Fall 2010

Stop Pummeling My Primates: Effects of Land Use Change on Behaviors of Papio Anubis Near Lake Manyara National Park in Mto wa Mbu, Tanzania

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Acknowledgements:

To start this off without mentioning the five ridiculous girls I had the pleasure of spending three weeks with in Mto wa Mbu would seem wrong. So, to Chelsea, Rachel, Kelsey, Audrey and Karri: thank you for the nights of rice and vegetable cooking, for the bizarre conversations over Safari and Redds, and for the constant supply of laughter and good-natured insults.

To Twiga campsite, thank you for the mid-day breaks of swimming to recharge. To the staff, thank you for happily putting up with six American girls and our absurd pool games.

To the street mamas of Mto wa Mbu, thank you for your delicious wali na maharage na chapati and for not over charging us. Bafana Bafana, I'll remember you fondly.

To my wonderful baboons, thank you for leaving the park everyday, risking speeding cars and flying rocks. Thank you for constantly being adorable, for visiting all three habitats and for always keeping me on my toes. To Stubbs, you terrified me but you were sweet with the little ones. Keep them safe.

Finally, to Adam, to the handsome baboon on two legs, thank you for being amazing. For keeping up with the troop on two feet, for nearly bringing me to tears every time you popped out of the brush looking precious. You will be thought of warmly and often.

Abstract:

The ever-increasing human population means more land is required for housing and agricultural needs to sustain the growing population. This study involves a group of olive baboons living in and on the boundary of Lake Manyara National Park in Mto wa Mbu, Tanzania. They leave the park everyday and travel to surrounding areas. There are three different habitats near the baboons' exit point of the park, a residential area with houses and some people, an undisturbed area without homes and residents, and an agricultural area, full of farms and the most densely populated area. The object of this study was to determine whether the behaviors of the baboons were influenced or changed by the different habitats. 389 total scans of the males, females and young were conducted over a three-week period, observing and recording their feeding, moving, resting, vigilant, grooming and playing behaviors. The results demonstrated that the baboon's behaviors are dependent on the habitats they are in (p values 2.34707E-06, 7.43812E-09, 0.000115921). The study also showed that the baboons spend very little time in the agricultural habitat where the most people are (8.7%, 34/389 scans). The influx of humans and farms has affected the baboons and their actions. If the population continues to increase and development continues to expand, the baboons' behaviors will likely continue to be affected.

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Introduction:

The creation of national parks in Africa does not mean fences in all cases. South Africa fences their parks in an effort to control human and wildlife interactions. Though not impossible, the fences restrict the ability for the animals to leave the park boundaries. In contrast, Tanzania's parks are not fenced, thus the possibility of human and wildlife interaction is more likely. With rising human populations in many areas, the chance of these interactions being interactions of conflict dramatically increases. Higher population numbers require more land use to sustain that population growth. More farms are cultivated and more homes are built, ever decreasing the habitats of wildlife. Animals are required to adapt to the changing environment or remain completely within the protected park areas. Some species may be able to adapt to these more densely populated areas, but with adaptation comes conflict. Animals travel into neighboring farms and settled areas, raiding crops and disrupting cultivation. Those that frequently interact near humans can either become habituated to their presence, thus less nervous, or they can be much more skittish, as they have learned to fear humans a great deal more. Though many animals remain almost exclusively in the parks, some species venture out to developed locations. Olive baboons in Lake Manyara National Park are an example of one such species that does leave the park to enter the surrounding town of Mto wa Mbu. Though this can and does cause problems, the implementation of fences could have consequences much more extreme. Some corridors have already been affected by land development; fences would completely restrict the movement of the animals, limiting their migrations and food sources.

Savannah baboons are incredibly successful as terrestrial creatures, able to adapt to just about any climate from "semiarid bush to tropical forest, and from sea level to the slopes of high mountains" (Moss 1982). Olive baboons, or *papio anubis*, are one of four subspecies of savannah baboons found in Kenya, Uganda, Ethiopia, and Tanzania (Estes 1991). They are generally light to dark brown with a brindle pattern, weighing up to 50kg. Full grown, male baboons have razor sharp canines measuring 5cm in length (Estes 1991). Troops are non-territorial, multi-male

groups ranging from 8 to 200 individuals, with the average troop consisting of 30 to 40 members. Baboons are incredibly social and have a number of calls ranging in tone and meaning. Different calls are used to express fear, dominance, play and submission. Calls vary from high-pitched screeching to low, soft crying.

Females remain with their birth group while males disperse at about four years old when they experience a growth spurt and develop the strength to overpower females. Hierarchy within troops is somewhat established at birth, though it can change with age and time. The highest-ranking female will give birth to high-ranking offspring. But when that female gives birth again, the new infant will become higher ranked than the older offspring. This system is known as reverse birth order hierarchy (Strum 1987). A lower ranked adult female baboon is submissive to an infant or juvenile baboon whose mother is higher ranked than she.

According to Richard Estes, author of "The Safari Companion," Lake Manyara National Park probably has the highest concentration of baboons of any park in Africa (1993), making it an excellent study site. David Maige, park warden of Lake Manyara National Park and employee of TANAPA for the last twenty years, said the 2002 census found the baboon population to be at least 15,000 individuals strong (Pers. comm. 2010). The large population means that some troops in the park reach the top number of 200 members. Due to the large population, troops can be difficult to distinguish from one another, as they are constantly overlapping. Troops are clustered around well stocked foraging sites and roosting trees. Such close quartered living is possible because of the non-territorial aspect of baboon societies. The high number of troops and individuals mean some must search for food in other areas besides the park.

Olive baboons leave the park everyday and venture into one of the three habitats surrounding the park. They move either towards an escarpment area, a residential area, or to farmlands. Although the escarpment area is uninhabited, during data collection the herding of cattle, goats and sheep was observed. The farming land has the highest density of people, both living in the area and working on the agricultural lands. While there are quite a few houses in the residential area, they are farther apart and set in a wooded area, putting it in the middle of the three

environments in regards to level of human occupancy. The baboons leaving the park are generally in small feeding groups numbering seven to twenty individuals, although groups as large as sixty have been witnessed crossing the road together. With the large population of baboons, the troops are frequently interacting, clustered and cramped in foraging for food. In their search for food, these groups repeatedly travel into yards and farms, rummaging along the way without the restriction of fences.

Baboons are opportunistic omnivores; they will eat anything they can find, including: flowers, fruits, seeds, leaves, bark, roots, mushrooms, insects, occasionally rodents, hares and other small - usually infant - ruminants (Melnick and Pearl 1986). It should be no surprise that with the baboons' wide-ranging diet the crops of farms neighboring Lake Manyara National Park are attractive foraging sites. Since more farms have sprouted, the abundance of tempting food has risen, luring the baboons into human populated areas. This climb in the number of farms and number of people means the chance of a baboon encountering a person outside the park is higher. Troops in and around Lake Manyara National Park are littered with injuries that are consequences of run-ins with people. There are limping, scarred baboons, baboons missing chunks of flesh, and baboons completely without some appendages. To scare off baboons near farms people use slingshots, spears, rocks, and guns (David Maige, pers. comm. 2010). It is quite possible that from these frequent interactions between humans and baboons, behavior changes among the baboons are occurring. To determine whether this is the case my study questioned became: *How does land use change affect the behaviors of Olive baboons in three different environments in the areas outside of Lake Manyara National Park*? Since baboons have quite a few behaviors, I chose to narrow down my study to six behaviors that I believed would be most affected by land use change. Those behaviors were feeding, resting moving, vigilance, grooming and playing.

Before conducting my study, I hypothesized that the baboons would display higher numbers of vigilant behavior in the more populated areas. I thought that due to the increased human population, baboons would be wearier during their travels into those habitats. I also believed the baboons would feed more in the agricultural

habitat as compared to the other two habitats, since that is where the large number of banana farms are. I hypothesized that the behaviors of the individuals and the groups as wholes would vary depending on the habitat they were in. If there were more people around, the baboons would surely have to alter their behaviors. In Molly Mayes' ISP "Monkey Talk: Frequency of vocal communication based on activity and location" done in 2002, her results demonstrated a rise in vocalizations in the areas with frequent human disturbance. This supported my hypothesis that behavior would change based on habitat. Though I was not recording vocalizations, the change she observed among different habitats surely meant I would, too.

Study site:

My study site was the area of Mto wa Mbu, Tanzania, a town 110km west of Arusha. The entrance to Lake Manyara National Park sits on the eastern edge of town and acts as one of the exit points for the troops of Olive baboons in the park. The park is 330km□, with 230km□ of that taken up by the lake itself (Lyogello 1998). This leaves the baboon troops only 100km□ in which to roam and forage. The various uses of land made this location an ideal place to study the behaviors of baboons in accordance to the land use change. The human population of Mto wa Mbu has increased a great deal over the last few years, mainly as a result of tourism, resulting in the need for more housing and agricultural land to house and feed that growing population. Mto wa Mbu has 1,1117 hectares of viable farmland, half of the total area of the town (CTP 2010). This includes farms of banana, rice, maize, and many other fruits and vegetables. The crops are sold both in town and in surrounding areas.

With half of the total area used for farming, conflict between humans and baboons is inevitable. Due to the interaction between the two, behavioral differences were sure to be observed depending upon the land use. My study site allowed me to observe the baboons in three different habitats. To the west of the park entrance is an escarpment, an undisturbed area void of human settlement and farms. The terrain is steep and unfriendly as farmland. There are a few scattered trees but the land is mostly covered with small shrubs and loose rocks. Traveling west from Mto wa Mbu on the paved road, the escarpment is on the right. Directly across from the park entrance sits the park headquarters and other buildings - some connected with the park and some not. A dirt road leads up to the residential area, passing underneath trees filled with nesting storks and pelicans. There are a large number of trees, many of which are fig trees. Patches of these large trees provide resting spots and foraging sites for the different groups of baboons. During the day there are people walking around the area, mostly staff connected with Lake Manyara National Park. This is the residential habitat, as there are no farms and a

large number of homes. It is more populated than the escarpment but less than the habitat to the east. To the east of the park entrance, towards town, are agricultural land areas, filled with banana trees and other crops. There are a few dukas and restaurants located throughout the area. During daylight, there are always people out working on the farms, whether it be plowing, planting or harvesting crops. Livestock herds of cattle and goats are walked through this area quite often on their way to lands past the escarpment. Dogs are also a common sight in this habitat, as the abundance of people and their trash create attractive food scavenging sights for them.

With three habitats so clearly defined, I was able to distinguish which area the group I was observing was utilizing at any time. The paved road allowed for easy access to each habitat and lessened the time to walk between the three areas when trying to maintain a visual of the baboon group. With such a large population of baboons living in Lake Manyara National Park, the competition for foraging areas is high, leading to the need for some groups to disperse from the park during the day in search of food. Mto wa Mbu was a perfect place to study behavior changes according to land use change as there are three different environments right next to each other and the baboons leave the park everyday without fail.

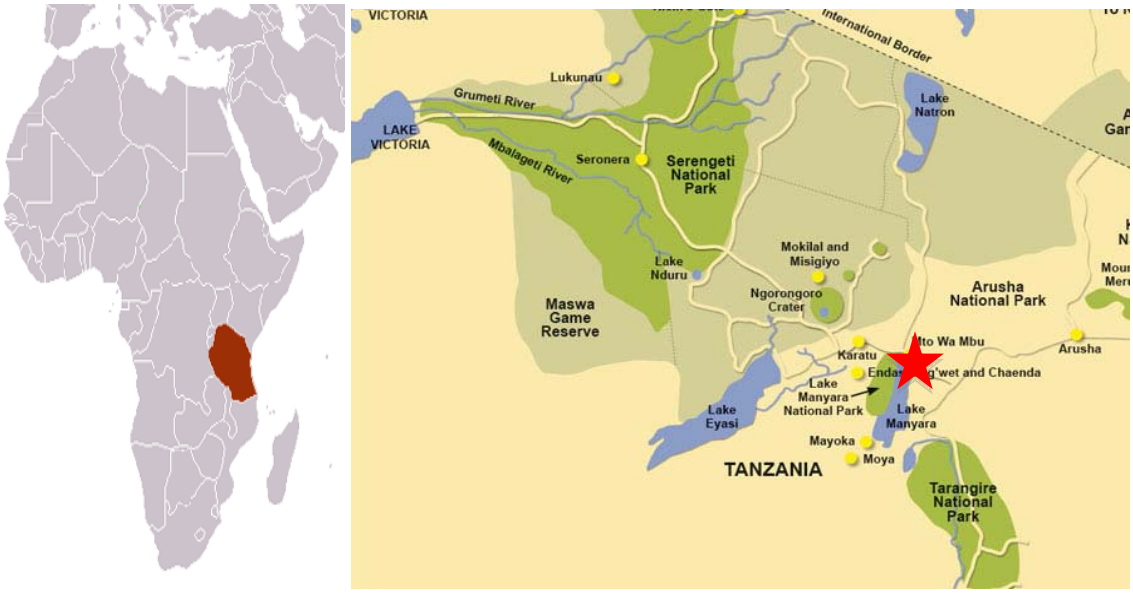

Figure 1. Tanzania is located on the eastern coast of Africa, below Kenya.
Figure 2. Study site of Mto wa Mbu is located in north central Tanzania

Methods:

My sample frame was the population of Olive baboons in Mto wa Mbu. Specifically, my sample population was the first group I encountered each day leaving the park and dispersing into the surrounding areas. With my sample population being as such, I did not follow the same sub-group everyday. To counteract this non-random selection method, I kept my observation hours constant. I observed for three hours in the morning, from 0700-1000, and three hours in the afternoon, from 1400-1700. These hours remained the same regardless of whether or not I was able to find the same group during the two time periods. My intention was to gain an understanding of the behavior of LMNP baboons as a whole, so observing different sub-groups was beneficial to the goal of my study. I chose these time periods based on preliminary data during my preparation days: these were the times the baboons were most observable. The weather was also more hospitable during these hours; troops seemed to retreat back into the park during the middle of the day when the short rains were frequent.

I conducted one scan of each set every ten minutes to record activities. The first scan was of the adult males in the group, the second was of the adult females, and the third was of both male and female juveniles and infants, as sexing individuals at that age is difficult. During prep week, the groups I observed were all small enough to warrant these three different scans of every individual. Each scan lasted the length of time it took me to record each individuals actions. Ten-minute intervals gave me enough time to record the activities for each set. At the start of each scan I recorded which habitat the troop was in (undisturbed, residential or agricultural) for later comparison and analysis of the differences in behavior between each habitat. During the time I was not conducting a scan I recorded any instance of abnormal behavior such as human/baboon interaction, altercations with vehicles, copulation, or aggressive behaviors and categorized this information as meta data. The activities I recorded during my scans were: feeding, grooming, resting, vigilance, moving, and playing. I categorized feeding both as foraging for food and actual chewing. Grooming was one individual using its hands and/or

mouth to comb through another's hair. Self–grooming was also counted. Resting was sitting or lying down; the individual could be awake or asleep. Vigilance was any instance of alertness or alarm call. To distinguish vigilance from resting, any individual who was standing, but not moving, was considered vigilant. Moving was walking, running, or swinging in trees, but not playing, as playing had its own category. To differentiate playing from moving, the individuals had to be making "play faces" in which their mouths are opened in a non-aggressive manner, with eyebrows raised and ears back. The play may or may not have been accompanied by chattering, grunting, or occasional screams.

The direction of the scan was switched each time, alternating between moving from left to right and right to left to rule it out as a bias. Scans were conducted only on the individuals that could be seen at that time. Trees, shrubs, buildings, and other baboons blocked visuals during some scans. This meant that the number of individuals in each scan was not always constant. This potential bias was unavoidable since foliage and other obstacles could not be moved to maintain visuals.

Because the groups I followed moved a great deal, whenever they left an area I followed. The only exception was when the group retreated back into the park, as I could not follow them there. Once the group went into the park, I waited ten minutes, until the next scan to see if they would come back out. If after ten minutes they had not returned to a visible place, I went in search of another group. If at any other location I found myself unable to see enough of the group, or at least one individual in each category (males, females, young) I also waited ten minutes to see if that would change, and if it did not, I left to find another group.

To gather more information on the baboons of Lake Manyara National Park, as well as the villagers and parks' feelings towards the baboons, I conducted a one hour long semi-structured interview with David Maige, park warden and TANAPA employee. Questions about the baboon populations, troop sizes, foraging behaviors, and peoples' perceptions of the baboons were asked.

Results:

The total number of scans conducted was 389, collected between November 6, 2010 and November 23, 2010. 189 scans (48.6%) were recorded in the residential habitat, 166 scans (42.7%) in the undisturbed habitat and 34 scans (8.7%) in the agricultural habitat. Figure 3 shows that the majority of the baboons' time I observed was spent in the residential and undisturbed areas.

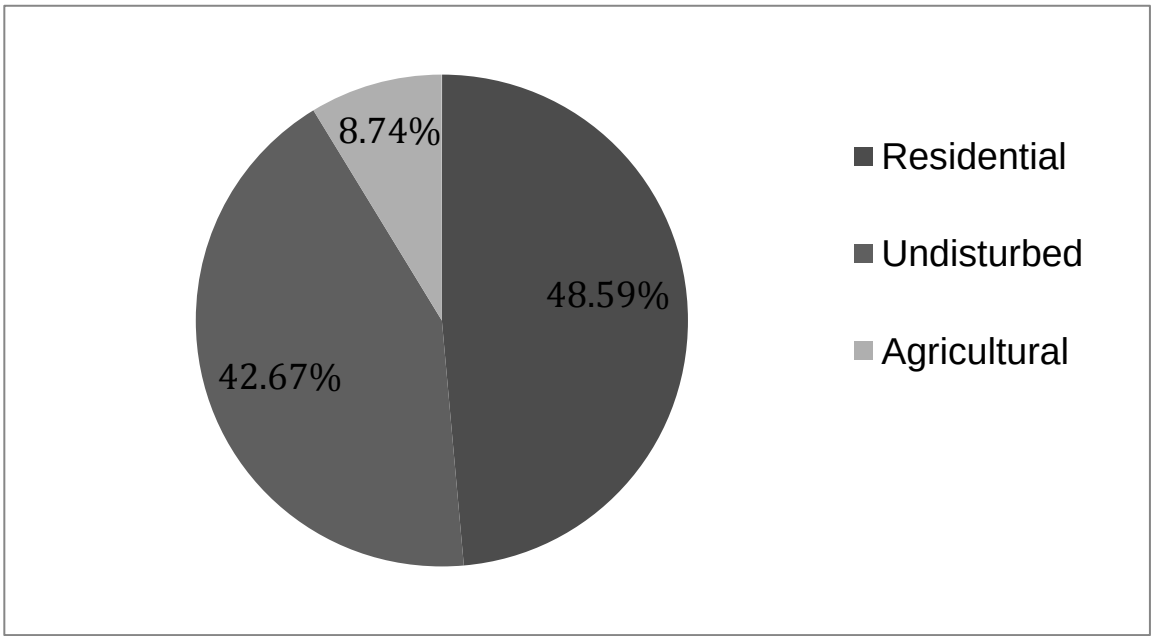

Figure 3. Percentage of scans collected in each habitat.
Note: data was collected in Mto wa Mbu, Tanzania in November 2010 with scans (n=389). The results of the number of scans in each habitat are presented in percentages (%).

As Figures 4a, 4b, and 4c show, in the residential habitat the behaviors most recorded were moving, resting and feeding, with males having the highest percentage of resting instances. The young had the highest percentage of scans in which they were moving, while the females had the highest percentage of recorded feeding. Vigilance was the least recorded behavior during scans in all three groupings. Play was observed in the young, while neither the males or the females were seen playing during the scans. Grooming was observed in males and females but not among the young. The males were the only grouping in which all six

behaviors were observed and recorded in the residential habitat. Both the females and the young were only observed partaking in five of the included behaviors.

Figures 4a, 4b, and 4c. Behaviors of each grouping in residential habitat.

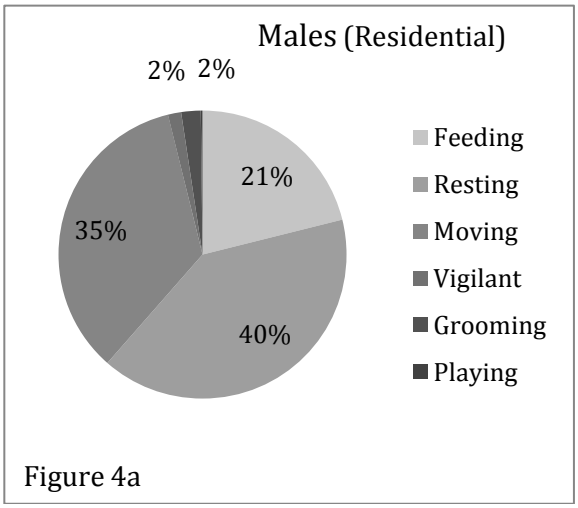

Figure 4a

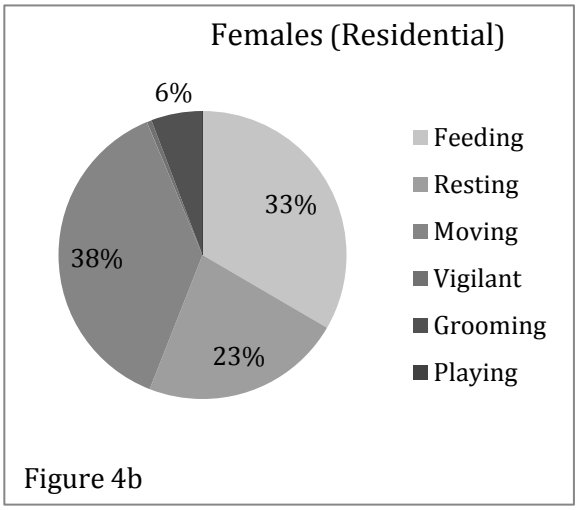

Figure 4b

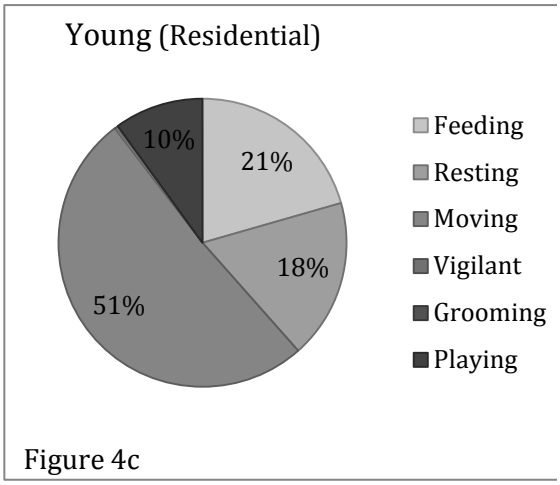

Figure 4c

Note: Data was collected in Mto wa Mbu, Tanzania in November 2010. Data is presented by behavior percents (%) for each sample set (males, females, young). Total number of scans: 189.

Figures 5a, 5b, and 5c show that of the 166 scans recorded in the undisturbed habitat, feeding, resting and moving were the most observed behaviors by all three groupings. Vigilance was observed in males and females while grooming was observed in females only. Playing instances were observed in both the males and young's groupings, though it was a very small percentage in the males. The behavior recorded the most in all three groupings was moving, while feeding was the second most recorded behavior. In both the residential and undisturbed habitats, scans were able to be collected in long durations. There were a few instances in which

only two or three scans were recorded in the habitat before the group went out of site but generally five to fifteen scans were collected in a row in the two areas.

Figures 5a, 5b, and 5c. Behaviors of groupings in undisturbed habitat

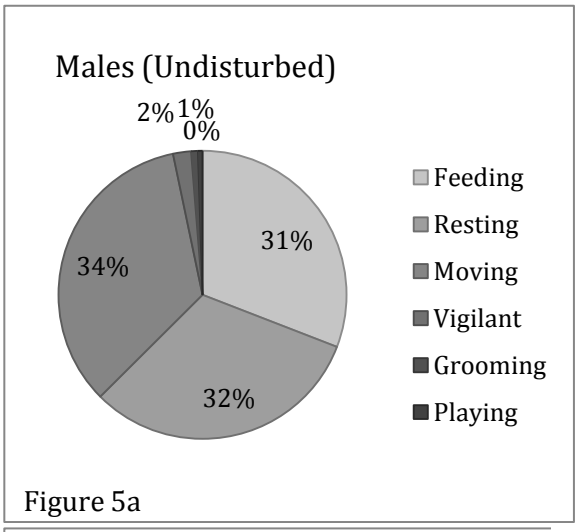

Figure 5a

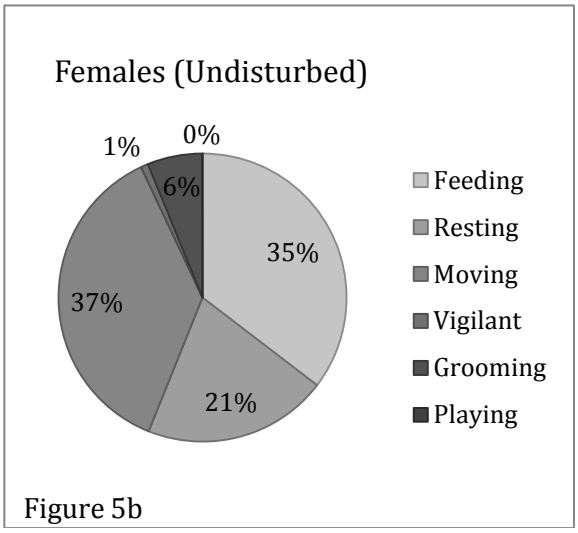

Figure 5b

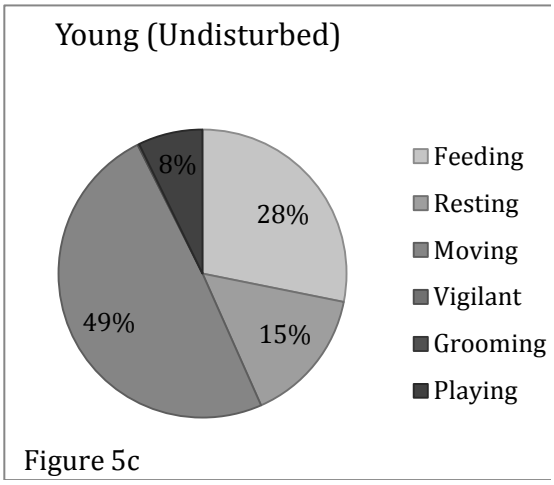

Figure 5c

Note: Data was collected in Mto wa Mbu, Tanzania in November 2010. Data is presented by behavior percents (%) for each sample set (males, females, young). Total number of scans: 166.

In the agricultural habitat, the young were the group that moved the most, and feeding was their second most recorded behavior. Both the female's and male's frequencies of feeding and moving observed were very similar in numbers. Grooming was a recorded behavior in females only while the young were the only group that had instances of play within the agricultural environment. Males had the least number of recorded behaviors and the most instances of vigilant behavior, though the females followed close behind.

The agricultural habitat was the only area with somewhat substantial percentages of vigilant behaviors in all three groupings. In 10% (3.4/34) of the scans, males were displaying vigilance in the agricultural habitat, compared to only 2% (3.78/189 and 3.32/166) in both the residential and undisturbed environments (see figures 4a, 5a, 6a).

Figures 6a, 6b, and 6c. Behaviors of groupings in agricultural habitat

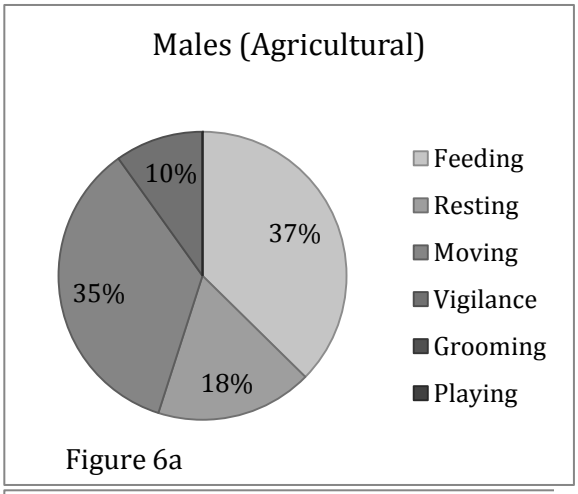

Figure 6a

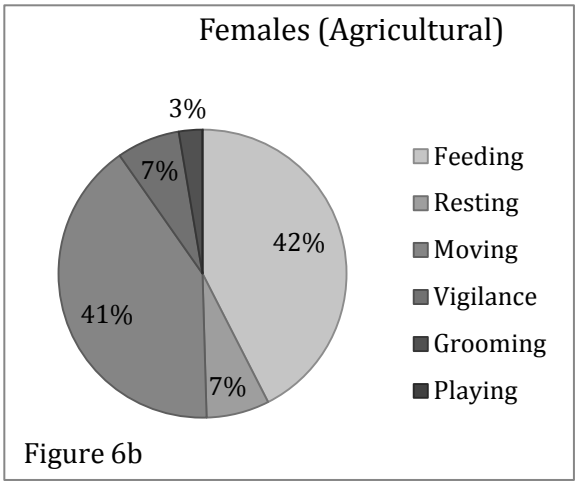

Figure 6b

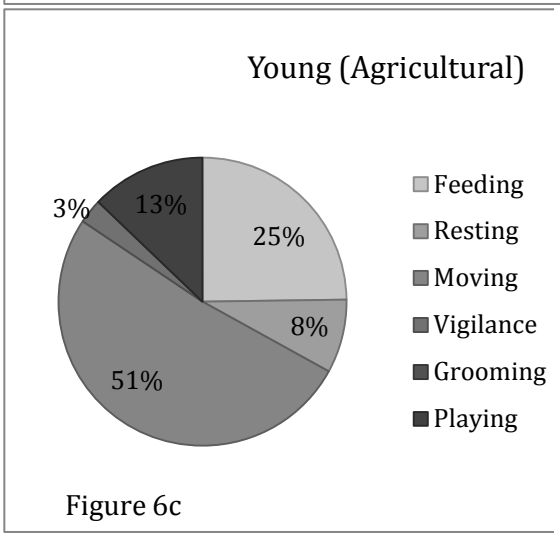

Figure 6c

Note: Data was collected in Mto wa Mbu, Tanzania in November 2010. Data is presented by behavior percents (%) for each sample set (males, females, young). Total number of scans: 34.

Figure 7 provides a visual representation of the total percentages of each recorded behavior within each habitat. The percentages of males, females, and young have been added together to compare them as a whole. The chart shows that the highest total percentage of moving behavior was recorded in the agricultural habitat (42.8%, 134/313), followed by the both the undisturbed and the residential areas, both in which they moved 41% (641/1573 and 815/1968) of the time.

Feeding and resting within the residential habitat were close in numbers while the group members rested less than they fed in the undisturbed habitat. In all three habitats vigilance, grooming and playing were the least recorded behaviors, thus the lowest percentages. Figure 7 shows the percentage of time spent feeding and vigilant was highest in the agricultural habitat.

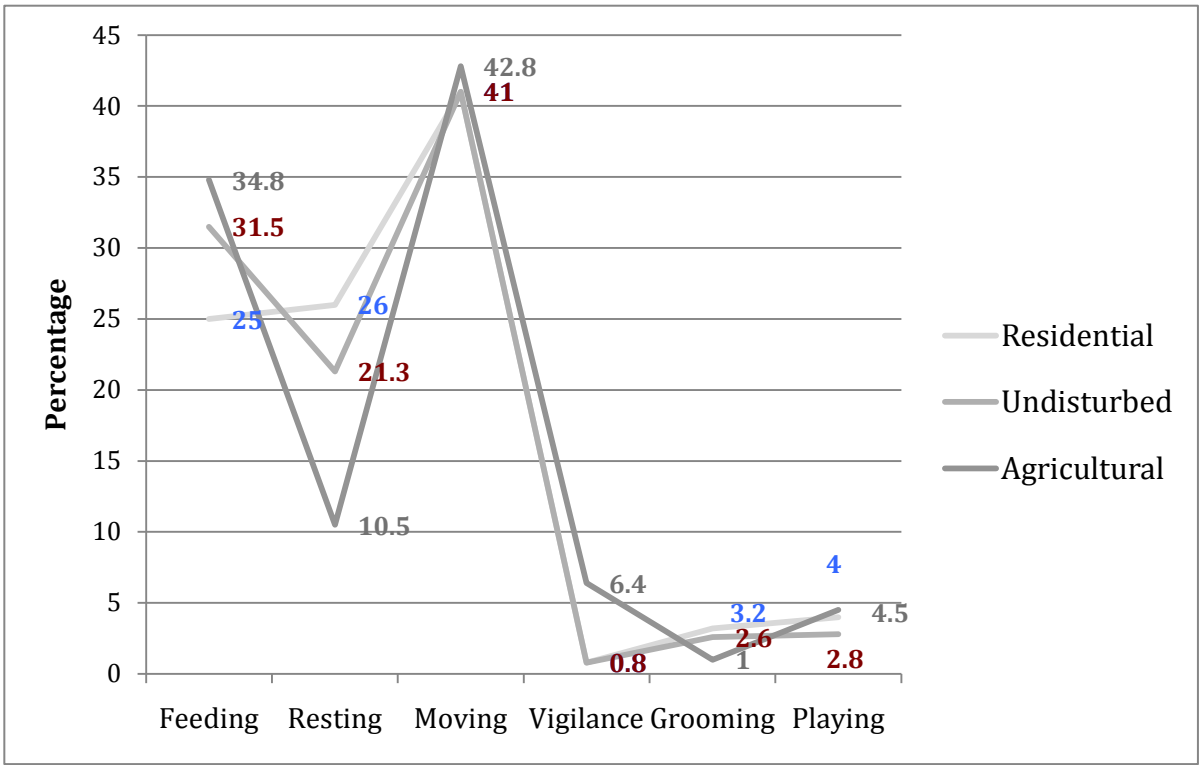

Figure 7. Comparing the percentages of recorded behaviors in each habitat of all three groupings together (males, females and young).

Note: Data was collected in Mto wa Mbu, Tanzania in November 2010. The behaviors of each set (males, females, young) were added together and percentages were calculated using the total number of behaviors observed during all scans in each habitat, residential (n=1968), undisturbed (n=1573), and agricultural (n=313).

To determine whether my results were significant, I calculated the chi-square value. The p value for the males was 2.34707E-06, the female value was 7.43812E-09 (see note at bottom of table) and the value for the young was 0.000115921 (see Table 1). Values less than 0.05 were considered significant, meaning there was a 95% chance that it did not happen randomly. The products showed that all were significant, signifying that behavior is not independent of habitat or, behavior is dependent on habitat. Possible issues with the results include instance of zero behavior in a certain category. These were counted into the equation and could have

affected the outcome. The females had the lowest p value, suggesting that their behavior depended most on the habitat, while the young had the largest number, meaning that behavior was not as affected by habitat (but the value was still less than 0.05). The male's p value was in between the other two groupings, so though they were affected more than the young, they were less affected by habitat than the females.

Chi-square test

Grouping	P Value	Significance
Males	**2.34707E-08**	Very significant
Females	**7.43812E-09**	Very significant
Young	**0.000115921**	Very significant
Overall	**5.67378E-22**	Very significant

Table 1. Results of chi-square

**Play behavior was not observed in females in any of the habitats so it was not included in the χ^2 equation*

Note: Data was collected in Mto wa Mbu, Tanzania in November 2010. Values were considered significant if <.05, meaning there is a 95% chance it did not happen randomly. The results of the chi-square test display the dependence of behavior on habitat.

Discussion:

My hypothesis stated that the behavior of the baboons around Lake Manyara National Park would differ depending on the habitat they were observed in. I thought that the instances of vigilance would be greater in the agricultural area, as the higher number of people would not allow the baboons to roam freely; they would have to constantly be on the look out for angry farmers and flying rocks. I also thought that the baboons would have a higher level of feeding behavior compared to the other five behaviors in the agricultural habitat as there is an abundance of food, including banana trees and trash piles.

Overall, the three behaviors with the highest percentages of totals in all three habitats were feeding, moving and resting. All three groupings, males, females, and young, engaged in these behaviors a great deal more than the other three behaviors (See Figure 7). The young had the highest percentage of playing time, and the females had absolutely no instances of play. From my observations I think this is because the female's role is as a mother, to protect and to discipline. The males were seen playing more, perhaps to gain trust and loyalty from the females who would then find them to be better mates. This role of a "godfather" in baboons is important, as it can create strong bonds between individuals. Moving was the most observed behavior in all three habitats though I think for different reasons. When the baboons were moving in the agricultural habitat it was usually because they were running away from the farms, and the screaming people. In both the undisturbed and the residential areas, moving was usually going from one foraging site to another, or other transitional activities. Also, in the undisturbed and residential areas, the groups observed were much larger, so more individuals were included in the scans. Large groups in the agricultural area would draw far too much attention, so they were generally limited to fewer than five individuals.

One of my original hypotheses, that all three groupings would display a higher level of vigilance in the agricultural area as compared to the other two

habitats is shown to be true according to my results. Looking at figure 7, it shows vigilant behavior to have the highest percentage in the agricultural area. The baboons were observed participating in vigilant behaviors 5.6% more in the agricultural habitat than in the residential and undisturbed areas (both 0.8%, 15/1968 and 13/1573). Breaking it into each grouping shows that males overall had the highest instances of vigilant behavior, as, in my opinion, it is their duty to be responsible for the other members of the group. I think that another reason the vigilance percentage was not as high as previously predicted has to do with feeding. While in the agricultural area, around the farms, the baboons are only focused on eating, and eating as much as fast as they can. My hypothesis that baboons would feed more in the agricultural habitat turned out to be partly true; the percentage was higher (34.8%, 109/313) compared to the total percentages in the residential and undisturbed areas (31.5% and 25%, 504/1968 and 497/1573), though the number of scans in agricultural areas was low. More vigilant behavior may be beneficial to them, but they are concentrating on feeding because their time is limited in that area. To determine whether there is an actual great increase in vigilant behavior, a longer-term study would have to be conducted in which more scans within the agricultural habitat would need to be recorded.

The residential habitat and the undisturbed habitat both had high levels of individuals feeding during scans as well. In the residential habitat I believe this is because of the number of fig trees there, a favorite fruit of the baboons. The baboons were constantly seen picking figs and climbing around the trees. Due to the large sizes of the fig trees in the residential area, a large number of baboons were able to utilize the tree at the same time. Also, since there are homes in this area, there was more trash, which the baboons were seen rooting around, searching for discarded food. At one point I witnessed a man actually feeding the baboons in this area as well.

Though the undisturbed area is mostly void of large trees, there are a great number of rocks that when turned over are home to a variety of insects. The baboons were seen flipping over rocks to get the insects underneath. Also, the undisturbed habitat was closest to the entrance of Lake Manyara National Park,

meaning if the baboons need fast shelter, they could scurry across the road, and settle safely within the park boundaries. The percentage of resting behaviors observed in the undisturbed habitat was less than that in the residential habitat. This surprised me some, as I assumed the less people around would mean the baboons were less weary, and would rest more. During my data collection though I observed that the undisturbed area was not always the least populated area during certain times of the day. Though there are not homes or farms on the escarpment, people would periodically walk through, herding their livestock to places for grazing or water. Children and women were also observed collecting firewood, especially on the weekends near this area. When people did traverse through, the baboons usually ran back into the park since there is not much cover on the escarpment, which may account for the high percentages of moving instances in all three groupings during scans.

The results of my data show the baboons did not travel to the agricultural habitat nearly as much as the residential and undisturbed areas. Figure 3 shows that scans were taken in the agricultural habitat only 8.7% (34/389) of the time. During data collection I observed a great deal of conflict between humans and wildlife, perhaps making the baboons wearier of traveling into areas where the human population is denser. There were times when I witnessed baboons running out of the agricultural area, usually with bananas or other items in their hands or tucked in their cheek pouches and people chasing after them, throwing rocks and yelling. This is why, I believe, the baboons only ventured into agricultural areas such a small percentage of time. Though there was an abundance of bananas and other appetizing foods in the agricultural fields, the watchful eyes of farm owners made prolonged foraging in such areas difficult for groups of hungry baboons.

At first, the number of eyes of people in the habitat to the west made it unclear as to why the baboons were so frequently heading to the residential habitat since there are still people around. But looking at the types of buildings in that area shows why this is the case. There are a number of buildings associated with TANAPA and Lake Manyara National Park, including housing for park officers and other officials. Since these people work with the park, protecting and studying the

wildlife, they may be more forgiving to the foraging troops. Those who work for the park do not need to grow and maintain crops to sell, as their income is generated by their careers with TANAPA and Lake Manyara National Park. The baboons foraging in this habitat were mainly around large fig trees near the LMNP hostel and headquarters. The sizeable quantities of figs, Ficus sycamorous (Dinse 2001), keep the troop fed enough to decrease their need to enter into yards and near homes. Only once in the residential habitat did I witness the baboons being chased out of the yard they were in, as they were stealing directly off the porch area.

In 2001, SIT student Megan Kefauver studied the foraging behavior and home range of the baboons in Mto wa Mbu (Foraging Behavior and Home Range for a Papio anubis Troop, 2001). She found that the troop spent only 10% of their time in areas disturbed or inhabited by humans. Since her study, the population of Mto wa Mbu has increased a great deal, perhaps making it more difficult for the baboons to remain in human populated areas for longer periods of time. The percentage of scans I observed in the agricultural habitat support the theory that increasing populations and structures have affected where the baboons will travel to and for how long they will remain there. It is interesting to note that since Kefauver's study, the road through Mto wa Mbu was paved. This allowed for heavier, faster traffic that can inhibit the baboons from crossing the road. During data collected, I watched cars, daladalas, buses and safari Land Rovers speed up and down the road, narrowly missing baboons crossing the road. There is a sign at the beginning of the park asking drivers to reduce their speeds, but it does little to deter drivers anxious to arrive at their destination.

During the weekends, while school was not in session, there were a good number of children out collecting firewood. Though there were people collecting firewood during the week as well, it was mostly older women who simply walked by the baboons. When the children collected firewood, scaring away the baboons was a favorite activity that accompanied the collection. Many villagers see the baboons only as pests, not as animals to be protected as part of the park. During my interview with park warden David Maige, he spoke of the peoples' dissatisfaction with the baboons. They are considered "vermin" and unwelcome outside of the

park. The constant chasing, and throwing of things at the baboons bear reason to their infrequent trips to agricultural land. Even the dominant, very large males, who could easily over power a grown man, were nervous of the firewood-collecting children. A simple wave of a slingshot or throwing motion would send the group running.

During my last two days of data collection there were certain occurrences that altered my observations. I was only able to get a combined observation time of about three hours in two days. This had never happened during any other data collection day; I never had too much trouble locating the baboons. My second to last day of data collection was November 22nd. In Mto wa Mbu, every month on the 22nd, there is a large market in which fruit and vegetables are sold but more importantly and with more emphasis, animals are auctioned off. On that Monday there were larger than usual groups of cows, goats, and sheep herded down the road in front of the Lake Manyara National Park entrance sign. With the herds were also larger numbers of people, headed to the market. I believe the added people and animals affected the baboon's behaviors a great deal, as they were hardly around! When people are continuously walking through the stretch of road where the baboons usually cross the road, the troops can be frightened off and choose to stay within the park boundaries. On my last day of data collected, November 23rd, I had a very tough time finding any groups to observe. I walked into the residential area, specifically near the LMNP hostel where I had seen the baboons many times. Instead of foraging baboons I found a group of twenty park officers being trained in martial arts. I also saw the officers participating in other exercise activities, going on short distance runs and strength workouts. I ran into David Maige, park warden, during my morning data collection and he mentioned that the officers were not only being trained in martial arts, but in firearms as well. These changes to the daily schedules of the officers did not go unnoticed by the baboons. David Maige said it best, "When things change, the baboons know to stay away."

Limitations and Recommendations:

While conducting my study there were a number of small issues that limited my ability to carry out my data collection to its full potential. I was unable to enter within the park boundaries, prohibiting me from observing the behaviors taking place. In some areas, such as the stretch of land directly behind the park hostel, the brush was too dense so I was not able to follow the group into it. Also, due to the thick vegetation I could not see how close I was to the group and I had no desire to surprise a full-grown male baboon with huge canines. It was important for me to keep somewhat of a distance from the groups not only for safety but also to make sure I was not affecting their behaviors. My last limitation was the intervals between my scans. Though the majority of the time I had exactly ten minutes between scans, there were instances in which I was engaged in conversation with passing people who refused to move on until I told them where I was from, what I was doing and why was I doing it. It was usually the result of curiosity on their part and not wanting to offend, I humored their questions though this meant I had a few scans fifteen minutes apart.

To further learn about behavior differences in changing environments, a study on the level and frequency of aggressive behaviors could be conducted. During my study I witnessed many moments of aggression both within troops and between troops but since aggression was not one of my behavioral categories, the instances were not recorded. It would be interesting to see whether the presence or absence of humans had an affect on the intensity or frequency of aggressive behaviors.

Another interesting study would be a follow up of my same study in a few years. Has the human population continued to increase, thus affecting baboon behavior even more? Has TANAPA been able to extend the park boundaries,

allowing more area for the baboons to roam? Also, according to park warden David Maige, there are plans to build another lodge on the escarpment, a frequent visiting place for the baboons. Once the lodge is built, a study on its effects on the baboons would be beneficial. Though I did not observe the baboons on the escarpment a great deal, they did go there. Blocking off that area with a large hotel and more tourists would surely affect the troops. It would be interesting to see whether the escarpment becomes a more popular place of the baboon because of more people. Another hotel means more food, trash and waste created by people. These things attract baboons, almost guaranteeing an increase in humans/wildlife conflict and a change in the baboons' behaviors.

Conclusion:

The objective of this study was to determine whether or not different habitats, varying in human population numbers and development levels, affect six behaviors seen in baboons of Lake Manyara National Park. The baboons were observed in a residential habitat, an undisturbed area and in agricultural land, taking note of their feeding, resting, moving, vigilance, grooming and resting behaviors. The data shows that the baboons spent only a small number of scans in the area most inhabited by humans, displaying higher levels of vigilance around them. The behavior of the baboons is not independent of habitat; different environments will affect their actions.

Human populations are without a doubt increasing. This trend is especially seen in tourist towns like Mto wa Mbu, entry points for popular national parks. Learning that behaviors of baboons change in areas where there are higher numbers of people shows what may continue to happen in the coming years with population increases. As more land is needed to support the growing numbers of people, foraging and resting lands for baboons and other wildlife species will decrease, creating more conflict between humans and their animal counterparts. Without fences to restrict the interaction between humans and wild animals, and with more land needed to provide the necessities for the growing communities, clashes will continue and hostilities will rise. Without compromise and creative solutions on the part of the people, tension will only build, further jeopardizing the natural behaviors of animals and forcing them to adapt to unnatural environments.

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