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A PHOTOGRAPHIC TECHNIQUE TO QUANTIFY LATERAL COVER DENSITY

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ABSTRACT

The paper describes a technique to measure the degree of obstruction to horizontal vision through vegetation using photographic transparencies and explains the method of analysis used to achieve statistically valid results. The importance of this parameter in wildlife habitat studies is discussed and applications of the technique to other conservation practices are suggested.

INTRODUCTION

Lateral cover density or the degree of obstruction to horizontal vision through vegetation varies considerably, even in the same vegetation type, and appears to be closely related to habitat carrying capacities for the black rhinoceros (*Diceros bicornis*) (Thomson 1971). It may therefore also be an important factor influencing the population dynamics of other species. However there appears to be a singular lack of information on accurate methods to quantify lateral cover density although several means of assessment are discussed by Giles (1969).

During studies of black rhinoceros habitats, Hitchins (1969) calculated the number of woody plants per unit area and Joubert and Eloff (1971) used the density board method (Wight 1938 cited by Giles 1969) to evaluate cover density. Giles (1969) points out the limitations of both these methods, however, and cautions against their use as they provide nothing more than indications of cover. During a black rhinoceros habitat study in Rhodesia (Thomson 1971), a method of quantifying lateral cover density which would produce statistically valid data was required and a photographic technique, which achieved this goal, was developed. Besides having a wide application in the evaluation of wildlife habitats it may also be of use in measuring the results of veld management programmes.

MATERIALS AND METHODS

Initially the various vegetation-type patterns in different habitats were mapped from aerial mosaics and stereo-paired aerial photographs and the results were ground checked. Known home ranges were then superimposed upon these details and the areas of home range and of specific vegetation types within each home range were measured with a planimeter. The lateral cover density in each vegetation type was then quantified using the new photographic technique and a unit of measurement, termed a Relative Cover Factor (RCF) for each vegetation type in every home range, was achieved by mathematical calculation:

$$RCF = \frac{\text{Mean Cover Measurement (\%) X Area of Vegetation (km}^2\text{)}}{\text{Area of Home Range (Km}^2\text{)}}$$

This measurement expresses available cover in each vegetation type, relative to the home range in which it occurs, as a number per unit area, thus reducing all cover factors to a common denominator and permitting comparison between habitats or between home ranges within the same habitat.

Photographic technique

A point well inside the vegetation type to be measured was randomly selected and a peg, which formed the base point for the first of three transects, was hammered into the ground. The remaining transects in this group were taken at fixed distances and parallel to the first. The first 25 m long transect was laid out from the base peg and the other pegs were positioned at 5 m intervals along the transect line, which ran at an angle of 90° to the rays of the sun (Fig. 1).

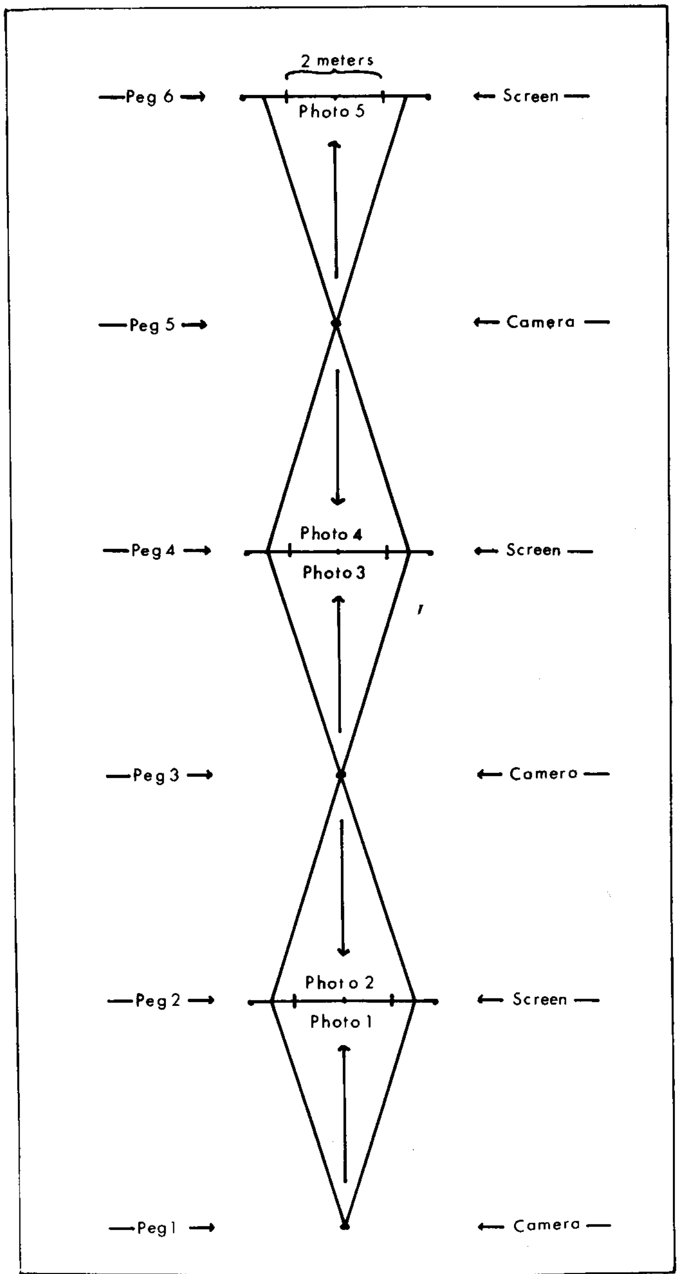

Fig. 1. Diagram of a transect. The 2 m marking indicates that portion of the photograph which will fall within the quadrat matrix on the 2 m viewing screen.

A 35 mm reflex camera, fitted with a standard 55 mm lens and loaded with colour transparency film, was set up on a tripod over the base peg (Peg 1). A tough, plain white cotton-sheet screen, ca 3 m wide and 2 m high, attached at each end to straight 2 m high brandering timbers, was then stretched across the next peg (Peg 2), facing the camera, and held in position by two assistants. In this way the cotton sheet screened from the camera all vegetation except that which occurred along the first 5 m segment of the transect. A serial number, identifying both the transect and the photograph, was then chalked on a small blackboard which was held in sight by one of the assistants and a photograph was taken of the screen and all forelying vegetation.

The screen was left in position over Peg 2 and the camera moved to Peg 3 from which position another photograph was taken of the reverse side of the screen and all the vegetation which lay between it and the camera. The screen was then moved to a position over Peg 4, the camera reversed on its tripod and a further photograph was taken. The camera was then moved to Peg 5 where a photograph was taken of the other side of the screen and the fifth and last photograph of the transect was taken with the camera over Peg 5 and the screen across Peg 6.

The second transect of the series was set up 50 m to the right and parallel to the first and conducted in the same manner. A third transect was carried out 50 m to the right of the second one. The series, therefore, comprised a total of 15 photographs and several series, based on similar groups of three parallel transects, were used to analyse each vegetation type.

Basis for standards

The objective of the study was to quantify cover factors in black rhinoceros habitats and since even a very large rhinoceros stands no higher than 2 m with head erect, only the cover to this height was considered pertinent. Through experimentation it was discovered that, with the camera equipment used, an image of the cover a little over 2 m in height was obtained at a range of 5 m so this was the distance used to divide the transect. The length of the transect at 25 m, the interval of 50 m between transects, the choice of three transects per series and therefore of 15 photographs per group, had no statistical significance but were purely arbitrary decisions, subjectively determined because they resulted in each transect series covering a wide area which improved the probability of randomness.

Elimination of confusing factors

There were four practical treatments employed to eliminate confusing factors encountered when using this technique.

1. Experimentation proved that vegetation portrayed on the slides could be confused with shadows of the surrounding vegetation cast either onto the front of the transect screen or through the screen from behind, thus complicating analyses. The difficulty was solved by setting up the transect line at 90° to the angle of the sun's rays so that the screen was erected parallel to them and no confusing shadows were possible. This also contributed to the randomness of the sampling by further avoiding subjective siting of the transect line.
2. Images closer than 0,5 m to the camera lens proved too distorted to analyse so, on every transect segment, any vegetation occurring within this distance was removed before the sample photograph was taken. This represented the apex of the pyramid of vegetation under calculation and constituted 0,1 percent of the total measurable lateral cover.
3. In thick bush it proved impossible to focus at ranges of 0,5 m and 5,0 m simultaneously and analysis of the photographic slides was simplified when the camera was focussed at 2,5 m. With this focus images at 0,5 m and 5,0 m were slightly distorted but readily distinguishable and measurable.
4. Sometimes a thicket-tuft interfered with the positioning of the transect screen which had to be fed through the obstruction with the aid of the brandering supports.

Analysis

Analysis of the slides was simple but required the preparation of a "standard" slide and a viewing screen marked with quadrats. The standard slide comprised a photograph, taken at a distance of 5 m, of a 2 m long black-painted wooden plank fixed on top of a 1 m high upright which was centrally situated in front of the transect screen (Fig. 2). The viewing screen consisted of 1,5 m^2 piece of hardboard painted matt-white and marked with a matrix of quadrats each 4 cm^2 (Fig. 3). This matrix contained 24 vertical and 25 lateral quadrats to provide a total of 600 which simplified the mathematical calculations that followed.

The standard slide was inserted into a projector which was moved backwards or forwards until the horizontal bar in the projected image on the viewing screen coincided exactly with the width of the quadrat grid. The projector was then adjusted vertically until the base of the upright support, which occupied the position of the transect peg, coincided with the baseline of the matrix (Fig. 4). A transect slide (Fig. 5) was then fed into the projector, the image cast upon the viewing screen (Fig. 6) and a record sheet prepared with the slide identification. Each quadrat on the viewing screen was examined for the occurrence of woody vegetation and if such vegetation was present the corresponding quadrat on the record sheet was marked with a cross. Upon completion of the analysis the crosses were added up and expressed as a percentage of cover density (Fig. 7).

To speed up analysis a quick appreciation of the cover was made when the image first appeared on the screen and if the cover density was obviously in excess of 50 percent then the quadrats showing no cover at all were marked with a zero. Because of the nature of the study

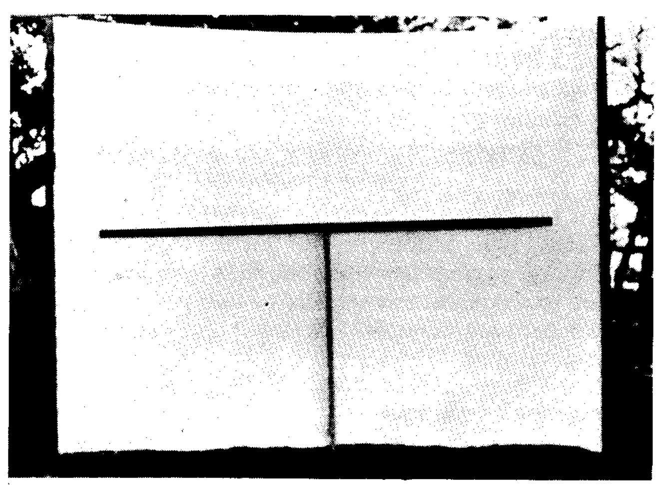

Fig. 2. The 'standard' slide used for setting the projector.

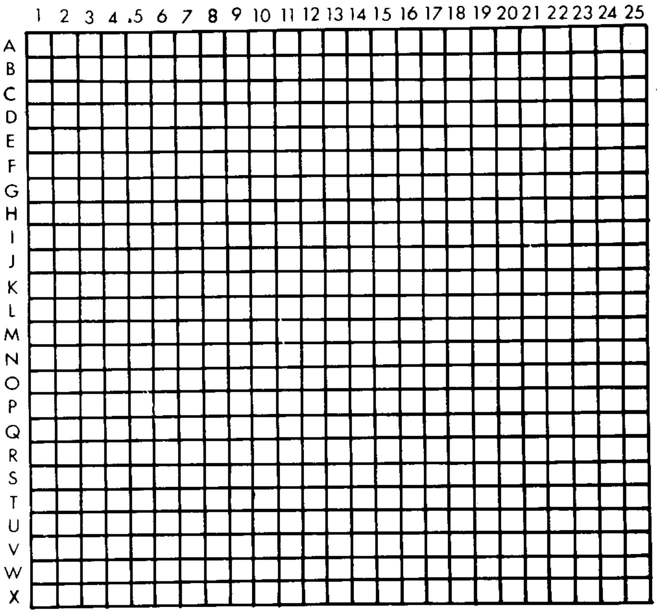

Fig. 3. The layout of the quadrat matrix on the viewing screen. Actual size of matrix: 1 m across.

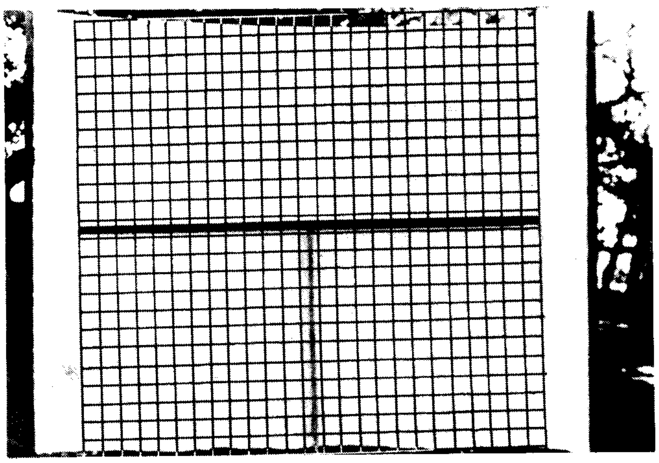

Fig. 4. Image of the 'standard' slide when set correctly on the viewing screen.

Fig. 5. A sample of a transect photograph. Note identification board held by assistant.

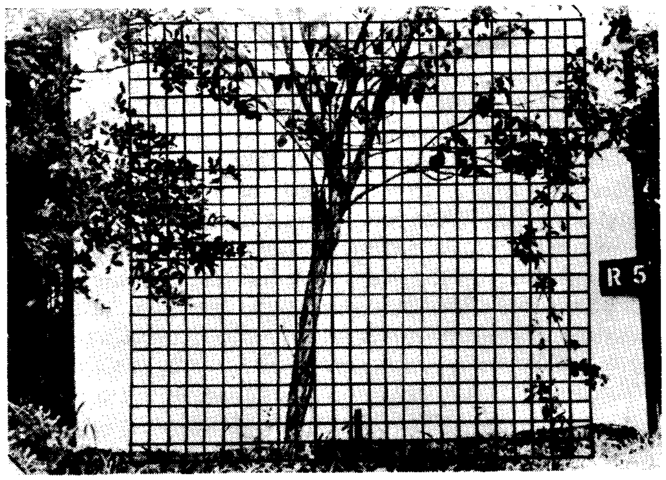

Fig. 6. Image of sample photograph on the quadrat matrix of the viewing screen.

only woody vegetation (the permanent cover factor) was assessed and when grass appeared inside a quadrat it was ignored.

DISCUSSION

There appears to be no acceptable measure of cover density that will consider adequately all the factors involved for all species of wildlife (Giles 1969). In view of the complex problems involved, it is probably that there may never be a perfect method and the practical measurement of this important parameter will continue to be marred by limitations. This technique also has its limitations but it has distinct advantages when compared with other methods of lateral cover density evaluation. It's principal virtue is that the results provide statistically valid data and there is the added convenience of being

	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	TOTALS
A	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x			23
B	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x					x	21
C	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x					x	x	21
D		x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x			x	x	x		x	x	21
E	x				x	x	x	x	x	x	x	x	x	x	x	x	x		x	x	x	x	x	x	x	21
F	x	x					x	x	x	x	x	x	x	x	x			x	x	x	x	x	x	x	x	19
G	x	x	x						x	x	x	x	x	x	x		x	x	x	x	x	x	x	x	x	19
H	x	x	x	x	x	x				x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	22
I	x	x	x	x	x	x	x				x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	22
J	x	x	x	x	x	x					x	x	x	x									x	x	x	13
K	x	x	x	x	x	x					x	x	x										x	x	x	12
L	x	x	x	x	x	x					x	x										x	x	x		11
M	x	x	x	x	x	x	x			x	x	x									x	x	x			13
N	x	x	x	x	x		x	x		x	x											x	x			11
O	x	x	x							x	x												x	x		7
P	x	x	x	x					x	x	x												x	x		9
Q									x	x	x												x	x		5
R									x	x	x												x	x	x	6
S									x	x													x	x	x	5
T									x	x													x	x	x	5
U									x	x												x	x	x	x	6
V								x	x	x													x	x		5
W								x	x	x														x		4
X								x	x	x																3

GRAND TOTAL 304

STUDY AREA: Manzituba.

DATE: 15.8.1974.

TRANSECT: R.

PHOTOGRAPH: 5.

COVER ASSESSMENT

Recorded: 304

Max. Possible: 600

Percentage: 50,7

Fig. 7. Cover Assessment Record Sheet for the sample photograph shown in Figs. 5 and 6.

able to compile extensive and accurate records quickly and easily in the field for subsequent analysis indoors.

This latter consideration has substantial merit when time and/or distance factors preclude prolonged work periods in the field.

The importance of cover to wildlife depends upon the influence it exerts on individuals or populations and is most important when it becomes a limiting factor. Cover density will vary in different plant communities and at different times of the year, with the greatest fluctuation occurring in deciduous associations. However, although the time to measure cover density will depend upon the nature of the study, evaluation is likely to be most critical when cover factors become limiting, so, unless it can be shown to be important during other seasons, it may only be necessary to measure cover when it exerts its greatest influence.

Although the technique was devised to quantify lateral cover density in black rhinoceros habitats, by using fixed transects and with slight modifications to the method of analysis, it could be used with equal facility to determine the effectiveness of several veld management programmes (e.g. the horizontal quadrats on the record sheet could be used to document the rate of degeneration or recovery of woody plant species under different land husbandry regimes). It provides therefore a possible answer to the problem of analysing one parameter of wildlife habitats and may also have several other applications in conservation practices.

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