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INTERNATIONAL COURT OF JUSTICE

CASE CONCERNING ARMED ACTIVITIES ON THE TERRITORY OF THE CONGO

(DEMOCRATIC REPUBLIC OF THE CONGO *v.* UGANDA)

SECOND PHASE

QUESTION OF REPARATION

MEMORIAL

OF THE

DEMOCRATIC REPUBLIC OF THE CONGO

VOLUME 9

(Annexes 5.15 to 5.20)

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[Translation by the Registry]

LIST OF ANNEXES

Volume 9
Annexes 5.15 to 5.20

ANNEX 5.15

Kes Hillman Smith, Fraser Smith, Amube Ndey, Mbayma Atalia, Jean Mafuko, Paulin Tshikaya, Giningayo Panziama and John Watkin, ***Garamba National Park and reserves — general aerial counts 1998, 2000, 2002 & 2003 and evaluation of the effects of the civil wars on the ecosystem***

PARC NATIONAL DE LA GARAMBA
Et DOMAINES DE CHASSE

GENERAL AERIAL COUNTS 1998, 2000, 2002 & 2003 AND EVALUATION OF THE EFFECTS OF THE CIVIL WARS ON THE ECOSYSTEM

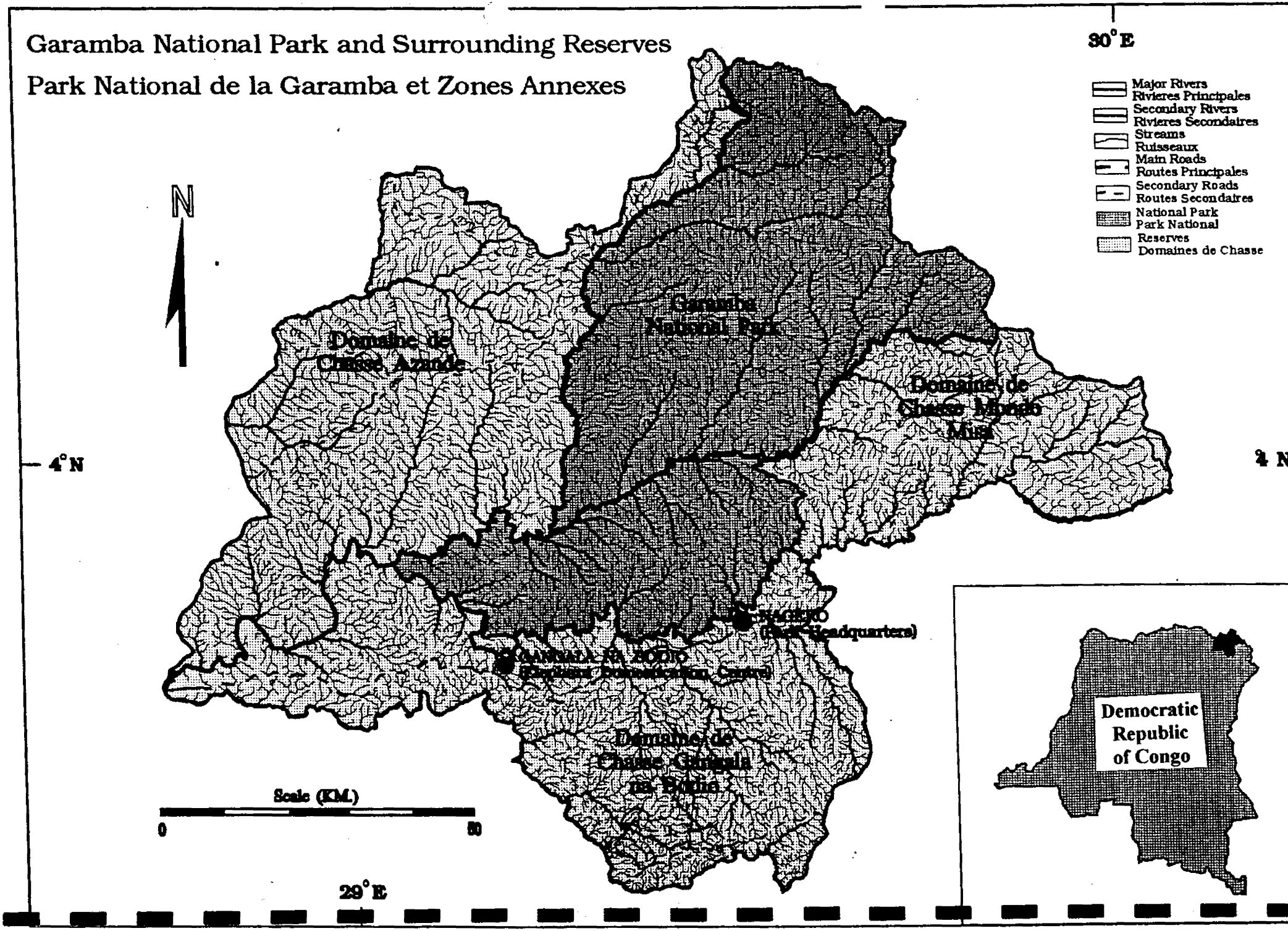
RECENSEMENTS AERIENS GENERAUX DE 1998,2000, 2002 & 2003 ET EVALUATION DES EFFETS DES GUERRES CIVILES SUR L'ECOSYSTEME

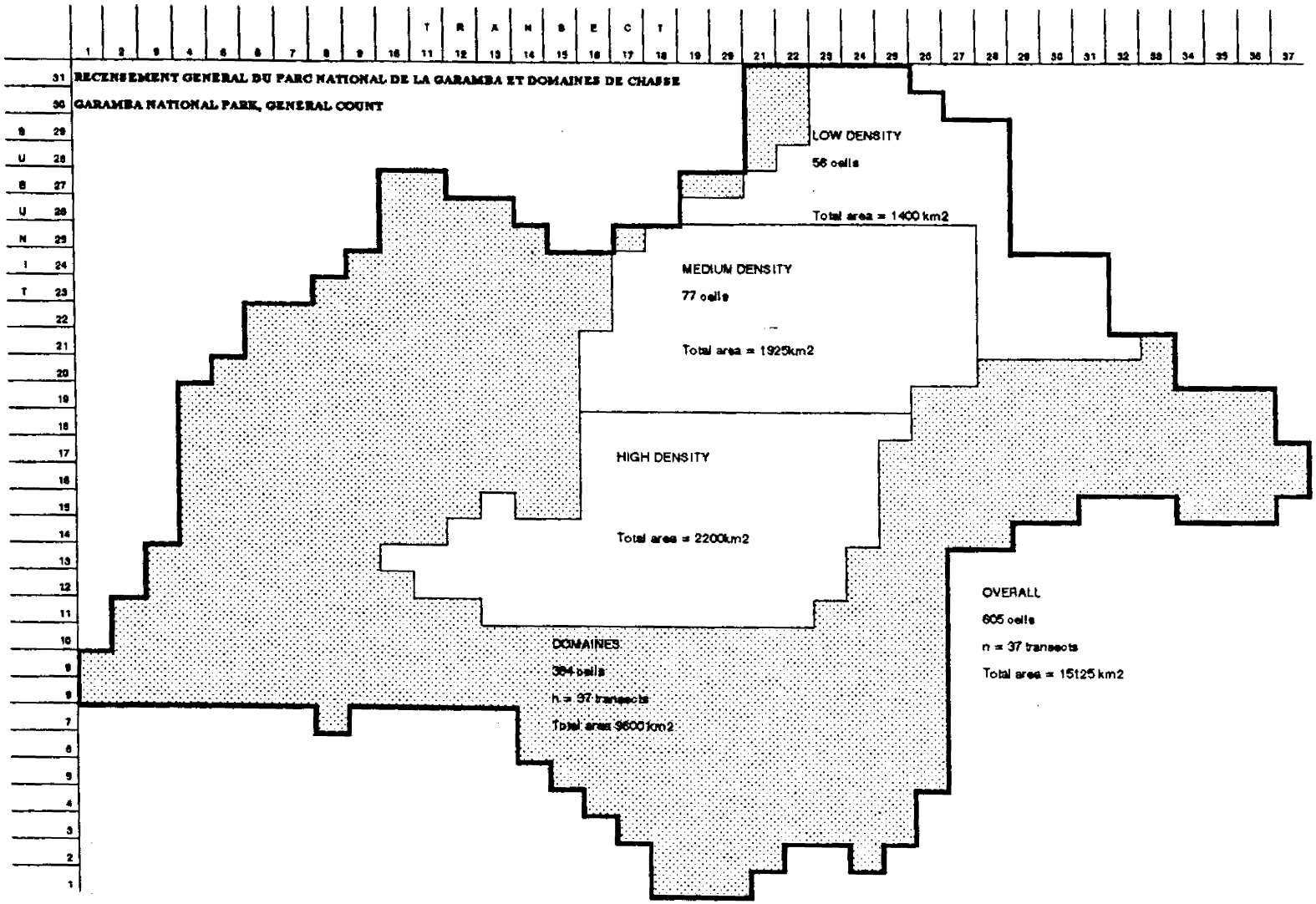
Kes Hillman Smith, Fraser Smith, Amube Ndey, Mbayma Atalia
Jean Mafuko, Paulin Tshikaya, Giningayo Panziama & John Watkin

Version Française traduite par Jean Bigirimana Mugabushaka

Garamba National Park and Surrounding Reserves

Park National de la Garamba et Zones Annexes




RECENSEMENT GENERAL DU PARC NATIONAL DE LA GARAMBA ET DOMAINES DE CHASSE
GARAMBA NATIONAL PARK, GENERAL COUNT
TRANSECT
LOW DENSITY
56 cells
Total area = 1400 km2
MEDIUM DENSITY
77 cells
Total area = 1925km2
HIGH DENSITY
Total area = 2200km2
DOMAINES
384 cells
n = 97 transects
Total area 9600 km2
OVERALL
605 cells
n = 37 transects
Total area = 15125 km2

GARAMBA NATIONAL PARK AND RESERVES

GENERAL AERIAL COUNTS 1998, 2000, 2002 & 2003

INTRODUCTION

General all species aerial censuses of the Garamba National Park and surrounding Domaines de Chasse are carried out as part of the ecosystem monitoring programme. This is a report of the counts carried out in May 1998, June 2000, May 2002 and May 2003, with discussion on the status of the ecosystem and the effects of the civil wars during this period.

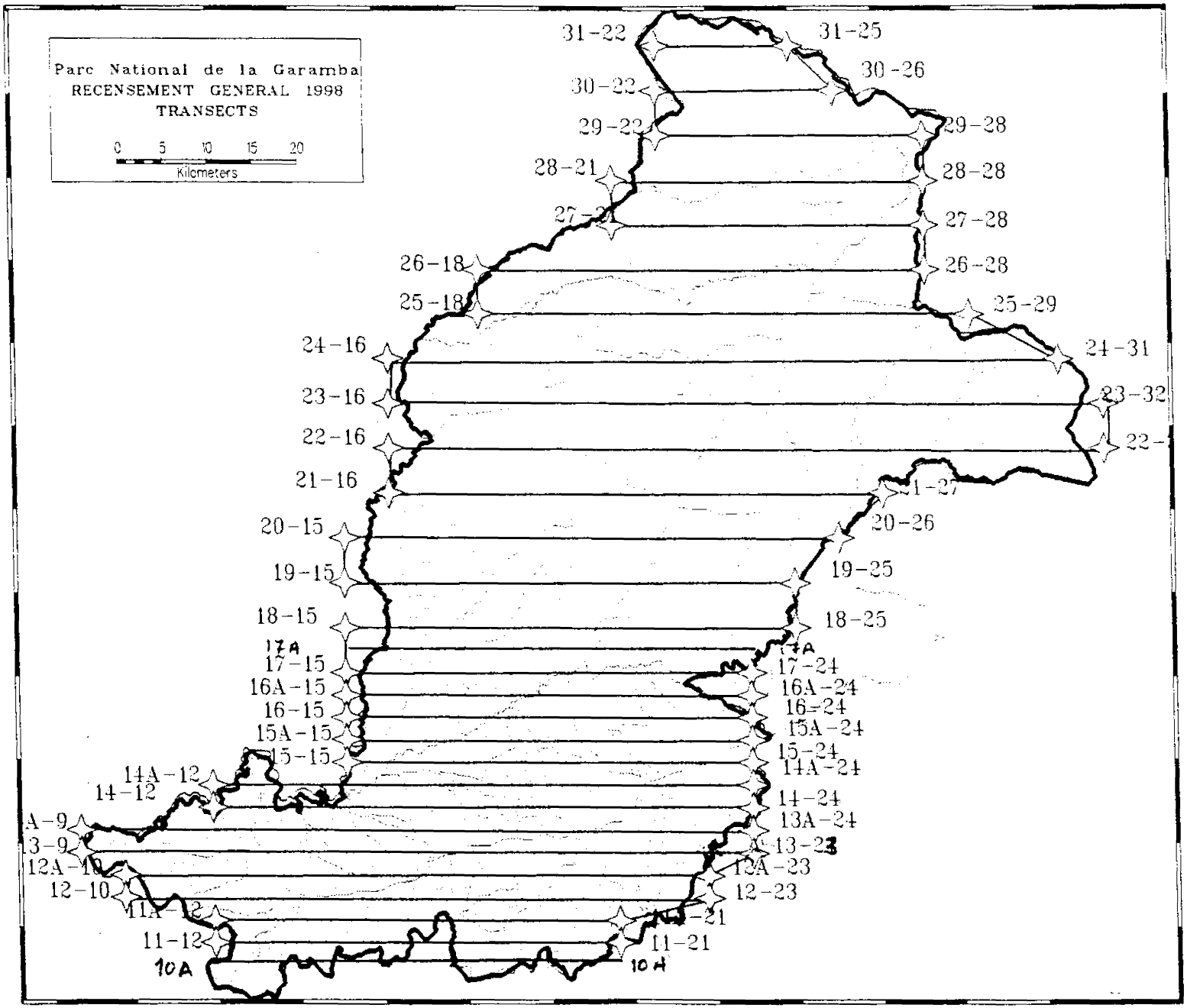
The Garamba National Park (4,900 km^2) is situated between 4° and 3° north and 29° and 30° east in the north east of the Democratic Republic of Congo (DRC). It is surrounded on three sides by reserves, the Domaines de Chasse Azande, 2,892 km^2 to the west, Gangala na bodio, 2,652 km^2 to the south, and Mondo Misa, 1,983 km^2 to the east. All these areas were counted. On the north east, within Sudan, the park is bordered by the Lantoto game reserve. This area was not included, due to the political situation.

The park is situated within the sudano-guinean savanna biome. The southern two thirds of the park comprises long grass savanna dominated by *Loudetia arundinacea* with *Hyparrhenia* species. The reserves are dominated by a complex of deciduous *Combretum* woodland and gallery forest. Within them is limited human settlement and gold mining.

The first aerial census of the area was carried out in 1976 (Savidge et al 1976) by an FAO project. Since then the ecosystem has been censused in 1983 during a survey of northern white rhinos (*Ceratotherium simum cottoni*) (Hillman et al 1983) and since 1984 as part of the Garamba National Park Project. (Hillman Smith 1990, Smith et al 1993).

The counting technique and basic analysis has remained standard throughout, based on the systematic aerial sample count method described by Norton Griffiths (1978) and Jolly Method 2 analysis (In Norton Griffiths 1978), but the process of analysis has varied. Analysis is now carried out with a system developed using the commercial software programme Quattro pro 4 (Borland 1992) for the 1993 count (Watkin et al 1995). The method of counting and analysis as applied at Garamba has been written up as a handbook (Hillman Smith et al 1995) to guide long term standard application of the technique in the monitoring programme at Garamba. We hope it may also contribute a few guidelines for easy analysis of aerial counts elsewhere.

A UTM (universal transverse mercator) compatible system of coordinates, which was based on the transect lines used since the 1983 count has been used to locate all animal and habitat observations since 1983 and all law enforcement monitoring observations since 1992. In conjunction with the establishment of a geographic information system (GIS) at Garamba in 1993, this has now been expanded to cover the surrounding reserves and is maintained as the basis for the positioning of the flown transects. A Garmin global positioning system (GPS) was used to navigate the transects and sub-units. The GIS programme Idrisi has been used in mapping the vegetation cover.


Parc National de la Garamba
RECENSEMENT GENERAL 1998
TRANSECTS
0 5 10 15 20
Kilometers
31-22
31-25
30-26
30-22
29-22
29-28
28-21
28-28
27-28
26-18
26-28
25-18
25-29
24-16
24-31
23-16
23-32
22-16
22-
21-16
20-15
20-26
19-15
19-25
18-15
18-25
17A
17-15
17-24
16A-15
16A-24
16-15
16-24
15A-15
15A-24
15-15
15-24
14A-12
14A-24
14-12
14-24
A-9
13A-24
3-9
13-23
12A-10
12A-23
12-10
12-23
11A-
-21
11-12
11-21
10A
10A

Counting method

The counting method is the standard aerial systematic reconnaissance flight (srf) using parallel transect sampling as described by Norton Griffiths (1978) and widely used for aerial counting of wildlife and livestock. Heights, strip widths and general application of the method have been relatively standard throughout the series of counts. Analysis is carried out using jolly's method ii (Norton Griffiths 1978) in the spreadsheet programme quattro pro, and shaded vegetation mapping uses the gis programme idrisi.

Aircraft:	Cessna 206, 9Q-CBR			
Pilot:	Fraser Smith			
Front seat obs.:	Kes Hillman Smith			
	1998	**2000**	**2002**	**2003**
Middle seat obs.:	Mbayma Atalia Mafuko Girineza	Mbayma Atalia Giningayo Panziama	Amube Ndey Giningayo Panziama	Amube Ndey Paulin Tshikaya
Rear seat obs.: Training & analysis	Amube Ndey Giningayo Panziama	Amube Ndey		Serge Iliabo Mambo Marindo
Analysis design:	John Watkin & KHS,, re-design for EW transect re-orientation K H.S & Kerin Adcock			
Analysis:	Amube Ndey, Kes H. Smith, Mbayma Atalia, based on Hillman Smith et al (1995) and Watkin et al (1995)			
Census zone:	Garamba National Park Total area 4,900 km^2			

Timing:

For greatest accuracy in population estimation the period April to mid June, just after the start of the long wet season offers best visibility. The grass is short and the air is cleared by the rain. The preparation, calibrations and counts reported here were carried out in May or in one case June.

Stratification:

The count was stratified in relation to animal distribution. Very few anmials remain in the north and central sectors and these are flown at by transects spaced at 5 km apart. The southern sector is where over 90% of the animals are currently distributed. This was flown at 2.5 km spacing for greater accuracy. Sub-units are spaced at 5 km, as measured by GPS. The stratification that has been adopted since 1993 is based on the elephant distribution observed in 1993, which is known to reflect the elephant distribution over the preceding ten years, is as follows. The count boundaries are based on sub-unit boundaries rather than those of the park and reserves. Hence they are slightly larger than the actual boundaries:

park: 5,500 km^2

- Low density: 1,400 km^2
  14 transects, 55 sub-units
- Medium density: 1,925 km^2
  12 transects, 77 sub-units
- High density: 2,200 km^2
  16 transects, 88 sub-units

domaines de chasse: 9,600 km^2

37 transects, 384 sub-units

The counts reported here since the first war in DRC have included only the park as the objectives have been a rapid assessment of the status of the park, and fuel has always been a limiting factor.
At the start of the project transect used to be flown north south also with 5 km sub-units. In order to mare accurately and correctly analyse a stratified count, since 1998 the transects have been flown east-west with the sub-unit divisions east west. The grid system and method of analysis remain the same and the counts therefore continue to be comparable

Equipment:

King radar altimeter, Garmin global positioning system (gps) , marker rods, tape recorder per observer, tapes and batteries, stopwatch, data sheets, computer for analysis.

Fibreglass fishing rod blanks mounted on a support fitting designed for the wing strut were used as marker rods.

Duties of crew
Pilot:

piloting the aircraft, navigating to the ends of transects and along transects using gps, calling out transects and sub-units at 5km intervals based on the data sheet subunits. The gps was pre-programmed with the beginning and end waypoints of the transects, which are listed in the table gps waypoints.

Front seat observer:

recording the time and speed of each transect and maintaining the transect summary sheet (in annex). Within each sub-unit recording height a.g.l. from the radar altimeter and habitat factors as defined below. (Fso data sheet in hillman smith et al 1995)

Middle seat observers:

counting and recording into the tape-recorders all animal species and signs of human occupancy, as listed on the table: **code des especes** , that are seen within the strips. On return from each flight the observations are transcribed onto rso data sheets (example in hillman smith et al 1995). The middle seat observers also noted the habitat in which the animals were seen. Cameras were available, but were only used on two occasions for large groups of buffaloes and of houses.

Rear seat observers:

the rear seat observers made the same observations as the middle seat observers. There were three main values to the second row of animal observers: comparison of the two data sets to verify and improve the data and to enable other methods of analysis to be applied, back-up if a tape-recorder fails and training. To make the first two objectives valid, the strip widths were adjusted to be as near as possible to covering the same strip on the ground as seen by the middle observers. Their strip markers were cords stretched from the wing struts to the tail.

Sample intensity:

sample intensity: 8-10% Low, 15-20% high
transect spacing - low 5km
high 2.5 km
sub-unit spacing: 5 km
target flying height: 350' a.g.l.
Overall mean actual flying height 347' a.g.l.
Target strip width: 400 -500 m total.(200-250 metres each side)

Strip widths are preset according to Norton Griffiths (op.cit.) and calibrated by flying at different heights over markers spaced at 20 metre and 100 metre intervals on the airstrip, simultaneous with radar altimeter readings. Observers count the numbers of spaces between markers included within the strip widths, to calculate the observed widths. These passes were carried out both during training, before counting began and at the beginning and end of each counting flight. The results, analyzed and plotted in quattro pro 4.0 are shown in the graph **calibrations**, and were used combined with measured altitudes per sub-unit to calculate strip widths for each transect and sub-unit. On the basis of this the combined strip widths for middle seat observers are calculated per sub-unit and the sample areas per sub-unit are calculated and used in the calculation of population estimates from animals of each species seen per sub-unit:

Transects:

Transects are spaced at 5 km intervals in the low and medium intensity zones and at 2.5 km in the high intensity southern zone. They are flown east/west as shown on the map **projected transect lines.** The co-ordinates for the start and end points of each transect flown alternately north and south are given on the table **gps waypoints in annex.** Subunit were at 5 km intervals as measured using the gps and is used, sub-unit boundaries are located in multiples of 5 km from the end waypoint, using the tables **of transect and subunits in Annex**.

Species:

Animal species were counted by both middle and rear seat observers, as listed on the table: **codes des espèces**. Signs of human habitation and land use were also counted. Elephant and other species carcases are classified as:

1. Fresh, with flesh present
2. Recent bones, with rot patch present
3. Bones white, no rot patch
4. Bones grey old

(Douglas-hamilton & hillman 1981)
in this high rainfall, high scavenger density environment, fresh recognisable rot patches remain for a considerably shorter time than in east africa. Carcases monitored have usually remained at stage 2. less than two months.

Habitat factors :

Within each sub-unit the front seat observer recorded the height a.g.l. as measured by the radar altimeter and estimates percentages of the following habitat parameters in units of 10% intervals:
tree cover, as percent of sub-unit
tree greenness as percent of trees present

bush cover, as above
bush greenness, as above
grass cover, as above
grass greenness, as above
long old grass, as percent of grass present
burn, as percent in sub-unit
water availability,
0 = none
1 = available to humans and livestock
2 = limited availability
3 = unlimited availability
4 = running water
5 = floods
agriculture, as percent in sub-unit
Vegetation zones are classified within each sub-unit.

Analysis

Analysis was carried out in quattropro according to the method described in detail in Watkin et al (1995) and Hillman smith et al (1995). The method is based on entering the animal and habitat observations and the altitudes per sub-unit onto separate versions of a spreadsheet, which is laid out like a map of the census zone, in which each cell represents a subunit. This was printed directly, to map the distribution of animal observations, and with conversion, to map density distributions. Habitat data was entered in the same way. To produce the shaded mapping it can be transferred to idrisi. The overlay map of the park and reserves was created in arcinfo and they were combined in coreldraw.

A graph of strip width calibrations was created in quattro and the resulting regression applied to the map of altitudes per sub-unit. This enables transect width correction per sub-unit, as opposed to an average applied to whole transects as previously. Superimposition of this on the map of animal observations calculates the densities. Within the map spreadsheet the transect and strata totals are summed and these data were transposed to a second spreadsheet, which was laid out with the formulae from Jolly (1969) and Norton Griffiths (1978) for calculating population estimates and confidence limits. This is printed directly with the details of the observed numbers, stratified population estimates and confidence limits.

Results

Distribution maps in the spreadsheet formats are given for each species for each of the count years. These are followed in each set by the tables calculating population estimates and Standard Errors and 95% Confidence limits for each species. Signs of threat, ie carcasses and poaching camps are mapped for each year.

Vegetation parameters are mapped for one year. Tree cover is dense in the north of the park and relatively dense in the Domaine de Chasse, but very sparse in the south of the park due to the effects of fire and elephants. Bush cover is increasing further and further south each year as the elephants and other large mammals are pushed down or poached out from the north and now even from the centre of the park.

The **summary table** gives population totals and stratified totals, densities and biomasses for the period 1976 until 1995, before the war . The weights used to calculate the biomasses were those used by savidge et al (1976), haltenorth & diller (1977) and d'huart (1978). A second summary table gives the situation since then.

DISCUSSION OF RESULTS WITH EVALUATION OF TRENDS AND THE STATUS OF THE ECOSYSTEM

Methods

The aerial survey manual for Garamba National Park, based on the standard methods developed during the 1993 census was applied throughout as guidance and training manual. However since 1998 the transects have been flown east west instead of north south in order to make more accurate the stratified analysis. The sub-unit cells remain the same.

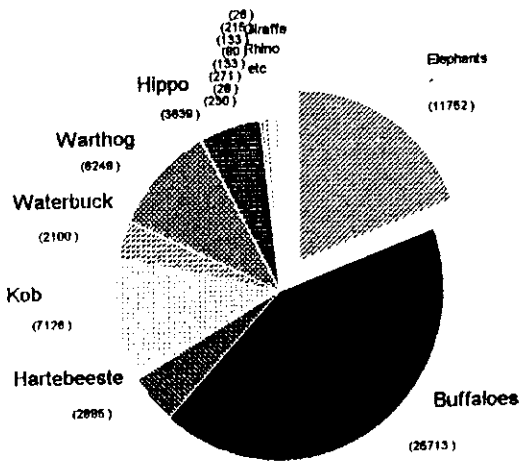
The front seat observer has been standard since 1983. This therefore minimises errors due to observer bias. However the two middle seat observers have varied over the four year period, and have included Guy Mbayma, the late Jean Mafuko, Jerome Amube, Giningayo Panziama and Paulin Tshikaya. The rear seat positions have been used for training. Practice and training was given by both estimating and counting from digital photos of buffalos, elephants and hippos, but the need to estimate large groups because the observers are not sufficiently practiced with cameras to use them, is a potential source of bias.

Animal numbers and distribution over time in relation to external events

Historical

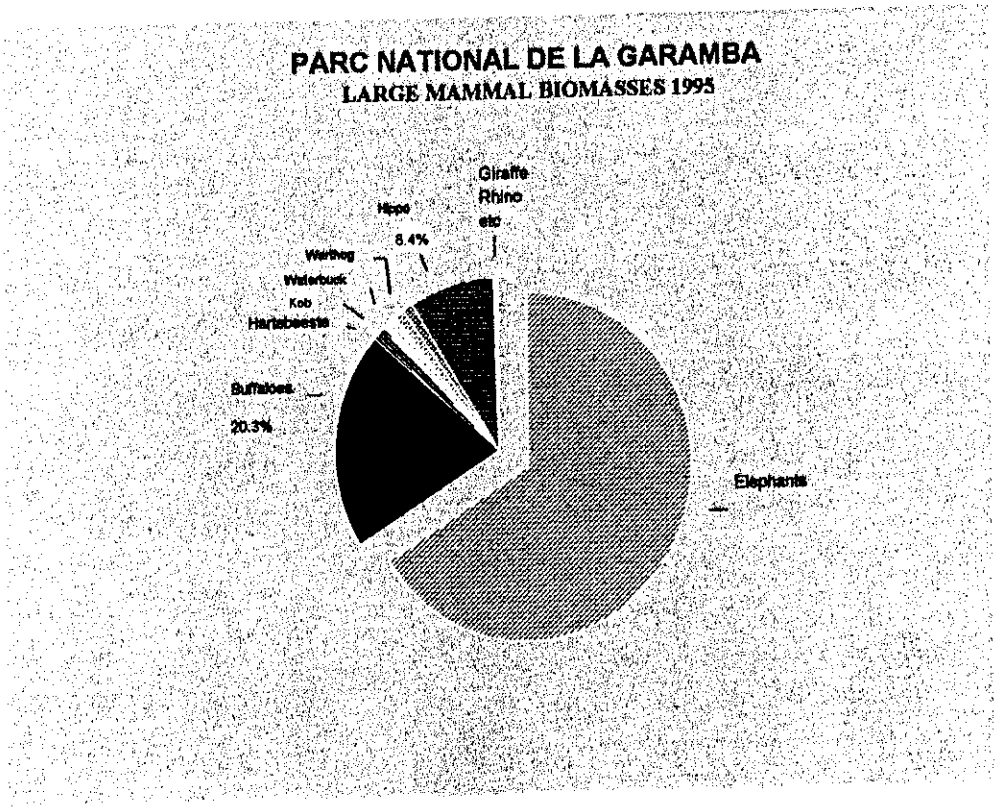
Table 1 gives the large mammal numbers from aerial census from 1976, when the FAO project ended through 1983 before the Garamba project started, to 1995, before the civil war. Table 2 gives numbers since the first war, from 1998 to 2003. The graphs Figs.3 and 4 summarise the trends of key species. Pie charts indicate the biomasses and relative species numbers for the two periods.

PARC NATIONAL DE LA GARAMBA
LARGE MAMMAL NUMBERS 1995

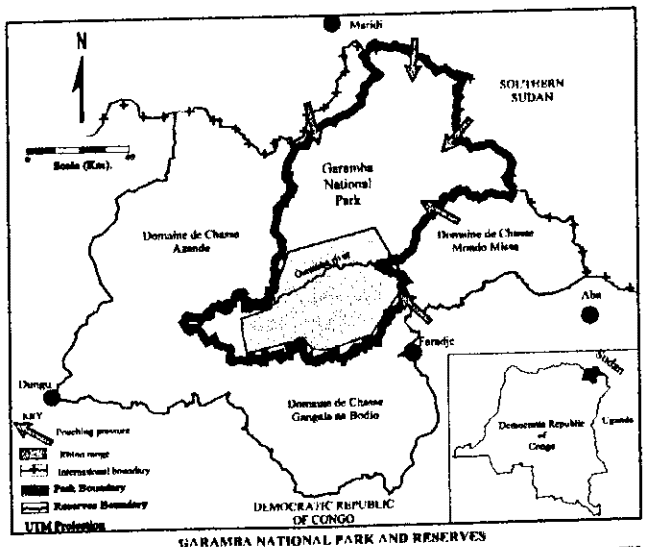


PARC NATIONAL DE LA GARAMBA ET DOMAINES DE CHASSE
WILDLIFE NUMBERS/ NOMBRES DES ANIMAUX 1976 - 1995

YEAR	BUFFALO	GIRAFFE	HIPPO	KOB	HARTEBEESTE	WATERBUCK	REDBUCK	ROAN	WARTHOG	GR.DUIKER	RE DUIKER	ORIBI	LION	HYENA	BUSHBUC
1976															
PARC	53000	350	1700	7180	7750	3680	640	360	3340	140		380	35	35	4
DC															
95% cl	42390	250		2300	1470	1330	310	530	1440	100		150	40	50	1
1983															
PARC	53312	175	1290	3978	1932	2215	183	91	1117	91		234	15	87	
DC	2864	20		766	146	455	151	0	241	169	36	17			1
95% cl	16960	163	1781	2321	812	1420	107	104	244	72	31	152	15	14	1
1984															
PARC	46284	373	448	3792	1224	568	175	0	404	109		153	33	44	1
DC	76	0	0	0	0	218	0		0	11		0	0	0	
95% cl	5982	144	442	214	442	293	101		182	126		103	69	38	
1986															
PARC	29419	153	2874	7222	1705	1322	328	34	943	12		230	63	157	
DC	341	13	0	490	75	669	93	0	86	23	25	13	0	0	
95% cl	3485	140	1668	2601	589	456	135	25	344	12	26	90	46	121	
1988 1988															
PARC	32163		2851												
1991															
PARC	33910	346	2205	3423	967	718	38	13		13	51	39			
DC															
95% cl	19708	422	2002	2045	675	440	42	25		25	60	56			
1993															
PARC	30555	347	1023	6738	3444	1113	75	150	2692	75	120	90			
DC	549	0	0	564	85	358	0	0	163	15	45	0			
95% cl	15795	419	617	3647	2114	823	91	255	1624	60	87	87			
1995															
PARC	25242	178	3601	6601	2819	1680	271	81	5606	98	107	0	14	14	
DC	472	32	39	524	56	420	0	0	643	39	105		0	0	
95% cl	16930	210	2636	3033	1198	1340	180	159	2646	74	82		27	25	



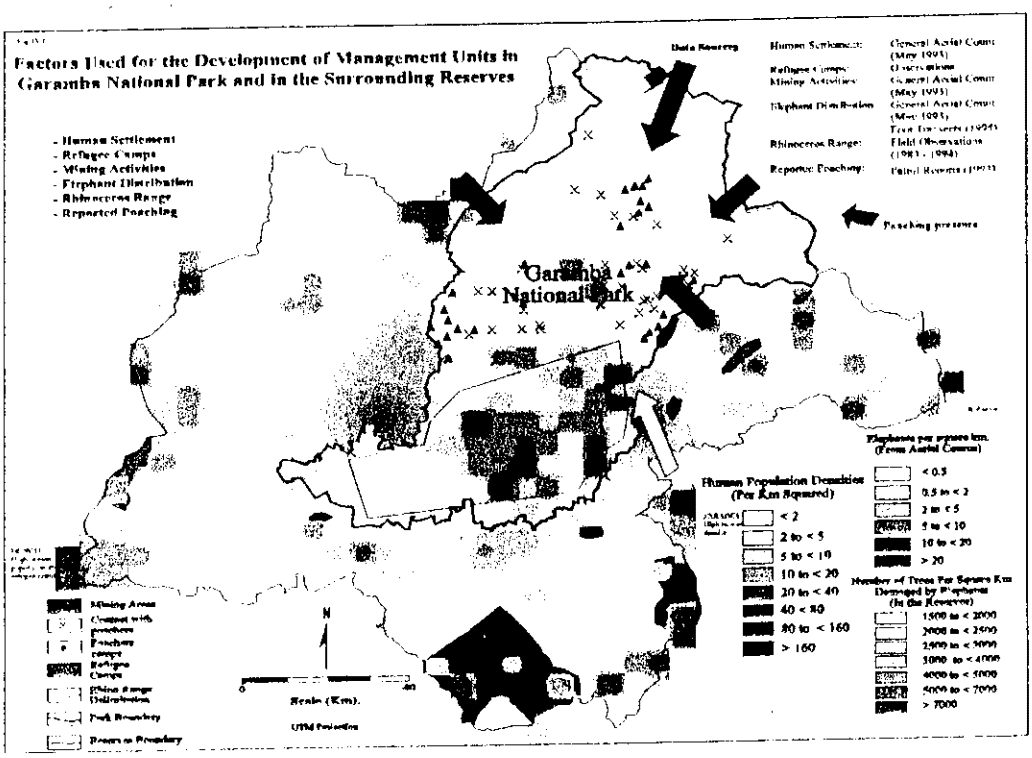
Between the FAO Project and the Garamba project most large mammal numbers dropped dramatically with heavy poaching. This also changed the distribution of the most valuable species, elephants and rhinos, who were eliminated from the north and remained concentrated in the better protected south of the park. The Garamba Project/IZCN partnership was able to eliminate the commercial poaching of elephants and rhinos but a continuation of poaching in the north of the park for meat maintained their unequal distribution and they did not move back to re-populate the centre or north. As the elephants increased they tended to move out more into the wooded Domaine de Chasse at night (Hillman Smith et al)



GARAMBA NATIONAL PARK AND RESERVES

The north of the park is on the Sudan border and it is easy for poachers to cross. Elephant and rhino numbers rose through the first few years of the project, doubling in eight years, (Fig & Table 1), but buffaloes which remained widely distributed throughout the park became the main meat prey species in the north and centre

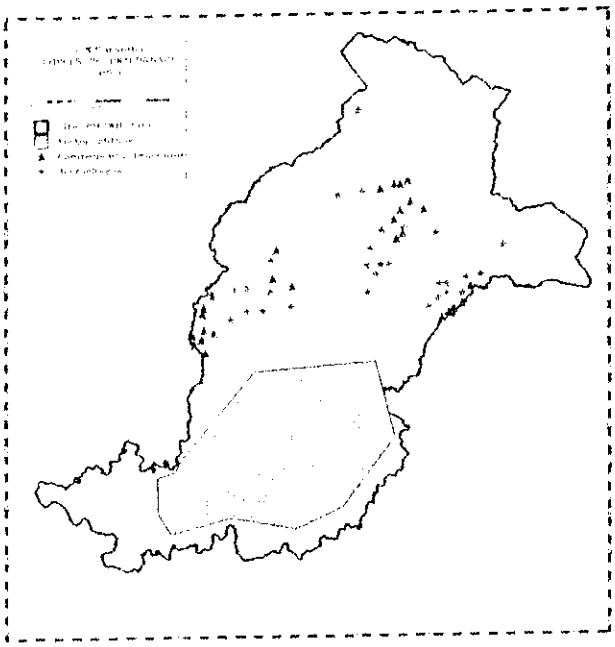
of the park.. Because of this, buffalo numbers have declined steadily throughout the project, but they acted as a buffer to the more valuable species.



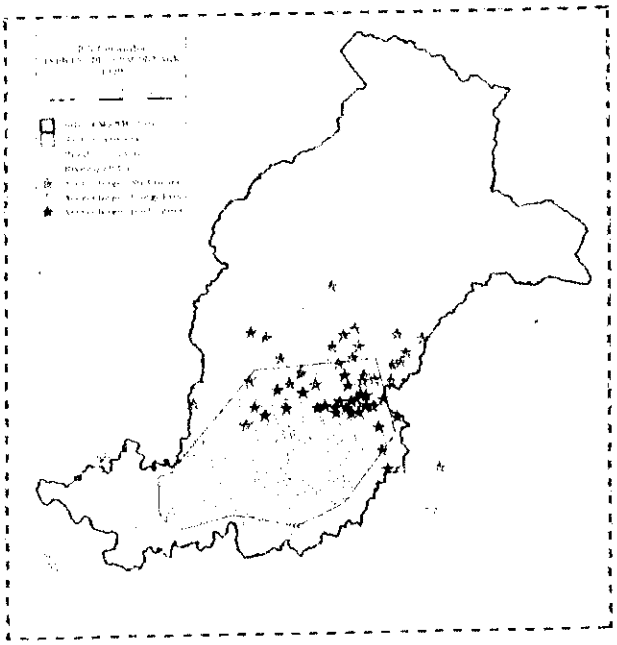
The effects of wars

In 1991 the Sudanese civil war moved south, as the town of Maridi, just across the border from Garamba, was taken by the Sudan Peoples' Liberation army. Arms and ammunition became widely available and about 80,000 refugees were settled east and west of the reserves surrounding the park. SPLA camps were set up adjacent to the border and well armed and trained militia or ex-militia became the main source of poaching pressure, as evidenced by the law enforcement monitoring (LEM) results (Fig.4).

Commercial meat poaching was the main driving force. Most active anti-poaching effort was concentrated in the centre of the park, where the prey species and the poachers were concentrated. In the south, where the elephants and rhinos were concentrated, there was very little poaching before the civil wars. Most patrulling focused on monitoring and on seeking any signs of incursions and on research. However the strength and arms of the SPLA militia, their long periods of inaction away from the Sudanese front line and the market for meat in the area, meant that meat poaching increased in intensity, with poacher groups increasing in size and operating with heavier weapons, including grenades and rocket launchers. Despite extreme efforts, the guards could not completely stop this poaching and the front line of poaching gradually moved south through the park, as the LEM maps show. Major efforts were being made to raise higher levels of funds, ammunition and to bring in training and support, but in 1996 the first two rhinos were lost to poaching. Towards the end of 1996, the civil Liberation war began in the then Zaire.



Poaching Camps & armed contacts 1993

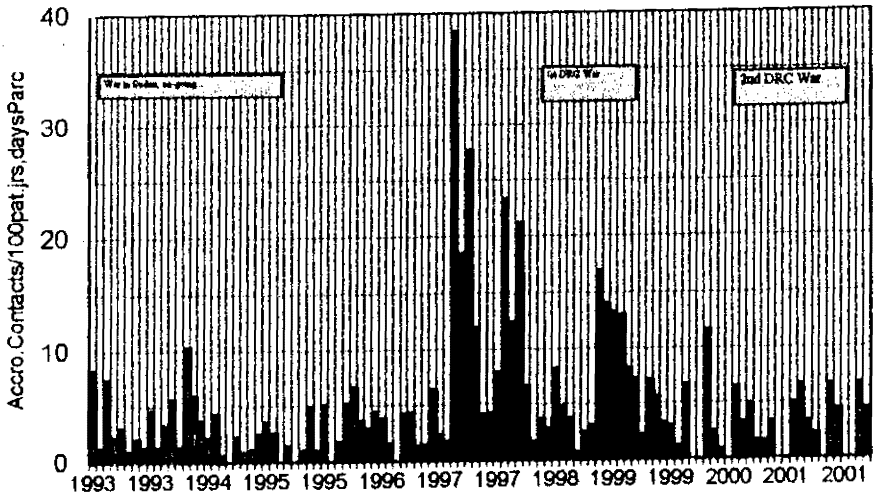


Armed contacts 1998

In 1997 the Liberation war forces reached Garamba, the guards were disarmed and anti-poaching was forced to stop for several months. The poachers took advantage of the situation and moved into the high concentration southern sector. The figures of poaching per unit search effort (per 100 patrol days) show how the intensity of poaching increased significantly in the first war (Fig.5).

Parc National de la Garamba

BRACONNAGE/POACHING 1993-2001



As Table 2 shows, over half the elephants, buffaloes and hippos were killed at this time and an aerial survey of the southern sector in 1997 showed fresh carcases and occupied poaching camps widely distributed. Major efforts by the ICCN and project personnel in Garamba, Kinshasa and internationally re-established anti-poaching, evaluated the situation, obtained clearance for training and back-up and began re-equipping and re-activating the conservation operations.

Table 2 Impact of the wars 1996/97 and 1998 to present

Espèces	1995 Population calculation	SE	1998 Pop calc.	SE	2000 Pop. Calc.	SE	2002 Pop. Calc.	SE	2003 Pop. Calc	SE
Elephant	**11,175**	3,670	**5,874**	1,339	**6,022**	1,046	**5,963**	1,184	**6,948**	1995
Buffalo	**25,242**	8,299	**7,772**	2,063	**13,115**	3,066	**13,281**	3,930	**14,480**	4231
Hippopotamus	**3,601**	1,299	**786**	207	**967**	485	**948**	787	**3,036**	1191
Giraffe	**178**	108	**144**	73	**118**	64	**62**	13	**62**	75.4
Waterbuck	**1,680**	669	**1,382**	433	**1,058**	363	**797**	316	**421**	210
Hartebeest	**2,819**	590	**1,685**	398	**1,065**	218	**1,139**	232	**1,224**	260
Kob	**6,601**	1,495	**6,505**	1,558	**3,902**	984	**3,587**	991	**6,235**	2121
Warthog	**5,606**	1,261	**4,765**	668	**1,075**	213	**990**	254	**789**	155
Roan Antelope	**81**	78	**8**	7					**57**	67

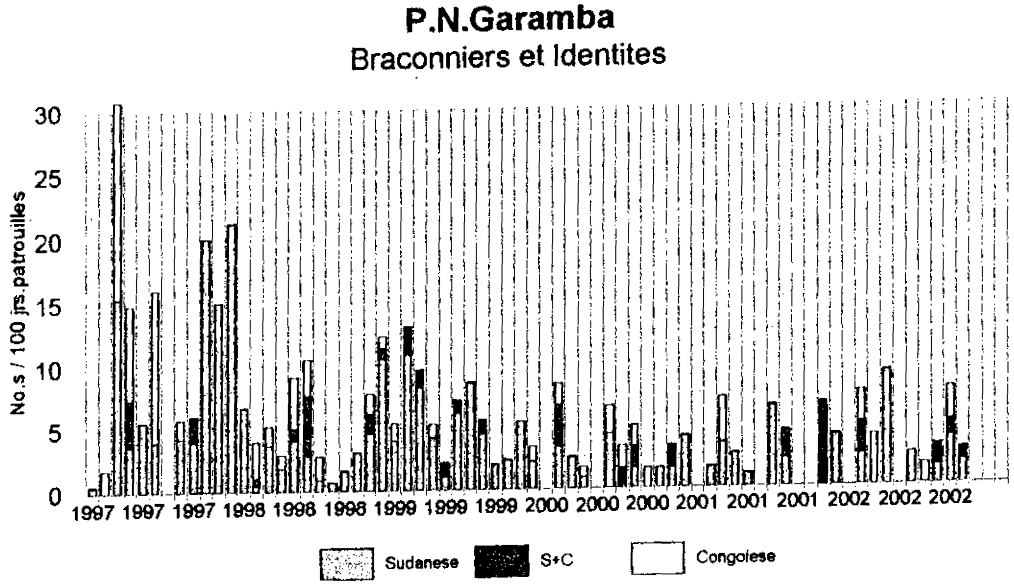
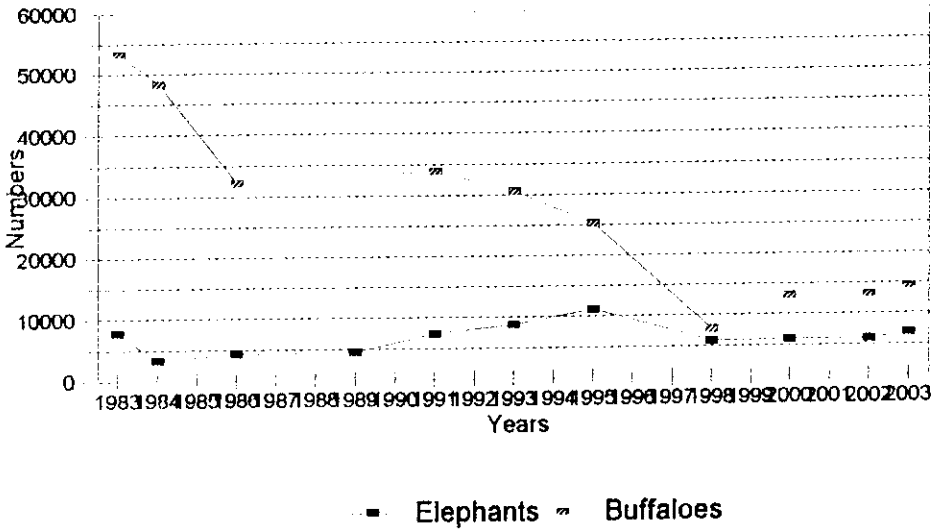


Fig.: Identities of poachers

In August 1998, the second civil war began. This time guards were not disarmed and although the senior staff and project personnel had to leave, the guards themselves continued patrolling and law enforcement monitoring and as soon as possible the project back paid them in relation to this. However, with Uganda being linked to the rebel forces holding the area, and the Ugandan links with the SPLA, it became very much easier for the Sudanese to move across the border semi-officially. The refugee camps were raided. In August 1999 a group of SPLA came across into the Domaine de Chasse Mondo Missa to the east of the park and began recovering weapons and "deserters". At first this had a positive effect on reducing poaching and in December park forces and local authorities joined them for a mixed operation supported by the project to recover more weapons. Agreement was given for a second two month operation in 2000. It delayed for several months and in the meantime, according to patrol reports, the local people were harrassed for food by the SPLA in the area and many moved away from their homes and fields. The official mixed operation involved support from the project in terms of vehicles, fuel and rations and although it was only for an agreed period of two months, at the end of which they were supposed to return to Sudan and continue a more limited trans border collaboration, the park warden at the time built houses for them close to the park border in the Domaine de Chasse in DRC to the east. They therefore did not want to move back to their side of the border even though the project was unable to support this kind of activity in the long term, in one area out of the park, to the detriment of the conservation activities within the park. The SPLA have remained there ever since, demanding support from the park or threatening to wipe out the animals if this is not given. Representation has been made to all the concerned authorities and the park's position has been made officially clear, but the threat remains and has in 2003 become extremely serious.

P.N.Garamba

Large Mammal Populations 1983-2003

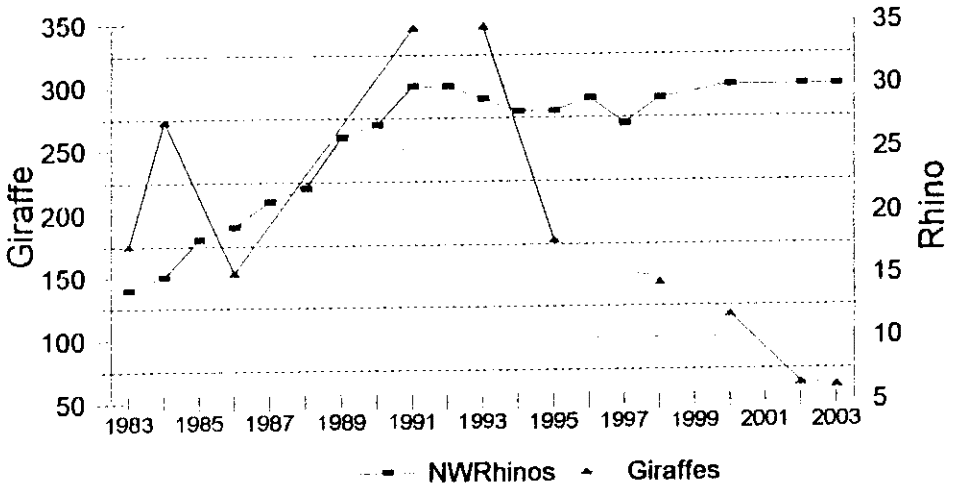


Current trends

As noted above, although the poaching front line had been moving south through the park under pressure from Sudan, while it was still largely for meat and while buffaloes and other species were available in the centre of the park, the rhinos and elephants in the south were relatively secure. During the most active phases of the wars, in early 1997 and late 1998, the poachers were able to penetrate the southern sector, but at times that the guards were able to operate more effectively, they were able to push them back. The most

PARC NATIONAL DE LA GARAMBA

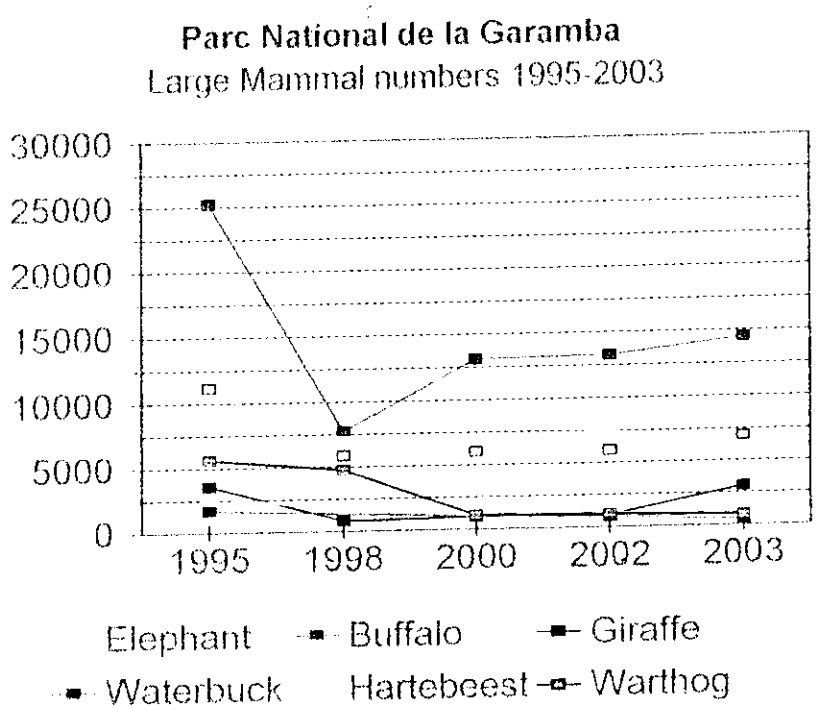
Rhino & Giraffe 1983-2003



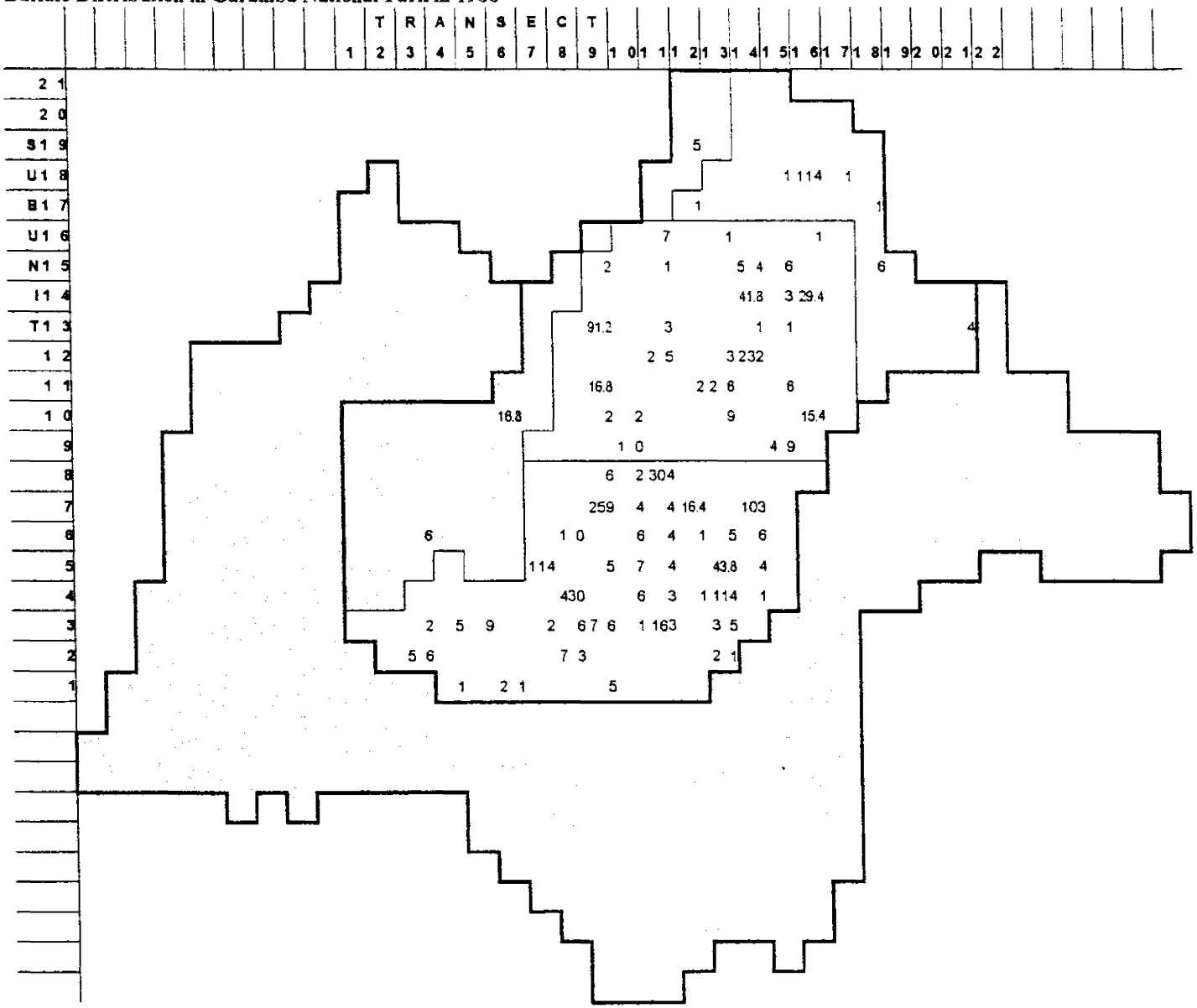
striking result of recent aerial surveys has been the almost complete lack of large mammals in the central and northern sectors of the park . The series of maps of buffalo distribution over time demonstrate this

effectively. As these have been the main prey species for meat poaching, all the attraction for poachers for either meat or rhino horn and ivory is focussed in the southern sector. The pressure is serious. In response the guards prefer to go on patrol in very large groups, which halves or quarters the cover of the area and makes them easy to detect. In addition, with the key poachers now established close to the park in the Domaine de Chasse, they no longer have to make camps to smoke meat before travelling 100km back to Sudan, but can move in and out in a day

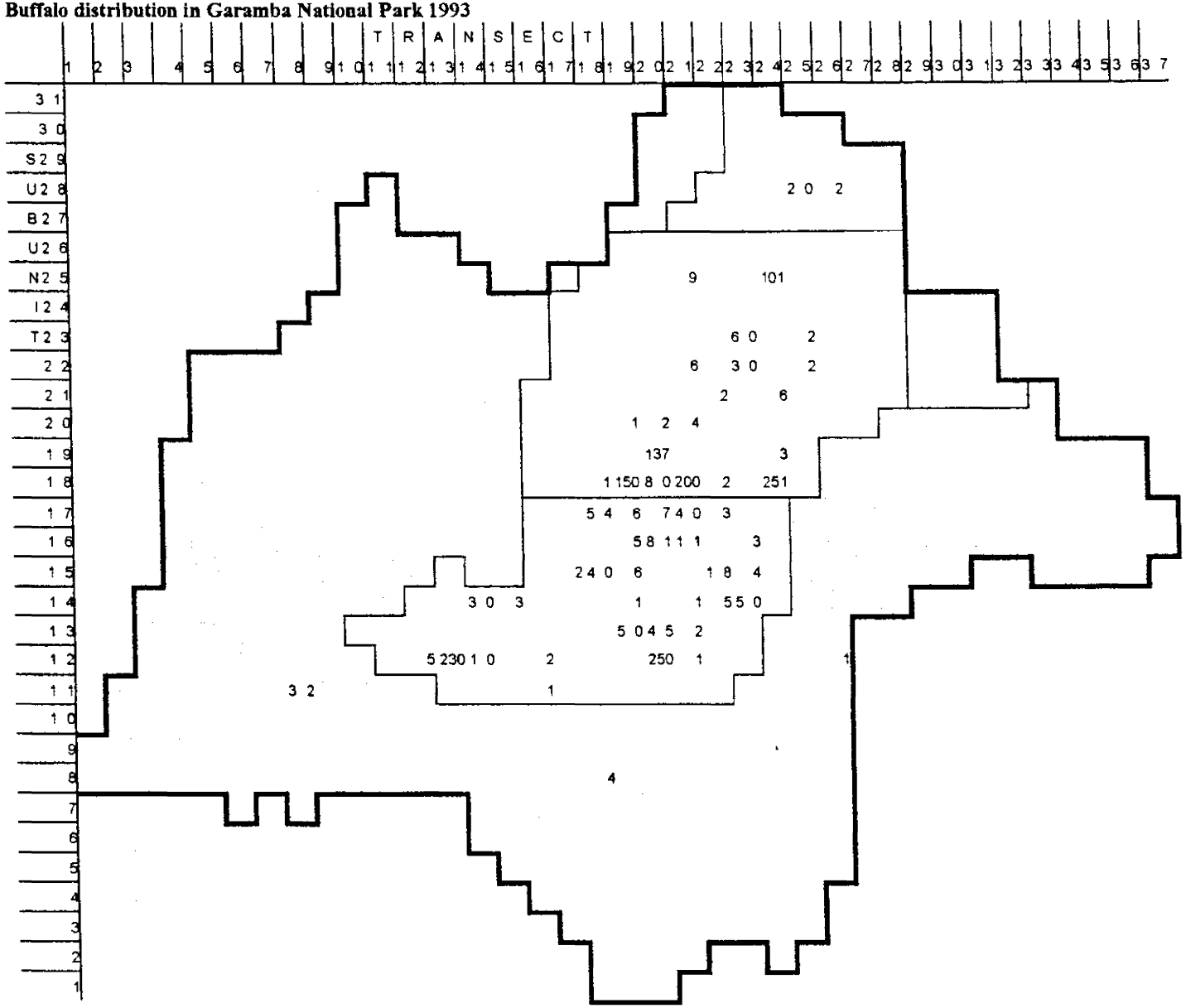
Recent patrol reports indicate that the trend since May has been to kill elephants for ivory and leave the meat, which also means that many more elephants can be killed in a short space of time. In June and July there have been three instances of guards being attacked in their camps, including the new radio relay station which is at Km 15 the very centre of the southern sector and only 15 km from Nagero, the park head-quarters. It is urgent that guards receive effective training, back up and leadership. that more young guards are recruited and trained and that an effective strategy is developed and followed. A rhino and poaching recce survey of the southern sector will be carried out in August.



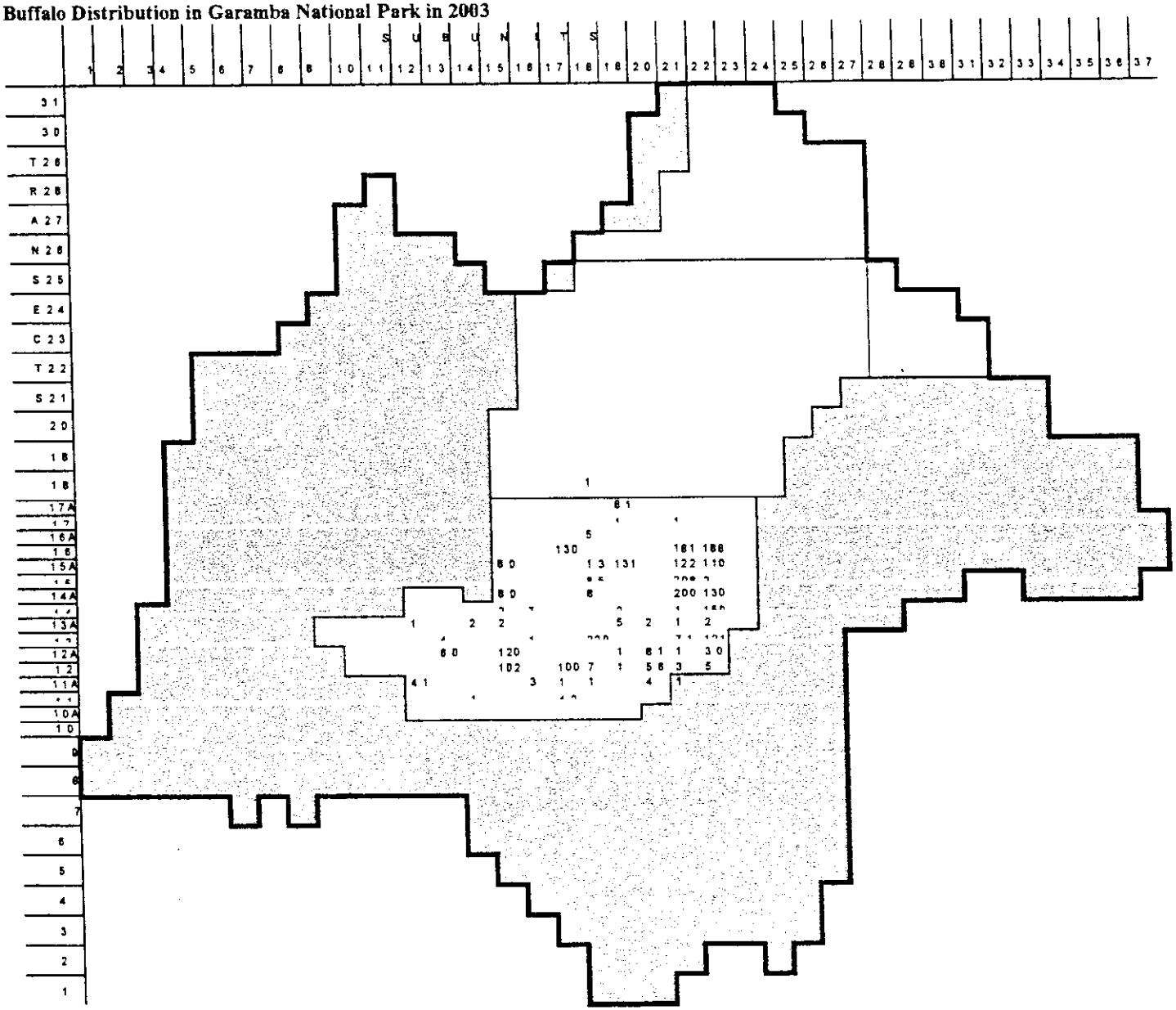
Buffalo Distribution in Garamba National Park in 1986



Buffalo distribution in Garamba National Park 1993



Buffalo Distribution in Garamba National Park in 2003



Elephants

The table and graph of elephant numbers since 1976 show the precipitous decline between 1976 and 1984, with a low of about 4,500 and a time lag in increase as such a slow reproducing species. Numbers then rose exponentially, until they had more than doubled with over 11,000 in 1995. Despite the broad confidence limits inherent in sample counting, the difference was significant at the 5% level (anal. of variance, Cochran in Norton Griffiths 1978). The graph of elephant and buffalo populations, plotted with equally spaced years and lines of best fit calculated from the regression, show that the actual slopes of decline and increase were similar. ($r=0.18$) both were of the order of 10% per annum. The overall increase in the elephant population since the project started was largely due to the elimination of most of the commercial poaching of internal and external origin. However, the pressure from the war across the border in Sudan, exacerbated by the civil war preventing anti-poaching in early 1997 resulted in a loss of some 5,000 elephants between the counts of 1995 and 1998. Since then elephant numbers have remained relatively stable to slightly increasing, but the recent trends are of considerable concern and the aerial recces and next large mammal survey will be needed to assess the degree of effect.

Although the elephant population remained largely concentrated in the better protected south of the park, as their numbers increased, they increasingly used the woody vegetation in the Domaines de Chasse at night (Hillman Smith et al 1995 and Nicholas & Amube 1995) often forming into large groups near the periphery of the park during the day. In 2003 a large aggregation of some 800 was seen in May, concentrated in long grass patches during the day and moving out into the Domaine in the evening. However no elephants are now found north of the Garamba river in their previous concentration areas. It has been shown, from the results of counts, general observation and from aerial total counts over fire experiment blocks that elephants and rhinos favour long old grass for cover. During the war periods a management effort has been made to maintain mosaics of long old grass with patches of short palatable grass. Their distribution favouring these areas indicates the value of the long grass in helping to protect the more vulnerable species.

Dead to live ratios from carcase counts were relatively low during these surveys compared with the 1 dead to 8 live ratio found in 1983 before the project started. During the recce flight in 1997 carcase numbers had been very high, but by the time of the 1998 sample count reported here, many of those carcases had disappeared and the lack of new ones indicated how the guards were pushing back the poaching. Carcases disappear extremely quickly. Rainfall is over 1300 mm per year, aiding rapid breakdown and hyena and vulture densities are high. Even elephant carcases can sometimes be so scattered as to be unrecognisable from the air a week after death. The 12% cover of termitaria clearings and the tendency of animals to use them and therefore die in them, together with the rapid rate of grass growth also makes it difficult to distinguish all rot patches for as long as in east africa.

Figures for large mammal numbers and biomasses are expressed as pie charts. The biomass contribution of elephants to the ecosystem is very striking. The relative sizes of the populations of elephants and buffaloes in 1995 were the same as those found in 1976 (savidge et al 1976).

An examination of the tree and bush cover from aerial surveys throughout the project reflects both the overall reduction in mature trees within the park compared with the surrounding domaines and the advancing bush regeneration in the north and centre of the park, as the elephant have to a large extent been absent from this area for over twenty years. This is borne out by the 1976 distribution of elephants throughout the park compared with the present and by reports of guards, who say there used to be many elephants in the north of the park, and that much of the poaching between 1978 and 1984 was done by guards themselves. The reduction of woody vegetation is compounded by the effects of fire. The action of the elephants and the hot fires is to damage smaller trees. The elephants further prevent regeneration from old rootstocks by selection for these plants. This leads to dominance by rapidly growing coarse perennial grasses (*loudetia arundinacea and hyparrhennia spp.)* that grow over 2 metres tall. In addition to competing with the woody regrowth amongst them, they provide a huge combustible biomass for the hot fires that sweep through, further destroying that year's regrowth of woody plants that might remain. The management activity of maintaining mosaics of long and old grass is therefore doubly important

Elephant distribution and use of natural woody vegetation in the domaines de chasse was found to be positively correlated with proximity to their daytime core distribution, and negatively with distance from human settlement in the dry season. (Hillman smith et al 1995). This showed that they were not moving out solely to raid crops, though this appeared to be the human perception of the situation. More recent comments by guards are that elephants are escaping from the poaching dangers in the park!

Rhinos

A sample count is not adequate for accurate estimation of so small a rhino population. The difference between seeing 2 or 4 means the difference between population estimates of 27 or 53. We have been monitoring the rhino population through individual recognition over the years, and a rhino total block count using individual recognition was done in April each year, with further observations from recce flights. A minimum of 28 were accounted for in April and on the basis of earlier observations at least 30 were almost certainly present. With the recent poaching pressure in the southern sector, however, several may have been lost.

Rhino numbers increased exponentially before the wars, doubling in eight years. The known population dynamics through the war periods are given in the table. Throughout the wars the population has remained relatively stable and over 12 births were recorded. However according to the rate of reproduction and the previously demonstrated rate of increase, the population should be over 60 individuals now, double current numbers. We cannot be complacent about relative stability and must do all possible to improve protection combined with back up measures to avoid loss of this, the most endangered large mammal sub-species. Under the IUCN red list categories of endangered species (IUCN/SSC,1995), they are classed as **critically endangered** by reason of their low numbers.

The rhinos, like the elephants, are also found only in the south of the park. They are at an over all density of $0.003/km^2$, but a local density of $0.03/km^2$. Prior to the war, as the population had been expanding and sub-adults in particular had been dispersing, there was more movement north of the Garamba river. Since 1996, however, most rhinos venturing north of the river have been eliminated.

Home ranges for dominant males average $188.6km^2$ (124-228). For females the mean is $345km^2$ (185-492), and for sub-adults 534 km^2 (up to 786). These ranges are of the order of 100 time larger than those recorded for southern white rhinos. Their size may be related to the very low density of rhinos, which places little restriction on their movement, but may also be related to the dispersal of available food resources at certain times of the year. The extensive movements of the animals, however maximise the chances of encounters between different individuals for breeding. The ecosystem has been shown to be ideal for them as demonstrated by rate of breeding. However adequate protection and monitoring is essential if they are to survive.

Buffalo

Buffalo numbers have fallen steadily throughout and the change in their distribution has been significant. Buffalo are the most numerous large mammals, but contribute less than a third of the biomass of elephants.

However buffalo numbers in 1995 were approximately half what they were in 1976 and are closer to one quarter in 2003. The difference is significant at the 5% level (d=2.07,anal.of variance, Cochran in Norton Griffiths 1978). The graph of buffalo numbers shows no significant change between 1976 and 1983, followed by a gradual decline, which has steepened in recent years. During the period of the project, buffalo have been the species most poached for meat. This meat poaching increased in 1994, with large, well-armed groups of sudanese causing the majority of it. Buffaloes have now been completely eliminated from the north and central sectors of the park. This insidious offtake over the years, while decreasing a once extremely numerous population, had a buffering effect on the protection of the more commercially valuable species, rhinos and elephants. Now, with all species concentrated in the south, all poaching is also concentrated there.

Giraffe

This giraffe population is the only one extant in DRC and probably the only representative of the sub-species (*Giraffa camelopardalis congoensis*). It is classified as **endangered** by the IUCN red list categories

(IUCN/SSC 1995). The northern white rhinos and the giraffes were the main reason for the creation of the park in 1938 and for its world heritage status in 1981.

The population, however is very small and has been decreasing. This estimate in 2003 is only 62 ± 75. The woody habitat needed by the giraffe is only found in the north of the park or around the peripheries of the south or in the Domaines de Chasse, all areas which are very vulnerable now. A preliminary study showed their selection for *acacias* which are very poorly represented in this ecosystem.

Giraffe were not widely poached, because the Azande believe that eating their meat confers leprosy, although their tails are used by local chiefs. However these beliefs are not shared by the Sudanese, who form the majority of the poachers now.

Hippos

Sample counting is not ideal for hippos, whose distribution tends to be in local concentrations, leading to large variations in estimates, and for whom correction factors are needed to allow for those underwater. However the specialised hippo count carried out in 1988 yeilded figures very similar to the preceding sample count. The graph of the results from all the counts shows a gradual trend of increase from 1976 to 1995. This is borne out by personal observation that the hippos appear to have been increasing, and by reports from nagero and faradje of increasing problems of crop-raiding by hippos. If the correction factor calculated in 1988 was applied to the 1995 there would have been over 6,000 hippos. However, as figures since the wars show, hippos were hard hit by the poaching during the 1997 war. The aerial survey we carried out in July 1997 of the southern sector confirms the reality of this, since the Garamba river was full of dead hippos floating belly up. Clearly when poachers penetrated as far as the river, they fired fairly indescriminantly at the hippos, but were unable to recover all the bodies.

The 1998 figures are lower than the subsequent figures. There are possibly at least three contributing factors to this: Some hippos may have moved out along the rivers during the major killing of 1997, the other two reasons may be linked to count biases. After training and discussion and practice with photos, I suspect that observers were making some allowances for the up:down ratio in their own counting or estimating of very large dense concentrations. The third factor is the shift in count transects from north south to east west. Transects north south cross the Garamba and Dungu rivers at near right angles. However east west transects, that are only spaced 2.5 km apart fly along relatively parallel to the river and slight drifts in course could easily lead to duplicate counting of some of the large groups. We have tried to check for any obvious duplications here and to control for observer bias in counting, but a spcific hippo count would give more precise figures.

Kob

Apart from an apparent high in 1986, kob appear to have followed a similar pattern to other antelope species, with a decrease between 1976 and 1983, continuation at a similar level, and an increase again in 1993 and 1995 and a decrease then relative stability since the wars. Observer bias may be one factor in their apparent fluctuations, and it will be important to try to standardise on observers for several years. They are distributed mainly in the high density stratum, but with several in the medium density and even the low. They were also seen in parts of the domaines de chasse. Kob tend to show a certain fidelity to areas where the grass is generally shorter all year round, for example on the shallow soils near the naulokoko/cleti confluence and at bac garamba. Their social organisation shows large harem groups, smaller, less coherent female and calf groups, male groups and "leks", with birth peaks in early dry season and breeding peaks in early wet.

Hartebeeste

Hartebeeste were 7750 ± 1470 in 1983, and down to 1932 ± 146 in 1993. They stayed at a similar level until a major increase in 1993 and 1995. The difference between the 1991 and 1995 figures was significant (d=4.9, >5%). They were reduced by about half during the first war of 1997, but since then have remained relatively stable. They tend to be relatively sedentary and their prefered habitat is on ridge tops of the savanna grassland (hp).

Waterbuck
Waterbuck are widely distributed throughout the park and domaines, in association with water courses. They did not show a major drop during the first war, but numbers have shown a steady decline since then.

Reedbuck
Reedbuck are not numerous. Like most of the antelopes they show a decrease from the 1976 figures and an apparent, but insignificant rise in 1995. Numbers are currently low. They are fairly cryptic and not easily seen unless they move. Their distribution was apparentely towards the south and east of the park, but they may have been more difficult to see in the more bushed north and west. Numbers are undoubtedly an undercount.

Roan
Roan antelope are represented by a very small population, which was apparentely larger in 1976 (360± 530). There used to be group south of mt kpaza, near the kasi, but any that remain are now only found south of the Garamba river. A small group usually occupies the region near to source Nauloko each short grass season, and apart from that scattered observations are made from time to time. 57+- 67 were estimated in 2003, but this could be on the high side from chance sightings of several individuals.

Bushbuck
The population estimate for bushbuck is undoubtedly lower than the true population. They are very cryptic, preferring relatively thick bush near to water courses. The apparent reduction or lack of increase in numbers in the last two counts may be associated with lower visibility from a count later in the year than previously. From the ground, however they are fairly frequently seen and Nicholas (1995) found that they were the most numerous small antelope in the Domaines.

Oribi
Oribi are also difficult to see and are in low numbers and only 58 were estimated in 2003, though this was higher than the population estimated of two preceding years. Their population estimate will probably always be lower than the actual, since they are small and not easily seen. Verschuren in 1989 (pers.comm) had a strong impression that oribi had increased since the 1950s, but he conceded that it might have been the effect of more open vegetation.

Duikers
Population estimates for duikers will be minimal, since they are small and not easily seen. Grey duikers are mainly found within the park, but two were seen outside. Their population estimates do not show significant change over time. Red-flanked duikers are found more in the wooded areas to the north of the park and in the domaines. No yellow-backed duikers were seen on this count, but they have previously been seen from the air in wooded areas to the north and in the domaines de chasse. Figures within the park were apparentely higher in the 1993 and 1995 counts despite lower visibility overall. This could be associated with the increasing woody vegetation in the north.

Warthog
The warthog population has shown a rapid decline since 1995. This may be partly due to poaching but is probably largely due to some other factor like disease. Their populations have always fluctuated widely over the years. One suggestion mooted by guards for the previous decline was lion predation, but it was more likely to be an epidemic. Warthog probably go into their burrows to die and carcases would not often be noted.

Lion and hyena
Lion and hyena are both relatively plentiful predators, but are not easily counted by aerial sample counts and their population estimates are definitely lower than true values.

Monkeys, baboons and crocodiles
No reliance is placed on these population estimates that were based on chance sightings. Crocodiles are very plentiful.

Other species

Some species occur only or more commonly in the domaines or the very north of the park, such as the chimpanzee *(pan troglodytes)* , giant forest hog, bushpig, leopard and two of the duiker species. Other valuable species, like bongo *(tragelaphus euryceros)* have been reported only from the domaines de chasse (nicholas 1995) and a derby's eland was once observed walking through the park from the domaines. These differences are largely due to habitat differences as can be seen from the vegetation maps. However, they add weight to the fact that the domaines and park support complementary and different habitats and both need to be considered to maintain maximum biodiversity of the ecosystem as a whole.

Vegetation

The vegetation maps plotted in 1995 (Hillman Smith et al 1995a) and recorded but not necessarily plotted every year on the counts, show the clear differentiation between the wooded reserves and the grassland savanna of the south of the park. The southern half of the park is long grass savanna dominated by *loudetia arundinacea* and *hyparrhenia species*, with scattered *kigelia africana* and *vitex doniana* trees. Relict gallery forest and riverine trees add further to the sparse tree cover in the south. A few areas of sparse tree savanna usually dominated by *crossopteryx febrifuga* exist. They appear to be relicts of a more wooded savanna in the past. They are not favoured by elephants and are usually on patches of shallow soil, where the effect of fire may be less due to reduced grass cover. *Crossopteryx* has also been found in Lope reserve in Gabon to be the relict species remaining in savanna that has in the past been forested (White L. pers.comm). Areas of regenerating bush in the centre of the park are usually dominated by *piliostigma thoningii*, which is relatively fire resistant. The interactions of elephants and fire as controlling factors in the maintenance of the open savannas of the park are dsicussed in the section under elephants. Because the count was done at the early wet season, the greenness factor was high throughout.

Towards the north of the park the ground rises with rocky kopjes and increasing woodland and galerry forest. Monodominant patches of *lophira lanceolata* are noted and other areas domainated by *terminalia mollis, isoberlinia or anogeissus leocarpus* occur. The domaines support a variety of degrees and types of woodland and tree/bush savanna. In some areas particularly towards the west, these are interspersed with dense gallery forest along the water courses. In other areas, particularly to the east and in the north of the park, many of the rivers are bounded by papyrus swamp or grassy plains. Over 104 tree species were recorded by nicholas and ndey (1995) on their ground transects in the domaines.

In the south of the domaines de chasse Gangala na Bodio are limited areas of secondary forest, and in areas. To the east, just outside the domaines, are some conserved forest patches, which indicate the climax type of vegetation of the area when protected. Rainfall averages 1400mm per annum. Most of the region, however shows the effects of human clearing at some stage in the past. In every case where the bush was being cleared for new agriculture it was in areas of secondary forest or dense tree bush savanna, the most species rich stage of this habitat type, or in woodland. There is a positive correlation between tree density and human tree destruction. The people choose these areas because the soil is more fertile in the forest or woodland. The selection for these regions of highest biodiversity and very limited extent is having a destructive effect on the reserves, which would be probably be irrecoverable for several hundred years. Agriculture is not prohibited in the domaines de chasse, but its current method of slash and burn practice is not compatible with sustainable use of natural resources. A proper crop rotation system and the use of fertilizers, with prohibition of tree felling in specified areas is needed if the few remaining forest patches are to be protected to maintain plant and animal biodiversity.

Water availability

Water is not a limiting factor anywhere in the park and reserves, but more surface water appears to be available in the park. In the reserves more of it is tied up in transpiration through trees.

Human influences

Poaching

There was a widespread distribution of poaching camps in 1998, but decreasing numbers since then. A few camps were seen in the north and central sectors on the last count, but as noted previously there is less need for poachers to make meat smoking camps now that they are based so close to the remaining wildlife. On the 2002 count a small group of poachers in military uniform were found close to the eastern border of the park drying manioc on the rocks, and they fired at the aircraft.

Poaching is currently extremely brazen, but far more difficult to detect. The effects of the wars and instability has been most marked where it led to disarming of the guards and reduction of their ability to combat the poaching. As the graphs show, the majority of poaching groups are largely Sudanese and in the current situation in the region weapons and ammunition are readily available. It is urgent that really major effective training and leadership is given to the guards, with development of a new strategy of anti-poaching and recruitment and training of an adequate numbers of guards that can be fully supported and effective in their work. Numbers alone are not the answer.

CONCLUSIONS

There was some loss of most species except buffalo between 1976 and 1983. However the focus of poaching during that time appears to have been for the commercially valuable elephants and rhinos. Both species provided plenty of meat in addition to the trophies, if it was required. Since 1984 most species increased with the better protection, notably the rhinos and elephants, which have shown high rates of increase, and warthog, which showed a recent spectacular rise prior to 1995. The exceptions are buffalo and giraffe. Both have declined steadily. The buffalo population has dropped overall since 1983, probably as a result of meat poaching. Although carcase ratios and patrol reports show how poaching was brought down to minimal levels by the combined action of the project and IZCN, prior to 1991, after this time the effect of the war in adjacent Sudan has been the major influence on loss of animals and of the protected area of the park. The main drive for poaching has been for meat, and was hitting the buffalo population.

However the reduction in anti-poaching during the first war led to major wildlife losses in 1997. Since then major efforts by the guards and by the project personnel, principally in developing the UNF/UNESCO project to provide both financial and political support and in keeping up support on the ground, has enabled conservation work to continue as far as possible and has held many of the populations relatively stable. However there have been almost complete losses of wildlife in the northern and central sectors of the park. The combined effects of this is that all poaching focuses on the south, the proximity of well armed poachers to this area and the trends towards ivory and rhino horn poaching put the park in extreme danger, that must be tackled by extreme measures, now that peace is on the horizon in the DRC.

It is important for the sake of the park and its wildlife that sufficient resources and political negotiations are mobilised to stop the trans-border poaching, and that the poaching is tackled on all fronts, including positive integration of local people in resource conservation. For the sake of faunal and floral biodiversity and for long term conservation of the ecosystem and its particularly valuable components, it is important that the park and reserves are considered as a whole in an integrated plan backed with the resources to implement it.

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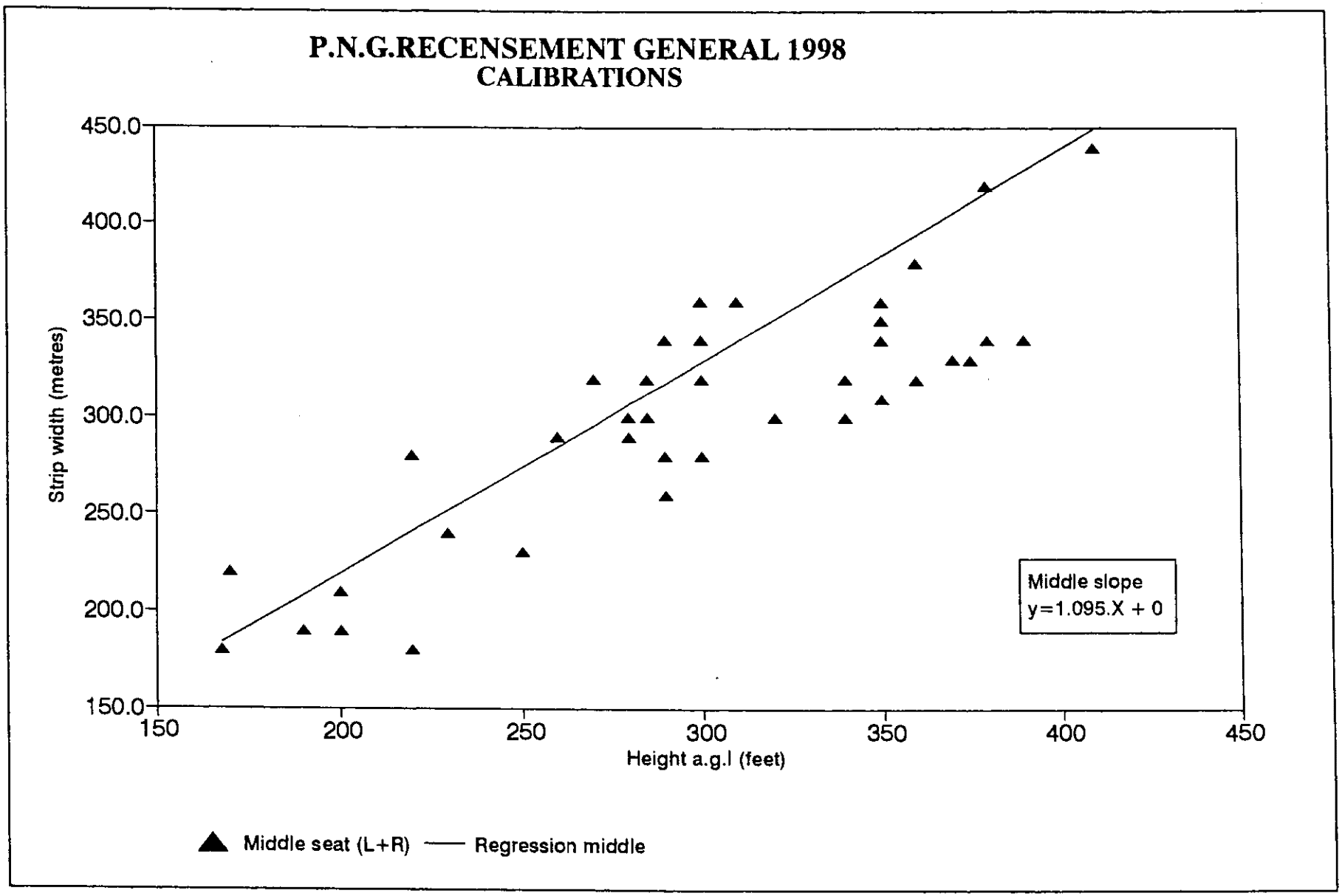
PARC NATIONAL DE LA GARAMBA
GARAMBA NATIONAL PARK

RECENSEMENT GENERAL SYSTEMATIQUE
GENERAL AERIAL SYSTEMATIC SAMPLE COUNT

Calibration Graphs, Distribution Maps and Population Estimate Calculations

May / Mai 1998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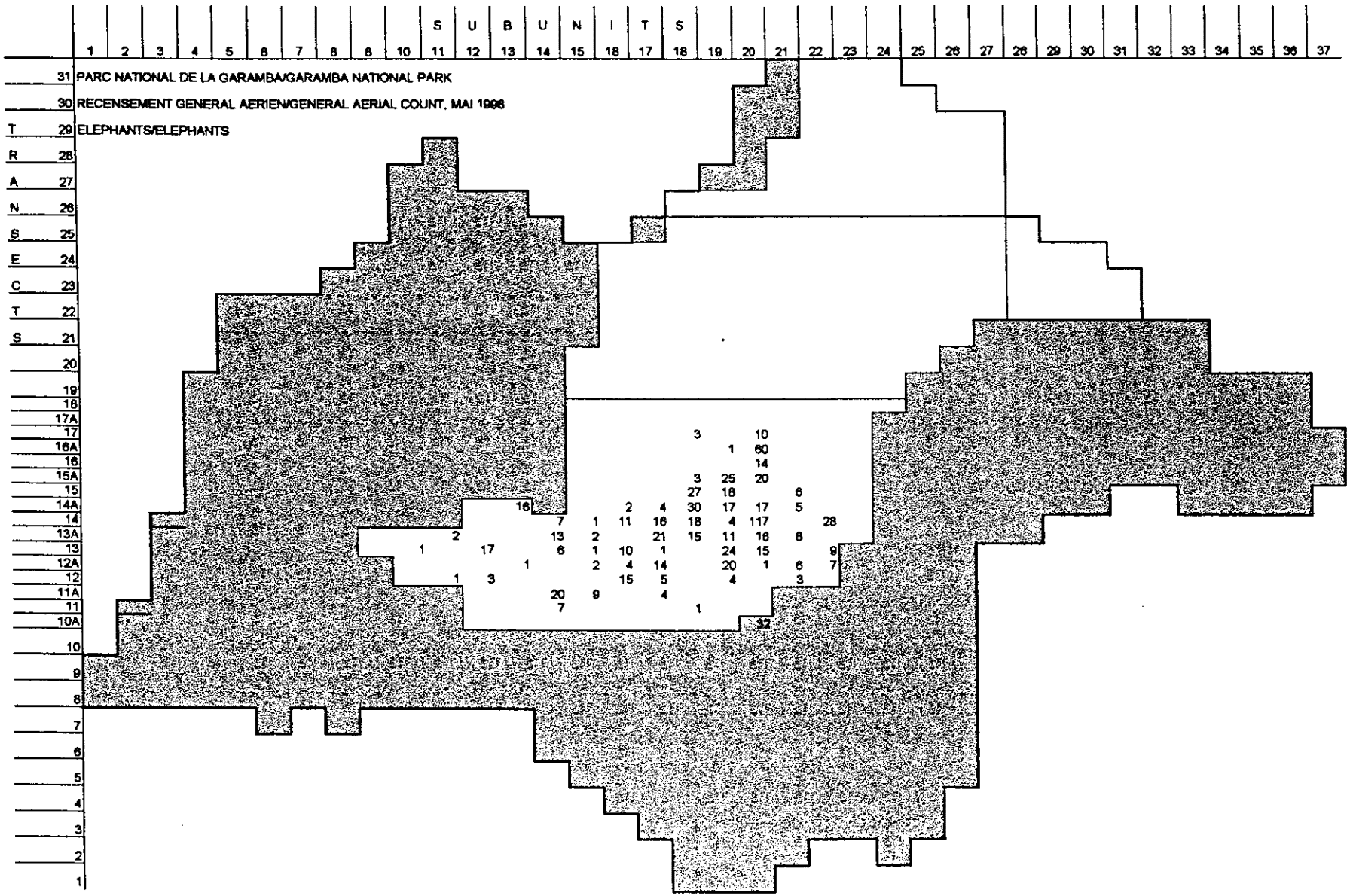
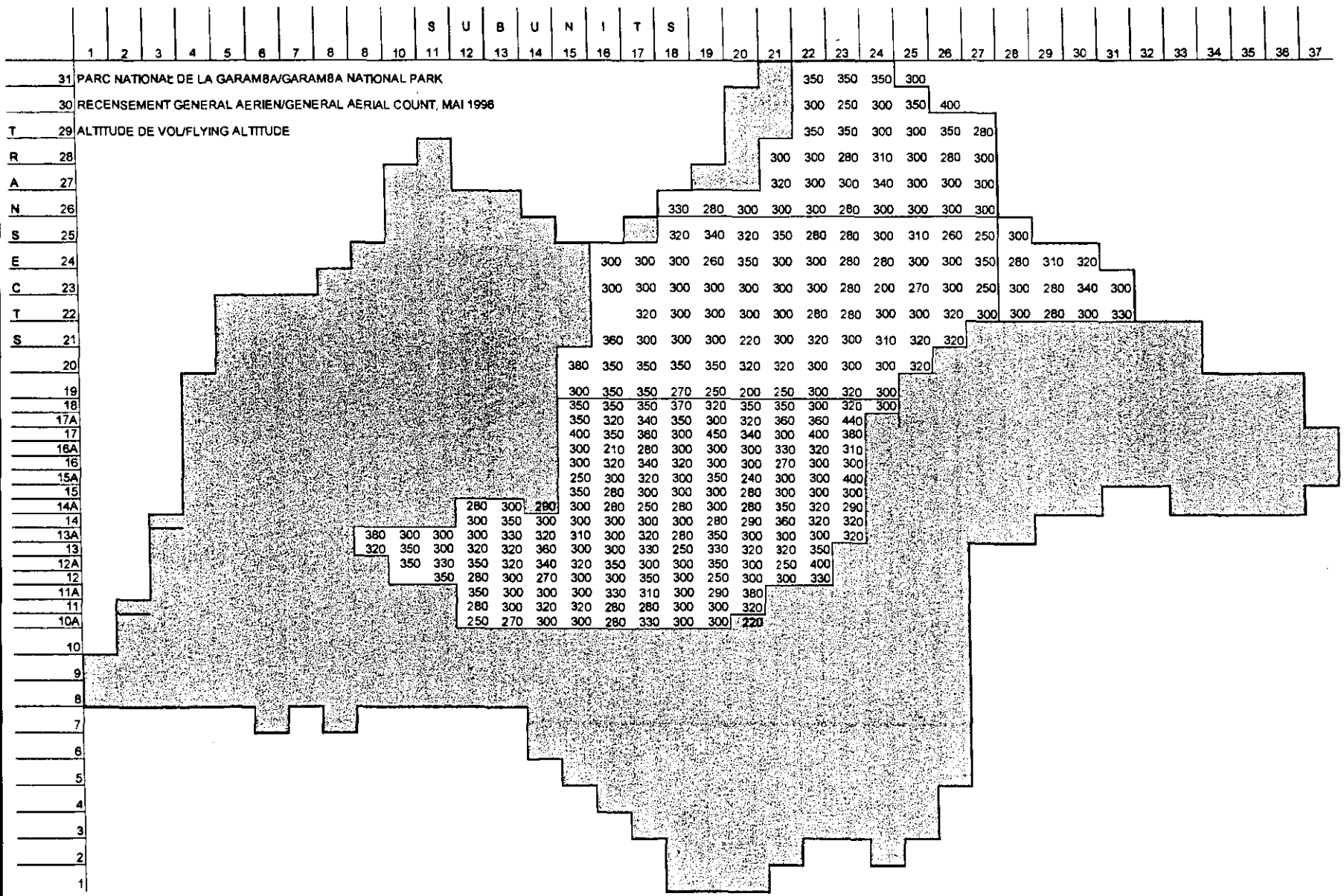
Strip width (metres)
450.0
400.0
350.0
300.0
250.0
200.0
150.0
150
200
250
300
350
400
450
Height a.g.l (feet)
Middle slope
y=1.095.X + 0
Middle seat (L+R)
Regression middle



PARC NATIONAL DE LA GARAMBA/GARAMBA NATIONAL PARK

RECENSEMENT GENERAL AERIEN/GENERAL AERIAL COUNT, MAI 1996

ELEPHANTS/ELEPHANTS



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			1200	300	
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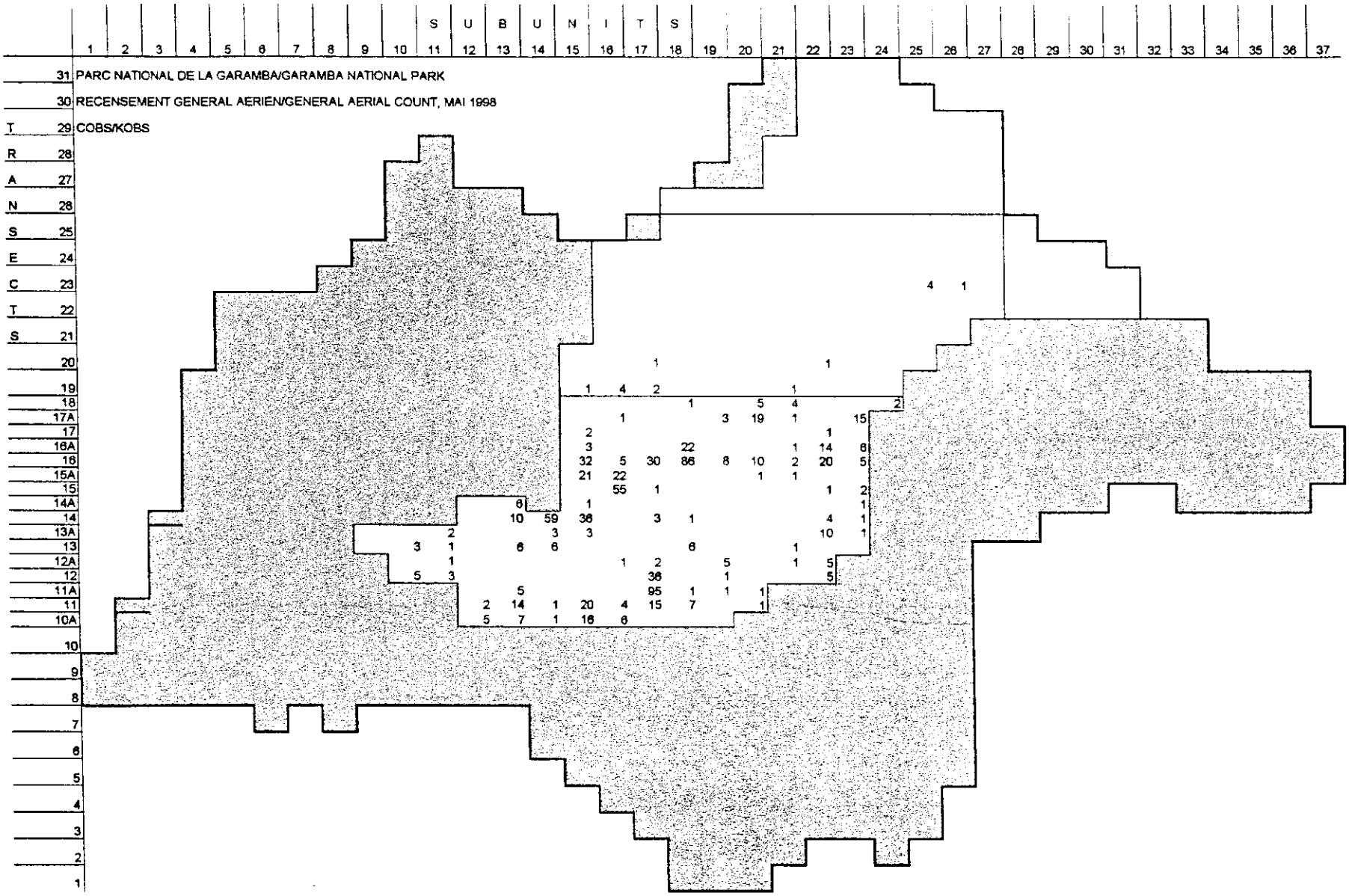
			2160	309	
			2990	299	
		3010	300	301	
		3620	910	302	
		3400	2430	289	
		3300	1210	301	
		3350		305	
		3640		331	
		2890		289	
18		3360		336	
17A		3140		349	
17		3280		384	
16A		2650		294	
16		2750		306	
15A		2760		307	
15		2710		301	
14A		3520		293	
14		3720		310	
13A		4710		314	
13		4470		319	
12A		4260		328	
12		3630		303	
11A		2860		318	
11		2700		300	
10A		2330		291	
10		0	0	11700	312 Tot
9		23210	23210	4850	302 Tot
8		52850	0	0	315 Tot
7		52850	23210	16550	311 TO
6					
5					
4					
3					
2					
1					



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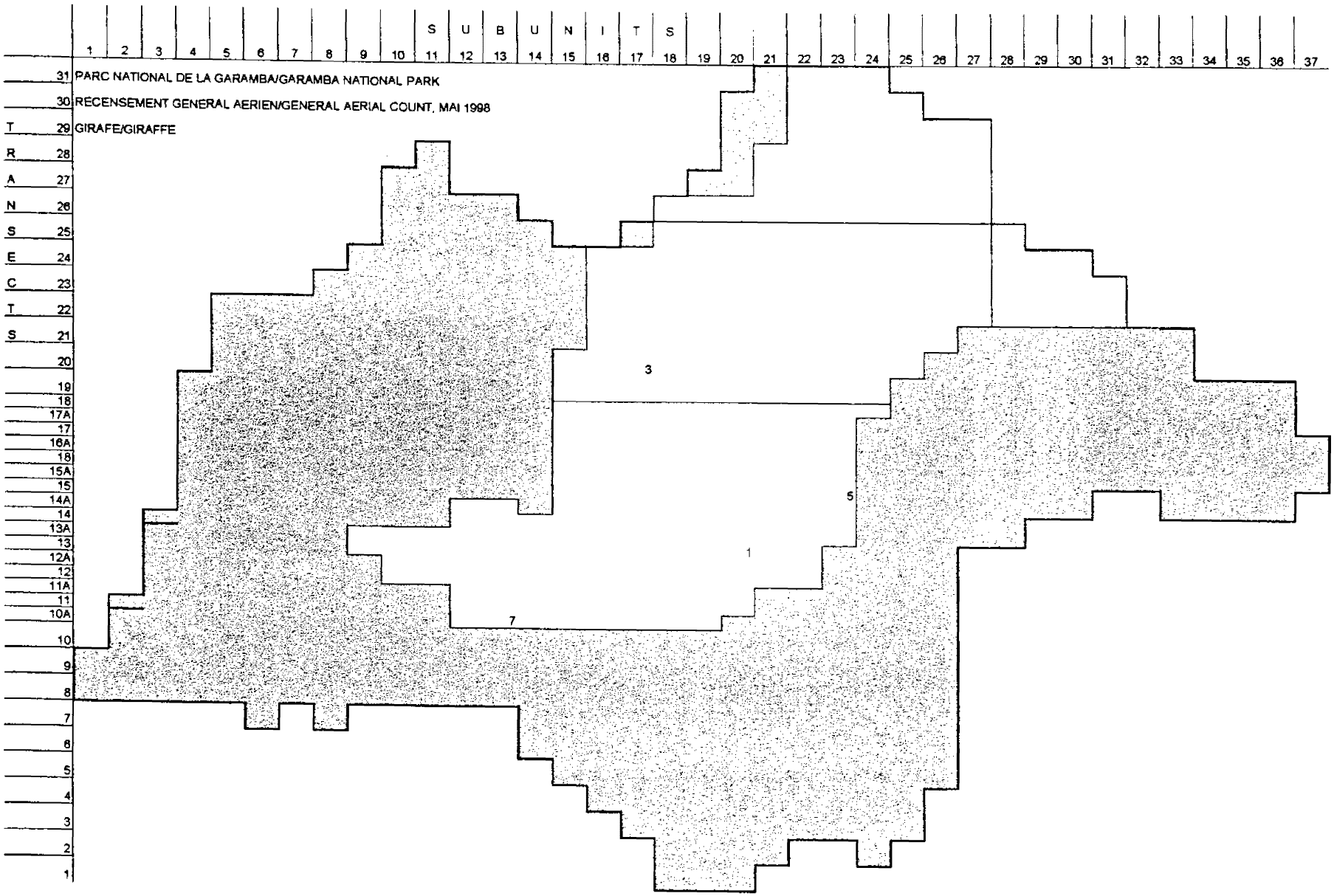
		2	
		6	
		12	
		39	
		3	
		46	
		196	
		45	
		59	
		6	
		114	
		19	
		23	
		15	
		50	
		103	
		84	
		32	
0	0	0	Total Nord
15	15	0	Total Centre
830	0	0	Total Sud
830	15	0	TOTAL



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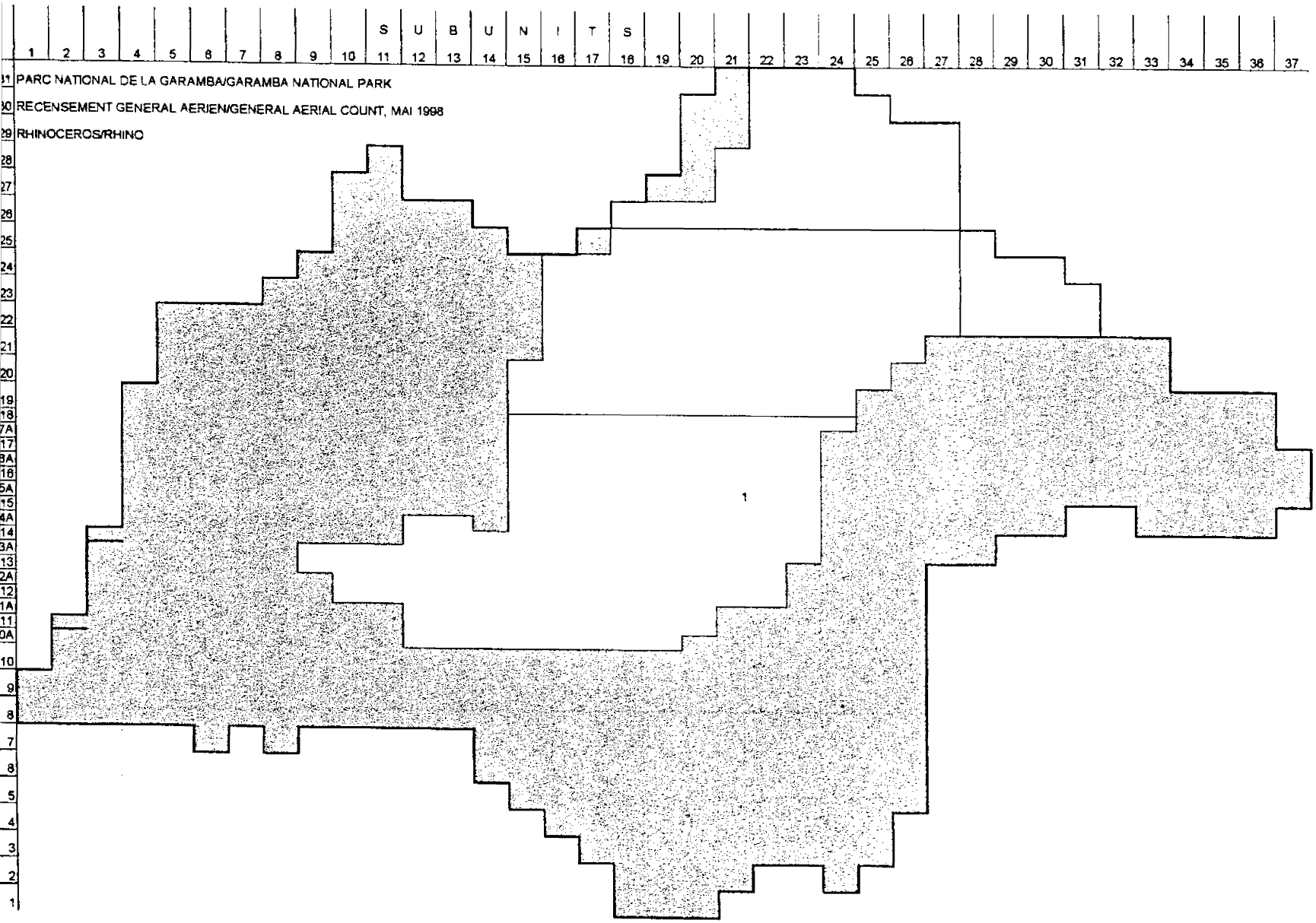
		3	
		0	
0			
0			
0			
0			
0			
0			
5			
0			
0			
0			
1			
0			
0			
0			
0			
7			
0	0	0	Total Nord
3	3	0	Total Centre
13	0	0	Total Sud
13	3	0	TOTAL



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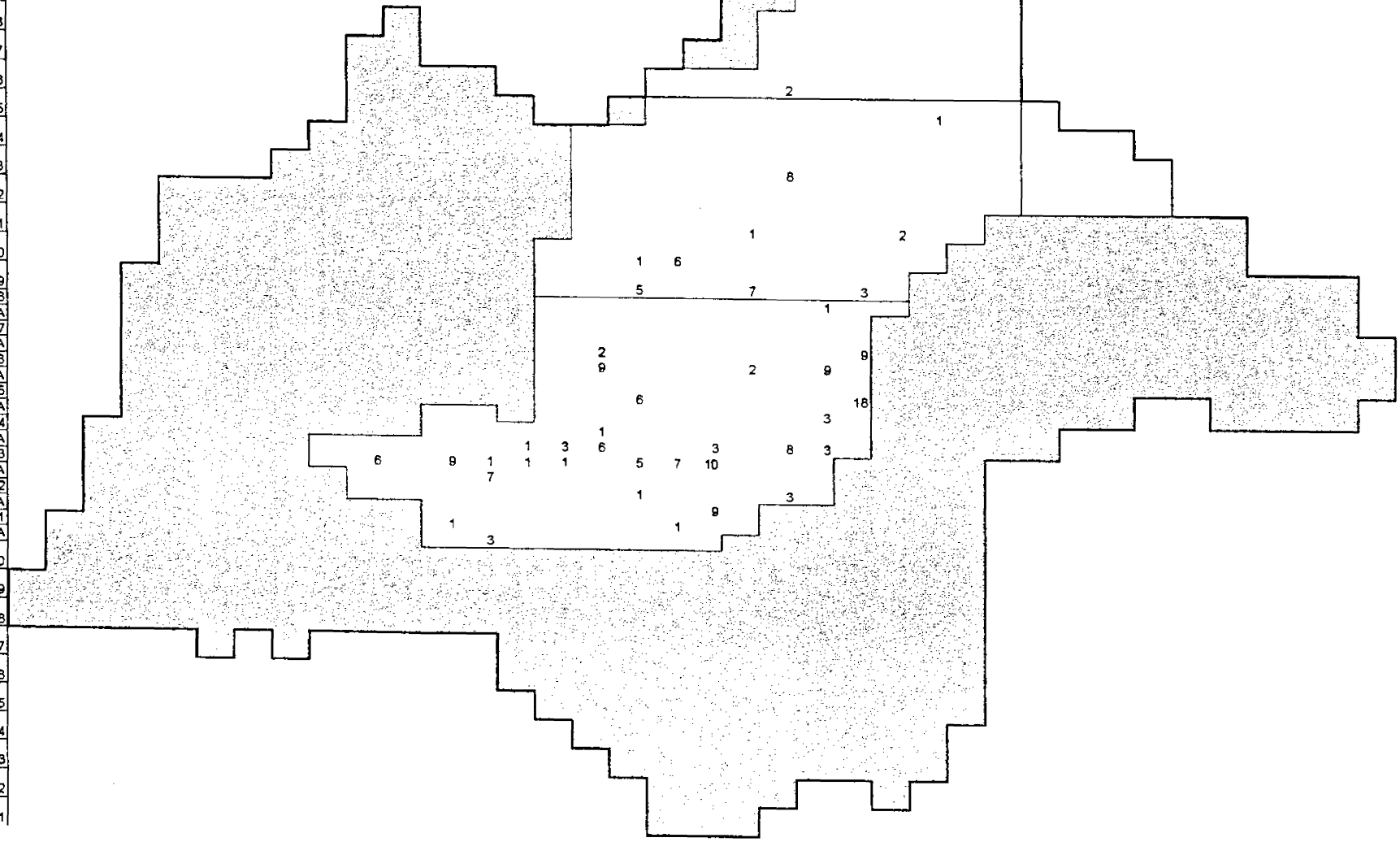
0			
0			
0			
0			
0			
1			
0			
0			
0			
0			
0			
0			
0			
0			
0			
0	0	0	Total Nord
0	0	0	Total Centre
1	0	0	Total Sud
1	0	0	TOTAL

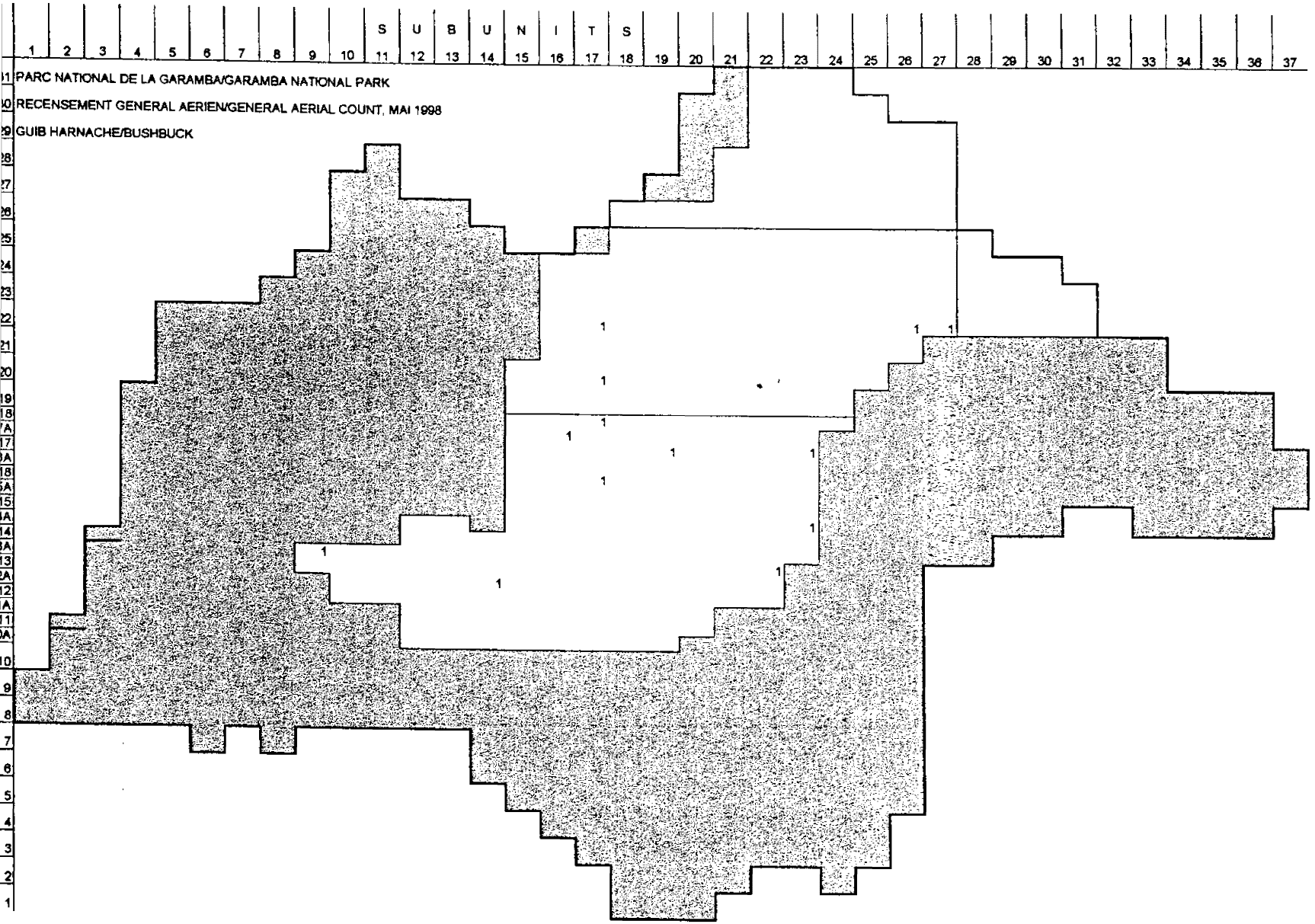
PARC NATIONAL OE LA GARAMBA/GARAMBA NATIONAL PARK

RECENSEMENT GENERAL AERIEN/GENERAL AERIAL COUNT, MAI 1998

BUBALES/HARTEBEESTES



0			
0			
0			
0			
0			
2			
1	0		
0	0		
6	0		
0	0		
3			
7			
15			
1			
0			
0			
11			
20			
0			
24			
3			
1			
26			
42			
7			
4			
9			
2			
3			
0	0	2	Total Nord
32	32	0	Total Centre
153	0	0	Total Sud
153	32	2	TOTAL



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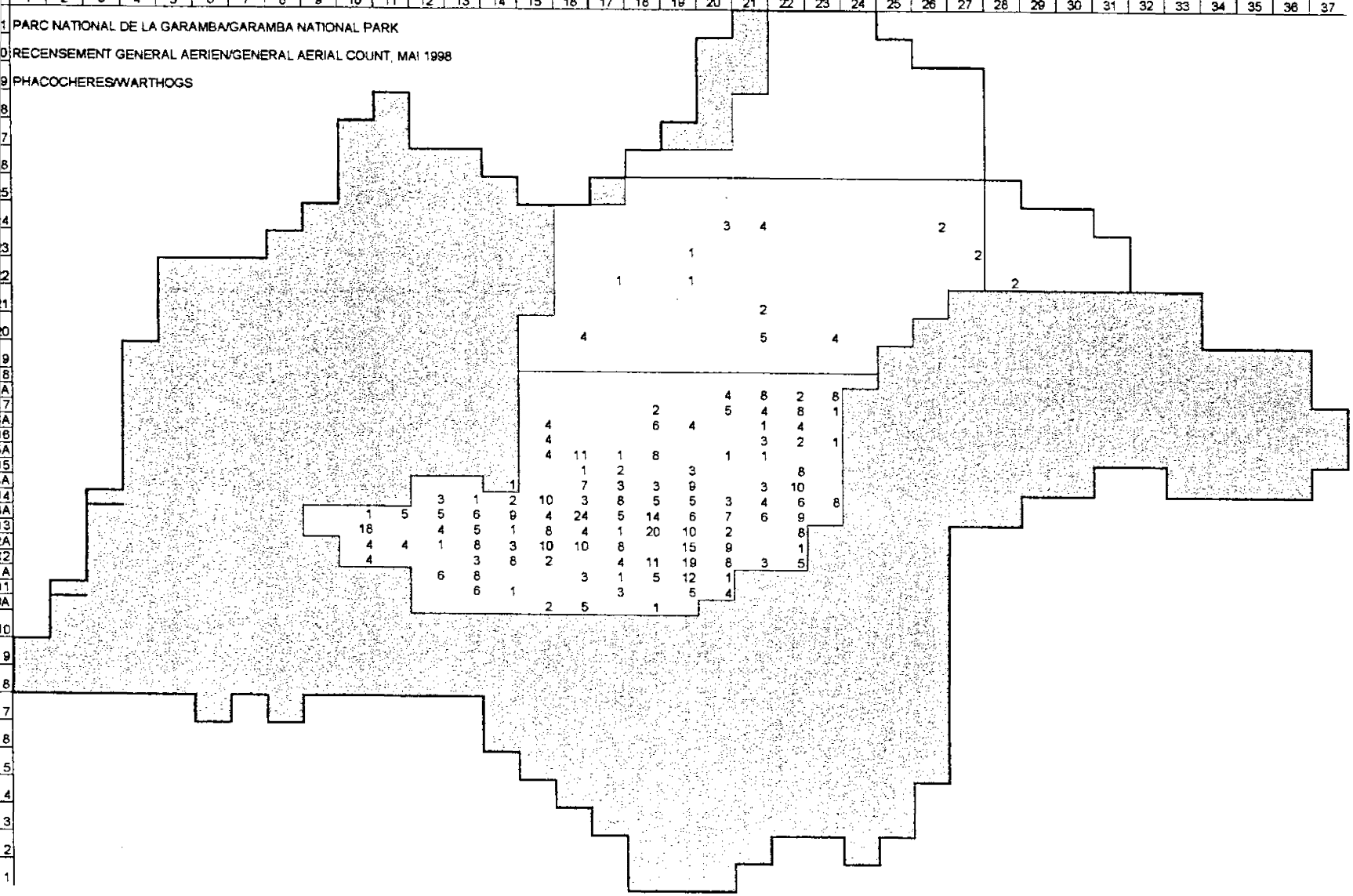
0			
0	0		
0	0		
0	0		
3	0		
0			
1			
0			
1			
1			
2			
0			
1			
0			
0			
1			
0			
1			
1			
1			
0			
0			
0			
0			
0	0	0	Total Nord
4	4	0	Total Centre
9	0	0	Total Sud
9	4	0	TOTAL

PARC NATIONAL DE LA GARAMBA/GARAMBA NATIONAL PARK

RECENSEMENT GENERAL AERIEN/GENERAL AERIAL COUNT, MAI 1998

PHACOCHERES/WARTHOGS



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0		
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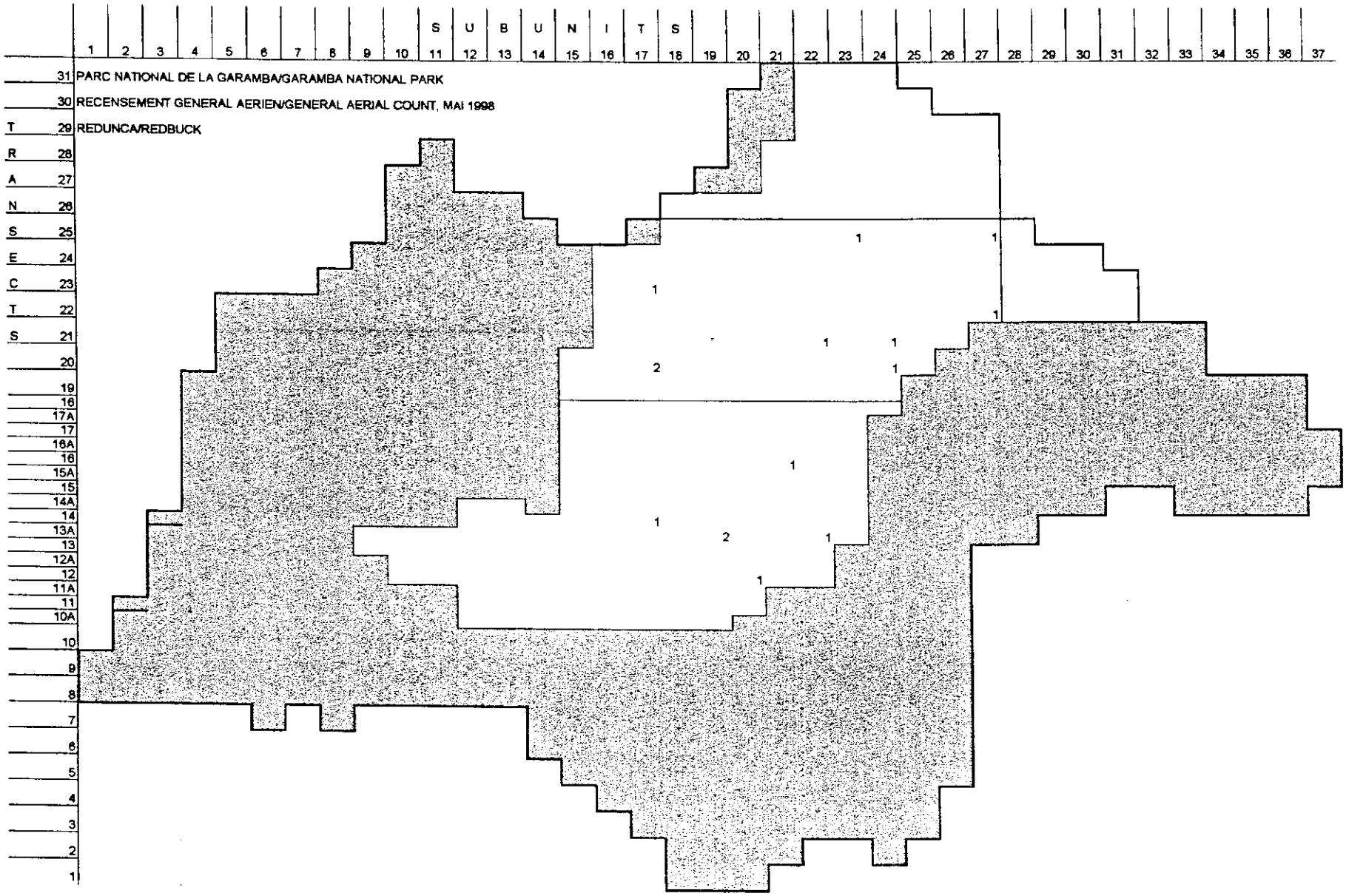
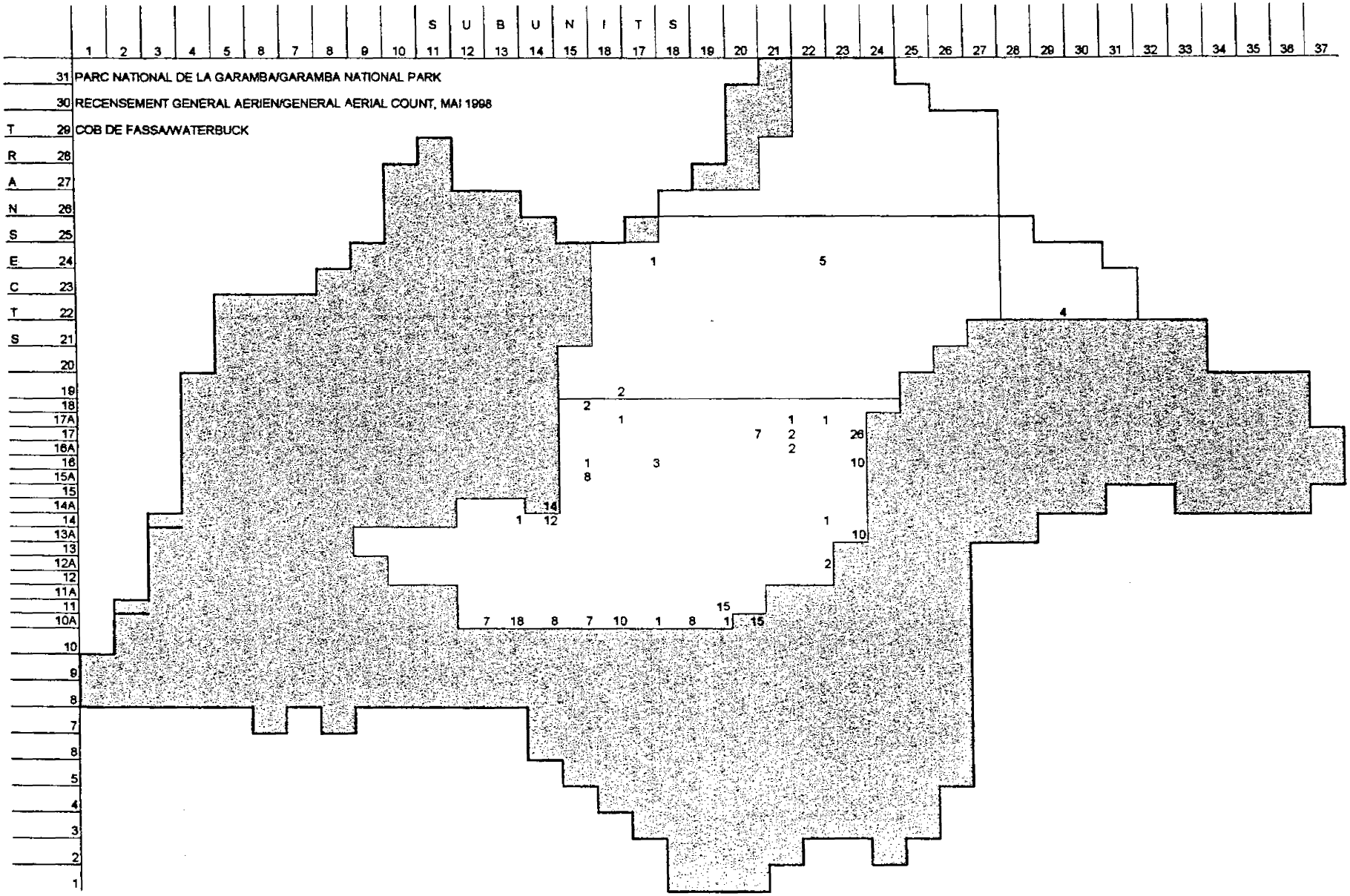
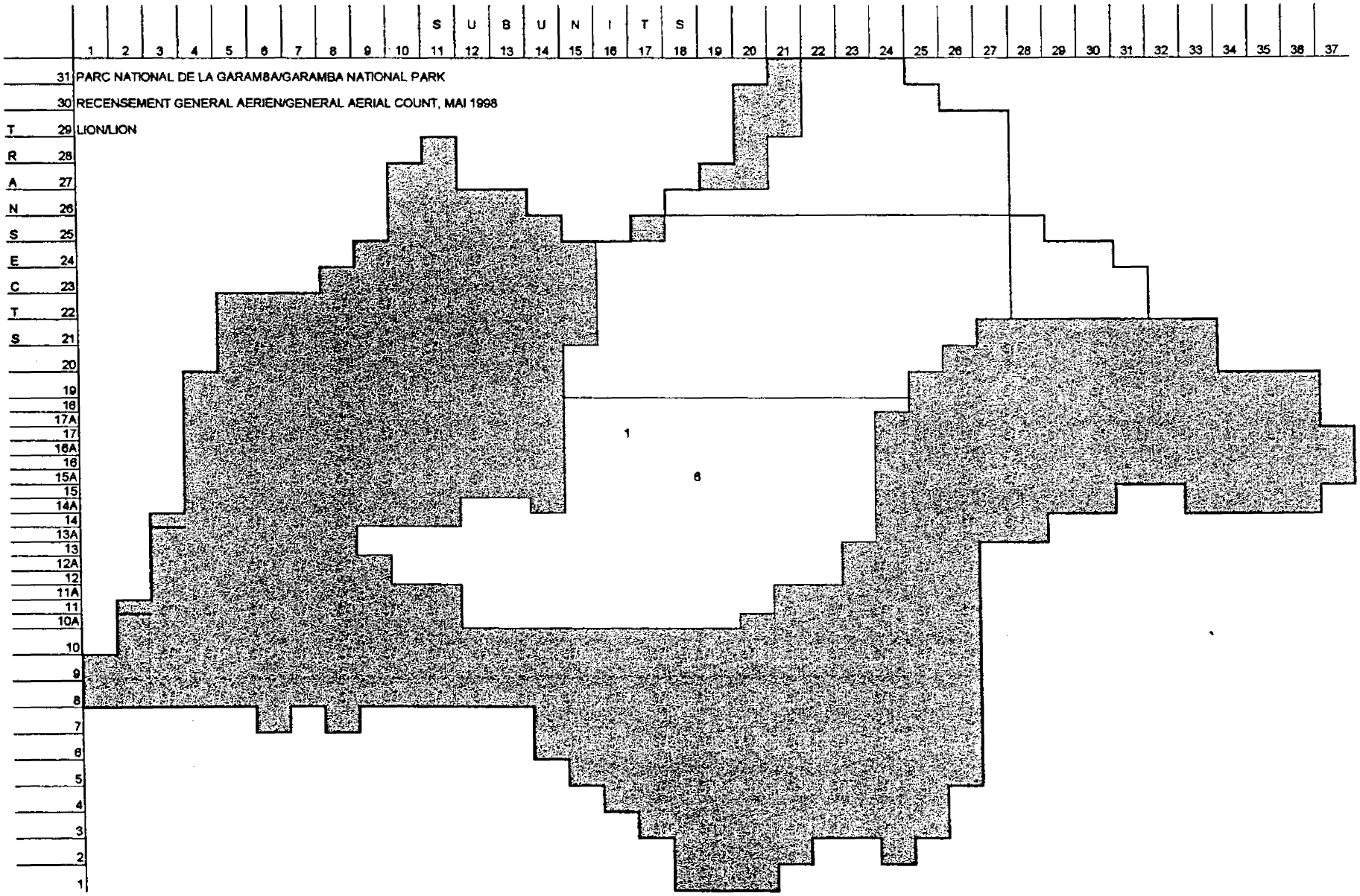
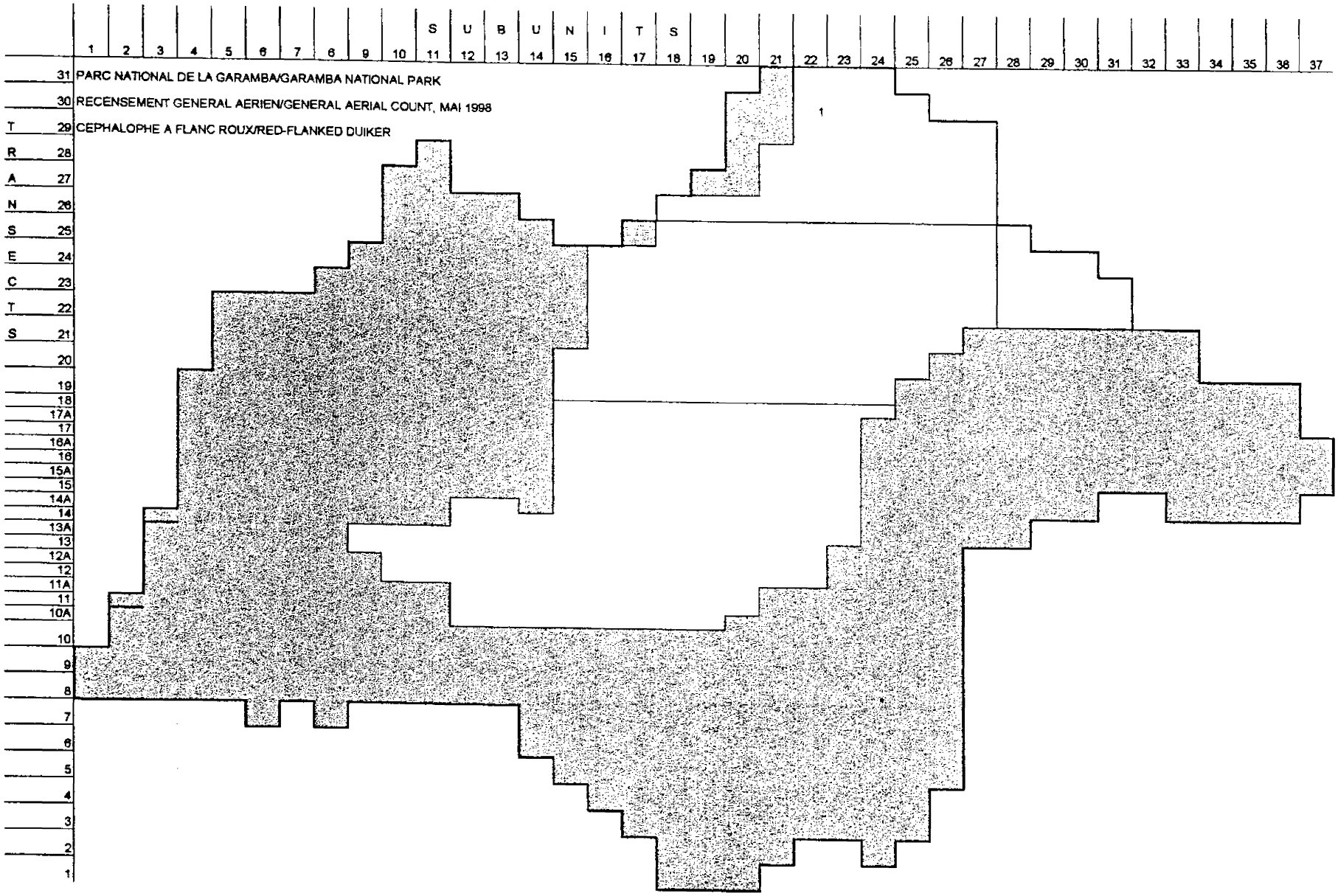
0		
0		
0	0	
9	0	
3	2	
2	2	
2		
13		
0		
0		
20		
20		
19		
10		
24		
12		
36		
58		
101		
75		
69		
65		
36		
19		
8		
0	0	0 Total Nord
29	29	4 Total Centre
572	0	0 Total Sud
572	29	4 TOTAL

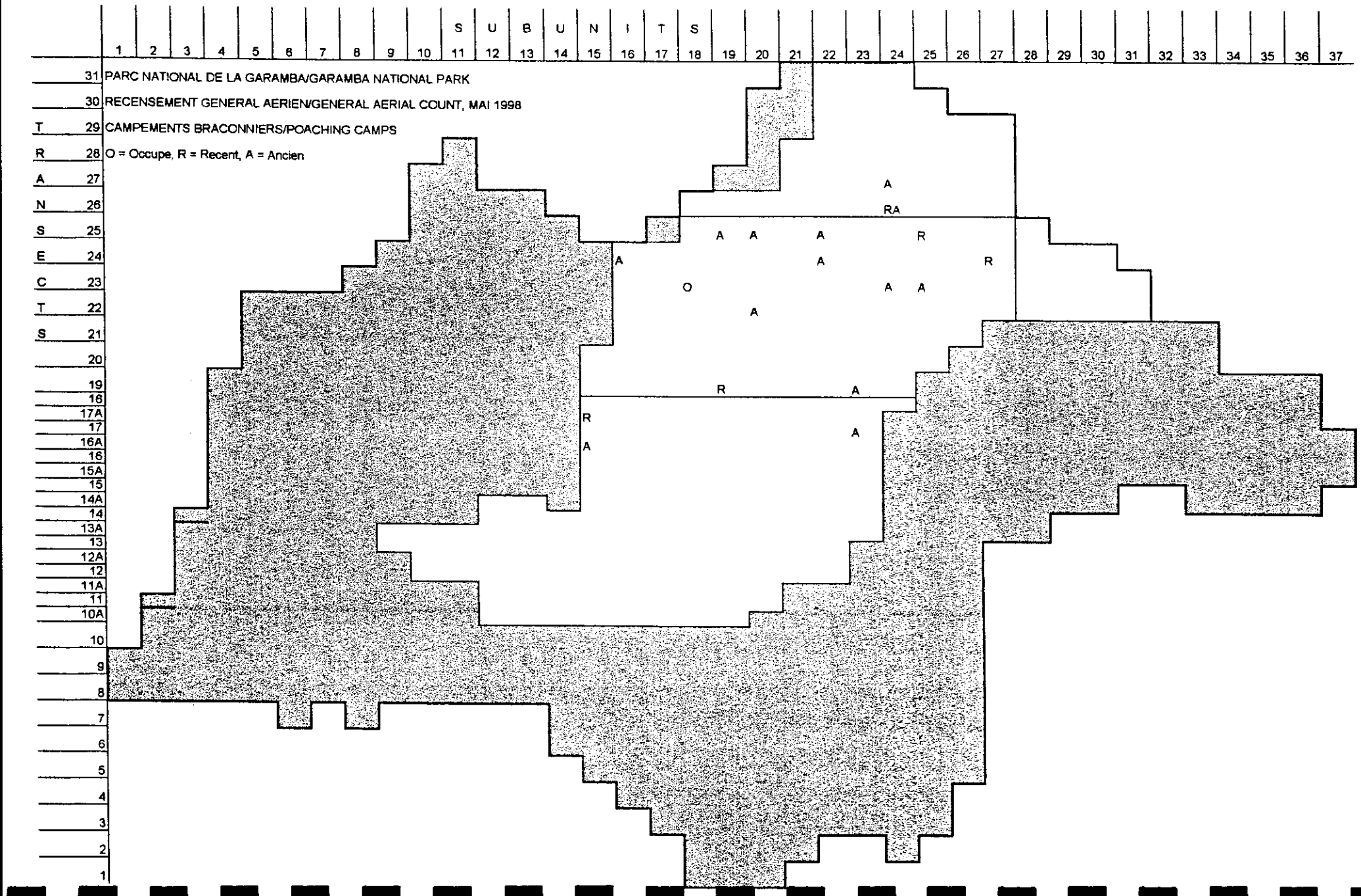

PARC NATIONAL DE LA GARAMBA/GARAMBA NATIONAL PARK
RECENSEMENT GENERAL AERIEN/GENERAL AERIAL COUNT, MAI 1998
REDUNCA/REDBUCK
SUBUNITS
TRANSECTS
0 Total No
0 Total Ce
0 Total Su
0 TOTAL

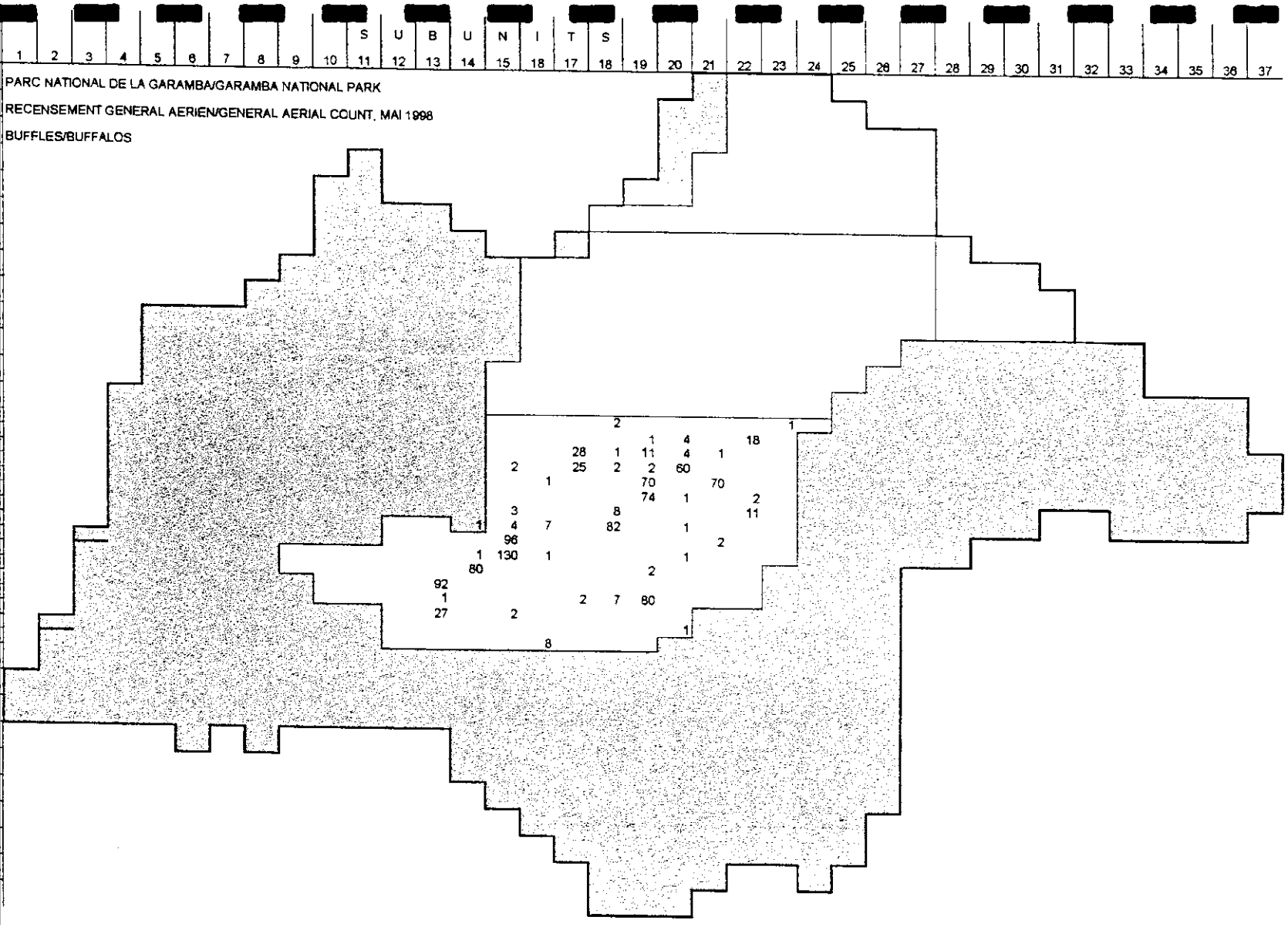

PARC NATIONAL DE LA GARAMBA/GARAMBA NATIONAL PARK
RECENSEMENT GENERAL AERIEN/GENERAL AERIAL COUNT, MAI 1998
COB DE FASSA/WATERBUCK
SUBUNIT
1 2 3 4 5 8 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22 23 24 25 26 27 28 29 30 31 32 33 34 35 36 37
TRANSECT
31 30 29 28 27 26 25 24 23 22 21 20 19 18 17A 17 16A 16 15A 15 14A 14 13A 13 12A 12 11A 11 10A 10 9 8 7 8 5 4 3 2 1
0
0
0
0
0
0 0
8 0
0 4
0 4
0
0
2
2
3
35
2
14
8
0
14
14
10
0
2
0
0
15
51
0 0 0 Total No
8 8 8 Total Co
170 0 0 Total Su
170 8 8 TOTAL


PARC NATIONAL DE LA GARAMBA/GARAMBA NATIONAL PARK
RECENSEMENT GENERAL AERIEN/GENERAL AERIAL COUNT, MAI 1998
LION/LION
SOUS-TRANSECTS
1
6
0 Total Nor
0 Total Cer
0 Total Sud
0 TOTAL


PARC NATIONAL DE LA GARAMBA/GARAMBA NATIONAL PARK
RECENSEMENT GENERAL AERIEN/GENERAL AERIAL COUNT, MAI 1998
CEPHALOPHE A FLANC ROUX/RED-FLANKED DUIKER

0 0 1 Total Nor
0 0 0 Total Cer
0 0 0 Total Suc
0 0 1 TOTAL


PARC NATIONAL DE LA GARAMBA/GARAMBA NATIONAL PARK
RECENSEMENT GENERAL AERIEN/GENERAL AERIAL COUNT, MAI 1998
CAMPEMENTS BRACONNIERS/POACHING CAMPS
O = Occupe, R = Recent, A = Ancien
FRONTIERE SUD/SOUTH BORDER
1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22 23 24 25 26 27 28 29 30 31 32 33 34 35 36 37
31 30 29 28 27 26 25 24 23 22 21 20 19 16 17A 17 16A 16 15A 15 14A 14 13A 13 12A 12 11A 11 10A 10 9 8 7 6 5 4 3 2 1



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	0		0	
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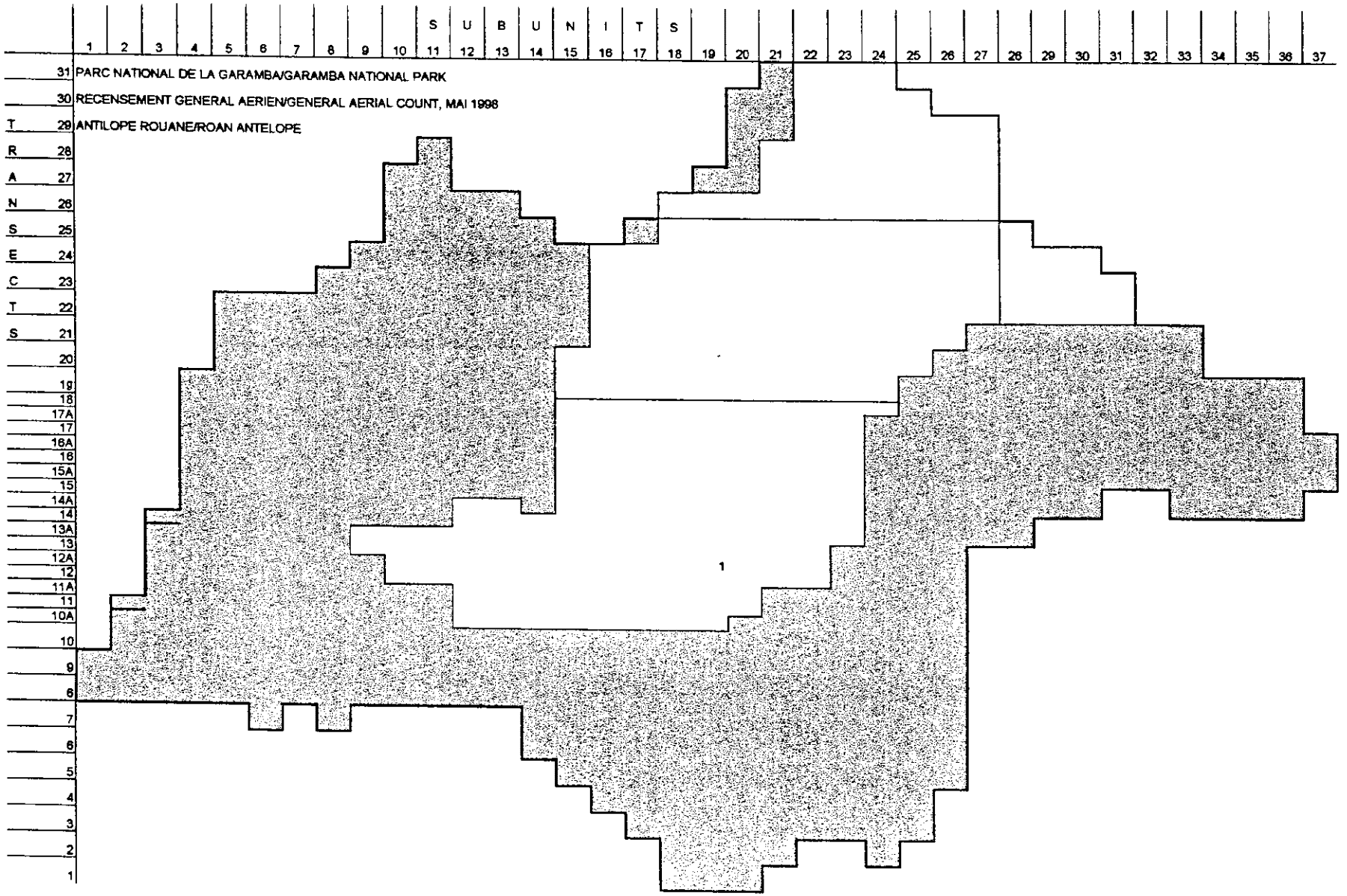
3				
23				
43				
91				
141				
77				
22				
95				
98				
133				
82				
92				
90				
29				
1				
8				
0		0	0	Total Nord
0	0			Total Centre
1028				Total Sud
1028	0	0	1028	TOTAL

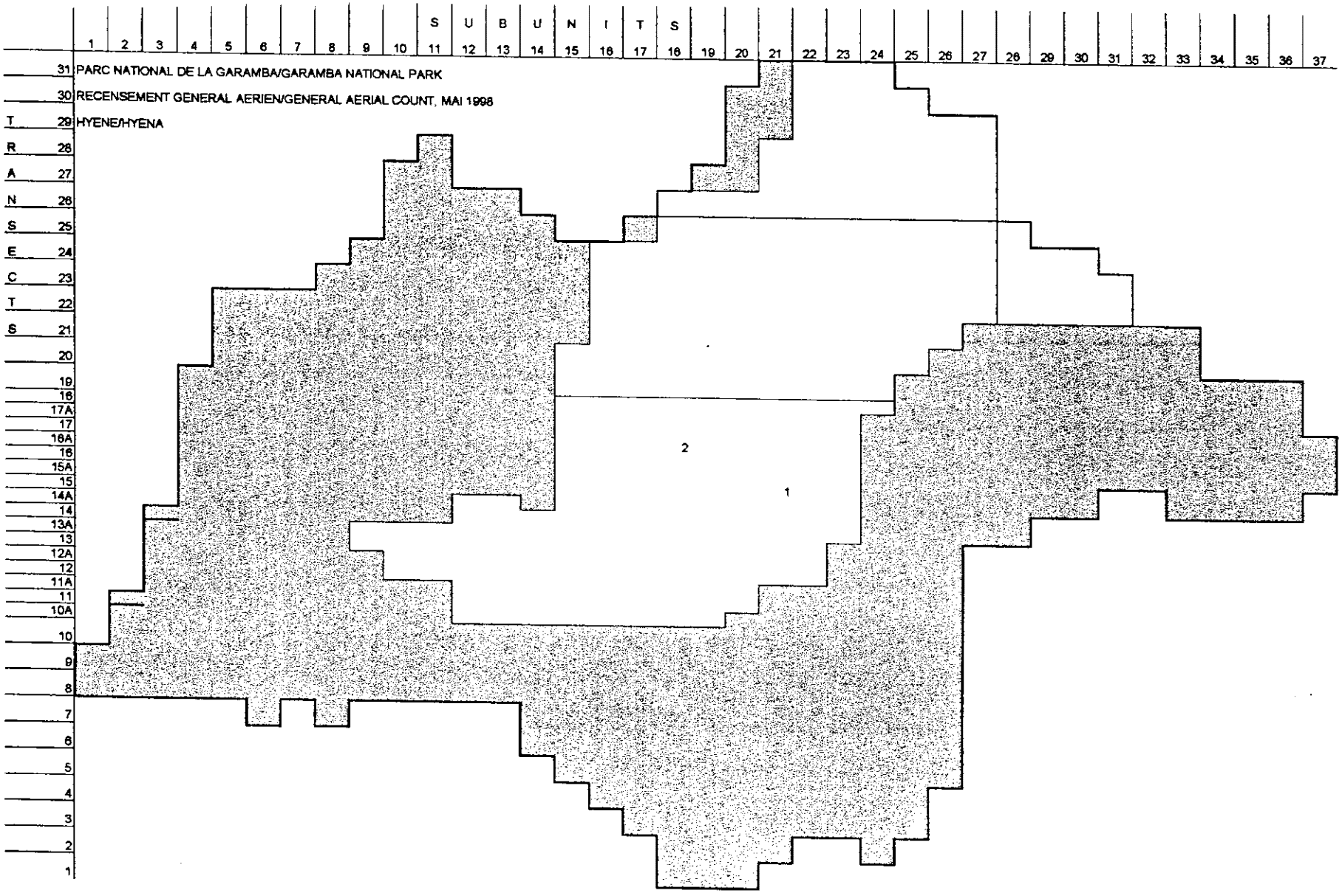

PARC NATIONAL DE LA GARAMBA/GARAMBA NATIONAL PARK
RECENSEMENT GENERAL AERIEN/GENERAL AERIAL COUNT, MAI 1998
ANTILOPE ROUANE/ROAN ANTELOPE
SUBUNIT 1
TRANSECTS
1
Low D
Med D
High D
Dom
Total

TRANS	1998 AREA				GIRAFES					HIPPOPOTHAMES				
	HIGH STR	MID NTH	LOW NTH	TOT.NORTH	HIGH STR	MID NTH	LOW NTH	TOT.NTH	TOTAL	HIGH STR	MID NTH	LOW NTH	TOT.NTH	TOTAL
31			7.39	7.39			0	0				0	0	
30			6.57	6.57			0	0				0	0	
29			10.57	10.57			0	0				0	0	
28			11.33	11.33			0	0				0	0	
27			11.83	11.83			0	0				0	0	
26			16.37	16.37			0	0				0	0	
25		16.48	1.64	18.12		0	0	0				0	0	
24		19.82	4.98	24.80		0	0	0			0	0	0	
23		18.62	13.30	31.92		0	0	0			0	0	0	
22		18.07	6.62	24.69		0	0	0			0	0	0	
21		18.34		18.34		0		0			0	0	0	
20		19.93		19.93		3		3			0		0	
19		15.82		15.82		0		0			0		0	
18	18.40				0						0			
17a	17.19				0					0				
17	17.96				0					0				
16a	14.51				0					4				
16	15.06				0					1				
15a	15.11				0					0				
15	14.84				0					11				
14a	19.27				5					4				
14	20.37				0					18				
13a	25.79				0					10				
13	24.47				0					1				
12a	23.32				1					2				
12	19.87				0					28				
11a	15.66				0					7				
11	14.78				0					8				
10a	12.76				0					7				
					7					3				
Total	289.4	127.1	64.1	217.7	13.0	3.0	0.0	3.0		104.0	0.0	0.0	0.0	
Sum squ	5457.7	2321.3	745.7	4301.7	75.0	9.0	0.0	9.0		1538.0	0.0	0.0	0.0	
				Sum (Z*y)	188.0	59.8	0.0	59.8		1996.4	0.0	0.0	0.0	
				R=σy/σz	0.0	0.0	0.0	0.0		0.4	0.0	0.0	0.0	
				Var y	4.3	1.3	0.0	0.7		57.5	0.0	0.0	0.0	
Var z	15.0	2.4	12.4	54.7					STRAT.					STRAT.
Covar zy					-3.1	-0.8	0.0	0.5	TOTAL	7.7	0.0	0.0	0.0	TOTAL
					GIRAFES					HIPPOPOTHAMES				
				Pop.est.(Y)	**98.3**	**46.0**	**0.0**	**43.4**	**144.3**	**786.2**	**0.0**	**0.0**	**0.0**	**786.2**
				SE(Y)	60.5	41.3	0.0	43.5	73.2	206.8	0.0	0.0	0.0	206.8
				95% C.L.	123.4	84.2	0.0	88.8	143.6	421.9	0.0	0.0	0.0	405.3
				95% C.L.as %	125.6	183.0	ERR	204.5	99.5	53.7	ERR	ERR	ERR	51.6

PARC NATIONAL DE LA GARAMBA/GARAMBA NATIONAL PARK

RECENSEMENT GENERAL AERIEN/GENERAL AERIAL COUNT, MAI 1998

HYENE/HYENA



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1			
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0			
0			
0			
0			
0			
0			
0	0	0	Total Nord
0	0	0	Total Cent
3	0	0	Total Sud
3	0	0	TOTAL

1998	AREA				COBES DE THOMAS					PHACOCHERES				
TRANS	HIGH STH	MID NTH	LOW NTH	TOT.NORTH	HIGH STH	MID NTH	LOW NTH	TOT.NTH	TOTAL	HIGH STH	MID NTH	LOW NTH	TOT.NTH	TOTAL
31			7.39	7.39			0	0				0	0	
30			6.57	6.57			0	0				0	0	
29			10.57	10.57			0	0				0	0	
28			11.33	11.33			0	0				0	0	
27			11.83	11.83			0	0				0	0	
26			16.37	16.37			0	0				0	0	
25		16.48	1.64	18.12		0	0	0			0	0	0	
24		19.82	4.98	24.80		0	0	0			9	0	9	
23		18.62	13.30	31.92		5	0	5			3	2	5	
22		18.07	6.62	24.69		0	0	0			2	2	4	
21		18.34		18.34		0		0			2		2	
20		19.93		19.93		2		2			13		13	
19		15.82		15.82		8		8			0		0	
18	18.40				12					0				
17a	17.19				39					20				
17	17.96				3					20				
16a	14.51				46					19				
16	15.06				198					10				
15a	15.11				45					24				
15	14.84				59					12				
14a	19.27				8					36				
14	20.37				114					58				
13a	25.79				19					101				
13	24.47				23					75				
12a	23.32				15					69				
12	19.87				50					65				
11a	15.66				103					36				
11	14.78				64					19				
10a	12.76				32					8				
Total	289.4	127.1	64.1	217.7	830.0	15.0	0.0	15.0		572.0	29.0	0.0	33.0	
Sum squ	5457.7	2321.3	745.7	4301.7	80904.0	93.0	0.0	93.0		33174.0	267.0	0.0	295.0	
				Sum (Z*y)	13988.6	259.5	0.0	326.0		11832.8	566.1	0.0	777.3	
				R=ȳy/ȳz	2.9	0.1	0.0	0.1		2.0	0.2	0.0	0.2	
				Var y	2523.2	10.1	0.0	6.3		848.3	24.5	0.0	17.6	
Var z	15.0	2.4	12.4	54.7					STRAT.					STRAT.
Covar zy					-68.1	-11.6	0.0	4.9	TOTAL	99.2	-9.6	0.0	16.2	TOTAL
					COBES DE THOMAS					PHACOCHERES				
				Pop.est.(Y)	6275	230	0	217	6505	4324	445	0	478	4769
				SE(Y)	1553	129	0	125	1558	639	193	0	188	668
				95% C.L.	3168	263	0	256	3054	1304	394	0	384	1309
				95% C.L.as %	50	114	ERR	118	47	30	89	ERR	80	27

	AREA				ELEPHANTS					BUFFLES				
TRANS	HIGH ST	MID NTH	LOW NTH	TOT.NORTH	HIGH ST	MID NTH	LOW NTH	TOT.NTH	TOTAL	HIGH ST	MID NTH	LOW NTH	TOT.NTH	TOTAL
31			7.39	7.39			0	0				0	0	
30			6.57	6.57			0	0				0	0	
29			10.57	10.57			0	0				0	0	
28			11.33	11.33			0	0				0	0	
27			11.83	11.83			0	0				0	0	
26			16.37	16.37			0	0				0	0	
25		16.48	1.64	18.12		0	0	0			0	0	0	
24		19.82	4.98	24.80		0	0	0			0	0	0	
23		18.62	13.30	31.92		0	0	0			0	0	0	
22		18.07	6.62	24.69		0	0	0			0	0	0	
21		18.34		18.34		0		0			0		0	
20		19.93		19.93		0		0			0		0	
19		15.82		15.82		0		0			0		0	
18	18.40				0					3				
17a	17.19				0					23				
17	17.96				13					43				
16a	14.51				61					91				
16	15.06				14					141				
15a	15.11				48					77				
15	14.84				49					22				
14a	19.27				91					95				
14	20.37				202					98				
13a	25.79				88					133				
13	24.47				84					82				
12a	23.32				55					92				
12	19.87				31					90				
11a	15.66				33					29				
11	14.78				8					1				
10a	12.76				0					8				
Total	289.4	127.1	64.1	217.7	777.0	0.0	0.0	0.0		1028.0	0.0	0.0	0.0	
Sum squ	5457.7	2321.3	745.7	4301.7	77815.0	0.0	0.0	0.0		97474.0	0.0	0.0	0.0	
				Sum (Z*y)	15508.4	0.0	0.0	0.0		19924.7	0.0	0.0	0.0	
				R=Sy/Sz	2.7	0.0	0.0	0.0		3.6	0.0	0.0	0.0	
				Var y	2672.1	0.0	0.0	0.0		2095.0	0.0	0.0	0.0	
Var z	15.0	2.4	12.4	54.7					STRAT.					STRAT.
Covar zy					97.1	0.0	0.0	0.0	TOTAL	88.9	0.0	0.0	0.0	TOTAL
					ELEPHANTS					BUFFLES				
				Pop.est.(Y)	5,874	0	0	0	5,874	7,772	0	0	0	7,772
				SE(Y)	1339.2	0.0	0.0	0.0	1339.2	2062.8	0.0	0.0	0.0	2062.85
				95% C.L.	2732.0	0.0	0.0	0.0	2624.9	4208.2	0.0	0.0	0.0	4043.18
				95% C.L.as %	46.5	0.0	0.0	0.0	44.7	54.1	ERR	ERR	ERR	52.02

1998	AREA				ANTILOPE ROANNE					GUIB HARNACHE				
TRANS	HIGH ST	MID NTH	LOW NTH	TOT.NORTH	HIGH ST	MID NTH	LOW NTH	TOT.NTH	TOTAL	HIGH ST	MID NTH	LOW NTH	TOT.NTH	TOTAL
31			7.39	7.39			0	0				0	0	
30			6.57	6.57			0	0				0	0	
29			10.57	10.57			0	0				0	0	
28			11.33	11.33			0	0				0	0	
27			11.83	11.83			0	0				0	0	
26			16.37	16.37			0	0				0	0	
25		16.48	1.64	18.12		0	0	0			0	0	0	
24		19.82	4.98	24.80		0	0	0			0	0	0	
23		18.62	13.30	31.92		0	0	0			0	0	0	
22		18.07	6.62	24.69		0	0	0			3	0	3	
21		18.34		18.34		0		0			0		0	
20		19.93		19.93		0		0			1		1	
19		15.82		15.82		0		0			0		0	
18	18.40				0					1				
17a	17.19				0					1				
17	17.96				0					2				
16a	14.51				0					0				
16	15.06				0					1				
15a	15.11				0					0				
15	14.84				0					0				
14a	19.27				0					1				
14	20.37				0					0				
13a	25.79				0					1				
13	24.47				0					1				
12a	23.32				1					1				
12	19.87				0					0				
11a	15.66				0					0				
11	14.78				0					0				
10a	12.76				0					0				
Total	289.4	127.1	64.1	217.7	1.0	0.0	0.0	0.0		9.0	4.0	0.0	4.0	
Sum squ	5457.7	2321.3	745.7	4301.7	1.0	0.0	0.0	0.0		11.0	10.0	0.0	10.0	
				Sum (Z*y)	23.3	0.0	0.0	0.0		179.4	74.1	0.0	94.0	
				R=Sy/Sz	0.0	0.0	0.0	0.0		0.0	0.0	0.0	0.0	
				Var y	0.1	0.0	0.0	0.0		0.4	1.3	0.0	0.7	
Var z	15.0	2.4	12.4	54.7					STRAT.					STRAT.
Covar zy					0.3	0.0	0.0	0.0	TOTAL	1.1	-2.1	0.0	1.9	TOTAL
					ANTILOPPE ROANNE					GUIB HARNACHE				
				Pop.est.(Y)	8	0	0	0	8	68	61	0	58	187
				SE(Y)	7	0	0	0	7	16	43	0	43	46
				95% C.L.	14	0	0	0	14	34	87	0	87	90
				95% C.L.as %	187	ERR	ERR	ERR	179	49	142	ERR	151	48

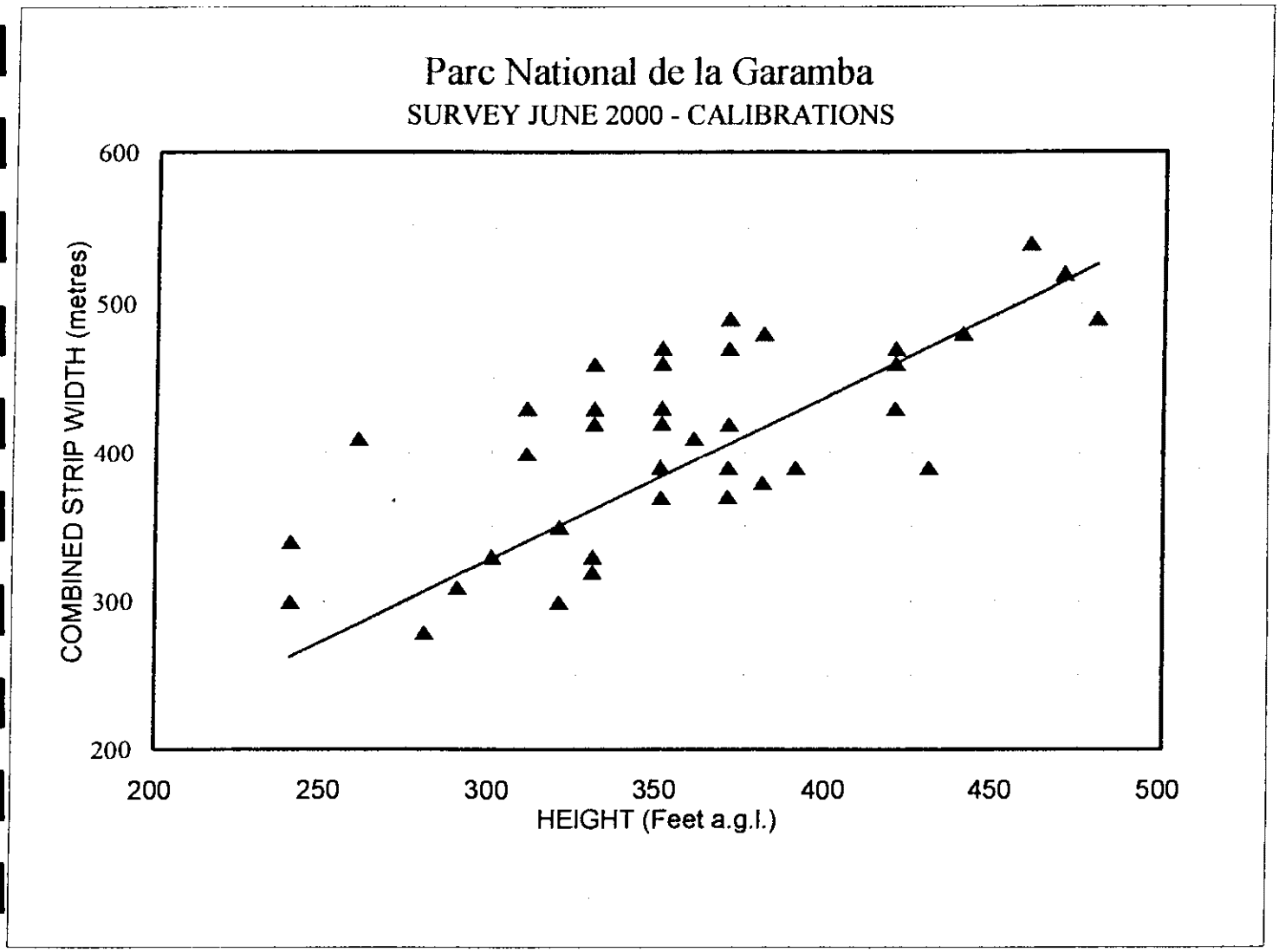
	AREA				BUBALES					WATERBUCK				
TRANS	HIGH STI	MID NTH	LOW NTH	TOT NORTH	HIGH STI	MID NTH	LOW NTH	TOT NTH	TOTAL	HIGH STI	MID NTH	LOW NTH	TOT NTH	TOTAL
31			7.39	7.39			0	0				0	0	
30			6.57	6.57			0	0				0	0	
29			10.57	10.57			0	0				0	0	
28			11.33	11.33			0	0				0	0	
27			11.83	11.83			0	0				0	0	
26			16.37	16.37			2	2				0	0	
25		16.48	1.64	18.12		1	0	1			0	0	0	
24		19.82	4.98	24.80		0	0	0			6	0	6	
23		18.62	13.30	31.92		6	0	6			0	4	4	
22		18.07	6.62	24.69		0	0	0			0	4	4	
21		18.34		18.34		3		3			0		0	
20		19.93		19.93		7		7			0		0	
19		15.82		15.82		15		15			2		2	
18	18.40				1					2				
17a	17.19				0					3				
17	17.96				0					35				
16a	14.51				11					2				
16	15.06				20					14				
15a	15.11				0					8				
15	14.84				24					0				
14a	19.27				3					14				
14	20.37				1					8				
13a	25.79				26					10				
13	24.47				42					0				
12a	23.32				7					2				
12	19.87				4					0				
11a	15.66				9					0				
11	14.78				2					15				
10a	12.76				3					51				
Total	289.4	127.1	64.1	217.7	153.0	32.0	2.0	34.0		164.0	8.0	0.0	16.0	
Sum squ	5457.7	2321.3	745.7	4301.7	3707.0	320.0	4.0	324.0		4692.0	40.0	0.0	72.0	
				Sum (Z*y)	3063.3	560.0	32.7	674.2		2687.2	150.6	0.0	406.9	
				R=σy/σz	0.5	0.3	0.0	0.2		0.6	0.1	0.0	0.1	
				Var y	149.6	29.0	0.7	19.6		200.7	5.1	0.0	4.4	
Var z	15.0	2.4	12.4	54.7					STRAT.					STRAT.
Covar zy					19.8	-23.5	2.2	5.2	TOTAL	-18.6	-3.8	0.0	10.6	TOTAL
					BUBALES					WATERBUCK				
				Pop.est.(Y)	1,156.7	491.0	37.5	492.0	1,685.2	1,239.8	122.8	0.0	231.5	1,362.6
				SE(Y)	324.9	229.8	18.0	223.8	398.3	424.2	85.2	0.0	88.4	432.7
				95% C.L.	662.7	468.8	36.7	456.5	780.7	865.4	173.8	0.0	180.3	848.0
				95% C.L.as %	57.3	95.5	98.0	92.8	46.3	69.8	141.5	ERR	77.9	62.2

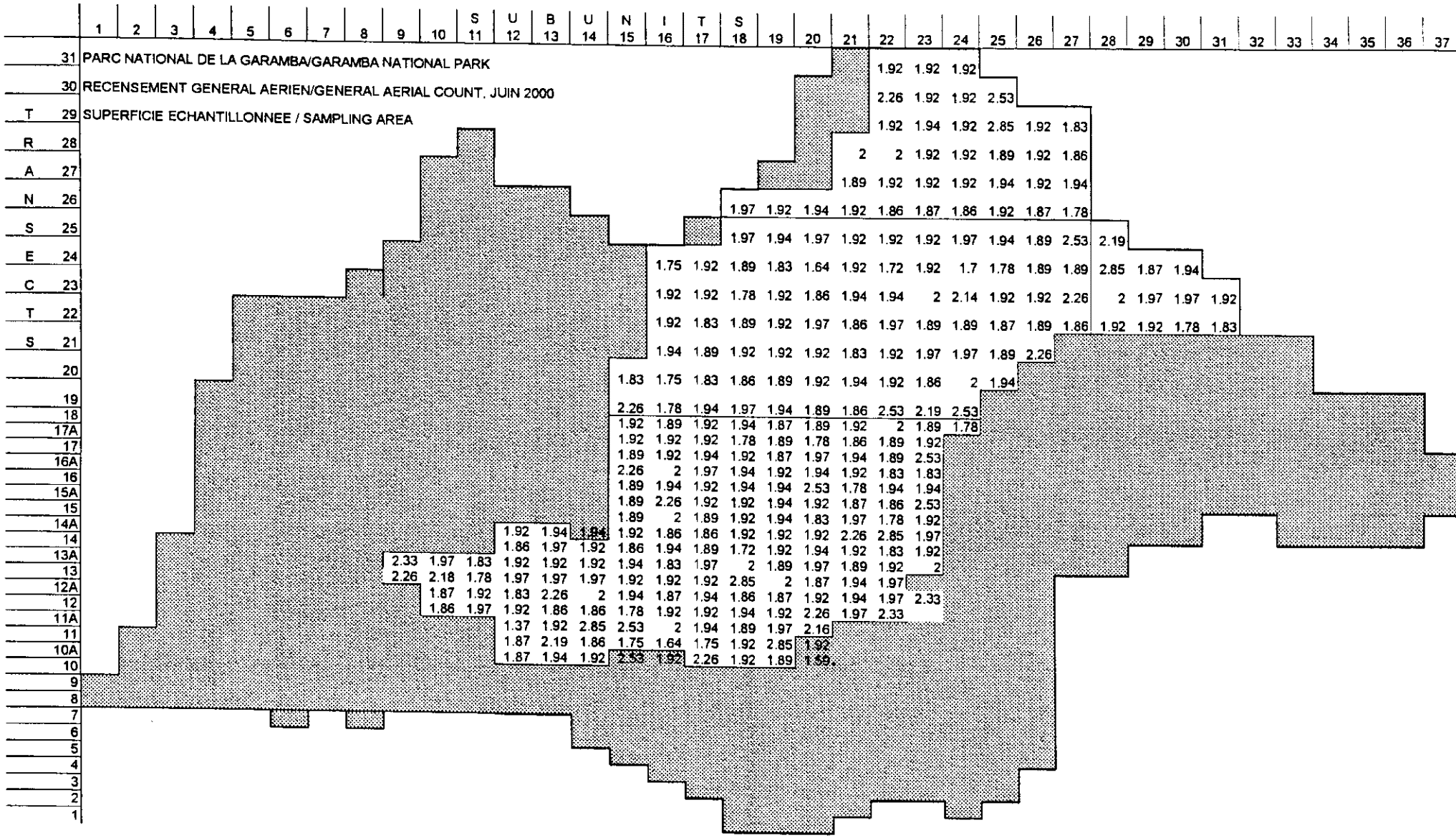
PARC NATIONAL DE LA GARAMBA
GARAMBA NATIONAL PARK

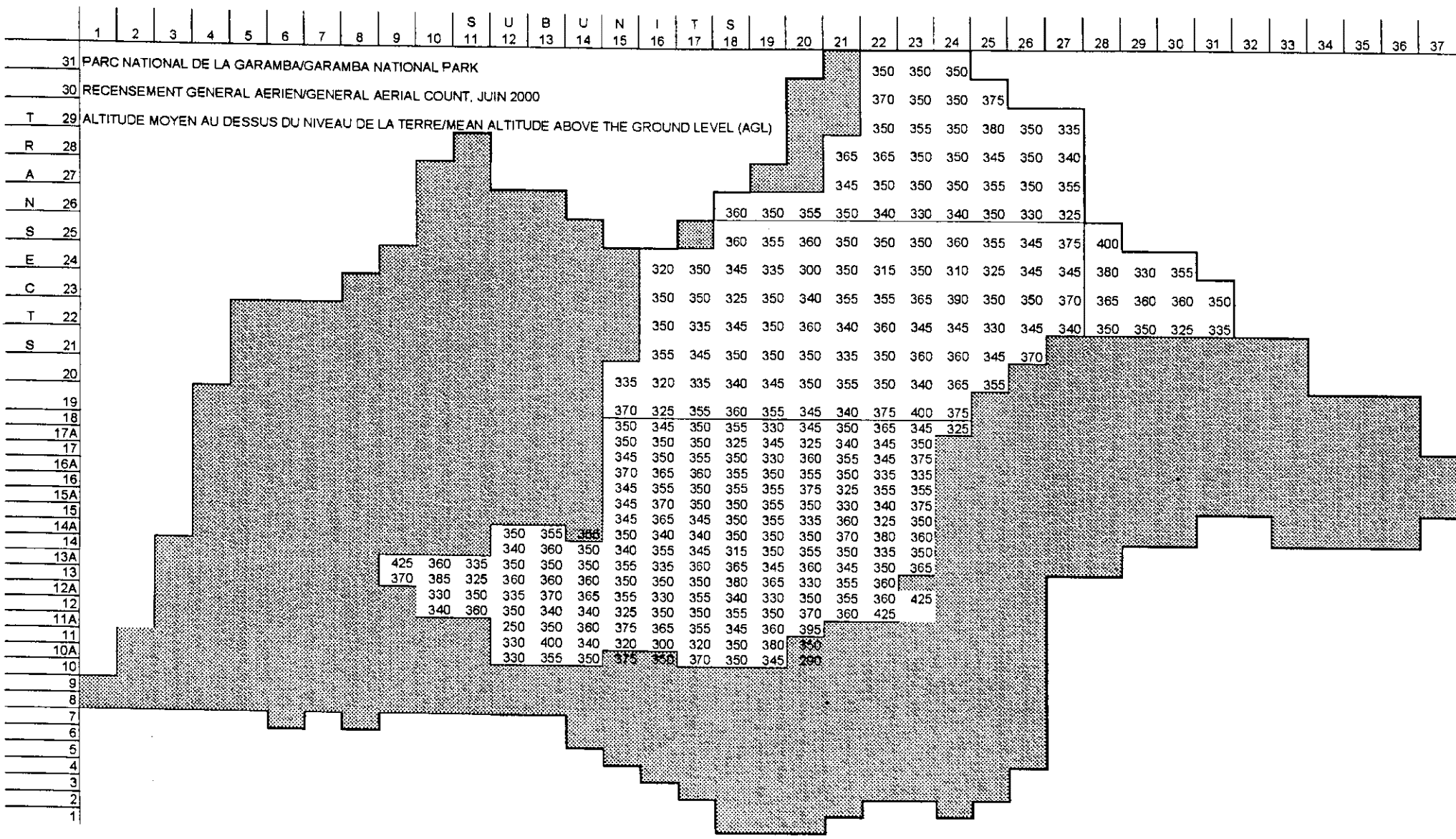
RECENSEMENT GENERAL SYSTEMATIQUE
GENERAL AERIAL SYSTEMATIC SAMPLE COUNT

Calibration Graphs, Distribution Maps and Population Estimate Calculations

June / Juin 2000


Parc National de la Garamba
SURVEY JUNE 2000 - CALIBRATIONS
COMBINED STRIP WIDTH (metres)
600
500
400
300
200
200
250
300
350
400
450
500
HEIGHT (Feet a.g.l.)


PARC NATIONAL DE LA GARAMBA/GARAMBA NATIONAL PARK
RECENSEMENT GENERAL AERIEN/GENERAL AERIAL COUNT, JUIN 2000
SUPERFICIE ECHANTILLONNEE / SAMPLING AREA
1 2 3 4 5 6 7 8 9 10 S 11 U 12 B 13 U 14 N 15 I 16 T 17 S 18 19 20 21 22 23 24 25 26 27 28 29 30 31 32 33 34 35 36 37
31 30 T 29 R 28 A 27 N 26 S 25 E 24 C 23 T 22 S 21 20 19 18 17A 17 16A 16 15A 15 14A 14 13A 13 12A 12 11A 11 10A 10 9 8 7 6 5 4 3 2 1
Low D
Med D
High D
Dom 0 0 0 0 0 0 0 0 4.58 7.88 7.5 16.5 18 16.3 4.09 11.1 11.3 1.97 1.92 1.94 5.8 11.9 11.5 11.4 11.1 7.62 7.42 8.95 5.75 5.69 3.75
Total 0 0 0 0 0 0 0 0 4.58 7.88 7.5 16.5 18 18.2 35.9 41.9 42.3 46.6 46.9 46.5 44.3 51.8 48 27.4 22.5 17.5 16 8.95 5.75 5.69 3.75

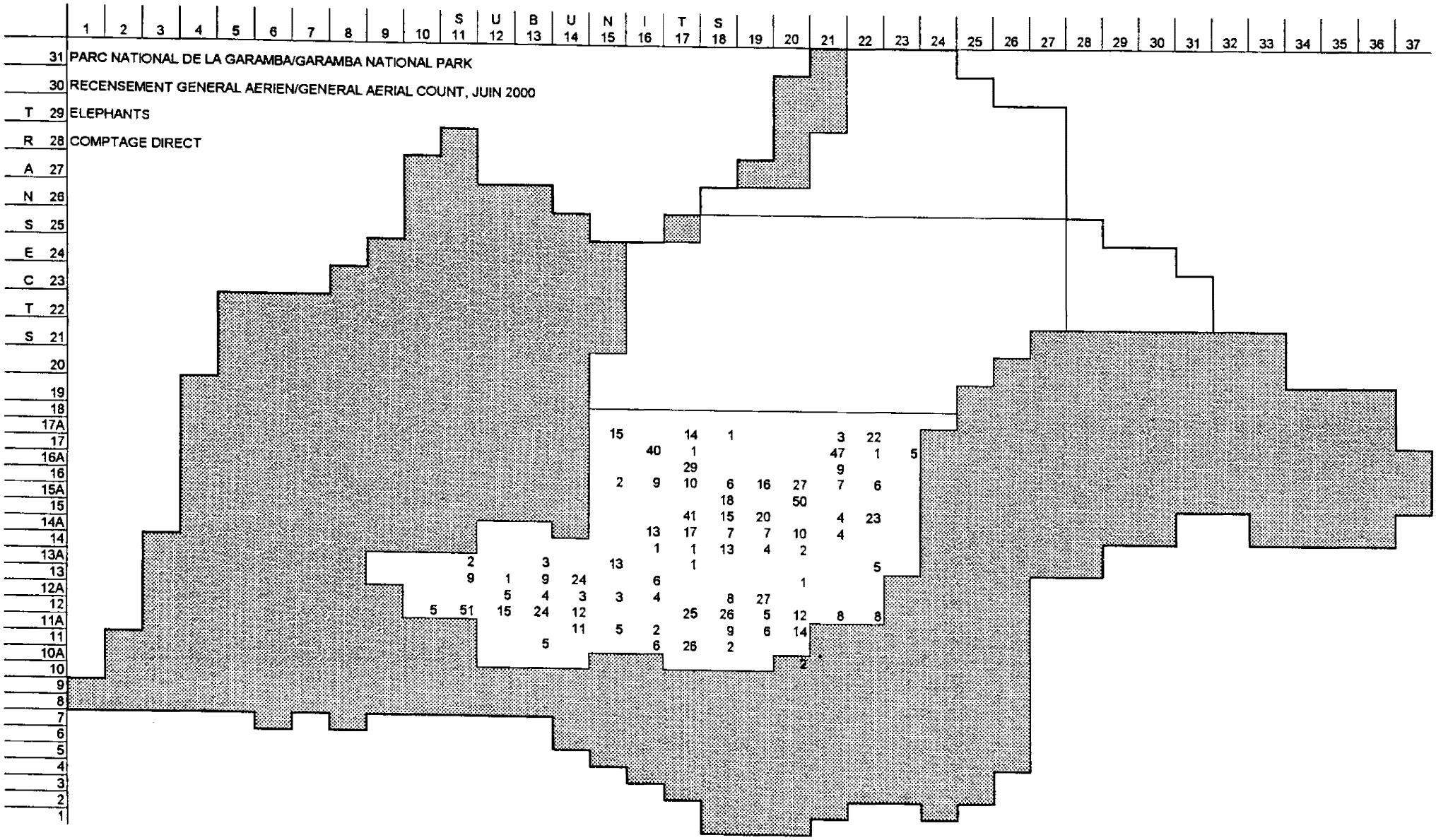


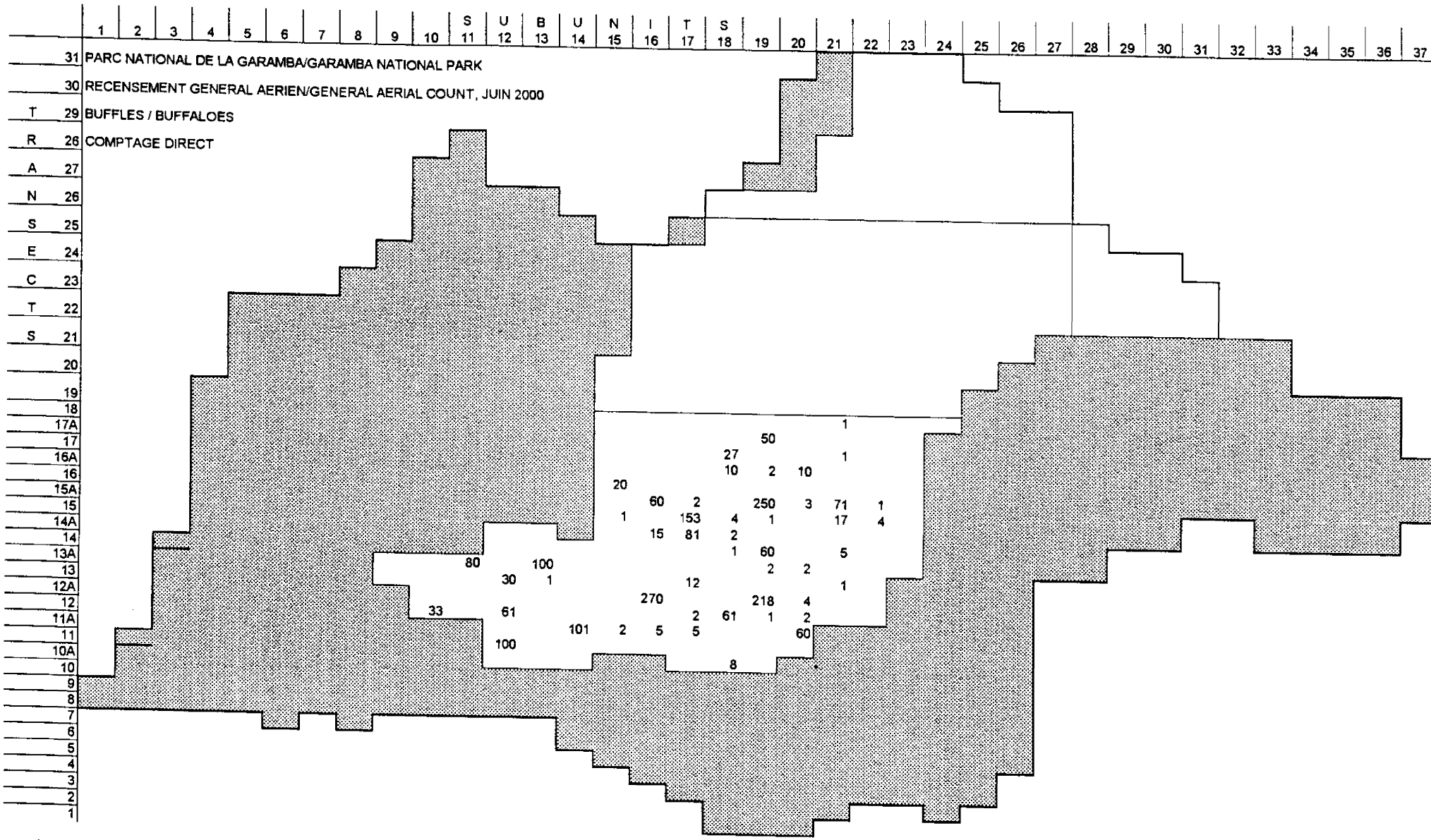
PARC NATIONAL DE LA GARAMBA/GARAMBA NATIONAL PARK

RECENSEMENT GENERAL AERIEN/GENERAL AERIAL COUNT, JUIN 2000

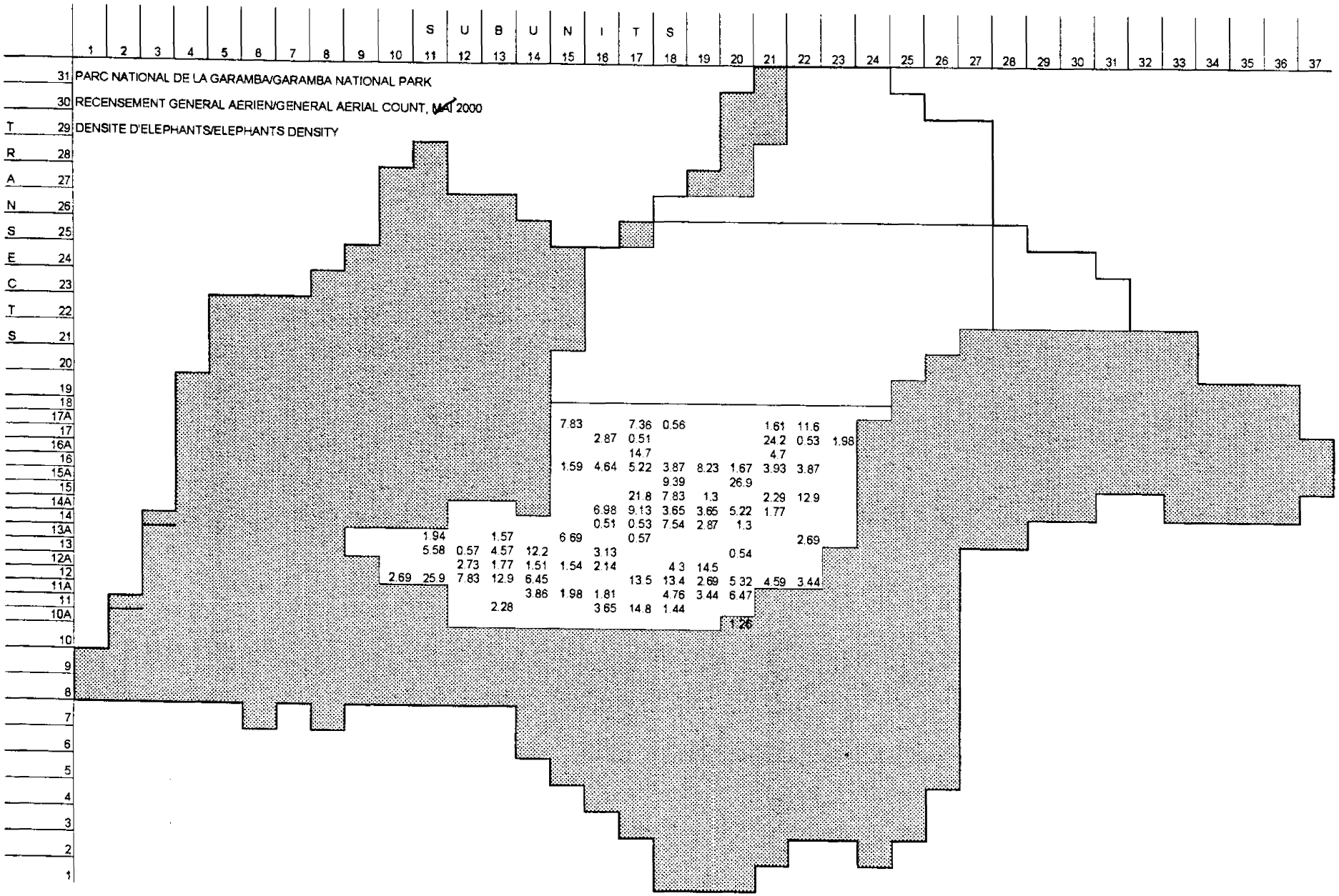
ALTITUDE MOYEN AU DESSUS DU NIVEAU DE LA TERRE/MEAN ALTITUDE ABOVE THE GROUND LEVEL (AGL)

		1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31	32	33	34	35	36	37
												S	U	B	U	N	I	T	S																			
	31																						350	350	350													
	30																						370	350	350	375												
T	29																						350	355	350	380	350	335										
R	28																					365	365	350	350	345	350	340										
A	27																					345	350	350	350	355	350	355										
N	26																		360	350	355	350	340	330	340	350	330	325										
S	25																		360	355	360	350	350	350	360	355	345	375	400									
E	24																320	350	345	335	300	350	315	350	310	325	345	345	380	330	355							
C	23																350	350	325	350	340	355	355	365	390	350	350	370	365	360	360	350						
T	22																350	335	345	350	360	340	360	345	345	330	345	340	350	350	325	335						
S	21																355	345	350	350	350	335	350	360	360	345	370											
	20															335	320	335	340	345	350	355	350	340	365	355												
	19															370	325	355	360	355	345	340	375	400	375													
	18															350	345	350	355	330	345	350	365	345	325													
	17A															350	350	350	325	345	325	340	345	350														
	17															345	350	355	350	330	360	355	345	375														
	16A															370	365	360	355	350	355	350	335	335														
	16															345	355	350	355	355	375	325	355	355														
	15A															345	370	350	350	355	350	330	340	375														
	15															345	365	345	350	355	335	360	325	350														
	14A												350	355	355	350	340	340	350	350	350	370	380	360														
	14												340	360	350	340	355	345	315	350	355	350	335	350														
	13A									425	360	335	350	350	350	355	335	360	365	345	360	345	350	365														
	13									370	385	325	360	360	360	350	350	350	380	365	330	355	360															
	12A										330	350	335	370	365	355	330	355	340	330	350	355	360	425														
	12										340	360	350	340	340	325	350	350	355	350	370	360	425															
	11A												250	350	360	375	365	355	345	360	395																	
	11												330	400	340	320	300	320	350	380	350																	
	10A												330	355	350	375	350	370	350	345	290																	
	10																																					
	9																																					
	8																																					
	7																																					
	6																																					
	5																																					
	4																																					
	3																																					
	2																																					
	1																																					
	Low D																		360	350	355	1060	2125	2085	2090	1805	1380	1355	1495	1040	1040	685						
	Med D															705	2020	2070	2425	2440	2405	2425	2455	2510	2505	2060	1755	1430										
	High D									795	1415	1370	2995	3240	2835	5220	5225	5605	5590	5595	5305	4545	4620	3560	325													
	Dom	0	0	0	0	0	0	0	0	0	0	0	0	0	355	375	350	0	0	0	290	0	0	425	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	Total	0	0	0	0	0	0	0	0	795	1415	1370	2995	3240	3190	6300	7595	7675	8375	8385	8355	8030	9200	8580	4920	3865	3135	2785	1495	1040	1040	685	0	0	0	0	0	0


PARC NATIONAL DE LA GARAMBA/GARAMBA NATIONAL PARK
RECENSEMENT GENERAL AERIEN/GENERAL AERIAL COUNT, JUIN 2000
ELEPHANTS
COMPTAGE DIRECT
Low D
Med D
High D
Dom
Tota

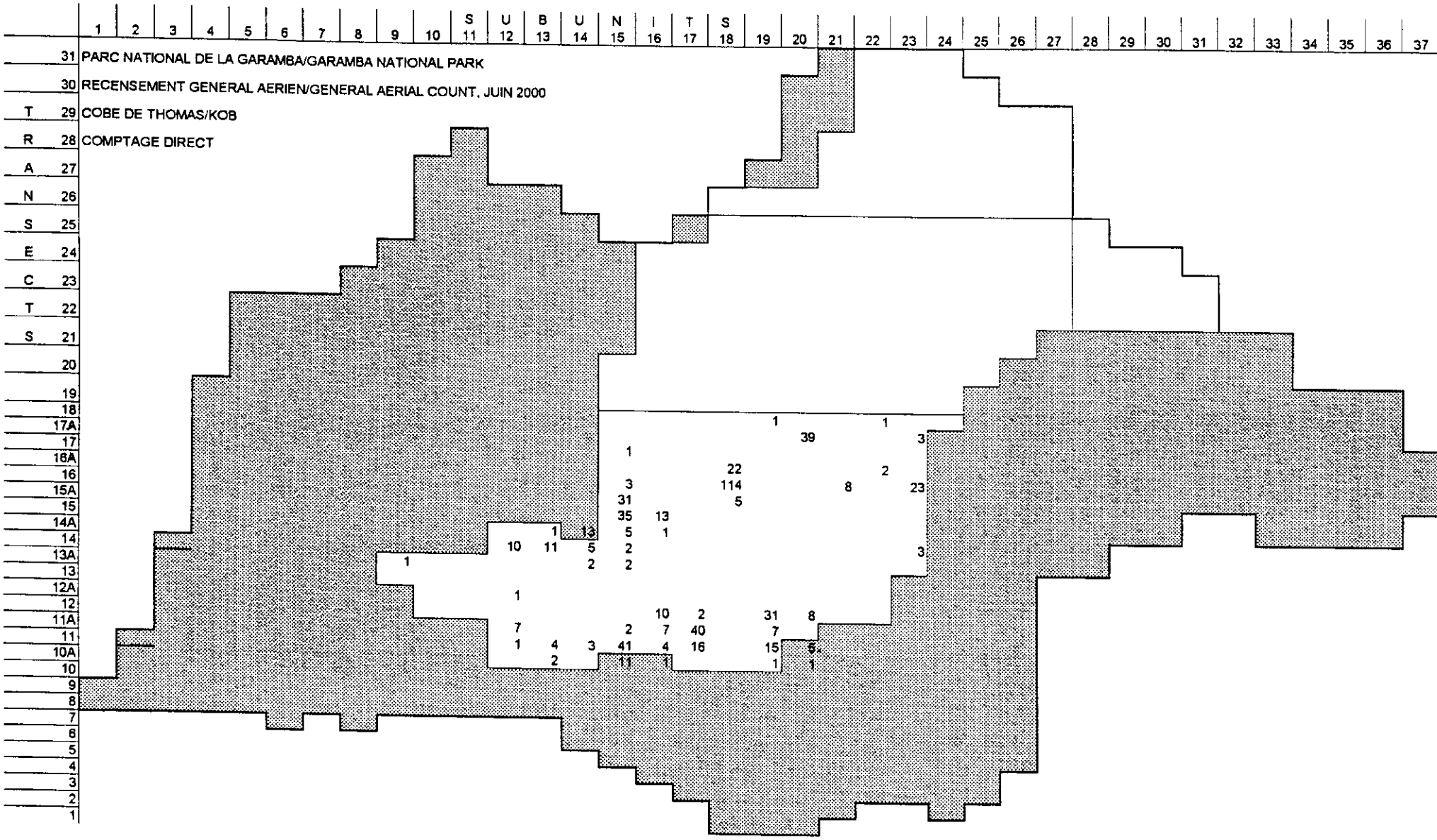

PARC NATIONAL DE LA GARAMBA/GARAMBA NATIONAL PARK
RECENSEMENT GENERAL AERIEN/GENERAL AERIAL COUNT, JUIN 2000
BUFFLES / BUFFALOES
COMPTAGE DIRECT
TRANSECTS
SUBLINE 11 SUBLINE 12 SUBLINE 13 SUBLINE 14 SUBLINE 15 SUBLINE 16 SUBLINE 17 SUBLINE 18
Low D
Med D
High D
Dom
Total

PARC NATIONAL DE LA GARAMBA/GARAMBA NATIONAL PARK
RECENSEMENT GENERAL AERIEN/GENERAL AERIAL COUNT, ~~MAI~~ 2000
DENSITE D'ELEPHANTS/ELEPHANTS DENSITY



	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19
Low D																			0
Med D																0	0	0	0
High D										0	31.5	11 1	23.1	24	10.2	25.7	88.1	56.7	36.6
Dom	0	0	0	0	0	0	0	0	0	2.69	0	0	0	0	9.42	0	0	0	0
Total	0	0	0	0	0	0	0	0	0	2.69	31.5	11.1	23 1	24	19.6	25.7	88.1	56.7	36.6

	20	21	22	23	24	25	26	27	28	29	30	31	32	33	34	35	36	37
Low D	0	0	0	0	0	0	0	0	0	0	0	0	0					
Med D	0	0	0	0	0	0	0	0										
High D	47.4	43.1	35.1	1.98	0	0												
Dom	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Total	47 4	43.1	35.1	1.98	0	0	0	0	0	0	0	0	0	0	0	0	0	0



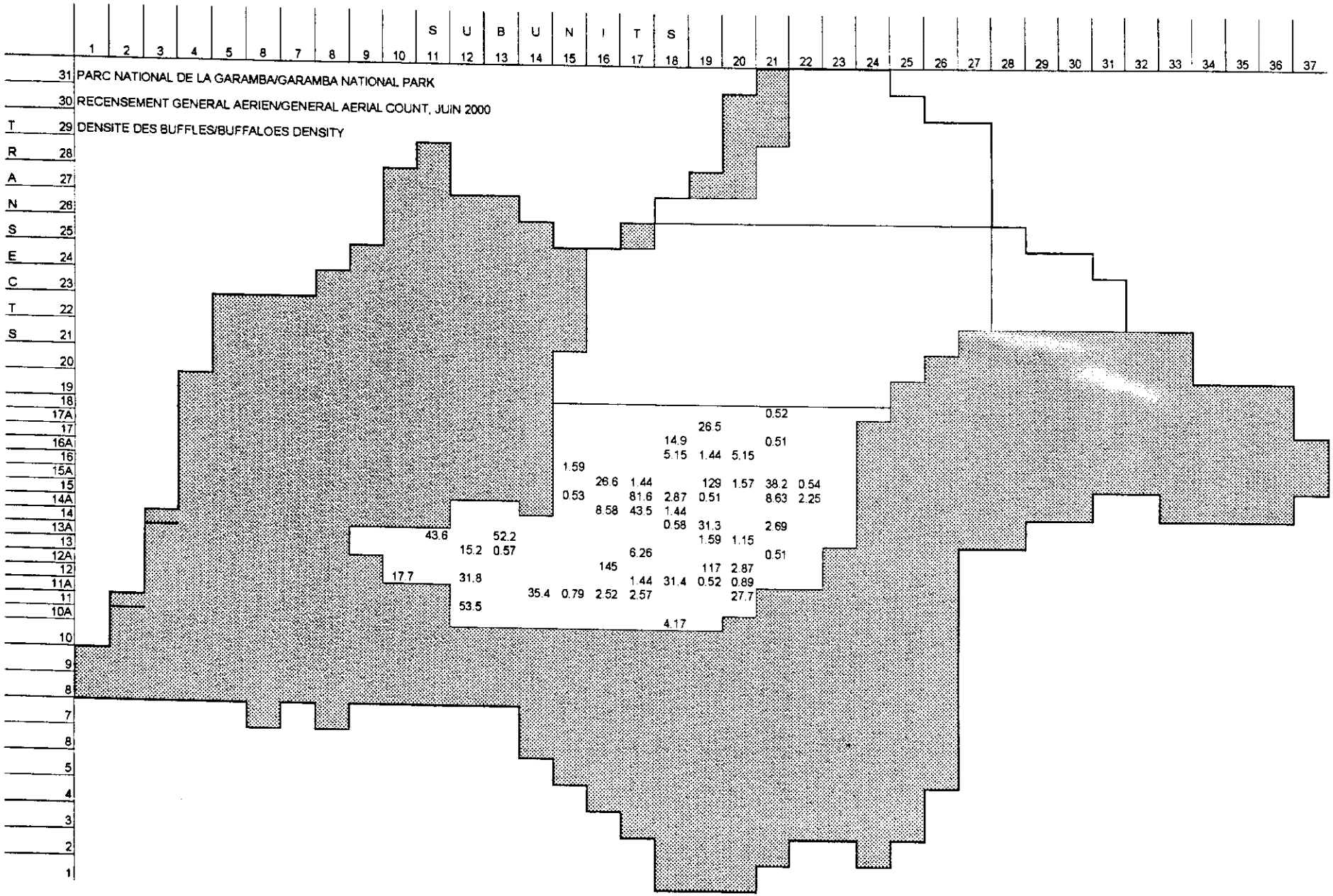
PARC NATIONAL DE LA GARAMBA/GARAMBA NATIONAL PARK

RECENSEMENT GENERAL AERIEN/GENERAL AERIAL COUNT, JUIN 2000

COBE DE THOMAS/KOB

COMPTAGE DIRECT

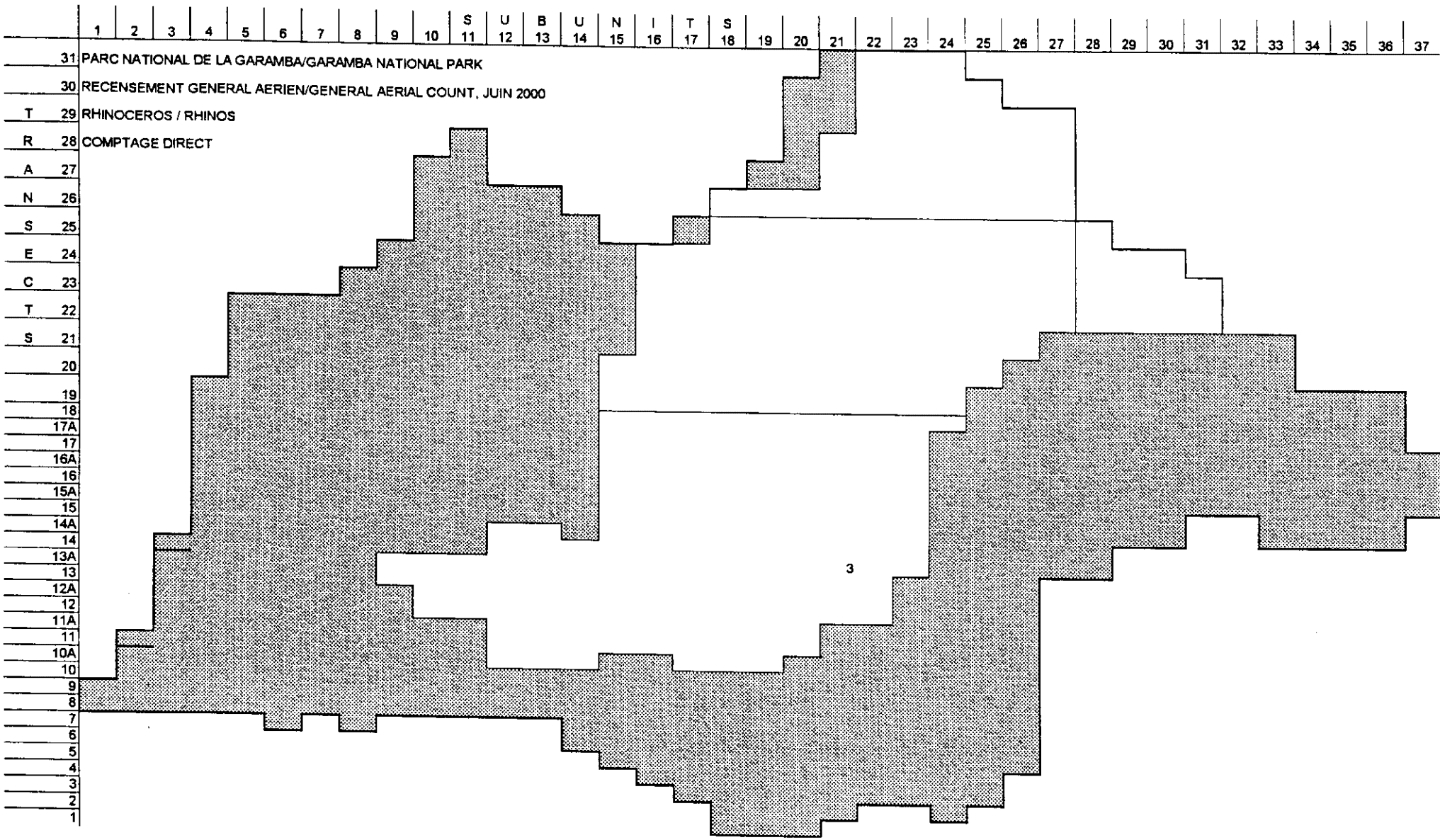
	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31	32	33	34	35	36	37
Low D																			0	0	0	0	0	0	0	0	0	0	0	0	0	0					
Med D																0	0	0	0	0	0	0	0	0	0	0	0										
High D										0	0	ERR	35	15	10	157	93	199	195	106	60	3	32	29	0												
Dom	0	0	0	0	0	0	0	0	1	ERR	0	ERR	0	0	70	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Total	0	0	0	0	0	0	0	0	1	ERR	0	ERR	35	15	80	157	93	199	195	106	60	3	32	29	0	0	0	0	0	0	0	0	0	0	0	0	0


PARC NATIONAL DE LA GARAMBA/GARAMBA NATIONAL PARK

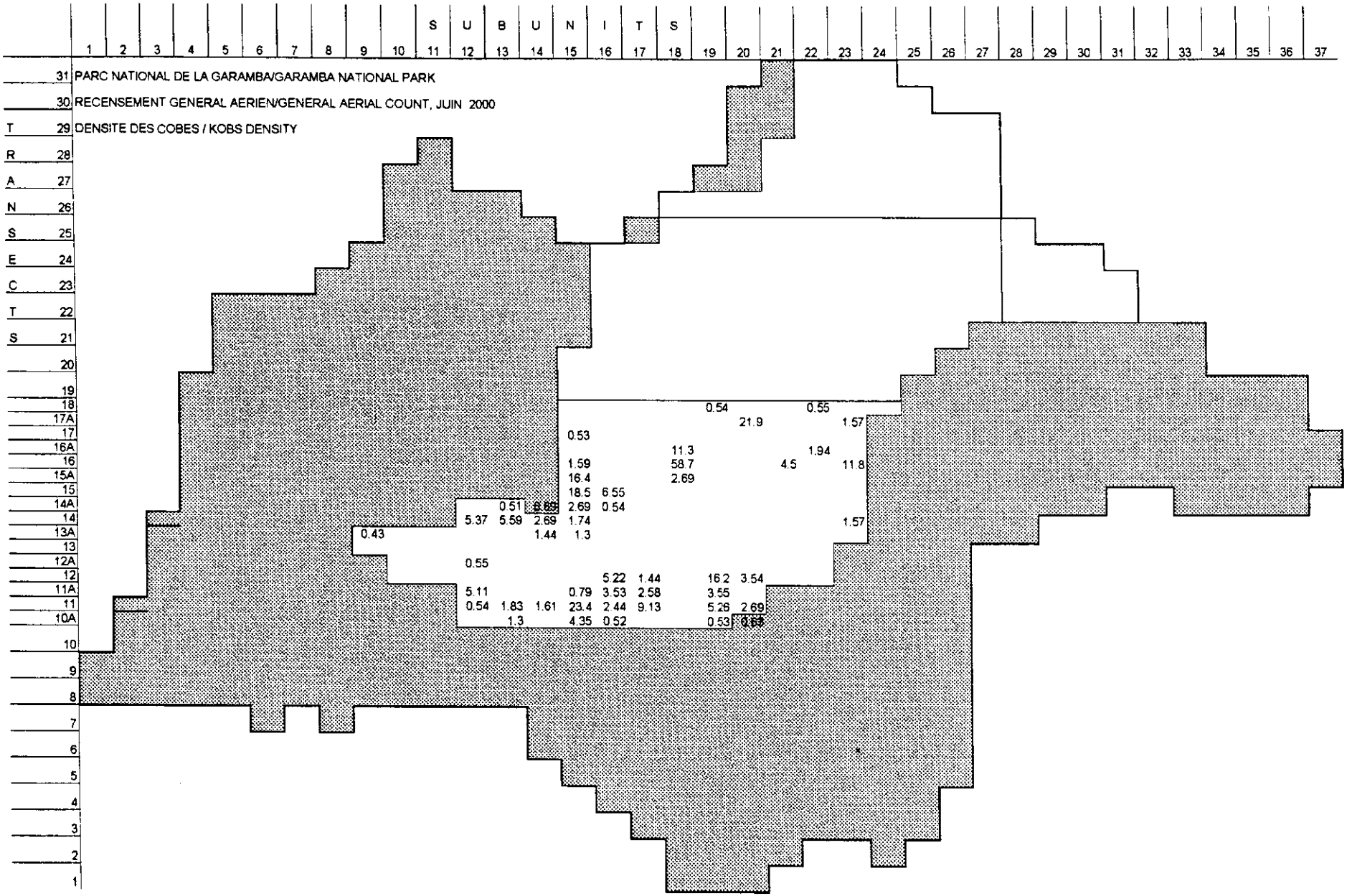
RECENSEMENT GENERAL AERIEN/GENERAL AERIAL COUNT, JUIN 2000

DENSITE DES BUFFLES/BUFFALOES DENSITY

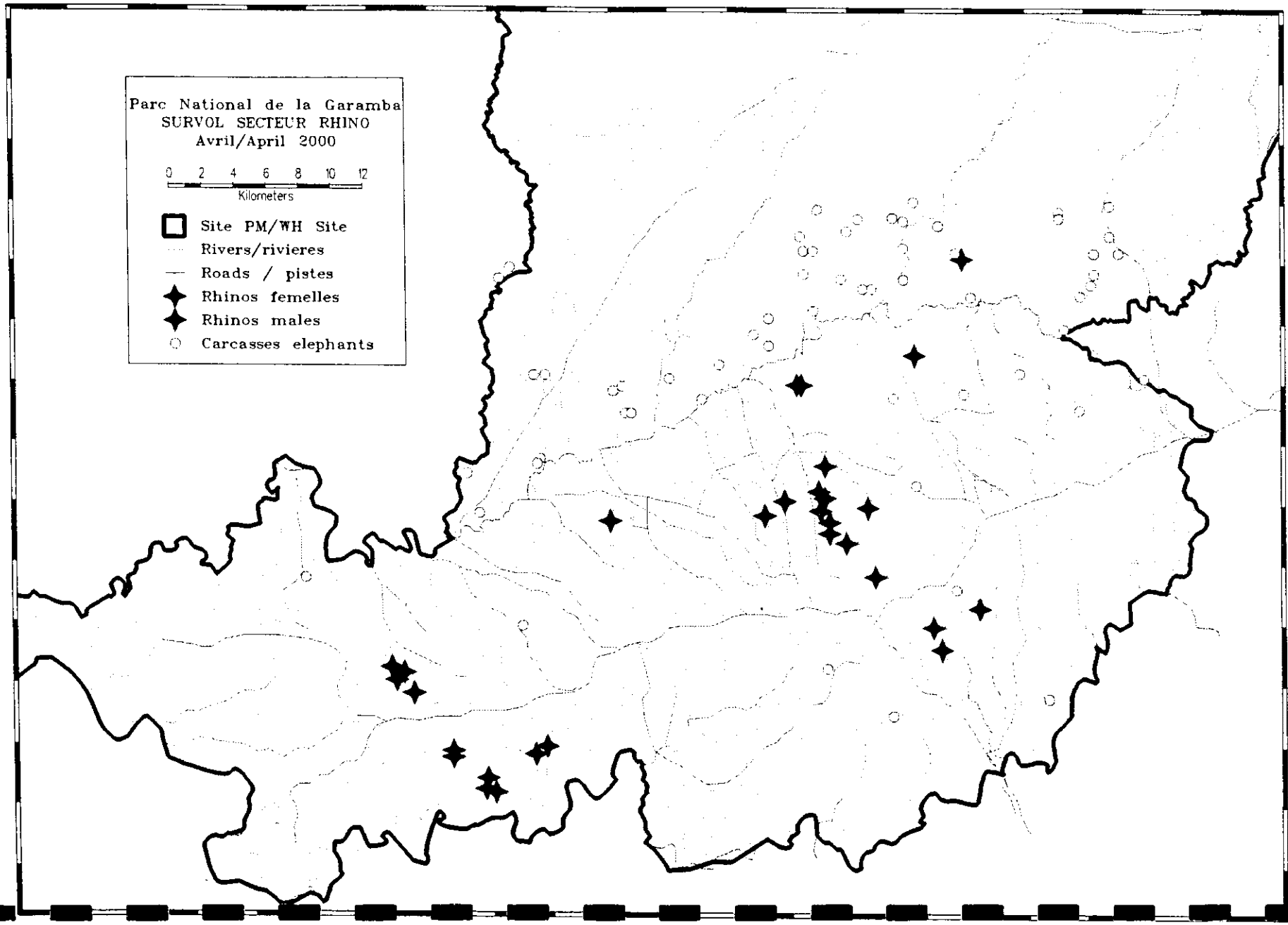
Low D																			0	0	0	0	0	0	0	0	0	0	0	0	0	0					
Med D																0	0	0	0	0	0	0	0	0	0	0	0										
High D										0	0	47.1	52.8	35.4	0.79	182	137	56.3	307	39.4	51.1	2.79	0	0	0												
Dom	0	0	0	0	0	0	0	0	0	17.7	0	53.5	0	0	2.12	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Total	0	0	0	0	0	0	0	0	0	17.7	0	101	52.8	35.4	2.91	182	137	56.3	307	39 4	51.1	2.79	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0

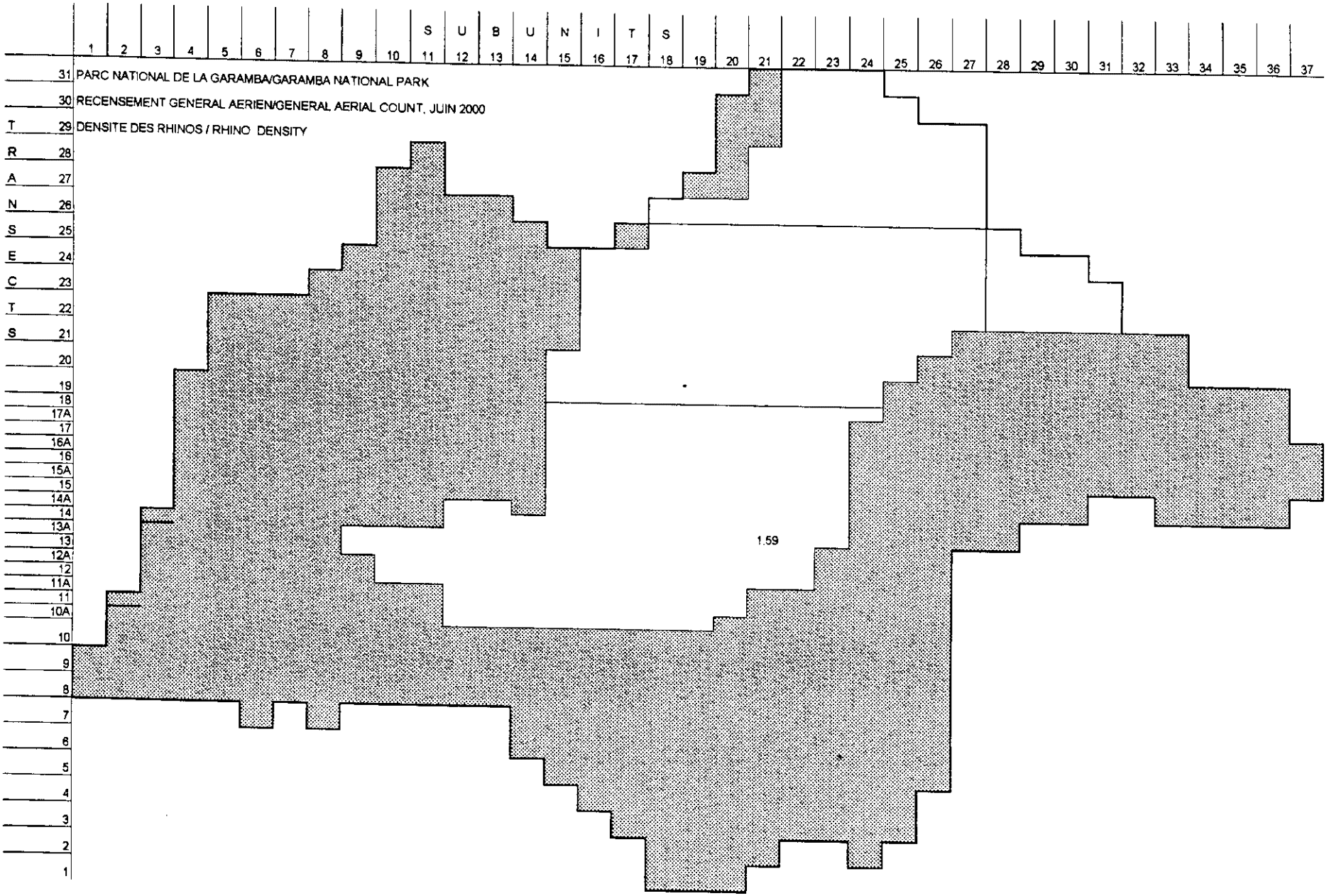


	1	2	3	4	5	6	7	8	9	10	S 11	U 12	B 13	U 14	N 15	I 16	T 17	S 18	19	20	21	22	23	24	25	26	27	28	29	30	31	32	33	34	35	36	37
Low D																																					
Med D																																					
High D																																					
Dom	0	0	0	0	0	0	0	0	0	0	ERR	ERR	0	0	ERR	0	0	0	0	0	0	3	0	0	0	0											
Total	0	0	0	0	0	0	0	0	0	0	ERR	ERR	0	0	ERR	0	0	0	0	0	0	3	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0



	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31	32	33	34	35	36	37
Low D																				0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
Med D																	0	0	0	0	0	0	0	0	0	0	0	0	0	0							
High D												0	0	5.92	7.93	5.74	27.2	18.3	13.2	72.7	25.5	28.2	4.5	2.49	15	0	0										
Dom	0	0	0	0	0	0	0	0	0.43		0	0	0.54	0	0	37.1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Total	0	0	0	0	0	0	0	0	0.43		0	0	6.45	7.93	5.74	64.3	18.3	13.2	72.7	25.5	28.2	4.5	2.49	15	0	0	0	0	0	0	0	0	0	0	0	0	0


Parc National de la Garamba
SURVOL SECTEUR RHINO
Avril/April 2000
0 2 4 6 8 10 12
Kilometers
Site PM/WH Site
Rivers/rivieres
Roads / pistes
Rhinos femelles
Rhinos males
Carcasses elephants

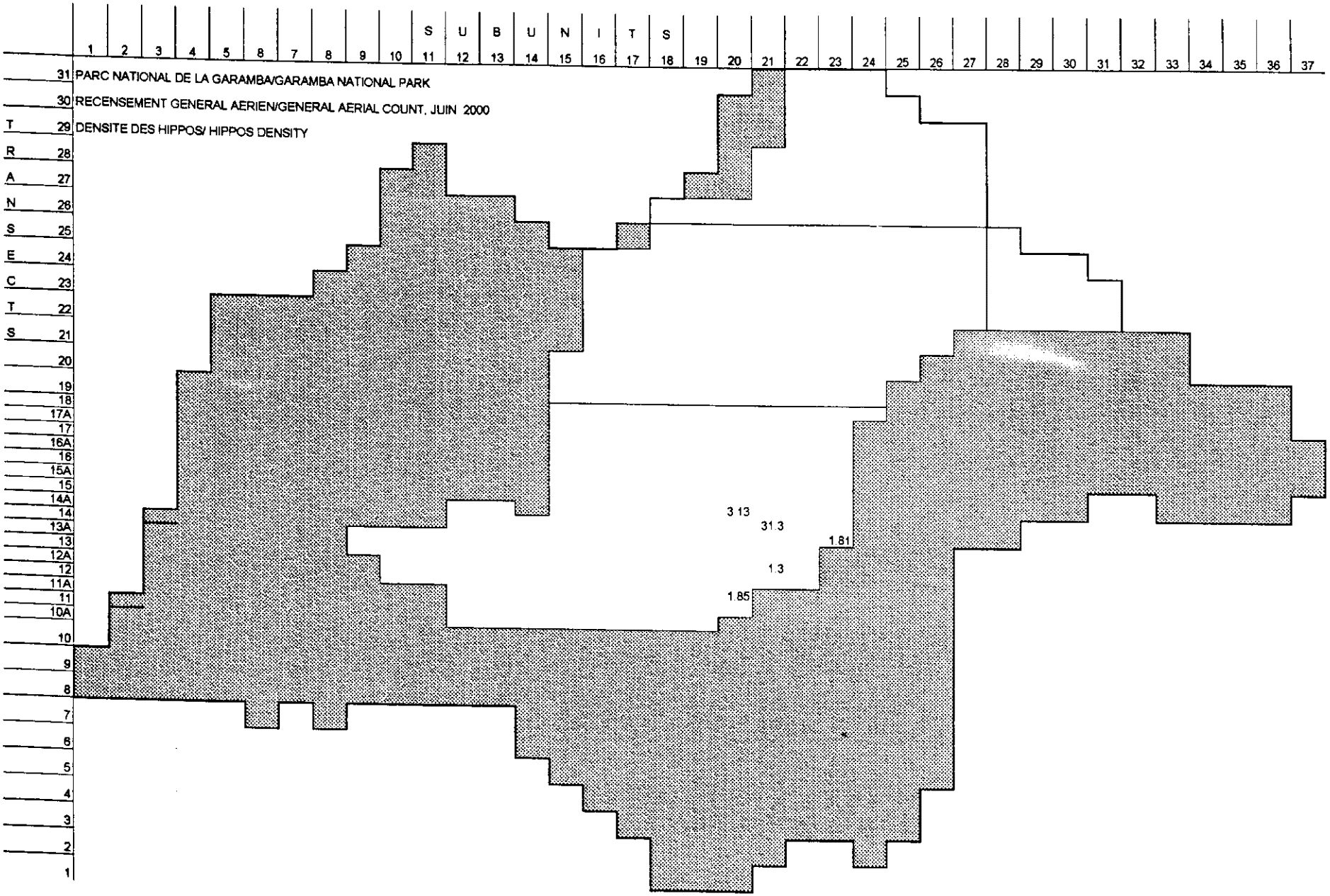


	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31	32	33	34	35	36	37
Low D																				0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
Med D																				0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
High D										0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
Dom	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1.59	0	0	0	0												
Total	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1.59	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0

PARC NATIONAL DE LA GARAMBA/GARAMBA NATIONAL PARK

RECENSEMENT GENERAL AERIEN/GENERAL AERIAL COUNT, JUIN 2000

DENSITE DES HIPPOS/ HIPPOS DENSITY



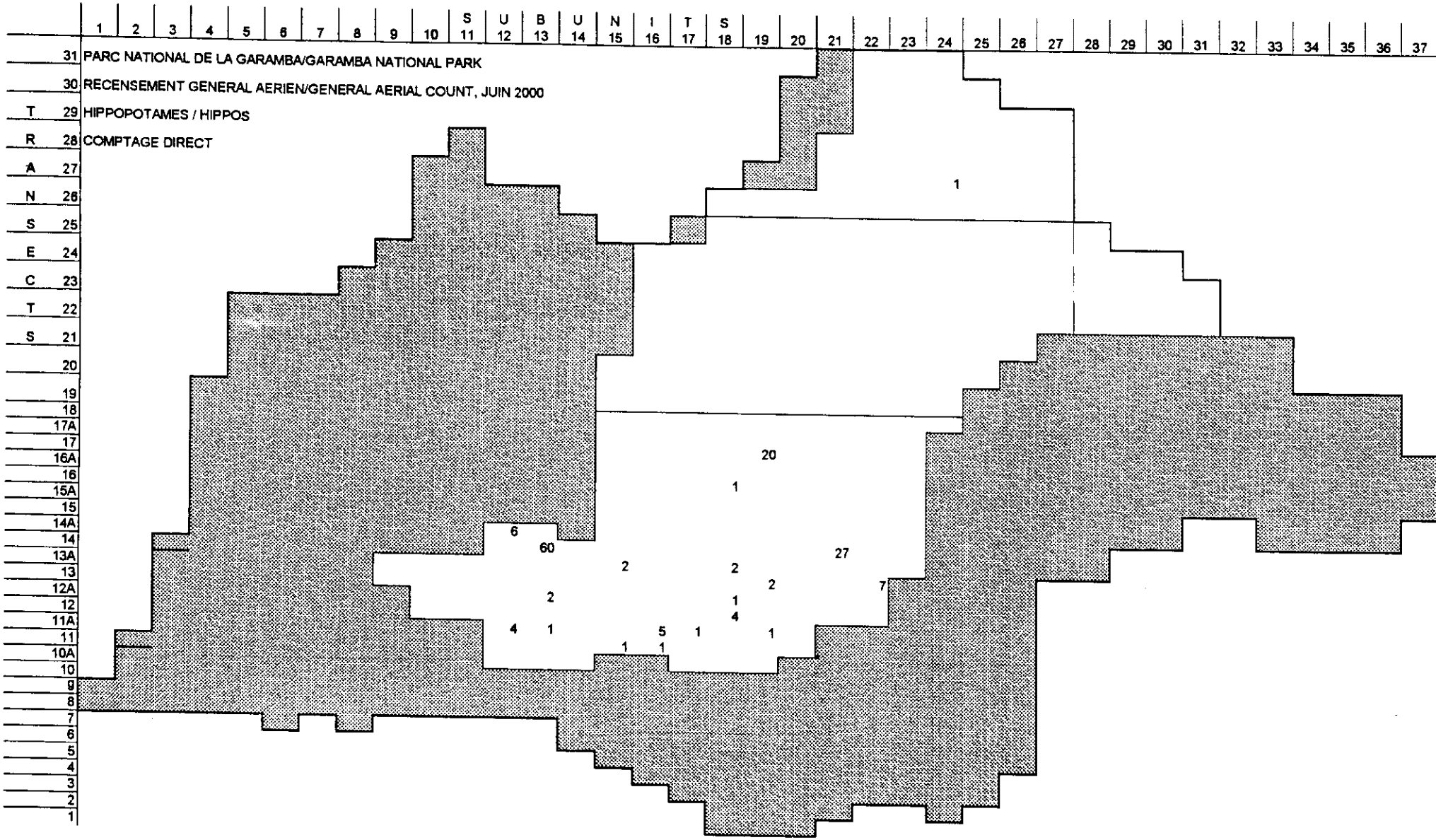
	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31	32	33	34	35	36	37
Low D																				0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
Med D																				0	0	0	0	0	0	0	0	0	0								
High D																	0	0	0	0	0	0	0	0	0	0	0										
Dom	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	4.98	32.6	0	1.81	0	0											
Total	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	4.98	32.6	0	1.81	0	0	0	0	0	0	0	0	0	0	0	0	0

PARC NATIONAL DE LA GARAMBA/GARAMBA NATIONAL PARK

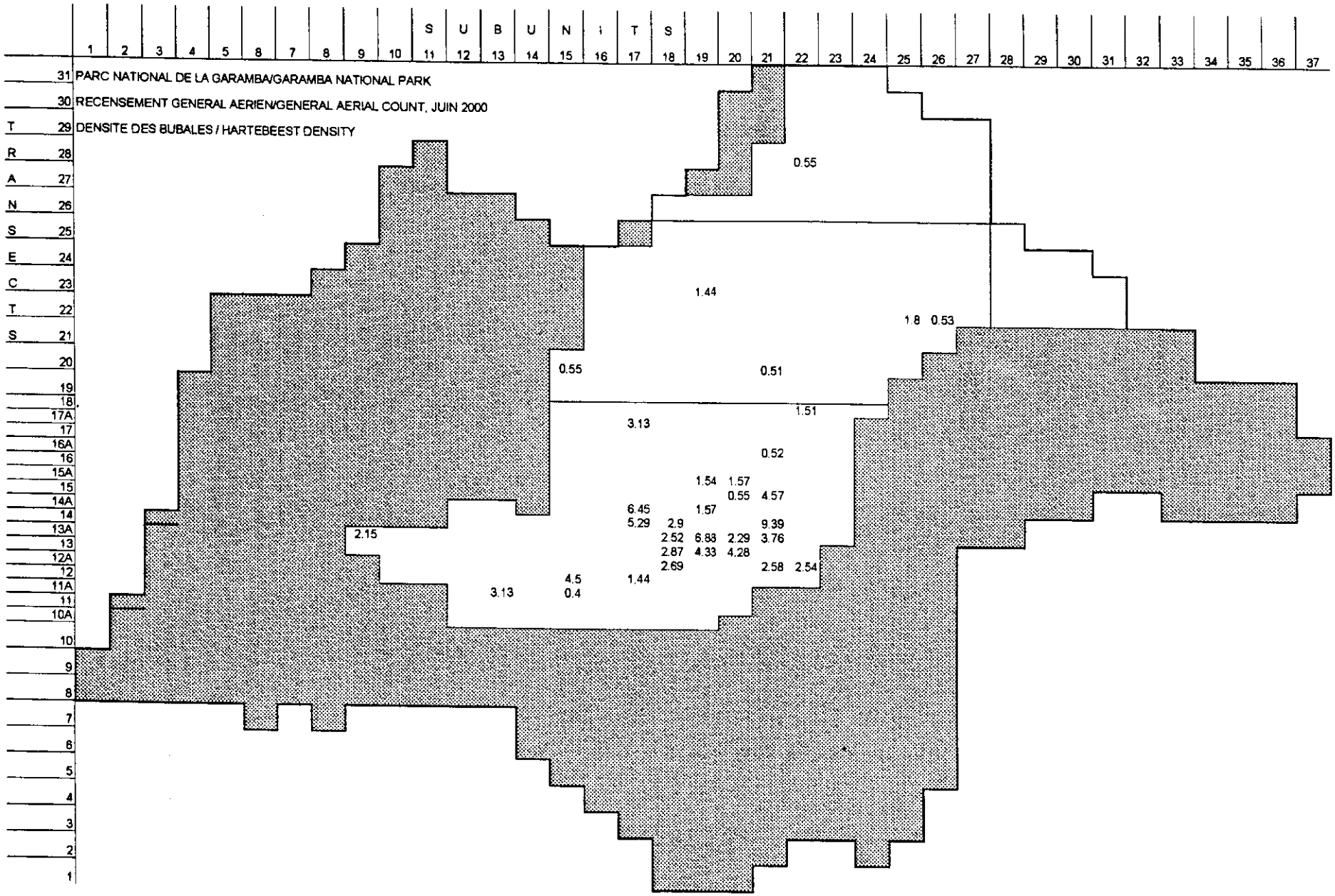
RECENSEMENT GENERAL AERIEN/GENERAL AERIAL COUNT, JUIN 2000

HIPPOPOTAMES / HIPPOS

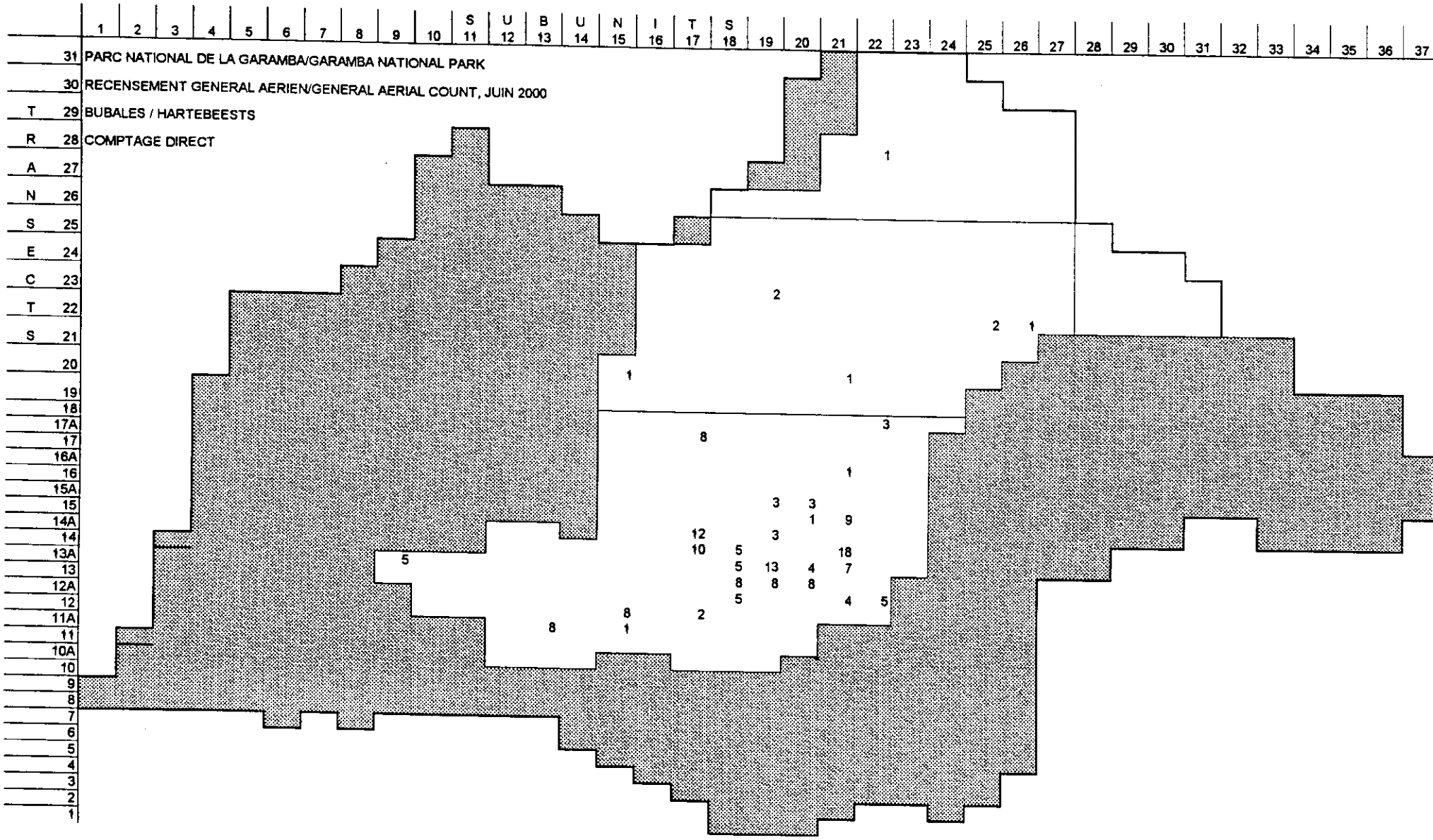
COMPTAGE DIRECT

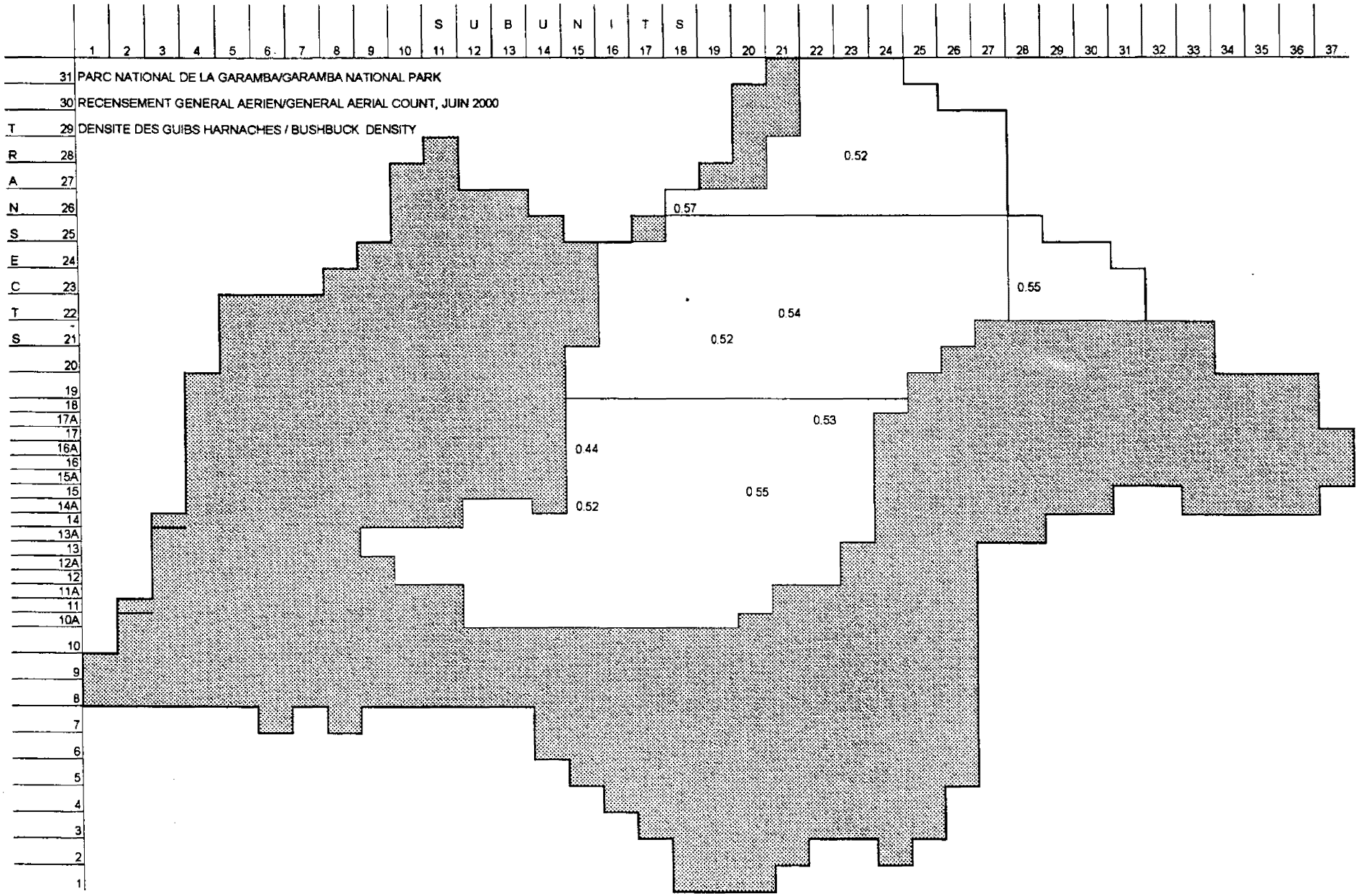


	1	2	3	4	5	6	7	8	9	10	S 11	U 12	B 13	U 14	N 15	I 16	T 17	S 18	19	20	21	22	23	24	25	26	27	28	29	30	31	32	33	34	35	36	37
Low D																					0	0	0	0	0	1	0	0	0	0	0	0	0	0				
Med D																					0	0	0	0	0	0	0	0									
High D																																					
Dom	0	0	0	0	0	0	0	0	0	0	ERR	ERR	63	0	ERR	7	8	9	31	23	27	7	0	0	0												
Total	0	0	0	0	0	0	0	0	0	0	ERR	ERR	63	0	ERR	7	6	9	31	23	27	7	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0



	1	2	3	4	5	8	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31	32	33	34	35	36	37
Low D																				0	0	0	0.55	0	0	0	0	0	0	0	0	0	0						
Med D																	0	0	0	1.44	0	0.51	0	0	0	1.8	0.53	0										
High D											0	0	0	3.13	0	4.89	0	16.3	11	14.3	8.69	20.8	4.05	0	0	0												
Dom	0	0	0	0	0	0	0	0	2.15	0	0	0	0	0	0	0.55	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Total	0	0	0	0	0	0	0	0	2.15	0	0	0	3.13	0	5.44	0	16.3	11	15.8	8.69	21.3	4.6	0	0	1.8	0.53	0	0	0	0	0	0	0	0	0	0	0


PARC NATIONAL DE LA GARAMBA/GARAMBA NATIONAL PARK
RECENSEMENT GENERAL AERIEN/GENERAL AERIAL COUNT, JUIN 2000
BUBALES / HARTEBEESTS
COMPTAGE DIRECT
TRANSECTS
SUBLOCK
1 2 3 4 5 6 7 8 9 10 S11 U12 B13 U14 N15 I16 T17 S18 19 20 21 22 23 24 25 26 27 28 29 30 31 32 33 34 35 36 37
31 30 29 28 27 26 25 24 23 22 21 20 19 18 17A 17 16A 16 15A 15 14A 14 13A 13 12A 12 11A 11 10A 10 9 8 7 6 5 4 3 2 1
Low D
Med D
High D
Dom 0 0 0 0 0 0 0 0 5 0 ERR ERR 6 0 ERR 9 30 53 50 43 55 8 0 0 0
Total 0 0 0 0 0 0 0 0 5 0 ERR ERR 6 0 ERR 9 30 53 52 43 56 9 0 0 2 1 0



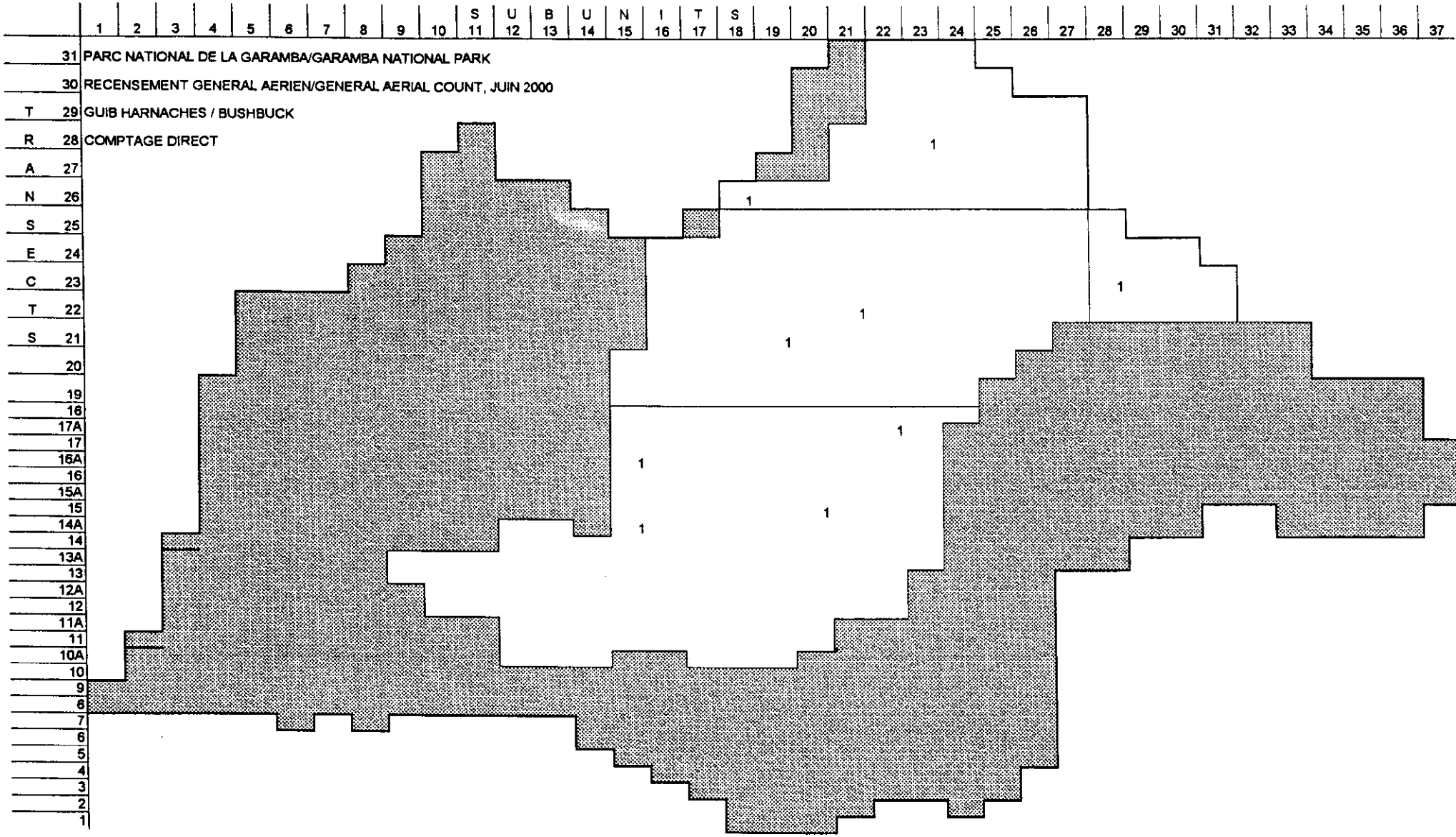
PARC NATIONAL DE LA GARAMBA/GARAMBA NATIONAL PARK

RECENSEMENT GENERAL AERIEN/GENERAL AERIAL COUNT, JUIN 2000

DENSITE DES GUIBS HARNACHES / BUSHBUCK DENSITY

	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19
Low D																			0
Med D																0	0	0	0.52
High D										0	0	0	0	0	0	0	0	0	0
Dom	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0 44	0	0	0	0
Total	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0 44	0	0	0	0.52

	20	21	22	23	24	25	26	27	28	29	30	31	32	33	34	35	36	37
Low D	0	0	0	0.52	0	0	0	0	0.55	0	0	0	0					
Med D	0	0.54	0	0	0	0	0	0										
High D	0.55	0	0.53	0	0	0												
Dom	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Total	0.55	0.54	0.53	0.52	0	0	0	0	0.55	0	0	0	0	0	0	0	0	0

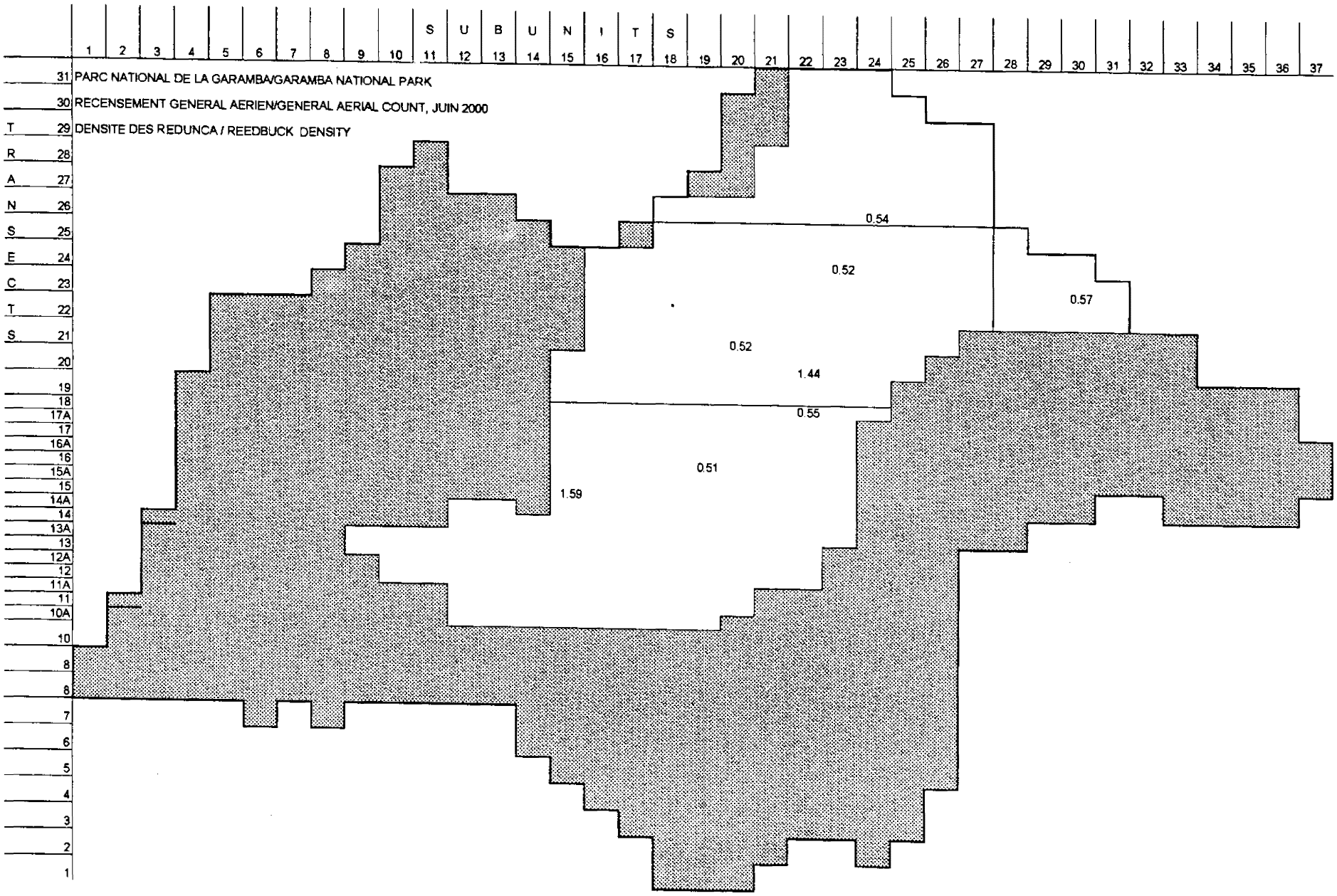

PARC NATIONAL DE LA GARAMBA/GARAMBA NATIONAL PARK

RECENSEMENT GENERAL AERIEN/GENERAL AERIAL COUNT, JUIN 2000

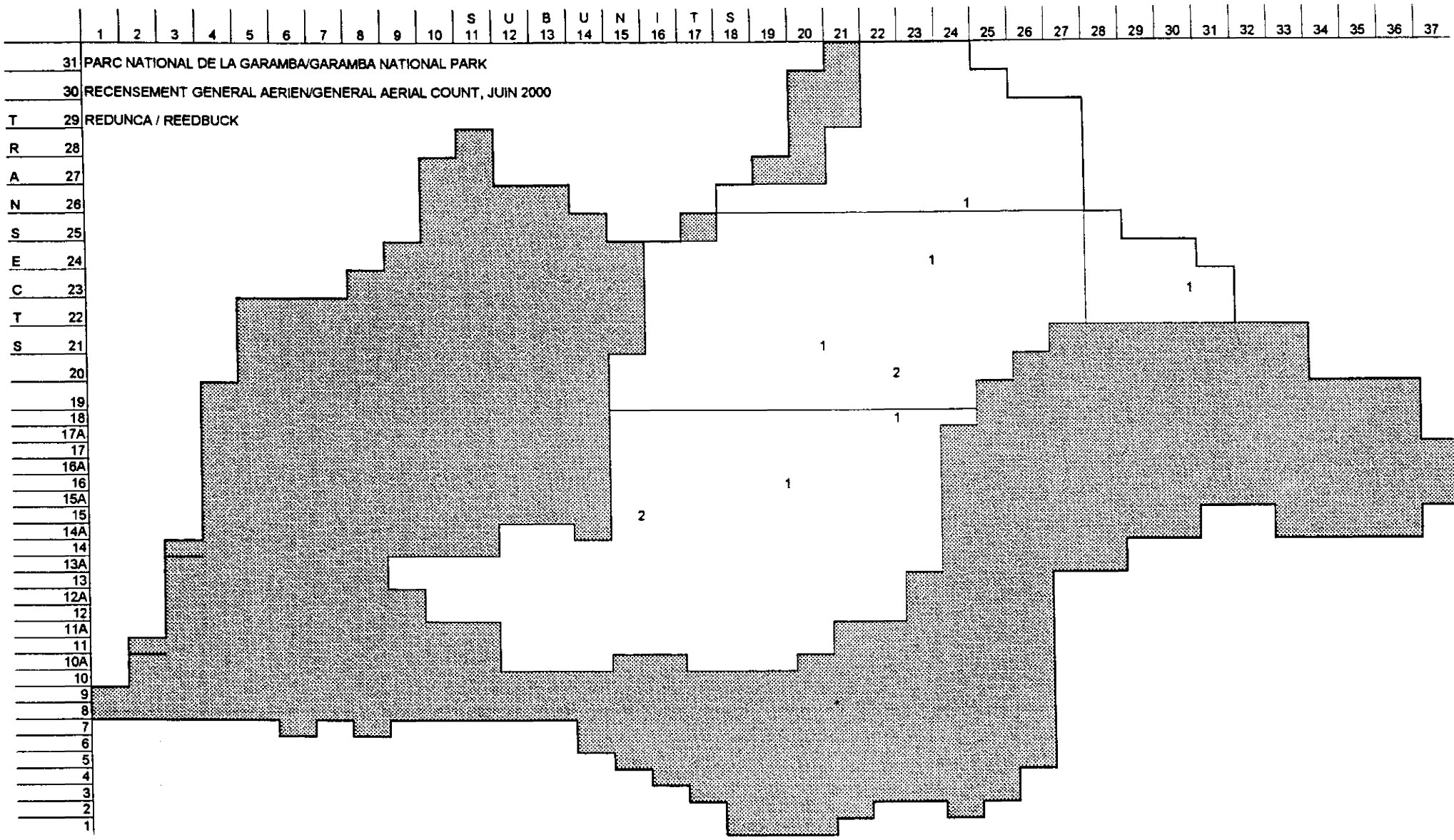
GUIB HARNACHES / BUSHBUCK

COMPTAGE DIRECT

	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31	32	33	34	35	36
Low D																			0	0	0	0	1	0	0	0	0	1	0	0	0	0				
Med D																0	0	0	1	0	1	0	0	0	0	0	0									
High D										0	ERR	ERR	0	0	ERR	2	0	0	0	1	1	1	0	0	0											
Dom	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Total	0	0	0	0	0	0	0	0	0	0	ERR	ERR	0	0	ERR	2	0	0	1	1	2	1	1	0	0	0	0	1	0	0	0	0	0	0	0	0



	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31	32	33	34	35	36	37
Low D																				0	0	0	0	0	0.54	0	0	0	0	0	0.57	0	0					
Med D																0	0	0	0	0.52	0	0	1.44	0.52	0	0	0	0										
High D										0	0	0	0	0	0	0	0	0	0.51	0	0	0	0.55	0	0	0												
Dom	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Total	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1.59	0	0	0	0.51	0.52	0	1.98	0.52	0.54	0	0	0	0	0	0.57	0	0	0	0	0	0	0

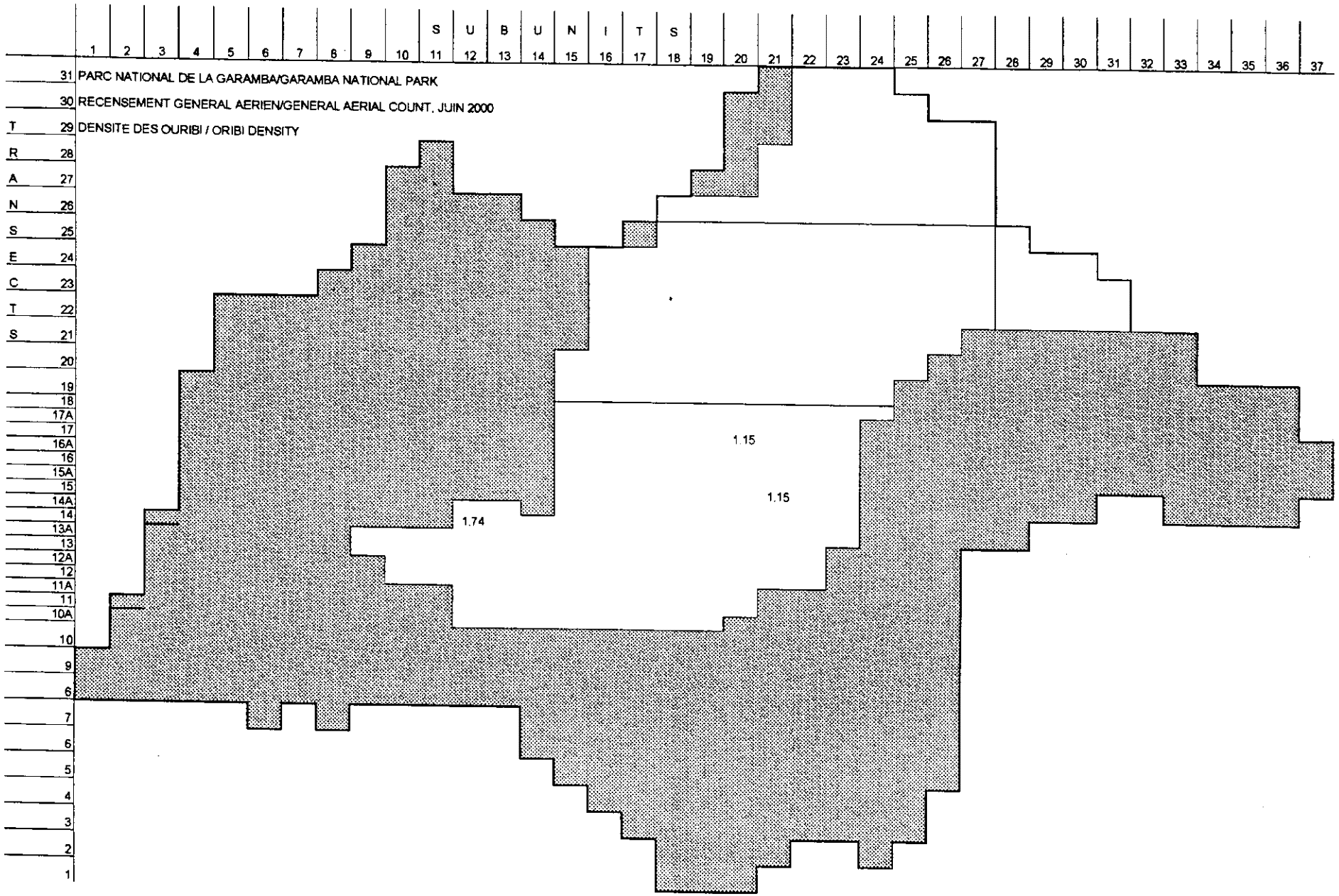


PARC NATIONAL DE LA GARAMBA/GARAMBA NATIONAL PARK

RECENSEMENT GENERAL AERIEN/GENERAL AERIAL COUNT, JUIN 2000

REDUNCA / REEDBUCK

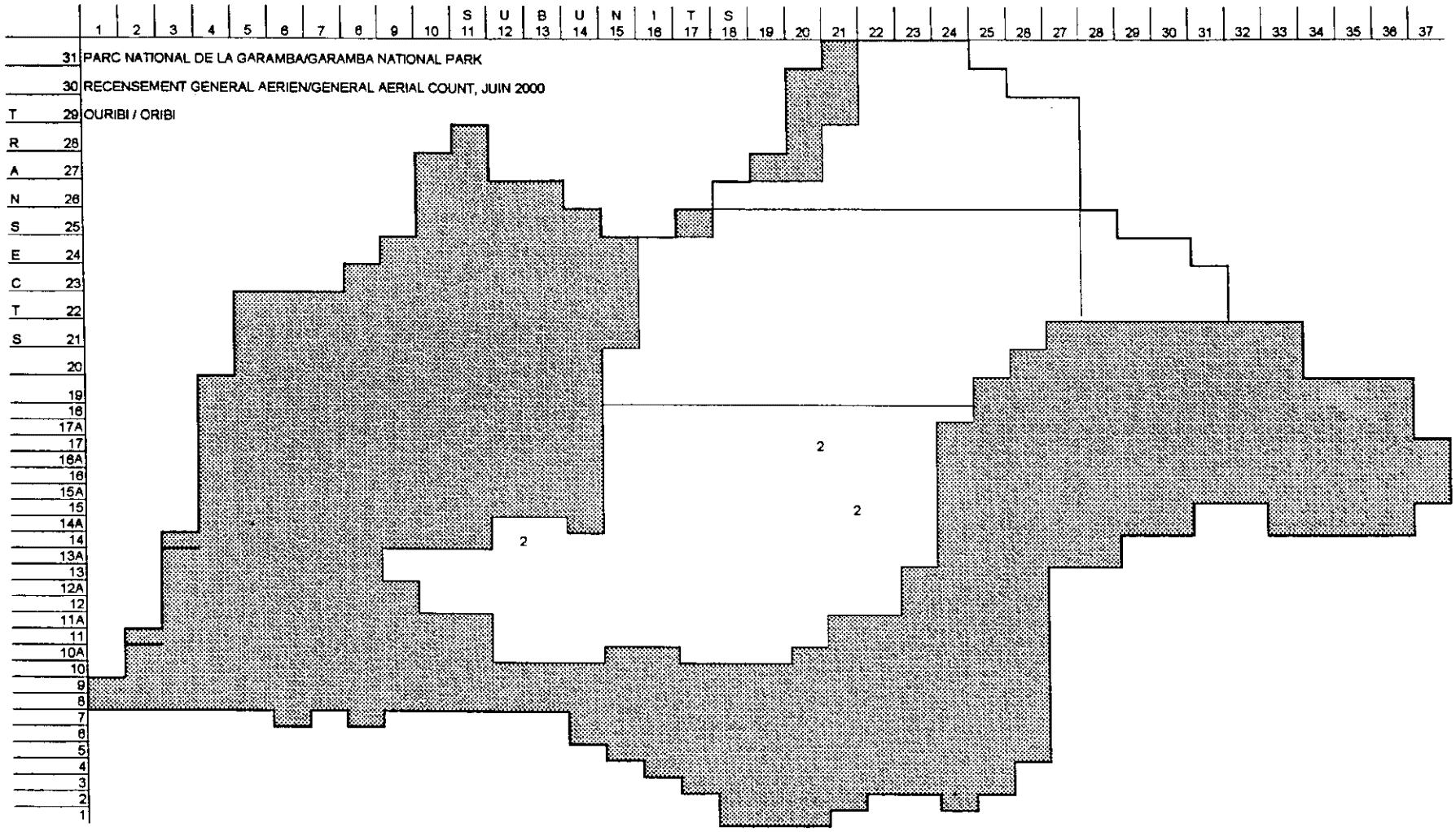
	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31	32	33	34	35	36	37
Low D																				0	0	0	0	0	1	0	0	0	0	0	1	0	0				
Med D																	0	0	0	0	1	0	2	1	0	0	0	0									
High D											0	ERR	ERR	0	0	ERR	2	0	0	1	1	0	1	0	0	0											
Dom		0	0	0	0	0	0	0	0	0	0	0	0	0	0	2	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Total		0	0	0	0	0	0	0	0	0	0	ERR	ERR	0	0	ERR	2	0	0	1	2	0	3	1	1	0	0	0	0	0	1	0	0	0	0	0	0



PARC NATIONAL DE LA GARAMBA/GARAMBA NATIONAL PARK
RECENSEMENT GENERAL AERIEN/GENERAL AERIAL COUNT, JUIN 2000
DENSITE DES OURIBI / ORIBI DENSITY

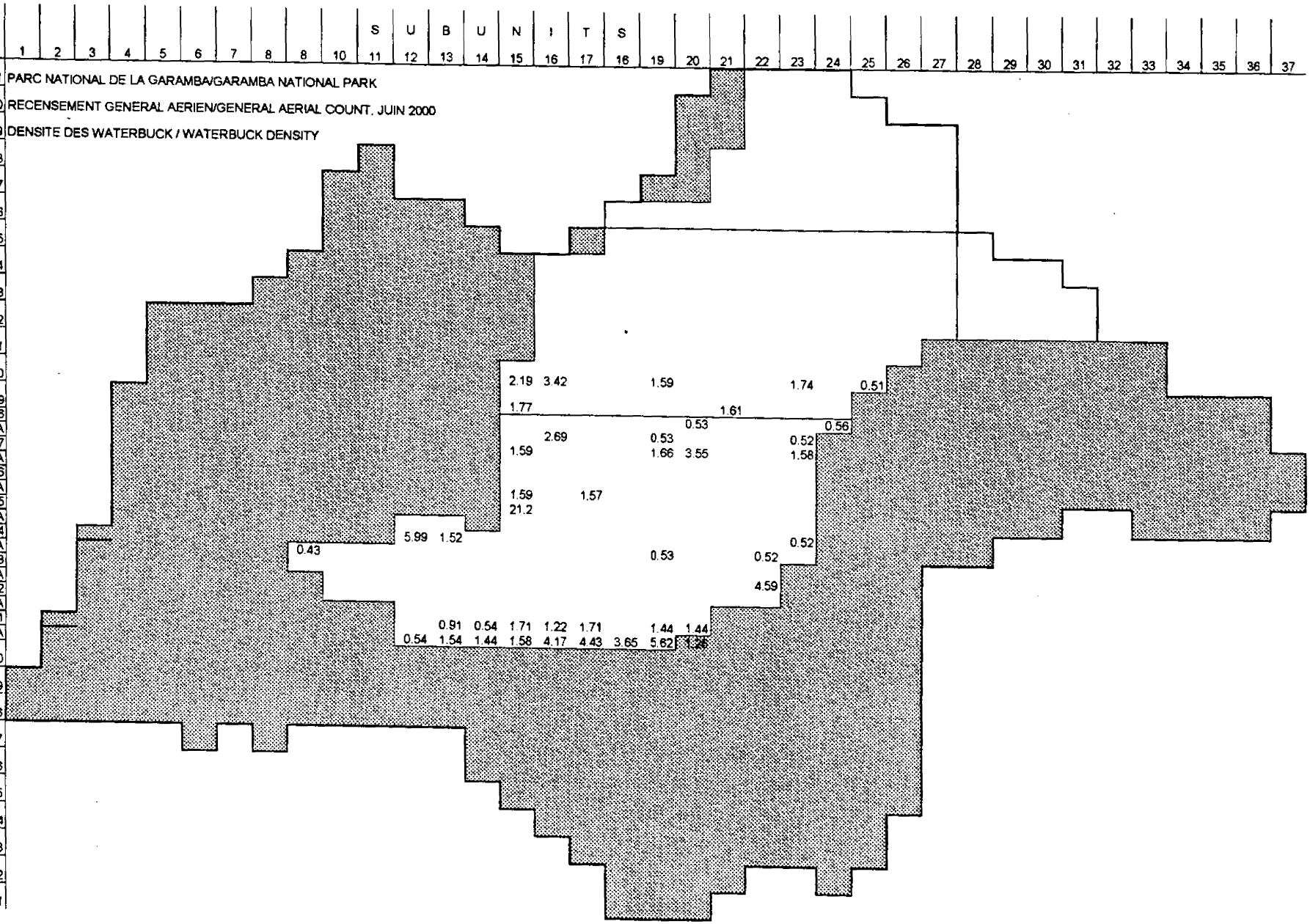
	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19
Low D																			0
Med D																0	0	0	0
High D										0	0	1.74	0	0	0	0	0	0	0
Dom	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Total	0	0	0	0	0	0	0	0	0	0	0	1.74	0	0	0	0	0	0	0

	20	21	22	23	24	25	26	27	28	29	30	31	32	33	34	35	36	37
Low D	0	0	0	0	0	0	0	0	0	0	0	0	0					
Med D	0	0	0	0	0	0	0	0										
High D	1.15	1.15	0	0	0	0												
Dom	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Total	1.15	1.15	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0

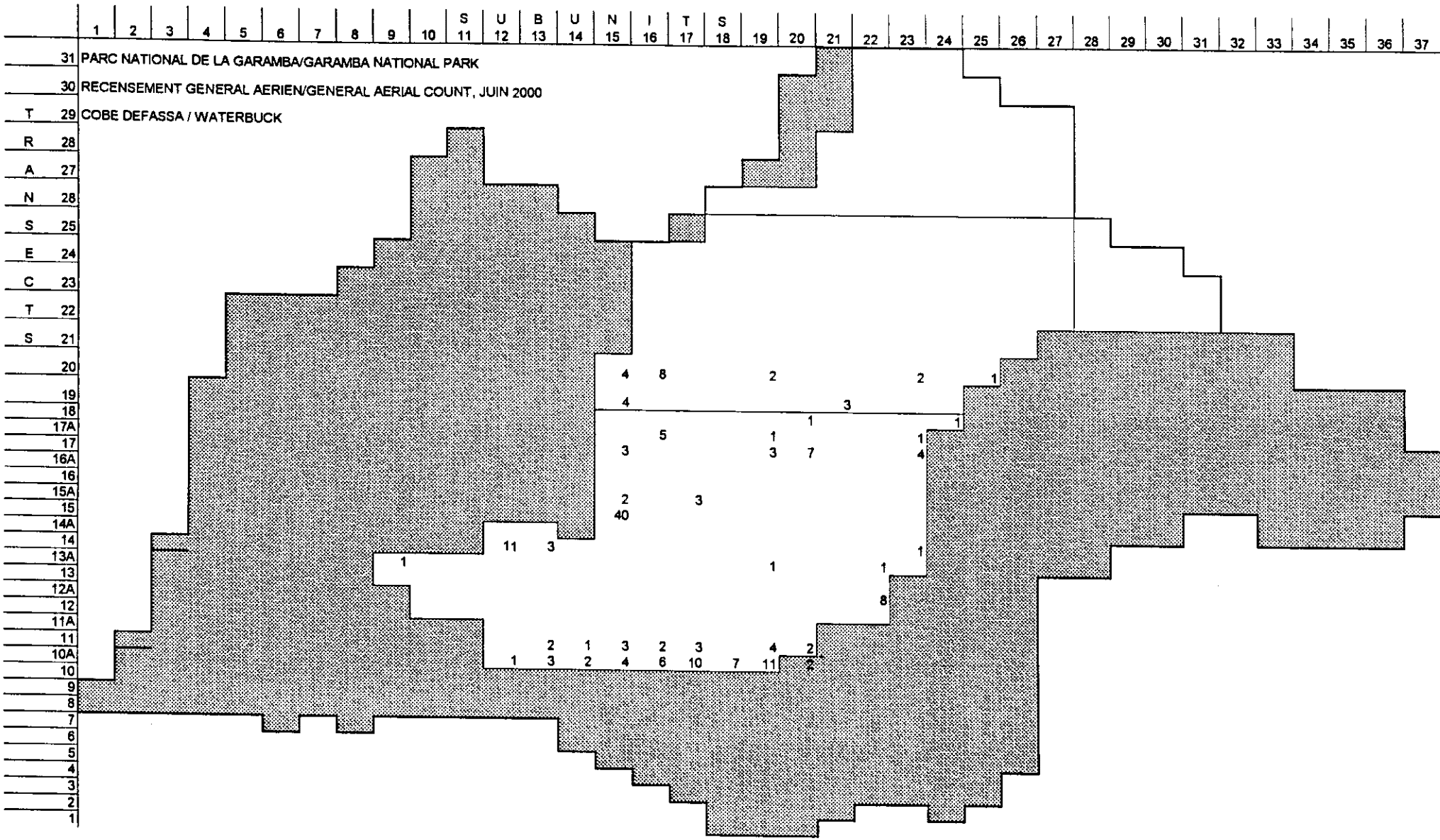


	1	2	3	4	5	6	7	8	9	10	S 11	U 12	B 13	U 14	N 15	I 16	T 17	S 18	19	20	21	22	23	24	25	26	27	28	29	30	31	32	33	34	35	36	37
Low D																				0	0	0	0	0	0	0	0	0	0	0	0	0							
Med D																0	0	0	0	0	0	0	0	0	0	0	0	0	0										
High D											0	ERR	ERR	0	0	ERR	0	0	0	0	2	4	0	0	0	0													
Dom	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Total	0	0	0	0	0	0	0	0	0	0	0	ERR	ERR	0	0	ERR	0	0	0	0	2	4	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0

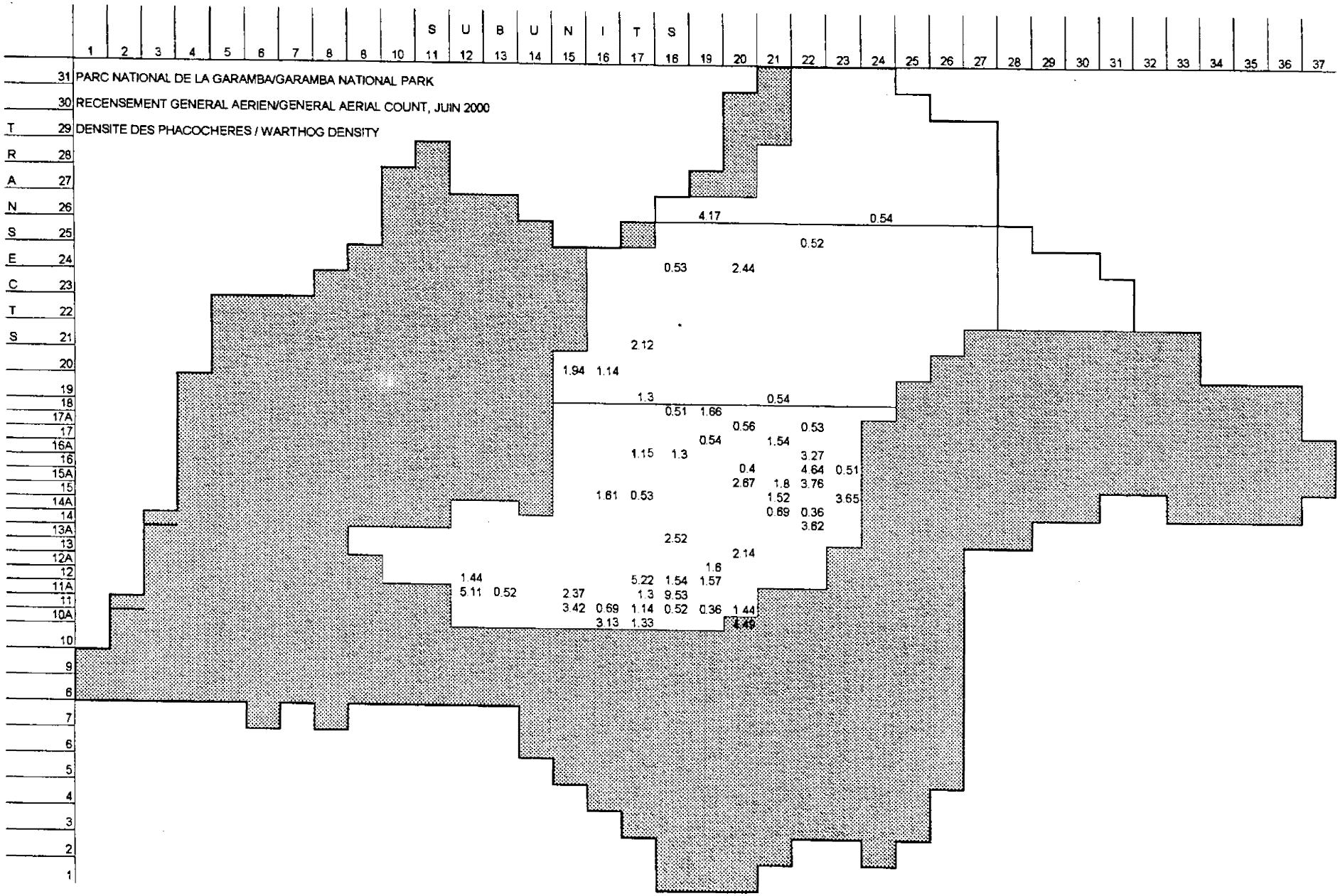
31			0 0
30			0 0
T 29			0 0
R 28			0 0
A 27			0 0
N 26			0 0
S 25			0 0 0
E 24			0 0 0
C 23			0 0 0
T 22			0 0 0
S 21			0 0
20			0 0
19			0 0
18			0
17A			0
17			2
16A			0
16			0
15A			0
15			2
14A			0
14			2
13A			0
13			0
12A			0
12			0
11A			0
11			0
10A			0
10			0
9		0	0 Total
8	0		Total
8			Total
8	0	0	8 TOT



	1	2	3	4	5	6	7	8	8	10	11	12	13	14	15	16	17	16	19	20	21	22	23	24	25	26	27	28	29	30	31	32	33	34	35	36	37
Low D																			0	0	0	0	0	0	0	0	0	0	0	0	0	0					
Med D																3.42	0	0	1.59	0	1.61	0	1.74	0	0.51	0	0										
High D										0	0	5.99	2.44	0.54	1.71	3.91	3.28	0	4.16	5.52	0	5.11	2.63	0.56	0												
Dom	0	0	0	0	0	0	0	0	0.43	0	0	0.54	0	0	28.3	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Total	0	0	0	0	0	0	0	0	0.43	0	0	6.53	2.44	0.54	30	7.33	3.28	0	5.75	5.52	1.61	5.11	4.37	0.56	0.51	0	0	0	0	0	0	0	0	0	0	0	0



	1	2	3	4	5	6	7	8	9	10	S11	U12	B13	U14	N15	I16	T17	S18	19	20	21	22	23	24	25	26	27	28	29	30	31	32	33	34	35	36	37
Low D																																					
Med D																																					
High D																6	0	0	2	0	3	0	2	0	1	0	0										
Dom	0	0	0	0	0	0	0	0	1	0	0	1	0	0	53	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Total	0	0	0	0	0	0	0	0	1	0	ERR	ERR	5	1	ERR	61	13	6	11	19	13	9	8	1	1	0	0	0	0	0	0	0	0	0	0	0	0

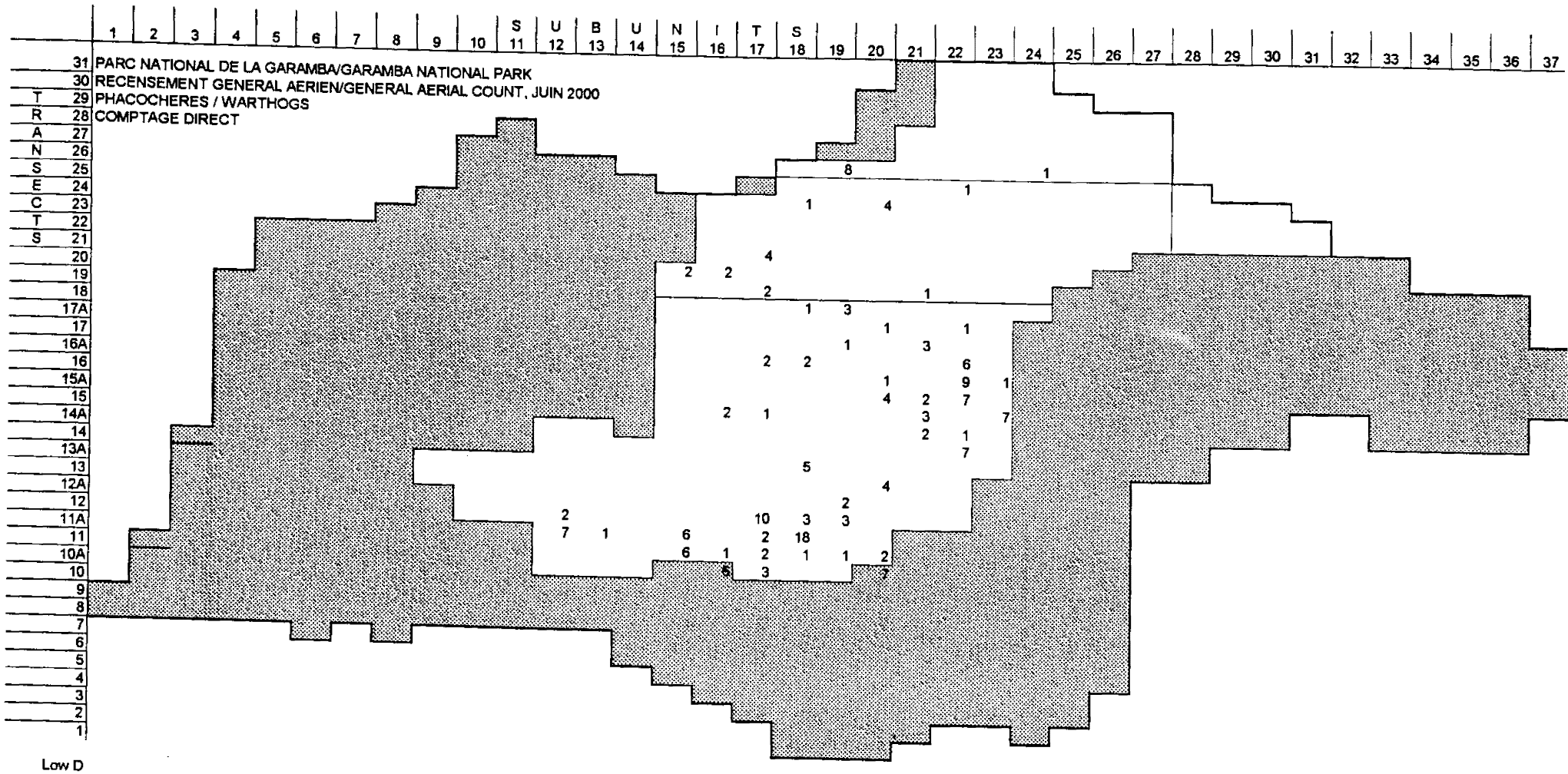


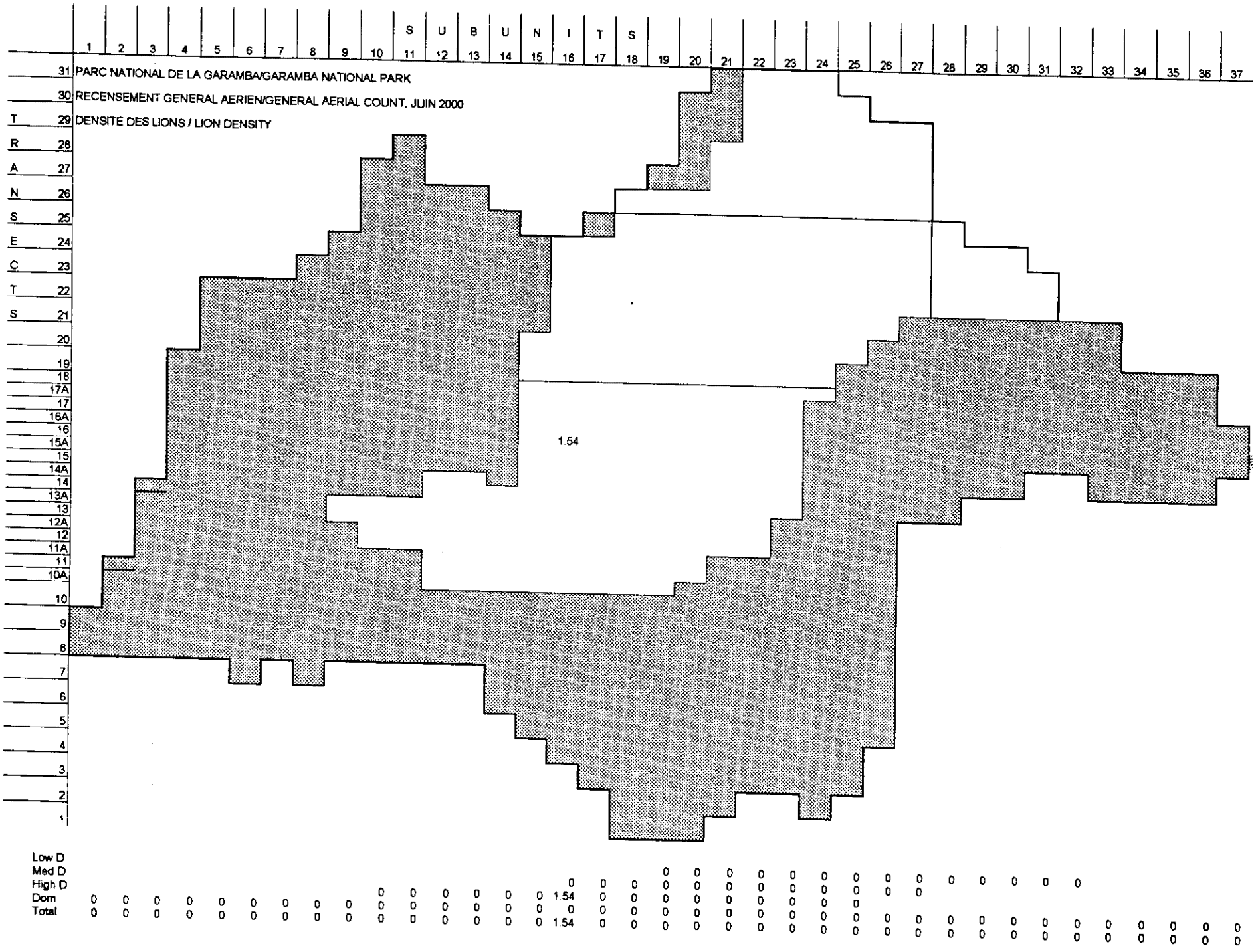
PARC NATIONAL DE LA GARAMBA/GARAMBA NATIONAL PARK

RECENSEMENT GENERAL AERIEN/GENERAL AERIAL COUNT, JUIN 2000

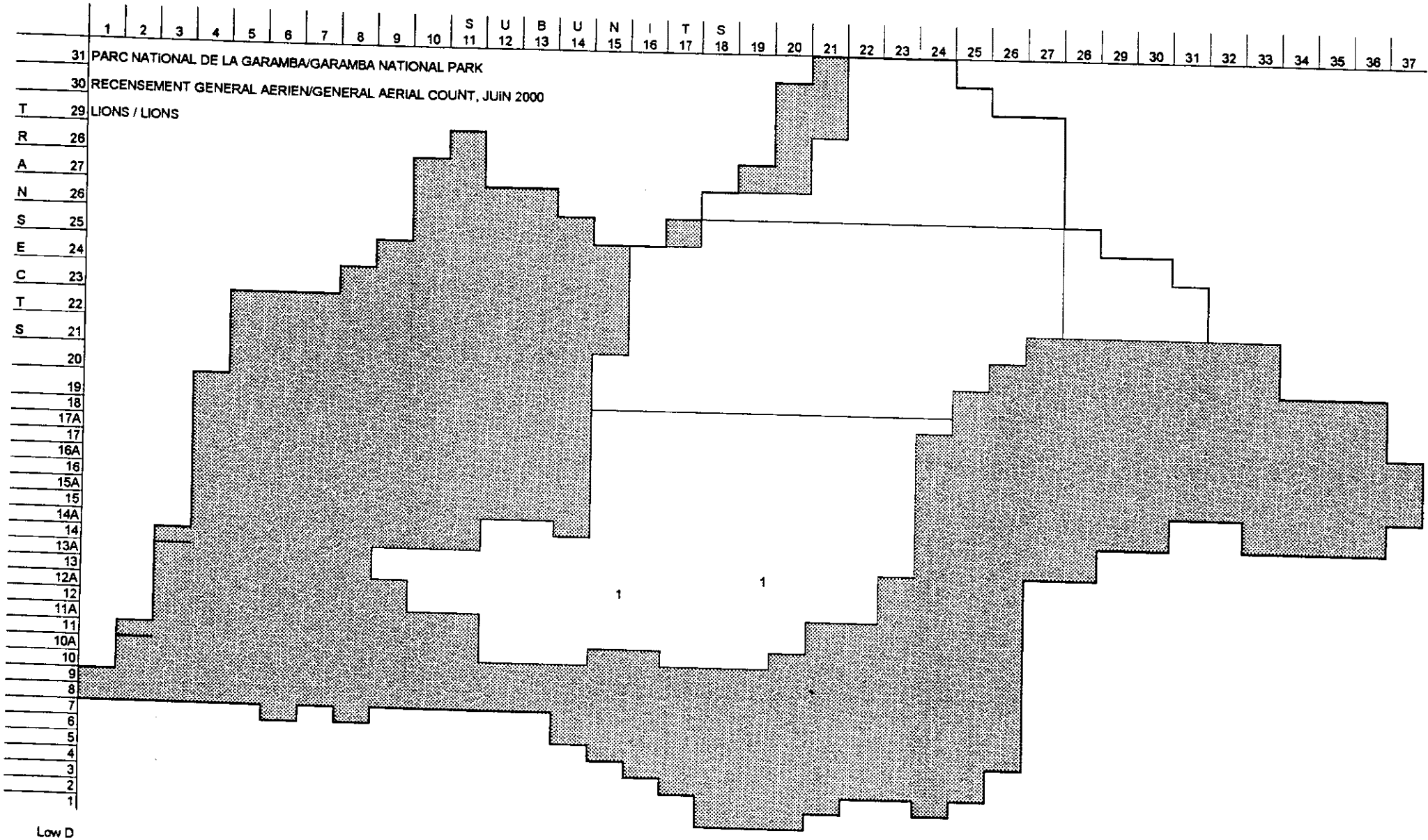
DENSITE DES PHACOCHERES / WARTHOG DENSITY

Low D																			4.17	0	0	0	0	0.54	0	0	0	0	0	0	0	0					
Med D																1.14	3.41	0.53	0	2.44	0.54	0.52	0	0	0	0	0										
High D										0	0	1.44	0.52	0	5.6	2.5	9.33	15.9	5.92	7.41	5.75	16.4	4.17	0	0												
Dom	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1.94	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Total	0	0	0	0	0	0	0	0	0	0	0	1.44	0.52	0	7.74	3.64	12.7	16.5	10.1	9.85	6.26	16.9	4.17	0.54	0	0	0	0	0	0	0	0	0	0	0	0	0


PARC NATIONAL DE LA GARAMBA/GARAMBA NATIONAL PARK
RECENSEMENT GENERAL AERIEN/GENERAL AERIAL COUNT, JUIN 2000
PHACOCHERES / WARTHOGS
COMPTAGE DIRECT
TRANSECTS
Low D
Med D
High D
Dom
Total



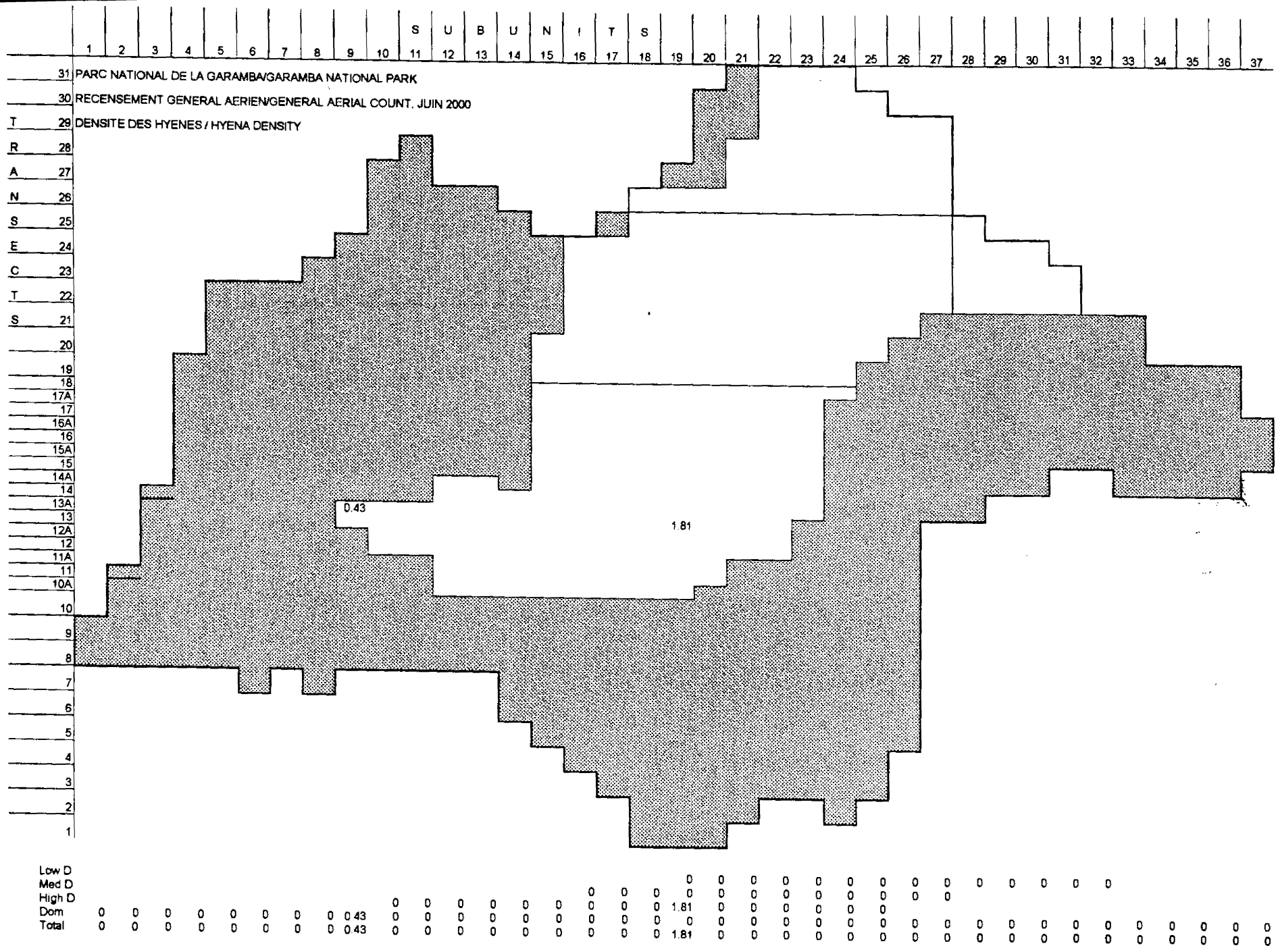
	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31	32	33	34	35	36	37
Low D																																					
Med D																																					
High D																0																					
Dom	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1.54	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Total	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1.54	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0


PARC NATIONAL DE LA GARAMBA/GARAMBA NATIONAL PARK

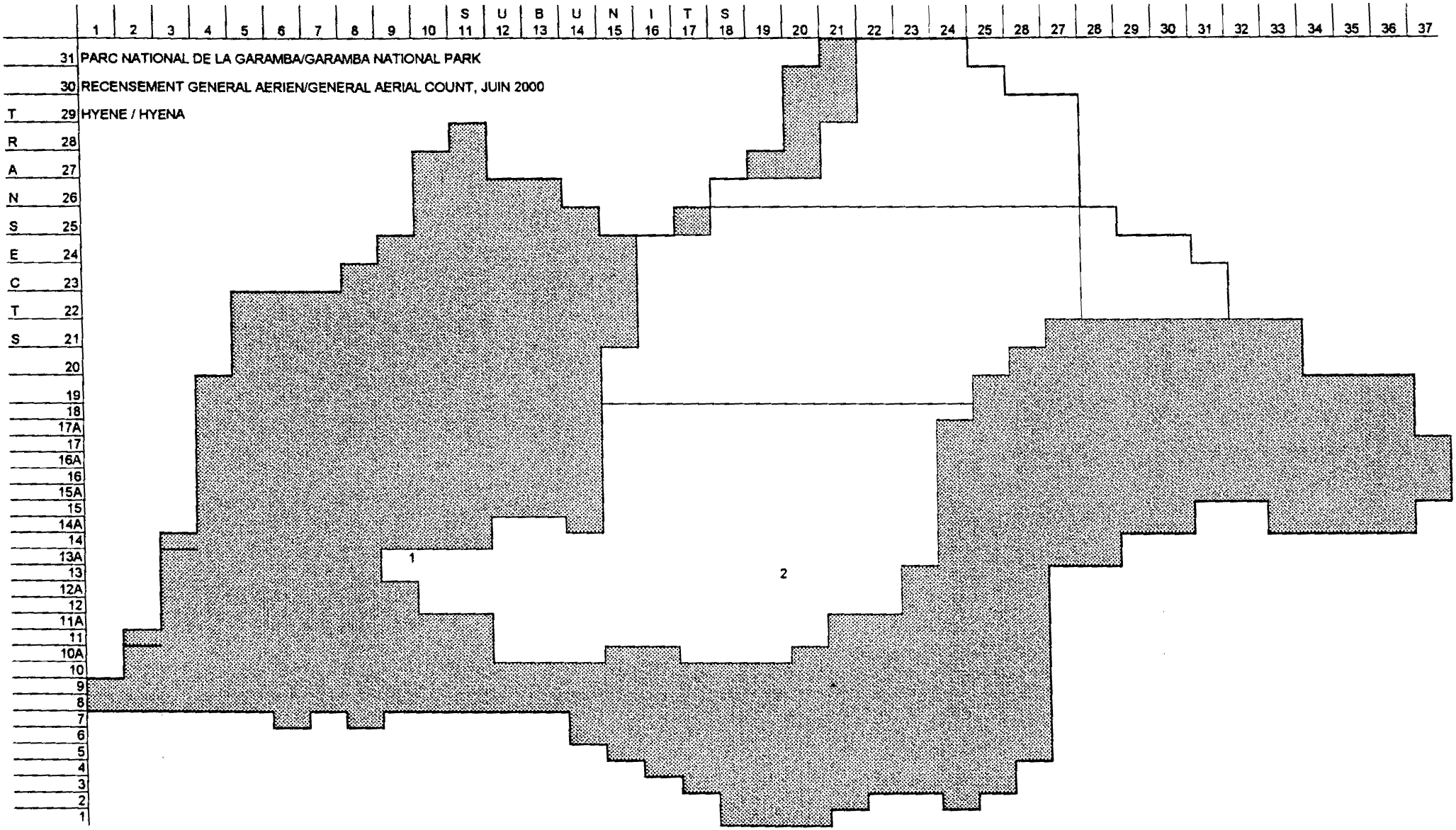
RECENSEMENT GENERAL AERIEN/GENERAL AERIAL COUNT, JUIN 2000

LIONS / LIONS

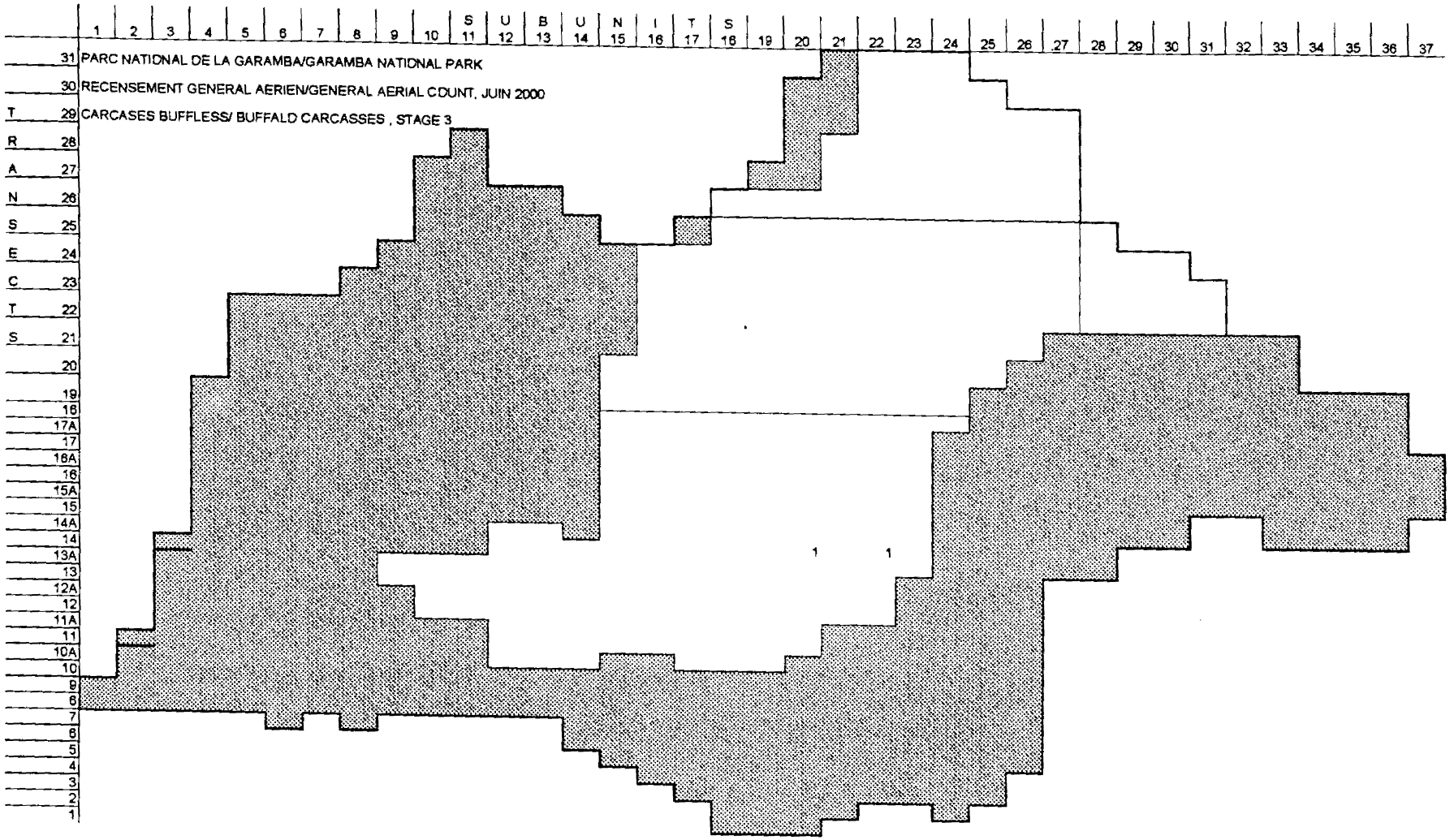
	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31	32	33	34	35	36	37
Low D																			0	0	0	0	0	0	0	0	0	0	0	0	0	0					
Med D																0	0	0	0	0	0	0	0	0	0	0	0										
High D										0	ERR	ERR	0	0	ERR	1	0	0	1	1	0	0	0	0	0												
Dom	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Total	0	0	0	0	0	0	0	0	0	0	ERR	ERR	0	0	ERR	1	0	0	1	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0



	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31	32	33	34	35	36	37
Low D																				0	0	0	0	0	0	0	0	0	0	0	0	0	0	0					
Med D																				0	0	0	0	0	0	0	0	0	0	0	0	0	0	0					
High D											0	0	0	0	0	0	0	0	1.81	0	0	0	0	0	0														
Dom	0	0	0	0	0	0	0	0	0.43		0	0	0	0	0	0	0	0	1.81	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Total	0	0	0	0	0	0	0	0	0.43		0	0	0	0	0	0	0	0	1.81	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0

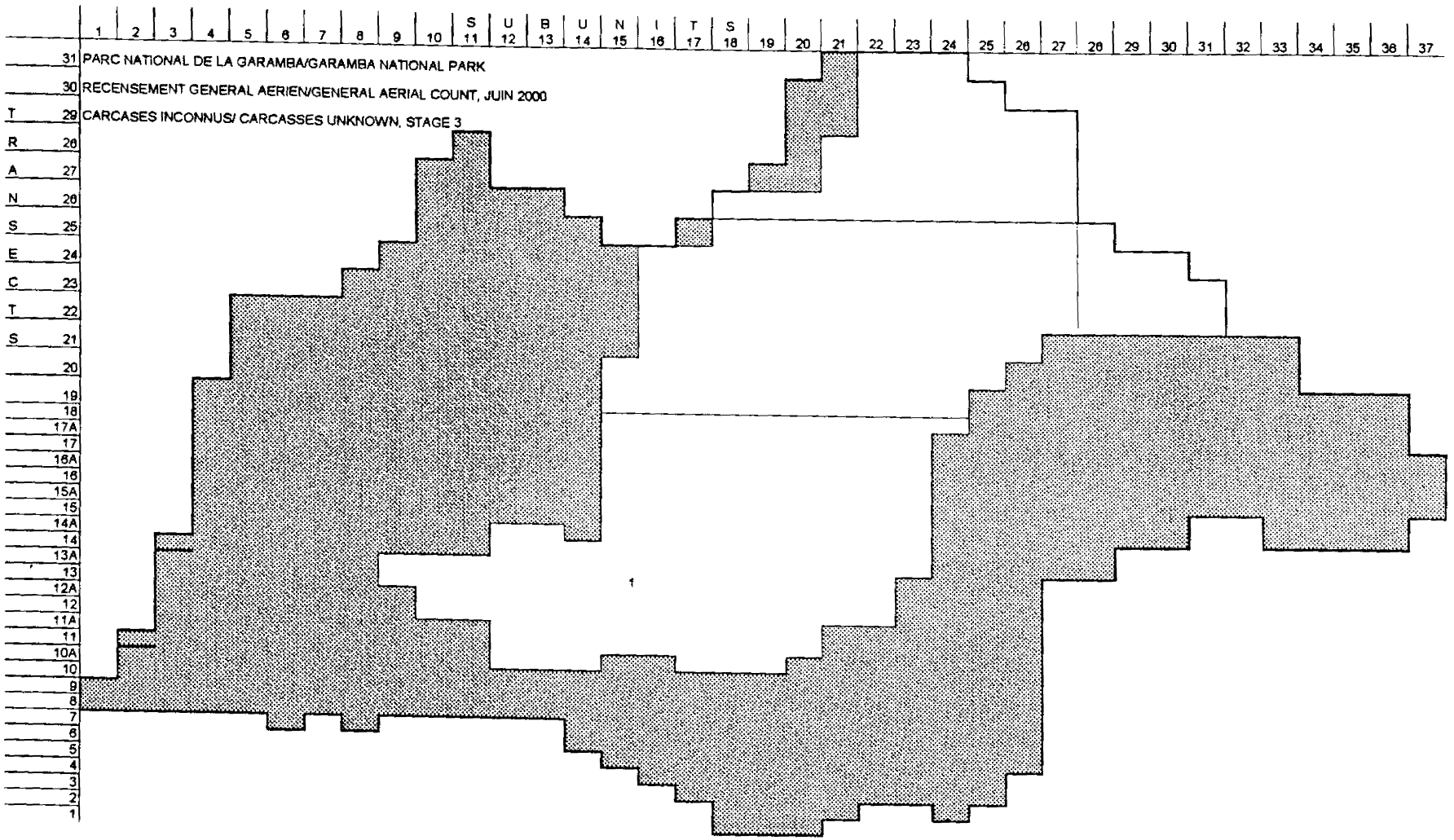


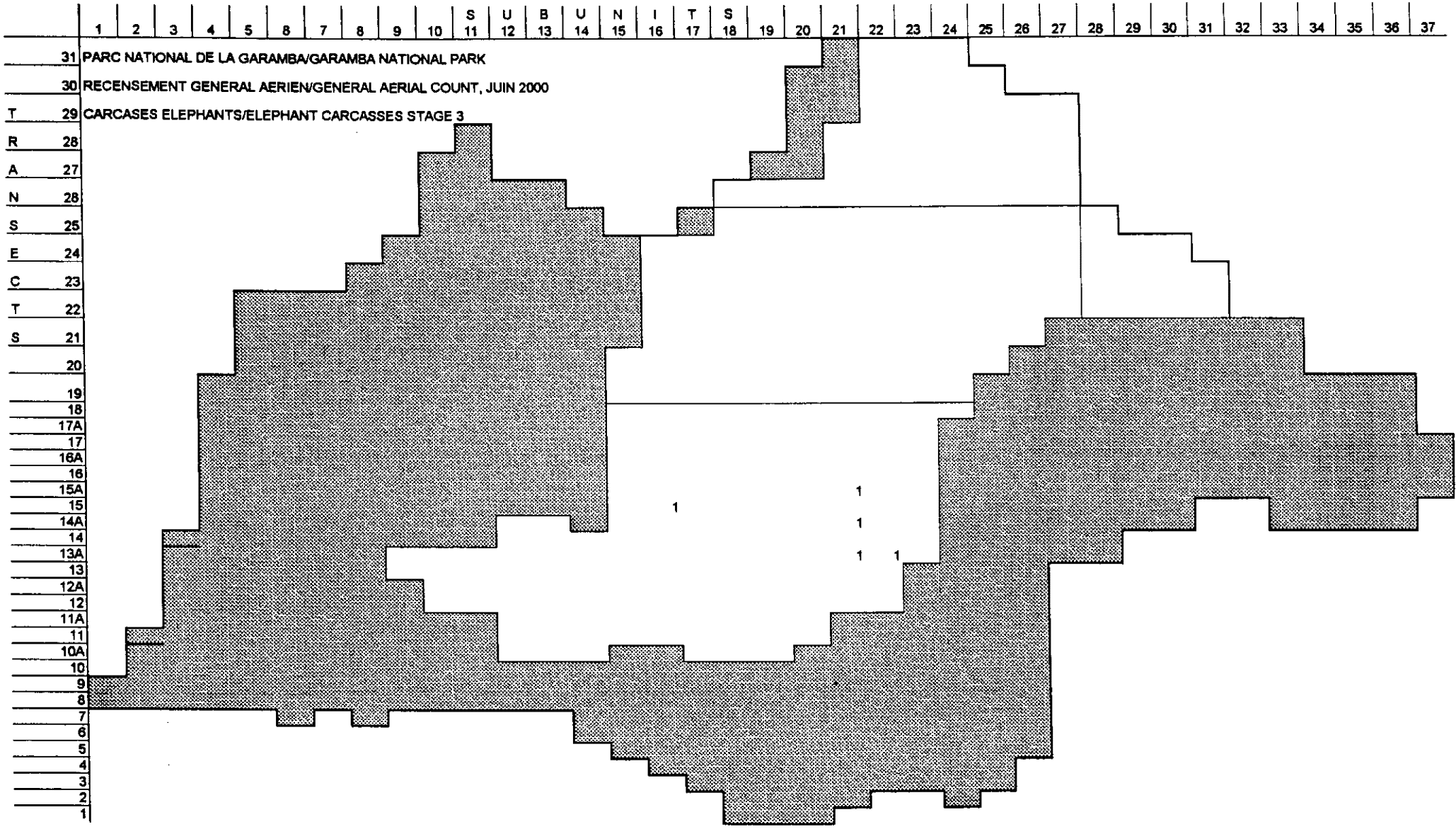
	1	2	3	4	5	6	7	8	9	10	SU 11	BU 12	BU 13	UN 14	NI 15	IT 16	TS 17	18	19	20	21	22	23	24	25	26	27	28	29	30	31	32	33	34	35	36	37
Low D																				0	0	0	0	0	0	0	0	0	0	0	0	0	0	0			
Med D																	0	0	0	0	0	0	0	0	0	0	0	0									
High D											0	ERR	ERR	0	0	ERR	0	0	0	2	2	0	0	0	0	0											
Dom	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Total	0	0	0	0	0	0	0	0	1	0	ERR	ERR	0	0	ERR	0	0	0	2	2	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0



	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31	32	33	34	35	36	37
Low D																																					
Med D																				0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
High D																0	0	0	0	0	0	0	0	0	0	0	0	0	0								
Dom	0	0	0	0	0	0	0	0	0	0	ERR	ERR	0	0	ERR	0	0	0	0	0	1	1	1	0	0	0											
Total	0	0	0	0	0	0	0	0	0	0	ERR	ERR	0	0	ERR	0	0	0	0	0	1	1	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0

31			0
30			0
T 29			0
R 28			0
A 27			0
N 26			0
S 25			0
E 24			0
C 23			0
T 22			0
S 21			0
20			0
19			0
18			0
17A			0
17			0
16A			0
16			0
15A			0
15			0
14A			0
14			0
13A			0
13			2
12A			0
12			0
11A			0
11			0
10A			0
10			0
9			0
8			0
7			2
6			2
5			2
4			2
3			2
2			2
1			2
	0	0	2 TOT

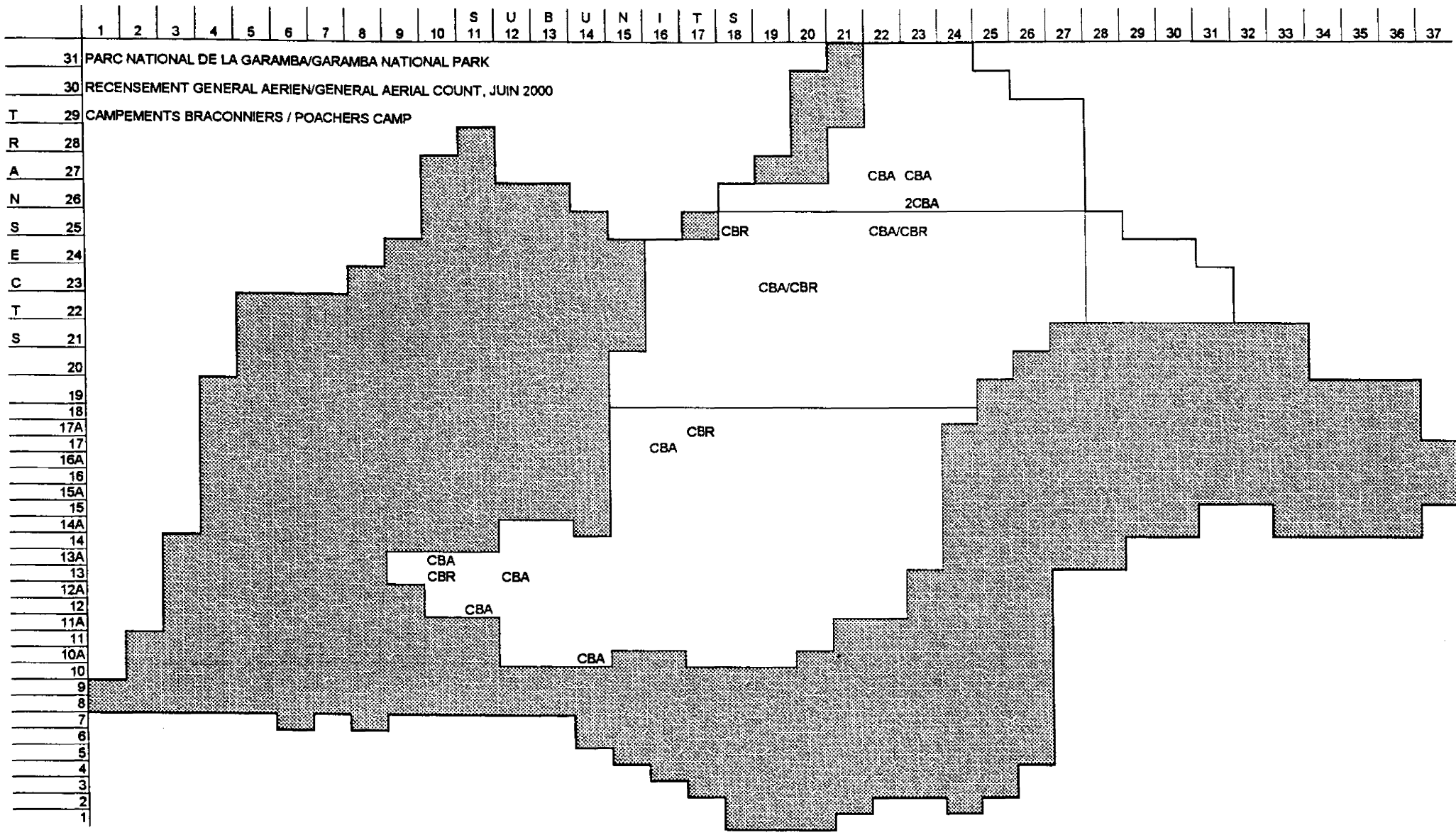

PARC NATIONAL DE LA GARAMBA/GARAMBA NATIONAL PARK
RECENSEMENT GENERAL AERIEN/GENERAL AERIAL COUNT, JUIN 2000
CARCASES INCONNUS/ CARCASSES UNKNOWN, STAGE 3
TRANSECTS
1 2 3 4 5 6 7 8 9 10 S11 U12 B13 U14 N15 I16 T17 S18 19 20 21 22 23 24 25 26 27 28 29 30 31 32 33 34 35 36 37
31 30 29 28 27 26 25 24 23 22 21 20 19 18 17A 17 16A 16 15A 15 14A 14 13A 13 12A 12 11A 11 10A 10 9 8 7 6 5 4 3 2 1
Low D
Med D
High D
Dom
Total
ERR
Total
TOTA


PARC NATIONAL DE LA GARAMBA/GARAMBA NATIONAL PARK

RECENSEMENT GENERAL AERIEN/GENERAL AERIAL COUNT, JUIN 2000

CARCASES ELEPHANTS/ELEPHANT CARCASSES STAGE 3

Low D																			0	0	0	0	0	0	0	0	0	0	0	0	0	0					
Med D																0	0	0	0	0	0	0	0	0	0	0	0										
High D										0	ERR	ERR	0	0	ERR	1	1	0	0	0	3	1	0	0	0												
Dom	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Total	0	0	0	0	0	0	0	0	0	0	ERR	ERR	0	0	ERR	1	1	0	0	0	3	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0



PARC NATIONAL DE LA GARAMBA/GARAMBA NATIONAL PARK

RECENSEMENT GENERAL AERIEN/GENERAL AERIAL COUNT, JUIN 2000

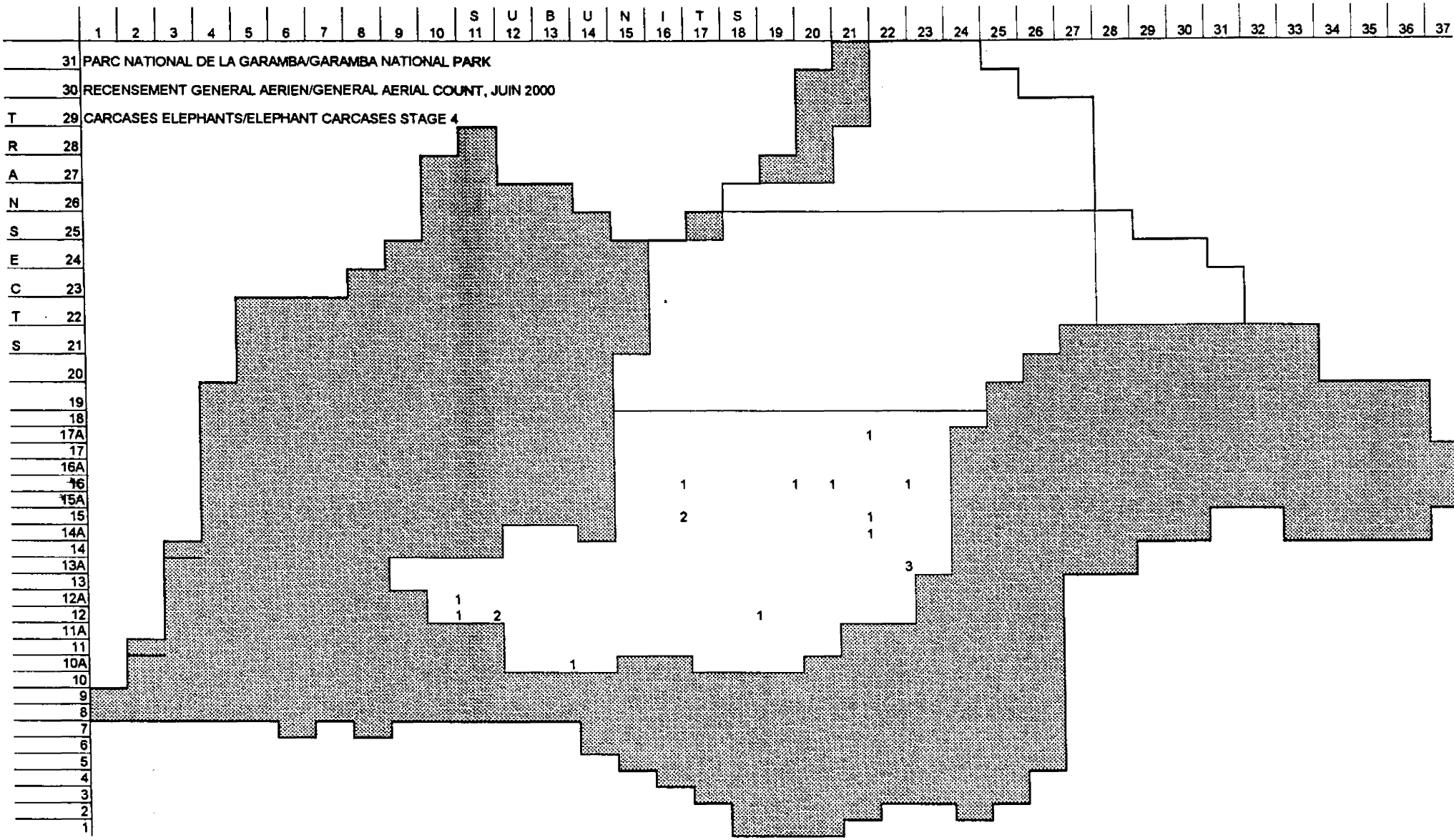
CAMPEMENTS BRACONNIERS / POACHERS CAMP

	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31	32	33	34	35	36	37
Low D																			0	0	0	0	0	0	0	0	0	0	0	0	0	0					
Med D																0	0	0	0	0	0	0	0	0	0	0	0										
High D										0	ERR	ERR	0	0	ERR	0	0	0	0	0	0	0	0	0	0												
Dom	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
Total	0	0	0	0	0.	0	0	0	0	0	ERR	ERR	0	0	ERR	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	

PARC NATIONAL DE LA GARAMBA/GARAMBA NATIONAL PARK

RECENSEMENT GENERAL AERIEN/GENERAL AERIAL COUNT, JUIN 2000

CARCASES ELEPHANTS/ELEPHANT CARCASES STAGE 4



	1	2	3	4	5	6	7	8	9	10	S 11	U 12	B 13	U 14	N 15	I 16	T 17	S 18	19	20	21	22	23	24	25	26	27	28	29	30	31	32	33	34	35	36	37
Low D																				0	0	0	0	0	0	0	0	0	0	0	0	0					
Med D																	0	0	0	0	0	0	0	0	0	0	0	0									
High D											0	ERR	ERR	0	0	ERR	3	3	1	2	2	4	4	0	0	0											
Dom	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Total	0	0	0	0	0	0	0	0	0	1	ERR	ERR	0	0	ERR	3	3	1	2	2	4	4	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0

	PNG 2000 AREA				ELEPHANTS					BUFFALOS				
TRANS	HIGH STH	MID NTH	LOW NTH	TOT NORTH	HIGH STH	MID NTH	LOW NTH	TOT NTH	TOTAL	HIGH STH	MID NTH	LOW NTH	TOT NTH	TOTAL
31			5.75	5.75			0	0				0	0	
30			8.62	8.62			0	0				0	0	
29			12.38	12.38			0	0				0	0	
28			13.50	13.50			0	0				0	0	
27			13.44	13.44			0	0				0	0	
26			18.90	18.90			0	0				0	0	
25		19.97	2.19	22.16		0	0	0			0	0	0	
24		21.85	6.66	28.51		0	0	0			0	0	0	
23		23.50	15.30	38.80		0	0	0			0	0	0	
22		22.75	7.45	30.20		0	0	0			0	0	0	
21		21.42		21.42		0		0			0		0	
20		20.75		20.75		0		0			0		0	
19		20.90		20.90		0		0			0		0	
18	19.00				0					1				
17a	16.86				55					50				
17	17.87				94					28				
16a	17.61				38					22				
16	17.83				83					20				
15a	18.10				68					387				
15	17.14				103					180				
14a	22.33				58					98				
14	22.69				21					66				
13a	29.29				24					184				
13	28.51				50					44				
12a	25.19				54					492				
12	25.50				191					160				
11a	18.63				47					173				
11	17.75				39					100				
10a	17.83				2					8				
Total	332.1	151.1	104.2	255.3	927.0	0.0	0.0	0.0		2013.0	0.0	0.0	0.0	
Sum squ	7163.0	3272.1	980.6	6028.1	85439.0	0.0	0.0	0.0		543747.0	0.0	0.0	0.0	
				Sum (Z*y)	19486.2	0.0	0.0	0.0		44138.3	0.0	0.0	0.0	
				R=Sy/Sz	2.8	0.0	0.0	0.0		6.1	0.0	0.0	0.0	
				Var y	2115.4	0.0	0.0	0.0		19365.8	0.0	0.0	0.0	
Var z	17.9	1.5	20.5	84.5					STRAT.					STRAT.
Covar zy					16.2	0.0	0.0	0.0	TOTAL	156.8	0.0	0.0	0.0	TOTAL
					ELEPHANTS					BUFFALOS				
				Pop.est.(Y)	5,896	0	0	0	5,896	12,804	0	0	0	12,804
				SE(Y)	1066.0	0.0	0.0	0.0	1066.0	3084.5	0.0	0.0	0.0	3084.54
				95% C.L.	2174.5	0.0	0.0	0.0	2089.3	6292.5	0.0	0.0	0.0	6045.70
				95% C.L.as %	36.9	0.0	0.0	0.0	35.4	49.1	ERR	ERR	ERR	47.22

	PNG 2000 AREA				COBS					HARTBEEST				
TRANS	HIGH ST	MID NTH	LOW NTH	TOT NORTH	HIGH STH	MID NTH	LOW NTH	TOT NTH	TOTAL	HIGH STH	MID NTH	LOW NTH	TOT NTH	TOTAL
31			5.75	5.75			0	0				0	0	
30			8.62	8.62			0	0				0	0	
29			12.38	12.38			0	0				0	0	
28			13.50	13.50			0	0				1	1	
27			13.44	13.44			0	0				0	0	
26			18.90	18.90			0	0				0	0	
25		19.97	2.19	22.16		0	0	0			0	0	0	
24		21.85	6.66	28.51		0	0	0			0	0	0	
23		23.50	15.30	38.80		0	0	0			2	0	2	
22		22.75	7.45	30.20		0	0	0			3	0	3	
21		21.42		21.42		0		0			0		0	
20		20.75		20.75		0		0			2		2	
19		20.90		20.90		0		0			0		0	
18	19.00				2					3				
17a	16.86				42					6				
17	17.87				1					0				
16a	17.61				24					1				
16	17.83				148					0				
15a	18.10				36					6				
15	17.14				48					10				
14a	22.33				7					15				
14	22.69				31					33				
13a	29.29				5					34				
13	28.51				0					24				
12a	25.19				1					14				
12	25.50				51					10				
11a	18.63				63					7				
11	17.75				89					0				
10a	17.83				16					0				
Total	332.1	151.1	104.2	255.3	564.0	0.0	0.0	0.0		163.0	7.0	1.0	8.0	
Sum squ	7163.0	3272.1	980.6	6028.1	43632.0	0.0	0.0	0.0		3573.0	17.0	1.0	18.0	
				Sum (Z*y)	10670.8	0.0	0.0	0.0		3957.7	156.8	13.5	223.2	
				R=Sy/Sz	1.7	0.0	0.0	0.0		0.5	0.0	0.0	0.0	
				Var y	1583.4	0.0	0.0	0.0		127.5	1.7	0.2	1.1	
Var z	17.9	1.5	20.5	84.5					STRAT.					STRAT
Covar zy					-69.1	0.0	0.0	0.0	TOTAL	38.3	-3.9	0.3	4.8	TOTAL
					COBS					HARTBEEST				
				Pop.est.(Y)	3,587	0	0	0	3,587	1,037	90	12	99	1,139
				SE(Y)	990.8	0.0	0.0	0.0	990.8	222.4	51.2	9.9	38.4	231.66
				95% C.L.	2021.2	0.0	0.0	0.0	1941.9	453.8	104.4	20.1	78.3	454.05
				95% C.L.as %	56.3	0.0	0.0	0.0	54.1	43.8	115.6	170.9	78.7	39.87

TRANS	PNG 2000 AREA				WARTHOGS					WATERBUCK				
	HIGH STH	MID NTH	LOW NTH	TOT NORTH	HIGH STH	MID NTH	LOW NTH	TOT NTH	TOTAL	HIGH STH	MID NTH	LOW NTH	TOT NTH	TOTAL
31			5.75	5.75			0	0				0	0	
30			8.62	8.62			0	0				0	0	
29			12.38	12.38			0	0				0	0	
28			13.50	13.50			0	0				0	0	
27			13.44	13.44			0	0				0	0	
26			18.90	18.90			9	9				0	0	
25		19.97	2.19	22.16		1	0	1			0	0	0	
24		21.85	6.66	28.51		5	0	5			0	0	0	
23		23.50	15.30	38.80		0	0	0			0	0	0	
22		22.75	7.45	30.20		0	0	0			0	0	0	
21		21.42		21.42		4		4			0		0	
20		20.75		20.75		4		4			15		15	
19		20.90		20.90		3		3			7		7	
18	19.00				4					2				
17a	16.86				2					7				
17	17.87				4					17				
16a	17.61				10					0				
16	17.83				10					0				
15a	18.10				13					5				
15	17.14				6					40				
14a	22.33				3					0				
14	22.69				7					15				
13a	29.29				5					3				
13	28.51				4					0				
12a	25.19				2					8				
12	25.50				18					0				
11a	18.63				34					0				
11	17.75				11					17				
10a	17.83				9					48				
Total	332.1	151.1	104.2	255.3	142.0	17.0	9.0	26.0		162.0	22.0	0.0	22.0	
Sum squ	7163.0	3272.1	980.6	6028.1	2226.0	67.0	81.0	148.0		4858.0	274.0	0.0	274.0	
				Sum (Z*y)	2858.6	360.6	170.1	566.2		3022.9	457.5	0.0	457.5	
				R=Sy/Sz	0.4	0.1	0.1	0.1		0.5	0.1	0.0	0.1	
				Var y	64.4	4.3	13.5	8.0		214.5	34.1	0.0	19.7	
Var z	17.9	1.5	20.5	84.5					STRAT.					STRAT.
Covar zy					-5.9	-13.5	8.5	1.2	TOTAL	-22.7	-19.3	0.0	-1.0	TOTAL
					WARTHOG					WATERBUCK				
				Pop.est.(Y)	**903**	**219**	**106**	**323**	**1,228**	**1,030**	**284**	**0**	**274**	**1,314**
				SE(Y)	195.4	97.3	85.4	120.4	234.4	355.6	226.5	0.0	192.8	463.63
				95% C.L.	398.6	198.6	174.3	245.7	459.5	725.5	462.1	0.0	393.4	908.72
				95% C.L.as %	44.1	0.0	0.0	0.0	37.4	70.4	162.8	ERR	143.8	69.14

TRANS	PNG 2000 AREA				RHINOS					HIPPOS				
	HIGH STH	MID NTH	LOW NTH	TOT NORTH	HIGH STH	MID NTH	LOW NTH	TOT NTH	TOTAL	HIGH STH	MID NTH	LOW NTH	TOT NTH	TOTAL
31			5.75	5.75			0	0				0	0	
30			8.62	8.62			0	0				0	0	
29			12.38	12.38			0	0				0	0	
28			13.50	13.50			0	0				0	0	
27			13.44	13.44			0	0				1	1	
26			18.90	18.90			0	0				0	0	
25		19.97	2.19	22.16		0	0	0			0	0	0	
24		21.85	6.66	28.51		0	0	0			0	0	0	
23		23.50	15.30	38.80		0	0	0			0	0	0	
22		22.75	7.45	30.20		0	0	0			0	0	0	
21		21.42		21.42		0		0			0		0	
20		20.75		20.75		0		0			0		0	
19		20.90		20.90		0		0			0		0	
18	19.00				0					0				
17a	16.86				0					0				
17	17.87				0					20				
16a	17.61				0					0				
16	17.83				0					1				
15a	18.10				0					0				
15	17.14				0					0				
14a	22.33				0					6				
14	22.69				0					87				
13a	29.29				3					4				
13	28.51				0					9				
12a	25.19				0					3				
12	25.50				0					4				
11a	18.63				0					12				
11	17.75				0					2				
10a	17.83				0					0				
Total	332.1	151.1	104.2	255.3	3.0	0.0	0.0	0.0		148.0	0.0	1.0	1.0	
Sum squ	7163.0	3272.1	980.6	6028.1	9.0	0.0	0.0	0.0		8276.0	0.0	1.0	1.0	
				Sum (Z*y)	87.9	0.0	0.0	0.0		3293.9	0.0	13.4	13.4	
				R=Sy/Sz	0.0	0.0	0.0	0.0		0.4	0.0	0.0	0.0	
				Var y	0.6	0.0	0.0	0.0		460.5	0.0	0.2	0.1	
Var z	17.9	1.5	20.5	84.5					STRAT.					STRAT.
Covar zy					1.7	0.0	0.0	0.0	TOTAL	14.8	0.0	0.3	-0.7	TOTAL
					RHINOS					HIPPOS				
				Pop.est.(Y)	19	0	0	0	19	941	0	12	12	953
				SE(Y)	16.7	0.0	0.0	0.0	16.7	486.5	0.0	9.9	12.4	486.77
				95% C.L.	34.1	0.0	0.0	0.0	32.8	992.5	0.0	20.1	25.3	954.08
				95% C.L.as %	178.9	0.0	0.0	0.0	171.8	105.4	ERR	171.0	203.7	100.10

TRANS	PNG 2000 AREA				BUSHBUCK					REEDBUCK				
	HIGH STH	MID NTH	LOW NTH	TOT NORTH	HIGH STH	MID NTH	LOW NTH	TOT NTH	TOTAL	HIGH STH	MID NTH	LOW NTH	TOT NTH	TOTAL
31			5.75	5.75			0	0				0	0	
30			8.62	8.62			0	0				0	0	
29			12.38	12.38			0	0				0	0	
28			13.50	13.50			1	1				0	0	
27			13.44	13.44			0	0				0	0	
26			18.90	18.90			1	1				1	1	
25		19.97	2.19	22.16		0	0	0			0	0	0	
24		21.85	6.66	28.51		0	0	0			1	0	1	
23		23.50	15.30	38.80		0	1	1			0	1	1	
22		22.75	7.45	30.20		1	0	1			0	0	0	
21		21.42		21.42		1		1			1		1	
20		20.75		20.75		0		0			2		2	
19		20.90		20.90		0		0			0		0	
18	19.00				0					1				
17a	16.86				1					0				
17	17.87				0					0				
16a	17.61				1					0				
16	17.83				0					1				
15a	18.10				0					0				
15	17.14				1					2				
14a	22.33				1					0				
14	22.69				0					0				
13a	29.29				0					0				
13	28.51				0					0				
12a	25.19				0					0				
12	25.50				0					0				
11a	18.63				0					0				
11	17.75				0					0				
10a	17.83				0					0				
Total	332.1	151.1	104.2	255.3	4.0	2.0	3.0	5.0		4.0	4.0	2.0	6.0	
Sum squ	7163.0	3272.1	980.6	6028.1	4.0	2.0	2.0	5.0		6.0	6.0	1.0	8.0	
				Sum (Z*y)	73.9	44.2	32.4	122.8		71.1	84.8	18.9	149.1	
				R=Sy/Sz	0.0	0.0	0.0	0.0		0.0	0.0	0.0	0.0	
				Var y	0.2	0.2	0.3	0.3		0.3	0.6	0.2	0.4	
Var z	17.9	1.5	20.5	84.5					STRAT.					STRAT.
Covar zy					-0.6	-1.2	0.1	1.5	TOTAL	-0.8	-3.2	-0.2	2.0	TOTAL
					BUSHBUCK					REEDBUCK				
				Pop.est.(Y)	**25**	**26**	**35**	**62**	**87**	**25**	**52**	**24**	**75**	**101**
				SE(Y)	10.7	18.7	12.9	19.2	25.1	13.7	31.9	10.5	25.4	44.23
				95% C.L.	21.8	38.1	26.2	39.2	49.2	27.9	65.1	21.3	51.7	86.70
				95% C.L.as %	85.6	0.0	0.0	0.0	56.8	109.5	126.1	90.7	69.3	86.21

PNG 2000	AREA				LION					HYENA				
TRANS	HIGH STH	MID NTH	LOW NTH	TOT NORTH	HIGH STH	MID NTH	LOW NTH	TOT NTH	TOTAL	HIGH STH	MID NTH	LOW NTH	TOT NTH	TOTAL
31			5.75	5.75			0	0				0	0	
30			8.62	8.62			0	0				0	0	
29			12.38	12.38			0	0				0	0	
28			13.50	13.50			0	0				0	0	
27			13.44	13.44			0	0				0	0	
26			18.90	18.90			0	0				0	0	
25		19.97	2.19	22.16		0	0	0			0	0	0	
24		21.85	6.66	28.51		0	0	0			0	0	0	
23		23.50	15.30	38.80		0	0	0			0	0	0	
22		22.75	7.45	30.20		0	0	0			0	0	0	
21		21.42		21.42		0		0			0		0	
20		20.75		20.75		0		0			0		0	
19		20.90		20.90		0		0			0		0	
18	19.00				0					0				
17a	16.86				0					0				
17	17.87				0					0				
16a	17.61				0					0				
16	17.83				3					0				
15a	18.10				0					0				
15	17.14				0					0				
14a	22.33				0					0				
14	22.69				0					0				
13a	29.29				0					1				
13	28.51				0					2				
12a	25.19				0					0				
12	25.50				0					0				
11a	18.63				0					0				
11	17.75				0					0				
10a	17.83				0					0				
Total	332.1	151.1	104.2	255.3	3.0	0.0	0.0	0.0		3.0	0.0	0.0	0.0	
Sum squ	7163.0	3272.1	980.6	6028.1	9.0	0.0	0.0	0.0		5.0	0.0	0.0	0.0	
				Sum (Z*y)	53.5	0.0	0.0	0.0		86.3	0.0	0.0	0.0	
				R=Sy/Sz	0.0	0.0	0.0	0.0		0.0	0.0	0.0	0.0	
				Var y	0.6	0.0	0.0	0.0		0.3	0.0	0.0	0.0	
Var z	17.9	1.5	20.5	84.5					STRAT.					STRAT.
Covar zy					-0.6	0.0	0.0	0.0	TOTAL	1.6	0.0	0.0	0.0	TOTAL
					LION					HYENA				
				Pop.est.(Y)	19	0	0	0	19	19	0	0	0	19
				SE(Y)	17.4	0.0	0.0	0.0	17.4	11.9	0.0	0.0	0.0	11.87
				95% C.L.	35.4	0.0	0.0	0.0	34.0	24.2	0.0	0.0	0.0	23.26
				95% C.L.as %	185.7	0.0	0.0	0.0	178.4	126.9	ERR	ERR	ERR	121.92

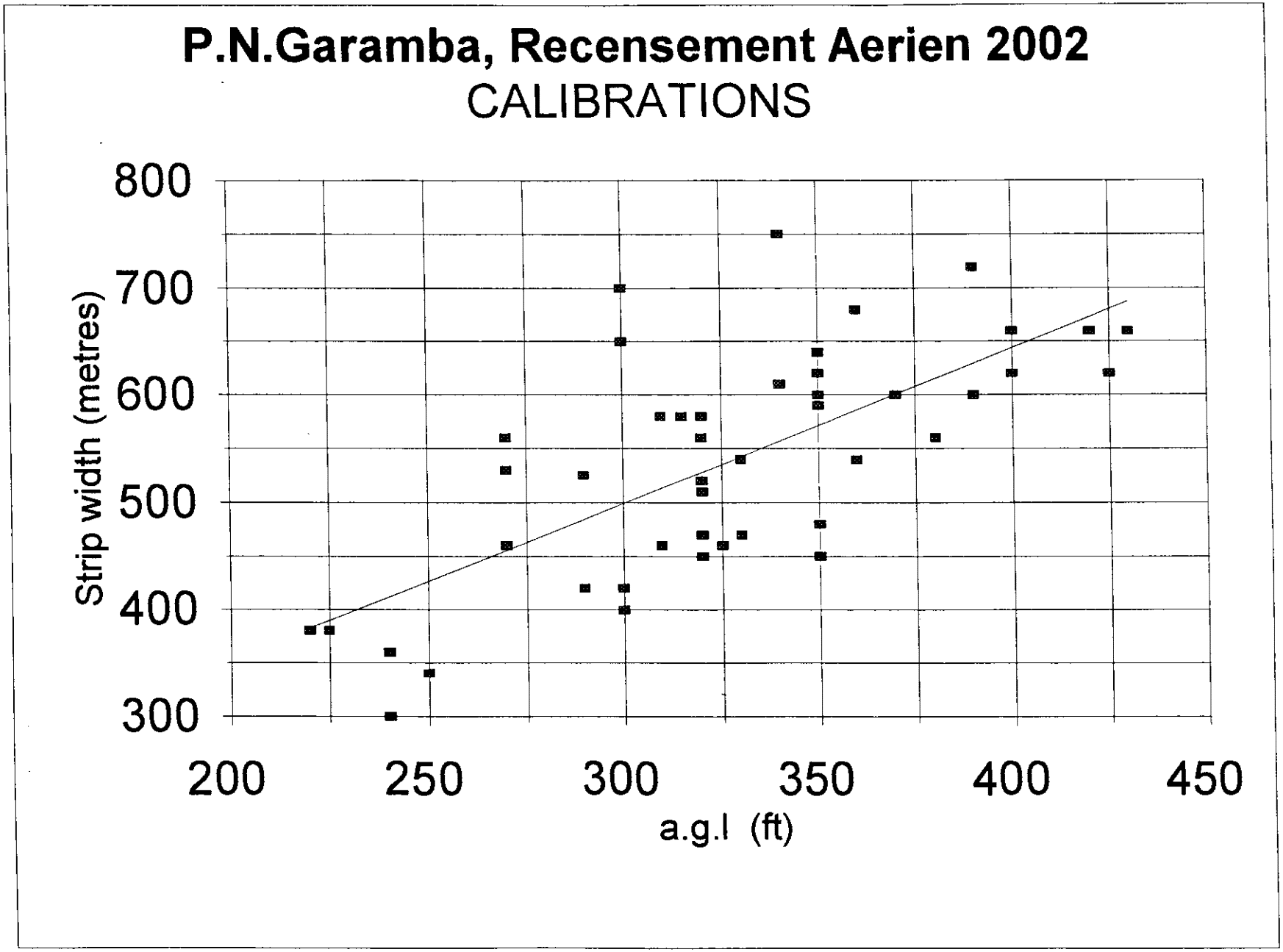
TRANS	PNG 2000 AREA				ORIBI					ELEPHANTS CARCASES, STAGE 3					ELEPHANTS CARCASES, STAGE 4				
	HIGH STH	MID NTH	LOW NTH	TOT NORTH	HIGH STH	MID NTH	LOW NTH	TOT NTH	TOTAL	HIGH STH	MID NTH	LOW NTH	TOT NTH	TOTAL	HIGH STH	MID NTH	LOW NTH	TOT NTH	TOTAL
31			5.75	5.75			0	0				0	0				0	0	
30			8.62	6.62			0	0				0	0				0	0	
29			12.38	12.38			0	0				0	0				0	0	
28			13.50	13.50			0	0				0	0				0	0	
27			13.44	13.44			0	0				0	0				0	0	
26			18.90	18.90			0	0				0	0				0	0	
25		19.97	2.19	22.16		0	0	0			0	0	0			0	0	0	
24		21.85	6.66	28.51		0	0	0			0	0	0			0	0	0	
23		23.50	15.30	38.80		0	0	0			0	0	0			0	0	0	
22		22.75	7.45	30.20		0	0	0			0	0	0			0	0	0	
21		21.42		21.42		0		0			0		0			0		0	
20		20.75		20.75		0		0			0		0			0		0	
19		20.90		20.90		0		0			0		0			0		0	
18	19.00				0					0					0				
17a	16.86				0					0					1				
17	17.87				2					0					0				
16a	17.61				0					0					0				
16	17.83				0					0					4				
15a	18.10				0					1					0				
15	17.14				2					1					3				
14a	22.33				0					1					1				
14	22.69				2					0					0				
13a	29.29				0					2					3				
13	28.51				0					0					0				
12a	25.19				0					0					1				
12	25.50				0					0					4				
11a	18.63				0					0					0				
11	17.75				0					0					0				
10a	17.83				0					0					1				
Total	332.1	151.1	104.2	255.3	6.0	0.0	0.0	0.0		5.0	0.0	0.0	0.0		18.0	0.0	0.0	0.0	
Sum squ	7163.0	3272.1	980.6	6028.1	12.0	0.0	0.0	0.0		7.0	0.0	0.0	0.0		54.0	0.0	0.0	0.0	
				Sum (Z*y)	115.4	0.0	0.0	0.0		116.1	0.0	0.0	0.0		394.8	0.0	0.0	0.0	
				R=Sy/Sz	0.0	0.0	0.0	0.0		0.0	0.0	0.0	0.0		0.1	0.0	0.0	0.0	
				Var y	0.7	0.0	0.0	0.0		0.4	0.0	0.0	0.0		2.3	0.0	0.0	0.0	
Var z	17.9	1.5	20.5	84.5					STRAT.					STRAT.					STRAT.
Covar zy					-0.6	0.0	0.0	0.0	TOTAL	0.8	0.0	0.0	0.0	TOTAL	1.4	0.0	0.0	0.0	TOTAL
					ORIBI					ELEPHANTS CARCASES, STAGE 3					ELEPHANTS CARCASES, STAGE 4				
				Pop.est.(Y)	38	0	0	0	38	32	0	0	0	32	114	0	0	0	114
				SE(Y)	18.9	0.0	0.0	0.0	18.9	13.4	0.0	0.0	0.0	13.39	33.6	0.0	0.0	0.0	33.59
				95% C.L.	38.5	0.0	0.0	0.0	37.0	27.3	0.0	0.0	0.0	26.25	68.5	0.0	0.0	0.0	65.84
				95% C.L.as %	100.8	0.0	0.0	0.0	96.9	85.9	ERR	ERR	ERR	82.55	59.9	ERR	ERR	ERR	57.51

PARC NATIONAL DE LA GARAMBA
GARAMBA NATIONAL PARK

RECENSEMENT GENERAL SYSTEMATIQUE
GENERAL AERIAL SYSTEMATIC SAMPLE COUNT

Calibration Graphs, Distribution Maps and Population Estimate Calculations

May / Mai 2002


P.N.Garamba, Recensement Aerien 2002
CALIBRATIONS
Strip width (metres)
800
700
600
500
400
300
200
250
300
350
400
450
a.g.l (ft)

CALIBRATION , May 2002

No	Alt agl	Strip Width
1	330	470
2	315	580
3	370	600
4	290	525
5	270	460
6	270	530
7	320	560
8	350	450
9	350	590
10	320	450
11	270	560
12	350	480
13	320	470
14	390	720
15	310	460
16	300	400
17	300	420
18	380	560
19	425	620
20	390	600
21	300	700
22	300	650
23	330	540
24	360	680
25	420	660
26	320	520
27	400	660
28	400	620
29	340	750
30	220	380
31	320	510
32	360	540
33	340	610
34	350	640
35	430	660
36	350	600
37	360	540
38	225	380
39	250	340
40	240	300
41	240	360
42	290	420
43	310	580
44	325	460
45	320	580
46	350	620

Regression Output:

Constant	**131.8018**
Std Err of Y Est	**80.24209**
R Squared	**0.436305**
No. of Observations	**47**
Degrees of Freedom	**45**
X Coefficient(s)	**1.23E+00**
Std Err of Coef.	**0.2090577828**

Y = M.X + C

Y = 1.23380318303919 X + 131.801796597442

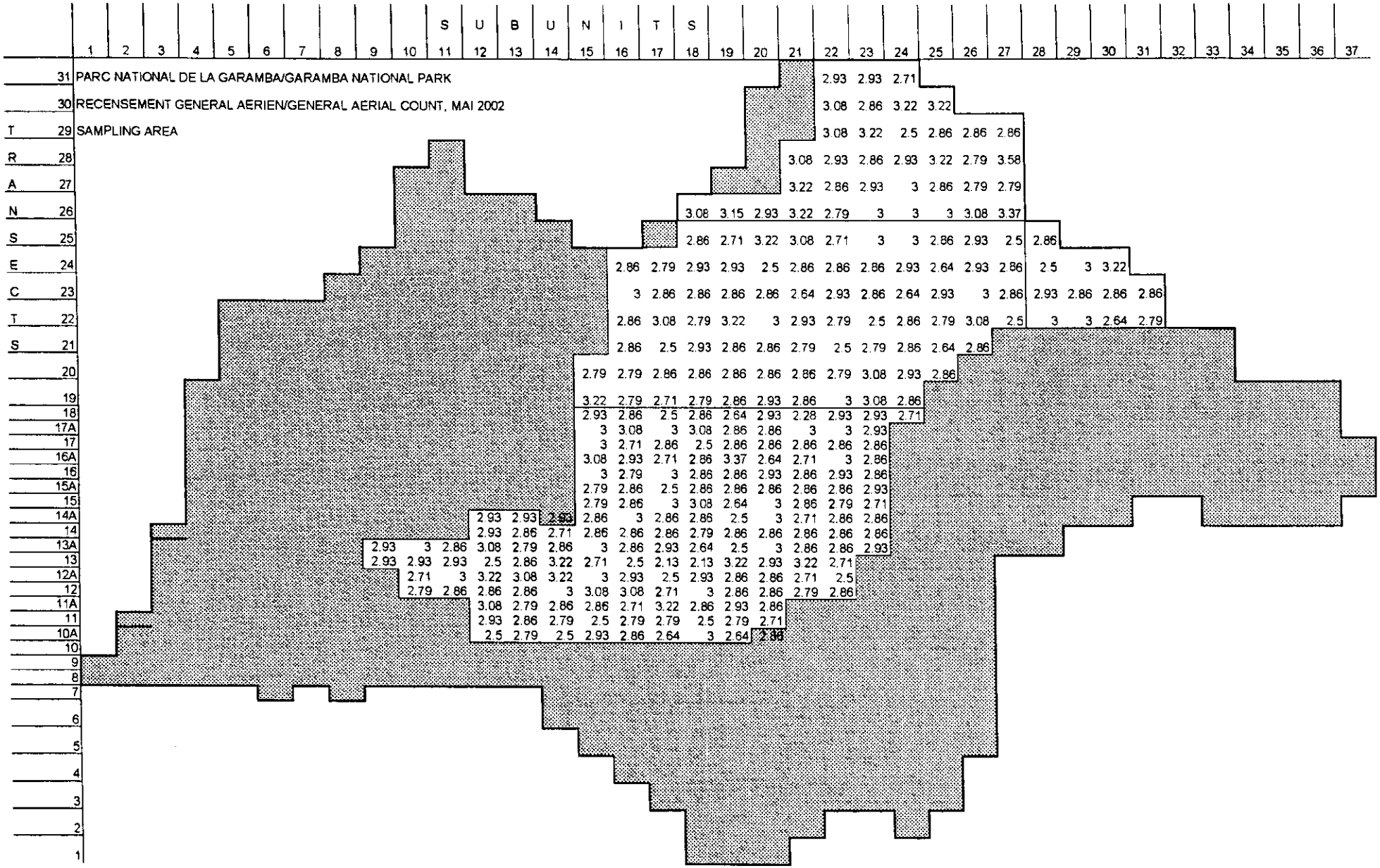
not used - eliminated 500/600 anomolous reading

Regression Output:

Constant	64.00504
Std Err of Y Est	77.10593
R Squared	0.48747
No. of Observations	46
Degrees of Freedom	44
X Coefficient(s)	1.4506150141
Std Err of Coef.	0.2242389917

Y= 1.4506 . X + 64.005

220	380	383.137
225	380	390.39
240	360	412.149
240	300	412.149
250	340	426.655
270	560	455.667
270	460	455.667
270	530	455.667
290	525	484.679
290	420	484.679
300	400	499.185
300	420	499.185
300	700	499.185
300	650	499.185
310	580	513.691
310	460	513.691
315	580	520.944
320	580	528.197
320	510	528.197
320	450	528.197
320	560	528.197
320	520	528.197
320	470	528.197
325	460	535.45
330	540	542.703
330	470	542.703
340	750	557.209
340	610	557.209
350	640	571.715
350	590	571.715
350	450	571.715
350	600	571.715
350	480	571.715
350	620	571.715
360	540	586.221
360	540	586.221
360	680	586.221
370	600	600.727
380	560	615.233
390	600	629.739
390	720	629.739
400	620	644.245
400	660	644.245
420	660	673.257
425	620	680.51
430	660	687.763



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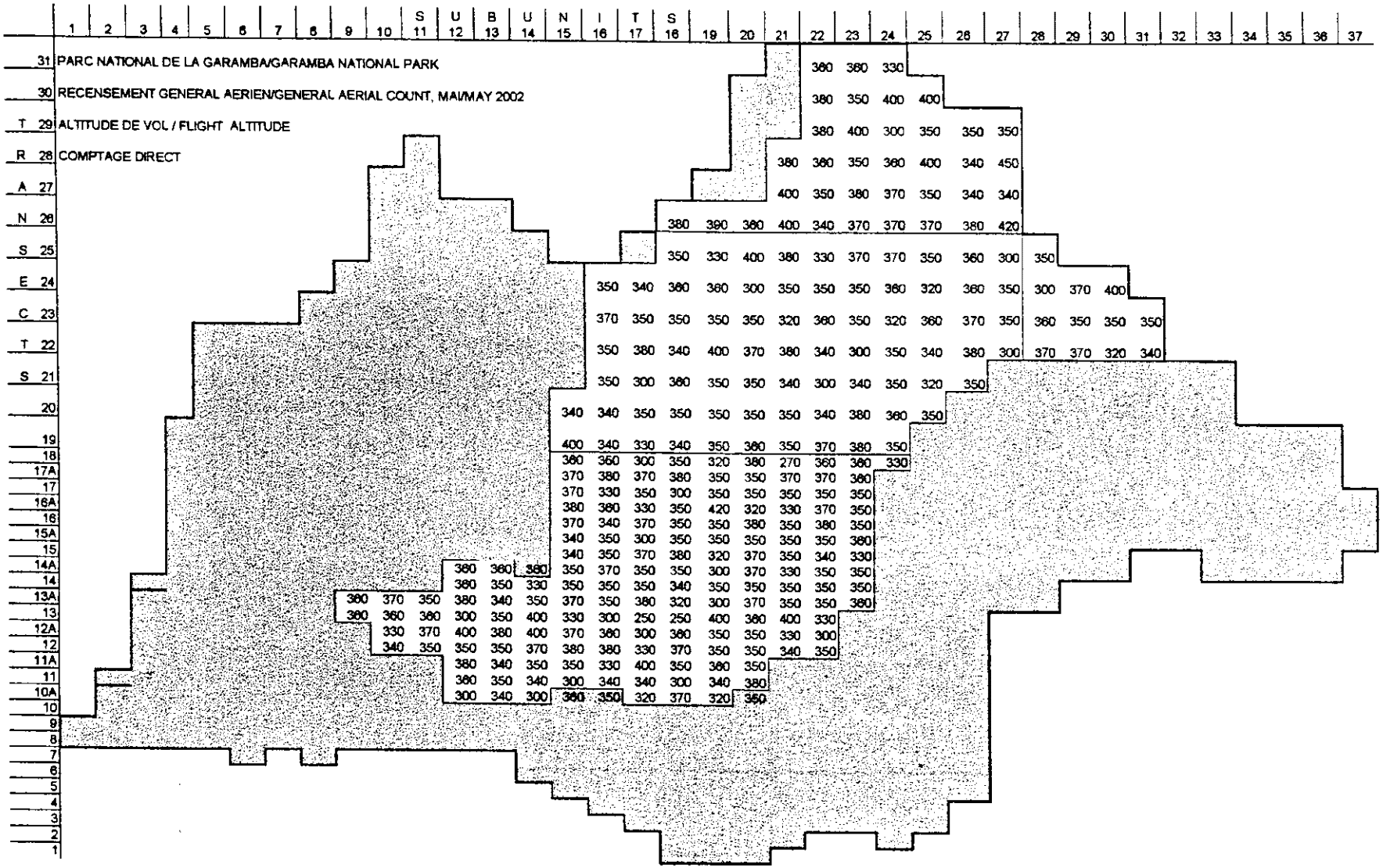
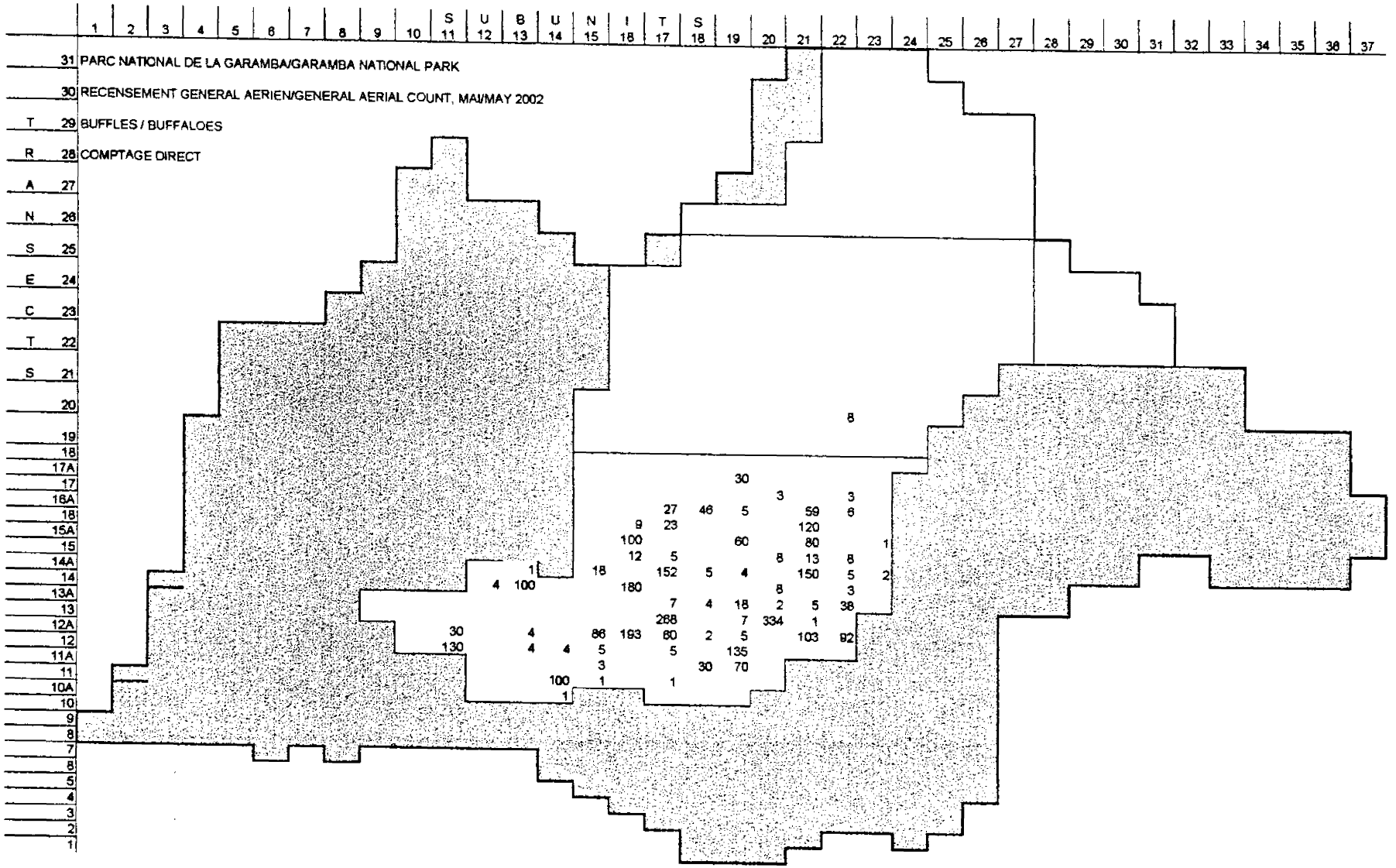
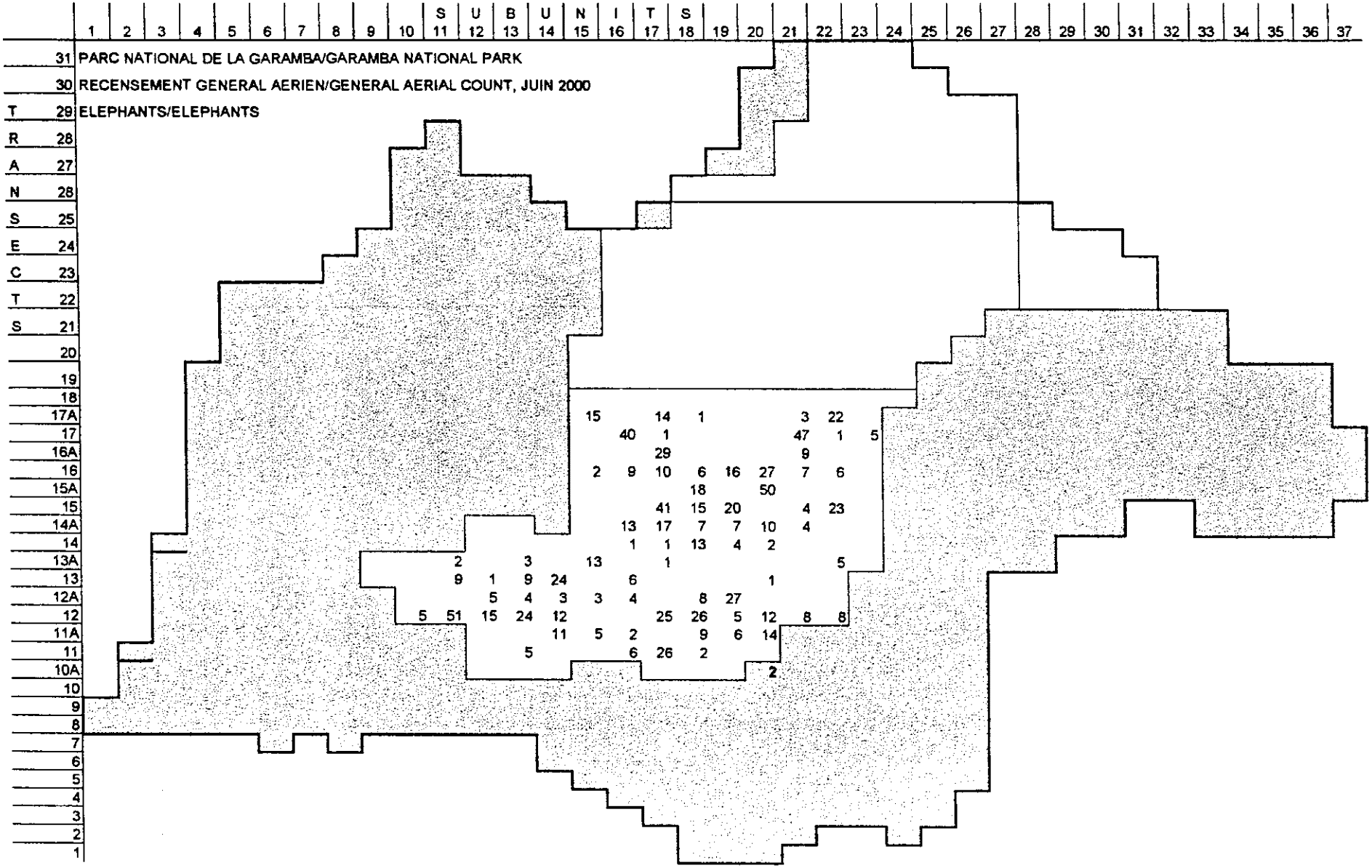
Low D																				3.15	2.93	6.44	8.58	17.8	17.4	15.2	11.5	12.6	11.3	8.87	8.72	5.64	0					
Med D																8.43	16.8	20	20.3	20.2	20	19.6	20.2	20.1	16.7	14.8	10.7											
High D											2.93	8.79	14.6	23	20.7	20	42.8	41.6	41.8	42.6	43.2	36.6	37	28.7	2.71	0											
Dom	0	0	0	0	0	0	0	0	5.86	2.79	0	5.43	0	0	26.6	8.72	0	0	0	0	0	3.08	9.08	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Total	0	0	0	0	0	0	0	0	5.86	5.72	8.79	20	23	20.7	46.6	60	58.4	61.8	66	66.3	66.1	74.3	66.7	40.2	31.9	26.3	23.3	11.3	8.87	8.72	5.64	0	0	0	0	0	0



	1	2	3	4	5	6	7	8	9	10	S 11	U 12	B 13	U 14	N 15	I 16	T 17	S 18	19	20	21	22	23	24	25	26	27	28	29	30	31	32	33	34	35	36	37
Low D																			390	360	400	350	365	355	374	352.5	390	345	363	357	345	0							
Med D																343	342	350	355.7	354	350	341	353	351	340	364	325											
High D									ERR	350	350	341	353	353	358	349	338	340	347.3	353	344	348	352	330	0												
Dom	ERR	ERR	ERR	****	ERR	ERR	ERR	ERR	360	ERR	ERR	ERR	ERR	ERR	360	357	0	ERR	0	ERR	360	373	ERR	ERR	ERR	ERR	ERR	ERR	ERR	ERR	ERR	ERR	ERR	ERR	ERR	ERR	ERR
Tota	ERR	ERR	ERR	****	ERR	ERR	ERR	ERR	ERR	ERR	ERR	ERR	ERR	ERR	358	350	227	ERR	273.3	ERR	368	353	ERR	ERR	ERR	ERR	ERR	ERR	ERR	ERR	ERR	ERR	ERR	ERR	ERR	ERR	ERR

	350	350	
	383	382.5	
	355	355	
	377	377.1	
	359	358.8	
	378	378	
354	350	352	
346	357	351.3	
	350	351	350.6
	351	350	350.4
	337		337.3
	351		350.9
	357		357
336			
366.7			
344.4			
356.7			
355.6			
344.4			
350			
349.1			
348.3			
352			
339.3			
353.8			
354.6			
358.7			
333.3			
334.4			
	367		Total
349			Total
348.5			Total
348.5	349	381	352.9 TOTA


PARC NATIONAL DE LA GARAMBA/GARAMBA NATIONAL PARK
RECENSEMENT GENERAL AERIEN/GENERAL AERIAL COUNT, MAI/MAY 2002
BUFFLES / BUFFALOES
COMPTAGE DIRECT


PARC NATIONAL DE LA GARAMBA/GARAMBA NATIONAL PARK
RECENSEMENT GENERAL AERIEN/GENERAL AERIAL COUNT, JUIN 2000
ELEPHANTS/ELEPHANTS
TRANSECT
SUBNIT
1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22 23 24 25 26 27 28 29 30 31 32 33 34 35 36 37
31 30 29 28 27 26 25 24 23 22 21 20 19 18 17A 17 16A 16 15A 15 14A 14 13A 13 12A 12 11A 11 10A 10 9 8 7 6 5 4 3 2 1
15 14 1 3 22
40 1 47 1 5
29 9
2 9 10 6 16 27 7 6
18 50
41 15 20 4 23
13 17 7 7 10 4
1 1 13 4 2
2 3 13 1 5
9 1 9 24 6 1
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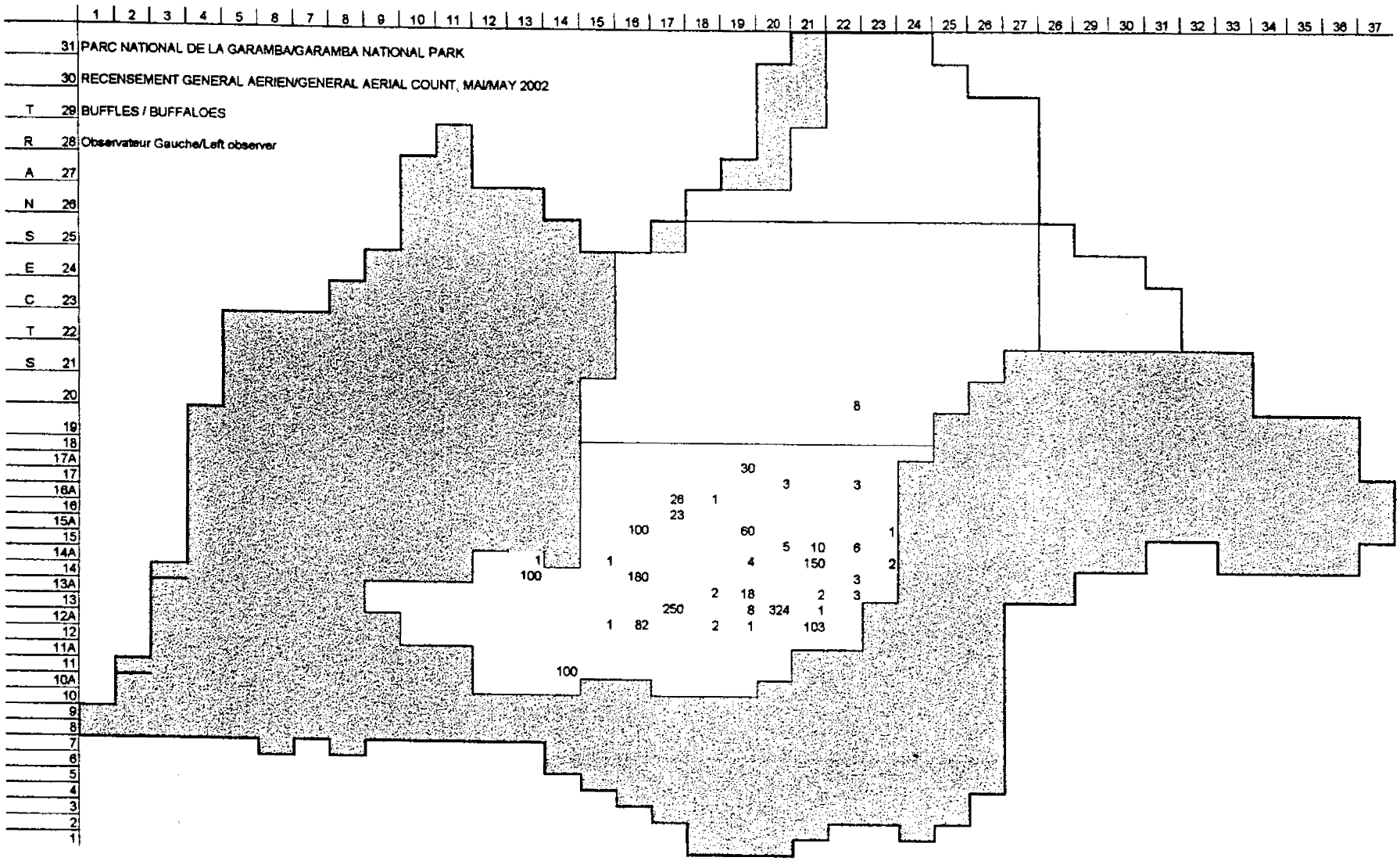
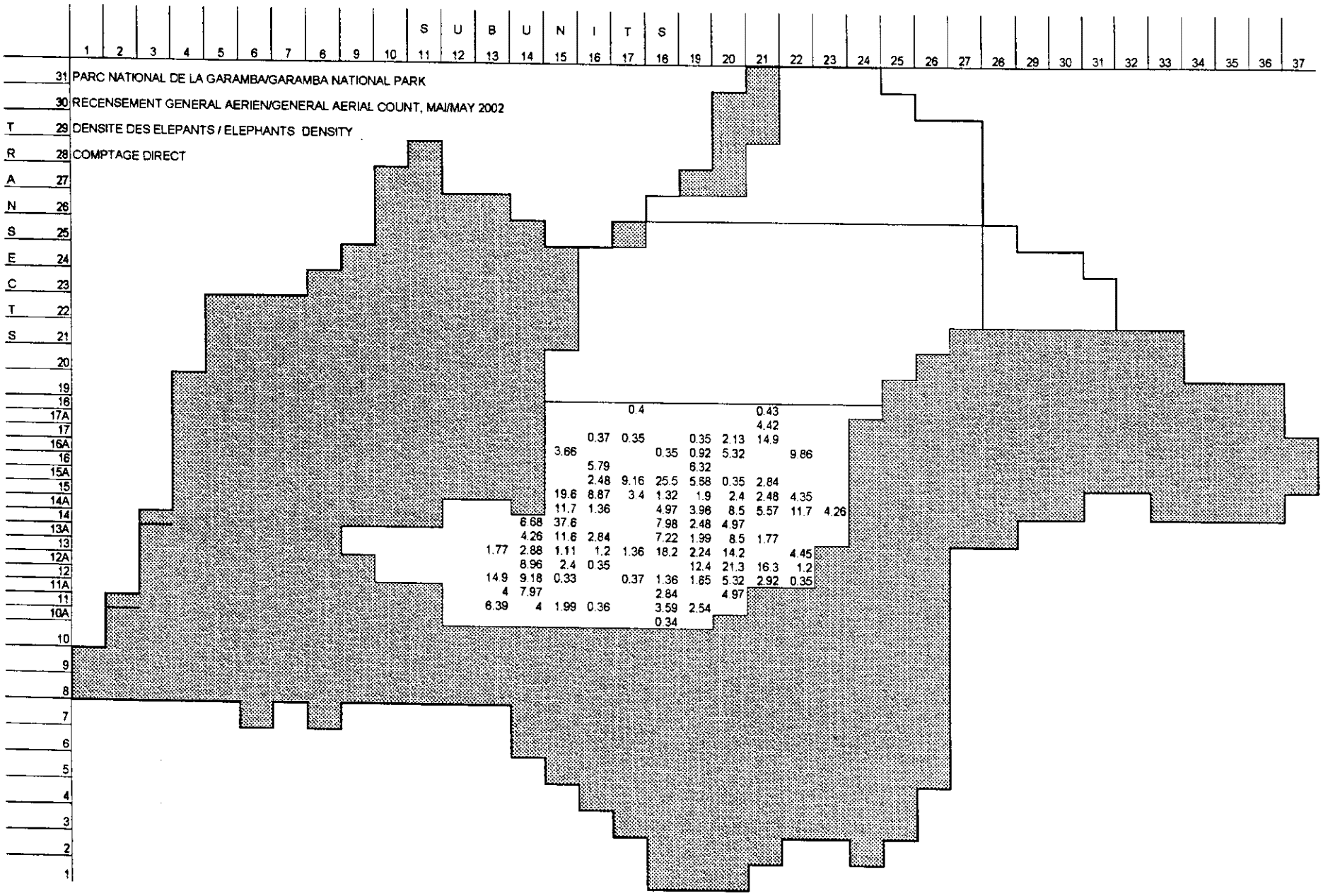
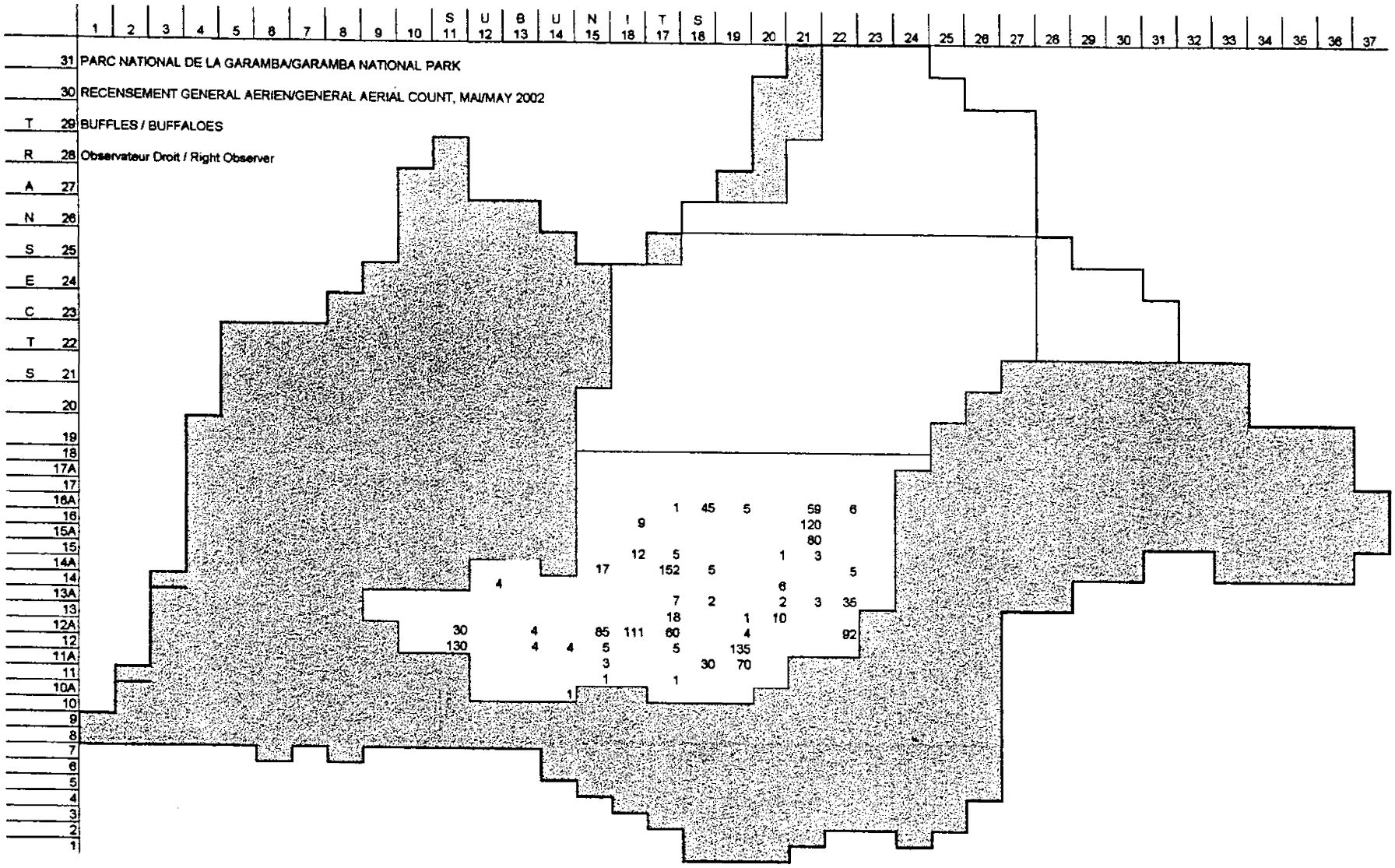
11 5 2 9 6 14
5 6 26 2
2


PARC NATIONAL DE LA GARAMBA/GARAMBA NATIONAL PARK
RECENSEMENT GENERAL AERIEN/GENERAL AERIAL COUNT, MAI/MAY 2002
BUFFLES / BUFFALOES
Observateur Gauche/Left observer
TRANSECTS
Low D
Med D
High D
Dom
Total


PARC NATIONAL DE LA GARAMBA/GARAMBA NATIONAL PARK
RECENSEMENT GENERAL AERIEN/GENERAL AERIAL COUNT, MAI/MAY 2002
DENSITE DES ELEPANTS / ELEPHANTS DENSITY
COMPTAGE DIRECT

Low D																			0	0	0	0	0	0	0	0	0	0	0	0	0	0					
Med D																0	0	0	0	0	0	0	0	0	0	0	0										
High D										0	0	0	27.1	43.9	55	23.6	15.1	73.3	42.5	78	51.7	31.9	4.26	0	0												
Dom	0	0	0	0	0	0	0	0	0	0	0	0	0	0	23.3	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Total	0	0	0	0	0	0	0	0	0	0	0	0	27.1	43.9	78.3	23.6	15.1	73.3	42.5	76	51.7	31.9	4.26	0	0	0	0	0	0	0	0	0	0	0	0	0	0

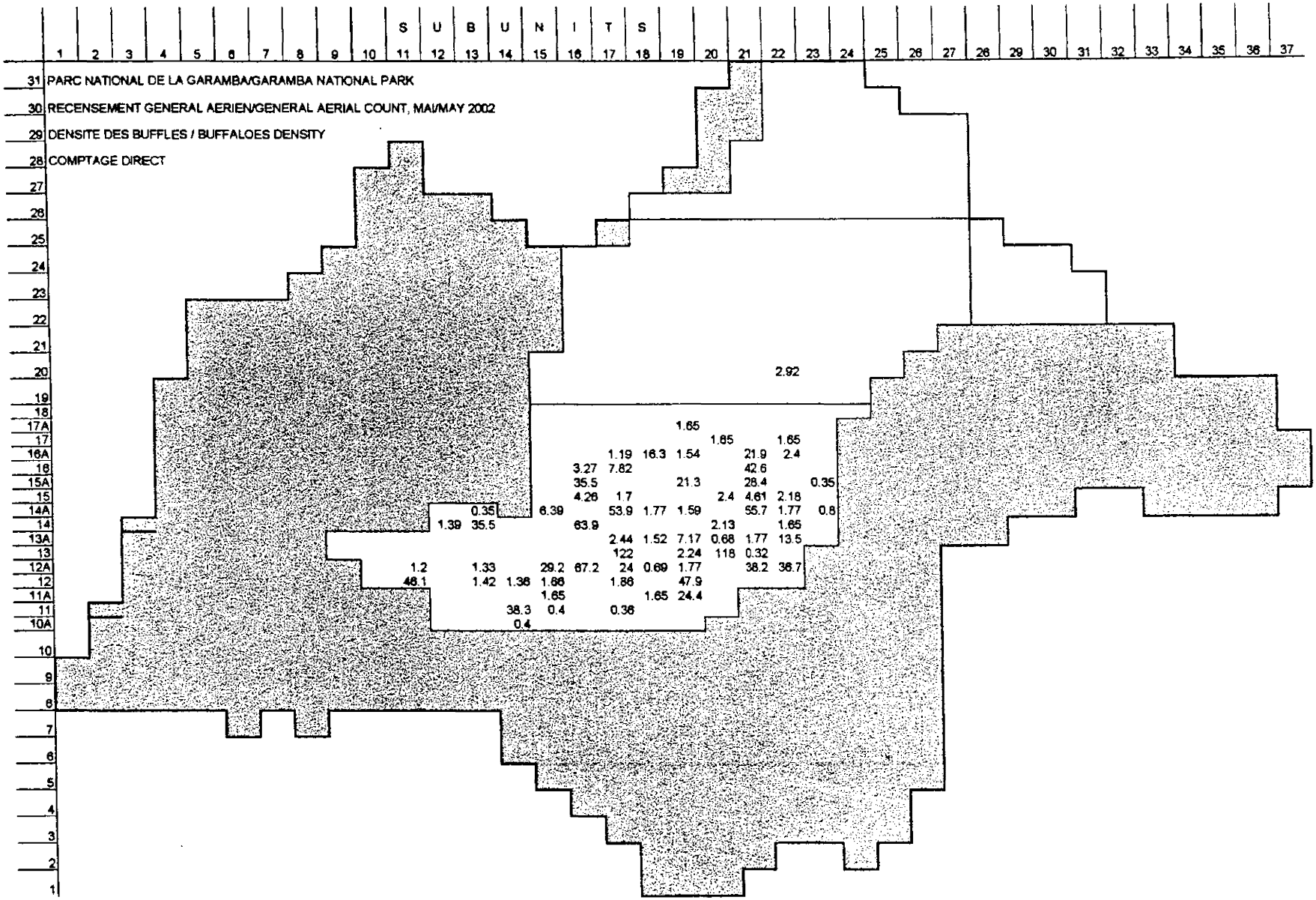

PARC NATIONAL DE LA GARAMBA/GARAMBA NATIONAL PARK
RECENSEMENT GENERAL AERIEN/GENERAL AERIAL COUNT, MAI/MAY 2002
BUFFLES / BUFFALOES
Observateur Droit / Right Observer
Low D
Med D
High D
Dom
Total

PARC NATIONAL DE LA GARAMBA/GARAMBA NATIONAL PARK

RECENSEMENT GENERAL AERIEN/GENERAL AERIAL COUNT, MAI/MAY 2002

DENSITE DES BUFFLES / BUFFALOES DENSITY

COMPTAGE DIRECT



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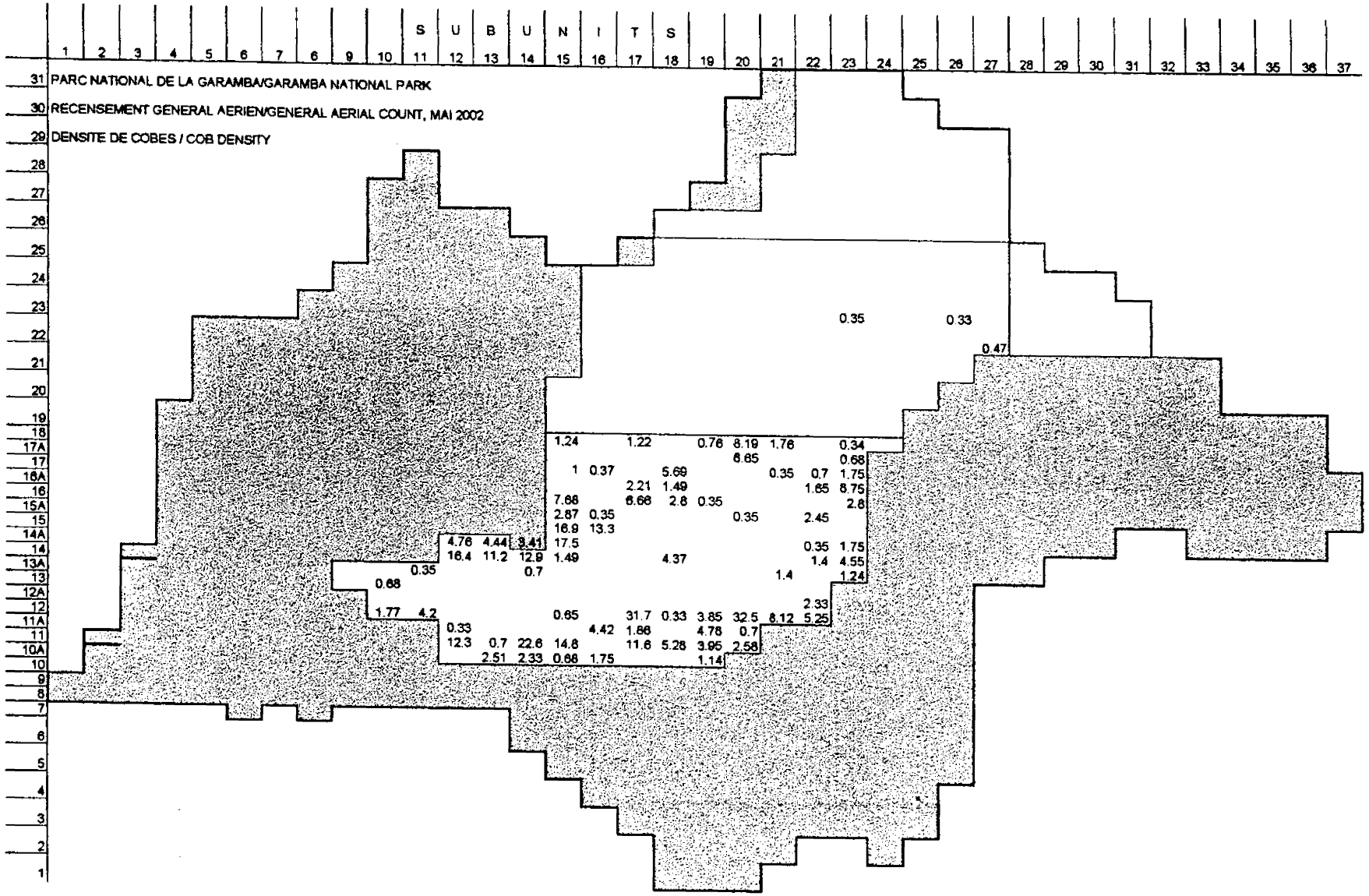
27			0	ERR	
26			0	ERR	
25		0	0	ERR	
24		0	0	ERR	
23		0	0	ERR	
22		0	0	ERR	
21		0		ERR	
20		2.92		2.92	
19		0		ERR	
18	0			ERR	
17A	1.65			1.65	
17	3.29			1.65	
16A	43.3			8.87	
16	53.7			17.9	
15A	65.5			21.4	
15	15.1			3.03	
14A	122			15.3	
14	105			20.9	
13A	27.1			4.51	
13	240			60.1	
12A	200			22.3	
12	100			18.7	
11A	27.7			9.22	
11	37			12.3	
10A	0.4			0.4	
	0	0	0	ERR	Total Nord
	2.92	2.92	0	ERR	Total Centr
	1062	0	0	ERR	Total Sud
	1062	2.92	0	ERR	TOTAL

	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31	32	33	34	35	36	37
Low D																			0	0	0	0	0	0	0	0	0	0	0	0	0	0					
Med D																0	0	0	0	0	0	2.92	0	0	0	0	0										
High D										0	47.3	1.39	38.6	37.6	32.9	174	215	22	110	123	193	59.8	1.14	0	0												
Dom	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Total	0	0	0	0	0	0	0	0	0	0	47.3	1.39	38.6	37.6	32.9	174	215	22	110	123	193	62.7	1.14	0	0	0	0	0	0	0	0	0	0	0	0	0	0



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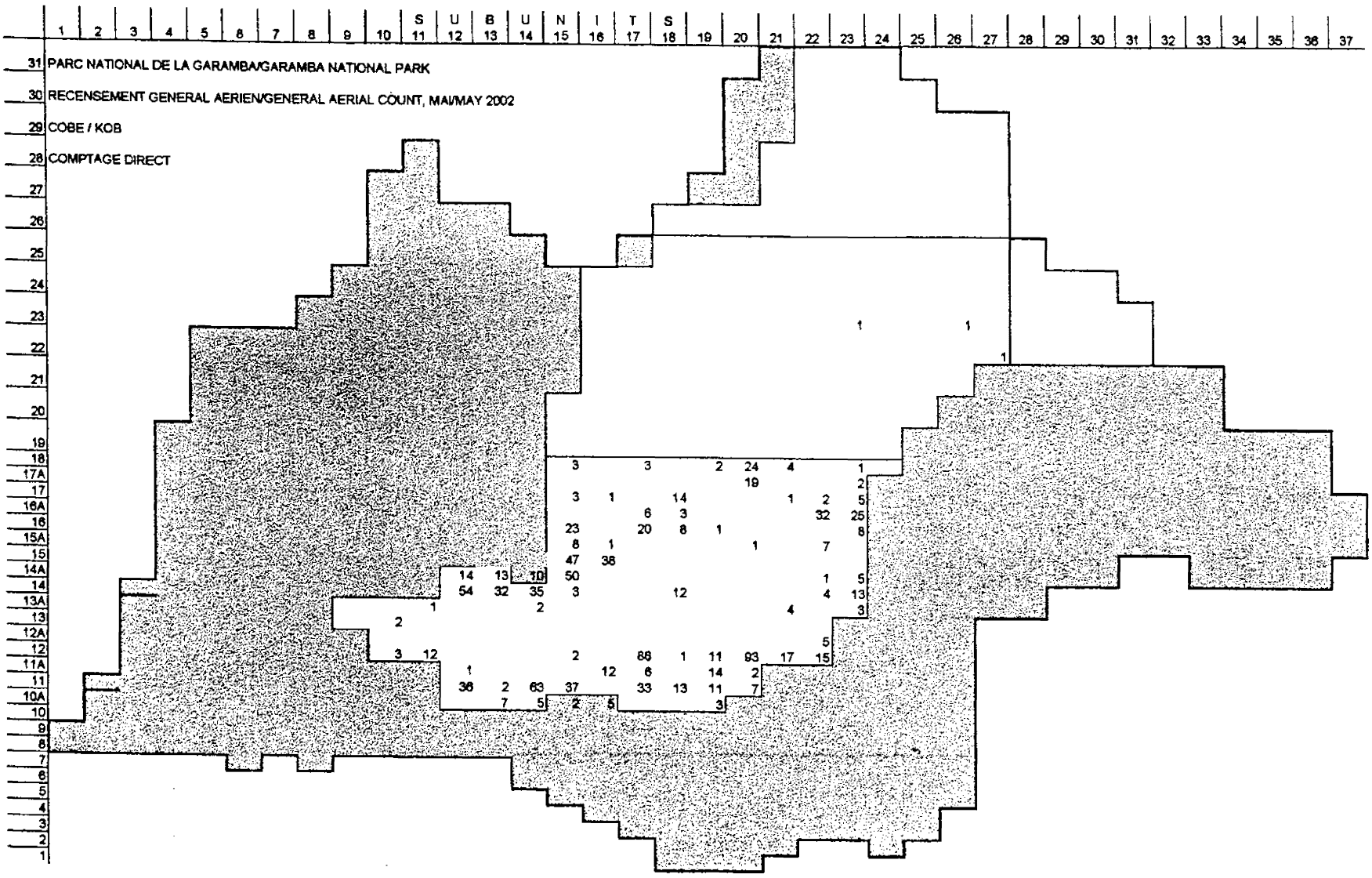
Low D																				0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Med D																				0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
High D										0.68	4.2	18.4	16.3	36.2	17	16.4	55.5	20	13.7	51	9.62	14.1	21.6	0	0	0.33	0.47										
Dom	0	0	0	0	0	0	0	0	0	1.77	0	12.3	0	0	29.6	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Total	0	0	0	0	0	0	0	0	0	2.45	4.2	30.7	16.3	36.2	46.6	18.4	55.5	20	13.7	51	9.62	14.1	22.2	0	0	0.33	0.47	0	0	0	0	0	0	0	0	0

0	0	0	
13.5		13.5	
7.33		7.33	
9.86		9.86	
14.1		14.1	
20.3		20.3	
6.02		6.02	
30.2		30.2	
32.2		32.2	
54.3		54.3	
3.66		3.66	
0.68		0.68	
2.33		2.33	
86.4		86.4	
12.1		12.1	
74.1		74.1	
6.41		6.41	
0	0	0	Total Nord
1.15	1.15	0	1.15 Total Cent
375	0	0	375 Total Sud
375	1.15	0	377 TOTAL



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Low D																				0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Med D																				0	0	0	0	1	0	0	1	1									
High D									0	5	5	39	102	169	142	0	0	0	0	0	0	0	0	0	0	0											
Dom	0	0	0	0	0	0	0	0	0	0	0	0	0	0	2	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
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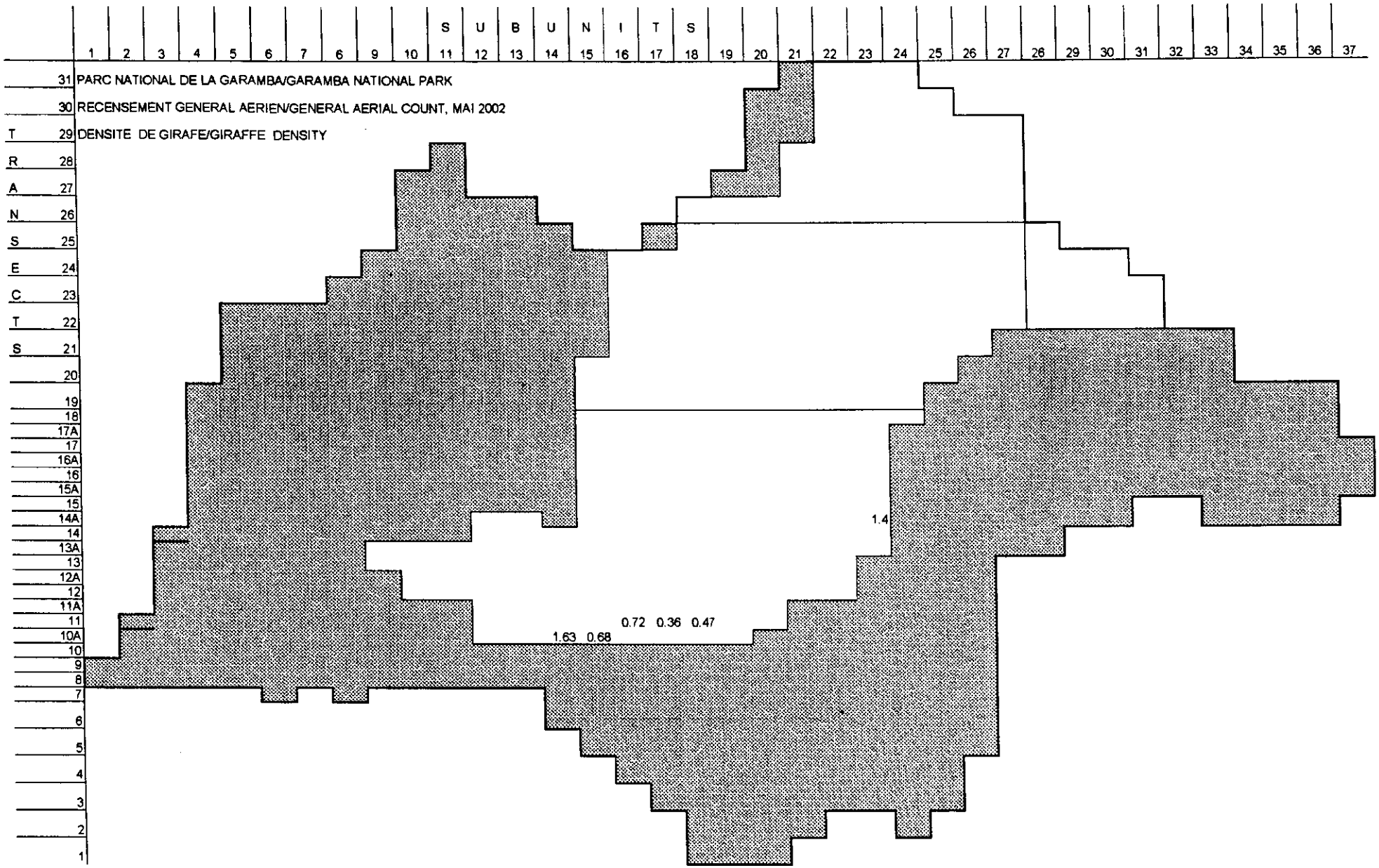
0	0			
0	0	0		
0	0	0		
2	0	2		
1	0	1		
0		0		
0		0		
0		0		
37				
21				
26				
66				
60				
17				
85				
83				
153				
10				
2				
5				
240				
35				
202				
22				
0		0		Total Ne
	3			Total Co
1064				Total Su
1064	3	0	1067	TOTAL



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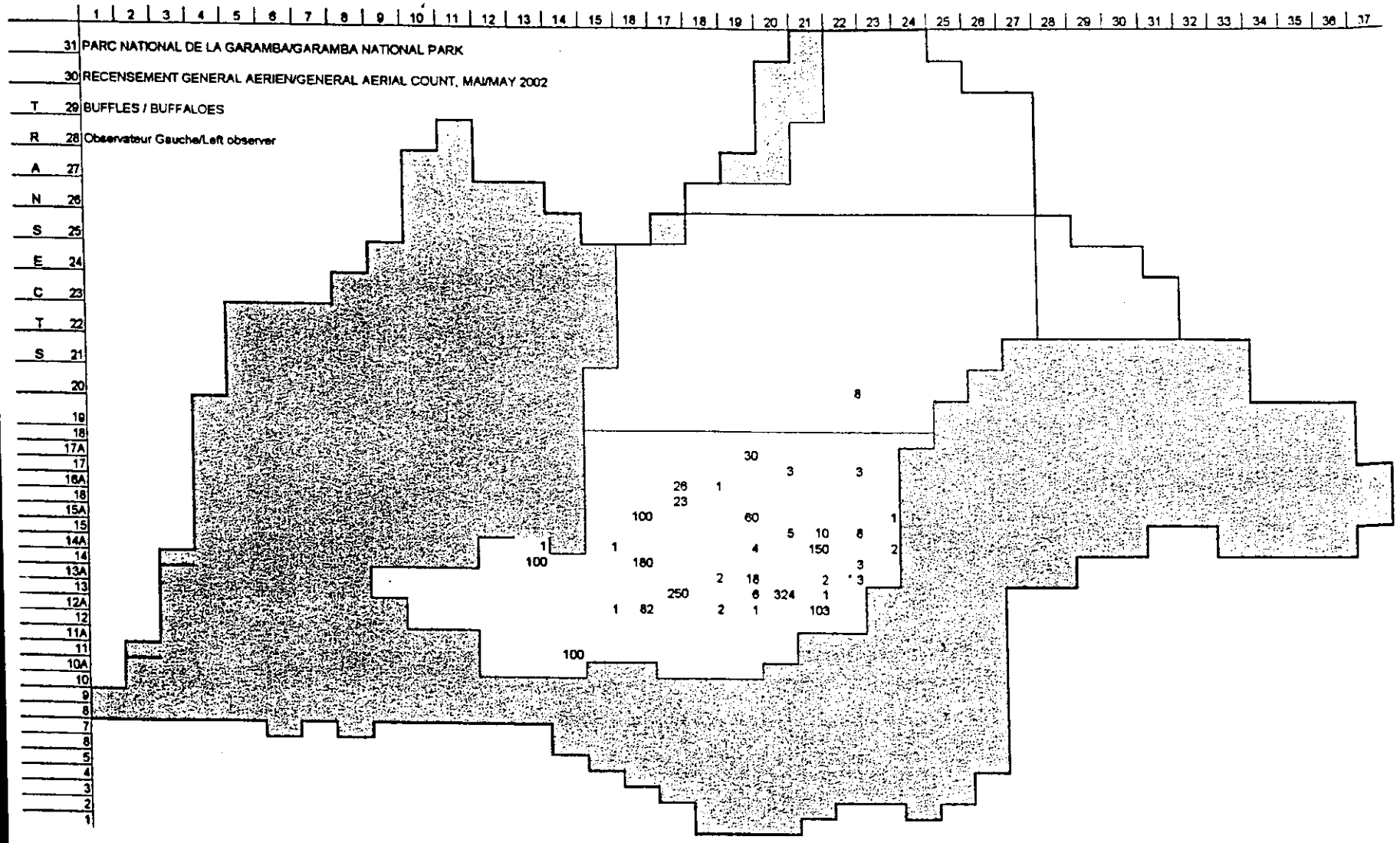
Low D																				0	0	0	0	0	0	0	0	0	0	0	0	0	0				
Med D																	0	0	0	0	0	0	0	0	0	0	0	0									
High D											0	0	0	0	0	0	0.72	0.36	0.47	0	0	0	0	1.4	0	0											
Dom	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Total	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.72	0.36	0.47	0	0	0	0	1.4	0	0	0	0	0	0	0	0	0	0	0	0	0



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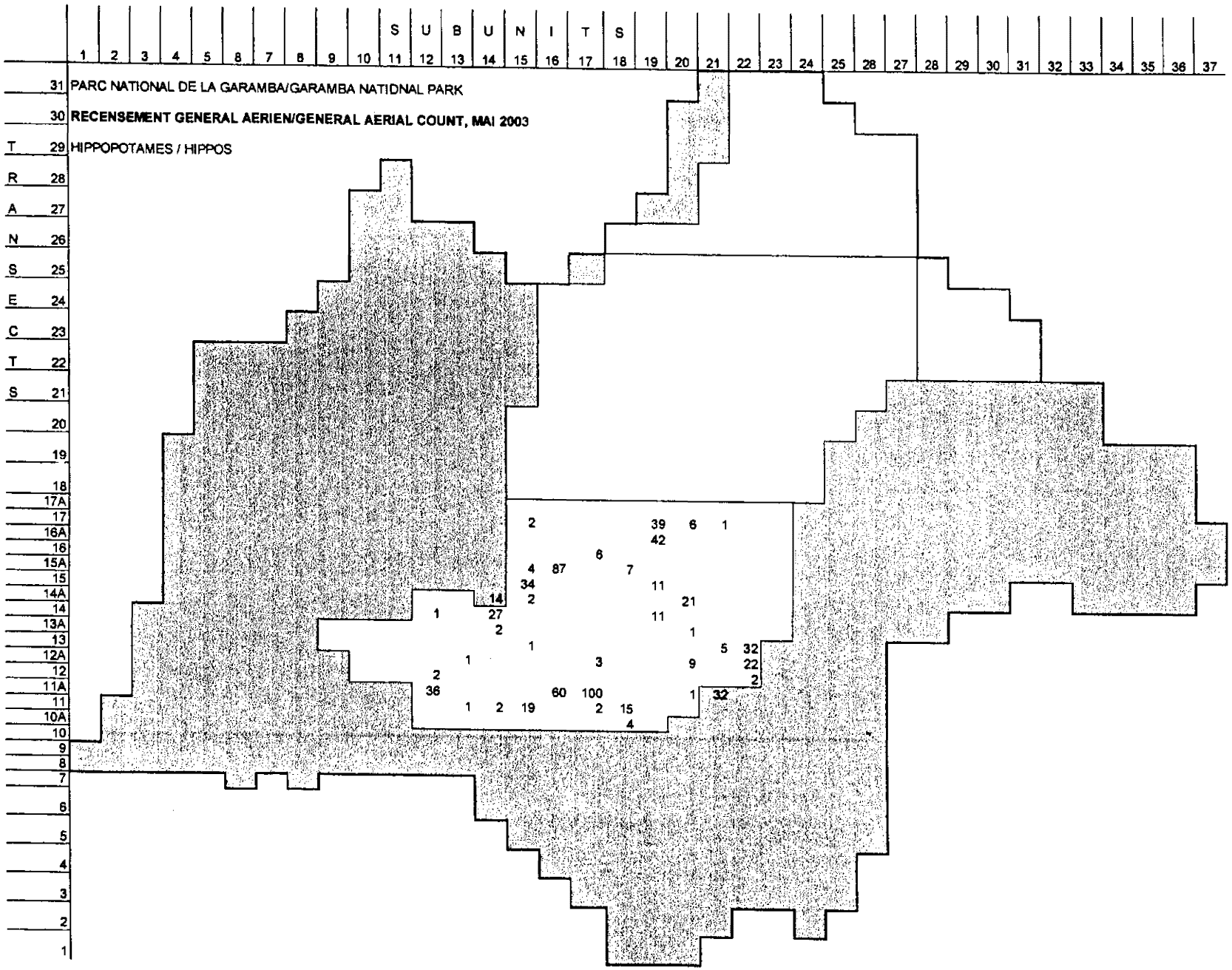
Low D																				0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Med D																	0	0	0	0	0	0	8	0	0	0	0	0									
High D										0	0	0	29	324	201	101	362	299	5	119	332	266	15	3	0	0											
Dom	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Total	0	0	0	0	0	0	0	0	0	0	0	0	29	324	201	101	362	299	5	119	332	266	23	3	0	0	0	0	0	0	0	0	0	0	0	0	0

31			0 0
30			0 0
T 29			0 0
R 28			0 0
A 27			0 0
N 26			0 0
S 25			0 0 0
E 24			0 0 0
C 23			0 0 0
T 22			0 0 0
S 21			0 0
20			6 8
19			0 0
18			0
17A			30
17			6
16A			27
16			23
15A			181
15			21
14A			158
14			283
13A			25
13			581
12A			189
12			0
11A			0
11			100
10A			0
10			0 0 Tota
9			8 Tota
8			1604 Tota
7			1604 6 0 1812 TOT
6			
5			
4			
3			
2			
1			



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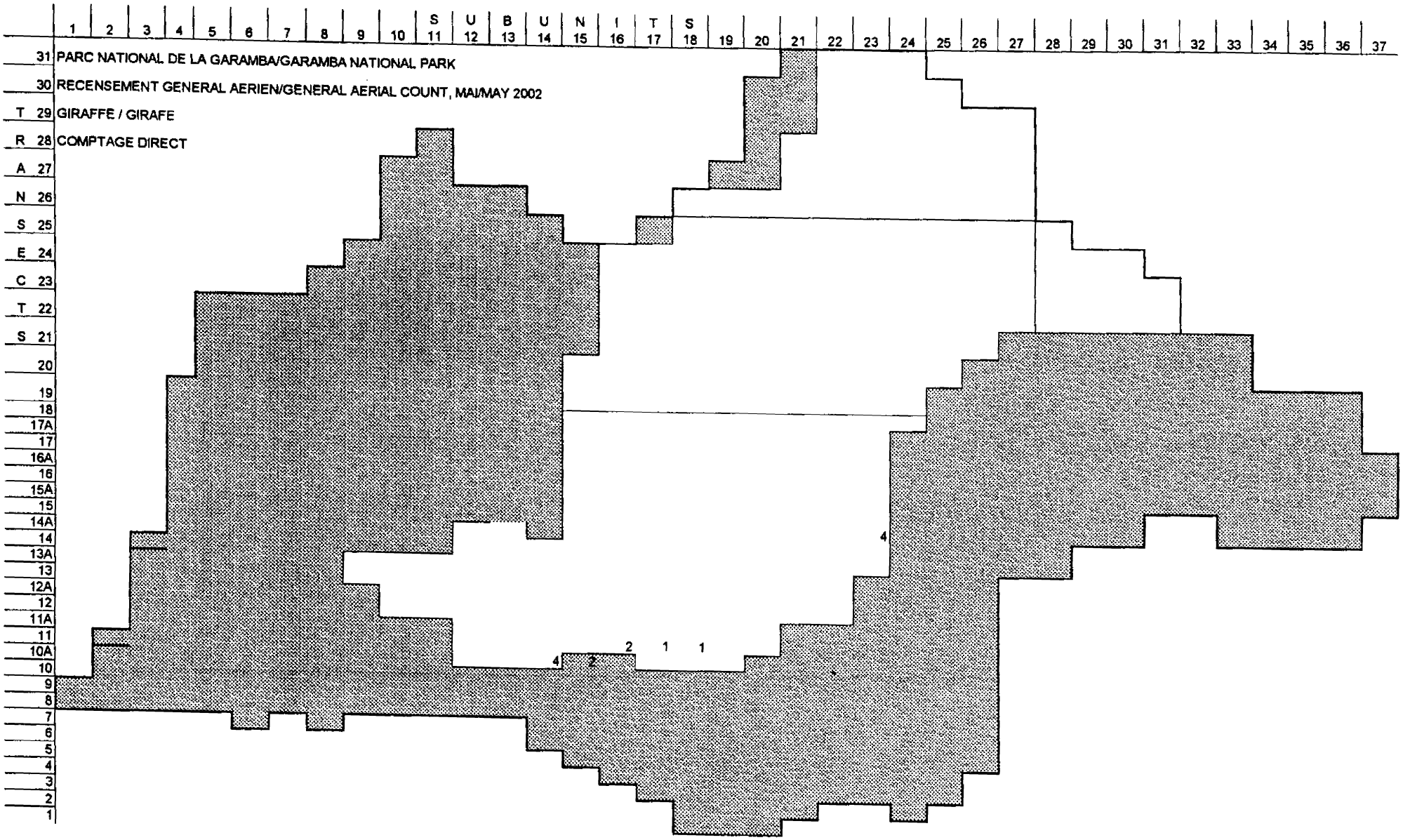
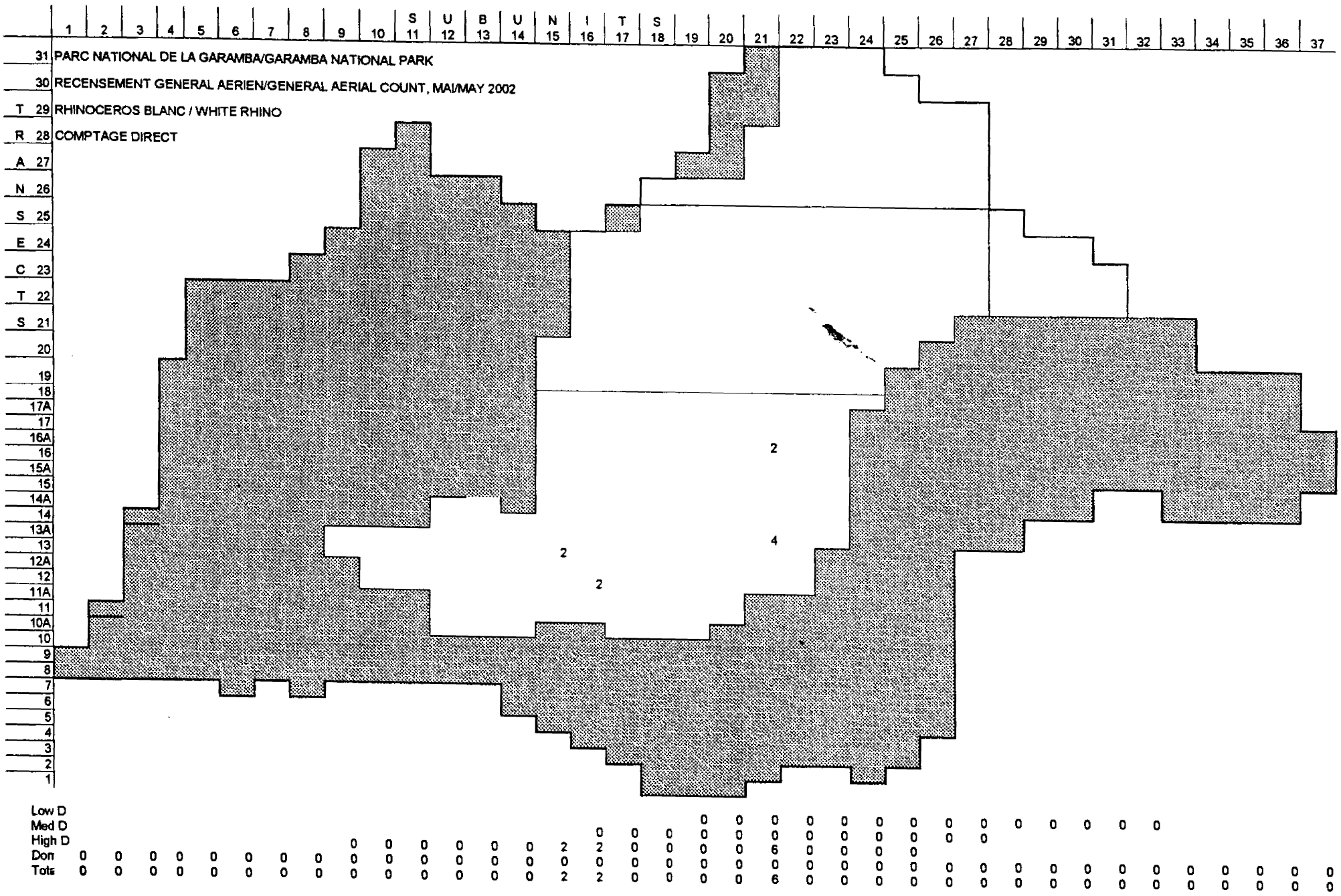
0	0	0		
0	0	0		
0		0		
0		0		
0		0		
0		0		
48		48		
42		42		
6		8		
98		98		
45		45		
37		37		
39		39		
3		3		
38		38		
35		35		
4		4		
197		197		
39		39		
4		4		
0	0	0	0	Total Nord
0	0	0	0	Total Centre
635	0	0	635	Total Sud
635	0	0	635	TDTAL

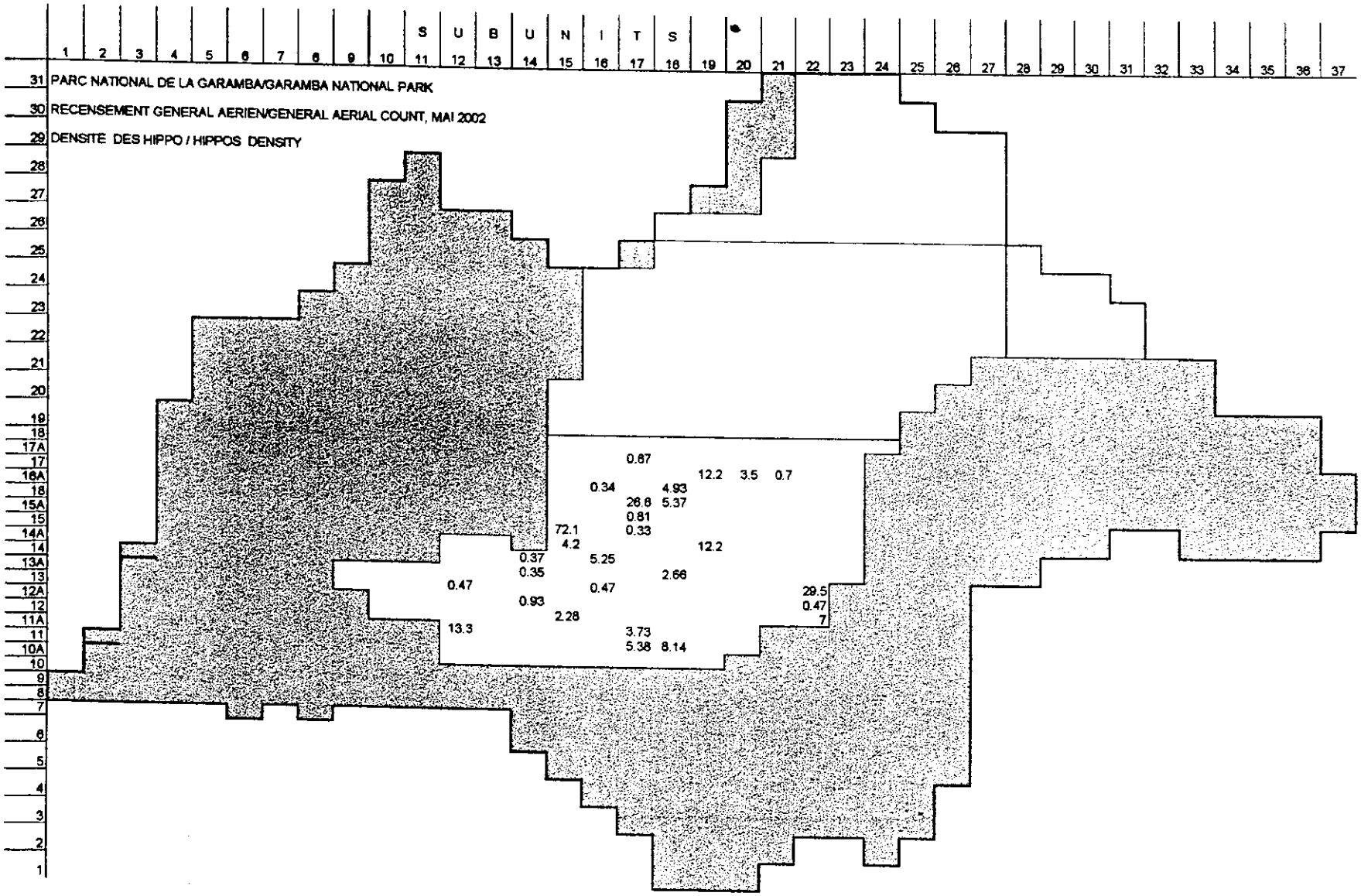

PARC NATIONAL DE LA GARAMBA/GARAMBA NATIONAL PARK
RECENSEMENT GENERAL AERIEN/GENERAL AERIAL COUNT, MAI/MAY 2002
GIRAFFE / GIRAFE
COMPTAGE DIRECT
Low D
Med D
High D
Don
Tots


PARC NATIONAL DE LA GARAMBA/GARAMBA NATIONAL PARK
RECENSEMENT GENERAL AERIEN/GENERAL AERIAL COUNT, MAI/MAY 2002
RHINOCEROS BLANC / WHITE RHINO
COMPTAGE DIRECT
2
4
2
2
Low D
Med D
High D
Don
Tots

PARC NATIONAL DE LA GARAMBA/GARAMBA NATIONAL PARK

RECENSEMENT GENERAL AERIEN/GENERAL AERIAL COUNT, MAI 2002

DENSITE DES HIPPO / HIPPOS DENSITY



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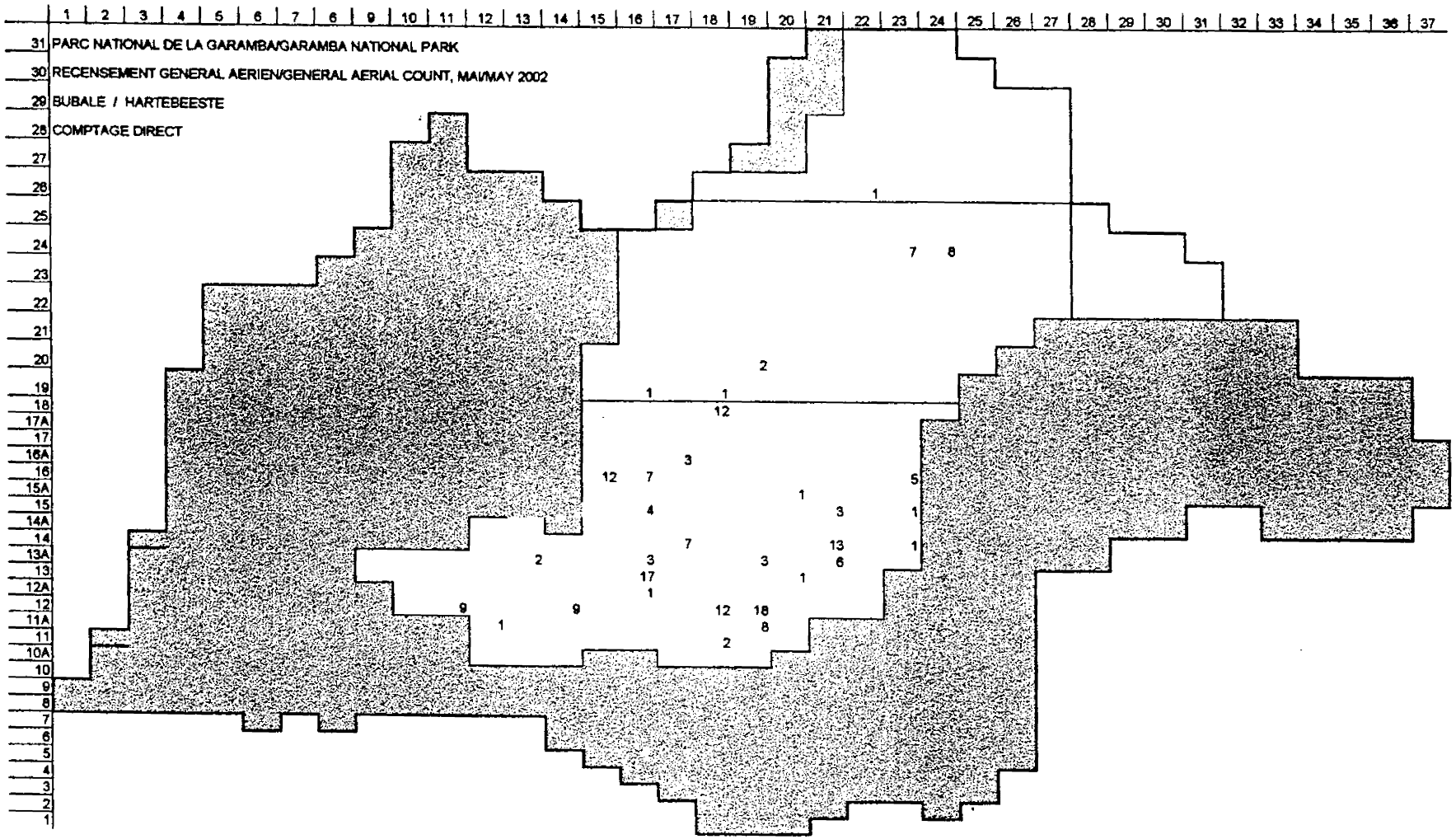
	0		0	
	0		0	
0			0	
0.67			0.87	
16.4			16.4	
5.27			5.27	
32			32	
0.61			0.61	
72.5			72.5	
16.4			16.4	
5.62			5.62	
3.01			3.01	
30.4			30.4	
1.4			1.4	
9.27			9.27	
17.1			17.1	
13.5			13.5	
0			0	
0	0	0	0	Total Nord
0	0	0	0	Total Centr
224	0	0	224	Total Sud
224	0	0	224	TOTAL

Low D																			0	0	0	0	0	0	0	0	0	0	0	0	0	0					
Med D																0	0	0	0	0	0	0	0	0	0	0	0										
High D										0	0	0.47	0	1.65	2.28	8.05	37.6	21.1	24.4	3.5	0.7	38.9	0	0	0												
Dom	0	0	0	0	0	0	0	0	0	0	0	0	0	0	72.1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Total	0	0	0	0	0	0	0	0	0	0	0	0.47	0	1.65	74.4	8.05	37.6	21.1	24.4	3.5	0.7	36.9	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0



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Low D																				0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	
Med D																1	0	1	2	0	0	0	0	7	6	0	0	0									
High D									0	0	0	29	1	11	9	32	10	26	29	2	24	0	7	0	0												
Dom	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Total	0	0	0	0	0	0	0	0	0	0	0	29	1	11	9	33	10	27	31	2	24	1	14	8	0	0	0	0	0	0	0	0	0	0	0	0	0

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1	1		
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15	0	15	
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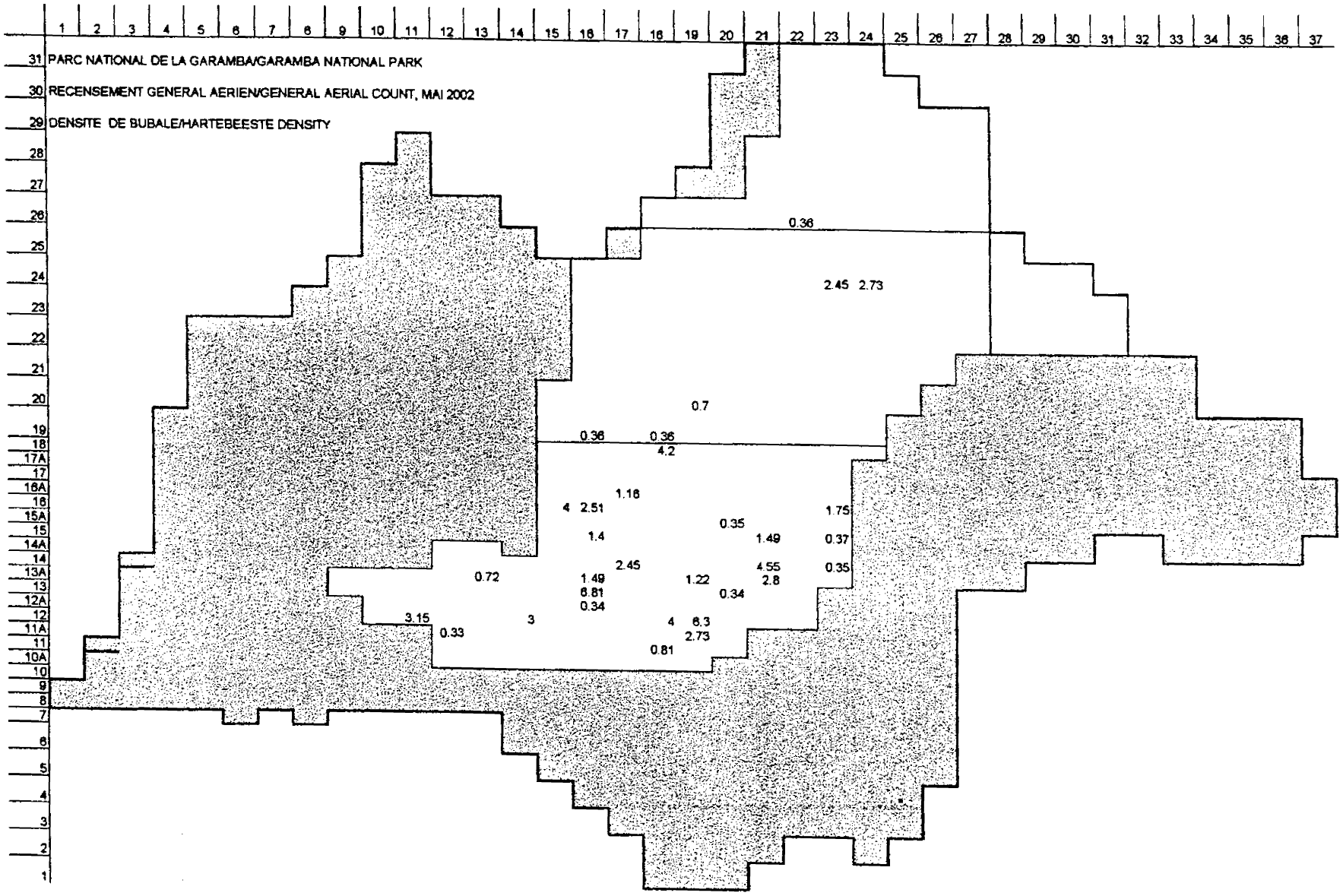
0		0	
2		2	
2		2	
12			
0			
0			
3			
24			
1			
8			
0			
21			
16			
18			
1			
48			
9			
2			
0			
0	1		Total N
	19		Total C
163			Total S
163	19	1	183 TOTAL

PARC NATIONAL DE LA GARAMBA/GARAMBA NATIONAL PARK

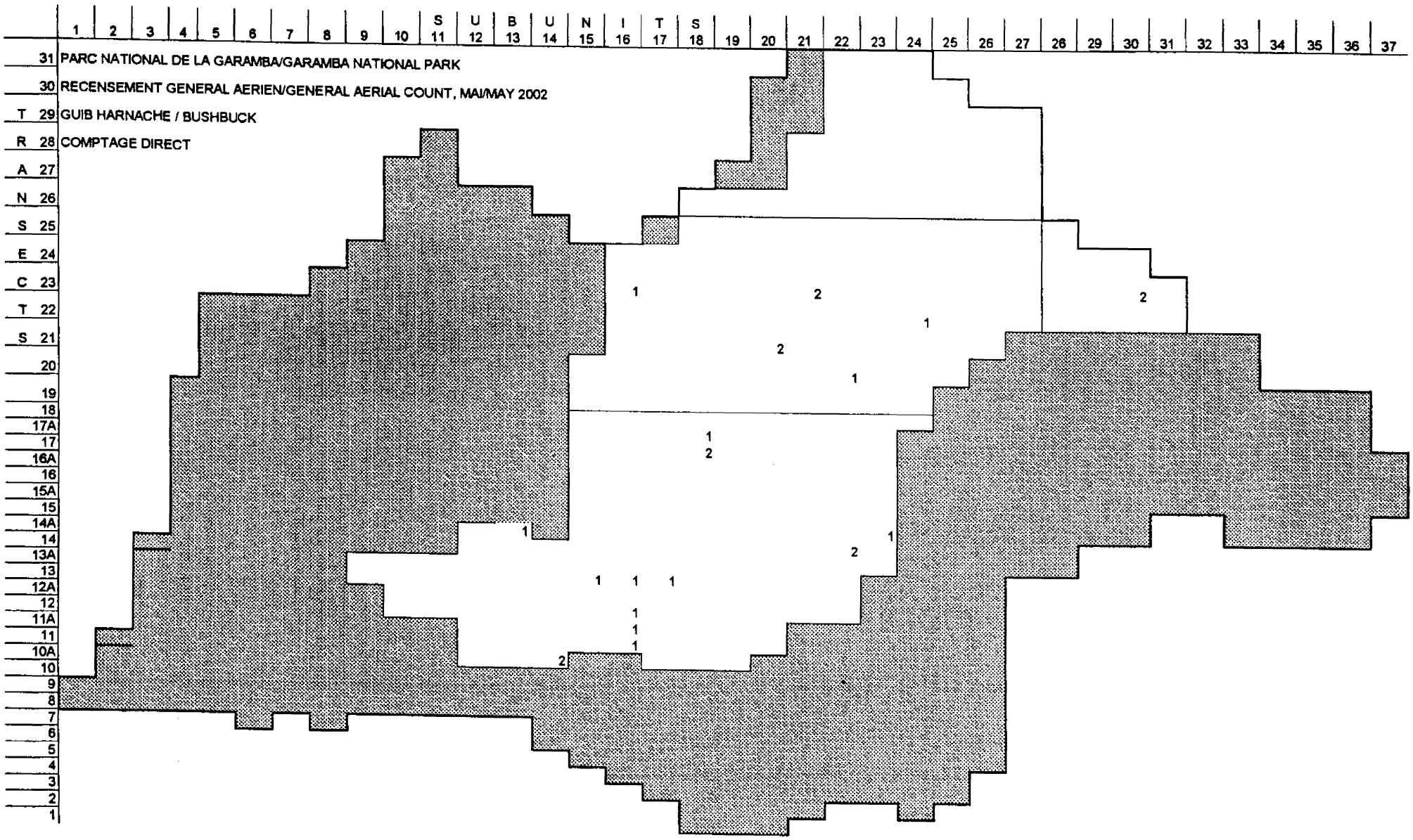
RECENSEMENT GENERAL AERIEN/GENERAL AERIAL COUNT, MAI 2002

DENSITE DE BUBALE/HARTEBEESTE DENSITY

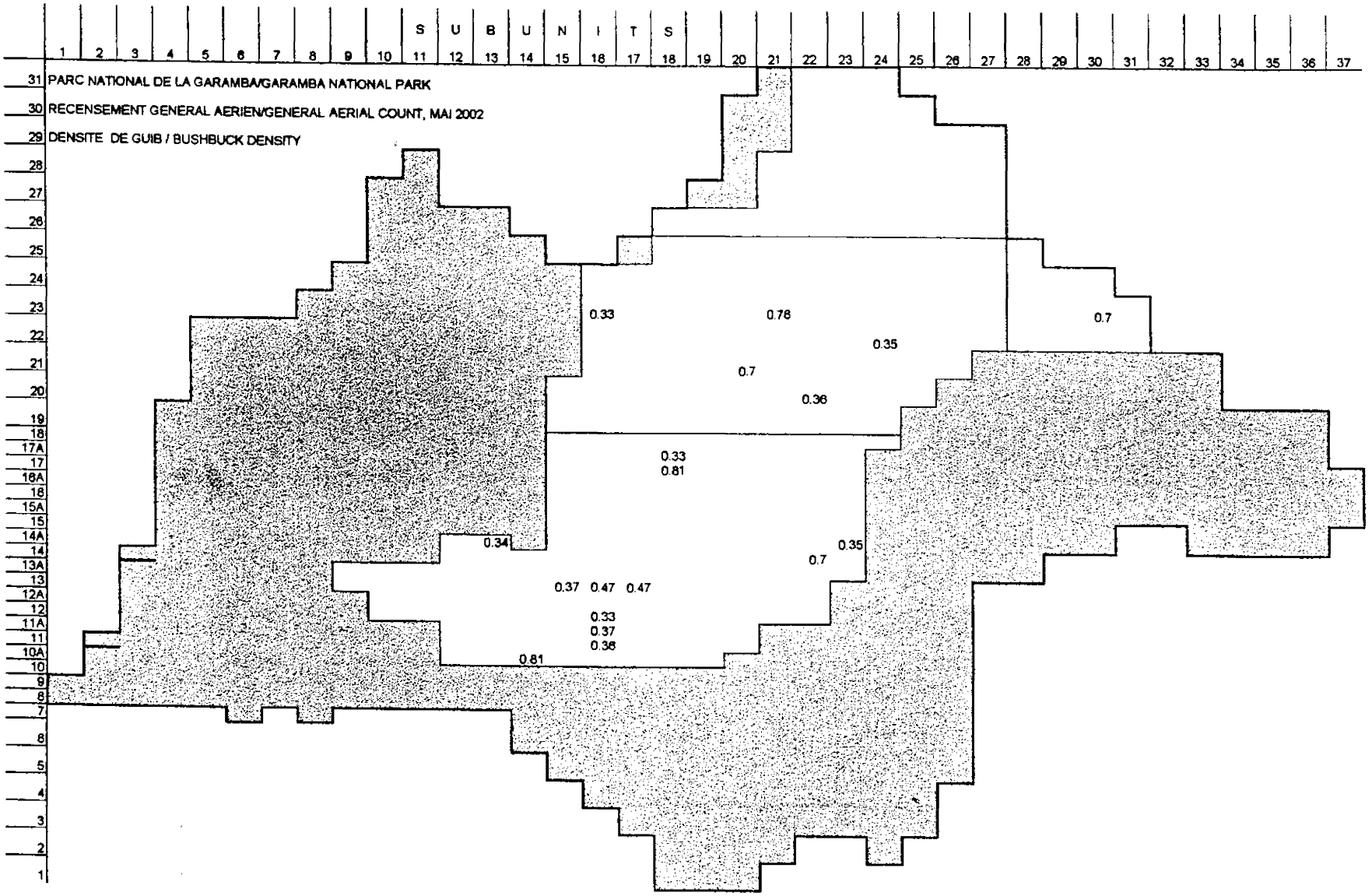


Low D																			0	0	0	0.36	0	0	0	0	0	0	0	0	0	0					
Med D																0.36	0	0.36	0.7	0	0	0	2.45	2.73	0	0	0										
High D										0	3.15	0	0.72	3	0	12.6	3.6	9.01	10.2	0.69	8.64	0	2.47	0	0												
Dom	0	0	0	0	0	0	0	0	0	0	0	0	0	0	4	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Total	0	0	0	0	0	0	0	0	0	0	3.15	0	0.72	3	4	12.9	3.6	9.37	10.9	0.69	8.64	0.36	4.92	2.73	0	0	0	0	0	0	0	0	0	0	0	0	0

		0	0	
		0	0	
		0	0	
		0	0	
		0	0	
		0.36	0.36	
	0	0	0	
	5.18	0	5.18	
	0	0	0	
	0	0	0	
	0		0	
	0.7		0.7	
	0.72		0.72	
4.2			4.2	
0			0	
0			0	
1.16			1.16	
8.26			8.26	
0.35			0.35	
3.26			3.26	
0			0	
7.35			7.35	
6.23			6.23	
7.15			7.15	
0.34			0.34	
16.4			16.4	
3.06			3.06	
0.61			0.61	
0			0	
0	0	0.36	0.36	Total Nord
6.6	6.6	0	6.6	Total Cen
58.6	0	0	58.6	Total Sud
58.6	6.6	0.36	65.6	TOTAL



	1	2	3	4	5	6	7	8	9	10	S 11	U 12	B 13	U 14	N 15	I 16	T 17	S 18	19	20	21	22	23	24	25	26	27	28	29	30	31	32	33	34	35	36	37
Low D																																					
Med D																																					
High D																																					
Dorr	0	0	0	0	0	0	0	0	0	0	0	0	0	3	1	4	1	3	0	0	0	2	1	0	0	0											
Tots	0	0	0	0	0	0	0	0	0	0	0	0	0	3	1	5	1	3	0	2	2	3	1	1	0	0	0	0	0	2	0	0	0	0	0	0	0



PARC NATIONAL DE LA GARAMBA/GARAMBA NATIONAL PARK

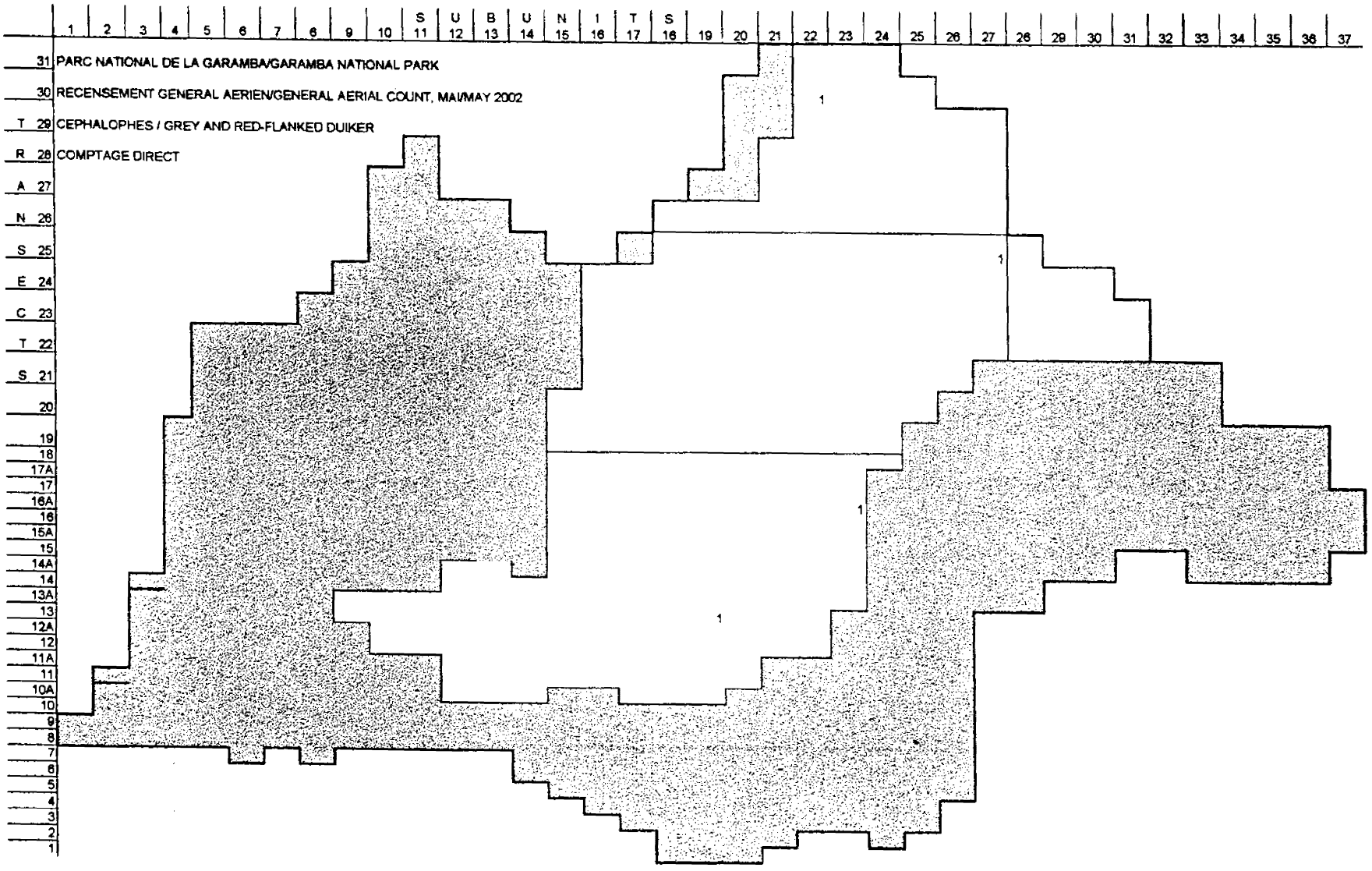
RECENSEMENT GENERAL AERIEN/GENERAL AERIAL COUNT, MAI 2002

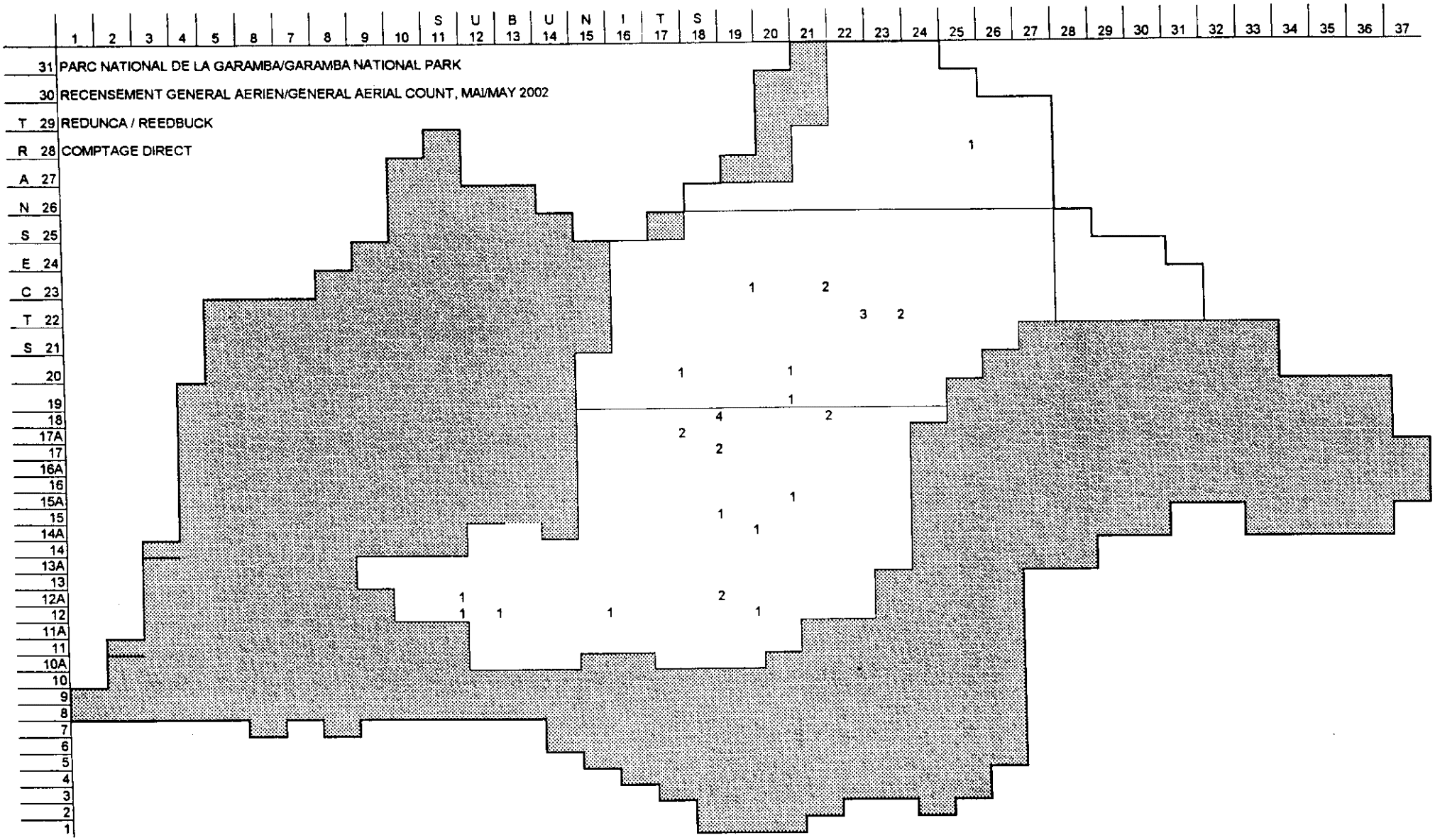
DENSITE DE GUIB / BUSHBUCK DENSITY

		0	0	
		0	0	
		0	0	
		0	0	
		0	0	
		0	0	
	0	0	0	
	0	0	0	
	1.09	0.7	1.79	
	0.35	0	0.35	
	0.7		0.7	
	0.36		0.36	
	0		0	
0			0	
0.33			0.33	
0.61			0.61	
0			0	
0			0	
0			0	
0			0	
0.69			0.69	
0.7			0.7	
0			0	
1.3			1.3	
0			0	
0.33			0.33	
0.37			0.37	
0.36			0.36	
0.81			0.81	
0	0	0	0	Total Nord
2.5	2.5	0.7	3.2	Total Cent
5.7	0	0	5.7	Total Sud
5.7	2.5	0.7	8.9	TOTAL

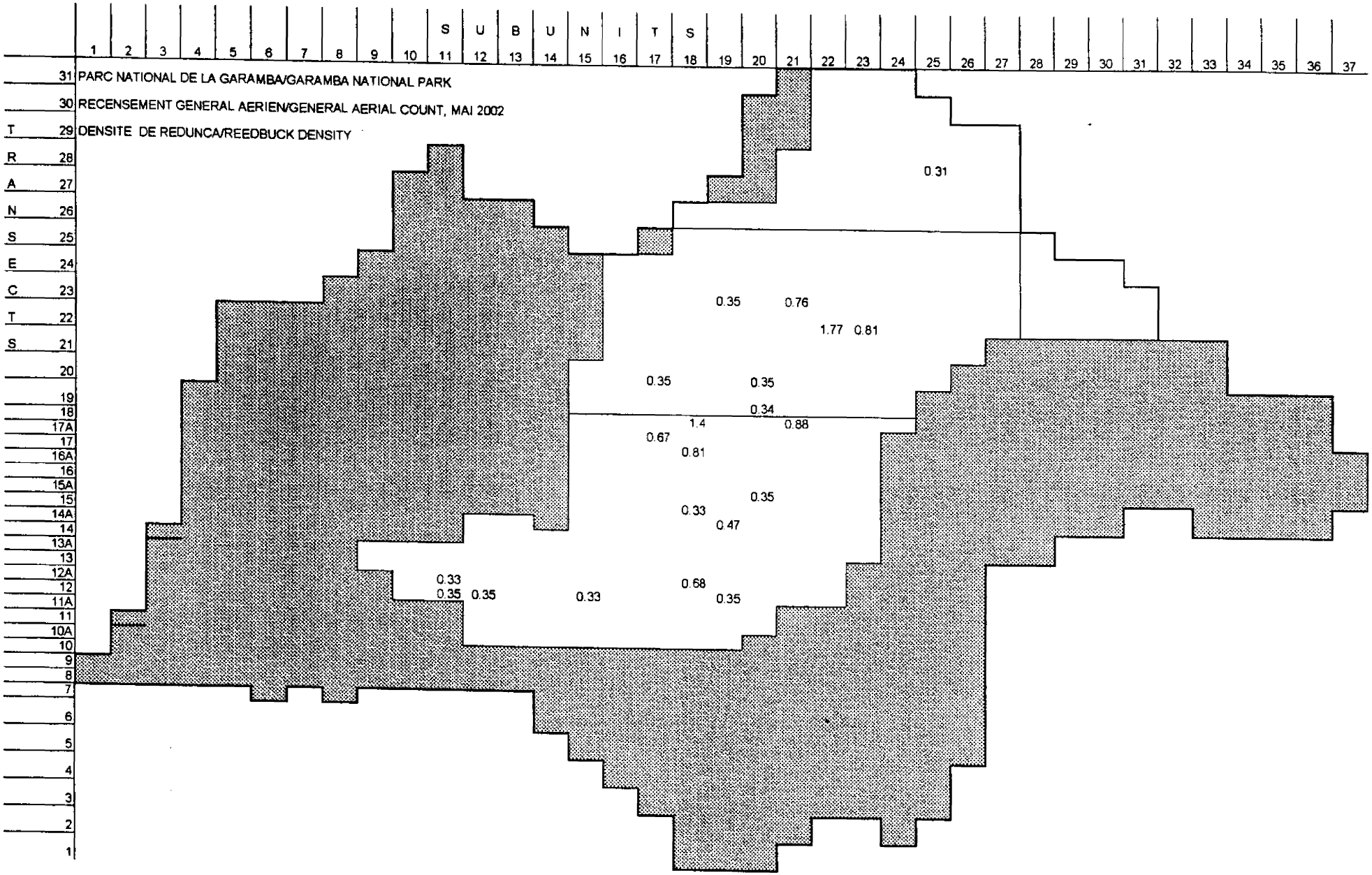
Low D																			0
Med D																0	0	0	0
High D										0	0	0	0.34	0	0.37	1.52	0.47	1.14	0
Dom	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.33	0	0	0
Total	0	0	0	0	0	0	0	0	0	0	0	0	0.34	0	0.37	1.85	0.47	1.14	0

Low D	0	0	0	0	0	0	0	0	0	0	0.7	0	0					
Med D	0.7	0.78	0.36	0	0.35	0	0	0										
High D	0	0	0.7	0.35	0	0												
Dom	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Total	0.7	0.78	1.06	0.35	0.35	0	0	0	0	0	0.7	0	0	0	0	0	0	0

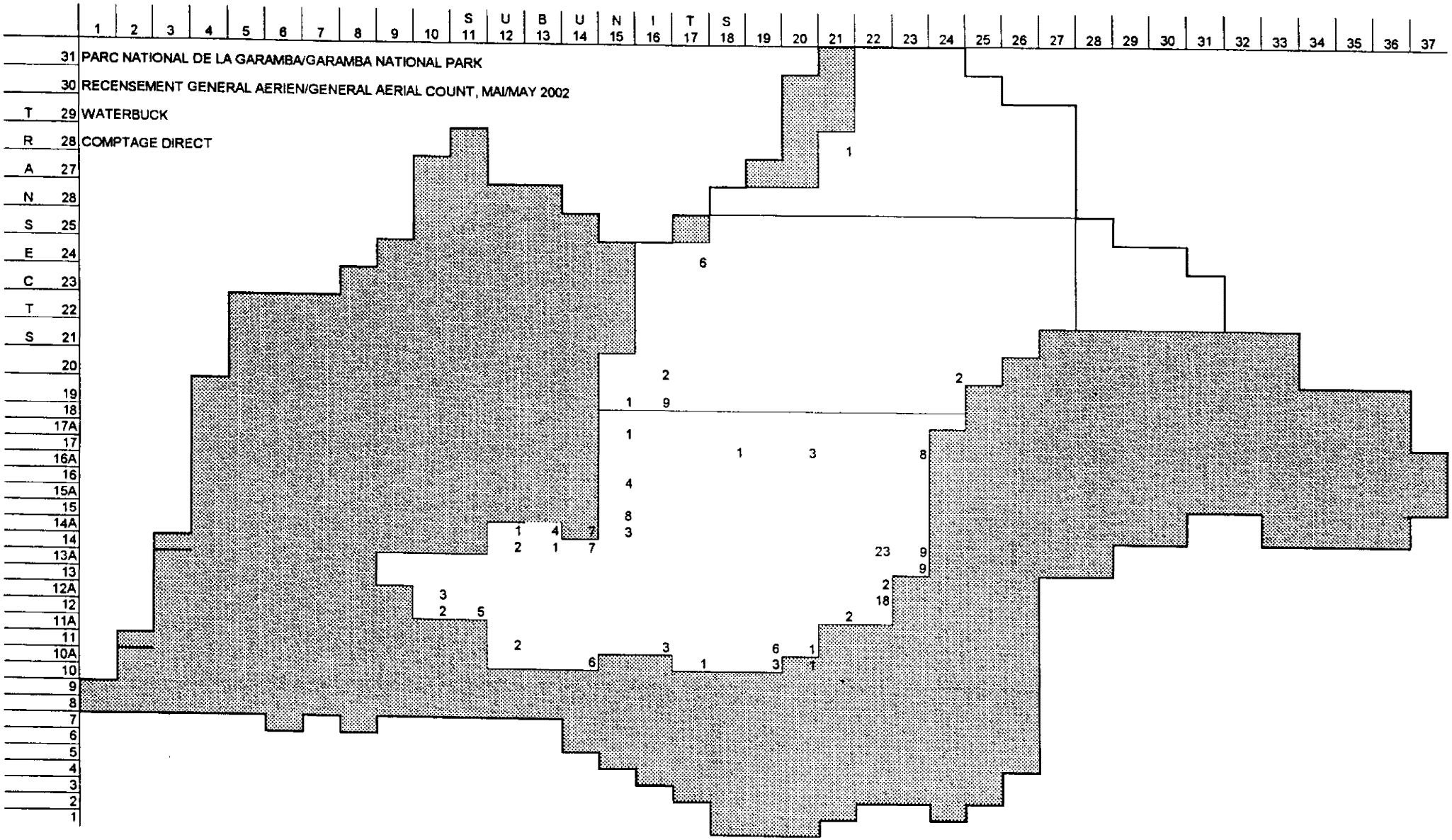

PARC NATIONAL DE LA GARAMBA/GARAMBA NATIONAL PARK
RECENSEMENT GENERAL AERIEN/GENERAL AERIAL COUNT, MAI/MAY 2002
CEPHALOPHES / GREY AND RED-FLANKED DUIKER
COMPTAGE DIRECT
Low D
Med D
High D
Dom
Tota

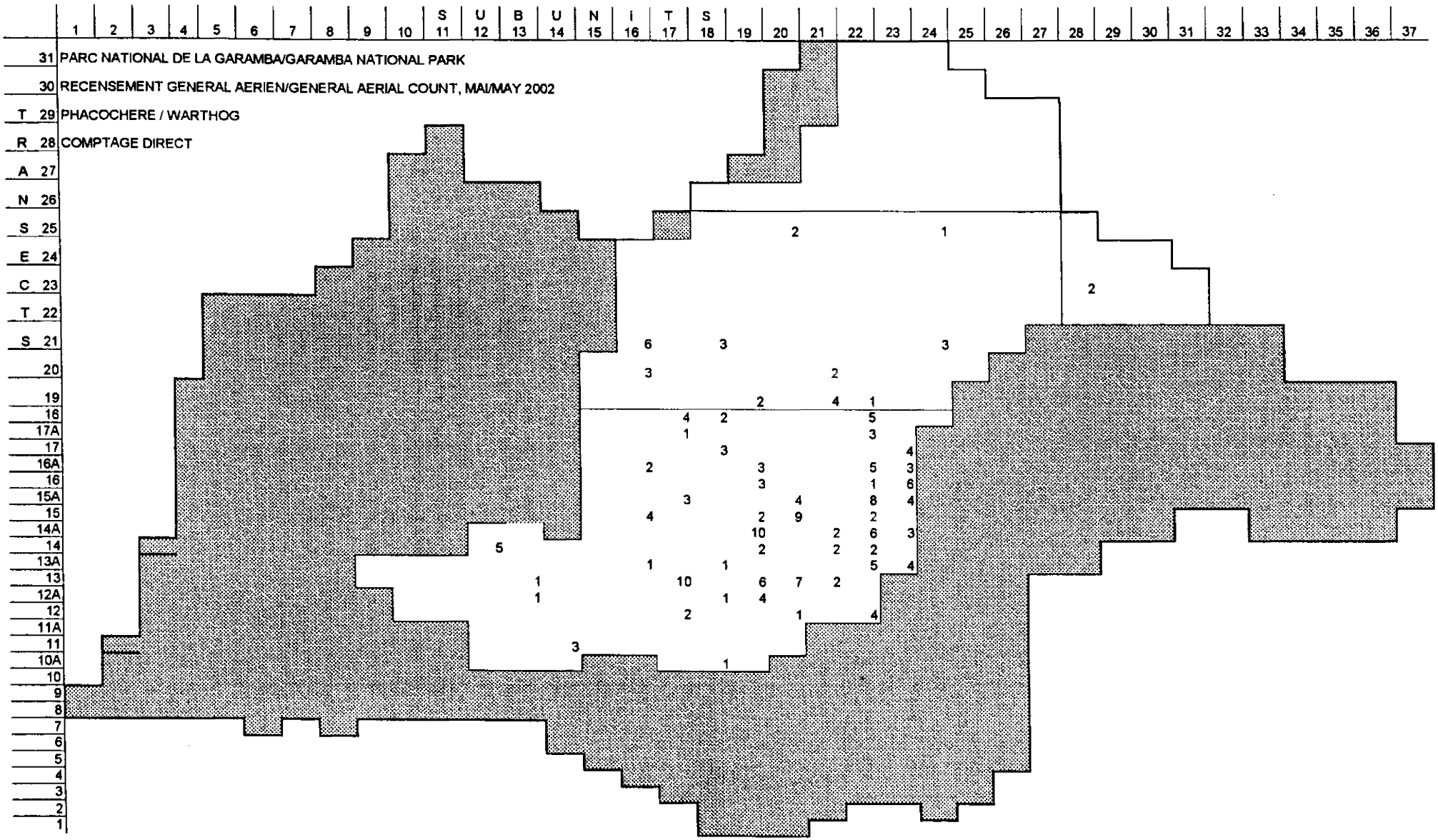


	1	2	3	4	5	8	7	8	9	10	S 11	U 12	B 13	U 14	N 15	I 16	T 17	S 18	19	20	21	22	23	24	25	26	27	28	29	30	31	32	33	34	35	36	37
Low D																				0	0	0	0	0	0	1	0	0	0	0	0	0	0						
Med D																	0	1	0	1	2	2	3	2	0	0	0	0										
High D									0	0	0	2	0	0	1	0	2	9	2	1	2	0	0	0	0													
Don	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Tots	0	0	0	0	0	0	0	0	0	0	0	2	0	0	1	0	3	9	3	3	4	3	2	0	1	0	0	0	0	0	0	0	0	0	0	0	0

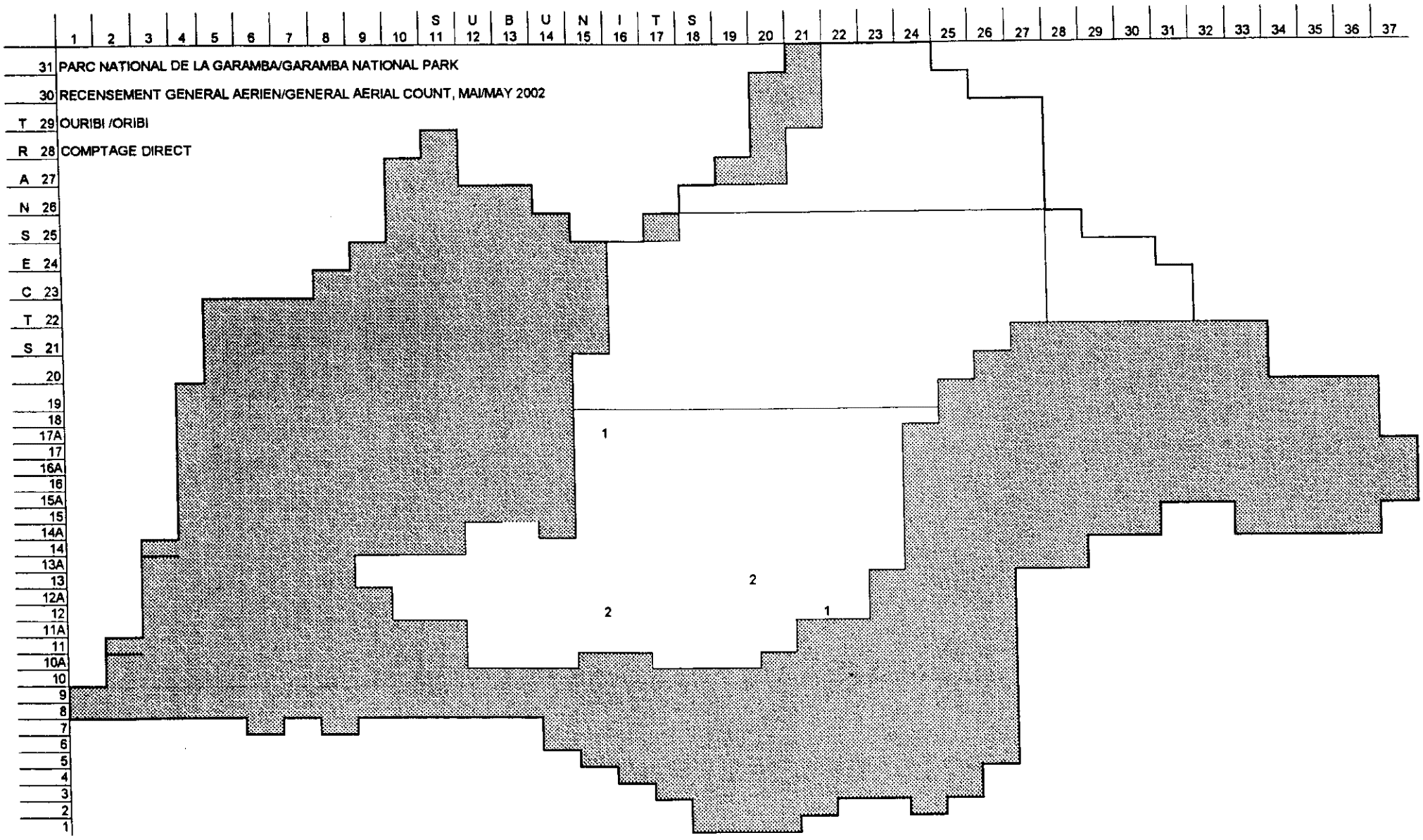


	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31	32	33	34	35	36	37
Low D																					0	0	0	0	0	0	0.31	0	0	0	0	0	0						
Med D																			0	0.35	0	0.35	0.69	0.76	1.77	0.81	0	0	0	0									
High D										0	0.68	0.35	0	0	0.33	0	0.67	3.22	0.82	0.35	0.88	0	0	0	0													
Dom	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Total	0	0	0	0	0	0	0	0	0	0	0	0.68	0.35	0	0	0.33	0	1.02	3.22	1.17	1.04	1.64	1.77	0.81	0	0.31	0	0	0	0	0	0	0	0	0	0	0

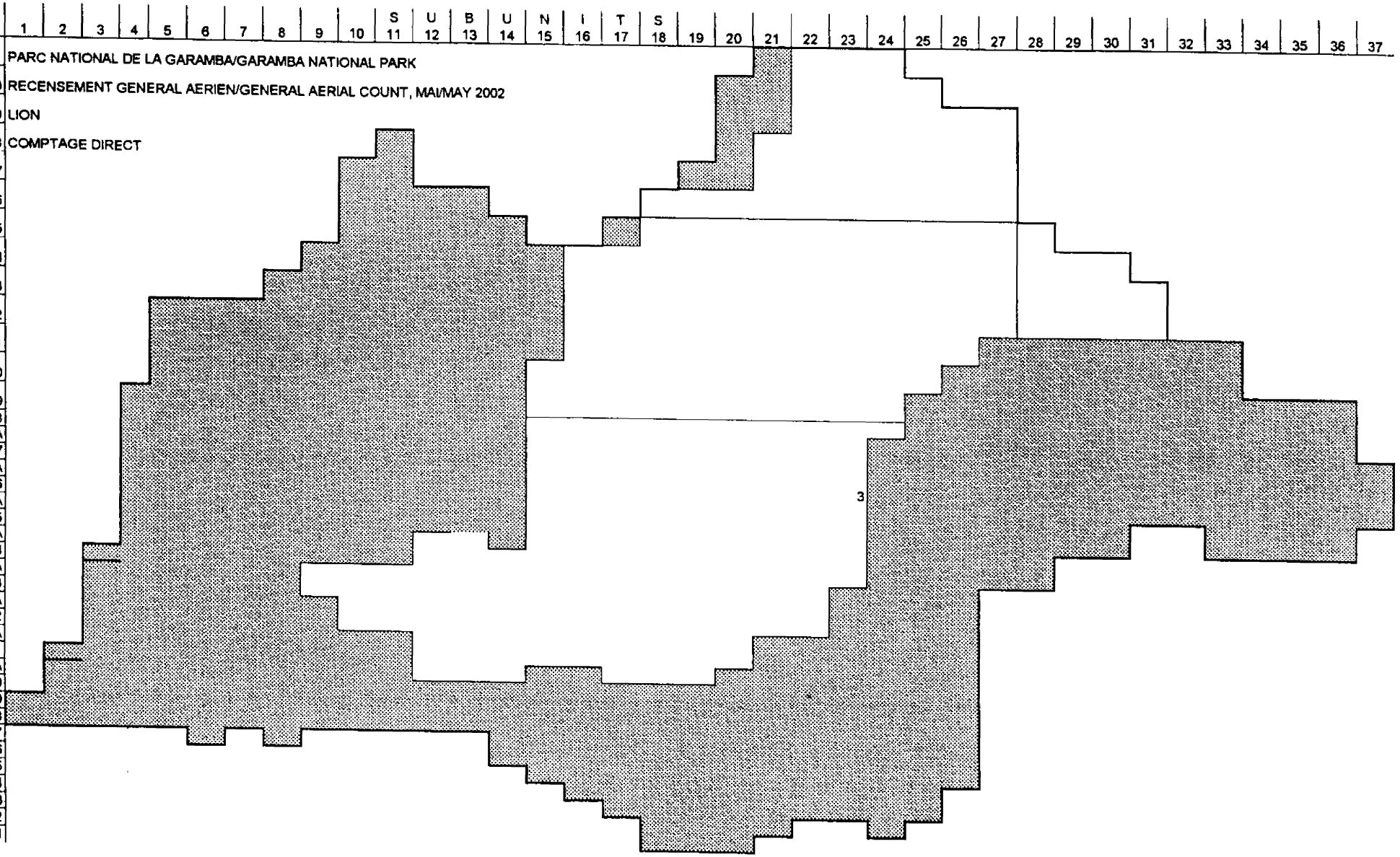

PARC NATIONAL DE LA GARAMBA/GARAMBA NATIONAL PARK
RECENSEMENT GENERAL AERIEN/GENERAL AERIAL COUNT, MAI/MAY 2002
WATERBUCK
COMPTAGE DIRECT
TRANSECTS
SUBSECTIONS
Low D
Med D
High D
Dom
Total



	1	2	3	4	5	6	7	8	9	10	S 11	U 12	B 13	U 14	N 15	I 16	T 17	S 18	19	20	21	22	23	24	25	26	27	28	29	30	31	32	33	34	35	36	37
Low D																				0	0	0	0	0	0	0	0	0	2	0	0	0	0						
Med D																	9	0	3	2	2	6	1	0	4	0	0	0										
High D										0	0	0	22	8	5	3	7	20	7	30	21	6	41	24	0	0												
Dont	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Tota	0	0	0	0	0	0	0	0	0	0	0	0	22	8	5	3	16	20	10	32	23	12	42	24	4	0	0	0	2	0	0	0	0	0	0	0	0



	1	2	3	4	5	6	7	8	9	10	S 11	U 12	B 13	U 14	N 15	I 16	T 17	S 18	19	20	21	22	23	24	25	26	27	28	29	30	31	32	33	34	35	36	37
Low D																				0	0	0	0	0	0	0	0	0	0	0	0	0	0					
Med D																	0	0	0	0	0	0	0	0	0	0	0	0										
High D										0	0	0	2	0	0	2	0	0	0	2	0	1	0	0	0	0												
Dom	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Tots	0	0	0	0	0	0	0	0	0	0	0	0	2	0	0	2	0	0	0	2	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0

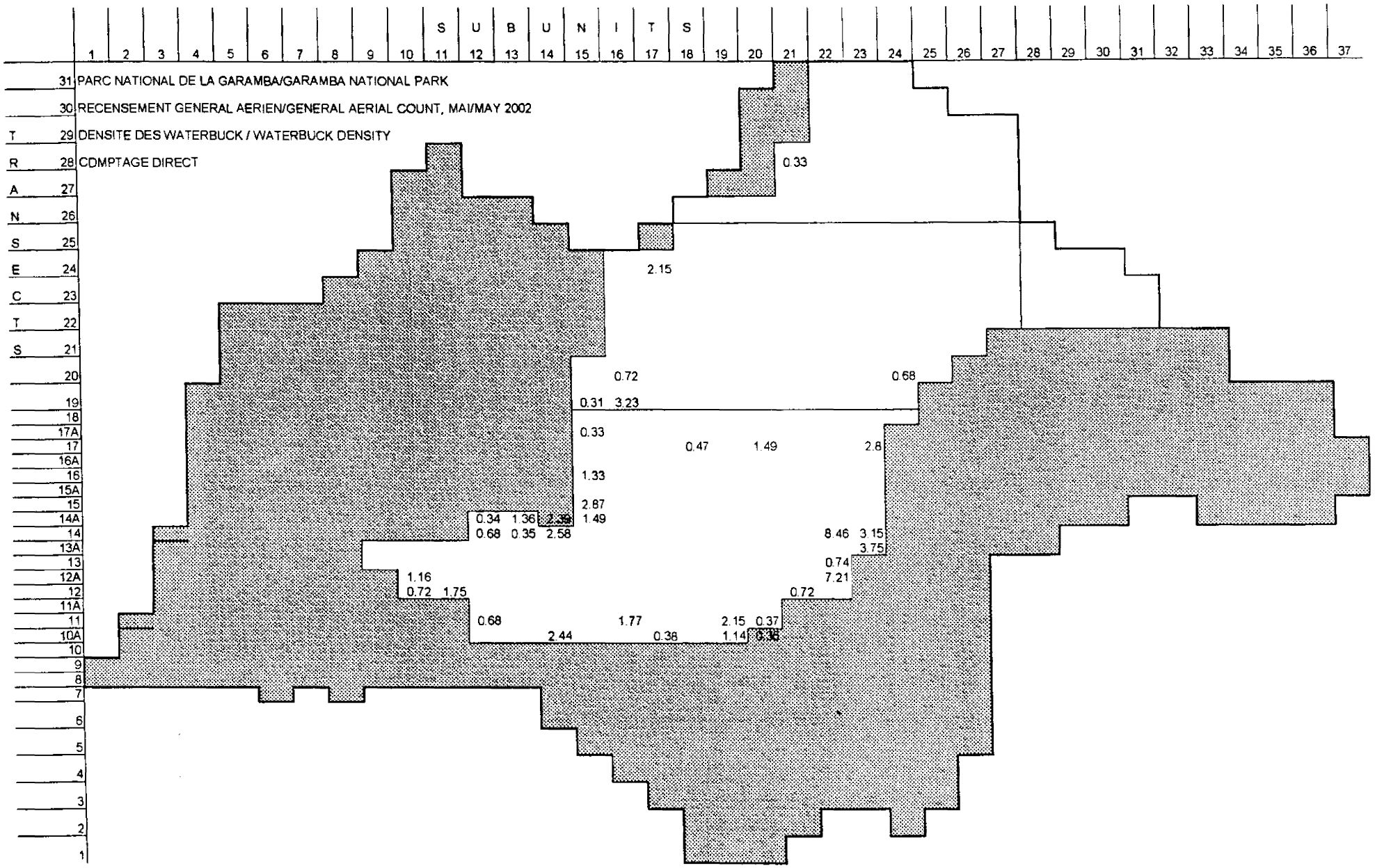

PARC NATIONAL DE LA GARAMBA/GARAMBA NATIONAL PARK

RECENSEMENT GENERAL AERIEN/GENERAL AERIAL COUNT, MAI/MAY 2002

LION

COMPTAGE DIRECT

	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31	32	33	34	35	36	37
Low D																			0	0	0	0	0	0	0	0	0	0	0	0	0	0					
Med D																0	0	0	0	0	0	0	0	0	0	0	0										
High D									0	0	0	0	0	0	0	0	0	0	0	0	0	0	3	0	0												
Dorr	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Tots	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	3	0	0	0	0	0	0	0	0	0	0	0	0	0	0



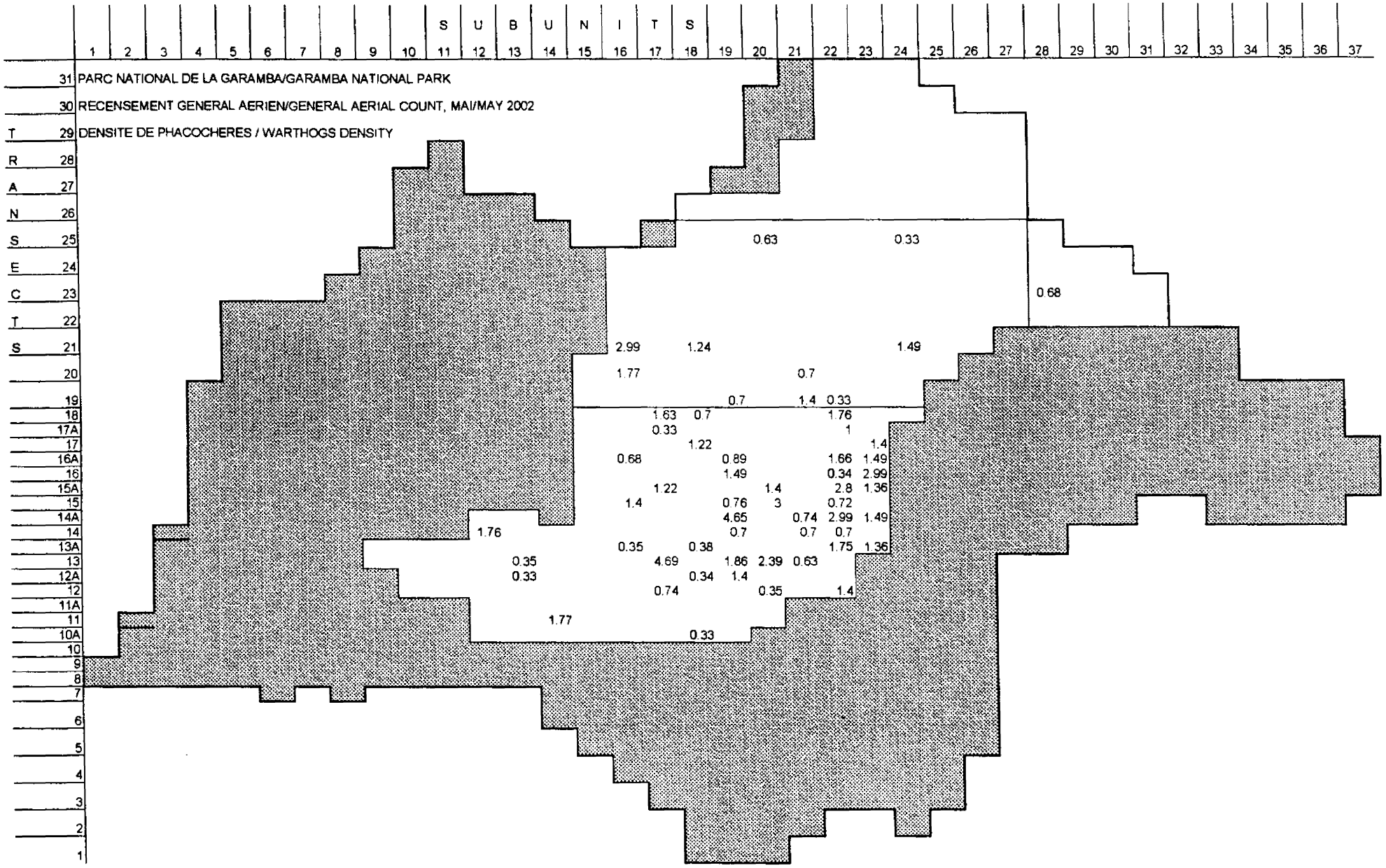
PARC NATIONAL DE LA GARAMBA/GARAMBA NATIONAL PARK

RECENSEMENT GENERAL AERIEN/GENERAL AERIAL COUNT, MAI/MAY 2002

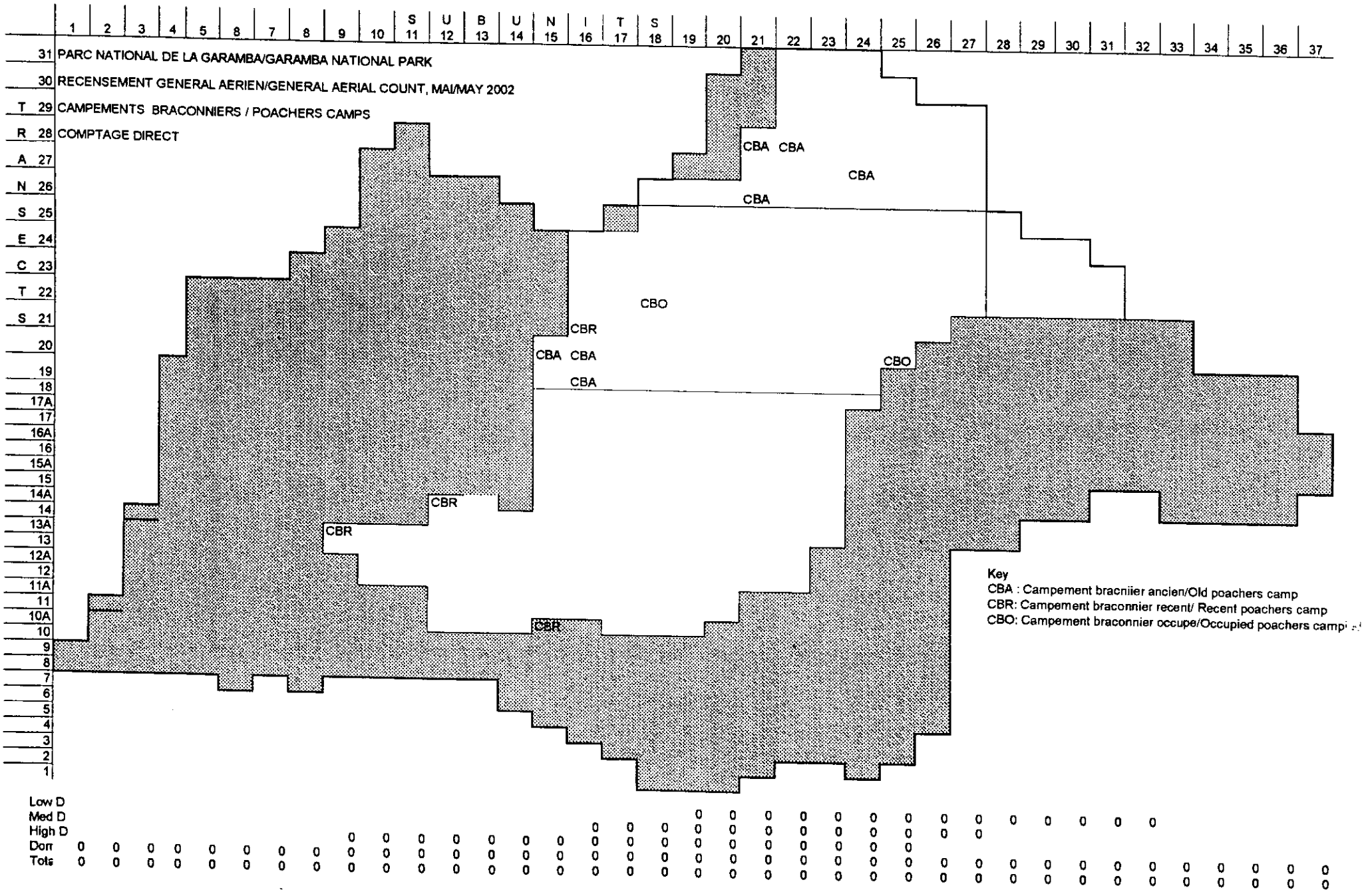
DENSITE DES WATERBUCK / WATERBUCK DENSITY

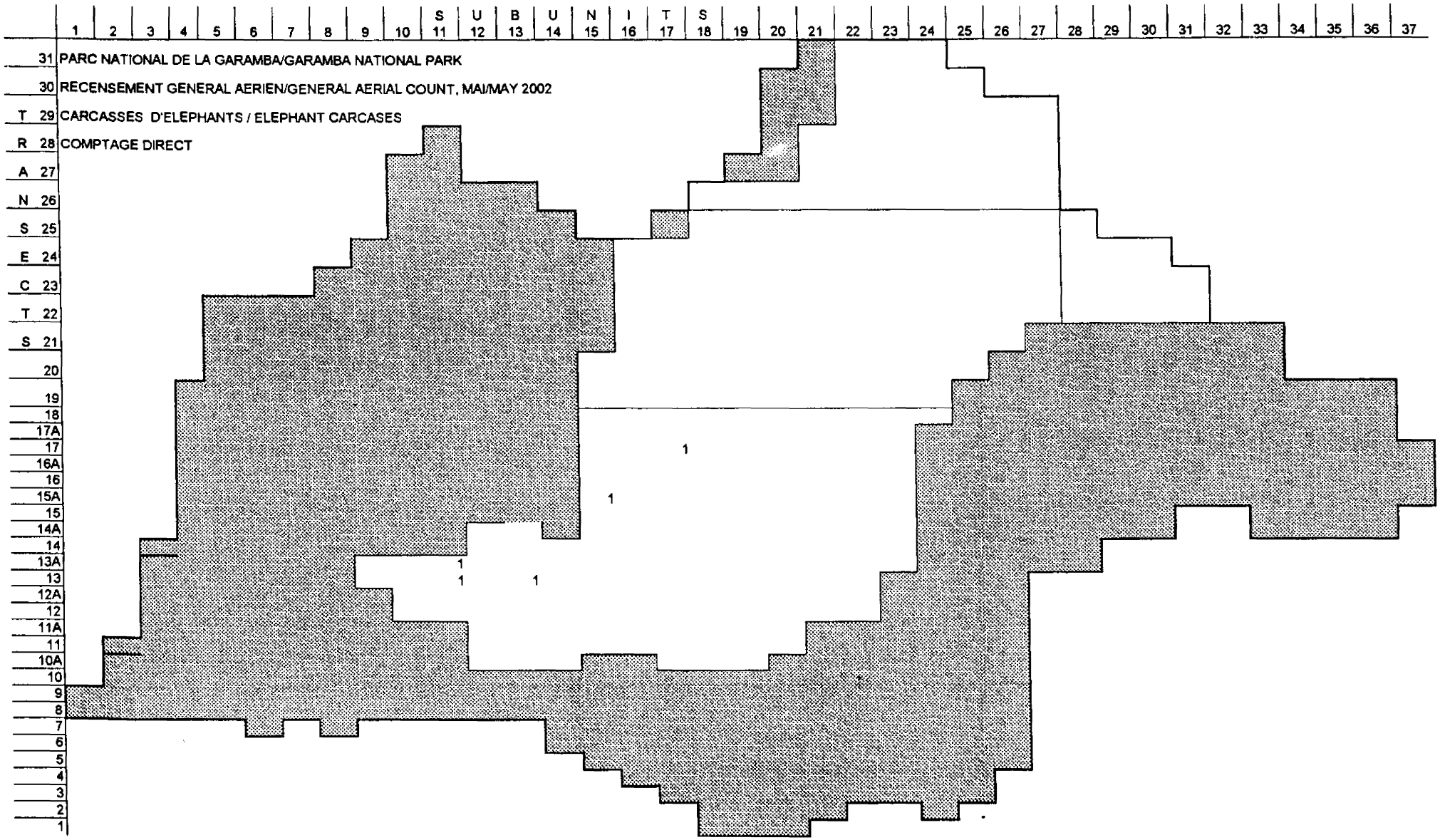
CDMPTAGE DIRECT

	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31	32	33	34	35	36	37
Low D																			0	0	0	0	0	0	0	0	0	0	0	0	0	0					
Med D																3.95	2.15	0	0	0	0	0	0	0.68	0	0	0										
High D										0	1.75	0.68	1.71	2.58	0	1.77	0	0.47	2.15	1.86	0.72	16.4	9.7	0	0												
Dom	0	0	0	0	0	0	0	0	0	0.72	0	0.68	0	0	4.85	0	0	0	0	0	0.33	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Total	0	0	0	0	0	0	0	0	0	0.72	1.75	1.36	1.71	2.58	4.85	5.72	2.15	0.47	2.15	1.86	1.04	18.4	9.7	0.68	0	0	0	0	0	0	0	0	0	0	0	0	0



Low D																			0	0	0	0	0	0	0	0	0	0.68	0	0	0	0							
Med D															4.76	0	1.24	0.7	0.63	2.1	0.33	0	1.83	0	0	0													
High D										0	0	1.76	0.68	1.77	0	2.43	8.6	2.64	11.8	7.13	2.07	15.1	10.1	0	0														
Dom	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Total	0	0	0	0	0	0	0	0	0	0	0	1.76	0.68	1.77	0	7.19	8.6	3.87	12.5	7.76	4.16	15.4	10.1	1.83	0	0	0	0.68	0	0	0	0	0	0	0	0	0	0


PARC NATIONAL DE LA GARAMBA/GARAMBA NATIONAL PARK
RECENSEMENT GENERAL AERIEN/GENERAL AERIAL COUNT, MAI/MAY 2002
CAMPEMENTS BRACONNIERS / POACHERS CAMPS
COMPTAGE DIRECT
CBA CBA
CBA
CBA
CBO
CBR
CBA CBA
CBA
CBO
CBR
CBR
CBR
Key
CBA : Campement bracniier ancien/Old poachers camp
CBR: Campement braconnier recent/ Recent poachers camp
CBO: Campement braconnier occupe/Occupied poachers camp
Low D
Med D
High D
Dorr
Tots

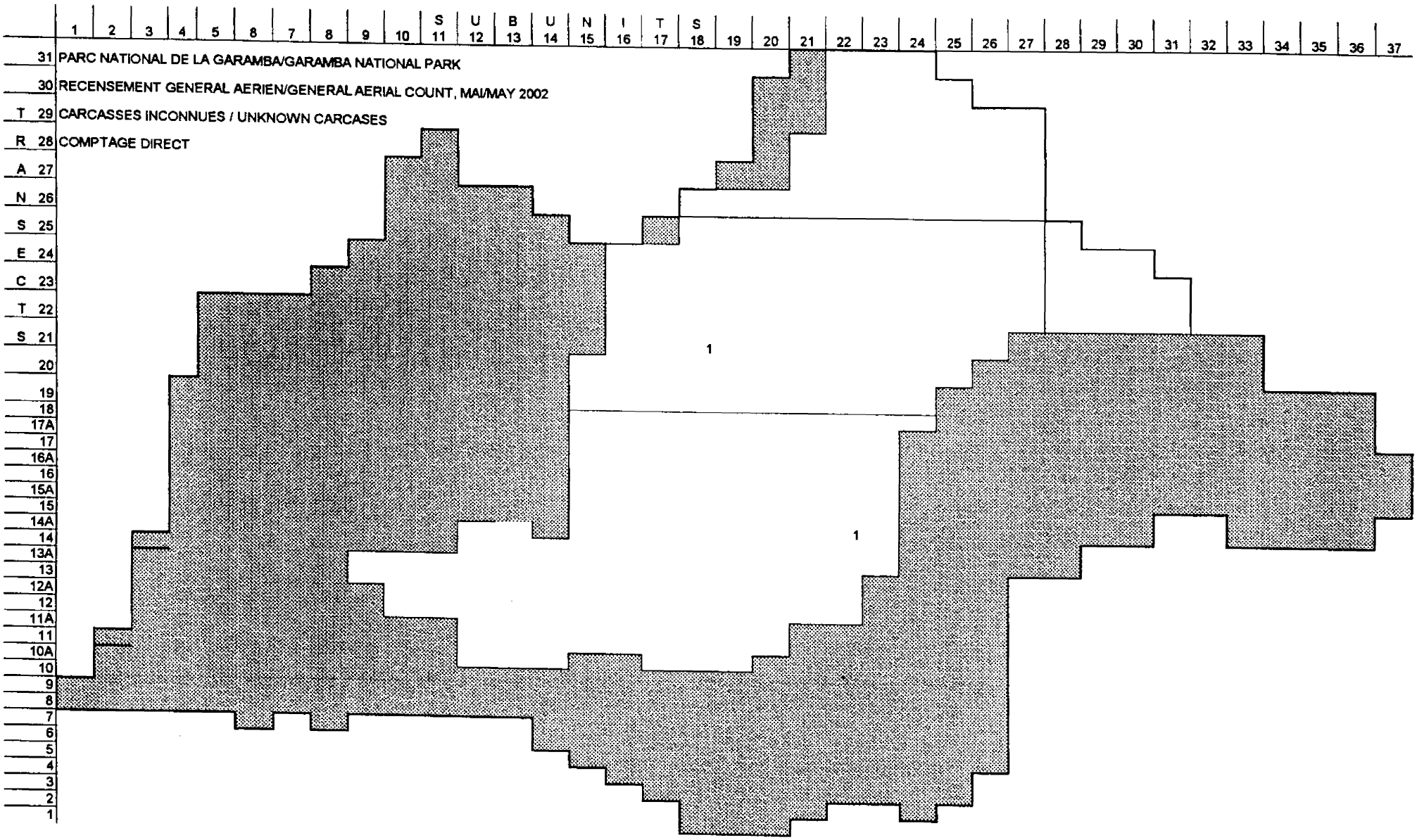

PARC NATIONAL DE LA GARAMBA/GARAMBA NATIONAL PARK

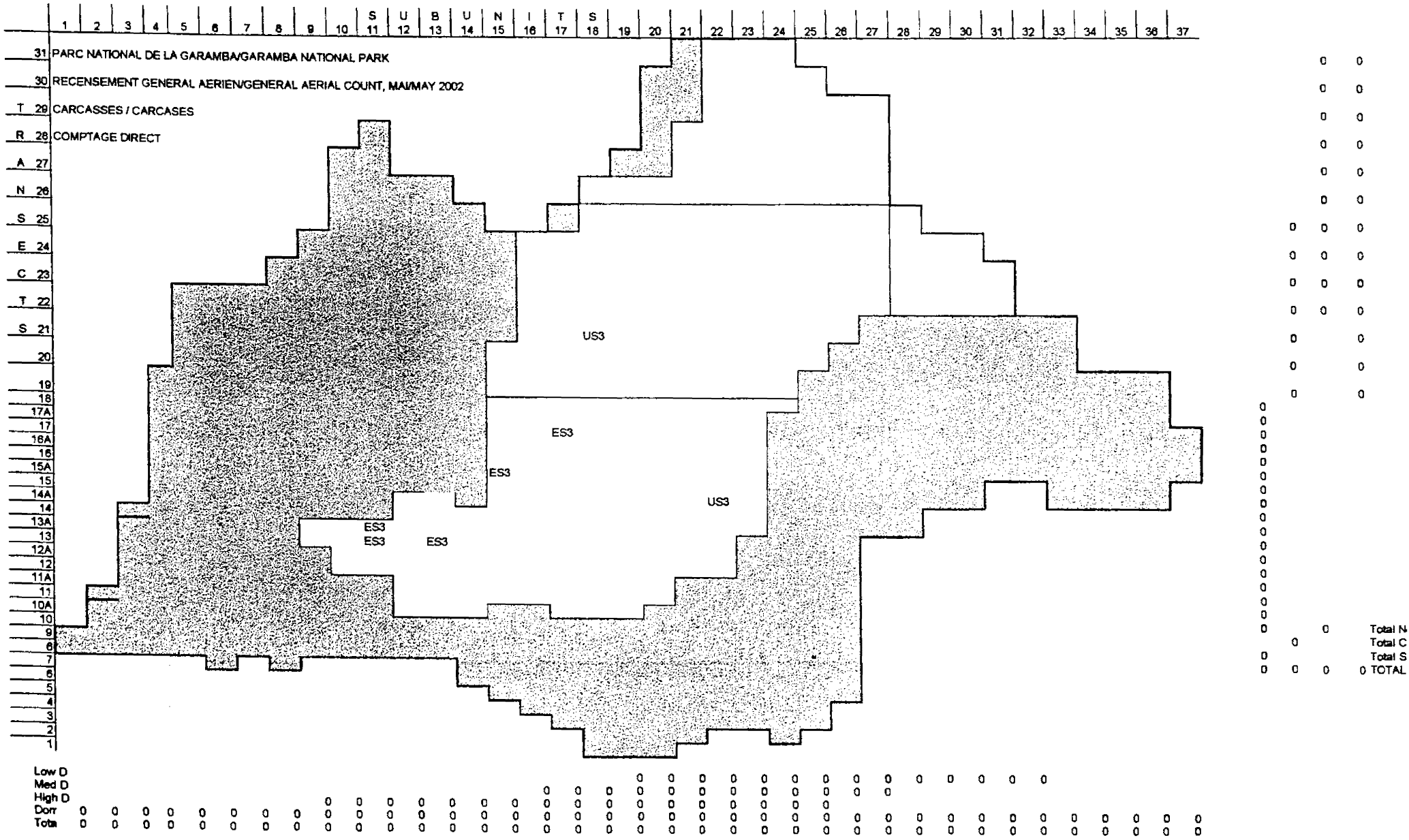
RECENSEMENT GENERAL AERIEN/GENERAL AERIAL COUNT, MAI/MAY 2002

CARCASSES D'ELEPHANTS / ELEPHANT CARCASES

COMPTAGE DIRECT

Low D																			0	0	0	0	0	0	0	0	0	0	0	0	0	0					
Med D																0	0	0	0	0	0	0	0	0	0	0	0										
High D									0	0	0	0	0	1	0	0	1	0	0	0	0	0	0	0	0												
Don	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Tote	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0

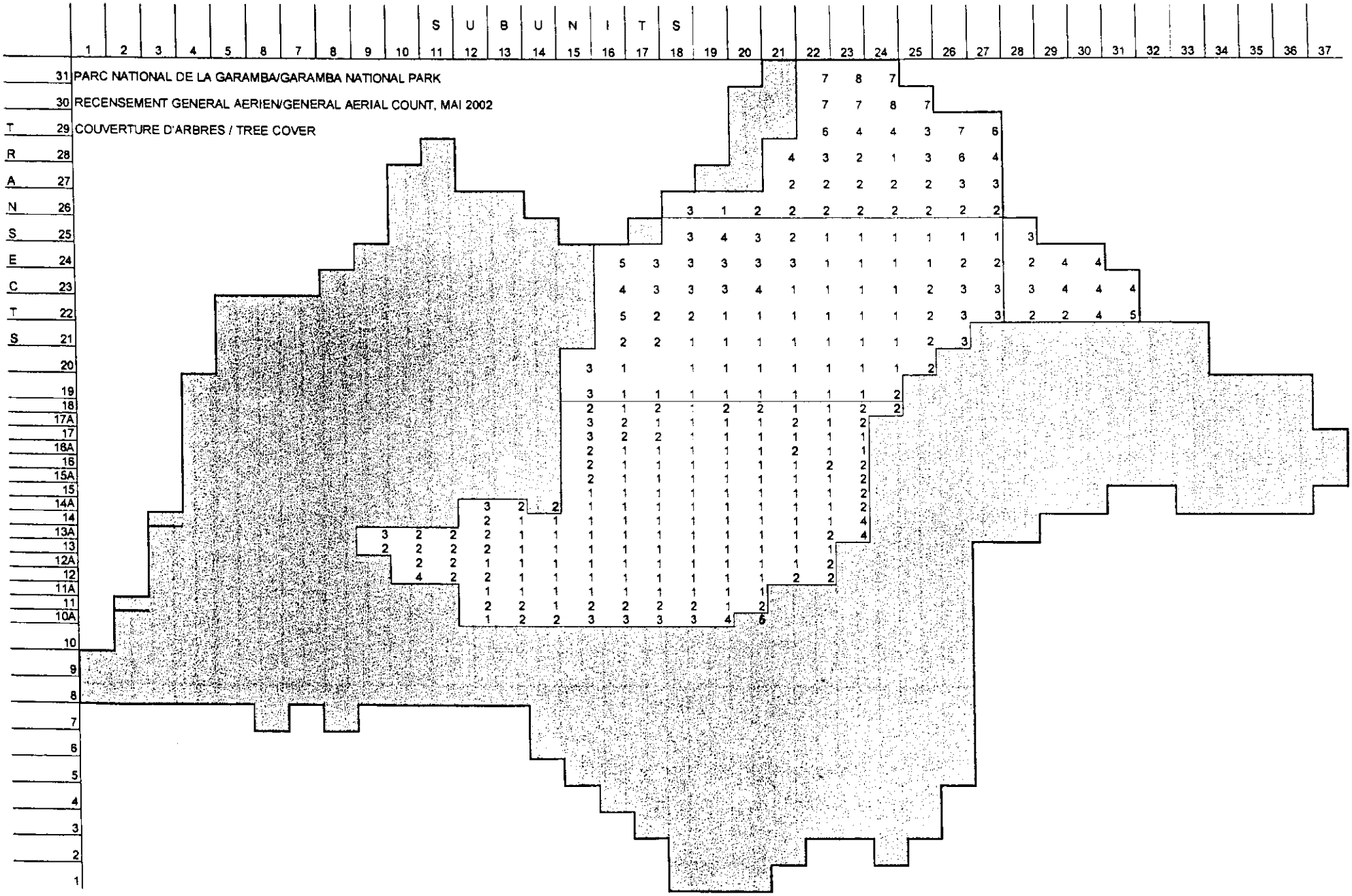

PARC NATIONAL DE LA GARAMBA/GARAMBA NATIONAL PARK
RECENSEMENT GENERAL AERIEN/GENERAL AERIAL COUNT, MAI/MAY 2002
CARCASSES INCONNUES / UNKNOWN CARCASES
COMPTAGE DIRECT
1
1
Low D
Med D
High D
Dorr
Tots


PARC NATIONAL DE LA GARAMBA/GARAMBA NATIONAL PARK
RECENSEMENT GENERAL AERIEN/GENERAL AERIAL COUNT, MAI/MAY 2002
CARCASSES / CARCASES
COMPTAGE DIRECT
US3
ES3
ES3
ES3
ES3
US3
Low D
Med D
High D
Dorr
Tota
Total N
Total C
Total S
TOTAL

PARC NATIONAL DE LA GARAMBA/GARAMBA NATIONAL PARK

RECENSEMENT GENERAL AERIEN/GENERAL AERIAL COUNT, MAI 2002

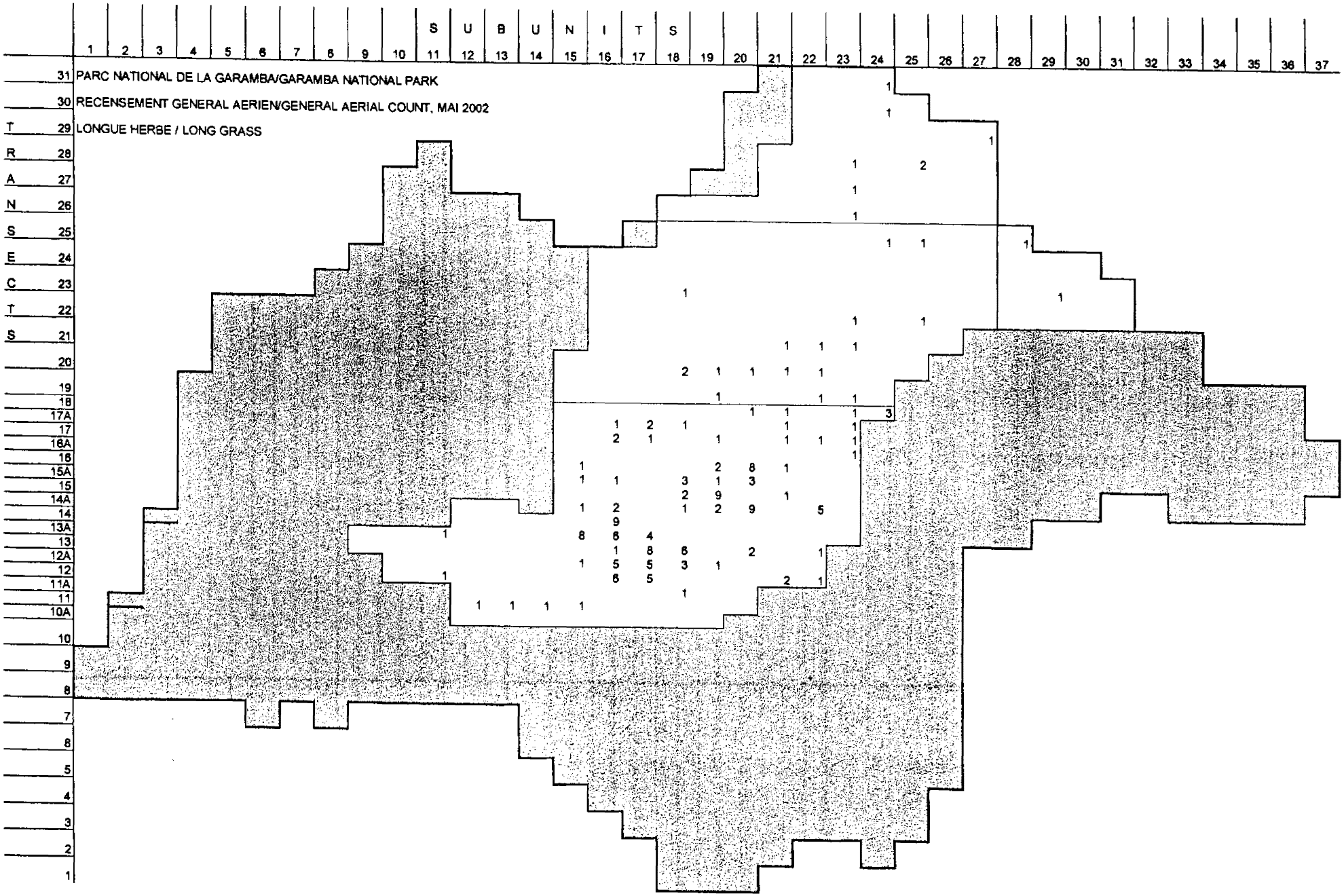
COUVERTURE D'ARBRES / TREE COVER

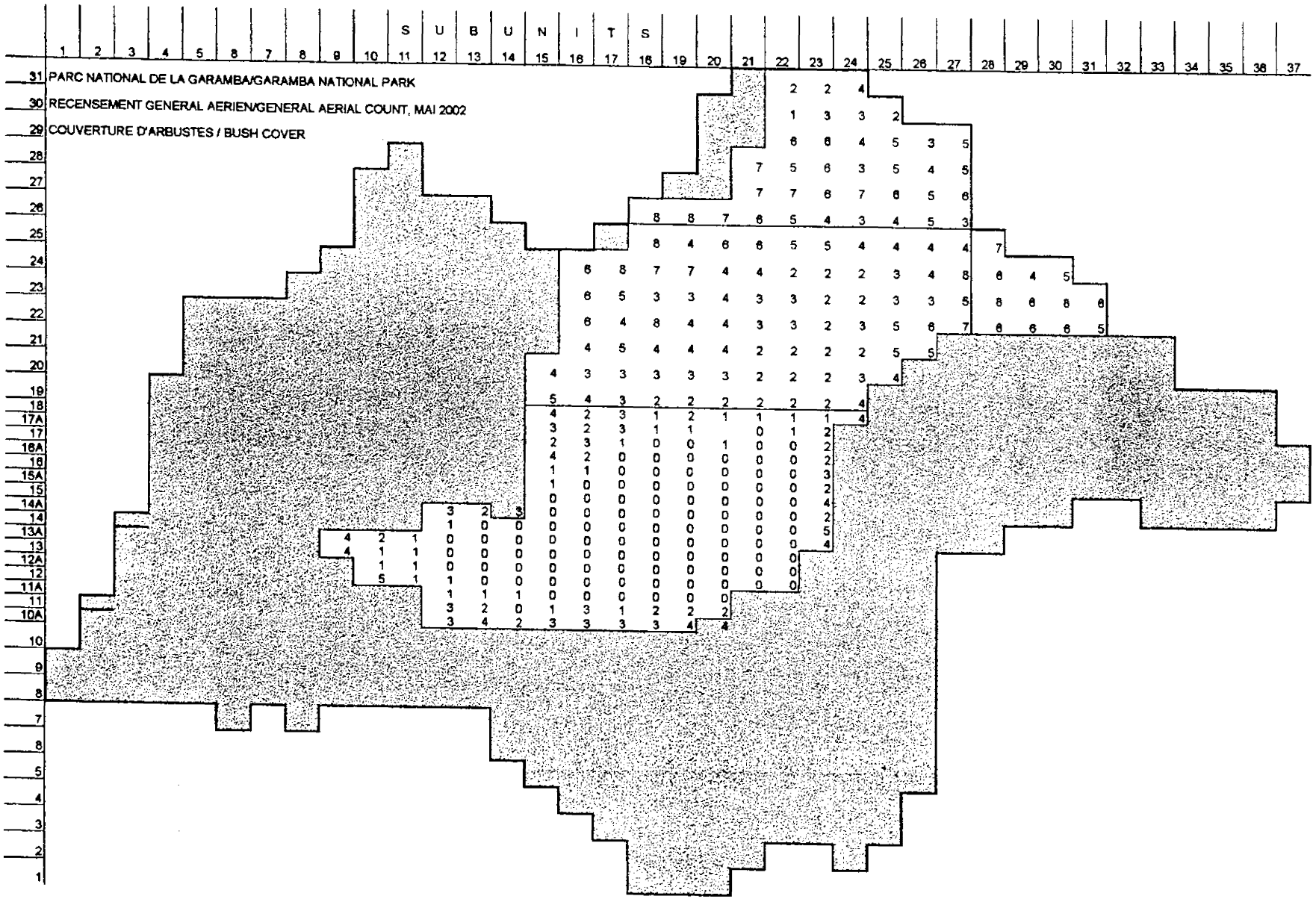


PARC NATIONAL DE LA GARAMBA/GARAMBA NATIONAL PARK

RECENSEMENT GENERAL AERIEN/GENERAL AERIAL COUNT, MAI 2002

LONGUE HERBE / LONG GRASS




PARC NATIONAL DE LA GARAMBA/GARAMBA NATIONAL PARK

RECENSEMENT GENERAL AERIEN/GENERAL AERIAL COUNT, MAI 2002

COUVERTURE D'ARBUSTES / BUSH COVER

	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31	32	33	34	35	36	37
Low D																			8	7	13	17	27	24	22	17	19	25	16	17	11	0					
Med D																11	28	35	27	27	22	19	17	20	24	22	22										
High D										1	3	2	5	1	1	13	8	4	5	4	1	2	27	4	0												
Dom	0	0	0	0	0	0	0	0	8	5	0	8	0	0	24	18	0	0	0	0	7	9	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Total	0	0	0	0	0	0	0	0	6	8	3	8	5	1	25	42	36	39	40	38	43	47	71	48	46	39	41	25	16	17	11	0	0	0	0	0	0

		6	2.67	
		9	2.25	
		29	4.83	
		35	5	
		44	8.29	
		53	5.3	
	50	7	5.18	
	55	15	4.67	
	42	47	4.13	
	55	23	4.88	
	39		3.55	
	32		2.91	
	26		2.8	
20			2	
13			1.63	
9			1	
6			0.89	
5			0.56	
3			0.33	
4			0.44	
10			0.83	
6			0.5	
11			0.73	
6			0.43	
2			0.15	
7			0.54	
3			0.33	
16			1.78	
25			3.13	
0	0	178	4.39	Total Nord
301	301	92	4.01	Total Cen
148	0	0	0.95	Total Sud
148	301	270	2.4	TOTAL

TRANS	PNG 2002 AREA HIGH STH	MID NTH	LOW NTH	TOT NTH	WARTHOG HIGH STH	MID NTH	LOW NTH	TOT NTH	TOTAL	WATERBUCK HIGH STH	MID NTH	LOW NTH	TOT NTH	TOTAL
31			8.58	8.58			0	0				0	0	
30			12.38	12.38			0	0				0	0	
29			17.37	17.37			0	0				0	0	
28			21.39	21.39			0	0				1	1	
27			20.45	20.45			0	0				0	0	
26			30.62	30.62			0	0				0	0	
25		28.88	2.86	31.73		3	0	3			0	0	0	
24		33.94	8.72	42.66		0	0	0			6	0	6	
23		34.30	22.94	57.24		0	2	2			0	0	0	
22		34.38	11.43	45.81		0	0	0			0	0	0	
21		30.43		30.43		12		12			0		0	
20		31.52		31.52		5		5			4		4	
19		29.09		29.09		7		7			10		10	
18	27.57				11					0				
17a	26.82				4					1				
17	25.36				7					12				
16a	26.16				13					0				
16	26.09				10					4				
15a	25.36				19					0				
15	25.73				17					8				
14a	31.37				21					8				
14	34.16				11					42				
13a	43.10				11					9				
13	38.93				26					2				
12a	37.52				6					21				
12	37.60				7					9				
11a	26.16				0					0				
11	24.64				3					12				
10a	24.71				1					11				
Total	481.3	222.5	156.7	379.3	167.0	27.0	2.0	29.0		139.0	20.0	1.0	21.0	
Sum squ	15040.7	7109.8	2341.3	13309.4	2559.0	227.0	0.0	231.0		2925.0	152.0	1.0	153.0	
				Sum (Z*y	5216.2	813.0	0.0	936.1		4486.6	620.6	21.4	694.4	
				R=Sy/Sz	0.3	0.1	0.0	0.1		0.3	0.1	0.0	0.1	
				Var y	54.4	20.5	0.0	13.9		114.5	15.8	0.2	9.9	
Var z	37.6	5.9	59.2	187.1					STRAT.					STRAT.
Covar zy					12.8	-37.7	-3.5	1.8	TOTAL	20.4	-24.2	0.6	2.8	TOTAL
			Pop.est.(Y)		WARTHOG 737	237	16	243	990	WATERBUCK 614	175	8	176	797
				SE(Y)	162.0	195.7	7.7	159.3	254.2	235.8	161.4	9.8	134.0	315.75
				95% C.L.	330.5	399.2	15.7	325.1	498.2	480.9	329.3	20.0	273.4	618.88
				95% C.L.	44.8	0.0	0.0	0.0	50.3	78.4	187.9	256.3	155.5	77.67

PNG 2002	AREA				ELEPHANTS					BUFFALOS				
TRANS	HIGH STH	MID NTH	LOW NTH	TOT NTH	HIGH STH	MID NTH	LOW NTH	TOT NTH	TOTAL	HIGH STH	MID NTH	LOW NTH	TOT NTH	TOTAL
31			8.58	8.58			0	0				0	0	
30			12.38	12.38			0	0				0	0	
29			17.37	17.37			0	0				0	0	
28			21.39	21.39			0	0				0	0	
27			20.45	20.45			0	0				0	0	
26			30.62	30.62			0	0				0	0	
25		28.88	2.86	31.73		0	0	0				0	0	
24		33.94	8.72	42.66		0	0	0			0	0	0	
23		34.30	22.94	57.24		0	0	0			0	0	0	
22		34.38	11.43	45.81		0	0	0			0	0	0	
21		30.43		30.43		0		0			0		0	
20		31.52		31.52		0		0			0		0	
19		29.09		29.09		0		0			8		8	
18	27.57				2						0		0	
17a	26.82				13					0				
17	25.36				50					30				
16a	26.16				58					6				
16	26.09				31					143				
15a	25.36				127					152				
15	25.73				150					241				
14a	31.37				142					42				
14	34.16				167					337				
13a	43.10				108					293				
13	38.93				123					74				
12a	37.52				177					610				
12	37.60				102					575				
11a	26.16				53					283				
11	24.64				51					103				
10a	24.71				1					102				
										1				
Total	481.3	222.5	156.7	379.3	1355.0	0.0	0.0	0.0		2992.0	8.0	0.0	8.0	
Sum squ	15040.7	7109.8	2341.3	13309.4	167617.0	0.0	0.0	0.0		1113056.0	64.0	0.0	64.0	
				Sum (Z*y)	43825.3	0.0	0.0	0.0		100824.0	252.1	0.0	252.1	
				R=Sy/Sz	2.8	0.0	0.0	0.0		6.2	0.0	0.0	0.0	
Var z	37.6	5.9	59.2	Var y	3524.4	0.0	0.0	0.0		36903.5	9.1	0.0	4.9	
Covar zy					204.4	0.0	0.0	0.0	STRAT. TOTAL	721.6	-8.9	0.0	-0.1	STRAT. TOTAL
			Pop.est.(Y)		ELEPHANTS					BUFFALOS				
					5,983	0	0	0	5,983	13,210	70	0	67	13,281
				SE(Y)	1184.2	0.0	0.0	0.0	1184.2	3927.6	112.4	0.0	95.9	3930.42
				95% C.L.	2415.7	0.0	0.0	0.0	2321.0	8012.4	229.2	0.0	195.7	7703.62
				95% C.L.	40.4	0.0	0.0	0.0	38.8	60.7	326.9	ERR	292.2	58.01

TRANS.	PNG 2002 AREA HIGH STH	MID NTH	LOW NTH	TOT NOR	GIRAFFE HIGH STH	MID NTH	LOW NTH	TOT NTH	TOTAL	LION HIGH STH	MID NTH	LOW NTH	TOT NTH	TOTAL
31			8.58	8.58			0	0				0	0	
30			12.38	12.38			0	0				0	0	
29			17.37	17.37			0	0				0	0	
28			21.39	21.39			0	0				0	0	
27			20.45	20.45			0	0				0	0	
26			30.62	30.62			0	0				0	0	
25		28.88	2.86	31.73		0	0	0			0	0	0	
24		33.94	8.72	42.66		0	0	0			0	0	0	
23		34.30	22.94	57.24		0	0	0			0	0	0	
22		34.38	11.43	45.81		0	0	0			0	0	0	
21		30.43		30.43		0		0			0		0	
20		31.52		31.52		0		0			0		0	
19		29.09		29.09		0		0			0		0	
18	27.57				0					0				
17a	26.82				0					0				
17	25.36				0					0				
16a	26.16				0					0				
16	26.09				0					3				
15a	25.36				0					0				
15	25.73				0					0				
14a	31.37				4					0				
14	34.16				0					0				
13a	43.10				0					0				
13	38.93				0					0				
12a	37.52				0					0				
12	37.60				0					0				
11a	26.16				0					0				
11	24.64				4					0				
10a	24.71				6					0				
Total	481.3	222.5	156.7	379.3	14.0	0.0	0.0	0.0		3.0	0.0	0.0	0.0	
Sum squ	15040.7	7109.8	2341.3	13309.4	68.0	0.0	0.0	0.0		9.0	0.0	0.0	0.0	
				Sum (Z*y	372.3	0.0	0.0	0.0		78.3	0.0	0.0	0.0	
				R=Sy/Sz	0.0	0.0	0.0	0.0		0.0	0.0	0.0	0.0	
				Var y	3.7	0.0	0.0	0.0		0.6	0.0	0.0	0.0	
Var z	37.6	5.9	59.2	187.1					STRAT.					STRAT.
Covar zy					-3.3	0.0	0.0	0.0	TOTAL	-0.8	0.0	0.0	0.0	TOTAL
					GIRAFFE					LION				
			Pop.est.(Y)		**62**	**0**	**0**	**0**	**62**	**13**	**0**	**0**	**0**	**13**
				SE(Y)	45.5	0.0	0.0	0.0	45.5	17.4	0.0	0.0	0.0	17.36
				95% C.L.	92.8	0.0	0.0	0.0	89.1	35.4	0.0	0.0	0.0	34.02
				95% C.L.	150.1	0.0	0.0	0.0	144.2	267.3	ERR	ERR	ERR	256.85

PNG 2004 TRANS	AREA HIGH STH	AREA MID NTH	AREA LOW NTH	AREA TOT NOR	COB HIGH STH	COB MID NTH	COB LOW NTH	COB TOT NTH	COB TOTAL	HARTBEEST HIGH STH	HARTBEEST MID NTH	HARTBEEST LOW NTH	HARTBEEST TOT NTH	HARTBEEST TOTAL
31			8.58	8.58			0	0				0	0	
30			12.38	12.38			0	0				0	0	
29			17.37	17.37			0	0				0	0	
28			21.39	21.39			0	0				0	0	
27			20.45	20.45			0	0				0	0	
26			30.62	30.62			0	0				0	0	
25		28.88	2.86	31.73			0	0				1	1	
24		33.94	8.72	42.66		0	0	0			0	0	0	
23		34.30	22.94	57.24		0	0	0			15	0	15	
22		34.38	11.43	45.81		2	0	2			0	0	0	
21		30.43		30.43		1	0	1			0	0	0	
20		31.52		31.52		0		0			0		0	
19		29.09		29.09		0		0			2		2	
18	27.57				37						2		2	
17a	26.82				21					12				
17	25.36				26					0				
16a	26.16				66					0				
16	26.09				60					3				
15a	25.36				17					24				
15	25.73				85					1				
14a	31.37				83					8				
14	34.16				153					0				
13a	43.10				10					21				
13	38.93				2					16				
12a	37.52				5					18				
12	37.60				240					1				
11a	26.16				35					48				
11	24.64				202					9				
10a	24.71				22					2				
Total	481.3	222.5	156.7	379.3	1064.0	3.0	0.0	3.0		0				
Sum squ	15040.7	7109.8	2341.3	13309.4	148496.0	5.0	0.0	5.0		163.0	19.0	1.0	20.0	
				Sum (Z*y)	32138.9	103.0	0.0	160.3		4205.0	233.0	1.0	234.0	
										5501.2	630.3	30.6	791.8	
				R=Sy/Sz	2.2	0.0	0.0	0.0						
				Var y	5182.7	0.6	0.0	0.4		0.3	0.1	0.0	0.1	
Var z	37.6	5.9	59.2	187.1						169.6	30.2	0.2	16.9	
Covar zy									STRAT.					STRAT.
					8.9	-1.7	0.0	6.0	TOTAL	39.9	-14.9	1.7	14.5	TOTAL
			Pop.est.(Y)		COB 4,698	26	0	25	4,724	HARTBEEST 720	166	8	167	894
				SE(Y)	1672.3	29.3	0.0	22.2	1672.6	277.7	205.7	9.4	169.7	385.13
				95% C.L.	3411.5	59.7	0.0	45.4	3278.2	566.6	419.6	19.2	346.1	754.86
				95% C.L.a	72.6	0.0	0.0	0.0	69.4	78.7	252.0	245.7	206.7	84.44

	PNG 2002	AREA			BUSHBUCK					REEDBUCK				
TRANS	HIGH STH	MID NTH	LOW NTH	TOT NOR	HIGH STH	MID NTH	LOW NTH	TOT NTH	TOTAL	HIGH STH	MID NTH	LOW NTH	TOT NTH	TOTAL
31			8.58	8.58			0	0				0	0	
30			12.38	12.38			0	0				0	0	
29			17.37	17.37			0	0				0	0	
28			21.39	21.39			0	0				1	1	
27			20.45	20.45			0	0				0	0	
26			30.62	30.62			0	0				0	0	
25		28.88	2.86	31.73	0	0	0	0			0	0	0	
24		33.94	8.72	42.66	0	0	0	0			0	0	0	
23		34.30	22.94	57.24	3	2	5				3	0	3	
22		34.38	11.43	45.81	1	0	1				5	0	5	
21		30.43		30.43	2		2				0		0	
20		31.52		31.52	1		1				2		2	
19		29.09		29.09	0		0				1		1	
18	27.57				0					6				
17a	26.82				1					2				
17	25.36				2					2				
16a	26.16				0					0				
16	26.09				0					0				
15a	25.36				0					1				
15	25.73				0					1				
14a	31.37				2					1				
14	34.16				2					0				
13a	43.10				0					0				
13	38.93				3					0				
12a	37.52				0					3				
12	37.60				1					4				
11a	26.16				1					0				
11	24.64				1					0				
10a	24.71				2					0				
Total	481.3	222.5	156.7	379.3	15.0	7.0	2.0	9.0		20.0	11.0	1.0	12.0	
Sum equ	15040.7	7109.8	2341.3	'13309.4	29.0	15.0	0.0	31.0		72.0	39.0	1.0	40.0	
				Sum (Z*y	463.2	229.7	0.0	424.4		615.2	366.9	21.4	514.3	
				R=Sy/Sz	0.0	0.0	0.0	0.0		0.0	0.0	0.0	0.0	
				Var y	1.0	1.3	0.0	2.1		3.1	3.6	0.2	2.4	
Var z	37.6	5.9	59.2	187.1										
Covar Zy					0.8	-6.0	-3.5	12.7	STRAT. TOTAL	0.9	-8.2	0.6	12.3	STRAT. TOTAL
			Pop.est.(Y)		BUSHBUCK					REEDBUCK				
					66	61	16	75	143	88	96	8	100	193
				SE(Y)	22.7	47.0	7.7	52.2	52.8	40.5	75.7	9.8	55.2	102.56
				95% C.L.	46.3	96.0	15.7	106.6	103.5	82.6	154.4	20.0	112.7	201.02
				95% C.L.	70.0	0.0	0.0	0.0	72.3	93.5	160.2	256.3	112.2	104.42

PNG 2002	AREA				RHINOS					HIPPOS				
TRANS	HIGH STH	MID NTH	LOW NTH	TOT NOR	HIGH STH	MID NTH	LOW NTH	TOT NTH	TOTAL	HIGH STH	MID NTH	LOW NTH	TOT NTH	TOTAL
31			8.58	8.58			0	0				0	0	
30			12.38	12.38			0	0				0	0	
29			17.37	17.37			0	0				0	0	
28			21.39	21.39			0	0				0	0	
27			20.45	20.45			0	0				0	0	
26			30.62	30.62			0	0				0	0	
25		28.88	2.86	31.73		0	0	0				0	0	
24		33.94	8.72	42.66		0	0	0			0	0	0	
23		34.30	22.94	57.24		0	0	0			0	0	0	
22		34.38	11.43	45.81		0	0	0			0	0	0	
21		30.43		30.43		0		0			0	-	0	
20		31.52		31.52		0		0			0		0	
19		29.09		29.09		0		0			0		0	
18	27.57				0					0				
17a	26.82				0					2				
17	25.36				0					47				
16a	26.16				2					118				
16	26.09				0					224				
15a	25.36				0					2				
15	25.73				0					202				
14a	31.37				0					42				
14	34.16				0					16				
13a	43.10				4					8				
13	38.93				2					82				
12a	37.52				0					4				
12	37.60				2					27				
11a	26.16				0					139				
11	24.64				0					35				
10a	24.71				0					0				
Total	481.3	222.5	156.7	379.3	10.0	0.0	0.0	0.0		948.0	0.0	0.0	0.0	
Sum squ	15040.7	7109.8	2341.3	13309.4	28.0	0.0	0.0	0.0		137220.0	0.0	0.0	0.0	
				Sum (Z*y	377.8	0.0	0.0	0.0		26490.1	0.0	0.0	0.0	
				R=Sy/Sz	0.0	0.0	0.0	0.0		2.0	0.0	0.0	0.0	
				Var y	1.5	0.0	0.0	0.0		5403.4	0.0	0.0	0.0	
Var z	37.6	5.9	59.2	187.1					STRAT.					STRAT.
Covar zy					5.1	0.0	0.0	0.0	TOTAL	-135.1	0.0	0.0	0.0	TOTAL
					RHINO					HIPPOS				
			Pop.est.(Y)		44	0	0	0	44	4,186	0	0	0	4,186
				SE(Y)	25.6	0.0	0.0	0.0	25.6	1786.8	0.0	0.0	0.0	1786.80
				95% C.L.	52.3	0.0	0.0	0.0	50.3	3645.1	0.0	0.0	0.0	3502.12
				95% C.L.	118.5	0.0	0.0	0.0	113.9	87.1	ERR	ERR	ERR	83.67

PNG 2002	AREA				GREY AND RED-FLANKED DUIKER					ORIBI				
TRANS	HIGH STH	MID NTH	LOW NTH	TOT NOR	HIGH STH	MID NTH	LOW NTH	TOT NTH	TOTAL	HIGH STH	MID NTH	LOW NTH	TOT NTH	TOTAL
31			8.58	8.58			0	0				0	0	
30			12.38	12.38			1	1				0	0	
29			17.37	17.37			0	0				0	0	
28			21.39	21.39			1	1				1	1	
27			20.45	20.45			0	0				0	0	
26			30.62	30.62			0	0				0	0	
25		28.88	2.86	31.73		1	0	1			1	0	1	
24		33.94	8.72	42.66		0	0	0			0	0	0	
23		34.30	22.94	57.24		0	0	0			0	0	0	
22		34.38	11.43	45.81		0	0	0			0	0	0	
21		30.43		30.43		0		0			0		0	
20		31.52		31.52		0		0			0		0	
19		29.09		29.09		0		0			0		0	
18	27.57				0					0				
17a	26.82				0					0				
17	25.36				0					0				
16a	26.16				1					0				
16	26.09				0					0				
15a	25.36				0					0				
15	25.73				0					0				
14a	31.37				0					0				
14	34.16				0					0				
13a	43.10				0					0				
13	38.93				1					2				
12a	37.52				0					0				
12	37.60				0					3				
11a	26.16				0					0				
11	24.64				0					0				
10a	24.71				0					0				
Total	481.3	222.5	156.7	379.3	2.0	1.0	2.0	3.0		5.0	1.0	1.0	2.0	
Sum squ	15040.7	7109.8	2341.3	13309.4	2.0	1.0	2.0	3.0		13.0	1.0	1.0	2.0	
				Sum (Z*y	65.1	28.9	33.8	65.5		190.7	28.9	21.4	53.1	
				R=Sy/Sz	0.0	0.0	0.0	0.0		0.0	0.0	0.0	0.0	
				Var y	0.1	0.1	0.3	0.2		0.8	0.1	0.2	0.1	
Var z	37.6	5.9	59.2	187.1					STRAT.					STRAT.
Covar zy					0.3	-1.6	0.3	-2.7	TOTAL	2.7	-1.6	0.6	-0.9	TOTAL
			Pop.est.(Y)		GREY AND RED-FLANKED DUIKER 9	9	16	25	33	ORIBI 22	9	8	17	39
				SE(Y)	7.8	14.3	12.7	20.9	20.6	19.3	14.3	9.8	16.8	30.90
				95% C.L.	15.8	29.1	25.9	42.7	40.4	39.4	29.1	20.0	34.2	60.56
				95% C.L.	179.2	0.0	0.0	0.0	121.6	178.5	332.0	256.3	204.5	156.66

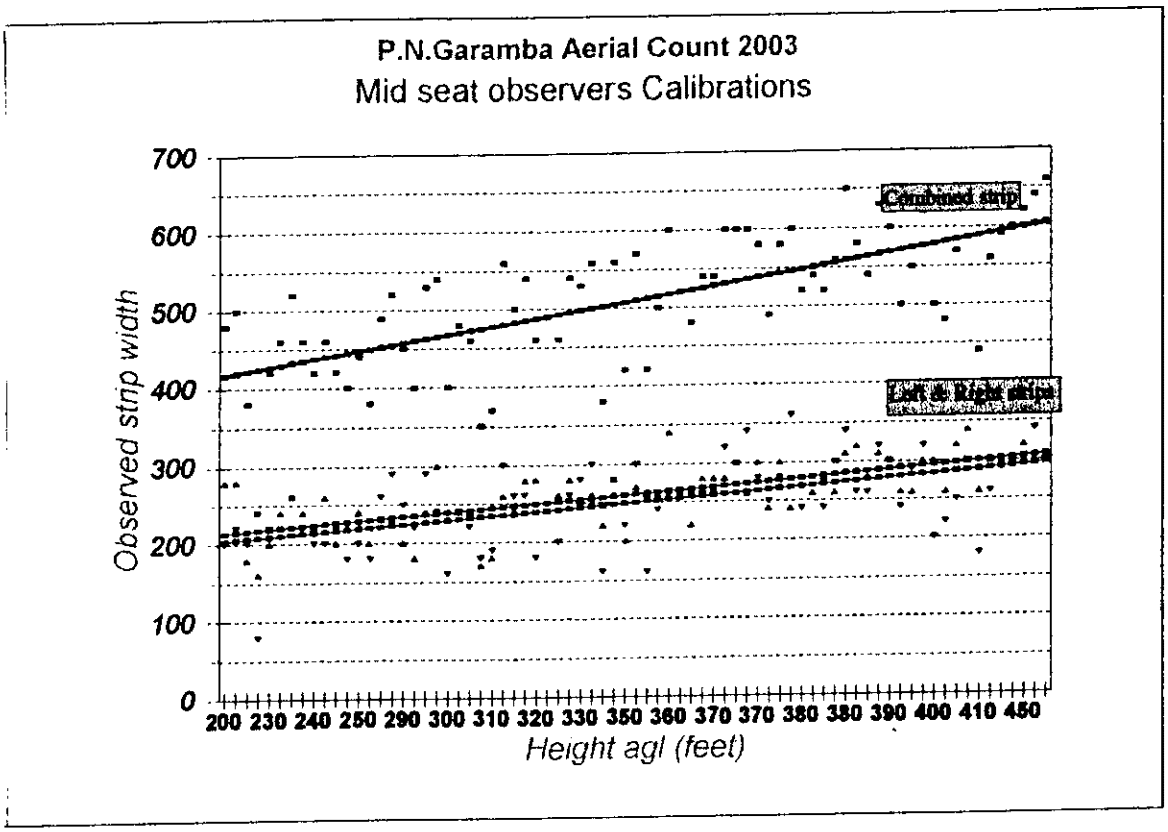
	AREA				ELE CARCASES					UNKNOWN CARCASES				
TRANS	HIGH STH	MID NTH	LOW NTH	TOT.NTH	HIGH STH	MID NTH	LOW NTH	TOT.NTH	TOTAL	HIGH STH	MID NTH	LOW NTH	TOT.NTH	TOTAL
31			8.58	8.58			0	0				0	0	
30			12.38	12.38			0	0				0	0	
29			17.37	17.37			0	0				0	0	
28			21.39	21.39			0	0				0	0	
27			20.45	20.45			0	0				0	0	
26			30.62	30.62			0	0				0	0	
25		28.88	2.86	31.73		0	0	0			0	0	0	
24		33.94	8.72	42.66		0	0	0			0	0	0	
23		34.30	22.94	57.24		0	0	0			0	0	0	
22		34.38	11.43	45.81		0	0	0			0	0	0	
21		30.43		30.43		0		0			1		1	
20		31.52		31.52		0		0			0		0	
19		29.09		29.09		0		0			0		0	
18	27.57				0					0				
17a	26.82				0					0				
17	25.36				1					0				
16a	26.16				0					0				
16	26.09				0					0				
15a	25.36				1					0				
15	25.73				0					0				
14a	31.37				0					1				
14	34.16				0					0				
13a	43.10				1					0				
13	38.93				2					0				
12a	37.52				0					0				
12	37.60				0					0				
11a	26.16				0					0				
11	24.64				0					0				
10a	24.71				0					0				
Total	481.3	222.5	156.7	379.3	5.0	0.0	0.0	0.0		1.0	1.0	0.0	1.0	
Sum squ	15040.7	7109.8	2341.3	13309.4	7.0	0.0	0.0	0.0		1.0	1.0	0.0	1.0	
				Sum (Z*y	171.7	0.0	0.0	0.0		31.4	30.4	0.0	30.4	
				R=Sy/Sz	0.0	0.0	0.0	0.0		0.0	0.0	0.0	0.0	
				Var y	0.4	0.0	0.0	0.0		0.1	0.1	0.0	0.1	
Var z	37.6	5.9	59.2	187.1					STRAT.					STRAT.
Covar zy					1.4	0.0	0.0	0.0	TOTAL	0.1	-1.3	0.0	-0.1	TOTAL
					ELE CARCASES					UNKNOWN CARCASES				
			Pop.est.(Y)		22	0	0	0	22	4	9	0	8	13
				SE(Y)	13.3	0.0	0.0	0.0	13.3	5.7	14.1	0.0	12.0	19.42
				95% C.L.	27.1	0.0	0.0	0.0	26.1	11.7	28.8	0.0	24.5	38.07
				95% C.L.	122.9	0.0	0.0	0.0	118.1	264.2	329.0	ERR	293.2	288.89

PARC NATIONAL DE LA GARAMBA
GARAMBA NATIONAL PARK

RECENSEMENT GENERAL SYSTEMATIQUE
GENERAL AERIAL SYSTEMATIC SAMPLE COUNT

Calibration Graphs, Distribution Maps and Population Estimate Calculations

May / Mai 2003

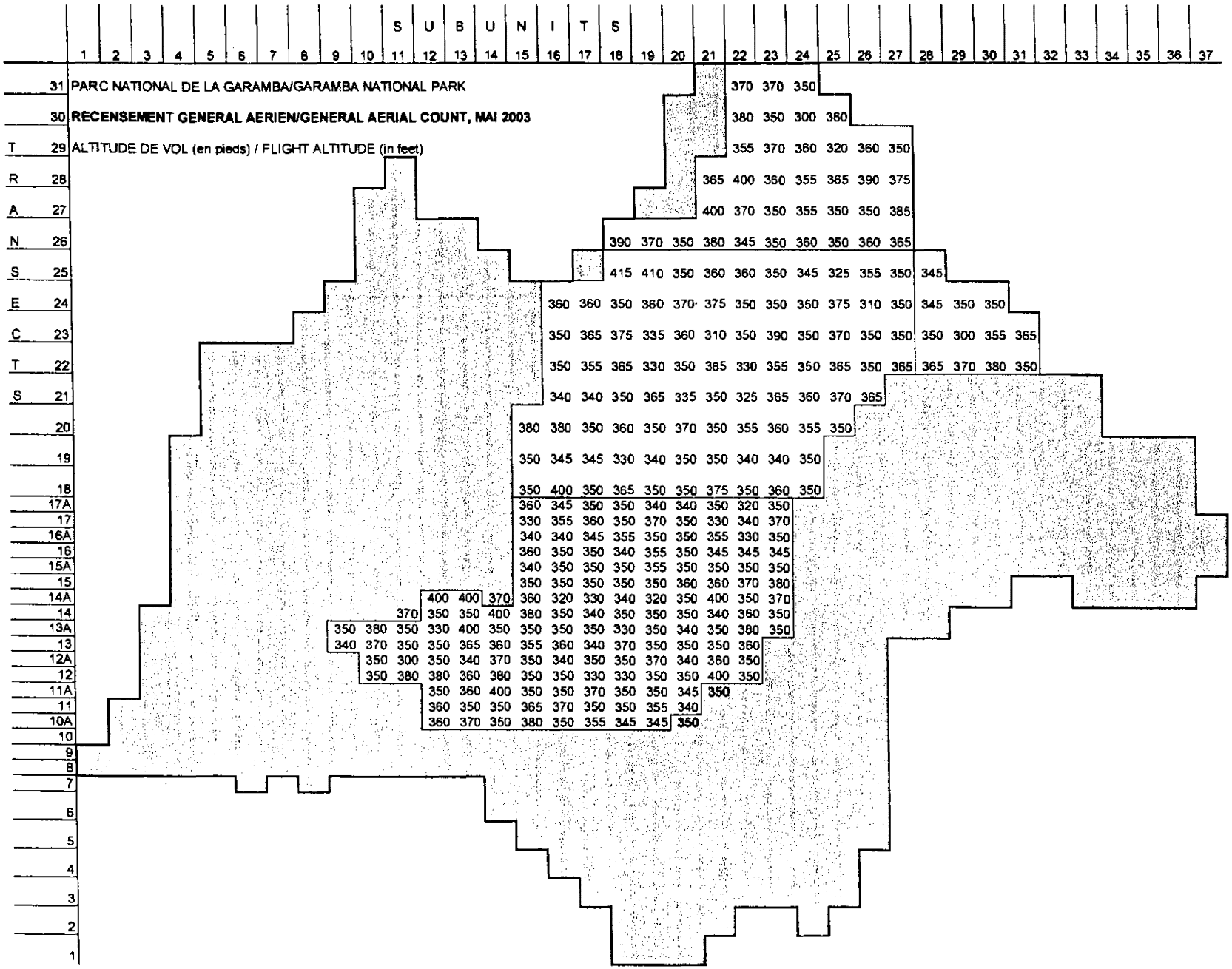


Regression Output:

Constant	218.1045
Std Err of Y Est	59.65976
R Squared	0.480829
No. of Observations	75
Degrees of Freedom	73
X Coefficient(s)	0.87003
Std Err of Coef.	0.105812

y=mx+c

y= 0.87003 *alt + 218.1045



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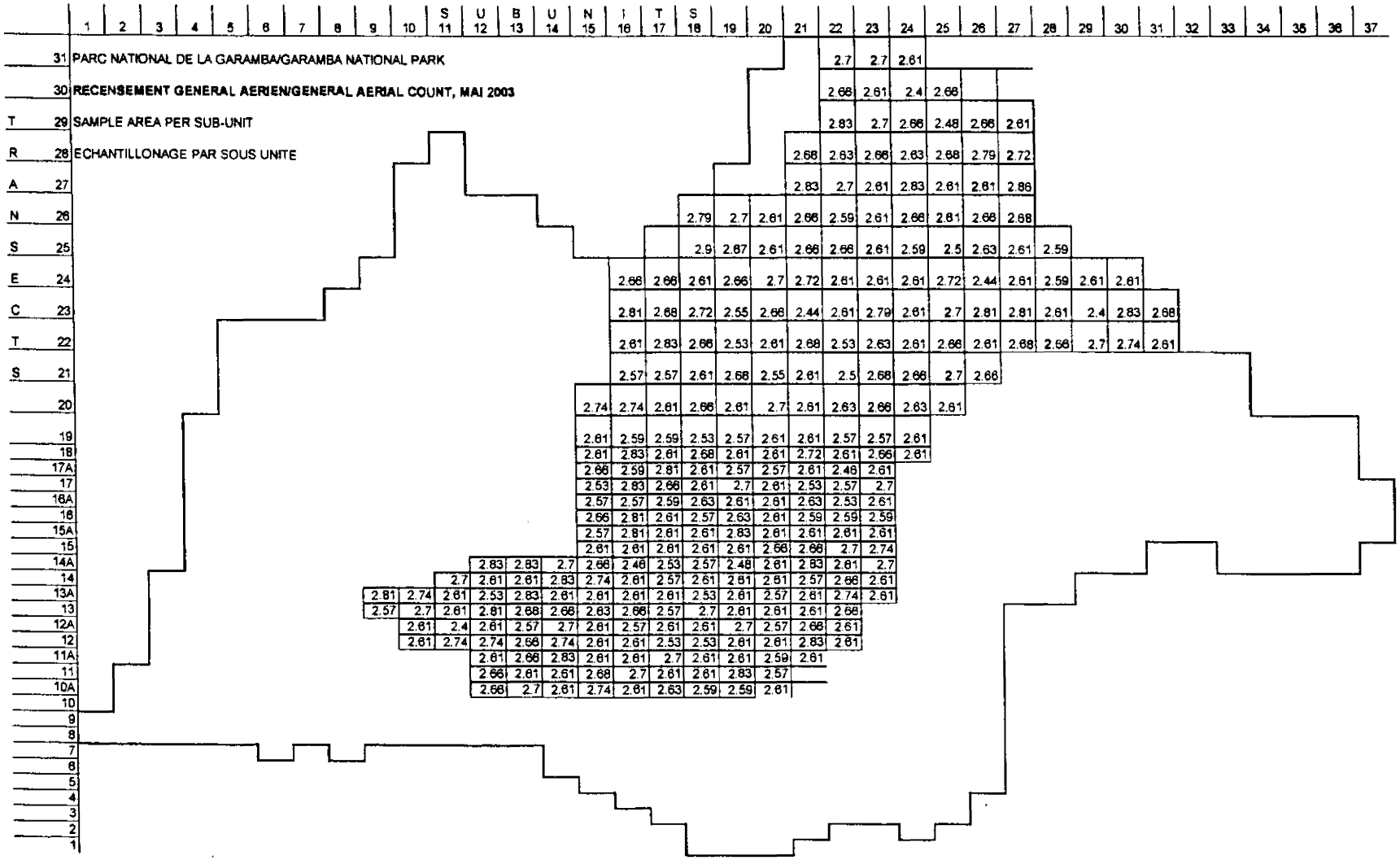
			343	343
			353	353
			373	373
			363	363
			360	360
		362	345	360
		355	348	354
		355	354	352
		353	366	356
		351		351
		360		360
		344		344
360				360
345				345
351				351
346				346
349				349
349				349
358				358
359				359
356				356
354				354
355				355
348				348
358				358
358				358
354				354
357				357
			359	359 Total Nord
354	354	353	354	Total Centre
354			354	Total Sud
354	354	357	355	TOTAL

PARC NATIONAL DE LA GARAMBA/GARAMBA NATIONAL PARK

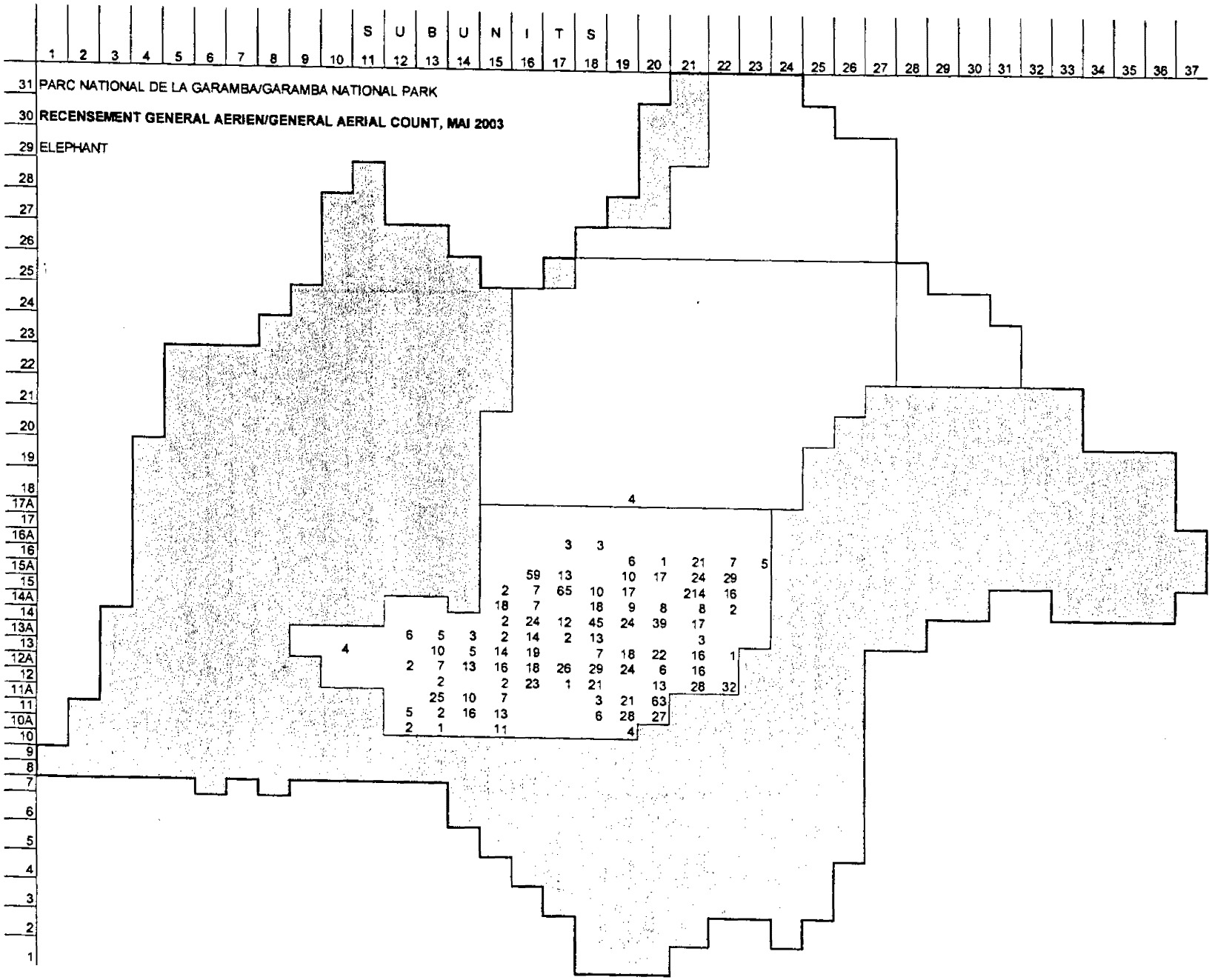
RECENSEMENT GENERAL AERIEN/GENERAL AERIAL COUNT, MAI 2003

SAMPLE AREA PER SUB-UNIT

ECHANTILLONAGE PAR SOUS UNITE



			8.01	8.01
			10.32	10.32
			15.74	15.74
			18.99	18.99
			16.68	16.68
			26.57	26.57
		26.65	2.59	29.24
		31.62	7.82	39.44
		31.60	21.06	41.92
		31.49	10.74	42.22
		28.81		26.81
		29.22		29.22
		25.87		25.87
	26.57			26.57
	23.32			23.32
	23.54			23.54
	23.37			23.37
	23.47			23.47
	23.50			23.50
	23.82			23.82
	31.84			31.84
	31.66			31.66
	39.46			39.46
	36.89			36.89
	33.84			33.84
	34.45			34.45
	23.84			23.84
	23.69			23.69
	21.14			21.14
0.00	0.00	98.32	98.32	Total Nord
0.00	205.26	42.20	238.72	Total Centre
444.39	0.00	0.00	444.39	Total Sud
444.39	205.26	140.52	779.43	TOTAL



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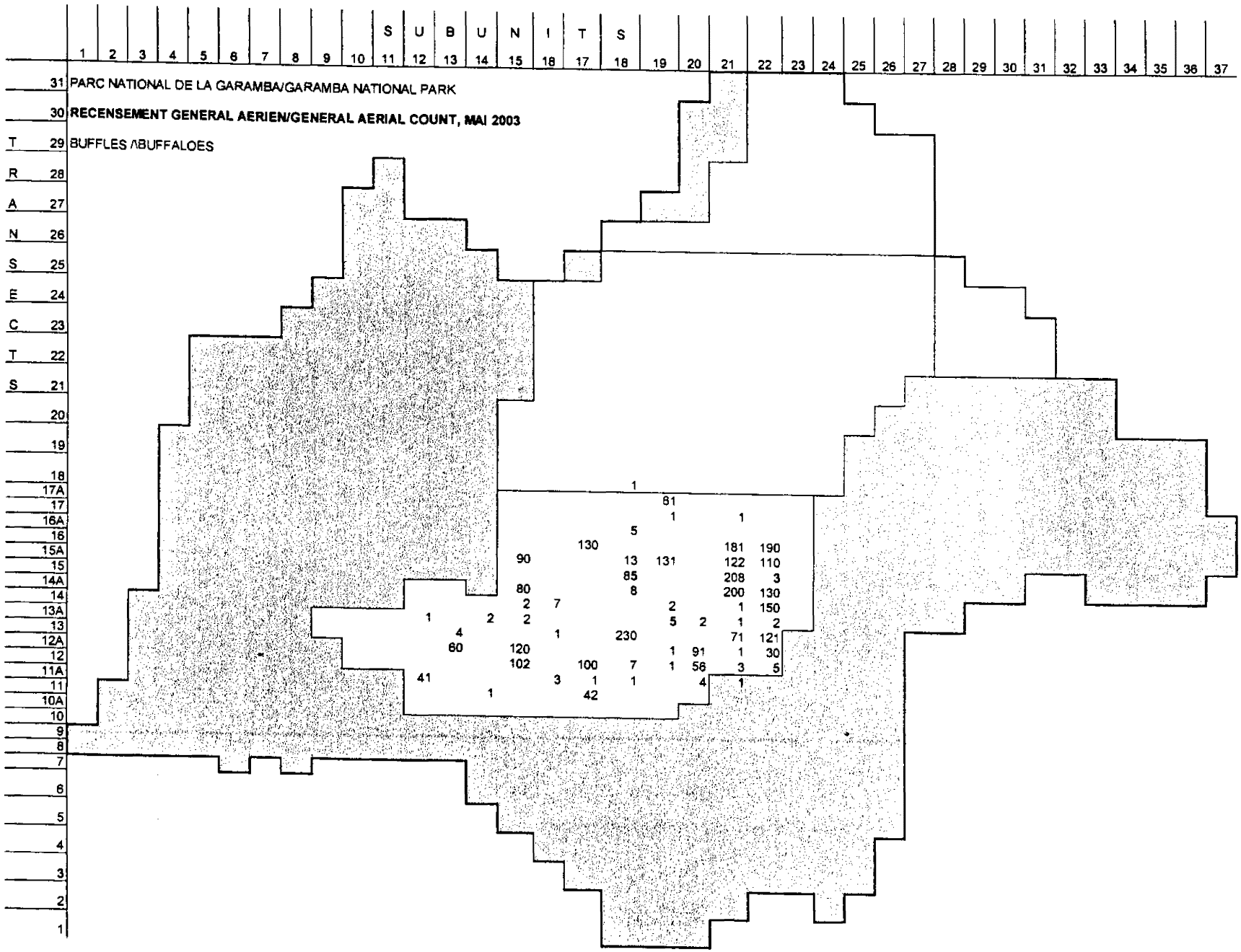
	0	0	0
	0	0	0
	0	0	0
	0		0
	0		0
	0		0
4			4
0			0
0			0
6			6
40			40
152			152
331			331
70			70
163			163
48			48
116			116
157			157
122			122
129			129
97			97
18			18
	0	0	0 Total Nord
	0	0	0 Total Centre
1453	0	0	1453 Total Sud
1453	0	0	1453 TOTAL

PARC NATIONAL DE LA GARAMBA/GARAMBA NATIONAL PARK

RECENSEMENT GENERAL AERIEN/GENERAL AERIAL COUNT, MAI 2003

BUFFLES /BUFFALOES



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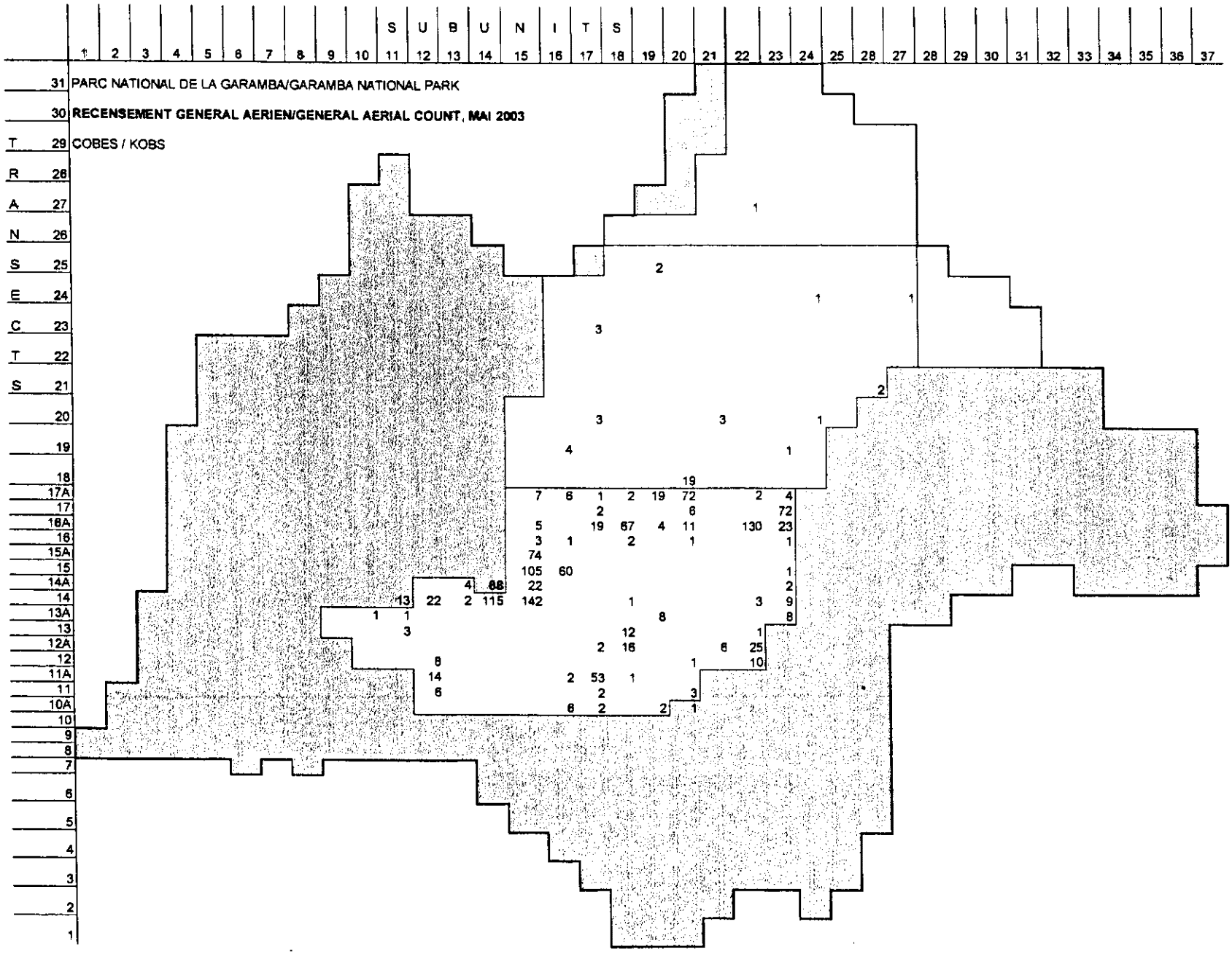
	0	0	0
	0		0
	0		0
	0		0
1			1
81			61
2			2
5			5
501			501
466			466
296			296
418			418
162			162
15			15
427			427
303			303
274			274
50			50
43			43
0			0
0	0	0	0 Total Non
0	0	0	0 Total Cer
3024	0	0	3024 Total Suc
3024	0	0	3024 TOTAL



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2		2	
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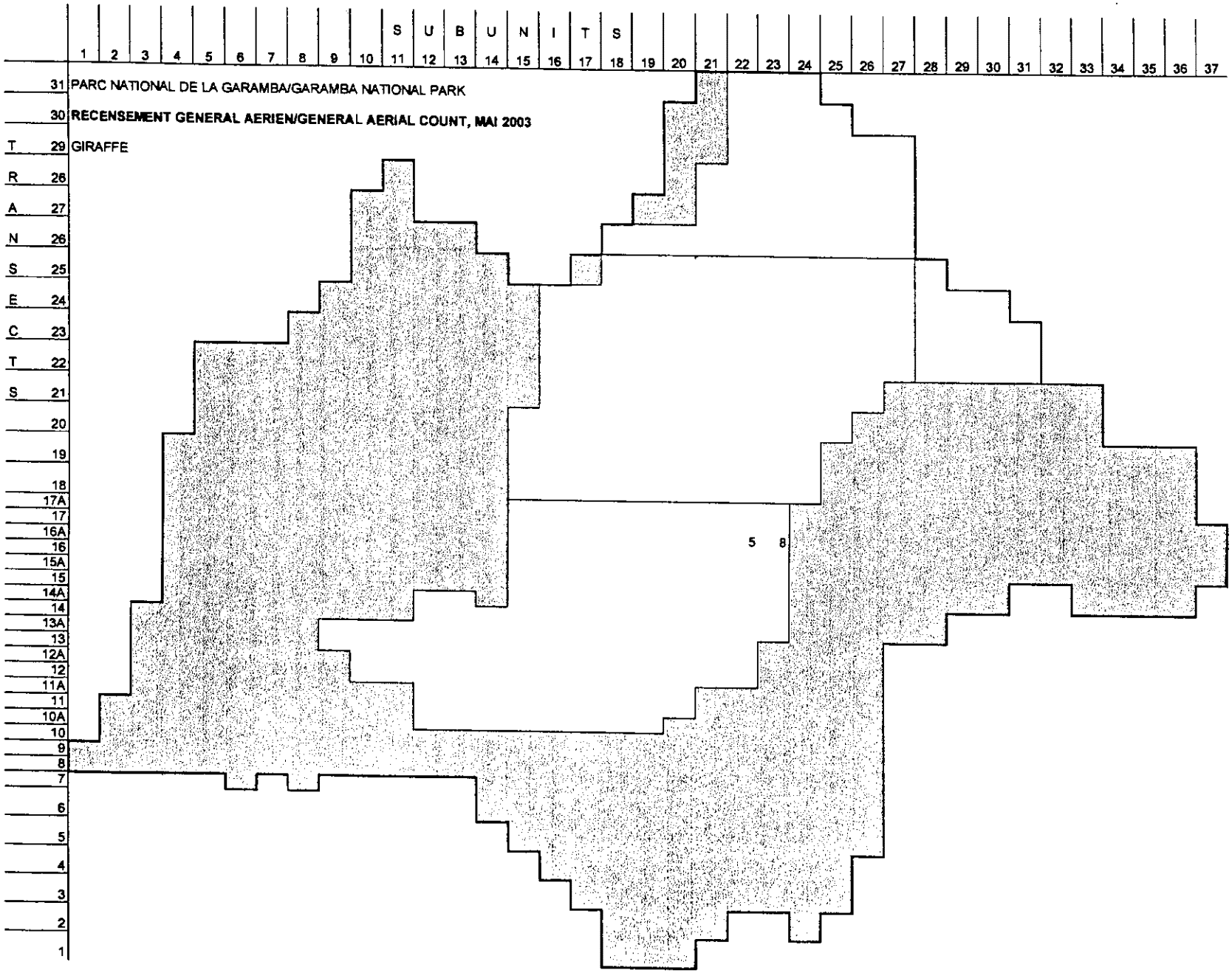
5		5	
19		19	
113		113	
80		80	
259		259	
6		6	
74		74	
166		166	
96		96	
294		294	
16		16	
16		16	
49		49	
19		19	
70		70	
11		11	
12		12	
0	0	1	1 Total Nord
21	21	0	21 Total Centre
1304	0	0	1304 Total Sud
1304	21	1	1326 TOTAL



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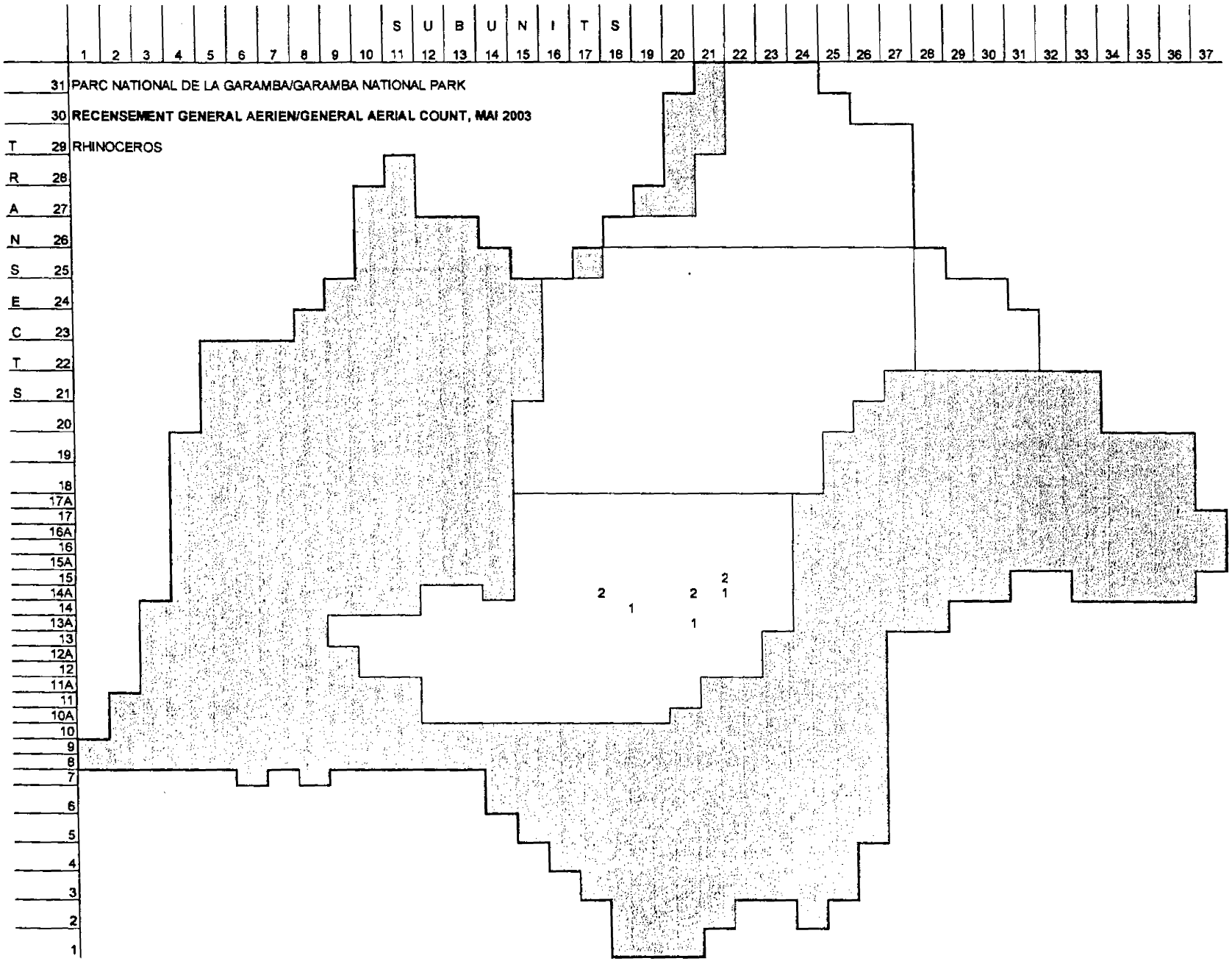
0			0
0			0
0			0
13			13
0			0
0			0
0			0
0			0
0			0
0			0
0			0
0			0
0			0
0			0
0			0
0			0
0	0	0	0 Total Nord
0	0	0	0 Total Centre
13	0	0	13 Total Sud
13	0	0	13 TOTAL


SUBUNITS
1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22 23 24 25 26 27 28 29 30 31 32 33 34 35 36 37
31 PARC NATIONAL DE LA GARAMBA/GARAMBA NATIONAL PARK
30 RECENSEMENT GENERAL AERIEN/GENERAL AERIAL COUNT, MAI 2003
T 29 RHINOCEROS
R 28
A 27
N 26
S 25
E 24
C 23
T 22
S 21
20
19
18
17A
17
16A
16
15A
15
14A
14
13A
13
12A
12
11A
11
10A
10
9
8
7
6
5
4
3
2
1
2
1
2
2
1
1
0 0
0 0
0 0
0 0
0 0
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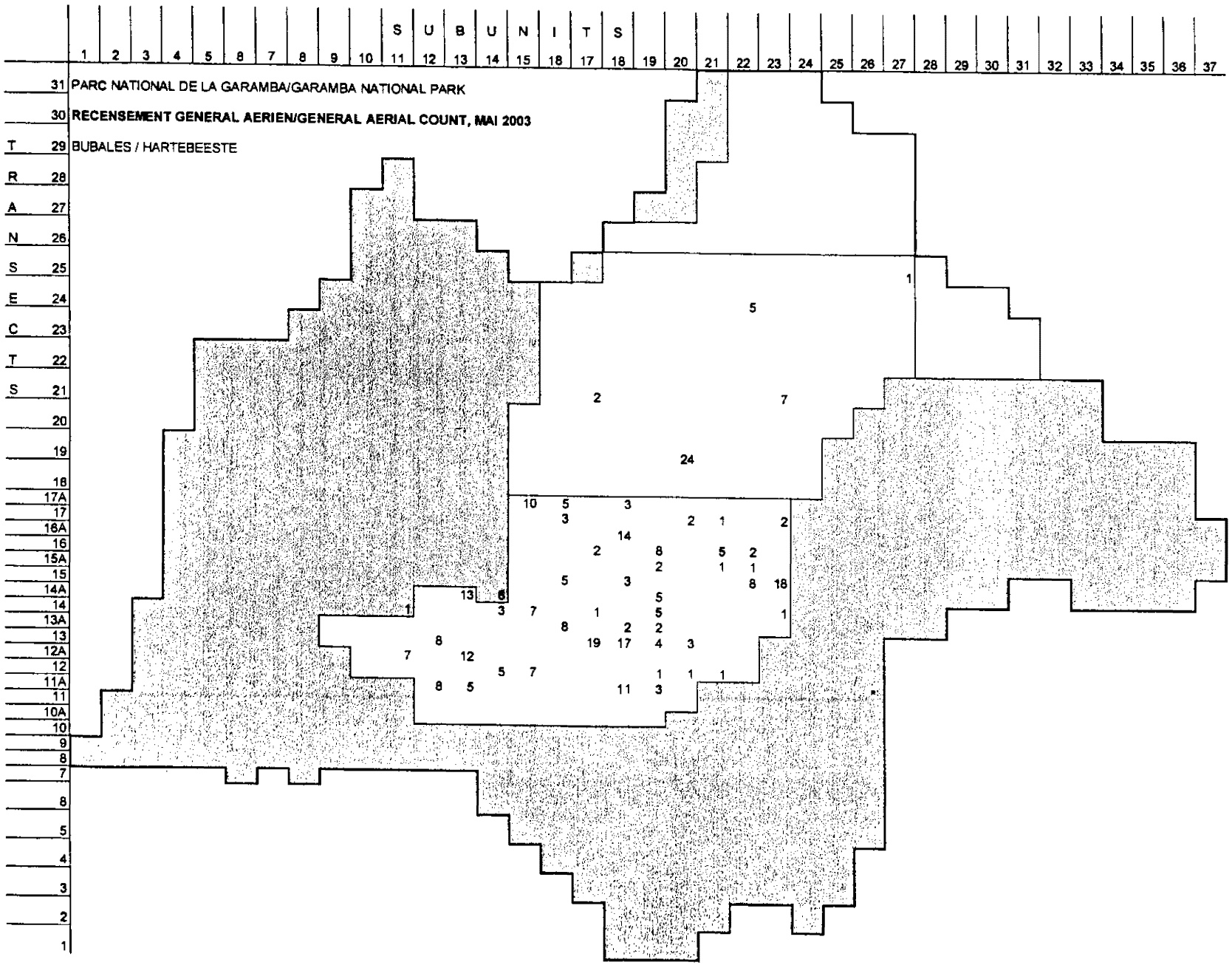
0 0 0
0 0
0 0
0 0
0 0
0 0
0 0
0 0
0 0
0 0
0 0
0 0
0 0
0 0
2 2
5 5
1 1
1 1
0 0
0 0
0 0
0 0
0 0
0 0
0 0
0 0 0 0 Total Nord
0 0 0 0 Total Centre
9 0 0 9 Total Sud
9 0 0 9 TOTAL



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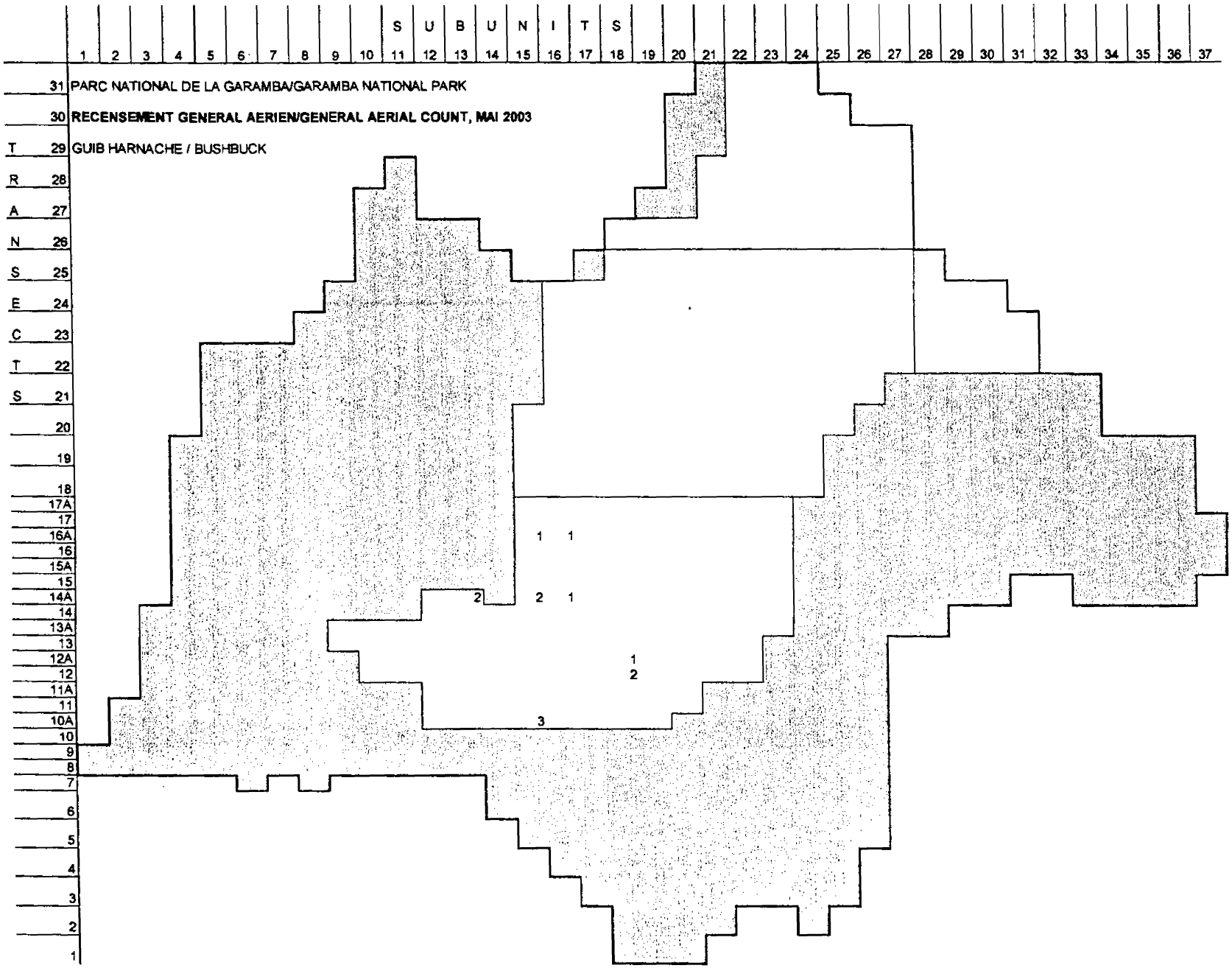
	5	0	5
	0	0	0
	0	0	0
	9		9
	0		0
	24		24
0			0
18			18
8			8
14			14
17			17
4			4
32			32
24			24
17			17
12			12
51			51
19			19
15			15
25			25
0			0
0			0
0	0	0	0 Total Nord
39	39	0	39 Total Centre
256	0	0	256 Total Sud
256	39	0	295 TOTAL



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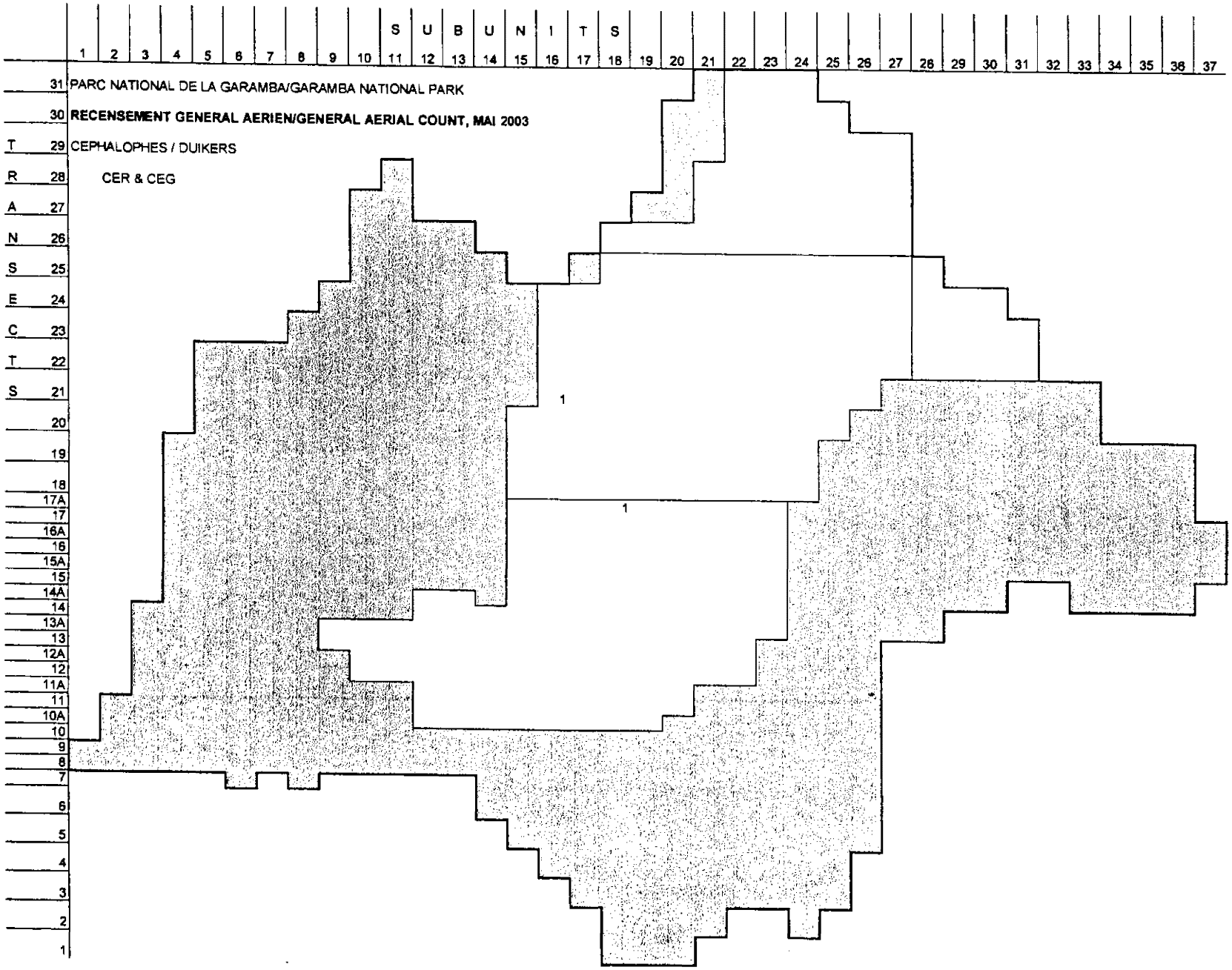
		0	0	0
		0		0
		0		0
		0		0
0				0
0				0
0				0
2				2
0				0
0				0
0				0
5				5
0				0
0				0
0				0
1				1
2				2
0				0
0				0
3				3
0	0	0	0	Total Nord
0	0	0	0	Total Centre
13	0	0	13	Total Sud
13	0	0	13	TOTAL



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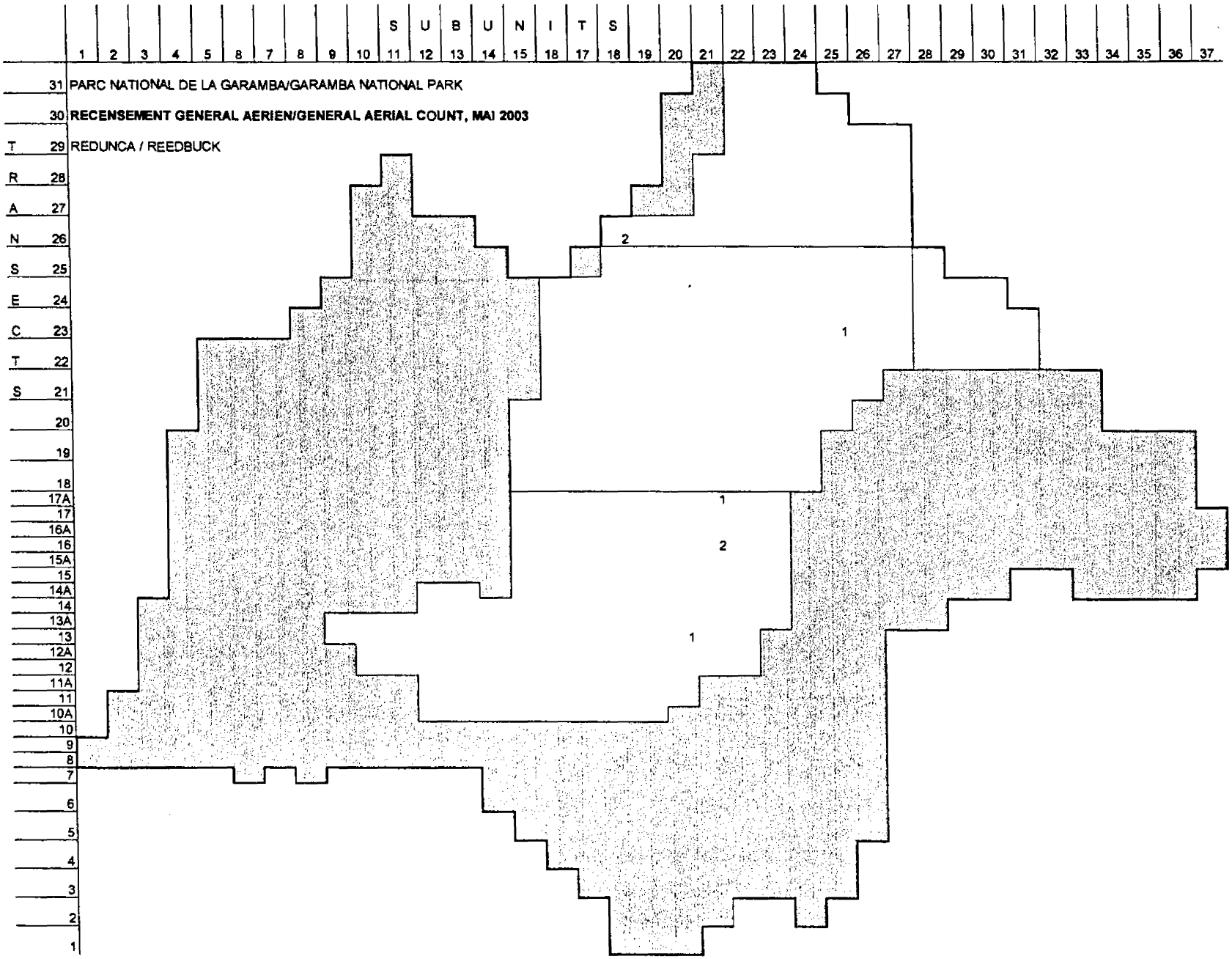
	0	0	0	
	1		1	
	0		0	
	0		0	
0			0	
1			1	
0			0	
0			0	
0			0	
0			0	
0			0	
0			0	
0			0	
0			0	
0			0	
0			0	
0			0	
0			0	
0			0	
0			0	
0	0	0	0	Total Nord
1	1	0	1	Total Centre
1	0	0	1	Total Sud
1	1	0	2	TOTAL



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		0	0
		0	0
		0	0
		2	2
0	0	0	
0	0	0	
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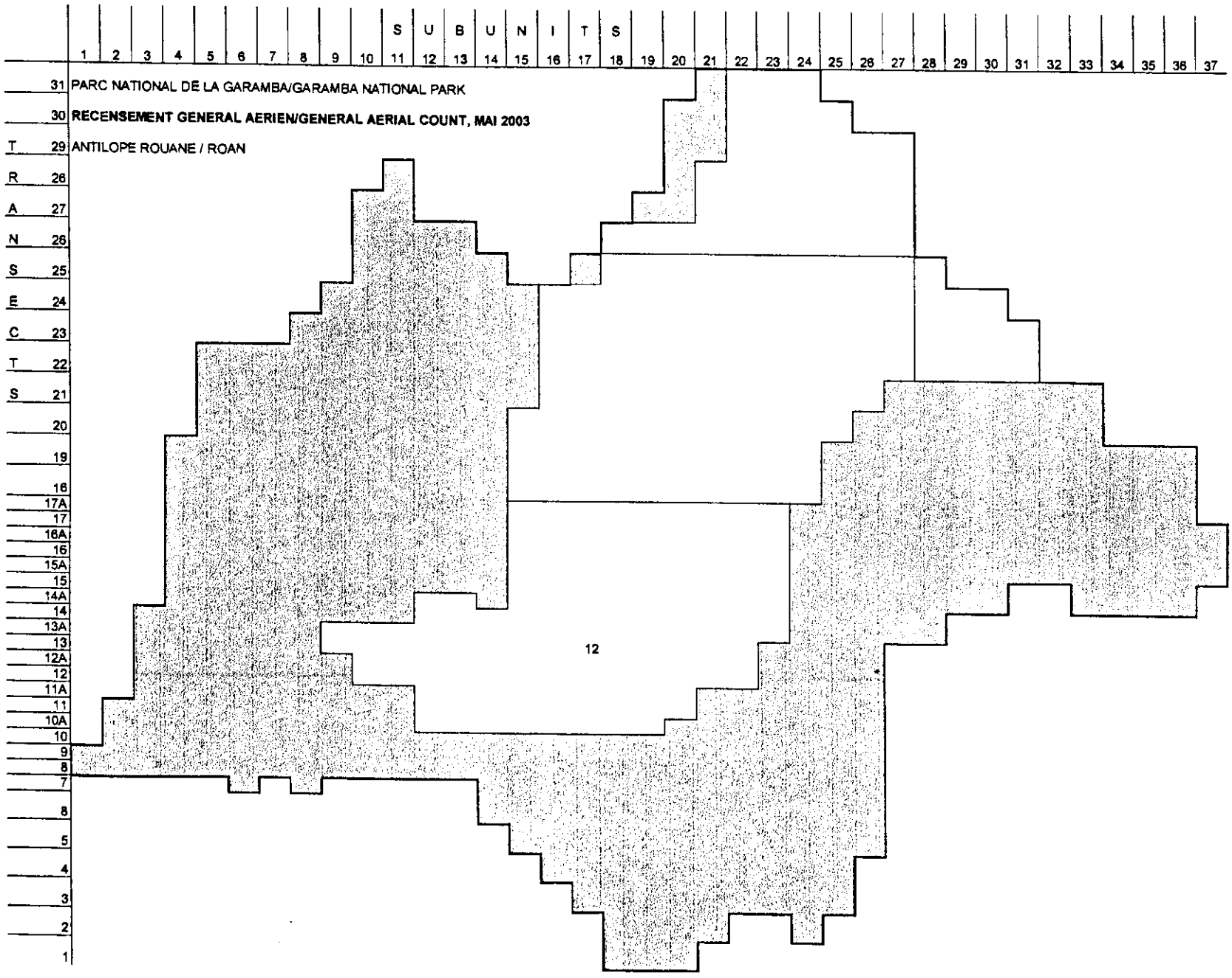
0	0	0	
0		0	
0		0	
0		0	
0		0	
1		1	
0		0	
2		2	
0		0	
0		0	
0		0	
0		0	
0		0	
1		1	
0		0	
0		0	
0		0	
0		0	
0		0	
0	0	2	2 Total Nord
1	1	0	1 Total Centre
4	0	0	4 Total Sud
4	1	2	7 TOTAL



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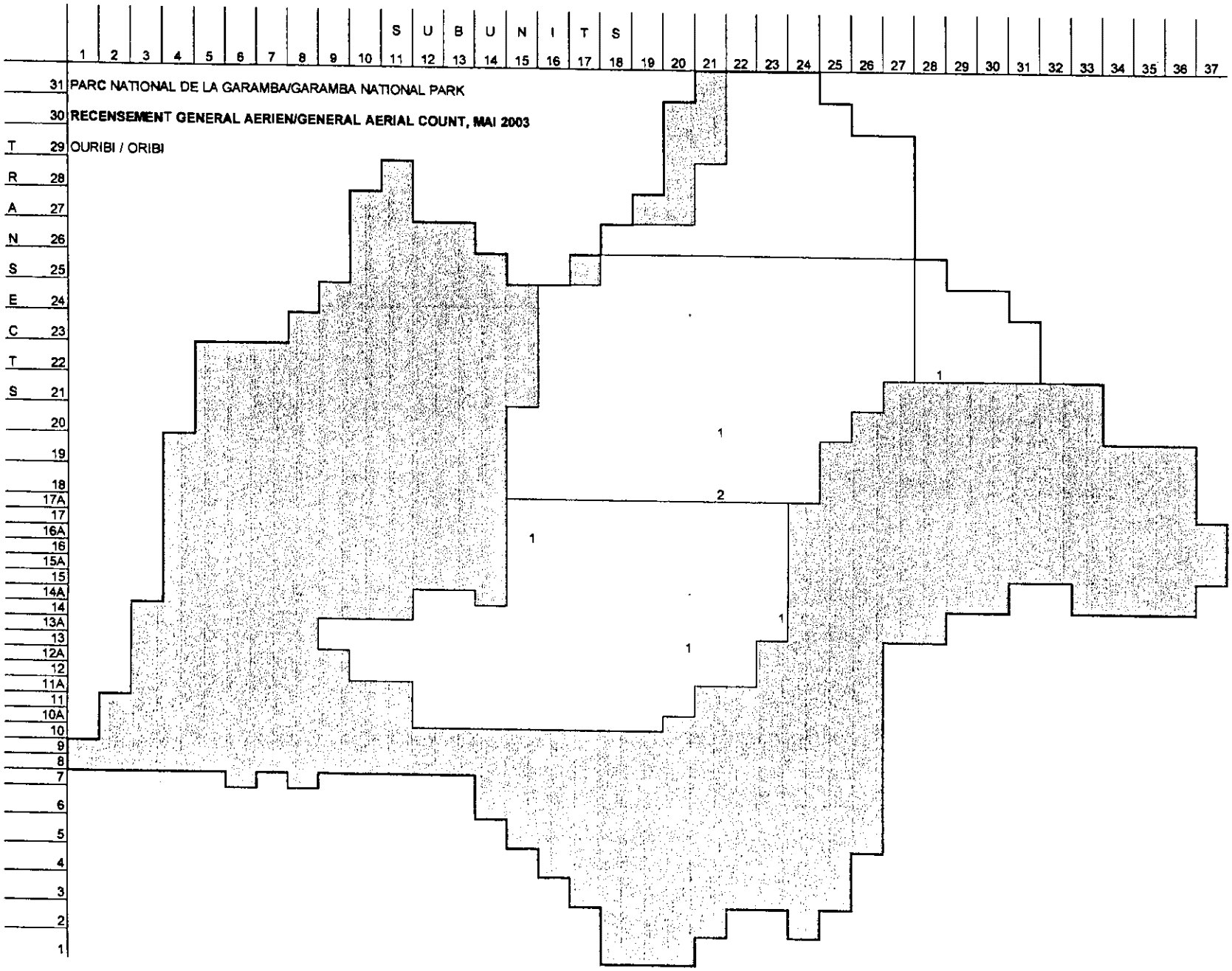
0			0
0			0
0			0
0			0
0			0
0			0
0			0
0			0
12			12
0			0
0			0
0			0
0			0
0			0
0	0	0	0 Total Nord
0	0	0	0 Total Centre
12	0	0	12 Total Sud
12	0	0	12 TOTAL



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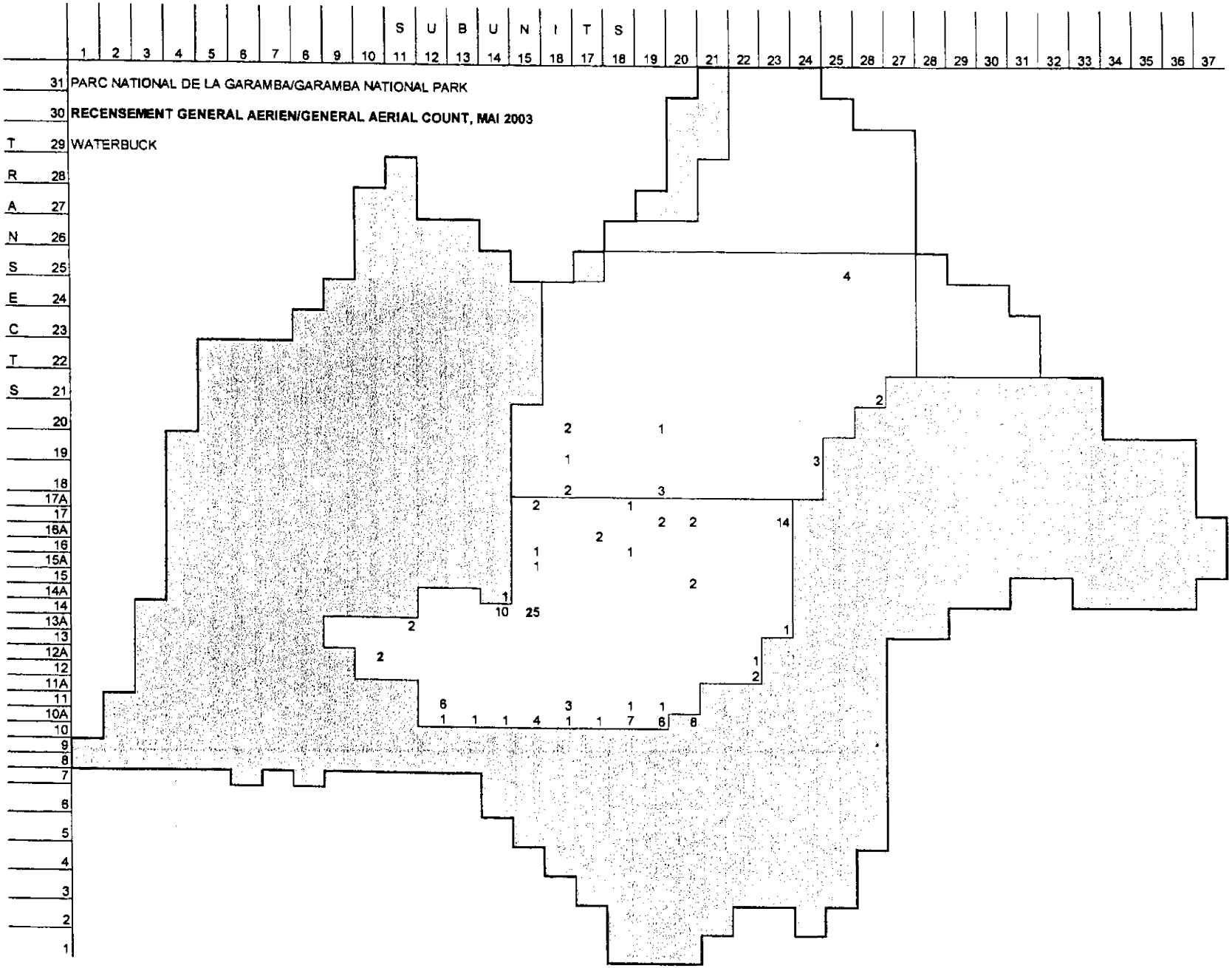
0		0	
1		1	
0		0	
2		2	
0		0	
0		0	
1		1	
0		0	
0		0	
0		0	
0		0	
1		1	
0		0	
1		1	
0		0	
0		0	
0		0	
0		0	
0		0	
0	0	0	0 Total Nord
1	1	2	2 Total Centre
5	0	0	5 Total Sud
5	1	2	7 TOTAL



0		0	0
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0		0	0
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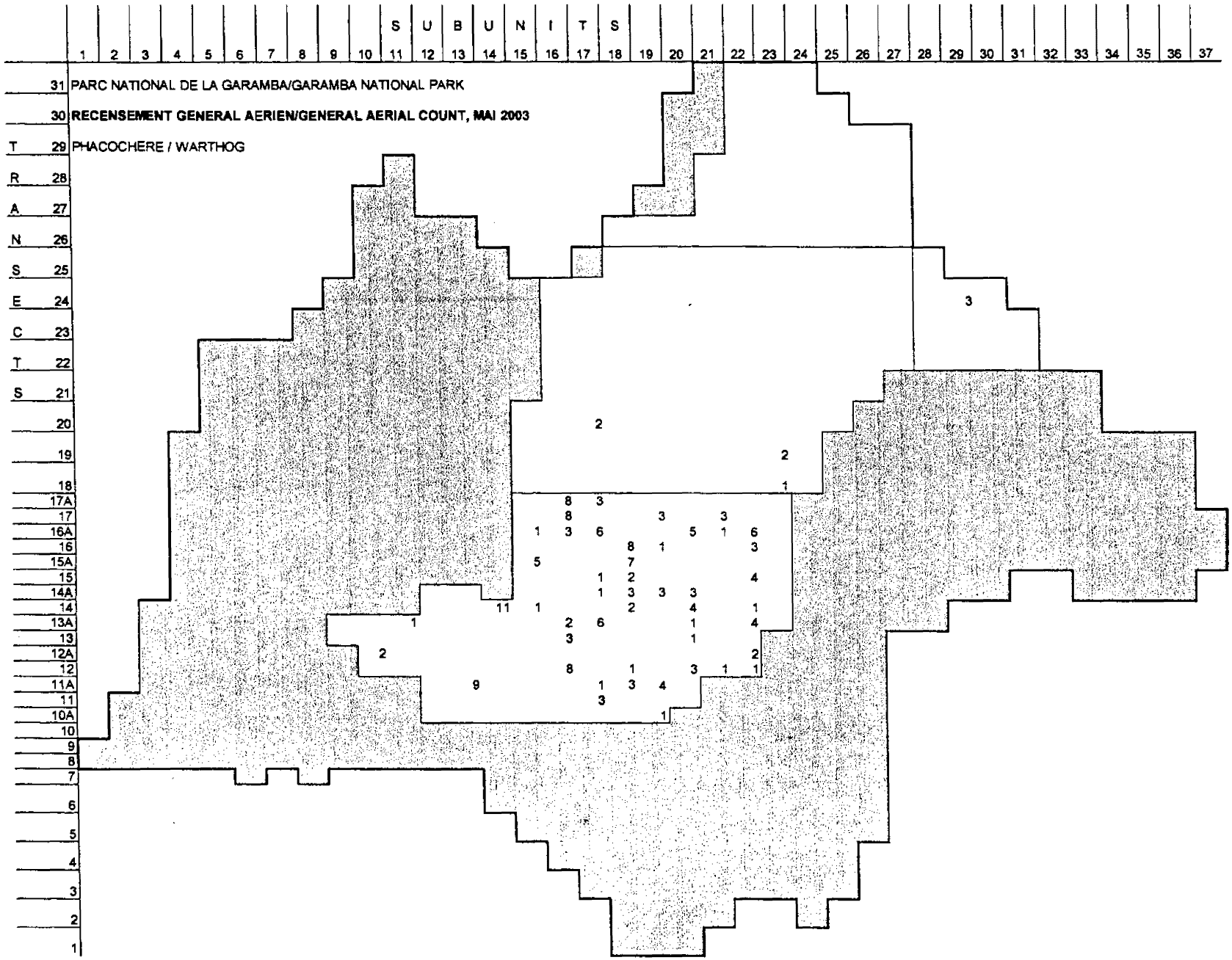
0		0	0
0		0	0
0		0	0
2			2
3			3
4			4
5			5
3			3
18			18
2			2
2			2
1			1
2			2
1			1
35			35
3			3
0			0
3			3
2			2
0			0
11			11
22			22
0	0	0	0 Total Nord
13	13	0	13 Total Centre
110	0	0	110 Total Sud
110	13	0	123 TOTAL



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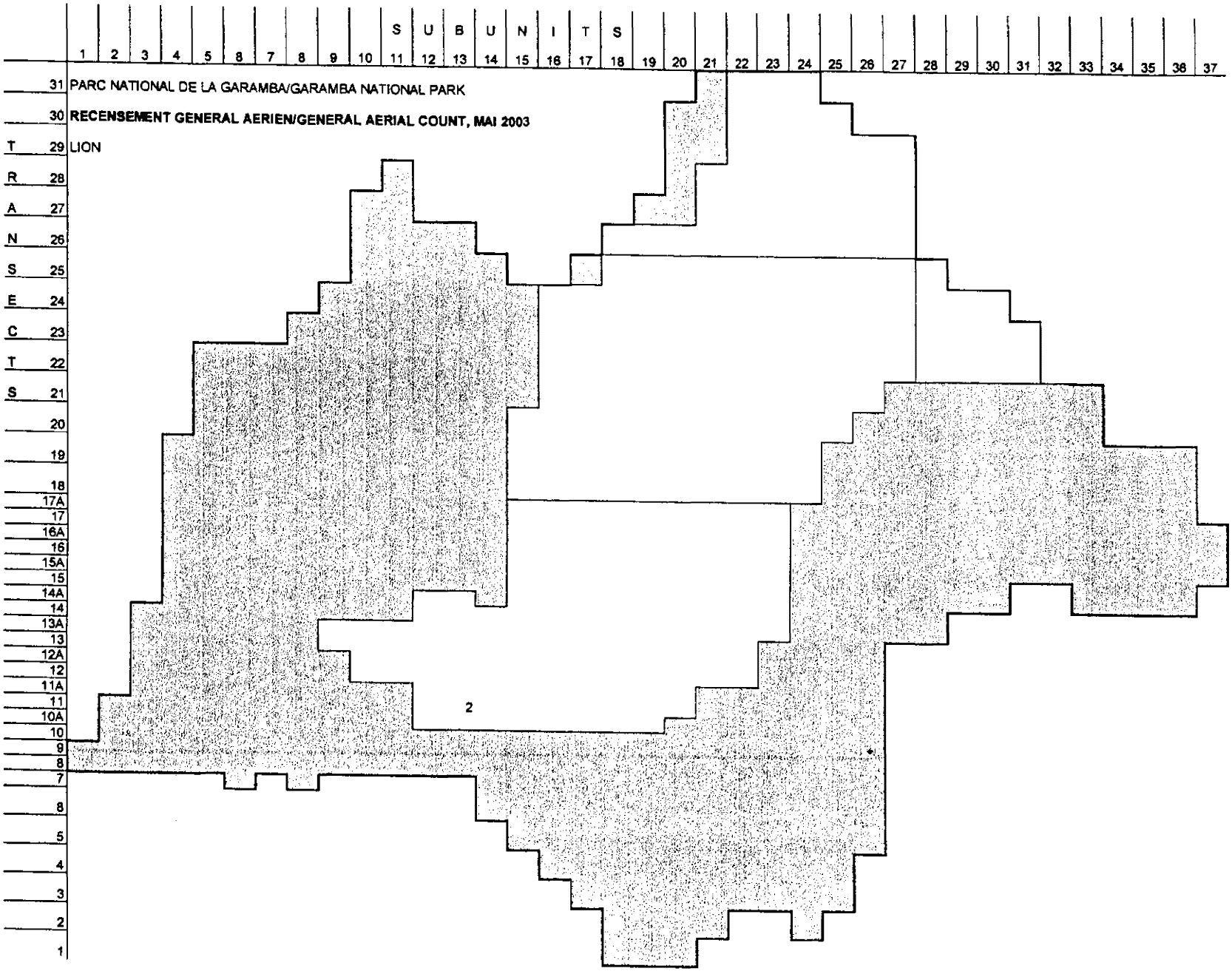
	0	0	0	
	0	0	0	
	0		0	
	2		2	
	2		2	
1			1	
11			11	
14			14	
22			22	
12			12	
12			12	
7			7	
10			10	
19			19	
14			14	
4			4	
4			4	
14			14	
17			17	
3			3	
1			1	
0	0	0	0	Total Nord
4	4	3	7	Total Centre
165	0	0	165	Total Sud
165	4	3	172	TOTAL



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0	0		
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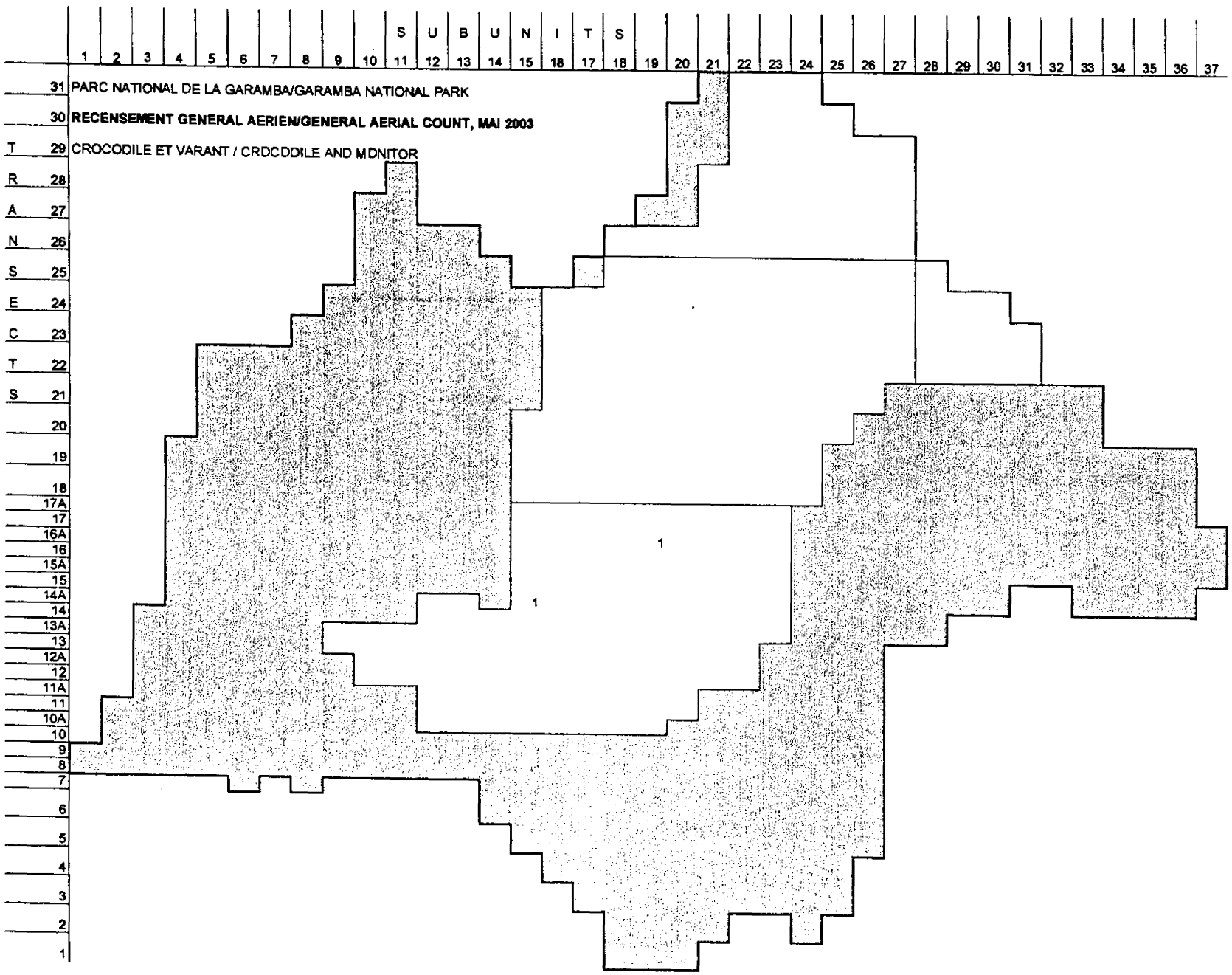
0	0		
0	0		
0	0		
0	0		
0	0		
0	0		
0	0		
0	0		
2	2		
0	0		
0	0	0	0 Total Nord
0	0	0	0 Total Centre
2	0	0	2 Total Sud
2	0	0	2 TOTAL



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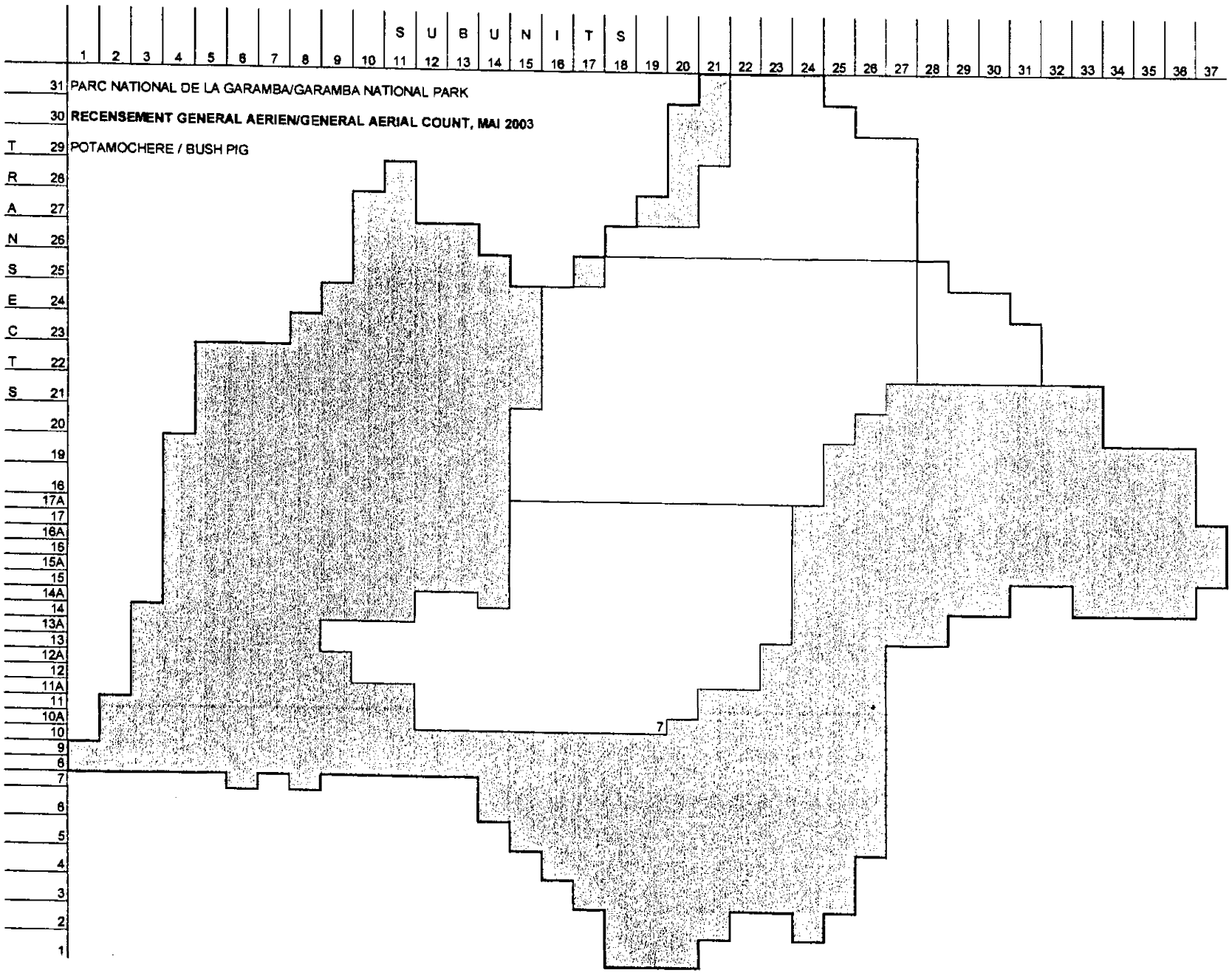
1				1
0				0
0				0
0				0
1				1
0				0
0				0
0				0
0				0
0				0
0				0
0				0
0	0	0	0	Total Nord
0	0	0	0	Total Centre
2	0	0	2	Total Sud
2	0	0	2	TOTAL



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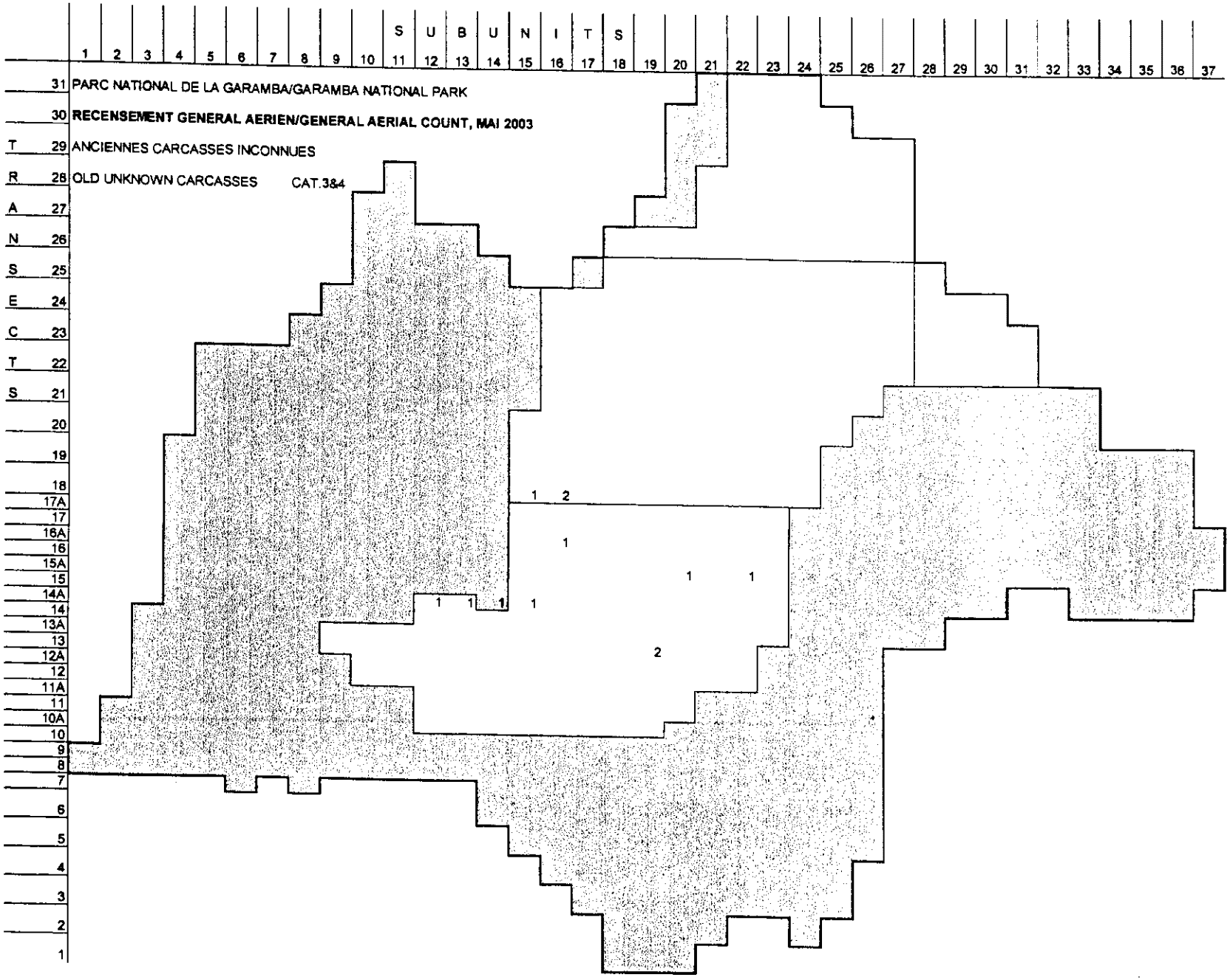
0		0	
0		0	
0		0	
0		0	
0		0	
0		0	
0		0	
0		0	
7		7	
0	0	0	0 Total Nord
0	0	0	0 Total Centre
7	0	0	7 Total Sud
7	0	0	7 TOTAL



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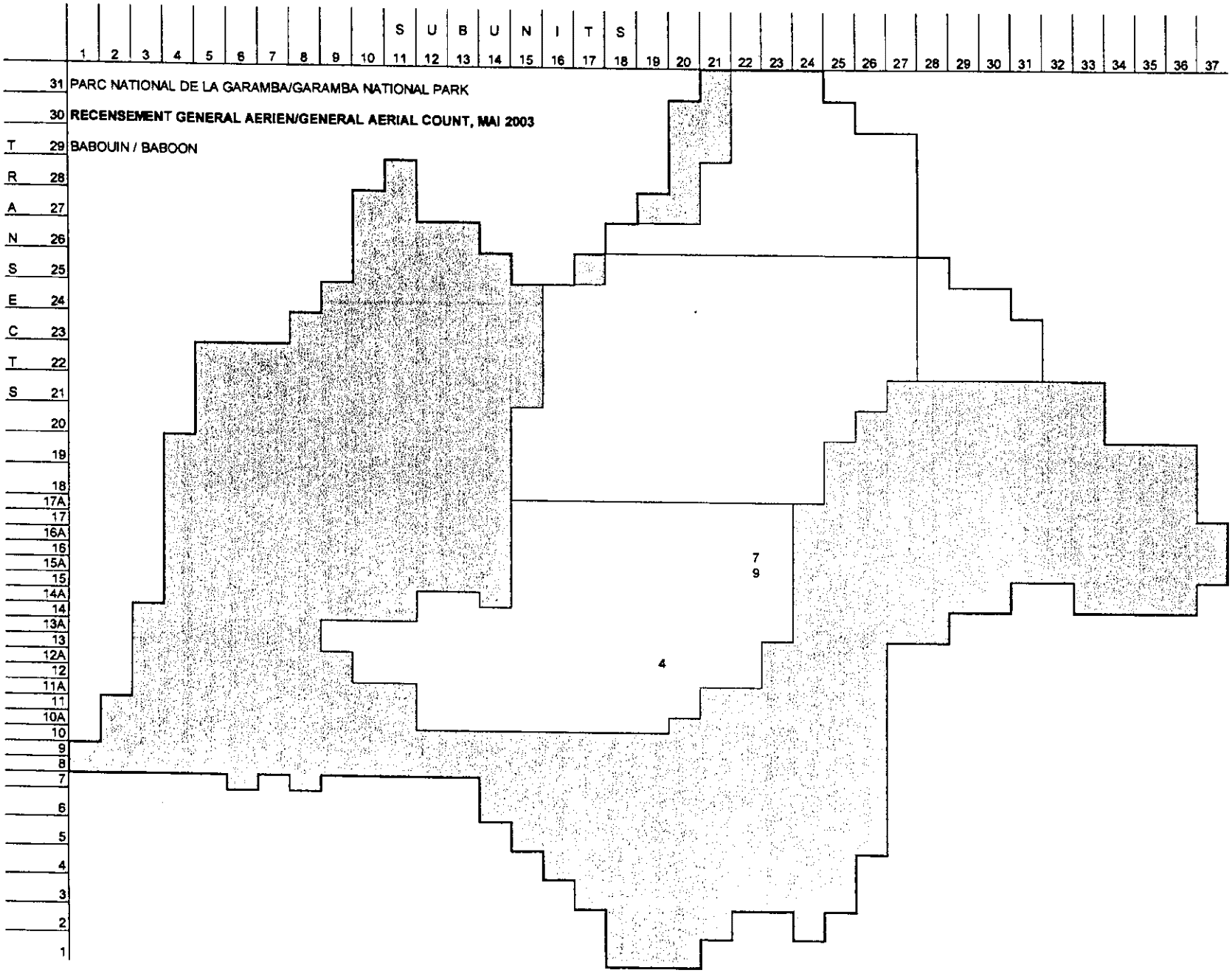
2		2	
0		0	
4		4	
0		0	
0		0	
2		2	
0		0	
0		0	
0		0	
0		0	
0		0	
0	0	0	0 Total Nord
0	0	0	0 Total Centre
12	0	0	12 Total Sud
12	0	0	12 TOTAL



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9		9	
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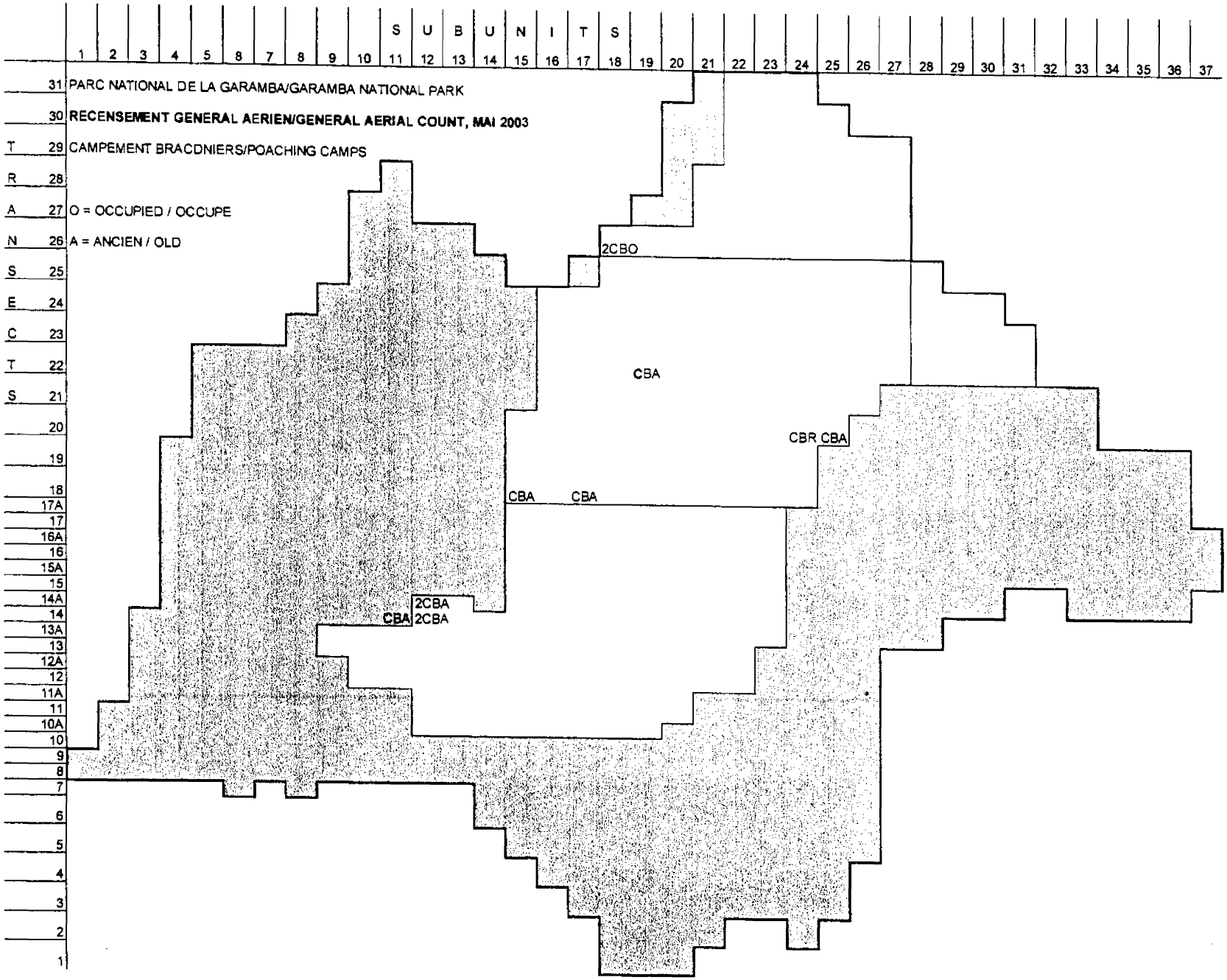
4		4	
0		0	
0		0	
0		0	
0		0	
0	0	0	0 Total Nord
0	0	0	0 Total Centre
20	0	0	20 Total Sud
20	0	0	20 TOTAL



PARC NATIONAL DE LA GARAMBA/GARAMBA NATIONAL PARK

RECENSEMENT GENERAL AERIEN/GENERAL AERIAL COUNT, MAI 2003

CAMPEMENT BRACDNIERS/POACHING CAMPS

O = OCCUPIED / OCCUPE

A = ANCIEN / OLD

		0	0	
		0	0	
		0	0	
		0	0	
		0	0	
		0	0	
	0	0	0	
	0	0	0	
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0			0	
0			0	
0			0	
0			0	
0			0	
0	0	0	0	Total Nord
0	0	0	0	Total Centre
0	0	0	0	Total Sud
0	0	0	0	TOTAL

	AREA				ELEPHANTS					BUFFALOES/BUFFLES					COBS				
TRANS	HIGH STH	MID NTH	LOW NTH	TOT.NOR	HIGH STH	MID NTH	LOW NTH	TOT.NTH	TOTAL	HIGH STH	MID NTH	LOW NTH	TOT.NTH	TOTAL	HIGH STH	MID NTH	LOW NTH	TOT.NTH	TOTAL
31			8.01	8.01			0	0				0	0				0	0	
30			10.32	10.32			0	0				0	0				0	0	
29			15.74	15.74			0	0				0	0				0	0	
28			18.99	18.99			0	0				0	0				0	0	
27			18.66	18.68			0	0				0	0				1	0	
26			26.57	26.57			0	0				0	0				0	0	
25		26.65	2.59	29.24		0	0	0			0	0	0			2	0	0	
24		31.62	7.82	39.44		0	0	0			0	0	0			2	0	0	
23		31.60	21.06	41.92		0	0	0			0	0	0			3	0	0	
22		31.49	10.74	42.22		0	0	0			0	0	0			0	0	0	
21		28.81		28.81		0		0			0		0			2		0	
20		29.22		29.22		0		0			0		0			7		0	
19		25.87		25.87		0		0			0		0			5		0	
18	26.57				4					1					19				
17a	23.32				0					81					113				
17	23.54				0					2					80				
16a	23.37				8					5					259				
16	23.47				40					501					8				
15a	23.50				152					466					74				
15	23.82				331					296					166				
14a	31.84				70					418					96				
14	31.66				163					162					294				
13a	39.46				48					15					18				
13	36.89				116					427					16				
12a	33.84				157					303					49				
12	34.45				122					274					19				
11a	23.84				129					50					70				
11	23.69				97					43					11				
10a	21.14				18					0					12				
Total	444.39	205.26	98.32	98.32	1453.0	0.0	0.0	0.0		3024.0	0.0	0.0	0.0		1304.0	21.0	1.0	0.0	
Sum squ	12862.49	205.26	42.20	236.72	247453.0	0.0	0.0	0.0		1114280.0	0.0	0.0	0.0		223866.0	95.0	1.0	0.0	
		0.00	0.00	444.39	41474.2	0.0	0.0	0.0		88056.5	0.0	0.0	0.0		35117.0	602.9	18.7	0.0	
		205.26	140.52	779.43															
				R=Sy/Sz	3.3	0.0	0.0	0.0		6.8	0.0	0.0	0.0		2.9	0.1	0.0	0.0	
				Var y	7700.2	0.0	0.0	0.0		36182.9	0.0	0.0	0.0		7839.3	5.3	0.2	0.0	
Var z	34.6	5.7	44.6	125.2					STRAT.					STRAT.					STRAT.
Covar zy					74.5	0.0	0.0	0.0	TOTAL	271.1	0.0	0.0	0.0	TOTAL	-73.4	-23.1	1.0	0.0	TOTAL
					ELEPHANTS					BUFFALOES/BUFFLES					COBS				
			Pop.est.(Y)		6,948	0	0	0	6,948	14,460	0	0	0	14,480	6,235	200	12	0	6,447
				SE(Y)	1995.3	0.0	0.0	0.0	1995.3	4231.0	0.0	0.0	0.0	4231.00	2120.9	114.2	9.5	0.0	2124.0
				95% C.L.	4070.4	0.0	0.0	0.0	3910.8	8631.2	0.0	0.0	0.0	8292.76	4326.7	233.0	19.4	0.0	4163.1
				95% C.L.	58.6	0.0	0.0	0.0	56.3	59.7	0.0	0.0	0.0	57.35	69.4	0.0	0.0	0.0	64.6

	AREA				GIRAFFES					RHINOS					HIPPOPOTAMES/HIPPOS				
TRANS	HIGH STH	MID NTH	LOW NTH	TOT.NOR	HIGH STH	MID NTH	LOW NTH	TOT.NTH	TOTAL	HIGH STH	MID NTH	LOW NTH	TOT.NTH	TOTAL	HIGH STH	MID NTH	LOW NTH	TOT.NTH	TOTAL
31			8.01	8.01			0	0				0	0				0	0	
30			10.32	10.32			0	0				0	0				0	0	
29			15.74	15.74			0	0				0	0				0	0	
28			18.99	18.99			0	0				0	0				0	0	
27			18.68	18.68			0	0				0	0				0	0	
26			26.57	26.57			0	0				0	0				0	0	
25		26.65	2.59	29.24		0	0	0			0	0	0			0	0	0	
24		31.62	7.82	39.44		0	0	0			0	0	0			0	0	0	
23		31.60	21.06	41.92		0	0	0			0	0	0			0	0	0	
22		31.49	10.74	42.22		0	0	0			0	0	0			0	0	0	
21		28.81		28.81		0		0			0		0			0		0	
20		29.22		29.22		0		0			0		0			0		0	
19		25.87		25.87		0		0			0		0			0		0	
18	26.57				0					0					0				
17a	23.32				0					0					0				
17	23.54				0					0					48				
16a	23.37				13					0					42				
16	23.47				0					0					6				
15a	23.50				0					0					98				
15	23.82				0					2					45				
14a	31.84				0					5					37				
14	31.66				0					1					39				
13a	39.46				0					1					3				
13	36.89				0					0					38				
12a	33.84				0					0					35				
12	34.45				0					0					4				
11a	23.84				0					0					197				
11	23.69				0					0					39				
10a	21.14				0					0					4				
Total	444.39	205.26	98.32	98.32	13.0	0.0	0.0	0.0		9.0	0.0	0.0	0.0		635.0	0.0	0.0	0.0	
Sum squ	12862.49	205.26	42.20	236.72	169.0	0.0	0.0	0.0		31.0	0.0	0.0	0.0		61663.0	0.0	0.0	0.0	
		0.00	0.00	444.39	303.8	0.0	0.0	0.0		277.9	0.0	0.0	0.0		16587.5	0.0	0.0	0.0	
		205.26	140.52	779.43															
				R=Sy/Sz	0.0	0.0	0.0	0.0		0.0	0.0	0.0	0.0		1.4	0.0	0.0	0.0	
				Var y	10.6	0.0	0.0	0.0		1.7	0.0	0.0	0.0		2430.8	0.0	0.0	0.0	
Var z	34.6	5.7	44.6	125.2					STRAT.					STRAT.					STRAT.
Cover zy					-3.8	0.0	0.0	0.0	TOTAL	1.9	0.0	0.0	0.0	TOTAL	-70.0	0.0	0.0	0.0	TOTAL
					GIRAFFES					RHINOCEROS					HIPPOS				
			Pop.est.(Y)		62	0	0	0	62	43	0	0	0	43	3,036	0	0	0	3,036
				SE(Y)	75.4	0.0	0.0	0.0	75.4	29.6	0.0	0.0	0.0	29.59	1190.9	0.0	0.0	0.0	1190.9
				95% C.L.	153.7	0.0	0.0	0.0	147.7	60.4	0.0	0.0	0.0	58.00	2429.4	0.0	0.0	0.0	2334.2
				95% C.L.	247.3	0.0	0.0	0.0	237.6	140.3	0.0	0.0	0.0	134.77	80.0	0.0	0.0	0.0	76.9

	AREA				WATERBUCK					PHACOCHERE					LION				
TRANS	HIGH STH	MID NTH	LOW NTH	TOT.NOR	HIGH STH	MID NTH	LOW NTH	TOT.NTH	TOTAL	HIGH STH	MID NTH	LOW NTH	TOT.NTH	TOTAL	HIGH STH	MID NTH	LOW NTH	TOT.NTH	TOTAL
31			8.01	8.01			0	0				0	0				0	0	
30			10.32	10.32			0	0				0	0				0	0	
29			15.74	15.74			0	0				0	0				0	0	
28			18.99	18.99			0	0				0	0				0	0	
27			18.68	18.68			0	0				0	0				0	0	
26			26.57	26.57			0	0				0	0				0	0	
25		26.65	2.59	29.24		4	0	0			0	0	0			0	0	0	
24		31.62	7.82	39.44		0	0	0			0	3	0			0	0	0	
23		31.60	21.06	41.92		0	0	0			0	0	0			0	0	0	
22		31.49	10.74	42.22		0	0	0			0	0	0			0	0	0	
21		28.81		28.81		2		0			0		0			0		0	
20		29.22		29.22		3		0			2		0			0		0	
19		25.87		25.87		4		0			2		0			0		0	
18	26.57				5					1					0				
17a	23.32				3					11					0				
17	23.54				18					14					0				
16a	23.37				2					22					0				
16	23.47				2					12					0				
15a	23.50				1					12					0				
15	23.82				2					7					0				
14a	31.84				1					10					0				
14	31.66				35					19					0				
13a	39.46				3					14					0				
13	36.89				0					4					0				
12a	33.84				3					4					0				
12	34.45				2					14					0				
11a	23.84				0					17					0				
11	23.69				11					3					2				
10a	21.14				0					1					0				
Total	444.39	205.26	98.32	98.32	68.0	13.0	0.0	0.0		165.0	4.0	3.0	0.0		2.0	0.0	0.0	0.0	
Sum squ	12862.49	205.26	42.20	236.72	1740.0	45.0	0.0	0.0		2323.0	8.0	0.0	0.0		4.0	0.0	0.0	0.0	
		0.00	0.00	444.39	2480.7	355.4	0.0	0.0		4592.2	110.2	0.0	0.0		47.4	0.0	0.0	0.0	
		205.26	140.52	779.43															
				R=5y/Sz	0.2	0.1	0.0	0.0		0.4	0.0	0.0	0.0		0.0	0.0	0.0	0.0	
				Var y	83.7	3.5	0.0	0.0		41.4	1.0	0.0	0.0		0.3	0.0	0.0	0.0	
Var z	34.6	5.7	44.6	125.2															
Cover zy					2.4	-17.9	0.0	0.0	5TRAT. TOTAL	0.6	-5.3	-3.3	0.0	5TRAT. TOTAL	-0.5	0.0	0.0	0.0	5TRAT. TOTAL
					WATERBUCK					PHACOCHERE					LION				
			Pop.est.(Y)		421	124	0	0	544	788	38	37	0	864	18	0	0	0	10
				SE(Y)	210.2	86.2	0.0	0.0	227.1	155.0	38.7	12.0	0.0	160.18	11.6	0.0	0.0	0.0	11.6
				95% C.L.	428.7	175.8	0.0	0.0	445.2	316.1	79.0	24.5	0.0	313.95	23.8	0.0	0.0	0.0	22.7
				95% C.L.	101.9	0.0	0.0	0.0	81.8	40.1	0.0	0.0	0.0	36.32	247.1	0.0	0.0	0.0	237.4

	AREA				BUBALES / HARTEBEEST					GUIB HARNACHE /BUSHBUCK					CEPHALOPHES /DUIKERS				
TRANS	HIGH STH	MID NTH	LOW NTH	TOT.NOR	HIGH STH	MID NTH	LOW NTH	TOT.NTH	TOTAL	HIGH STH	MID NTH	LOW NTH	TOT.NTH	TOTAL	HIGH STH	MID NTH	LOW NTH	TOT.NTH	TOTAL
31			8.01	8.01			0	0				0	0				0	0	
30			10.32	10.32			0	0				0	0				0	0	
29			15.74	15.74			0	0				0	0				0	0	
28			18.99	18.99			0	0				0	0				0	0	
27			18.68	18.68			0	0				0	0				0	0	
26			26.57	26.57			0	0				0	0				0	0	
25		28.65	2.59	29.24		1	0	0			0	0	0			0	0	0	
24		31.62	7.82	39.44		5	0	0			0	0	0			0	0	0	
23		31.60	21.06	41.92		0	0	0			0	0	0			0	0	0	
22		31.49	10.74	42.22		0	0	0			0	0	0			0	0	0	
21		28.81		28.81		9		0			0		0			1		0	
20		29.22		29.22		0		0			0		0			0		0	
19		25.87		25.87		24		0			0		0			0		0	
18	26.57				0					0					0				
17a	23.32				16					0					1				
17	23.54				8					0					0				
16a	23.37				14					2					0				
16	23.47				17					0					0				
15a	23.50				4					0					0				
15	23.82				32					0					0				
14a	31.84				24					5					0				
14	31.66				17					0					0				
13a	39.46				12					0					0				
13	36.89				51					0					0				
12a	33.84				19					1					0				
12	34.45				15					2					0				
11a	23.84				25					0					0				
11	23.69				0					0					0				
10a	21.14				0					3					0				
Total	444.39	205.26	98.32	98.32	256.0	39.0	0.0	0.0		13.0	0.0	0.0	0.0		1.0	1.0	0.0	0.0	
Sum squ	12862.49	205.26	42.20	236.72	6734.0	683.0	0.0	0.0		43.0	0.0	0.0	0.0		1.0	1.0	0.0	0.0	
		0.00	0.00	444.39	7603.4	1064.9	0.0	0.0		372.1	0.0	0.0	0.0		23.3	28.6	0.0	0.0	
		205.26	140.52	779.43															
				R=Sy/Sz	0.8	0.2	0.0	0.0		0.0	0.0	0.0	0.0		0.0	0.0	0.0	0.0	
				Var y	175.9	77.6	0.0	0.0		2.2	0.0	0.0	0.0		0.1	0.1	0.0	0.0	
Var z	34.6	5.7	44.6	125.2					STRAT.					STRAT.					STRAT.
Covar zy					32.9	-53.9	0.0	0.0	TOTAL	0.7	0.0	0.0	0.0	TOTAL	-0.3	-1.1	0.0	0.0	TOTAL
					BUBALES /HARTEBEEST					GUIB HARNACHE/BUSHBUCK					CEPHALOPHES / DUIKERS				
			Pop.est.(Y)		1,224	371	0	0	1,595	62	0	0	0	62	5	10	0	0	14
				SE(Y)	280.1	356.0	0.0	0.0	453.0	33.6	0.0	0.0	0.0	33.59	5.8	14.1	0.0	0.0	15.2
				95% C.L.	571.5	726.2	0.0	0.0	867.8	68.5	0.0	0.0	0.0	65.84	11.8	28.7	0.0	0.0	29.6
				95% C.L.	46.7	0.0	0.0	0.0	55.7	110.2	0.0	0.0	0.0	105.91	247.3	0.0	0.0	0.0	208.8

	AREA				CARCASSES CAT 3&4					CROCODILES					POTAMOCHERES				
TRANS	HIGH STH	MID NTH	LOW NTH	TOT.NOR	HIGH STH	MID NTH	LOW NTH	TOT.NTH	TOTAL	HIGH STH	MID NTH	LOW NTH	TOT.NTH	TOTAL	HIGH STH	MID NTH	LOW NTH	TOT.NTH	TOTAL
31			8.01	8.01			0	0				0	0				0	0	
30			10.32	10.32			0	0				0	0				0	0	
29			15.74	15.74			0	0				0	0				0	0	
28			18.99	18.99			0	0				0	0				0	0	
27			18.68	18.68			0	0				0	0				0	0	
26			26.57	26.57			0	0				0	0				0	0	
25		26.65	2.59	29.24		0	0	0			0	0	0			0	0	0	
24		31.62	7.82	39.44		0	0	0			0	0	0			0	0	0	
23		31.60	21.06	41.92		0	0	0			0	0	0			0	0	0	
22		31.49	10.74	42.22		0	0	0			0	0	0			0	0	0	
21		26.81		26.61		0		0			0		0			0		0	
20		29.22		29.22		0		0			0		0			0		0	
19		25.67		25.67		0		0			0		0			0		0	
18	26.57				3					0					0				
17a	23.32				0					0					0				
17	23.54				0					0					0				
16a	23.37				1					1					0				
16	23.47				0					0					0				
15a	23.50				2					0					0				
15	23.82				0					0					0				
14a	31.84				4					1					0				
14	31.66				0					0					0				
13a	39.46				0					0					0				
13	36.89				2					0					0				
12a	33.84				0					0					0				
12	34.45				0					0					0				
11a	23.84				0					0					0				
11	23.69				0					0					0				
10a	21.14				0					0					7				
Total	444.39	205.26	98.32	98.32	12.0	0.0	0.0	0.0		2.0	0.0	0.0	0.0		7.0	0.0	0.0	0.0	
Sum squ	12862.49	205.26	42.20	236.72	34.0	0.0	0.0	0.0		2.0	0.0	0.0	0.0		49.0	0.0	0.0	0.0	
		0.00	0.00	444.39	351.2	0.0	0.0	0.0		55.2	0.0	0.0	0.0		148.0	0.0	0.0	0.0	
		205.26	140.52	779.43															
				R=Sy/Sz	0.0	0.0	0.0	0.0		0.0	0.0	0.0	0.0		0.0	0.0	0.0	0.0	
				Var y	1.7	0.0	0.0	0.0		0.1	0.0	0.0	0.0		3.1	0.0	0.0	0.0	
Var z	34.6	5.7	44.6	125.2					STRAT.					STRAT.					STRAT.
Covar zy					1.2	0.0	0.0	0.0	TOTAL	-0.0	0.0	0.0	0.0	TOTAL	-3.1	0.0	0.0	0.0	TOTAL
					CARCASSES CAT 3&4					CROCODILES					POTAMOCHERES				
			Pop.est.(Y)		57	0	0	0	57	10	0	0	0	10	33	0	0	0	33
				SE(Y)	29.2	0.0	0.0	0.0	29.2	7.9	0.0	0.0	0.0	7.86	40.8	0.0	0.0	0.0	40.8
				95% C.L.	59.6	0.0	0.0	0.0	57.3	16.0	0.0	0.0	0.0	15.40	83.2	0.0	0.0	0.0	79.9
				95% C.L.	103.9	0.0	0.0	0.0	99.8	167.6	0.0	0.0	0.0	181.02	248.6	0.0	0.0	0.0	238.8

	AREA				REDUNCA / REEDBUCK					ANTELOPE ROUANE /ROAN					OURIBI / ORIBI				
TRANS	HIGH STH	MID NTH	LOW NTH	TOT.NOR	HIGH STH	MID NTH	LOW NTH	TOT.NTH	TOTAL	HIGH STH	MID NTH	LOW NTH	TOT.NTH	TOTAL	HIGH STH	MID NTH	LOW NTH	TOT.NTH	TOTAL
31			8.01	8.01			0	0				0	0				0	0	
30			10.32	10.32			0	0				0	0				0	0	
29			15.74	15.74			0	0				0	0				0	0	
28			18.99	18.99			0	0				0	0				0	0	
27			18.68	18.68			0	0				0	0				0	0	
26			26.57	26.57			2	0				0	0				0	0	
25		26.65	2.59	29.24		0	0	0			0	0	0			0	0	0	
24		31.62	7.82	39.44		0	0	0			0	0	0			0	0	0	
23		31.60	21.06	41.92		1	0	0			0	0	0			0	1	0	
22		31.49	10.74	42.22		0	0	0			0	0	0			0	1	0	
21		28.81		28.81		0		0			0		0			0		0	
20		29.22		29.22		0		0			0		0			1		0	
19		25.87		25.87		0		0			0		0			0		0	
18	26.57				0					0					2				
17a	23.32				1					0					0				
17	23.54				0					0					0				
16a	23.37				0					0					1				
16	23.47				2					0					0				
15a	23.50				0					0					0				
15	23.82				0					0					0				
14a	31.84				0					0					0				
14	31.66				0					0					1				
13a	39.46				0					0					0				
13	36.89				1					12					1				
12a	33.84				0					0					0				
12	34.45				0					0					0				
11a	23.84				0					0					0				
11	23.69				0					0					0				
10a	21.14				0					0					0				
Total	444.39	205.26	98.32	98.32	4.0	1.0	2.0	0.0		12.0	0.0	0.0	0.0		5.0	1.0	2.0	0.0	
Sum squ	12862.49	205.26	42.20	236.72	6.0	1.0	4.0	0.0		144.0	0.0	0.0	0.0		7.0	1.0	0.0	0.0	
		0.00	0.00	444.39	107.2	31.6	53.1	0.0		442.7	0.0	0.0	0.0		145.0	29.2	0.0	0.0	
		205.26	140.52	779.43															
				R=Sy/Sz	0.0	0.0	0.0	0.0		0.0	0.0	0.0	0.0		0.0	0.0	0.0	0.0	
				Var y	0.3	0.1	0.7	0.0		9.0	0.0	0.0	0.0		0.4	0.1	0.0	0.0	
Var z	34.6	5.7	44.6	125.2					STRAT.					STRAT.					STRAT.
Covar zy					-0.3	-0.5	3.7	0.0	TOTAL	7.3	0.0	0.0	0.0	TOTAL	0.4	-1.0	-2.2	0.0	TOTAL
			Pop.est.(Y)		REDUNCA /REEDBUCK					ANTELOPE ROUANE /ROAN					OURIBI / ORIBI				
					19	10	25	0	54	57	0	0	0	57	24	10	25	0	58
				SE(Y)	13.4	13.8	17.9	0.0	25.3	67.3	0.0	0.0	0.0	67.32	13.7	14.0	8.0	0.0	21.2
				95% C.L.	27.3	28.2	36.5	0.0	51.5	137.3	0.0	0.0	0.0	131.94	28.0	28.6	16.4	0.0	41.5
				95% C.L.	142.7	0.0	0.0	0.0	96.1	239.3	0.0	0.0	0.0	229.94	116.9	0.0	0.0	0.0	71.2

	AREA				BABOUINS / BABOONS					CROCODILES					POTAMOCHERES				
TRANS	HIGH STH	MID NTH	LOW NTH	TOT.NOR	HIGH STH	MID NTH	LOW NTH	TOT.NTH	TOTAL	HIGH STH	MID NTH	LOW NTH	TOT.NTH	TOTAL	HIGH STH	MID NTH	LOW NTH	TOT.NTH	TOTAL
31			8.01	8.01			0	0				0	0				0	0	
30			10.32	10.32			0	0				0	0				0	0	
29			15.74	15.74			0	0				0	0				0	0	
28			16.99	16.99			0	0				0	0				0	0	
27			18.68	18.68			0	0				0	0				0	0	
26			26.57	26.57			0	0				0	0				0	0	
25		26.65	2.59	29.24		0	0	0			0	0	0			0	0	0	
24		31.62	7.82	39.44		0	0	0			0	0	0			0	0	0	
23		31.60	21.06	41.92		0	0	0			0	0	0			0	0	0	
22		31.49	10.74	42.22		0	0	0			0	0	0			0	0	0	
21		28.81		28.81		0		0			0		0			0		0	
20		29.22		29.22		0		0			0		0			0		0	
19		25.87		25.87		0		0			0		0			0		0	
18	26.57				0					0					0				
17a	23.32				0					0					0				
17	23.54				0					0					0				
16a	23.37				0					1					0				
16	23.47				7					0					0				
15a	23.50				9					0					0				
15	23.82				0					0					0				
14a	31.84				0					1					0				
14	31.66				0					0					0				
13a	39.46				0					0					0				
13	36.89				0					0					0				
12a	33.84				4					0					0				
12	34.45				0					0					0				
11a	23.84				0					0					0				
11	23.69				0					0					0				
10a	21.14				0					0					7				
Total	444.39	205.26	98.32	98.32	20.0	0.0	0.0	0.0		2.0	0.0	0.0	0.0		7.0	0.0	0.0	0.0	
Sum squ	12862.49	205.26	42.20	236.72	146.0	0.0	0.0	0.0		2.0	0.0	0.0	0.0		49.0	0.0	0.0	0.0	
		0.00	0.00	444.39	511.1	0.0	0.0	0.0		55.2	0.0	0.0	0.0		146.0	0.0	0.0	0.0	
		205.26	140.52	779.43															
				R=Sy/Sz	0.0	0.0	0.0	0.0		0.0	0.0	0.0	0.0		0.0	0.0	0.0	0.0	
				Var y	8.1	0.0	0.0	0.0		0.1	0.0	0.0	0.0		3.1	0.0	0.0	0.0	
Var z	34.6	5.7	44.6	125.2					STRAT.					STRAT.					STRAT.
Covar zy					-3.0	0.0	0.0	0.0	TOTAL	-0.0	0.0	0.0	0.0	TOTAL	-3.1	0.0	0.0	0.0	TOTAL
					BABBOUINS / BABOONS					CROCODILES					POTAMOCHERES				
			Pop.est.(Y)		98	0	0	0	96	10	0	0	0	10	33	0	0	0	33
				SE(Y)	66.4	0.0	0.0	0.0	66.4	7.9	0.0	0.0	0.0	7.86	40.6	0.0	0.0	0.0	40.8
				95% C.L.	135.5	0.0	0.0	0.0	130.2	16.0	0.0	0.0	0.0	15.40	83.2	0.0	0.0	0.0	79.9
				85% C.L.	141.7	0.0	0.0	0.0	136.1	167.8	0.0	0.0	0.0	161.02	248.6	0.0	0.0	0.0	238.8

PARC NATIONAL DE LA GARAMBA, RECENSEMENT GENERAL
PILOT SUMMARY SHEET

Survey..... Garamba N.P. General large mammal systematic sample survey

Dates: From.. 14 May 2003 To: 18th May 2003

Pilot.....Fraser Smith..... Aircraft....9Q-CBR C 206.....

DATE	TAKE OFF	LAND	HOURS	PURPOSE	FUEL
14.5.2003	15:40	16:05	0.4	Calibrations	
15.5.2003	08:25	10:50	2.4	Transect 31-26	
15.5.2003	16:08	17:38	1.5	Transects 25-24	
16.5.2003	08:22	11:20	2.8	Transects 23-18	
16.5.2003	16:02	17:52	1.8	Transects 17A-16	
17.5.2003	08:10	10:37	2.5	Transects 15A-13A	
17.5.2003	16:29	17:25	0.9	Transects 11-10A	
18.5.2003	08:20	10:45	2.4	Transects 13A-11A	
4 days			14.7	Hrs@55Lit/hr =	808.5lit

TRANSECT SUMMARY

SURVEY. General systematic large mammal survey

DATES: From.14 May 2003..... To.18 May 2003..... Aircraft..C206 9Q-CBR.....

AREAS....Garamba National Park (5,000 km2)

Nominal flying height.....350.....feet Target strip width (L+R).....500.....metres

Pilot.....Fraser Smith..... FSO.....Kes Hillman Smith

RSO L.M. Amube Ndey RSO R.M..... Paulin Tshikaya

RSO L.R. Serge Iliabo RSO R.R..... Mambo Marindo

Z.....N.....n.....

TRANS	DIR	ORDER FLOWN	DATE	SUBUNITS	FROM-TO	DISTANCE (km)	TIME (mins)	SPEED (kph)
31	W-E	1	15.5.03	3	22-24	15	4.5	200
30	E-W	2	15.5.03	4	25-22	20	6.38	188
29	W-E	3	15.5.03	6	22-27	30	9.42	191
28	E-W	4	15.5.03	7	27-21	35	11.18	188
27	W-E	5	15.5.03	7	21-27	35	11.08	190
26	E-W	6	15.5.03	10	27-18	50	16.25	185
25	W-E	7	15.5.03	11	18-28	55	17	194
24	E-W	8	15.5.03	15	30-16	75	25	180
23	W-E	9	16.5.03	16	16-31	80	27.2	176
22	E-W	10	16.5.03	16	31-16	80	24.38	197
21	W-E	11	16.5.03	11	16-26	55	17.6	187
20	E-W	12	16.5.03	11	15-25	55	16.12	205
19	W-E	13	16.5.03	10	15-24	50	15.25	197
18	E-W	14	16.5.03	10	24-15	50	14.1	213
17A	W-E	15	16.5.03	9	15-23	45	15.1	179
17	E-W	16	16.5.03	9	23-15	45	11.57	233
16A	W-E	17	16.5.03	9	15-23	45	15.25	177
16	E-W	18	16.5.03	9	23-15	45	13.18	205
15A	W-E	19	17.5.03	9	15-23	45	14.58	185
15	E-W	20	17.5.03	9	23-15	45	13.26	204
14A	W-E	21	17.5.03	12	12-23	60	19.04	189
14	E-W	22	17.5.03	13	23-11	65	19.4	201
13A	W-E	23	17.5.03	15	9-23	75	23.29	193
13	E-W	26	18.5.03	15	23-9	75	24	188
12A	W-E	27	18.5.03	13	10-22	65	20	195
12	E-W	28	18.5.03	13	23-11	65	19	205
11A	W-E	29	18.5.03	11	12-22	55	17.4	190
11	E-W	24	17.5.03	9	20-12	45	14.45	187
10A	W-E	25	17.5.03	9	12-20	45	14.22	190
					Trans.tot.km	**1505**	**Avg kph**	**193**

COUNT EAST-WEST WAYPOINTS

EAST			NORTH	
-29	31.84957	4	37.94531	31-22
-29	39.96121	4	37.94466	31-25
-29	42.66391	4	35.24904	30-26
-29	31.84957	4	35.25033	30-22
-29	31.84989	4	32.55535	29-22
-29	48.06996	4	32.55246	29-28
-29	48.06449	4	29.85877	28-28
-29	29.14204	4	29.86263	28-21
-29	29.14204	4	27.16797	27-21
-29	48.06352	4	27.16379	27-28
-29	48.05902	4	24.47010	26-28
-29	21.03007	4	24.47815	26-18
-29	21.03007	4	21.78317	25-18
-29	50.76011	4	21.77352	25-29
-29	56.15972	4	19.07307	24-31
-29	15.62145	4	19.09109	24-16
-29	15.62145	4	16.39612	23-16
-29	58.85984	4	16.37584	23-32
-29	58.85727	4	13.68118	22-32
-29	15.62113	4	13.70114	22-16
-29	15.62017	4	11.00616	21-16
-29	45.34312	4	10.99683	21-27
-29	42.63849	4	8.30314	20-26
-29	12.91714	4	8.31248	20-15
-29	12.91231	4	5.61750	19-15
-29	39.93031	4	5.61010	19-25
-29	39.92903	4	2.91512	18-25
-29	12.91264	4	2.92252	18-15
-29	12.93291	4	1.57487	17A-15
-29	37.24789	4	1.56876	17A-24
-29	12.91264	4	0.22754	17-15
-29	37.22600	4	0.22175	17-24
ROUTE SOUTH 4				
-29	37.22472	3	58.87443	16A-24
-29	12.91264	3	58.88022	16A-15
-29	12.91264	3	57.53289	16-15
-29	37.22472	3	57.52678	16-24
-29	37.22343	3	56.17945	15A-24
-29	12.91264	3	56.18524	15A-15
-29	12.91264	3	54.83792	15-15
-29	37.22343	3	54.83180	15-24
-29	37.22182	3	53.48190	14A-24
-29	4.80904	3	53.49220	14A-12
-29	4.80871	3	52.14487	14-12
-29	37.22150	3	52.13457	14-24
-29	37.21957	3	50.78209	13A-24
-28	56.70544	3	50.79787	13A-9
-28	56.70576	3	49.45054	13-9
-29	37.21924	3	49.43477	13-24
-29	34.51654	3	48.09130	12A-23
-28	59.40621	3	48.10289	12A-10
-28	59.40621	3	46.75556	12-10
-29	34.51654	3	46.74365	12-23
-29	29.11339	3	45.40180	11A-21
-29	4.80743	3	45.40759	11A-12
-29	4.80743	3	44.05994	11-12
-29	29.11339	3	44.05447	11-21
-29	29.09151	3	42.70553	10A-21
-29	4.78908	3	42.71133	10A-12

P.N.Garamba RECENSEMENT GENERAL 2003 Centre 1998,2000,2002,2003

24	E-W	23	W-E	22	E-W	21	W-E	20	E-W	19	W-E	18	E-W
Dist(km)	Subunit	Dist(km)	Subunit	Dist(km)	Subunit	Dist(km)	Subunit	Dist(km)	Subunit	Dist(km)	Subunit	Dist(km)	Subunit
	goto 24-31E	80	start 23-16		goto 22-32	55	start 21-16		goto20-26	50	start 19-15		goto18-25
75	start 24-30	75	17	80	start 22-31	50	17	55	start su 25	45	16	45	start 18-24
70	29	70	18	75	30	45	18	50	24	40	17	40	23
65	28	65	19	70	29	40	19	45	23	35	18	35	22
60	27	60	20	65	28	35	20	40	22	30	19	30	21
55	26	55	21	60	27	30	21	35	21	25	20	25	20
50	25	50	22	55	26	25	22	30	20	20	21	20	19
45	24	45	23	50	25	20	23	25	19	15	22	15	18
40	23	40	24	45	24	15	24	20	18	10	23	10	17
35	22	35	25	40	23	10	25	15	17	5	24	5	16
30	21	30	26	35	22	5	26	10	16	0	end 19-25	0	end 18-15
25	20	25	27	30	21	0	end 21-27	5	15				
20	19	20	28	25	20			0	end 20-15				
15	18	15	29	20	19								
10	17	10	30	15	18								
5	16	5	31	10	17								
0	end 24-16	0	end 26-32	5	16								
				0	end 22-16								

P.N.Garamba RECENSEMENT GENERAL 2003 Sud 1998,2000,2002,2003

17A	W-E	17	E-W	16A	W-E	16	E-W	15A	W-E	15	E-W	14A	W-E
Dist(km)	Subunit	Dist(km)	Subunit	Dist(km)	Subunit	Dist(km)	Subunit	Dist(km)	Subunit	Dist(km)	Subunit	Dist(km)	Subunit
45	start17A-15		goto 17-24	45	start16A-15		goto 16-24	45	start15A-15		goto 15-24	60	start 14A-12
40	16	45	start 23	40	16	45	start 23	40	16	45	start 23	55	13
35	17	40	22	35	17	40	22	35	17	40	22	50	14
30	18	35	21	30	18	35	21	30	18	35	21	45	15
25	19	30	20	25	19	30	20	25	19	30	20	40	16
20	20	25	19	20	20	25	19	20	20	25	19	35	17
15	21	20	18	15	21	20	18	15	21	20	18	30	18
10	22	15	17	10	22	15	17	10	22	15	17	25	19
5	23	10	16	5	23	10	16	5	23	10	16	20	20
0	end17A-24	5	15	0	end16A-24	5	15	0	end15A-24	5	15	15	21
		0	end 17-15			0	end 16-15			0	end 15-15	10	22
												5	23
												0	end14A-24

P.N.Garamba RECENSEMENT GENERAL 2003 Sud 1998,2000,2002,2003

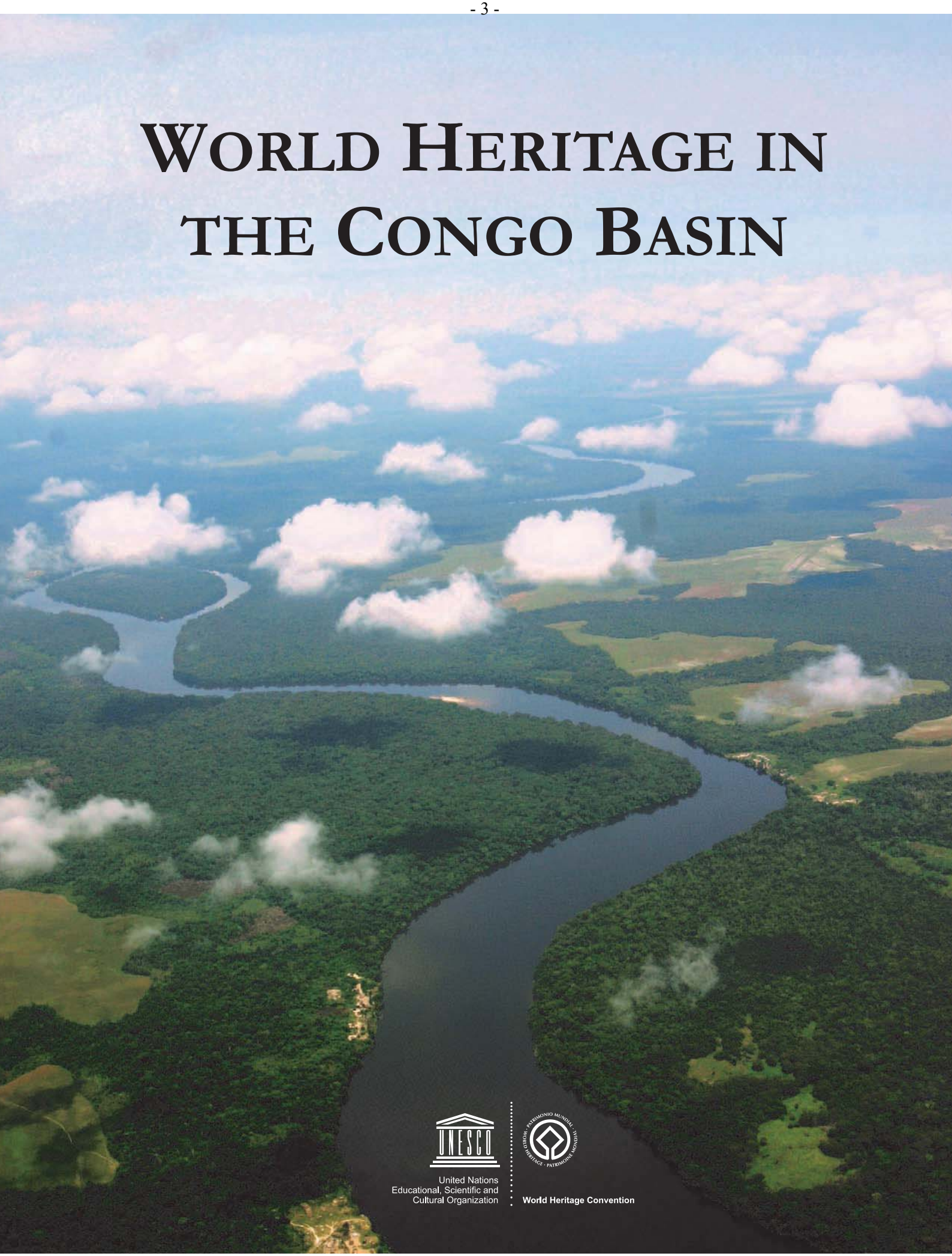
14A	W-E	14	E-W	13A	W-E	13	E-W	12A	W-E	12	E-W	11A	W-E
Dist(km)	Subunit	*Dist(km)*	Subunit	*Dist(km)*	Subunit	*Dist(km)*	Subunit	*Dist(km)*	Subunit	*Dist(km)*	Subunit	*Dist(km)*	Subunit
60	start 14A-12		goto 14-24	*75*	start 13A-9		goto 13-24	*65*	start 12A-10		goto 15-23	*45*	start 11A-12
55	13	*60*	start 23	*70*	10	*70*	start 23	*60*	11	*65*	start 22	*40*	13
50	14	*55*	22	*65*	11	*65*	22	*55*	12	*60*	21	*35*	14
45	15	*50*	21	*60*	12	*60*	21	*50*	13	*55*	20	*30*	15
40	16	*45*	20	*55*	13	*55*	20	*45*	14	*50*	19	*25*	16
35	17	*40*	19	*50*	14	*50*	19	*40*	15	*45*	18	*20*	17
30	18	*35*	18	*45*	15	*45*	18	*35*	16	*40*	17	*15*	18
25	19	*30*	17	*40*	16	*40*	17	*30*	17	*35*	16	*10*	19
20	20	*25*	16	*35*	17	*35*	16	*25*	18	*30*	15	*5*	20
15	21	*20*	15	*30*	18	*30*	15	*20*	19	*25*	14	*0*	end 11A-21
10	22	*15*	14	*25*	19	*25*	14	*15*	20	*20*	13		cont 5km 21
5	23	*10*	13	*20*	20	*20*	13	*10*	21	*15*	12		
0	end14A-24	*5*	12	*15*	21	*15*	12	*5*	22	*10*	11		
		0	wpt 14-12	*10*	22	*10*	10	*0*	end 12A-23	*5*	10		
			cont.5km	*5*	23	*5*	9			*0*	end 12-10		
				0	end13A-24	*0*	end 13-9						

11	E-W	10A	W-E
Dist(km)	Subunit	*Dist(km)*	Subunit
	goto 11-21	*45*	start 10A-12
45	start 20	*40*	13
40	19	*35*	14
35	18	*30*	15
30	17	*25*	16
25	16	*20*	17
20	15	*15*	18
15	14	*10*	19
10	13	*5*	20
5	12	*0*	end 10A-21
0	end 11-12		

ANNEX 5.16

UNESCO, *World Heritage in the Congo Basin*, 2010

World Heritage in the Congo Basin



United Nations
Educational, Scientific and
Cultural Organization

World Heritage Convention

World Heritage in the Congo Basin

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World Heritage in the Congo Basin

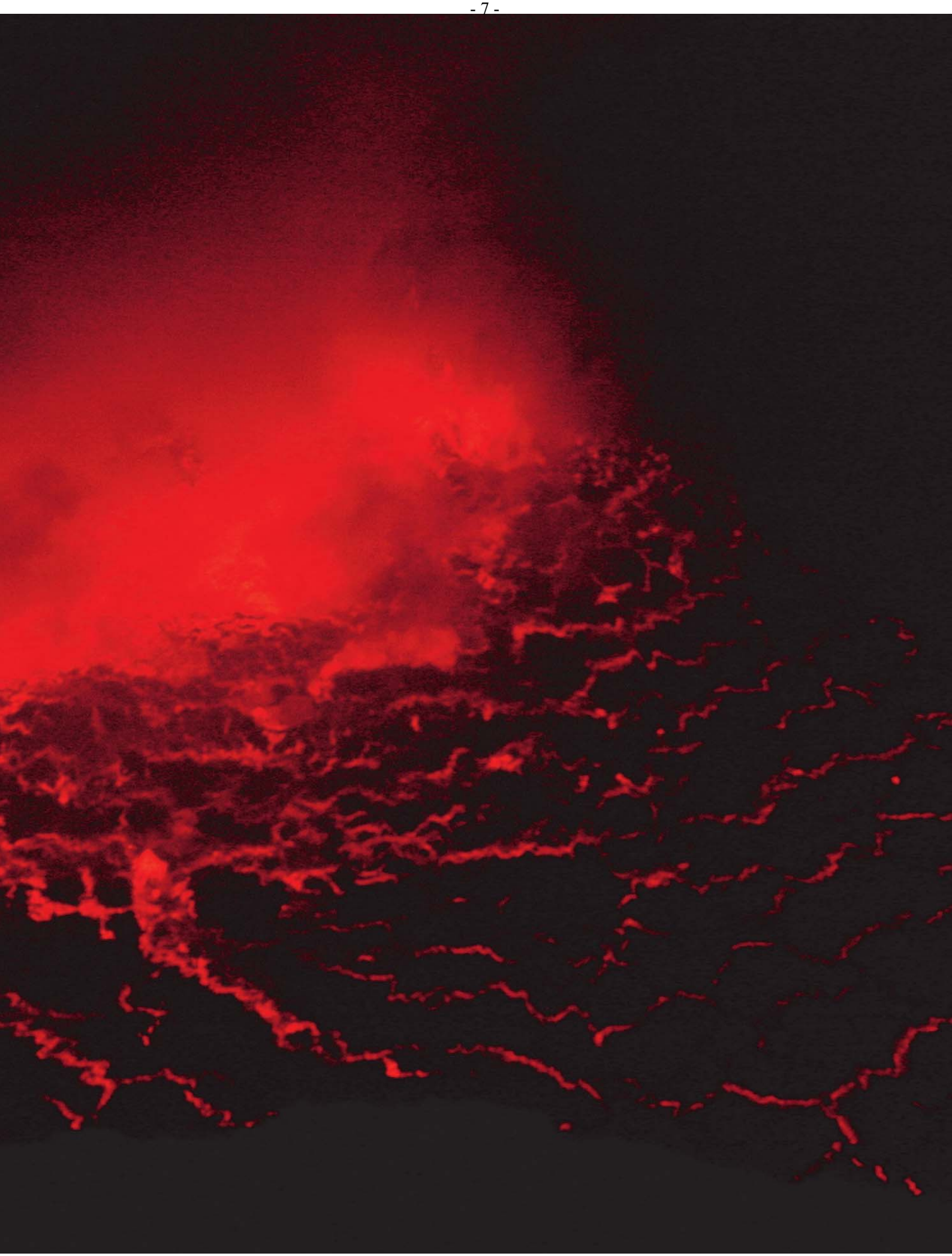
United Nations
Educational, Scientific and
Cultural Organization

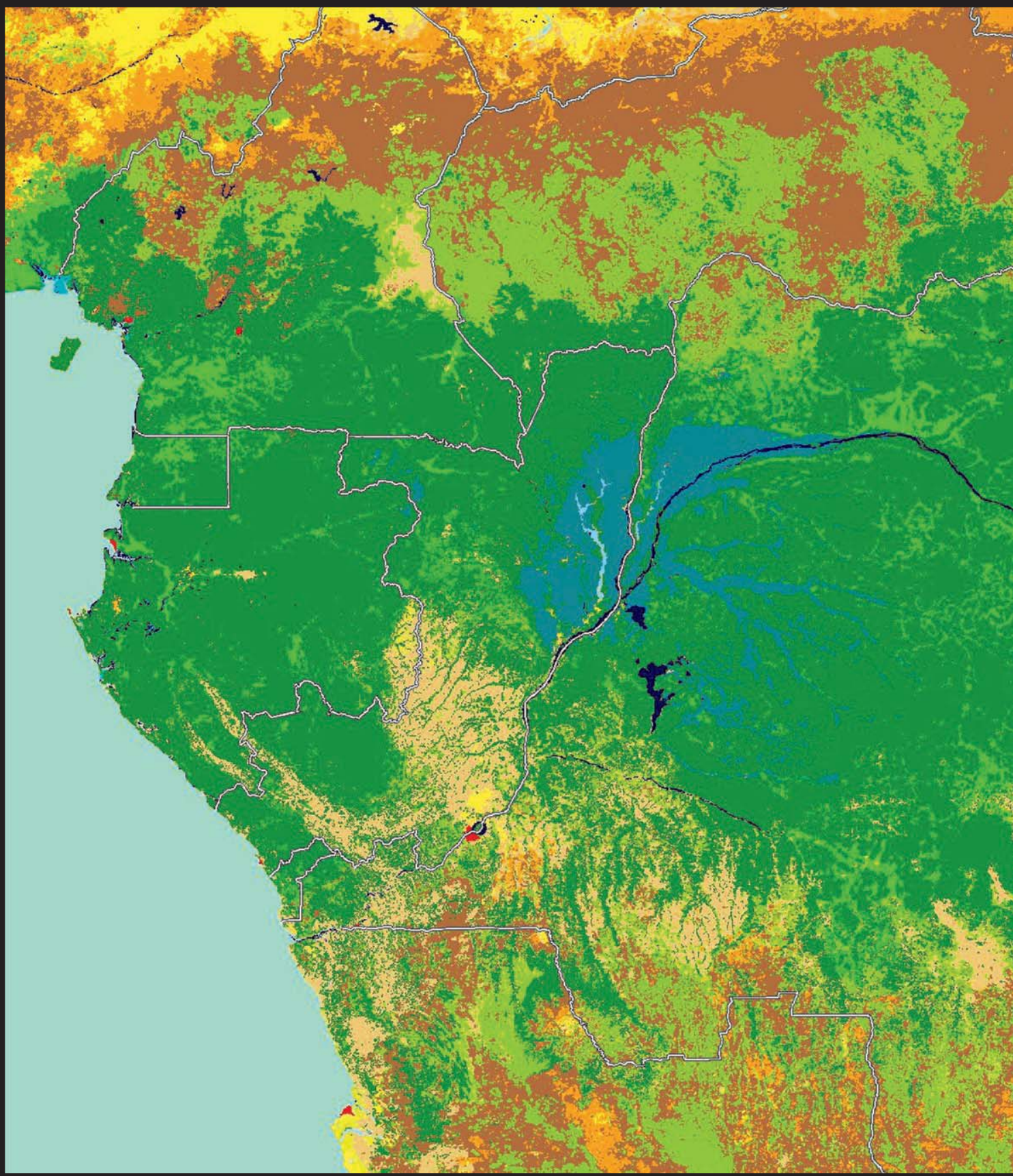
World Heritage Convention

SUMMARY

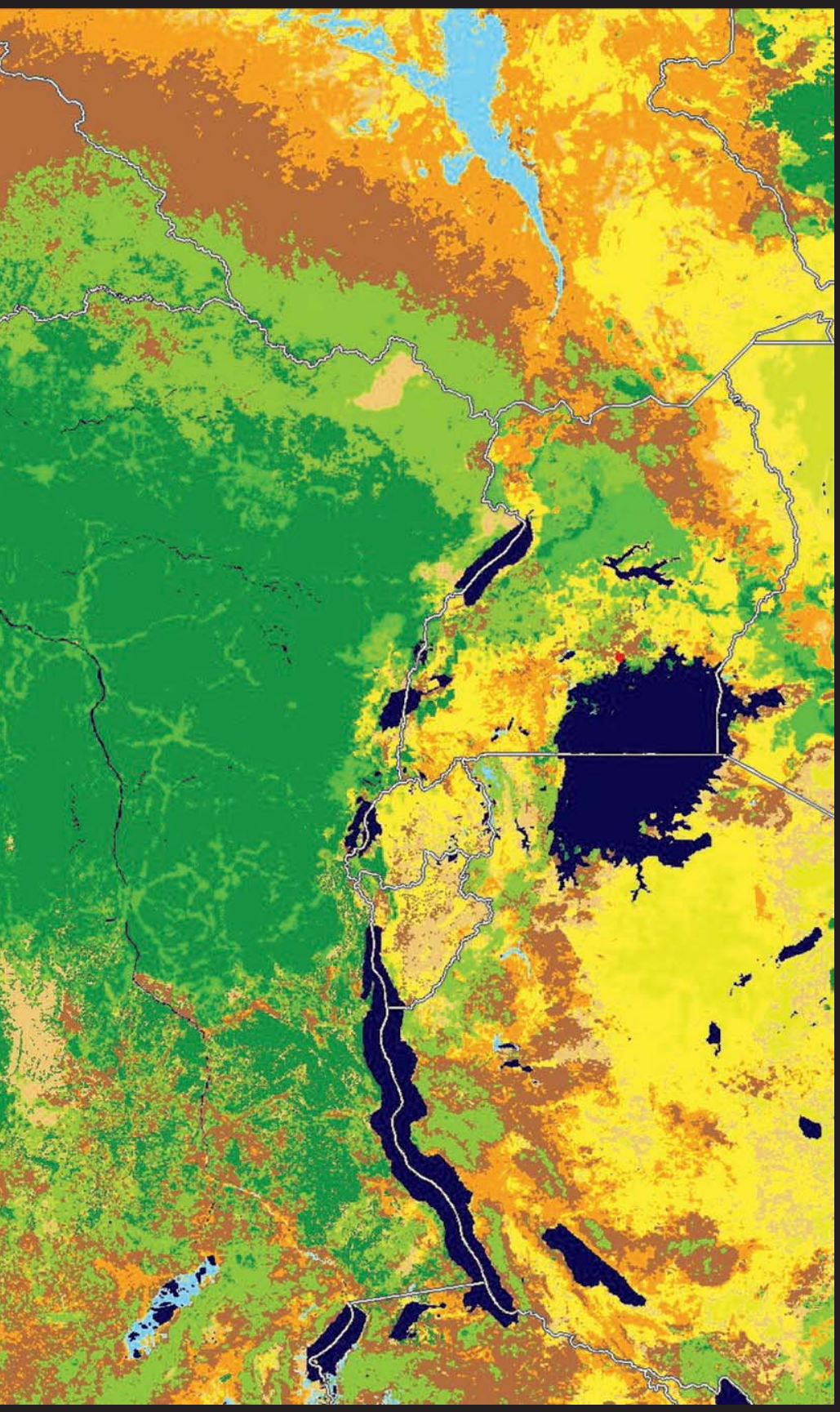
Front cover: A mosaic of lowland rainforest and savannah in the southern part of Salonga National Park, DRC.

This page : A lake of molten larva in the crater of Nyaragongo volcano, Virunga National Park, DRC.





The moist forests of central Africa represent the world's second largest area of tropical rainforest after the Amazon . It is one of the last regions in the to continue undisturbed. A forest elephant could, in theory, move from the Albertine Rift to the coast of Gabon without leaving the forest.



world where vast areas of interconnected rainforest allow biological processes
Vegetation cover image © Joint Research Centre, EC

PREFACE

The central African humid forests, covering an estimated surface area of roughly 1.62 million km², constitute one of the world's most important natural heritages. They contain a large proportion of the world's biodiversity, they play a central role in climate regulation and carbon sequestration and they are home to over 30 million forest dwelling peoples who depend on the innumerable environmental products and services that the forests provide.

The immense natural riches of central Africa, particularly its timber and mineral resources, are also seen as important components of the countries' economic growth and development. However if they are to contribute in a sustainable manner to the nations' social and economic welfare, wise management of these resources will be essential and a fully representative network of well managed protected areas will be a critical element in this process.

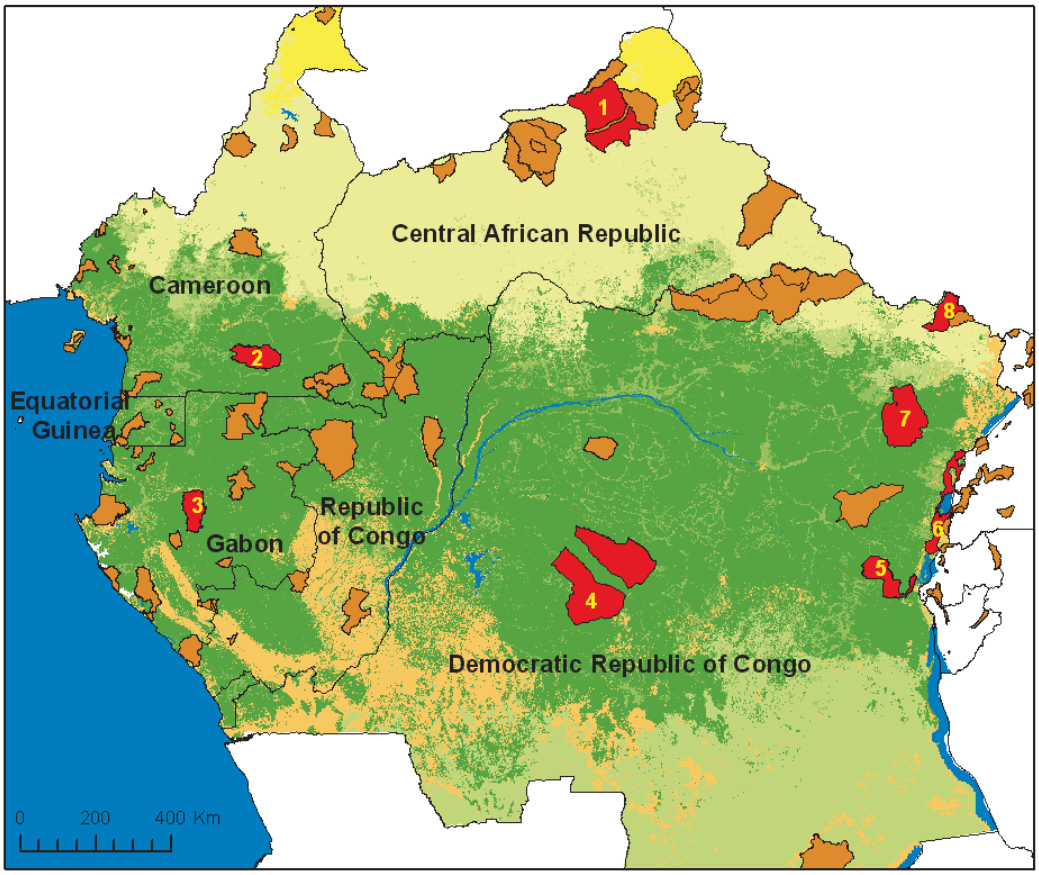
The vast majority of the central African forests have remained, until quite recently, relatively untouched by large scale human activities such as mechanized logging and mining largely because of the difficulties of access. Industrial logging, for example, was confined largely to the coastal area. However the situation is now changing rapidly as more and more of the central African forests are attributed as logging concessions and an increasingly dense network of new roads spreads out through the forest block. Figures presented in the 2008 Congo Basin State of the Forests Report indicate that 32% of the exploitable dense humid forests in central Africa have already been attributed. In Equatorial Guinea, Gabon, CAR and Congo-Brazzaville the figures are particularly high with between 77% and 93% of

the exploitable forests already attributed. Opening up of the forest brings with it many threats. Not only is the forest structure disturbed by the logging activities itself (felling, road building, logging camps) but the influx of people into the newly opened areas in search of employment and other economic opportunities leads to biodiversity impoverishment through increased rates of deforestation for agriculture and commercial exploitation of non timber forest products, particularly bushmeat. Local indigenous communities are also often severely disrupted in the face of this "open access" onslaught on their natural resources.

While a fully a representative network of protected areas is a central pillar for biodiversity conservation in central Africa it is increasingly recognized that a more global landscape approach is also necessary so that gene flows, ecosystem processes and local livelihoods can be sustained in the mosaic of multiple use zones that link the networks of protected areas. Only in this way can the protected areas avoid becoming isolated pockets of biodiversity.

This booklet describes how the UNESCO World Heritage Convention is contributing to this process through the reinforcement of existing protected areas and the promotion of key landscapes where clusters of protected areas can be linked through sound landscape management.

Francesco Bandarin, Director,
World Heritage Center, UNESCO



Currently approximately 18.5 million ha of central Africa's forests, some 10% of the surface area of humid forest block, have been designated as protected areas. Eight World Heritage Sites exist in Central Africa (shown in red), 6 in the tropical forest zone and 2 in the savanna zone to the north.

1. *Gounda-St. Floris National Park*
2. *Dja Wildlife Reserve*
3. *Lopé-Okanda National Park*
4. *Salonga National Park*
5. *Kahuzi-Biega National Park*
6. *Virunga National Park*
7. *Okapi Wildlife Reserve*
8. *Garamba National Park*

Six of Central Africa's World Heritage Sites have been placed on UNESCO's list of the World Heritage in Danger.

THE WORLD HERITAGE CONVENTION

The World Heritage Convention, is an international agreement adopted by the General Conference of UNESCO in 1972 and is founded on the premise that certain places on Earth are of Outstanding Universal Value and thus are part of the common heritage of humankind. In August 2009, there were 186 States Parties to the Convention, making it a globally recognized legal instrument.

In order to ensure their safekeeping for future generations, countries are encouraged to identify natural and cultural sites of Outstanding Universal Value for inclusion in the World Heritage List. By nominating these sites, countries take on a commitment before the international community to preserve and manage them for current and future generations. The World Heritage List comprises 890 sites (as of June 2009) in 146 countries, of which 176 are natural sites and 25 are designated for both their natural and cultural values. Sometimes referred to as the "Nobel Prize for Nature", the List comprises some of the most spectacular natural places on earth. Natural World Heritage sites protect currently almost 180 million ha of land and sea and account for 11% of the world's protected areas' surface area. World Heritage sites protect important refuges of threatened or rare plant and animal species, large-scale ecosystems where on-going ecological processes that are important for the

BOX 1 HOW ARE WORLD HERITAGE PROPERTIES INSCRIBED?

For a property to be nominated a country must first undertake an inventory of its significant cultural and natural properties (known as a Tentative List). From this list, it can then nominate a site for inscription, by submitting a detailed Nomination File which describes why the site is deemed of "Outstanding Universal Value" The nomination is then evaluated by the International Council on Monuments and Sites (ICOMOS) for cultural sites and the International Union for the Conservation of Nature (IUCN) for natural sites. These advisory bodies make their recommendations to the World Heritage Committee which meets once a year to determine whether the nominated properties can be inscribed in the World Heritage List.

To be considered of Outstanding Universal Value, a site must meet at least one of the 10 natural and cultural criteria to be eligible for inclusion on the list. In the case of natural heritage the following criteria apply:

- **Criterion vii** :to contain superlative natural phenomena or areas of exceptional natural beauty and aesthetic importance;
- **Criterion viii** : to be outstanding examples representing major stages of earth's history, including the record of life, significant on-going geological processes in the development of landforms, or significant geomorphic or physiographic features;
- **Criterion ix** : to be outstanding examples representing significant on-going ecological and biological processes in the evolution and development of terrestrial, fresh water, coastal and marine ecosystems and communities of plants and animals;
- **Criterion x** : to contain the most important and significant natural habitats for in-situ conservation of biological diversity, including those containing threatened species of outstanding universal value from the point of view of science or conservation.

A nominated natural heritage property must also meet a number of conditions relating to its integrity. This requires assessing the extent to which the property:

- includes all elements necessary to express its Outstanding Universal Values,
- is of adequate size to ensure complete representativity of the features and processes which convey the property's significance and
- suffers from adverse effects of development and/or neglect.

Furthermore, sufficient legal protection and management measures have to be in place to guarantee the conservation of the values for which the site is proposed for inscription. In other words the property must justify its uniqueness and demonstrate that the necessary protection and management structures are in place to safeguard its integrity and unique values.

very survival of the planet are preserved including some of the most outstanding geological features or natural phenomena. The Convention has thus become an extraordinarily important international instrument for *in situ* nature conservation.

World Heritage sites are our common heritage, to cherish and to respect. Their disappearance would be an irreplaceable loss to humanity. In spite of their global recognition, many sites are threatened by the impacts of unsustainable development, excessive tourism pressure or war and conflict. The UNESCO World Heritage Centre therefore monitors their status closely with the assistance of the International Union for the Conservation of Nature (IUCN). In case of serious imminent threat, a site can be inscribed on the List of World Heritage in Danger. Currently 15 natural sites are listed as endangered, including all five of the DRC's World Heritage sites. There are currently only 7 World Heritage sites in Central Africa, six of them in the moist forest zone of the Congo basin. One of them, the Ecosystem and Relict Cultural Landscape of Lopé-Okanda in Gabon, is a mixed natural and cultural World Heritage site. Several other areas of outstanding natural importance exist in Central Africa but most of them do not yet meet the criteria for inscription in the list of World Heritage properties.

The okapi is one of 28 mammal species endemic to the DRC. This strange forest giraffe, which clearly shows its savannah origins, is the evolutionary result of intermixing of savannah and forest species in the evolutionary whirlpool of the Congo Basin, as wet and dry periods succeeded one another over millions of years.

Photo © Kim S. Gjerstad

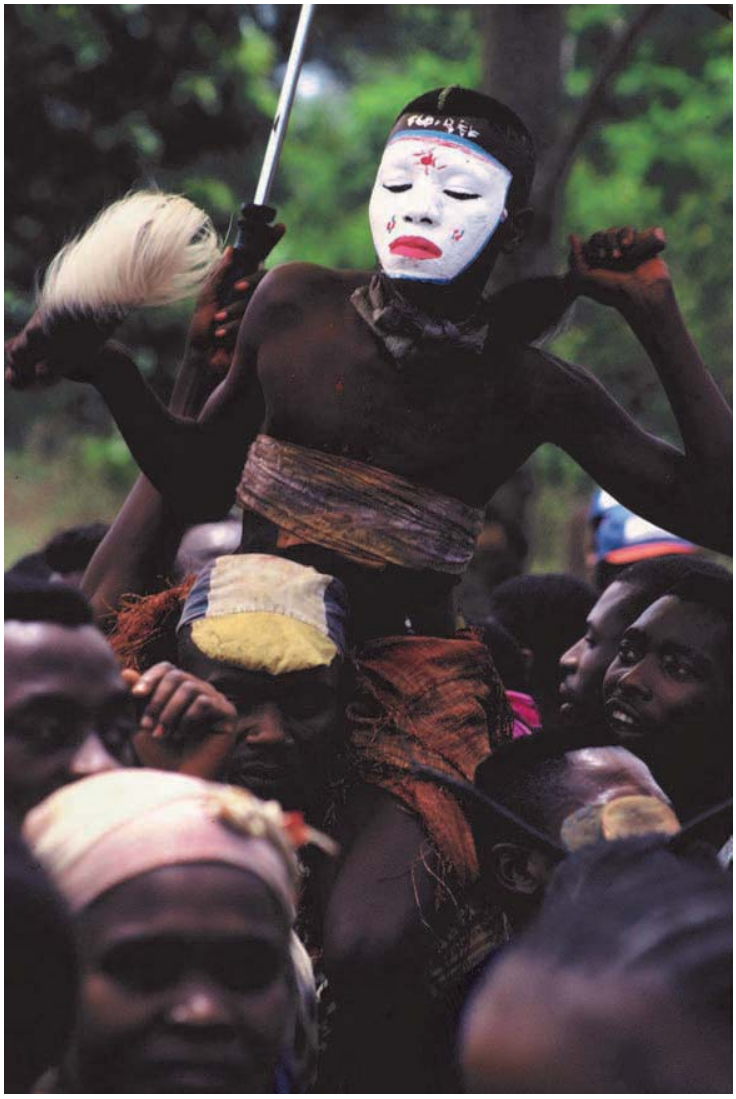
THE GLOBAL IMPORTANCE OF THE CONGO BASIN FORESTS

The moist forests of central Africa represent the world's second largest area of tropical rainforest after the Amazon. Stretching over 2.000 km from the Atlantic coast of the Gulf of Guinea to the highlands of the Albertine Rift in the east of the Democratic Republic of Congo they cover a surface area of about 1.62 km² shared between 7 countries – Cameroon, Central African Republic, Congo Republic, Democratic Republic of Congo, Gabon, Equatorial Guinea and small areas of Nigeria and Angola – with roughly half lying within the DRC. Over 80% are guineo-congolean forests, with two areas of afro-montane forests 2.000 km apart in Cameroon and the Albertine Rift of eastern RDC. Although this vast forest block is commonly referred to as the Congo basin, strictly speaking it is spread over several watersheds (Congo, Sanaga, Ntem, Ogooué, Nyanga, Niari and Kouilou) but with the Congo River watershed covering by far the largest area. Roughly two thirds of the central African moist forests are drained by the Congo River and 50% of these forests fall within the DRC.

Like the Amazon, but unlike the forests of southeast Asia or west Africa, the forests of the Congo basin form an essentially uninterrupted forest block. Unlike the Amazon however, where most of the forests lie just above sea level, roughly 80%

of the Congo forests lie between 300 and 1.000m above sea level. Average annual rainfall is between 1.600 and 2.000 mm, although along the coasts between Cameroon and Gabon annual rainfall is much higher (3.000 to 11.000 mm). The cycle of climate changes over the past 2 million years has had a profound influence on the forests of the Congo basin. In response to expansions and contractions of the polar ice caps, cool dry periods have alternated with warmer, humid periods, causing the forests to shrink and expand. During drier periods, the forests were reduced to a series of scattered refuges situated along the Atlantic coastal mountain ranges, the highlands of eastern DRC, and along the gallery forests and swamps associated with the Congo River. These so called forest refuges acted as reservoirs of forest species in periods of forest contraction and as the forest fragmented and expanded, forest and non forest species were repeatedly intermixed in a kind of "evolutionary whirlpool". The Okapi, the DRC's endemic forest giraffe, is a spectacular example of a forest species clearly displaying its savanna origins. Today these areas are characterized by higher levels of biological diversity and endemism than in the rest of the Congo basin forests.

Overall species diversity of the central African forests is high, although not as high as the Amazon or south-east Asia. However what makes these forests particularly interesting is that much of the fauna and flora is found nowhere else in the world and this is true not only at the species level but also at the genus and even family levels. The lowland forests contain around 10.000 higher plants, of which 30% are endemic (including 9 endemic families), while the afro-montane forests contain around 4.000 species, of which 70% are endemic (including 2 endemic families). Several endemic and charismatic mammals live in the central African forests including the okapi, bongo, fishing genet, gorilla and bonobo and many of the small primates and duikers are also unique to these forests. In addition to the endemic Congo peacock the forests contain at least 5 bird families endemic to Africa. Amphibian, reptile and fish diversity are also high although all three groups are relatively poorly known and new species are regularly discovered. In the DRC alone over 1.000 species of freshwater fish are known.



A young Bakota boy in Mbomo, near Odzala Koukoua National Park in Congo celebrating « Likinda », the traditional circumcision ceremony. Over 150 different ethnic groups live in the central African rainforests.

Photo © C. Aveling

In addition to its importance in terms of species diversity and endemism the Congo basin is one of the last regions in the world where vast areas of interconnected rainforest allow biological processes to continue undisturbed. A forest elephant could, in theory, move from the Albertine Rift to the coast of Gabon without leaving the forest. The Congo basin is also a gigantic carbon sink and as such plays a vital role in regulating the planet's greenhouse gases. Lastly it has a dominating influence on local weather patterns since over 50% of the rain that falls on the central Congo basin comes from evaporation and evapotranspiration from the forest itself.

Some 30 million people, belonging to over 150 different ethnic groups, live in the central African rainfor-

An Mbuti net hunter in the Ituri forest, Okapi Wildlife Reserve. Semi-nomad pygmy hunter-gatherers and Bantou agriculturalists maintain complex relations of interdependence.

Photo © Kim S. Gjerstad

ests. Vestiges of human occupation in some sites (for example the Ecosystem and Relict Cultural Landscape of Lopé-Okanda) go back 400.000 years, although these people were probably living mostly on the forest fringes in the mosaic of savannas and forests created by the fluctuating global climate. It is not known exactly when humans started living permanently in the forest but it is thought that the forest dwelling semi-nomad pygmy hunter-gatherers have been living in the forests for the past 20.000 years and that Bantou farmers started penetrating the forest from the north-west about 4.000 years ago. Over the millennia relatively complex relations of interdependence built up between the hunter-gatherers and the Bantou farmers, the hunter-gatherers providing meat, fish and other forest products for the farmers, and the farmers providing much needed extra sources of carbohydrates for the hunter-gatherers. These relationships still exist today although increasingly pygmy groups are becoming more settled.

Traditional agricultural practices in the central African forest have evolved on the basis of slash and burn with relatively long fallow periods between forest clearance (>25 years). Given the generally poor fertility of the soils in most of the central African forests slash and burn agriculture, combined with a continuing dependence on the forests' natural resources, has been an appropriate survival strategy for forest dwelling peoples. However this traditional way of life can only remain sustainable as long as population densities remain low. Over large areas of the Congo basin, where population densities are below 2 inhabitants/ km², traditional agriculture still predominates. However, where population densities are rising, particularly in settlements along roads and around towns and villages, fallow periods are shortening and characteristic halos of forest degradation, with associated problems of soil fertility, are beginning to appear. With the development of economic activities (in particular industrial extractive industries such as logging and mining), and the creation of increasingly dense road networks along which human settlements become established, these

Chimpanzee and crocodile, both protected species, on sale in Lambarene bush meat market, Gabon. The increasingly widespread phenomenon of "open access" to natural resources is leading to impoverishment of wildlife populations through overhunting for the bushmeat trade.

Photos © S. Louembet (below) & C. Aveling (right)

A mosaic of fallow fields and mature forest in a lightly populated area of northern Congo Republic. In the generally poor soils of the central African rainforests traditional slash and burn agriculture is sustainable only as long as population densities remain low (< 2 inhabitants/ km²) and fallow periods remain greater than 25 years.

Photo © C. Aveling.

halos of forest clearance coalesce to form ribbons of forest degradation which fragment the remaining forest blocks. This process of forest degradation is further exacerbated when rural populations begin commercializing the forest products (eg bushmeat and other non timber forest products) to supply neighboring urban centers. Unfortunately these same populations are the first to be affected by the negative impacts of this process of forest degradation.

The shifting patterns in human distribution over the past 30 years have had profound socio -cultural and socio-economic influences on rural populations. New, and often less sustainable, ways of extracting and commercializing natural resources have been introduced and the increasing mix with immigrants often brings conflicts with traditional systems of natural resource management. The increasingly widespread phenomenon of "open access" to forest resources is leading to natural resource depletion and this is exacerbated by the uneasy cohabitation of traditional and normal land tenure systems throughout much of the central African forests. The impact of civil strife and war in the Congo basin, occasionally causing massive movements of refugees, has created further strains on traditional land tenure structures and natural resource management systems.

Currently approximately 22.96 million ha of central Africa's moist forests, some 14% of the surface area, have been designated as protected areas. Sizes of protected areas vary considerably, from a few hundred ha to 3.3 million ha (Salonga National Park, a World Heritage site). However while species diversity is high in the Congo basin forests, densities of species are relatively low and for this reason most of the protected areas, except the very largest and best protected, are probably not large enough to ensure the long term conservation of the full range of species and biological processes. This has led to a shift in conservation

strategies in recent years with an increasing emphasis on a landscape approach to conservation. The idea here is to enhance the ecological integrity of protected areas and their surroundings by addressing conservation management issues in the multiple-use zones that link them. The strategy is to manage the impact of human activities, through for example sustainable forestry management and community-based natural resource management, in such a way that gene flows and ecosystem processes are maintained across the landscape, so that protected areas are prevented from becoming isolated, and often unsustainable, islands of biological diversity.

Since most ecological landscapes lie astride international boundaries a regional approach to conservation goes hand in glove with the landscape approach. In 2000 a major priority setting workshop, involving over 160 national and international conservation scientists, was organized by WWF in Libreville to identify the most important sites for biodiversity conservation in central Africa. Some of these sites fell within the existing network of protected areas, but many others were outside protected areas. These sites were then regrouped within a series of vast and relatively intact landscapes on the basis of their biological representativity, the viability of the wildlife populations, and the integrity and resilience of their ecosystems and ecosystem processes.

The landscape concept was integrated as a central pillar of the COMIFAC's (*Commission des Forêts d'Afrique Centrale*) strategic Convergence Plan which emerged from the 1999 Yaoundé Heads of State Summit on sustainable forest management. The landscape concept is now embraced by the majority of the conservation partners currently active in the region within the framework of a major international partnership known as the Congo Basin Forest Partnership, (CBFP).

BOX 2. CONGO BASIN FOREST PARTNERSHIP

The partnership brings together the 10 member states of the COMIFAC, donor agencies, NGOs, scientific institutions and private sector representatives. It currently has 45 members who share the commitment to enhance communication and coordination among the members and to create synergies between their respective projects, programs and policies, in support of the COMIFAC Convergence Plan.

Governments
Belgium, Burundi, Cameroon, Canada, Central African Republic, Chad, Democratic Republic of Congo, Equatorial Guinea, European Commission, France, Gabon, Germany, Japan, Netherlands, Republic of Rwanda, São Tomé and Príncipe, South Africa, Spain, United Kingdom, United States of America.

International Organizations:
African Development Bank, COMIFAC, FAO, Global Mechanism of the United Nations Convention to Combat Desertification, GRASP (Great Apes Survival Partnership), International Tropical Timber Organisation, Secretariat of the Convention on Biological Diversity, Secretariat of the Convention on Migratory Species, UNDP, UNEP, UNESCO, World Bank.

NGOs and research groups:
African Wildlife Foundation, Centre for International Forestry Research (CIFOR), Conservation International, Forest Trends, IUCN, Jane Goodall Institute, Wildlife Conservation Society (WCS), World Resources Institute (WRI), WWF International.

Private sector:
American Forest and Paper Organisation, Inter-African Association of Forest Industries (IFIA), International Technical Association for Tropical Timber (ATIBT), Society of American Foresters

source: http://www.cbfp.org

The CBFP (Box 2) was launched at the World Summit on Sustainable Development in Johannesburg, 2004. It is an association of 45 governmental and non-governmental organizations, including UNESCO, active in the Congo basin whose aim is to coordinate programs and policies of the different partner organizations in order to improve the coherence and effectiveness of their programs for the sustainable development of the Congo Basin's forest ecosystems. In particular the partnership aims to promote programs that improve biodiversity protection and governance and raise the standard of living of the region's inhabitants. Strengthening of the COMIFAC institutions and aligning CBFP activities with those of the COMIFAC's strategic Convergence Plan (Box 3) are central to CBPF's strategy.

BOX 3. THE 10 PILLARS OF THE COMIFAC CONVERGENCE PLAN

1. Harmonization of forestry and fiscal policies
2. Knowledge of the forest resource
3. Ecosystem management and reforestation
4. Biodiversity conservation
5. Sustainable development of forest resources
6. Development of alternative activities and poverty reduction
7. Capacity building, stakeholder participation, information and training
8. Research and development
9. Development of funding mechanisms
10. Regional cooperation and partnerships

Source: http://www.biodiv.be/comifac2

The partnership is governed through a facilitation process provided by one of the partners for a set period. The first facilitator was the USA (2003-2004), followed by France (2005-2007) and now Germany (2008-2009).

WORLD HERITAGE IN THE CONGO BASIN

Given the global importance of the central African rainforests in terms of their species diversity and their sheer size as large intact ecosystems, it is surprising that so few forest sites have achieved World Heritage status (map, page 8). Currently there are only six forest World Heritage properties in the Congo basin forest, all of which fall within one or other of the 12 priority CBFP forest landscapes. Four of them are in the DRC (Virunga, Kahuzi-Biega, and Salonga National Parks and the Okapi Wildlife Reserve[1]), one in Cameroon (Dja Wildlife Reserve) and one in Gabon (Ecosystem and Relict Cultural Landscape of Lopé-Okanda). Furthermore the four DRC sites have been inscribed on the List of World Heritage in Danger since the late 90s because of the threats to the sites resulting from the civil war. As for the other central African countries, the Congo Republic, Central African Republic and Equatorial Guinea[2], do not have World Heritage properties in the forest zone[2] despite harboring some of central Africa's most spectacular and biologically important forest sites. The forests of the islands of the Gulf of Guinea (São Tomé, Príncipe and Bioko) are also not represented in the World Heritage list despite being of immense biological importance because of their high levels of endemism.

The central African forests are therefore a high priority for UNESCO's World Heritage Centre and a number of activities have been developed over the past decade aimed at i) protecting sites inscribed on the List of World Heritage in Danger, ii) identifying new potential sites and iii) improving the management standards of potential sites so that they can meet the World Heritage criteria for inclusion of the World Heritage List.

[1] DRC's fifth World Heritage site, Garamba National Park, is situated in the savanna zone in the north east of the country.

[2] Equatorial Guinea is not yet a signatory to the World Heritage Convention

[3] CAR's Manovo-Gounda-St Floris National Park is located in the savanna zone in the north of the country. It is also on the list of World Heritage in Danger.

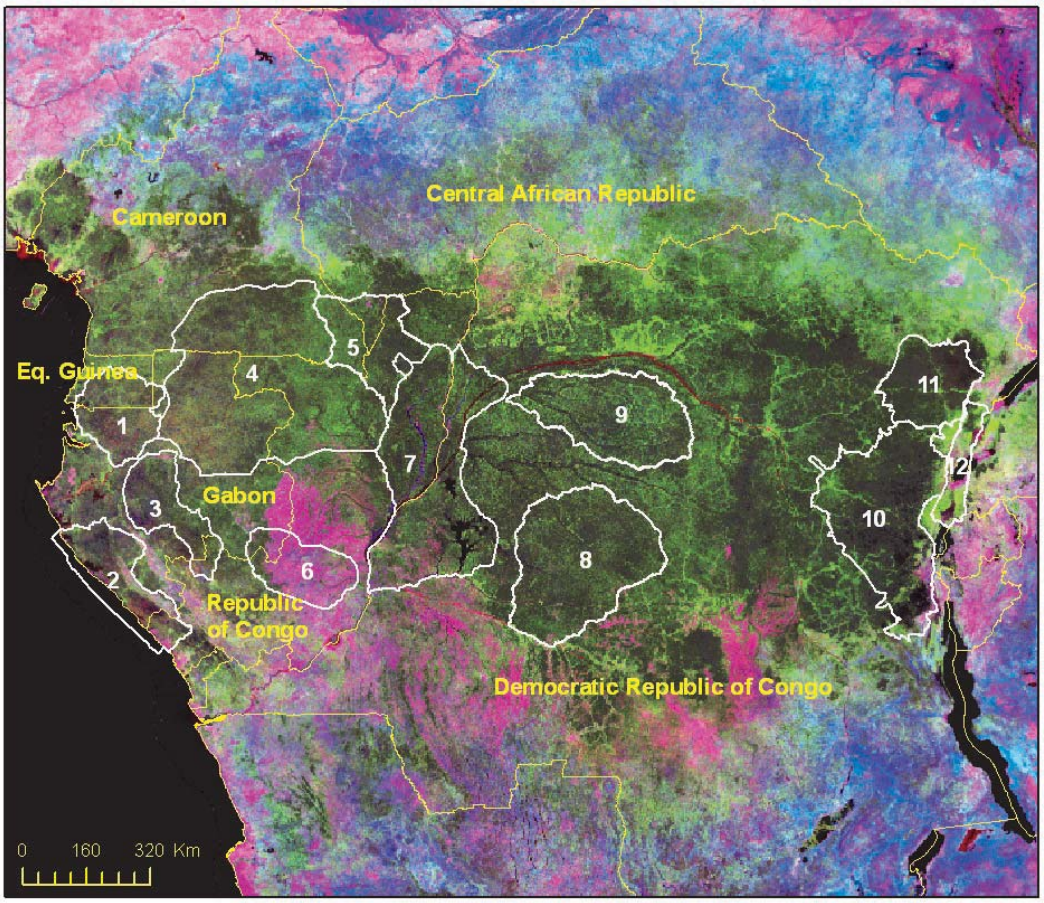
To meet these challenges UNESCO has established an innovative alliance between UN agencies, national authorities and locally experienced international NGOs, each organization bringing its own network, experience and expertise to the partnership:

- **National governments** have protected area networks, but often lack effective management structures on the ground due to lack of capacities and resources;

- **International NGOs** bring their conservation experience, organizational capacities, training resources and core funding to support and strengthen the protected areas on the ground;

- **UNESCO** uses the World Heritage Convention to leverage political support for biodiversity conservation through its permanent contact with State Parties and mobilizes funding from bilateral, multilateral and nongovernmental organizations to support the development and protection of key sites.

UNESCO's central African forest agenda is currently being implemented through two major initiatives: a programme of emergency support to the DRC World Heritage properties entitled *Biodiversity in Regions of Armed Conflict: Protecting World Heritage Sites in the Democratic Republic of the Congo* launched in 2000, and the *Central African World Heritage Forest Initiative* (CAWHFI) launched in 2004 and targeting three transboundary landscapes in Gabon, Congo Republic, Cameroon and CAR.



The central African forest landscapes include protected areas and the multiple use zones that surround them and / or link them. The strategy of the landscape approach to conservation is to manage conservation and development activities across the landscape in such a way that the integrity of ecological processes is preserved.

The landscapes are:
1. *Monte Alén-Monts de Cristal*
2. *Gamba-Mayumba - Conkouati*
3. *Lopé-Chaillu-Louesse*
4. *Dja - Odzala - Minkebe (TRIDOM)*
5. *Tri-National de la Sangha (TNS)*
6. *Léconi-Batéké-Léfini*
7. *Lac Télé-Lac Tumba*
8. *Salonga-Lukenie-Sankuru*
9. *Maringa-Lopori-Wamba*
10. *Maiko-Tayna-Kahuzi Biega*
11. *Ituri-Epulu-Aru*
12. *Virunga*

Source : OFAC

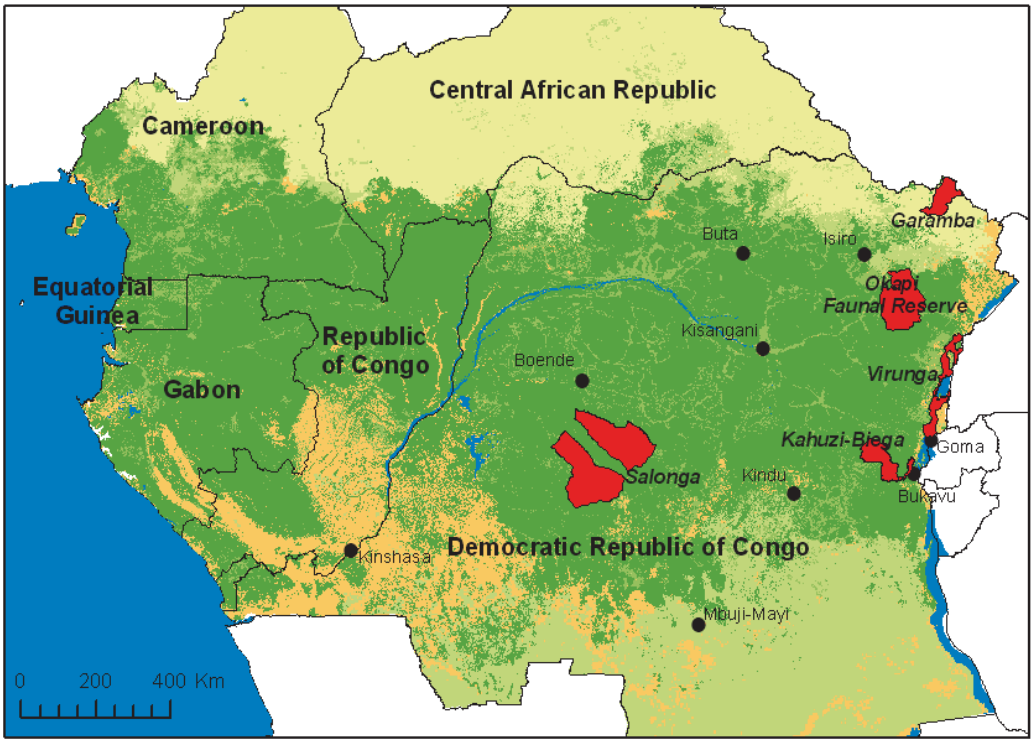
BIODIVERSITY CONSERVATION IN REGIONS OF ARMED CONFLICT

Protecting World Heritage Sites in the Democratic Republic of the Congo

Twenty years of civil strife and economic collapse, followed by a full blown civil war have placed all five of the DRC's World Heritage properties (four forest sites and one savanna site) under severe pressure from human activities, particularly from large-scale poaching for the ivory and bush meat trades, illegal logging and mining and illegal settlements. Between 1994 and 1999 all five sites were placed on the List of World Heritage in Danger. In response to this crisis UNESCO's World Heritage Center brought together an alliance of conservation partners to provide emergency aid to these sites. The partners included the national protected areas agency l'*Institut Congolais pour la conservation de la Nature* (ICCN), and a group of international conservation NGOs all of whom had a proven track record of work on the ground.

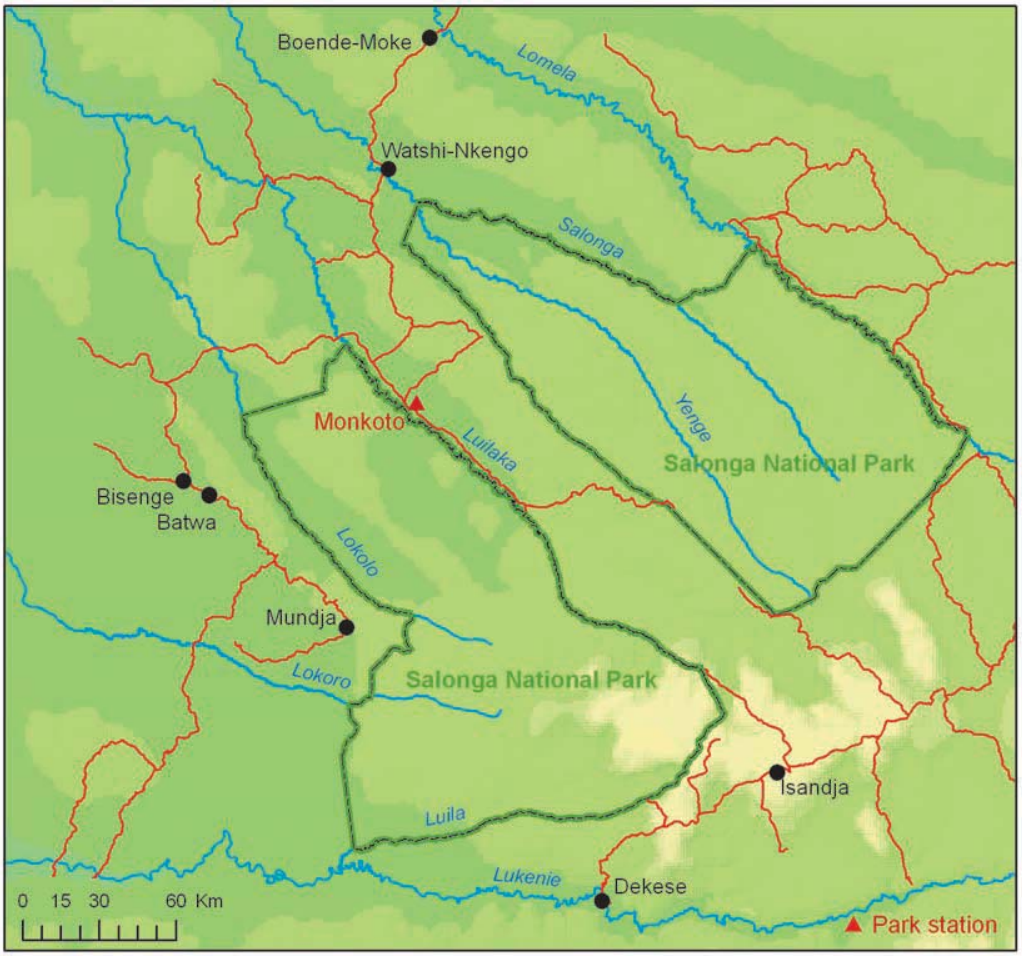
The original partnership included the World Wide Fund for Nature, Wildlife Conservation Society, Gilman International Conservation, Milwaukee Zoological Society, the International Rhino Fund and the International Gorilla Conservation Programme[4] as well as the German bilateral aid agency GTZ and the Belgian government. The program, entitled *Biodiversity in Regions of Armed Conflict: Protecting World Heritage in the Democratic Republic of the Congo*, was launched in 2000 at the height of the civil war with funding from the United Nations Foundation and the Government of Belgium, and provided critical support to enable these sites to maintain their values and integrity at a time when four of the sites found themselves in rebel-held territory and almost all bilateral and multilateral aid partners had temporarily withdrawn from the country. Other NGOs have since joined this partnership (Fauna and Flora International, London Zoological Society, Frankfurt Zoological Society, African Parks Foundation, African Conservation Fund, IUCN) and the second phase of the program has also received funding from Italy. Discussion for a third phase are currently underway with contributions from Belgium and Spain.

[4] *The International Gorilla Conservation Program is a coalition of three partners: African Wildlife Foundation; Fauna and Flora International; World Wide Fund for Nature)*



The long period of conflict in the DRC has seriously threatened the integrity of the country's protected area network. Between 1994 and 1999 all five of the DRC's World Heritage Sites (in red) were placed on the list of World Heritage in Danger.

SALONGA NATIONAL PARK



Salonga National Park at a glance	
Status	National Park (1970); World Heritage List (1984 - criteria vii and ix); World Heritage Site in Danger (1999)
Coordinates	1°00'-3°20'S, 20°-22°30'E
Surface area	33,346 km²
Altitude	350 – 700 m
Terrestrial Ecoregions	Eastern Congolian Swamp forests; Central Congolian lowland forests
Aquatic Ecoregions	Central basin
UNESCO's site partners	MZL, WCS, WWF

Salonga National Park is the largest protected area of dense humid forest on the African continent, so managing this vast area with less than 200 park staff presents enormous challenges for ICCN. Travel in and around the park is on foot or by pirogue and simply visiting all the patrol posts can take up to 3 months! Transferring a poacher to the nearest tribunal involves a 200 km journey on foot or by bicycle.

The park comprises lowland guineo-congolean rainforest dominated by leguminous species from the Caesalpinacea family, mixed with large areas of swamp and riverine forest. Mineral rich forest clearings ("*botoka njoku*"), which attract large mammals particularly elephants, also occur. To the south of the park, areas of forest/savanna mosaic add to its floral diversity. While overall biodiversity is not as high as the Atlantic forests to the west or the Alber-

The vegetation in the Salonga National Park is dominated by species from the Caesalpinacea family mixed with large areas of swamp and riverine forest. To the south areas of forest/savannah mosaic add to the floral diversity of the park. Photos © Kim S. Gjerstad

tine Rift forests to the east, this is more than offset by the fact that its sheer size means that it has the potential to harbour very large assemblages of the species that do occur there. The presence of two endemic primate genera (the bonobo and the marsh monkey), as well as an endemic species (the Salonga monkey) and several endemic sub-species of primate, make this an important protected area bio-geographically. Its vast size also makes it hugely important in terms of climate regulation and carbon sequestration.

Human population densities are low in this remote area, averaging around 2,4 inhabitants/ km². Exploitation of the area's natural resources accounts for over 95% of human activities (agriculture, fishing, hunting, non-lignite forest products (NTFPs). The socio-economic collapse brought on by the past 20 years of conflict has made local populations ever more dependant on natural resource exploitation as an economic activity. Two populations live within the park's boundaries. The Kitwalistes, a religious sect, took refuge in the north-eastern part of the northern block in the 70s and have remained there, essentially beyond the reach of the law, ever since. They currently number between 3.000 and 4.000. In the southern block the Iyaelema, belonging to the Mongo group, who refused to leave their ancestral lands when the park was created, currently occupy 8 villages and number about 2.340 inhabitants. Their presence is tolerated by the parks authorities who have a tacit agreement with them about the scope of activities permitted.

Human populations rely heavily on exploitation of natural resources in this remote area. Fishing accounts for 65% of household revenues around the Salonga National Park. Commercial hunting has also increased dramatically.

Photo © J.T Hart

Despite its size and apparent inaccessibility recent surveys have shown that wildlife populations have been depleted during the period of political instability. The large navigable rivers in fact provide easy access for poachers and armed groups, including uncontrolled elements of the army, to penetrate deep into the park to hunt for ivory and bushmeat. Massive quantities of bushmeat from Salonga National Park are now finding their way to distant markets in Kinshasa and Katanga province where they fetch prices up to 10 times higher than in the villages and camps around Salonga. However a wildlife survey report published by WCS in 2006 estimates that bonobo numbers are still relatively healthy, with a population estimate of 14,800.

VIRUNGA NATIONAL PARK

Virunga National Park at a glance

Status	National Park (1925); World Heritage site (1979 - criteria vii, viii, x); World Heritage site in Danger (1994); Ramsar Site (1996)
Coordinates	0°55'N -1°35'S and 29°10 - 30°00'E
Surface area	7,900 km²
Altitude	798 – 5,119 m
Terrestrial Ecoregions	Albertine Rift montane forests; East Sudanese savanna
Aquatic Ecoregions	Rift Valley lakes, Albertine Rift mountains
UNESCO's site partners	WWF, LZS, IGCP (a consortium of FFI, WWF and AWF), FZS, ACF

Situated along the Albertine Rift, the Virunga National Park is arguably the most spectacular protected area in Africa. From freshwater lakes, to active volcanoes, savannas, dry forests, dense humid forests, afro-tropical alpine meadows and snow-capped mountains it is tempting to suggest that the only biomes that are missing in the PNV are the desert and the sea. The first park in Africa, it was created in 1925 to protect the mountain gorillas of the Virunga volcanoes and was later extended northwards to include the Rwindi grassland plains, Lake Edward, the dense humid forest of the Semiliki valley and the snow-capped Ruwenzori Mountains. Virunga National Park is contiguous with 6 other national parks in neighbouring countries (Volcans in Rwanda; Mgahinga, Bwindi, Queen Elizabeth, Ruwenzori and Semliki in Uganda) which act as reservoirs for commonly shared wildlife species, a vital consideration in times of war. Both Bwindi and Ruwenzori are also World Heritage Sites.

The enormous variety of habitat types means that Virunga has by far the greatest diversity of fauna and flora in the DRC. Of the 2,077 plant species recorded in the park 230 are endemic to the Albertine Rift mountains. In an area representing only 0,3% of the total surface area of DRC, the Virunga is home to over half of the DRC's mammal species (218 out of 415 species, including 22 primate species) and two thirds of its bird species (706 out of 1094 species, of which 25 are endemic to the Albertine Rift). In addition to the world famous population of mountain gorillas, comprising 700 individuals shared between DRC, Uganda and Rwanda, Virunga is unique in that it also harbours a small population of a second subspecies of gorilla, Grauer's gorilla, on Mount Tchiaberimu. Chimpanzees also occur in several sites in the park. Before the war gorilla and chimpanzee viewing was the basis of a flourishing tourism industry in the park, generating up to half a million dollars per year in park entrance fees. Between 2008 and 2009 the gorilla sector was occupied by FDLR rebel forces. However despite initial fears for the survival of the gorilla population, the rebels appeared to have understood the economic returns of keeping the gorillas alive since in the early stages of their occupation they were reported to be running tourist excursions! Recent surveys in the VNP have also confirmed the presence of one of the DRC's other

charismatic large mammal endemics, the Okapi, which had not been seen in the park for over 50 years.

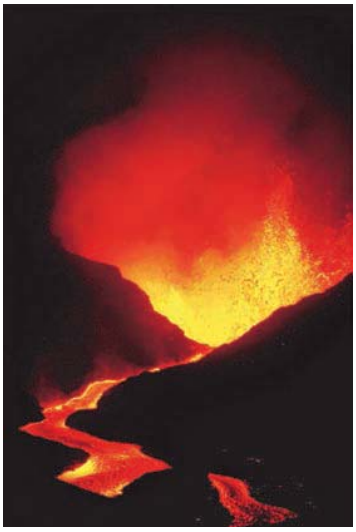
Virunga National Park is contiguous with several protected areas in neighbouring Uganda and Rwanda. Once peace returns to eastern Congo wildlife populations, including the charismatic flagship species, should be able to recover through a process of repopulation from the neighbouring protected areas.

Photo © Kim S. Gjerstad

Virunga National Park is particularly vulnerable to pressure because of its geographic location and its shape. The park is over 200km long with nearly 1,000km of border. In addition the fertile volcanic soils of the region support one of the highest human population densities in Africa (as high as 600 inhabitants/km² in some areas), of which 80% are engaged in permanent agriculture and 5% in fishing on the Lakes. However the last decade of civil war has seen a dramatic increase in incursions into the park accompanied by massive scale poaching for the bushmeat trade. Hippos in the central sector of the park declined from 23,000 in 1989 to less than 500 today, and most of the plains species (elephant, buffalo, and antelope) have declined sharply as well. Fishing villages have mushroomed along the shore line of Lake Edward and fish production is declining through overfishing. This is a particular concern since of the 80 species of fish described from Lakes Edward and George, 60 are endemic.

Clearance of the forest, particularly in the larva plains around the two active volcanoes, to supply fuel wood and charcoal for the burgeoning city of Goma, is a massive threat to the integrity of the southern sector of the park and is proving particularly difficult to eliminate because of the many interest groups involved. These include military, local authorities, and even some of the park staff themselves.

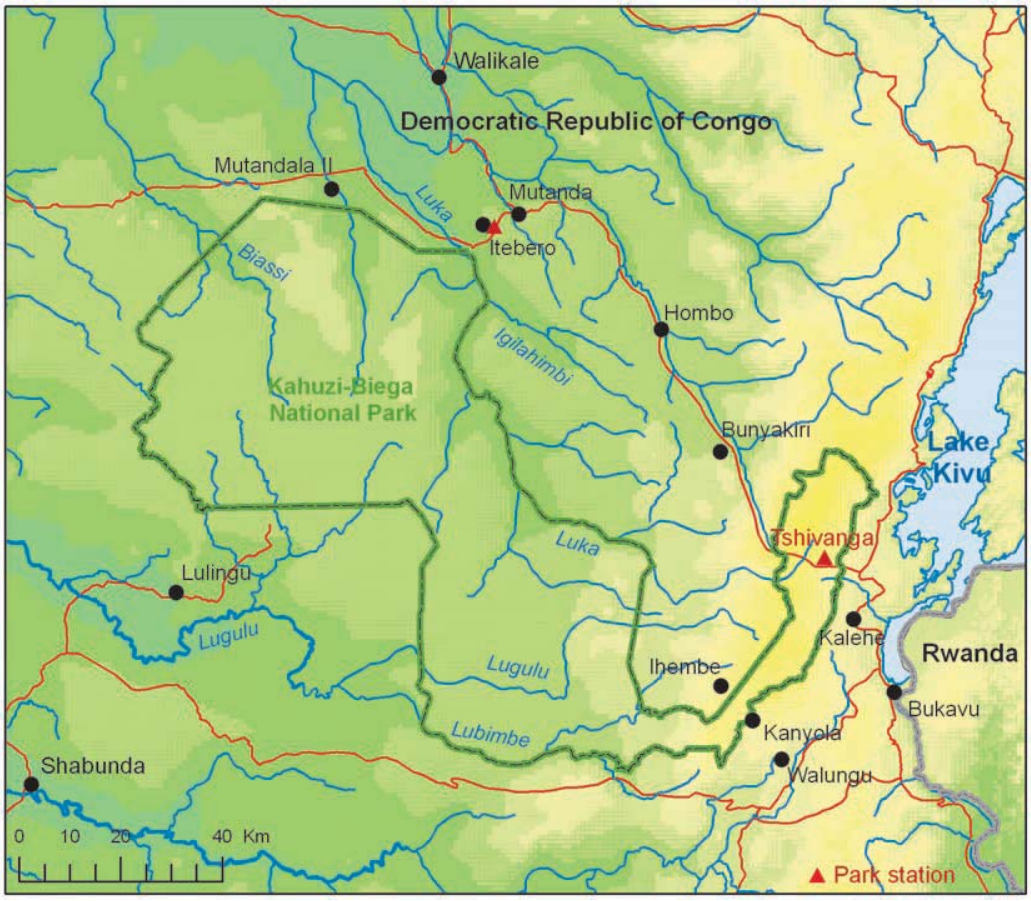
Finally increasing interest in the oil and gas reserves under the Albertine Rift in Uganda and DRC, for which several exploration permits are awaiting Presidential approval, represents yet another threat to the integrity of the complex of protected areas shared by Uganda, DRC and Rwanda.



An exceptional diversity of landscapes including volcanoes, snow-capped mountains, dense forests, savannahs, rivers and lakes makes the Virunga National Park one of the most biologically diverse ecosystems in Africa. *Photos © Kim S. Gjerstad (left), C. Aveling (centre and right)*

KAHUZI-BIEGA NATIONAL PARK

Originally created in 1970 to protect the montane habitat of the Grauer's gorilla, a subspecies endemic to DRC, the park was later extended to cover the lower altitude forests to the west. Today the park covers 6,000 km². The great altitudinal range of (from 600m to 3,300m) covered by the park is rare for a forested protected area in Africa. Almost everywhere else in Africa the mid-altitude forests have been cleared for agriculture and ranching. The land around the highland sector of the park is heavily populated with densities of up to 300 inhabitants /km², their main activities being permanent agriculture and livestock. To the west, in the lowland sector, population densities are less than 30 inhabitants/km². Here subsistence slash and burn agriculture dominates although recently many people have abandoned agriculture in favour of artisanal



Status	National Park (1970, extended 1975); World Heritage site 1980 (criteria vii, viii, x); World Heritage site in Danger 1994
Coordinates	1°36' – 2°37'S and 27°33' - 28°40'E
Surface area	6,000 km²
Altitude	700 – 3308 m
Terrestrial Ecoregions	Northeastern Congolian lowland forests Afro-montane forests of the Albertine Rift
Aquatic Ecoregions	Upper Congo, Albertine Rift mountains
UNESCO's site partners	GTZ, WWF, WCS

Tourism based on gorilla viewing was pioneered in the 1970s in Kahuzi-Biega National Park . Gorilla viewing has now become a multi-million dollar business in the three countries of the Great Lakes region that share the remaining mountain gorilla populations.

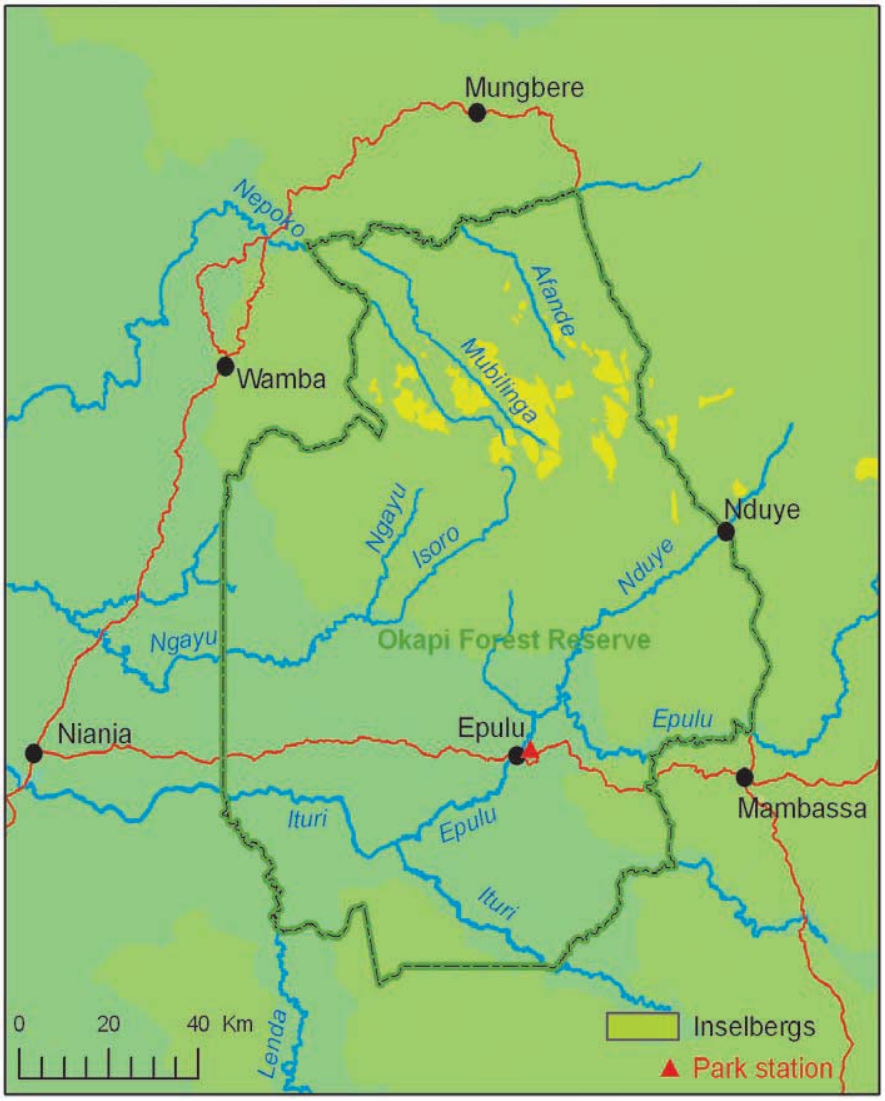
Photo © Simon J. Childs

mining activities (gold, diamonds, coltan, tin).

Situated within the species-rich Albertine Rift the forests of Kahuzi-Biega National Park have exceptionally high floral diversity with 1,171 recorded species, of which 145 are endemic to the Albertine Rift. In addition to the low and mid-altitude closed canopy moist tropical forests a number of other important habitat types occur including extensive bamboo forests, swamp forests, peat bogs, and afro-alpine fern forest and meadows. This floral diversity is matched by a high faunal diversity with 136 mammal species (with 15 Albertine Rift endemics) and 335 bird species (with 29 Albertine Rift endemics).

The civil war has had a devastating effect on wildlife in Kahuzi-Biega National Park with widespread poaching to supply Bukavu's burgeoning bushmeat trade during the 90's. By 2003 the highland sector of the park had lost more than 95% of its elephant population and about 50% of its gorilla population, including several of the habituated families used for tourism. Recently completed surveys in the lowland sector also confirm that wildlife populations appear to have been badly hit. However no species have been lost and there is every reason to believe that populations can recover once ICCN recovers control of the area. Until recently the presence of armed bandits, rebel militias, and army deserters, many of whom are involved in the bushmeat trade and illegal mining, made much of this area a "no-go" zone for ICCN. However the situation is now improving slowly, although settlements and land clearance for agriculture in the narrow corridor linking the highland and lowland sectors of the park remains a serious problem.

Okapi Wildlife Reserve



Okapi Wildlife Reserve at a glance

Status	Wildlife Reserve (IUCN cat II National Park), World Heritage site 1996 (criterion x), World Heritage site in Danger 1999
Coordinates	1°00'-2°42'N and 28°02'- 29°08'E.
Surface area	13,726 km²ha
Altitude	500 – 1,000 m
Terrestrial Ecoregions	Northeastern Congolian lowland forests
Aquatic Ecoregions	Uélé, Central basin
UNESCO's site partners	GIC, WCS

The Okapi Wildlife Reserve is situated in the Ituri forest to the west of the Albertine rift and covers almost 14,000 km² of lowland and mid-altitude forest, with extensive areas of mono-dominant *Gilbertiodendron* forest. As its name suggests it was created to protect the habitat of the Okapi, DRC's most intriguing endemic mammal (photo page 10). This strange forest dwelling giraffe was described to the explorer

Stanley by the Mbuti pygmy inhabitants as he passed through the Ituri forest in the 1860's but it was not until 1901 that scientists collected and described this species. Later studies confirmed that the Okapi, so unlike any other forest species, has a very limited distribution and is confined to north eastern DRC.

A male bongo, Africa's largest forest antelope species, in a forest clearing (edo) in the OWR.

Photo © Reto Kuster

There are several other spectacular and endemic species in the OWR including the rarely seen Congo peacock, the aquatic fishing genet and the giant genet. Over 90 mammal species are recorded from the reserve including the highest number of primates of any single forest block in Africa (13 diurnal, 4 nocturnal - Virunga has more species but dispersed over several habitat types). These include chimpanzees but, interestingly, not gorillas even though the Ituri forest is contiguous with other forested areas where gorillas are found. In the north of the reserve spectacular granite inselbergs tower above the forest canopy and are home to a number of plant and animal species specially adapted to this micro-habitat.

The area covered by the OWR has been occupied by man since at least the Stone Age. The earliest occupants were probably the Mbuti and Efe semi-nomads who currently number around 30,000 in the landscape. The status of Reserve rather than National Park for this area ensures that these semi-nomad groups are able to maintain their traditional way of life in the forest. The area has remained, until relatively recently, one of the most lightly populated areas of north east DRC. However the past 30 years has seen a steady immigration of people leaving the overpopulated highlands to the east in search of new agricultural land. This is now one of the key threats to the area as it has led to increased pressure on the Ituri forest through forest clearance for agriculture, and increased hunting. It has also led to conflict between resident ethnic groups and the newcomers.

Inselbergs in the north of the OWR are home to a number of plant and animal species specially adapted to this micro-habitat.

Photo © Reto Kuster

During the civil war Epulu was the front line between the warring parties. The breakdown in law and order during the 90's provided the opportunity for thousands of itinerant miners, as well as elements from the Ugandan army, to enter the forests of eastern DRC to extract timber and mine for gold, diamonds and coltan. Temporary mining camps composed of miners, their families, hunters, itinerant traders and other hangers-on appeared all over the forest. The effects on wildlife were devastating as the mining camps became centres for the commercial bushmeat and ivory trades. Fortunately the situation has improved considerably since 2007 when ICCN managed to regain control of 95% of the Reserve and, with the support of administrative and traditional authorities, closed down most of the mining camps. Elephant poaching has also been brought under better control through more effective surveillance and improved collaboration with the armed forces and administrative authorities.

GARAMBA NATIONAL PARK

Established in 1938, Garamba is of particular importance in the DRC's network of protected areas as its geographic situation at the northern limit of the forest / savannah mosaic zone gives it a unique mix of forest and savannah plant and animal species. The southern part of the park is predominantly grassland savannah with scattered trees. Along the Dungu and Garamba rivers, there are mosaics of riverine galleries, forests and thickets. Further north the vegetation is mainly mixed woodland, dense dry forests and riverine and small swamp forests. In contrast, the surrounding hunting areas are predominantly dense bush savannahs, mixed woodlands and forests.

Garamba's flagship mammal species is the highly endangered northern white rhino whose last remaining population was, until very recently, confined to Garamba National Park. Garamba is also famous for its large population of elephants which display morphological characteristics that are intermediate between the forest and the savannah forms. Other purely savannah species include the Congo giraffe - an endemic subspecies occurring only

Garamba National Park at a glance

Status	National Park (1938); World Heritage site (1980 – criteria vii, x); World Heritage site in Danger (1996)
Coordinates	3°45' - 4°41'N, 28°48' - 30°00'E
Surface area	4,920 km² surrounded by three hunting reserves (Azande, Mondo-Missa, Gangala na Bodio) totaling 10,000 km²
Altitude	710m to 1,061m
Terrestrial Ecoregion	Northern Congolian forest-savanna mosaic
Aquatic Ecoregion	Uélé
UNESCO's site partners	IRF, WWF, FFI, APN

in Garamba, the roan antelope and the hartebeest. Typical forest mammal species found in the extensive areas of gallery forest include the chimpanzee, 8 small primates (baboons, colobus and guenons), 3 duikers, the bongo, red river hog and giant forest hog.

Garamba National Park contained, until recently, the last remaining population of the northern white rhino. No specimens have been seen since November 2007.

Photo © C. Aveling

The traditional inhabitants of this region are the Azande people who practice subsistence agriculture and hunting. Population densities are not high (about 4 inhabitants / km²) but the social dynamics and security of the region have been adversely affected not only by the DRC wars but also by the wars in the neighbouring countries of Sudan and Uganda. At the beginning of the 1990s the war in Sudan resulted in the displacement of some 80,000 refugees to camps to the east and west of the park, and well armed and organised Sudanese militias have frequently targeted the park for poaching of bushmeat, ivory and rhino horn. Since 2005 the Ugandan Lord's Resistance Army rebels frequently use DRC to avoid the Ugandan army and in January 2009 staged a raid on the park destroying vital equipment (valued at 1.6m$US) and killing ten people, including ICCN staff and family members.

As a result the park has seen significant declines in its wildlife populations. In 2006 elephant and buffalo numbers were estimated at 3,800 and 8,000 respectively, compared with 11,000 and 25,000 respectively in 1995 and 20,000 and 50,000 respectively in the late 70's. There are also serious concerns about the survival of the world's last population of northern white rhinos. In 2004, when approximately 10 individuals remained, a proposal was made for the translocation of a breeding group of five individuals to a safe haven but the idea was rejected at the last minute by the DRC government in the face of opposition from the local community. By 2006 there were only 4 known individuals, and none have been seen since. There have been no sightings since November 2007 and it is possible that the sub-species is now extinct.

Rolling grasslands, woodlands and riverine forests, together with a plentiful supply of water makes Garamba National Park an ideal habitat for large herbivores, including, elephant, buffalo and giraffe. There are signs that the elephant population has started to recover since the end of hostilities.

Photos © C. Aveling

Most of the wildlife is currently concentrated in the southern section of the park which is the only area where ICCN is still able to maintain a minimum level of surveillance. However as the security situation improves and ICCN, with the support of its conservation partners, gradually regains control of the north of the park, wildlife numbers are expected to recover. In March 2006 an aerial survey, covering 4,400 km² of the southern part of GNP and parts of the neighbouring hunting domains, was conducted by the IUCN African Rhino Specialist Group on behalf of the African Parks Foundation who have been managing the Garamba National Park under contract to ICCN since September 2005. While the survey only covered about one third of the Garamba ecosystem the results showed encouraging signs of recovery with respect to the elephant, buffalo and hippo populations. There was also a significant improvement in the ratio of old to new carcasses (many more old carcasses than new carcasses) indicating that poaching pressure has been reduced.

USING THE WORLD HERITAGE CONVENTION TO ENHANCE INTERNATIONAL SUPPORT AND STRENGTHEN PARTNERSHIPS

PROTECTING THE WORLD HERITAGE SITES IN DRC DURING PERIODS OF CONFLICT

UNESCO launched its intervention in favour of the five DRC World Heritage Sites at a time when most development aid agencies had suspended the majority of their activities in DRC because of the chaos and insecurity caused by the civil war. The World Heritage sites were in a desperate state, devoid of resources and cut off from their headquarters in Kinshasa. Four of the sites had fallen into rebel hands and the ICCN field staff found themselves having to deal with a disparate band of war lords whose least concern was the protection of these natural World Heritage sites. On the contrary occupation of the sites was seen as an opportunity to loot the parks' infrastructures and organise the massive exploitation of their mineral, wildlife and timber resources. In the general breakdown of law and order, illegal settlements, mining camps, fishing villages, farms, and cattle ranches mushroomed inside the parks and there was a real fear that the sites would be irremediably damaged if emergency action was not taken immediately.

In response to this situation UNESCO's project strategy was to address the immediate crisis on the ground by using the World Heritage Convention to raise awareness for protection of the sites and deliver urgently needed material and technical support on the ground, while at the same time pursuing more long term objectives (strengthening international partnerships, retraining of field staff, sustainable funding) in order to prepare ICCN for the post-war challenges.

In the confused and dangerous situation facing the five World Heritage Sites, UNESCO was in the unique position of being able to intervene, and most importantly be seen to intervene, in an entirely neutral capacity both at the international and local levels since all the countries involved directly or indirectly in the conflict (DRC, Sudan, Uganda, Rwanda) were signatories of the World Heritage Convention.

DIRECT FIELD SUPPORT TO ADDRESS URGENT THREATS TO THE INTEGRITY OF THE SITES

Support on the ground is delivered through a coalition of ICCN's conservation partners brought together by UNESCO. These were all organisations with many years of experience in DRC which had all opted to remain at ICCN's side in this moment of crisis. In the initial 5-year phase from 1999 to 2004 a major part of this support took the form of cash bonuses for the unpaid park guards in order to keep them motivated and active in the field. This was accompanied by the provision of essential equipment such as vehicles, radio communications, and uniforms, much of which had been lost in the looting. Services such as aerial surveillance in Garamba and Virunga were also provided. There is little doubt that this direct support in the form of bonuses and supplies was absolutely critical to ensuring that the sites survived the war. While it is evident that certain of the values for which the sites were nominated were degraded during this crisis, with the possible exception of the northern white rhino, all appear to have survived. It is unlikely that this would have been the case if

UNESCO had not intervened. The courage and fortitude of the ICCN field staff and their NGO conservation partners (who shouldered the considerable risks and costs of delivering cash and equipment to the sites) were also critical to the success of these early operations.

However, while the parks may have survived the wars between 1999 and 2004, the situation at the time of the signature of the 2004 peace accords was still highly precarious in all five sites and emergency actions were still required to deal with site specific issues that had not been targeted in the initial project design. Therefore in the second phase of the programme emergency action plans were developed to address urgent threats to the 5 sites. Implementation is currently on going and will be continued in the third phase.

BOX 5. EMERGENCY ACTION PLANS DEVELOPED FOR DRC'S FIVE WORLD HERITAGE SITES

	Threats to the sites	Emergency Actions supported by UNESCO
Garamba National Park	• Poaching of rhino, elephant and buffalo by local hunters and highly armed and well-organised horsemen from Sudan. • Isolation and derelict infrastructures • The presence of tens of thousands of Sudanese refugees in the immediate vicinity of the park • Gold and diamond mining in the hunting reserves adjoining the park	• Guard training specifically designed to strengthen the rangers' capacities to confront the paramilitary Sudanese poachers • Infrastructure rehabilitation • Development of a community conservation strategy. Community initiatives are funded within the framework of co-management agreements with traditional authorities. Key activities include support for social infrastructures (health centres, schools….)
Kahuzi-Biega National Park	• Presence of armed militia in lowland sector rendering much of the lowland sector a no-go area • Poaching of elephant and commercial hunting for the bushmeat trade • Mining for coltan, gold and tin • Illegal farming and cattle ranching in the narrow corridor (Nindja corridor) linking the highland and lowland sectors of the park	• Support to ICCN to strengthen surveillance activities and regain control over the lowland sector of the park. • Intensive high level awareness raising, communication and participatory boundary marking to resolve the illegal occupation issue in the Nindja biological corridor.
Okapi Wildlife Reserve	• Poaching of elephant and commercial hunting for the bushmeat trade • Mining for gold and diamonds • Immigration into the permanent village enclaves within the Reserve as a result of the rehabilitation of the RN4 highway.	• Collaboration with military and police authorities to deploy joint surveillance activities. By 2007 control over most of the reserve had been recovered, illegal mining camps had been closed down and military and police involved in poaching, particularly of elephants, had been removed from the area. • Establishment of a system to monitor and control immigration into the legally recognised village enclaves within the Reserve along the main RN4 highway. • Elaboration of an updated management plan. Immigration into the Reserve, and resource use within the Reserve by Bantou and Pygmy semi-nomad communities, are specifically addressed.
Salonga National Park	• Poaching of elephant and commercial hunting for the bushmeat trade	• Collaboration with military and police authorities to deploy joint surveillance activities to combat elephant poaching.
Virunga National Park	• Illegal occupation of the park, particularly along the western shore of lake Edward • Illegal charcoal making in the dry forests of the southern sector • Poaching of large mammals, particularly hippo, in the central and northern sectors of the park.	• Participatory park boundary marking followed by voluntary evacuation. By the end of 2008 some 70.000 people had voluntarily moved out of the park. (note that the UNESCO project is part of a coalition of agencies contributing to the voluntary evacuation initiatives). • Support for the development of alternatives to the use of charcoal.

STRENGTHENING CAPACITIES

Years of neglect, followed by the devastating effects of the civil war had eroded the institutional capacities of ICCN and left it in a dangerously weak position to face the post-war challenges. The project therefore focused on three key areas:

- Strengthening law enforcement and monitoring systems in order to improve the effectiveness of ICCN's surveillance activities
- Assessing the post-war conservation status of the sites, and establishing bio-monitoring and information management systems
- Modernising ICCN's approach to conservation by introducing new concepts of community conservation.

Strengthening law enforcement and monitoring systems

As from 2002 a major effort has been placed on guard training. The initial phase took place in Garamba NP, organised by the African Field Ranger Training Services based in South Africa. A group of the most promising elements were selected to become future trainers. Between 2005 and 2006 further extensive training was then organised in Virunga by FZS and LZS (with additional EC emergency funding) using Ishango as the operations base.

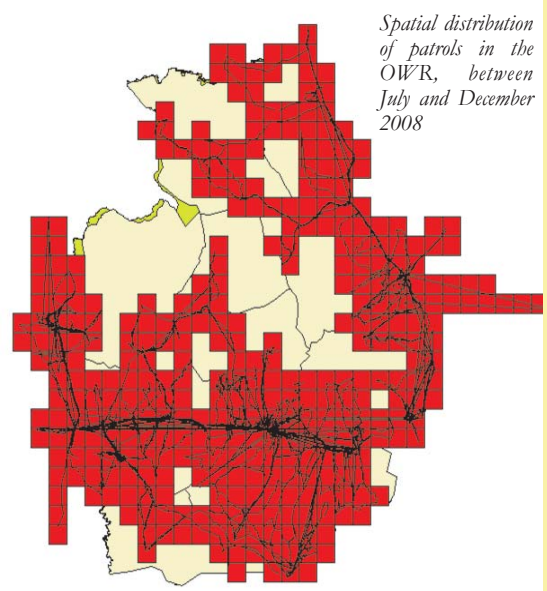
BOX 6. RANGER BASED MONITORING

Ranger-based monitoring is an essential tool for park managers to monitor what is going on in their parks. It enables them to adjust management strategies as a function of the information gathered by the rangers on patrol. Historically park rangers in the DRC have always been required to produce patrol reports but the information has usually been poorly exploited, because it was rarely recorded in a sufficiently systematic manner and because the park managers never had the time or resources to analyse the data adequately. All too often the result has been piles of unread paper reports gathering dust on the floor of an overstretched park warden's office!

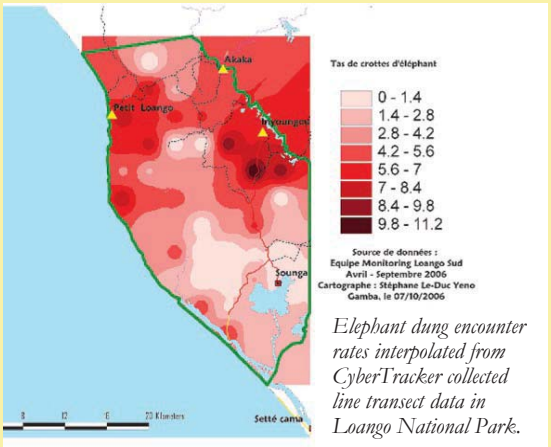
Modern computer and GPS technology, however, has changed all that. Detailed geo-referenced observations can now be simply recorded in the field and entered into GIS systems for rapid analysis. One such system, MIST (*Monitoring Information System*), is being successfully employed in the DRC's Virunga National Park and the Okapi Wildlife Reserve. Information generated is enabling park managers to obtain up to date (almost real time) information on threats to the park which enables a more efficient deployment of their ranger force. MIST enables surveillance effort (spatial distribution, man-days of patrol), and its effectiveness in controlling illegal activities and protecting target species, to be monitored continuously.

In the TRIDOM and Gamba-Mayumba-Conkouati landscapes data recording in the field has been taken a step further by using CyberTracker technology* to record detailed geo-reference observations directly onto a hand-held computer (PDA, or smart phone as they are commonly referred to) using the tactile screen. The data can then be downloaded directly into a GIS system without going through the time consuming, and error prone, process of manual data entry. CyberTracker also speeds up the data recording step as paper and pencil are not required in the field.

* *www.cybertracker.org*



Spatial distribution of patrols in the OWR, between July and December 2008



Elephant dung encounter rates interpolated from CyberTracker collected line transect data in Loango National Park.

Guards from all sites were trained. Training focused on leadership, wildlife law, law enforcement, conflict resolution, paramilitary skills and vehicle maintenance.

Law Enforcement Monitoring (LEM) is now a universally accepted management tool for protected areas, particularly in Africa where poaching is often a major threat to park integrity. LEM enables park managers to evaluate the efficiency and effectiveness of its surveillance activities by monitoring conservation "effort" (man-days of surveillance, spatial distribution) and relating this to levels of illegal activities in the park. The project elaborated a standardised LEM system for all the sites, trained the personnel and provided the GPS and computer equipment to enable all data collected to be geo-referenced and integrated into GIS data bases on site.

Establishment of bio-monitoring and information management systems

Status surveys: Having lost control of considerable areas of the sites during the wars it was essential to assess the status of the areas in order to understand the scale of the damage done and target post-conflict conservation measures. Bio-monitoring teams were trained and surveys conducted wherever the security situation permitted. The bio-monitoring activities were coordinated by the WCS Wildlife Inventory Unit in collaboration with the MIKE programme (*Monitoring of Illegal Killing of Elephants*), the International Rhino Fund and African Parks northern white rhino monitoring activities. In some cases, such as the lowland sector of Kahuzi-Biega the security situation prevented the completion of surveys. In others, such as Salonga and the Okapi Wildlife Reserve it was possible to cover the entire area, although not without considerable difficulties and delays for logistical and security reasons. Although the results show widespread impoverishment of wildlife populations (Box 7) the situation is not without hope. With the exception of the northern white rhino no species appear to have disappeared and the general situation indicates that recovery can be ensured if strong conservation measures can be maintained.

Information management: Management of data relating to protected areas is of fundamental importance. Not only does good data management provide protected managers with information essential for planning their management activities, but it also enables parks to communicate more effectively with local, national and international stakeholders. Surprisingly a significant gap was the existence of accurate maps of the sites. As a first step the project established accurate base maps of all the sites. This work was piloted by two Belgian Universities (Louvain Catholic University and Gent University with the support of the Belgian Federal Science Policy Office).

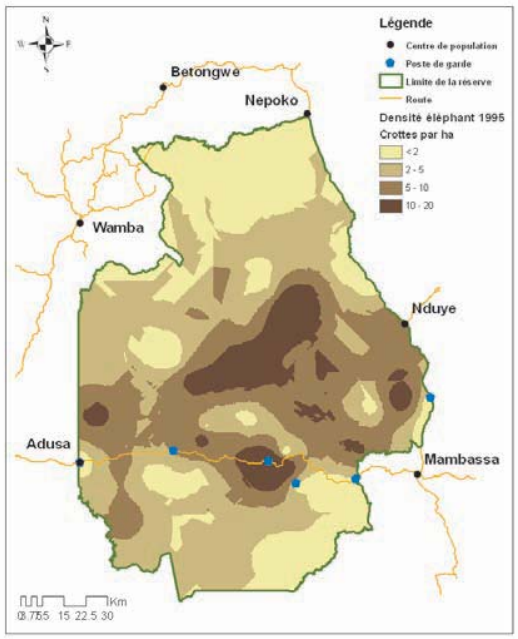
In parallel the project set about designing and implementing a protected areas information management system known as SYGIAP (*Système de Gestion de l'Information des Aires Protégées*). Equipment has been provided, operators trained and data, particularly site-based LEM data, has started to flow into the system from the sites (Box 6).

Everywhere else the Congo basin forest elephants have suffered intensive poaching for the international ivory trade. Civil and military authorities are often involved.

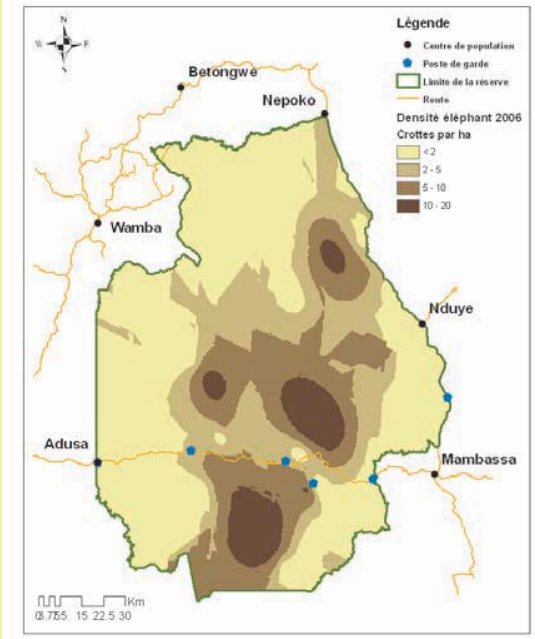
Photos © Reto Kuster

BOX 7. THE VALUE OF LONG TERM DATA FOR MONITORING POPULATION TRENDS.

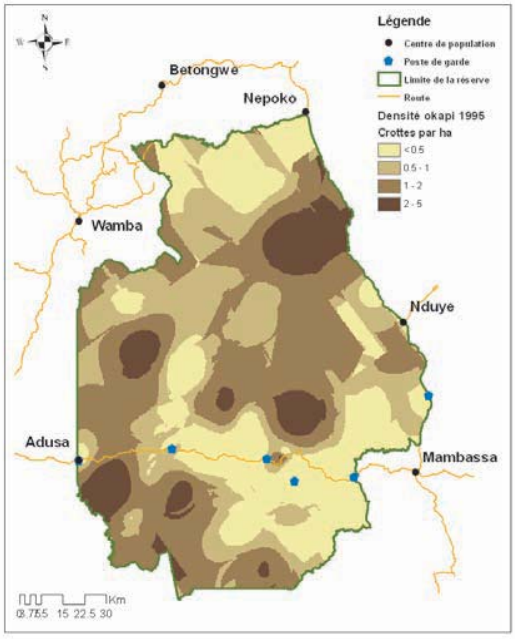
Using a standardised methodology ICCN and WCS bio-monitoring teams have been able to show the impact of the war on wildlife populations in the OWR. Significant declines have occurred not only in the populations of flagship species such as forest elephant and okapi (below), but also in most of the duiker species.



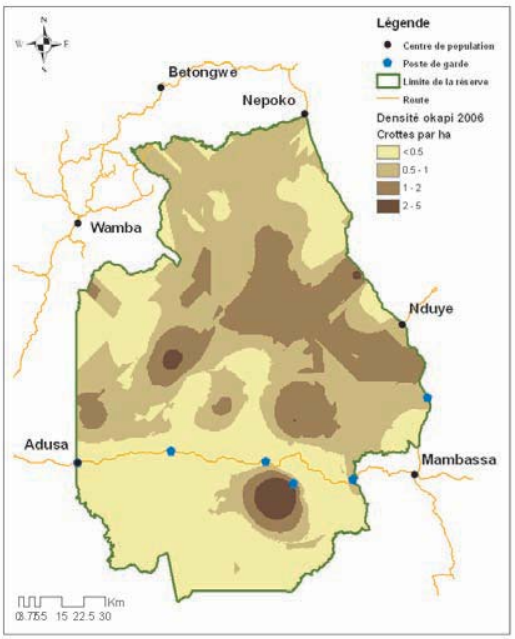
Elephant dung density 1995



Elephant dung density 2006



Okapi dung density 1995



Okapi dung density 2006

Maps: Rene Beyers

BOX 8 PARTICIPATORY BOUNDARY MARKING IN THE VIRUNGA NATIONAL PARK

The boundaries of the VNP were established well over 70 years ago when the demographic and political contexts were very different from those of today. Natural demographic growth, and the population movements caused by the recent conflicts in the Great Lake region, have meant that pressure for land has increased dramatically and made the land within the park particularly attractive. Furthermore over the years many of the original boundary markers have disappeared, descriptions of many of the landmarks used in the wording of the original legal texts are no longer recognisable today and "arrangements" have sometimes been made between ICCN and local populations in an attempt to dissipate conflicts arising from the huge pressure for land. As a result in many areas the park boundaries have been violated, often deliberately but sometimes inadvertently, by local populations. The recent period of conflict has sharply accelerated this process. As ICCN attempts to reassert its control over the park the confused situation over the park boundaries merely serves to heighten tensions and inflame conflicts since at least three versions of the park boundary are being employed: the "ICCN boundary" (which may or may not correspond to the true boundary), the "populations' boundary" (which corresponds to their understanding, erroneous or otherwise, of the park boundary) and the "legal" boundary (which is the true boundary as defined in the legal texts).

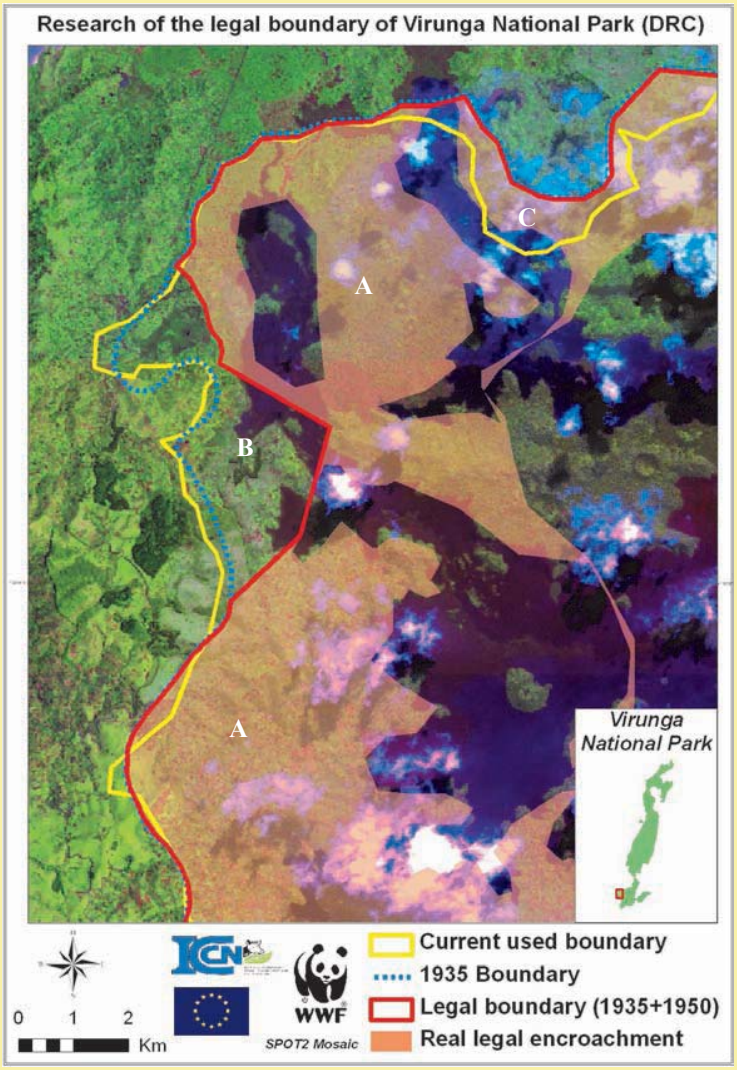
ICCN and WWF, with support from the UNESCO program, have developed an innovative method of tackling the problem by involving all the local stakeholders in a process of participatory boundary marking. Underlying principles are that:

- The VNP is a national and international heritage that only a Presidential decree can change.
- The boundaries are those originally published in 1935 and 1950
- Local communities should know the exact limits in order to plan their livelihood activities.
- Boundary markers, whether natural or artificial, must be accepted by all and officially registered (GPS points, placement of marker and written description of sites).
- Wherever possible, ICCN should help local communities who demonstrate willingness to respect the park boundaries to obtain access to alternative land outside the park.

The method involves working sector by sector with a mixed commission comprising representatives of the Governor's office, land title office, traditional authorities, WWF, ICCN. Land surveyors, agronomists and resource persons who have particular historical knowledge of the area may also participate. Disagreements are resolved by consensus and the decisions formally acted. Markers are then placed and registered and a certified report is signed jointly by ICCN and the traditional authorities.

This process provides the basis on which voluntary evacuation of illegal settlers can be negotiated. ICCN and its conservation partners help identify areas where they can be resettled and negotiate with host communities to receive them. Currently some 70,000 people have been voluntarily evacuated from the park. Communities living on the edge of the park who respect the boundaries receive support from ICCN. This can vary from tree nurseries to various social infrastructures (water sources, school, dispensary, etc).

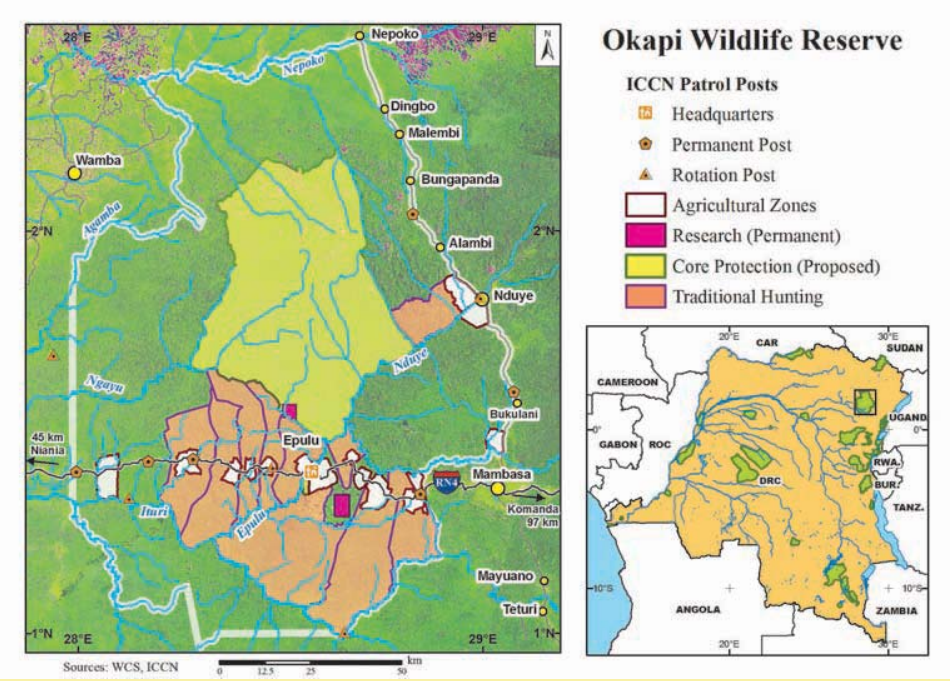
Source: WWF - PNVi.



The map illustrates the confusions that exist over the exact alignment of the park boundary in the Kirolirwe sector of the southern sector of Virunga NP. ICCN enforces the boundary marked in yellow, which follows more or less the original 1935 boundary (blue dots), rather than the true legal boundary which integrates the 1950 modifications (red). While much of the area is indeed illegally occupied (A - areas in pink) ICCN's erroneous interpretation of the boundary means that in some areas it is excluding people from areas that they do in fact have the right to occupy (B), while in others it is allowing people to occupy areas that are in fact inside the park (C). *Map: Bruno Hugel, WWF*

BOX 9. ZONING OF HUMAN ACTIVITIES AND MANAGEMENT OF IMMIGRATION IN THE OWR

The Okapi Wildlife Reserve has a number of permanent human settlements within its borders. These are essentially the villages situated along the main RN4 highway that existed prior to the creation of the Reserve and along the road forming the eastern border of the Reserve. Mbuti and Efe pygmies also live in the Reserve and are permitted to pursue their traditional hunting and gathering activities. Ensuring that human activities within the Reserve do not threaten the integrity of the site is therefore one of the key challenges facing ICCN.



The recent period of conflict, followed by the rehabilitation initiatives since the signature of the peace accords, has brought new challenges to the OWR. Migration away from the war-torn and overpopulated highlands to the east resulted in many new families settling in the villages along the RN4 highway. The problem was exacerbated by the rehabilitation of the RN4 which, after 20 years of being little more than a footpath, suddenly became a major highway with hundreds of vehicles, carrying would-be immigrants, crossing the Reserve each month. It also led to a sharp increase in the volumes of natural resources coming out of the Ituri forest (bushmeat, timber and other NTFP).

Since 2000 ICCN and its conservation partners WCS and GIC, through the UNESCO programme, have been developing strategies to manage the critical issues of immigration and unsustainable natural resource use by villagers in the OWR. Through a participatory process involving all the stakeholders, agricultural zones have been established around the villages and rules and regulations about the type and scale of activities within these zones are being formally agreed upon. In return the OWR helps residents develop more sustainable agricultural practices using a variety of agro-forestry techniques. In parallel a system to monitor and control immigration into the Reserve has been established in order to stabilise the number of people settling in the agricultural zones.

Integrating the special needs of the Mbuti and Efe Pygmies into the management strategy for the Reserve is a special challenge. Their semi-nomadic way of life as hunter-gatherers, and their particular relationship with their bantu neighbours (described by anthropologists as « political clientelism » - a voluntary relation between two parties with a degree of inequality regarding power and access to resources) makes this a particularly complex management issue.


Photo © Kim S. Gjerstad

While their traditional hunting and gathering activities within the reserve are guaranteed it is clear that limits need to be set since monitoring data clearly shows that current levels of traditional net hunting, together with snare hunting practised by bantu residents, much of it to supply the commercial bushmeat trade, is significantly reducing ungulate populations. The establishment of hunting zones, with clear rules and responsibilities accepted and adhered to by all parties, together with the creation of a totally protected core zone, will be the key to safeguarding the resource base on which their traditional lifestyles depend.

Introducing new concepts of community conservation

Historically ICCN was one of Africa's leaders in the field of protected area management. However the decades of turmoil and neglect has meant that ICCN has not kept up with modern trends in conservation which place greater emphasis on consultation rather than relying solely on coercion. Clearly in the particular Congolese context of widespread break down of law and order, law enforcement and dealing with the impact of uncontrolled military actions will remain for the foreseeable future an important component of park management. However in the long term parks will only survive if local communities understand that it is in their best interests to support them. One of the project's objectives was therefore to help ICCN to develop a national strategy for community conservation. This strategy was elaborated with the technical support of FFI, in collaboration with UNDP/GEF, with contributions from all the conservation partners, and is now the reference document for all protected areas in the DRC.

Based on the strategy, the programme also developed a training programme for protected area staff on community conservation. Training sessions are currently ongoing for key staff from all World Heritage sites and other DRC protected areas.

Community conservation activities must be tailored to suit the particular situations in the different sites. However one thing that is common to all community conservation activities is the existence of permanent dialogue between the parks authorities and local communities. Through this dialogue the problems and aspirations of all parties can be discussed and solutions negotiated on the basis of clearly defined rights and responsibilities. Pilot projects were developed in the first phase of the project, and more substantial activities were launched in the second phase (Boxes 8 & 9).

STRENGTHENING AND COORDINATING PARTNERSHIPS

Coordination between partners

Good coordination between the different implementing partners is essential for the success of the project interventions and here again UNESCO's role has been critical. Conservation NGOs and funding agencies do not always manage to work effectively together but in this case the scale of the crisis was such that UNESCO was able to provide the pillar around which the conservation partners could federate. Together they were able to achieve what would have been impossible to achieve alone. The basis for this coordinated approach is the Conservation Coalition for Congo (*CoCoCongo*), a concept that emerged from the "Core Group" comprising ICCN and its conservation partners that convened for the first time in Nairobi in 1998 (through the initiative of GTZ) to discuss emergency actions for the World Heritage Sites and which led to the development of the UNESCO project. The *CoCoCongo* is currently made up of ICCN, its conservation partners and the aid agencies that provide the funds. It is based in Kinshasa and ensures a concerted and coordinated approach at the national level. It is an important tool for communication with the international conservation community, and is also a point of reference for new conservation partners wishing to join the on-going efforts.

At each World Heritage site a Site Coordination Committee (*CoCoSi*) was also created to ensure that on-the-ground activities by the different field partners were properly coordinated and addressed ICCN priorities. This innovative structure has proved very successful and has enabled ICCN to reaffirm its leadership role in the sites – a role that had been eclipsed during the troubles with the different partners tending to work in isolation as they struggled to meet the ever-evolving challenges The CoCoSi has since been replicated throughout the DRC protected area network.

Conservation diplomacy, lobbying and communication

Effective delivery of support on the ground depended on all parties involved in the conflict understanding the overriding importance of these sites and the necessity of allowing the ICCN staff and their partners to carry out their conservation activities. In the early stages of the conflict so-called "diplomatic missions" were organised to meet the various protagonists and obtain agreement for the conservation activities to go ahead. These missions involved meeting high-level political representatives from all three countries involved in the war as well as local commanders of the different armed forces operating in the region and coordinating this with the UN peace-keeping force, MONUC, and the Congolese army. They were accompanied by information campaigns in the news media and within the conservation and development community in order to highlight the plight of the sites. Tripartite meetings between the protected area authorities of the areas controlled by the DRC Government and the areas under rebel control were also organised on neutral ground in Nairobi. Awareness raising through UNESCO-led missions enabled some of the excesses of the Congolese army in the parks to be curbed, and also provided the political backing for dealing with the issues of illegal settlements in the parks.

BOX 10. COMMITMENTS GIVEN BY THE DRC GOVERNMENT AT THE 2004 PARIS DONOR CONFERENCE

- Establish a Trust Fund for the rehabilitation of the World Heritage sites, to which the contribution by the Government will be established in the 2005 budget;
- Take active measures to evacuate armed troops and other populations that have invaded the sites and are contributing to their destruction;
- Contribute to the preservation and restoration of the integrity of the World Heritage sites;
- Ensure salary payments to site staff;
- Facilitate the work of ICCN;
- Ensure that the integrity of the sites is respected and take into account the interests of local people through participatory development and reconstruction projects;
- Ensure that local populations get a fair share of the financial benefits generated through ecotourism.

At the national and international level the World Heritage Committee has been an important mechanism for communicating with the wider conservation community and lobbying for increased commitments. In September 2004 the World Heritage Centre organised an international conference of donors and conservation partners at its headquarters in Paris. It was attended by over 240 participants and provided an ideal forum for the DRC to demonstrate to the international community its continued commitment to biodiversity conservation despite the desperate circumstances prevailing in the country (Box 10), and to lobby for further political and financial support for the World Heritage sites. Important donor commitments to ICCN in favour of World Heritage Sites were made by Belgium, Italy, Germany (GTZ and KfW), US (CARPE), EC, World Bank (GEF) and UNDP (GEF), and UNF.

UNESCO's World Heritage Committee was also a particularly useful mechanism for bringing pressure to bear to resolve a number of key issues threatening the sites, such as:

- Ensuring that the rehabilitation of the RN3 and RN4 highways, which cross KBNP and OWR respectively, were suspended until appropriate impact assessments had been made and mitigation measures agreed upon,
- Ensuring that recently attributed mining permits which overlapped with three of the World Heritage sites were redrawn and a mixed technical working group set up to monitor the situation.
- Obtaining written assurances from the government that the oil exploration permit attributed to Dominion Congo Limited, which encompasses the whole of the central and southern sectors of the PNV, will respect the special legal status of the park.
- Establishing better collaboration between ICCN and MONUC and FARDC to ensure that ICCN can continue its conservation activities. In certain cases MONUC now participates in joint surveillance activities and has facilitated meetings with some of the rebel groups in control of certain sites. FARDC and MONUC and are also members of a series of committees, known as *Comités de Sauvegarde* (rescue committees), for the different sites.

Sustainable funding

In the first phase of the programme, from 1999 to 2004, more than 60% of project funds were used to pay salary bonuses to park staff in order to enable them to continue the conservation field activities. However, while continuing to rely on donor support for guard payments in the short term it was essential to start moving towards a more long term solution for funding the running costs of the five World Heritage sites.

Working closely with sustainable funding specialists from WWF UNESCO developed a concept for a trust fund and lobbied donors to participate. The fund will be a private entity benefiting from the legal and fiscal guarantees that are necessary in order to attract new actors. Its capital will be invested in perpetuity on the international financial markets and the return on the investments will be used to support the financial needs of priority protected areas, including natural resource management in their peripheral zones. The fund will be managed by an independent and mixed Board of Directors representing the interests of all actors involved, with a majority from the private sector. Potential sources of funding include both national and international donors and could include contributions resulting from debt conversions and carbon markets. An internationally recognized investment manager will manage the assets on the basis of guidelines provided by the Board and specific social and environmental criteria would be guaranteed. The investment strategy should be based on diversification of the types of investments and markets.

The Belgian government has agreed to donate 1 million € to set up the fund and various other donors including France, Germany and the United Kingdom have also expressed an interest in contributing to the fund. The DRC government has established a Steering Committee which will be responsible for defining in detail the profile of the fund, producing its legal and management tools and mobilizing financial resources. The Steering Committee will be made up of representatives of the Government, the civil society, conservation NGOs, the donor community and the private sector.

Below: Direct field support to ICCN rangers in the form of field equipment, cash bonuses and training enabled DRC's World Heritage sites to survive the civil war. Sadly many ICCN staff and family members lost their lives during this difficult time.

Photos © Kim S. Gjerstad

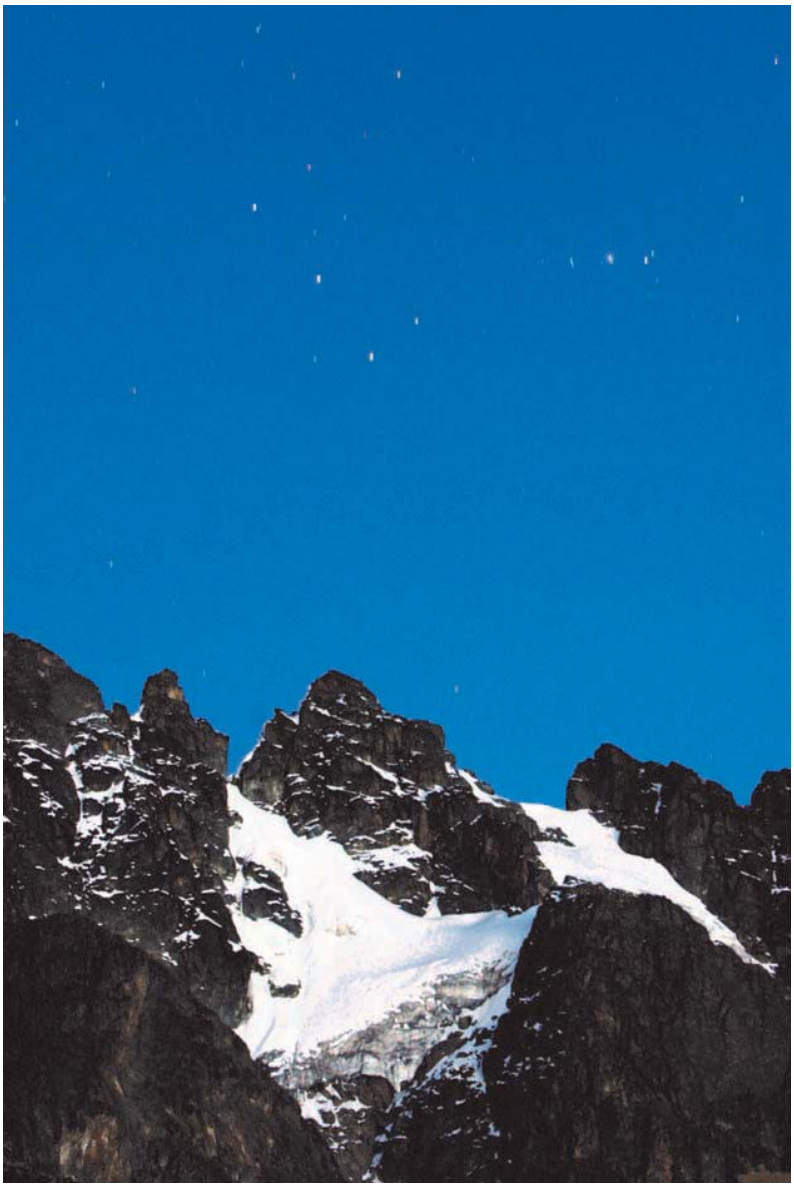
10 YEARS ON IN THE DRC….

It is widely recognized that without the support, at such a critical time, provided by the Biodiversity in Regions of Armed Conflict project, and without the remarkable commitment of ICCN's staff on the ground, as well as that of its conservation partners who remained on site throughout the crisis, there would be little left of the natural heritage that had justified the original inscription of these sites on the World Heritage list. The mounting tide of pressures that were threatening to overwhelm the sites in 2000 was stemmed, and control over the protected areas has slowly but surely been reasserted in the intervening eight years. There are many reasons for optimism. ICCN has regained control over the Okapi Wildlife Reserve, thousand of illegal settlers have voluntarily moved out of Virunga and poaching pressure in Garamba has declined significantly.

However the struggle is far from over and new crises continue to shake the region and test the resolve of ICCN and its conservation partners. In early 2009, renewed fighting erupted in eastern DRC as a result of efforts of the DRC Government to neutralize CNDP, FDLR and LRA rebels and this fighting has affected Kahuzi-Biega, Virunga and Garamba. In all sites varying levels of illegal natural resource exploitation still continues and illegal settlements remain a problem. However the breathing space afforded by the support of the international community during this period of crises has enabled ICCN to regroup and prepare to move from a crisis management mode to a more measured approach in which long term objectives are pursued in a more strategic manner with the coordinated support of the international community.

The project has demonstrated how the World Heritage Convention can be used to mobilize the international community for biodiversity conservation in a time of crisis and bring pressure to bear to resolve problems affecting sites of global biodiversity importance. The particular context in which this project operated demonstrated the added value that comes when conservation partners adopt a common vision and collaborate closely on the ground. Conservation partners collaborated to develop innovative linkages between biodiversity conservation and sustainable development and significant threats to biodiversity were addressed by developing replicable models at the site level.

The international attention generated by UNESCO's intervention has raised the profile of biodiversity conservation issues not only in DRC but also more widely in the central African region and has set the stage for broadening the scope of World Heritage in the Congo basin.



Snow and ice on the equator. The Ruwenzori mountains - one of the many exceptional features that justify the inclusion of the Virunga National Park on the World Heritage list. Africa's oldest National Park was able to survive the war thanks to support from UNESCO and a coalition of dedicated international conservation NGO's.

Photos © Kim S. Gjerstad

SETTING THE STAGE FOR NEW WORLD HERITAGE SITES IN CENTRAL AFRICA

THE CENTRAL AFRICAN WORLD HERITAGE FOREST INITIATIVE (CAWHFI)

Although the DRC contains the lion's share of central Africa's rainforests and World Heritage sites there are a number of other sites outside the DRC which are of exceptional importance and have the potential to become World Heritage sites. Building on the successes of the DRC project UNESCO's World Heritage Centre has been facilitating, since 2004, a series of interventions aimed at preparing the way for the inclusion of additional central African sites in the World Heritage list. This is being achieved through the Central African World Heritage Initiative, CAWHFI.

As with the DRC project, CAWHFI is a collaborative undertaking between UNESCO's World Heritage Centre, FAO, international NGOs (WWF, WCS, CI) and the national protected area authorities. The initiative is funded by the United Nations Foundation, the French Global Environment Facility (FFEM) and the European Commission. Matching funds are provided by the participating NGOs. The initiative involves a four-pronged approach of:

- Field support to improve management of selected clusters protected areas with recognized potential for becoming World Heritage properties
- Working with the private sector and other local stakeholders to promote and monitor the sustainable use of natural resources, particularly the bushmeat trade, in the multi-use landscapes within which the targeted clusters of protected areas are located.
- Using the World Heritage process to raise awareness of the exceptional natural value of the targeted sites and help governments to identify and prioritize other sites which, through inscription on the World Heritage List, would enable a better representation of the Outstanding Universal Values of the region's natural heritage to be achieved.
- Support for the development of sustainable conservation finance mechanisms.

CAWFHI's trans-boundary landscape approach is fully in line with COMIFAC and CBFP strategic priorities. It focuses on three outstanding landscapes :

i. Conkouati-Mayumba-Gamba (Republics of Gabon and Congo)
ii. Tri-national Sangha (TNS) (Republics of Cameroon and Congo, and Central African Republic)
iii. Tri-national Dja-Odzala-Minkebe (TRIDOM) (Republics of Gabon, Cameroon and Congo)

Each of these transborder landscapes contains a cluster of globally important protected areas, which together represent 25% of the total surface area of the landscapes.

GAMBA-MAYUMBA-CONKOUATI LANDSCAPE

The Gamba-Mayumba-Conkouati landscape at a glance*

Countries involved: Republics of Congo and Gabon
Coordinates: 1°36'26"S to 4°26'26"S; 9°15'48"E to 12°24'28"E
Surface area: 47.346 km², of which 36.926 km² terrestrial and 10.420 km² marine
Altitude: 0 – 840 m
Terrestrial Eco-regions: Atlantic Equatorial Forest; south-western Congolian Savanna-Forest Mosaic
Aquatic Eco-region: Southernmost western equatorial coastal eco-region
Protected Areas:
Loango National Park, 153,581 ha, 2002, Gabon
Moukalaba-Doudou National Park, 502,805 ha, 2002, Gabon
Mayumba National Park, 80,000 ha, 2002, Gabon
Conkouati-Douli National Park, 505,000 ha, 1980/1999, Republic of Congo
Ngové-Ndogo Hunting Area, 1956, Gabon (legal status unclear, under reclassification)
Iguela Hunting Area, 1962, Gabon (legal status unclear, under reclassification)
Moukalaba Hunting Area, 20,000 ha, 1962, Gabon (legal status unclear, under reclassification)
Sette Cama Hunting Area, 1962, Gabon (legal status unclear, under reclassification)
Ouanga Plain Wildlife Reserve, 1962, Gabon (legal status unclear, under reclassification)
Monts Doudou Wildlife Utilisation Area, 1988 (almost entirely reclassified as Moukalaba-Doudou National Park; legal status of remaining areas unclear)
UNESCO's site partners : WWF, WCS.

(*) sources: State of Forests Report 2006 & WWF Gabon

Situated along the Atlantic coast of Gabon and Congo the Gamba-Mayumba-Conkouati landscape covers 34.258 km², three quarters of which lies within Gabon. It is centered on the Loango, Moukalaba-Doudou and Mayumba National Parks in Gabon and the Conkouati-Douli National Park in Congo. The Mayumba and Conkouati-Douli National Parks have marine sections extending respectively 15 and 22 km from the shoreline and as they are contiguous they provide 120km of protected shoreline. The landscape also includes 1.500 km² of forestry concessions, 4.300 km² of oil and gas exploration and production permits, a cattle ranch of 1,000 km² in Gabon and 276 km² of eucalyptus plantations in Congo.

The landscape is particularly diverse because it falls within three of the WWF Global 200 Eco-regions: the Atlantic Equatorial Forest, the Western Congolian Savanna-Forest Mosaic, and the Guinean-Congolian Coastal Mangroves. This rich mix of ecosystems results in an exceptionally high biodiversity and places it among the highest regional and global conservation priorities. Overall some 11% of the plant species in the landscape are endemic to this bio-geographical zone. Plant species diversity on Mount Doudou is particularly high and lends support to the theory that Mount Doudou was one of the Pleistocene forest refuges. The landscape's floral diversity is matched by its faunal diversity, both terrestrial and aquatic. It harbors important large mammal populations such as the forest elephant, the western lowland gorilla, chimpanzee, mandrill, forest buffalo, probably the world's most important west African manatee population and hippo. The fact that several of these species can be observed along the shoreline makes this a particularly intriguing landscape. The spectacle is further enhanced by the presence of the Nile crocodile, four species of marine turtle and 17 species of Cetacean, including five whale species, in the off-shore waters of the landscape. Humpback whales, migrating from the Southern Ocean to breed in the warmer tropical waters, are particularly abundant between June and October. The 120 km of protected beach in the Mayumba and Conkouati-Douli National Parks is also the most important site in the world for the nesting of Leatherback turtles.

The natural resources of the landscape's forests and waters, especially fish and bushmeat, are crucial to the livelihoods of local human populations. The total human population is estimated at 26,000 people. Rural exodus has resulted in a rural population density of 0.7people/km² but the large towns within or close to the landscape exercise a strong pressure on its natural resources, particularly fish and bushmeat. The most important towns within the landscape are Gamba, which came into existence with the arrival of Shell Gabon in 1963, and Mayumba. Congo's second largest city, Pointe Noire, is located just south of Conkouati-Douli National Park. With a population of around 663,400 inhabitants (2005 census) the large urban markets of Pointe Noire have a particularly strong impact on the natural resources of Conkouati-Douli.

The main direct threats to the landscape's biodiversity are unsustainable commercial and local hunting and fishing practices, unsustainable logging practices and unsustainable agricultural practices, risks of oil pollution linked to on-shore and off-shore oil exploration and production activities, and environmental impacts of potential upcoming mining activities. Several companies have been granted oil and gas as well as mining exploration permits which overlap with all National Parks in the Landscape. Off-shore oil production is ongoing in both Mayumba and Conkouati-Douli National Parks.

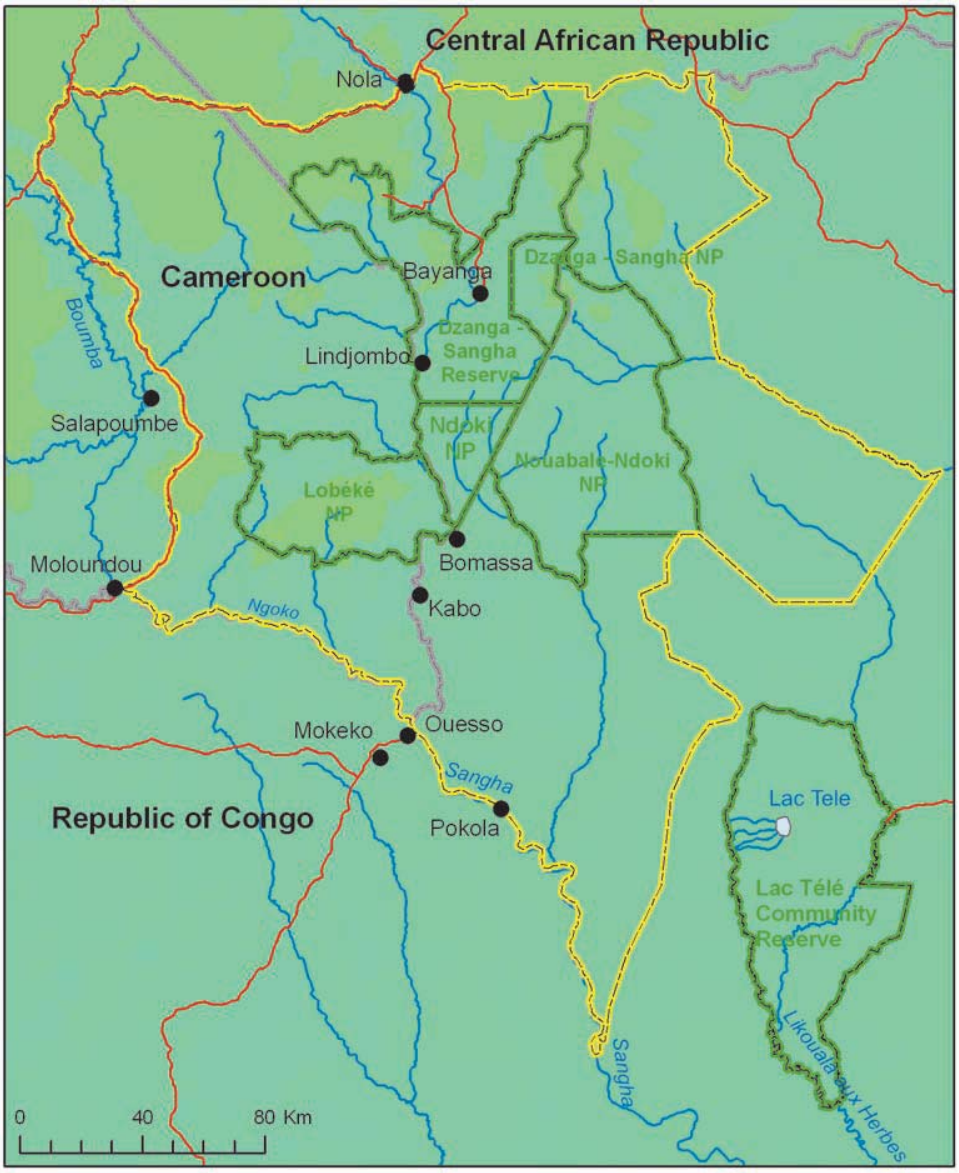
Above: A humpback whale breaching off the coast of Mayumba National Park, Gabon. It is estimated that 10% of the world's humpback whale population breeds in the Gulf of Guinea.

Photo © Tim Collins - Ocean Giants/WCS

Below: Forest elephants can often be seen in the lagoons and on the beaches of the Gamba complex of protected areas in Gabon.

Photo © A. Marin

TRINATIONAL SANGHA LANDSCAPE



The Tri-national Sangha Landscape at a glance*

Countries involved: Republics of Congo, Cameroon and Central Africa
Coordinates: 3°32'12"S to 0°40'29"S; 15°28'26"E to 1°34'08"E
Surface area: 36.236 km²
Altitude: 330 - 700 m
Terrestrial Eco-regions: North West Congolian Forests.
Aquatic Eco-regions: Sangha Eco-region
Protected Areas:
Nouabalé-Ndoki National Park, 419,000 ha, 1993, Republic of Congo
Lobéké National Park, 43,000 ha, 2001, Cameroon
Dzanga-Ndoki National Park, 125,100 ha, 1990, Central African Republic
Dzanga-Sangha Special Reserve, 310,100 ha, 1990, Central African Republic
UNESCO's site partners: WWF, WCS.
(*) source: State of Forests Report 2006

As its name suggests, this landscape covers three countries and is bisected from north to south by the Sangha River. It contains vast areas of intact forest, displaying a high degree of ecological integrity, and harbours a great number of Africa's large mammal populations, particularly forest elephants and gorillas. Opportunities for effective conservation over a vast area are particularly good because protected areas cover 21.5% of the landscape and formal agreements between the three countries for transborder cooperation exist since 2000. There is good potential for developing eco-tourism, in particular for forest elephant and lowland gorilla viewing, and this constitutes a significant opportunity for focusing international interest on the landscape. Consumptive tourism in the form of safari hunting also has considerable potential and is conducted in Cameroon and CAR.

On the Congolese side the landscape covers a total area of 21,470 km² and includes the Nouabalé-Ndoki National Park and five active logging concessions which act as a buffer zone to the park. The Central African section covers 4,644 km² made up essentially of the Dzanga-Ndoki National Park, divided into two sectors, Dzanga and Ndoki, and the Dzanga-Sangha Special Reserve which acts as a buffer zone between them. The two Forest Management Units in the Dzanga-Sangha Special Reserve are currently not being logged. The Cameroonian section is centred on the Lobéké National Park which is surrounded to its north, west and south by buffer zones comprising six community-managed hunting zones, seven Sport Hunting Zones and 14 Forest Management Units attributed to 5 logging concessionaires.

The famous mineral rich Bayanga bai in the CAR section of the Tri-National Sangha landscape attracts large numbers of forest elephant.

Photo © A. Billand, CIRAD

The floral communities of this landscape include semi-deciduous *terra firma* forest, monodominant *Gilbertiodendron* forest, Marantaceae forest, swamp forest and *Uapaca* dominated riparian forest. Several commercially valuable timber species found in this landscape figure in the IUCN Red Data list including African teak (afromosia), African mahogany sipo, sapelli and acajou. The cluster of National Parks therefore serves as a vital sanctuary of these important species.

The landscape includes some of Africa's largest assemblages of emblematic large mammal species such as the forest elephant, western lowland gorillas, bongo, and forest buffalo. This is partly due to the presence of more than 100 forest clearings (or *bais* in the local language) where these species congregate, attracted by the mineral salts and the particular vegetation types . In Cameroon some of the bais attract very high numbers of African grey parrots. There are therefore exceptional opportunities for eco-tourism. A remarkable population of "naïve" chimpanzees has also been discovered in the south of Nouabalé-Ndoki in the Goualogou Triangle. Because of the isolated nature of this area of forest, the chimpanzees display almost no fear of man and this has enabled scientists to make ground-breaking behavioural studies on tool use by these chimpanzees.

Threats to the landscape are commercial bushmeat hunting, elephant poaching for ivory, unsustainable industrial logging, and artisanal mining. The international pet trade for African grey parrots (below right) is also a threat.

Photos © Reto Kuster

The average population density in the landscape is 0.7 inhabitants/km², although the majority of the population is concentrated around the main towns and logging camps. In the CAR and Congo sections around 30% of the population is made up of various groups of semi-nomads (Baka, Bambendzélé, Bangombé). The influence of logging activities on human demographics in the forest zone are well-illustrated in this landscape where annual growth increases of over 10% (essentially through immigration) have been recorded in and around some logging camps. Immigrant populations tend to exert strong pressures on natural resources by overriding traditional systems of natural resource use. While logging related activities are the main occupation of human populations in the landscape, artisanal mining (mainly for diamonds), hunting, fishing and agriculture are also important.

WWF and WCS have been active in this zone for the better part of two decades and were instrumental, along with GTZ, in the creation of the TNS Foundation, the first trans-border conservation initiative of its kind in Africa. After nearly ten years of negotiations the Foundation is now up and running with an initial capital of 12 million € (Box 11).

BOX 11. SANGHA TRI NATIONAL FOUNDATION. AN EXAMPLE OF A CONSERVATION TRUST FUND FOR SUSTAINABLE FUNDING OF PROTECTED AREAS

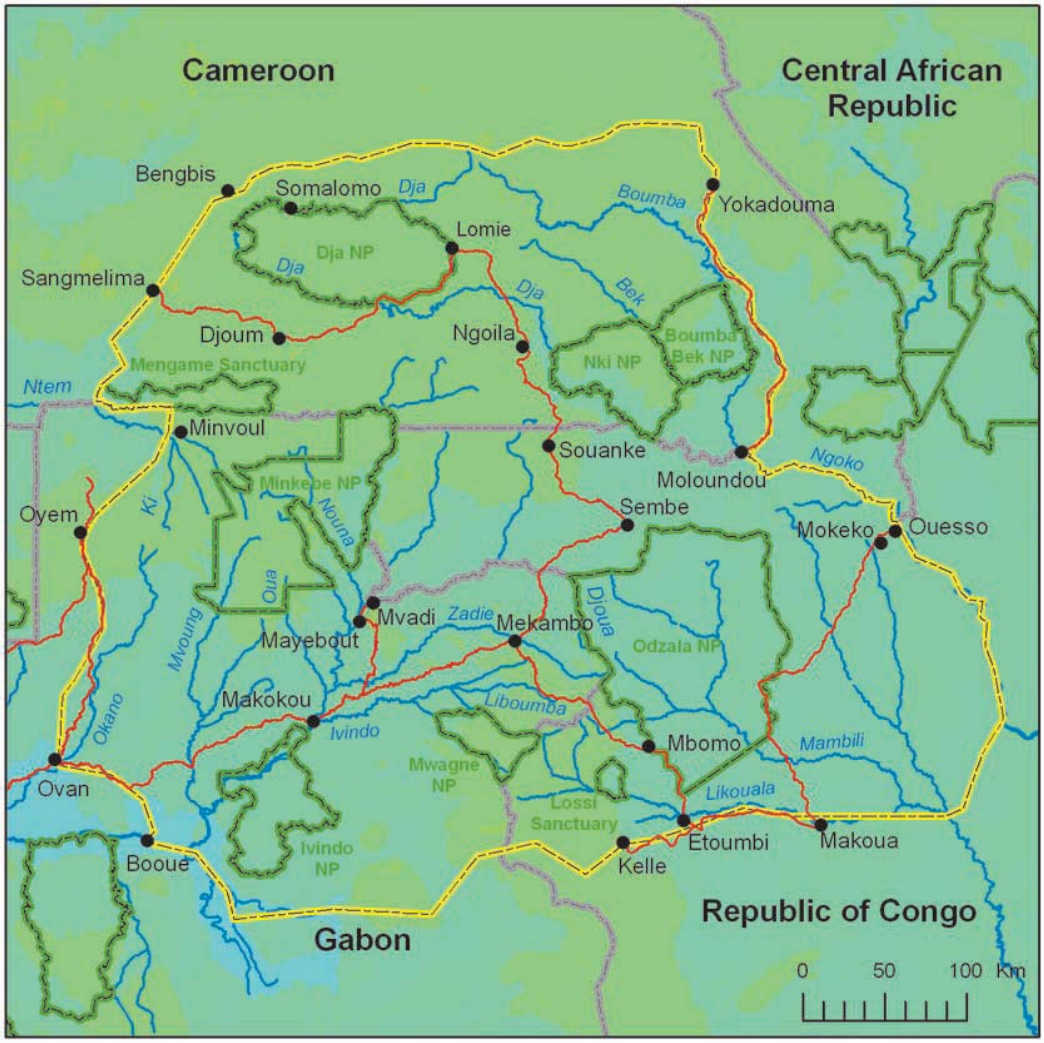
The TNS covers a total surface area of 28.000km² of lowland forest and includes the three contiguous National Parks of Lobeke in Cameroun, Dzanga-Ndoki in CAR and Nouabale-Ndoki in Congo and their buffer zones. The process for the development of the Sangha Tri-National Trust Fund ("Fondation pour le Tri-National de la Sangha") received support mainly from the World Bank/WWF Alliance for Forest Conservation and Sustainable Use, GTZ, Wildlife Conservation Society (WCS), the French Cooperation, AFD and the USAID-funded Central African Regional Program for the Environment (CARPE).

The Foundation was established in March 2007 as a Charity under British law, with executive headquarters in Central Africa. Formal agreements define the terms of the collaboration between the Foundation and each of the three countries. The Foundation is managed by a Board of Directors of 11 members consisting of representatives of the Governments of Cameroon, Congo and CAR, WCS, WWF, Regenwald Stiftung, KfW, AFD and civil society. Around 12 million Euros have already been mobilized so far by KfW, AFD, and Regenwalt Striftung through the "Krombacher Regenwald Kampagne". These funds will be invested in international markets and will produce a stable revenue stream to cover targeted activities for conservation and sustainable management of natural resources in the TNS. A recent EC grant to CAWHFI will enable the Foundation to disburse a series of small grants, totaling €400,000 over three years, to the parks and other eligible stakeholders

Sources; http://carpe.umd.edu/tns_foundation, EC, WWF.

Mbeli bai in Nouabalé-Ndoki National Park, an exceptional site for observing the large mammal fauna typical of the central African forests. Photo © M. Azink & J. Oonk

TRIDOM LANDSCAPE



The Trinational Dja-Odzala-Minkebe (TRIDOM) landscape at a glance*

Countries concerned: Republics of Gabon, Congo and Cameroon
Coordinates: 3°29'53"N to 0°26'28"N; 11°51'54"E to 15°57'21"E
Surface area: 186.500 km²
Altitude: 300 - 1000 m
Terrestrial Ecoregions: North-West Congolian Forests;
Aquatic Ecoregions: South-West Equatorial Coastal; Sangha
Protected Areas:
Odzala-Koukoua National Park, 1,350,000 ha, 1935/1999, Republic of Congo
Minkebe National Park, 756,700 ha, 1997/2000/2002, Gabon
Ivindo National Park, 300,000 ha, 1971/2002, Gabon
Mwanga National Park, 116,500 ha, 2002, Gabon
Boumba-Bek National Park, 238,255 ha, 2005, Cameroon
Nki National Park, 309,365 ha, 2005, Cameroon
Dja Wildlife Reserve, 526,000 ha, 1950, Cameroon (World Heritage Site)
Mengame Gorilla Sanctuary / Kom complex, 95,800 ha, Cameroon (final stages of classification)
Lossi Gorilla Sanctuary, 38 000 ha, 2001, Congo
UNESCO site partners: WWF, WCS, CI / CyberTracker Conservation
(*) source: State of Forests Report 2006 & WWF Gabon

The TRIDOM landscape lies astride Gabon, Cameroon and Congo Republic. It covers a surface area of 186,500 km², four times larger than either of the other two CAWHFI landscapes and includes nine protected areas totalling 37,360 km² (20% of the landscape). The landscape lies on a plateau ranging from 300 to 1,000 m above sea level. It is punctuated by several spectacular inselbergs (particularly in Minkebe National Park) and bisected by a 75 km long escarpment running from north to south along the Gabon – Congo frontier which separates the two main watersheds that this landscape feeds, the Ogooué and the Congo. A series of spectacular rapids and waterfalls occur on the Ivindo River, acting as a biogeographic barrier in the Ogooué watershed.

Lowland gorillas and forest buffalo (above) meet in the Lokué bai in Odzala-Koukoua National Park, Congo..

Photo © C. Aveling

The majority of the landscape is covered by *terra firma* forests including semi-deciduous forests rich in Meliaceae, Ulmaceae and Sterculiaceae, open canopy Marantaceae forests and mono-dominant *Gilbertiodendron* forests. Large areas of permanently and seasonally flooded forest and swamps also occur. The floristic composition shows a gradient from Atlantic influences in the west to Congo influences in the east. The inselbergs and lower rocky outcrops in Minkebe and Dja are covered with herbaceous prairies and woody thickets comprising many specialized species with limited distributions from the Euphorbia and Orchid families. Many hundreds of forest clearings punctuate the landscape, of which those in Odzala-Koukoua National Park are the most well known. As in the TNS landscape many of these *bais* are rich in mineral salts and attract large concentrations of mammals including forest elephants, lowland gorillas, bongo, forest buffalo and giant forest hog. Finally in the south eastern part of the landscape (Odzala-Koukua National Park) there is a zone of forest -savannah mosaic which represents the northernmost limit of the Batéké plateau.

Several typically savannah mammal species occur in the forest-savannah mosaic of Odzala-Koukoua National Park, including the spotted hyena and possibly a relict population of lions.

Photo © C. Aveling

This landscape contains central Africa's highest concentrations of forest elephants (an estimated 30,000 occur in the Minkebe forest alone) and forest buffalo. The fact that so much of the landscape is relatively inaccessible means that large mammal populations have remained relatively protected from the impacts of commercial bushmeat and ivory hunting. However in some areas recent outbreaks of the Ebola virus appear to have caused a dramatic decline in great ape populations. Minkebe National Park appears to have lost 98% of its great ape population since the early 90s and in Odzala-Koukoua National Parks, where the first known outbreaks of Ebola were recorded in 2002, the decline has also been very severe.

Human population densities vary between 1-2 inhabitants/km² throughout most of the landscape, but reach 3-4 inhabitants/km² in the south of the Cameroon section of the landscape. Vast areas of the Gabon and Congo sections are virtually uninhabited. The main activities are agriculture (slash and burn and some cocoa/coffee), industrial logging, hunting, and artisanal mining (mainly gold panning). In Cameroon timber exploitation has become an important part of the village economy since 40% of timber taxes are returned to the local communities. As a result community forests are developing rapidly in Cameroon.

As in the other landscapes commercial hunting for bushmeat and the ivory trade are major threats. Emerging diseases (notably Ebola) have also recently become a threat. The expansion of industrial logging in the landscape has been very rapid over the past 10 years, with over 50% of the landscape currently attributed. Much of the vast central area of the landscape (south of Ngoïla and west of Sounake) is still unattributed but pressure to log these areas is mounting. Finally large-scale industrial mining is scheduled to begin in the near future and this is certain to have a very significant impact on the landscape (Box 12).

Box 12. MINING IN THE TRIDOM LANDSCAPE

Artisanal mining for gold attracts many thousands of people into the heart of the TRIDOM landscape. In addition to the physical damage to the forest, this type of essentially unregulated activity is generally associated with large-scale poaching, cross-border smuggling and illegal immigration.

Large-scale industrial mining projects are planned in the TRIDOM heartland and inevitably pose a serious threat to the ecological integrity of the landscape. In Gabon a Chinese company (CMEC) has acquired the rights to develop the Belinga iron ore deposits and an Australian company (Sundance Resources Ltd) has acquired the rights to the Mbalam deposit in Cameroon as well as other deposits (Nabeba, Letioukbala) in the neighbouring Souanke District in Congo. Another company, Core Mining (Australia/France) has started exploration of iron ore deposits in the Avima mountains, also in Congo in the remote area to the west of Souanke. The Belinga and Mbalam deposits are estimated at 1 billion tons each, among the richest in the world. To exploit the Mbalam deposit a railway may be constructed to Kribi, on the Cameroon coast. To exploit Belinga an extension to the trans-gabonese railway is planned and the construction of a hydroelectric dam on the Ivindo river has been considered. This would severely impact the Ivindo National Park with its spectacular series of rapids and waterfalls at Koungou. Finally a major cobalt and nickel deposit near Lomié, on the edge of the Dja Wildlife Reserve World Heritage site in Cameroon has been attributed to an American company (GEOVIC).

A large gold mining camp close to the boundary of Minkebe National Park, Gabon.

Photo © Gustav Mabaza

All these industrial mining activities will have a profound impact on the landscape and might herald the end of TRIDOM as a continous forest with interconnected protected areas if adequate mitigation measures are not taken. They will attract thousands of immigrant workers into the landscape and this will inevitably result in increasing pressures on the natural resources particularly through forest clearance for agriculture and hunting for bushmeat and ivory. The construction of railways or special roads might have an even greater impact. The potential for biodiversity offsets linked to these mining projects is currently being investigated.

CAWHFI ACTIVITES IN THE THREE LANDSCAPES

CAWHFI activities are organized around three components:

1. Strengthening management of protected areas
2. Managing wildlife in the multi-use zones linking the protected areas
3. Identifying potential World Heritage sites and developing new nominations

Most CAWFHI field activities are implemented by WWF and WCS, both of whom have been active in the landscapes for over 20 years. Both organizations are currently implementing a wide range of conservation activities with funding from several private, bilateral and multilateral sources. Given the enormous conservation challenges facing the landscapes, and the critical shortage of financial resources available to tackle them, CAWHFI has opted for a pragmatic approach designed to achieve economies of scale by supporting field activities that complement or scale up those already being implemented by WWF and WCS. Overall, CAWHFI funding represents roughly 15 to 20% of the total funds mobilized by these organizations in the landscapes.

Strengthening management of the protected areas

Law enforcement and monitoring (LEM)

Strengthening of park management has involved scaling up the intensity and effectiveness of surveillance activities and supporting the additional costs incurred such as bonuses, field allowances, equipment, fuel, spare parts and the construction of patrol posts. Basic training of guards has been provided and LEM systems have been established to allow park managers to assess the level and impact of their surveillance activities. Training in bio-monitoring has also been provided.

In addition to the classic surveillance within the protected areas CAWHFI has also supported joint trans-border patrols, particularly in the TNS and TRIDOM landscapes. In the case of TNS the protected areas are contiguous and so cooperation between the protected area authorities is relatively straightforward. The situation is more complex in the centre of the TRIDOM landscape where the protected areas are not contiguous along the international boundaries and the remoteness of the area means that there is very little control over the movement and activities of people operating in the border area. The Mouloundou sector of the Dja River along the Cameroon-Congo border is a particular hot-spot for poaching and illegal trafficking of ivory and bushmeat and CAWHFI has pioneered trans-border surveillance patrols along the international border.

A key problem, common to all the landscapes, concerns the difficulty of ensuring that wildlife laws are properly applied and offenders appropriately prosecuted. While poor governance and corruption are certainly contributing factors, it is also clear that the judi-

Training has been a central element of UNESCO's support to the World Heritage sites. In Central Africa. Given the remoteness of many of these sites a well-developed ability to adapt to local conditions is essential.

Photo © Kim S. Gjerstad

Unsustainable fishing practices are threatening the marine resources in the Gamba-Mayumba-Conkouati landscape. Illegal inshore trawling (right) and the destructive practice of shark fin fishing (left) are closely monitored by the CAWHFI conservation partners.

Photo © Tim Collins - Ocean Giants/ WCS

ciary is often unaware of the importance of wildlife laws and consequently has little interest in applying them. CAWHFI funding has therefore been used to organize workshops and site visits for magistrates and other senior members of the local administration and this type of relatively simple intervention appears to produce positive results in terms of successful prosecutions.

In the case of the Gamba-Mayumba-Conkouati landscape, which encompasses large areas of marine habitat, special surveillance and monitoring techniques have been developed to address the specific conservation issues related to illegal industrial fishing activities within the national park boundaries and pollution from offshore oil exploitation (some of which also occurs with the park boundaries). Illegal industrial fishing is having a devastating impact on fish stocks and threatens the livelihoods of local fishing communities. Charismatic marine wildlife species, such as whales, dolphins, sharks (fished for their fins) and marine turtles also require special attention in view of their global importance and their position in the food chains. In Mayumba an observation tower equipped with radar to monitor illegal fishing activities has been installed and this is proving to be very effective in reducing illegal fishing activities in the park. In both Gabon and Congo, however, more effort is needed from the relevant government fisheries services to end these unsustainable practices.

The impact of oil exploitation on marine resources requires close monitoring and oil companies must be made accountable for the effects of oil pollution.

Photo © Tim Collins - Ocean Giants/WCS

Well-equipped teams of guards, supported by local NGOs such as *Aventure Sans Frontière*, *Gabon Environnement* and *Ibonga* also patrol the beaches during the marine turtle nesting season. Nest counting and turtle tagging (including with GPS receptors) confirm the global importance of these beaches, with up to 194 nest /km at the height of the nesting season.

CAWHFI also supports monitoring of the impacts of oil exploitation activities, particularly in Mayumba. However while detecting oil spills is relatively straightforward, responding to them and persuading the industry to accept the principle of accountability for this kind of pollution are proving to be more challenging. Since there is currently no national plan in Gabon for pollution response the project is working closely with the government Anti-Pollution Centre to provide input to a future national plan. As oil exploitation within Mayumba is a *fait*

accompli (because it existed prior to the creation of the park), and is likely to become so in Conkouati (where the permit was granted after the creation of the park), the project is actively exploring ways to turn a potentially negative situation into a positive one through working agreements with the companies involved.

Protected area management planning

Protected areas management planning is an important component of CAWHFI activities. This is particularly complex in Conkouati-Douli National Park where the issues of logging and oil exploration in the park must be resolved. An updated and more coherent zoning plan has been proposed for the park and its immediate periphery but this has yet to be approved. The CAWHFI intervention therefore comes at an opportune moment for the park as it lends impetus to an important series of ongoing conservation activities and brings additional international pressure to bear on the controversial issue of industrial extractive industries operating within a globally important, and legally fully-protected, conservation area.

***Eco-tourism*:**

The potential for eco-tourism development in the landscapes is enormous, although so are the challenges. CAWHFI is supporting these activities as they have considerable potential for giving added value to the sites and bringing tangible benefits to local stakeholders. Where local NGOs are directly involved with the implementation of the activities local support for the park is greatly enhanced. This kind of partnership is proving to be particularly promising in the Gamba complex where a local environmental NGO *Ibonga* is closely involved. The project has also provided support for development of great ape tourism in Nouabalé-Ndoki National Park through the rehabilitation of viewing platforms in the famous Mbeli bai and the implementation of a feasibility study for chimpanzee viewing. However many hurdles remain to be overcome before significant levels of tourism can occur in these sites. These constraints, which affect tourism throughout central Africa, are largely outside of the control of the park and concern issues such as high costs of international travel to the region, reliability of in-country transport, suitability of local accommodation and the willingness of local operators to invest in nature based tourism.

Whale watching is likely to become an important tourist attraction off the coasts of Gabon and Congo.

Photo © Tim Collins - Ocean Giants/WCS

Managing wildlife in the landscapes

Moving beyond the boundaries of protected areas

One of the unique aspects of protected areas in the Congo Basin, is that in most cases, they are still embedded in larger natural landscapes, even if natural resources in these landscapes are utilized, for example as logging concessions. These landscapes cover a much greater surface area than protected areas themselves in central Africa and it can be assumed that a very significant proportion of the wildlife can be found within them. Management of wildlife in these logging concessions can therefore make a very significant contribution to biodiversity conservation in the region. By preserving the ecosystem processes across the landscapes also ensures that biological linkages between protected areas are preserved. In addition, these landscapes are in many cases essential to sustain the key values of the protected area. For example home ranges of most elephants extend well beyond the boundaries of the

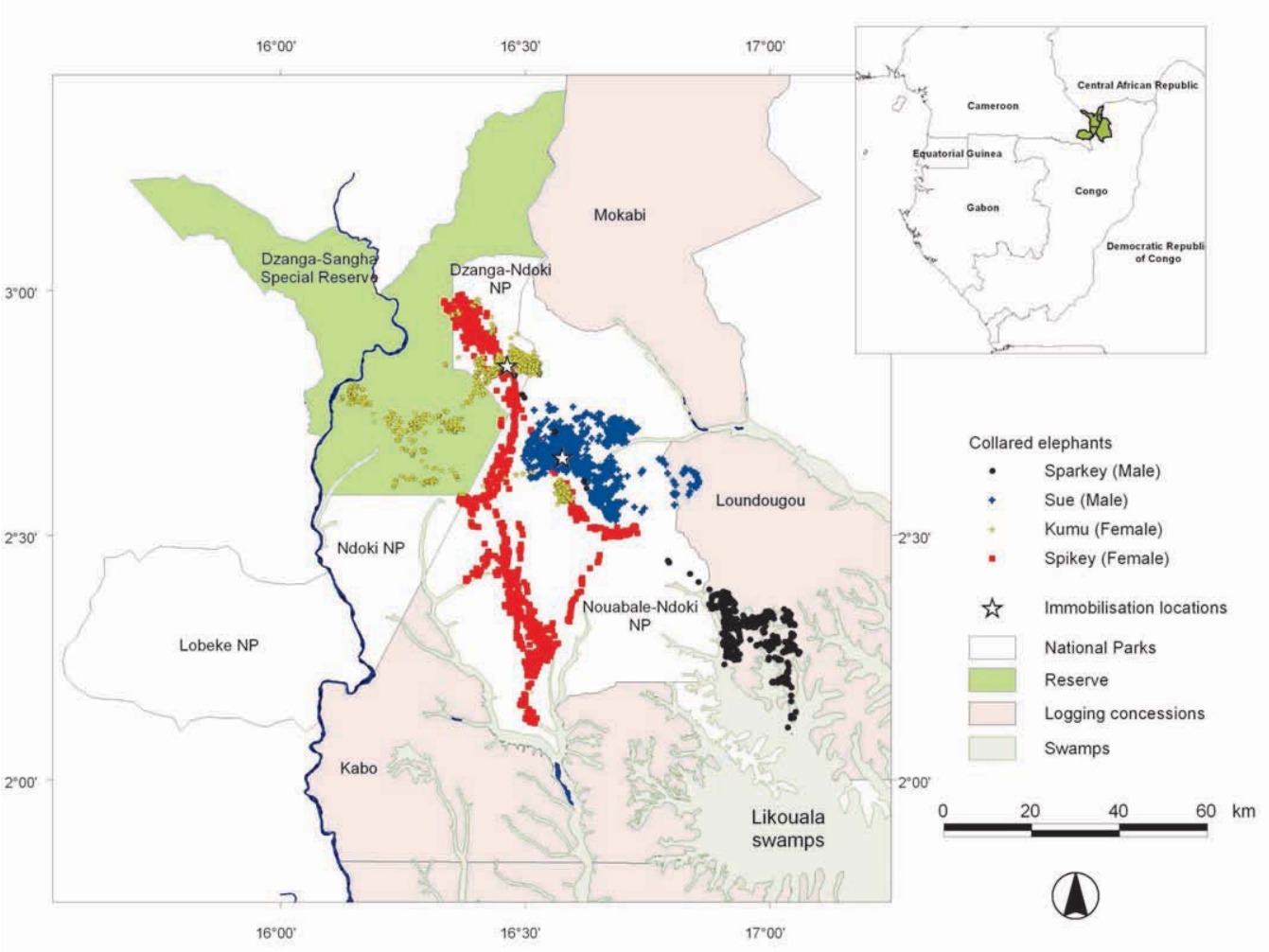
BOX 13. SOME COMMON PRINCIPLES FOR MANAGING WILDLIFE IN MULTIPLE-USE LANDSCAPES

Although the models for wildlife management will vary from site to site, a certain number of common underlying principles can be identified from the different pilot projects implemented in the CAWHFI landscapes:

- In logging concessions control of hunting is promoted by strictly enforcing national wildlife laws throughout the concession and ensuring that logging companies enforce internal rules and regulations, particularly with respect to the transport of bushmeat, hunters and hunting equipment in company vehicles.
- Access to wildlife resources is regulated through forest use planning and zoning. This generally involves the definition of hunting zones and the elaboration of simple management plans. These may be designated zones within the logging concession as part of the logging company's management plan as in the CIB and IFO concessions in northern Congo. In Gabon WWF has worked with the logging company CBG, local authorities and park managers to facilitate the official recognition of a traditional village zone (*terroir villageois*), an enclave within the Moukalaba-Doudou National Park, for the exclusive use of the indigenous inhabitants of Pény village. In Cameroon community hunting zones (*Zones d'Intérêt Cynégétique à Gestion Communautaire - ZICGC*) or sport hunting zones (*Zones d'Intérêt Cynégetique - ZIC*) can be located within logging concessions, communal forests or agro-forestry zones. In the forest concessions around Minkebe National Park WWF has pioneered a simple, pragmatic and participative approach based on the principle that if the use of vehicles for hunting is prevented (by controlling the roads entering the forest concessions), hunting will be limited to a 15 to 20 km band along public roads and rivers since this is the maximum distance that hunters will cover on foot in a day. A large part of the Minkebe forest block can thus stay outside of hunting territories. However the principle is only valid as long as hunters are targeting mainly fresh meat. Once they switch to smoked meat, as in Cameroon, hunters will be able to hunt at much greater distances from the roads using camps deep in the forest to smoke the meat.
- Local communities are empowered to take responsibility for wildlife management so that the "open access" system of wildlife use, which is so destructive to wildlife populations, can be eliminated. This will involve the creation of community-based natural resource management structures. In the TNS and TRIDOM landscapes special consideration is being given to semi-nomad pygmy communities whose particular lifestyles mean that they are often marginalised. Sensitization campaigns are essential and need to be sustained over long periods since there is so much resistance (through ignorance and/or economic hardship) to the need for limiting wildlife offtake in order to make hunting sustainable. Capacity-building and mentoring for the natural resource management structures are essential.
- Economic and protein alternatives to hunting bushmeat may also be promoted in order to reduce the hunting pressure. Various initiatives are being tested including importation by concessionaires of domestically reared meat for the workforce, support for livelihood activities such as family-scale animal husbandry and agro-forestry, local crafts enterprises and revenue-sharing systems for tourism revenue. Employment on protected area management activities is also an important economic incentive for local stakeholders, although this could never rival the levels of employment generated by a logging concession.
- Research and monitoring provide feed-back into the management process. A variety of research and monitoring methods are used to measure hunting pressure, bushmeat availability and consumption and the status of wildlife populations.

There are of course economic costs related to wildlife management in concessions but most of these can, and should, be borne by the concessionaire. Logging, unlike protected areas management, generates revenue and so the costs should be passed on to the customer, particularly in the case of certified timber.

Sources: WWF-Gabon, WWF-Cameroon WCS-Congo.



Home ranges of forest elephants usually extend well beyond the boundaries of the protected areas where they occur. A landscape approach is needed to ensure that their ecological requirements are covered. This map displays the movements of four elephants fitted with GPS collars in the TNS landscape and shows how their movements straddle international boundaries and include several habitat types and land use areas (swamps, logging concessions, protected areas).

Map © S. Blake

protected areas where they occur (map above).

Sustainable forest management plans are now a central legal requirement of the forestry laws of the three countries. This means, amongst other things, that social issues and questions relating to the conservation and management of wildlife and other NTFP within the logging concessions now have to be specifically addressed in the management planning process. This involves undertaking detailed socio-economic and wildlife surveys to establish baselines on natural resource use and wildlife populations, and setting aside conservation areas within the concession.

Furthermore since logging companies, particularly European ones, are increasingly moving towards certification of their timber for the European markets, wildlife conservation and management has become an important consideration. As most logging companies do not have expertise in this field they are increasingly open to collaboration with specialists to help them. Through the FFEM-funded component of the initiative WWF and WCS have been able to expand the scope of their collaboration with logging companies active in the three landscapes. CAWHFI is currently contributing to the implementation of on-going agreements with 11 logging companies whose concessions cover some 5,3 million ha of forest. Box 13 presents some common principles for managing wildlife in multiple-use landscapes where logging is a major activity.

Finding the right balance between sustainable wildlife use and the economic needs of local communities

Bushmeat is an important component of rural people's diet but all indicators from the Congo basin show that commercialisation of bushmeat, which is strongly influenced by the demand from urban markets, is leading to severe impoverishment of wildlife and local extinctions of many large and medium bodied mammal species. Fish and other aquatic resources are also very important in local diets but here again excessive off take for the commercial trade (both local and international) is leading to diminishing stocks. The tragedy is that it is the local communities who have most need of these resources and who are the most adversely affected (both in terms of diet and economic spin-offs) by the loss of these resources. CAWHFI is therefore supporting initiatives aimed at achieving more sustainable wildlife use so that local livelihoods can be safeguarded. A range of initiatives are being tested from improved natural resource exploitation techniques such as sustainable hunting and fishing techniques (Box 15 opposite) and eco-tourism, to alternative economic activities such as small scale animal husbandry, agricultural, agro-forestry schemes and handicrafts.

However living with wildlife also has its down side. Crop raiding, particularly by elephants, can occasionally cause considerable hardships to villagers. The problem is often particularly acute in the periphery of protected areas, where conservation measures have allowed elephant populations to thrive, and is a constant source of antagonism between the villagers and the protected area authorities. If the issue is not seen to be addressed this can create enormous bad feeling and can seriously undermine efforts to develop collaborative partnerships with local communities. CAWHFI supports efforts to address this problem (Box 14).

BOX 14. FINDING SOLUTIONS TO CROP RAIDING BY FOREST ELEPHANTS

In Nouabalé-Ndoki National Park an innovative approach is being developed by WCS using a variety of chilli pepper plant from southern Africa. Dried bricks made of elephant dung and chilli peppers, when burnt, produce a smoke that appears to be a deterrent to elephants. Ground chilli pepper mixed with grease can also be smeared on cable fences (provided by logging companies) set up around fields. Furthermore, since there appears to be a market for this variety of chilli peppers, families participating in the pilot project may be able to use it as an additional cash crop.

In the Gamba complex of protected areas WWF is attempting to address the issue with the help of one of the oil sector service companies which provides discarded metallic flow lines (used to clean oil pipes) for use as anti-elephant fences. In Conkouati-Douli community-managed solar powered electric fences to protect fields are being tested.

While no miracle solutions have ever been found for this thorny problem experience, elsewhere in Africa has shown that the active participation of the farmers themselves in protection strategies is essential.

Forest elephants are often attracted into village plantations in the Gamba protected area complex (above). Discarded metal cables used by the oil industry make good anti-elephant fences (below). Metal drinks cans attached to the cable enhance the deterrent affect by jangling when the cable moves.

Photo © R. Beville (above); WWF-Gabon (below)

Sources: WCS & WWF

BOX 15. PROMOTING SUSTAINABLE OYSTER HARVESTING IN MAYUMBA

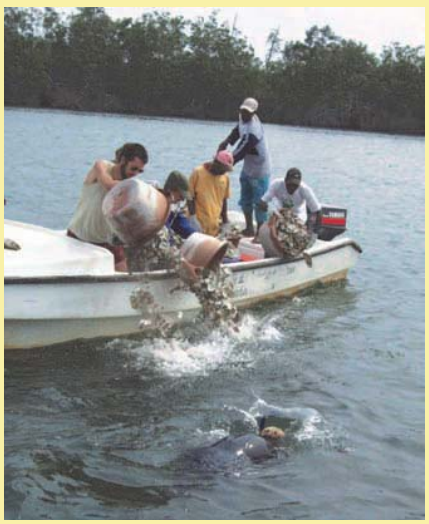
No residents of Mayumba can remember a time when diving for oysters was not part of the town's culture. The Mayumba oyster grows on the aerial roots of mangrove trees, and more commonly on the sandy or muddy bed of the Banio Lagoon. Oyster beds are known to promote high productivity within estuarine ecosystems. The shells slow down water currents and provide habitat for crabs, other shellfish, benthic fish species, and invertebrates. These in turn help to feed other animal communities. While feeding, oysters filter enormous quantities of water each day and are thus extremely important in maintaining water quality.

Oyster harvesting (photo top right) has declined sharply over the past two years and a survey by WCS in 2008 found very few live oysters in the lagoon, and these were largely restricted to one small area. Traditional oyster beds were found to be devoid of adult oysters, and the situation was judged to be critical.

The reason for this decline is primarily the lack of any control on the number of oyster divers, the length of the oyster season, and the number of oysters lifted by any one operator. Compounding this is the devastating effect of removing oyster shells from the lagoon. Traditionally, oysters were opened by hand while still in the canoe. Shells were then thrown back overboard. More recently, however, practices have changed and oysters have been taken ashore and opened using hot water and steam. The empty shells are then abandoned in large heaps on the lagoon shore (photo middle right). Steaming opens the shells kills all juvenile and non-exploitable oysters on the block. In some cases, there may be as many as 15 young oysters growing on the shell of a single adult. The level of wastage is therefore extreme. In addition to killing all the oysters that would otherwise form the basis for the following year's adult generation, the removal of hundreds of tons of oyster shells from the lagoon removes the very substrate upon which larval oysters depend for attachment. These two effects have combined to bring about the collapse of the oyster population, and the end of commercial oyster harvesting in Mayumba. Furthermore the overall effect on lagoon water quality and productivity of losing the oyster beds is likely to be massive.

A number of management interventions are therefore being implemented in order to a) rehabilitate the oyster beds and b) establish a sustainable system of commercial harvesting of oysters. These interventions include:

- an immediate ban on oyster harvesting
- instigation of a monitoring program to measure recovery and provide guidance to local authorities and resource users as to an appropriate time to recommence harvesting
- the creation of an oyster - divers and -sellers association
- controls on harvesting effort and timing of the harvesting season to enable sustainable use, and continued capability of the oyster population to replenish
- development of a zoning system for no-take zones to ensure a permanent breeding stock of oysters
- mandatory return of oyster shells to the lagoon immediately after harvesting
- rejuvenation of oyster habitat using old harvested oyster shells from the lagoon edge (photo bottom right)



Much of the success of this project is due to the Mayumba Oyster-Divers Association, which has provided an effective and locally accepted mechanism for regulating oyster harvesting (numbers of divers and length of the harvesting season are limited, only members of the association are permitted to dive).

These efforts to regenerate the oyster habitat and control harvesting have enabled a serious crisis to be avoided. Results from the monitoring program are showing encouraging indications of the beginnings of recovery, with an increase seen in 2009 in the abundance of juvenile oysters.

Source WCS-Mayumba

Photos © R. Parnell

Awareness building with local communities

A precondition for the success of all activities aimed at promoting sustainable use of natural resources in local communities is good communication and awareness building, and CAWHFI therefore provides support for these activities. The best results are obtained in situations where the project can involve dynamic and competent local organizations. In central Africa such organizations are still rather rare so capacity building has to be an integral part of the project's support. In the Gamba complex CAWHFI works with a local NGO, Ibonga –ACPE *(Association pour la Connsiassance et Protection de l'Environnement)* which is involved in a wide rage of awareness building activities and these are among the most successful activities that CAWHFI supports (Box 16).

BOX 16. SUPPORTING GRASS ROOTS ENVIRONMENTAL ORGANIZATIONS. IBONGA-ACPE, A LOCAL NGO PROMOTING UNDERSTANDING AND PROTECTION OF THE ENVIRONMENT.

Created in 1999, Ibonga - which means turtle in the local balumbu language - is a local non-profit organization based in the Gamba complex of protected areas and dedicated to the understanding and protection of the environment. This is achieved through a variety of activities that CAWHFI supports:

- **Formal environmental education and training** for the schools in the town of Gamba, targeting both the school children and the teachers. A comprehensive environmental curriculum has been developed in collaboration with the local education authorities. Regular field trips to Loango South National Park are also organized.

- **Public awareness building and communication** within the communities of the Gamba complex of protected areas. A particularly effective communication tool has been the Conservation Roadshow - a mobile road show involving song and dance, plays, puppet shows, films, books and posters (photo right). The Ministry of Water and Forests are closely involved with the public awareness activities and this is important since there is understandable antagonism to the vital anti-poaching activities that they undertake and little understanding on the part of local communities of the reasons for enforcing wildlife laws.

- **Visitors centre.** In collaboration with the park authorities Ibonga manages the South Loango National Park Visitors Centre. The centre serves as the official park entrance, information point and museum. Ibonga also sells local books, postcards and handicrafts to tourists.

- **Promotion of local handicrafts**. Ibonga helps develop and promote local handicrafts and runs a shop at Gamba airport where the products are sold.

- **Marine turtle monitoring and protection**. Ibonga is a member of the Gabon Marine Turtle Partnership dedicated to monitoring and protecting the globally important marine turtle nesting sites along Gabon's 800 km of coastline. Ibonga runs a research and monitoring programme (photo right) on the beaches of the Gamba complex of protected areas and also offers guided tours and educational visits.

Source: www.ibonga.org *Photos ©WWF-Gamba*

Identifying potential World Heritage sites and developing new nominations

In parallel with the site-based activities, which are aimed at helping sites raise their standards to meet World Heritage criteria, CAWHFI also aims to enlarge the scope of World Heritage in central Africa by helping ites that have the potential to meet the criteria to prepare their dossiers for submission to the World Heritage Committee, and assisting the countries to draw up Tentative Lists of other sites for possible submission.

In the case of Lopé National Park in Gabon the site was inscribed on the list in 2007. In view of the exceptional archeological richness of the site, showing evidence of human activities as far back as 400,000 years, the site was inscribed as a mixed cultural and natural World Heritage site. The TNS dossier for the cluster of trans-border protected areas is currently under preparation with the support of the CAWHFI component funded by the European Commission.

A two day workshop in Brazzaville in March 2008, organized by CAWHFI, established an exhaustive list of central African forest sites displaying significant natural heritage values and assessed them according to the World Heritage criteria. Their ecological representativity was also cross-checked with respect to the WWF 200 Ecoregions classification, of which 17 occur in central Africa. Six sites are considered of particularly high value, either because of their intrinsic richness or because they bring unique and/or new characteristics to the existing list of World Heritage properties. These priority sites are:

- The volcanic islands of São Tomé, Príncipe and Annobón (São Tomé & Príncipe[5] and Equatorial Guinea[6])
- The trans border protected area complex of Korup and Cross River National Parks (Cameroon and Nigeria)
- The Mount Cristal National Park (Gabon)
- The Itombwe mountain massif and Nyungwe National Park (DRC and Rwanda respectively)
- The Batéké Plateaux National Park (predominantly savannas, with some forest) (Gabon & Congo)

In addition three other sites were identified as potentially important but requiring further investigation before deciding if they can be added to the list of priority sites. These are:

- Mbam and Djerem NP (Cameroon),
- the Montane forests of western Cameroon (Cameroon)
- the Montane forests Mount Cameroun and Bioko (Cameroon & Equatorial Guinea).

The workshop also examined the existing Tentative Lists prepared by Cameroon, Gabon CAR and Congo, in order to provide an objective analysis of the value of these sites with respect to World Heritage criteria. A publication was edited to disseminate the results of this work to decision makers and other interested parties in the region. The publication can be downloaded at http://whc.unesco.org/fr/cawhfi.

[5] São Tomé & Príncipe has not yet drawn up a Tentative List

[6] Equatorial Guinea is not yet a signatory to the World Heritage Convention. This is a major concern since Equatorial Guinea contains several areas of outstanding natural value, particularly on its two islands, Bioko and Annobón.

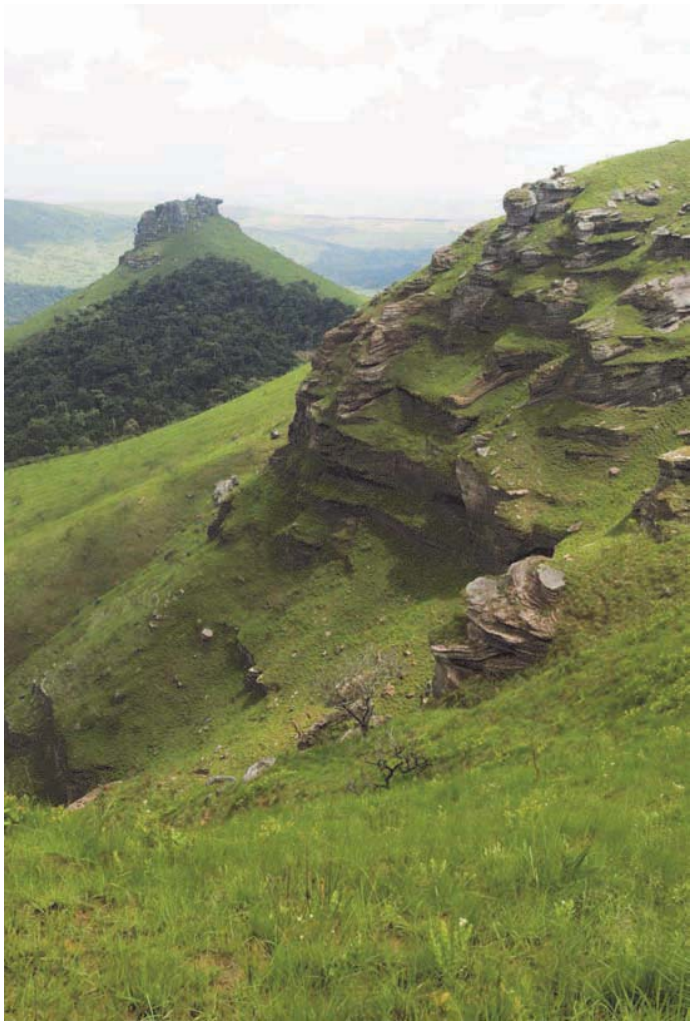
Cão Grande, a spectacular volcanic plug towering above the forest canopy in the south of the Ôbo National Park, São Tomé, where annual rainfall often exceeds 7 meters.

Photo © C. Aveling

INTEGRATION OF WORLD HERITAGE ACTIVITIES INTO NATIONAL AND REGIONAL CONSERVATION POLICIES

The Yaoundé Declaration, signed by the central African Heads of State at the Yaoundé Summit in 1999, recognizes the protection of the Congo Basin's ecosystems as an integral component of the development process and reaffirms the signatories' commitments to work cooperatively to promote the sustainable use of the central African forests in accordance with their social, economic, and environmental agendas. This Declaration led to the creation of the Central African Forest Commission (COMIFAC) which is the primary authority for decision-making and coordination of sub-regional initiatives for conservation and sustainable management of the central African forests. It also set the scene for the creation of Congo Basin Forest Partnership. It was formalised by the signature of a treaty in 2005 giving it the legal framework to implement its 10 point strategic plan, known as the *Plan de Convergence* .

One of the most important considerations for UNESCO was that its actions should be fully in line with regional and national conservation priorities and that its initiatives should be firmly integrated in national, regional and international development partnerships. The Table below summarises the COMIFAC's Strategic Plan and associated activities and shows clearly that World Heritage activities are fully in line with at least nine of the Strategic Plan's ten points. Furthermore a close working relationship is maintained with the regional association, Central African Protected Areas Network (better known by its french acronym RAPAC), COMIFAC's officially recognised technical partner for matters relating to protected areas.



Mount Kalami in the Batéké Plateaux National Park in Gabon, a potential World Heritage site. It could also become a trans boundary protected area, one of the COMIFAC priorities, if Congo creates a Batéké Plateaux protected area.

Photo © J-P Vander Weghe

By implementing its activities through long standing conservation actors within the sub-region the World Heritage Centre reinforces the complementarity of its activities and its integration into regional and international development partnerships. Working in seven different protected areas over eight landscapes, integration of all activities with existing initiatives is essential since no single initiative is able to mobilise enough resources on its own to address the many conservation problems in these vast landscapes. By combining forces with locally active partners considerable economies of scale can be achieved in the use of CAWHFI resources while maintaining the specificity of its intervention which is its focus on World Heritage.

In the case of the DRC programme, the World Heritage Centre has been instrumental in the development of a new partnership between the different conservation NGOs and ICCN to improve conservation the 5 World Heritage sites. This model has now been extended by ICCN to include all protected areas and conservation partners.

The coordination unit, working out of the RAPAC offices in Libreville, ensures visibility for its activities and takes and active role in national and regional fora. Of particular inter-

	Components of COMIFAC Strategic Plan	COMIFAC Activities (activities supported by CAWHFI are marked in bold)
1	Harmonization of forestry and fiscal policies	**Adherence to International Conventions**; render forest policies coherent between countries and with other sector policies; Fiscal harmonization
2	Knowledge of the resource	**Inventories of forest resources**; Establishment / strengthening of national and regional observatories and **data bases**
3	Management of the ecosystem and reforestation	**Land use planning of forested areas**; **Management planning of concessions and protected areas**; **Reforestation / regeneration**; Combating desertification
4	Biodiversity conservation	**Strengthening protected area networks ; Collaborative management of trans-border areas;** Identification, development and protection of phyto-genetic resources
5	Sustainable development of forest resources	**Economic development of timber, NTFP, wildlife, tourism; Monitoring of management and use of resources; Forest certification** and traceability; **Law enforcement against illegal exploitation of forest resources including poaching**
6	Development of alternative activities and poverty reduction	**Alternatives to poaching; Revenue generating micro-projects**
7	Capacity building, stakeholder participation, information, training	**Participation of actors / forums; Implication of local populations and indigenous groups; Communication, information, sensitization, education; Training**
8	Research – Development	Develop research programs in line with forest policies; create partnerships with research institutions; **Use traditional knowledge for natural resource management; Define techniques for using / regenerating NTFPs; Set up structures for monitoring wildlife diseases**
9	Develop sustainable funding mechanisms	**Trust Funds; Forestry Funds,** common Regional funds; **Private sector funding; Carbon credits**; Forest conversion taxes.
10	Regional cooperation and partnerships	Develop collaboration mechanisms & codes of conduct.

est is the impetus that the CAWHFI regional coordination is able to give to the work of the different national World Heritage committees as they prepare their lists of potential World Heritage sites for submission to the World Heritage Centre.

Finally it is worth also underlining that by focusing on trans-border collaboration between clusters of protected areas, CAWHFI effectively promotes regional integration, which is an important factor for economic and social stability within the region.

The Sangha river which bisects the Sangha Tri-national landscape. This transboundary cluster of three protected areas is soon to be nominated as a new world heritage site.
Photo © C. Aveling

PERSPECTIVES

Since the signing of the Yaoundé declaration, important progress has been made in terms of sustainable forestry and biodiversity conservation in the Congo Basin. Both are now firmly on the national and regional political agendas. Protected areas are the cornerstone of efforts to conserve the exceptional biodiversity of the region and over the past two decades the protected area network has been expanded significantly. At the same time there has been a major increase in the international attention and support for forest conservation in Central Africa. It is now widely recognised that the Congo Basin forests are not only part of our global heritage but also play an essential role in climate regulation and as such are vital for the future of mankind. International recognition of this role of the Congo Basin forests at the next round of discussions on climate change within the framework of the United Nations Framework Convention on Climate Change could potentially generate substantial resources for forest conservation in the region.

Nevertheless, important challenges remain. Protected areas remain seriously under funded and are heavily dependant on external support, both financial and technical. The long term future of protected areas can only be assured if governments commit the appropriate resources to ensuring that they are properly managed.

In spite of efforts to implement more sustainable forest practices, the bush meat crisis remains a reality. Forestry operations and other economic activities open up large areas of previously undisturbed forest, and commercial poaching is increasingly affecting many of the protected areas. Recent studies show that greater economic wealth is leading to an increased demand for bushmeat, particular in urban areas. A fundamental shift in attitudes towards bushmeat is necessary but this can only happen when wildlife is considered as part of the nation's natural heritage, and once issues of ownership of wildlife resources by local communities have been more clearly defined.

At the same time, a growing interest for the important mineral and oil resources in the region brings new threats and challenges to protected areas, some of which contain substantial reserves of these resources. As the countries of the sub region tackle the critical issue of poverty alleviation political pressures to de-gazette parts of the protected areas in order to exploit their oil and mineral resources are bound to build up. Currently at least five of the protected areas in the CAWHFI landscapes, together with Virunga National park in the DRC, are threatened by large scale commercial industrial extractive activities despite having legal statuses that preclude this type of activity. Even when protected areas are not directly affected, most of these industrial projects will entail profound changes in the economic and social fabric of the areas where they are located, and this will inevitably affect protected areas and biodiversity in the vicinity.

The Democratic Republic of the Congo is of particular concern since it includes a major part of the Congo Basin forest and has so many important areas for biodiversity conservation. Even though the war is officially over, instability and insecurity continues to plague many parts of the country. In these areas a parallel economy based on the illegal extraction of mineral and natural resources developed during the war and continues to flourish today. These activities are having serious detrimental consequences not only for the biodiversity but also for the local communities.

UNESCO and its conservation partners believe that the World Heritage Convention can make an important contribution to addressing some of these challenges. With the exception of Equatorial Guinea, all the countries in the Congo Basin are State Parties to the Conven-

tion and as such, have made a commitment towards protecting natural heritage of "Outstanding Universal Value". Currently, seven protected areas in the region are recognized under the Convention and several others have been included in the Tentative Lists of the countries.

Through its initiatives, UNESCO and its partners are assisting countries to prepare nominations to the World Heritage List. Parallel to this, UNESCO is raising awareness about the Convention among regional decision makers and other stakeholders by communicating the benefits of the World Heritage system.

World Heritage listing can bring about national pride and increase national support for the conservation of this heritage, at both government and local community levels. In many other regions of the world governments have used the World Heritage status to promote the biodiversity potential of their countries, with tourism being one of the key spin-offs. While the central African countries are still a long way from being able to match, for example, Australia's marketing of its Great Barrier Reef World Heritage site, the forests of the Congo basin are just as unique in their own way and have an undoubted potential that can, and should, be marketed. Before the war, gorilla tourism was an important driver of economic development around the Kahuzi-Biega and Virunga National Parks. In the Trinational Sangha and Gamba-Mayumba-Conkouati landscapes this potential is already being successfully tapped through low volume, high quality, eco-tourism and if developed wisely these initiatives will continue to grow.

In the particular case of the five World Heritage sites in DRC, communication and awareness raising has been a central element of UNESCO's interventions, the aim being to mobilize support for the sites from all of the different stake holders - government at the national and regional levels, the DRC army, the UN mission to DRC (MONUC), local communities and civil society.

Inscription on the World Heritage List will also provide international recognition of the global importance of the most significant protected areas in the region. The case of the DRC sites showed clearly how World Heritage listing can mobilise international support for the conservation of the sites. Under the Convention, countries accept a shared responsibility for the conservation of World Heritage sites. The development of Trust Funds can provide sustainable funding for the management of these sites and provides a mechanism for donor countries to fulfil their commitments under the Convention. The developing carbon markets, particularly if avoided deforestation becomes an acceptable criterion, also have massive potential for contributing to sustainable funding particularly as deforestation rates in central Africa are twice as low as those of Amazonia, and four times lower than those of south east Asia.

However, to achieve recognition under the Convention, areas not only have to demonstrate their exceptional global value and integrity, but must also show that appropriate management systems in place to ensure that the value and integrity of the sites can be maintained over time. Therefore an important focus for UNESCO's initiatives in the Congo Basin is on improving the management of the sites within the context of their wider landscape by developing appropriate management models and building capacities of the management agencies and other stakeholders. This has been achieved through the strategic partnerships that were developed with our international NGO conservation partners.

Our hope is that these combined efforts will ultimately lead to a network of well managed World Heritage sites across the Congo Basin which reflect the exceptional natural heritage of the region and which are sustained through local, national and international support..

ACRONYMES

APN	African Parks Network
AFD	Agence Française de Développement
AFC	Africa Conservation Fund
AWF	African Wildlife Foundation
CAWHFI	Central African World Heritage Initiative
CARPE	Central African Programme for the Environment
CBFP	Congo Basin Forest Partnership
CBG	Compagnie des Bois du Gabon
CI	Conservation International
CoCoCongo	Conservation Coalition for Congo
CoCoSi	Comité de Coordination du Site
Coltan	A valuable metallic ore containing Columbite and Tantalite
COMIFAC	Commission des Forêts d'Afrique Centrale
CNDP	Congrès National pour la Défense du Peuple (armed militia)
CMEC	China National Machinery & Equipment Import & Export Corporation
CIB	Congolaise Industrielle des Bois
DRC	Democratic Republic of Congo
EC	European Commission
FAO	Food and Agriculture Organisation
FARDC	Forces Armées de la République Démocratique du Congo
FFI	Faune and Flora International
FFEM	Fonds Français pour l'Environnement Mondial
FZS	Frankfurt Zoological Society
FDLR	Force Démocratique pour la Libération du Rwanda (armed militia)
GIC	Gilman International Conservation
GIS	Geographic Information System
GEF	Global Environment Facility
GPS	Global Positioning System
GRASP	Great Apes Survival Partnership
GTZ	Deutsche Gesellschaft für Technische Zusammenarbeit
ICOMOS	International Council on Monuments and Sites
IFO	Industries Forestières d'Ouesso
IRF	International Rhino Fund
ICCN	Institut Congolais pour la Conservation de la Nature
IGCP	International Gorilla Conservation Program
IUCN	International Union for the Conservation of Nature
KfW	Banque Kreditanstalt für Wiederaufbau
KBNP	Kahuzi-Biega National Park
LEM	Law Enforcement Monitoring
LRA	Lord's Resistance Army (armed militia)
LZS	London Zoological Society
MIKE	Monitoring of Illegal Killing of Elephants
MIST	Monitoring Information System
MONUC	United Nations Organisation Mission in DR Congo
MZS	Milwaukee Zoological Society
NGO	Non Governmental Organisation
NP	National Park
NTFP	Non Timber Forest Product
OWR	Okapi Wildlife Reserve
OFAC	Observatory for the Forests of Central Africa
PDA	Personal Digital Assistant
RAPAC	Réseau des Aires Protégées en Afrique Centrale
RN	Route Nationale (Main Road)
TRIDOM	Tri National Dja-Odzala-Minkebe
TNS	Tri National Sangha
VNP	Virunga National Park
WWF	World Wide Fund for Nature
WCS	Wildlife Conservation Society
UNESCO	United Nations Education, Scientific and Cultural Organisation
UNEP	United Nations Environment Program
UNDP	United Nations Development Program
UNF	United Nations Foundation
USAID	United States Agency for International Development

THE WORLD HERITAGE CENTRE

Established in 1992, the World Heritage Centre is the UNESCO secretariat to the World Heritage Convention. Ensuring the day-to-day management of the Convention, the Centre organizes the annual sessions of the World Heritage Committee, provides advice to States Parties in the preparation of site nominations, prepares international assistance from the World Heritage Fund and ensures, together with the advisory bodies to the Convention IUCN and ICOMOS, the reporting on the state of conservation of the inscribed sites. The Centre has been managing a number of large scale conservation initiatives such as the ones in the Congo Basin, thanks to outside donor funding.

THE PARTNERSHIP

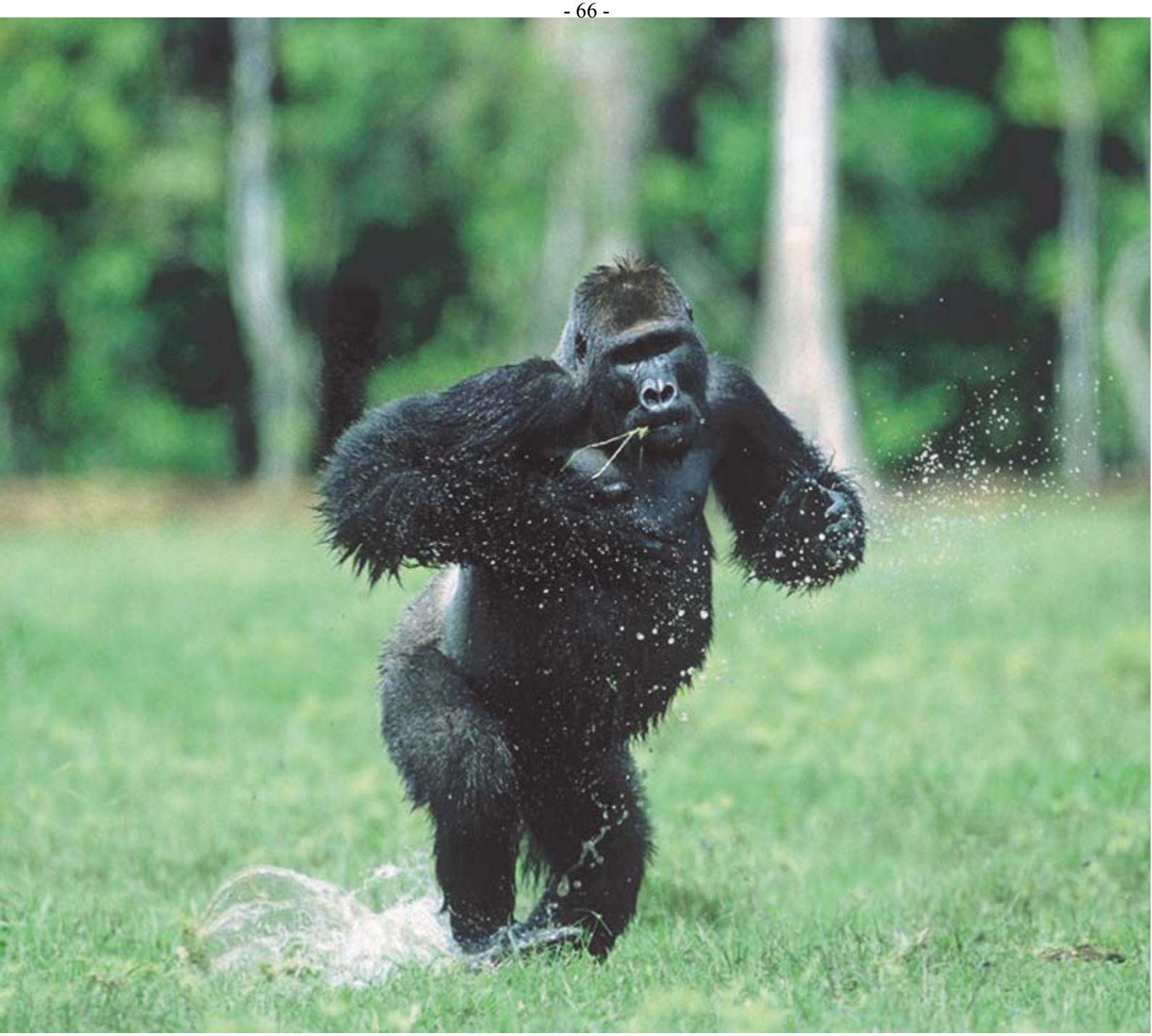
The most important actors in this partnership are the State Parties to the Convention concerned by this initiative, the Governments of the Republic of Cameroun, Central-African Republic, Republic of Congo, Democratic Republic of Congo and Republic of Gabon, and their respective ministries and technical agencies such as the DRC protected areas agency ICCN. Activities support the COMIFAC strategic plan and are coordinated with COMIFAC and its technical partner on protected area-related issues, RAPAC. The FAO is a partner to the UNF funded component of CAWHFI.

The field activities are implemented by a consortium of international and regional conservation organisations, most of which have many years of experience supporting the protected area authorities of the Congo basin. WWF, WCS and Conservation International have also mobilized important matching funds for the programmes.

IMPLEMENTING PARTNERS

Back cover: a western lowland gorilla male displaying in a forest clearing (bai) in the Odzala-Koukoua National Park, north Congo.

Photo © Sylvain Gatti & Florence Levréro, CNRS, Station Biologique Paimpont-Université de Rennes



Our programmes in the Congo basin receive support from

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FFEM
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ANNEX 5.17

David Sheldrick Wildlife Trust, *Dead or Alive? Valuing an Elephant,* n.d.

iworry

DEAD or ALIVE?

VALUING AN ELEPHANT

PREFACE

“Elephants are among the world’s most charismatic mega fauna and our largest living land mammals. However, the survival of Africa’s elephants is threatened by continuing demand for ivory desired for trinkets, religious statues, ornaments and accessories from Far Eastern Countries. As a result, elephant poaching is rife across Africa, with elephants being killed even in supposed safe and protected areas. The result is the unsustainable slaughter of one elephant every 15 minutes, decimating populations and damaging ecosystems.

This report looks at the financial value of elephants; alive. Every year, thousands of tourists travel to African nations to see elephants, yet without protective regulations, these nations can become devoid of the very animals which the hordes of eager tourists have come to see.

This report finds that alive, elephants present a huge revenue stream to local economies through tourism and, in the long term, elephants are worth significantly more roaming the world’s savannahs and forests than with their tusks sitting on a mantlepiece or adorning someone’s wrist.

Protecting elephants makes monetary sense. Data of this type can be used to show key decision makers that elephant conservation is a far more viable economic proposition than the ivory trade. It’s a powerful incentive to decision makers in charge of our natural resources to protect the species against rampant poaching.

Referring to wild animals as ‘economic commodities’ has created controversy in the past but where policy is determined by the value of an object, it’s time to give the elephant a fair footing.

We must recognise the need to realise the value of our wildlife and environmental heritage in order to pass policies that safeguard against their destruction. Policy makers will not pass effective measures without tangible benefits to society, yet so far the discussion has seemly only focused on the consumptive value of an elephant, it’s tusks. We need to look at the animal alive.

Arguments to protect Africa’s elephants have typically been based on emotive and environmental reasons – their cognitive abilities, their benefit to the wider environment and their ancient beginnings. To many decision makers, this might be enough. But we must reach those that balance the purse strings to make effective policies happen.

Protecting elephants makes economic sense, whether you’re responsible for a reserve in Tanzania or a National Park in Kenya -- if elephants live, tourists will come and economies can be boosted. It’s another argument as to why we must save elephants and a financially compelling one.”

Rob Brandford, **iworry Director**

METHODOLOGY

This publication identifies reported ivory seizures worldwide. By 'reported ivory seizures', we mean publicly reported ivory seizures, focusing on newspaper and online reports. We have used a wide range of open source resources, including English, Chinese, and French-language media, but it should be noted that the reported ivory seizures identified in this document may not represent the total number of seizures this year and are only a proportion of all illegal ivory trade.

As part of international monitoring of the illegal trade in ivory, countries party to CITES (Convention on International Trade in Endangered Species of Wild Fauna and Flora) are mandated to report information on elephant ivory seizures to TRAFFIC via the CITES Secretariat within 90 days of their occurrence which is then added to the ETIS database, though the time frame is often ignored. Variances in law enforcement, the rule of law and corruption levels, mean that reporting rates differ from country to country, and our figures may vary from TRAFFIC reported seizures.

The number of estimated elephants killed per seizure is an estimate and not a definitive number. We are using TRAFFIC's estimate that an average tusk weighs 5kg , extrapolating that an average elephant with two tusks carries 10kg of ivory.

We note that this is a very conservative estimate with 'tuskers' carrying much larger quantities, however this estimate serves as a basis to translate ivory seizure data into a relative estimate of the numbers of elephants represented by individual ivory shipments. There may be a variation between country or even regions with heavily poached elephant populations yielding smaller average tusk sizes while recently poached populations provide larger yields.

This report is produced by iworry, an elephant awareness campaign by the David Sheldrick Wildlife Trust. The iworry campaign raises awareness of the ivory poaching crisis and the impact trade in ivory is having on elephant populations. More information: **www.iworry.org**

The David Sheldrick Wildlife Trust has worked in Kenya for over 35 years to protect, conserve and preserve wildlife and habitats. Their conservation projects include Anti-Poaching and Aerial Surveillance initiatives, Mobile Vet Units, the Orphans' Project, Saving Habitats and Community Outreach. More information: **www.sheldrickwildlifetrust.org**

iworry would like to thank Gabriella Minerva and Amanda Woomer for their editorial assistance and contributions.

SUMMARY

Elephants are one of the world's most recognisable mammals, thanks to their size and distinctive tusks. It is these distinctive teeth that are making the species increasingly vulnerable to the point that populations have reached a tipping point; if the slaughter of elephants continues then they will be wiped out within our lifetime .

Policy and decision making in the conservation of natural resources which includes, in many countries, elephants, is influenced more by dollar-denominated measures of benefits and costs than non-monetary measures. With ongoing slaughter threatening Africa's elephant populations, in order to secure the long term future of the species, it is imperative to speak to natural resource policy makers in a language they understand to highlight the benefits of protecting the species and identify the tangible benefits elephants can bring.

A single dead elephant's tusks are estimated to have a raw value of $21,000 (based on TRAFFIC estimate that an elephant carries an average of 5kg of ivory per tusk). By comparison, the estimated tourism value of a single living elephant is $1,607,624.83 over its lifetime to travel companies, airlines and local economies thanks to tourists willing to pay generously for a chance to see and photograph the world's largest land mammal. That makes a living elephant, in financial terms, as valuable as 76 dead elephants.

Our research finds that between January and August 2014, a reported 17,799.29kg (17.8 tonnes) of ivory was seized worldwide, representing 1,940 elephants slaughtered for their tusks. But it's not just elephants that are in danger. The slaughter so far has lost Africa's tourism industry, local communities and economies a total of $44,554,844.47 alone this year. More killings every day only increases this figure.

As a form of wildlife crime, the illegal trade in ivory benefits criminal gangs, corrupt military units and militia and even terrorist groups including Al-Shabaab and the Lord's Resistance Army.

Taken together, the findings demonstrate that the species are worth more alive than dead. Ending the killing and protecting elephants makes monetary sense. Worldwide, a single living elephant drives tens of thousands of dollars in tourism-related revenues. Alive, they benefit local communities and economies; dead they benefit criminal and even terrorist groups.

Given the overlap of ivory poaching locations and elephant tourism operations, every elephant killed makes these regions much less profitable. As a result of the findings, iworry recommends:

- An immediate end to all sales of ivory
- Greater funding for Anti-Poaching operations; boots on the ground
- Education in communities from which poachers are drawn as to the value elephants could bring to them in the long term
- Ensure tourism initiatives and projects give tangible benefits to communities
- Enhancing campaigns in ivory consumer countries to inform the public about the true cost of ivory.

Sources:

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THE YEAR SO FAR...

JAN-AUG 2014

43 seizures

TRAFFICKED **IVORY**

17.8 tonnes

IVORY SEIZED

1,940

17.8 tonnes

ELEPHANTS **KILLED TO PRODUCE** IVORY

VALUE OF ELEPHANT over its lifetime to tourism

$1,607,624.83

Average raw **VALUE OF IVORY** an elephant carries

$21,000

76x **MORE VALUABLE**
is an elephant alive than dead

10% of **CONTRABAND** is usually seized

90% **ILLEGAL IVORY**
benefitting terrorist and criminal groups

up to

19,400

elephants killed
this year so far

IVORY

a popular product

Ivory has long been prized in cultures across the world but since 1989, it has been illegal to trade internationally in ivory. Two exceptions to this ban have since occurred; in 1999, Botswana, Namibia and Zimbabwe were allowed a 'one off sale' of ivory to Japan and in 2002, and a further 'one off sale' to China and Japan was approved, which took place in 2008.

Prior to the 'one-off' sales, the ban was initially successful in halting the elephant killing of the 1980's and combined with declining popularity among Western countries throughout the 20th century, meant the price of ivory slumped and poaching rates fell dramatically. By comparison, as a result of the sales to China, demand has been stimulated and a market has been created in which illegal poached ivory can be laundered, thus boosting domestic demand for ivory products. Combined with China's growing middle class who can afford endangered wildlife products such as ivory, the result has been a soar in demand.

Two types of elephant exist in Africa, the Forest Elephant and the Savannah Elephant; both are poached for their ivory. Research by Save The Elephants found that in 2014, uncarved ivory was worth $2,100 per kilo in China, three times its value in 2010.

2014. Born Free USA, Ivory›s Curse: The Militarization and Professionalization of Poaching in Africa. http://www.bornfreeusa.org/a9_ivorys_curse.php

17.8 TONNES OF IVORY SEIZED THIS YEAR

seizures and terrorism

The illegal wildlife trade, which includes the illegal trade in ivory, is estimated to be worth $15–20 billion annually and is the fourth most lucrative illegal activity behind arms, drugs and human trafficking.

Between January and August 2014, 43 seizures of ivory were reported or more than one a week. The combined weight of the seizures amounts to more than 17.779 tonnes (17.8 tonnes), or approximately 1,940 elephants slaughtered for their tusks.

Of the reported ivory seized: 10 seizures were in Kenya, five were in Gabon, five were in Vietnam and four were in China (including Hong Kong). Whilst this is significantly less than the 50 tonnes of ivory seized globally in 2013, it cannot be seen as indicating poaching rates have diminished. Changing shipping routes, ports, reduction in a region's rule of law and reporting can all impact seizure rates.

It is widely known that corrupt officials, criminal groups and even terrorist groups are involved in the illegal trade in ivory. Using current estimates, the value of the seized ivory in 2014 amounts to $37,378,509.

Yet, it is estimated that a seizure rate of 10% in a developed country is considered "good" for general goods contraband – which includes ivory. This suggests that so far this year, an estimated 177,993kg (178 tonnes) of ivory has been illegally trafficked representing 19,400 elephants killed.

TOURISM

an Economic Alternative

The current population of elephants in Africa is unknown but estimates place the figure at between 300,000 and 400,000. As a species, elephants do not reach sexual maturity until at least 11 years old, live until 70 on average and reproduce slowly meaning at the current rate of slaughter, they will be wiped out within our lifetime.

As one of Africa's famous Big Five, elephants are a significant source of revenue for the tourism industry. In Kenya, Tanzania, Zambia and South Africa elephants are now an important part of the regional and national tourism industry, driving multi-million dollar revenue streams. Elephant viewing camps, safaris and photo-tours are all based around the thrilling experience of viewing wild elephants. When viewed through a non-consumptive lens (tourism), alive a single elephant can contribute $22,966 to tourism per year and because elephants live for multiple decades, the total revenue that each elephant can generate during its lifespan is immense - $1,607,624.83.

By comparison, an elephant carries an estimated two 5kg tusks or a total of 10kg (a conservative estimate). Dead, an elephant is worth an estimated $21,000. Alive, an elephant is worth 76 times as much.

As a key stone species, elephants shape their environment with species and animals within the ecosystem dependent on elephants for their own survival. Grazing the world's forests and savannahs, elephants generate vast sums of renewable cash for the local economy in the process.

Regionally, Kenya and Gabon account for the most seizures within Africa. Though tourism in Gabon remains largely underdeveloped, in Kenya elephants and wildlife tourism alone generates 12% of the Gross Domestic Product and creates over 300,000 jobs.

In fact Kenya is well established as a destination to view wildlife, raising Kshs'4,216,756,000 in National Park entrance fees in 2012 (around $47,657,000). Home to Africa's 'Big Five', elephant herds alongside rhino and buffalo draw hundreds of thousands of tourists each year. For instance, Tsavo East National Park, home to Kenya's single largest population of elephants accounts for over 20% of average annual visitation into Kenya Wildlife Service National Parks with other parks including Amboseli National Park and Samburu National Reserve home to world famous herds.

The slaughter of over 1,940 elephants so far this year to furnish the illegal trade in ivory represents $44,554,844 lost to tourism. This pales in comparison to the potential $445,548,444 lost to tourism if we take into account a 10% seizure rate - which is a standard among developed countries. Further loss of elephants only increases this figure and makes these regions less profitable.

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alive a single
elephant can
contribute
$22,966 to
tourism per year

IVORY SEIZURES

DATE OF SEIZURE	IVORY SEIZED	WEIGHT (KG)	NUMBER OF ELEPHANTS KILLED PER SEIZURE	COUNTRY OF SEIZURE
January	34kg	34.00	3.4	Gabon
January	2 tusks	not known	1	Gabon
January	1.8 tonnes	1,800.00	180	Singapore
01-Jan-14	81 tusks	not known	40.5	Tanzania
08-Jan-14	35 tusks	275.00	17.5	China
10-Jan-14	34kg	34.00	3.4	Gabon
14-Jan-14	14kg	14.00	1.4	China
16-Jan-14	5kg	5.00	0.5	Kenya
18-Jan-14	3.4kg	3.40	0.34	Kenya
29-Jan-14 23-Jan-14	3.815 tonnes	3,815.00	381.5	Togo
30-Jan-14	120kg	120.00	12	China
February	95.82kg	95.82	9.582	China
February	4.2kg	4.20	0.42	Vietnam
08-Feb-14	143kg	143.00	14.3	Cameroon
14-Feb-14	0.68 kg	0.68	0.068	Kenya
16-Feb-14	79.5kg	79.50	7.95	Cambodia
06-Mar-14	36 tusks	170.00	18	Cameroon
21-Mar-14	77 pieces	263.00	26.3	Cambodia
27-Mar-14	106 pieces of raw ivory tusks	1,000.00	100	Singapore
04-Apr-14	7 tusks	50.00	3.5	Gabon
07-Apr-14	48kg	48.00	4.8	Kenya
01-May-14	0.092kg	0.09	0.0092	Zimbabwe
09-May-14	3 tonnes	3,000.00	300	Cambodia
24-May-14	1266kg	1,266.00	126.6	Vietnam
05-Jun-14	2152 kg	2,152.00	215.2	Kenya
08-Jun-14	125kg	124.00	12.4	Togo
10-Jun-14	790kg	790.00	79	Ethiopia
18-Jun-14	700kg	700.00	70	Togo

SOURCE

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IVORY SEIZURES

DATE OF SEIZURE	IVORY SEIZED	WEIGHT (KG)	NUMBER OF ELEPHANTS KILLED PER SEIZURE	COUNTRY OF SEIZURE
22-Jun-14	90Kg	90.00	9	Vietnam
28-Jun-14	6 tusks	not known	3	Namibia
July	4 spikes	14.00	1.4	Gabon
25-Jul-14	260kg	260.00	26	Kenya
28-Jul-14	18 tusks	46.00	9	Thailand
31-Jul-14	9 tusks	84.00	4.5	Kenya
01-Aug-14	14.6 kg	14.60	1.46	Vietnam
04-Aug-14	5 tusks	12.00	1.2	Kenya
04-Aug-14	84kg	84.00	8.4	Kenya
12-Aug-14	4 tusks	30.00	2	Benin
15-Aug-14	30kg	30.00	3	Benin
17-Aug-14	1000kg	1,000.00	100	Vietnam
18-Aug-14	62kg including 2 tusks	62.00	6.2	Kenya
12-Aug-14	30kg	30	3	Benin
22-Aug-14	56kg	56	5.6	Benin
		Total:17799.29	**Total**:1940.0292	

SOURCE

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iworry is an elephant awareness campaign by the David Sheldrick Wildlife Trust.

ANNEX 5.18

UNEP and UNWTO, *Tourism — Investing in energy and resource efficiency*, 2011

Peter Prokosch

Tourism

Investing in energy and resource efficiency

This chapter was developed in partnership with the World Tourism Organization

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List of acronyms

BAU - Business-as-usual
Bn - Billion
CSR - Corporate Social Responsibility
DFI - Development Finance Institutions
DMO - Destination Management Organization
ERT - Environment-related tourism
EU - European Union
FDI - Foreign Direct Investment
G2 - Green Scenario 2
GDP - Gross Domestic Product
GEF - Global Environment Facility
GER - Green Economy Report
GHG - Greenhouse Gas
GSTC - Global Sustainable Tourism Criteria
Ha - Hectare
HCT - Hotels, catering and tourism
ICOMOS - International Council on Monuments and Sites
ILO - International Labour Organization
IPA - Investment promotion agencies
IUCN - International Union for Conservation of Nature
LDC - Least-developed countries
M&E - Monitoring and evaluation
Mt - Million tonnes
OSH - Occupational safety and health
PPI - Pro-poor income
ROI - Return on investment
SIFT - Sustainable Investment and Finance in Tourism network
SME - Small and Medium-sized Enterprise
ST-EP - Sustainable Tourism for Eliminating Poverty initiative
TEEB - The Economics of Ecosystems and Biodiversity
TIES - The International Ecotourism Society
TSA - Tourism Satellite Account
UNCTAD - United Nations Conference on Trade and Development
UNEP - United Nations Environment Programme
UNESCO - United Nations Educational, Scientific and Cultural Organization
UNWTO - World Tourism Organization
WTP - Willingness to pay
WTTC - World Travel & Tourism Council
WWF - World Wildlife Fund

Key messages

1. Tourism has significant potential as a driver for growth for the world economy. The tourism economy represents 5 per cent of world GDP, while it contributes to 6-7 per cent of total employment. International tourism ranks fourth (after fuels, chemicals and automotive products) in global exports, with an industry value of US$1trillion a year, accounting for 30 per cent of the world's exports of commercial services or 6 per cent of total exports; 935 million international tourists were recorded in 2010 and 4 billion domestic arrivals in 2008. In over 150 countries, tourism is one of five top export earners, and in 60 it is the number one export. It is the main source of foreign exchange for one-third of developing countries and one-half of LDCs.

2. The development of tourism is accompanied by significant challenges. The rapid growth in both international and domestic travel, the trends to travel farther and over shorter periods of time, and the preference given to energy-intensive transportation are increasing the non-renewable energy dependency of tourism, resulting in the sector's contribution of 5 per cent to global GHG emissions. Other challenges include excessive water consumption compared with residential water use, discharge of untreated water, the generation of waste, the damage to local terrestrial and marine biodiversity, and the threats to the survival of local cultures, built heritage and traditions.

3. Green tourism has the potential to create new jobs and reduce poverty. Travel and tourism are human-resource intensive, employing directly and indirectly 8 per cent of the global workforce. It is estimated that one job in the core tourism industry creates about one and a half additional or indirect jobs in the tourism-related economy. The greening of tourism, which involves efficiency improvements in energy, water, and waste systems, is expected to reinforce the employment potential of the sector with increased local hiring and sourcing and significant opportunities in tourism oriented toward local culture and the natural environment.

4. Tourism development can be designed to support the local economy and poverty reduction. Local economic effects of tourism are determined by the share of tourism spending in the local economy as well as the amount of the resulting other economic activities. In greening the tourism sector, therefore, increasing the involvement of local communities, especially the poor, in the tourism value chain can contribute to the development of local economy and poverty reduction. This can include the local supply of products, labour, tourism services, and increasingly "green services" in energy and water efficiency and waste management. There is increasing evidence that more sustainable tourism in rural areas can lead to more positive poverty-reducing effects.

5. Investing in the greening of tourism can reduce the cost of energy, water, and waste and enhance the value of biodiversity, ecosystems and cultural heritage. Investment in energy efficiency has been found to generate significant returns within a short payback period. Improving waste management is expected to save money for tourism businesses, create jobs and enhance the attractiveness of destinations. The investment requirement in conservation and restoration is small relative to the value of forests, mangroves, wetlands, and coastal zones including coral reefs, which provide ecosystem services essential for the foundation of economic activities and for human survival. Investment in cultural heritage—the largest single component of consumer demand for sustainable tourism—is among the most significant and usually profitable investments a society or tourism sector can make. Under a green-economy investment scenario, tourism makes a larger contribution to GDP growth and significant environmental benefits include reductions in water consumption (18 per cent), energy use (44 per cent) and CO_2 emissions (52 per cent) compared with "business-as-usual".

6. Tourists are demanding the greening of tourism. More than a third of travellers are found to favour environmentally-friendly tourism and be willing to pay for related experiences. Traditional mass tourism has reached a stage of steady growth. In contrast, ecotourism, nature, heritage, cultural, and "soft adventure" tourism are taking the lead and are predicted to grow rapidly over the next two decades. It is estimated that global spending on ecotourism is increasing about six times the industry-wide rate of growth.

7. The private sector, especially small firms, can, and must be mobilised to support green tourism. The tourism sector involves a diverse range of actors. The awareness of green tourism exists mainly in a selection of larger scale firms. Smaller firms are mostly outside this sphere and diverse supplier groups may not be connected at all. Specific mechanisms and tools to educate small and medium sized tourism related enterprises are critical and are most effective when they are accompanied by actionable items. The promotion and widespread use of internationally recognised standards for sustainable tourism, such as the Global Sustainable Tourism Criteria (GSTC), can help businesses understand the practical aspects of sustainable tourism and assist with mobilising investment.

8. Much of the economic potential for green tourism is found in small and medium-sized Enterprises (SMEs), which need better access to financing for investing in green tourism. The majority of tourism businesses are SMEs with potential to generate greater income and opportunity from green strategies. Their single greatest limiting factor for greening, however, is lack of access to capital. Governments and international organisations can facilitate the financial flow to these important actors with an emphasis on contributions to the local economy and poverty reduction. Public-private partnerships can spread the costs and risks of large green tourism investments. Besides reducing administrative fees and offering favorable interest rates for green tourism projects, in-kind support such as technical, marketing or business administration assistance, could also help.

9. Destination planning and development strategies are the first step towards the greening of tourism. In developing tourism strategies, local governments, communities and businesses need to establish mechanisms for coordinating with ministries responsible for the environment, energy, labour, agriculture, transport, health, finance, security, and other relevant areas. Clear requirements are needed in such areas as zoning, protected areas, environmental rules and regulations, labour rules, agricultural standards, and health requirements particularly related to energy, emissions, water, waste and sanitation.

10. Government investments and policies can leverage private sector actions on green tourism. Government spending on public goods such as protected areas, cultural assets, water conservation, waste management, sanitation, public transport, and renewable energy infrastructure can reduce the cost of green investments by the private sector in green tourism. Governments can also use tax concessions and subsidies to encourage private investment in green tourism. Time-bound subsidies can be given, for example, on the purchase of equipment or technology that reduces waste, encourages energy and water efficiency, the conservation of biodiversity, and the strengthening of linkages with local businesses and community organisations. At the same time, resource and energy use as well as waste generation need to be correctly priced to reflect their true cost to society.

1 Introduction

This chapter seeks to make the case, primarily an economic one, for investing in the "greening" of tourism and it provides guidance on how to mobilise such investments. The objective is to inspire policy makers to support increased investment in greening the sector. The chapter shows how green investment in tourism can contribute to economically viable and robust growth, decent work creation and poverty alleviation; while improving resource efficiency and minimising environmental degradation.

There is a growing body of evidence that greening tourism can lead to broad economic, social and environmental benefits for the host countries and their communities (Mill and Morrison 2006, Rainforest Alliance 2010, World Economic Forum 2009a, Klytchnikova and Dorosh 2009). Tourism's potential for creating employment, supporting livelihoods and enabling sustainable development is huge, given that it is one of the main sources of foreign-exchange income—the principal source for one-third of developing countries and one-half of the world's Least Developed Countries (LDCs) according to the UN Conference on Trade and Development (UNCTAD 2010).

The chapter starts with an explanation of what is meant by greening tourism, followed by a discussion of the challenges and opportunities facing the sector. It then discusses the goals for greening the sector and the potential economic implications of green investment being made in the sector, including the results from a modelling exercise. Finally, the chapter presents the conditions that are important for enabling the greening of the sector.

1.1 Tourism in a green economy

Tourism in a green economy refers to tourism activities that can be maintained, or sustained, indefinitely in their social, economic, cultural, and environmental contexts: "sustainable tourism". Sustainable tourism is not a special form of tourism; rather, all forms of tourism may strive to be more sustainable (UNEP and UNWTO 2005). A clear distinction should be made between the concepts of ecotourism and sustainable tourism: "the term ecotourism itself refers to a segment within the tourism sector with focus on environmental sustainability, while the sustainability principles should apply to all types of tourism activities, operations, establishments and projects, including conventional and alternative forms". [1]

Sustainable tourism describes policies, practices and programmes that take into account not only the expectations of tourists regarding responsible natural-resource management (demand), but also the needs of communities that support or are affected by tourism projects and the environment (supply)[2]. Sustainable tourism thus aspires to be more energy efficient and more "climate sound" (e.g. by using renewable energy); consume less water; minimise waste; conserve biodiversity, cultural heritage and traditional values; support intercultural understanding and tolerance; and generate local income and integrate local communities with a view to improving livelihoods and reducing poverty. Making tourism businesses more sustainable benefits local communities and raises awareness and support for the sustainable use of natural resources. In this chapter, the conceptual and operational framework for sustainability in tourism is based on the Global Sustainable Tourism Criteria (GSTC), an international consensus on the minimum criteria that a tourism business should follow to approach sustainability[3]. A group of key variables based on the GSTC are used for the analysis of the "greening" of tourism in this chapter.

The movement toward more sustainable tourism implies significant improvements in the performance of conventional tourism, as well as growth and improvements in smaller, niche areas centred on natural, cultural and community resources. The expansion of the latter, as a proportion of the industry as a whole, may have especially positive implications for biodiversity conservation and rural poverty reduction; whereas the greening of conventional and mass tourism is likely to have its largest effects on resource use and management, as well as on increased economic spillovers and the inclusion of disadvantaged populations.

1. *International Year of Ecotourism 2002*, http://www.unep.fr/scp/tourism/events/iye/pdf/iye_leaflet_text.pdf.

2. ILO (2010b) views sustainable tourism as "composed of three pillars: social justice, economic development, and environmental integrity. It is committed to the enhancement of local prosperity by maximizing the contribution of tourism to the destination's economic prosperity, including the amount of visitor spending that is retained locally. It should generate income and decent employment for workers without affecting the environment and culture of the tourists' destination and ensures the viability and competitiveness of destinations and enterprises to enable them to continue to prosper and deliver benefits in the long term".

3. The Global Sustainable Tourism Criteria were developed as part of a broad initiative managed by *The Partnership for Global Sustainable Tourism Criteria* (GSTC Partnership), a coalition of over 40 organisations working together to foster increased understanding of sustainable tourism practices and the adoption of universal sustainable tourism principles. The Partnership was initiated by the Rainforest Alliance, the United Nations Environment Programme (UNEP), the United Nations Foundation and the United Nations World Tourism Organization (UNWTO). See www.gstcouncil.org/resource-center/gstc-criteria.htm.

2 Challenges and opportunities for tourism in a green economy

2.1 Challenges

The tourism industry faces a multitude of significant sustainability-related challenges. Challenges that need to be resolved through the greening of the industry include (1) energy and GHG emissions; (2) water consumption; (3) waste management; (4) loss of biological diversity; and (5) effective management of cultural heritage.

Energy and GHG emissions

The tourism sector's growing consumption of energy, especially in travel and accommodation, and its dependence on fossil fuels has important implications for global GHG emissions and climate change as well as for future business growth. Several elements contribute to tourism's increasing energy consumption, including growth rates in international tourist arrivals and domestic travel; trends to travel further and over shorter periods of time; as well as preference given to energy-intense transportation (e.g. aircraft and car travel over train and bus, and flying first and business class instead of economy (Peeters et al. 2010). The sustainability and competitiveness of tourism depends in part on energy efficiency (reductions in overall energy use) and a more intensive use of renewable sources.

After transport, accommodation is the most energy-intensive component of the tourism industry, through its demand for heating or cooling, lighting, cooking (in restaurants), cleaning, pools and, in tropical or arid regions, the desalination of seawater. A general rule is that the more luxurious the accommodation, the more energy will be used. In a wide review of studies, energy-use in hotels range between 25 and 284 MJ/guest-night (Peeters et al. 2010). Tourism-related transport consumption of energy is related to travel mode. Coach and rail transport, cars and buses, aircraft and cruise ships have diverse energy intensities.[4]

There is no systematic international country dataset on energy consumption from tourism activities. UNWTO and UNEP (2008) estimate 250 MJ per person is consumed through activities not related to travel to the destination or accommodation on an average international tourist trip, 50 MJ per person is expended on shorter and less activity-oriented business trips and 100 MJ per person for Visiting Friends and Relatives (VFR) trips. The weighted global average of energy consumption for activities of international tourists is estimated at 170 MJ per trip, excluding transport and accommodation. As a comparison, world daily energy consumption per capita is estimated at 135MJ (a value that includes energy generation and industry).[5]

Given the rising global trend for travel and the growing energy intensity of most trips, future emissions from the tourism sector are expected to increase substantially, even considering current trends in technological energy-efficiency gains in transport (air and ground) and accommodation. Tourism is estimated to create about 5 per cent of total GHG emissions (1,302 Mt CO_2), primarily from tourist transport (75 per cent) and accommodation (21 per cent, mainly from air-conditioning and heating systems). A globally-averaged tourist journey is estimated to generate 0.25 tonnes of CO_2 (UNWTO and UNEP 2008). The World Economic Forum (WEF 2009b), using a different set of sub-sectors, estimated global GHG emissions from tourism to be 13 per cent higher (1,476 Mt CO_2 in 2005). The report distinguishes direct and indirect emissions from tourism, with direct emissions being defined as "carbon emissions from sources that are directly engaged in the economic activity of the tourism and travel sector." While these are included in the WEF estimate, indirect emissions are excluded, i.e. emissions from electricity usage in airline or travel agent offices, and emissions from transportation of hotel consumables, such as food or toiletries (Peeters et al. 2010). Scott et al. (2010) estimate the sector contributed between 5.2 per cent and 12.5 per cent of all anthropogenic radiative forcing in 2005.

Over the next 30-50 years, GHG emissions from the tourism sector are projected to grow substantially in a "business-as-usual" scenario, in large part because emissions from aviation, the most important emitter in the industry, are expected to grow by at least a factor of 2 to 3 (UNWTO and UNEP 2008, WEF 2009b). Aviation

4. For instance, in New Zealand, the total energy consumed for tourism transport and accommodation is distributed by 43 per cent for road transport, 42 per cent for air travel, 2 per cent for sea transport and 1 per cent for rail transport, with accommodation comprising the remaining 12 per cent. For local travel, coach tourism consumes the greatest energy per day, followed by camper tourists, soft comfort and auto tourists (Becken et al. 2003).

5. Own estimation with data from the International Energy Agency, available at http://data.iea.org/ieastore/default.asp.

and tourism are expected to account for a large share of emissions unless a major change in the emission trajectories is achieved (Peeters et al. 2010).

Water consumption

While water use by tourism, on a global basis, is far less important than agriculture, industry, or urban domestic use, in some countries and regions, tourism can be the main factor in water consumption. In such areas, it can increase pressure on already diminished water resources and compete with other sectors as well as subsistence needs of local populations (Box 1). Tourism can also directly affect water quality, for instance through the discharge of untreated sewage or freshwater abstraction (Gössling 2010).

Global direct water consumption by international tourism (accommodation only) is estimated to be 1.3 km^3 per year (Gössling 2005). Available data suggests that direct water use in tourism varies between 100 and 2,000 litres per guest night, with a tendency for larger, resort-style hotels to use significantly more water than smaller, pension-like establishments or campsites. The main water-consuming factors are golf courses, irrigated gardens, swimming pools, spas, wellness facilities and guest rooms.

UNEP (2003) estimates that in the USA, tourism and recreation consumes 946 million cubic metres of water per year, of which 60 per cent is linked to lodging (mostly spent on guest consumption, landscape and property management and laundry activities), and another 13 per cent to foodservice. Total yearly water consumption by tourism in Europe is estimated at 843 million cubic metres. Each tourist consumes 300 litres of freshwater per day on average, whereas "luxury" tourists can consume up to 880 litres. By comparison, average per capita residential consumption in Europe is estimated at 241 litres per day.[6]

Waste management

Waste management is another increasing and well-recognised challenge in the industry. Every international tourist in Europe generates at least 1 kg of solid waste per day, and up to 2 kg/person/day for the USA (UNEP 2003). By comparison, CalRecovery and UNEP (2005) report total country waste generation, including industrial and other sources, for Austria (1.18 kg/person/day), Mexico (0.68 kg/person/day), India (0.4 kg/person/day) and the USA (2.3 kg/person/day).

Impacts are also considerable for wastewater management, even in high-income countries. In the Mediterranean region, for instance, it is commonplace for hotels to discharge untreated sewage directly into the sea (WWF 2004), with 60 per cent of water used in tourism resulting in sewage in need of disposal (GFANC 1997). In the European Mediterranean, only 30 per cent of municipal wastewater from coastal towns receives any treatment before discharge. Anecdotal evidence suggests that this is also the case in many other countries outside the European Union (Gössling 2010).

6. Author's estimation with data from AQUASTAT-FAO. Available at http://www.fao.org/waicent/faoinfo/agricult/agl/aglw/aquastat/dbase/index.stm.

Box 1: Water consumption for tourism and local communities

Tourism development is concentrated in coastal areas and on small islands, where potable water is typically scarce. This scarcity can be caused by either a physical absence of freshwater, or because the necessary infrastructure or resources are lacking. A tourism-thirsty industry can secure its water needs wherever it operates although this can create situations of stark water inequity between tourists and neighbouring communities. Tourism's water demands can even lead to the appropriation of supply to the detriment of local domestic and agricultural needs, caused by the overexploitation of aquifers and reservoirs and the lowering of groundwater tables.

In a popular resort area of one South Asian country, for example, privately-owned water tankers buy water from villages through local elites and transport it to supply nearby hotels. This leaves villagers with water supply to their communal standpipes for a few hours a day only (Tourism Concern 2009 and 2010). Luxury resorts on an East African island are estimated to use up to 2,000 litres of water per tourist per day, almost 70 times more than the average daily domestic consumption of local people (Gössling and Hall 2006).

Golf tourism is rapidly expanding. An estimated 9.5 billion litres of water are used to irrigate the world's golf courses per day, equivalent to the daily needs of 80 per cent of the global population. One Mediterranean island, where water is so scarce it must sometimes be shipped in, is planning to increase its golf courses from three to 17, with tourism cited as the principal driver. This will involve building over agricultural land and constructing several desalination plants to ensure continual supply (Tourism Concern 2009).

Source: Tourism Concern (2010)

Loss of biological diversity

There are many examples where large-scale tourism has had detrimental effects on biodiversity, including coral reefs, coastal wetlands, rainforests, arid and semi-arid ecosystems and mountainous areas (UNWTO 2010d). Coral ecosystems have suffered strong adverse impacts from the use of coral for construction materials for hotels, over-fishing off reefs to feed tourists, sewage dumping and sedimentation from improperly managed runoff from buildings, parking lots, and golf courses. Coastal wetlands, particularly mangroves, have routinely been damaged or destroyed to build beach resorts. And in arid and semi-arid ecosystems, golf courses and other water-intensive activities have lowered water tables affecting local fauna and flora. Biodiversity will be greatly affected by the way in which tourism grows and develops, especially in developing countries (UNEP 2010). And failure to incorporate biodiversity concerns in destination planning and investment will have detrimental effects on the natural environment, increase conflict with local communities, and lead to reduced value-creation potential for both the destination and investors (notably as interest in nature-based tourism is growing rapidly around the world and represents therefore a strategic argument for maintaining biodiverse environments, which are often tourist destinations in developing countries).

Management of cultural heritage

Interest in unique cultures by tourists can result in adverse impacts and severe disruption for communities. There are examples of communities overrun by large numbers of visitors, commercialisation of traditions and threats to cultural survival from unplanned and unmanaged tourism. Tourism destinations are occasionally built by outsiders (usually with government approval) in areas that indigenous or traditional communities consider to be theirs, and where the development was neither desired nor locally validated. These situations lead to conflicts that make cooperation and mutual benefits nearly impossible to achieve, and instil animosities that negatively affect the local communities and the tourism destination. Frequently, the cultural issues overlap and are aggravated by environmental issues such as access to water, coastal resources and wildlife. Over the last two decades, with the growth in ecotourism and alternative travel, tourism impacts on vulnerable cultures has begun to be taken seriously by the tourism industry, governments, non-governmental organisations and the cultural groups involved (Wild 2010).

2.2 Opportunities

The following trends and developments provide a particularly promising space for greening tourism: (1) sizing and growth of the sector; (2) changing consumer patterns; and (3) potential for addressing local development and poverty reduction.

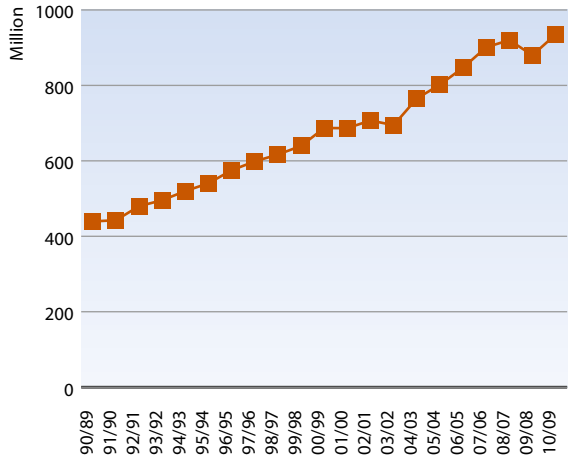


Figure 1: World international tourist arrivals

Source: UNWTO (2008, 2010b and 2011)

Sizing and growth of the tourism sector

Tourism is one of the most promising drivers of growth for the world economy. The sheer size and reach of the sector makes it critically important from a global resource perspective. Even small changes toward greening can have important impacts. Furthermore, the sectors' connection to numerous sectors at destination and international levels means that changes in practices can stimulate changes in many different public and private actors.

The tourism economy represents 5 per cent of global GDP, while it contributes to 6-7 per cent of total employment. International tourism ranks fourth (after fuels, chemicals and automotive products) in global exports, with an industry value of US$1 trillion a year, accounting for 30 per cent of the world's exports of commercial services or 6 per cent of total exports. Tourist arrivals have shown continuous yearly growth over the last six decades, with an average 4 per cent annual increase during the last two. This trend has held in spite of occasional short drops from international crises, such as pandemics, recessions and terrorism. International tourism arrivals reached 922 million in 2008, dropped to 880 million in 2009, and then recovered in 2010 with 935 million (UNWTO 2011) (Figure 1), while 4 billion domestic arrivals were recorded in 2008 (UNWTO and UNEP 2008). The tourist industry has been sensitive but resilient to economic, political and social global phenomena. The number of tourist trips is expected to continue to grow for the next decade, with the number of international tourist arrivals expected to reach 1.6 billion by 2020 (UNWTO, 2001).

The economic significance of tourism is highly variable across countries, however. While it represents only 1.9

per cent and 3.3 per cent of GDP in Japan and Peru respectively, it represents 7.7 per cent and 10.9 per cent of GDP in South Africa and Spain respectively (UNWTO 2010c, WTTC 2010b). Regarding employment, the tourism industry contributes with 2.8 per cent, 3.1 per cent, 6.9 per cent and 11.8 per cent of total employment for the same countries (UNWTO 2010c, WTTC 2010b). In terms of investment, it accounts for 5.8 per cent, 9.9 per cent, 13 per cent, and 13.8 per cent of total investment respectively (WTTC 2010 and 2010b).[7]

Proportionately, tourism will grow faster in less developed countries than in developed economies in the next ten years. Destinations in emerging economies receive 47 per cent of worldwide international tourist arrivals and US$306 billion in international tourism receipts (36 per cent of the global total). Moreover, growth in the decade since 2000 has been most marked in emerging economies (58.8 per cent). Market share has also grown more significantly in emerging economies (from 38.1 per cent in 2000 to 46.9 per cent in 2009). Recent trends and forecasts point to a spreading of tourism to new destinations**,** largely in developing countries, where there is outstanding potential to support development goals, and where new environmental and cultural attributes can make an important contribution to more sustainable tourism destinations (UNWTO 2010b).

Changing consumer patterns

Tourist choices are increasingly influenced by sustainability considerations. For instance, in 2007 TripAdvisor surveyed travellers worldwide and 38 per cent said that environmentally-friendly tourism was a consideration when travelling, 38 per cent had stayed at an environmentally-friendly hotel and 9 per cent specifically sought such hotels, while 34 per cent were willing to pay more to stay in environmentally-friendly hotels (Pollock 2007). CEDS and TIES (2005) found that a majority of international tourists are interested in the social, cultural and environmental issues relevant to the destinations they visit and are interested in patronising hotels that are committed to protecting the local environment, and increasingly view local environmental and social stewardship as a responsibility of the businesses they support. Choice experiments conducted in Uganda conclude that biodiversity attributes increase the willingness to visit tourism attractions, independently of other factors (Naidoo and Adamowickz 2005). Research also indicates that consumers are concerned about the local environments of their travel destinations and are willing to spend more on their holidays if they are assured that workers in the sector are guaranteed ethical labour conditions in the places they are visiting (ILO 2010b). On the other hand, Rheem (2009) argues that less than a third of American travellers indicate a willingness to pay some sort of premium for "green" travel, higher prices (cost premium) being seen as a demand barrier for 67 per cent of respondents.

Traditional mass tourism such as "sun-and-sand" resorts has reached a steady growth stage. In contrast, ecotourism, nature, heritage, cultural and "soft adventure" tourism, as well as sub-sectors such as rural and community tourism are taking the lead in tourism markets and are predicted to grow most rapidly over the next two decades. It is estimated that global spending on ecotourism is increasing by 20 per cent a year, about six times the industry-wide rate of growth (TEEB 2009a). Nature-based tourism is an important economic component of the entire tourism market, including 75 per cent of Australia's international tourism, 42 per cent of European recreational tourists in 2000 and contributing US$122.3 billion to the USA's tourism market in 2006 (UNWTO 2010d). About 14 per cent of international visitors to South Africa in 1997 engaged in an "adventure activity" during their stay (Travel to South Africa). Of the 826,000 tourists to Kenya in 1993, 23 per cent visited national parks and reserves for wildlife safari tourism (Sindiga, 1995). The Asia-Pacific region alone reported 10 per cent of tourism revenue came from ecotourism activities in 1993 (Dalem 2002).

There is empirical evidence that tourists seeking environmental and culturally differentiated destinations are willing to pay more for this experience. Inman et al. (2002) estimate this to be between 25 per cent and 40 per cent. WEF (2009) estimates that 6 per cent of the total number of international tourists pay extra for sustainable tourism options and 34 per cent would be willing to pay extra for them. One third to one half of international tourists (weighted toward the USA) surveyed in a CESD and TIES (2005) study said they were willing to pay more to companies that benefit local communities and conservation. Research by SNV (2009) records two studies where 52 per cent of respondents in a UK survey would be more likely to book a holiday with a company that had a written code to guarantee good working conditions, protect the environment and support local charities, while some 58.5 million US travellers would "pay more" to use travel companies that strive to protect and preserve the environment.

Wells (1997) presents a survey of nature-tourism willingness to pay (WTP) studies and shows that, in almost all cases, consumer surplus (private value of benefits from nature tourism) is higher than collected fees from tourists. In other words, the value of ecosystems for tourism is undervalued in many cases. For instance, Adamson (2001) estimates that 50 per cent or more of the economic value from Manuel Antonio National Park in Costa Rica is not captured in entrance

7. See Annex 1 for an indication of the economic dimension of tourism in a country sample.

fees. WTP for entrance fees from international tourists was estimated at US$12 (compared with a US$6 actual entrance fee) and US$6 for national tourists (compared with an actual fee of US$2). Furthermore, it is estimated that the average value of coral reef opportunities for recreation and tourism is US$65,200 per hectare per year in 2007 values, while it could reach up to more than US$1 million (TEEB 2009a). The maximum monetary value of ecosystem services for tourism, per hectare per year, has been estimated for coastal systems (US$41,416), coastal wetlands (US$2,904), inland wetlands (US$3,700), rivers and lakes (US$2,733) and tropical forests (US$1,426).

Potential for local development and poverty reduction

Making tourism more sustainable can create stronger linkages with the local economy, increasing local development potential. Of particular and recognised importance (Hall and Coles 2008) are: purchasing directly from local businesses, recruiting and training local unskilled and semi-skilled staff, entering into neighbourhood partnerships to make the local social environment a better place to live, work and visit for all; as well as the ability to improve the local natural environment within its areas of direct and indirect influence (Ashley et al. 2006). The move toward more sustainable tourism has been shown in a number of destinations to enhance this local development potential through several mechanisms:

1. Its ability to harness biodiversity, landscape and cultural heritage available in developing countries can play a major role in enhancing incomes and employment opportunities;

2. Tourism is a relatively labour-intensive sector traditionally dominated by micro and small enterprises with activities particularly suited for women and disadvantaged groups;

3. As a tourism product is a combination of different activities and inputs produced by many sectors, enhanced spending by tourists can benefit a wide range of sectors such as agriculture, handicrafts, transport, water and waste management, energy efficiency and other services;

4. As tourism development at destinations requires investment in facilities such as roads, water supply, and energy, it improves the basic common infrastructure facilities required for development of other sectors and improvement of quality of life (Bata 2010); and

5. Tourism employs more women and young people than most other sectors; providing economic benefits and independence to women is very important in terms of supporting child development and breaking the cycle of poverty.

3 The case for investing in the greening of tourism

3.1 Spending in the tourism sector

Tourism drives significant investments. Adding even small percentages of investment for a greener sector results in very significant increases in investment flows. Furthermore, much new investment flow is directed toward developing countries, where increased investment could have greater impact on green outcomes. It is estimated that travel and tourism-sector investments reached US$1,398 billion in 2009, or 9.4 per cent of global investment. It increased on average by 3 per cent during the last decade, notwithstanding a significant contraction in 2009 (-12 per cent). Global investment in tourism has fluctuated between 8 per cent and 10 per cent of total world investment over the last 20 years. In developing countries, such as in the Caribbean region, this figure could be as high as 50 per cent (WTTC 2010).[8] In OECD countries, investment in hotels, travel agencies and restaurants range from 6 per cent of national gross value added in Germany to 32 per cent in Portugal (OECD 2010).

Foreign Direct Investment (FDI) is an important source of world tourism investment. The stock of outward and inward FDI in the "hotels and restaurants" sector reported by UNCTAD (2009) accounts for almost 1 per cent of total FDI stock. This figure, however, does not take into account other tourism-related elements in other sectors, such as construction, transport or business activities. There is a growing focus on tourism as a generator of FDI in developing countries, where it is a priority of many Investment Promotion Agencies (IPAs). In this regard, the case of Costa Rica is illustrative as foreign investment in the tourism sector represented 17 per cent of total FDI inflows in 2009 and 13 per cent on average for 2000-09.[9]

3.2 Benefits in employment

Tourism is human-resource intensive due to the service nature of the industry. It is among the world's top job creators and allows for quick entry into the workforce for youth, women and migrant workers. The *wider* tourism economy provides, both directly and indirectly, more than 230 million jobs, which represents about 8 per cent of the global workforce. Women make up between 60 and 70 per cent of the labour force in the industry and half the workers are aged 25 or younger (ILO 2008). In developing countries, sustainable tourism investment can help create job opportunities, especially for poorer segments of the population.

The move toward more sustainable tourism can increase job creation. Additional employment in energy, water, and waste services and expanded local hiring and sourcing are expected from the greening of mainstream tourism segments. Furthermore, an increasing body of evidence suggests significantly expanded indirect employment growth opportunities from segments oriented toward local culture and the natural environment (Cooper et al. 2008, Moreno et al. 2010, Mitchell et al. 2009).

Tourism creates jobs directly and leads to additional ("indirect") employment. It is estimated that one job in the core tourism industry creates about one and a half additional jobs in the tourism-related economy (ILO 2008). There are workers indirectly dependent on each person working in hotels, such as travel-agency staff, guides, taxi and bus drivers, food and beverage suppliers, laundry workers, textile workers, gardeners, shop staff for souvenirs and others, as well as airport employees (ILO 2008). These relationships influence the many types of workplace relationships that include full-time, part-time, temporary, casual and seasonal employment and have significant implications for employment opportunities within the sector. A study of South Africa shows that direct employment in the core tourism sector only accounts for 21 per cent of total employment creation due to tourism spending in 2008 (Pan African Research & Investment Services 2010). Available data indicate that every new job in tourism can have multiplying effects in the whole economy, as illustrated in Table 1.

8. It is worth mentioning that WTTC estimates incorporate all fixed investment expenditure by tourism service providers and government agencies, in facilities, capital equipment and infrastructure for visitors. In this sense, it could be overestimating infrastructure investments that are not tourism sector specific but affect the whole economy (for instance, road improvements or airport construction). Still, it is the only cross-country source of tourism investment data available.

9. Author's calculations with data from the Central Bank of Costa Rica, www.bccr.fi.cr, accessed on September 12, 2010.

For the EU 27, GHK (2007) estimates direct and indirect employment multipliers for environment-related tourism at between 1.69 and 2.13. This means that for every 100 jobs directly created in the sector, 69 more are created elsewhere in the economy as a result of indirect effects and the figure increases to 113 when induced effects are taken into account. The authors define environment-related tourism (ERT), as activities where the natural environment (not the built environment) is responsible for influencing the choice of destination for the tourism activity, including visits to hills, mountains, coasts, farmland, woods, forests, springs, lakes and wildlife and the activities of fishing (sea, game and coarse), walking, climbing, golfing, skiing, cycling, bathing/swimming, etc.

It is estimated that sustainable tourism in Nicaragua, a destination that focuses very prominently on its culture and natural environment, has an employment multiplier of 2. That is, for every job in the tourism sector, an additional local employment is created, with higher wages than the national averages (Rainforest Alliance 2009).

	Total employment per single job in the tourism sector	Employments per US$10,000 tourist expenditure
Jamaica	4.61	1.28
Mauritius	3.76	not available
Bermuda	3.02	0.44
Gibraltar	2.62	not available
Solomon Islands	2.58	not available
Malta	1.99	1.59
Western Samoa	1.96	not available
Republic of Palau	1.67	not available
Fiji	not available	0.79
UK (Edinburgh)	not available	0.37

Table 1: Sample of tourism employment multipliers
Source: Cooper et al. (2008)

3.3 Local economic development and poverty reduction

Local economic development

Tourism is an important and effective driver of local economic development. Tourist spending enters the local economy to varying degrees depending principally on the structure of the tourism business and its supply chain at a destination. The economic contribution entering the economy is the "local contribution" and is typically measured as an average amount per tourist, and as a percentage of the total tourism spending that stays in the local economy. That which is not retained in the local economy is "leakage." Multiplier effects are limited by leakages, which reduce the positive economic impacts of tourism. Wells (1997) reports values of leakage as a percentage of gross tourism receipts ranging from 11 per cent (Philippines) to 56 per cent (Fiji).

The "income multiplier" is used to describe the amount of the indirect economic activity resulting from the local contribution. The economic development potential of tourism is a direct function of the local contribution and multiplier—larger local contributions and larger multipliers each lead to greater economic activity in the local economy and there are important synergies between them. From a global perspective, Mill and Morrison (2006) review the literature on income multipliers and present a list of estimations from different countries and regions. Income multipliers can be relatively low for specific destinations such as the City of Winchester (0.19) and higher for a country such as Turkey (1.96). According to Cooper (2008), tourism impacts income in different ways depending on the country or region where it develops. Every US dollar spent by overnight tourists impacts income in the economy between 1.12 to 3.40 times. This high variability indicates that local economic impact development will depend on particular characteristics of the tourism business "model", in particular the quantity and type of products and services sourced from the local economy.

In destinations where a large percentage of tourist needs are locally supplied (beds and linens, food and beverage, equipment and supplies, labour, tour and transportation services, souvenirs, among others), local contribution and multipliers tends to be high, and the resulting economic impact correspondingly greater. In destinations where substantial income is not captured locally, economic impact from tourism is less. This effect can vary dramatically between destinations:

- For Granada, Nicaragua, the Rainforest Alliance (2009) reports a case study of sustainable tourism where local purchases represent only 16 per cent of total purchases;

- For the Canary Islands, Hernández (2004) finds that 43 per cent of total tourism expenditure is supplied from outside the local economy through direct, indirect and induced imports; and

- In New Zealand, it is estimated that 24 per cent of tourism expenditure is for imports of goods and services sold directly to tourists by retailers (Hernández 2004).

Looking at a single destination illustrates how substantial tourism's economic impact can be. For example, for Panama, Klytchnikova and Dorosh (2009) present a detailed evaluation of tourism's impact in the local economy of three different regions. The income multiplier for the tourism industry (hotels and restaurants) is the largest of all economic sectors. An additional US$1 in

value added results in US$2.87 total income. This large multiplier is due to strong backward linkages in terms of demand for local food products as well as forward linkages of household spending from tourism income. This gain results from consumer spending effects as incomes earned in various activities are spent in the domestic economy. By way of comparison, multipliers are smallest (1.30 to 1.64) in sectors such as the Panama Canal, mining and textiles where there are few production linkages (as much of the inputs are imported). In contrast, the multipliers for the fruits, shellfish and other agricultural exports are especially large because much of the income earned accrues to rural households who spend a high proportion of their incomes on non-tradable goods and services in the local economy.

There is an increasingly convincing body of evidence indicating that more sustainable tourism can increase both the local contribution and multiplier effect. Within a given (or similar) destination, local contribution and multiplier increase the more the local community is involved in the tourism value chain, through the supply of products, labour, tourism services and, increasingly, "green services." The few available meta-studies indicate considerably higher multipliers for natural and culturally-oriented destinations (Chang 2001). And destination specific studies, such as Brenes (2007) for Costa Rica indicate similar effects. The logic is sound—more local purchases (substituting imports) will increase local contribution, and the income effect will be greatest when local actors are the beneficiaries of those linkages.

Poverty reduction

When tourism-related income grows with a substantial reorientation in favour of the poor, poverty can be reduced. In this regard, UNWTO launched in 2002 the ST-EP (Sustainable Tourism for the Elimination of Poverty) initiative, aimed at reducing poverty levels through developing and promoting sustainable forms of tourism.[10] Increased tourism, local contributions and multiplier effects can accrue to wealthy, middle income, or poor alike. Therefore, interventions must be made to help poor people become part of the processes that drive the industry (ILO 2010a). Investors and developers, as well as local and national governments, play a critical role in determining the role poorer populations play in the tourism industry. The local industry can also help by engaging in and encouraging the use of local companies for the provision of transport, services and food in order to generate local income and employment multipliers and contribute to alleviate local poverty:

■ In the case of Malaysia, TPRG (2009) describes the case of accommodation businesses and the shares of income generated and distributed across the chain. The final impact on local communities depends on the business structure and the economic activities related to tourism. In the case of the accommodation sector, most income is captured by hotel owners. However, an important share is received by small-business owners and local people involved in informal activities (Figure 2). From all tourism expenditure, 28 per cent is captured by hotels, while crafts artisans obtain 5 per cent and local small businesses 11 per cent.

■ In Zanzibar, Tanzania, Steck et al. (2010) estimate that only 10.2 per cent of total tourism income is captured by "poor" local people. The study found that the industry is heavily dependent on imports for both primary supplies and staff of suitable quality, both of which are normally avenues for participation of locals.

■ In Panama, households capture 56 per cent of total local tourism income (Klytchnikova and Dorosh 2009). Which households benefit the most, however, depends on the region in which the tourism revenues are generated. In the Colón Zone, most of the gains in household incomes (63 per cent) go to urban non-poor households and only 20 per cent of the income gains accrue to poor households. In contrast, in Bocas del Toro, where poor households account for a larger share of the regional labour force, 43 per cent of the total increase in household incomes accrues to the poor while the percentage gain in household incomes is nearly the same across household groups. The results for Chiriqui Province report household income gains received by the poor of 19 per cent, although the share earned by rural households is higher (46 per cent).

Empirical studies suggest that, at best, between one-fifth and one-third of total tourist expenditure in the destination is captured by "the poor" from direct earnings and supply chains (Mitchell and Ashley 2007). The impact of tourism on poverty depends on various factors including employment, the skill level of the labour force, changes of prices (goods and services and factors of production), ownership of micro and small enterprises and labour-market composition. As with income effects, there is increasingly convincing evidence that more sustainable tourism (particularly in rural areas) can lead to more positive poverty-reducing effects.

■ In Costa Rica, Rojas (2009) estimated the impact of tourism on poverty levels and found that without

10. The Sustainable Tourism for Eliminating Poverty (ST-EP) initiative has identified seven different mechanisms through which the poor can benefit directly or indirectly from tourism: (1) Undertaking measures to increase the level of the poor working in tourism enterprises; (2) Maximising the proportion of tourism spending that is retained in local communities and involving the poor in the supply process; (3) Promoting the direct sales of goods and services to visitors by the poor from informal businesses; (4) Establishing and managing more formal tourism enterprises by the poor, either individually or at a community level; (5) Using taxes or levies on tourism income or profits with proceeds benefiting the poor; (6) Supporting the poor in money or in kind, by visitors or tourism enterprises; and (7) Investing in infrastructure that offers local communities the chance to gain new access to available resources (UNWTO 2004b).

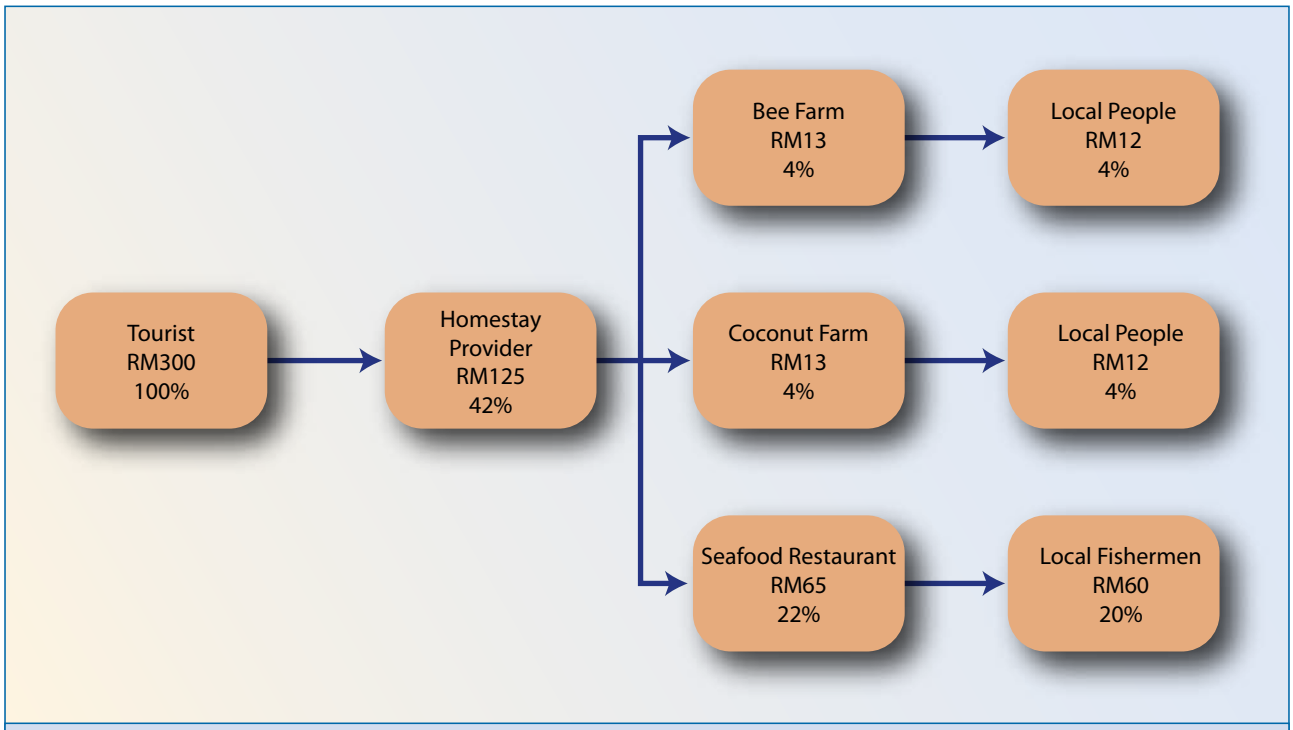


Figure 2: Accommodation linkages and tourist income distribution in Tanjong Piai, Malaysia
Source: TPRG (2009). Note: RM=Ringgit Malaysia (1 RM=US$0.30)

tourism incomes the local incidence of poverty would be higher in urban and rural sectors (Table 2). This result is consistent with other studies for the country. For instance, CEPAL (2007) estimates that tourism contributes to a reduction in poverty of 3 per cent in Costa Rica (and 1 per cent in Nicaragua). From a site comparison perspective, Brenes et al. (2007) estimated the impact of Tamarindo (mass tourism destination) and La Fortuna (natural and adventure attractions destination) and found that average monthly wages in La Fortuna (US$437) were higher than in Tamarindo (US$392). Moreover, they estimated a 0.64 probability of income improvement for La Fortuna inhabitants when working in the tourism sector. The evidence indicates that tourism is contributing to poverty reduction in Costa Rica, with the sustainability approach of the country as a driver of living conditions improvement.

■ In Malaysia, using a value-chain analysis, TPRG (2009) finds that economic benefits received by local people account on average for 34 per cent of total income generated by tourism. The relatively high "pro-poor" income share, particularly in restaurants (Table 3), may reflect various public and private initiatives to employ or involve locals in tourism business operations.

3.4 Environmental benefits

There is increasing motivation from both the private and public sectors to invest in making tourism more sustainable. Although the availability of global investment data specific to "sustainable tourism" is currently not of a sufficient quantity to draw any robust conclusions, it is clear that there is an increased awareness of the need and value of conserving unique natural, social and cultural assets of destinations.

Private and public investment in tourism includes infrastructure (roads, airports, national parks, private reserves, hospitality installations and other sites and facilities); environmental conservation (natural attractions, beaches, mountains, rivers, biodiversity, natural barriers and endemic species); education

	With tourism income	Without tourism income
National	17.69%	19.06%
Urban	16.93%	18.40%
Rural	18.73%	20.0%

Table 2: Impact of tourism on poverty rates in Costa Rica, 2008
Source: Rojas (2009)

	Share in tourism revenue	Share of PPI
Accommodation and hotel meals	88.4%	7.3%
Restaurants	4.4%	47.0%
Retail	3.7%	27.0%
Tours and excursions	3.0%	18.8%
Other	0.5%	n.a

Table 3: Breakdown of tourism income and pro-poor income (PPI) contribution in Malaysia
Source: TPRG (2009)

(labour-force skills, including the "greening" of the skills base); capacity building; and technology improvements (cleaner production, sustainable management). Investment in sustainable tourism offers a wide range of opportunities, notably in the areas of water, energy, waste and biodiversity, which can generate significant returns.

There is a growing trend within the tourism industry of investment in sustainability. For instance, the Accor hotel chain has been testing environmental technologies such as photovoltaic electricity, grey water re-use and rain-water recovery. Additional capital expenditure in energy efficiency and sustainable construction and renovation projects is estimated at a relatively modest 6 per cent of total construction costs (for a 106-room hotel), with excellent returns (WTTC 2009). Sol Meliá Hotels & Resorts have institutionalised their sustainability programme with independent certification for the company, including hotels and corporate offices on an international level, and a specific budget for the strategic project of sustainable development, financed entirely by company funds (WTTC 2010).

Energy

In hotels and other accommodation there is considerable scope for investment in energy-efficient features and services, including refrigeration, television and video systems, air conditioning and heating (particularly reduction or elimination of these systems through improved design), and laundry. Such investments are driven by increasing energy costs; likely carbon surcharges; increasing expectations of customers (particularly from Europe and North America); technological advances with low-carbon technology; and in some cases, government incentives. Many leading airlines are exploring alternative fuel strategies, as well as changes in routing, aircraft and flight practices. The railroad industry, particularly in Europe, is positioning itself as a "green" and "community-linking" alternative to air travel. Increased energy efficiency for tourism translates as reduced operational costs, increased customer satisfaction, and higher investment in energy efficiency (through retrofits and improvements).

Evidence suggests that investment in a more efficient use of energy in the sector generates significant returns (Box 2). Hamele and Eckardt (2006) reported the results of environmental initiatives in European hotels, bed & breakfast and camping sites, on energy consumption. On average, energy costs in hotels represented about 6 per cent of their annual turnover, whereas in the "best practice" establishments, this expense factor typically represented 1.5-2.8 per cent. Recent studies have shown that a 6 per cent increase in investment in energy-efficient design & equipment can lower electrical consumption by 10 per cent (Six Senses 2009); low-cost water-efficient design and operation can reduce consumption by 30 per cent (Newsom et al. 2008, Hagler Bailly 1998), and

Box 2: Investment in energy efficiency and savings

Six Senses, a luxury hotel group, reports that the return on investment of various energy-savings measures applied in resorts located in Thailand ranges from six months to ten years:

- The energy monitoring system cost US$4,500, enabling the resort to achieve 10 per cent energy savings as well as to identify areas for further savings;
- Investment for the mini chiller system was US$130,000, which saves US$45,000 annually, and thus pays off in 2.8 years;
- The heat-recovery system cost US$9,000, saving US$7,500 annually, corresponding to 1.2 years payback time;
- The laundry hot-water system cost US$27,000, saving US$17,000 annually (1.6 year payback time);
- Efficient lighting cost US$8,500, resulting in US$16,000 savings per year, i.e. taking six months to pay back (not considering the longer life-span of the lights);
- Investment in a water reservoir was US$36,000, leading to annual savings of US$330,000 (less than a month payback time);
- Biomass absorption chillers cost US$120,000 resulting in US$43,000 saving annually, i.e. 2.8 years payback; and
- Medium voltage (6.6kV) underground electric copper cables cost US$300,000. Payback is roughly 10 years from lower energy loss, but other benefits include less radiation, less power fluctuation, reduced fire risk and a prettier resort compared to old hanging low voltage electrical cables.

Source: Six Senses (2009)

that overall financial cost-recovery of a destination's green strategy (ratio of present value savings to present value capital expenditures) can be between 117 per cent and 174 per cent for investment recovery from hotel buildings operation efficiency (Ringbeck et al. 2010).

Rainforest Alliance (2010) presents an estimate of costs and benefits of sustainable-energy management practices for a sample of 14 tourism businesses in Latin America (Belize, Costa Rica, Ecuador, Guatemala and Nicaragua) based on GSTC indicators. The energy bill was reduced in 64 per cent of companies, with average annual savings of US$5,255 (maximum of US$17,300). Required investment ranged from 1 per cent to 10 per cent of annual operations costs. Average investment was US$12,278 (maximum US$56,530). The average payback of investments is 2.3 years.

Water

Internal water efficiency and management programmes, and investments in water-saving technology in rooms, facilities and attractions reduce costs. Greater efficiency and improved management allows for the increase of number of rooms/visitors in water-constrained destinations. With regard to the most water-consuming factor, irrigation, considerable reductions can be achieved through alternative gardening (choice of species, landscaping) as well as the use of grey water. Golf courses can be designed to require less water, and operators can measure soil moisture to help control and optimise water use. Hotels with spas and health centres can engage in a range of water-saving measures, while new hotel constructions can seek to avoid pool landscapes and other water-intensive uses (Gössling 2010).

With regard to direct water use for tourists, Fortuny et al. (2008) demonstrated that many water-saving technologies relevant to hotels and other businesses have short payback times (between 0.1-9.6 years), making them economically attractive. Investments in water-saving systems, grey water reuse and rainwater collection and management systems can help reduce water consumption by 1,045 m^3 per year, or a 27 per cent lower volume per guest per night.

Rainforest Alliance (2010) estimates the costs and benefits of sustainable tourism management practices for a sample of 14 businesses in Latin America (Belize, Costa Rica, Ecuador, Guatemala and Nicaragua) based on GSTC indicators. The water bill was reduced in 31 per cent of companies, with average annual savings of US$2,718 (maximum of US$7,900), a particularly large number given the very low price of water charged in those countries. Required investment ranged from 1 per cent to 3 per cent of annual operations costs. Average investment was US$2,884 (maximum US$10,000). Average annual savings were US$2,718, for a payback period of 1.1 years.

Waste

Improved waste management provides opportunities for business and society. Lower levels of generation improves financial return for private sector actors, and better management of that waste creates opportunities for jobs, and enhances the attractiveness of destinations. Hamele and Eckardt (2006), reporting the results of an analysis of 36 hotels in the 2 to 4-star categories in Germany and Austria, showed average values per overnight-stay for solid waste (1.98 kg) and waste water (6.03 litres). The average cost of managing these two waste streams is €0.28 per occupied room night. Rainforest Alliance (2010) presents an estimation of costs and benefits of sustainable tourism management practices for a sample of 14 very small businesses in Latin America (Belize, Costa Rica, Ecuador, Guatemala and Nicaragua) based on GSTC indicators where solid waste was reduced in 71 per cent of companies, with average annual savings of US$3,600.

Biodiversity

UNEP (2010) argues that biodiversity conservation will be greatly affected by the way in which tourism grows and develops, especially in developing countries hosting biodiversity hotspots, where tourism is expected to become increasingly important. Demand growth for experiences that involve contact with wildlife and pristine (or near pristine) ecosystems and the expectations from guests that tour operators respect and protect the natural resource base are increasingly driving changes in the tourist industry. Policies of mainstream tourism are likely to change towards more effective conservation of sensitive ecosystems, driven by market demand and large operator programmes (for instance, cruise-industry guidance on coastal systems). Moreover, the increasing trends for nature-based tourism will encourage conservation and tourism revenues (including protected-area fees) to grow in tandem. Current trends towards increasing nature-based and ecotourism are likely to continue or accelerate as pristine areas become increasingly rare, leading in turn to the incorporation of natural areas in tourism development and greater transfer of benefits toward natural areas.

Conservation and restoration provides a highly profitable, low-cost investment for maintaining ecosystem services (Box 3). Avoiding loss of ecosystems by conservation, particularly of forests, mangroves, wetlands and the coastal zone, including coral reefs, is a sound investment from a cost-benefit analysis. This appears to hold from both a societal investment perspective as well as a private one. The review of dozens of restoration projects worldwide concludes that restoration compared with biodiversity loss provides a benefit/cost ratio of 3 to 75

Box 3: Strengthening the Protected Area Network (SPAN)

Strengthening the Protected Area Network (SPAN) is an initiative funded by the Global Environment Facility (GEF) designed to maximise the potential of the protected-area system in Namibia by strengthening its management and establishing partnerships. It is a six-year project with a GEF grant of US$8.5 million and co-financing amounting to US$33.7 million. GEF analysis indicates that tourism in Namibia's protected areas contribute to 3.1 to 6.3 per cent of the country's GDP. Investment by the government of Namibia in the past 20 years has achieved a rate of return of 23 per cent. The government has increased the annual budget for park management and development by 300 per cent in the past four years. A quarter of the park-entrance revenue is to be reinvested in park and wildlife management through a trust fund, providing additional sustainable financing of US$2 million annually. First implemented in 2007, The National Policy on Tourism and Wildlife Concessions on State Land has approved more than 20 new tourism and hunting concessions. After two years it had generated more than US$1 million annually in fees payable to the government. Local communities were granted most of the concession rights in protected areas, creating revenue and jobs for local people.

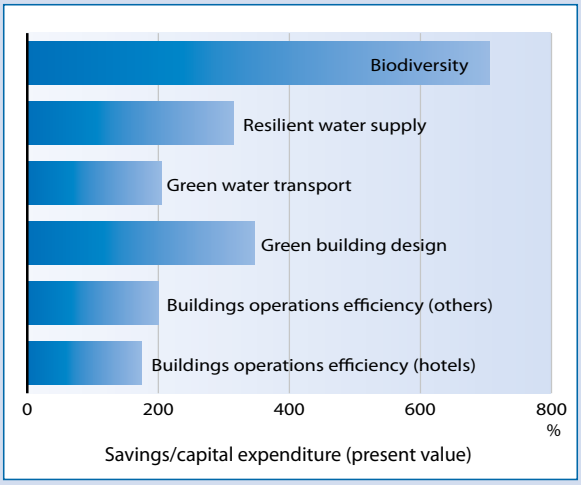
Source: GEF (2009)

in return of investments and an internal rate of return of 7 to 79 per cent (Nellemann and Corcoran 2010).

More than 70 per cent of Latin American hotels surveyed by Rainforest Alliance (2010) support biodiversity conservation while 83 per cent of them indicate that conservation practices have created competitive advantages through operation savings, improved image and process improvements. Ringbeck et al. (2010) report significant returns of green investments in tourism at major sun and beach destinations in Spain (Box 4). The authors estimated a present value of investments (capital expenditure) on water and energy efficiency, emissions mitigation and biodiversity conservation of

Box 4: Financial cost-recovery of green programmes in tourism

Based on its experience with the greening process of one of the world's leading sun-and-beach tourist destinations (a seaside locale in Spain), Booz & Company report significant returns from investment in energy efficiency and GHG emissions, lower water consumption, better waste management practices and biodiversity conservation. The green transformation strategy was developed after a thorough baseline analysis that showed, like most tourist destinations, unsustainable water and energy consumption patterns, problems with waste management and the risk of total depletion of key natural resources such as coral reefs and marine animals (main attractions). Capital expenditure on greening the tourism sector can quickly be offset by the savings in operation costs, which include not only the costs of greening initiatives, but also the socioeconomic effects of lost tourism revenue. Savings by reducing operation costs from green programmes, compared with the capital expenditure, range from 174 per cent (hotel buildings operation efficiency) to 707 per cent (biodiversity conservation). Private investment and public funding was used to secure sufficient funding. The greening transformation followed a three-step process, including an assessment of the destination's environmental status, the development of a green strategy and the collaborative execution of projects related to the green strategy.



Source: Ringbeck et al. (2010)

US$1 billion and a significantly higher present value of savings (US$2.5 billion), with strongest investment recovery from biodiversity.

3.5 Cultural heritage

The largest single component of consumer demand for more sustainable tourism is for cultural authenticity (CESD and TIES 2005). Cultural heritage includes living cultures, both mainstream and minority, as well as historical, religious, and archaeological sites. Tourism can offer opportunities for continuation, rejuvenation or enhancement of traditions and a way of life.

Culture is rarely static, and linking tourism and cultural survival may bring benefits as well as changes and challenges for a community to address. The possible socio-cultural costs and benefits of tourism to a vulnerable culture are rarely quantified. Tourism projects need to include a programme to monitor economic and cultural benefits so that vulnerable cultures can assess and manage the impacts of tourism on their communities (Wild 2010). Aside from the intangible benefits, most commentators believe that investment in cultural heritage is among the most significant, and usually profitable, investments a society, or tourism sector, can make (Box 5).

3.6 Modelling tourism[11]

To quantify the likely effects of increased investments in tourism, the green investment scenario (G2) simulated in the modelling exercise allocates on average 0.2 per cent of global GDP[12] (or US$248 billion at constant 2010 US dollar prices) per year between 2011 and 2050 to the tourism sector, which is further disaggregated into energy, water and waste management, staff training, and biodiversity conservation.[13] The green investment represents 4% of tourism GDP. This would most likely comprise a mixture of public as well as private investments. Assumptions of the model are presented in Annex 3 and results of simulations are detailed below.

Results of the simulation

The results of the simulations of the green investment scenario indicates that total arrivals of international tourists will increase by 2.8 per cent per year by 2030 and then at a lower rate of 2.5 per cent per year in the longer term to reach 2.6 billion in 2050, which is 30 per cent below the corresponding "business-as-usual" scenario (BAU2) due to the shift towards less frequent -but longer- trips in the green scenario[14]. The immediate impacts of international and domestic tourism will lead to a yearly direct tourism expenditure of US$11.3 trillion on average between 2010 and 2050 in the green investment scenario (in such areas as sales in the hotel sector, hotel payments for wages and salaries, taxes, and supplies and services). These direct expenditures have strong impacts on the destination economies resulting from various rounds of re-spending of tourism expenditure in other industries (i.e., industries supplying products and services to hotels). The total expenditure, including direct and indirect expenditures, will reach US$21.5 trillion on average over the next 40 years in the green scenario. The resulting higher economic growth drives the sector GDP to grow from US$3 trillion today to US$10.2 trillion in 2050, exceeding the corresponding BAU scenario by 7 per cent. Direct employment in this sector is expected to grow to 580 million in the green scenario by 2050, compared with 544 million in the corresponding BAU projection. The training of these new employees requires US$31 billion of investment per year on average in the next 40 years.

Despite the rising flow of tourists, the green investment will lead to significant resource conservation through considerable efficiency improvements and reduction of losses:

11. This section is based on the Millennium Institute's work for the Green Economy Report.

12. Tourism accounts for 5% of global GDP.

13. In the G2 green investment scenario, an additional 2 per cent of global GDP is allocated to a green transformation of a range of key sectors, of which tourism is one (see Modelling chapter for more detailed explanation of scenarios and results).

14. BAU2 refers to the BAU scenario with an additional 2 per cent of global GDP per year invested according to current patterns and trends (see Modelling chapter).

Box 5: Differential economic contribution from cultural areas

In Western Australia, attempts have been made to measure the economic value of cultural heritage through direct tourism expenditure, using three locations: the city of Freemantle, the city of Albany and the town of New Norcia. In order to determine the proportion of the total overnight visitor expenditure that could be directly attributable to cultural heritage, an attribution factor was generated based on data from visitor surveys and other sources. The study found that between 63 per cent and 75 per cent of a visitor's expenditure was due to the cultural heritage of the area, generating in the region of US$40-$80 per visitor per day.

Source: Tourism Western Australia (http://www.westernaustralia.com, accessed on September 10, 2010)

■ Tourism **water consumption** is projected to be 6.7 km^3 in 2050 in the green scenario, undercutting the corresponding BAU scenario by 18 per cent. In the meantime, additional investments are projected to increase water supply, which is essential for many tourism-dependent, water-stressed countries—on average 0.02 km^3 per year above BAU2 from desalination, and 0.6 km^3 per year from conventional sources (treated wastewater, surface and underground water) through better management over the 40-year period.

■ Under the green scenario, tourism **energy supply and demand** will see both the expansion of renewables and efficiency improvements across all tourism activities. The incremental renewable-energy supply associated with tourism will be 43 Mtoe per year on average, including the expansion and introduction of renewable power generation and biofuels. On the demand side, the total energy consumption for various tourism activities will reach 954 Mtoe in 2050 under the green scenario, representing 44 per cent of avoided energy use relative to BAU2. These savings come from a mix of effective measures in individual activities—a modal shift to less carbon-intensive transport (e.g. electrified train and coach), behavioural changes (e.g. shorter-haul trips) to reduce total travel distance, better energy management (e.g. setting targets and benchmarking for hotels)—as well as across all sectors—technological advances in fuel efficiency and fewer inefficient uses due to better equipment or greater environmental awareness. More specifically, tourism transport, thanks to the transport-sector investments, will see the largest saving (604 Mtoe below the corresponding BAU scenario), followed by tourist accommodation, with 150 Mtoe of avoided consumption in 2050.

■ As a result of these energy savings, **CO_2 emissions** will be mitigated substantially relative to the corresponding BAU projection (-52 per cent by 2050), returning to the current level of 1.44 Gt in 2050, or 7 per cent of global emissions. The relative increase of the share of global emissions generated by tourism derives from a projected growth of tourism GDP higher than the average projected growth of global GDP. Tourism is expected to grow faster than most other sectors; and, without green investments, its environmental impacts would be much higher. By 2050, transportation is still the principal emitter (0.7 Gt), with aviation and cars accounting for 74 per cent and 24 per cent of the reduction respectively. Accommodation, as the second-largest emitter, will account for 0.58 Gt of emissions in 2050. The remaining CO_2 emissions (98 Mt) are caused by other tourism activities. In addition to the mitigation of CO_2 emissions in the green economy, as climate is a key resource for tourism and the sector is highly sensitive to the impacts of climate change, these sustainable practices will strengthen the capacity of tourist destinations to adapt to unfavourable climatic conditions.

■ Furthermore, the investment in tourism **waste management** allow for a higher rate of waste collection and reuse (recycling and recovery). In 2050, 207 Mt of waste will be generated by the tourism sector in the green scenario, compared with 180 Mt in the corresponding BAU scenario (due to higher GDP and tourist visitor nights in green scenarios). On the other hand, green investment is estimated to allow 57 Mt more reuse of waste than in the corresponding BAU scenario, therefore cutting net waste disposal (taking into consideration waste reuse) in 2050 by 30 Mt relative to BAU2.

■ These savings will result in potential avoided costs that can be reinvested in socially and environmentally responsible local activities (such as protected areas, local transportation or staff capabilities and skills), increasing the indirect and induced effects of tourism expenditure on local development. In particular, spending by visitors from wealthier regions to developing countries helps to create much-needed employment and opportunities for development, reducing economic disparities and poverty.

4 Overcoming barriers: enabling conditions

Tourism can have positive or negative impacts depending on how it is planned, developed and managed. A set of enabling conditions is required for tourism to become sustainable: to contribute to social and economic development within the carrying capacities of ecosystems and socio-cultural thresholds. This section presents recommendations to create the enabling environment for increased investment in sustainable tourism development, overcoming barriers in the areas of (1) private-sector orientation; (2) destination planning and development; (3) fiscal and government investment policies; (4) finance and investment; (5) local investment generation. Recommendations are based substantially on the policy recommendations of the International Task Force on Sustainable Tourism Development (ITF-STD).[15]

Tourism market tendencies indicate that the main drivers towards sustainable tourism investment decisions are consumer demand changes; business actions to reduce operational costs and increase competitiveness; coherent policies and regulations for environmental protection; technology improvements; private efforts for environmental and social responsibility and natural resource conservation. These are leading the transformation of the industry and determining the returns on investments.[16] The systemic characteristic of a sustainable tourism industry stresses the need to invest more in energy and water efficiency, climate-change mitigation, waste reduction, biodiversity conservation, the reduction of poverty, the conservation of cultural assets and the promotion of linkages with the local economy. The savings and higher returns expected from actions in those areas can simultaneously be invested in new green investment projects, creating a self-enforcing greening dynamic that could enhance competitiveness and strengthen sustainability.

A cross-cutting barrier to greener or more sustainable tourism investment is the lack of understanding and recognition of the value created for companies, communities and destinations from the greening of tourism. The sharing of knowledge, information and experiences among public, private and civil society actors is a necessary first step towards overcoming these barriers.

4.1 Private-sector orientation

Tourism is a heterogeneous industry[17] where hundreds (and sometimes thousands) of actors operate in multiple market segments, even within a single country or region. These segments include conventional and mass tourism as well as niche areas such as ecotourism, adventure tourism, rural tourism, community-based tourism, sports fishing, cruise tourism and more recently, health tourism. The principal businesses within the tourism industry are accommodation, tour operation, and transport (land, air, and aquatic). In addition, tourism has diverse linkages through several economic activities, from lodging, entertainment and recreation, to transportation, professional services and advertisement, among others.[18] While all can and should benefit in the medium to long term, greening will require very different actions and investments, and benefit companies in different ways—there is no single strategy or "recipe" for all to follow. A coherent strategy for green tourism growth must, therefore, cover all segments and activities, and the ways in which they interact.

The tourism industry is dominated by small and medium sized enterprises (SMEs). Although online travel agencies and large conventional tour operators control an important share of international travel from Europe and North America, tourism destinations are characterised

15. The ITF-STD was comprised of members from UNEP, UNWTO, 18 developed and developing countries, seven other international organisations, seven non-governmental organisations, and seven international business associations. It was an outcome of the 2002 World Summit on Sustainable Development, which declared that "fundamental changes in the way societies produce and consume are indispensable for achieving global sustainable development". The work of the Task Force will continue with its successor, the Global Partnership for Sustainable Tourism.

16. Drivers and likely implications of sustainable investments in key strategic areas for tourism (energy, climate change, water, waste, biodiversity, cultural heritage and the local economy) are summarised in Annex 2.

17. Tourism does not fit the standard notion of an "industry" because it is a demand-based concept. It is not the producer who provides the distinguishing characteristics that determine how tourism is classified, but rather the purchaser, i.e. the visitor (OECD 2000).

18 The Tourism Satellite Account (TSA) indicates that "tourism industries comprise all establishments for which the principal activity is a tourism characteristic activity." Tourism characteristics consumption products and tourism industries are grouped in 12 categories: accommodation for visitors, food and beverages serving activities, railway passenger transport, road passenger transport, water passenger transport, air passenger transport, transport equipment rental, travel agencies and other reservation services activities, cultural activities, sports and recreational activities, retail trade of country-specific tourism characteristic goods, and other country-specific tourism characteristic activities (see UNWTO 2010c).

by the predominance of smaller businesses. For example, close to 80 per cent of all hotels worldwide are SMEs (WEF 2009a) and, in Europe, this figure is 90 per cent.[19] Additionally, providers of goods and services for the industry tend to be small, local businesses. Reaching out to such a wide variety of small businesses, across numerous sectors, continents and languages is a daunting task. Without information, knowledge and tools, greening will be nearly impossible. Nonetheless, engaging these critical actors is a necessary condition for a sustainable industry. In Nepal, for instance, incentives for private-sector participation in capacity-building events and the implementation of sustainable action plans have helped to increase their access to international sustainable tourism markets, improved project performance and stimulated interest among other companies in Nepal in sustainable tourism business practices, creating synergies throughout the industry (UNEP 2008).

Organisational management is a key element of business sustainability. According to By and Dale (2010), successful management of change (political, economic, social and technological) is crucial for the survival and success of tourism SMEs, particularly with the following eight critical factors: adaptability and flexibility; commitment and support; communication and co-operation; continuous learning and improvement; formal strategies; motivation and reward; pragmatism; and the right people (skilled and motivated collaborators). Kyriakidou and Gore (2005) argue that best performing SME operations in hospitality, tourism and leisure industry share cultural features such as cooperative setting of missions and strategies, development of teamwork and organisational learning.

Tourism businesses are no different to other businesses when it comes to the criteria that must be considered in deciding whether to invest in them. However, there are some specific characteristics that will affect tourism business costs (Driml et al. 2010):

■ Tourism businesses are relatively labour-intensive and therefore labour costs often make up the largest proportion of operating costs;

■ The cost of inputs for capital investment and operation are higher for remote locations;

■ The cost of capital will attract a premium if there is uncertainty about returns from investment in tourism;

■ The price of land in tourist-desirable locations will be governed by competition with other land uses which may be able to pay more (due to higher returns);

■ Project planning and approvals cost will be high if assessment is lengthy or complex; and

■ Labour and land make up a high proportion of inputs and are subject to payroll tax and land tax.

A question is how to address these *basic* issues while making sustainable investment decisions. In this regard, the ITF-STD recommends that "tourism businesses and government institutions in charge of tourism should adopt innovative and appropriate technology to improve the efficiency of resource use (notably energy and water), minimise emissions of greenhouse gases (GHG) and the production of waste, while protecting biodiversity, helping reduce poverty and creating growth and sustainable development conditions for local communities." The business case for investing in these areas is sound. At the private-sector level, hotel owners, tour operators, and transport services can play a key role in protecting the environment and influencing tourists to make sustainable choices. Increased public environmental awareness, including traveller awareness, has contributed to the development of a host of voluntary industry initiatives and the definition of environmental performance at the national, regional and international levels (UNEP 1998). Many larger corporations are already addressing their environmental and social impacts. In many countries, SMEs account for the vast majority of businesses and can have a significant environmental impact; however, they tend to be more reactive to addressing environmental issues (Kasim 2009). Nevertheless, increasing pressure from consumers could force them to address more impacts in order to remain competitive.

Enabling conditions for engaging the industry

1. Tourism promotion organisations, resource management agencies and destination management organisations (DMOs) should link tourism products (i.e. parks, protected areas and cultural sites) more closely with marketing positions. This will ensure a consistent and unique selling position in world tourism markets based on high-value experiences at natural and cultural sites in a compact geographical area.

2. Tourism industry associations and wider industry platforms play an important role in engaging tourism businesses in sustainability as well as developing practical tools to respond to many common challenges. As in most industries, the concept of Corporate Social Responsibility is increasingly recognised in the tourism sector and is being promoted by industry bodies, at the international as well as national levels. However, a formal response, including measures such as triple-bottom-line reporting, environmental management systems and certification appears to be prevalent only within

19. www.hotelenergysolutions.net, accessed on September 30, 2010.

a selection of larger firms. Smaller firms are largely outside this sphere, and diverse supplier groups may not be connected at all. Experience in many countries has shown that well designed mechanisms and tools to educate SMEs are critical, but are most effective when they are accompanied by concrete, actionable items.

3. International development institutions, such as multilateral and bilateral cooperation agencies, and Development Finance Institutions (DFIs) should engage directly to inform, educate and work collaboratively with the tourism industry to integrate sustainability into policies and management practices, and secure their active participation in developing sustainable tourism. At the national level, government and civil-society engagement should be a critical part of these efforts to coordinate action.

4. The increased use of industry-oriented decision-support tools would help speed the adoption of green practices. Hotel Energy Solutions, TourBench and SUTOUR are examples of projects designed to provide assistance to Europe's tourism enterprises to identify potential investments and cost-saving opportunities for sustainable decision making to ensure profitability and competitiveness (saving money and investment in ecological building measures and equipment with low energy consumption); provide visitor satisfaction (fulfilling their demands and expectations for high environmental quality); achieve efficient use of resources (minimising the consumption of water and non-renewable energy sources); secure a clean environment (minimising the production of CO_2 and reducing waste); and conserve biological diversity (minimising the usage of chemical substances and dangerous waste products).

5. The promotion and widespread use of internationally recognised standards for sustainable tourism is necessary to monitor tourism operations and management. The private sector tends to perform best when clear criteria, objectives and targets can be identified and incorporated into their investment plans and business operations. The Global Sustainable Tourism Criteria (GSTC), issued in October 2008, provides the most promising current platform to begin the process of grounding and unifying an understanding of the practical aspects of sustainable tourism, and prioritising private sector investment.[20] The GSTC should be adopted in order to assess industry's performance and support policy recommendations. At a national and even sub-national level, GSTC, supported by information sharing and access to experts and experienced "greening" pioneers, is a critical step.

6. Economies of scope in the tourism sector could be achieved by means of *clustering*. A high environmental quality is a key input by those companies that pursue competitive advantages based on sound environmental management. In the case of tourism, the conservation of the natural capital of a country has a chainable effect and complementary influence on many firms. Clustering can strengthen backward and forward linkages in the tourism value chain and drive sustainability in the whole industry. Natural and cultural attractions are the most valuable assets for tourism development. The tourism *cluster* must become actively engaged in environmental management and conservation. Active collaboration with the public sector and community organisations will strengthen competitive position for the entire cluster. In the case of Croatia, for instance, Ivanovic et al. (2010) show that small businesses dominate the tourism market share in the total number of enterprises and generate the highest employment rates and income. However, they also show the lowest rate of productivity. This situation partly results from limited understanding of the potential benefits of clustering in tourism, including economies of scale; growth of technological and organisational know-how, and higher market share.

4.2 Destination planning and development

Destination planning and development strategies will be a critical determinant for the greening of tourism. Every destination is unique, and therefore each development strategy must be sensitive to the destination's unique assets and challenges, while creating a vision to deliver the destination's goals for environmental sustainability. Destination planners and policy officials are frequently unaware of the opportunities that greener tourism can bring to their destination. And even those who are aware usually lack the skills or experience necessary to build sustainability into new or ongoing destination development efforts.

Advancing greening goals through tourism planning and destination development requires the ability and institutional capacity to integrate multiple policy areas; consider a variety of natural, human and cultural assets over an extended time frame; and put in place the necessary rules and institutional capacity. A destination cannot successfully implement a green tourism strategy

20. The Global Sustainable Tourism Criteria Partnership began in 2007 and member organisations include the World Tourism Organization (UNWTO), United Nations Environmental Programme (UNEP), United Nations Foundation, Expedia.com, Travelocity-Sabre, and over 50 other organisations (Bien et al. 2008).

without the right laws and regulations in place, or the right governance structure to oversee them. Legislation should protect the environment, limit potentially harmful development, control detrimental practices, and encourage healthy behaviour. Clear rules in these areas, based on the destination strategy and its unique asset base, determine the direction, scale and scope of government and private investment in more sustainable tourism.

Enabling conditions for greener destination planning

1. Higher-level government, community and private tourism authorities must establish mechanisms for coordinating with ministries responsible for the environment, energy, labour, agriculture, transport, health, finance, security, and other relevant areas, as well as with local governments. Clear requirements such as zoning, protected areas, environmental rules and regulations, labour rules, agricultural standards, and health requirements (particularly for water, waste and sanitation) establish clear "rules of the game," and define the operating climate for investment. These decisions relate very closely to fiscal and investment considerations discussed in the following section.

2. Organisations engaged in developing tourism strategies should make use of credible scientific methods and tools encompassing economic, environmental and social approaches and assessments for sustainable development that will help stakeholders related to different components of the value chain understand their environmental and socio-cultural impacts.

3. Tourism Master Plans or Strategies provide a supply-side approach for developing a tourism destination. Environmental and social issues must be included in these plans in order to manage the critical assets and promote greener outcomes. Green transformation programmes will be more effective if produced by a multi-stakeholder participatory planning process, as well as through the development of partnerships at local, national, regional and international levels. Multilateral environmental and social agreements and the organisations that support them should be included in the process.[21] Public, private and civil-society stakeholders should make a decision on the kind of tourism industry they want to consolidate in the medium and long terms, considering the possible impacts on the natural resource base and the development opportunities for the country. Therefore, the creation of a sound institutional framework is required. Coordination among key actors and environmental regulations enforcement are key conditions. In addition, when investing in tourism sustainability, main short-, medium- and long-term objectives should be followed, based on:

   ■ The contribution to country macroeconomic balances;

   ■ The creation of local direct and indirect employment;

   ■ The use of local raw materials and inputs;

   ■ The benefits created in other productive sectors (multipliers *outside* the industry);

   ■ The effects on local development and poverty;

   ■ The modernisation, diversification and sustainability of the tourism value chain; and

   ■ The growth of the internal and external demand for sustainable tourism.

4. When promoting sustainable tourism, a coherent destination planning policy is necessary to create a sound international reputation, a *country brand* that differentiates and positions the country competitively. According to FutureBrand (2008), while tourism is often the most visible manifestation of a country brand, it is clear that the image, reputation and brand values of a country impact its products, population, investment opportunities and even its foreign aid and funding. Therefore, a holistic nation approach is required in order to align public and private sector initiatives to create a successful country brand based on sustainability.

5. Assessment of carrying capacity and social fabric should be considered to take into account external and internal impacts of tourism at destination. While it is difficult to evaluate due to great differences from one destination to another, maximum thresholds could be agreed on so as to provide guidance for the development of planning policies.

4.3 Fiscal policies and economic instruments

The greening of tourism will require a more sophisticated use of instruments within government purview, such as fiscal policy, public investment, and pricing mechanisms for different public goods.

21. For instance, the principles of the Global Code of Ethics for Tourism adopted by UNWTO and endorsed by the UN General Assembly as well as the recommendations and guidelines provided by Multilateral Environmental Agreements and conventions, as appropriate, including the Convention on Biological Diversity (CBD), the World Heritage Convention, the United Nations Framework Convention on Climate Change (UNFCCC), the United Nations Convention to Combat Desertification (UNCCD) and the Code of Conduct for the protection of children against sexual exploitation in travel and tourism.

Tourism investment from government should focus on business motivations for sustainable management as key targets. Incentives should be consistent with both environmental protection and value added creation. Market trends and competitive advantages need to be mutually reinforced. In this regard, policy coherence is a necessary condition. From a national perspective, sustainable tourism policy should address market failures (including externalities) in a consistent manner, avoiding the creation of additional distortions through government interventions. Like markets, governments can fail. Selected interventions must incentive a more efficient allocation of goods and resources than would occur in the absence of government action. Social policy should address compensation and benefits to workers, access to improved opportunities, human resource development, and value chain integration strategies. In the case of sustainable tourism policies, more coherence in terms of targets (location investments, development of specific areas for destination, national and local infrastructure investments), management (institutional coordination, impact analysis studies) and incentives (effectiveness, cost-benefit, and adequacy) is required to maintain sound competitive advantages. Where possible, the use of incentives should be based on market instruments rather than "command and control" measures. Some forms of market failures deserve special attention, particularly those that prevent learning how new sustainable tourism businesses can be produced profitably (self-discovery externalities), impede simultaneous and integrated investments which decentralised markets cannot coordinate (coordination externalities), and missing public inputs (legislation, accreditation, transport and other infrastructure, for instance).

Enabling conditions in fiscal and government investment policies

1. In the case of tourism, policy intervention towards investment sustainability can be justified as far as enabling conditions promote the sustainable use of natural resources and therefore create positive externalities for the society. Alternative, less productive uses of natural resources (i.e. unsustainable agriculture) or possible depletion activities (i.e. housing construction) could be compensated (for their opportunity cost) with policy instruments that increase profitability for sustainable tourism businesses and generate positive environmental externalities. Free-riding (non-compliance by companies) should be avoided with an effective performance monitoring and impact evaluation mechanism. There is a need to conduct periodical evaluations and impact analysis of tourism incentives, from an economic, social and environmental perspective.

2. Defining and committing to critical government investments in the green enabling environment plays a central role in determining private sector investment and direction. Government investments in protected areas, cultural assets, water, waste management, sanitation, transportation and energy infrastructure investments play a critical role in private sector investment decisions toward greener outcomes. Investments in public infrastructure related to tourism or investments in private tourism businesses should estimate their social and environmental impacts and adopt economic measures to compensate and offset unavoidable impacts.

3. Appropriate taxation and subsidy policies should be framed to encourage investment in sustainable tourism activities and discourage unsustainable tourism. Use of taxation is often resorted to for keeping developments in limits (for instance, taxes on use of resources and services at the destinations) and controlling the specific inputs and outputs (like effluent charges and waste services).

4. Tax concessions and subsidies can be used to encourage green investment at the destinations and facilities. Subsidies can be given on purchase of equipment or technology that reduces waste, encourages energy and water efficiency, or the conservation of biodiversity (payments for environmental services) and the strengthening of linkages with local businesses and community organisations.

5. Establish clear price signals to orient investment and consumption. The price for such public goods as water production and supply, electricity and waste management send important signals to the private sector. Governments frequently price these goods at very low levels (frequently even free) to encourage investment, only to find that low prices encourage waste, place a drain on communities and make it very costly (financially and politically) to raise prices.

4.4 Financing green tourism investments

Environmental and social investments are relatively new, and remain outside the mainstream of financial markets (particularly in developing countries). In many cases, barriers are based on misperceptions or lack of knowledge. For example, for many green investments, payback periods and amounts are not clearly established (due to limited experience with them), creating uncertainty for banks or other investors that can jeopardise financing. Also, the return on many green investments includes easily measurable components (such as energy savings), combined with more difficult

to measure components such as "guest satisfaction" which can make calculating returns tricky.[22]

In other cases, framework conditions in destination countries limit investment. For example, higher interest rates in many countries make investments that are completely viable in wealthy countries, unviable in the local environment. Another frequently cited situation found in many developing countries is that the financial regulatory systems classify "environmental" investments as "non-productive assets", requiring banks to hold greater reserves, resulting in higher interest rates and less investment.

Enabling conditions for finance

1. The single greatest limiting factor for SMEs in moving toward greener tourism is lack of access to capital for this type of investments. Green investments must be seen as value-adding and made on their economic and financial merits, without prejudice. This will require greater private sector awareness of the value of green investment, and also policy coordination with Ministries of Finance and regulatory authorities.

2. Regional funds for local tourism development could help overcome financial barriers for green investments where investments also generate public returns (through positive externalities). Foreign direct investment (FDI), private equity, portfolio investment, and other potential funding sources should be also aligned with sustainable projects and strategies for the tourism industry. Ringbeck et al. (2010) argue that not all green initiatives are financially possible for the local or national parties undertaking them, and destinations are not always able to generate enough revenue through their own resources. When local financial resource limitations exist, obtaining external funding could help ensure the long-term sustainability of investments.

3. Mainstream sustainability into tourism development investments and financing. In this regard, the Sustainable Investment and Finance in Tourism (SIFT) network is working to integrate the expectations of private investors, the leveraged strength of the financing and donor community, and the needs of developing destinations. The SIFT Network aims to establish a common, voluntary standard to encourage greater sustainability in tourism investments by public, private and multilateral investors; intensify financing of sustainable tourism projects; increase sustainable investments in the tourism sector; improve capacity of developing destinations; and leverage unique knowledge and reach others. SIFT efforts should permeate to regional, national and local financial organisations (counterparts), and help integrate other global sustainable financial initiatives (e.g. UNEP FI, Equator Principles) to support green investments in tourism.

4. Establish partnership approaches to spread the costs and risks of funding sustainable tourism investments. In the case of small and medium enterprises, for example, besides sliding fees and favourable interest rates for sustainability projects, in-kind support like technical, marketing or business administration assistance, could help to offset the cash requirements of firms by offering them services at low cost. In addition, loans and loan guarantees could include more favourable grace periods, soften the requirements on personal asset guarantees or offer longer repayment periods. Loans for sustainable tourism projects could be set up with guarantees from aid agencies and private businesses, lowering risk and interest rates.

4.5 Local investment

As discussed above, sustainable tourism creates additional opportunities to increase local economic contribution from tourism. An often-overlooked aspect of these linkages is that they also offer opportunities for increased investment in local communities. Capitalised and formalised businesses in the tourism value chain enhance local economic opportunity (through employment, local contribution and multiplier effects) while also enhancing local competitiveness among tourists demanding greater local content. This win-win situation is recognised in the UNWTO's ST-EP initiative. Notably, many of the targeted mechanisms are investment enhancing as well as local-income enhancing.

This promotes a greater number and variety of excursions in a given destination, a "buy local" movement in food and beverages sector and growth of specialised niches. Efforts by tourism businesses to include local communities within value creation, public and private initiatives of local workers training, and the development of infrastructure and supporting industries, creates new conditions for business development, more equitable growth and less leakage. These businesses require investment, and can expect substantial growth opportunities in successful destinations.

Enabling conditions for increasing local contribution

1. Strengthen tourism value chains to back SME investment. Destination tourism is usually stable enough to provide sufficient guarantees for investors

22. For example, Frey (2008) found in a survey of South African tourism businesses that 80 per cent of respondents agree that responsible tourism management leads to enhanced employee morale and performance, improves company reputation and is an effective marketing tool. However, businesses are not investing sufficient time or money into changing management practices.

and bankers. Long-term contracts for products and services to hotels or other "anchor" businesses create suitable conditions, and simple mechanisms to monitor performance.

2. Expand the use of solidarity lending mechanisms to permit groups of local suppliers to access credit and build capital. Solidarity lending (guarantees provided by a peer group) has proven successful in fisheries, agriculture, and handicrafts – all industries of critical importance to successful sustainable tourism destinations.

3. Enhance development bank access to individuals and small businesses that are not eligible for credit, or are involved in the provision of public services (such as protected areas management, guiding, waste management, infrastructure construction, among others).

4. Establish seed funds to permit new green industries to develop locally. For example, solar collectors and photovoltaic systems can be imported as complete systems, or can be assembled locally from imported components. The latter encourages local investment and promotes local economic contribution. It also permits adaptation of the technologies to better suit local tourism needs.

5 Conclusions

Tourism is a leading global industry, responsible for a significant proportion of world production, trade, employment, and investments. In many developing nations, it is the most important source of foreign exchange and foreign direct investment. Tourism growth, environmental conservation, and social wellbeing can be mutually reinforcing. All forms of tourism can contribute towards a green economy transition through investments leading to energy and water efficiency, climate-change mitigation, waste reduction, biodiversity and cultural heritage conservation, and the strengthening of linkages with local communities. Making tourism businesses more sustainable will foster the industry's growth, create more and better jobs, consolidate higher investment returns, benefit local development and contribute to poverty reduction, while raising awareness and support for the sustainable use of natural resources.

The potential economic, social and environmental costs of a "business-as-usual" (BAU) scenario in the tourism industry are not always considered when evaluating the cost of investments toward sustainability. Concern about required investments and financing sources availability are common when considering actions for making tourism more sustainable. Nevertheless, empirical evidence shows that demand for traditional mass tourism has reached a mature stage whereas the demand for more responsible forms of tourism is booming and are predicted to be the fastest growing tourism markets in the next two decades. Tourism-market tendencies indicate that main drivers towards investment in sustainable tourism relate to consumer demand changes, actions to reduce operations costs and increase competitiveness, coherent policy and regulations, technology improvements, stronger efforts for environmental and social responsibility and natural resource conservation. These are leading transformation of the industry and determining the returns on investments.

In a BAU scenario up to 2050, tourism growth will imply increases in energy consumption (111 per cent), greenhouse gas emissions (105 per cent), water consumption (150 per cent), and solid waste disposal (252 per cent). On the other hand, under an alternative greener investment scenario (in energy and water efficiency, emissions mitigation and solid waste management) of US$248 billion (i.e. 0.2 per cent of total GDP), the tourism sector can grow steadily in the coming decades (exceeding the BAU scenario by 7 per cent in terms of the sector GDP) while saving significant amounts of resources and enhancing its sustainability. The green investment scenario is expected to undercut the corresponding BAU scenario by 18 per cent for water consumption, 44 per cent for energy supply and demand, 52 per cent for CO_2 emissions. This will result in potential avoided costs that can be reinvested in socially and environmentally responsible local activities—such as local transportation and staff capabilities and skills—increasing the indirect and induced effects of tourism expenditure on local development. In particular, the spending by foreign visitors from wealthier regions to developing countries helps to create much-needed employment and opportunities for development, reducing economic disparities and poverty, notably through the multiplier effect and the reduction of "leakage".

Tourism can have positive or negative impacts depending on how it is planned, developed and managed. Various enabling conditions are required for transforming tourism to contribute to social and economic development within the carrying capacities of ecosystems.

To promote sustainable tourism in a green economy, the national, regional, and local economy should first provide a good investment climate, featuring security and stability, regulation, taxation, finance, infrastructure, and labour. Various tourism stakeholders should collaborate and share knowledge and tools in order to understand the overall picture of environmental and socio-cultural impacts of tourism activities at destinations. There is also a need for policy coherence, which can include economic instruments and fiscal policy to reward sustainable investments and practices and discourage the most costly externalities associated with uncontrolled tourism expansion. In the case of tourism, government and private tourism authorities should coordinate with ministries responsible for the environment, energy, agriculture, transport, health, finance, security, and other relevant areas, as well as with local governments.

By steering the direction of policy and spearheading sustainability efforts, government authorities can motivate and influence other stakeholders—both public and private—to engage in behaviour that bolsters a destination's sustainability. It is necessary that tourism promotion and marketing initiatives emphasise sustainability as a primary option. To create local development opportunities, marketing efforts should ensure access to domestic and international markets

by sustainable local, small, medium, community-based and other tourism suppliers (especially in developing countries). As the tourism industry is dominated by SMEs, it is also essential to facilitate their access to industry-oriented decision-support tools, information, knowledge as well as to capital. Partnership approaches to lower the costs and risks of funding sustainable tourism investment and in kind support to SMEs should be considered so as to facilitate the shift toward green tourism activities.

The design and implementation of a sustainable tourism *enabling environment* should be based on a sound formal and well-documented analysis. Policymakers should set baselines and measurable targets with regard to short-, medium-, and long-term results of sustainable tourism promotion and marketing. It is important to note that the "success" of tourism destinations should be evaluated not only in terms of "arrivals" but also in terms of broader economic, social and environmental drivers, as well as its impacts. Sustainable tourism policymaking should be based on sound quantitative analysis. Valuation exercises (such as choice experiments) can help identify opportunities for sustainable tourism development from the demand side. Tools such as input-output and general equilibrium models, business surveys, and the Tourism Satellite Accounts (TSA) can support policy design and business strategy. The adoption of international standards and criteria (e.g. GSTC) at a global scale is highly recommended in order to assess comparable results and unify an understanding on the practical aspects of sustainable tourism enabling prioritising of private sector investments. Further, increased adoption of management standards for environmental and labour performance[23] would greatly assist tourism operators in strengthening their internal management capacity to reduce environmental impacts and protect their workers, and enhance capacity to relate to community stakeholders.

The effects of tourism can vary dramatically between destinations. More quantitative studies are necessary to clearly understand the reasons for such variations, to expand the evidence base at a national and sub-national level on tourism and local employment, procurement through local supply chains, poverty reduction, environmental benefits, and other relevant areas. Domestic tourism (in many countries the most important source of tourism income) should be further analysed. Business performance and the determinants of higher ROI on green investments are key variables to study.

This chapter analyses the main variables that influence tourism development and aims to demonstrate that concerted "greener" policies can steer the growth of the sector toward a more sustainable path, generating economic benefits, while strengthening its social and environmental context. Its findings and recommendations are addressed to all tourism stakeholders.

23. Such as ISO 14000 series for environmental management, ISO 26000 series for social responsibility management and S.A. 8000 series for working conditions.

Annex 1: Economic sizing of the sector

Country	Domestic tourism consumption / total tourism consumption (%)*	Tourism gross domestic product / GDP (%)*	Jobs in tourism industries / total jobs (%)*	Tourism investment / total investment (%)**
Australia	73.9	4.1	4.8	12.5
Chile	75.0	3.1	2.6	7.5
China	90.8	4.2	2.3	8.5
Czech Republic	45.3	3.0	3.3	11.0
Ecuador	69.4	4.1	1.8	12.4
Honduras	54.5	5.7	5.3	8.4
Israel	61.0	1.8	2.6	7.6
Japan	93.5	1.9	2.8	5.8
Latvia	51.4	1.9	9.0	7.4
Lithuania	56.4	2.6	2.6	9.8
Netherlands	80.8	3.0	4.3	7.3
New Zealand	56.2	12.0	9.7	15.0
Peru	74.4	3.3	3.1	9.9
Philippines	80.7	6.9	9.7	11.3
Poland	41.0	2.0	4.8	7.1
Romania	47.7	2.2	8.3	7.3
Saudi Arabia	61.5	5.0	3.9	3.9
Slovakia	44.1	2.9	7.3	11.4
Slovenia	43.0	4.9	11.5	12.0
Spain	42.3	10.9	11.8	13.8

* Estimated with TSA country data for latest year available (mainly 2007). ** 2009 values.

Table A1-1: Economic relevance of tourism in selected countries

Source: Author's calculations with data from UNWTO (2010c) and WTTC (2010)

Annex 2: Drivers and likely implications of investment in sustainable tourism strategic areas

Strategic area	Sustainability drivers	Likely implications
Energy	■ Increased energy costs ■ Likely carbon surcharges ■ Customers expectations (particularly from Europe and North America) driving operators and entire supply chain ■ Availability of low-carbon technology ■ Possible government incentives ■ Decreasing costs of renewable energy technologies ■ Eco-labels and/or voluntary standards ■ Regulations/legislation on energy efficiency and performance of buildings	■ Maintain or reduce operating costs for tourism operators through energy efficiency ■ Increased customer satisfaction ■ Investment in energy efficiency (retrofits, improvements) ■ New energy-efficient investment stock ■ Investment in more energy efficient features and services (such as efficient refrigeration, television and video systems, air conditioning and heating, and laundry) ■ Differentiation of operators and their value chains ■ Modest shift toward short-haul versus long-haul tourism, with the effect increasing with energy costs (and offset to the extent efficiency is increased)
Climate change	■ Costs of GHG emissions (driven by post-Kyoto rules) ■ Concern of customer base about footprint ■ Host government policies and priorities (climate change mitigation and energy) ■ Uptake of Corporate Social Responsibility (CSR) ■ Climate change impact on tourism sites	■ Same as for energy efficiency ■ Increased substitution of fuels toward electricity, particularly increased investment in passive solar collectors and PV, alternative fuels for vehicles ■ Increased number of project developers orienting business strategies toward lower-carbon footprint ■ Expectations of broader stakeholder base ■ Demand for carbon offsets and other mechanisms to compensate for residual emissions
Water	■ Water scarcity ■ Price for water and conflicts ■ Expectations from travellers for responsible water management ■ Expectations from major tour operators	■ Reduction in water costs from internal water efficiency ■ Investments in water saving technology in rooms, facilities (such as laundry and swimming pools) and attractions (such as golf courses, gardens, and water-based attractions) ■ Increase in number of rooms/visitors in water-constrained destinations ■ Slight advantage to destinations with more abundant water supplies in terms of variety of activities and cost of water resources ■ Increased use of water treatment systems, at firm/project level and destination
Waste	■ Customer demand for clean destination ■ Public opinion ■ Degradation of water resources owing to waste dumping and waste water ■ Pressure from major tour operators	■ Lower pollution and natural resource ■ Improved solid waste management ■ Reduction of open waste dumping sites and poorly managed landfills ■ Investments in waste water management equipment, treatment and disinfection. ■ Investment in sanitary landfills and solid waste recycling capacity ■ Lower sewage and clean-up fees
Biodiversity	■ Increased tourist preference for experiences that involve contact with wildlife and pristine (or near pristine) ecosystems ■ Expectations from guests that operators protect the natural resource base ■ Government regulations regarding sensitive ecosystems such as coral reefs, coastal wetlands and forests ■ National policies to attract resources through tourism capable of protecting critical biological habitat ■ Ecosystem services potential for tourism revenue generation	■ Demand for nature-based tourism likely to accelerate as pristine areas become increasingly rare ■ Increased number of policies and related practices in mainstream tourism to more effectively protect sensitive ecosystems ■ Improved design of individual projects and destinations incorporating biodiversity conservation *in situ*, and through compensatory mechanisms ■ Increased incorporation of natural areas in tourism development and greater transfer of benefits toward natural areas through entrance fees and Payment for Environmental Service (PES) schemes

Table A2-1: Drivers and likely implications of investment in sustainable tourism strategic areas
Source: Author's compilation

Strategic area	Sustainability drivers	Likely implications
Cultural heritage	■ Tourist preference for experiences that involve contact with authentic cultural landscapes ■ Expectations from guests that their tourism operators respect and protect traditional culture ■ Increased awareness of World Heritage Sites ■ Recognition and appreciation for cultural diversity	■ Respect and recognition of traditional culture, particularly in context of assimilation into a dominant culture. Help to community members to validate their culture, especially when external influences of modern life cause the young to become dissociated from traditional life and practices ■ Conservation of traditional lands and natural resources on which the culture has traditionally relied ■ Help to reduce poverty within a community or cultural group; Increased opportunities for young to remain in community instead of seeking alternative opportunities in cities and towns; Meeting needs of cultural group, such as health care, access to clean water, education, employment, and income ■ Reduced risk of losing unique cultural attributes
Linkages with Local Economy	■ Demand for more contact with local communities ■ Greater number and variety of excursions in a given destination ■ "Buy local" movement in food and beverages sector ■ CSR uptake ■ Public and private initiatives of local workers training ■ Growth of specialised niches (ecotourism, rural tourism, adventure tourism, sports fishing, agrotourism, and community-based tourism) ■ Development of infrastructure and supporting industries	■ Concerted efforts by tourism authorities, local officials and civil society organisations to increase local content ■ Responses by tourism operators and increasing use of indicators to track local contribution (which feed into tourism satellite accounts) ■ Deepening of supply chain in local economy, generating increased indirect employment ■ Increased spending in local economy from income effects in direct and indirect employee consumption and purchases ■ Improved income distribution among industry stakeholders ■ Decreased leakage (imports of intermediate goods and foreign workers)

Table A2-1: Drivers and likely implications of investment in sustainable tourism strategic areas

Source: Author's compilation

Annex 3: Assumptions of the model

1. Tourism energy management:
25 per cent of the tourism sector green investment (on average US$61 billion per year) is allocated in 2011-2050 to both energy demand reduction through efficiency improvements and increase of renewable energy supply.

Abatement of emissions from energy use: Emissions from tourism activities are reduced in the green scenario through efficiency improvements in tourism electricity and fuel consumption and behavioural changes towards longer stay and fewer trips, shorter travel distance and transport modal shifts (from aviation and private cars to cleaner transport, e.g. coach and electric railway). This investment adds up to US$18 Bn per year on average over the next forty years, or 29 per cent of the tourism energy green investment in the green investment case (G2). The same rates of efficiency gain and modal shifts as in associated GER sectors are assumed, while the assumption in increase of stay (by 0.5 per cent per year) and reduction of trips (to retain total guest nights) is based on the scenarios presented by UNWTO and UNEP (2008). The investment is estimated by using CO_2 abatement costs included in IEA (2009). More specifically, for tourism transportation:

■ The length of stay is assumed to increase by 0.5 per cent per year (on average 3.7 days in 2050) instead of a 0.5 per cent decrease per year (2.5 days in 2050) in business-as-usual (BAU), in line with the scenarios of UNWTO and UNEP (2008). To be consistent with the projected total guest nights in other scenarios, tourist arrivals in the green investment scenario are reduced. Thereby these travelling behavioural changes result in fewer but longer trips, but would not affect total number of guest nights. In addition, IEA's assumption of reduced travel is a good fit with the green tourism goal (short travel and longer stays).

■ With respect to transport modal shift and energy efficiency in the green scenario, to ensure coherence across the sectors, the same assumptions as in the GER transportation sector are used for tourism. In accordance with IEA's reports, it is assumed that by 2050 in the green scenario, 25 per cent of car travel and air travel is replaced by bus or rail. The ratio of transport energy efficiency in the green investment scenario (by 60 per cent) is based on the amount of green investment and unit abatement costs from IEA.

■ Renewable energy production: Additional investments of 71 per cent of the tourism energy green investment (or US$43 Bn on average per year) between 2010 and 2050 are allocated to the introduction and expansion of renewable power generation and biofuel production. The cost assumptions are collected from IEA (2009).

2. Tourism water management:
0.1 per cent of the tourism-sector green investment (on average US$0.24 billion per year) is allocated in 2011-2050 to both water demand reduction through efficiency improvements and increase of water supply[24]:

Water efficiency improvement: The amount of investment in water-efficiency improvement, aimed at reducing tourism water demand, is assumed to be US$0.16 billion per year on average (or 65 per cent of investment in tourism water management) over the 40-year period. The unit cost is assumed to be US$0.28/m3.

Water supply: The remaining (35 per cent) of tourism-sector water investment (US$0.86 billion per year on average between 2010 and 2050) aims to increase water supply from desalination and conventional water sources:

■ Desalination: 30 per cent of water-supply investment (US$0.026 billion per year on average), over the 40-year period will be invested in water desalination. The cost to supply water desalination is set at US$1.1/$m^3$.

■ Conventional water supply management: 70 per cent of the total water-supply investment (US$0.06 billion per year on average) is allocated to conventional water-supply management measures, including treatment of wastewater, reservoir storage, and surface and underground water supply. The unit cost to increase conventional water supply is set at US$0.11/$m^3$.

3. Waste management:
13 per cent of tourism-sector green investment (on average US$32 billion per year) is allocated in 2011-2050 to upstream (collection) and downstream (reuse) waste treatment:

■ Waste reuse: 8 per cent of the tourism waste investment is invested in waste recycling and recovery, totalling on average US$2.4 Bn per year over the next 40 years under the green investment scenario. The unit costs of recycling and compost are assumed to be US$138 per tonne and US$44.85 per tonne respectively.

24. The low level of investment allocated to tourism water sector is due to the relatively small amount of water consumption in tourism compared to the total of all sectors, as the same unit costs and improvement percentage are used for all water users.

■ Waste collection: the remaining 92 per cent of green investment in tourism waste management is allocated to improve the waste collection rate, totalling on average US$30 billion per year over the next 40 years under the green investment scenario. The upstream cost of waste treatment is assumed to rise from US$1083 per tonne in 1970 to US$1695.5 per tonne in 2050.

4. Training of employees:
12 per cent of tourism investment in the green investment scenario, or US$31 billion on average each year between 2011 and 2050. The cost of training per employee is assumed to be US$117 for 120 hours, while all new employees attend training for one year in total over the duration of their career (together with the assumption that as many as possible would be local workforce). Overall, the total cumulative cost of training one employee is assumed to reach US$2,854. A variety of scenarios were simulated to study and evaluate the impacts of the variation in training cost per employee per year, in the range of between 30 per cent lower and higher than the assumed cost (or from US$1,998 to US$3,711).

5. Biodiversity conservation:
50 per cent of tourism investment, or US$123 billion on average each year between 2011 and 2050. Three scenarios are simulated based on different biodiversity conservation costs. These are (a) US$119 per hectare, assuming only forest conservation—using the average cost offered by FONAFIFO[25]; (b) US$451 per hectare assuming the possibility to undertake forestry and agriculture on that land (based on the experience in Costa Rica, from Forestry chapter); (c) US$1,380 per hectare assuming that housing and other related business opportunities can be created, based on what is offered by Amazon Carbon and Biodiversity Investment Fund (ACIF)[26].

25. Fondo Nacional de Financiamiento Forestal, Costa Rica.

26. The Amazon Carbon and Biodiversity Investment Fund (ACIF) offers between US$276 and US$3,450 per ha, but it is a very specific case for 100,000 ha (US$3,450/ha seems high for an average). As a consequence, US$1,380/ha is used as a maximum value of conservation cost in this analysis.

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ANNEX 5.19

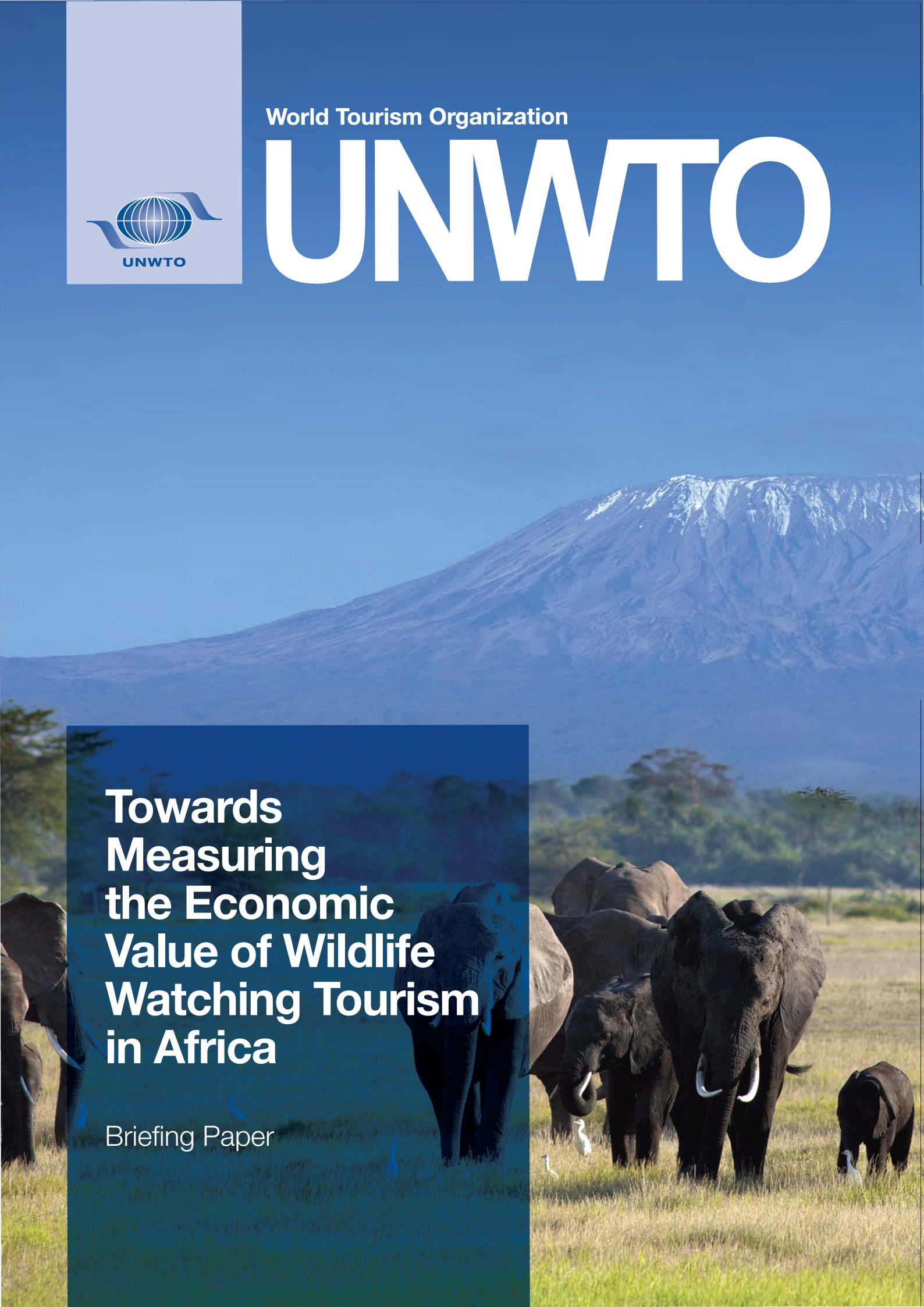
UNWTO*, Towards Measuring the Economic Value of Wildlife Watching Tourism in Africa*, 2015

World Tourism Organization

UNWTO

Towards Measuring the Economic Value of Wildlife Watching Tourism in Africa

Briefing Paper



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Towards Measuring the Economic Value of Wildlife Watching Tourism in Africa

Briefing Paper

Table of Contents

Executive summary

Set against the backdrop of the ongoing poaching crisis driven by a dramatic increase in the illicit trade in wildlife products, this briefing paper intends to support the ongoing efforts of African governments and the broader international community in the fight against poaching. Specifically, this paper looks at the wildlife watching market segment within the tourism sector and highlights its economic importance with a view to encouraging tourism authorities and the tourism industry to collaborate in strengthening anti-poaching measures and raising awareness of these issues among tourists. The analysis identifies key economic indicators and characteristics of wildlife watching tourism in African countries. This paper acts a first step towards a more systematic measurement of the economic value of the wildlife watching tourism market segment in Africa and in defining the role of the tourism sector in the fight against poaching. In its research, UNWTO followed a multi-level, participatory approach, collecting as much information as was available at the international, national and local levels and creating a network of contacts for potential future research.

This paper focuses specifically on non-consumptive forms of wildlife tourism which offer visitors the experience of observing wildlife in natural and non-captive habitats. Generally, the species of wildlife that can be observed through this form of tourism are the very same as those most often threatened by poaching and other environmental detriments. The research findings are based on a review of publications, economic data, case studies and other sources related to wildlife watching tourism, as well as on the exchange of experiences with international organizations working in the fields of nature conservation, tourism, sustainable development and wildlife crime. In addition, to address a scarcity of data and statistical information about the wildlife watching tourism segment and its economic value, a survey was carried out among African tourism ministries and authorities, protected area and wildlife

Note: The report was prepared under the supervision of Dr. Dirk Glaesser, *Director of Sustainable Development of Tourism, World Tourism Organization* with support from the *Regional Programme for Africa* and *Communications and Publications,* and contributions from Dr. Mohcine Bakhat, Gordon Clark, Virginia Fernandez-Trapa, Sofia Gutierrez, Borja Heredia Salis, Dr. Oliver Herrmann, Lyris Lyssens, Stephanie Roth, Enrico Saltarelli, Michèle Schaul, Stephanie Stein.

conservation institutions, and international and African-based tour operators. This briefing paper was likewise prepared in collaboration with the Convention on Migratory Species of Wild Animals (UNEP/CMS), which played an especially important role in establishing contact with protected area and wildlife conservation authorities.

A total of 48 governmental institutions (tourism authorities and protected area and wildlife conservation agencies) from 31 African countries participated in the survey. The sample represents 63% of UNWTO African Member States. Additionally, a total of 145 tour operators selling trips to Africa from 31 different countries participated, 50% of which were tour operators mainly from Europe (generally the principal source market for Africa) and 50% were Africa-based tour operators. The survey findings confirm that wildlife watching is a very important segment of tourism for most African countries, representing 80% of the total annual trip sales to Africa for the participating tour operators, with that share only increasing. The survey findings also indicated that for the vast majority of the countries denoted in the paper, poaching is seen as a serious problem that has negative impacts on tourism that threatens the sector's long-term sustainability and its development opportunities. For example, the employment opportunities generated for the local community in accommodation, restaurants and guiding, as well as the indirect benefits linked to the redistribution of protected area fees and community funds are at risk from the negative impacts of poaching.

Feedback from the survey also reveals a picture of where wildlife watching tourism is taking place and what kinds of activities travellers are taking part in. Wildlife watching tourism occurs mainly in protected areas; and nature, national parks and wildlife are considered the most important tourism assets for tourists travelling to Africa. While the regions that are most visited for the purposes of experiencing wildlife watching tourism are East Africa and Southern Africa, Central and West African tourism authorities are committed to further developing this type of tourism. Safari is the most popular kind of wildlife watching and is being offered by 96% of the participating tour operators. This is followed by bird watching, which is offered by 80% of the participating tour operators and seems to be combined frequently with other activities. In countries that are not considered classic safari destinations, the observation of great apes, marine wildlife and tracking of particular species are particularly important.

The exercise has also been successful in identifying key indicators related to wildlife watching tourism that assist in measuring the segment's economic importance and potential growth. For instance, a typical wildlife watching tour involves on average a group of six people, lasts 10 days, has an average daily price per person of US$ 433 and captures an additional US$ 55 in out-of-pocket expenses per person, per day. The findings also indicated the differences between standard and luxury segments with the greatest variation being in both average daily price per person per day (US$ 753 for a luxury package and US$ 243 for a standard package) and in out-of-pocket expenditures (US$ 59 for a traveller on a luxury package and US$ 44 per person per day on a standard package). Little variation was found between the segments related to the size of the group or the average length of stay which seem to be consistent characteristics of the wildlife watching product instead of factors directly related to the comfort of the experience.

With regards to protected area visitors and receipts, results suggest that a total of 14 countries are generating an estimated US$ 142 million in entrance fees for protected

areas. Because this figure covers only a small number of countries and is based on some inconclusive data, it can be assumed that protected area receipts are indeed much higher than the figure suggests. Fortunately for the purposes of future analysis, the research found that there are numerous ongoing efforts being carried out by African governments to monitor data that could be useful in estimating the economic value of the wildlife watching tourism sector. That being said, further improvements are needed as these efforts are often not consistent and commonly lead to inconclusive results.

The data also indicated that while a majority of protected area authorities are involved in anti-poaching measures, the tourism authorities are only involved to a minor extent and most do not distribute information on poaching to tourists. Of the participating tour operators about 50% are funding anti-poaching initiatives and/or engaging in nature conservation projects, however only a few are proactively taking the initiative to inform their customers on the issue.

In conclusion, the findings suggest that guidance and capacity building in developing consistent monitoring of protected area visitors and receipts and subsequently putting together a framework for the analysis of these data are needed. In this regard, establishing a model linked to an overall assessment of the economic value of wildlife watching tourism in Africa that would connect data from protected areas with tour operators' performance would be most useful. In addition, based on the experiences gathered and the network established through this exercise, such a model could be developed and tested with relevant stakeholders, namely tourism and wildlife conservation authorities at the national and local levels, and the tour operator community. Ideally, the model should be able to look at specific kinds of wildlife watching tourism (safari, marine, bird watching, etc.) in order to be applicable to the very different settings in which wildlife watching tourism takes place.

Finally, while the involvement in anti-poaching initiatives by tour operators is not very extensive yet, the survey results suggest that there is potential for mobilizing the tourism sector in anti-poaching campaigns, which is significant in that the sector can play a key role in raising awareness and potentially financing (or co-financing) anti-poaching initiatives. Further research is recommended in order to assess the level of tour operators' concern with nature conservation as well as their involvement with conservation and anti-poaching initiatives and other types of initiatives in place. Such research could be designed in close cooperation with the target group and not be restricted to European and North American travel markets but could also include emerging markets for outbound tourism to Africa like Asia.

1. Background

1.1 Wildlife crime challenges nature conservation

African countries have long promoted biodiversity conservation through the sustainable use of natural resources and there have been major achievements in the protection and recovery of wildlife populations[1]. The dramatic increase in poaching and illicit trade of wildlife products since 2005 – often referred to as 'wildlife crime' – threatens to undermine these conservation achievements and endangers some of the most iconic species to become extinct within only a few decades – most prominently, elephants and rhinos, but also other big mammals such as lions and gorillas as well as smaller species[2]. Furthermore, wildlife is also threatened by the increasing loss of habitat and loss of range[3], among other pressures.

The increase in wildlife crime is a result of widespread poverty, underfunding of wildlife conservation efforts, lack of law enforcement and political instability in the concerned countries and a rising demand for exotic animal products overseas, foremost in the rapidly growing economies of Asia due to increasing wealth and recent changes in consumer spending patterns[4]. While in the past much of the poaching in Africa had been opportunistic, wildlife crime has become a serious criminal activity involving transnational networks of well-resourced and organized groups[5].

Poaching and the illegal wildlife trade lead to detrimental environmental, economic and social consequences. Wildlife crime threatens the future existence of species and impacts the ecological integrity of whole ecosystems, especially as big mammals are essential for the maintenance of biodiversity and ecosystem functions. Poaching deprives communities of their natural capital and cultural heritage and undermines sustainable economic development and poverty alleviation. Wildlife crime is also a security challenge that threatens national security, undermines government authority, breeds corruption and restricts the potential for sustainable investment, constraining a country's social and economic development[6].

Over time, the international community has become aware of the fact that poaching is the most immediate and direct threat to wildlife in Africa, making its upward trend a cause of serious concern. There has been progress in a number of countries but compliance with international conventions and law enforcement are still insufficient in many parts of the world[7]. Therefore, actions against wildlife crime are being reinforced and readjusted through the statements and agreements among numerous international governmental and nongovernmental bodies.

Examples of the enhanced efforts that are active in the international community to address these issues can be seen in programmes such as the Monitoring the Illegal Killing of Elephants (MIKE) and the Elephant Trade Information System (ETIS); the commitments made at Rio+20 (June 2012), CITES COP 16 (March 2013) and the G8 Summit (June 2013); the discussions held during the United Nations General Assembly (UNGA, September 2013), the African Elephant

1. Miliken/Shaw (2012); UNEP/IUCN/ TRAFFIC/CITES (2013); Blanc et al. (2007).
2. UNEP/IUCN/TRAF-FIC/CITES (2013); WWF/Dalberg (2012); Milliken/Shaw (2012); WWF (2013); UNODC (2014a).
3. Miliken/Shaw (2012); UNEP/IUCN/TRAF-FIC/CITES (2013); CITES (2010).
4. UNODC (2014a); UNEP/IUCN/TRAF-FIC/CITES (2013); CITES (2013).
5. UNODC (2013a); UNODC (2014a); WWF/Dalberg (2012); IISD (2013); UNEP/IUCN/TRAFFIC /CITES (2013).
6. WWF/Dalberg (2012); Republic of Botswana/IUCN (2013); ICCWC (2011); Ripple (2014); CITES (2013).
7. Nowell (2012); WWF/Dalberg (2012); IISD (2013); Milliken/Shaw (2012).

Summit (December 2013) and the London Conference on Illegal Wildlife Trade (February 2014); the side event held at the First United Nations Environment Assembly (UNEA) of UNEP (June 2014); and the launch of the Strategic Mission of the International Consortium on Combating Wildlife Crime (ICCWC) at CITES SC 65 (July 2014), among others[8].

1.2 Tourism is a driver of sustainable development

Tourism is increasingly referred to as a driver of sustainable development. It was mentioned in the UNGA Resolution 66/288 which endorses the Outcome Document of the United Nations Conference on Sustainable Development (Rio+20), "The future we want", as one of the sectors capable of making a significant contribution to the three dimensions of sustainable development, noting also that tourism is linked closely to other sectors and can create decent jobs and generate trade opportunities. The document builds on the previous Resolution 65/173, Promotion of Ecotourism for poverty eradication and environment protection, which "recognizes that the development of ecotourism, within the framework of sustainable tourism, can have a positive impact on income generation, job creation and education, and thus on the fight against the poverty".

Moreover, tourism has been identified as one of the ten key sectors to evolve towards a Green Economy and is included as one of the initial 10-Year Framework of Programmes (10YFP) to accelerate the shift towards more sustainable consumption and production patterns. Additionally, the Conference of the Parties (COP) of Multilateral Environmental Agreements (MEAs) such as the Convention on Biological Diversity (CBD) or the Ramsar Convention on Wetlands of International Importance have also approved respectively Decisions VII/14, on "Biological diversity and tourism" and XI/6 on "Cooperation with other conventions, international organizations, and initiatives" and Resolution XI/7 on "Tourism, recreation and wetlands", recognizing the potential of tourism to advance biodiversity conservation.

In economic terms, many countries in Africa, especially in Sub-Saharan Africa, have benefitted from strong growth in their tourism sector in recent years. Although the economic importance of tourism in Africa and the continent's share of the worldwide tourism market are relatively modest (5% of global international arrivals and 3% of global international receipts), tourism has been increasing steadily with an average annual growth rate of international tourist arrivals of about 6.1% per year between 2005 and 2013. During the same period, arrivals grew from 35 million in 2005 to reach a new record of 56 million in 2013[9]. The total international tourism receipts for Africa in 2013 reached US$ 34.2 billion. Absolute numbers are predicted to more than double during the upcoming decade, reaching 134 million international arrivals in 2030.

From a policy perspective, it is important to note that over 30 African countries have identified tourism as a national priority within the Enhanced Integrated Framework (EIF)[10]. This underlines that tourism is considered a priority sector for many African countries and much hope is put into future tourism development as a vehicle for economic growth, job creation and poverty alleviation[11]. The multiplier effects on local and national economies due to the broad range of goods and services included in its value chain have benefits beyond generating income and revenue[12].

Research related to pro-poor tourism and experiences have demonstrated the functions of tourism from the perspective of sustainable development and poverty alleviation[13]:

- Tourism can support the transformation and diversification of national economies;
- Tourism can be developed in remote areas and developing regions that do not offer other export options;
- Tourism is a labour-intensive industry and can create decent employment for women, young people and marginalized populations;
- Cultural and wildlife heritage is one of the assets of many developing countries that can be harnessed for economic development; and
- Tourism can create net benefits and offers a wide range of opportunities for micro, small and medium enterprises (MSMEs).

1.3 Tourism is affected by the loss of species

The world's highest levels of biodiversity occur in less-developed countries and these offer some of the world's most well-known wildlife watching destinations. Africa is exceptional for mammal diversity and the main destination for wildlife watching tourism[14]. According to the Centre for the Promotion of Imports from developing countries in the Netherlands (CBI), the destination of about half of all wildlife watching tourism trips booked worldwide is an African country. The global market size of wildlife tourism has been estimated at 12 million trips annually and is growing at a rate of about 10% a year[15].

The leisure tourism market in Africa represents over half of the international tourist arrivals to Africa[16] and is characterized by high-end trips to top wildlife watching and nature destinations, niche tourism products such as adventure trips and cultural heritage tours and lower-end beach holidays. The middle-income market on the other hand remains relatively underdeveloped[17]. The most established tourism products in Africa are safari, beach resort, business and Diaspora tourism[18] while newly emerging products are

adventure tourism (mainly nature-related such as trekking and adventure sports), cultural heritage and wellness/health tourism[19].

The most important long-haul markets for Africa are France, United Kingdom, United States of America, Germany and Portugal. Smaller markets include tourists from other European countries, Canada and Australia, while important future source markets are in emerging countries like China, India and Russian Federation[20]. Furthermore, there is a significant increase in domestic and intraregional travel in Africa undertaken for a variety of purposes from business and shopping to visiting family, to cultural heritage sight-seeing and other leisure reasons.

Wildlife watching tourism, like other types of tourism, is sensitive to economic circumstances and has decreased during this recent economic recession. Nevertheless, wildlife watching tourism is a growing market segment and interest in wildlife watching trips has only increased with a rise in media coverage and Internet communication. Conservation issues and awareness of the risk of extinction of an increasing number of species also contribute to tourists' motivation to observe wildlife ranging freely in their natural habitats[21].

Countries in East and Southern Africa are known as the world's top destinations for the so-called "Big Five" watching (African Elephant, Cape Buffalo, leopard, lion and rhinoceros). In addition to Africa's classic safari destinations, alternative or complementary destinations are emerging with new products, for example gorilla trekking in Central Africa. These wildlife-related tourism products can only be experienced on the African continent and thus represent a unique selling proposition for African tourism. In addition to the mentioned iconic species, all African countries offer outstanding opportunities to experience wildlife and nature – including bird watching, observation of marine wildlife and viewing of agglomerations of wildlife along migration routes.

However, wildlife crime is threatening the very existence of iconic species that are essential to Africa's image as home to the world's top wildlife destinations and thus jeopardizes the basis of one of Africa's most important tourism products. Security, safety, the conservation of ecosystems, and the quality of tourism products and services are basic prerequisites for successful tourism development, while poaching has serious negative impacts on the political, social and economic framework in which tourism development can take place. Consequently, the loss of wildlife caused by poaching is likely to significantly impact tourism development in Africa as well as the tourism sector worldwide linked to the African market with the subsequent reduction of the sustainable development opportunities linked to the sector.

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8. CITES (2014); WWF/Dalberg (2012); IISD (2014); ICCWC (2011).
9. UNWTO (2013); UNWTO (2014a); UNWTO (2014b); UNWTO (2014c).
10. A multi-donor programme providing trade-related assistance to LDCs (online), available at: www.enhancedif.org.
11. AFTFP (2009); Christie et al. (2013); UNWTO (2002a); UNWTO (2002b); (Ebbe 2010); UNWTO (2013); WTTC (2012).
12. Christies et al. (2013: 1).
13. UNEP/CMS (2006); Job/Paesler (2013); Christie et al. (2013); Higginbottom (2004).
14. Higginbottom (2004).
15. CBI (2014).
16. UNWTO (2014c).
17. Christie et al. (2013).
18. African Americans wishing to visit the countries of their ancestors.
19. Christie et al. (2013), AFTFP (2009).
20. AFTFP (2009); UNWTO (2014a).
21. CBI (2014).

2. Scope of the briefing paper

2.1 Objective

This briefing paper aims to identify key economic indicators and characteristics of wildlife watching tourism in African countries in order to highlight this market segment's economic importance and encourage tourism authorities and the tourism sector to collaborate in strengthening anti-poaching measures and raising awareness of these issues among tourists.

This paper is a first step towards measuring more systematically the economic value of the wildlife watching tourism market segment in Africa and in defining the role of the tourism sector in the fight against poaching.

2.2 Methodology

This briefing paper is based on a review of publications, economic data, case studies and other sources related to wildlife watching tourism; a survey among African tourism ministries and authorities; protected area and wildlife conservation agencies; international and African-based tour operators; as well as an exchange of experiences with international organizations working in the fields of nature conservation, tourism, sustainable development and fighting wildlife crime (a list of contributors can be found in annex 1).

The collaboration with the Convention on Migratory Species of Wild Animals (UNEP/CMS) for the preparation of the briefing paper is to be highlighted, especially for the key role that it played when establishing contact with protected area and wildlife conservation agencies.

The desk research was initiated in February 2014 and was followed by an online survey which was concluded on 15 April 2014. Consultations with representatives from a variety of relevant organizations took place during the process. A first draft of the document was presented to the

African Ministers of Tourism during the UNWTO Commission for African Member States[1] celebrated in Luanda, Angola, on 28 April 2014. A second round of consultations focusing on key questions of the survey was carried out with tour operators in the month of May applying the Delphi method[2]. The final analysis of data was carried out between June and July 2014. The validation of the results by the governmental institutions and contributors was completed in September 2014.

2.3 Definition of wildlife watching tourism[3]

Based on the definition of UNEP/CMS[4], this briefing paper defines: "Wildlife watching tourism is a type of tourism that is organized and undertaken in order to watch or encounter wildlife. Wildlife watching tourism exclusively relates to non-consumptive forms of wildlife-based activities as observing and sometimes touching or feeding of animals, in contrast to consumptive forms like hunting and fishing."

The specific tourism products with a main purpose of wildlife observation are often named after the animal or the group of animals primarily observed. For instance:

- Big Five watching (buffalo, elephant, leopard, lion, rhino);
- Gorilla tracking;
- Lemur tracking;
- Bird watching;
- Whale watching; and
- Dolphin watching.

Safari is the most common term for wildlife watching tourism. The word "Safari" originates from Swahili and means "journey". When used in English or German in colonial times, it referred to hunting expeditions. Currently the term safari is most often used as a synonym for wildlife watching tourism and refers to tourism taking place mainly in protected areas that offers the opportunity to observe and photograph wild animals in their natural habitats. The classic form of safari entails observing wildlife from four-wheel drive vehicles and staying in tented safari camps or lodges. Newly emerging forms of safari include trekking, kayaking or camel safaris[5].

While safari tours and the above-mentioned specific tourism products may represent the most common forms of wildlife-related tourism, this briefing paper encompasses all kinds of wildlife that may be observed by tourists. The research does not include captive or semi-captive settings of animals such as zoos. This paper aims to showcase the economic value and related characteristics of tourism products that are based on the opportunity to observe wild animals in their natural habitat, as it is this form of wildlife tourism that is threatened by poaching and other environmental detriments.

Furthermore, this paper focuses on non-consumptive forms of wildlife tourism and therefore does not include trophy hunting tourism. Trophy hunting tourism can be a legitimate

1. UNWTO has 49 African Member States (online), available at: http://www2.unwto.org/members/africa.
2. The Dephi method is an interactive method of analysis based on a survey which is conducted in two or more rounds, providing the participants in the second round with the results of the first so that they can alter their original assessment or stick to their previous opinion, (online), available at: www.rand.org.
3. For the following cf. Higginbottom (2004).
4. UNEP/CMS (2006).
5. FTFP (2009); Wikipedia.

and profitable wildlife conservation tool if managed effectively. Nevertheless, against the background of poaching and the illegal trade of wildlife products, the discussion of hunting tourism among stakeholders including nature conservation institutions and the African countries that take different approaches with regards to trophy hunting, remains controversial. Additionally, from both the tourism sector and the consumer perspectives, wildlife watching tours and trophy hunting are separate segments.

2.4 The economic value of wildlife watching tourism

It is important to note that the subject of this briefing paper is the economic value of tourism, most precisely of the wildlife watching market segment, and not the economic value of wildlife itself. The intrinsic value of wildlife and its various contributions to sustainable development and human well-being – including ecological, genetic, social, economic, scientific, educational, cultural, recreational and aesthetic – are manifold and maybe more or equally important as the economic value, but they are not the subject of this paper.

The economic value of tourism can be defined as the result of all economic impacts caused by tourism. These impacts are direct, indirect and induced through the total of tourism expenditures, creation of employment, positive and negative externalities, revenues from taxes and other public charges, foreign exchange earnings and the related multiplier effects[6].

UNWTO Statistics focus on measuring the direct economic contribution[7] of tourism to the national economy. They provide data and indicators on inbound, outbound and domestic tourism, as well as on tourism industries, employment and macroeconomic indicators related to inbound tourism such as for instance, the contribution of tourism to GDP. The inclusion of the full economic benefits of tourism[8] into UNWTO Statistics is currently under discussion[9].

Analyzing the economic value of the wildlife watching tourism market segment in Africa faces some of the following challenges[10]:

1. The availability of national tourism statistics for African countries is quite limited and refers to the direct economic contribution of tourism. At the national level, data on international tourist arrivals and international tourism receipts are available for the majority of countries. However, data on employment or tourism industries or indicators on the average length of stay and the average expenditure per day are being reported for only a small number of African countries[11]. In addition, Tourism Satellite Accounts (TSA)[12] are only available for a limited number of African countries.
2. Where data are available at national level, they mostly refer to the whole tourism sector, regardless of the different travel purposes. A few countries account indicators according to three different travel purposes, i.e. leisure, business, visiting friends and relatives (VFR) and others; but different segments of tourism such as beach tourism, nature tourism, cultural tourism or wildlife-related tourism are not identified.
3. Data on the tourism expenditure of wildlife watching tourism at the destination level are not collected systematically, or, where data are generated by registrations, surveys or studies, these are often not published.

The review of the literature and case studies revealed that there are numerous studies, projects and publications analyzing wildlife watching tourism. Although the economic value of wildlife watching tourism is usually referred to as important, the reviewed literature focuses mainly on how the economic value could be evaluated and points out that there are no valid data available for such analysis. The very few studies that eventually gathered concrete economic figures on the segment were based on very specific locations and demonstrate that the economic value of wildlife watching tourism can reach significant dimensions. They also reveal that, while the economic potential of wildlife watching tourism might be underestimated, the realization of its benefits in terms of tangible impacts on local economies and pro-poor benefits can only be achieved if tourism development is participatory, well-planned, managed and monitored, and follows the principles of sustainability.[13]

2.5 The survey

Given the scarcity of data at the national level for the region as well as the absence of relevant statistical information for the segment of wildlife watching tourism, UNWTO fielded a survey among relevant stakeholders. Specific questions addressing the number of arrivals to protected areas and related receipts were included in the survey. The existing official data on international tourism arrivals and receipts was used as a benchmark against which the results of the survey were contrasted (the available data on international tourism arrivals and receipts can be found in annex 2).

The survey was distributed to national tourism authorities, protected area and wildlife conservation authorities and individual protected areas. With the objective of accessing relevant data on the wildlife watching tourism segment potentially available at the national and local level, a selection of questions related to key economic indicators and characteristics of wildlife watching tourism were included in the survey. Moreover, international and African tour operators were surveyed to describe the supply side of wildlife watching tours.

The survey was conducted following a consultative process with various tour operator associations via online questionnaires from 26 February to 15 April 2014. A second round of consultations with tour operators focusing on validating the findings took place during May 2014 using the Delphi method.

The following four specific versions of the questionnaire were developed and sent to governmental institutions and the tourism sector:

- Ministries of tourism and national tourism authorities;
- National and local protected area and wildlife conservation agencies;
- Tour operators from Europe and United States of America (aka 'international tour operators'); and
- African-based tour operators.

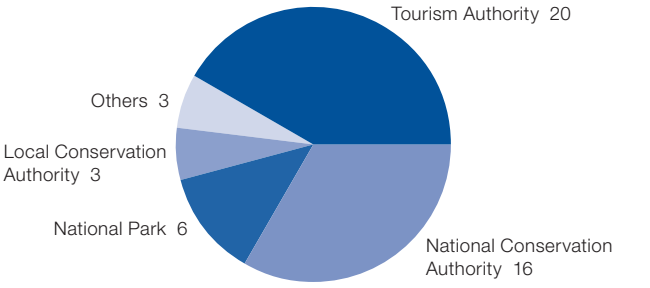
All questionnaires were available in English and French, and in the case of international tour operators, also in German.

2.5.1 Survey participation: governmental institutions

Tourism ministries of all 49 UNWTO African Member States[14] were invited to participate in the survey. The national authorities for protected areas and wildlife conservation were addressed through the national focal points of UNEP/CMS which is a partner in this UNWTO initiative. The UNEP/CMS focal points were asked to forward the survey to relevant conservation institutions and individual national parks (a list of participating governmental institutions can be found in annex 3).

In total, 48 governmental institutions from 31 countries replied, i.e. Benin, Botswana, Burkina Faso, Burundi, Cameroon, Cabo Verde, Chad, Congo, Cote d'Ivoire, Democratic Republic Congo, Eritrea, Ethiopia, Gabon, Gambia, Ghana, Kenya, Lesotho, Malawi, Mali, Mauritania, Mozambique, Niger, Senegal, Seychelles, Sierra Leone, South Africa, South Africa, Swaziland, Uganda, United Republic of Tanzania and Zimbabwe. The sample represents 63% of UNWTO Member States and the respondents include 20 national tourism authorities, 16 national wildlife conservation authorities, three local wildlife conservation authorities, six individual national parks and three other institutions. The balanced response of both governmental branches can be interpreted as a sign of their shared interest in the topic.

Figure 2.1 Survey participants: governmental institutions

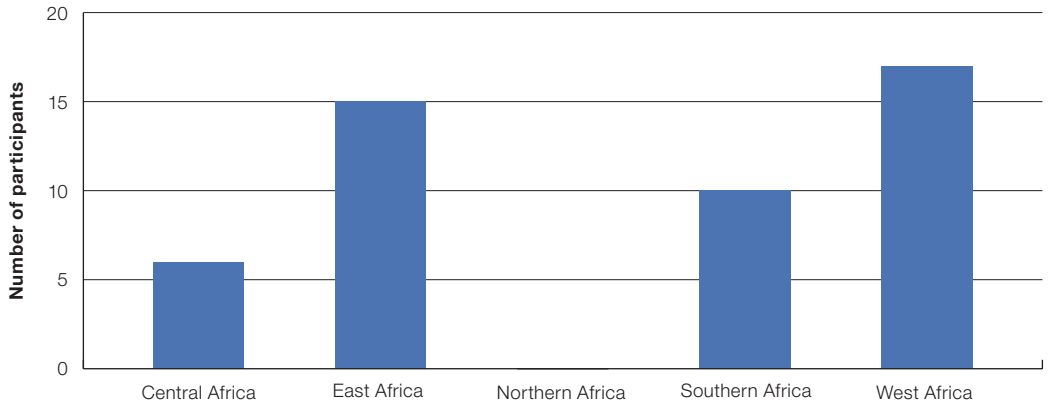


Governmental institutions, n = 48

The participating governmental institutions are from four African sub-regions – six participants from five Central African countries; 15 participants from 10 East African countries; 10 participants from four Southern African countries and 17 participants from 12 West African countries. There were no participating countries from Northern Africa. For nine countries (Democratic Republic of Congo, Ghana, Kenya, Lesotho, Senegal, South Africa, Swaziland, Tanzania and Uganda), replies were received from both the governmental branches of tourism and protected area and wildlife conservation.

6. Smith (1998); Freyer (2011).
7. Tourism Economic Contribution is understood as the direct, positive effects of Tourism Consumption, Tourism Gross Fixed Capital Investment and Tourism Collective Consumption on a national economy. This includes the Tourism Satellite Account (TSA) measures of Tourism Direct Gross Value Added, Tourism Direct Gross Domestic Product (GDP), and Employment in the tourism Industries consistent with the System of National Accounts. (UNWTO, 2011).
8. Tourism Economic Benefits are defined as the Tourism Economic Contribution plus the secondary effects (including both indirect effects and induced effects) on the national economy. (UNWTO, 2011).
9. UNWTO (2011).
10. cf. Higginbottom(2004).
11. This absence of detailed economic data on tourism is not restricted to Africa; it is common for many countries worldwide. (UNWTO, 2014c, UNWTO, 2014d).
12. The TSA is a distinctive method of measuring the direct economic contributions of tourism consumption to a national economy. It is a macroeconomic policy analysis tool. (UNWTO, 2011).
13. cf. Higginbottom (2004).
14. UNWTO has 49 African Member States: Algeria, Angola, Benin, Botswana, Burkina Faso, Burundi, Cameroon, Cabo Verde, Central African Republic, Chad, Congo, Côte d'Ivoire, Democratic Republic of Congo, Djibouti, Equatorial Guinea, Eritrea, Ethiopia, Gabon, Gambia, Ghana, Guinea, Guinea-Bissau, Kenya, Lesotho, Liberia, Madagascar, Malawi, Mali, Mauritania, Mauritius, Morocco, Mozambique, Namibia, Niger, Nigeria, Rwanda, Sao Tome and Principe, Senegal, Seychelles, Sierra Leone, South Africa, Sudan, Swaziland, Togo, Tunisia, Uganda, United Republic of Tanzania, Zambia and Zimbabwe, (online), available at: http://www2.unwto.org/members/africa.

Figure 2.2 Survey participants: Governmental institutions by sub-regions



Governmental institutions, n = 48

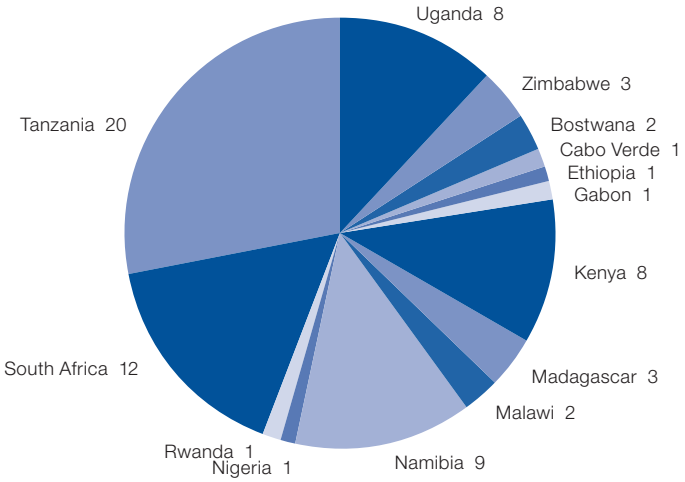
2.5.2 Survey participation: tour operators

Fifty-eight tour operator associations from 27 European and American countries and 12 African countries were contacted and requested to forward the survey invitation to their members. 17 responded positively and supported the survey (a list of the supporting tour operator associations can be found in Annex 4). In addition, about 700 individual tour operators from 38 countries were contacted directly and invited to participate in the survey.

A total of 159 tour operators from 34 countries replied to the survey. Tour operators were from Australia, Bangladesh, Botswana, Canada, Cabo Verde, Croatia, Czech Republic, Denmark, Ethiopia, Finland, France, Gabon, Germany, India, Italy, Kenya, Lithuania, Madagascar, Malawi, Namibia, Netherlands, Nigeria, Peru, Portugal, Republic of Korea, Rwanda, South Africa, Spain, Switzerland, Uganda, United Kingdom, United Republic of Tanzania, United States of America and Zimbabwe (a detailed list of the tour operators participating is given in Annex 5). 14 of the international tour operators surveyed do not offer trips to Africa and were therefore excluded from further analysis. The remaining 145 tour operators are from 31 countries; 72 are based in Africa and 73 in Europe, North America, Asia and Oceania.

Among the African tour operators, a majority of the participants are from countries that are well-known wildlife watching destinations such as Tanzania (20 participants),

Figure 2.3 Survey participants: African tour operators by countries of origin



African tour operators, n = 72

South Africa (12 participants), Namibia (9), Uganda (8) and Kenya (8). Zimbabwe and Madagascar are represented by three participants each, Botswana, Cabo Verde, Ethiopia, Gabon, Malawi, Nigeria and Rwanda by either one or two participating tour operators each.

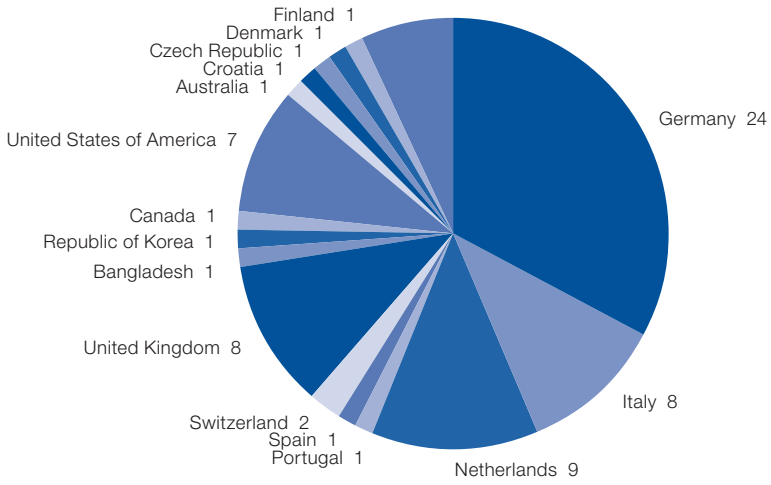
The majority of the participating international tour operators are from Europe (62 out of 73), mainly from Germany (24), The Netherlands (9), Italy (8), United Kingdom (8), France (5) and another four European countries. The high participation of European tour operators is linked to the fact that these are the main source markets for Africa and thus greater emphasis was placed in ensuring participation. Additionally, eight of the tour operators participating are from United States of America and Canada, two from Asia (Bangladesh and Republic of Korea) and one from Australia.

2.5.3 Size of participating tour operators

Out of the 145 tour operators that offer trips to Africa who responded, 140 provided information on their size[15]: 51% fall into the category of micro-enterprises having less than 10 employees; 32% are considered small enterprises with 10 to 50 employees; 10% correspond to medium enterprises with 50 to 250 employees, and; 7% are large enterprises with more than 250 employees. In total, 93% of the participating tour operators are considered MSMEs. It should be noted that from the large enterprises, 2 tour operators employ more than 6,000 employees.

15. The classification of enterprises per size used by the European Commission has been followed, (online), available at: http://epp.eurostat.ec.europa.eu/portal/page/portal/european_business/special_sbs_topics/small_medium_sized_enterprises_SMEs.

Figure 2.4 Survey participants: International tour operators by countries of origin



International tour operators, n = 73

3. Analysis of the surveys

The following section presents the analysis of the results of the surveys (the questionnaires can be found in Annex 6).

3.1 Characteristics of wildlife watching tourism

3.1.1 Safari is the most practiced type of wildlife watching tourism

Governmental institutions were asked about the type of wildlife watching that can be practiced in their countries through a multiple choice question: a) safari (Big Five and others); b) great apes (chimpanzee, gorillas); c) marine wildlife (including whale watching); d) bird watching; e) special wildlife tracking, and f) others. Additionally, tour operators were asked about the kinds of wildlife watching tours that they offer and the countries in which they operate.

All participating governmental institutions from 31 different countries answered this question. A total of 92% of the respondents mention that bird watching can be practiced in their country; 73% state this for safari; 35% state this for the observation of great apes; 45% state this for marine wildlife watching; 38% state that special wildlife tracking; and 29% state this for other kinds of wildlife watching tours.

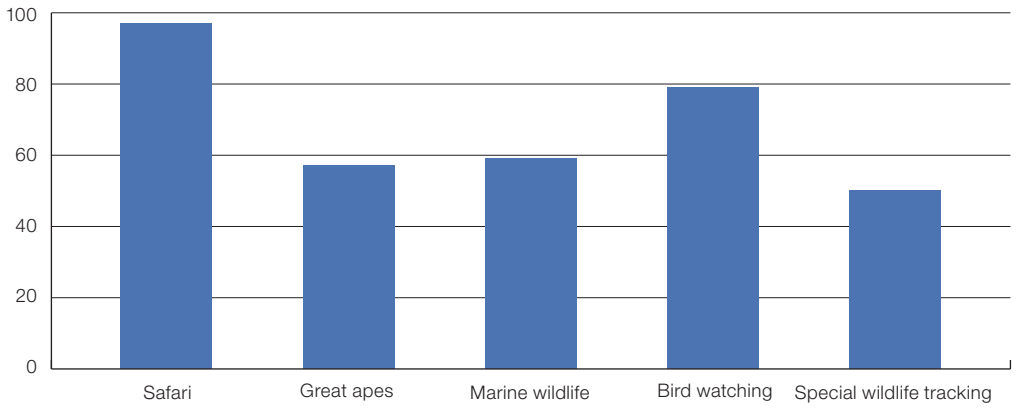
Analyzing the replies from the participating tour operators, bird watching is offered in 71% of African UNWTO Member States, safari tours in 65%; special wildlife watching in 49%; marine wildlife watching in 33%; observation of great apes in 24%; and other kinds of wildlife watching in 61%.

A total of 25 countries were mentioned by both the governmental institutions and tour operators as wildlife watching destinations. When comparing the public and private answers for the same country, it was noted that in a majority of cases (67%) those countries highlighted by the governmental institutions as wildlife watching destinations were also viewed by the tour operators. The biggest discrepancy between the answers of governmental institutions and tour operators related to the practice of bird watching. Bird watching was reported as available by governmental institutions in 92% of their countries, but was only highlighted by tour operators as being practiced in 71% of African countries. This discrepancy could be linked to the fact that although bird watching can be practiced in almost every African country, tour operators might often combine it with other activities rather than offer it as a specialized product and therefore the number of countries in which they view themselves operating is smaller.

The other discrepancy between responses related the percentage of countries that were considered in the replies of governmental institutions as wildlife watching destinations that were not considered as such by tour operators. Upon review, this group of countries fall into two general categories. Firstly, countries where despite the availability of natural resources, tourism is in its initial stages of development and secondly, countries that are specialized in a different type of product, such as beach and sun holidays.

All in all, 96% of the 145 tour operators participating offer safari tours; 56% offer tours focusing on the observation of great apes; 57% offer marine wildlife tours; 80% offer bird watching tours; 48% offer special wildlife tracking tours; and 36% other kinds of tours.

Figure 3.1 Kinds of wildfile watching offered per tour operator (%)



Tour operators, n = 145

The results of the survey show that those countries in which a higher number of tour operators are active, are countries that are already known as wildlife watching destinations. Between 54%-61% of the 145 participating tour operators offer wildlife watching tourism products in each of the following countries: Botswana, Kenya, Namibia, South Africa and Tanzania. Data indicates that the main wildlife watching product are safari tours, offered by 55% of the tour operators, followed by bird watching (offered by 31%) and tours for the observation of marine wildlife, currently offered by 16% (this product is not available in Botswana).

Countries where wildlife watching tours are operated by 22%-50% of the participating tour operators are Madagascar, Malawi, Mozambique, Rwanda, Uganda, Zambia and Zimbabwe. For this second cluster of countries, the main product is also safari, which is being offered by 22% of the tour operators, followed by bird watching (offered by 18%) and tours for the observation of great apes which is offered by 11% (this product is only available in Rwanda and Uganda).

Between 5% and 18% of the tour operators offer wildlife watching tourism products in Congo, Ethiopia, Lesotho, Mauritius, Morocco, Senegal, Seychelles and Swaziland. Nineteen more countries are mentioned as wildlife watching destinations. This leaves out only 10 of the 49 UNWTO Member States in Africa without being mentioned as destinations for wildlife observation for the participating tour operators. However, it is important to note that this last group includes post-conflict countries and countries with very limited tourism development.

3.1.2 Locating wildlife watching tourism

When answering the question "does wildlife watching in your country/during your tours take place in protected areas?" a total of 96% of the participating governmental institutions and tour operators replied positively. Additionally, when listing the top five destinations for wildlife watching in their respective country, governmental institutions refer almost exclusively to protected areas. Some tour operators mention that wildlife watching tourism also takes place on private and communal lands, but to a much lesser extent.

From a sub-regional perspective, it is interesting to note that most of the activities of the 145 participating tour operators are taking place in East Africa (90% of the tour operators operate in the sub-region) and Southern Africa (66% of the tour operators operate in the sub-region[1]). In both sub-regions, the main products offered are safari followed by bird watching. The third most popular products are the observation of the Great Apes in East Africa and marine wildlife watching for Southern Africa. These two sub-regions also obtained the highest number of replies from their respective governmental institutions when they were asked to highlight the resources available in their countries (80% and 73% respectively); a correlation which could reflect the efforts of both the regions to create an enabling framework for the development of wildlife watching tourism.

West and Central African governmental institutions were asked if wildlife watching tourism takes place in their respective country, of which the replies were 73% and 44% respectively. However, as tour operators confirm this only with 14% and 19% respectively for the sub-regions, these figures can suggest rather the commitment of governmental institutions from West and Central Africa to opt for and develop wildlife watching tourism, which has not yet made it into the distribution channels.

In the Northern African sub-region no governmental institutions and only 2% of the tour operators mentioned wildlife watching tourism as a product on offer. This coincides with the fact that Northern African destinations are traditionally placing greater efforts in the development of other tourism products such as beach and sun as well as cultural tourism.

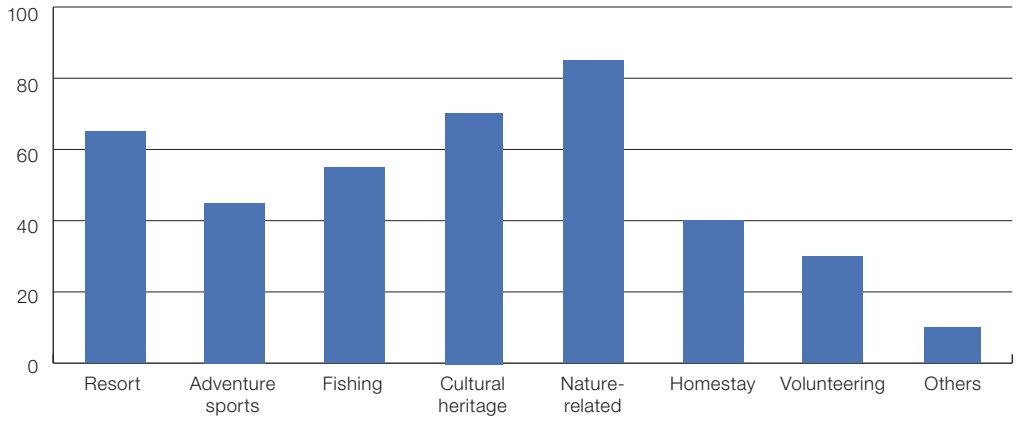
3.1.3 Wildlife watching takes place in combination with other tourism activities

National tourism authorities[2] were asked about the opportunities to combine wildlife watching with other activities in their countries as well as about the types of activities that are normally combined with wildlife watching through a multiple choice question including the following options: a) Resort; b) Adventure sports; c) Fishing; d) Cultural heritage; e) Nature-related activities; f) Homestay; g) Volunteering; h) Others. Additionally, tour operators were asked about the additional activities that are included in their wildlife tours.

A total of 23 governmental replies were received for this question out of which 90% indicate that wildlife watching tourism is indeed being combined with other activities. Most commonly wildlife watching is combined with nature-related activities (85%), followed by cultural heritage (70%) and resort/beach holidays (65%). Fishing, adventure sports such as dune surfing or kayaking. Homestay and volunteering are less frequently mentioned as activities typically combined with wildlife watching tours.

For the 145 participating tour operators, the most important additional activities included in their tours are cultural visits (history, architecture, tribal and village culture, wine tasting, city tours etc.), other nature-related and adventure/sports activities (including mountaineering, hiking, trekking, 4x4 drives, mountain biking, golf, scuba diving, snorkelling, kayaking, canoeing, white water rafting, etc.).

Figure 3.2 Activities combined with wildlife watching tours (%)



Governmental institutions, n = 23

Case Studies (1)

Bird watching in South Africa

In 1997, a quantitative study on avitourism to South Africa conservatively estimated that the country received between 11,400 and 21,200 birdwatchers per year which contributed US$ 12 to 26 million to the South African economy (Turpie & Ryan, 1998; cited after Biggs et al., 2011). South Africa is a well-known bird watching destination with a diversity of bird habitats and a high number of endemic species. Since 1997, there has been a significant increase in bird watching tourism in South Africa, reflected in the increasing number of tour operators specializing in birding and the number of bird watching tourism products being offered. The market has undergone considerable growth and the number of bird watching tourists and revenues generated by this market segment have only continued to increase to date. The development of birding tourism has been promoted by community projects supported by NGOs from the tourism sector. Currently, there are more opportunities for small business development along birding routes, which contributes to the creation of jobs for local communities (e.g., local birding guides) and supports conservation. (Biggs et al., 2011).

1. UNWTO African sub-regions are: Central Africa (Angola, Cameroon, Central African Republic, Chad, Congo, Democratic Republic of Congo, Equatorial Guinea, Gabon and São Tome and Principe); East Africa (Burundi, Djibouti, Eritrea, Ethiopia, Kenya, Madagascar, Malawi, Mauritius, Mozambique, Rwanda, Seychelles, Tanzania, Uganda, Zambia and Zimbabwe); Northern Africa (Algeria, Morocco, Sudan and Tunisia); Southern Africa (Botswana, Lesotho, Namibia, South Africa and Swaziland); and West Africa (Benin, Burkina Faso, Cabo Verde, Côte d'Ivoire, Gambia, Ghana, Guinea, Guinea-Bissau, Liberia, Mali, Mauritania, Niger, Nigeria, Senegal, Sierra Leone and Togo).
2. The question was only addressed to the tourism authorities and not included in questionnaire of the conservation agencies.

Mountain Gorillas in Uganda

In the Bwindi Forest National Park in Uganda, mountain gorilla families that are accustomed to humans can be visited by small tourist groups for one hour with a special guide. The permit to visit a gorilla family costs between US$ 500 and 700 per person. The visits to a single gorilla family that attracts an average of 10 tourists in a day generates between US$ 5,000 and 7,500 per day. Over a year's time, visits to this same family can generate up to about US$ 500,000 per year (visits are not made every day).The total income of gorilla visits in the Bwindi Forest National Park is about US$ 15 million per year. Additionally, a similar amount is spent by the tourists on accommodation, transport and other services. (Lengefeld, 2013).

Kichwa Tembo Masai Mara Tented Camp, Kenya

The tented camp Kichwa Tembo Masai Mara is located on the Masai Mara Nature Reserve in the remote western Mara in Kenya's southwest. The main attractions are the year-round concentration of wildlife and the camp's location on the route of the Great Migration. As it is a private concession land, bush walks and night drives are allowed. The tented camp offers considerable luxury for a maximum of 80 guests. The camp has about 200 employees, 70% of whom are locals from the Masai Mara region. An average of 60% of the fruits, vegetables and other farm products that are consumed are obtained from local suppliers. The camp also supports local schools, reforestation, environmental education, health, and anti-AIDS programmes. The camp generates total annual revenues of US$ 8 to 10 million, of which US$ 1.5 million is paid directly to local communities for the lease fee, salaries and purchases of local products. (Lengefeld, 2013).

Marine turtle observation

In 2004, a WWF study analyzed the non-consumptive use of marine turtles for observation in 13 locations in the tropics and subtropics of Africa, Asia, Latin America and the Caribbean. In nine of these locations, this activity is considered a major revenue generator while in the other four locations is only one of many attractions. The gross-revenue attributed to marine turtle observations was calculated by multiplying the average tourist expenditure by the number of tourists that participated in this activity. The analysis included all expenditures (food, accommodation, souvenirs, transport and others) made by tourists during their stay at the turtle-watching site. The costs of turtle observation tours were relatively low as little transport and no special equipment were needed. On the other hand, tourists needed to travel to remote beaches and the excursions were undertaken mainly at night, which generates higher travel costs.

At the nine locations where marine turtles were the major attraction, the study showed revenues generated from US$ 41,000 to US$ 6.7 million per site per year, with an average of US$ 1.7 million per year at a single site. The sites employed anywhere from 30 to 1,280 tour guides, and the hostel/resort owners and their employees received direct economic benefits from the turtle-watching tourism. At the four destinations where turtles are only one of many attractions, the revenue from turtle observation ranged from US$ 3,000 to US$ 106,000 per year with an average of US$ 41,000 per year. (Troëng/Drews, 2004).

3.2 Importance of wildlife watching tourism and its main beneficiaries

3.2.1 Nature, national parks and wildlife are among the most important assets for wildlife watching destinations

To better understand the perceived importance of wildlife watching tourism in the African countries surveyed, the national tourism authorities were asked both "how important is wildlife for tourism in your country?" and "is wildlife watching tourism a valuable source of income for your country?" In response, a total of 24 replies were received, out of which 79% state that wildlife watching tourism is "very important" for their countries; 17% state that it is "important" for their countries. 79% found that wildlife watching is a valuable source of income.

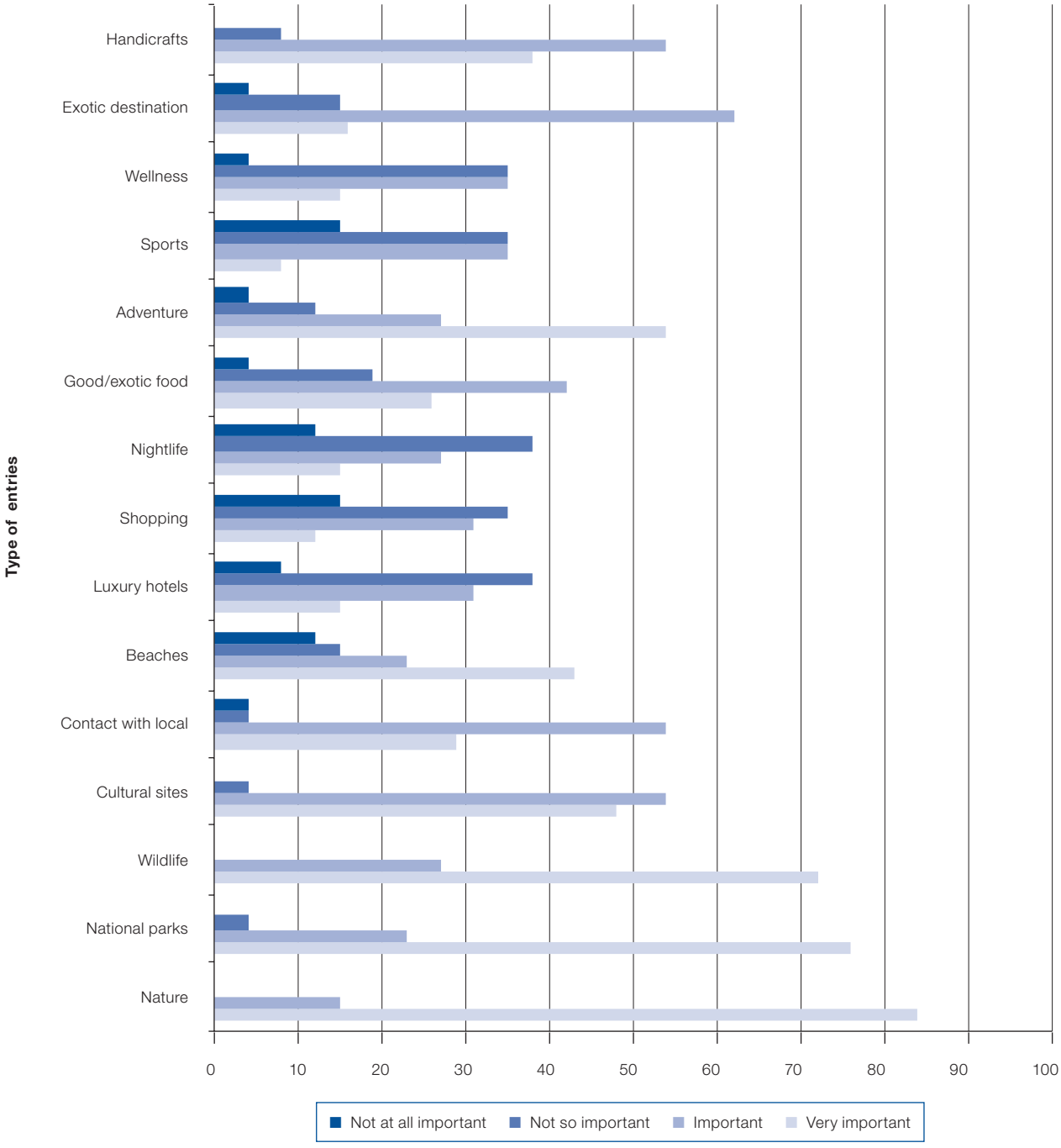
National tourism authorities[3] and tour operators were also asked to highlight the degree of importance for the visitor/customer of the following items: a) Nature; b) National Parks; c) Wildlife; d) Cultural sites; e) Contact with local community; f) Beaches; g) Luxury hotels; h) Shopping; i) Nightlife; j) Good/exotic food; k) Adventure; l) Sports; m) Wellness; n) Exotic destination; o) Handicrafts.

The 25 governmental replies received reveal that nature, national parks, wildlife, adventure and cultural sites are among the most important assets for the visitors to their countries (rated as "very important" by 84%, 76%, 72%, 54% and 48% of respondents, respectively). Also "important" but to a lesser extent, are beaches (43%), handicrafts (38%), good/exotic food (26%), the contact with local communities (29%). Exotic destinations, shopping, nightlife, wellness and sports are not so important for the tourists from the perspective of the governmental institutions. One participant also mentioned in the comments section that security is an important issue for tourists.

Tour operators were asked the same questions. The 145 replies received from tour operators show that 95% of the respondents evaluate wildlife, nature and national parks as "very important" for their customers (rated 95%, 92% and 87% respectively). Culture, contact with local communities, adventure, exotic destinations, good/exotic food and exotic destinations get high rankings as well (36%, 31%, 31%, 27% and 25% respectively). Beaches, luxury hotels and handicrafts range in the middle, while the majority evaluates shopping, wellness, sports and nightlife as "not so important" or "not at all important".

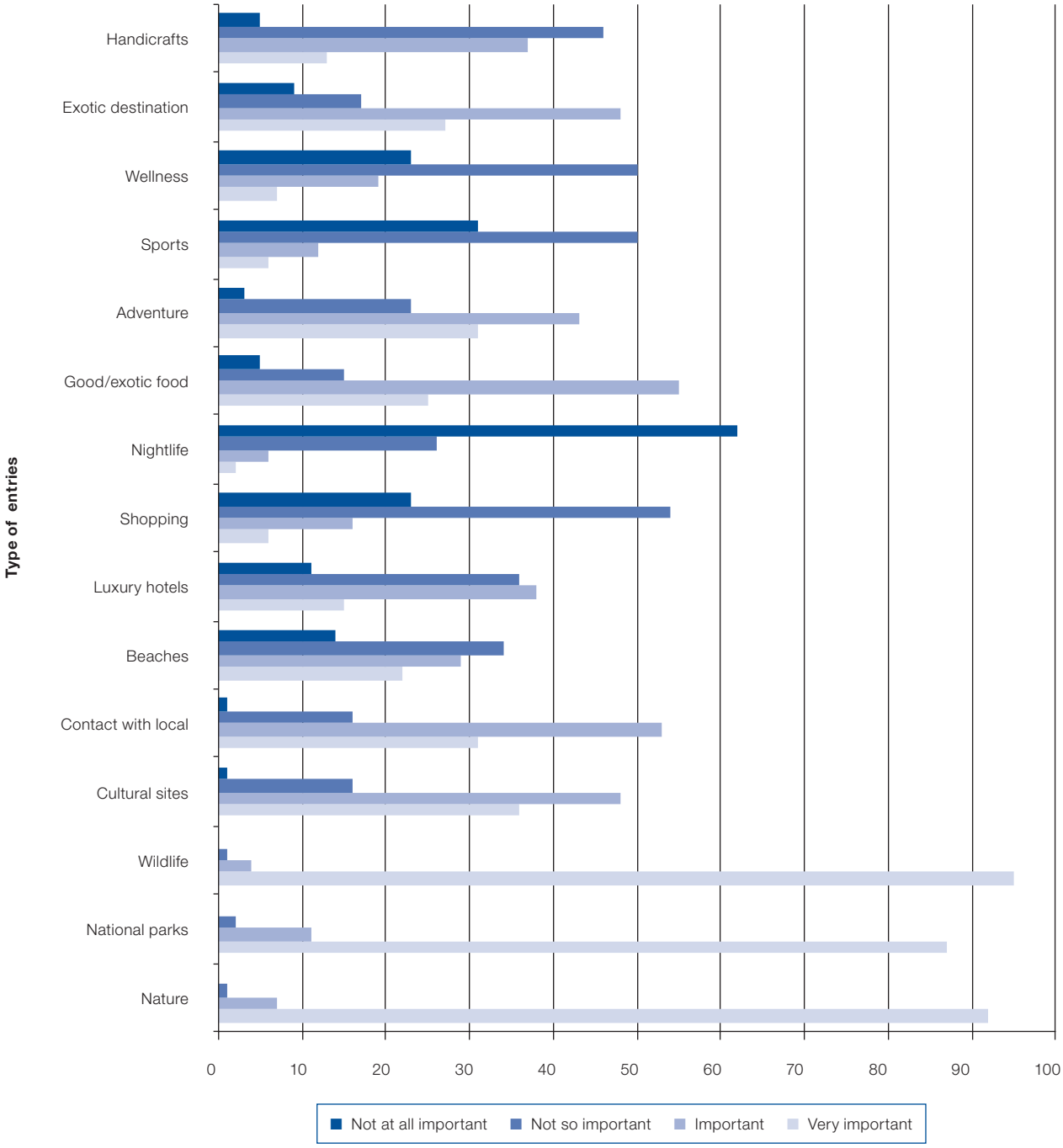
3. The question was only addressed to the tourism authorities and not included in questionnaire of the conservation agencies.

Figure 3.3 Importance of tourism assets for visitors (%)



Governmental institutions, n = 25

Figure 3.4 Importance of tourism assets for customers (%)



Tour operators, n = 145

3.2.2 Wildlife watching tourism benefits a wide range of stakeholders, especially national parks, local tourism providers and the local community

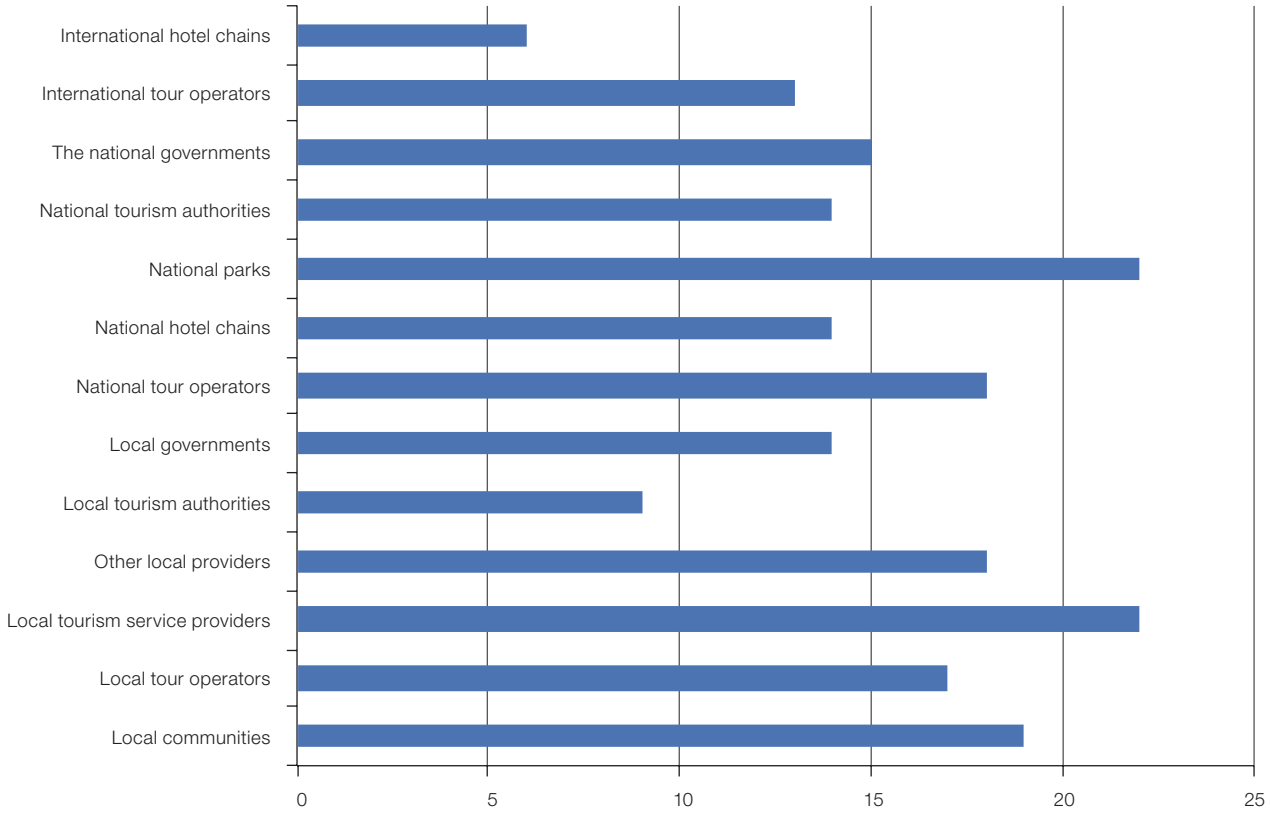
National tourism authorities[4] were asked about who benefits from wildlife watching tourism through a multiple choice question, which gave the following options: a) Local communities; b) Local tour operators; c) Local tourism service providers; d) Other local providers; e) Local tourism authorities; f) Local governments; g) National tour operators; h) National hotel chains; i) National Parks; j) National tourism authorities; k) National governments; l) International tour operators; m) International hotel chains.

The 26 governmental institutions that responded indicated that there is a wide range of beneficiaries from wildlife watching tourism in their countries (the majority selected an average of eight different beneficiary categories from the 13 options proposed). National parks and local tourism providers are mentioned most frequently as beneficiaries (both by 85% of respondents), but also local communities (73%), national tour operators (69%) and other local providers (69%). Between 50% and 58% of the participants state that national and local governments, national tourism authorities, international tour operators and national hotel chains benefit as well. Local tourism authorities are mentioned by 35%, and international hotel chains by 23% of the participants.

Governmental institutions were also requested to indicate whether local communities "receive direct and/or indirect benefits" from wildlife watching tourism by selecting among the following replies: a) Supply of food and beverages; b) Supply of cultural goods and services; c) Supply of other goods and services; d) Proportion of national park fees; e) Proportion of taxes/licenses related to tourism.

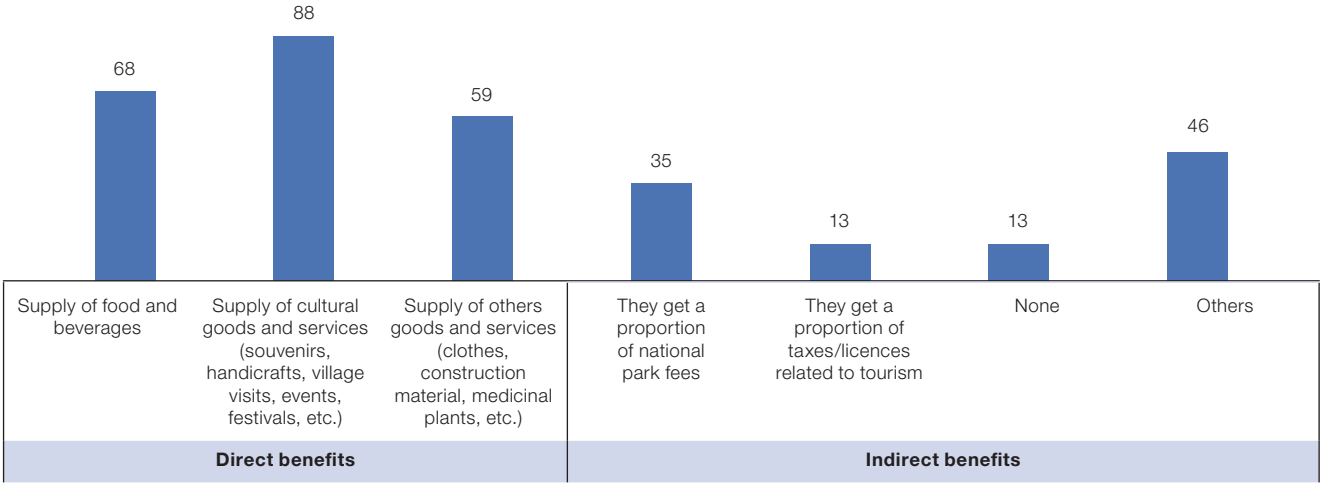
The replies from the majority of the 47 governmental institutions that answered this question indicate that local communities are involved in wildlife watching tourism and obtain direct (72%) and indirect (82%) benefits from it. In most cases, local communities provide different goods and services directly to the tourists, cultural goods and services being the most important ones for the participating governmental institutions (mentioned in 88% of the cases), followed by food and beverages (68%) and other goods and services (59%). With regard to indirect benefits, 35% of the responses from participating governmental institutions

Figure 3.5 Beneficiaries of wildlife watching tourism (%)



Governmental institutions, n = 26 (cases) Question included only in the questionnaire addressed to Tourism authorities.

Figure 3.6 Direct and indirect beneficiaries for wildlife watching tourism (%)



reported that communities get a proportion of national park fees; 13% mention the proportion of tourism-related taxes or licenses as an indirect benefit for communities, and; 46% of the replies list other indirect benefits. For instance:

- Community development programmes, e.g., education, health, youth, SME development, ecotourism, alternative livelihoods;
- Establishment of infrastructure like water supply and access roads to parks in remote areas;
- Tourism concessions areas allowing for the establishment of self-employed/SME tourism businesses; and
- Nature conservation.

3.2.3 Wildlife watching offers a wide range of employment areas for the local community

Governmental institutions were requested to indicate whether "local communities are employed by tourism service providers that offer wildlife watching tours in your country" and the type of jobs that they are offered through the following multiple choice options: a) Accommodation; b) Restaurants; c) Tour guides; d) Local tour operators; e) Transport; f) Porters; g) Craftsmen; h) Rangers[5]; and i) Others.

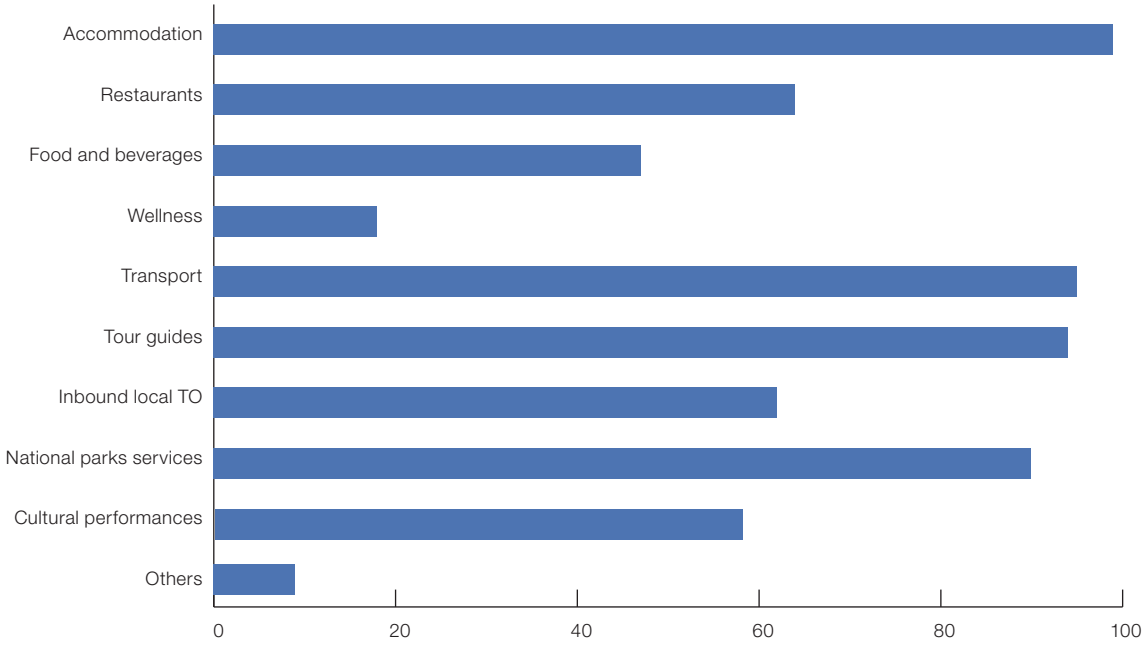
A total of 48 governmental institutions replied to this question and 75% of those responses state that members of local communities are employed within the wildlife watching tourism sector. Where the response indicates local community involvement, the most important employment areas are tour guiding (86%), accommodation (83%), restaurants (75%), craftsmen (72%) and rangers (70%). To a lesser extent opportunities for work are provided in transport companies and with local tour operators (61% and 58%). Porters are mentioned by only a small number of participants (36%) but this may be due to the fact that porters are only required for certain forms of tourism that involve challenging and/or overnight trekking in remote areas, e.g., tracking of primates in dense rainforests. Other forms of employment mentioned by the participants are cultural performances, jobs in accounting, security, outreach and communication.

Additionally, tour operators were asked to list the local services that they commonly include in their wildlife watching tours as well as those services that are typically used by their customers but not included in their tours through the following multiple choice answer: a) Accommodation, b) Restaurants; c) Food and beverages; d) Wellness; e) Transport; f) Tour guides; g) Inbound local tour operators; h) National park/ protected area service; i) Cultural performances; j) Others.

The responses from the 145 tour operators that replied to this question mention that their wildlife watching tours commonly include accommodation (99%), transport (95%), tour guides (94%) and national park services (90%). Restaurants (64%), local tour operators (62%), cultural performances (58%) and food and beverages (47%) are included to a lesser extent. Wellness services (e.g., beauty treatments, massages) and other services are not commonly included in the tours. Among the other services listed by the participants are sports and adventure activities, meet and greet services, special wildlife permits, luggage service, souvenirs, motorcycle rent and trophy fees.

4. The question was only addressed to the tourism authorities and not included in questionnaire of the conservation agencies.
5. Only the national and local protected area and wildlife conservation agencies questionnaire included "Rangers" among the multiple choice answers and not the national tourism authorities' questionnaire. 23 governmental institutions answered this question.

Figure 3.7 Local services included in wildlife watching tour packages (%)



Tour operators, n = 145

On the other hand, with regards to the services that their customers typically use in addition to their tour package, all the listed services are mentioned by fewer participants. This could imply that local services are booked through the tour operators rather than purchased by the tourists on-site. Cultural performances/ souvenirs (66%), wellness (63%) and food and beverages (47%) get the highest numbers, followed by restaurants (33%), local tour operators (13%) and national park services (12%). Other services typically used by customers of the participating tour operators but not included in the packages are sports and adventure activities, education, homestay, tips, porter fees and laundry.

3.3 Economic dimension of wildlife watching tourism

3.3.1 Efforts are ongoing in protected areas to monitor wildlife watching tourists, but results are not yet consistent

All governmental institutions were requested to indicate whether they monitor the numbers of wildlife watching tourists through any or all of the following multiple choice options: a) Entrance tickets; b) Official registration forms; c) Surveys; d) Tourist information point; e) Others.

A total of 47 governmental institutions provided an answer and 81% report that numbers of wildlife watching tourists are monitored, in all cases by official registration, entrance tickets sold for protected areas, monitoring tourist information points or similar records. Nevertheless, only six of the national level governmental institutions entered information on the results of these activities and further research would need to be undertaken to ensure their comparability.

Additionally, national and local protected area and wildlife conservation agencies were asked the question “do tourists visit your national park mainly for wildlife watching or do they come for other activities?” offering the following multiple choice options: a) 100% of visitors come to observe wildlife; b) Visitors come to observe wildlife and for other nature-related activities; c) Visitors come mainly for other nature-related activities.

A total of 24 national and local wildlife and conservation agencies provided an answer that 38% reporting that 100% of the visitors to protected areas come to observe wildlife; 54% visitors come to observe wildlife and for other nature-related activities, and 8% visitors come mainly for other nature-related activities.

In the absence of regular statistical records of the number of wildlife watching tourists, the number of protected area visitors and receipts is valuable information for the evaluation

of the importance of wildlife watching tourism for a country or a destination and therefore the questionnaires addressed to governmental institutions included detailed questions in this regard.

Governmental institutions from 14 countries entered data on the number of protected area visitors and receipts. Based on the results, three groups of countries can be distinguished according to their visitor numbers:

1. Countries with a major number of visitors in protected areas: between 2 and 5 million visitors per year. It is estimated that these countries have receipts up to US$ 90 million. (Kenya, South Africa).

2. Countries with a medium number of visitors in protected areas: between 100,000 and over 500,000 visitors per year. It is estimated that they have receipts between US$ 2 and 15 million. (Ethiopia, Lesotho, Swaziland, Tanzania, Uganda and Zimbabwe).

3. Countries with a limited number of visitors in protected areas: between 1,000 and 90,000 visitors per year. It is estimated that they have receipts between US$ 20,000 and 700,000 per year. (Burkina Faso, Chad, Cote d'Ivoire, Democratic Republic of Congo, Ghana, Niger).

According to the survey replies, protected area receipts from the 14 above-mentioned countries would total US$ 142 million per year. When using the total number of visitors in combination with the average entry fees provided for the same calculation, the total protected area receipts for the same countries would add up to US$ 168 million per year.

It should be noted that the replies related to protected area visitors and receipts of protected areas are spread over a very large range. This could be linked to the different circumstances of the participating countries. Nevertheless, further research would be required to validate and complement these data and therefore, only estimations are being presented.

3.3.2 Wildlife watching represents 80% of the total annual sales of trips to Africa and sales are increasing

The tour operators were asked to describe their business performance to provide information about the following items: a) the number of tours sold that includes wildlife watching; b) the number of customers on tours that include wildlife watching; c) the percentage of their product portfolio that wildlife watching tours represent; d) their annual sales, and; e) the sales trends.

From the participating 145 tour operators, depending on the question, between 105 and 123 entered data related to the number of tours, customers and percentage of their product portfolio that wildlife watching represents. In total, the tour operators participating represented more than 26,500 tours per year[6], with the biggest seller selling 3,000 and the smaller seller selling 1 tour per year. The average tours sold is 181 tours per year per tour operator. However, this figure is not representative for the whole sample of respondents due to the difference in sizes of the tour operating companies (83% of the respondents are MSMEs) and therefore, the data has been split depending on the size of the tour operator in the table below.

	Micro	Small	Medium	Large
Tours sold including wildlife[7]	4,076	9,656	7,337	4,323
Share of wildlife tours out of all tours sold with Africa as a destination	76%	70%	72%	66%
Number of tour operators replying	57	43	11	6
Average number of tours sold annually per operator	72	225	667	721

Participating tour operators sold tours to more than 144,000 customers per year. The range started as low as 2 customers and reached 13,500 customers per year per tour operator, with an average of 1,203 customers per year per tour operator. In the following, data is provided related to the size of the tour operating companies (82% of the respondents are MSMEs).

6. Replies totalled in 26,783 tours.

7. In order to calculate the breakdown of tours per size of tour operator, only the entries from tour operators which had provided information on their size was used.

	Micro	Small	Medium	Large
Customers booking wildlife[8]	17,167	50,621	44,135	25,236
Share of wildlife tours out of all tours sold with Africa as a destination	78%	77%	65%	62%
Number of tour operators replying	57	40	12	5
Average customers annually per operator	301	1,266	3,678	5,047

All in all, wildlife watching represents a high percentage of the participating tour operators' product portfolio (73%) and clients (75%).

A total of 83 tour operators provided data on annual sales from wildlife watching tours, which totaled US$ 263 million. When analyzing the annual revenue from wildlife watching tours by tour operator size, it was discovered that out of the sample, 52% are micro enterprises which have annual sales of US$ 47 million in total (average per company is US$ 1 million); 31% of the sample is comprised of small enterprises which have annual total sales of US$ 92 million (average per company is US$ 3.5 million); 12% of the sample is composed of medium enterprises with annual sales of US$ 48 million (average per company is US$ 5 million), and; 5% of the sample is represented by large enterprise with annual sales adding up to US$ 70 million (average per company is US$ 17.5 million).

In total, wildlife watching tours represent 88% of the total annual revenues of trips to Africa for the participating tour operators. Interestingly, 20% of the participating tour operators sell only wildlife watching tours.

The majority (60%) of the 140 participating tour operator respondents state that the sales of wildlife watching tours have been increasing over the last five years. Another 24% find the situation stable and only 16% experienced a decrease in the wildlife watching tours sold in the same period. Some of the participants state that the reasons for decreased demand most probably link to the financial crisis and recession in North America and Europe. However, security issues, poaching and negative media coverage are also mentioned as factors influencing the decrease of arrivals.

3.3.3 The average price per person per day of a standard wildlife watching tour is US$ 243 and US$ 753 for a luxury wildlife watching tour

Tour operators were also asked to elaborate on the following key economic indicators: a) average size of groups; b) average length of stay; c) average tour price per day (excluding flights), and; d) average additional out-of-pocket spending per day.

Replies provided by the tour operators have been analyzed by splitting them into the two main segments, i.e. standard tours and luxury tours. This segmentation was done based on data provided and validated with each operator. Key economic indicators were provided by 114 to 128 tour operators. 128 tour operators replied to the second round of consultations which intended to confirm some initial results.

Out of the 128 tour operators that participated in the second round of consultations, 42% are specialized in the "standard" segment while 28% are specialized in the "luxury" segment. Another 30% positioned themselves in both segments targeting customers from the "standard" and the "luxury" markets.

The data of the survey suggests that the average number of participants in a wildlife watching tour is 6 persons, though the number of participants can range from 1 to 30 persons. In the "standard" market segment the average number of participants per tour is 7 and can range from 2 to 30 persons. In the "luxury" market segment the average number of participants per tour is 5 and ranges from 1 to 24.

The average length of stay for a typical wildlife watching tour from the overall sample (128 tour operators) is 10 days. In the "standard" market segment the average length of stay is 11 days; the range starts at half a day and reaches up to 42 days. In the "luxury" market segment the average length ranges from a day and half to 18 days.

The average daily price (excluding flights) for a wildlife watching tour from the overall sample (128 tour operators) is US$ 433. In the "standard" market segment the average price per day for a wildlife watching tour is US$ 243 and ranges from US$ 86 to 500 per day. In the "luxury" market segment the average price per day of a wildlife watching tour is US$ 753 and ranges from US$ 179 to 2,500 per day.

As the average number of participants and the average length of stay for both the luxury and standard segments are very similar, it can be concluded that they are intrinsic characteristics to the wildlife watching product that do not necessarily relate to the level of comfort of the experience. The indicator that clearly differentiates the segments is the average daily price, and this clearly works to identify which market the tour operators are targeting. It is important to note that within the African region the prices for both the "standard" and the "luxury" segments vary in each country depending on the level of tourism development of the destination and the size of the market offer.

Based on the overall responses, the average daily additional out-of-pocket spending from the full sample (128 tour operators) is US$ 55. In the "standard" market segment the average the reported additional spending per day is US$ 44, with additional spending ranging from US$ 7 to 250 per day. In the "luxury" market segment the average additional spending per day is US$ 59 with a range of US$ 1 to US$ 104.

The typical wildlife watching tour

Average number of participants:

6

Average length of stay:

10 days

Average tour price per day:

US$ 433 per person

Average out-of-pocket spending per day:

US$ 55 per person

8. In order to calculate the breakdown of customers per size of tour operator, only the entries from tour operators which had provided information on their size could be used.

Case Studies (2)

Serengeti-Ngorongoro Circuit, Tanzania

According to a study conducted in 2009, the southern circuit at Serengeti-Ngorongoro receives 300,000 tourists per year on the 300 km stretch between Arusha and Serengeti. The total inbound tourism expenditure generated at this destination is US$ 500 million per year, which is more than half of Tanzania's foreign exchange earnings from tourism. The price of a typical wildlife watching package is US$ 1,600 for 6 days/ 5 nights (US$ 320 per day). Additionally, tourists spend an average US$ 226 out-of-pocket (US$ 37/day).

Among the local tourism providers that benefit from this income are tour operators and providers of accommodation, parking, transport, cultural goods and services as well as food and beverages. Along the safari circuit there are about 3,500 crafts and souvenir stalls that employ 7,000 sellers and 21,000 crafters. About US$100 million per year (19% of the earnings) are considered pro-poor, meaning that they reach local people via wages and tips when they are employed by tourism providers. Furthermore, local small producers provide about half of the food consumed at the circuit. The local population obtains indirect benefits from tourism through funds allocated by the protected area management to the communities.

Together with the second part on Kilimanjaro tourism, the 2009 study reveals that Tanzania captures about half of the total value of the global value chain for a package holiday sold in Europe. The great majority of the inbound tour operators and tourism providers are owned by Tanzanians. Foreign companies are not common but pay significantly higher wages than local companies. The benefits of tourism at Serengeti-Ngorongoro could be enhanced by establishing better linkages between accommodations and local food producers as well as capacity building to foster local employment in the tourism sector and to increase the margins of the craft sector. (Steck/ODI, 2009).

Economic impact of nature tourism in Zambia

In Zambia, tourism is one of the fouressential sectors identified for sustainable development. Yet, the economic impact of nature tourism has been underestimated. In 2005, tourism was characterized by a small and fragmented private sector, inconsistent policies, weak incentive structures, poor business climate, limited fiscal support of the tourism sector and lacking financial resources of the Zambia Wildlife Authority and the Ministry of Tourism. Even under such unfavourable circumstances, a World Bank study showed that the economic impact of nature tourism is significantly higher than previously perceived.

In 2005, only 26% of international tourist arrivals were nature-tourists, but these 176,000 visitors realized an export value of tourist spending of US$ 194 million which is 3.1% of the direct GDP. Summing up direct and indirect linkages, the 176,000 nature tourists contributed nearly 16% of Zambian exports and 6.5% of the GDP, more than 6% of wages and net income of unincorporated business, 7% of government revenues and nearly 10% of formal sector employment (54,000 formal jobs). The fiscal revenues generated in 2005 by international nature tourists visiting national parks were about US$ 5 to US$ 8 million, meaning that the revenues exceeded by far the US$ 1 million in funds allocated to the Zambia Wildlife Authority in the same year.

In 2007, approximately 206,000 international tourists (30% of overall international tourist arrivals) came to Zambia to experience Victoria Falls, wildlife and nature-based activities. Considering the many challenges the tourism sector in Zambia was facing in 2005, the opportunities for developing nature and wildlife tourism and enhancing the benefits of tourism are growing. Tourism, and specifically nature and wildlife tourism, can be an important source of revenues and employment if appropriate revenue-sharing mechanisms are put in place to enhance the benefits for local communities and pro-poor impacts of tourism. (Hamilton et al., 2007).

3.4 Effects of poaching on tourism

3.4.1 Nature conservation and wildlife are managed but with many shortcomings

Governmental institutions and tour operators were requested to evaluate nature conservation and wildlife management in their countries or the countries in which they operate through a multiple choice answer: a) Very well managed; b) Well managed; c) Managed but there are many shortcomings; d) Poorly managed or not at all.

Of the 23 governmental institutions that answered this question, 57% of the responses indicate that nature conservation and wildlife are "managed but with many shortcomings", 26% state "well managed", 17% reply "very well managed". "Poorly managed or not at all" was not mentioned in the replies.

Of the 144 tour operators that answered this question, 51% state that nature conservation and wildlife are "managed but with many shortcomings", 31% reply "well managed, 13% state "very well managed", while 5% reply with "poorly or not at all".

The quite similar assessment indicates that nature conservation and wildlife are equally important from a conservation but also tourism sector perspective. In their replies, many tour operators singled out poaching as the biggest threat to wildlife.

3.4.2 Poaching has a negative impact on the tourism experience

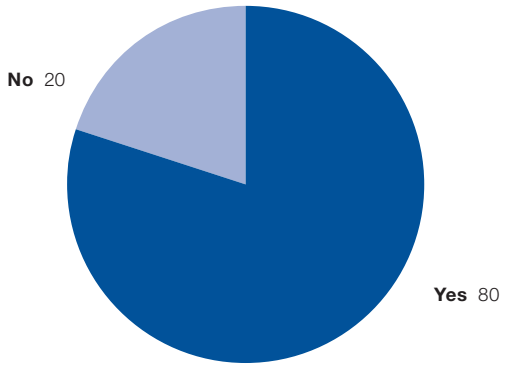
Governmental institutions were requested to indicate whether there are problems with poaching in their respective countries and which animals are being poached among the following: a) terrestrial mammals; b) marine wildlife; c) birds; d) others. Additionally, both governmental institutions and tour operators answered the question "Do you consider poaching as an issue that affects wildlife watching tourism?" and tour operators were requested to indicate the "difficulties encountered during tours because of poaching activities".

Out of the 46 governmental institutions that replied to the first question, 93% confirm that there are problems with poaching in their countries or in their protected areas. The majority of the governmental institutions state that terrestrial mammals are the most commonly poached (70%). Marine wildlife and birds are threatened to a much lesser extent (indicated by 25% and 30% of the participants respectively). Other species were mentioned by 5% of the governmental institutions that replied.

Additionally, out of the 46 governmental institutions and the 145 tour operators that replied to these questions, 80% of the governmental institutions and 70% of the tour operators state that it is affecting wildlife watching tourism. The following explanations were provided:

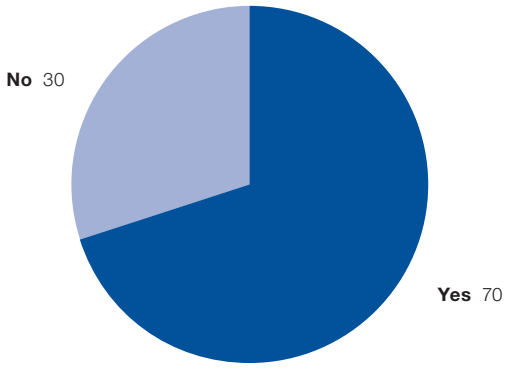
Figure 3.8 Does poaching affect wildlife watching tourism? (%)

Government institutions respond:



Government institution respondents, n = 46

Tour operators respond:



Tour operators respondents, n = 145

- Poaching decreases wildlife populations and adversely affects ecosystems;

- Poaching has a deteriorating effect on the tourism experience: reduced wildlife populations and changes in animal behaviour diminish the chance to observe wildlife. Animals become shyer and are harder to find and approach;

- Bad sightings occur (carcasses, rhinos without horns, marked animals, slaughtered and living animals on sale) that significantly affect the tourism experience;

- Poaching threatens security. Shootings in the parks, no-go areas, warning signs, encounters with poachers and armed anti-poaching patrols make tourists feel unsafe or are put in actual danger;

- It creates a bad image of a country or a destination and therefore fewer tourists visit the places affected by poaching;

- Anti-poaching measures are a big financial burden for the protected areas and countries in general; and

- Poaching results in lower numbers of tourists, reduces tourism receipts and affects the long-term sustainability of tourism.

While a majority of the tour operators state that tourism is affected by poaching, only 26% of the participants report direct impacts on their operations, e.g., additional costs for extra security measures, the necessity to change itineraries because of blocked roads or closed areas and a negative impact on the tourists' satisfaction as wildlife observation is less guaranteed and bad sightings as described above occur.

3.4.3 Tour operators can play an important role in raising awareness of the issue and (co-) funding anti-poaching initiatives

Governmental institutions and tour operators were requested to indicate whether they "are involved or fund anti-poaching activities" and/or "distribute specific information on poaching". Additionally, tour operators were asked whether their "customers are concerned with poaching".

A total of 47 governmental institutions provided responses with 77% indicating that they are involved with anti-poaching measures. For instance: patrolling and law enforcement (prosecution), awareness raising campaigns, environmental education and working with communities are important anti-poaching measures. Other actions are gaining the support of other authorities, participating in policy making at regional and international levels and the gathering intelligence and research on poaching. Many participants indicate a variety of measures or state that there is a broad anti-poaching strategy in place.

The 26% of governmental institutions that replied that are not engaging in such measures are in most cases tourism ministries or national tourism authorities that are not responsible for wildlife conservation. Otherwise, all but one protected area/wildlife conservation authority state that they engage in anti-poaching activities.

Of the 145 tour operators that replied, 49% state that they fund anti-poaching initiatives; 51% do not engage in such measures; 34% of the tour operators know that their suppliers are involved in anti-poaching support; 58% are not aware of such initiatives and 8% indicate that their suppliers do not fund anti-poaching.

A total of 45 governmental institutions mentioned that 42% do not distribute information on poaching, however, 22% state that this is planned for the future. Looking at the different types of institutions, the answers are the same: a third of the tourism ministries and a third of the protected area/wildlife conservation authorities distribute information on poaching to visitors and/or the general public, more than half of them do not distribute such information or are only currently developing it.

Of the 145 tour operators that replied, the majority (58%) does not distribute information on poaching. 23% say they use a variety of media and measures to inform their clients (websites, flyers, travel information, newsletters, press releases, give-aways, brochures etc.). In many cases, the tour guides inform the tourists about the topic. Sometimes tourists visit an education center that informs them about poaching. Some tour operators distribute information materials developed by nature conservation NGOs. About 40 NGOs, institutions and anti-poaching projects and other organizations are mentioned in the responses to the survey.

32% of 145 participants state that their customers actively ask about poaching, another 51% say that the customers express their concern when the topic comes up – depending on the tour operator, this was found to happen very often (70%) or occasionally (30%). Only 16% report not experiencing concerns of the tourists regarding the topic.

The extensive comments of the participating tour operators reveal their deep concern with the topic of poaching (see box below).

Tour operators' comments (selection)

"Africa without wildlife would deprive all TO the basis of their existence. Semi-captive settings are no solution, wildlife needs to be at free range in big game parks."

(Germany, translated from German)

"Wildlife conservation should play a bigger role for the tourism sector and the revenue it generates. (…)"

(Germany, translated from German)

"(…) It is terrible that human beings with intelligence can be so barbaric at this day and age. (…) PLEASE DO something to save the rhinos and elephants."

(South Africa)

"We are willing to support anti-poaching activities but only if the government gets serious with the whole issue. Without government intervention, it will be a fruitless effort (…)."

(Tanzania)

"The increased media coverage about poaching has been a matter for our clients. In many cases, they have seen evidence of poaching (…) with skittish animals, carcasses or areas devoid of game."

(Tanzania)

"Great concern with the elevated rhino and elephant poaching activity occurring in Africa, this will ultimately impact the wildlife viewing opportunities as well as devastate the tourism industry."

(United States of America)

4. Conclusions and recommendations

The review of the literature and case studies reveal that while there are numerous studies, projects and publications analyzing wildlife watching tourism, more is needed in terms of measuring its value. Although the economic value of wildlife watching tourism is usually referred to as important, the reviewed literature focuses mainly on how the economic value could be evaluated and points out that there are no valid data readily available for such analysis. Additionally, an estimation of the overall value of the segment based only on the available case studies of specific destinations are not broadly representative and can be misleading given the different levels of tourism development in Africa. However, although there are ongoing efforts being carried out to monitor data that could be relevant for estimating the economic value of the wildlife watching tourism sector, such as monitoring the number of arrivals and receipts of protected areas, these efforts are often inconsistent and commonly lead to inconclusive analysis.

The main findings of this briefing paper are based on the primary data gathered through the surveys carried out among national tourism authorities, protected area and wildlife conservation authorities, individual protected areas and international and African tour operators. In a majority of cases, the replies of governmental institutions are aligned with the replies of tour operators and in the cases where alignment did not happen, an interesting debate on the links between governmental perception and market presence of destinations was triggered. The representative response to the survey and the correlation of replies from public and private sectors supports most of the findings well.

The results of the survey reflect the serious concern of both governmental institutions and tour operators related to the poaching crisis and its negative impact on tourism. It is clear this criminal activity is viewed as a threat to the long-term sustainability of tourism and potentially jeopardizes the development opportunities linked to the sector. Moreover, the feedback from the participating governmental institutions and tour operators confirm that wildlife watching is a very important segment of tourism for most African countries as well as a

profitable one, with potential to benefit the local community. In fact, local communities appear to be involved in wildlife watching tourism in most of African countries, mainly through employment in accommodation, restaurants and guiding. Communities also function as suppliers of goods and services, primarily food and beverages and receive sometimes indirect tourism benefits through redistribution of revenues from protected area entrance fees and funds allocated to community development projects. Additionally, the annual revenues of wildlife watching tours represent 80% of the total annual revenues of trips to Africa for the participating tour operators. The replies provided indicate that revenues are expected to grow further. On average, the annual turnover of a micro tour operator is US$ 1 million; US$ 3.5 million for a small tour operator, US$ 5 million for a medium tour operator; and US$ 17.5 million for a large tour operator.

According to the survey, wildlife watching tourism takes place mainly in protected areas and nature, national parks and wildlife are among the most important assets for wildlife watching destinations. Safari appears to be the main kind of wildlife watching. Safari tours are being operated by 96% of the participating tour operators and the sub-regions that are most frequented for safari tours are East and Southern Africa, where countries which are already known as wildlife watching destinations are located. From both sub-regions also higher numbers of governmental replies were received; an indication that here enabling frameworks for the development of wildlife watching tourism are already in place. It is to be noted that a great number of governmental replies were also received from the Central and West African sub-regions, which indicates the existing will to further develop wildlife watching tourism in these destinations. However, the number of tour operators active in Central and West Africa is still small.

Bird watching appears to be the second most practiced type of wildlife watching which can be observed in almost every African country and is being offered by 80% of the tour operators. The operation of bird watching tours mainly takes place in top safari destinations and indicates that bird watching could be offered more frequently in combination with other activities than as a specialized product. In fact, the results of the survey point out that wildlife watching tourism is normally combined with nature-related activities, cultural heritage and resort/beach holidays. In the third place and with variations depending of the region come marine wildlife tours and the observation of Great Apes, followed by special tracking of wildlife, which are especially important for countries that are not classic safari destinations but do play a role as wildlife watching destinations.

Through analysis of the data, it was possible to identify key characteristics and economic indicators related to the segment of wildlife watching tourism in Africa. A typical wildlife watching tour involves a group of 6 persons, lasts 10 days and has an average daily price per person per day

of US$ 433 as well as involves out-of-pocket expenses of US$ 55 per person per day. These indicators were also analyzed per market segment (standard, luxury) and it was noted that neither the size of the group or average length of stay would register remarkable variations for the different segments. In this regard, the analysis seems to indicate that the average size of the group and length of stay are intrinsic characteristics to a wildlife watching product which do not necessarily relate to the level of comfort of the experience. The variation in the average price per person per day is on the other hand significant: US$ 753 for a luxury package and US$ 243 for a standard package. From the participating sample, 42% of the participating tour operators offer standard wildlife watching tours, 28% are specialized in luxury tours and 30% target both standard and luxury clients.

Data on protected area visitors and receipts from 14 countries was used were conclusive data was provided, and indicates that wildlife watching tourism is generating a considerable amount of revenues for the countries where it is taking place. The protected area receipts of these 14 countries totaled US$ 142 million per year. As this figure relates to only a small number of countries, one can assume that protected area receipts are indeed much higher. Guidance and capacity building for a more consistent monitoring of protected area visitors and receipts as well as a framework for their analysis are needed. In this regard, the development of a model for the structured integration and evaluation of available data, in order to harness it for an overall assessment of the economic value of wildlife watching tourism in Africa, which would connect data from protected areas with tour operators' performance, would be useful.

A majority of the protected area authorities participating in the survey is involved in anti-poaching measures. Tourism authorities are involved only to a minor extent and the majority does not distribute information on poaching. From the side of the participating tour operators, about half of them fund anti-poaching initiatives or engage in a nature conservation project. Only a few inform their customers on the issue. Although the involvement in anti-poaching initiatives is not very extensive yet, the survey shows that there is potential for mobilizing the tourism sector in anti-poaching campaigns since they can play a key role in awareness raising and potentially (co-) finance anti-poaching initiatives.

Finally, this briefing paper is to be seen as a first step towards measuring the economic value of wildlife watching tourism in Africa and defining the role of the tourism sector in the fight against poaching. The exercise has succeeded in identifying key economic indicators and characteristics of wildlife watching tourism in African countries. Despite the limitations, the findings support the potential of the tourism sector to advance its contribution to the fight against poaching in Africa and confirm the importance of wildlife watching tourism for the sustainable development of the region.

Annex I
List of contributions and tour operators

List of contributions

The following organizations and institutions contributed to the briefing paper by providing case studies, other publications and expertise:

- Adventure Travel Trade Association (ATTA)
- African Travel and Tourism Association (ATTA)
- Association of British Travel Agents (ABTA)
- Convention of Migratory Species of Wild Animals (UNEP/CMS)
- Convention on International Trade in Endangered Species of Wild Fauna (CITES)
- Deutsche Gesellschaft für Internationale Zusammenarbeit (GIZ)
- Federal Agency for Nature Conservation of Germany (BfN)
- International Consortium on Combating Wildlife Crime (ICCWC)
- International Fund for Animal Welfare (IFAW)
- International Institute for Sustainable Development (IISD)
- International Union for Conservation of Nature (IUCN)
- United Nations Office on Drugs and Crime (UNODC)
- World Wildlife Fund (WWF)

List of tour operator associations

The following tour operators associations provided support to circulate the survey invitation:

- ABTA, UK
- Tour Operators' Initiative for Sustainable Tourism Development (TOI)
- Deutscher ReiseVerband e.V. (DRV), Germany
- Association of French Tour Operators (SETO/CETO)
- Netherlands Association of Travel Agents and Tour Operators (ANVR)
- The African Travel & Tourism Association (ATTA), UK
- Adventure Travel Trade Association (ATTA), USA
- American Society of Travel Agents (ASTA)
- Association of Danish Travel Agents and Tour Operators (Danmarks Rejsebureau Forening)
- Tanzania Association of Tour Operators
- Africa Travel Association, USA
- forum anders reisen e.V., Germany
- Association of Independent Tour Operators (AITO), UK
- Schweizerrischer Reise-Verband (SRV), Switzerland
- Association for the Promotion of Tourism in Africa (APTA), USA
- Association of Croatian Travel Agencies
- ASTOI Confindustria Viaggi (Associazione Tour Operator Italiani)

List of participating tour operator

AFRICA		
1	**Botswana**	Gavin Blair Safaris
		Golden Okavango t/a Golden Africa
2	**Cabo Verde**	Naturalia Capa Verde Lda
3	**Ethiopia**	Abeba Tours Ethiopia
4	**Gabon**	ngondetour
5	**Kenya**	African Quest Safaris Ltd
		Asilia Safaris
		Eco Adventures Africa
		Impact Adventure Travel
		Kent Tours & Travel Ltd
		Outdoor Africa
		Simba Holidays
		Arp Travel Group
6	**Madagascar**	Asisten Travel
		Le Voyageur
		SETAM
7	**Malawi**	Rpss
		Ulendo Safaris
8	**Namibia**	ATC Namibia
		Chameleon Holidays
		Chameleon Safaris Namibia
		E. Safaris & Tours
		Eagles Rock Tours & Safaris
		Karibu Safari Namibia
		Namib Enviro Tours cc
		Sense of Africa and Wild Africa Travel, Tourvest
		Ultimate Safaris
9	**Nigeria**	Johnpaul Ezeani
10	**Rwanda**	Amahoro Tours
11	**South Africa**	ATC-African Travel Concept (DMC)
		Africa Geographic Travel
		African Adventure Safaris
		Bushtracks Expeditions
		Kirfara
		Mozambique Tourism
		Roads to roam
	South Africa	Rockjumper Birding Tours
		Sun Safaris
		Sunway Safaris
		The Savannah Africa
		Wow Cape Town Tours
12	**Uganda**	Around Africa Safaris
		BIC Tours Ltd
		Kagera Safaris / Miriam Kyasiimire
		Kombi Nation Tours
		Mamaland safaris. Tony Byarugaba
		Matoke Tours
		Surf Tours & Travel
		The Far Horizons
13	**United Republic of Tanzania**	BMS Safaris Limited
		Blackmamba Travels Lts
		Chem Chem Safaris
		Duma Explorer
		Fast Travel & Adventure Limited
		Four Seasons Safari Lodge Serengeti
		Intoafrica Eco Travel Ltd
		Kibo Guides (TZ) Ltd
		Leopard Tours Ltd
		Manyara Ranch Conservancy
		Melau Tours and Safaris
		Nomad Tanzania Ltd
		Safari Makers Ltd
		Serengeti Balloon Safaris
		Summit Expeditions & Nomadic Experience
		The African Footprint Co. Ltd (B2B Safaris)
		The Map's Edge Ltd
		Wild Things Ltd
		Wildlife (East Africa) Ltd
		Karibu Africa Safaris Ltd
14	**Zimbabwe**	Natureways Safaris Pvt Ltd
		Nyati Travel
		Zambezi Safari & Travel Co.

EUROPE

15	**Croatia**	Olymptours by Ratko Flajpan
		El-pi Tours Malinska*
		Frodo d.o.o., Yacht Base travel agency*
		Hvar Touristik*
		Katarina Line*
		Lang International*
		PENTA d.o.o.*
		Zlatna Greda Ltd. tourist agency*
16	**Czech Republic**	Stella Travel
17	**Denmark**	Limpopo Travel
18	**Finland**	Koonono Tours Ltd
19	**France**	Kuoni
		Les Circuits Découverte by Club Med
		Rev Vacances
		Vacance Transat (Transat France)
		Voyageurs du Monde
20	**Germany**	AST African Special Tours GmbH
		Afrika à la Carte Reisen
		Albatros-Tours
		Art of Travel GmbH
		Bikeworld Travel GmbH
		Chamäleon Reisen GmbH
		DER Touristik
		Daktaritravel
		Djoser Reisen GmbH
		ETC Reisen Edutainment Travel Company
		Elangeni African Adventures
		Escape tours GmbH
		Globetrotter Select
		Jacana Tours
		Karibu Safaris GmbH
		Klipspringer-Tours GmbH
		Makalali - African Exclusive Tours
		S.A.Landprogramm
		SA Travel
		Severin Travel Africa
		Studiosus Reisen
	Germany	Tour Vital
		Thomas Cook AG Segment Continental Europe
		Wikinger Reisen
		R.U.F Touristik GmbH*
		Rucksack Reisen*
		Tour Exquisit*
21	**Italy**	FollowMe
		Best Tours Italia
		Hoteplan Italia Spa
		Il Diamante
		NAAR Tour Operator
		Settemari Spa
		Viaggi Dell'elefante
		Viaggi del Mappamondo
22	**Lithuania**	Baltic tour*
23	**Netherlands**	Bongo Asili Travel
		Kuoni Netherlands/NDTC
		Live To Travel
		Mondi Reizen
		SNP Natuurreizen (SNP Nature Travel)
		Travel Trend
		Travelhome
		Vamonos Travels
		De Jong Intra Vakanties
24	**Portugal**	Zoom Travel - Tailor Made Tour Operator
25	**Spain**	A Step Ahead S.L.
26	**Switzerland**	Stohler Tours
		Africa Design Travel
27	**United Kingdom**	Baobab Travel
		Jacada Travel Ltd
		Marketing Worldwide
		Natural High Safaris
		Rainbow Tours
		Thomas Cook
		TripAfrica
		Wildlife Trails

AMERICA		
28	**Canada**	Goway Travel
29	**Peru**	Andean Lodges*
30	**United States of America**	David Mark Erickson Travel
		Africa Adventure Consultants
		AfricanMecca Inc
		Infinite Safari Adventures
		Journeys International
		Timeless Africa
		Travcoa

ASIA		
31	**Bangladesh**	Discovery Tours And Logistics
32	**India**	Greener Pastures*
		Navigator India*
33	**Republic of Korea**	Sihnae Lee

AUSTRALIA		
34	**Australia**	The Classic Safari Company

*** Participating tour operators that were not offering trips to Africa at the time of the survey.**

Note: The above list of participating tour operators has been configured as per the entries to the survey.

Annex II
Available data

Available data on international tourism arrivals and receipts for African countries

		INTERNATIONAL TOURIST ARRIVALS (1,000)				INTERNATIONAL TOURIST RECEIPTS (US$ million)			
		2010	2011	2012	2013	2010	2011	2012	2013
1	Algeria	2,070	2,395	2,634	2,733	219	209	217	350
2	Angola	425	481	528	650	719	646	706	1,234
3	Benin	199	209	220	231	149	188	170	..
4	Botswana	2,145	..	..	..	78	33	34	45
5	Burkina Faso	274	238	..	218	72	133	84	..
6	Burundi	142	..	..	..	2	2	1	2
7	Cameroon	573	604	817	912	159	409	349	576
8	Cabo Verde	336	428	482	503	278	368	414	462
9	Central African Republic	54	..	..	..	11	..	11.	..
10	Chad	71	77	86	100	..	..	..	..
11	Congo	194	218	256	297	..	..	..	..
12	Côte d'Ivoire	252	270	289	..	201	141	..	..
13	Democratic Republic of the Congo	81	186	..	191	11	11	7	1
14	Djibouti	..	..	..	63	18	19	21	22
15	Equatorial Guinea	..	..	..	..	..	..	..	..
16	Eritrea	84	107	..	..	..	..	..	..
17	Ethiopia	468	523	596	681	522	770	607	621
18	Gabon	..	..	..	..	..	..	..	..
19	Gambia	91	106	157	171	74	83	88	..

		INTERNATIONAL TOURIST ARRIVALS (1,000)				INTERNATIONAL TOURIST RECEIPTS (US$ million)			
		2010	2011	2012	2013	2010	2011	2012	2013
20	Ghana	931	..	..	..	620	694	914	853
21	Guinea	..	..	..	56	2	2	1	..
22	Guinea-Bissau	..	..	..		13	9	7	..
23	Kenya	1,470	1,785	1,781	1,433	800	926	935	881
24	Lesotho	414	397	422	320	25	29	46	39
25	Liberia	..	..	..	..	12	232	..	..
26	Madagascar	196	225	256	196	321	..	..	..
27	Malawi	746	767	..	..	33	34	34	..
28	Mali	169	160	134	142	205	267	142	..
29	Mauritania	..	..	..	..	..	..	48	41
30	Mauritius	935	965	965	993	1,282	1,484	1,477	1,321
31	Morocco	9,288	9,342	9,375	10,046	6,703	7,281	6,703	6,854
32	Mozambique	1,718	1,902	2,113	1,886	197	231	250	241
33	Namibia	984	1,027	..	1,176	438	518	485	409
34	Niger	74	82	..	123	105	96	50	..
35	Nigeria	1,555	715	..	600	576	628	559	543
36	Rwanda	504	688	815	864	202	252	282	294
37	Sao Tome and Principe	8	12	..	..	11	16	13	13
38	Senegal	900	1,001	..	1,063	453	484	407	..
39	Seychelles	175	194	208	230	274	291	310	344
40	Sierra Leone	39	52	60	81	26	44	42	59
41	South Africa	8,074	8,339	9,188	9,537	9,070	9,515	9,994	9,238
42	Sudan	495	536	..	591	94	185	772	773
43	Swaziland	1,078	879	1,093	968	50	21	30	13
44	Togo	202	300	235	327	66	79	95	..
45	Tunisia	6,903	4,785	5,950	6,269	2,645	1,914	2,227	2,190
46	Uganda	946	1,151	1,197	1,206	784	959	1,135	1,184
47	United Republic of Tanzania	754	843	1,043	1,063	1,255	1353	1,713	1,880
48	Zambia	815	920	859	915	125	146	155	224
49	Zimbabwe	2,239	2,423	1,794	1,833	634	664	749	851

Annex III
Governmental institutions

List of participating governmental institutions

	COUNTRY	NAME	INSTITUTION TYPE
1	**Benin**	Direction du Parc National de la Pendjari	National Park
2	**Botswana**	Ministry of Tourism, Environment & Wildlife	Tourism Ministry
3	**Burkina Faso**	Ministère de la Culture et du Tourisme	Tourism Ministry
4	**Burundi**	Ministère du Commerce, de l'Industrie, des Postes et du Tourisme	Tourism Ministry
5	**Cameroon**	Ministry of Tourism and leisure	Tourism Ministry
6	**Cabo Verde**	General Directorate of Environment	National Wildlife Conservation Authority
7	**Chad**	Ministère de l'Environnement et des Ressources Halieutiques	Environment Ministry
8	**Congo**	Wildlife Conservation Society (WCS) Programme Congo	National Wildlife Conservation Authority
9	**Cote d'Ivoire**	Ministère du Tourisme	Tourism Ministry
10	**Democratic Republic Congo**	Administration Nationale du Tourisme	National Tourism Authority
		Institut Congolais pour la Conservation de la nature (ICCN)	National Wildlife Conservation Authority
11	**Eritrea**	Ministry of Agriculture	Agriculture Ministry
12	**Ethiopia**	Ethiopian Wildlife Conservation Authority (EWCA)	National Wildlife Conservation Authority
13	**Gabon**	Ministère des Mines, de l'Industrie et du Tourisme	Tourism Ministry
14	**Gambia**	Gambia Tourism Board	National Tourism Authority
15	**Ghana**	Bui National Park	National Park
		Wildlife Division of Forestry Commission	National Wildlife Conservation Authority
		Forestry Commission Wildlife Division	National Wildlife Conservation Authority
		Ministry of Tourism, Culture & Creative Arts	Tourism Ministry
16	Guinea	Office guinéen des Parcs et Réserves	National Wildlife Conservation Authority

	COUNTRY	NAME	INSTITUTION TYPE
17	**Kenya**	Kenya Wildlife Service	National Wildlife Conservation Authority
		Ministry of East African Affairs, Commerce and Tourism	Tourism Ministry
		County Government of Migori	Others (County Government)
18	**Lesotho**	Sehlabathebe National Park	National Park
		Ministry of Tourism, Environment and Culture	Tourism Ministry
19	**Malawi**	Department of National Parks and Wildlife	National Wildlife Conservation Authority
20	**Mali**	Office Malien du Tourisme et de l'Hôtellerie (OMATHO)	National Tourism Authority
21	**Mauritania**	Parc National du Diawling	National Park
		Direction des Aires Protégées et du Littoral	National Wildlife Conservation Authority
22	**Mozambique**	Ministry of Tourism	Tourism Ministry
23	**Niger**	Ministère du Tourisme et de l'artisanat	Tourism Ministry
24	**Senegal**	Direction des Parcs Nationaux: Parc National des Iles de la Madeleine	National Park
		Ministère du Tourisme et des Transports Aériens	Tourism Ministry
25	**Seychelles**	Seychelles Islands Foundation	Local Wildlife Conservation Authority
26	**Sierra Leone**	National Tourist Board of Sierra Leone	National Tourism Authority
27	**South Africa**	CapeNature	Local Wildlife Conservation Authority
		Western Cape Nature Conservation Board trading as CapeNature	Local Wildlife Conservation Authority
		South African National Parks	National Wildlife Conservation Authority
		National Department of Tourism	National Tourism Authority
28	**Swaziland**	Big Game Parks	National Wildlife Conservation Authority
		Swaziland National Trust Commission	National Wildlife Conservation Authority
		Swaziland Tourism Authority	National Tourism Authority
29	**Uganda**	Uganda Wildlife Authority	National Wildlife Conservation Authority
		Ministry of Tourism Wildlife and Antiquities	Tourism Ministry
30	**United Republic of Tanzania**	Tanzania National Parks	National Wildlife Conservation Authority
		Wildlife Division	National Wildlife Conservation Authority
		Tanzania Association of Tour Operators (TATO)	Others (Tour Operator Association)
31	**Zimbabwe**	Zimbabwe Tourism Authority	National Tourism Authority

Note: The above list of participating tour operators has been configured as per the entries to the survey.

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ANNEX 5.20

DRC, Directorate for Forest Management and Resources and Ministry of the Environment and Sustainable Development, *Projet TerraCongo — Protocole méthodologique de l'évaluation du couvert forestier national de référence en République démocratique du Congo*, May 2015

[Annex not translated]

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