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Habitats Map of Distributions of Key Wild Animal Species of Gambella National Park

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Abstract:

Lack of information on habitat map of Gambella National Park had resulted in problems of identification for abundance and distribution of studied wild animal species per their habitats use in the park. Therefore, the information gathered for habitat map of key studied wild animal species of the Park, was used to fill the knowledge gap on their most preference habitat types of the Park. The specific objectives of this research were to determine the abundance and distribution of studied wild animal species in each classified habitat, to determine the density of studied wild animal species of the Park. The data were collected by lines transect method, which were conducted in both dry and wet seasons. Accordingly, six men in a queue were involved in the surveys. The front man was using a compass to lead the team in a straight line along the transects and measure the bearing of track of animals, two men were positioned in the middle and one was observed on the right side of transects while the other observed on the left side of transects and rear man was used GPS receiver and keep recording of information on observed wild animal species. The data were analyzed by GPS in which relevant attribute information of key wild animal species for both dry and wet seasons were added in attribute tables and ArcGIS desktop as shape files. The shape files for recorded wild animals were overlaid on the habitat maps. The abundance and distributions of each recorded wild animal species were analyzed and presented on habitat map. The density was analyzed by kernel density and presented the number of each species per area in square kilometres on the map. Microsoft office excel was also used to analyze the abundance of studied wild animal species per their preference habitat types. The results had shown that, the abundance and distribution of studied wild animal species to be the higher in the dry season than wet season. Among the studied wild animal species, the abundance and distribution of White eared kob in dry season was 5,442 and 150-260 individuals respectively, higher than its abundance of wet season 1,851 and distributions 101-200 individuals. The abundance and distribution of White eared kob were observed in all habitat types of the Park. However, the abundance and distributions of Nile lechwe, Buffalo, Shoe bill stork, some Tiang and elephant were observed in the wetland of the Park. The density of studied wild animal species was higher in wet season than dry season.

Keywords: Gambella National Park, habitats map, abundance, distribution, density, studied wild animal species, Gambella national park

1. Introduction

Habitat mapping is typically undertaken by resource agencies to serve different purposes including: assessment of habitat change due to natural or human impacts, monitoring and protecting important habitats, design and location of marine reserves or aquaculture projects and species distributions and stock assessment (Lenton and Del Val, 2000). The ability to map spatial distribution and changes in distribution of wildlife is of considerable importance for wildlife conservation and management. Information collected with a GPS receiver would be combined with other geographic data using GIS technology for habitat mapping of key wild animal species (Lenton and Del Val, 2000). The characteristics of spatial analysis and spatial display of GIS not only provides efficient way of data handling, storage, and analyzing, more importantly, it also enables mapping of wildlife distribution (Kafley, 2008).

Habitats map had classified, the Gambella National Park into five major habitat types. These are woodland, wooded grassland, savannah, grassland and wetlands (Gatluak, 2014). Other minor habitat classifications indicated by the habitats map were temporary burned, water body, settlements and roads. All of the major habitat types have significant values for mapping the key studied wild animal species of the Gambella National Park, because each wild animal species have preference habitat type. The Habitats map of Gambella National Park had indicated the abundance and distribution of studied wild animal species per their preference habitat types. Accordingly, wetlands were found to be the most relevance and preference habitat types of Nile lechwe, Buffalo Tiang and Shoe bill stork in the Park whereas open grassland, wooded grassland, woodland and savannah grassland were the most relevant and preference habitat type of White eared kob. The lack of information on habitat map of Gambella National Park result in problem of identification for the abundance and distribution of the studied wild animal species per their habitats used in the Park. Therefore, information gathered for habitat map of key studied wild animal species was used to fill the knowledge gap on their most preference habitat types of the park.

2. Objective

The specific objectives to answer the research questions are:

- 1) To determine the abundance and distribution of studied wild animal species in each classified habitats.
- 2) To determine the density of studied wild animal species of the Park

3. Research Questions

- 1) What looks like the abundance and distribution of studied wild animal species in each classified habitat?
- 2) What are the densities of studied wild animal species of the Park?

4. Methods

Description of Study Area

Gambella National Park is located in the lowland plain of the Gambella People's National Regional State. According to EWCO (1993), the park is situated within latitude of 8°N and longitude of 34°15'E (Figure, 1). It is situated between eight administrative districts namely Jikawo, Lare, Wantawo in the north, Akobo in the west, Itang and Abobo in the east, Gog and Jor in the south. It was established in 1973 with newly, redemarcated area covered of 4,575km².

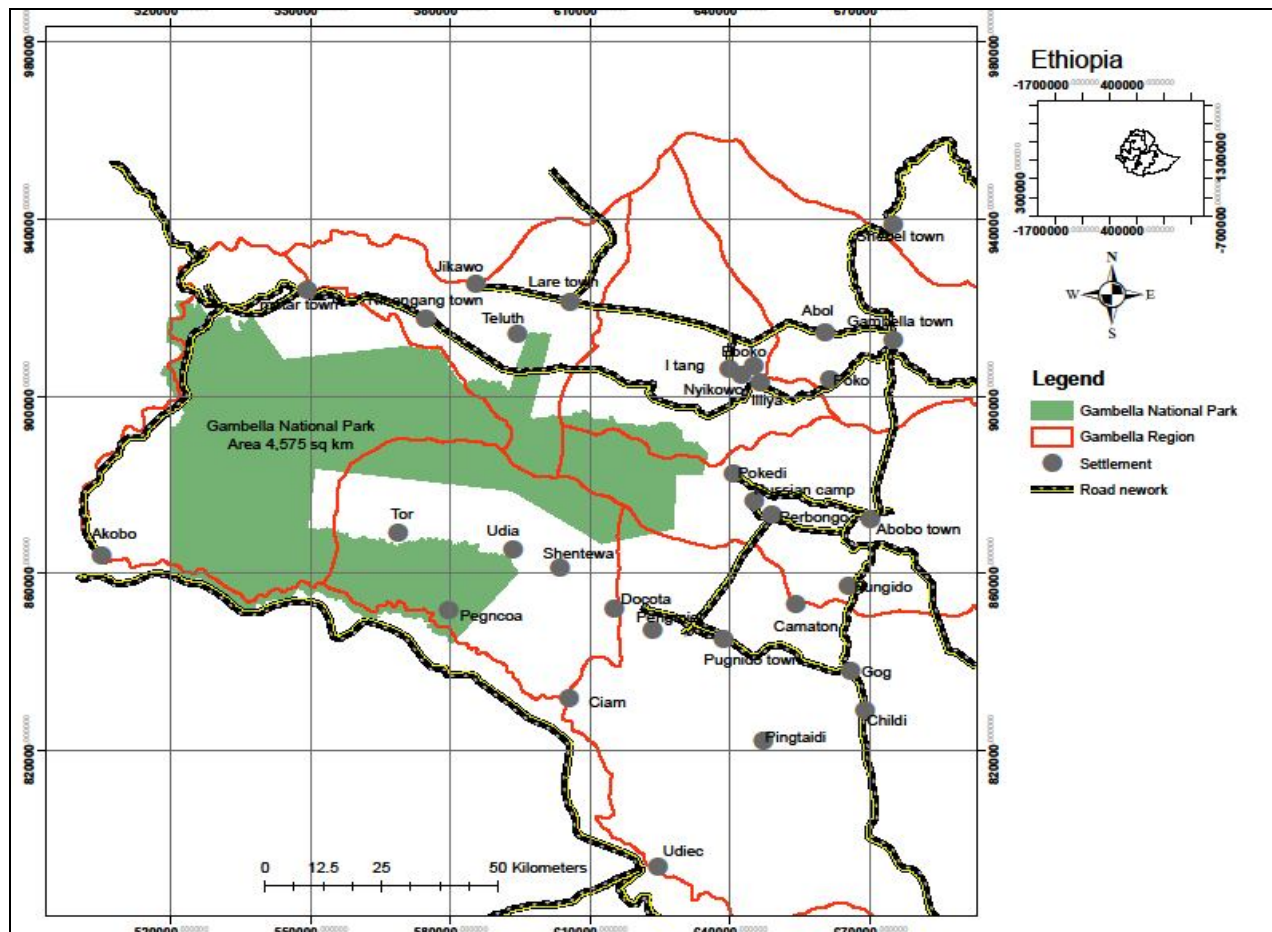


Figure 1: location of map Gambella National Park within Gambella Regional State

4.1. Climate

Gambella National Park is characterized by unimodal rainfall brought by tropical monsoon blowing from South Atlantic and Indian oceans. It is also characterized by heavy rainfall during the wet season (May to October) and very little precipitation during the dry season (November to April). The mean annual rainfall of the park is 1400mm. The mean annual temperature is 27°C but the mean monthly temperature varies significantly. The absolute maximum temperature of 45°C has been recorded in mid March while the absolute minimum temperature of 10.3°C has been recorded in December (CSG, 2000).

4.2. Vegetation

The vegetation communities of Gambella National Park comprise Combretum-Terminalia woodland, Terminalia woodland, Tamarindus-Terminalia woodland located in the eastern part of the Park and the Balanites-Acacia woodland, Acacia woodland, Ziziphus-Acacia wooded grassland, Orzya-Ziziphus savannah grassland and Hyparrhenia-Orzya open grassland situated in the west, northwest and central part of the Park (Gatluak, 2014). The Cyperus-Perpyrmuo-Orzya seasonal swamp, Orzya-Hyparrhenia permanent swamp and Orzya permanent swamps are also other major vegetation community types found in wetlands habitats of the Park.

4.3. Animal Species

The region is blessed with a variety of wild animals (mammals and birds). As noted by Selkhozpomexport (1989), the Gambella plain is one of the few places not only in Ethiopia and the African continent, but also in the whole world where the original and rich fauna and flora have not been altered by human activities. At present, 69 species of mammals and 327 species of birds are known to occur in the region in general and the park in particular (Hillman, 1993, Selkhozpomexport, 1989, and EWNHS, 1996). Extensive areas of swamp habitats, grassland, savannah and woodlands support unique varieties of faunastic populations that are rare, endangered and globally threatened. Larger mammalian species such as White-eared kob (*Kobus kob*), Nile Lechwe (*Kobus megaceros*), Nile Buffalo (*Syncerus caffer*), Elephants (*Loxodonta africana*), and Roan Antelope (*Hippotragus equinus*), are important species of the area. Rare bird species such as Shoe-billed Stork (*Balaeniceps rex*), Black-winged Pratincole (*Glareola nordmanni*), and Basra reed Warbler (*Acrocephalus griseldis*) are also unique features of the avian fauna of the region. Further, out of the 100 species of fish found in the country, 92 species have been identified in the river bodies of Gambella region (EWNHS, 1996). This indicates that the Park is extremely rich in fish resource diversity.

4.3.1. What looks like the abundance and distribution of studied wild animal species in each classified habitat type?

The total area was divided up into transects, known as sample units. A selection of these transects were based on seasonal and natural variation of the study area. Therefore, two seasons survey programs were conducted (Figure, 2). The first survey was conducted at dry season started from major road toward the central part of the Park. This survey had covered large part of north, west and east of Gambella National Park. The second survey was conducted at wet season of the year. This survey had covered small part of southeast, east and northern part of the Park. Within each survey program, the transect lines were used. Six men in a queue were involved in each survey. The front man was used a compass to lead the team in a straight line along the transects and measure the bearing of track of animals, two men were positioned in the middle and one was observed on the right side of the transect while the other observed on the left side of transects and the rear man was used GPS receiver and keep recordings of information of observed wild animals species.

Relevant attributed information of key observed wild animal species, both for dry and wet seasons were added in the attribute tables and ArcGIS desktop as a shape file. The shape files for recorded wild animals were overlaid on the habitat maps. Therefore, distribution and density of each recorded wild animals were analyzed and presented on habitat map.

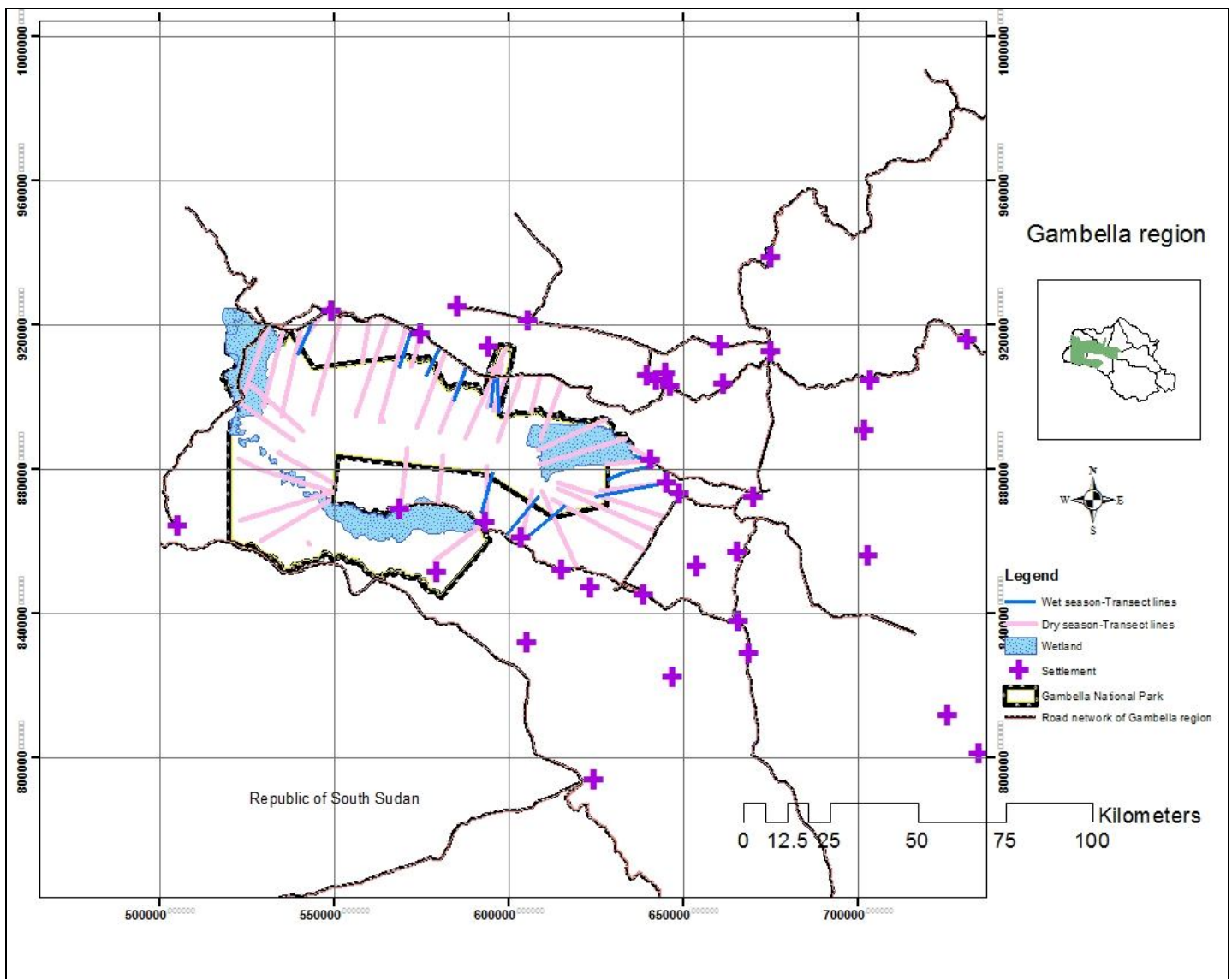


Figure 2: Survey transect lines for studied key wild animal species of Gambella National Park

The Microsoft office excels was used to analyze the seasonal abundances of key studied wild animal species of the Park.

4.3.2. What are the densities of studied wild animal species of the Park?

The shape files for recorded wild animals, which were overlaid on the habitat maps, were further analyzed by using Kernel density tool. The results of kernel density was represented for each studied wild animal and its area it occupied in the Park.

5. Results

5.1. Dry Season Abundance of Studied Wild Animal Species of Gambella National Park

The dry season results of this study had shown that, the highest abundance of key studied wild animal species of Gambella National Park was White eared kob with observation 5,442 individuals. Buffalo, African elephant and Nile lechwe had observation of 430, 348 and 228 individuals respectively, (Figure, 3). Other species such as Tiang and Shoe bill stork had observation of 69 and 12 individuals respectively. Among the studied wild animal species in the Park, the Shoe bill stork had the lowest abundance of all key studied wild animal species of the Park.

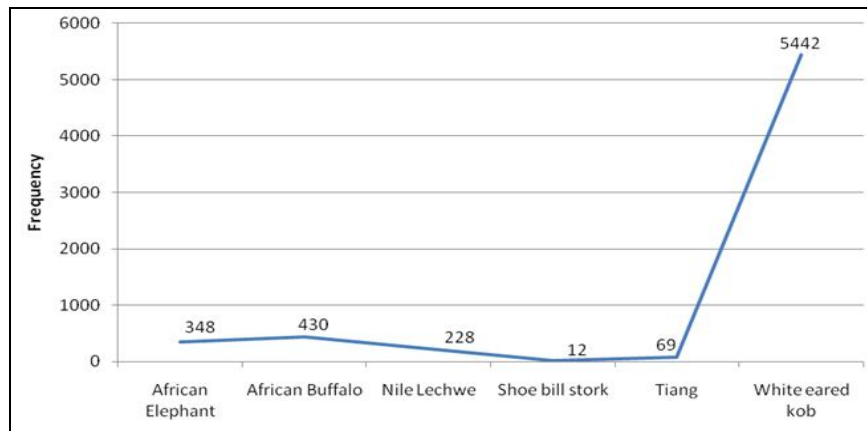


Figure 3: Dry season abundance of studied wild animal species of Gambella National Park

When compared the abundance of key studied wild animal species per habitat type, the White eared kob population was the most abundance of all in the terrestrial habitat types. The highest abundance of White eared kob in the terrestrial habitat type was observed in open grassland 1,695 individuals. The wooded grassland, woodland and savannah grassland had its abundance of 1,226, 1,193 and 1,065 individuals respectively, (Figure, 4). The remaining key studied wild animal species were observed in the wetlands exception of 15 African elephant and 36 Tiang populations, which were observed in the woodland of the Park.

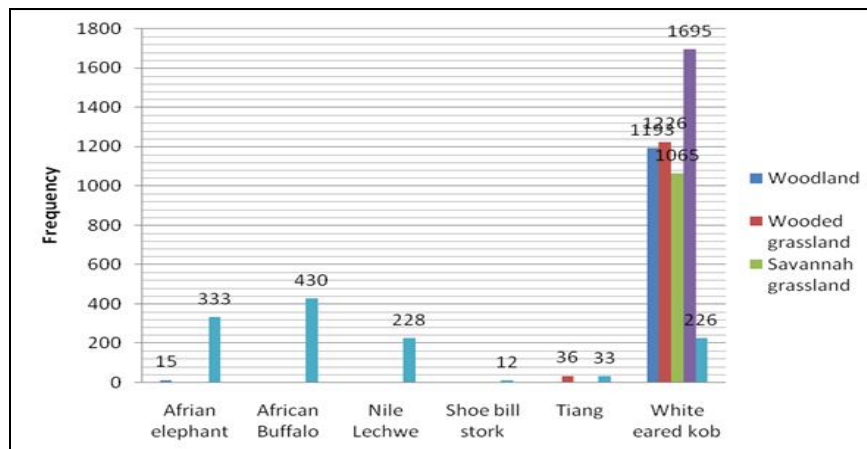


Figure 4: Dry season abundance of studied wild animal species per habitat types of Gambella National Park

5.2. Wet Season Abundance of Studied Wild Animal Species of Gambella National Park

The wet season results of this study had shown that, the highest abundance of key studied wild animal of Gambella National Park was White eared kob with overall observation 1,851 individuals. Buffalo and Nile lechwe had observation of 135 and 85 individuals respectively, (Figure, 5). Moreover, the Tiang had observations of 35 individuals. However, the shoe bill stork had the lowest abundance of all key studied wild animal species of the Park with observation of 5 individuals (Figure, 5).

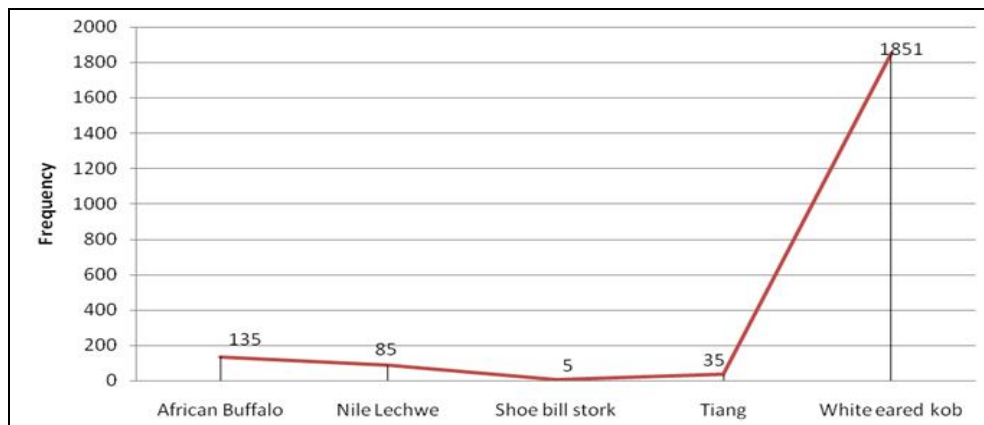


Figure 5: Wet season abundance of studied wild animal species of Gambella National Park

When compared the wet season abundance of key studied wild animal species per habitat type, the White eared kob population was the most abundance in wooded grassland and woodland. The Buffalo, Nile lechwe and Tiang were only observed in wooded grassland. However, only shoe bill stork which was observed in wetland habitat (Figure, 6).

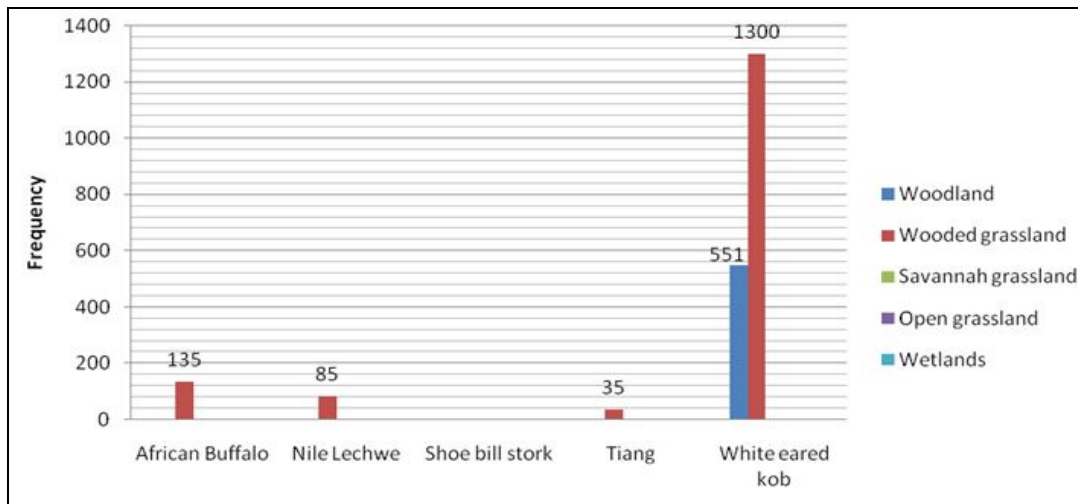


Figure 6: Wet season abundance of studied wild animal species per habitat types of the Park

5.3. Dry Season Distribution of Studied Wild Animal Species of Gambella National Park

5.3.1. Distribution of White Eared Kob (Kobus Kob)

This dry season results had indicated groups' distribution of White eared kob across all location. The largest groups of White eared kob (150-260) were observed at northern part of the Park followed by the groups of 90-150 individuals, which were observed at north of Gilo swamp. However, the groups which had 50-90 and 23-50 were observed in the central and southwestern part of the Park. The concentrations of smallest groups (1-23) were observed in the south of the National Park (Figure, 7).

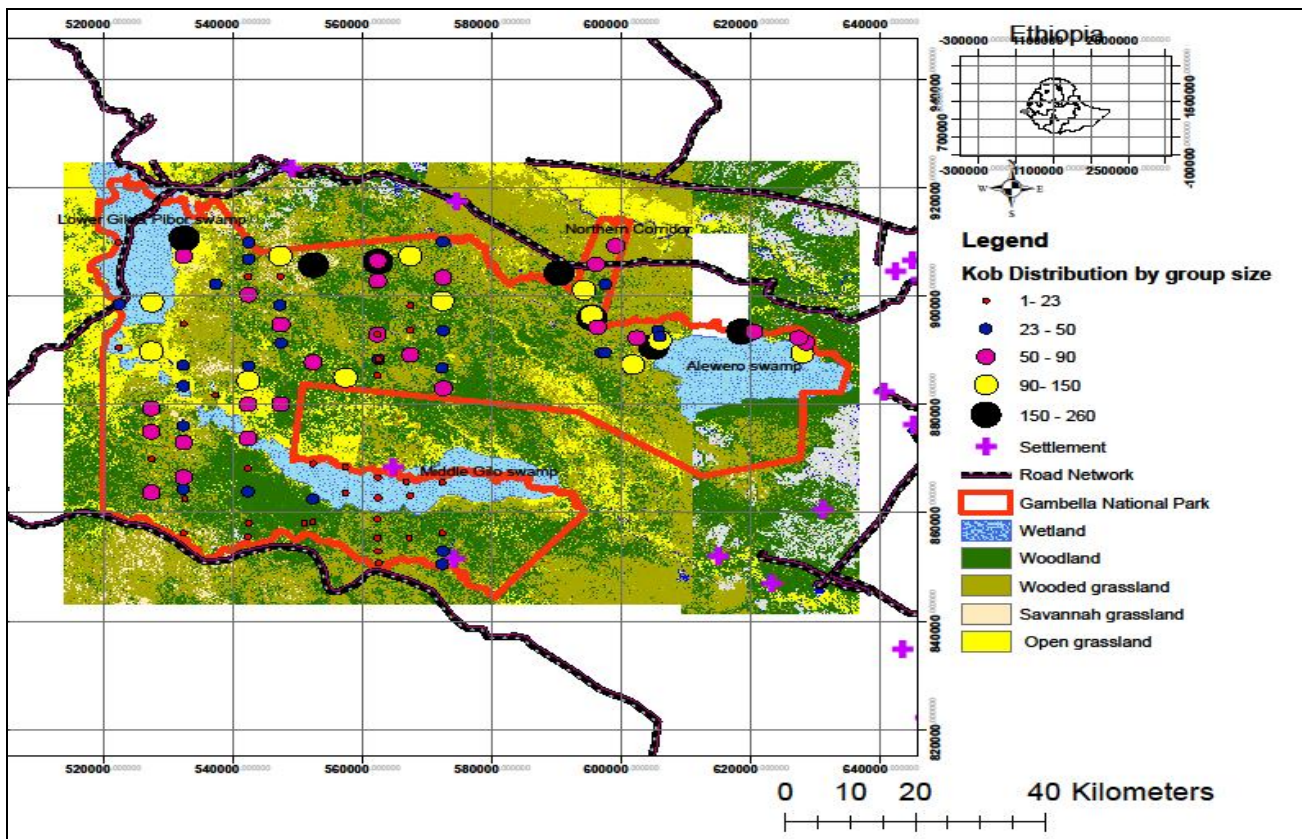


Figure 7: Dry season distribution of White eared kob in Gambella National Park

5.3.2. Distribution of White Eared Kob per Habitat Types

In general the, White eared kob was almost evenly distributed in all habitats type of the Park however, the largest number of White eared kob were observed in open grassland 1,695 individuals followed by wooded grassland 1,226 individuals, woodland 1,193 individuals and savannah grassland 1,065 individuals. The few individuals 265 of White eared kob were observed in wetland habitats (Table, 1). This distribution of White eared kob per habitat type had indicated the relationship between the White eared kob and its preference habitat type. The open grassland and wooded grassland had shown, it's the largest number of individuals. This may be due to presence of grass species which might be major feed for them.

Distribution of White eared kob per habitat type		
	Habitat type	White eared kob
1	Woodland	1,193
2	Wooded grassland	1,226
3	Savannah grassland	1,065
4	Open grassland	1,695
5	Wetland	265

Table 1: Distribution of White eared kob per habitat type

5.3.3. Distribution of Nile Lechwe (Kobus Megaceros)

The results had indicated the distribution of Nile lechwe both for groups and habitats. The largest group of Nile lechwe was 51-90 individuals followed by groups 41-50 and 9-40 individuals. The smallest group had only 8 individuals (Figure, 8). All its groups' sizes were observed in wetland habitat in general and the east of Alewero swamp in particular. Therefore, the population of Nile lechwe in the Gambella National Park was found to be limited to Alewero swamp which is locally, known as "Duma" in Anuak and "Kongdokuach" in Nuer.

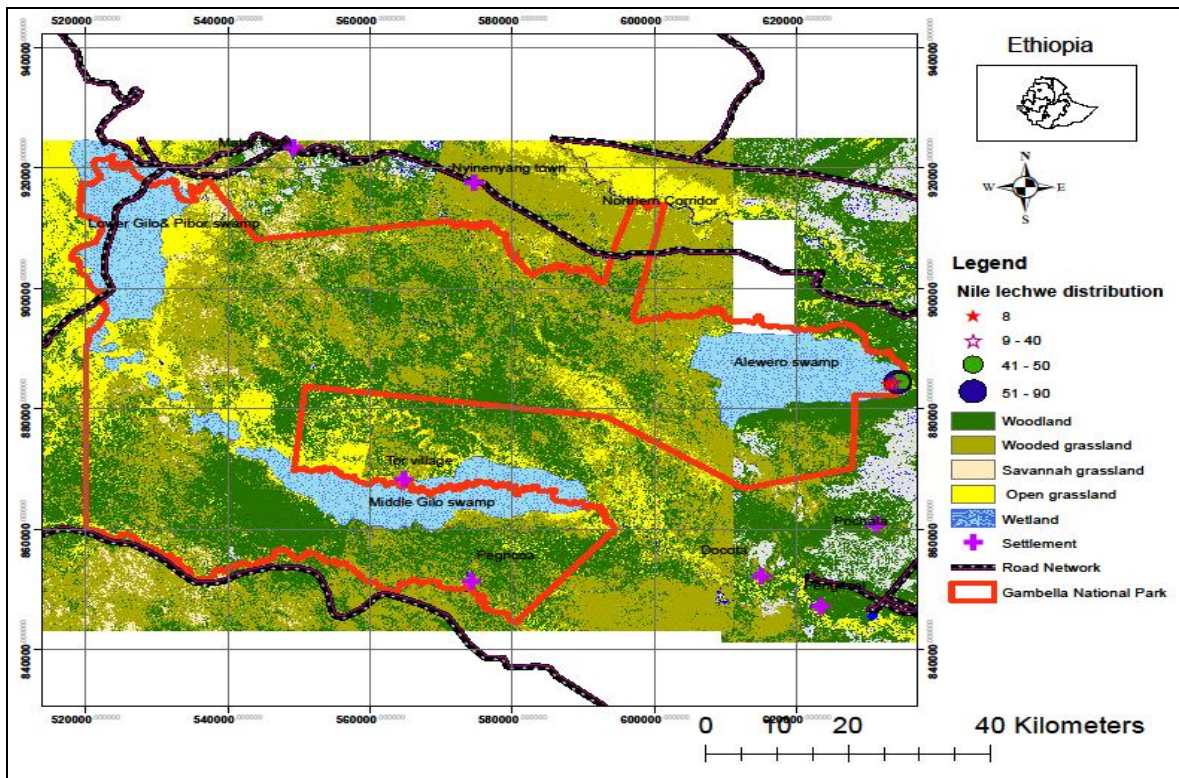


Figure 8: Dry season distribution Nile lechwe in Gambella National park

5.3.4. Distribution of Buffalo (Syncerus Caffer)

The distributions of Buffalo were observed in the wetlands of the Gambella National Park (Figure, 9). However, the highest groups distribution of Buffalo was observed in Alewero swamp 51-100 and 101-200 individuals. Its equal groups' distributions of 6-30 individuals were observed in both middle Gilo and Lower Gilo-Pibor swamp. The remaining groups' distributions of Buffalo 31-50 and 5 individuals were also observed in Alewero swamp (Figure, 9). Therefore, Alewero swamp locally known as "Duma" in Anuak and "Kongdokuach" in Nuer was found to be its most relevance habitat type in dry season of the year.

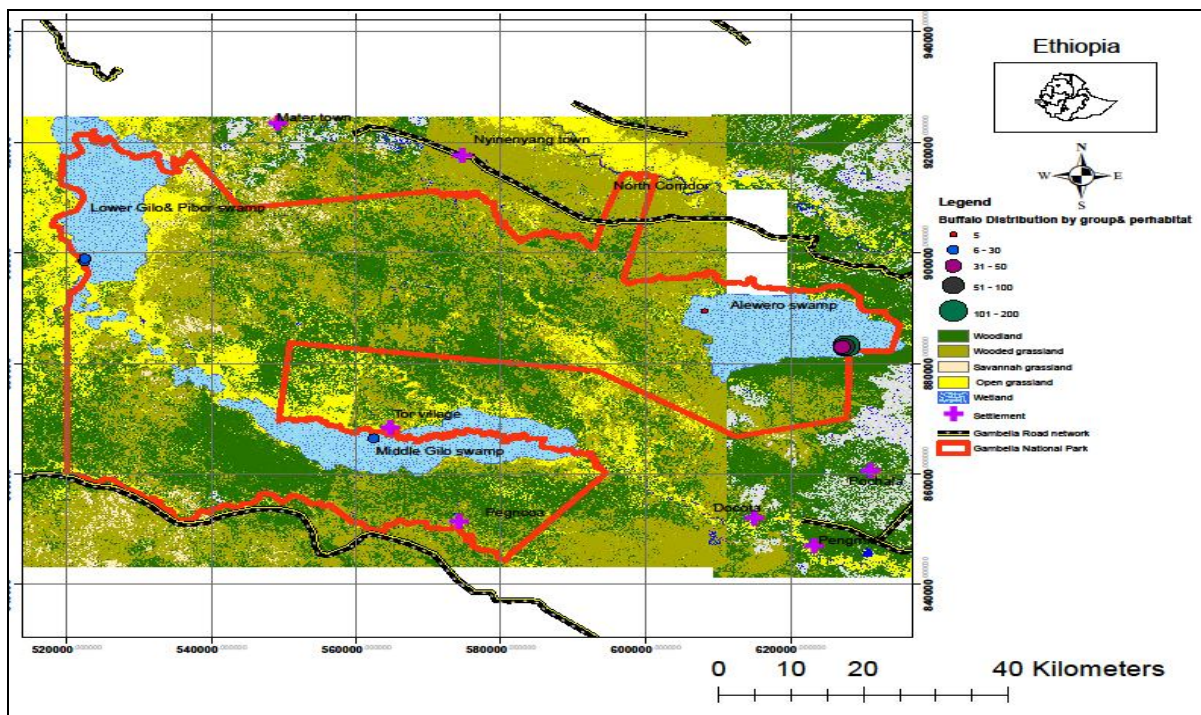


Figure 9: Dry season distribution of Buffalo in Gambella National Park

5.3.5. Distribution of African Elephant (*Loxodonta*)

The distribution of African elephant was observed in different habitat types. However, the largest group distribution was observed in wetland habitat of Gilo river. The main reason may be due to searching for water at Gilo river. This group had composed of 11-328 individuals. The smallest group of 5 individuals was observed in woodland habitat. Other group distribution of 6-10 individuals was also observed in woodland but outside the National Park (Figure, 10). Therefore, it can be concluded that, the dry season distribution of African elephant was restricted to the western part of the Gambella National Park.

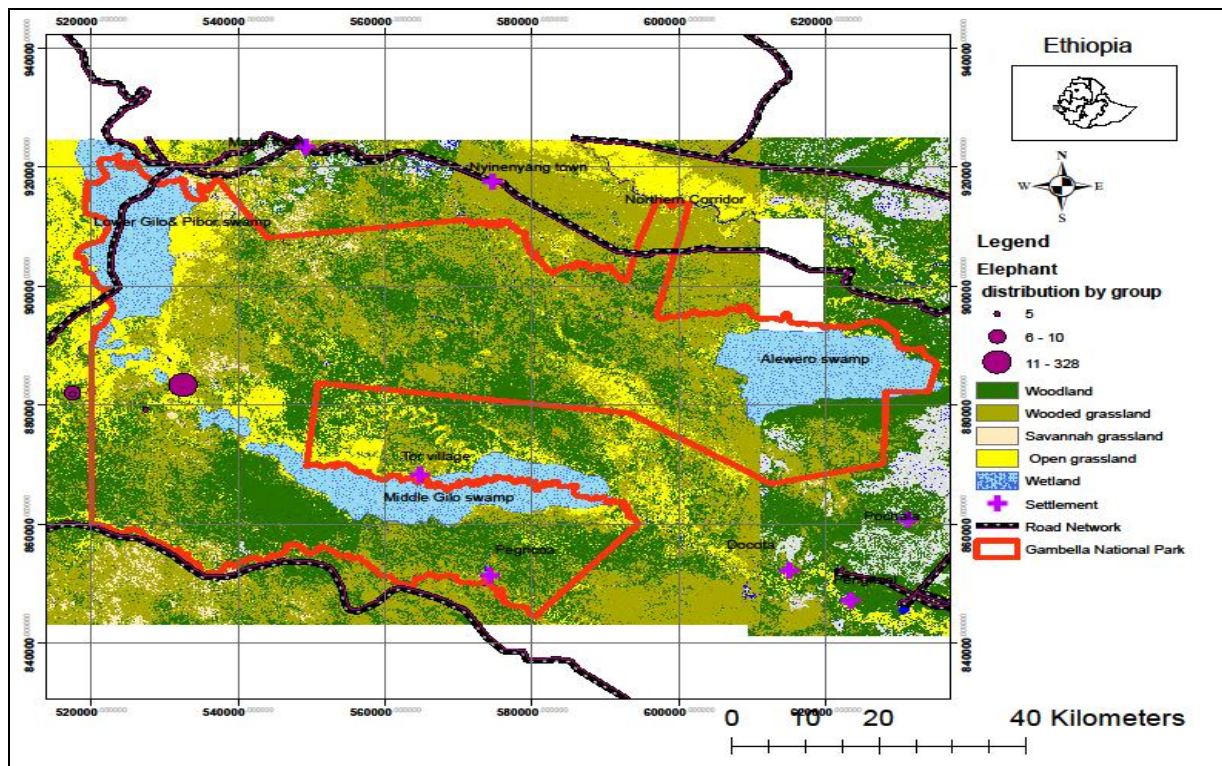


Figure 10: Dry season distribution of African elephant in Gambella National Park

5.3.6. Distribution of Tiang (*Damaliscus Lunatus*)

Tiang distribution was observed at the east of the Gambella National Park, south east of Alewero swamp. The largest group had 34-36 individuals observed in wooded grassland at the east course of Alewero swamp. The small group with 33 individuals was observed in wetland namely Alewero swamp (Figure, 11). Therefore, this study had indicated the wooded grassland and wetland in dry season as its most relevance habitat types. This may be due to presence of *Oryza* species in the wetland and *Hypparrhenia rufa* and *Sacciolepis africana* in wooded grassland, which were observed at the survey time as major feed for them.

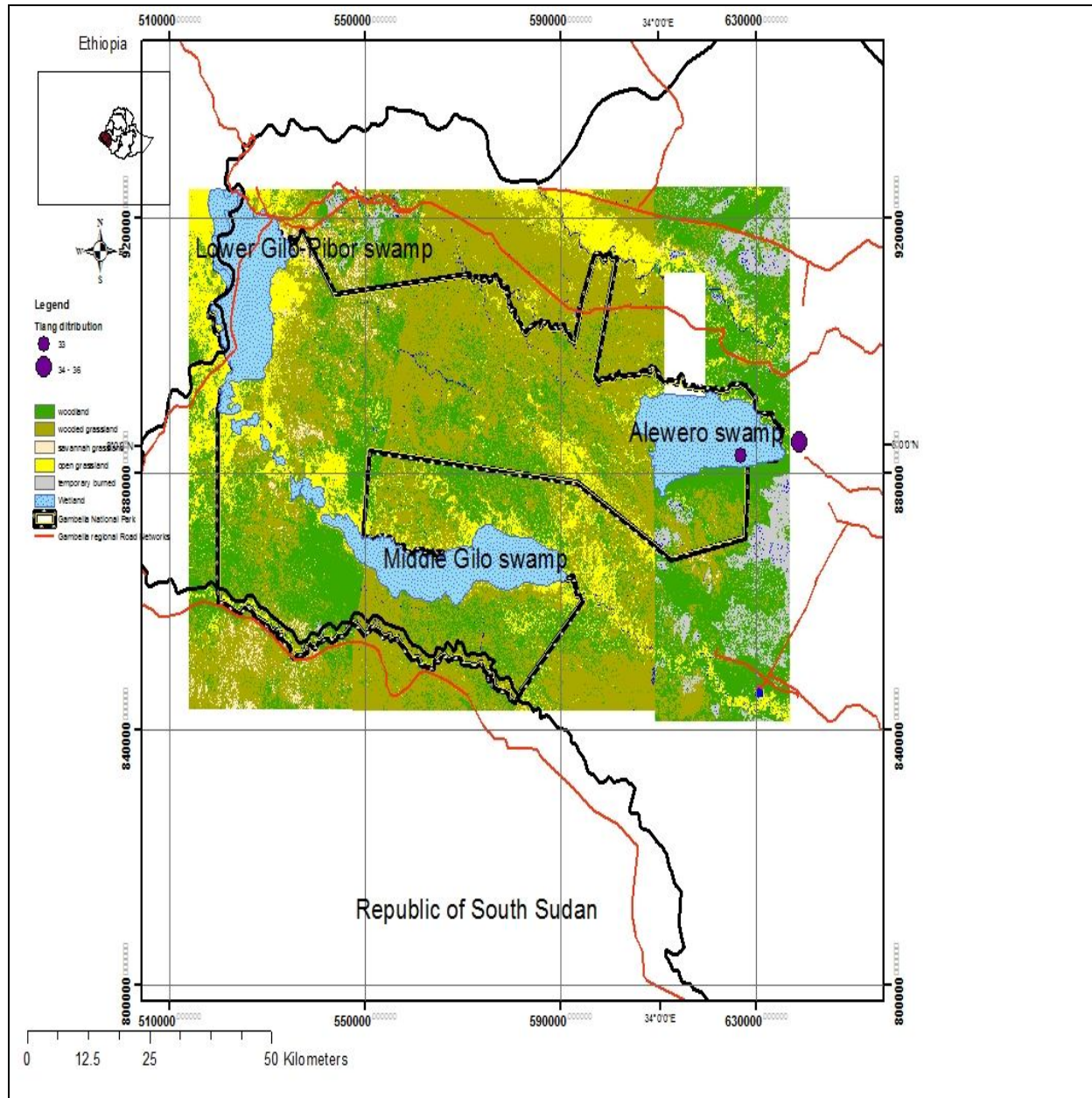


Figure 11: Dry season distribution of Tiang in the Gambella National Park

5.3.7. Distribution of Shoe Bill Stork in Gambella National Park

The distribution of Shoe bill stork in Gambella National Park was observed in the Alewero swamp with two separate groups. A large group 5-8 individual was observed in the central part of the Alewero swamp. A small group with 4 individuals was observed in the east of Alewero swamp (Figure, 12). The reason behind the presence of Shoe bill stork in Alewero swamp may be due to the presence of fish diversity in Alewero swamp than Middle Gilo and Lower Gilo-Pibor swamps. Its status listed as vulnerable by International Union for conservation of Nature and Natural Resources (IUCN) and listed under appendix II of Convention for International Trade of Endanger species of Wild fauna and Flora (CITES). Based on this research information, the Shoe bill stork had limited home range with small population in Gambella National Park. Therefore, Alewero swamps need to have watershed management at its upper course.

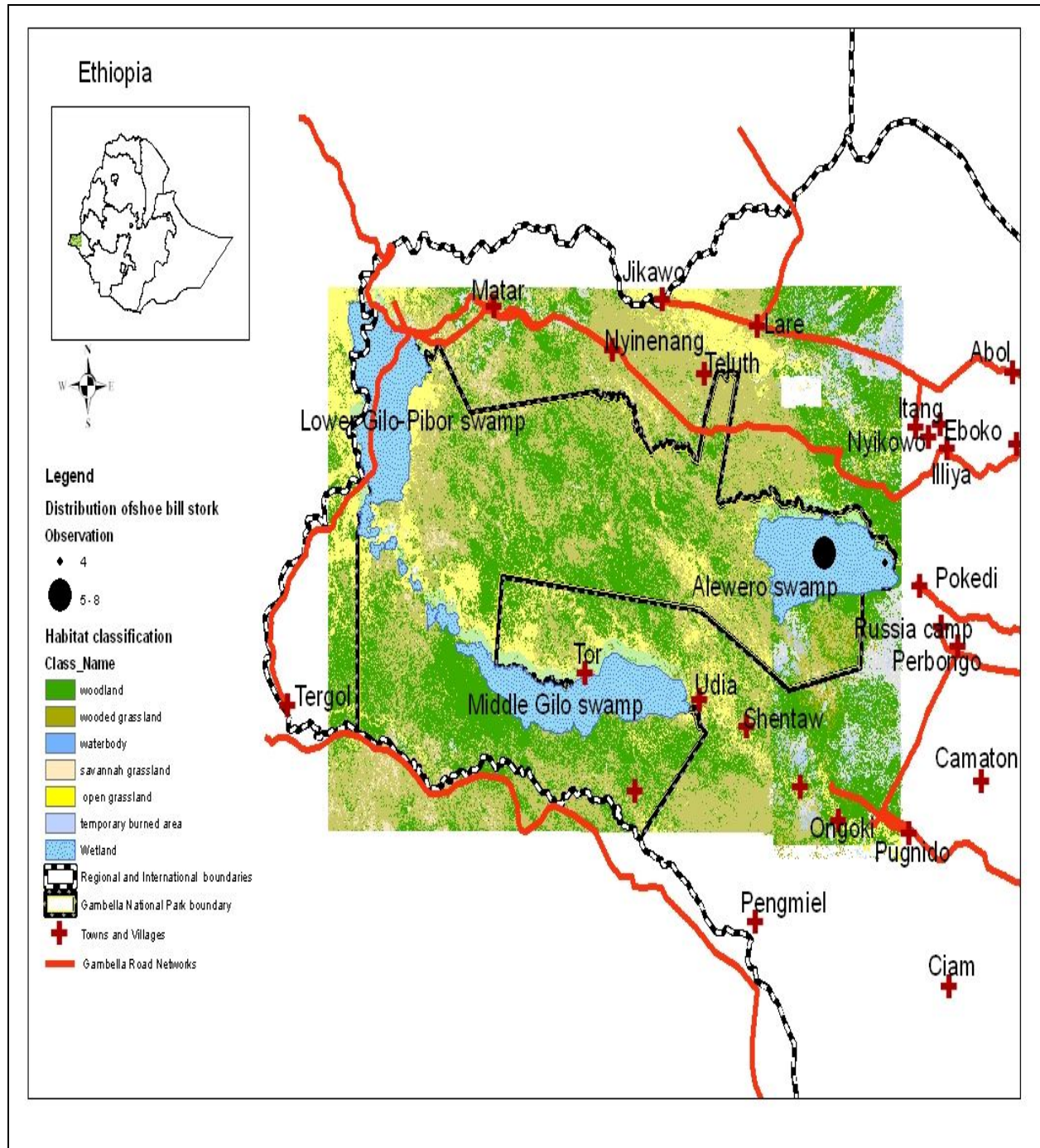


Figure 12: Dry season distribution of Shoebill stork in Gambella National Park

5.4. Dry Season Density of Studied Wild Animal Species of Gambella National Park

5.4.1. Density of White Eared Kob (Kobus Kob) in Dry Season

The highest density of White eared kob was 389-437 per square kilometer and the lowest density was 0-48 per square kilometer (Figure, 13). The highest density was observed in the north eastern part of the Park where as the lowest density was highly observed in the south of the National Park. Other densities between the maximum and the minimum were observed in the central and northern part of Park.

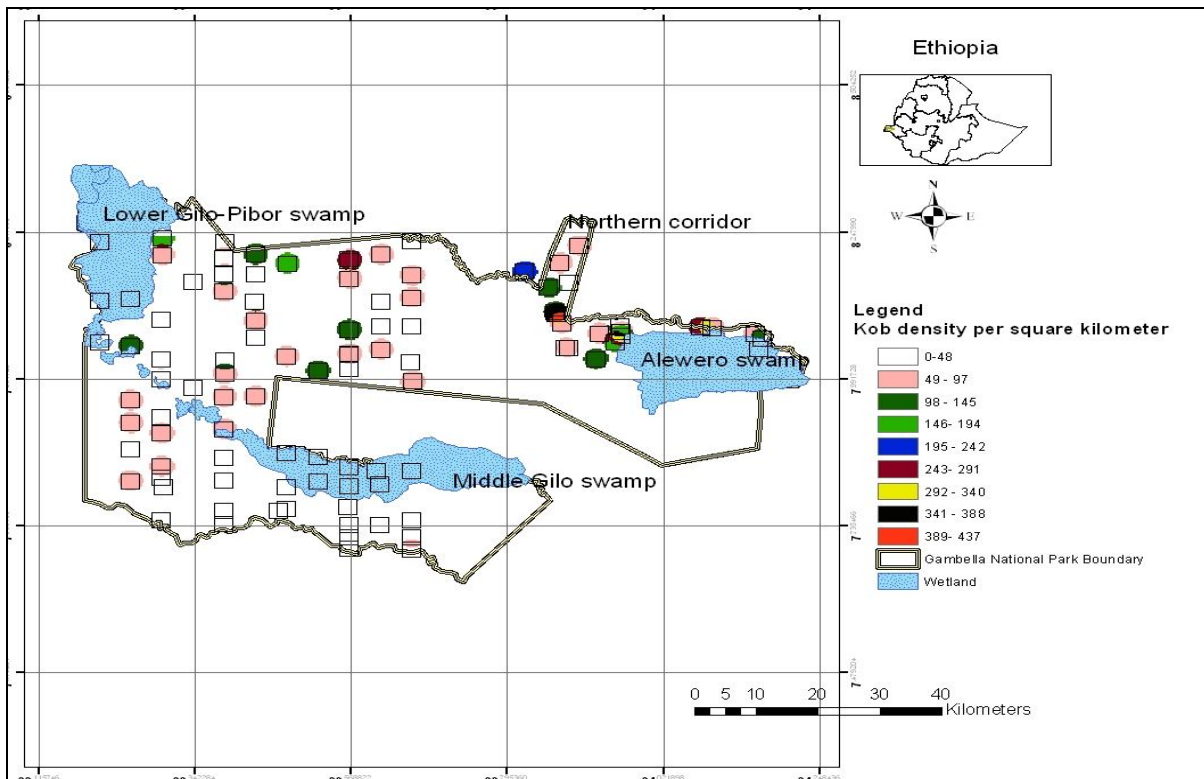


Figure 13: Dry season density of White eared kob in Gambella National park

5.4.2. Density of Nile Lechwe (*Kobus Megaceros*)

The Nile lechwe had a high density of 8-16 per square kilometer and its low density was 0-8 per square kilometer (Figure, 14). Its density was observed only on the east of Alewero swamp of the Gambella National Park. This is because the population of Nile lechwe was found only in the Alewero swamp.

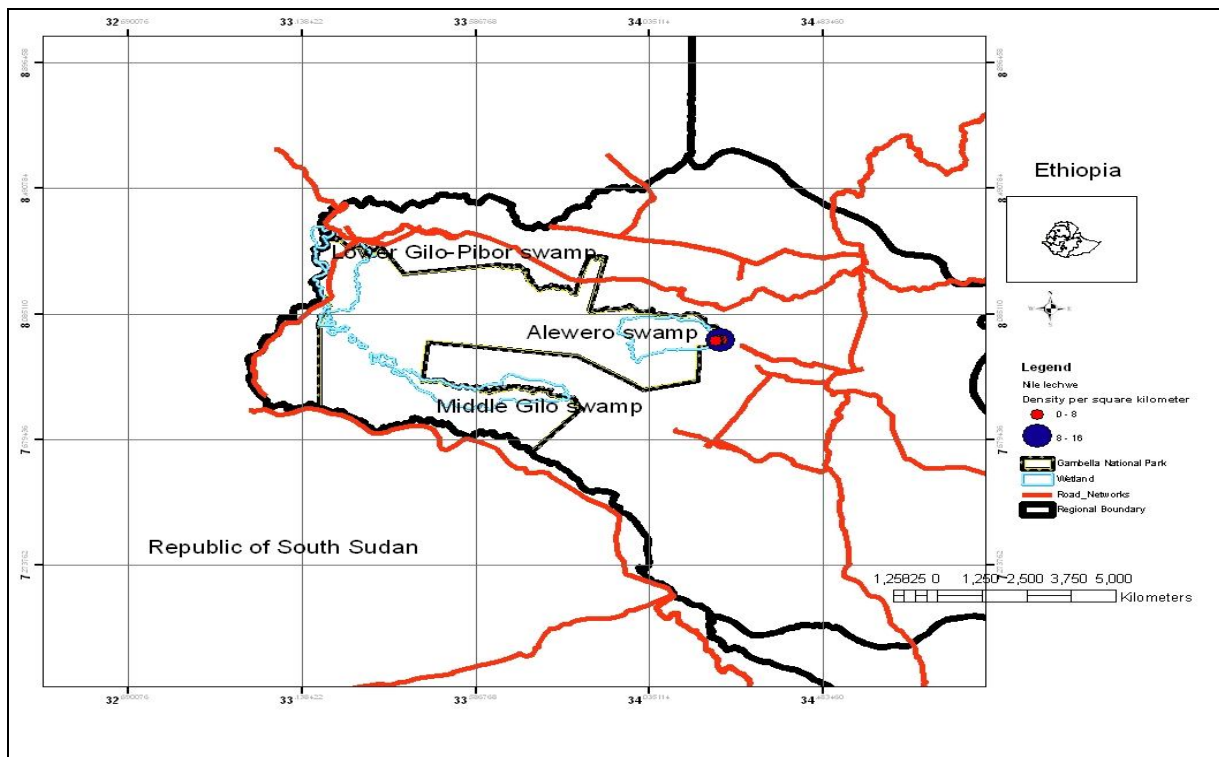


Figure 14: Density of Nile lechwe in Gambella National park

5.4.3. Density of Buffalo (*Syncerus Caffer*)

The density of Buffalo in dry season was observed in the wetlands of the Park however, its highest density of 51-150 per square kilometer was observed in the Alewero swamp (Figure, 15). The absence of poaching may be the reason to encourage the huge population of Buffalo to occupy small area in the Alewero swamp than other swamp in the Park. Its density of 4-50 per square kilometer was observed in Lower Gilo-Pibor swamp but its lowest density of 0-4 per square kilometer was shared by Alewero and Middle Gilo swamp.

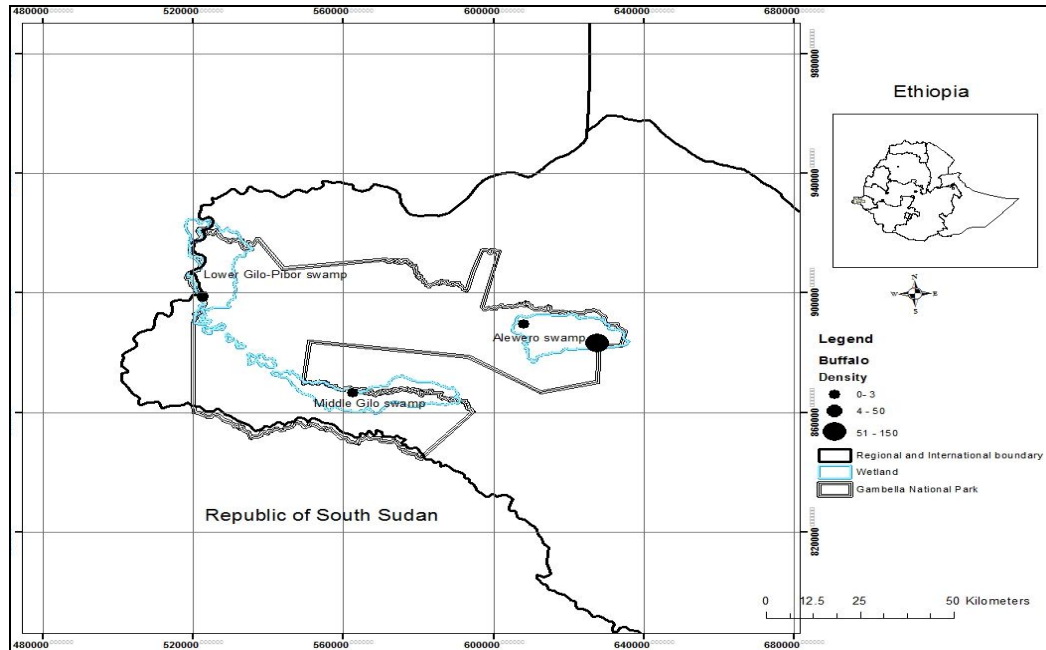


Figure 15: Dry season density of Buffalo in Gambella National Park

5.4.4. Density of African Elephant (*Loxodonta*)

The highest density was 44-66 elephant per square kilometer followed by 22-44 elephant per square kilometer (Figure, 16). The lowest density was 21 elephant per square kilometer. The density of elephant was highest at the bank of Gilo river. This may be probably this group was a temporary presence in this habitat for sack of pasture and drinking water at the river basin. The lower density of elephant per square kilometer may be due to presence of the pond in the woodland habitat where the smallest group was satisfied for its water need.

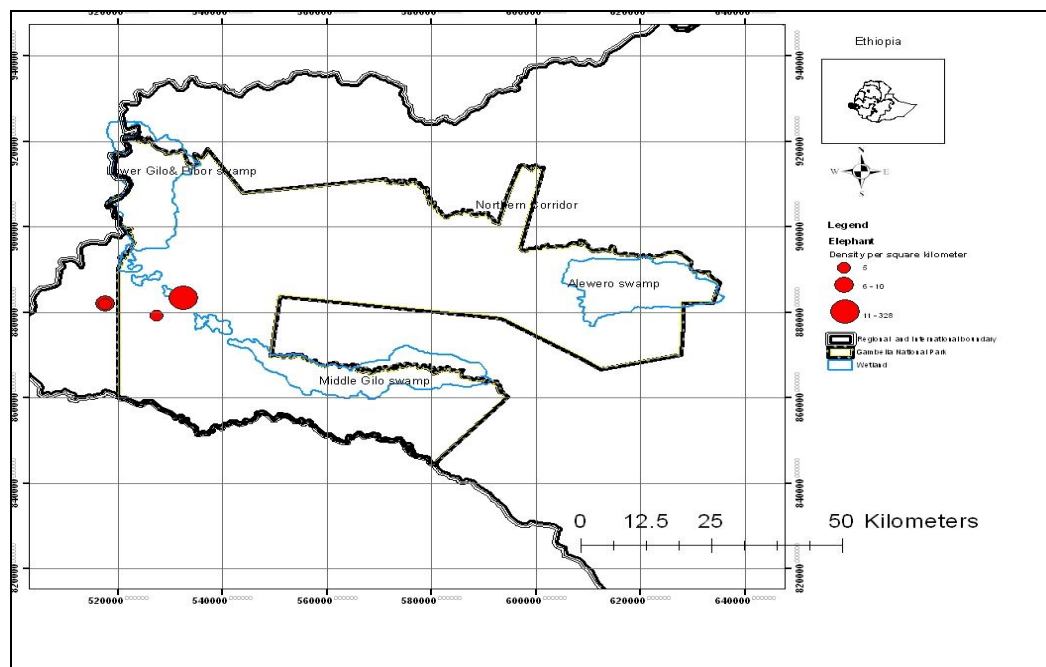


Figure 16: Dry season density of African elephant in Gambella National Park

5.4.5. Density of Tiang (*Damaliscus Lunatus*)

The highest density of Tiang was 49-75 per square kilometer followed by 25-48 per square kilometer however; its lowest density was 0-24 per square kilometer (Figure, 17). All its densities were observed in the east of Alewero swamp of Gambella National Park. This may be due to presence of its population in the east of Alewero swamp.

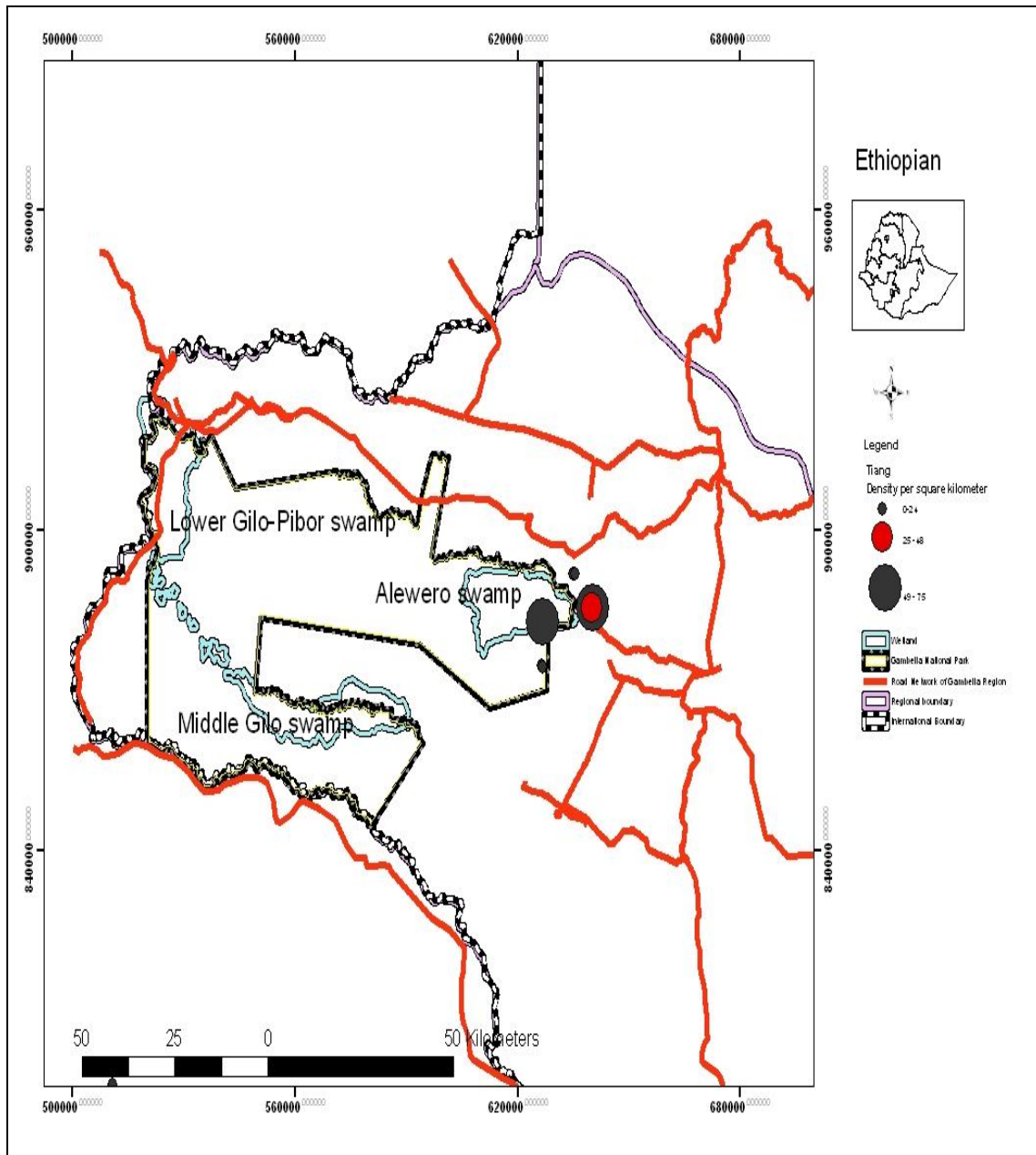


Figure 17: Dry season density of Tiang in Gambella National Park

5.5. Wet Season Distribution of Studied Wild Animal Species of Gambella National Park

5.5.1. Distribution of White Eared Kob (*Kobus Kob*)

The distribution of White eared kob in Gambella National Park was accompanied by the habitat classification of the Park and its distributions were categorized by group size. The largest group of 101-200 individuals was observed in wooded grassland in the northern part of the park (Figure, 18). Similar groups of 24-60 and 61-100 individuals were observed in wooded grassland in the north and grassland in the south respectively. However, those located in the south were observed outside of the National Park. The reason for presence of White eared kob in the north and the south of the National Park may be due to absent of flooding in those areas at the survey time. Therefore, the observed White eared kobs in the wet season were the resident of Gambella National Park.

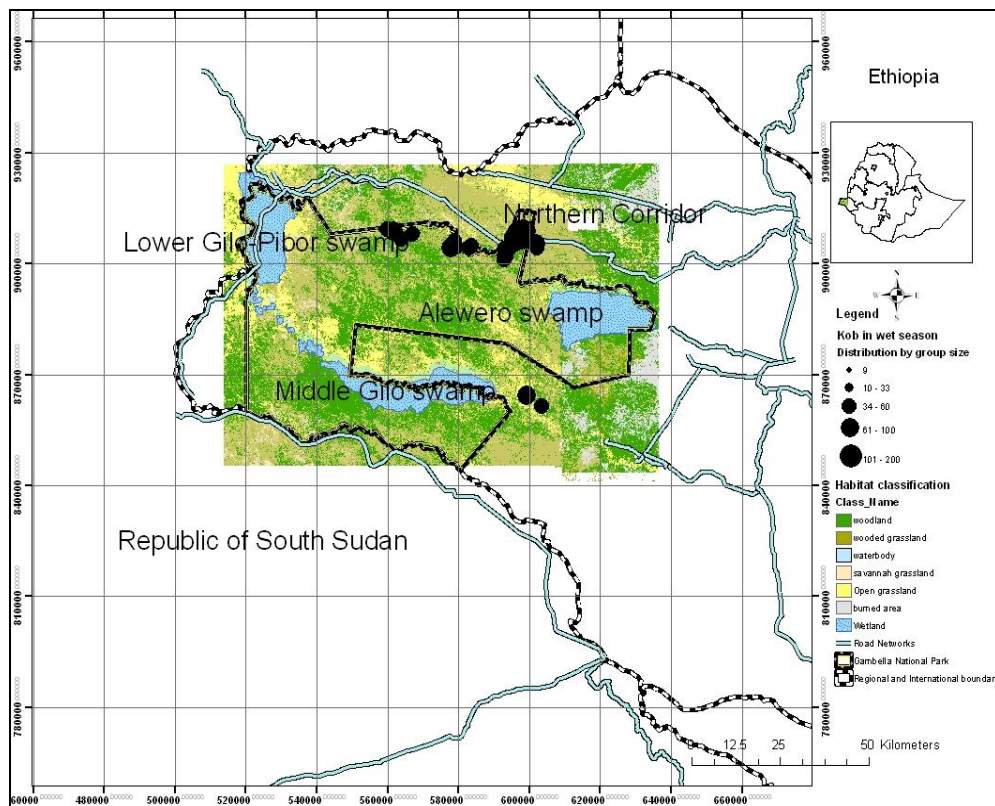


Figure 18: Wet season distribution of White eared kob in Gambella National Park

5.5.2. Distribution of Buffalo (Syncerus Caffer)

The distributions of Buffalos in the Gambella National Park were observed in groups. The largest group had 51-60 individuals followed by a group of 26-50 individuals. The smallest group had 1-25 individuals. All its groups' sizes were observed in wooded grassland in the northern part of the Park (Figure, 19). The main reason may be due to absence of flooding in these areas. The other reason may be due to its feeding habit on grass species.

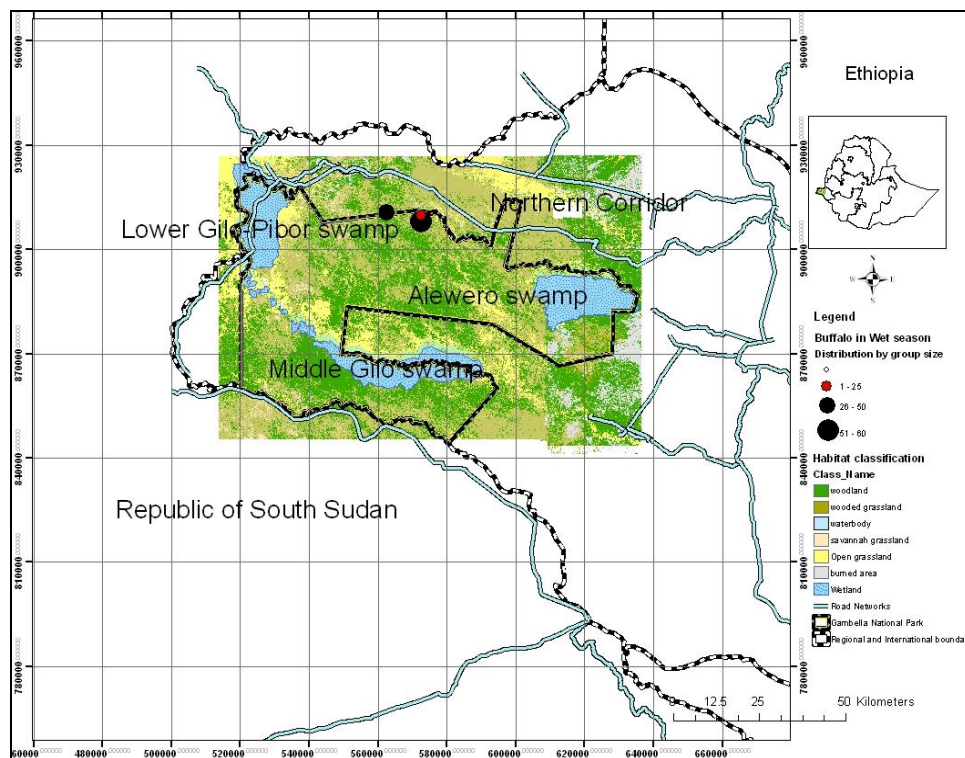


Figure 19: Wet season distribution of Buffalo in Gambella National Park

5.5.3. Distribution of Nile Lechwe (*Kobus Megaceros*)

The group distributions of Nile lechwe were observed in the periphery of the east of Alewero swamp (Figure, 20). The largest group had 21-50 individuals, where as the smallest group was 1-15 individuals. All groups' sizes were observed in wooded grassland, but outside the National Park. The main reason for Nile lechwe to be observed outside the National Park may be due to greater increase of volume water in the Alewero swamp at survey time.

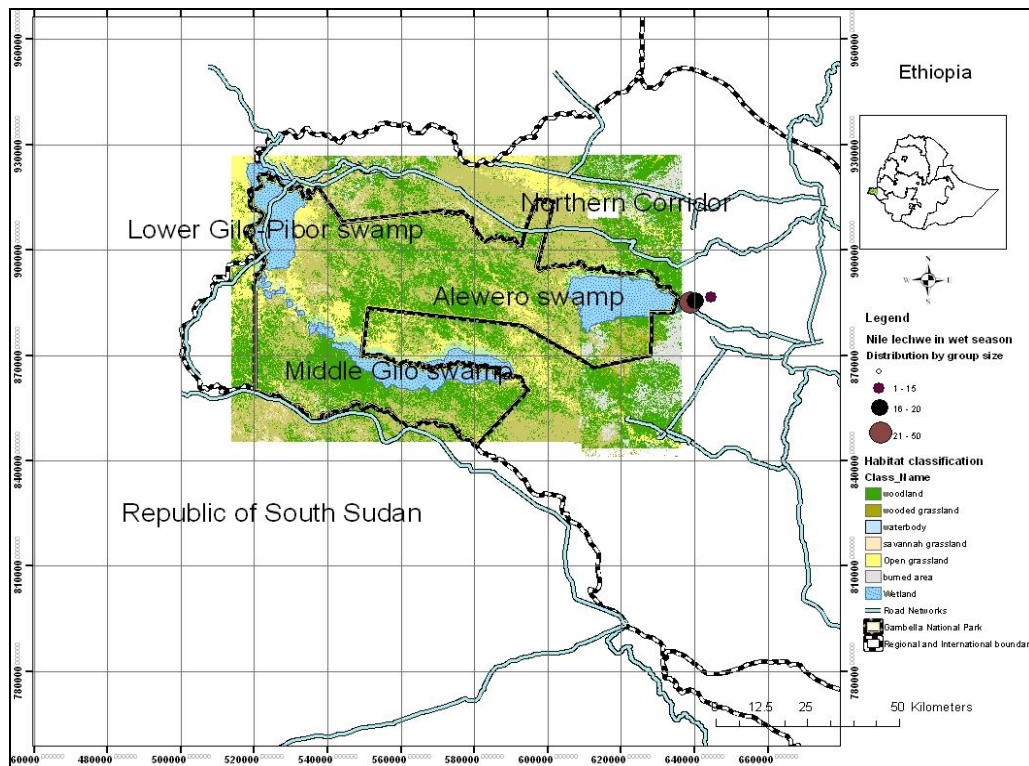


Figure 20: Wet season distribution of Nile lechwe in Gambella National Park

5.5.4. Distribution of Tiang (*Damaliscus Lunatus*)

The largest group distribution of Tiang had 11-20 individuals followed by group of 6-10 individuals (Figure, 21). The smallest group had only 5 individuals. All its groups' distributions of were observed in wooded grassland, southeast of the National Park however, its smallest group was observed outside the National Park.

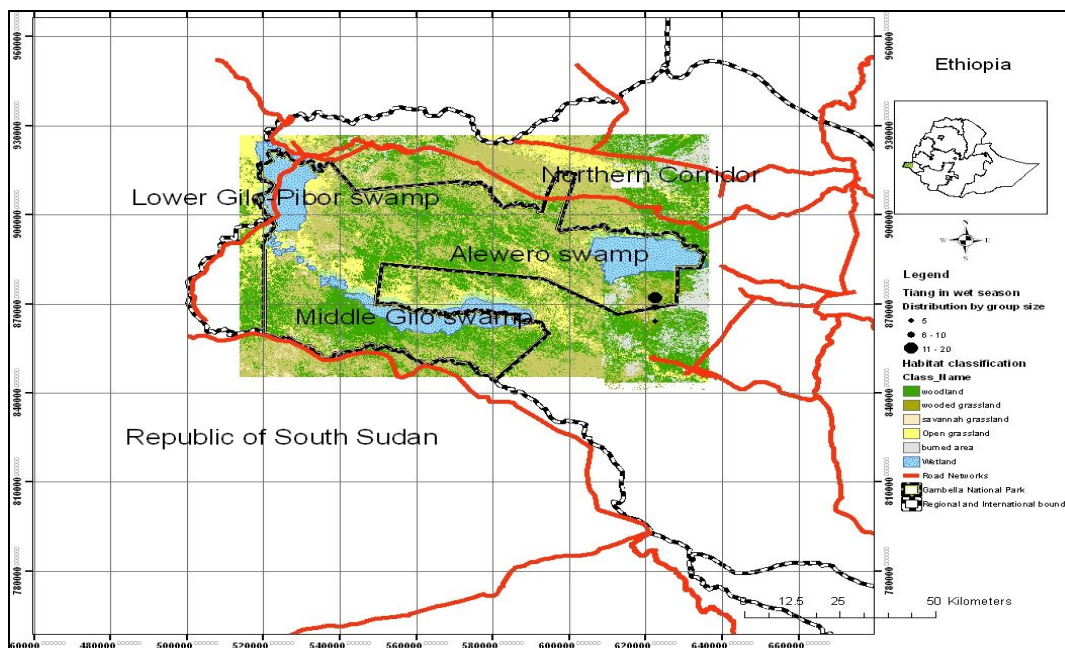


Figure 21: Wet season distribution of Tiang in Gambella National Park

The wet season distribution of Shoe bill stork in Gambella National Park was observed in the wetlands with two separate groups. A large group of 3 individual was observed at the Illiya-Adura road. A small group with 2 individuals was observed in the south of Illiya-Adura road (Figure, 22).The reason behind the presence of Shoe bill stork in this area may be due to the presence of flooding in Alewero swamp which was its preference habitat type in dry season.

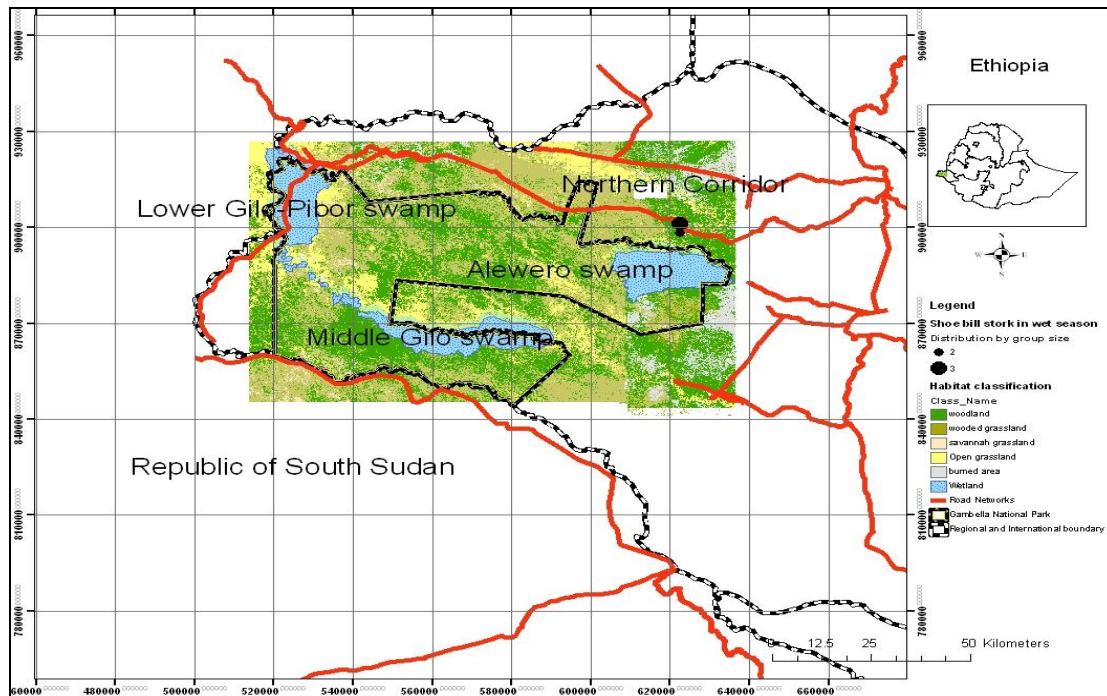


Figure 22: Wet season distribution of Shoe bill stork in Gambella National Park

5.6. Wet Season Density of Studied Wild Animal Species of Gambella National Park

5.6.1. Density of White Eared Kob (Kobus Kob)

The White eared kob had the highest density of 832-1,041 and the lowest density of 0-208 per square kilometer observed in the northern corridor of Gambella National Park. Its densities of 208-416 and 624-832 per square kilometer were observed in the middle Gilo swamp, southeast of the Park (Figure 23). The reason for the density to be observed in the north and the south east of the Park may be due to absence of heavy flooding in those areas.

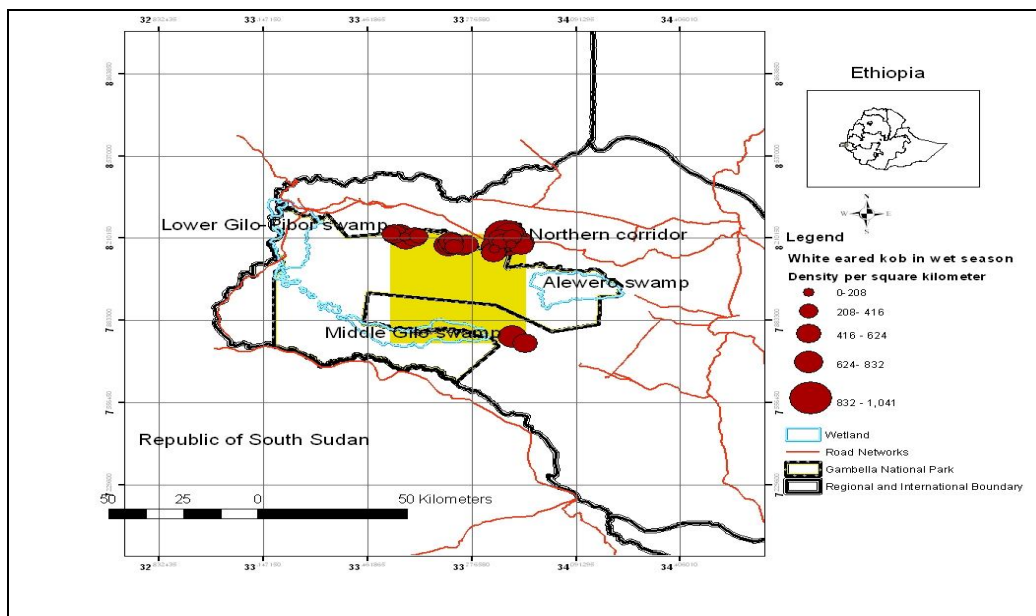


Figure 23: Wet season density of White eared kob in Gambella National Park

5.6.2. Density of Buffalo (*Syncerus Caffer*)

The highest density of buffalo was $\geq 1,071$ per square kilometer followed by 535-1,071 per square kilometer. The smallest density of Buffalo was 0-535 per square kilometer (Figure, 24). All its densities were observed in the north of the National Park. The main reason may be due to absence of flooding in the north of the National Park.

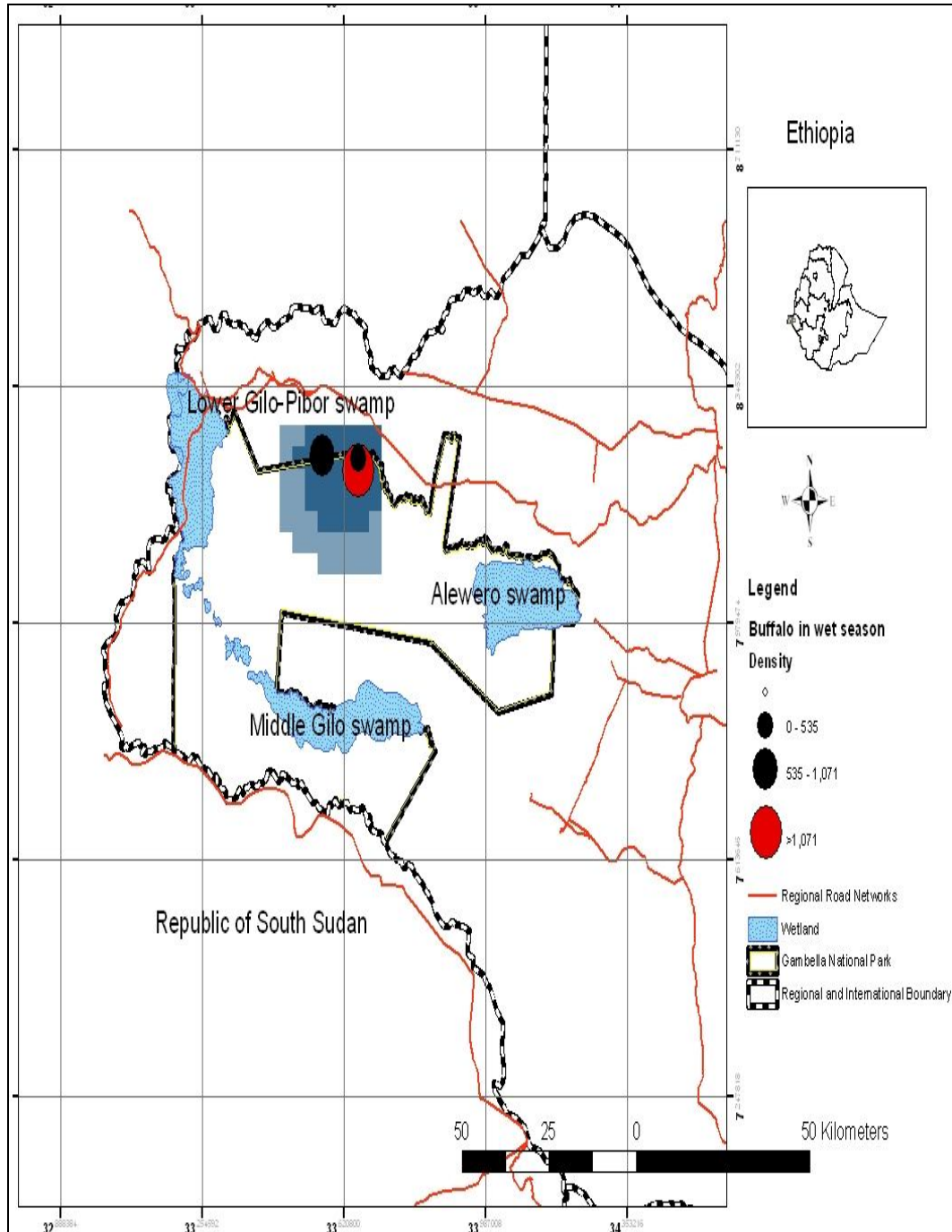


Figure 24: Wet season density of Buffalo in Gambella National Park

5.6.3. Density of Nile lechwe (*Kobus megaceros*)

The Nile lechwe had the highest density of ≥ 743 per square kilometer followed by the density of 341-743 per square kilometer. Its lowest density was 0-371 per square kilometer. All its densities in the wet season were observed at the east of Alewero swamp outside the Gambella National Park but too closed to Alewero swamp (Figure, 25). The reason for the Nile lechwe to be observed outside the National Park could be due to increase of the volume of water in the Alewero swamp.

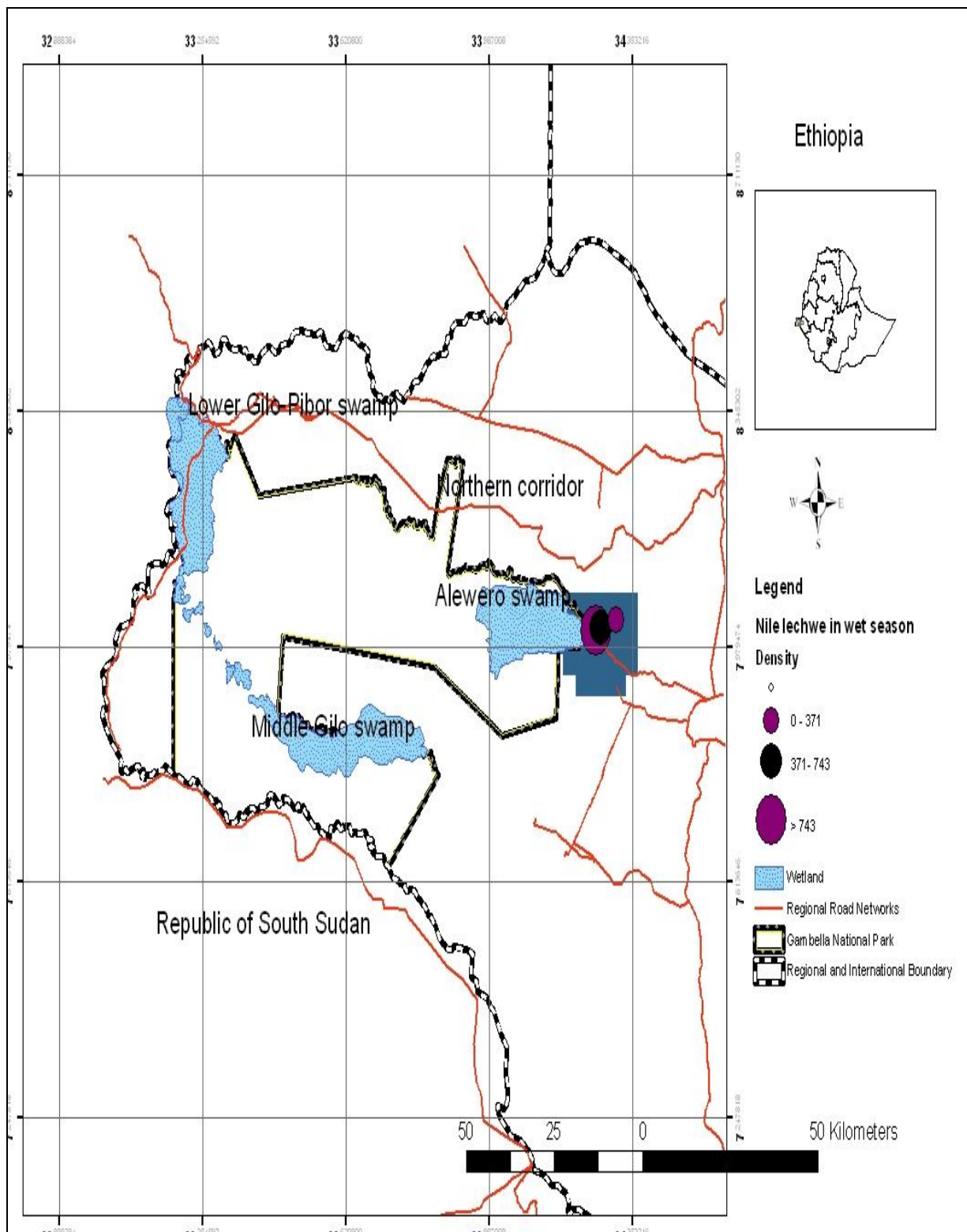


Figure 25: Wet season density of Nile lechwe in Gambella National Park

5.6.4. Density of Tiang (*Damaliscus lunatus*)

The Density of Tiang in wet season was observed in south of Alewero swamp of the Gambella National Park. The highest density was observed inside the National Park, which had 30-48 per square kilometer followed by 16-30 per square kilometer however, the smallest density 0-16 per square kilometer was observed outside the National Park (Figure, 29).

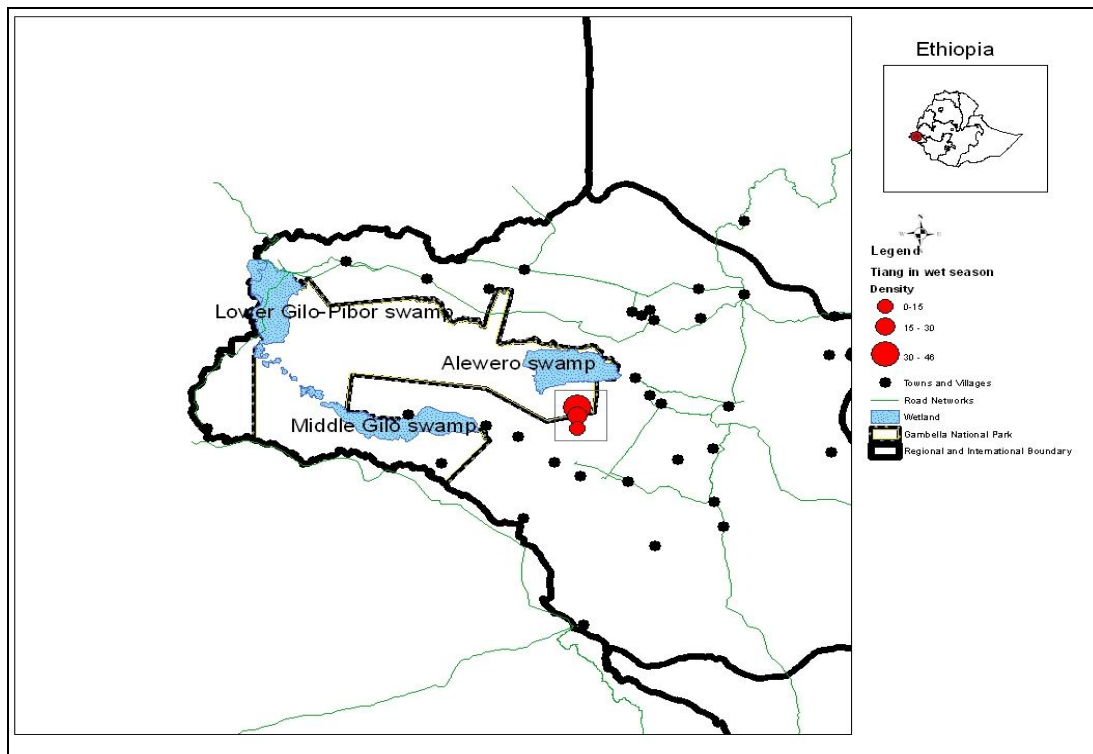


Figure 26: Wet season density of Tiang in Gambella National Park

6. Discussions

White eared kob had the highest abundance and distribution of all studied wild animal species in Gambella National Park followed by Buffaloes for both dry and wet seasons. However, African elephant had higher abundance and distribution next to Buffalo, which was only observed in dry season. The Shoe bill stork had the less abundance of all key studied wild animal species of the Park for both dry and wet season seasons. The preference of habitat types for all studied wild animal species varies between dry and wet seasons. In dry season, the most preference habitat types of White eared kob were observed in open grassland followed by woodland, wooded grassland and savannah grassland. In dry season, the Nile lechwe, Buffalo, Tiang and Shoe bill stork used wetlands as their preference habitat types. Major population African elephant and Tiang were also observed in the wetlands of the Park. But in wet season, the preference habitat types of White eared kob were wooded grassland and open grassland. However, wooded grassland was wet season preference habitat type for Buffalo, Nile lechwe and Tiang. The main reason for the difference in the seasonal preference habitat types for studied wild animal species may be due to presence of flooding in the wet season.

In general the densities of Buffalo, Nile lechwe and White eared kob were higher in the wet season than dry season. This may be due to flooding in the wet season where the studied wild animal species occupied and concentrated in smaller areas than the dry season. African elephant was not found in the wet season survey. This is because of flooding and lack of accessibility to its habitat in wet season.

This research had shown the difference with previous studied because it was mainly studied the abundance and distribution of key studied wild animal species as well as their preference habitat types. However, the Gambella aerial survey 2009, 2010 and 2013 reports were described only the geographical distribution of wild animal species in the Park as well as human activities of the region.

7. Conclusion

It can be concluded that, abundance and distribution of White eared kob were the highest of all studied wild animal species and observed in all habitat types of Gambella National Park. However, the abundance and distributions of Nile lechwe, Buffalo, Shoe bill stork were observed in wetland of the park. Moreover, half population of Tiang and Major population of African elephant were also observed in the wetland habitats of the Park. In general the densities of the studied wild animal species were higher in the wet season than dry season with exception of Tiang, which had higher density in the dry season than wet season.

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