CENTRO PESQUISA INDIGENA
Indian Research Center - CPI

ETNO-ZOOLOGICAL ANALYSIS AND WILDLIFE MANAGEMENT

Frans Leeuwenberg
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Indian Research Center - CPI

Center for Indian Research and Training on Resource Management

Etno-zoological Analysis and Wildlife Management in the Xavante territory, Pimentel Barbosa, Mato Grosso State
(december 1990 - dezember 1992)
REPORT of TWO YEARS STUDY

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1. INTRODUCTION

The study was started in december 1990 with the set up of the analysis of hunting activities in one of the largest indian reserves in the center of Brasil. This study is an essential part of the JABURU Pilot Project of the Xavante indians, supervised by the Indigenous Research Center, CPI. After being contacted in the late fourties the Xavante changed their semi-nomadic lifestyle and accepted clothing, pottery and pharmaceutic products and several other "civilized values" in their traditional customs. Game, fish, insects, fruits, herbs, roots and other plant resources were still abundant and available till the mid sixties, when the rush of farmers spread into the interior of Brasil, after the creation of the new capital Brasilia. Consequently, large scaled projects for soja, rice production and extense pastureland for cattle breeding devastated the remaining virgin cerrado and transition-zones to the Amazon. Satellite photos of the Xavante Reserve from LANDSAT in august 1990 showed that 80% of the habitat around the Reserve has been systematically replaced by agricultural production. Changes in the lifestyle of the Xavante and the degradation of almost the entire surrounding habitats caused decline of the wildlife species on which these indians greatly depend.

The Xavante are explicitly hunters, they practice little fishing, have traditionally small crop growing with their own races of corn and - until recently - of beans and potatoes. They grow rice, manjoc and several fruits and corn along edges of gallery forest. Their cropfields are close to the village, at the maximum 7 kilometers distant.

The project aims to analyse the causes of decline of involved game populations and to produce feasible management measurements respecting the traditional hunting practices and integrating its spiritual/cultural value for the Xavante community. The gathered data during these two years of analysis are an essential basis for a continuous discussion amongst the Xavante hunters and future generations. Due to strong cultural differences it should not be expected that a Wildlife Management Plan will be easy to be implanted. The very traditional Xavante hunters follow their instinct and "hunger" for game. This might lead to delay in their acceptance of strict management rules.

2. OBJECTIVES

1. To obtain basic knowledge on costumes, traditions, cultural values and the impact of the hunting practices by the indians. To achieve a dialogue

with the communities if certain practices seem to be predatory on their ecosystem.

2. To collect the indigenous knowledge on the reproductive cycles, habitat use and food habits of the game species.

3. To obtain knowledge on the actual densities of the game species.

4. To obtain knowledge on the nutritious and spiritual dependence of the population towards the game-species and other harvested natural products.

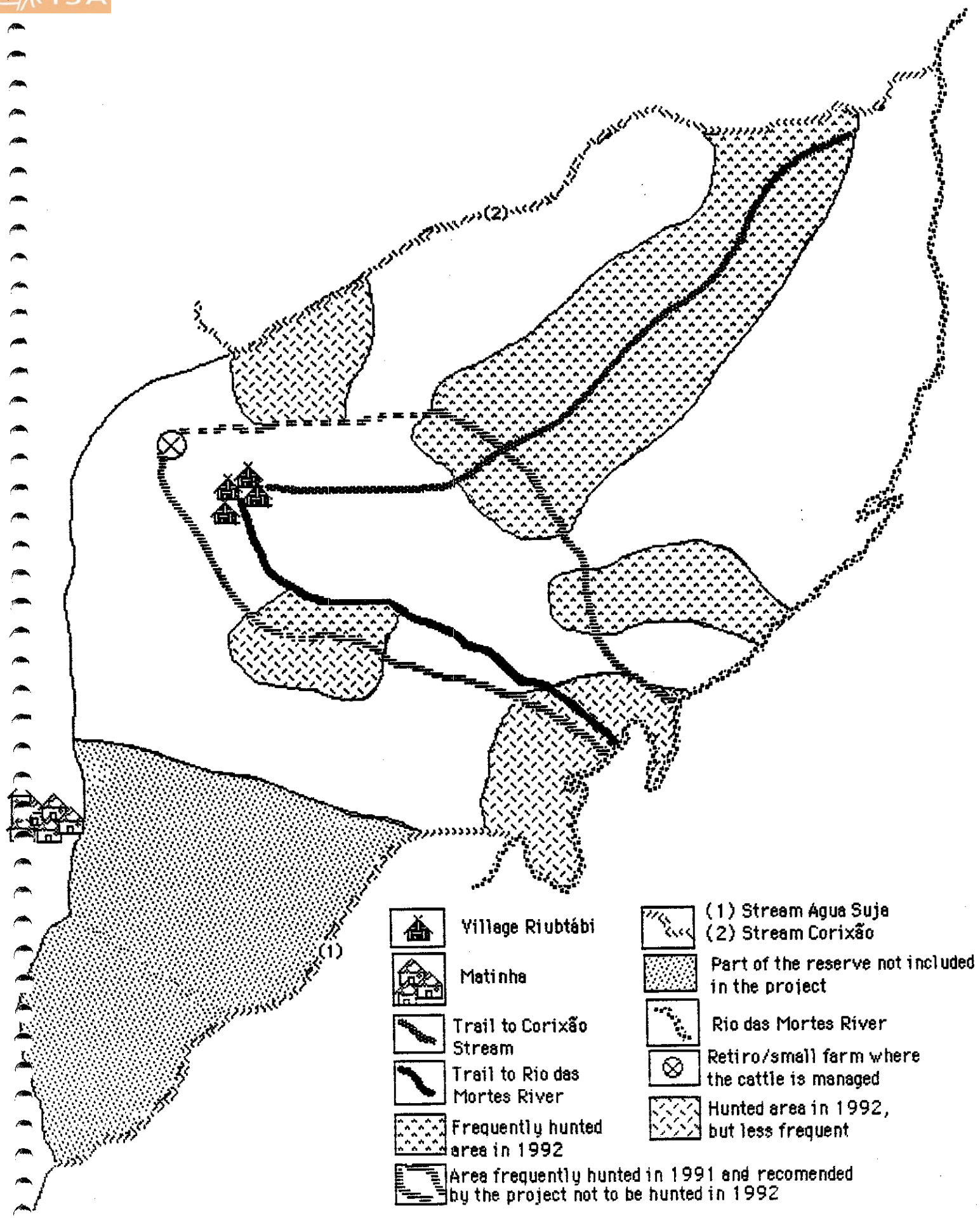
5. To study and analyses the feasibility of breeding of certain game-species in semi-captivity and accompany students (CPI) of different indigenous communities during these pre-studies.

6. To investigate and stimulate ways of self-regulations of the hunting by the Xavante indians.

7. To increase the carrying capacity of the different habitats.

3. DESCRIPTION OF THE AREA

The area of the Reserve Pimentel Barbosa is located in the east of Mato Grosso State , ca. 350 km north of the city Barra do Garças, where the southernmost Reserves are situated. The Xavantes are distributed over six Reserves beginning from Barra do Garças, with Pimentel Barbosa being the northern most. The Pimentel Reserve is 330.000 hectares of which 220.000 hectares are used by the village of Pimentel Barbosa. The remaining and smaller groups are divided over the villages Agua Bonita, Caçula and Tangura, and have tense relations with the Pimentel community because of political and family reasons. The native population density inside this part of the reserve is 0,13 persons per square kilometer. In august 1992 the village counted 289 inhabitants. The main activity of the community was concentrated in an area of ± 1.500 km2 during the years 1991 and 1992. The limits of the Reserve can be found: on the north by the Córrego Corixão, 13o13' S/051o50' W and 13o 10' S / 051o, 12' W on the east by the Rio das Mortes 13o 37' S /51o 28' W and 13o 46' S/051o54' W, on the south by Córrego Agua Suja 13o46' S / 052o02' W and 13o45' S / 051o 55' W and in the west by the Serra do Roncador,13o 40' S/52o 00' W and 13o 39' S/051o57' W. This is the legal area of the Xavante of Pimentel Barbosa. The Reserve Pimentel Barbosa was demarcated in 1980 by Decree 16034 Section 1 of 13/8/80. According to the memory of the older members and the



Mapa 1. Hunting areas in 1991 and 1992

descriptions by Maybury-Lewis (1984) the original area extended much further on the north and east side.

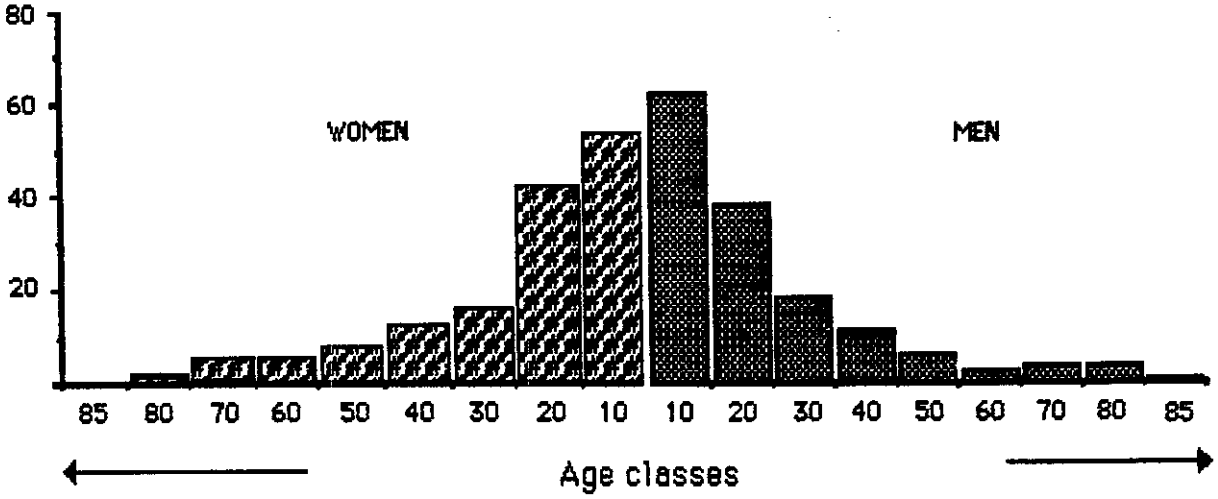


Figure 1. Age distribution of the Xavante community in 1992

There is a great variety of virgin habitat-types in the Reserve; grassland, tree-and-scrub open woodland, tree and scrub woodland, murundum/grassland, grassy marshes, gallery forests, mesophytic forests and open and closed canopy forest. Approximately 10% of the total area of the 330.000 hectares has been degradated severely due to illegal previous occupation by farmers. In those areas we find predominantly exotic grass species, amongst which Andropogon spp., Brachiaria spp., Panicum maximum and Rhynchelytrum repens. Andropogon and Panicum are considered as being very aggressive (Filgueiras, 1990). These areas are of no use to the Xavante community. The study is concentrated on the 220.000 hectares utilized by the community of the village Pimentel Barbosa. The Pimentel community counted 241 inhabitants - census by FUNAI on june 1991 - and 289 in august 1992 censused by the author. In this study only the last census will be considered as it was done very precisely. More than 53% of the xavante population are till 15 years. The FUNAI census was incomplete according to the comments of the chief and members of the Xavante Association. I did a detailed census in august 1992 and came to 289 inhabitants in the village. The sex-ratio was almost exactly equal and the structure of the age classes in the community seem to be healthy. (Figure 1)

The access to the area is very limited as there are only two sand-tracks, one between the pioneer village Matinha and the Pimentel village and one between the Pimentel village and the Rio das Mortes. Almost the whole

Reserve is surrounded by farmland, with an exception of an area on the eastside of the Rio das Mortes.

4. METHODS

The Reserve was visited each two months during a period of 2-3 weeks. Contact and if possible interviews were made with all hunters of the community to gain confidence and to prepare them on the collection of hunting data.

- From February 1991 onwards hunting records were registered on a questionnaire. This questionnaire had to be very simple as the Xavante are not used to fill in forms, neither are used to give value to quantitative data. From February till June '91 the chief and one of the members of the Xavante Association kept records on each hunting activity. From June '91 onwards one of the students returned from the Center for Indian Research/ Centro de Pesquisa Indigena de Goiania - CPI - was trained to continue the registration. During each visit several bag data of certain hunting days were confirmed with other hunters. Only slight differences were detected between the information obtained by the chief and one of the "shadow informants". However, it was confirmed in 1992 that principally small mammals and birds are strongly underestimated in the sampling. These small bags are not even mentioned in the questionnaire.

- Also from February onwards lower jaws of the larger game species were collected, such as the White lipped Peccary (Tayassu pecari), the collared Peccary (Tayassu tajacu), the South american Tapir (Tapirus terrestris), the Pampas Deer (Ozotoceros bezoarticus), the Marsh Deer (Blastocerus dichotomus), Red Brocket Deer (Mazama americana), Grey Brocket Deer (Mazama gouazoubira), the Giant Anteater (Myrmecophaga tridactyla), Paca (Agouti paca) and occasionally from the Giant Armadillo (Priodontes giganteus) and the Six-banded Armadillo (Euphractus sexcinctus). Collection of the whole cranium was not possible, as the hunters consume the brains as well. The lower jaws were cleaned and aged after separation of species and sex. As there are no references available on tooth wear in relation to age, the aging was realized based on Taber et al. (1980) and experience by the author with Roe-deer (Capreolus capreolus) and Wild Boar (Sus scrofa). A reference collection has been completed for the Tayassuidae and major part for the other critical species. However, for confirmation many measurements should be compared with museum collections in Brasil (Belém, Museu Emílio Goeldi and Rio de Janeiro, Museu Nacional).

- Plant and tree items indicated by the Xavante hunters to be eaten by the principal game species have been collected. This material was preserved with alcohol and submitted to two botanists of the Ecological Reserve of

IBGE in Brasília, Dr. Tarciso Filqueiras de Souza and Dr. Benedito da S. Perreira.

- The collection of other biometric data, principally directed on the reproduction status of harvested females seemed to be impossible owing to the fact that the Xavante hunters toast their game and divide it directly after the kill in order to preserve it. Only in a few occasions it was possible to take fresh weights.

- As censusing would not be appropriate in the beginning of the project, four transects were selected in three different areas to obtain indirect data on the presence and diversity of the game species. These transect were 5 km long, in a track, and crossed similar types of habitat, as a mixture of "tree and scrub open woodland" and "grassland/murundum". From april onwards each transect was slowly tracked for any kind of indication of game animal passing by, such as tracks, sleeping places, burrows, feces, food rests. Each transect was tracked down with one of the indicated experienced hunters, Simão and in fewer cases the hunter Cidanéri was involved. The long term data will be used as index for the indication of diversity and relative abundance of game species.

- By accompanying many of the community hunts with GPS after June 1991, it was possible to register the exact geographic position with the GPS. Also after hunts positions and important localities were taken with the GPS. The GPS turned to be indispensable for estimation of the hunting area of the Xavantes.

- In order to get a profound absorption of the detected problems in hunting practices, an explanation was given to the Warã -- Tribe Council -- in the beginning and at the end of each visit. In 1992 these discussions were intensified in order to reinforce the preliminary wildlife management plan I

- Reliable data on sex were only accepted from the hunting questionnaire, which always were filled in within 2 days after the hunt. The sex ratio derived from the collected lower-jaws is less reliable, as the registration of the sex linked with the returned lower jaw is done many days or weeks after the harvest and the "consumer" of the cranium and lower jaws is never the responsible hunter. Therefore sex-ratio is derived from hunting-statistics, the most reliable source for this information.

- Reliable data on age-classes were only accepted from the lower jaws, as hunters do not pay much attention to age. Therefore age information from the questionnaires had to be ignored. Although the age estimation based on the tooth wear is not perfect, deriving the age composition from the lower jaws is more reliable than the inaccurate information on age given on the questionnaires.

5. RESULTS and CONCLUSIONS

During the almost two years of study in the Xavante Reserve, 225 hunting days were registered, 544 lower jaws had its biometric data taken, but all not sufficient for a comparison of two complete year cicles. Therefore, only comparable months were separated, february to october, 9 months inside the principle hunting period. So part of the results will be presented in 9 month period data, other part will be expressed in use or harvest per year. These extrapolations might give some "over"estimate of the total harvest as the rainy season has lesser hunting results. On the other hand, this overestimation will be justified and compensated, as the true mortality loss caused by hunters is approx. 20-25% higher than registered.

5.1. Survey of the fauna used as food resource.

Table 1 shows all the mammals and principal birds in order of importance to the Xavante community as a food resource. The nomenclature is based on Wetzel(1982), Cotrim Corréa da Costa(1981), Eisenberg (1990) and Sick (1984).

Common names	Latin names
White-lipped Peccary	*Tayassu pecari*
Collared Peccary	*Tayassu tajacu*
Pampas Deer	*Ozotoceros bezoarticus*
Red Brocket Deer	*Mazama americana*
Grey Brocket Deer	*Mazama gouazoubira*
Marsh Deer	*Blastoceros dichotomus*
Tapir	*Tapirus terrestris*
Giant Armadillo	*Priodontes giganteus*
Six-banded Armadillo	*Euphractus sexcinctus*
Naked-tailed Armadillo	*Cabassous unicinctus*
Common Long-nosed Armadillo	*Dasypus novemcinctus*
Lesser Long-nosed Armadillo	*Dasypus septencinctus*
Three-banded Armadillo	Tolypeutus sp.
Giant Anteater	*Myrmecophaga tridactyla*
Southern Tamandua	*Tamandua tetradactyla*
Paca	*Agouti paca*
Cutia	Dasyprocta spp.
Coati	*Nasua nasua*
Gamba	*Didelphis spp.*
Preá	Cavia ou Galea sp.

Ema	*Rhea americana*
Partridge	Tinamidae
Mutum	Cracidae
Pato do mato	Cairina moscata
Seriema	Cariama cristata
Doves	Columbidae
Parrots/araras	Psittacidae
Tucans	Ramphastidae
Raptors	Falconidae/Accipitridae.
Amazionian tortoise	*Podocnemis expansa*
Tracajá tortoise	*Podocnemis unifilis*
Jabuti	Geochelone spp.

Table 1. Mammal, bird and reptile game-species of the Xavante community. Nomenclature based on Wetzel(1982), Cotrim Corréa da Costa(1981), Eisenberg (1990) and Sick(1984).

It is striking that the Xavante do not use any of the Primates, neither capivara (Hydrochaeris hydrochaeris) as food resource. So far it was not found that the reason for that could be any kind of a tabu. Also Maybury-Lewis (1984) does not mention a tabu for these species. Apart from the mammals and few birds harvested for food, the Xavante also collect large range of birds for traditional celebrations and for use as ornament for their rituals and weapons. Many of the birds are consumed after the use of feathers for ornaments. A survey on the birds, amphibians, reptiles, insects and fishes used for consumption has not been completed.

5.2. Hunting range

By means of interviews, use of the GPS and recording of Xavante names for regions and rivers, a rough estimation could be made of the hunting area utilized. Figure 2 shows the areas intensively hunted in 1991 and 1992, respectively 65.000 ha and 85.000ha. From February to October, the Xavante had 94 and 94 hunting days during 9 months (1991 and 1992). Part of this area is burned from mid June to October, an activity that most of the savanna indigenous communities practice at the end of the dry season. In 1992 the first fire hunt was in mid august. It will be tried to survey the intensity and extension of these fire-areas. Traditionally the Xavante are semi-nomadic (Maybury-Lewis, 1984 and Chiaccarria & Heide, 1984)) and therefore rotated their hunting and collecting throughout the area. They also have the so called "family hunts", which lasted up to two months. These family hunts were not only used to harvest game, but also served to collect

fruits, nuts, roots, medical plants, fish, honey, turtles and tortoises and their eggs. An important activity during these hunts is the training of adolescents in collecting natural food resources.

Lack of this training is clearly observed amongst the younger groups of the community. The last activity is still rarely practiced. Since their contact with FUNAI and the Salesian Missionaries, the attention of the Xavante was drawn to development of agriculture and rearing cattle. This sudden change in life style and the continuous threat to their families by invading farmers, made the Xavante change their rotation activity to sedentary villages. Consequently most of the family-hunts were left behind. The Xavante are worried to leave the village for more than a few days and therefore concentrate their hunting and plant collecting activities "closeby" the village. Figure 2, however, is a simplified survey and is based on data of 9 months in 1992. Only from August 1991 onwards the GPS could be used.

The figure illustrates a dispersion of hunting activity in the second study year. The hunted area in 1992 is larger and has small, but still significant overlaps with the overhunted area of 1991. There is a clear tendency for hunting in the extremities of the reserve and to control these areas against poachers and other intruders.

Some confrontations have already been taking place. Two principal factors influenced this change in hunting activity, the discussions with the council on the 'wildlife management plan' and the completion of the trail to the extreme northeast of the reserve.

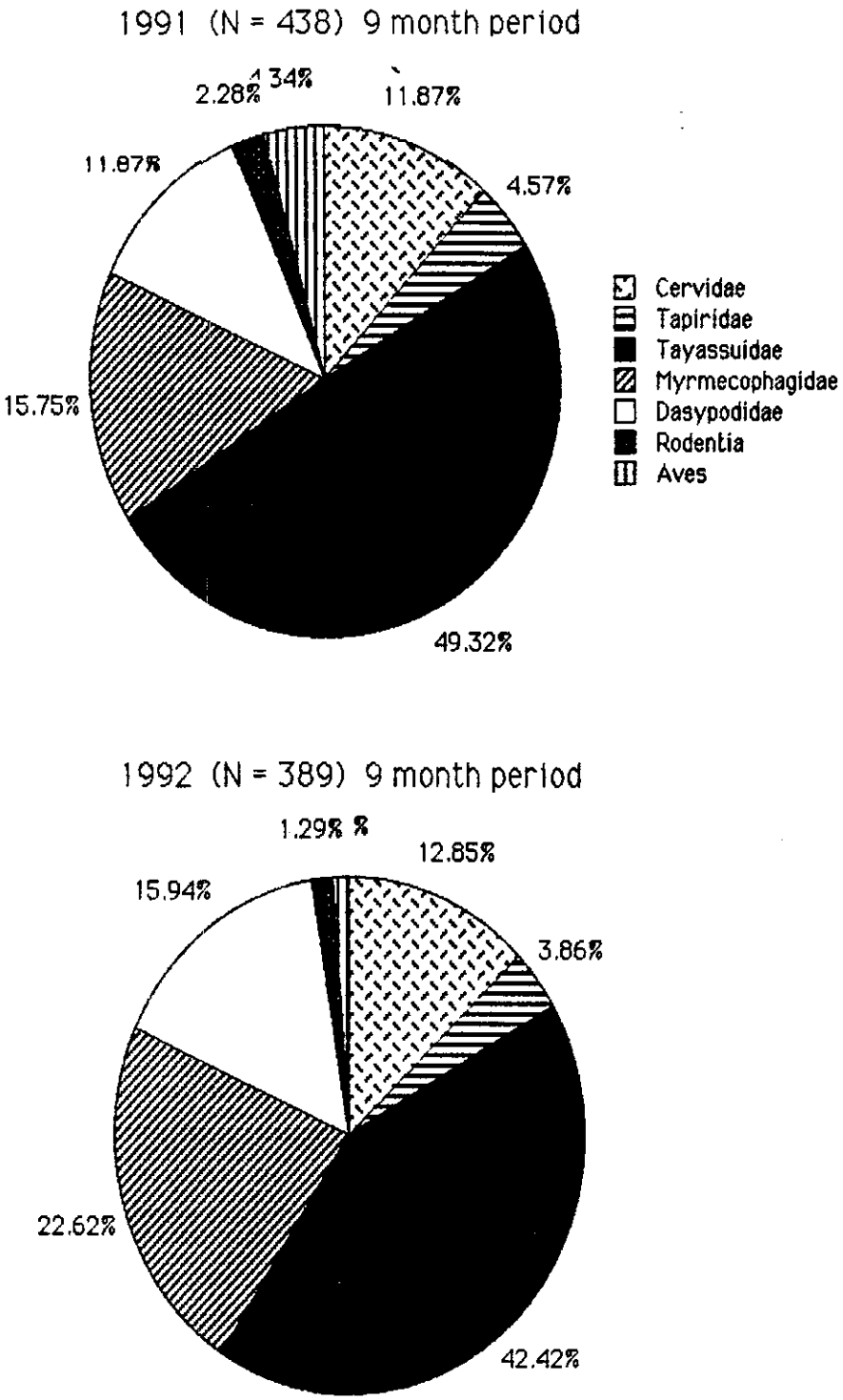


Figure 3. Hunting bag composition in two equal periods in 1991 and 1992

5.3 Bag Composition

Between February and October 1991 and 1992, respectively 89 and 95 hunting days were registered, with a total harvest of 426 specimen in 1991 and 381 in 1992. Figure 3 demonstrates that in both years the most frequently hunted species are the same, with an increase for the deer and the armadillos in 1992. The rodent and bird groups in both years are underestimated, as many small mammals and birds are not accurately mentioned, neither registered on the questionnaires. In both years there was no kill-record of the brazilian cottontail, capibara or one of the small rodents. There has not been any obvious switch in harvest composition of the Xavante hunters between the two years. The real change taken place was the change in hunting area, more dispersed towards the extremes of the reserve.

5.4. Age-structure and sex-ratio of the game bag

Through the collection of lower jaws and some skulls it was possible to survey the age-structure of some of the harvested species. This was the best possible for the White-lipped - and the Collared Peccary, and less for the Marsh and Pampas Deer. As the hunting behavior of the Xavante is purely at random with no preference for sexes or age classes we can assume that the age composition of the hunting bag reflects the age structure of the wild population. However, the Xavante hunters do not pay much attention to age classes. As a consequence the distinguishment between young, subadults and adults in the game records are not much reliable. For all major species counts the number of young under 1 year is not well represented in the sample of lower jaws. This was confirmed in the field experience: when Xavante hunters catch a young animal, it will be consumed immediately or it will be tried to "breed" it in the village. Although the age estimation based on the tooth wear is not perfect, deriving the age composition from the lower jaws is more reliable than the inaccurate information on age given on the questionnaires.

The sex ratio derived from the collected lower-jaws is less reliable, as the registration of the sex linked with the returned lower jaw is done many days or weeks after the harvest and the "consumer" of the head is never the responsible hunter. Therefore sex-ratio is derived from hunting-statistics, the most reliable source for this information.

Age structure and sex ratio have been worked out for the principle and most vulnerable species, whenever sufficient data were available;

White-lipped Peccary (*T. pecari*). Figures 4. demonstrate the age composition of the harvested White-lipped Peccaries based on the lower jaws. The different age classes are well represented in the sample. Comparing two equal periods - between February and October - 1991 and 1992 respectively 109 and 54 individuals of the White-lipped were harvested. Of all harvested White-lipped 63% were represented in the lower

	hunting statistics sex-ratio (N)			
	1991 male : female		1992 male : female	
O. bezoarticus	1 : 4,8	(23)	1 : 1,6	(33)
B. dichotomus	1 : 2,3	(13)	1 : 0,3	(14)
T terrestris	1 : 1,4	(19)	1 : 0,5	(15)
T. pecari	1 : 1,9	(58)	1 : 0,6	(40)
T. tayacu	1 : 1,1	(74)	1 : 0,8	(101)
M. tridactyla	1 : 1,8	(47)	1 : 1,1	(79)
E. sexcinctus	1 : 0,5	(31)	1 : 1,4	(41)

Table 2: Comparison of the sex-ratio derived from the hunting statistics in 1991 & 1992.

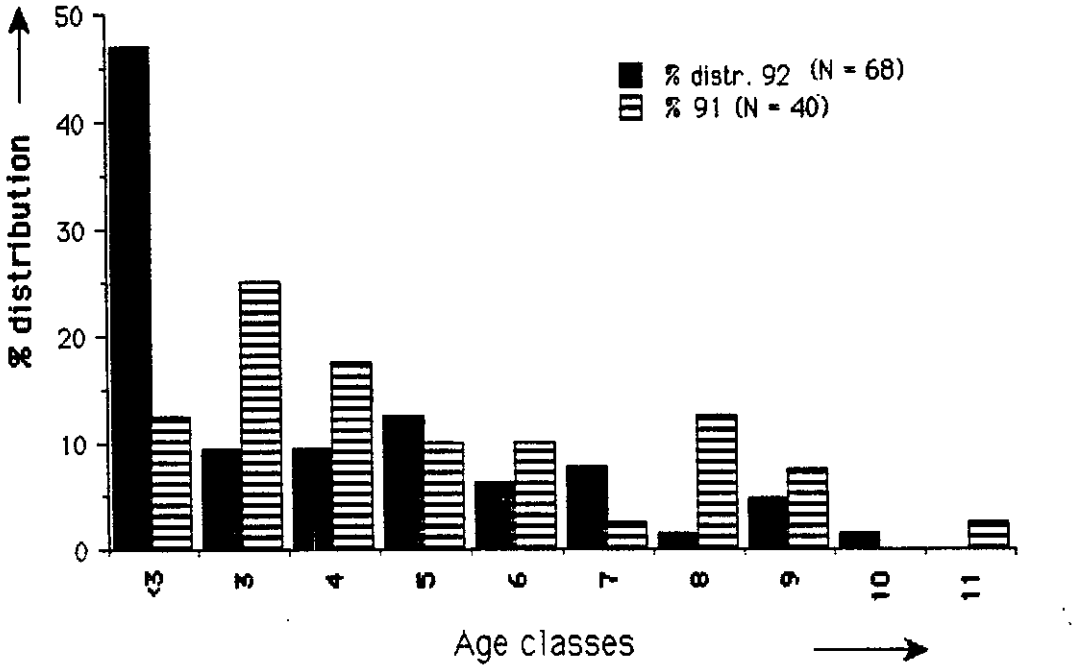


Figure 4. Age composition of White-lipped Peccary in the 1991 and 1992 bag.

jaw sample. It can be derived from the figure that in both years the percentage of young animals until 3 years is 59% and 37% in the two years. In the 1992 figure we notice a larger number in the mid age classes. The areas where the animals were shot are different and are ± 40Km apart. We assume that two different populations have been harvested. Also the sex-ratio of the two years shows a complete reversion which makes it very unlikely that we are dealing with the same population. This reinforces the suggestion of the two populations. It is known that White-lipped Pecaries migrate considerably, but no data referring the cerrado habitats. The major part of the population hunted in 1991 is the heavily hunted population from the region Rio das Mortes. In 1992 the Xavantes hunted in an area where years before there was a low hunting pressure.

Collared Peccary (*T. tajacu*). Figures 5 demonstrate the age composition of the harvested Collared Peccaries based on the lower jaws. The different age classes are well represented in the sample. Comparing two equal periods - between February and October - 1991 and 1992 respectively 107 and 111

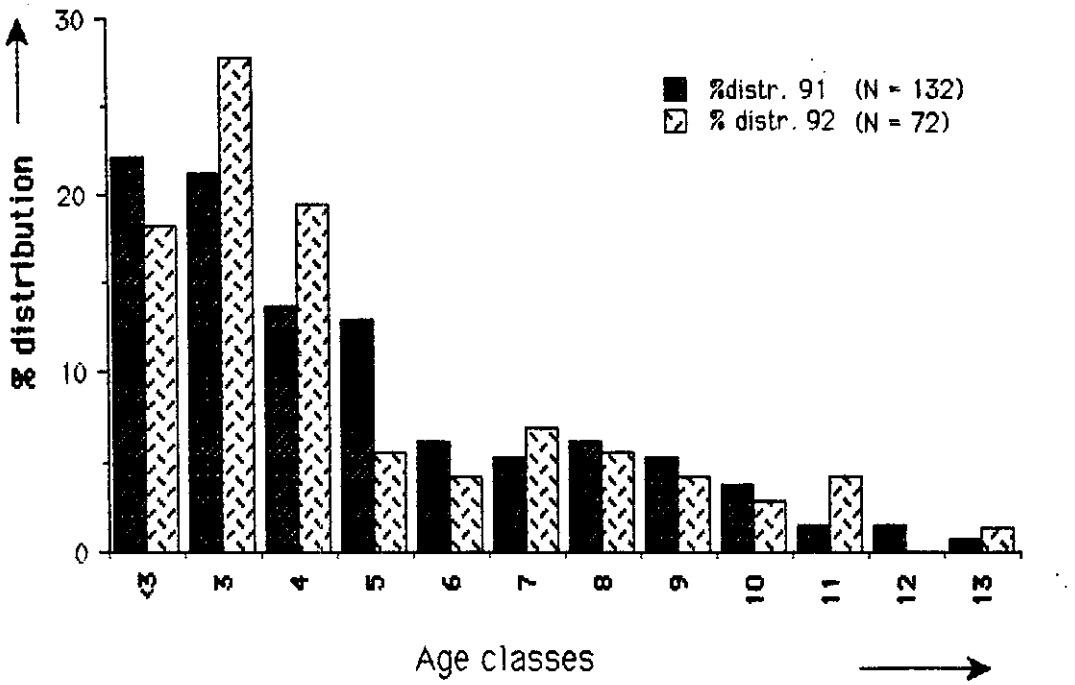


Figure 5. Age composition of Collared Peccary in the 1991 and 1992 bag.

individuals of the Collared were harvested. Of all harvested Collared 83% were represented in the lower jaw sample. It can be derived from the figures that in both years the percentage of young animals until 3 years is 44% and 43% in the two years. Young, mid and old age classes are equally present in the two years. Also the sex ratio is almost equal. In this case the two samples could either deal with the same or with a different population. Also for the Collared Peccary no data referring to their behaviour in the cerrado habitats are available. The major part of the population hunted in 1991 is the heavily hunted population from the region Rio das Mortes. In 1992 the Xavantes hunted in an area where years before there was a low hunting pressure.

Pampas Deer (*Ozotoceros bezoarticus*). Of all harvested Pampas Deer 78% were represented in the lower-jaw sample. Figures 6a shows the age structure of Pampas Deer. In both years >60% of the aged animals are <1,5 years. This indicates a high reproduction

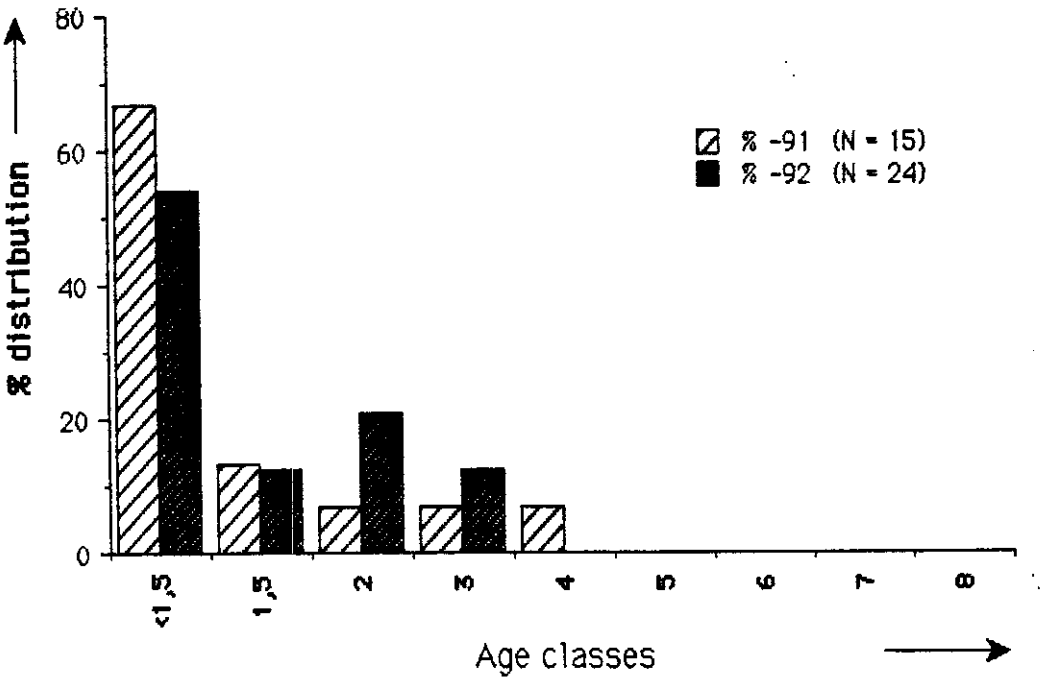


Figure 6. Age composition of Pampas Deer in the 1991 and 1992 bag.

level in both years and in both sampling areas. There is however a lack of animals >3 years in 1991, which supports the suggestion that the the area was overhunted. The second year has a better representation of the older age classes. There is a considerable change in sex-ratio from 1:4,8 (male : female) in 1991 to 1: 1,6 in 1992, which strengthens the idea of overhunting in 1991. In deer populations with none or low hunting pressure, the sex-ratio is less than 1 : 2.0.

Marsh Deer (*Blastoceros dichotomus*). Very few jaws were collected in order to have a comparison of age composition of the two years. Only the joint data of these years give us an age structure of use. Fig. 7 illustrates that very few animals under two years were harvested: 21%. That suggests a low reproduction rate. The hunting harvest data show a considerable change in sex-ratio from 1 : 2,3 in 1991 to 1: 0,3 in 1992. This suggests that two different populations were harvested. However the sample size is far too low to draw any conclusions. Only 44% of all hunted Marsh Deer were represented in the lower-jaw collection.

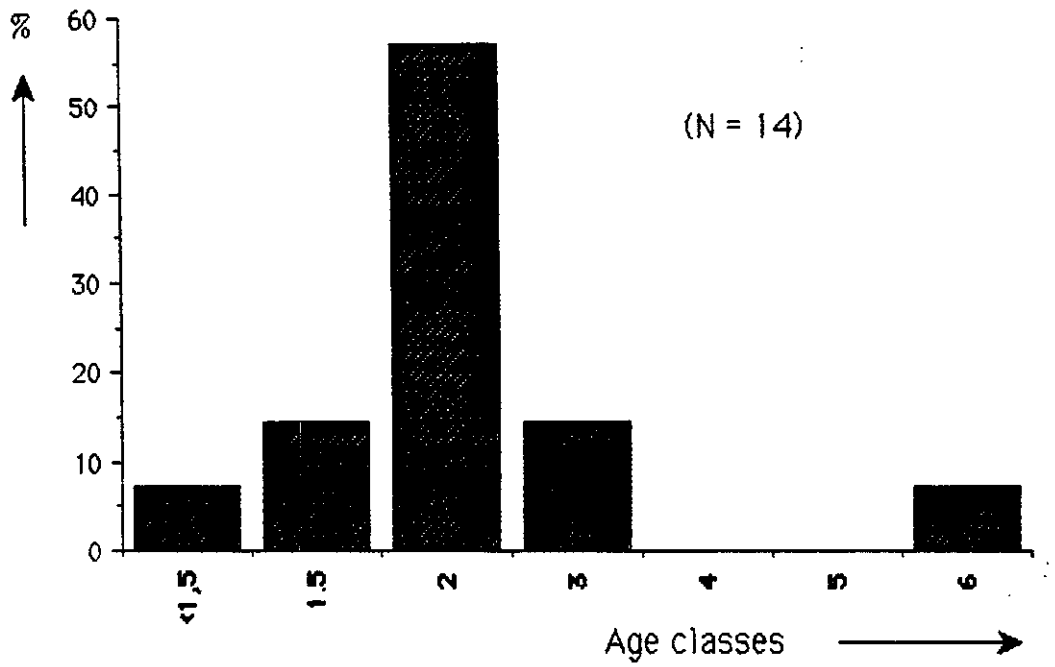


Figure 7. Age composition of Marsh Deer in the 1991 and 1992 bag.

Giant Anteater (*Myrmecophaga tridactyla*). No age composition was possible based on the lower-jaw length. Description of obvious juvenile animals give a rate of 8 and 14% juveniles in the years 1991 and 1992. This suggests a low reproduction rate in both years and so in both areas. Only 37% of all harvested animals were represented in the lower-jaw collection. Sex-ratio changed from 1:1,8 in 1991 to 1: 1,1 in 1992. This might suggest two different populations. I suggest that the 1991 area was very heavily over explored. Consequently the Giant Anteater produces more females to stabilize the population. In the 1992 area there was a low hunting pressure and the sex-ratio was close to one to one.

Tapir (*Tapirus terrestris*). Although the return rate of lower-jaws was 66% for all harvested tapirs during the two years, no age structure could be determined so far, as the tooth change pattern and the tooth wear of Tapir remained a mistery. It is still not clear at what age the Tapir has completed the change of his milkdentation. Careful analysis of the lower jaws reveals that 53% of all aged animals were equal or less than 1,5 year. No distinction could be made between the two years of collection. The sex-ratio took a clear reversion from 1:1,4 in 1991 to 1: 0,5 in 1992. This suggests - as with the previous hunted species - a different population. The data for the

Tapir only indicate a good reproduction rate, but no further conclusions can been drawn.

The sample of the lower-jaws of other game species was insufficient to get insight in their age composition, but might very well be used in the due course of the project. Estimated ages from lower-jaws should still be compared with museum collections and exchange of information with other researchers.

5.5. The importance of game as a food resource

During the first year of the study it was not possible to gather the complete quantitative data on the food habits of the Xavante community, as the project was concentrated on the game species. There were difficulties in the gathering of valid data. As explained before, the Xavante are not used to register information, lesser even they are not accustomed or interested to register their daily consumption. It was only feasible through direct observation to define in what proportion certain food items were available and consumed by the families. The principle protein source is game, which takes approximately 85-90% of the total consumption. In two occasions 4 heads of cattle were consumed: Christmas 1991 and the 'National Day of the Indian' in 1992. Each Xavante house breeds some chicken, but these are only consumed when for more than 10-14 days there is no game meat available.

It is assumed that the Xavante benefit 65% of the gross weight of each specimen harvested: it was observed that only hair, nails, bones and contents of stomach and intestines are not consumed. This consequently complicated the collection of skulls, as also brains are eaten. Gross weight for each species were derived from Eisenberg, 1990), Husson (1978), Robinson and Redford (1986), Roosmalen et al. (1983), Wetzel (1982) and in rarer cases from Alho et al. (1987), Deutsch & Puglia (1991), Leeuwenberg et all. (1992) and Silva (1986). Comparison of net weights of the hunting harvest for each group of species is illustrated in figure 8.

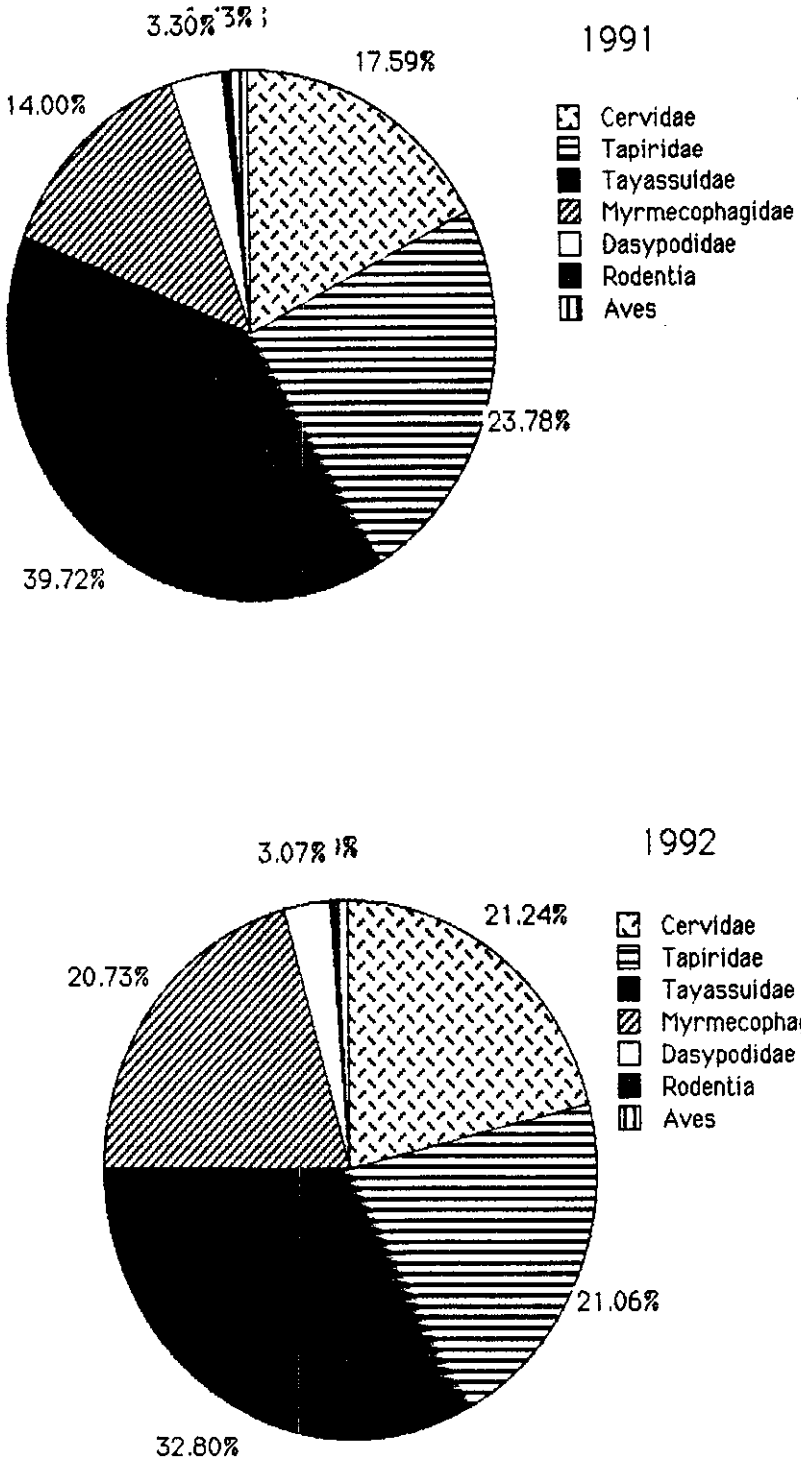


Figure 8. Biomass of species groups hunted in 1991 and 1992

This figure gives the absolute nutrition value of all game species; it demonstrates that the two Tayassu species occupy 33-40%, the Tapir 21-24%, the deer 18-21% and the Anteaters 14-21% of the food necessity. It is striking that the armadillos only cover 3% of the protein consumption. In total the Xavante harvested during 9 months 426 specimen with a net-weight of 8148 Kg of consumable proteins in 1991 and 381 specimen in 1992 with a net weight of 6903 Kg. If we may consider the demand of meat for children till 15 years being 50% of the consumption of the adult members of the community, the daily consumption per adult would be 171 and 121 grams in 1991 and 1992. If the mean weight of an adult Xavante is considered to be 70Kg, the protein consumption per Kg body weight per consumer per day would be 2.44 and 1.73 grams in both years. Muniz Calouro et al. (1990) found an almost equivalent value of 2,75 grams for a community of rubbertappers in the brazilian amazon region. According to Smith (1976) the average protein contents of game meat is 20%. With the total net-biomass we can derive that the net daily protein consumption per kilo bodyweight would be 0.49 and 0.35 grams. The criteria employed by the W.H.O. is 0.70 grams of net protein per kilo bodyweight (Smith, 1976). This means that in terms of animal protein consumption the Xavante consume 67%-50% of the required minimum. If game populations will decline as predicted under current hunting practices - the underfeeding of animal proteins will be seriously worrying, especially amongst the children until 15 years. Although the Xavante are almost completely depending on game in their protein consumption, occasionally they use reared chicken and cattle. Cattle breeding is in no way part of their culture and will be difficult to be accepted. Also the fishing and the capture of the fresh water-turtles (and eggs) are important food items, but it is estimated that these do not exceed 10-15%. It will be necessary to estimate the weights and the composition of fish and turtles in the near future as it is suspected that principally the consumption of turtles, tortoises (Geochelone sp.) and their eggs might have reached a level of over exploitation.

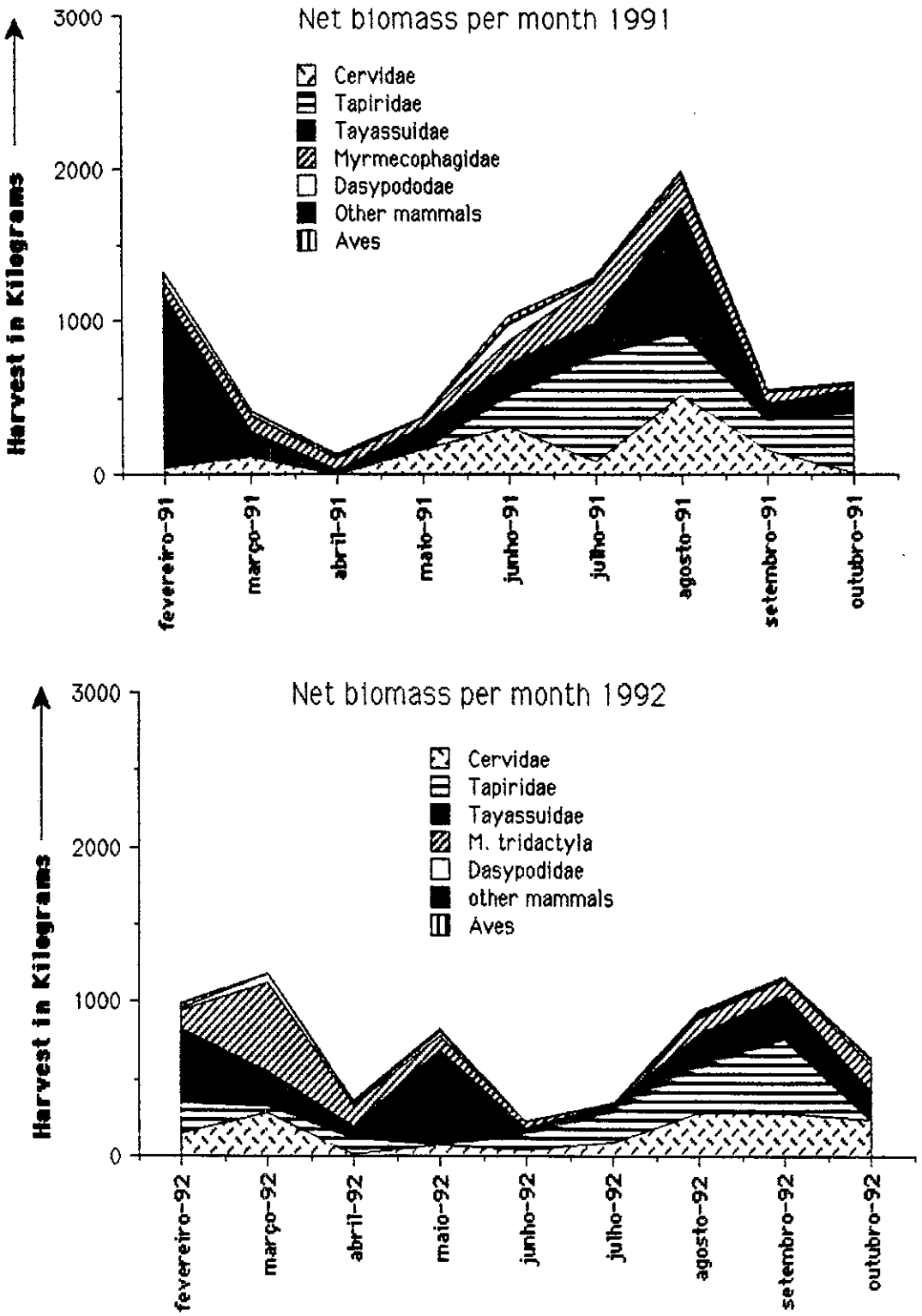


Figure 9. Biomass per species group during the different years.

From figure 9 we can observe the importance of each group of species as a food resource during the study period. It can be noted that the Peccaries are most important in February, May and August, in the end of the rainy season, early and late dry season. At the end of the rainy season the White-lipped Peccary migrates to the drier habitats distant from their principal habitats, the dense forest zone bordering the Rio das Mortes. They return to these dense habitats in August and September- at the end of the dry season - the Xavante have many hunting and fishing activities in the region of Rio das mortes. Tapir is an important food item from July through October, Deer in almost all months with a peak in August, while the Anteater - principally the Giant Anteater - is consumed throughout the whole period. The armadillos do not occupy a large part of the food consumption, but are frequently utilized in periods of lack of other game. The hunting-harvest from November through January and comes to a maximum of 500Kg in December.

Another approach to interpret these preliminary data is to compare those with other studies in South America. The data were calculated as number of animals taken per consumer-year as done by Robinson & Redford (1987) and Muniz Calouro et al. (1990).

Order	INDIANS		COLONISTS		
	Xavante (1991)	(1992)	R. & R. (1987)	Muniz Calouro (1990)	R. & R. (1987)
Edentata	0,92	0,95	1,04	0,11	0,33
Primates	----	----	2,30	1,00	1,28
Rodentia	0,08	0,03	1,95	2,08	1,84
Perisodactyla	0,15	0,09	0,05	0,01	0,06
Artiodactyla	2,03	1.36	1,53*	0,17	1,47*
Carnivora	0,02	0.04	0,98	0,002	0,01

Table III. Harvest-rate/consumer/year/animal Order. * All Ungulates, no data for Arthiodactyla.

All data of the current study on harvest per consumer/year are very well comparable with the data found by Robinson and Redford (1987) for 16 indian communities in South America. Except for Rodents and Carnivores which are hardly taken, the Xavante have superior consumption of Perisodactyla and Arthiodactyla. If we compare the harvest rate per species (Table IV) the Tapir is obviously more harvested. The Giant Anteater is not referred in the study of Robinson and Redford, as they didn't incorporate indian tribes from the cerrado region. Although the reproductive rate of the

Giant Anteater is lower than the Southern Anteater, the Xavante harvest rate is much higher than any harvest rate for the Anteater in other indian communities.

Number of species taken per consumer/year in indian communities

	Current study 1991	1992	Robinson & Redford (1987)
Tayassu pecari	0,8257	0.3404	0,9230
Tayassu tajacu	0,8106	0.6998	0,6520
Tapirus terrestris	0,1515	0.0945	0,0490
Blastocerus dichotomus	0,1061	0.0882	- - -
Ozotoceros bezoarticus	0,1742	0.2017	- - -
Mazama spp.	0,1136	0,0252	0.3850
Tamanduá tetradactyla	0.0378	0.0504	0,1830
Myrmecophaga tridactyla	0,4848	0.5043	- - -
Priodontes giganteus	0,0454	0.0189	- - -
Euphractus sexcinctus	0,2500	0.2585	- - -
Dasypus novemcinctus	0,0303	0.0000	0,7930
Agouti paca	0,0303	0,0315	0.8920
Dasyprocta sp.	0,0747	0,6390	0.6390

Table IV. Harvest rate per consumer year per species.

The harvest per consumer year for the White-lipped Peccary is lower than the mean rate for this species found by Redford and Robinson (1987), who surveyed literature on indigenous hunting in amazonian rainforest. This might explain the difference with the Xavante area, as the carrying capacity for White-lipped Peccary in amazonian forest is likely to be higher than the brasilian savanne (cerrado). The cerrado has many suitable but interrupted habitats for this species, as it also has for Paca and Red Brocket deer.

5.6. Hunting-pressure

As the biomass taken from fauna only indicates the nutritious importance for the consumer and the energy-loss for the ecosystem, aditional quantitative data are needed to estimate the hunting-pressure and hunting-success. To see whether some changes in the hunting practices have taken place after the introduction of the preliminary Wildlife Management Plan in March 1992, we should overview the frequency of hunting before and after the discussion of management with the hunters of the community.

It can be derived from table V that the small hunting parties with less than 15 persons has increased considerably, as the family ceremony hunts have declined. However, this change can also be caused by internal activities changes, such as the opening of a sandtrack of 49km completed in september and the outbrake of a fire in the village in september '92. To notice real changes in hunting pattern, a survey of several consecutive years is absolutely neccessary.

Type of hunting	1991	1992
community	23(%)	23(%)
with<15hunters	19(20%)	35(37%)
family ceremony	20 (21%)	6 (6%)
wedding ceremony	17(18%)	11(12%)
individual	15 (16%)	19 (20%)
N hunting days clearly discribed	94	94

Table V. Proportion of hunting days divided in the different types of hunting in the two study years 1991 and 1992.

As mentioned earlier in this report, the first impression is that the hunting pressure in 1992 has declined and the total harvest is one of the indicators for this conclusion. The total harvest of 1992 declined with 11% in number of kill and 15% in biomass. Although the number of hunting days has been equal in both years, the hunting pressure and success were different.

Hunting pressure can be expressed by bag/surface and hunterdays/period. The number of hunterdays over the two periods declined with 24%, from 1146 in 1991 to 878 in 1992. So with the decline in hunting pressure (less hunter-days), there was also a decrease in harvest per 1000ha for most of the game species. Both types of data confirm the suggested decrease in hunting pressure in 1992.

Hunting-success can best be expressed by the harvest per volume of efforts: bag per hunterdays/period (Table VI). If the hunting succes per same effort declines, and the hunted area is the same, than this can indicate a decline in the population. But in case the Xavante, the differences in hunting success are the result of a different hunting area! Declines in the table for Red Brocket, Grey Brocket,White-lipped Peccary, and the Giant Armadillo are more likely caused by inferior habitat conditions. The hunted area in 1992 is mostly dominated by half open and marshy habitats, which are more

favourable for the Marsh and Pampas Deer, the Collared Peccary, the Giant Anteater and all other Armadillos. It was found that all the last mentioned species were more successfully hunted in the second year.

Species	Hunting pressure Harvest/100 hunter-days		Hunting-success	
Harvest/1000 ha	1991	1992	1991	1992
Marsh Deer	0.31	0.24	1.22	1.59
Pampas Deer	0.50	0.56	2.01	3.61
Red Brocket	1.30	0.21	0.35	0.11
Grey Brocket	0.23	0.05	0.96	0.34
Tapir	0.41	0.24	1.75	1.71
White-lipped Pecc.	2.23	0.85	9.51	6.15
Collared Peccary	2.19	1.74	9.34	12.64
Giant Anteater	1.39	1.40	5.58	9.11
Lesser Anteater	0.11	0.14	0.43	0.91
Giant Armadillo	0.23	0.09	0.52	0.34
All other armadillos	2.18	0.95	4.01	6.72
paca	2.67	0.74	0.35	0.57
agouti	0.67	0.00	0.52	0.00
Long-nosed Raccoon			0.17	0.68
Ema	0.10	0.06	0.44	0.23

Table VI. Hunting-pressure and hunting-success during two equal periods 9 months

This might be caused by better habitat conditions (See table VI), but it is possible that one is dealing with different sub-populations. We still should be carefull in interpretation, as hunting succes is the consequence of hunting pressure and population density. And there are no density data upon 1992.

For Marsh, Red-brocket and Grey-brocket Deer, Tapir, White-lipped and Collared Peccary, Paca, Agouti, Giant Armadillo there was a decrease in harvest per 1000 ha and only slight increase for Pampas Deer.

Hunting pressure through the study period, is the highest in the late wet, - February to March - and late dry seasons, July to August (Figure 9).

5.7. Side impacts on the fauna

Apart from hunting, also other anthropogene factors influence the fauna populations;

a. Illegal activities. Poaching, fishing, illegal and threat of trade are occuring in and outside the reserve. Since the Xavante have achieved to get a sand track to the north-east and the donation of 22 bikes from WWF/US, the amount of poaching and fishing has been decreasing. The Xavante react very direct and heavy when encountering intruders. There are inhabitants from the region which try to offer good prices for skins and birds. So far the trade is at a low level and has no direct threat to the involved species.

b. Cattle breeding. The Xavante have 80 heads of cattle and maintain this stock in the degenerated areas 15Km from the village. There arise however two problems; - several farmers on the outside still put their cattle on purpose inside the reserve. With the coming of the bikes this problem may be diminished, as fiscalisation will improve considerably and scare off the farmers. It will stay questionable whether the current fiscalisation will be sufficient for the long term. - Secondly, the Xavante rent part of their reserve to farmers in exchange for cattle. It is suspected that this cattle has a negative impact on the ungulates in those areas. This has been discussed in the tribe council, but so far there was no positive reaction.

c. Fire. The Xavante have traditionally fires for hunting in the dry season. Interviews with the "old" of the village showed that normally these fires starts with the appearance of a cloud of stars in the south, ±july/august, most probably the "Cloud of Magellães". Different habitats were burned with a different interval of years. In1992 the period of fires started much later and the number of hunts with fire (Dû) was very low.

d. .22 Rifles. As rifles are cheaper than shotguns, during the exchange policy of FUNAI and other identities the .22 rifles were introduced. Between 20-25% of the hunters still use the bow and arrow once and a while. The suggestion that introduction of fire arms with indigenous communities increases the hunting bag is not applicable for the Xavante. Direct observations of the hunting, showed that time spent to obtain game has diminished, but after the hunters' bag has reached a certain weight (± 45-50Kg), the hunter simply will stop and return to the village. Not any time it was observed that a hunter returned with an excess of game or left game behind in the field. So the use of rifles or guns does not cause an increase in the hunting bag. However, the .22 riffle causes a considerable amount of wounding of game what does not enter into the bag. Especially larger animals such as deer, peccaries and tapir are often hit but not killed. It is estimated that of the referred species 20-25% of the bag number dies after the hunting without being used by the hunter.

5.8. Principle problems related to wildlife management

The study revealed the following main problems directly or indirectly related to the wildlife utilisation:

1. Without a permanent regulamentation stimulated by the community itself the hunting pressure will continue to be too high. This pressure was very low in 1992, but the Xavante will tend to return soon to this area before the populations might have recovered.
2. Although the carrying capacity for Giant Anteater, Marsh Deer, Tapir and Pampas Deer is possibly proportionally high, the hunting presure on these species might be close to the critical 0,6K of the Redford and Robinson model. At least for the Giant Anteater and the Marsh Deer, a year ban in a large part of the reserve is recomended.
3. The 'family hunts' almost do not exist anymore, but are extremely important for the transfer of traditional knowledge on hunting, fishing and fruit collection. The Xavante are aware now of this problem and it is expected that this costum will recover.
4. There is a serious lack of control of the territory. Poaching of game, fish, turtles and tortoises is increasingly detected afterwards. Farmers release on purpose cattle inside the Reserve and recently "pistoleiros" entered the Reserve. This fiscalisation has improved with the new sand track and the bicicles. The future experience will teach whether the Xavante manage to controle the whole area efficiently or whether other aditional means will be needed.
5. The young generation has less interest in hunting and the collecting of fruits and medicines in the forest and the cerrado: also their knowledge on these topics is poor, including the knowledge on their territory. Some meetings were organised with this generation in order to understand the causes of this passive attitude; many young expressed their worry, that they are hardly trained anymore by the adults, during the family hunts. Also they have no self confidence in their hunting abilities and their physical condition is weak. They are worried about confrontations with intruders as they feel the lack of experience.
6. The traditional hunting by means of fires in forest and cerrado is not only applied in the end of the dry season as traditionally, but already starts in the middle of the dry season. These fires are no more applied in the traditional scheme of 2-6 years. This traditional scheme depended on the type of habitat. Hardly any studies have been done on the impact of the fires on plant and animal communities of the tropical ecosystems, but there are clear indications that the diversity of the plant communities declines as a consequence of the

frequent fires (pers. com. Filgueiras de Souza), which indirectly affects the food and habitat conditions of the fauna.
7. The hunting with the fire is not adapted according to period of fruit collection.

Although the Reserve is over 300.000 ha, the Xavante are frequently confronted agression from outside. Goldrushers and permanent farmers have been wiped out. Still hunters and fishermen enter frequently, which leads to heavy confrontations. Since mid-1992 another wave of gossip dominates the region, dealing with the pressence of gold. Now with some small but very efficient support utilised from WWF/US and the dutch Ambassy in Brasil, the Xavante are better equiped to control their area. The bicicles from WWF and the sand track from the Dutch are very positively utilised for fiscalisation of the northern extremes. There is only lacking an independent vehicle and mobile radio's for efficient fiscalisation, but the brasilian institutions such as FUNAI and IBAMA are not able or willing to offer these facilities.

5.9. Feedback with the xavante community

During all working visits, there was participation in the "Warã", the Tribe Council, and explanation was given on activities and methods used in the project. It was also persistently explained that the collection of bag records and lower jaws was needed to get insight in their hunting practices. It was asked to pay attention to the sexes of the game, when recording the data. Three students selected by the community were involved to collect and register bag data and lower jaws. One of the pupils will be collecting data on the tortoises caught in Rio das Mortes. On the contrary of 1991, this year was hardly used to catch tortoises and their eggs. Contact has been layed with IBAMA - CENAQUA- to have an educative visit to the village, before the reproduction period starts in 1993. If the project will be continued in 1993, all pupils will be trained to execute transect counts.

Several times there was given a broad explanation in the Council about the diagnostics of the hunting practices. By means of examples , predator behaviour and strategy and comparison with the ancient traditions, it was explained that several species are obviously overhunted and that this will lead to an irreversible situation. It was also pointed out that continuation of the actual hunting practices will cause a severe decline in the game populations or even might cause their extinction. Two different options were brought into the discussion (march '92);

I. Continuation of the actual hunting practices: In the near future the game populations will not supply sufficient animal proteins for the community. The measurements to compensate this lack are;

a. Increase the stock of cattle up to 2000 heads and consequently the amount of pasture will have to increase.
b. To start the breeding in captivity or semi-captivity of game species, which have proved to be feasible for breeding. Any kind of breeding of game species will be less productive and economic than the breeding of domesticated species.
c. To start increasing the crop growing for commerce to cover the expenses for material consumption.
d. To change the remaining hunting activities to other species not hunted yet and to concentrate more on the exploration of the fish.

II. To start permanent management of wildlife species and their habitats. In this case urgently the Xavante have to rationalize their hunting practices and start management of the habitats by controlling their impact. At this point only rough suggestions were given in order start up gradually the process of conscience and discussion on this matter.

a. Closing the hunting season for one year for Giant Anteater, Marsh Deer and Pampas Deer in an area of 65.000 ha surrounding the village (The over exploitation of the Tapir had not been detected at that moment).
b. To recover the traditional family hunts spread throughout the territory.
c. To spread all hunting activities and applying a rotation system:
d. To relieve the hunting pressure by changing the hunted species, harvesting actually non-hunted species such as capivara, anacondas and increasing the fishing.
e. Creation of "game gardens" in small parcels throughout the territory with principally native species.

Not only the excessive hunting was brought into the discussion, but also the changing attitude of the young generation towards the hunting and the utilization of fruits and medicins from the cerrado and forest. It was mentioned that the lack of interest and knowledge by the young generation will have severe consequences for the community. These statements made in the Warã caused an intensive discussion, which will probably last a longer period before the Tribe Council takes a position.

Merely the same ideas will be discussed in early 1993, but emphases on hunting dispersion and hunting ban in a specific region.

6. DISCUSSION

The original aim of these two years of study was to analise hunting practises of Xavante indians and their ecological consequences on wildlife communities. Based on the situation of game populations and the cultural interrelation between fauna and indians measurements for wildlife management will have to be introduced with major care that these have feasibility to be integrated in the Xavante cultural pattern.

The data gathered with the Xavante during two years of study are very promising, but still permit little comparison as the data refer to two different hunted areas in the reserve. The calculated offspring is an underestimation and does not mention net birthrate. Valuable data were obtained as hunting pressure, hunting success, sex-ratio and age-structure. Most data will get major value when the same areas will be hunted and sampled again. Repetition and population census will be needed to understand the reaction of wildlife populations to human hunting pressure.

A survey has been made on the principal ecological, socio-cultural related problems inside the indigenous reserve of Pimentel Barbosa. It was calculated that the proteine consumption per adult is far below the criteria of the W.H.O., being 0.49 and 0.35 grams per kilo bodyweight instead of 0.7 grams per kilo bodyweight. As the Xavante have culturally few alternatives for proteines, the food situation is worrying. All attempts to acostum and train the Xavante to cattle-breeding have failed, so wildlife utilisation remains their principle food resource. Therefore wildlife management should be recovered to a sustainable practice without impact on the ecossystem. Apart from direct impact of hunting on wildlife, several other activities are considered to have an important impact on these populations: cattle-grazing inside natural habitats causes competetion and disturbance to game, level of fiscalisation is crucial to ban illegal hunting and fishing and the use of .22 riffles causes a suplementary mortality to hunting, which is lost as food resource for the Xavante community.

The analysis of material collected during the first year showed that the hunting pressure was far too high in an area of 65.000ha close to the village. It was suggested to the community to have a hunting ban for Marsh and Pampas Deer, Giant Anteater and Tapir in this area. The Xavante reacted positively, although there was still an overlap during 1992.

Each vulnerable species will be reviewed in order to join the indicative information on the health of the population;

- The consumption per consumer-year of Marsh Deer has declined in 1992, as has hunting pressure and the number of hunterdays. Highest numbers were caught in august and september. The sex-ratio in the area with high hunting pressure had 2.3 times more hinds than stags, while in the area with low hunting pressure almost the contrary. Although the harvest per surface is low, there are indications for both hunted areas that the off spring is very low, ±20%. So far census are not available to confirm the suspicion of low densities, so it would be wise to advise a hunting ban in both areas for one year.

- For Pampas Deer the consumption per consumeryear has increased in 1992, so did slightly the hunting pressure and the number of hunterdays. Highest numbers were harvested in the mid and late dry season. The sex-ratio in the area with high hunting pressure had 4.8 times more hinds than stags, while in the area with low hunting pressure only 1.6. Together with the data on the age structure, it can been seen that the offspring is above the 50%, but individuals above 4 years are extremely rare. Although census data are lacking, a hunting ban for e second year is suggested in the "1991" hunted area due to the extreme sex-ratio in that area.

-White-lipped Peccaries had a strong decrease in consumption per consumeryear, as did the hunting pressure and the number of hunterdays in 1992. Highest harvest were obtained in february and august, late rainy and late dry season. The sex-ratio in the area with high hunting pressure had 1.9 times more hinds than stags, while in the area with low hunting pressure the contrary 0.6 The offspring varies from 37-59%, the lowest in the area with high hunting pressure, the highest in the area with low hunting pressure. It will be recomended to have a hunting ban in the "1991 - area" to recover the reproductivity of that population. White-lipped Peccaries can react very sensitive to high hunting pressure. A refugium for this species is always recomendable, as local extinction occurs frequently in heavily hunted areas.

- Also the consumption per comsumeryear of Collared-Peccaries declined, but slightly, as did the hunting pressure and the number of hunter days in 1992. Highest number were bagged in may and october, early dry and early rainy season. The sex-ratio kept close to 1:1 in both areas, as did the offspring rate till 3 years, 43-44%. This suggests that the Collared-Peccary did not react differently in areas with a different hunting pressure in the past. So far there are no unusual indicative data on this species. But experience with tropical mammals is slowly growing. No ban will be needed, but the population should be sampled carefully to detect changes in population structure through time.

- The consumption of Tapir per consumer-year has declined considerably, as did the hunting pressure and the number of hunterdays. The

highest number were caught from july through september, mid till late dry season. The sex-ratio in the area with high hunting pressure had 1.4 times more females than males, while in the area with low hunting pressure the contrary 0.5. During the two years 53% of all animals were 1,5 year, so there is a good offspring. It will be recomended to have another hunting ban in the "1991 - area" to recover the population and to confirm how the population reacts with low hunting pressure.

- The consumption per consumer-year for Giant Anteater has slightly increased in 1992, while the hunting pressure kept the same and number of hunterdays declined. Highest harvests were registred in march and june through october. The sex-ratio in the area with high hunting pressure had 1.8 times more females than males, while in the area with low hunting pressure the ratio was almost 1:1 The yearly offspring varies from 8-14% juveniles, which is very low. Acording to Redford et al. (1992) the population density can get up to 20 individuals per 1000 ha. Possibly the anteater has naturally a low reproduction rate and population density is so high, that high harvest does not affect the population. The quantity and the composition of the habitats is very much in favour of the Giant Anteater. A second option is that the population in both areas have been hunted heavily for many years and the affected densities are so low that hardly any young is produced. Without census data both options are feasible. It will be recommended to have a repeated hunting ban on this species in the "1991-area".

The ideal indicator for the wildlife populations would be the correlation between hunting pressure - success with population densities. In 1993 the Xavante will be requested to have another hunting ban, as they will be involved in census of populations. However, traditionally the Xavante have no fixed rules for hunting. Hunting was practiced based on instinct, intuition and transmitted experience. The conditions for hunting have changed drastically: hunting range diminuished, almost no more migratory hunting, use of fire arms, lack of transmission of knowledge. All suggested changes in hunting management will have a delayed acceptance and still it is questionable whether census and game-gardening are feasible on the long term. It will be suggested to continue and strengthen the hunting ban in the "1991 area" for one more year. It will be emphasised the importance of dispersion of hunting towards the extremeties of the reserve. It has to be discussed repeatetly the danger of the cattle-breeding in natural habitats, the use of the .22 riffle, the possible use of "game-gardening" and the direct danger of any comercialization of animal products. All suggestions and

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highest number were caught from july through september, mid till late dry season. The sex-ratio in the area with high hunting pressure had 1.4 times more females than males. while in the area with low hunting pressure the contrary 0.5. During the two years 53% of all animals were 1,5 year, so there is a good offspring. It will be recomended to have another hunting ban in the "1991 - area" to recover the population and to confirm how the population reacts with low hunting pressure.

- The consumption per consumer-year for Giant Anteater has slightly increased in 1992, while the hunting pressure kept the same and number of hunterdays declined. Highest harvests were registred in march and june through october. The sex-ratio in the area with high hunting pressure had 1.8 times more females than males, while in the area with low hunting pressure the ratio was almost 1:1 The yearly offspring varies from 8-14% juveniles, which is very low. Acording to Redford et al. (1992) the population density can get up to 20 individuals per 1000 ha. Possibly the anteater has naturally a low reproduction rate and population density is so high, that high harvest does not affect the population. The quantity and the composition of the habitats is very much in favour of the Giant Anteater. A second option is that the population in both areas have been hunted heavily for many years and the affected densities are so low that hardly any young is produced. Without census data both options are feasible. It will be recommended to have a repeated hunting ban on this species in the "1991-area".

The ideal indicator for the wildlife populations would be the correlation between hunting pressure - success with population densities. In 1993 the Xavante will be requested to have another hunting ban, as they will be involved in census of populations. However, traditionally the Xavante have no fixed rules for hunting. Hunting was practiced based on instinct, intuition and transmitted experience. The conditions for hunting have changed drastically: hunting range diminuished, almost no more migratory hunting, use of fire arms, lack of transmission of knowledge. All suggested changes in hunting management will have a delayed acceptance and still it is questionable whether census and game-gardening are feasible on the long term. It will be suggested to continue and strengthen the hunting ban in the "1991 area" for one more year. It will be emphasised the importance of dispersion of hunting towards the extremeties of the reserve. It has to be discussed repeatetly the danger of the cattle-breeding in natural habitats, the use of the .22 riffle, the possible use of "game-gardening" and the direct danger of any comercialization of animal products. All suggestions and

critisism will have to be presented verbally in dialogue with the Tribe Council instead of only by document.

The Xavante will have to realize the choice they will have to make in a very short time. Continuing the same practices will lead them to advanced agriculture instead for subsistence and so they will loose an important aspect of their cultural and spiritual life. Game will no more supply sufficient animal proteins, if the Xavante will not begin with well defined and organised management of their game populations and the great diversity of habitats in their territory.

Most forest inhabitants, which traditionally have sustainable use of fauna resources, had during centuries a harmonious cohabitation with the ecosystem they took part in. They knew upon which level each species can be explored without having any impact on its population. Based on his own experience and intuition such communities allways prevented overexploration of their wildlife resources. Many indians applied rotation systems and switching of games-pecies when other game-populations got scarce. Merely from the moment that these communities got in contact with the comercial scheme of modern society - changing from the sustainable use to subsistance use with interest of profit - ignorance and a wrong optimism in relation to their "unlimited" fauna recources threat to dominate.

This project has improved xavante awareness of the degradation of their hunting traditions and they are willing to rationalize their hunting. But their priority interest is the food supply for the community. The access in the territory was limited to one sand "road" and insufficient to explore the whole reserve, but the completion of a track to the north-east in 1992 will facilitate the censuses to give more scientific bases to the wildlife management. This Reserve of the Xavante is one of the good examples where conservation of a large and representative area is still feasible. The integration of indigenous culture with the conservation of an important ecosystem in the tropical region can be an excellent example and stimulus for several other indigenous populations.

7. OBTAINED RESULTS IN RELATION TO THE OBJECTIVES OF THE PROJECT.

1. To obtain basic knowledge on costumes, traditions, cultural values and the impact of the hunting practices by the indians. To achieve a dialogue with the community if certain practices seem to be predatory on their ecosystem.

The cultural and social value of hunting is almost fully understood and indicates the strong dependancy of the Xavante on wildlife proteines. Basic data have been gathered on bag size and composition during the two study years. The impact of hunting on the wild fauna starts being visible and is worrying for several species. During the whole year there has been an active discussion with the Xavante about the neccesity of hunting rationalisation and doing censuses in different areas. They are prepared to participate at this stage of the project. As the census was strongly suggested by WWF-US consultants in Goiania in July 1990, they became confident that a vehicle of anykind would be supported by WWF in order to support the fieldwork.

2. To collect the indigenous knowledge on the reproductive cycles, habitat use and food habits of the game species.

The habitat use and food habits of game species could be surveyed for the major part, but the reproductive cycle is more complicated as the Xavante do not think in months, but in rainy and dry season. More data will have to gathered on these topics. Collected plant material on feeding habits of different species was hardly classified as no responses were given by the botanists requested.

3. To obtain knowledge on the actual densities of the game species.

During the first two years the Xavante were not prepared to execute censuses, but agreed to participate in counting during the third study-year. No data are available on densities as no field transport was present during the second study-year.

4. To obtain knowledge on nutritious and spiritual dependence of the population towards the game-species and other harvested natural products

The nutritious value of game is discussed widely in chapter 5.5. It was not possible to estimate the spiritual value of each species. The close association and dependancy with the ecossistem however is not only in terms of food supply, it is repeated in their rituals, ceremonies, myths and believe in supernatural forces in their biotic environment.

5. To study and analyse the feasabilty of breeding of certain game-species in semi-captivity and accompany students (CPI) of different indigenous comunities during these pre-studies.

Although the area is suitable for breeding in semi-captivity, this alternative should not be implanted within the community and the Reserve as long there is feasibility to recover and rationalize the game utilization by the Xavante hunters. The possibility was mentioned in the Warã with meaning to emphasize the urgent neccesity to change their actual hunting practices. The reaction of the Council was obvious and reforced; no breeding when wildlife can still be free-living.

6. To investigate and stimulate ways of self-regulations of the hunting by the Xavante indians.

In chapter 5.7. several suggestions concerning self regulation of the hunting are discussed. It should be mentioned that an effective change in the hunting behaviour of the Xavante will depend on time to assimilate the philosophy and the alternatives given. The realisation of the sand track with support from the dutch community, has made it posible to spread to hunting pressure and stimulate the utilization of natural resources throughout the territory. If access and communication with the extremities of the reserve are easy, the community will more adequately react to alternatives of hunting and control the reserve against destruction and poaching. It will take many years of education and small scaled support to achieve self-regulation of hunting without negative impacts.

7. To increase the sustainable capacity of the different habitats.

The idea to iniciate "game gardening" as described by Possey could work very positive for the wildlife populations and the Xavante community. At the current stadium of the project it is considered unfeasible to have game-gardening, unless with a few experimental areas. The question is whether the Xavante are capable to maintain and manage these "gardens" during the dry season,when these game-gardens are little distant. If the care for game-gardens is not integrated with the care and responsibility for game-

populations, game gardening will be of no use and other alternatives have to be sought.

RECOMMENDATIONS

It is recommended to continue with the data gathering for 2-3 more years, to make comparison between areas and different hunting regimes possible.
2. Census of populations should be started to back up hunting management.
3. Fiscalisation should be stimulated and encouraged to combat invasion, deforesstration and illegal hunting.

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