CENTRE FOR APPLIED SOCIAL SCIENCES **
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(CASS/MAT Working Paper 1-91 ; 1991)

(CPN 14)

CROP AND LIVESTOCK LOSSES TO WILD ANIMALS IN THE BULILIMANGWE NATURAL RESOURCES MANAGEMENT PROJECT AREA

By

Roland K. Hawkes *

26 September 1991

(Reprinted January 1997)

* Visiting Research Associate

** A Member of IUCN - The World Conservation Union

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CROP AND LIVESTOCK LOSSES TO WILD ANIMALS IN THE BULILIMAMANGWE NATURAL RESOURCES MANAGEMENT PROJECT AREA

Introduction

This working paper describes patterns of wildlife damage to crops and livestock in the seven wards surveyed by CASS in the wards of Bulilimamangwe district that are included in the Natural Resources Management Project. It attempts to formulate some implications for program policy. It is intended to provoke discussion and prompt response. A more finished version will be included in a more comprehensive report to be finished later. Response is solicited. Both encouragement and criticism are welcome.

Seven contiguous wards in the Bulilimamangwe district are included in the Natural Resources Management Project. The area included in the project is shown in Map 1 at the back of this paper. The wards are shown on Map 2.

From early January to late March 1991, a field research team from the University stayed in the area and interviewed in 966 households. The sampling method is briefly described in an appendix to this paper. It is these data that are used for the analysis reported here.

A focus of the project is to support and encourage community based wildlife management. It is based on the idea that the people who pay the costs of living with wildlife should reap the benefits. So, it is centrally important to find out who bears the costs of wildlife - damage to crops and predation of wildlife. This paper examines the patterns of damage in the area and suggests some implication for policy.

Representing the Variability of Wildlife Damage

The impact of wild animals on fields and herds can vary greatly from one area to another. This is true in the seven wards we surveyed. It varies from one ward to the next but it also varies within wards. The next lower political classification is the vidco. Inspection of the data - and experience in the field - shows that vidcos at the fringe of settlement and by the area where cattle and large wildlife intermingle suffer great damage to crops and cattle while others far removed from the periphery incur very few losses. This is true even within wards. So, simply to compare wards with reference to wildlife damage obscures the real differences by area.

However, we are reluctant to report statistics separately for each vidco. With only two sample points for each of them, our sample design does not allow reliability in the numbers for an individual vidco. We are more confident in reporting aggregated statistics for the ward level. Examining and comparing vidco statistics would be like looking too closely at a newspaper picture. Close examination of the picture shows only dots and empty places that seem to represent nothing at all. It is only when we step back and let the individual dots merge into the background that we see the pattern that the dots represent.

To get around this problem and still to convey the patterns of damage, we have classified vidcos according to their nearness to the unsettled areas used by wildlife and where wildlife and grazing conflict.

The unsettled areas include:

1. The area to the west of Makhulela ward. This area has only sparse (and illegal) settlement. The open area extends to Hwange National Park and to the Botswana border.

2. The area bounded on the north by the Thekwani river and on the south by Bambadzi and Madlambudzi wards. This area extends as a triangular wedge between two settled areas. It creates an open space and corridor for wildlife from Mabhongane and beyond into the geographic centre of the project area.

3. Botswana to the west of Bambadzi and Hingwe wards. This part of Botswana is only sparsely settled and is used by wildlife. Bull elephants regularly cross the veterinary control fence as do some cows without calves. The fence is no barrier to hyenas.

To tell the story of this variability from periphery to center, we have di /ided vidcos into four groups according to their position. The first group - the frontline - are those that share a border with the unsettled area. The second group are the next tier - those vidcos from which the unsettled area can be reached by passing through one other vidco in the first group. Similarly, the third are those from which the boundary of the unsettled area can be reached by passing through two other vidcos. The fourth consists of all the rest - places from which it is necessary to pass through three or four Vidcos to reach the boundary of settlement. Thus we have a crude but useful ordering of areas from those nearest the periphery of settlement to those most removed from the unsettled wildlife areas.

These areas are shown on Map 3. The percent of the households of each ward are shown in Table 1 at the back of the paper. About one fourth of the sample households is in each of the areas (29, 28, 24 and 19 percent of sample households are in the frontline through fourth tier respectively). The distribution of households varies greatly by ward. At one extreme is Bambadzi where every vidco borders on the unsettled wildlife area. It is followed closely by Makhulela where two thirds of the sample households live in frontline vidcos. At the other extreme is Gala where all of the vidcos are in the third and fourth tiers and ninety percent of the sample households are in the fourth. The other wards are between these extremes and vary in their exposure to the areas that harbor large wild animals.

There are probably more precise ways to represent this distinction. Perhaps we should have recorded the distances of each sample point from the periphery and used those distances to form the areas. However, we did not. The classification we are using makes the essential points. The reader must remember that because a particular vidco is in an area does not mean that statistics for the area are representative of the vidco. That would be like peering too close at the newspaper. However, the classification does help us to tell the story of how the risk of losses to wildlife depends heavily on where people live.

Cattle and Grazing

The unsettled area not only puts adjacent settlers close to wildlife, it provides them with opportunity for grazing their cattle as well. Now, we are not satisfied that our respondents were entirely forthcoming about their cattle holdings. Abundant information acquired informally indicates that there are large cattle holders who use the Mabhongane area and who do not want it known. However, we are confident of the patterns in our data if not of the precise numbers. Moreover, if there are large herd owners in the frontline vidcos that we have not uncovered it will only attenuate the differences we observe. With this in mind we can proceed to investigate those patterns. Table 2 demonstrates that people closer to the unsettled area are more likely to report owning cattle, are less likely to graze them near home in the dry season and are more likely to use the Mabhongane area.

Eighty percent of the frontline households report owning cattle compared to seventy percent of those in the fourth tier. Those in the second and third tiers are between those two values. This is not a large difference but it does suggest that the opportunity for keeping cattle is more available toward the periphery of the area. (For those who own cattle the average herd size is 9.6. There may be a very small tendency for cattle owners away from the frontline to have smaller herds but the difference is not statistically significant. Among cattle owners, about one third own five or fewer beasts, another third own six to ten. The top third own more than 10.)

The next line of table 2 shows that those cattle owners of the frontline are much less likely to keep their cattle around their homes to graze in the dry season. (This tabulation combines two responses to the question about dry season grazing - that cattle graze in the fields after harvest and that cattle graze nearby or around the place.) Nearly all - ninety two percent - of the cattle owners in the fourth tier keep their beasts around home to graze in the dry season. Fifty seven percent - still a majority but many fewer - of those in the frontline vidcos keep their cattle at home in the dry season. Those in the second and third tiers are between these two extremes in the extent to which their cattle graze around home in the dry season.

The question about where cattle are sent remains. One prime grazing area is Mabonghane in the unsettled area and where wild animals abound. It is those in the frontline who are most likely to send their cattle to Mabonghane in the dry season. The next line of the table shows that about a quarter - twenty four percent - of cattle owners in the frontline vidcos report sending their cattle to Mabonghane for winter grazing. In the second tier, the percent drops by more than half to eleven percent. It is nine percent in the third tier and drops to a mere two percent in the fourth tier which is most removed from the unsettled area.

It seems that those closer to the frontline are more likely to remove their cattle from home for winter grazing. Moreover, they are more likely to remove them to Mabonghane where wild animals abound. Combine this winter grazing pattern with the fact that their homes are closer to wildlife in the first place. It should come as no surprise that losses of cattle vary with distance from the unsettled area.

Livestock Losses to Predators

Hyenas are by far the most serious predator of cattle. We have isolated reports of cattle being taken by lions and leopards. Six households reported losinf cattle to snakes. There are nine reports of cattle being taken by jackals. For all of these predators, the incidents are too few to form a clear pattern or to generate trustworthy statistics. Losses to hyenas are frequent enough to be very important and to form patterns that are ststistically clear. Hyenas are especially likely to take cattle that have been weakened by insufficient grazing and by thirst.

The first line of table 3 shows the losses of cattle to hyenas in the various areas. (It includes those households that currently own cattle.) In the frontline vidcos, close to a third - thirty two percent - of cattle owners report losing them to hyenas. At the other extreme there was not even one report in the fourth tier removed from the unsettled area. In the second and third tiers, six percent and three percent respectively report losing cattle to Hyenas. Clearly, proximity to the unsettled area puts cattle at risk of their lives and their owners at risk of loss of this most important asset.
(Households with cattle loss to hyenas report an average of 2.3 beasts taken. The sample average is lower away from the wildlife area. Because of the small numbers of losses away from the frontline areas, the differences are not statistically significant.)

The next line of table 3 shows that hyenas exact a smaller toll of donkeys. Overall, two percent of donkey owning households report their loss to hyenas That they are less vulnerable than cattle most likely stems from two causes. They are probably kept closer to home and penned at night lessening their exposure to predatory hyenas. Also they are noted for keeping their strength and vitality in severe drought conditions and are probably more able to mount a defense against predation than are starving cattle.

However in spite of the relatively low risk, it is the frontline donkeys that are killed. Seven percent of these households report their loss to hyenas. Only one percent of the second tier homes lose donkeys to hyenas and not one household in the third and fourth tiers removed from the unsettled area reported a loss.

The most frequent predation of livestock is the taking of goats by jackals. The next line of table 3 tabulates these reports. Overall, fifty six percent of goat owning households report their loss to jackals. The small variation from one tier to the next shows that the risk is not a function of nearness to the unsettled area. Jackals are everywhere and goats become their victims equally without regard to the locations of their homes. (If anything, goats at a distance from the unsettled area are more at risk of predation than those by the frontline. However tempting it is to speculate on the meaning of this, the variation is not statistically significant.)

Crop Damage by Wild Animals

The next line of table 2 reports damage to crops by elephants. The differences among the four areas are dramatic. Exactly half of the homes in the frontline area report crop damage by elephants. Contrast this with the eight, seven and one percent reported in the second, third and fourth tiers respectively. We could calculate the table the other way and show that the

approximately one quarter of our sample which is in the frontline provides about three quarters of the reports of elephant damage to crops. The threat of elephants presents a risk that is very unevenly distributed.

The unevenness of the elephant threat prompts the observer to ask whether the CAMPFIRE project should be spread over this heterogeneous area. If it is premised on the idea that those who suffer the effects of wildlife should reap the benefits then it seems that the potential benefits are directed at a large pool, the majority of whom are not at risk. Since the project in Bulilimamangwe has been presented to people mostly as a project about income from elephants this issue deserves special attention. this issue is discussed below.

The last line of table 3 tabulates crop damage by springhares. This may seem to the reader to be a trivial sort of creature to attend to. However, it is the second most often mentioned crop damager among the wild animals. (Birds are most frequently mentioned. See the discussion below.) Further, the springhare, which is inordinately fond of groundnuts, provoked fervent and heartfelt complaints from our respondents. Thirty percent of our sample reported damage by springhares.

Damage by springhares differs by distance from the unsettled area in a small but interesting way. Reports are lowest in the frontline vidcos (nineteen percent) and highest in the fourth tier (thirty seven percent). Perhaps those on the periphery are growing fewer groundnuts. At this writing that has not been investigated. Our working hypothesis is that the more heavily settled places away from the wildlife areas is more congenial to the lifestyle of the springhare. If that is so then the price for protection from elephants and hyenas may be increased crop loss from springhares and their ilk.

Other Wildlife Damage to Crops

Sixty two percent of our sample households reported crop damage by birds. These reports are not tabulated with the other important kinds of damage in table 3. There are two reasons for this. One is that there are no significant differences among the areas.

The second reason is that we do not trust the data about birds. When asked about crop damage to wildlife, respondents usually did not speak spontaneously about birds. That birds eat the crops - especially mhunga - seems to be a condition of life that is taken for granted. It does not attract the notice nor evoke the fervor that other crop raiders induce. The springhare comes by night and unearths a large amount while householders sleep. The next morning the damage is discovered and is a large setback for the cultivator. An elephant in the field is an enormous indignity even when the damage is slight. It is remembered and discussed long after. Birds come in the day and do a little damage at a time. They can be chased away if constant vigilance is maintained. But vigilance flags and the birds migrate out of constant consciousness. Then they do not come to mind when the interviewer asks.

The question about crop damage was open ended and it was not printed on the questionnaire to ask about birds. We asked our interviewers to make a special effort to inquire about them. They sometimes did. But birds made such uninteresting conversation that we fear that they migrated from the interviewers consciousness too.

Suffice it to say that birds are ubiquitous. Proper research might show that they do more damage to crops than elephants - perhaps more than elephants and springhares combined.

Other animals damage crops to a lesser extent. Buck of various sorts are reported by about twelve percent of our respondents. there is a very slight but nonsignificant trend for those closer to the wildlife area to be affected.

About eight percent report damage from baboons. Reports may be a bit more frequent in the more settled areas but the differences observed are not statistically significant.

About six percent report crop damage from jackals. It seems that they eat watermelons - probably for the moisture content. There is no noticeable pattern of variation with distance from the frontline.

Warthogs and wild pigs - our respondents did not differentiate between them - are reported as crop damagers by about five percent of the sample households. there seems to be no difference by distance from the unsettled area.

About one percent of our sample report crop damage by buffalo. The numbers here are very small and their differences do not generate statistical significance. However the pattern suggests that like other very large wild animals, they are more common near the frontline.

Some Implications of Patterns of Wildlife Damage

Several important patterns with implications for policy have presented themselves:

1. Crop damage by elephants is heavily concentrated in the frontline vidcos adjacent to the unsettled areas which provides habitat for wildlife.

2. Households closer to the frontline seem to be more likely to own cattle than those farther back.

3. Frontline cattle owners use Mabonghane for winter grazing far more than anyone else.

4. Cattle (and other livestock) from the frontline area are much more at risk from predation by hyenas than cattle from farther back.

5. Widespread crop damage by springhares and birds and goat predation by jackals occurs throughout the seven ward area.

The scope of the Natural Resources Management Program in the Bulilimamangwe area is large compared to the area that is seriously suffering crop and livestock loss from large wildlife. If the CAMPFIRE philosophy as it is presented in DNPWLM publications and buttressed by theories of common property ownership is intended to apply here, then I think that the program is wide of the mark. CAMPFIRE guidelines emphasise that the producers of wildlife should reap its benefits and that those who pay the costs of living of living with

wildlife should be paid its rewards. I am not convinced that this is happening or is about to happen in the Bulilimamangwe area.

Elephants are a serious problem only for the quarter of the households who live in the frontline area. However, the returns from safari hunting will go to the whole area covered by the seven wards. Aside from questions of fairness, is this enough return from elephants to give residents of the frontline the sense of proprietorship of the elephants that the CAMPFIRE philosophy assumes must develop?

For good or ill, the scheduled reorganisation of grazing in the Mabhongane area will most affect the cattle owners in the frontline vidcos. Whether it provides better grazing or more restricted access it will be these cattle owners that reap the benefit or bear the cost. It would seem that the project would be on sounder footing if there was strong effort to ground the scheme in the consent of these owners rather than in the more diluted accession of people in the larger area. The simple determination of whether the access fence will remain intact could rest on this consent. Again, the CAMPFIRE philosophy would require that common property be regulated by its users. It is not clear that this is being done here.

The loss of livestock to predation seems not to be addressed by the project. Hyenas kill cattle in the frontline area and in the uninhabited area where they are also grazed. It may not be possible to do anything about it. It may even be desirable from an ecological point of view to keep predation pressure on cattle. However, agreement can hardly be expected from the owners of cattle. However, any program that attempts to get people to tolerate wildlife ought to make some attempt to address the problem of predation.

Will it be possible to spread the **CAMPFIRE** gospel to the diverse seven ward area? What is the reality of the common ownership of wildlife to people whose daily involvement with wildlife is the loss of crops to birds and springhares and of goats to jackals. I have no settled answers to these questions. I raise them to promote discussion and to sharpen our focus on the issues. I believe that they must be addressed to assure the success of the Natural Resources Management Project and that they have a wider and more general relevance to the **CAMPFIRE** program.

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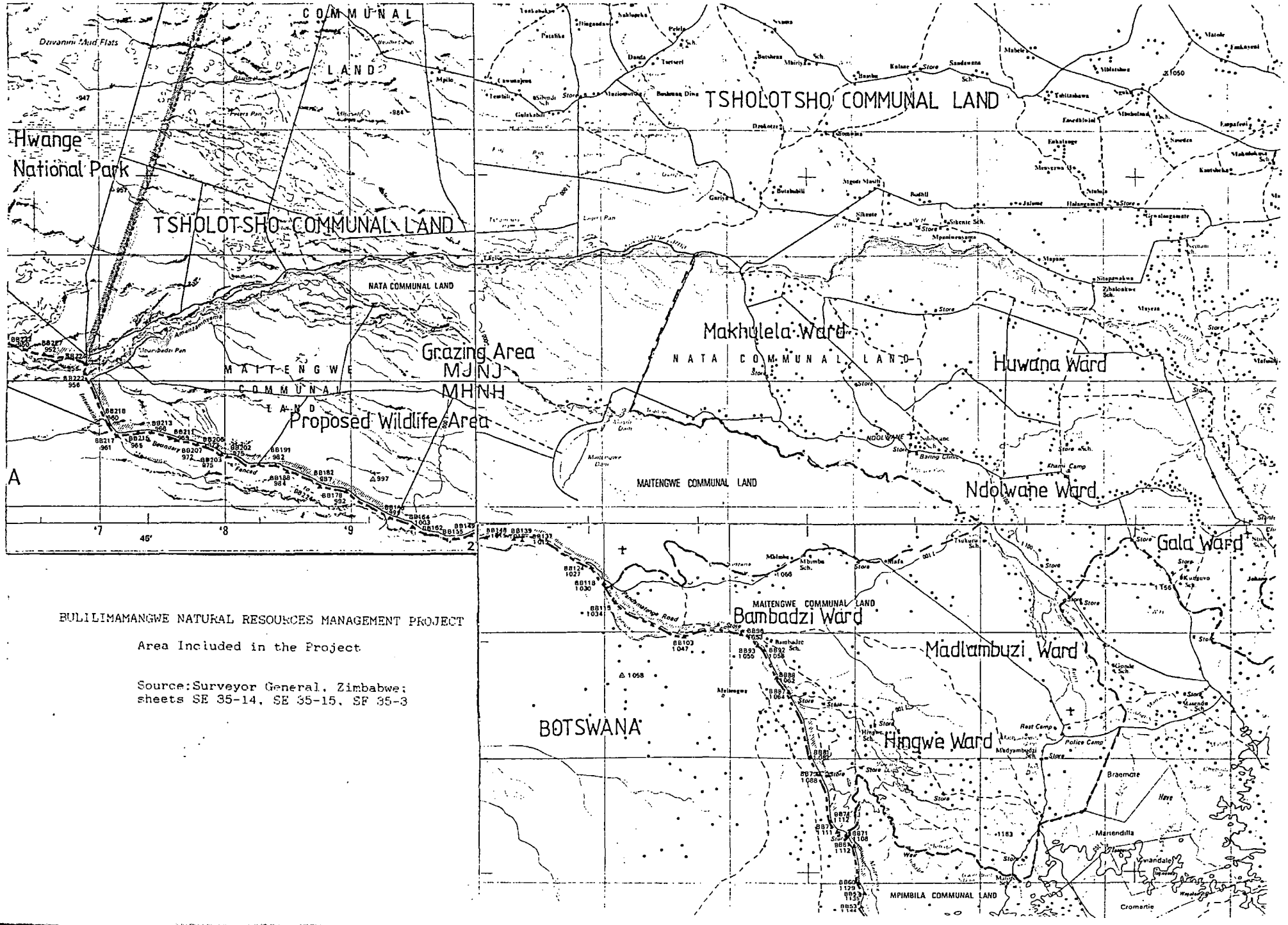

BULILIMAMANGWE NATURAL RESOURCES MANAGEMENT PROJECT

Area Included in the Project

Source: Surveyor General, Zimbabwe; sheets SE 35-14, SE 35-15, SF 35-3

BULILIMAMANGWE NATURAL RESOURCES MANAGEMENT PROJECT

DISTANCE OF VIDCOS FROM
UNSETTLED WILDLIFE AREA

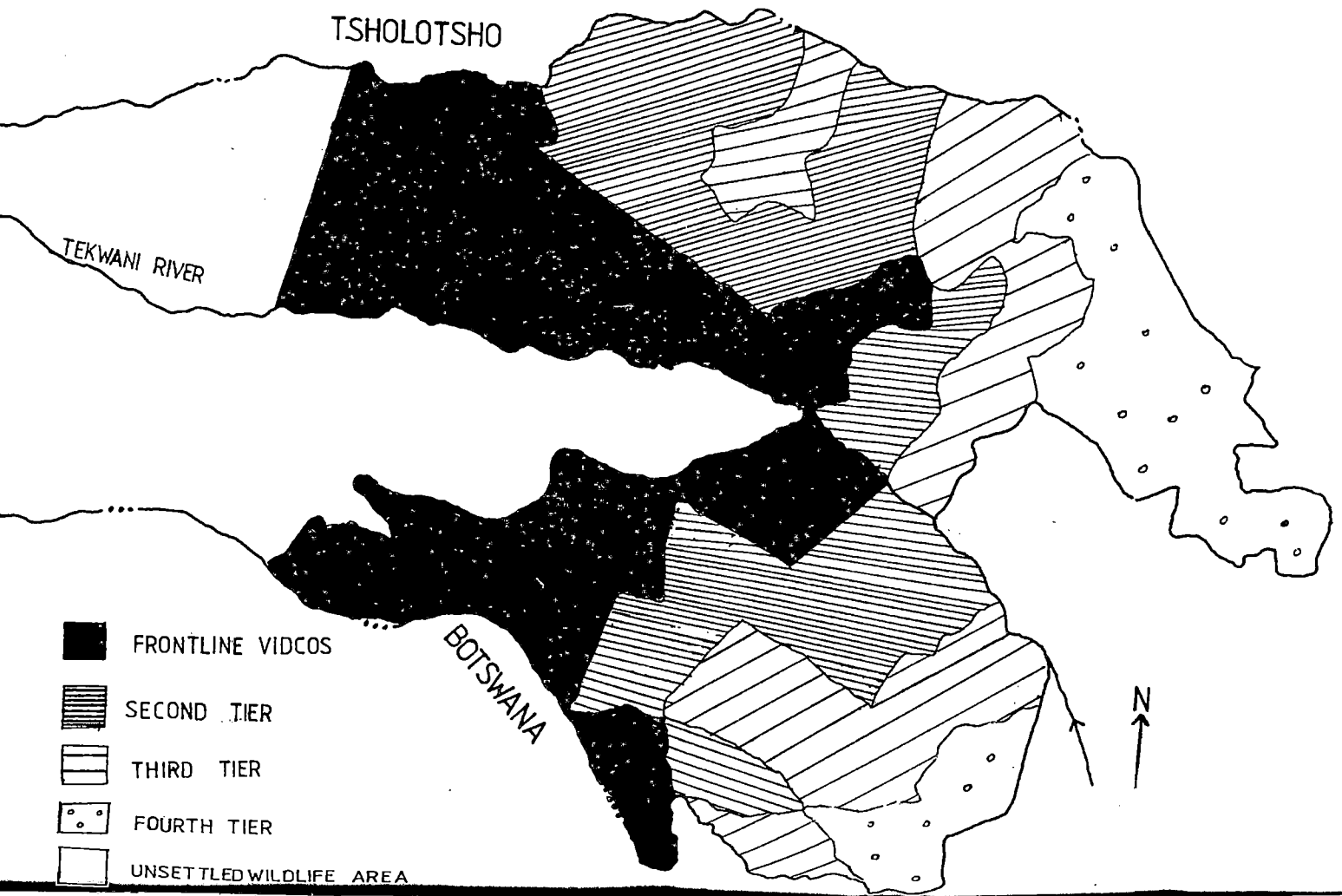

Table 1. Percent of Ward Sample Households by Distance from Unsettled Wildlife Area.*

Ward	Distance from Unsettled Wildlife Area: Front-line	Second Tier	Third Tier	Fourth Tier	TOTAL (N)
Makhulela	69	31	0	0	100% (164)
Ndolwane	24	64	12	0	100% (150)
Huwana	0	18	82	0	100% (169)
Gala	0	0	10	90	100% (170)
Bambadzi	100	0	0	0	100% (105)
Hingwe	13	44	44	0	101% (101)
Madlambudzi	8	50	14	28	100% (107)
TOTAL	29	28	24	19	100% (966)

Table 2. Cattle Ownership and Grazing by Distance from Unsettled Wildlife Area.*

Percent of Households	Distance from Unsettled Wildlife Area: Front-line	Second Tier	Third Tier	Fourth Tier	TOTAL
Owning Cattle	80% (278)	75% (272)	74% (233)	70% (183)	76% (966)
Grazing Cattle at Home[1]	57% (225)	73% (204)	78% (173)	92% (128)	73% (730)
Grazing Cattle at Mabonghane[1]	24% (225)	11% (204)	9% (173)	2% (128)	13% (730)

* Numbers in parentheses are the bases of the accompanying percents.

1. Dry season grazing is tabulated. Only households that own cattle are included in the base.

Table 3. Percent of Households Reporting Killing of Livestock and Damage to Crops by Wild Animals by Distance from Unsettled Wildlife Area.*

Percent of Households'	Distance from Unsettled Wildlife Area: Front-line	Second Tier	Third Tier	Fourth Tier	TOTAL
Cattle Killed by Hyenas[1]	32% (225)	6% (204)	3% (173)	0% (128)	12% (730)
Donkeys Killed by Hyenas[2]	7% (100)	1% (130)	0% (85)	0% (57)	2% (372)
Goats Killed by Jackals[3]	55% (242)	54% (246)	57% (217)	61% (166)	56% (871)
Crop Damage by Elephants	50% (278)	8% (272)	7% (233)	1% (183)	18% (966)
Crop Damage by Springhares	19% (278)	34% (272)	35% (233)	37% (183)	30% (966)

* Numbers in parentheses are the bases of the accompanying percents. All reports of livestock loss are for the one year period before the interview. Reports of crop damage are for the growing season preceding the interview.

1. Only households that own cattle are included in the base.

2. Only households that own donkeys are included in the base.

3. Only households that own goats are included in the base.

Appendix: A Note on Statistics

All of the percents in this paper have been rounded to the nearest integer. Not to do so would imply a specious precision that does not inhere in the data. All the numbers are subject to sampling error. Even the digit preceding the decimal is highly unreliable for the sample sizes we compare here. Rounding to integral values loses no information and it makes the tables far less cluttered.

I have not honored the common ritual of noting significance levels in the tables. Indeed, the significance tests calculated in the textbook way by standard computer programs (in this case SPSS-PC+) are not appropriate for our sample design. (Nor are they appropriate for most survey sample designs.) Our sample is a variant of a cluster sampling design. We have randomly selected two sabukus (kraalheads) from each vidco and interviewed them and all the households under their jurisdiction. Each sabuku and his people are a cluster. Since we expect that the lives and views of people under the same sabuku will be similar to each other, different respondents are not truly sources of independent information. The result is that our cluster sample - like most cluster sampling designs - will not be as close to representing the whole population as a simple random sample of the same size with observations selected independently. The textbooks and the computer programs assume that observations are generated by simple random samples.

Our design allows the estimation of reliability but it will require further work and custom made computer programs to do it. That will be done eventually. In the short run some simple estimates are used. Experience has shown that practical cluster sample designs for national social surveys in the industrialised part of the world yield a level of reliability about the same as that of random samples of about two thirds the size of the cluster sample. Before detailed analysis we do not have the equivalent information about our design. However it seems prudent to treat our sample as if it was from a simple random sampling design but of half the size that it actually is.

I have therefore considered differences to be statistically significant only if they pass muster when recalculated from the computer output with sample size cut in half. This is not so formidable as it sounds. It only requires that chi-square values be divided by two and that values of t (or normal deviates) be multiplied by 0.707 - the reciprocal of the square root of two.

For all the differences reported in this paper, the significance level of Kendall's tau-b has been recalculated with sample size halved. Only those differences that then pass muster at the 0.05 level (two tailed) have been treated as being established.

By happy circumstance, the results reported here are either clearly significant by almost any criterion or clearly not so. So the analysis was not difficult.

In any case to post the results of this crude rule of thumb on the tables would imply a precision that is not there. They would only make the tables too busy to convey information effectively.

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