

# Who Gets the Food?

Fred K. Waweru

## The Surroundings

Within the 01 Jogi Ranch in the Laikipia district of Kenya is a ring-fenced area of some seventy-three square kilometres, or 18,000 acres, which is the 01 Jogi Game reserve. This private reserve contains a number of shallow dams and, until recently, ample woody vegetation to feed all the animals within its bounds. Secure from hunters and with ample water and food, the animal populations have all been growing larger. Until 1988 this increase was assisted by 'traps' which encouraged individuals to enter the reserve but made it difficult for them to leave.

The reserve is on the eastern side of the ranch and separated from it by the Nanyuki-Doldol road. It includes the scenic Lodaika Mountains which rise to over 2,200 m above sea level, the Pyramid hills, and the Ilpollei plains which are at an altitude of 1760 m. Rainfall is about 500 mm a year if both the April-June and October-December rainy seasons are good, but the latter is somewhat unreliable.

## The Problem

Over the past few years the woody vegetation inside the reserve has been seen to be deteriorating in quality and quantity, particularly *Acacia drepanolobium*, one of the major browse plants for both rhinos and giraffes. Both the management of the reserve and the Kenya Wildlife Service became concerned that, especially in view of the increasing number of rhinos, there might be some risk to future food supplies.

In addition to the rhinos and giraffes, another 2,400 herbivores from 20 species live in the reserve; there are five species of carnivore. There are no lions and the three cheetah are tame, so the eight leopards, 32 hyenas and 50 jackals represent the only natural predators in the area. Without the usual predator-prey population control and with the current security and food supply, it is quite easy to have a very rapid expansion in numbers of fast breeding herbivores. Buffaloes and giraffe already account for some 65% of the total animal biomass. If the situation is allowed to continue unaltered there is a strong probability that the present diversity of animals will decrease as poor competitors starve. The ecosystem of the reserve is delicately balanced; the unreliable rains do not help.

Before any rational plan could be made it was obviously necessary to discover the total mass of animals living in the reserve, precisely which plants grew there and, in particular, which of these supplied rhinos and giraffes with the bulk of their food.

## Methods and Results

Plant samples were collected from all over the reserve, pressed, and later identified by the East African Herbarium; a list of the 101 species from 37 families is given in Table 1. Eleven transects each of at least 100 m in length were sampled using the Point Centred Quadrat technique and the data analysed for density and above-ground biomass.

Table 1. Checklist of plants in Ol Jogi Game Reserve

Family	Species	Species
Acanthaceae	<i>Barleria eranthemoides</i>	<i>Barleria acanthoides</i>
Agavaceae	<i>Sansevieria intermedii</i>	
	<i>Dracaena floribundum</i>	<i>Sansevieria rajfillii</i>
Amaranthaceae	<i>Aerva lanata</i>	<i>Psilotrichum elliotii</i>
	<i>Achyranthes aspera</i>	<i>Pupulia lappacea</i>
Amaryllidaceae	<i>Scadoxus multiflorus</i>	
Anacardiaceae	<i>Rhus natalensis</i>	
Apocynaceae	<i>Carissa edulis</i>	<i>Acokanthera schimperi</i>
Araliaceae	<i>Cussonia holstii</i>	
Asclepiadaceae	<i>Gramopocarpus stenophyllus</i>	<i>Sarcostemma viminalis</i>
Balanitaceae	<i>Balanites glabra</i>	<i>Balanites aegyptiaca</i>
Boraginaceae	<i>Cordia ovalis</i>	
Burseraceae	<i>Commiphora schimperi</i>	
Capparidaceae	<i>Boscia angustifolia</i>	<i>Maerua triphylla</i>
Commelinaceae	<i>Commelina benghalensis</i>	<i>Commelina africana</i>
Compositae	<i>Erlangea cordifolia</i>	<i>Helichrysum schimperi</i>
	<i>Helichrysum glumaceum</i>	<i>Felicia muricata</i>
	<i>Aspilia mossambicensis</i>	<i>Conyza volkesii</i>
	<i>Gutenbergia boranensis</i>	<i>Volutaria lippii</i>
	<i>Conyza floribunda</i>	
Convolvulaceae	<i>Convolvulus sagittatus</i>	<i>Ipomea blepharophylla</i>
Crassulaceae	<i>Kalanchoe densiflora</i>	
Curcubitaceae	<i>Cucumis aculeatus</i>	
Ebenaceae	<i>Euclea divinorum</i>	
Euphorbiaceae	<i>Croton dichogamus</i>	
Gramineae	<i>Pennisetum mezianum</i>	<i>Pennisetum stramenium</i>
	<i>Engrostis temifolia</i>	<i>Chloris virgata</i>
	<i>Aristida adoensis</i>	<i>Themeda triandra</i>
	<i>Panicum maximum</i>	<i>Sporobolus fimbriatus</i>
	<i>Harpachne schimperi</i>	<i>Chloris roxburghiana</i>
	<i>Emeapogon schimperiana</i>	<i>Sporobolus helvolus</i>
	<i>Rhynchelytrum repens</i>	<i>Hyparrhenia papillipes</i>
	<i>Aristida mutabilis</i>	
Iridaceae	<i>Gladiolus natanensis</i>	
Labiatae	<i>Fuerstia africana</i>	<i>Plectranthus latiflorus</i>
	<i>Ocimum suave</i>	<i>Plectranthus cylindrica</i>
	<i>Plectranthus tennifloris</i>	<i>Jasminium floribundum</i>
	<i>Dombeya rotundifolia</i>	
Liliaceae	<i>Asp haragus falcatus</i>	<i>Aspharagus buchananii</i>
Malvaceae	<i>Sida ovata</i>	<i>Hibiscus aponeuris</i>
	<i>Abutilon mauritanicum</i>	<i>Abutilon fruticosum</i>
	<i>Hibiscus flavifolius</i>	<i>Hibiscus lunarifolius</i>
Mimosaceae	<i>Acacia nilotica</i>	<i>Acacia drepanolobium</i>
	<i>Acacia mellifera</i>	<i>Acacia etbaica</i>
	<i>Acacia brevispica</i>	<i>Acacia xanthophloea</i>
	<i>Acacia tortilis</i>	
Nyctaginaceae	<i>Boerhavia diffusa</i>	
Papilionaceae	<i>Indigofera arrecta</i>	<i>Dolichos oliveri</i>
	<i>Indigofera bogdani</i>	
Portulacaceae	<i>Portulaca quadrifida</i>	
Rhamnaceae	<i>Rhamnus staddo</i>	<i>Ziziphus mucronata</i>
	<i>Scutia myrtina</i>	
Rubiaceae	<i>Xeromphis keniensis</i>	<i>Rytigynia toronthifolia</i>
	<i>Pavetta gardenifolia</i>	<i>Tarenna graveolus</i>
Sapindaceae	<i>Dodonaea viscosa</i>	
Solanaceae	<i>Solanum incanum</i>	<i>Monechma debile</i>
	<i>Solanum hastifolium</i>	
Sterculiaceae	<i>Dombeya rotundifolia</i>	
Tiliaceae	<i>Grewia bicolor</i>	<i>Grewia tembensis</i>
Umbelliferae	<i>Diplolophium africanum</i>	<i>Heteromorpha trifoliata</i>
Verbenaceae	<i>Clerodendrum myricoides</i>	
Vitaceae	<i>Roicissus tridentata</i>	<i>Cyphostema orondo</i>

Giraffes were observed from a distance and, with the aid of binoculars, the species they ate noted. Rhino feeding tracks were followed to discover their diet; shoots that have been bitten by a rhino are easy to identify.

## Diets

The records show rhinos eating from a total of 26 species with *Acacia etbaica* the most important. Giraffes utilized 15 species, 11 of them in common with the rhinos, and their favoured food was *Acacia mellifera*. This was also eaten by the rhinos but not so often as *Acacia nilotica*, *Acacia drepanolobium* and *Grewia* spp. Second and third choices for giraffes were *Acacia drepanolobium* and *Euclea divinorum*.

The full dietary breakdown for the two species is given in Table 2 and show a 42% overlap between them. *Acacia drepanolobium* is known to be preferred by rhinos but in the reserve is not readily available to them. However, this is not to imply that the giraffes have cornered the supply. There is no direct competition between the two animals as rhinos are solitary eaters of whole shoots at a height of  $1.0 \pm 0.7$  m while giraffes feed in groups off the non-lignified parts of plants growing at a height of  $2.2 \pm 1.0$  m.

## The Food Supply

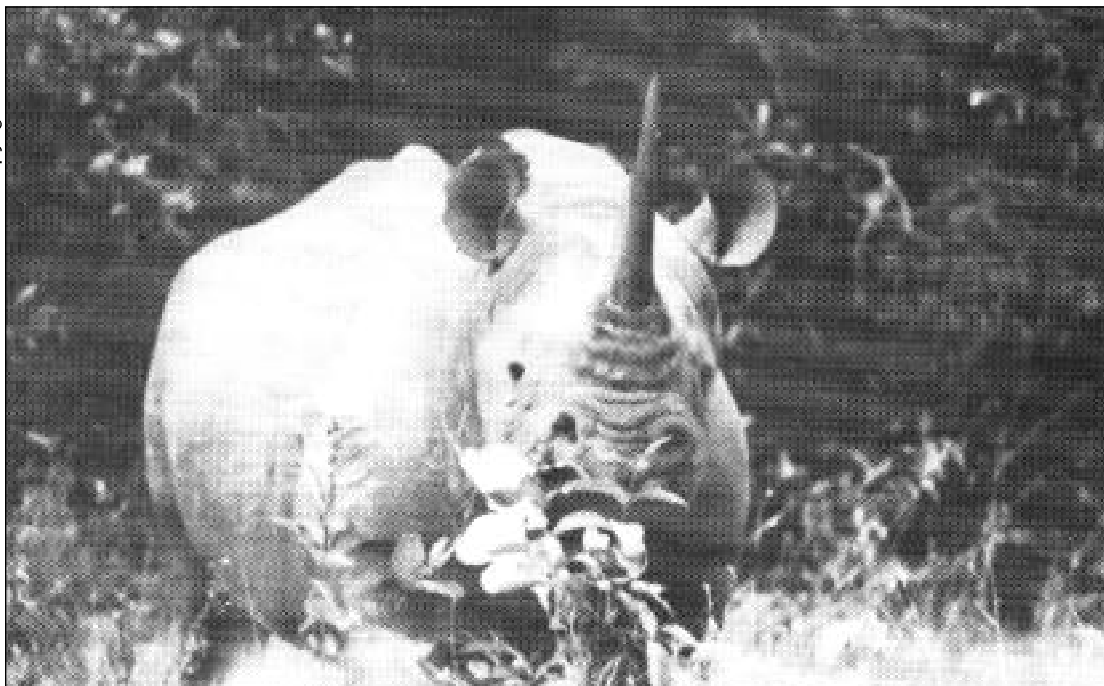
The above-ground biomass and density was computed from the data obtained during vegetation sampling and are expressed in  $\text{kg}/\text{km}^2$  and  $\text{stems}/\text{km}^2$  in Table 4. The results indicate that in the traps, outside the reserve, species diversity was lower but the densities and biomass values higher. Species which are indicators of poor range trends such as *Solanum incanum* and *Hibiscus* spp. are common within the reserve and in some cases absent outside. The higher biomass densities in the reserve's surrounds can be attributed to the healthier forest canopy which exists there compared to that inside the reserve. It is worthy of

**Table 2. Dietary Composition in the Reserve**

Species name	% composition	
	Rhinos	Giraffes
<i>Acacia etbaica</i>	36.6	4.9
<i>Acacia nilotica</i>	10.5	6.6
<i>Acacia drepanolobium</i>	9.9	16.5
<i>Grewia</i> spp.	8.8	0.9
<i>Acacia mellifera</i>	8.6	21.0
<i>Rhus natalensis</i>	4.9	6.4
<i>Commiphora schimperi</i>	2.7	-
<i>Solanum incanum</i>	2.7	0.6
<i>Clerodendrum myricoides</i>	2.4	-
<i>Barleria</i> spp.	1.9	-
<i>Hibiscus aponeuris</i>	1.5	5.3
<i>Plectranthus cylindrica</i>	1.5	-
<i>Carissa edulis</i>	1.3	-
<i>Olea africana</i>	1.3	-
<i>Sansevieria</i> spp.	1.1	-
<i>Justicia flava</i>	0.9	-
<i>Achyranthes aspera</i>	0.6	-
<i>Acacia brevispica</i>	0.6	-
<i>Balanites</i> spp.	0.4	5.1
<i>Euclea divinorum</i>	0.4	9.4
<i>Ziziphus mucronata</i>	0.2	-
<i>Kalanchoe densiflora</i>	0.2	-
<i>Phyllanthus</i> spp.	0.2	-
<i>Sarcostemma viminalis</i>	0.2	-
<i>Maerua triphylla</i>	0.2	3.6
<i>Scutia myrtina</i>	-	6.2
<i>Hibiscus flavifolius</i>	-	4.5
<i>Acokanthera schimperi</i>	-	4.2
<i>Acacia xanthophloea</i>	-	3.0
<b>Total %</b>	<b>99.6</b>	<b>98.2</b>

note that none of the dead *Acacia drepanolobium* seen in the reserve were only of rhino eating level height; they had been high enough for giraffe to have used them for food.

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Does a 1.7m tall photographer classify as rhino browse?

## The Chances of Hunger

Using the East African regression for rainfall bio-mass relationship, the expected animal stocking rate for the reserve is 5,155 kg of animal weight per square kilometre. With an area of 48.4  $\text{km}^2$  the theoretical mass of animals the reserve can support is thus 249,502 kg. Presently, Table 3 shows an estimated 581,285 kg of animals to be living there, 2.3 times the theoretical amount.



Kilimanjaro elephant after dining out in Amboseli

Table 3. Checklist of Game Animals in Ol Jogi

Name	Species	Number counted in 1989	Biomass kg
<b>Herbivores</b>			
Baboon	<i>Papio cynocephalus</i>	300	5,400
Gerenuk	<i>Litocranius walleri</i>	60	2,100
Giraffe	<i>Giraffa camelopardalis</i>	142	109,340
Greater Kudu	<i>Tragelaphus sdtrepsiceros</i>	38	11,400
Black rhinoceros	<i>Diceros bicomis</i>	11	11.0
Bland	<i>Tragelaphus oryx</i>	95	35,485
Buffalo	<i>Syncerus caffer</i>	540	270,00
Dikdik	<i>Madoqua guentheri</i>	30	150
Duiker	<i>Cepherlophus callipygus</i>	6	90
Grants gazelle	<i>Gazella granti</i>	102	5,100
Hartebeeste	<i>Alcelaphus buselphus</i>		
Impala	<i>Aepyceros melampus</i>	400	18,000
Klipspringer	<i>Oreotragus oreotragus</i>	32	64,000
Oryx	<i>Oryx gazella</i>	50	8,350
Reedbuck	<i>Redunca fulvorufula</i>	40	1,200
White rhino	<i>Ceratotherium simum</i>	3	6,000
Steinbok	<i>Raphicerus campestris</i>	6	120
Warthog	<i>Phacochoerus</i>	79	1,975
Waterbuck	<i>Kobus ellipsiprymnus</i>	120	14,400
Wildebeest	<i>Connochaetes taurinus</i>	11	1,815
Burchell zebra	<i>Hippotigris quagga</i>	260	61,880
Grevy zebra	<i>Hippotigris grevyi</i>	31	8,680
Total			581,285
<b>Carnivores</b>			
Cheetah	<i>Acinoryx jubabus</i>	3	
Leopard	<i>Panthera pardus</i>	8	
Spotted hyena	<i>Crocota crocuts</i>	32	
Striped hyena	<i>Hyaena hyaena</i>		
Jackal	<i>Caris</i>	50	

At first sight this would appear to be an insupportable situation but it must be remembered that the theoretical figure is a general one for the East African region and would only be ideal when estimating for large areas. It is, however, the only one available and does provide a rough guide to the stocking rate for a given location. Nevertheless, it would appear that the enhanced breeding has resulted in a rather larger herbivore population than the reserve can support on a continuing basis and this is confirmed by the presence of the poor-range species. It looks as if some of the giraffe, buffalo and zebra will have to go, to benefit both the remaining animals and the vegetation.

Table 4. Densities of above-ground woody biomass

Species Name	—Inside the Reserve—		—Outside the Reserve—	
	Density stems/km <sup>2</sup>	Biomass kg/km <sup>2</sup>	Density stems/km <sup>2</sup>	Biomass kg/km <sup>2</sup>
<i>Barleria spp.</i>	3,491	34.9		
<i>Hlibiscus spp.</i>	12,950	2,072.0	25,200	4,962.2
<i>Grewia spp.</i>	10,360	4,246.6	6,126	7,825.0
<i>Acacia drepanolobium</i>	19,031	175,085.2	14,201	130,649.0
<i>Euclea divinorum</i>	3,829	59,732.4	21,720	584,268.0
<i>Rhus natalensis</i>	3,941	59,903.2	7,936	95,232.0
<i>Aspilia mossambicensis</i>	1,013	91.2	14,201	11,787.0
<i>Aerva lanata</i>	901	9.0		
<i>Scutia myrtina</i>	1,126	49,994.4	7,101	418,959.0
<i>Psiadia punctulata</i>	113	0.6	2,367	24.0
<i>Asparagus spp.</i>	5,856	5.9	8,075	8.4
<i>Justicia flava</i>	901	0.03	975	1.0
<i>Claronedrum myricoides</i>	450	4.5	418	13.0
<i>Solanum hastifolium</i>	1,013	2.0		
<i>Solanum incanum</i>	15,089	75.4		
<i>Jusminum spp.</i>	338	0.7	4,316	49.0
<i>Phyllanthus spp.</i>	563	1.1		
<i>Abutilon mauritianum</i>	4,730	14.2		
<i>Indigofera arrecta</i>	563	0.6	975	195.0
<i>Sansevieria raffillii</i>	1,577	9.5		
<i>Achyranthes aspera</i>	901	18.0		
<i>Acacia etbica</i>	4,955	294,327.0		
<i>Sida ovata</i>	450	0.9		
<i>Acacia mellifera</i>	5,293	494,366.2	418	3,344.0
<i>Lippia javanica</i>	338	3.4		
<i>Balanites aegyptiaca</i>	1,802	1,585.7	975	1,141.0
<i>Cordia ovalis</i>	450	12,780.0		
<i>Dracaena spp.</i>	113	0.7		
<i>Pavetta spp.</i>	113	6.8		
<i>Acacia nilotica</i>	113	2,452.1		
<i>Plectranthus spp.</i>	1,013	8.1		
<i>Croton microstychs</i>	113	3.4		
<i>Kalanchoe densifolia</i>	113	0.6		
<i>Ocimum suave</i>	113	2.3	418	4.2
<i>Maerua triphylla</i>	1,013	445.7	1,949	39.0
<i>Acacia xanthophloea</i>			975	877.5
<i>Sarcostema viminiale</i>			1,949	195.0
<i>Xeromphis keniensis</i>			418	42.0
<i>Rhamnus staddo</i>			1,949	58.0
<i>Lantana triphylla</i>	450	4.5	4,734	95.0
<i>Carissa edulis</i>	113	1,021.5		
<i>Cucumis spp.</i>	113			
<i>Commiphora schimperi</i>	1,577	29,221.8		
Totals		1,158,310.3		1,259,768.3
Total density	1.07 x 10 <sup>6</sup>		1.27 x 10 <sup>6</sup>	