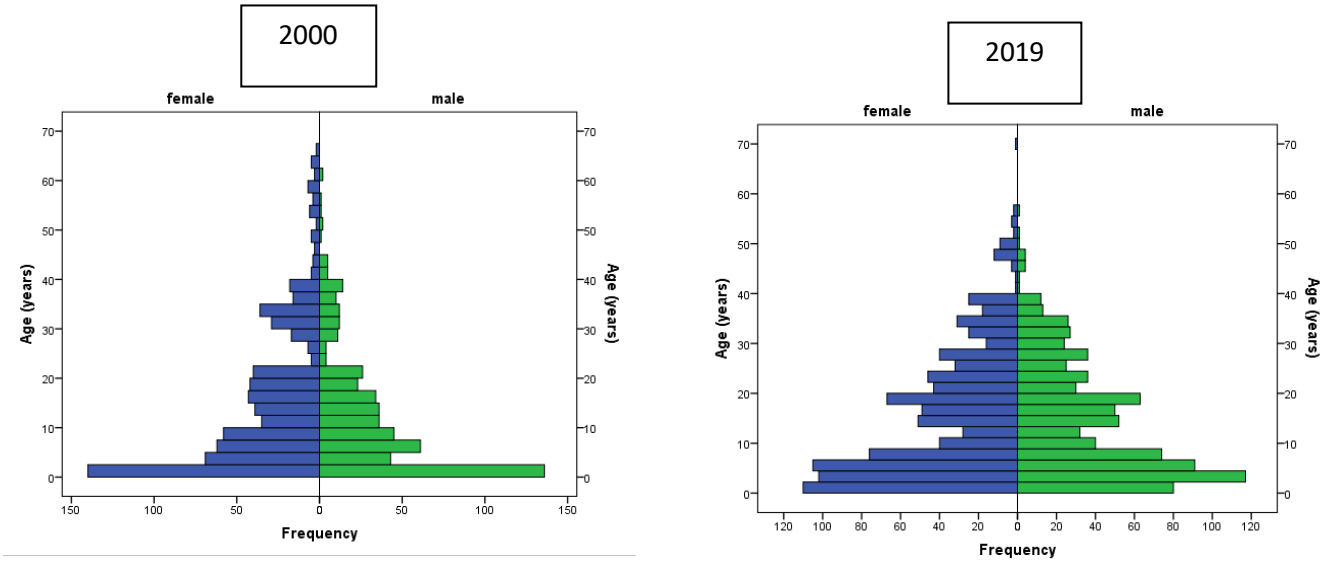


Figure 9. *Number of male and female elephants in 2000 (left) compared with current counts in 2019 (right), illustrating the loss of older animals due to drought over the decade.*

The population has recovered from the 2009 drought, although there was also considerable late dry season mortality in 2017, especially of calves (total deaths N= 56). The birth peaks in 2015 and 2016 have resulted in a young population profile, while the deaths of older elephants have truncated the top of the pyramid (Figure 9). We can also show how the number of middle-aged individuals has increased over time with good calf survival to middle age.

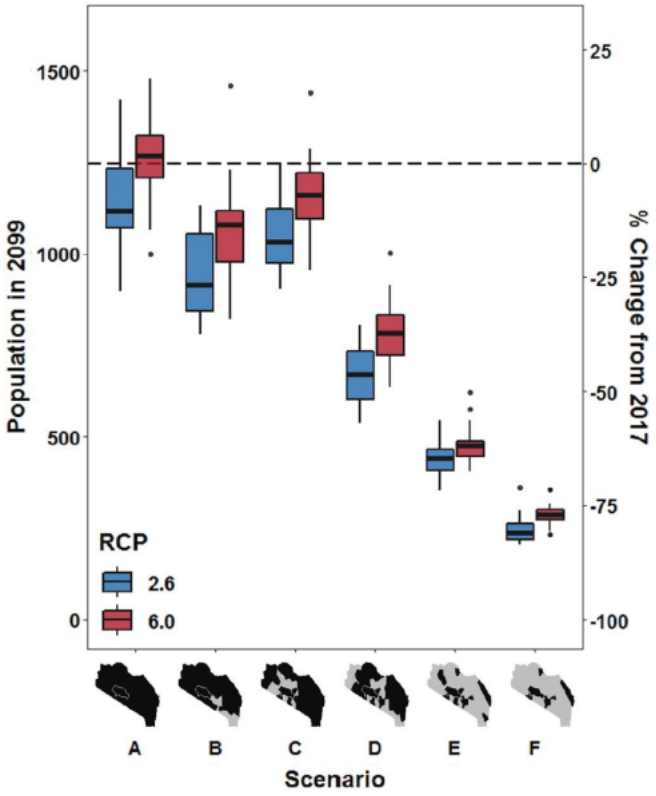


Figure 10: *Population projections over the next 50 years, from Boult et al. 2019 (Conservation Science and Practice, 1(9), e87), using land use changes (fragmentation increasing with greyness) and projected global temperature increases (RCP +2.6 and +6.0°C)*

Dr Vicky Boult modelled what will happen to elephant populations in future years as a function of a decrease in the areas available for elephants in the Amboseli area (Boult et al., 2019a). Effects of drought due to climate change scenarios, which will reduce food availability and reproduction, were modelled, along with the effects on elephant populations of the loss of habitat under different regimes of fencing and habitat conversion to agriculture. This work (Figure 10) shows that while elephants can sustain or recover from drought mortality with intact ecosystems even as global temperatures increase and rain becomes more unevenly distributed, the most severe form of ecosystem fragmentation, where only the national park and conservancies remain open to elephants, would lead to a 75% decline in the Amboseli elephant population.

II) Collaborations and Dissemination

a) Overview of ongoing research

Our vital and active monitoring team (Katito Sayialel, Norah Njiraini, Moses Saruni) has been locating and observing elephants across the ecosystem. They continue our long-term population monitoring, documenting family dynamics, independent males, and building our dataset on lifetime reproductive success for individuals.

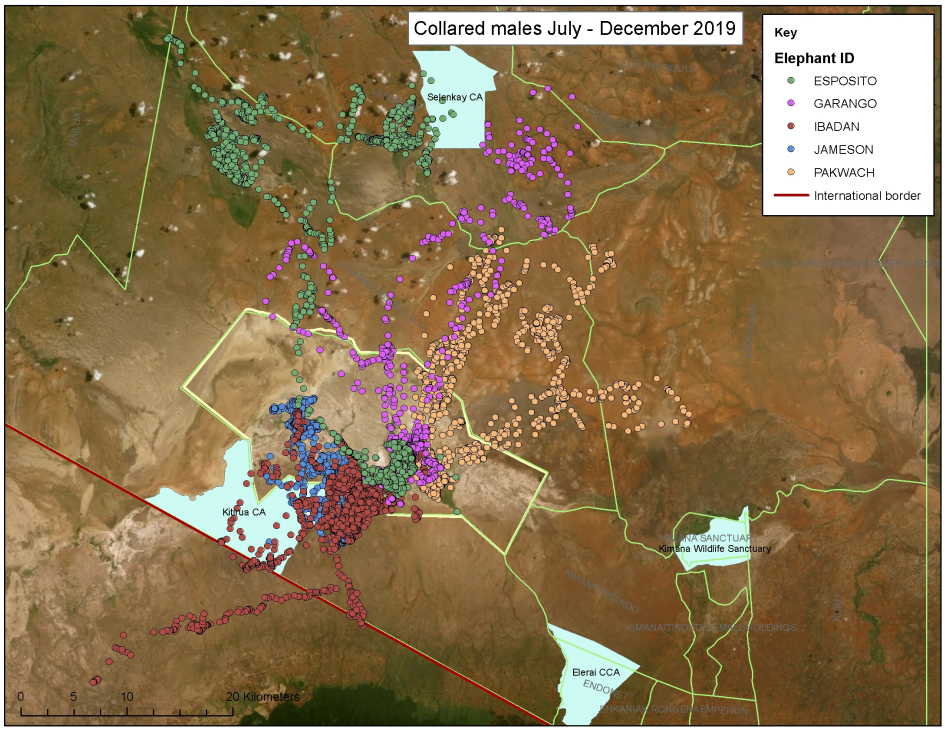
As we show above, our current theme is to link individual ranging and social and reproductive strategies to elephant population dynamics at a landscape scale. Our GIS coordinator, Tal Manor is vital to this work. Behavioural patterns confer resilience and flexibility on elephant populations, and are important for Amboseli, for Kenya and for elephant populations across Africa that face myriad threats from changes to their landscapes due to human activities.

We are currently developing collaborations with KWS scientists and the School for Field Studies to examine the changing vegetation types and distribution and the pressures on vegetation from drought, grazing and wildlife in this region. As part of this aim, we collaborated with the Amboseli Ecosystem Trust, and the Group Ranches on a UK Overseas Development Agency funded project to assess what group ranch members saw as the key challenges to pastoralism and resilience in the face of climate change.

ATE's Senior Research Scientist, Dr Vicki Fishlock, launched our study in collaboration with KWS on how young male elephants use social and ranging strategies to buffer against anthropogenic risks, by deploying collars on five young males who have recently dispersed from their families. These males have travelled widely over the ecosystem (Figure 11), although they have all returned at times to the central core of the protected area. A final three collars were not deployed in 2019 because of the very wet and flooded conditions; these will be deployed

during early 2020, when field conditions permit. These males show both the range across which elephants travel, and the variety of strategies they use to move across varying risk gradients within the landscape. We are tracking companion choices for all males in this cohort, to determine who these young males learn new social and ecological strategies from. By mapping these choices onto previous social experience, examining our records of who their families associated with while they were growing up, we can gain insights into how males expand their range and companion choices as they become independent, and more likely to test the human-elephant interface.

Figure 11. *Map of young male movements in 2019. Note the extensive movements in Tanzania and to the Northwest.*



b) Dissemination

Our research findings have been successfully published in a number of peer-reviewed journals. We aim to continue to disseminate our findings widely so that unique knowledge from these individuals will continue to act as a baseline for understanding elephant behaviour in general, communication and cognition, responses to landscapes and climate change as well as enabling comparative models of population dynamics across Africa.

Recent scientific publications by the ATE team and allied researchers for 2019.

Brakes, P., Dall, S.R.X., Aplin, L., Bearhop, S., Carroll, E.L., Ciucci, P., Fishlock, V., Ford, J.B., Garland, E.C., Keith, S.A., McGregor, P.K., Mesnick, S.L., Noad, M.J., Nortabartolo di Sciara, G., Robbins, M.M., Simmonds, M.P., Spina, F., Thornton, A., Wade, P.R., Whiting, M.J., Williams, J., Rendell, L., Whitehead, H., Whiten, A. & Rutz, C. (2019). Animal culture matters for conservation. *Science* 10.1126/science.aaw3557

Boult, V. L., Fishlock, V., Quaife, T., Hawkins, E., Moss, C., Lee, P. C., & Sibly, R. M. (2019a). Human-driven habitat conversion is a more immediate threat to Amboseli elephants than climate change. *Conservation Science and Practice*, *1*(9), e87.

Boult, V. L., Sibly, R. M., Quaife, T., Fishlock, V., Moss, C., & Lee, P. C. (2019b). Modelling large herbivore movement decisions: Beyond food availability as a predictor of ranging patterns. *African journal of ecology*, *57*(1), 10-19.

Moss, C. J., Fishlock, V., & Lee, P. C. (2019). Twinning in the Amboseli elephant population. *Pachyderm*, (60), 118-119.

Pardo, M. A., Poole, J. H., Stoeger, A. S., Wrege, P. H., O'Connell-Rodwell, C. E., Padmalal, U. K., & de Silva, S. (2019). Differences in combinatorial calls among the 3 elephant species cannot be explained by phylogeny. *Behavioral Ecology*, *30*(3), 809-820.

Aduma, M. M., Said, M. Y., Ouma, G., Wayumba, G., & Njino, L. W. (2018). Projection of future changes in elephant population in Amboseli under representative concentration pathways. *American Journal of Climate Change*, *7*(4), 649-679.

III) Activities with Stakeholders and Communities

a) Stakeholder engagement

ATE continues to play an active role as technical advisors to the Amboseli Ecosystem Trust, and especially to KWS and Big Life Foundation who are the principal agencies managing the human-wildlife interface.

The ODA BUILD Fund and ATE funded project on "*Co-developing community data skills to address the challenges of adapting pastoralist practices in Amboseli, Southern Kenya*" was participatory and co-designed with group ranch members. Working party meetings in June 2019 between group ranch members, coordinated by Amboseli Ecosystem Trust, established what members wanted to find out and enabled meetings with the Kajiado District Veterinary Officer. Participants designed a questionnaire for group ranch members to assess what they needed to know in relation to challenges for pastoralism, collecting data on stocking, grazing regimes, water accessibility and wildlife sustainability. The questionnaire was administered between August-September 2019. Responses were analysed by community members and reported back to each group ranch committee in December 2019. The final phases, designing governance mechanisms and strategies for monitoring of stocking and grazing regimes are now devolved to group ranch planning committees for implementation as and when they are developed and desired by stakeholders.

ATE seeks to place research results where they deliver most value to stakeholders and policy makers. To that end, in September 2019 we held a workshop with Dr Victoria Boult, whose model of elephant movement in response to habitat loss and climate change scenarios used the ATE dataset. During the workshop, participants from the natural resource working group and the planning consultant for the AEMP were introduced to the model and explored whether it could be developed into a useful tool for decision making about land use. Dr Boult hopes, with funding, to to continue extending the work, alongside the Amboseli Ecosystem Trust partners.

Protocols to deal with serious incidents occurring between people and elephants from the Human Wildlife Coexistence Committee have been developed and approved by the community organisations, Amboseli Ecosystem Trust and the Senior Warden and Assistant Director, Southern Region, and are now pending approval from KWS Senior Management. These protocols are vital as part of the effort to prevent retaliatory attacks, which result in further injuries and fatalities to humans and wildlife. We continue to work with Big Life Foundation to harmonise elephant mortality data for KWS, to identify elephants that have been treated for injuries or illness and where possible provide follow up information on treatment outcomes to KWS vet teams. Our team also participates in ecosystem counts as and when requested by KWS.

Training, sensitisation and filming

ATE provides training in elephant behaviour, biology, growth, ageing and sexing to our collaborators within the ecosystem and for range country biologists and conservation managers from Africa and Asia. Training events for 2019 were scheduled with Tanzanian stakeholders and Big Life rangers but were unable to proceed due to flooding during the exceptional wet season.

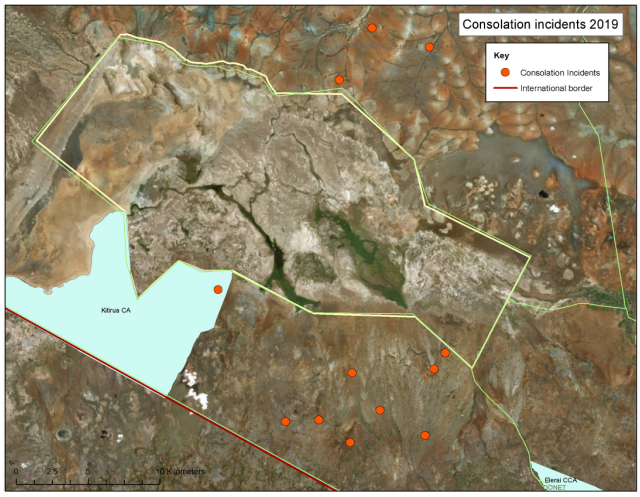
Meetings with school children are common ways of providing information and activities related to elephants and their conservation, such as for an ISK schoolchildren's visit, Sept 2019.

Supporting Government of Kenya authorised film-makers

- BBC filmmakers for series "Dynasties"
- Filming for UNESCO

b) Consolation Scheme

Our consolation scheme, which addresses the loss of cattle, sheep-goats, and donkeys as a result of interactions with elephants outside the protected area of Amboseli National Park was called on to support 12 events of livestock loss in 2019. Our programme remains vital to sustaining tolerance of elephants among Maasai pastoralists even when they experience livestock losses caused by elephants.



c) Scholarships

ATE fosters livelihood development among young men and women by funding scholarships for primary, secondary and university students from the Group Ranches surrounding Amboseli National Park.

During 2019, we sponsored four primary students and seven secondary students. We also funded four students at university and technical institutions. One student, Diana Parmares (photo, left), was sponsored by us through university and is now studying for a Master's Degree in Business Administration. Another one of our girls, who we have been supporting from the first year of secondary school and all through university, is currently studying for a Master's in Tax and Customs Administration. ATE's scholarships build capacity and develop livelihoods in many areas of learning and professional training for young community members who share their lives with elephants.

Cynthia Moss, Director
Phyllis Lee, Director of Science
February 2020