

Survey of eastern patas monkey *Erythrocebus patas pyrrhonotus*, other primates, warthogs, dik-diks, and waterbuck in Laikipia County, central Kenya



Report for Primate Conservation Inc. & Lolldaiga Hills Ranch

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Eastern Africa Primate Diversity and Conservation Program &
Lolldaiga Hills Research Programme

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All photographs and maps by Yvonne de Jong and Thomas Butynski

Cover photograph: Adult female eastern patas monkey *Erythrocebus patas pyrrhonotus*,
Kidepo Valley National Park, northeast Uganda.

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Abstract

The eastern patas monkey *Erythrocebus patas pyrrhonotus* is a subspecies whose abundance and geographic range are in decline. Laikipia County, central Kenya, supports a small, isolated, population which forms the stronghold and eastern limit of Kenya's patas population. This report presents the results of the third survey of the abundance and distribution of patas in eastern Laikipia. Additional aims of this survey were to: (1) answer, or contribute towards answering, several questions important to primate conservation, both in eastern Laikipia and globally; (2) stimulate further interest in primate research and conservation in eastern Laikipia; (3) improve on the information available for the IUCN Red List assessments of the primate species and subspecies of eastern Laikipia; and (4) obtain information on the biogeography and taxonomic status of the region's warthogs, dik-diks, and waterbucks.

The findings presented here are based on field surveys, questionnaires, and communications with long-term residents and property managers/owners.

Eastern Laikipia appears to hold 145–155 patas. These occur in about 13 groups (mean group size = c. 12 individuals). Twenty of the 60 properties (33%) surveyed in eastern Laikipia County supported patas during 2010–2017. No property has more than two groups and most groups use at least two properties. Groups range in size from two to 25 individuals. There are at least four solitary patas (all probably adult males) in this region.

The extent of occurrence of patas in eastern Laikipia is c. 1,750 km². The north and northwest limit of the geographic range of patas in Laikipia is Loisaba Conservancy where solitary individuals (but no groups) are occasionally observed. Borana Conservancy represents the east and southeast limit. Central Solio Ranch is the south and southeast limit. The west and southwest limit may be ADC Mutara Ranch, but a survey of patas in western Laikipia County is required to confirm this.

Comparisons with earlier studies show that the number of patas in eastern Laikipia has declined. This decline has occurred mainly through reduction in group size rather than through a reduction in the number of groups. Patas have been extirpated, or group sizes reduced, in areas affected by habitat degradation, loss, and fragmentation, loss of perennial water sources, and severe competition with people and livestock over access to water. Habitat degradation, loss, and fragmentation are predominantly caused by over-grazing and over-browsing by livestock, conversion of large areas to agriculture, uncontrolled logging, charcoal production, high concentrations of savanna elephant *Loxodonta africana*, and spread of invasive plants, particularly prickly pears *Opuntia* spp. Damage is most severe in and around rural and communal areas---where the human population is most dense and where the extraction of natural resources is most intense and unsustainable.

With the fast-growing human and livestock populations it is increasingly difficult for patas and other wildlife to find suitable habitat and to access water outside well-managed ranches. During the time of this study, eastern Laikipia experienced a drought and many, if not most, dams and rivers were dry for several months. In addition, pastoralists illegally brought very large numbers of livestock onto well-managed ranches for most of 2017. As a result, water on these ranches became difficult or impossible for patas and other wildlife to access.

In order to assess the abundance and distribution of patas for all of Laikipia County, a survey in western Laikipia is needed. Recommendations for patas research and conservation action in Laikipia are provided in this report.

Fifty-nine groups of diurnal primates, belonging to four genera and four species, were encountered during this survey (olive baboon *Papio anubis*, Hilgert's vervet monkey *Chlorocebus pygerythrus hilgerti*, Kolb's monkey *Cercopithecus mitis kolbi*, Mount Kenya guereza colobus *Colobus guereza kikuyuensis*). Only one species of nocturnal primate was observed--- Kenya lesser galago *Galago senegalensis braccatus*. Somali lesser galago *Galago gallarum* was encountered in Samburu County during this survey.

Both species of warthog *Phacochoerus* (common warthog *Phacochoerus africanus* and desert warthog *Phacochoerus aethiopicus*) and two species of dik-dik (Smith's dik-dik *Madoqua smithi* and Kirk's dik-dik *Madoqua kirkii*) were found in northeast Laikipia (Lekurruki Conservancy and Il 'Ngwesi Conservancy). These are the first records of desert warthog and Kirk's dik-dik for Laikipia County.

During this survey, the geographic ranges of defassa waterbuck *Kobis ellipsiprymnus defassa* and of common waterbuck *K. e. ellipsiprymnus* in Laikipia, Isiolo, and Samburu Counties were better defined, as was their 'hybrid zone'.



Figure 1. Northeast Laikipia County, Kenya. Mukogodo Forest lies on the hills in the distance.

Introduction

Although there have been many studies of the non-human primates of East Africa, almost all of these studies have focused on one or a few species at one or a few sites. At the country-level, the biogeography, taxonomy, abundance, and conservation status of most of East Africa's non-human primates remains poorly-known.

Among East Africa's primates, the eastern patas monkey *Erythrocebus patas pyrrhonotus* is of special concern. This subspecies was historically present in west, northwest, central and south Kenya. The geographic range of this monkey in Kenya has, however, declined from c. 93,120 km² to roughly 52,520 km², and populations have become increasingly fragmented. The current geographic range is c. 56% of the historic range, or c. 9% of Kenya's land surface area (De Jong *et al.* 2008; De Jong & Butynski 2014). This is now one of Kenya's most threatened primates (De Jong *et al.* 2008; De Jong & Butynski 2012, 2017). During the IUCN/SSC African Primate Red List Assessment Workshop in Rome (April 2016) we raised the degree of threat status for *E. patas* from 'Least Concern' to 'Near Threatened' (De Jong & Butynski 2017c), while assessing *E. p. pyrrhonotus* 'Vulnerable' (De Jong & Butynski 2017d). The justification for this is as follows:

"Although E. p. pyrrhonotus has a wide geographic range, there is an observed population reduction throughout the range. This decline is expected to continue as the causes (mainly habitat degradation, fragmentation, and loss) are on-going. Extent of occurrence and area of occupancy are in decline. The current level of exploitation is not likely to be reduced."

The known geographic distribution of *Erythrocebus p. pyrrhonotus* is from about Zakouma National Park in southeast Chad and east Central African Republic, through South Sudan and south North Sudan to west Ethiopia, southwards through north Uganda (*e.g.*, Kidepo Valley National Park, Pian Upe National Park) to northwest and central Kenya (*e.g.*, Turkana County, West-Pokot County, Laikipia County; De Jong *et al.* 2008; De Jong & Butynski 2012, 2013, 2014; Butynski & De Jong 2014a). The western limit is uncertain but probably lies in north Cameroon (Y. de Jong & T. Butynski unpubl. data). Laikipia County (hereafter 'Laikipia'), the eastern limit, appears to be the strong-hold for this subspecies in Kenya (Isbell & Chism 2007; De Jong *et al.* 2008; De Jong & Butynski 2012). Within Laikipia, groups of patas occur over an area of 700–1,000 km² (T. M. Butynski & Y. A. de Jong pers. obs.).

Erythrocebus p. pyrrhonotus (hereafter referred to as 'patas') is, by far, the least abundant and most restricted diurnal primate in Laikipia, and the primate of greatest conservation concern (Butynski & De Jong 2014a). Here, patas rely on the vast whistling thorn *Acacia drepanolobium* woodlands where it naturally occurs at low density (0.2–1.5 individuals/km²; Chism & Rowell 1988; Isbell & Chism 2007). Group size here was typically between 13 and 56 individuals (Chism & Rowell 1988) and group home ranges between 23 and 40 km² (Chism & Rowell 1988; Enstam & Isbell 2004). Patas are generally shy and difficult to encounter and observe. Adults are able to run at c. 55 km/hour (Hall 1965).

In Laikipia, the preferred habitat of patas is open whistling thorn woodland comprised of 0.5–6.0 m tall trees. Not only is whistling thorn important as a year-round source of food (contributing 83% of the diet) but also serves as sleeping trees (Isbell 1998). *Erythrocebus p. pyrrhonotus* typically have

numerous sleeping sites within tall trees (4–8 m in height) spread out over an area of c. 2 hectares (Chism & Rowell 1988) throughout their large home ranges (23–80 km²). *Erythrocebus p. pyrrhonotus* feed on *Acacia* spp. gum, as well as leaves, flowers, fruit, invertebrates (mainly ants), small mammals, and bird eggs (Chism & Rowell 1988; Isbell 1989).

The only Laikipia-wide information on the abundance, distribution, and conservation status of patas is that obtained by J. Chism and D. K. Olson during 1979–1981, and that obtained by L. A. Isbell and J. Chism during 1992–2004. Their findings are presented in detail in Isbell and Chism (2007). The 1979–1981 survey found at least 416 patas in 14–15 groups in Laikipia. The 1992–2004 survey found 300–450 patas in 13–17 groups. Isbell and Chism (2007) concluded that patas numbers remained stable in Laikipia during 1979–2004. De Jong (2004) and De Jong *et al.* (2008) surveyed Ol Pejeta Conservancy, Laikipia, as part of a country wide patas survey. They found two groups of patas and two solitary individuals. Kahiro *et al.* (2013) reported three groups of patas on Segera Ranch, Laikipia, in 2013.

This report presents the results of a third survey of patas in Laikipia, with a focus on eastern Laikipia. The specific goals were to:

- Determine the current abundance, distribution, and conservation status of patas and other primates in eastern Laikipia.
- Contribute to the long-term population monitoring baseline for patas and other primates in eastern Laikipia.
- Assess the threats to patas and other primates in eastern Laikipia.
- Obtain additional ecological information on patas in eastern Laikipia (*e.g.*, altitudinal limits, habitats used, group sizes, distance from the nearest perennial surface water, distance from the nearest human settlement).
- Make recommendations for actions to conserve patas in eastern Laikipia and bring political and conservation attention to the situation.

Seven (37%) of Kenya's 19 species of non-human primate (De Jong & Butynski 2012) occur in Laikipia, of which two are galagos and five are monkeys (Butynski & De Jong 2014a). Of these seven species, three are forest-dependent and four are woodland-dependent, two are nocturnal and five are diurnal, and four are arboreal and three are semi-terrestrial. The primate taxonomy applied in this report follows Butynski *et al.* (2013).

Although the focus of this survey was on patas, additional goals were to: (1) answer, or contribute towards answering, several questions important to primate conservation, both in eastern Laikipia and globally; (2) stimulate further interest in primate research and conservation in eastern Laikipia; and (3) improve on the information available for the IUCN Red List assessments of those primate species and subspecies present in eastern Laikipia. Our research on primates in Laikipia over the past 15 years has raised new biogeographic and taxonomic questions that we, at least partly, addressed during this survey. Here are a few of those questions:

- Is the Mount Kenya guereza monkey *Colobus guereza kikuyuensis* the only subspecies of guereza in Laikipia? Are *C. g. kikuyuensis* and the Mau Forest guereza *Colobus guereza matschiei* valid subspecies? The few guereza that we have observed to date on the western

edge of Laikipia [which is also the eastern escarpment of the Gregory (Eastern) Rift Valley] look somewhat like *C. g. matschiei*. If we find that there is a phenotypic cline from *C. g. kikuyuensis* in eastern Laikipia into *C. g. matschiei* in the Gregory Rift Valley, this would suggest that *kikuyuensis* is not a valid subspecies and should be treated as a synonym of *matschiei* (as *matschiei* is the first-named and, therefore, has taxonomic priority).

- Is the Kenya lesser galago *Galago senegalensis braccatus* the only subspecies of northern lesser galago in Laikipia? Are *G. s. braccatus* and the Senegal lesser galago *Galago senegalensis senegalensis* both valid subspecies? While *G. s. braccatus* is widespread and sometimes common in Laikipia, the one *G. senegalensis* that we have observed on the eastern slope of the Gregory Rift Valley in extreme western Laikipia looked like a *G. s. senegalensis*. If there is a phenotypic cline from *C. g. braccatus* into *C. g. senegalensis*, this would suggest that *braccatus* is not a valid subspecies and should be treated as a synonym of *senegalensis* (as *senegalensis* is the first-named and, therefore, has taxonomic priority).
- Is the Mount Kenya potto *Potto ibeanus stockleyi* present in Laikipia? This taxon is known from but one specimen obtained in 1938 on Mount Kenya off the eastern edge of Laikipia (Butynski & De Jong 2007, 2017b).

Beyond the primates, there are several other species that we have gathered taxonomic, abundance, distribution, conservation status, and threat information on for more than a decade, and on which we continued to obtain ‘opportunistic’ data on during this patas survey.

Here are some additional questions that we attempted to answer, or contribute towards answering, during the present survey:

- Is the desert (or Somali) warthog *Phacochoerus aethiopicus* present in Laikipia and, if so, is it sympatric with common warthog *Phacochoerus africanus*?
- Is Kirk’s dik-dik *Madoqua kirkii* present in Laikipia?
- Where in Laikipia are striped ground squirrel *Xerus erythropus* and unstriped ground squirrel *Xerus rutilus* sympatric and where are they allopatric?
- Three of Kenya’s four species of hyrax occur in Laikipia; bush hyrax *Heterohyrax brucei*, rock hyrax *Procavia capensis*, and southern tree hyrax *Dendrohyrax arboreus*. What is the distribution of, and extent of phenotypic variation within, each of these three species in Laikipia?
- What phenotypic variation occurs within Bright’s gazelle *Nanger (granti) notata* in Laikipia?
- Are both defassa waterbuck *Kobus ellipsiprymnus defassa* and common waterbuck *Kobus ellipsiprymnus ellipsiprymnus* present in Laikipia? If so, what are their geographic limits and areas of sympatry? Are phenotypic hybrids present?
- What is the distribution and abundance of the ‘Endangered’ Lewel hartebeest *Alcelaphus buselaphus lelwel* in Laikipia?
- What is the distribution and abundance of Chanler’s mountain reedbuck *Redunca fulvorufula chanleri* in Laikipia?

Study Area

Laikipia County (c. 9,700 km²; Figures 2, 3 & 4) is demarcated by Mount Kenya (5,200 m asl) to the east and south-east, Aberdares Range (4,000 m asl) to the south and south-west, Gregory Rift Valley (c. 970 m asl) to the west, Karisia Hills (2,580 m asl) to the north-west, Mathews Range (2,688 m asl) to the north, and Samburu National Reserve (c. 900 m asl) to the north-east (Butynski & De Jong 2014). Through Laikipia there is considerable variation in geography, altitude, rainfall, soil, flora, fauna, human population density, and land use. These variables typically change spatially through gradual transition but, sometimes, the change is abrupt.



Figure 2. Location of Laikipia County (in red), central Kenya.

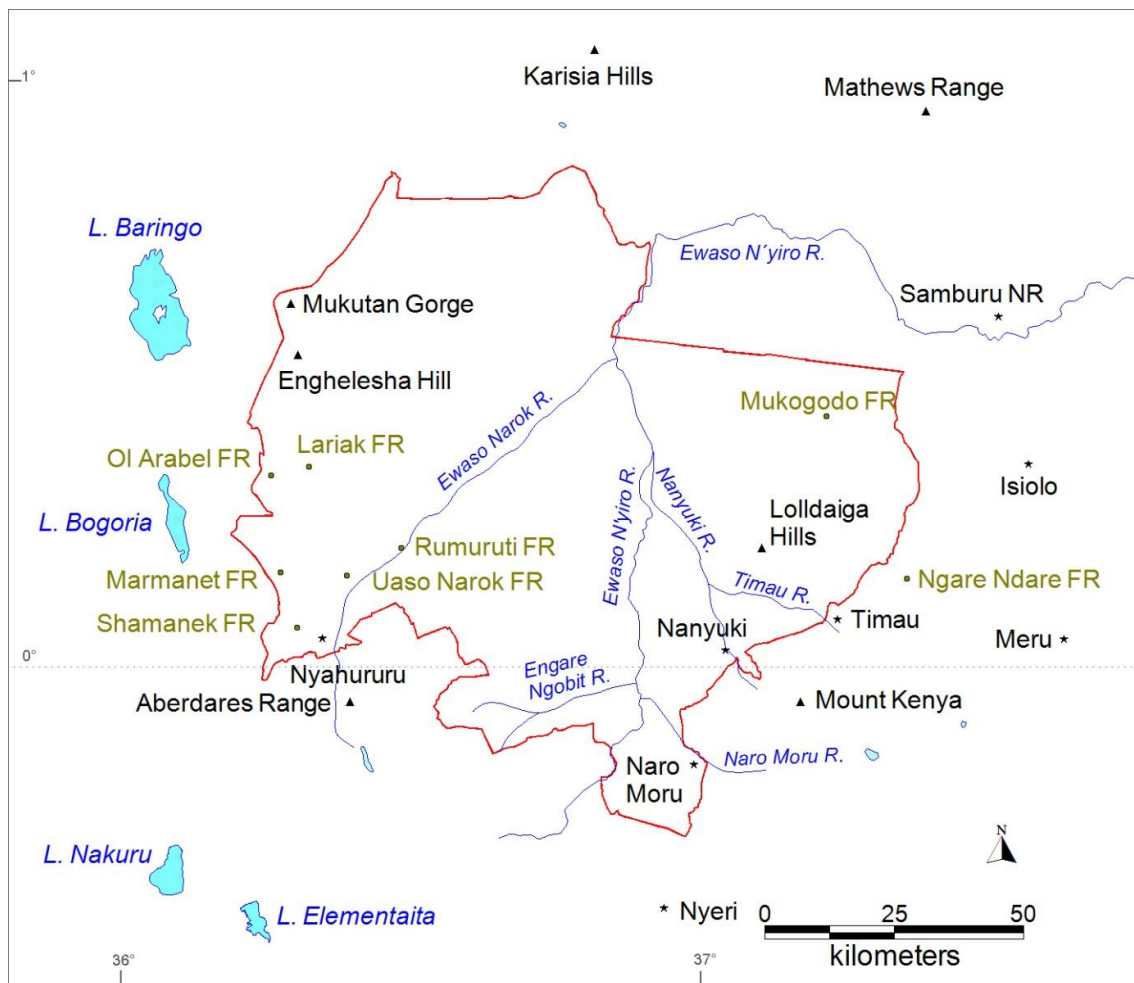


Figure 3. Laikipia County, central Kenya (outlined in red). 'FR' = Forest Reserve. 'NR' = National Reserve.

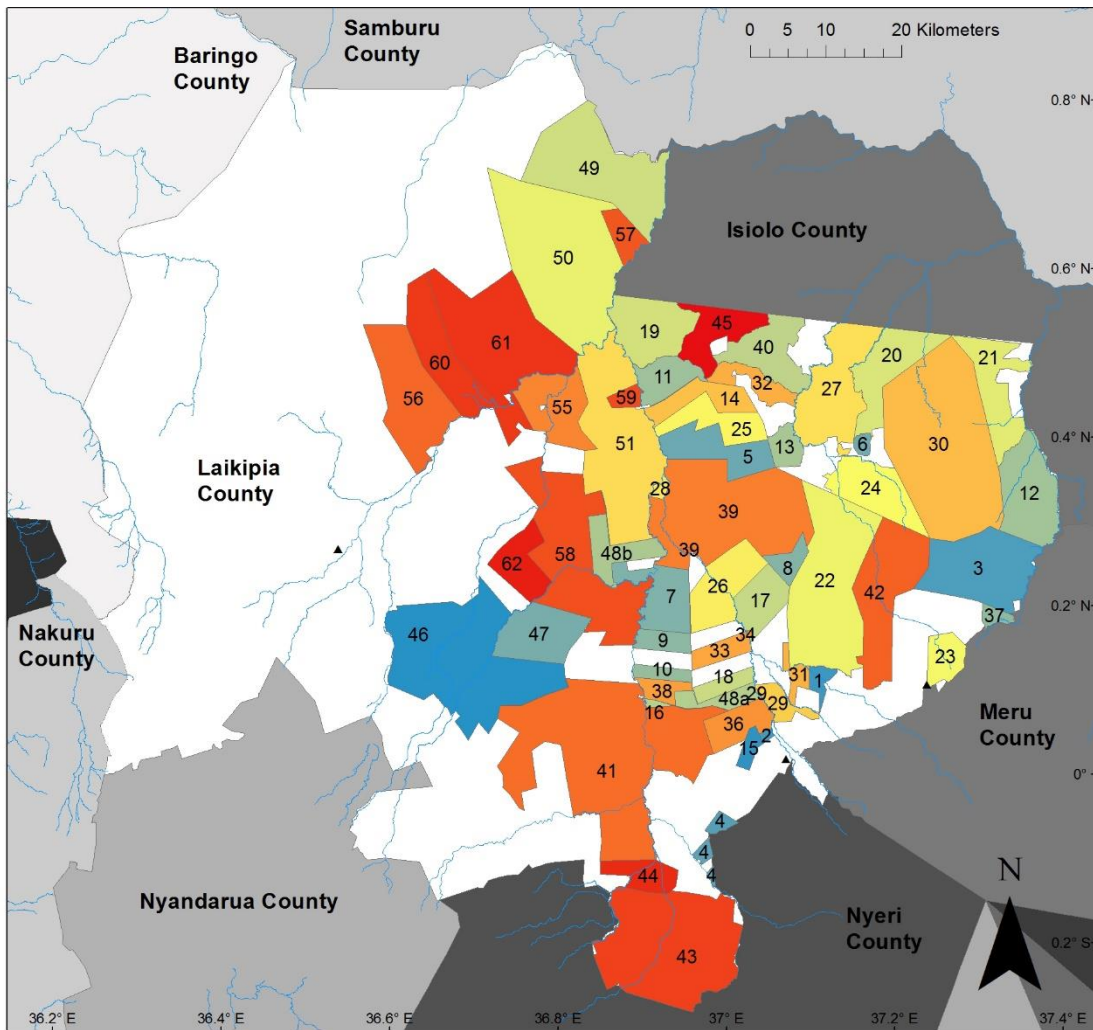


Figure 4. Government-owned, privately-owned, company-owned, and community-owned ('group ranches') properties of central and eastern Laikipia County, central Kenya. Property numbers correspond with those in Table 2.

Laikipia ranges in altitude from 1,260 m (Mukutan Gorge) to 2,400 m (Enghelesha Hill; Figures 3 & 5). Much of Laikipia is comprised of the Laikipia Plateau (c. 1,600–2,400 m asl), an area composed of a mix of flat ground (mostly), undulating plains, rolling hills, steep hills (some with extensive erosion gullies), and scattered, often steep, granitic inselbergs (or 'kopjes'). There are several perennial rivers—the largest being the Ewaso N'yiro—and many seasonally dry stream channels and gullies, some of considerable size.

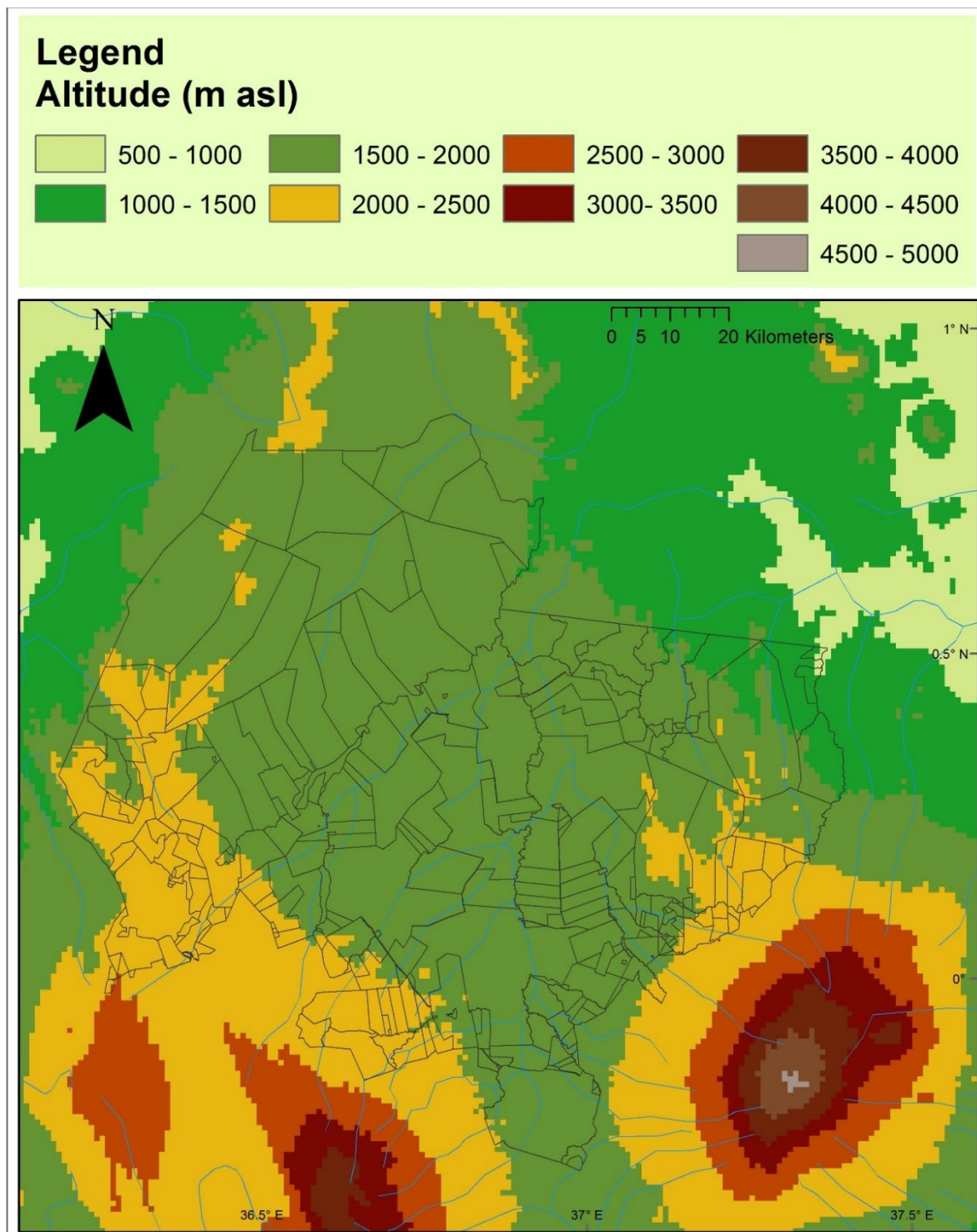


Figure 5. Altitude contours (m asl) for Laikipia County, central Kenya. Source: World Resources Institute (2007).

Mean annual rainfall in Laikipia ranges from c. 40 cm in the north to c. 120 cm in the south-west (Figure 6). Mean annual temperature ranges from 16–26°C. The primary vegetation types are grassland, bushland, woodland, and, on the higher ground, dry forest.

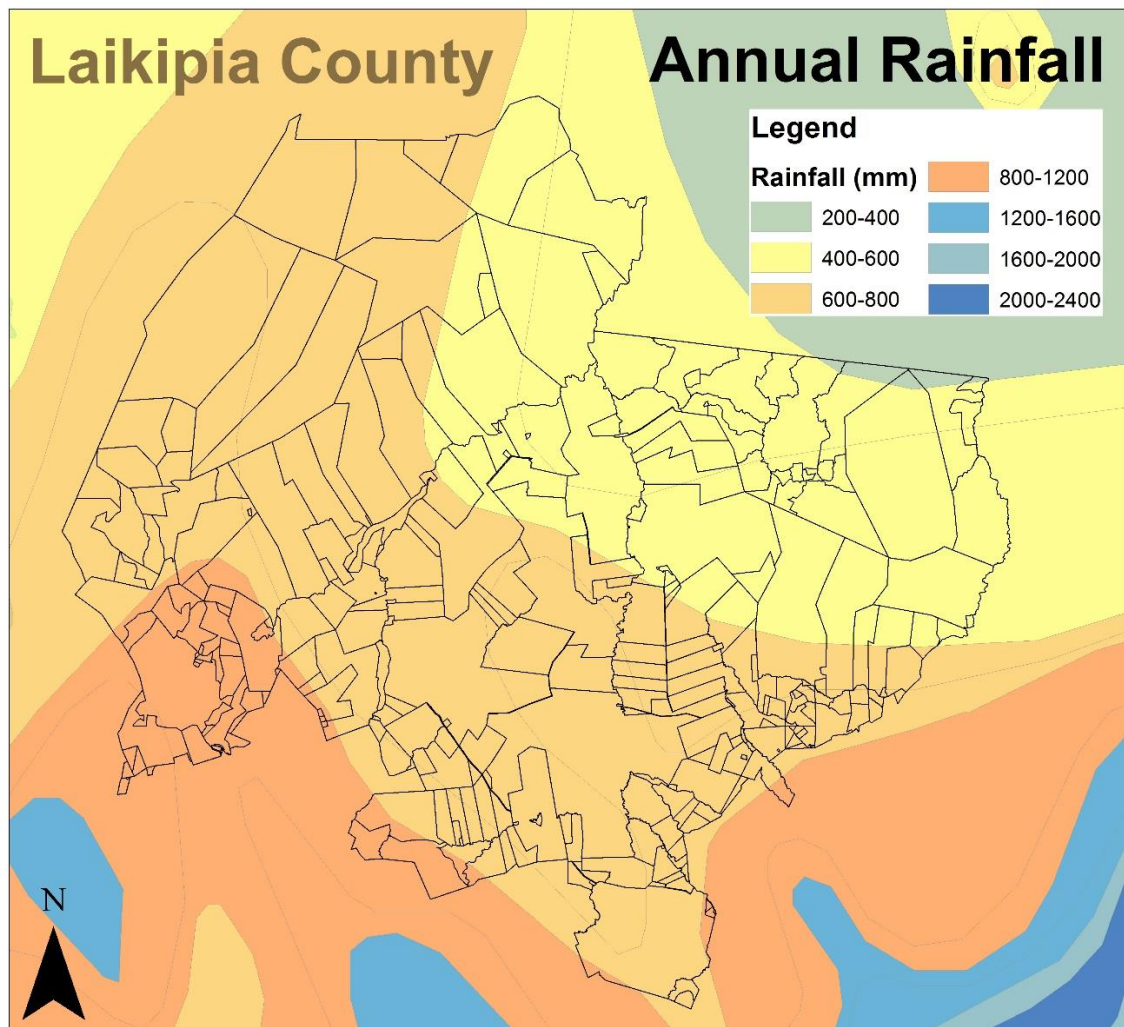


Figure 6. Annual rainfall isohyets (mm) for Laikipia County, central Kenya. Source: World Resources Institute (2007).

Laikipia lies at the overlap of the ‘Somalia-Maasai Bushland Biotic Zone’ and ‘Afromontane-Afroalpine Biotic Zone’ (Figure 7). In addition, Laikipia is in a transition zone for three major vegetation types; ‘Somalia-Masai Semi-desert Grassland and Shrubland’, ‘Somalia-Masai Acacia-Commiphora Bushland and Thicket’, and ‘Afromontane Undifferentiated Montane Vegetation’. Here, the savannahs of eastern Africa grade into both the semi-arid lands of the Horn of Africa and the montane elements of Mount Kenya and the Aberdares Range. The resultant great diversity of vegetation types, ecotones and mosaics accounts, in part, for the high biological diversity of Laikipia while, at the same time, leading to numerous questions concerning the taxonomic status and distribution of many taxa.

The most widespread soil type on the plains of Laikipia is ‘black cotton’. Bushland and woodland on black cotton is typically dominated by whistling thorn. The other widespread soil type in Laikipia is

'red sand', which typically supports bushland and woodland dominated by hook-thorn *Acacia mellifera*, savanna thorn *Acacia etbaica*, and wait-a-bit thorn *Acacia brevispica*.

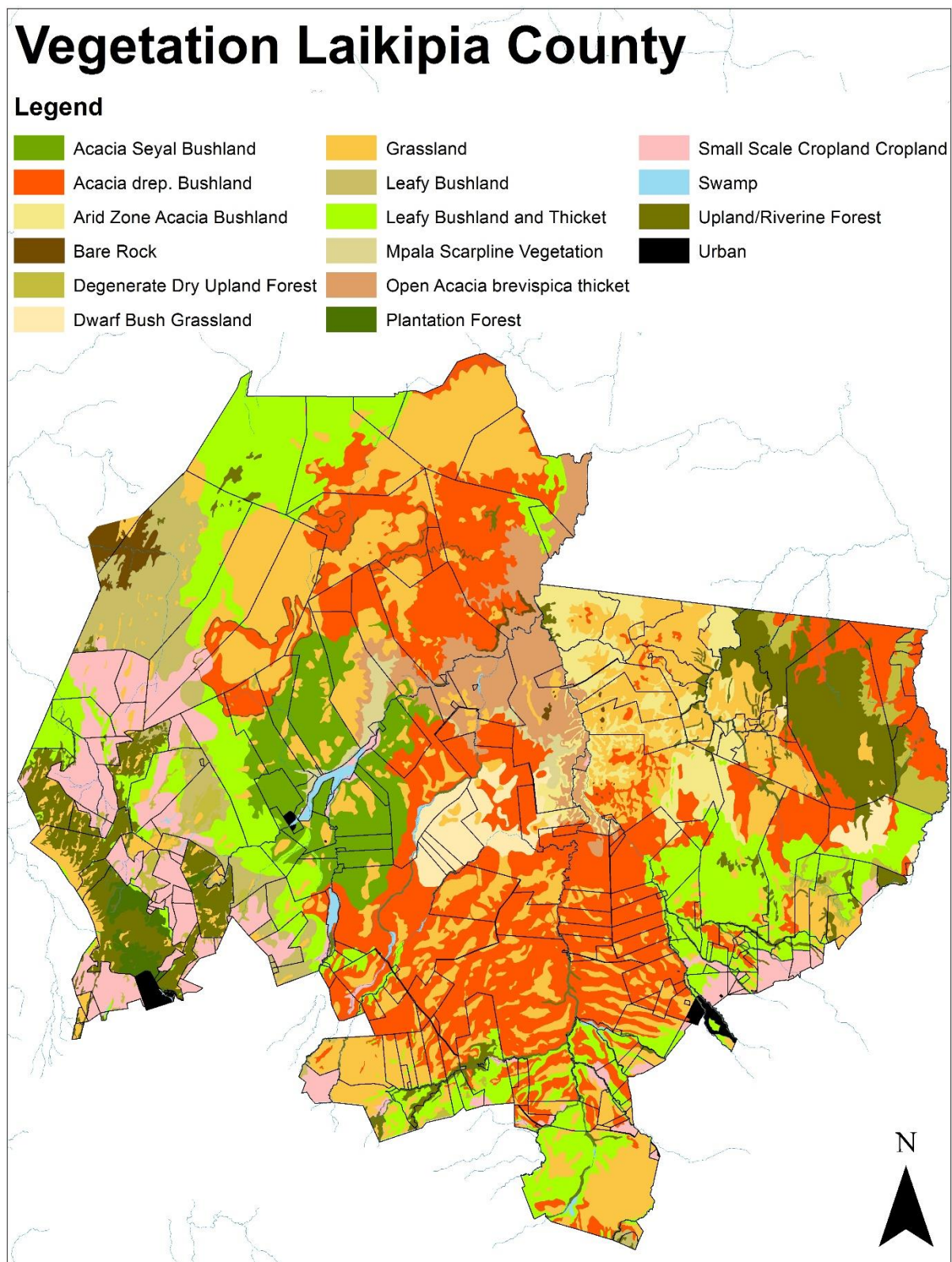


Figure 7. Vegetation of Laikipia County, central Kenya. Source: Taita (1992).

There are c. 400,000 people in Laikipia County, approximately 76% of which live in rural areas. Mean human population density is c. 42 people/km². Although some locations in south and south-west Laikipia have 100–300 people/km², most of Laikipia has <20 people/km². This population is expected to increase to 600,000 people by 2030 (King *et al.* 2013).

Nearly 90% of Laikipia is too dry for cultivation. About 65% (5,820 km²) is defined as wildlife habitat where sizeable populations of most species of large wild mammals still occur. About 38% (3,650 km²) of Laikipia comprises relatively intact, contiguous, natural habitat managed in ways compatible with the maintenance of the original biodiversity, including the larger mammals. There is an area of similar size (c. 33%; 3,196 km²) of high potential wildlife habitat that is currently used in ways not compatible with the maintenance of the original biodiversity and over which large mammals are absent or nearly so (King *et al.* 2013; Butynski & De Jong 2015).

Laikipia's soils, semi-arid climate, and low availability of water, dictate that the only viable, sustainable, economic uses for most of the land are livestock and wildlife production and tourism. Only 1.7% of Laikipia is classified as having high potential for agriculture, although, as of 1995, 8.4% was already under cultivation. As of 2013, 21% was under small-holder farmers (King *et al.* 2013).

Livestock ranching on privately-owned, government-owned, company-owned, and community-owned ('group ranches') rangeland is currently the primary economic activity in Laikipia. Over 80% of the people depend on livestock farming. In 2011, large ranches and group ranches comprised 40% and 7%, respectively, of Laikipia. The ten largest ranches are each greater than 200 km², with the largest being 375 km². In 2011, 48% of Laikipia was tenured as rangeland and at least 29% was tenured as cropland. Forest reserves and other government lands comprise 14% of Laikipia. Overall, in 2013, 37% of Laikipia was used for large-scale ranching, 32% was used by pastoralists, 21% was under small-holder farmers (most of whom grow crops as well as graze livestock), and 5% was used exclusively for wildlife-based tourism (King *et al.* 2013).

In Laikipia, rangeland management involves the removal of shrubs, trees, and invasive plants, burning of vegetation, manipulation of livestock numbers, movement of livestock, development and maintenance of sources of drinking water through dams and boreholes, and the control of large predators. The limiting resource for people, livestock and wildlife is most often water. The vast majority of the larger ranches encourage wildlife, tourism, and ecological/conservation research, and several have ecological/conservation training programs/centers. Several ranches are managed primarily for the purpose of conserving Laikipia's biodiversity and some of these hold 'Conservancy' status.

The focus of this survey is eastern Laikipia, here taken as that part of Laikipia that lies east of the purple line in Figure 8. This area covers c. 55% of Laikipia County (c. 5,300 km²). Anecdotal data were, however, collected from western Laikipia, here taken as that part of Laikipia that lies west of the purple line in Figure 8.

Methods

Field surveys

Since 2010, preliminary data were obtained for the ‘2016 Laikipia County Patas Survey’ by: (1) contacting owners and managers of group ranches and private ranches/conservancies in Laikipia; (2) making requests in local newsletters (Appendix 1; *e.g.*, De Jong & Butynski 2011); and (3) placing requests on websites and notice boards. The primary patas survey in eastern Laikipia included field surveys and questionnaires. Since we lived and worked in eastern Laikipia throughout the period of this survey, we, for various reasons, travelled thousands of kilometres by road through the region. *Ad libitum* data on the primates and other species of particular interest were collected during these travels.

Between 15 November 2016 and 21 September 2017, we undertook 18 days of field work (Table 1). Data and photographs were mainly collected from a vehicle but also by foot. Routes were selected to maximize the chances of encountering patas. Vehicle surveys typically began soon after first light and lasted until near dusk, with a break during the heat of the day. Vehicle speed was 10–20 km/h. Foot surveys were conducted at c. 2 km/h.

Table 1. Summary of eastern patas monkey *Erythrocebus patas pyrrhonotus* field surveys conducted in eastern Laikipia, central Kenya (November 2016–September 2017).

Survey Dates	Field days	Distance (km) by vehicle	Time (hours) by vehicle	Distance (km) by foot	Time (hours) by foot
Survey 1 Solio Ranch, Burguret, Lekurruki Conservancy, Il’ngwesi Conservancy, Samburu NR, Westgate Conservancy, Buffalo Springs NR 15–22 Nov. 2016	8	Total: 600.7 Diurnal: 584.3 Nocturnal: 16.4	Total: 60.4 Diurnal: 58.1 Nocturnal: 2.3	Total: 7.5 Diurnal: 0.0 Nocturnal: 7.5	Total: 3.0 Diurnal: 0.0 Nocturnal: 3.0
Survey 2 Dol Dol, Kuri Kuri Group Ranch, Kipsing, Sabuk, Loisaba Conservancy, Laikipia National Reserve (Kirimun), Koija Group Ranch, Tieramut Group Ranch, Musul Group Ranch, OI Lentille Conservancy, Moropusi Group Ranch 25–28 Nov. 2016	4	Total: 398.1 Diurnal: 386.1 Nocturnal: 12.0	Total: 33.0 Diurnal: 30.9 Nocturnal: 2.1	–	–
Survey 3	1	Total: 104.0	Total: 6.4	–	–

Ol Pejeta Conservancy 1 Dec. 2016		Diurnal: 104.0 Nocturnal: 0.0	Diurnal: 6.4 Nocturnal: 0.0		
Survey 4 Soita Nyiro Conservancy, Sosian Ranch, Suyian Ranch, Ol Doinyo Lemboro Ranch 12–13 Dec. 2016	2	Total: 162.4 Diurnal: 162.4 Nocturnal: 0.0	Total: 10.0 Diurnal: 10.0 Nocturnal: 0.0	–	–
Survey 5 Lolldaiga Hills Ranch 30 Nov. 2017 & 26 Apr. 2017	2	Total: 113.7 Diurnal: 113.7 Nocturnal: 0.0	Total: 9.0 Diurnal: 9.0 Nocturnal: 0.0	–	–
Survey 6 Lolldaiga Hills Ranch, Ole Naishu Ranch, Borana Conservancy 21 Sep. 2017	1	Total: 88.9 Diurnal: 88.9 Nocturnal: 0.0	Total: 9.3 Diurnal: 9.3 Nocturnal: 0.0	–	–
Total	18	Total: 1467.8 Diurnal: 1,439.4 Nocturnal: 28.4	Total: 128.1 Diurnal: 123.7 Nocturnal: 4.4	Total: 7.5 Diurnal: 0.0 Nocturnal: 7.5	Total: 3.0 Diurnal: 0.0 Nocturnal: 3.0

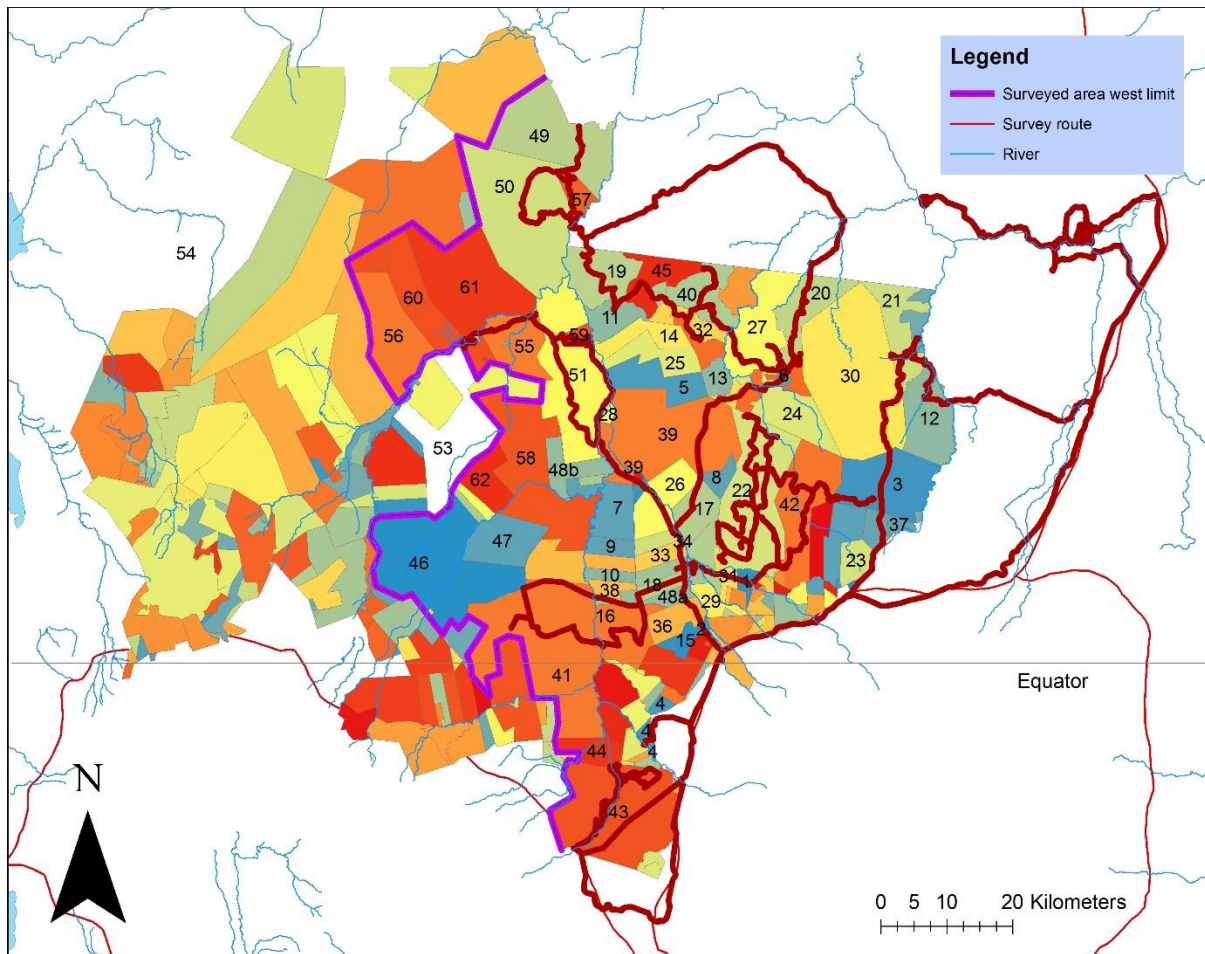


Figure 8. Eastern patas monkey *Erythrocebus patas pyrrhonotus* field survey routes in eastern Laikipia, central Kenya. Property numbers correspond to those in Table 2.

Information collected during each survey included date, weather, start time, end time, survey route with place names (Garmin GPSmap 64s), walking/driving speed (GPS), and travel distance (GPS). When primates were encountered, the following data were collected: time, coordinates (GPS), altitude, primate species/subspecies, detailed descriptions of the primates, number of individuals seen, height above ground, vegetation type, perpendicular distance from the road or trail, visual assessment of tree density, distance to the nearest permanent source of surface water, and distance to the nearest human settlement. Each primate encounter was appointed a unique number. The track of each survey was saved in a GPS and downloaded in a Dell Inspiron notebook using Garmin MapSource software.

During every primate encounter we attempted to obtain detailed descriptions (particularly of the distinguishing traits) and good photographs of as many individuals as time and visibility allowed. Zeiss Victory 10x42 and Zeiss Dialyt 7x42B were used. Photographs were taken with a Nikon D7100 digital camera fitted with a 400 mm Nikon lens, a Canon EOS 5D Mark III digital camera fitted with a Canon 100-400 mm lens, and a Sony Cyber shot DSC-RX100. Photographs were taken in resolution 'RAW'.

Eye-shine (reflection) from galagos and pottos can be observed at >100 m in suitably open habitats. Torches (Maglights and Petzl Tikka RXP headlamps) were used to scan for eye-shine. Photographs at night were taken using a Canon EOS 5D Mark III digital camera with a 100-400 mm Canon lens and Canon Speedlite 430EX II flash (sometimes fitted with a Better Beamer Flash Extender).

The advertisement call of galagos provides species specific information that can be used for species identification (Bearder *et al.* 1995; Zimmermann 1995; Butynski *et al.* 2006). Audio recordings of galago vocalizations, preferably of the loud advertisement call, were made using a Marantz Digital PMD660 recorder with Sennheiser Shot-Gun ME-66 microphone. The time and date of every recording were automatically saved within the audio file and additional notes made. Fixed-point, nocturnal listening surveys were mainly conducted from camp or from a higher point at dusk, dawn, and before and after nocturnal vehicle surveys or foot surveys.

Local knowledge and questionnaires

Local people are often a rich source of information concerning which primate taxa are present and where they are most readily observed. Most of the people in Laikipia have lived in the county their entire lives and, therefore, have a good knowledge of the local primate fauna. They were frequently consulted, particular as to the presence of patas.

Earlier patas surveys (De Jong 2004, Isbell & Chism 2007) were partly conducted by questionnaires. Applying a questionnaire that is similar to the one used by Isbell and Chism (2007) helped to make the results comparable and enabled the collection of patas presence/absence information over a relatively large area in a short period of time. In addition to the residents consulted during field surveys, Charles Muhoro (Soita Nyiro Conservancy) interviewed 65 local residents between March 2017 and July 2017, using the 'Patas Monkey Questionnaire' (Appendix 2).

Analyses

All locality records obtained during field surveys and through questionnaires were converted into a shapefile and plotted with the help of ArcGIS (10.4.1). For the purpose of this research, the names of all privately-owned, government-owned, company-owned, and group ranches (hereafter referred to as 'ranches') were taken from the Laikipia Wildlife Forum's (2011) map of Laikipia County. We used the ranches as the unit of analysis. With the help of the Laikipia Property shapefile, evidence of the presence of patas and the number of individuals and/or groups were mapped for each ranch.

By recording the start and end time of each survey, rate of travel, distance travelled, and number of individuals and/or groups observed of each species, a crude index of abundance was obtained (*i.e.*, primate groups encountered per kilometre and primate groups encountered per hour; Butynski & Koster 1994; White & Edwards 2000; Nekaris & Jayewardene 2004). By covering large areas, we obtained a rough idea of the distribution of each primate taxon within eastern Laikipia.

PatasBase

A Microsoft Access database (hereafter referred to as 'PatasBase'), holding patas locality data for eastern Africa, was initiated in 2003 by the authors. Locality records originate from the surveys of the authors and from colleagues, museums, residents, literature, and photographs. PatasBase, together with the findings of this Project, form the basis of publications by De Jong *et al.* (2008, 2009), and De Jong and Butynski (2017a,b).

Galago vocalization analysis

Audio files were transferred from a Marantz digital audio recorder to a laptop. The best recordings were used to identify species. When expert confirmation was needed, recordings were sent to S. K. Bearder and/or A. Perkin, Nocturnal Primate Research Group, Oxford Brookes University, Oxford, UK. Sonograms and spectrograms, as well as numerical acoustic parameters, were produced from vocalization using Avisoft-SASLab Pro software (R. Spect, Berlin; version 4.51).


Photographic maps

The design and implementation of effective conservation measures for primates and other species requires an efficient, low cost, and accessible resource for the identification of species and subspecies. Although photographs cannot replace a good museum collection as a resource for assessing species variation, geotagged photographs are a relatively fast, inexpensive, convenient, and unobtrusive means for detecting and assessing phenotypic variation within species/subspecies over large areas. Use of photographs to document phenotypic characters will become increasingly important as the collection of specimens for hands-on assessments becomes ever more difficult.

Photographs taken during this survey were placed on our 15 on-line photographic maps (or 'PhotoMaps'; wildsolutions.nl). These PhotoMaps hold >3165 images (November 2017) of African primates, warthogs, dik-diks, waterbuck, and hyraxes, together with the latest distribution maps (Figure 9 & 10). These 'living' collections of geotagged images are a practical tool for documenting and discussing diversity, taxonomy, biogeography, distribution and conservation status and, therefore, for planning actions for conservation.

Access the Photographic Map of your choice below!

Dwarf galagos	Galago	Small-eared greater galagos	
Large-eared greater galago	Savanna monkeys	Patas monkey	
Gentle monkeys	Baboons	Guereza colobus	Angola colobus
Red colobus monkeys	Sykes's x vervet hybrid	Warthogs	Hyraxes
Dik-diks			



Dwarf galagos

Galagoides & *Paragalago* sp. Small galago. Nocturnal, arboreal, primate, endemic to Africa.

[Click here to access the dwarf galago PhotoMap](#)

Figure 9. Screenshot of the 15 PhotoMaps published on wildsolutions.nl

PhotoMaps are useful to those who want to:

- identify species/subspecies;
- know which species/subspecies occur in which areas;
- obtain species/subspecies photographs;
- confirm species/subspecies distributions;
- describe variation within a species/subspecies, especially as it relates to geographic distribution.

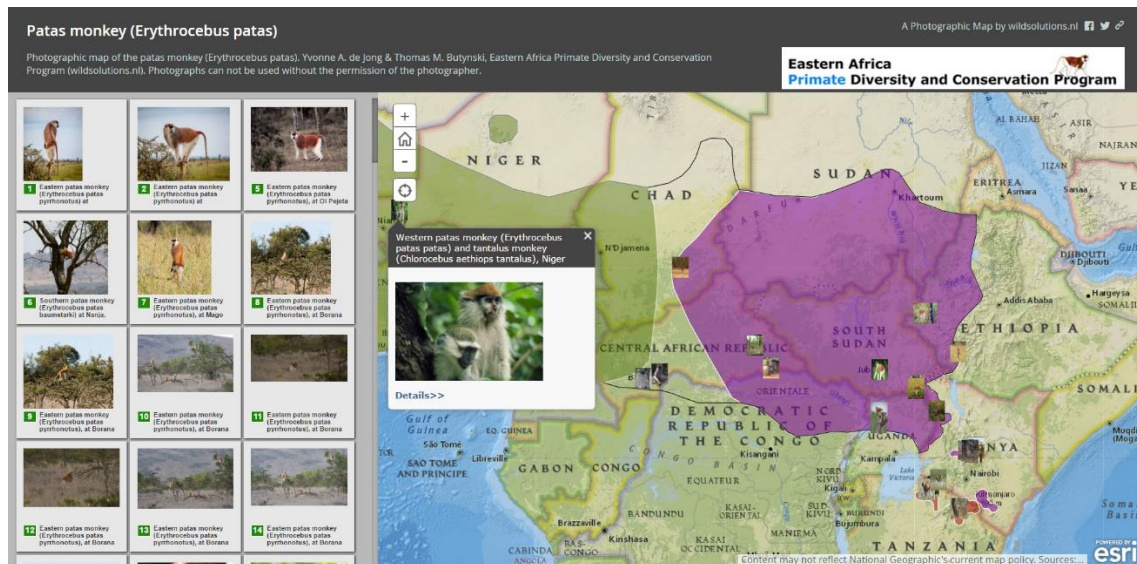


Figure 10. Patas monkey *Erythrocebus patas* PhotoMap published on wildsolutions.nl

Outcomes

Our research on Laikipia's seven species of primate has contributed to a better understanding of the distribution, abundance, taxonomic status, and conservation status of these primates in Laikipia (Butynski & De Jong 2014a), and improve upon their 2017 IUCN Red List assessments.

The outcomes of this survey include:

- IUCN Red List 2017 assessments for the 10 primate taxa and two warthog taxa encountered during this survey. These assessments will be published in *The IUCN Red List of Threatened Species 2017* (www.iucnredlist.org).
 - Butynski, T. M. & De Jong, Y. A. 2017. *Cercopithecus mitis*.
 - Butynski, T. M. & De Jong, Y. A. 2017. *Cercopithecus mitis kolbi*.
 - Butynski, T. M. & De Jong, Y. A. 2017. *Chlorocebus pygerythrus*.
 - Butynski, T. M. & De Jong, Y. A. 2017. *Galago senegalensis braccatus*.
 - De Jong, Y. A. & Butynski, T. M. 2017. *Chlorocebus pygerythrus hilgerti*.
 - De Jong, Y. A. & Butynski, T. M. 2017. *Colobus guereza kikuyuensis*.
 - De Jong, Y. A. & Butynski, T. M. 2017. *Erythrocebus patas*.
 - De Jong, Y. A. & Butynski, T. M. 2017. *Erythrocebus patas pyrrhonotus*.
 - De Jong, Y. A. & Butynski, T. M., Hart, J. & Struhsaker, T. T. 2017. *Colobus guereza*.
 - De Jong, Y. A. & Butynski, T. M., Svensson, M. S. & Perkin, A. W. 2017. *Galago senegalensis*.
- De Jong, Y. A., Cumming, D., d'Huart, J. & Butynski, T. M. 2016. *Phacochoerus africanus*. *The IUCN Red List of Threatened Species 2016*: e.T41768A109669842.
- De Jong, Y. A., Butynski, T. M. & d'Huart, J.-P. 2016. *Phacochoerus aethiopicus*. *The IUCN Red List of Threatened Species 2016*: e.T41767A99376685.
- Additions to PatasBase and refinement of the *Erythrocebus patas* distribution map.
- Blog in the May 2017 *Lolldaiga Hills Research Programme Newsletter* and on websites (Appendix 3; <http://www.lolldaiga.com/status-eastern-patas-monkey-lolldaiga-hills-ranch/> and <http://www.wildsolutions.nl/status-eastern-patas-monkey-lolldaiga-hills-ranch-laikipia-kenya/>). Title: Status of the eastern patas monkey *Erythrocebus patas pyrrhonotus* on Lolldaiga Hills Ranch.
- Photographic maps of the primates, warthogs, dik-diks, waterbucks, and hyraxes at <http://www.wildsolutions.nl/photography/photomap/>
- *Pocket Guide to the Primates of East Africa*, Global Wildlife Conservation (in prep.).
- Publication: De Jong, Y. A. & Butynski, T. M. 2017b. Distributions in Uganda, Kenya, and north Tanzania of members of the Günther's dik-dik *Madoqua (guentheri)* and Kirk's dik-dik *M. (kirkii)* species groups, regions of sympatry, records of aberrant-coloured individuals, and comment on the validity of Hodson's dik-dik *M. (g.) hodsoni*. *Gnusletter* 34: 11-20. (Figure 11). <http://www.wildsolutions.nl/madoquagnusletter/>

- Blog in the November 2016 *Lolldaiga Hills Research Programme Newsletter* (Appendix 4). Title: Two additions to the Laikipia Mammal List; desert warthog *Phacochoerus aethiopicus* and Kirk's dik-dik *Madoqua kirkii*. <http://www.lolldaiga.com/additions-laikipia-mammallist/>

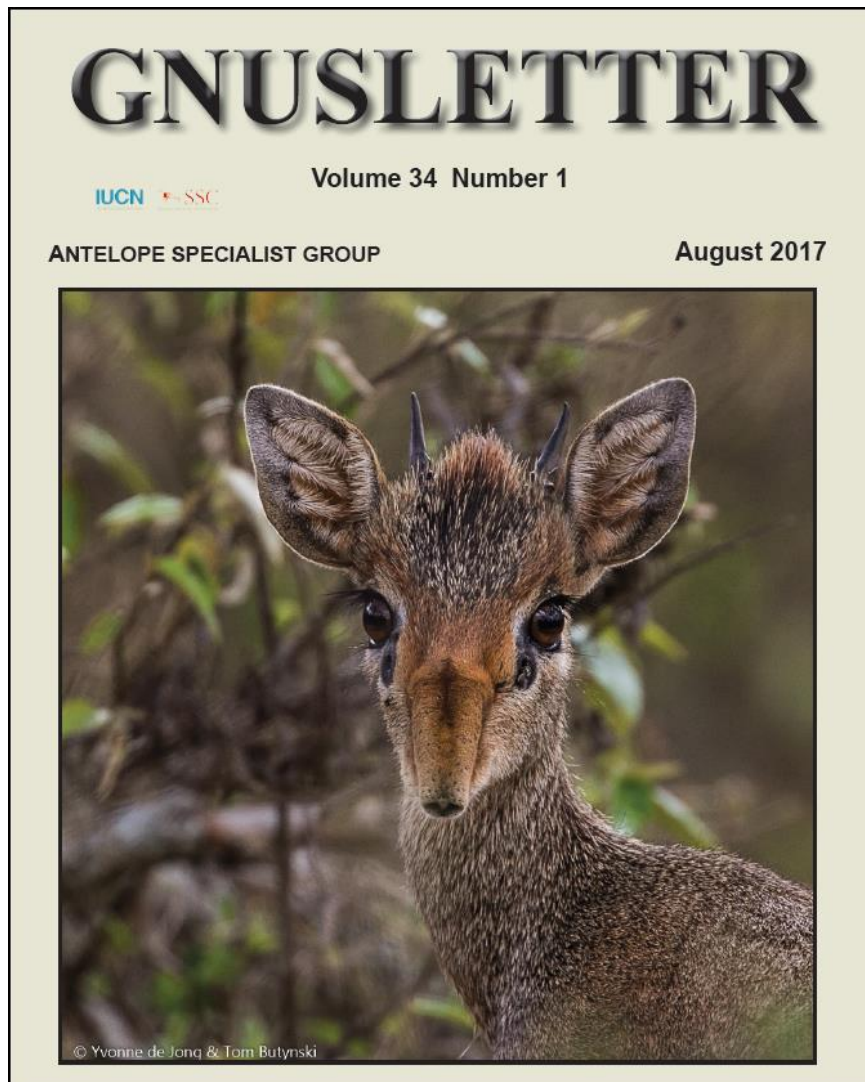


Figure 11. Cover of *Gnusletter* 34 (2017).

Results

Patas was not encountered during any of the field surveys undertaken under this project. Considerable evidence of the presence of patas within the study area was, however, obtained (Figure 12, Table 2).

Here is a summary of the number and distribution of patas in eastern Laikipia. See Figure 12 to match the property number with the location on the map.

- One group of about five individuals on Kibocha Farm (no. 16), Kimuri Farm (no. 18), and North Tetu (no. 38).
- One group of about 20 individuals on northwest Borana Conservancy (no. 3) and east Ole Naishu Ranch (no. 42).
- One group with an unknown number of individuals on south Kuri Kuri Group Ranch (no. 20) and Moropusi Group Ranch (no. 27).
- One group of about 17 individuals on northwest Ole Naishu Ranch (no. 42), northeast Lolldaiga Hills Ranch (no. 22), and Makurian Group Ranch (no. 24).
- One group with an unknown number of individuals on Il Motiok Group Ranch (no. 11), Tieramut Group Ranch (no. 45), and Musul Group Ranch (no. 32).
- One group of 10–15 individuals on Solio Ranch (no. 43).
- One group of about five individuals on south Mogwooni Ranch (no. 26) and, most likely, vicinity.
- Groups of about 10 individuals and 10–20 individuals and one solitary adult male on northeast Ol Pejeta Conservancy (no. 41).
- At least one group of ≥ 10 individuals on ADC Mutara Ranch (no. 46) and Ol Pejeta Conservancy (no. 41).
- Group of ≥ 2 individuals on south Mpala Ranch (no. 51).
- Groups of about 23 and 25 individuals Segera Ranch (no. 58) and Thome B Ranch (no. 62).
- One solitary individual on Il Motiok Group Ranch (no. 11).
- Two solitary individuals on Lolldaiga Hills Ranch (no. 22).
- One solitary individual on Loisaba Conservancy (no. 50).

No fewer than 20 of the 61 properties, 33%, in eastern Laikipia County supported patas during 2010–2017. No property had more than two groups of patas. Most groups range over at least two properties. Together, these properties held 13 groups of patas that range in size from two to 25 individuals. The best estimate is that there are ≥ 4 solitary individuals in eastern Laikipia. These are likely to be adult males. The size of two of the 13 groups is not known. The total number of individuals in the 11 groups of known size is between 117–127 (mean group size = 12 individuals). Assuming that the number of individuals in the two groups of unknown size is 24, the total number

of patas in eastern Laikipia is ≥ 145 (i.e., $117 + 24 + 4$). It is reasonable to assume that the number of patas in eastern Laikipia at this time is between 145 and 155 individuals.

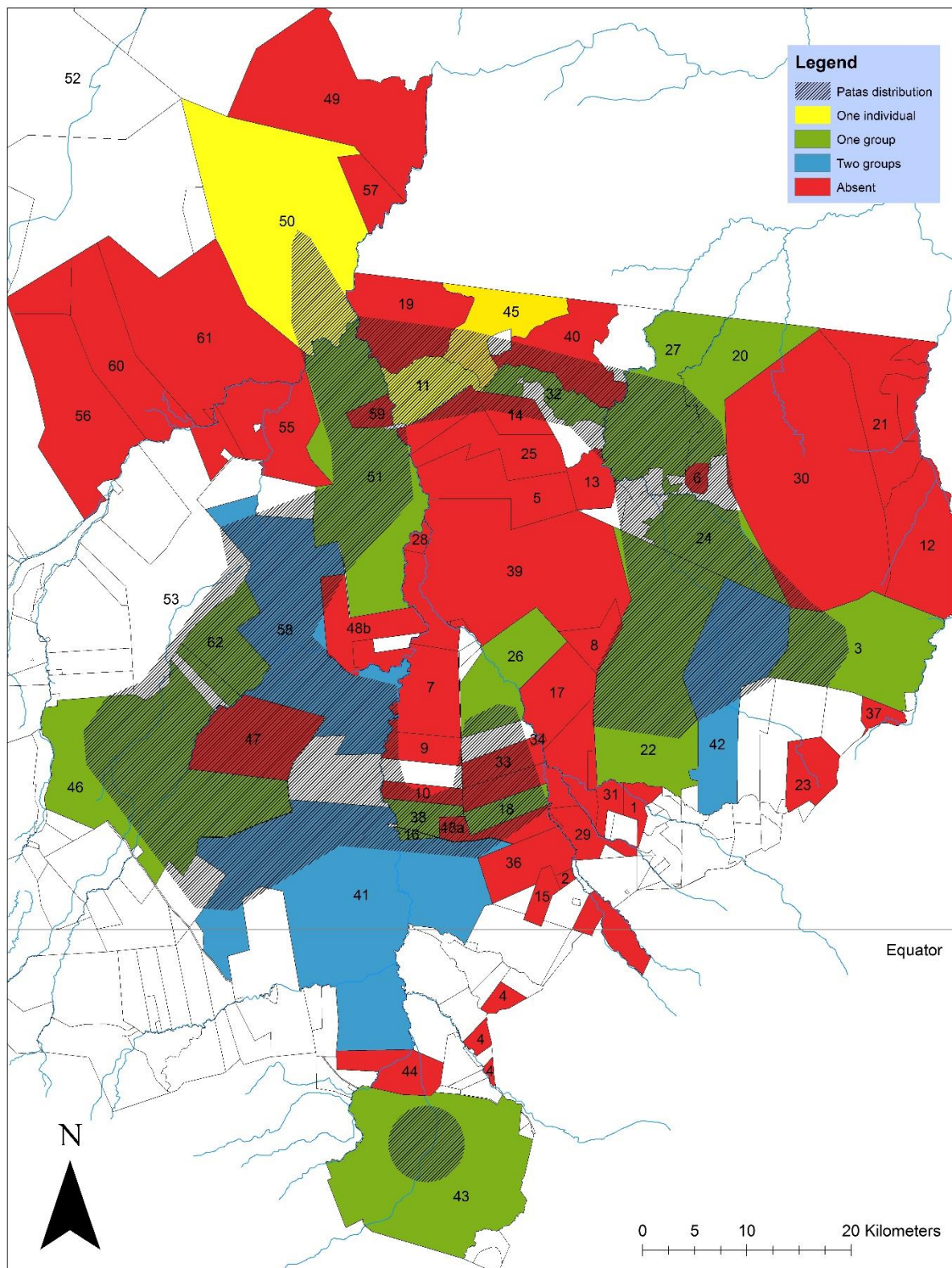


Figure 12. Distribution of eastern patas monkey *Erythrocebus patas pyrrhonotus* in eastern Laikipia County Laikipia County, central Kenya (2010-2017).

The north and northwest limit of the range of patas in Laikipia is Loisaba Conservancy where solitary individuals (but no groups) are occasionally observed. Consistent with Isbell and Chism (2007), Borana Conservancy (no. 3 in Figure 12 and Table 2.) continues to be the east and southeast limit for this species in Laikipia. Consistent with De Jong *et al.* (2008), central Solio Ranch (no. 43) remains the south and southeast limit. The west and southwest limit of patas in Laikipia may be ADC Mutara Ranch (no. 46), but this needs confirmation. The extent of occurrence of patas in eastern Laikipia is c. 1,750 km² (Figure 12).

The next phase of this project is to gather more detailed information on the abundance and distribution of patas over all of western Laikipia in order to provide estimates for the entire county.

Table 2. Evidence, based on field surveys (by the authors) and questionnaires ('Patas Monkey Questionnaire' by Charles Muhoro), for eastern patas monkey *Erythrocebus patas pyrrhonotus* in Laikipia County, central Kenya (January 2010–September 2017).

Nr.	Property name	Preliminary results January 2010–October 2016	Survey results November 2016–September 2017 (N = number of interviewees)
1	Akorino	Absent Y. de Jong & T. Butynski pers. obs.	Absent Y. de Jong & T. Butynski pers. obs.
2	Allas Farm	—	Absent Y. de Jong & T. Butynski pers. obs.
3	Borana Conservancy	Present Two groups. One group of c. 15. One group full-time on Borana. One group that also uses Ole Naishu. M. Dyer pers. comm.	Present One group c. 19–20 that also uses NW Ole Naishu. L. Ngugi, A. Sora., M. Dyer, W. Sambaine & C. Thouless pers. comm. Survey Sept. 2017 (N=6).
4	Burguret area	—	Absent J. Horsey & P. Horsey pers. comm. Survey Nov. 2016.
5	Chololo Ranch	—	Absent S. Strum pers. comm. Note: Presence reported by one Naibunga ranger. Questionnaire March 2017 (N=1).
6	Dol Dol town	—	Absent Questionnaire Nov. 2016 (N=6).
7	El Karama Ranch	—	Absent Questionnaire March 2017 (N=3).
8	Enasoit Game Sanctuary	Absent P. Glover pers. comm.	Absent P. Glover pers. comm.
9	Endana	—	Absent Questionnaire July 2017 (N=4).
10	Hohwe	—	Absent Questionnaire July 2017 (N=1).
11	Il Motiok Group Ranch	—	Present ≥1 individual in 2016. One group c. 10 in 2014. Questionnaire March 2017 (N=6).

12	Il N'gweni Conservancy	—	Absent Il N'gweni Lodge staff pers. comm. Survey Nov. 2016 (N=7).
13	Il Polei Group Ranch	Absent C. McConnell pers. comm.	Absent S. Strum pers. comm. Questionnaire March 2017 (N=17). Note: One of 7 elders stated that patas present in c. 1960). Survey Nov. 2016. One elder reported a group of 10 in c. 2002. Questionnaire March 2017.
14	Tumaren Ranch	Absent J. Christian & K. Glen pers. comm.	Absent J. Christian & K. Glen pers. comm. Note: One group of c. 7 in 2011. Questionnaire March 2017 (N=1).
15	Kenya Defence Forces (KDF) area, Nanyuki	—	Absent Y. de Jong, J.-P. Dekker, & T. Butynski pers. obs. Questionnaire July 2017 (N=4). Note: Patas here until c. 2010. M. Grant pers. comm.
16	Kibocha Farm	—	Present One group c. 4 in 2016 at Ngarengiro River. Questionnaire July 2017 (N=1).
17	Kimungandura (including Tumbili Estate)	—	Absent Y. de Jong & J.-P. Dekker pers. obs. Questionnaire July 2017 (N=7).
18	Kimuri Farm	—	Present One group c. 5. Last seen June 2017. Questionnaire July 2017 (N=3).
19	Koiya Group Ranch	—	Absent Survey Nov. 2017 (N=11).
20	Kuri Kuri Group Ranch	—	Present One group near Moropusi, south Kuri Kuri. Nov. 2016. No records elsewhere on ranch. Survey Nov. 2016 (N=5). Note: This probably same group as on Moropusi.
21	Lekurruki Conservancy	Absent M. Wheeler pers. comm.	Absent M. Wheeler & I. Torongos pers. comm.
22	Lolldaiga Hills Ranch	Present One small group and 2 solitary individuals. Total c. 4. De Jong <i>et al.</i> 2015.	Present One group c. 4 in 2015 in NE. Two solitary individuals, 1 in SW and 1 SE. De Jong <i>et al.</i> 2017. Note: Group in NE likely uses NW Ole Naishu and part of Makurian Group Ranch.
23	Lolomarik Farm	—	Absent T. Murray pers. comm.
24	Makurian Group Ranch	—	Present One group of 10–20 3–4 km north of Lolldaiga in 2015. Survey Nov. 2016 (N=1).
25	Male (or Lekolele) Farm	—	Absent Questionnaire March 2017 (N=1). Note: One group of c. 5 on Male moved into Mpala in 2007. Questionnaire March 2017 (N=1).

26	Mogwooni Ranch	Present One individual. S. Robinson pers. comm. Note: No groups. M. Roberts pers. comm.	Present One group of c. 5 in extreme south in July 2017. Group seen by ≥4 herders 2012–2017. Questionnaire July 2017 (N=4). Note: No groups. J. Kenyon, A. Roberts, M. Roberts pers. comm.
27	Moropusi Group Ranch (south section)	—	Present One group Sept. 2016. Questionnaire Nov. 2016 (N=4). Note: This probably same group uses Kuri Kuri.
28	Muhamud Smik Ranch	—	Absent Questionnaire Nov. 2017 (N=1). Note: One individual in c. 2008. Questionnaire Nov. 2017 (N=1).
29	Mukima Ridge	Absent P. Benson pers. comm.	Absent P. Benson pers. comm.
30	Mukogodo Forest Reserve	—	Absent Questionnaire March 2017 (N=1).
31	Muramatie	Absent Y. de Jong & T. Butynski pers. obs.	Absent Y. de Jong & T. Butynski pers. obs.
32	Musul Group Ranch	—	Present One group of 3 in 2014 near Chololo. Questionnaire March 2017 (N=2).
33	Mutirithia Farm	—	Absent Questionnaire July 2017 (N=4).
34	Naibor / Jua Kali	Absent Y. de Jong & J.-P. Dekker pers. obs.	Absent Y. de Jong, J.-P. Dekker & T. Butynski pers. obs. Questionnaire July 2017 (N=2).
35	Naibunga Group Ranch	—	Absent Questionnaire March 2017 (N=7).
36	Nanyuki Ranching	—	Absent Y. de Jong, J.-P. Dekker & T. Butynski pers. obs. Questionnaire July 2017 (N=5).
37	Ngare Ndare Forest Reserve	Absent Y. de Jong, T. Butynski & J. Mathiu pers. obs.	Absent Y. de Jong, T. Butynski & J. Mathiu pers. obs.
38	North Tetu Farm	—	Present One at Ireri in 2016. Questionnaire July 2017 (N=1). Note: Two interviewees said patas absent. Questionnaire July 2017 (N=2).
39	Oi Jogi Ranch	Absent J. Gaymer, K. Kuria & J. Weller pers. comm.	Absent J. Gaymer, J. Weller & T. Butynski pers. comm. Questionnaire April 2017 (N=3).
40	Oi Lentille Conservancy (Kijabe)	Absent J. Elias pers. comm.	Absent J. Elias pers. comm. Questionnaire Nov. 2017 (N=7).
41	Oi Pejeta Conservancy	Present Three groups totalling ≥42; Sirima Group (17), Muturu Group (15), Loirugurugu Group (≥10). Loirugurugu Group ranges	Present ≥2 groups totalling >20. One group of 10–20 near Kamok Gate in north (April 2016). One group of ≥10 between Sirima and Milima Chui in NW (Nov. 2016).

		into ACD Mutara. O.W. Maina & M. Mulama pers. comm.	Solitary adult male in NE seen 2015. R. van Aardt, A. Clark & OPC Research pers. comm. Questionnaire Dec. 2016 (N=11).
42	Ole Naishu Ranch	Present One group of 6–7. Probably ranges onto Lolldaiga and/or Borana. C. Burt pers. comm.	Present ≥2 groups totalling ≥29. One group of ≥17 in NW seen Sept. 2017. Probably ranges onto NE Lolldaiga. One group of ≥12 in NE that ranges onto Borana. J. Block, M. Roberts & S. Abollo pers. comm. Questionnaire Sept. 2017 (N=6).
43	Solio Ranch	Absent C. Thomlinson pers. comm.	Present One group 10–15 seen Sept. 2016. M. Finch-Newey pers. comm.
44	Tharua (Lewcetia) Farm	Absent H. Dufreshne pers. comm.	Absent H. Dufreshne & C. Abbonizio pers. comm.
45	Tieramut Group Ranch	—	Present One individual in 2013. Questionnaire March 2017 (N=1). Note: Two interviewees said patas absent. Questionnaire March 2017 (N=2).
46	ADC Mutara Ranch	Present Loirugurugu Group (≥10) ranges into Ol Pejeta. O.W. Maina & M. Mulama pers. comm.	Present Questionnaire March 2017 (N=5). Note: One group of 11 in 2006. Questionnaire April 2017 (N=1).
47	Eland Downs / Laikipia National Park	—	Absent M. Grant & S. Grant pers. comm. Note: Patas common in the past. M. Grant pers. comm.
48a	Jessel's Farm	Absent S. Jessel pers. comm.	Absent Y. de Jong, J.-P. Dekker & T. Butynski pers. obs. Questionnaire July 2017 (N=1).
48b	Jessel's Farm	Absent S. Jessel pers. comm.	Absent Questionnaire July 2017 (N=1).
49	Laikipia National Reserve (Kirimun)	—	Absent Questionnaire November 2016 (N=2).
50	Loisaba Conservancy	Absent A. Powys & G. Powys pers. comm.	Present One adult male June or July 2016. T. Sylvester pers. comm. One adult male December 2015. S. Strum pers. comm.
51	Mpala Ranch	Absent T. O'Brien, K. Wreford-Smith, T. Young & G. Powys pers. comm.	Present One group of 2 at KLEE in 1995. F. Keesing pers. comm. One adult male near Mukenya c. 2007. R. Olivier & P. Winter pers. comm. One group of 7 near Mukenya 2010. Questionnaire March 2017 (N=1). One group of 4 south of Mukenya 2010. Questionnaire March 2017 (N=1).

			<p>One group of 2 near Mukenya October 2016. Questionnaire March 2017 (N=3).</p> <p>One group of 2 near Molo Maisiki. Questionnaire March 2017 (N=1).</p> <p>Note: Five interviewees never saw patas on Mpala Ranch.</p>
55	Ol Donyo Lomboro Ranch (Laikipia Wilderness)	Absent S. Carey pers. comm.	Absent S. Carey pers. comm.
56	Ol Maisor Ranch	—	Absent M. Evans & J. Logan pers. comm.
57	Ol Malo Ranch / Sabuk	—	Absent V. Williams pers. comm. Questionnaire November 2016 (N=15).
58	Segera Ranch	Present Two groups of 23 and 25. Kahirol <i>et al.</i> 2013.	Present Patas present (N=6)
59	Soita Nyiro Conservancy	Absent T. Butynski pers. obs. C. Muhoro pers. obs.	Absent T. Butynski pers. obs. C. Muhoro, M. Ewoi, N. Bill & D. Loboikai pers. comm. Questionnaire April 2017 (N=3).
60	Sosian (Kisima) Ranch	Absent G. Powys pers. comm.	Absent S. Kenyon, K. Wreford-Smith & M. Wreford-Smith pers. comm.
61	Suyian (Kisima) Ranch	Absent G. Powys, A. Powys, K. Wreford-Smith & M. Wreford-Smith pers. comm.	Absent K. Wreford-Smith, M. Wreford-Smith, G. Powys & A. Powys pers. comm. Note: One interviewee reported one group of 4 in 2014, Questionnaire March 2017.
62	Thome B Ranch	Present One group shared with Segera. Kahirol <i>et al.</i> 2013.	—

In October 2007, a solitary adult patas was encountered in open *Acacia* bushland in southwest Samburu National Reserve by I. Douglas–Hamilton and D. Lentipo (pers. comm. in De Jong *et al.* 2008). During this survey, no evidence of patas was obtained for Samburu National Reserve, Buffalo Springs National Reserve, West Gate Conservancy, Kipsing, Longopito, or Oldonyiro.



Figure 13. Adult leopard *Panthera pardus* on Solio Ranch with (unidentified) prey in yellow fever *Acacia xanthophloea* woodland near where a group of eastern patas monkeys *Erythrocebus patas pyrrhonotus* was encountered 2 months earlier.

Patas conservation in Laikipia

Eastern Laikipia appears to support between 145 and 155 patas. Most of these are in 13 groups. A survey of patas in western Laikipia is required to provide an estimate of the number and distribution of patas in the entire county, as well as a better understand the conservation status of this population and the threats.

Table 3 compares the number of patas groups and individuals on each property in eastern Laikipia during 2010–2017 with data obtained during earlier surveys. Presence / absence data for patas on 24 of the 60 properties are given in Isbell and Chism 2007). Of those 24 properties, it appears that patas numbers have declined on 11 properties, increased on three properties, and remained unchanged on 10 properties.

Table 3. Changes in the population of eastern patas monkey *Erythrocebus patas pyrrhonotus* in Laikipia.

Eastern patas monkey <i>Erythrocebus patas pyrrhonotus</i> population Laikipia County					
ID	Property name	1979–1981 Isbell & Chism 2007 (total individuals)	1992–2004 Isbell & Chism 2007 (total individuals)	January 2010–July 2017 De Jong & Butynski 2017 (total individuals)	Trend
1	Akorino	—	—	Absent	—
2	Allas Farm	—	Present	Absent	↓
3	Borana Conservancy	—	Present 2–3 groups (22)	Present 1 group (19–20)	↓
4	Burguret	—	—	Absent	—
5	Chololo Ranch	Absent	Absent	Absent	=
6 / 24	Dol Dol area / Makurian Group Ranch	—	Present 1 group (20)	Present 1 group (10–20)	=
7	El Karama Ranch	Absent	Absent	Absent	=
8	Enasoit Game Sanctuary	—	Present Rarely seen	Absent	↓
9	Endana	Present 1 group (13)	Present	Absent	↓
10	Hohwe	—	—	Absent	—
11	Il Motiok Group Ranch	—	—	Present >1 individual 1 group (10)	—

12	Il N'gweni Conservancy	—	—	Absent	—
13	Il Polei Group Ranch	—	—	Absent	—
14	Tumaren Ranch	—	—	Absent	—
15	Kenya Defence Forces (KDF) Nanyuki	—	Present	Absent	↓
16	Kibocha	—	—	Present 1 group (4)	—
17	Kimungandura (incl. Tumbili Estate)	—	—	Absent	—
18	Kimuri Farm	—	—	Present 1 group (5)	—
19	Koiya Group Ranch	—	—	Absent	—
20	Kuri Kuri Group Ranch	—	—	Present 1 group (?)	—
21	Lekurruki Conservancy	—	—	Absent	—
22	Lolldaiga Hills Ranch	Present 2 groups (36)	Present 1–2 groups (50)	Present 1 group (4) 2 solitary individuals	↓
23	Lolomarik Farm	—	—	Absent	—
24	Makurian Group Ranch, see Dol Dol area (no. 6)	—	—	—	—
25	Male (or Lekolele) Farm	—	—	Absent	—
26	Mogwooni Ranch	Absent	Absent	Present 1 group (5)	↑
27	Moropusi Group Ranch (southern section)	—	—	Present 1 group (?)	—
28	Muhamud Smik Ranch	—	—	Absent	—
29	Mukima Ridge	—	—	Absent	—
30	Mukogodo Forest Reserve	—	—	Absent	—
31	Muramatie	—	—	Absent	—
32	Musul Group Ranch	—	—	Present 1 group (3)	—
33	Mutirithia Farm	—	—	Absent	—

34	Naibor / Jua Kali	—	—	Absent	—
35	Naibunga Group Ranch	—	—	Absent	—
36	Nanyuki Ranching	—	Present 1 group (≥8)	Absent	↓
37	Ngare Ndare Forest Reserve	—	—	Absent	—
38	North Tetu Farm	—	—	Present (1)	↑
39	Oi Jogi Ranch	Absent	Absent	Absent	=
40	Oi Lentille Conservancy (Kijabe)	—	—	Absent	—
41	Oi Pejeta Conservancy	Present 3–4 groups (160)	Present 2–3 groups (80)	Present ≥2 groups, one solitary individual (49)	↓
42	Ole Naishu Ranch	—	Present 1 group (50)	Present 2 groups (29)	↓
43	Solio Ranch	Present ≥1 group	—	Present 1 group (10–15)	=
44	Tharua (Lewcetia) Farm	Present 1 group (20)	Present 1 group (10)	Absent	↓
45	Tieramut Group Ranch	—	—	Present (1)	—
46	ADC Mutara Ranch	Present 4 groups (136)	Present 2–3 groups (100)	Present	=
47	Eland Downs / Laikipia National Park	Present 1 group (28))	Present 1 group (20)	Absent	↓
48a	Jessel's Farm	—	—	Absent	—
48b	Jessel's Farm	—	—	Absent	—
49	Laikipia National Reserve (Kirimun)	—	—	Absent	—
50	Loisaba Conservancy	—	—	Present (1)	—
51	Mpala Ranch	—	Present 1 (2); Mpala-Segera Group (extinct 1995)	Present 1 group (2)	=
55	Oi Donyo Lomboro (Laikipia Wilderness)	—	—	Absent	—
56	Oi Maisor Ranch	—	—	Absent	—
57	Oi Malo / Sabuk	—	—	Absent	—

58	Segera Ranch	—	Present 1 group; Segera-Jessel Group (15)	Present 2 groups (48) Kapiro <i>et al.</i> 2013.	↑
59	Soita Nyiro Conservancy	—	—	Absent	—
60	Sosian (Kisima) Ranch	Absent	Absent	Absent	=
61	Suyian (Kisima) Ranch	Absent	Absent	Absent	=
62	Thome B Ranch	—	Present 1 group; Thome B-Segera Group	Present 1 group; Thome B-Segera Group (23–25) Kapiro <i>et al.</i> 2013.	=

In Laikipia, whistling thorn woodland is the preferred habitat of patas. Not only is whistling thorn important to them as a year-round source of food but also as sleeping trees (Isbell 1998). Patas groups typically have many 4–8 m high trees spread-out over areas >2 hectares (Chism & Rowell 1988) throughout their large home range (23–80 km²).

Generally, well-managed, large (50–600 km²) ranches, with sustainable livestock densities, many well-spaced perennial water sources, and extensive areas of relatively undisturbed woodlands, are compatible with the long-term conservation of patas (Isbell & Chism 2007; De Jong *et al.* 2008; Butynski & De Jong 2014a). In the Laikipia rangeland agroecosystem, patas benefit from man-made perennial water sources and habitat protection. The level of conflict between humans and non-human primates in this rangeland agroecosystem is low relative to that in neighbouring cropland agroecosystems (Butynski & De Jong 2014a).

Main threats to patas throughout their geographic range are habitat degradation, loss, and fragmentation to agricultural expansion and intensification (both crops and livestock), charcoal production, and 'development' activities (*e.g.*, settlements, roads, powerlines, dams, irrigation; De Jong & Butynski 2017c,d). All these threats are highly interlinked and relevant to Laikipia. It is not known to what extent climate change is a threat to patas in Laikipia. Droughts and high temperatures have, however affected Laikipia over the last few decades. Desertification and the rapid degradation of vegetation, soil and water (including the vital water catchments of Mount Kenya and the Aberdares Range, and glaciers on Mount Kenya) are threats to Laikipia which have led to a great loss of productivity, food insecurity, and political unrest (also IUCN 2013).

Figure 14. Lekurruki Conservancy, northeast Laikipia County. Eastern patas monkeys *Erythrocebus patas pyrrhonotus* have never been reported for this area.



Habitat degradation, loss, and fragmentation

In Laikipia, the root-cause of habitat degradation, loss, and fragmentation (Figure 15) is the fast growing human population. The human population of Laikipia County is c. 400,000 people, c. 76% of which live in rural areas. The population is expected to increase to c. 600,000 people by 2030 (King *et al.* 2013).

Habitat degradation, loss, and fragmentation are predominantly caused by over-grazing by livestock, conversion of large areas to agriculture, uncontrolled logging, charcoal production, high concentrations of savanna elephant *Loxodonta africana*, invasive plants (particularly prickly pears *Opuntia* spp.). These problems are enabled by mismanagement, corruption, and insecurity. Damage is most severe in and around rural areas and communal areas---where the extraction of natural resources is most intense.

Patas have been extirpated from those parts of Laikipia with the highest human population, where habitat degradation, loss, and fragmentation are most severe. For example, Isbell and Chism (2007) and De Jong *et al.* (2008) report a group of patas off the northwest side of Nanyuki town (KDF, Allus Farm, Nanyuki Ranching, and Jessel's Farm). Patas were regularly seen in this area of high-quality whistling thorn woodland. Today, this area has many buildings, a large human population, and is heavily (illegally) over-grazed and over-browsed by cattle, goats, sheep, and camels. Patas have not been observed here since about 2010 (M. Grant, pers. comm.).

Within Laikipia National Reserve (=Kirimun), the only National Reserve within Laikipia, little natural vegetation remains. This National Reserve has a large resident human population that depends on livestock and crops. During this survey, no large wild animals were encountered here. This degraded National Reserve appears to be unsuitable for patas.



Figure 15. Degraded habitat on Il'Ngwesi Conservancy, northeast Laikipia County, as a result of over-use by livestock. Note the lack of grass and herbs. Eastern patas monkeys *Erythrocebus patas pyrrhonotus* are absent in this area.

Charcoal production is one of the main threats to Laikipia's forests and woodlands (also King *et al.* 2013) affecting all forest- and woodland-dependent species, including patas (Figure 16). Charcoal is a major cooking fuel in Kenya, providing energy for 82% of urban and 34% of rural households. Laikipia is one of Kenya's 'key charcoal hotspots'. Yearly, Laikipia County licences 12,000 bags of charcoal which mainly go to Nyeri, Karatina, Nyahururu, and Naivasha (Kenya Forest Service 2013). It is unclear how many bags of illegal charcoal are produced in Laikipia County each year. "In Kenya, close to 22 million cubic metres of wood is carbonised to meet Kenya's annual charcoal demand. About 40% of the charcoal comes from rangelands, 40% from farmlands and 20% from government forests

(Republic of Kenya, 2002).” (Kenya Forest Service 2013; p. 5). Whistling thorn produces good quality charcoal (Okello 2001). With the fast growing human population in Kenya, the demand for charcoal is expected to rise.



Figure 16. Bag of charcoal being sold along a road near Il Polei, central Laikipia County. Note the low density of trees and the large areas of bare ground. Eastern patas monkeys *Erythrocebus patas pyrrhonotus* are rare in this area.

There is increasing competition between people and patas for water (De Jong *et al.* 2008, Isbell 2013; Butynski & De Jong 2014b; Ashagrie 2015). Patas drink water daily. As such, the location of water sources affects their movements, especially during the dry season (Struhsaker & Gartlan 1970; Chism & Rowell 1988). As mentioned above, patas are able to benefit from human-made water sources



Figure 17. Water trough on Ol Pejeta Conservancy, central Laikipia, Kenya. This is one of the private ranches on which eastern patas monkeys *Erythrocebus patas pyrrhonotus* still occur.

(Chism & Rowell 1988; Isbell & Chism 2007; De Jong *et al.* 2008; Butynski & De Jong 2014a; Figure 17). Most, if not all, large ranches have established, and maintain, water tanks, troughs and dams throughout the property. These sources of water, many of which are perennial, enable patas to access these areas to forage and make use of the secure sleeping and refuge sites (Chism & Rowell 1988; De Jong 2004; Isbell & Chism 2007; De Jong *et al.* 2008). Dams not only provide drinking water for patas and other wildlife, they promote and support large trees (particularly yellow fever *Acacia xanthophloea* and *Ficus* spp.) that serve as important foraging, sleeping and refuge sites (Butynski & De Jong 2014a).

With the fast-growing human and livestock population it is increasingly hard for wildlife to access water outside well-managed ranches in Laikipia. In fact, during the time of this study, Kenya (Laikipia included) was experiencing a drought (Figures 18 & 19). Many, if not most, dams in eastern Laikipia were dry for several months. Water on communal land was difficult or impossible for wildlife to access at this time. During dry seasons and droughts, pastoralist illegally bring tens of thousands of livestock onto well-managed ranches. As a result, water on these ranches may become insufficient for patas and other wildlife to access.



Figure 18. Livestock carcasses were commonly observed on Laikipia's rangelands during the 2016 drought. Note the absence of grass.

From November 2016 until November 2017, ranches in Laikipia were illegally and aggressively invaded by large numbers of Samburu and Pokot from the north and west, respectively, as well as from nearby Maasai. Thousands of the invaders were armed with automatic weapons. The enormous influx of armed men and their livestock (135,000 cattle and 200,000 sheep and goats) had a great negative impact on Laikipia's natural habitats and biodiversity (Anonymous 2017).



Figure 19. Carcass of a newborn plains zebra *Equus quagga* on Lolldaiga Hills Ranch, eastern Laikipia, during the 2016 drought.

Laikipia's landscape has changed dramatically over the last 50 years, mainly as a result of human actions, but also to an increase in the number of elephant. Due to increased poaching and changing land use practices in the 1970s and 1980s, elephants moved southwards into Laikipia seeking refuge, food and water on well-managed ranches (Thouless 1995). The elephant population in Laikipia and Samburu Counties increased from c. 3,000 in 1992 to c. 6,400 in 2012 (Nyumba *et al.* 2013). Figure 20 shows the elephant population trend in Laikipia based on aerial surveys (Hillman Smith *et al.* 2016).

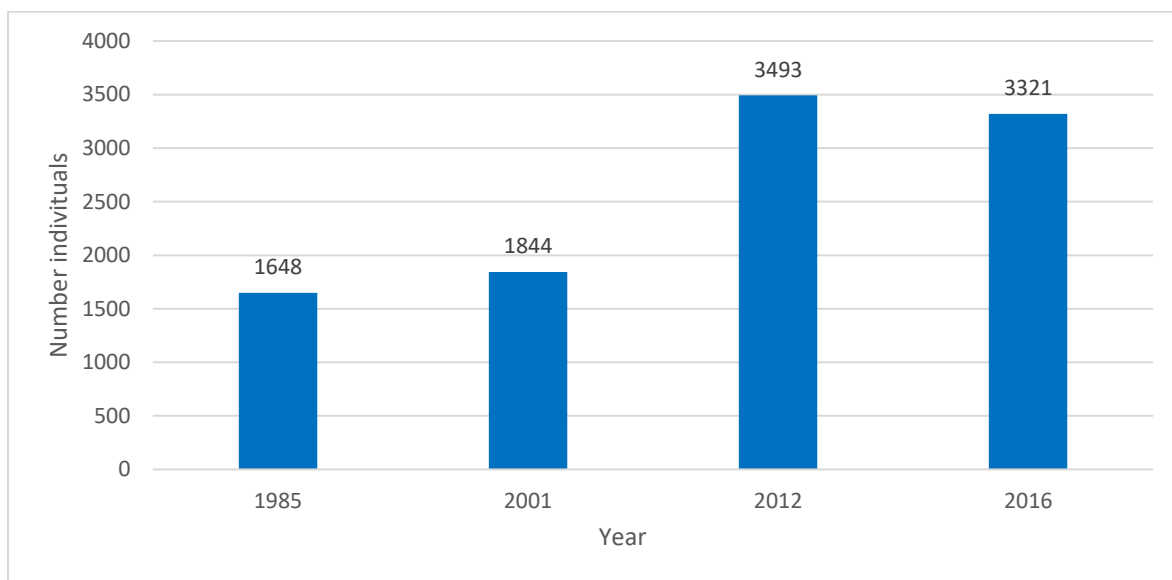


Figure 20. Change in the number of savanna elephants *Loxodonta africana* in Laikipia County during 1985–2016 (Hillman Smith *et al.* 2016).

High densities of elephant have a great impact on woody plants, reducing canopy cover, tree density, tree height, tree basal diameter, and tree species diversity (Barnes 1983; Pellew 1983; Gandiwa *et al.* 2011). *Acacia* spp. are particularly affected. Laikipia's once expansive whistling thorn woodlands have been extensively damaged and reduced by elephant (Figure 21). This is thought to have had considerable negative impact on patas as whistling thorn is a key food and refuge species for this monkey. The most affected areas are the 'elephant friendly' properties, including Lolldaiga Hills Ranch, Ol Pejeta Conservancy, Borana Ranch, Ole Naishu Ranch, and Mpala Ranch.



Figure 21. Severe elephant damage to whistling thorn *Acacia drepanolobium* woodland, northern Lolldaiga Hills Ranch, eastern Laikipia.



Figure 22. Reticulated giraffe *Giraffa reticulata* in whistling thorn *Acacia drepanolobium* woodland on Borana Conservancy, eastern Laikipia.

During our survey on Lolldaiga Hills Ranch, we interviewed 33 rangers, herders, and other staff. The most common opinion among interviewees is that the number of patas here has declined due to the considerable loss of whistling thorn woodland as a result of destruction by elephant. Interviewees also said that the herders and livestock on north Lolldaiga disturb this monkey (see Appendix 3 or <http://www.lolldaiga.com/status-eastern-patas-monkey-lolldaiga-hills-ranch/> or <http://www.wildsolutions.nl/status-eastern-patas-monkey-lolldaiga-hills-ranch-laikipia-kenya/>).

Other species which impact whistling thorn woodland include reticulated giraffe *Giraffa reticulata* (Figure 22) and black rhinoceros *Diceros bicornis* (De Jong *et al.* 2008).

Invasive species

Invasive species are widely recognized as a top driver of biodiversity loss. Laikipia has at least 55 naturalized or nearly naturalized, invasive and potentially invasive plant species (Witt 2017).

Australian pest pear *Opuntia stricta*

In Laikipia, patas feed on young pads and fruits of *Opuntia* spp., as do other primates (olive baboons, vervet monkeys, humans), other wildlife species (*e.g.* elephant), and livestock (Chism & Rowell 1988; Butynski & De Jong 2014a; Strum *et al.* 2015). *Opuntia* spp., native to southeast USA, east Mexico and the Caribbean, were brought to Kenya in the 1950's (Vernon 2008; Strum *et al.* 2015; Shackleton *et al.* 2017). *Opuntia* includes many problematic species that invade the arid and semi-arid lands of the world, including Laikipia County (Shackleton *et al.* 2017). The Australian pest pear *Opuntia stricta* is a source of food and water during times of drought for various species but it also aggressively over-takes indigenous vegetation (Figures 23–28). Already, *O. stricta* has invaded thousands of hectares in Laikipia. The result is a dramatic decline in food for wildlife and livestock, decrease in the health of livestock, abandonment of farmlands (Witt 2017), and in-flux of elephants in times of scarcity.



Figure 23. Flowering and fruiting Australian pest pear *Opuntia stricta* near Il Polei, central Laikipia.



Figure 24. *Opuntia stricta* Australian pest pear in open *Acacia-Boscia* woodland in central Laikipia that has been severely damaged by elephant and over-grazing and over-browsing by livestock.

Opuntia stricta is particularly abundant on over-grazed rangelands typical of the group ranches of Laikipia, but is also present on well-managed ranches (Shackleton *et al.* 2017), including Ol Jogi, Chololo, Mpala, Ole Naishu, and Lolldaiga Hills. Primary dispersers *O. stricta* seeds are wildlife (particularly olive baboons and elephants; Figure 26) and livestock (Foxcroft *et al.* 2004; Strum *et al.* 2015; Shackleton *et al.* 2017; Y. de Jong & T. Butynski pers. obs.). Olive baboons prefers *O. stricta* over native fruits (Dyck 2017).



Figure 25. Australian pest pear *Opuntia stricta* near Il Polei, central Laikipia. The Lolldaiga Hills are in the background.

Opuntia stricta causes health problems in livestock and humans (Shackleton *et al.* 2017; Witt 2017). It is not known if the consumption of *Opuntia* fruit has negative effects on patas, olive baboons, or other wild species.

Elephants appear to be attracted to areas where *O. stricta* is dense (Figure 26). This has led to an increase in human-elephant conflict on group ranches and greatly affected the movement of elephants through Laikipia (Shackleton *et al.* 2017; J. King & I. Craig pers. comm.). Not only does *O. stricta* degrade patas habitat, the altered elephant movements and increased densities appear to affect habitat quality for patas. It is not clear if *O. stricta* has a positive impact on baboon densities, or if high densities of baboons negatively impact patas.

Figure 26. Elephant dung with a large number of the purple fruits of Australian pest pear *Opuntia stricta*. Photographs taken on Lolldaiga Hills Ranch, eastern Laikipia.



Opuntia management is currently being undertaken in Laikipia by several programmes, including Northern Rangelands Trust, Naibunga Conservancy, Laikipia Wildlife Forum, Ol Jogi Ranch, and National Environmental Management Authority (NEMA).

Figure 27. Reduction of Australian pest pear *Opuntia stricta* by a biological control agent, prickly pear cochineal *Dactylopius opuntiae*, on Ol Jogi Ranch, central Laikipia.



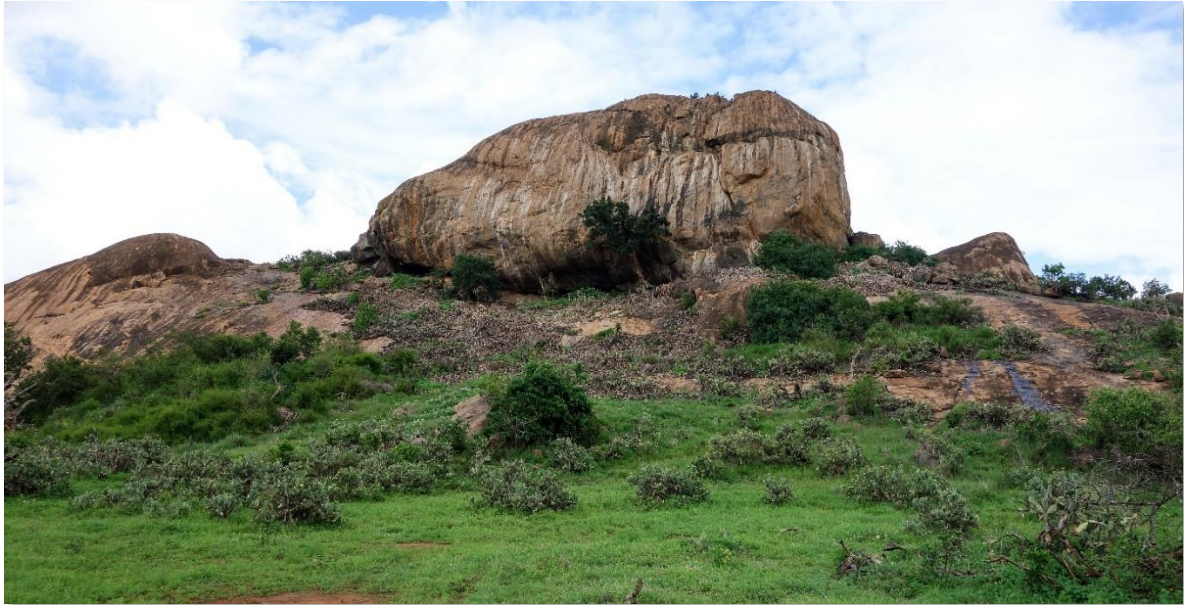


Figure 28. Site on Ol Jogi Ranch, central Laikipia, where the biological control agent, prickly pear cochineal *Dactylopius opuntiae*, has been introduced to reduce the abundance of Australian pest pear *Opuntia stricta*. The grey on the rock in the centre of this photograph is dead *O. stricta*.

Big-headed ant *Pheidole megacephala*

Reprinted here from: *Newsletter of the Lolldaiga Hills Research Programme* (Issue 6, October 2016, www.lolldaiga.com)

Does the invasive big-headed ant occur on Lolldaiga Hills Ranch?

By Yvonne A. de Jong & Thomas M. Butynski, Lolldaiga Hills Research Programme

The big-headed ant *Pheidole megacephala*, originally from either Ethiopia or Madagascar, has spread worldwide throughout the tropics and subtropics. This species feeds on other insects, including other ants. First recorded in Kenya in 1911, the big-headed ant has established itself in Laikipia County (e.g., El Karama Ranch, Ol Pejeta Conservancy, Lewa Conservancy, Segera Ranch, Ol Jogi Ranch, and Mpala Ranch). There are, as yet, no records for the big-headed ant on Lolldaiga Hills Ranch.

Laikipia's whistling thorn acacias *Acacia drepanolobium* are occupied by four native species of ants with which they maintain a complex mutualistic relationship. Each species of ant has a distinct niche within whistling thorn. The aggressive cocktail ants (*Crematogaster mimosae* and *C. nigniceps*; Figure 29) help protect the tree from browser damage. With the arrival in Laikipia of the big-headed ant, this ant-plant mutualism has been severely disrupted (Riginos *et al.* 2015). In some areas, whistling thorns are dominated by the invasive ant, leaving the trees without the defence provided by cocktail ants. One effect is that



Figure 29. Red-headed cocktail ant *Crematogaster mimosae* on a whistling thorn acacia *Acacia drepanolobium*, Lolldaiga Hills Ranch. Photograph by Paul Benson.

some areas have experienced a five- to seven-fold increase in the number of trees damaged by elephants (Riginos *et al.* 2015). This loss of tree cover affects the ecosystem in general with severe negative impact on many species.

With the help of Paul Benson, TMB and YDJ are spot-checking Lolldaiga's woodlands and bushlands for the presence of the big-headed ant. As part of this project, photographs of ants are being taken throughout the Ranch and sent to experts for identification in order to compile the 'Lolldaiga Hills Ranch Ant Species List'.

Reprinted here from: *Newsletter of the Lolldaiga Hills Research Programme* (Issue 6, October 2016, www.lolldaiga.com)

Big-headed ants and patas monkeys

By Yvonne A. de Jong & Thomas M. Butynski, Lolldaiga Hills Research Programme

In Laikipia, whistling thorn *Acacia drepanolobium* is the key food plant for the globally 'Vulnerable', semi-terrestrial, eastern patas monkey *Erythrocebus patas pyrrhonotus*, contributing *ca.* 83% of the diet (Isbell 1998). Patas primarily feed on the gum, but also take the soft thorns, flowers, seed pods, and arthropods living in the swollen thorns.

TMB and YDJ are currently undertaking a survey of the patas monkey in eastern Laikipia. Preliminary findings indicate that this population has declined considerably from the 310-445 individuals (in 13-17 groups) estimated for 2000 and may be rapidly sliding towards extinction. Results of a

questionnaire survey conducted during 1992–2004 (Isbell & Chism 2007), indicated that Lolldaiga Hills Ranch had one, perhaps two, groups of patas. As of May 2015, the number of patas using the Ranch was probably no more than four. None were resident on the Ranch (De Jong *et al.* 2015). The last record of patas on the Ranch, a lone adult male, was obtained in July 2014.



Figure 30. Eastern patas monkey *Erythrocebus patas pyrrhonotus*, Ole Naishu Ranch, Laikipia, Kenya. Photograph by Yvonne de Jong and Tom Butynski.

Main threats to the patas monkey throughout its range, but probably particularly in East Africa, are habitat degradation, fragmentation, and loss due primarily to agricultural expansion and intensification (both crops and livestock), charcoal production, and 'development' activities (*e.g.*, settlements, roads, powerlines, dams). Human populations are doubling every 20-30 years over much of the range of this species. As such, there is ever increasing competition between people and patas for habitat and water (De Jong & Butynski in press). There may also be a new, as yet unidentified, threat; might the invasive big-headed ant *Pheidole megacephala* be a threat?...through its negative impacts on whistling thorn? This is a question that no one has yet looked into but which appears worth investigating. See the blog: *Does the invasive big-headed ant occur on Lolldaiga Hills Ranch?*



Now, 12 years after the last survey of patas in Laikipia, we are undertaking the third 'Laikipia Patas Survey'. We will survey eastern Laikipia during November and December 2016. This survey will comprise a combination of fieldwork and questionnaires.

Figure 31. Adult female eastern patas monkey *Erythrocebus patas pyrrhonotus*, Kidepo Valley National Park, northeast Uganda. Photograph by Yvonne de Jong and Tom Butynski.

Patas conservation action

There has been, and is, considerable action to conserve natural habitats and species in Laikipia (*e.g.*, research, education, environmental planning, law enforcement), but these actions are being undermined by a rapidly increasing human population, unsustainable use of natural resources (particularly water, forests, woodlands, and grasslands), decisions for short-term economic and political gain, corruption, and insecurity. Priority actions for the long-term conservation of patas in Laikipia are:

1. Expand the present survey of the distribution and abundance of patas to include western Laikipia County.
2. Establish a network of interested people throughout Laikipia to monitor the size and age/sex composition of the groups of patas they encounter, with the resulting data maintained in PatasBase.
3. Survey Laikipia's patas population every 10 years to determine distribution, abundance, and population trend, and reassess priorities for conservation action.
4. Halt unsustainable charcoal production practices within the range of patas.
5. Halt unsustainable and illegal livestock grazing and browsing within the range of patas.
6. Halt the invasion of the *O. stricta* and other invasive plant species, and continue eradication programmes across the range of patas.
7. Investigate the direct and indirect impact of the invasive big-headed ant on the patas of Laikipia.
8. Halt further invasion of the big-headed ant and, if possible, establish an eradication programme across the range of patas.
9. Establish elephants corridors in Laikipia to prevent further destruction of *Acacia* woodland.
10. Protect perennial water sources and establish exclusive wildlife water-points throughout the range of patas.
11. Put in place a sustainable livestock production programme for Laikipia County to stop overstocking and degradation of the rangelands.
12. Re-establish security in Laikipia County.
13. Encourage education and family planning in Laikipia as part of a strategy to halt the unsustainable use of natural resources and loss of environmental productivity.

Primates of Laikipia

Excluding Lolldaiga Hills Ranch, 59 groups of diurnal primates, belonging to four genera and four species, were encountered during this survey. Nineteen galagos of two species were also encountered.

- Olive baboon *Papio anubis* - 30 groups (Figure 32)
- Hilgert's vervet monkey *Chlorocebus pygerythrus hilgerti* - 20 groups (Figure 33)
- Kolb's monkey *Cercopithecus mitis kolbi* - 4 groups
- Mount Kenya guereza colobus *Colobus guereza kikuyuensis* - 5 groups
- Kenya lesser galago *Galago senegalensis braccatus* - 13 individuals (Figure 33)
- Somali lesser galago *Galago gallarum* - 6 individuals (all in Sasaab Conservancy, Samburu County; Figure 32)

The most common primate species of Laikipia are those that are woodland-dependent; olive baboon and vervet monkey (which is only locally common). The two forest-dependent taxa, Kolb's monkey and Mount Kenya guereza colobus, are far less widespread due to the fact that forest is a scarce habitat. Kenya lesser galago is widespread and sometimes common. The small-eared greater galago *Otolemur garnettii* was not encountered during this survey. The loud call of this species might, however, have been heard at Ol Lentille Conservancy. The presence of this species in Laikipia County requires confirmation. The Mount Kenya potto *Potto ibeanus stockleyi* was not encountered and no reports of presence were obtained (see the blog 'Mount Kenya potto, a 'lost' subspecies'; De Jong & Butynski 2017e; www.wildsolutions.nl/mount-kenya-potto-lost-subspecies/)



Figure 32. Left: Adult female olive baboon *Papio anubis*, Lekurruki Conservancy, northeast Laikipia.

Below: Somali lesser galago *Galago gallarum* West Gate Conservancy, south Samburu County.



Figure 33. Right: Adult male Hilgert's vervet monkey *Chlorocebus pygerythrus hilgerti*, Solio Ranch, southeast Laikipia.

Below: Kenya lesser galago *Galago senegalensis braccatus*, Tumbili Estate, east Laikipia.



Other mammals of Laikipia

Desert warthog

Both common warthog *Phacochoerus africanus* and desert warthog *Phacochoerus aethiopicus* were encountered on Lekurruki Conservancy, extreme northeast Laikipia, in November 2016 (Figure 34). One sounder of eight desert warthogs (three adult females and five piglets) were seen several times near Tassia Lodge. Four solitary adult males desert warthogs were encountered elsewhere on Lekurruki Conservancy. One common warthog sounder (one adult female and three piglets) and one solitary adult male were also encountered on this Conservancy.



Figure 34. Adult male desert warthog *Phacochoerus aethiopicus* at Lekurruki Conservancy, northeast Laikipia.

On Il'Ngwesi Conservancy, two desert warthog sounders (one of two adult females and one of two adult females and three piglets) were seen in November 2016 (Figure 35). Although common warthogs was not seen during a 1-day survey on Il'Ngwesi Conservancy, it is almost certainly present.

These are the first records of desert warthog for Laikipia County. Over its extensive range in Africa, the common warthog occurs at 0-3,500 m asl (Butynski & De Jong 2017a). Desert warthog, on-the-other-hand, has yet to be found >1,690 m asl (De Jong & Butynski 2017a). As most of Laikipia is >1,600 m asl, desert warthog is expected to be confined to the low ground of northeast Laikipia and to be absent from the Laikipia Plateau. For more information, see Appendix 4 and <http://www.lolldaiga.com/additions-laikipia-mammallist/> and <http://www.wildsolutions.nl/additions-laikipia-mammallist/>.



Figure 35. Subadult female desert warthog *Phacochoerus aethiopicus* in Il'Ngwesi Conservancy, northeast Laikipia County, central Kenya.

Kirk's dik-dik

During this survey, in November 2016, we found both Kirk's dik-dik *Madoqua (kirkii) kirkii* (Figure 36) and Smith's dik-dik *Madoqua (guentheri) smithi* near Tassia Lodge, Lekurruki Conservancy, northeast Laikipia. Kirk's dik-dik was also encountered on Il'Ngwesi Conservancy. We strongly suspect that Smith's dik-dik is also present on Il'Ngwesi. It appears that, in general, Kirk's dik-dik occupies the lower, flatter ground, while Smith's dik-dik occupies the higher, more hillyground of this region. These are the first records of Kirk's dik-dik for Laikipia County. For more information, see Appendix 4 and <http://www.lolldaiga.com/additions-laikipia-mammallist/> and <http://www.wildsolutions.nl/additions-laikipia-mammallist/>.



Figure 36. A wet adult male Kirk's dik-dik *Madoqua (kirkii) kirkii* at Lekurruki Conservancy, northeast Laikipia County, central Kenya.

Waterbuck

Both 'subspecies' of waterbuck *Kobus ellipsiprymnus* occur in Kenya: defassa waterbuck *K. e. defassa* and common (or ellipse) waterbuck *K. e. ellipsiprymnus*. Their taxonomic arrangement is debated; some authors (e.g., Lorenzen *et al.* 2006; Kingdon 1982, 2015; Spinage 2013) view these as

subspecies, while others (e.g. Stewart & Stewart 1963; Groves & Grubb 2011) consider them species. Here we treat them as subspecies.

Generally, defassa waterbuck occur in Kenya and Tanzania west of the Eastern Rift Valley, and common waterbuck east of the Rift. Their geographic ranges overlap in north Tanzania (e.g., Lake Manyara) and in south and central Kenya (Stewart & Stewart 1963; Lorenzen *et al.* 2006; Spinage 2013). Defassa waterbuck occur on Lolldaiga Hills Ranch in eastern Laikipia, while common waterbuck are present at lower altitude c. 50 km northeast in Samburu National Reserve and c. 100 km east in Meru National Park. It is not known where defassa waterbuck give way to common waterbuck in this region, or whether common waterbuck are present in Laikipia.

These two subspecies are similar in appearance. The main distinguishing character in the field is the colour pattern on the rump; common waterbuck have a distinct white ellipse (or crescent) around the rump, whereas defassa waterbuck have a wholly white (or whitish) rump (Figure 37). We used the rump as the primary phenotypic indicator to distinguish these two taxa.

To better understand the geographic limits of defassa waterbuck and common waterbuck, photographs obtained during this and several previous surveys were geotagged and published on a Photographic Map (available at: <http://www.wildsolutions.nl/photomaps/kobus/>).



Figure 37. The colour pattern on the rump is the main trait by which the two subspecies of waterbuck *Kobus ellipsiprymnus* are distinguished in the field. Left: Adult male common (or ellipsen) waterbuck *K. e. ellipsiprymnus*. Right: Adult male defassa waterbuck *K. e. defassa*.

During these surveys, only defassa waterbuck were encountered in Laikipia. Previous records of waterbuck in Laikipia, as well as records on iNaturalist.com (11 records as of June 2017), are all of defassa waterbuck. It appears that common waterbuck are absent from Laikipia. We did not, however, encounter waterbuck in extreme northeast Laikipia (Lekurruki Conservancy and Il'Ngwesi

Conservancy) just south of Samburu National Reserve, which is that part of Laikipia where common waterbuck are most expected.

In Samburu National Reserve we observed common waterbuck. We also encountered one adult male waterbuck and one adult female waterbuck that were phenotypically intermediate between common waterbuck and the defassa waterbuck (Figures 38 & 39). Less than 15 km to the west, in southeast West Gate Conservancy, we observed an intermediate adult male (Figure 40).



Figure 38. Phenotypically intermediate adult female (left) waterbuck *Kobus ellipsiprymnus* and common waterbuck *Kobus ellipsiprymnus ellipsiprymnus*, Samburu National Reserve, central Kenya.

Figure 39. Phenotypically intermediate adult male waterbuck *Kobus ellipsiprymnus*, Samburu National Reserve, central Kenya.



Figure 40. Phenotypically intermediate adult male waterbuck *Kobus ellipsiprymnus*, southeast West Gate Conservancy, central Kenya.

Stewart and Stewart (1963), Kingdon (1982), Lorenzen *et al.* (2006), Groves and Grubb (2011), Spinage (2013), and Foley *et al.* (2014) refer to waterbuck hybrid (or ‘intermediate’) zones for East Africa. They report phenotypically intermediate individuals in several areas, including along the North Ewaso Nyiro River (*e.g.*, Samburu National Reserve), Athi River (*e.g.*, Nairobi National Park), South Ewaso Nyiro River, and Lake Manyara. In their molecular study, Lorenzen *et al.* (2006) suggest that “...*hybridization was probably very recent, perhaps within the past few centuries — or perhaps it is still undergoing.*” According to Spinage (2013), zones of intermediate-patterned waterbuck are narrow—possibly due to reduced fertility of hybrids.

Our preliminary findings indicate that the zone for intermediate-patterned waterbuck in central Kenya is, indeed, narrow. This zone lies in south Samburu County, probably extending southward across the North Ewaso Nyiro River into west Isiolo County and, perhaps, into extreme north and/or northeast Laikipia and the Nyambeni Range.

To clarify the geographic limits of this intermediate-zone, we are in particular need of photographs of waterbuck from south Samburu County (*e.g.*, West Gate Conservancy, Shaba National Reserve, Meibae Conservancy), west Isiolo County (*e.g.*, Mpus Kutuk Conservancy, Ol Donyiro Conservancy, Longopito area), north and northeast Laikipia County (*e.g.*, Lekurruki Conservancy and Il’Ngwesi Conservancy), and the Nyambeni Range.

Despite of a high density of lion *Panthera leo* (*c.* 80 individuals) within Solio Wildlife Sanctuary (70 km²) we encountered large herds of defassa waterbuck here during this survey (Figure 41).



Figure 41. Subadult male defassa waterbuck *Kobus ellipsiprymnus defassa* in Solio Wildlife Sanctuary, central Kenya.

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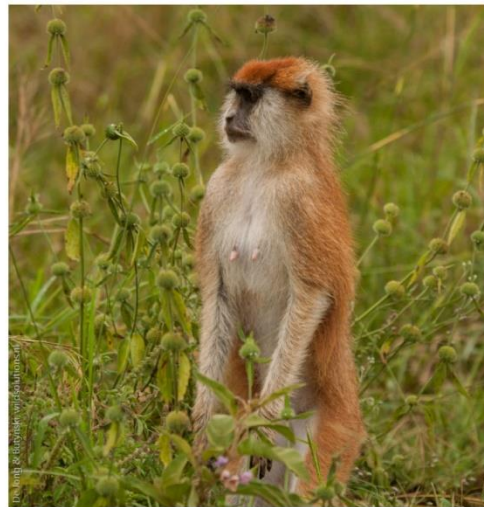
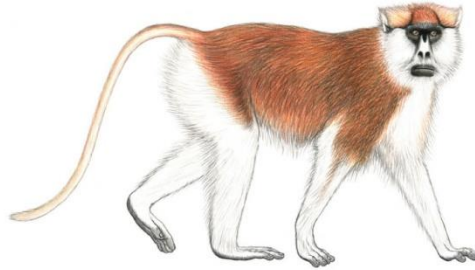
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Appendix 1. One example of a request for patas monkey records. This request appeared in local magazines, and on websites and notice boards in Laikipia County.

Have you seen patas monkeys in Laikipia (or elsewhere in East Africa) in the past two years?



We would appreciate a record of your sightings

Tom Butynski & Yvonne de Jong

Lolldaiga Hills Research Programme & Eastern Africa Primate Diversity and Conservation Program

Email: tbutynski@aol.com

Web: www.lolldaiga.com and www.wildsolutions.nl

Thank you!

(November 2014)

Appendix 2. Laikipia patas monkey survey questionnaire.

1. Name of the property you own/manage/conduct research on in Laikipia:
2. Size of the property: (please state whether acres, hectares, or square kilometres)
3. Property is primarily managed as a: (choose one option below)
 - ☐ Group ranch
 - ☐ Cattle ranch
 - ☐ Conservancy
 - ☐ Other (please specify)
4. Are patas present on this property at this time?
 - ☐ Yes
 - ☐ No
 - ☐ Don't know
5. If patas are no longer present on this property, how many years has it been since they were last reliably reported to have been present on this property?
If you are uncertain, please give your best estimate.
6. How many groups of patas are using this property at this time?
7. How many individuals do you estimate to be in each of the groups of patas on this property?
8. Do the patas groups using the property range on to neighboring properties? Please provide your estimate of the size of the group and the name of the neighboring property on which it ranges.
9. What was the population trend of patas on the property over the last 10 years?
 - ☐ Increased
 - ☐ Decreased
 - ☐ No noticeable change
 - ☐ Don't know
10. What do you suspect caused the change in numbers of groups or individuals?
 - ☐ Increase in predators
 - ☐ Decline in predators
 - ☐ Increase in year round water sources
 - ☐ Decline in year round water sources

- ☐ Increase in whistling thorn woodland
- ☐ Decline in whistling thorn woodland
- ☐ Increase in human disturbance
- ☐ Decline in human disturbance
- ☐ Don't know

Other (please specify)

11. Roughly what percent of the property supports whistling thorn (*Acacia drepanolobium*)?

- ☐ 0%
- ☐ 1-10%
- ☐ 11-20%
- ☐ 21-30%
- ☐ 31-40%
- ☐ 41-50%
- ☐ 51-60%
- ☐ 61-70%
- ☐ 71-80%
- ☐ 81-90%
- ☐ 91-100%

12. Has the percentage of whistling thorn woodland increased or decreased over the past 10 years?

- ☐ Increased
- ☐ Decreased
- ☐ No noticeable change
- ☐ Don't know

13. What percent of the property supports opuntia cactus?

- ☐ 0%
- ☐ 1-10%

- ☐ 11-20%
- ☐ 21-30%
- ☐ 31-40%
- ☐ 41-50%
- ☐ 51-60%
- ☐ 61-70%
- ☐ 71-80%
- ☐ 81-90%
- ☐ 91-100%

14. Has the percentage of opuntia cactus increase or decrease over the past 10 years?

- ☐ Increased
- ☐ Decreased
- ☐ No noticeable change
- ☐ Don't know

15. Have the number of year round water sources on this property increased or decreased over the past 10 years?

- ☐ Increased
- ☐ Decreased
- ☐ No noticeable change
- ☐ Don't know

16. Which other primate species occur on the property (find below photographs of all primates in Laikipia)?

- ☐ Olive baboon
- ☐ Vervet monkey
- ☐ Kolb's (Sykes's) monkey
- ☐ Black-and-white colobus

☐ Small-eared greater galago

☐ Kenya lesser galago

Olive baboon



Vervet monkey



Kolb's (Sykes's) monkey



Black-and-white colobus



Small-eared greater galago



Kenya lesser galago



17. Additional comments:

18. Your name:

19. Position on the property: (i.e., owner, manager, researchers, etc.)

20. For how many years have you lived and/or worked on this property?

21. Email address (if you like to be kept informed about the results of this survey):

Appendix 3

Butynski, T. M. & De Jong, Y. A. 2017. *Newsletter of the Lolldaiga Hills Research Programme*, May 2017.

Website: <www.lolldaiga.com>

Status of the Eastern Patas Monkey on Lolldaiga Hills Ranch, Laikipia, Kenya

By Yvonne de Jong, Tom Butynski & Julius Mathiu

Among East Africa's primates, the Eastern Patas Monkey *Erythrocebus patas pyrrhonotus* is of special concern. Historically, in Kenya, this subspecies occurred in the west, northwest, centre and south, with a geographic range of ca. 93,000 km². The range has, however, declined to ca. 52,500 km² (56% of the historic range), and the gaps among populations have increased (De Jong *et al.* 2008; De Jong & Butynski 2014).

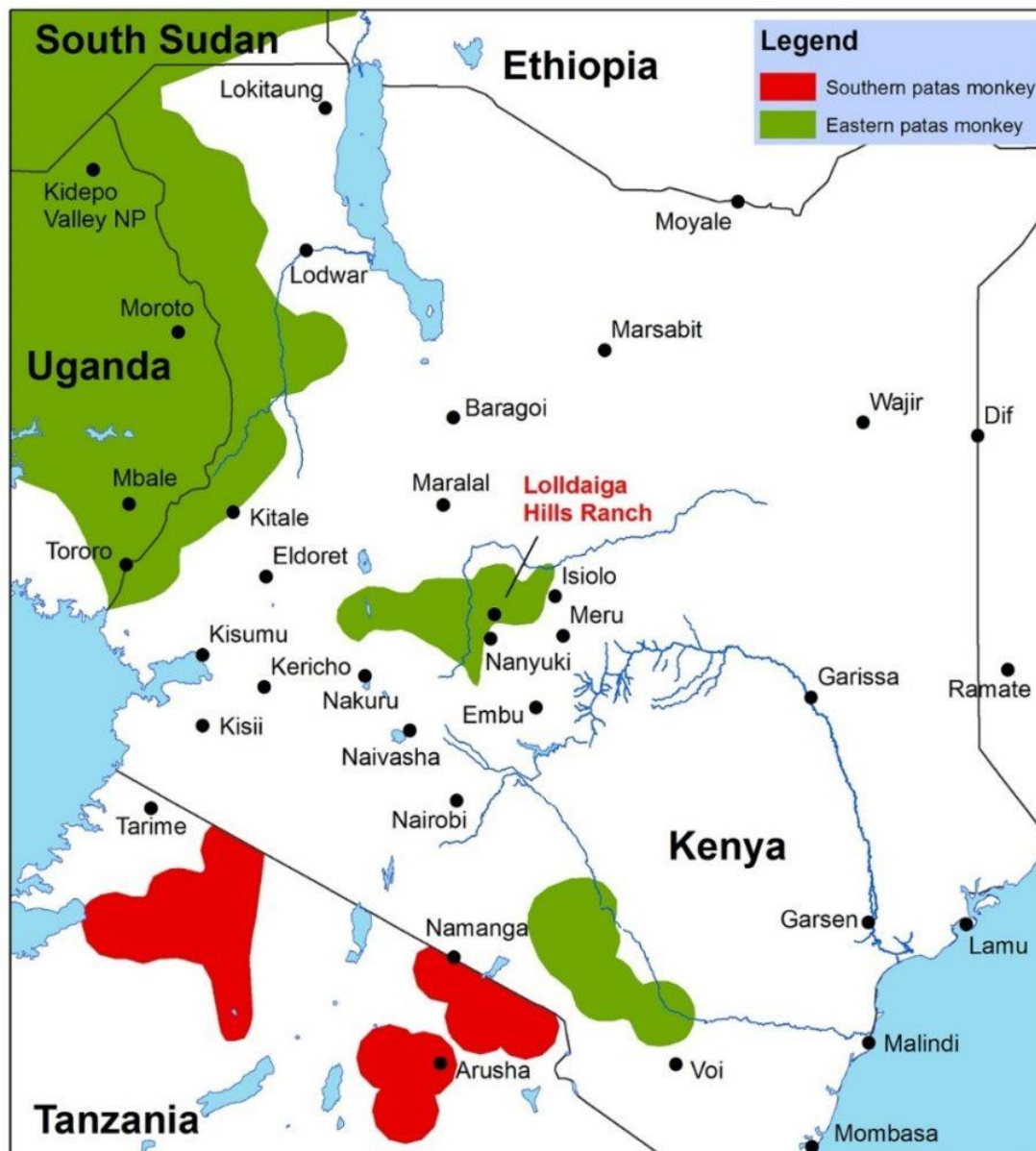


Eastern Patas Monkey *Erythrocebus patas pyrrhonotus*, Kidepo Valley National Park, Uganda.

During the April 2016 IUCN/SSC African Primate Red List Assessment Workshop in Rome, we raised the degree of threat status of Patas Monkey *Erythrocebus patas* from 'Least Concern' to 'Near Threatened' (De Jong & Butynski 2017c). *Erythrocebus patas pyrrhonotus*, the subspecies present on Lolldaiga Hills Ranch, was assessed as 'Vulnerable' (De Jong & Butynski 2017d). The justification for this is as follows:

"Although patas has a wide geographic range, there is an observed population reduction throughout the range. This decline is expected to continue as the causes (mainly habitat degradation, fragmentation, and loss) are on-going. Extent of occurrence and area of occupancy are in decline. The current level of exploitation is not likely to be reduced." (De Jong & Butynski 2017c).

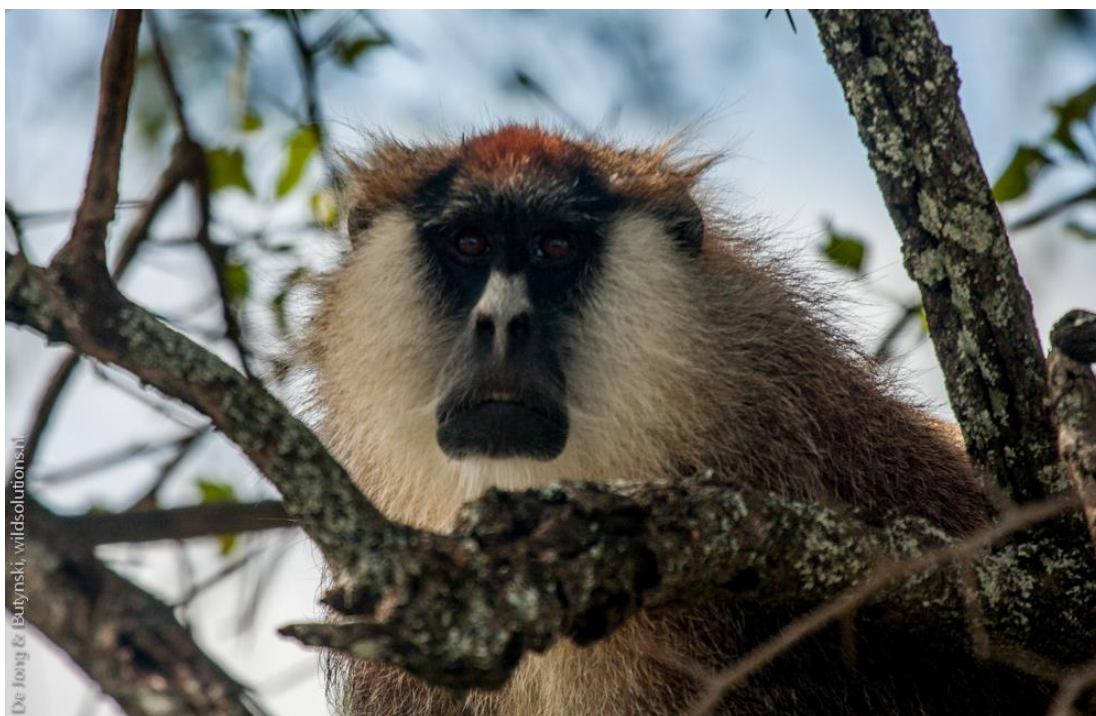
Today, the Eastern Patas Monkey (hereafter referred to as 'Patas') is one of Kenya's most threatened primates (De Jong *et al.* 2008; De Jong & Butynski 2012, 2017).



Current geographic range of the Eastern Patas Monkey *Erythrocebus patas pyrrhonotus* in Kenya.

Patas are supported by Laikipia's vast Whistling Thorn *Acacia drepanolobium* woodlands, where it naturally occurs at low densities (0.2–1.5 individuals/km²; Chism & Rowell 1988; Isbell & Chism 2007). In Laikipia, groups are typically between 13 and 56 individuals. Home ranges are extensive, ranging between 23–40 km² (Chism & Rowell 1988; Enstam & Isbell 2004). Patas have always been at low density on Lolldaiga Hills Ranch, occurring mainly in the North Valley (Mizutani 1995; Robert Wells pers. comm.; Lance Thomlinson pers. comm.; Ken Wreford-Smith pers. comm.).

As part of our current Patas survey in eastern Laikipia County, we visited ranger posts on Lolldaiga Hills Ranch during April 2017. With the help of photographs of Patas and a map, we interviewed 33 rangers, herders, and others. We asked if they had seen Patas on the Ranch and, if so, when, where, and how many? In addition, we asked if they thought Patas had decline in abundance and, if so, what they believe to be the main reason. We also examined Lolldaiga's Security Logbook for records of Patas.



Eastern patas monkey *Erythrocebus patas pyrrhonotus*, Kidepo Valley National Park, Uganda.

We obtained records of Patas from northeast, central north, southwest, and southeast Lolldaiga (Figure 1). According to the interviewees, Patas were last seen in 2015 in the northeast (Northern Borehole and Mlima Kofia area). Up to at least July 2014, south Lolldaiga was occasionally visited by 1–2 solitary adult males. Twelve of the 33 interviewees had never seen Patas on Lolldaiga. Most interviewees had been employed on Lolldaiga for <2 years.

When Lolldaiga's Patas population was first surveyed (1979-1981), there were about 36 individuals in two groups (Isbell & Chism 2007; Table 1.). At present, at most, there are 1–2 transient solitary adult males and a group of 3–4 individuals that occasionally come onto the Ranch.

Patas have not been reported for Lolldaiga since 2015, and tens of thousands of camera trapping hours have been accumulated since August 2014 without a single photograph of Patas. Considering their shy behaviour and large home ranges, this does not, however, mean that Lolldaiga no longer supports Patas. It seems likely that one small group of Patas and 1–2 solitary adult male Patas still make occasional use of Lolldaiga, but spend most of their time on south Makurian Group Ranch and/or northwest Ole Naishu Ranch.

So what is causing the decline of Patas on Lolldaiga? The most common opinion among interviewees is that there has been a considerable loss of Whistling Thorn woodland as a result of destruction by elephants...which have continued to increase on the landscape. Whistling Thorn is a key tree species for Patas in Laikipia (see LHRP Newsletter 6). Interviewees also said that the livestock and herders on north Lolldaiga disturb Patas.

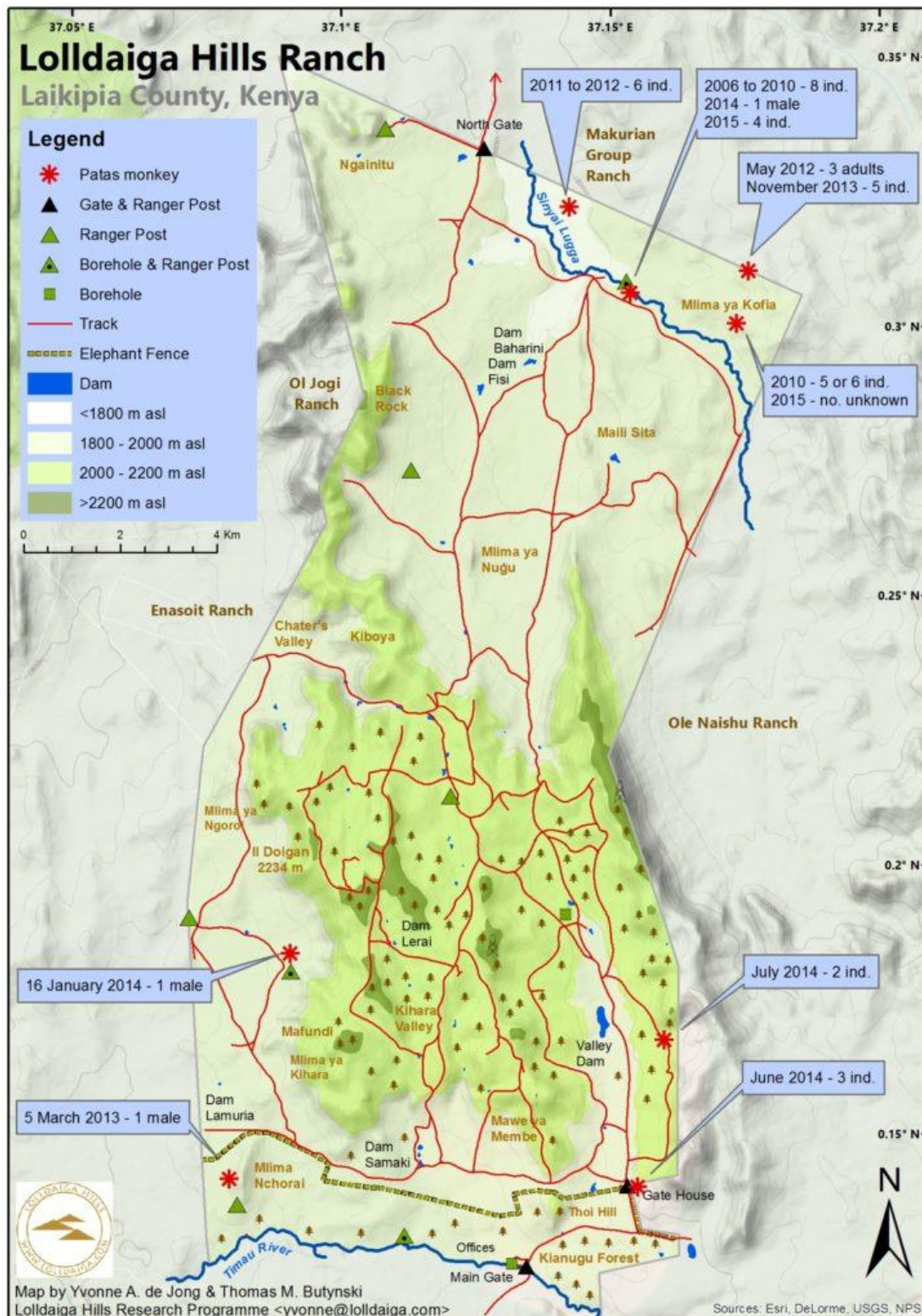
At the Western Borehole, rangers thought that leopard numbers had increased and that this species was affecting the Patas population. According to interviewees, availability of water on Lolldaiga has remained unchanged and is not the cause of the decline in Patas numbers.



Eastern Patas Monkey *Erythrocebus patas pyrrhonotus* along the Ole Naishu Ranch – Borana Ranch border.

Table 1. Changes in the population of Patas Monkey on Lolldaiga Hills Ranch, Laikipia, central Kenya

Survey period	1979–1981 Isbell & Chism (2007)	1992–2004 Isbell & Chism (2007)	2010–2015 De Jong, Butynski & Mathiu (2017)	2016–2017 De Jong, Butynski & Mathiu (2017)
Number of groups and individuals	2 groups (17 & 19 individuals)	1–2 groups (total 50 individuals)	Group of <8 individuals using Lolldaiga Hills Ranch, Makurian Group Ranch, and Ole Naishu Ranch. Group of 3 individuals using Lolldaiga Hills Ranch and, most likely, Ole Naishu Ranch. 1–2 solitary adult males.	No records. Probably, occasionally, a group of 3–4 individuals and 1–2 solitary adult males.



Results of the April 2017 survey of the Eastern Patas Monkey *Erythrocebus patas pyrrhonotus* on Lolldaiga Hills Ranch, Laikipia County, central Kenya.

Similar Patas surveys of staff on neighbouring properties, particularly Ole Naishu Ranch and Makurian Group Ranch, are expected to provide additional information on Patas in this region, particularly the size and location of the home range of the 'Mlima Kofia' Patas Group.

We thank Paul Benson, Per Aronsson, and all Lolldaiga staff who helped during this survey.

Appendix 4

Butynski, T. M. & De Jong, Y. A. 2016. *Newsletter of the Lolldaiga Hills Research Programme*, November 2016. Website: <www.lolldaiga.com>

Two Additions to the Laikipia Mammal List; Desert Warthog *Phacochoerus aethiopicus* and Kirk's Dik-dik *Madoqua kirkii*

Laikipia County, ca. 9,700 km², probably holds the highest diversity of larger mammal species of any region of its size in the world. Most of Laikipia County is covered by the Laikipia Plateau (ca. 1,600–2,400 m asl), an area composed of a mix of flat ground, undulating plains, rolling hills, steep hills, and scattered granitic inselbergs (or 'kopjes'). There are several small perennial rivers—the largest being the Ewaso N'gyiro—and many seasonally dry stream channels and gullies, some of considerable size. Within Laikipia County (hereafter referred to as 'Laikipia') there is considerable variation in geography, altitude, rainfall, soil, flora, fauna, human population density, and land use.



Rolling hills and grassland of Lolldaiga Hills Ranch, eastern Laikipia County. Photograph by Paul Benson.

We (YDJ and TMB) are currently undertaking a primate survey in eastern Laikipia, with a focus on the patas monkey *Erythrocebus patas*. Beyond the primates, there are several other species groups that we gather 'opportunistic' taxonomic, abundance, distribution, and conservation data for during these surveys. Two of these are the warthogs *Phacochoerus* spp. and the dik-diks *Madoqua* spp.

During November 2016, we conducted surveys in northeast Laikipia, below the Laikipia Plateau (<1,600 m asl). Two large mammals, not yet listed for Laikipia County (Laikipia Wildlife Forum. 2011. *Laikipia – A Natural History Guide*) were encountered on Lekurruki Conservancy and Il'Ngwesi Conservancy; the desert warthog *Phacochoerus aethiopicus* and Kirk's dik-dik *Madoqua kirkii*.

Desert warthog *Phacochoerus aethiopicus*

The desert warthog, one of the two species of warthog, occurs only in Ethiopia, Kenya and Somalia. Relative to the common warthog *Phacochoerus africanus*, the distribution, abundance, ecology, behavior, and conservation status of the desert warthog remain poorly known. In fact, this probably Africa's least known non-forest large mammal. A better understanding of the natural history of the

desert warthog is not only of considerable scientific interest, it is important to the development of effective conservation and management plans for this species.

Over the past 10 years, we have collected data from warthog sightings made during our primate surveys, as well as during warthog surveys in central north and northwest Kenya during 2012-2013 (see: wildsolutions.nl). With over 400 warthog records in our locality database (WarthogBase, a joint project with Jean-Pierre d'Huart), we estimate the species' geographic range to be *ca.* 330,000 km². Desert warthog and common warthog are sympatric in at least five areas (two in north Somalia, one in central Kenya, one in southeast Kenya, and one on Kenya's north coast). Total known area of sympatry is *ca.* 20,500 km².



Adult male desert warthog *Phacochoerus aethiopicus*, Lekurruki Conservancy, Laikipia.



During the November 2016 survey, we found both species of warthog on Lekurruki Conservancy. One sounder of eight desert warthog (three adult females and five piglets) was seen several times near Tassia Lodge. Four solitary adult males were seen elsewhere on Lekurruki Conservancy. One common warthog sounder (one adult female and three piglets) and one solitary adult male were also encountered on Lekurruki Conservancy.

Adult male common warthog *Phacochoerus africanus*, Lekurruki Conservancy, Laikipia.

During one afternoon on Il'Ngwesi Conservancy, we encountered one sounder of two adult female desert warthog and a sounder of two adult females with three piglets. Although only desert warthogs were encountered during our brief survey on Il'Ngwesi Conservancy, it is almost certain that common warthog are also present.

Common warthogs occupy an altitude range of 0-3,500 m asl. Desert warthog, on-the-other-hand, are not known above 1,690 m asl. Most of Laikipia is >1,600 m asl. As such, the desert warthog is expected to be confined to the lower ground of northeast Laikipia and absent from the Plateau.

How to distinguish the two warthog species in the field



Adult male desert warthog

- Ear tips bent backwards in all ages of both sexes.
- Adult male with a hook-shaped wart under each eye.
- Hind quarters relatively slender in adults.



Adult male common warthog

- Ear tips erect in all ages of both sexes.
- Adult male with a cone-shaped wart under each eye.
- Hind quarters relatively well-muscled in adults

Kirk's dik-dik *Madoqua kirkii*



Dik-dik's *Madoqua* spp. are a group of mini-antelopes with a complex and much debated taxonomy. The latest classification recognises four species, three of which occur in Kenya; Kirk's *M. kirkii*, Günther's *M. guentheri*, and Salt's *M. saltiana*. Günther's is the only dik-dik on the Laikipia Plateau (see Newsletter issue 6, October 2016). Günther's is often confused with Kirk's and, therefore, frequently misidentified. As far as we are aware, there are no valid records of Kirk's for the Laikipia Plateau.

Adult female Kirk's dik-dik *Madoqua kirkii*, Lekurruki Conservancy, Laikipia.

Kirk's dik-dik is patchily distributed in south Somalia, Kenya, extreme central east Uganda, and north and central Tanzania. Günther's dik-dik occurs in central and north Kenya, Somalia, northeast Uganda, south South Sudan, and south and southeast Ethiopia. Kirk's and Günther's are sympatric at some sites in Kenya. In Kenya, Salt's dik-dik occurs only in the extreme northeast.

Wet adult male Kirk's dik-dik, Lekurruki Conservancy, Laikipia.



During our November 2016 survey in northeast Laikipia we found both Kirk's dik-dik and Günther's dik-dik near Tassia Lodge, Lekurruki Conservancy. Kirk's were also encountered on Il N'gwesi Conservancy. We strongly suspect that Günther's is also present here. It appears that, in general, Kirk's occupies the lower, flatter ground while Günther's occupies the more rugged, higher ground of both Conservancies.



Adult male Günther's dik-dik, Lekurruki Conservancy, Laikipia.

We thank Isaiah Torongos, Martin Wheeler, Charlie Wheeler, and staff of Tassia Lodge, staff of Il'Ngwesi Lodge, and the rangers of Lekurruki Conservancy and Il'Ngwesi Conservancy for their kind hospitality and for information on warthogs and dik-diks.



Dik-diks are selective browsers, foraging on the freshest available leaves, flowers, and shoots of forbs and shrubs, as well as on fruits. Shown here is an adult male Günther's dik-dik browsing while standing on his hind legs at Sasaab Lodge, West Gate Community Conservancy, Samburu County. Kirk's dik-dik and Günther's dik-dik both occur at this site.

How to distinguish the two dik-dik species of Laikipia in the field



Kirk's dik-dik

- Grizzled-grey forehead blends into tan muzzle.
- Complete, wide, white eye-rings.
- Relatively short tan muzzle.



Günther's dik-dik

- Grizzled-grey forehead sharply demarcated from dark russet muzzle.
- Narrow white eye-rings.
- Relatively long, dark russet, mobile, muzzle (proboscis).