4. Long Term Changes at Toro-Semliki Wildlife Reserve

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Uganda Kob; Toro-Semliki Wildlife Reserve was created for this species

Introduction

Gazetted as the Toro Game Reserve in 1929 by General Notice 546 and since that time renamed and consolidated several times, this 548 km^2 conservation area (Figure 4.1) is now called Toro-Semliki Wildlife Reserve (hereafter TSWR). The Toro Game Preserve was originally gazetted to protect the large population of Uganda kob (Lamprey and Michelmore, 1996). TSWR is located northwest of Fort Portal, north of the Ruwenzori Mountains, and south of Lake Albert, within the western Great Rift Valley, (0^o 50' to 1^o 05'N, 30^o 20' to 30^o 35'E). The TSWR is made up principally of the relatively flat rift floor, but its eastern boundary runs along the top of the rift escarpment, thus including the eastern escarpment in the reserve (Fig. 4.1). Mean elevation of the reserve is 1200m, ranging from a low of 900m in the grassland to a high of 1900m on the escarpment. *Borassus* palm and *Combretum* grassland make up most of the reserve; *Hyparrhenia spp*. and *Themeda spp.* are the dominant grasses. Other grassland woody species include *Acacia, Albizia*, and *Bauhonia* (Verner & Jenik 1984, Allan *et al*. 1996, Hunt and McGrew, 2002).

The principal rivers in the reserve, the Wasa and Mugiri, and their numerous tributaries support gallery forests of *Celtis spp*. and *Cynometra alexandri* (Figure 4.1, Allan *et al*. 1996, pers. obs. K.D. Hunt, Hunt and McGrew, 2002), in which *Phoenix reclinata*, *Beilschmiedia ugandensis, Polyscias fulva*, and *Cola gigantea* are also common, among others (K.D. Hunt unpublished data). Both rivers support flora grading from woodland to 30-50m tall gallery forests in 50-250m wide strips flanking the river, (Allan *et al*. 1996, Hunt unpublished data, Hunt and McGrew, 2002).

Semliki Chimpanzee Project

There may be as many as four communities of chimpanzee in the reserve. The Nyabaroga community ranges in the far southwest of the reserve and some distance outside the reserve as well. A second occupies the gallery forest of the Muzizi River in the northeast of the reserve. Illegal logging has degraded the Muzizi forest, and the community may not persist there for long, if indeed it is still viable. A third community may occupy the middle third of the Wasa, if this community is independent of the study group. The study community is mostly confined to riverine forest along the banks of the Mugiri River and its tributaries, from the top to the base of the eastern escarpment. Thus, the Mugiri community range covers nearly the entire elevation range of the reserve (Figure 4.1).

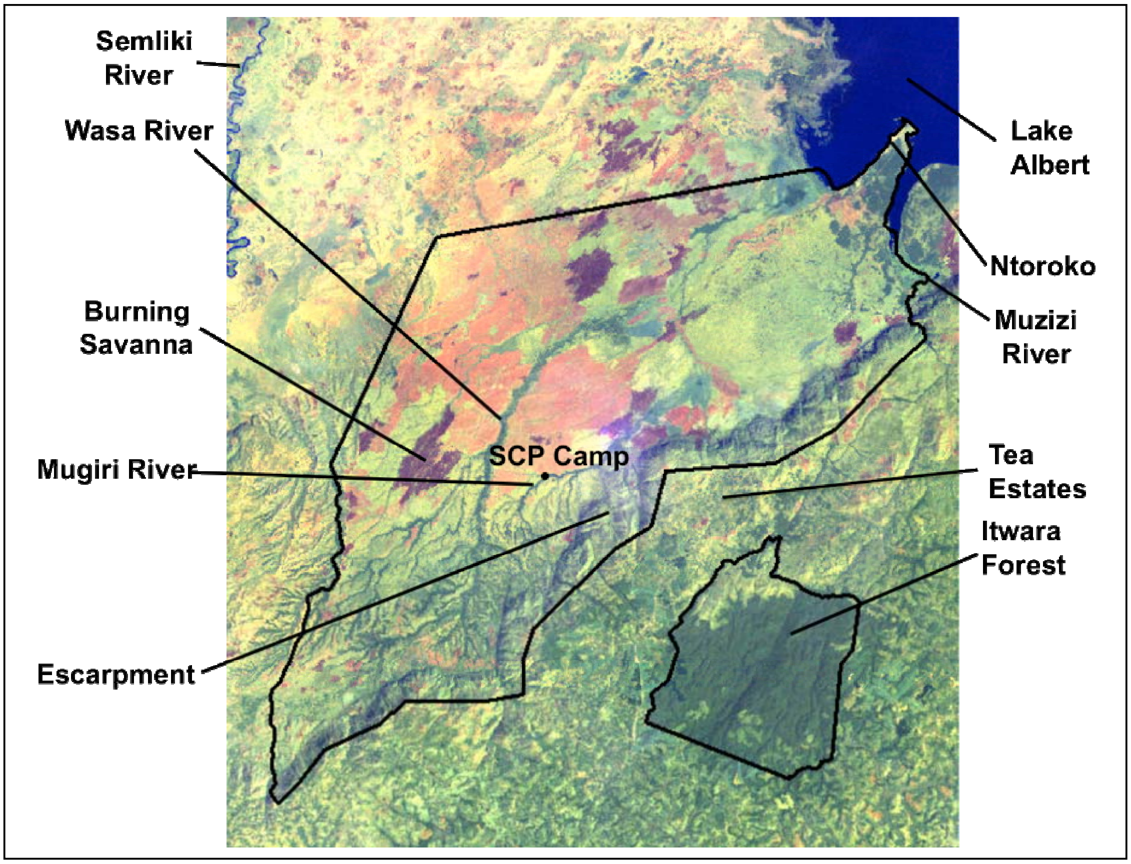


Figure 4.1. Toro-Semliki Wildlife Reserve in western Uganda south and west of Lake Albert.

Study of the Mugiri community began in 1996 when one of us (KDH) spent three months in the reserve establishing the extent of the community range and initiating habituation. Forty kilometres of research trails were cut to initiate habituation. Initial success led to further funding, but research and habituation were subsequently hampered by political unrest. Deadly attacks by rebels known as the Allied Democratic Front (ADF) on local villages nearly always culminated in ADF members retreating to the Mugiri research trails, after which the Uganda Peoples Defense Forces (UPDF) typically engaged the ADF in the study community range. Particularly damaging to habituation was an extended confrontation in late 2001, in which the UPDF made extensive use of mortar. Despite this unrest, since the inception of the Semliki Chimpanzee Project in 1996, there has been only one month (i.e., 1% of the project tenure) during which no project personnel were at the Mugiri study site. The area has been stable since 2002.

From 1996 until 2004 the research team camped near the Semliki Safari Lodge (an independent tourist lodge), some 5 km. from the Mugiri chimpanzee community. This distance from the chimpanzee home range prevented our team from monitoring the location of chimpanzees by their vocalizations over large stretches of time, including at night, and restricted search hours. Although the Uganda Wildlife Authority (UWA) consented in principle to a research facility in 1996, security issues delayed final approval until July 29, 2003.

Construction of the research camp began in late 2003 and was completed in early 2005. The small SCP camp is located at the ecotones of grassland, riverine forest, and escarpment in the approximate center of the Mugiri River chimpanzee range. Sightings and follow times increased dramatically once camp was occupied. Since 2005, the SCP research camp has been occupied continuously. Recently, researchers from Cambridge University and Miami University of Ohio have collaborated with SCP. A daily ranging and activity log records chimpanzee behavior and diet. Research has included work on social behavior, ecology, laterality, nest building, and locomotion and posture.

Climate and possible change at TSWR

The TSWR is unusually hot and dry, compared to other chimpanzee research areas. Long-term climate records through the early seventies recorded annual rainfall between 700 and 1300 mm (Pratt & Gwynne, 1977). Rainfall at Semliki is seasonal, with heavy rains between August and November and again between March and May (Figure 4.3). A distinct dry season with little or no rain is followed by a stepped increase in rainfall from January through mid-May, repeated during the June through mid-November interval. Rainfall peaks occur in late April to mid-May and November (Figure 4.2). The rapid decline in daily rainfall around May 18 and November 12 is particularly fixed year to year. Early May and early to mid-November are particularly wet and then late May and late November almost as dry as any time throughout the year. Average rainfall over the course of our study (1997-2008) is higher, 1344 mm, but much of this increase is due to four years (2000-2003) of unusually heavy rainfall. Semliki has a mean of 10 days of rain per month, and 111 days per year (all figures derived from 1996-2008 project records). The mean daily temperature maximum is 33.7° C, and minimum is 19.1° C. The mean relative humidity maximum is 92.4%, and the mean minimum is 51.9%. Annual rainfall varies, and the dry season is occasionally wet enough that the grassland does not burn (R. Patrick, pers. obs.).

Table 4.1 shows that since 1996 six months have suffered a decrease in rainfall (January, February, March, April, August, and December); May, June, September, October, and November show no change. Only July (typically a dry month) has seen an increase in rainfall, an increase that may be a factor in a decrease in grassland burns.

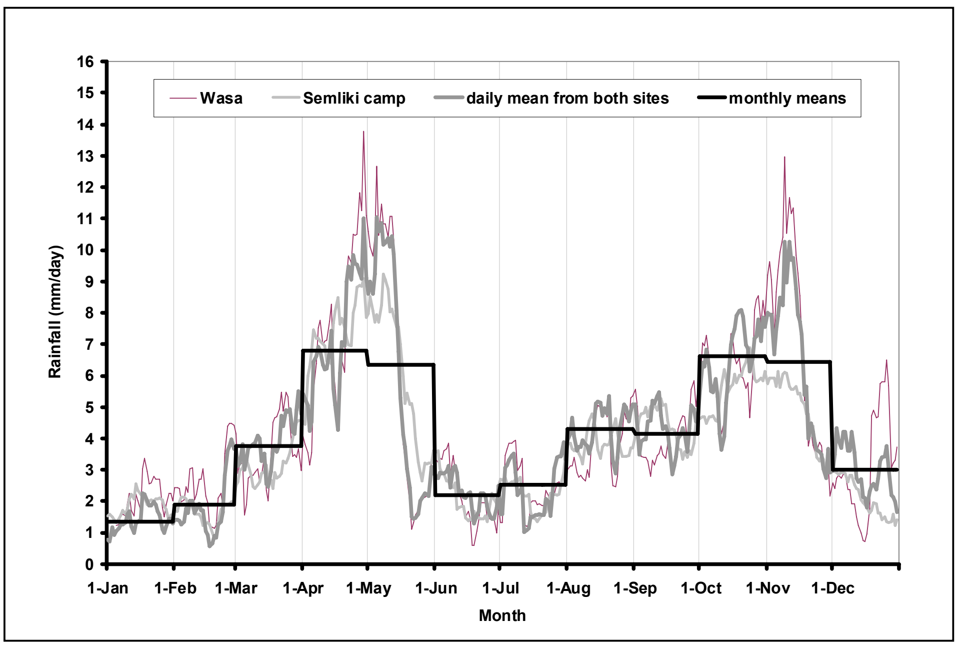


Figure 4.2. Daily rainfall averages plotted over a twelve-month period using HOBO and SCP assistant data collected from 1997 until August of 2008. Graph created by Anton Seimon.

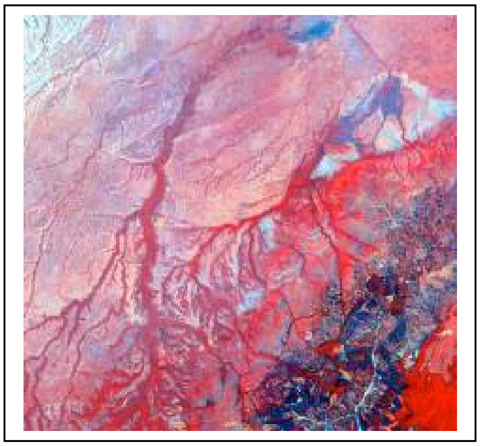
Table 4.1. Rainfall for the SCP camp area as collected by research assistants and UWA rangers from 1998 until 2008. Future rainfall data collection will show the significance if any of the trends.

Month	Variability through study time	Trend of months data
January - Dry	Lower variability	Downward slope
February - Dry	Lower variability	Downward slope
March	High variability	Downward slope
April	Low variability	Recent downward slope
May	Higher variability	No slope
June - Dry	Low rainfall	No slope
July - Dry	Low rainfall	Recent upward slope
August	High variability	Downward slope
September	Low variability	No slope
October	High variability	No slope
November	High variability	No slope
December	High variability	Downward slope

Total annual rainfall increased from 1997 to 2001 and has decreased from late 2006 until our latest data point in 2008. November-December of 1997 was the wettest period on record. The Wasa River flooded a large area of grassland and was measured as high as fifteen meters above normal high water level on the eastern flank of the escarpment within TSWR. While our records are incomplete, this possible cyclic precipitation pattern is tied to worldwide climatic events, particularly to the Indian Ocean El Nino effect (A. Seimon pers. comm.). El Nino induced warming covers the entire Indian Ocean with effects of this warming reaching at least as far west as the Lake Albert Section of the Western Great Rift Valley. The mature phase of the El Nino usually occurs in December, which coincides with the beginning of the December through February dry period. Strong Indian Ocean El Ninos, as in 1997, may cause additional rainfall in the TSWR area. Indian Ocean basin-wide warming following El Nino is coupled to sea surface temperature changes that lag two to four months from the aforementioned Indian Ocean wide event. Variation in the strength of the El Nino leads to variation in the sea surface temperature and the rate of evaporation. This variation in rainfall that may be linked to the strength of the El Nino is under study but as of March 2009 was not deemed predictable (Schott *et al.*, 2009, A. Seimon pers. comm.).

Landcover change in and around TSWR

In 2008, a satellite study was initiated (Figure 4.3) using the program Multispec that looked at major landuse and percentage of land cover change within the SCP study area and the surrounding areas of the TSWR. 1995 Landsat and 2006 ASTER images of the TSWR region were selected and converted for use in this study. Specific features were photographed in TSWR, ground-truthed, and used by RRP to select training fields that gave a satisfactory estimate of total area for a given landuse. Landuse classes were then discriminated and quantified. Maps were created of landuse areas within TSWR and percentage of total area for each landuse category (Table 4.2) compared between the 1995 Landsat image and the 2006 ASTER image (Landgrebe and Biehl, 2001). Repeat studies are planned at ten year intervals.



Landsat Image 1995 ASTER Image 2006

Figure 4.3. Portions of ASTER image number AST_L1B_00312252006083033 and Landsat TM image p173r059_5t19950117. The above two satellite images were used to create the landuse percentages for this study.

Table 4.2. Land cover classes as percent of total area selected from the ASTER 2006 image and the Landsat 1995 image.

Land Cover Class	1995 Landsat TM Image	2006 ASTER Image
Cynometra Forest	9.64%	3.04%
Grassland	12.51%	4.23%
Woodland (Mixed Forest and Grass)	32.95%	50.15%
Joga Joga Swamp & Wet Area	7.19%	2.34%
Tea Plantation	0.56%	0.99%
Bare soil	8.42%	16.66%
Escarpment grass	5.44%	1.20%

From 1995 to 2006 land use changes were observed that are almost certainly due to human factors. Figure 4.3 shows a 1995 Landsat and a 2006 ASTER image of the SCP study site and surrounding areas of grassland and escarpment that include the tea plantations on the top of the escarpment. The 1995 Landsat image was acquired during grassland burning.

Seven distinct landforms/landuse types were compared between the two images. Cynometra forest, grassland, mixed forest and grass, escarpment grass, Jogo Jogo Swamp and permanent wet areas, tea plantation, and bare soil were parsed out. Table 4.3 shows the percentage relationships derived from the initial study for each of the locations where test fields were created and run. The escarpment grass and grassland landforms show decreases in total area while the mixed forest and grass landforms show an increase in total area. This may be due to climate change in the form of increased rainfall or the drop in the total number of elephants and other grazers/browsers that would consume the young trees growing on the escarpment or in the grassland. These vertebrate populations anecdotally appear to be on the increase, and a future decrease in tree cover is expected. The reduction in *Cynometra* Forest may be due to an increased presence of forest elephants within the riverine forest. Their normal feeding pattern would remove smaller trees and the occasional medium-sized tree from the riverine forest. The area under tea cultivation at the top of the escarpment nearly doubled. The number of observable shambas increased possibly due to the greater pixel resolution in the ASTER image. The decrease in total area of Joga Joga Swamp (swamp forest northeast discharge area of Mugiri River) does not have a current explanation and may be due to the size of the training field selected or may be an artifact of the selection process. The bare soil increase may be the result of increased shamba numbers and roads on the escarpment. The pixel size variation between the two images could account for some of the disparity between the selected landform classifications.

Animal Populations

Large mammal populations of Uganda have been in flux from the 1960s until 2005 (Rwetsiba, 2005). Elephant, hippopotamus, hartebeest, waterbuck, and Uganda kob populations have increased during this time while Burchell's zebra, Rothschild's giraffe, buffalo, topi, impala, Bright's gazelle, roan, and eland have decreased, with black rhino, white rhino, oryx, Derby's eland now extinct in Uganda (Rwetsiba, 2005). Plumptre *et al*. (2003/2007) list 69 species of mammal, 33 species of reptile, 13 species of amphibian, and 435 avian species present in the TSWR. TSWR ranked with a low number of endemic species, and was ranked as 'medium' for number of globally threatened species. TSWR is rich in bird species; only six of thirty-three natural areas had a greater number of species (Plumptre *et al*., 2003/2007). The proximity of the TSWR to the greater Virunga landscape and the diversity of landscapes within TSWR contributed to this richness. Table 4.3 lists the large mammal species in the TSWR. Note the drop in total populations of all measured species from the 1960s until the early 1990s but there has been some recovery in the recent census of the reserve (Wanyama. Muhabwe and Enyagu, 2010).

Seven species of primate have been observed in the TSWR; Chimpanzee (*Pan troglodytes schweinfurthii*), olive baboon (*Papio anubis*), black and white colobus (*Colobus guereza*), redtail monkey (*Cercopithecus ascanius*), blue monkey (*Cercopithecus mitis*), vervet monkey (*Chlorocebus aethiops*), and the northern lesser bush baby (*Galago senegalensis*; identified by vocalization). All of the primate populations appear to be stable with little or no change since the founding of the Semliki Chimpanzee Project (Dorst and Dandelot, 1987, Hunt and McGrew, 2002, personal observations). The habitat has been relatively undisturbed since research began in 1996. There are occasional reports of firewood gathering, and pit sawing is discovered occasionally. With only rare exceptions only single individuals are harvested; the primate habitat has not been fragmented. The riverine forests of the Wasa and Mugiri are the principal paths of primate dispersal in the reserve, and the SCP's activity in the forests has prevented disturbance.

While no formal survey has been undertaken by SCP staff, UWA rangers, assistants, or researchers, all agree that their qualitative sense is that the number of large herbivores is increasing. Savanna elephant (*Loxodonta africana*) sightings have increased since 2002, and on two recent occasions (2009) elephants entered the SCP camp (pers. comm. M. Hirschauer and Mark Vibbert, lodge manager of the Semliki Safari Lodge). Forest elephant (*Loxodonta cyclotis*) have been observed within the riverine forest, woodlands, and grasslands of TSWR. TSWR may be the only area of Uganda with forest elephant. Figure 4.4 is a June 2010 image taken in the grassland showing one male savannah elephant and six forest elephants. Table 4.4 compares the Savannah elephant to the forest elephant in size, skin, tusk, and ear characteristics. Large groups of kob (*Kobus kob*) are seen with increasing frequency on the reserve tracks leading to the SCP camp. Cape buffalo (*Syncercus caffer*) are regularly observed and skirted as research groups move about the reserve habituating the chimpanzees of the Mugiri River group.

Table 4.3. History of large mammal surveys within TSWR. The "P" equals observed with no formal count or population total attempted.

Common Name	Scientific Name	Kyeyune 1969	Eltringham and Malpas 1993	Verner and Jenik 1984	Stubblefield 1993	Sivell et. al. 1997 (Count 1995)	Lamprey and Michelmore 1996	Wanyama *et al.* 2010	Semliki Chimpanzee Project Personnel
Duiker - Blue or Common	*Cephalophus sp.*				P	P	15		P
Defassa Waterbuck	*Kobus ellipsiprymnus*	537	33	18	P	P	5	135	P
Bohor Reedbuck	*Redunca redunca*	44		5	P	145	135	8	P
Bushbuck	*Tragelaphus scriptus*				P	P		3	P
Cape Buffalo	*Syncerus caffer*	696		50	P	P		261	P
Uganda kob	*Kobus kob*	19,117	3,460	2,500	357	652	853	2,584	P
Giant Forest Hog	*Hylochoerus meinertzhageni*			P	P	P	5		P
Warthog	*Phacohoerus aethiopicus*	43		P	P	P		137	P
Elephant	*Loxodonta cyclotis*								P
Elephant	*Loxodonta africana*	138		P	60	P	25	47	P
Jacksons Hartebeest	*Alcelaphus buselaphus*	650							
Lion	*Panthera leo*	36		28	P	P			P
Leopard	*Panthera pardus*			6		P			P
Hyena	*Crocuta crocuta*			25					

Lion (*Panthera leo*) numbers were affected by extensive poaching (Table 4.3) and intentional poisoning by cattle farmers (Lamprey and Michelmore, 1996). Current lion numbers are still (as of 2008) low, as few individuals are heard during the nights when active hunting is taking place. However, the calls of leopards have noticeably lessened. The local population of vultures have been reduced by poisoned carcasses set out as bait to kill large cats.

Estimates of bird species numbers range from 435 (Plumptre *et al*., 2003/2007), 475 (Rossouw and Sacchi, 1998, C. Schipper pers. comm.), and possibly as high as six hundred and seventy-five from the range charts of Stevenson and Fanshawe, (2002). Proximity of the TSWR to the high altitude moist forest to the east on the top of the escarpment, including the nearly contiguous Itwara Forest Reserve, the Semuliki National Park rainforest 20 km to the south east, and the immense Congo basin rainforest just west make this a global birding area.

Nile crocodile (*Crocodylus niloticus*) are abundant in Lake Albert; one individual was observed during the 2007 rainy season several hundred meters from the SCP camp. Dwarf crocodile (*Osteolaemus tetraspis*) are also reported in Lake Albert (Stubblefield, 1993), though no sighting have been reported by our assistants and staff. Stubblefield (1993) listed three species of chelonians (turtles and terrapins) and twenty-six species of lizard from the TSWR area. Snakes are common and observed on almost a daily basis within the riverine forest, the grassland, and the SCP camp. Spawls *et al*. (2001) lists sixty-six species of snakes in the TSWR with twenty of them venomous. Mark Vibbert (personal communication) has identified an additional venomous snake, the Egyptian cobra (*Naja haje*) within the TSWR. Common sightings of snakes and reptiles by SCP personnel indicate that this would be a good location for collections that could lead to the expansion of the total number of reptilian species found in this area.

Table 4.4. Comparison of basic morphologic features of savannah and forest Elephants of Africa (Shoshani, 2000, p. 40).

	Savannah Elephant	Forest Elephant
	Loxodonta africana	*Loxodonta cyclotis*
Weight	4000 – 7000 kg	2000 – 4500 kg
Height at shoulder	3 – 4 m	2 – 3 m
Skin	On average lighter	On average darker
Shape and size of ears	Triangular, extend below line of neck	Rounder, do not extend below line of neck
Skull, cranium	Much pneumatized	Less pneumatized
Skull, mandible	Shorter	Longer
Tusks	Curved out and forward, thicker	Straighter, downpointing, slender

Figure 4.4. Six forest elephants (*Loxodonta cyclotis*) one male (far right), three females, one juvenile, one infant and one savannah elephant (*Loxodonta Africana*) male (center left) in the grassland of TSWR.

Habitat Zones

Figure 4.5 shows the general distribution of types of flora at TSWR. Human encroachment has taken place mostly within the southwest section of TSWR and in the Ntoroko area near Lake Albert. *Acacia* species have increased on the escarpment slopes and possibly within the open grassland (Figure 4.6). Figure 4.6 gives two views of the same area of escarpment slope. One image was taken in September of 1997 and the other image taken in May of 2008. There is an increase in tree coverage between September 1997 and May of 2008. Two factors may have contributed to this change. The removal of elephants has had a significant impact on grassland tree species composition; since a large proportion of their browse is *Acacia* spp. Large herbivores may significantly decrease the density of trees in grassland habitats. It is possible that changes in precipitation patterns may also be decreasing the length of the burning season. Bush fires disproportionately kill saplings, and a decrease in burning removes one check on tree proliferation. Today, kob and elephant populations appear to be on the rise and if so many of the smaller trees in the grassland and on the escarpment will be consumed before they reach maturity.

Conflicts and the Human Population

Political instability involving the Allied Democratic Front (ADF), and on occasion supplemented by Congolese Mai Mai fighters and Rwandan Interhamwe militiamen, has impacted chimpanzee habituation and other research activities of the SCP. Rebel activity in and around TSWR and consequent Uganda Peoples Defense Force (UPDF) response have reversed habituation gains, disrupted normal activities and ranges of the chimpanzee groups and other TSWR wildlife, increased poaching, and added human refuse to the reserve.

Figure 4.7 gives the days per year of ADF and/or UPDF response in the TSWR from 1998 until 2008 based on SCP's daily log entries. The SCP assistants or affiliated UWA rangers keep this daily log of chimpanzee search information including comments about human activities within TSWR. The daily log is discontinuous only during two prolonged periods reflecting construction of the research camp and another period of funding interruption. Transient gaps in the log reflect personnel transitions.

Rebel activities, and UPDF response, including gunfire, have a negative effect on SCP staff and researchers' morale and productivity. The UPDF maintains a base camp within the southern part of TSWR. Camp policy is that rebel activity results in SCP evacuation, at least to the Semliki Safari Lodge. The UPDF conducts patrols and also accompanies SCP researchers surrounding times of rebel activity. UPDF protective patrolling with SCP researchers has an influence on trail choice and time in the field. The daily log documents search days lost to rebel activity. In recent years all ADF activities have subsided.

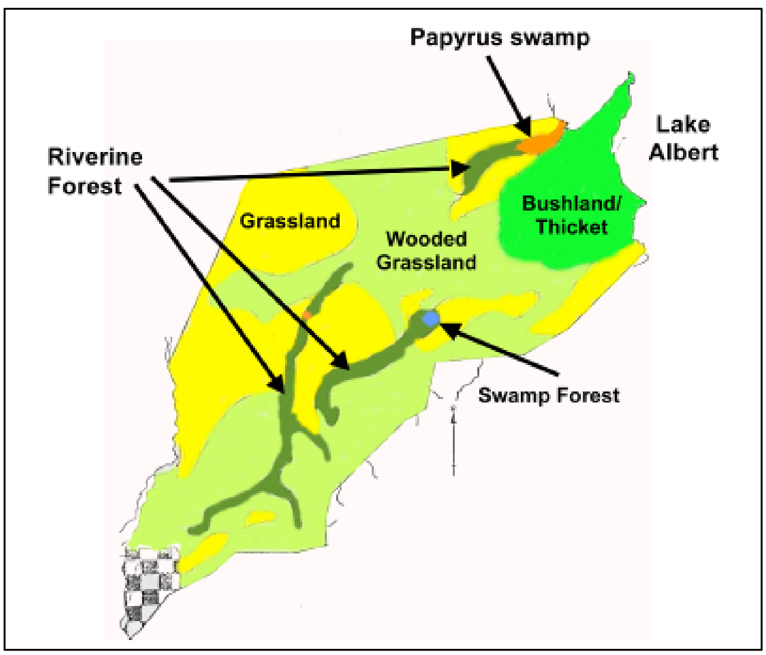


Figure 4.5. Habitat zones in TSWR showing the distribution of floral ecotomes within the reserve. The checkered area to the southwest has been completely changed by human occupation and is now cultivated land.


A B

Figure 4.6. Images of the escarpment looking northeast from the grassland west and north of the SCP. A. May 2008. B. September 1997.

A separate conflict in the year 2001 involving fighting in the Congo's Ituri province, between the Hema and the Lendu, resulted in between 3500 and 8000 (United Nations estimate) refugees crossing the Semliki River and dispersing over fifty kilometers, with Ntoroko suffering an influx of refugees. These refugees are thought to have contributed to encroachment in TSWR near Ntoroko, including poaching and firewood gathering.

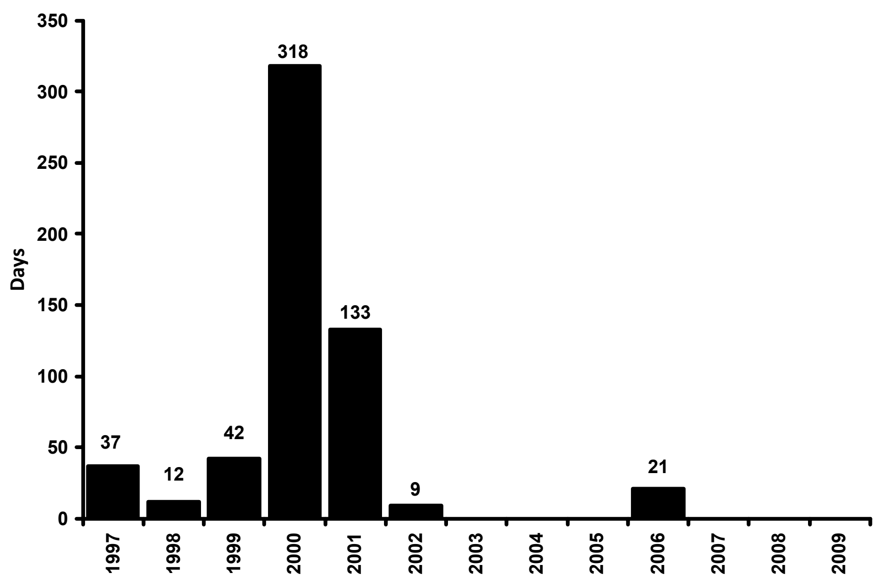


Figure 4.7. Days per year of ADF/UPDF activity in and near the SCP area.

Poaching

Following the 1978/79 Uganda-Tanzania war, poaching in the reserve was severe, with incursions by large groups utilizing spears, automatic weapons, and dogs to slaughter large numbers of Uganda kob and other large herbivores (Lamprey and Michelmore, 1996; Stubblefield, 1993). Poacher fires and snares were common, organized poaching groups from the Congo were on reserve land during the dry season, and numbers of local farmers grazed their cattle on reserve land (Lamprey and Michelmore, 1996: Stubblefield, 1993).

Figure 4.8 shows evidence of poachers taken from the SCP assistants' daily log from records initiated in 1997. In the first few months of SCP activity, July, August and September, 1996, snares were found on a weekly basis, but the number rapidly diminished as trail construction extended up the escarpment. Aside from evidence of poaching from snares, from July 1996 through all of 1999 footprints of presumed poachers in the forest were observed only once (January 1998). The active ADF years of 2000/2001, saw only one month each year of recorded poacher activity. The terse May recording "army kills two poachers at top of Mugiri" reflects the overall violence of that year. September 19th and 20^{th} of 2001 finds only "? Poachers" recorded. Physical evidence in the form of "found 2 snares" follows in February of 2002. August of the same year finds UPDF patrolling after a "? 2 individuals" were sighted. Numerically, 2003 documents the largest number in January ("1") and March ("5 poachers"). Mid-June to late November no Daily Log was kept as the efforts of our on-site staff were building the Research Camp.

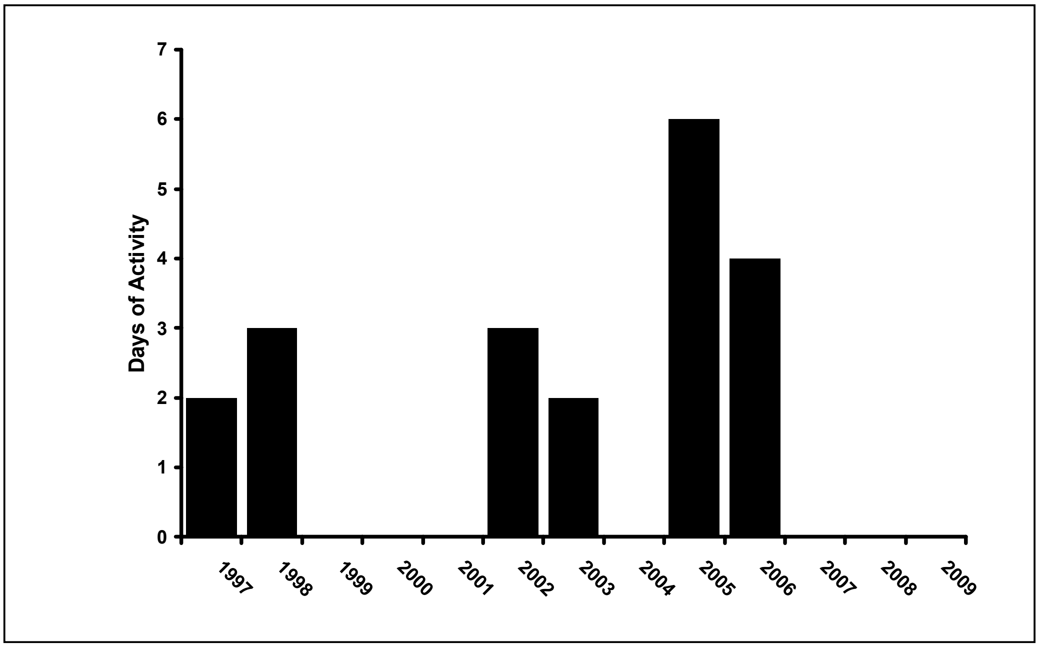


Figure 4.8. Days of poaching activity recorded within the daily log of the SCP assistants and UWA rangers.

Somewhat suggestive that poachers may be more frequent in the dry months of January to March are three notations in February of 2005 and 2006 of "poachers" and 2 days in March, 2006 in which 'several poachers" and "dogs" were recorded. "Several dogs" were first noted in October of 2005 along with "snares", "2 poachers", and later "9 snares". Poaching activity at TSWR appears to be at a lower level than in the early 1990's. The distance to population centers may be one factor for the low current number of poacher encounters. Also, the almost random nature of the chimpanzee follows within the Mugiri River gallery forest trail system may discourage poaching by making possible discovery by UWA Rangers a constant and unpredictable risk.

Conservation and the future of TSWR

The Toro-Semliki Wildlife Reserve appears to be a location that exhibits rainfall variation with links to global climate change. Rainfall variation may affect the frequency and intensity of fires in the grassland in such a way that this sensitive habitat will markedly decrease in total hectares in future. An associated decrease in grassland fauna and flora would also occur. The number of habitats contained within the Western Rift Valley floor to escarpment top of the TSWR should be monitored because of their possible sensitivity to climate change. The exact nature of the rain start and stop dates makes the TSWR a good location for testing and predicting climatic transition as described by Scheffer *et al.*, (2009).

Many locations within the TSWR have not had flora and fauna inventories completed. Reptiles are numerous and further study is needed for a complete listing of total reptilian species within the reserve. The chimpanzees under study by the SCP are only the second group of dry habitat chimpanzees to be habituated. The finger-like configuration of the riverine forest confines most of the primates to unique long narrow ranges that may be reflected in unique habits and culture. The unusual habitat, with its concomitant unusually large community range, may be responsible for the reduced levels of violence at Semliki (Hunt and McGrew, 2002). The sheer number of avian species and the number of biomes within the reserve ranging from escarpment forest to grassland should prompt an upgrade Toro-Semliki Wildlife Reserve to National Park status as first discussed by Lamprey and Michelmore, 1996.

We recommend that TSWR be raised to National Park status, that floral and fauna be protected, and the species lists completed. The park should have a nature-cultural center constructed for locals and tourists alike. TSWR is a unique area that with reasonable protection will harbor a floral and faunal population like none other within the Albertine Rift Valley.

Conclusion

Human induced changes in the TSWR that caused the reduction of large herbivore numbers through poaching, from the sporadically heavy grazing of cattle in the reserve, and perhaps indirectly from global climate change are all possible culprits that have reduced the number of large vertebrates currently observed within TSWR. Recent Uganda Wildlife Authority policies are attempting to push cattle grazing outside of the TSWR boundaries. Grassland avian species may be under pressure from loss of nesting area, changes in food types, and encroachment by new predator species due to changes in the grassland habitat. If grassland loss leads to forest expansion on the Rift Valley floor, primates may actually expand their numbers as new home range opens up.

Precipitation start and end dates may be shifting as global warming changes the wind and precipitation patterns associated with the Indian Ocean El Nino. The habitat types within the TSWR make it an ideal place to study climatic change that will affect regions of tropical riverine forest and grassland around the world. The location and twelve-month occupation of the SCP camp at the ecotone of grassland, riverine forest, swamp, and escarpment flank allow for the secure placement of climate data collection devices.

Acknowledgements

We wish to acknowledge the following groups and individuals for all of their support over the years at SCP within the TSWR. The Uganda Wildlife Authority and its Rangers for years of support, National Science Foundation BNS 97-11124, 98-15991, Jonathan Wright and the Semliki Safari Lodge for all levels of support, Heritage Oil Company for funding in 2004, Indiana University for ongoing support, Bill McGrew of the University of Cambridge and his graduate students who are continuing research at the SCP, Linda Marchant of Miami University of Ohio and her graduate students who continue to complete research projects at the SCP, and to the assistants and staff of the SCP who have dedicated years to the habituation and data collection efforts of the chimpanzee at SCP. Also, we wish to thank The School of Electrical and Computer Engineering, Purdue University, for MULTISPEC the analysis of satellite multispectral image data software.

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