Practical game count (game census) techniques

Game management is a vast topic that includes many different aspects. One of the most important aspects of proper game management is to keep healthy and balanced (sex and age) herds of animals in such numbers that the habitat thrives. Especially on game farms, the early recognition of trouble ahead is very important to avoid serious damage to the veld.

A game count, or more correctly, a game census[1], enables you to determine trends in animal population density, farm stocking rate and the condition of your veld.

A reliable count (census) is one of the important cornerstones of effective game ranch management

By doing game counts, you gather important information on:

- ❧ Numbers of animals in different species
- ❧ The spatial distribution of game species on a farm
- ❧ Trends in game numbers (some species may be thriving while head numbers of other species may be declining – why?)
- ❧ Habitat health, esp. identifying problem spots

This information enables you to make sound management decisions. Is the stocking rate realistic when compared to carrying capacity of the farm?? Should I harvest game? Can I add game? Which species do well, which don't?

By doing a game count, you try to make an accurate estimation of the population of animals on the farm but it is a mere snapshot in time. Far more important information is gained by comparing current to past game count results. This enables you to evaluate population trends e.g. how do numbers of animals change over the years? And how does the veld change with these numbers of animals?

For effective game management, and especially to establish trends in populations, **a thorough (ideally aerial) game count should be conducted annually or biannually**. This ideally should be done before considering harvesting large numbers of animals. It often happens that a farmer 'sells' more game than he or she actually has...

There are many different techniques of counting game. This article concentrates on game count techniques that are practical for our Namibian setting. **Accurate or exact** game counts on large areas are near impossible. Rather than knowing the exact number of animals you have, focus on obtaining **repeatable counts (estimates) in an area to** act as a reliable foundation for habitat and population management.

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[1] *A census is the procedure of systematically acquiring, recording and calculating population information about the members of a given population.*

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Before we go into the different techniques, some important considerations to keep in mind. You can choose to do **total counts**, whereby you try to count all the animals in a certain area, or **sample counts**, whereby you count smaller (representative) sample areas, and draw conclusions for the bigger area (e.g., counting game on 10 equally spaced strips of 200 m wide x 10 km long on a 10 000 ha farm amount to a 2000 ha area counted. One can now extrapolate the count to the entire farm by multiplying the game counted by 5). Obviously, the accuracy, repeatability and cost of the count increases as the proportion of the farm covered in the count increases.

The suitability of each game count technique varies between:

- Game species to be counted (some game not easily seen from the air...).
- Terrain and type of habitat (size of the area to be surveyed, topography, accessibility and vegetation).
- Season (e.g., waterhole counts are useless in the raining season or in areas with constant running rivers).
- Available budget and manpower.
- Purpose of the game count (e.g. to obtain a rough idea of animal numbers or to try and get accurate numbers needed to establish the value of game on the farm for consideration in a farm sale).

The best overall idea of game numbers (and sex ratios and age classes) on a farm is usually obtained by **combining game count techniques.** There is no single counting technique that is suitable for everything. You decide on a technique(s) based on the above factors. But knowledge of your animals and their preferred habitat is also important, antelopes in open areas can be easily counted by aerial counts, while klipspringers can be difficult to spot and are easier seen at night with the use of a spotlight.

Elephant herd on an open plain and a lonely kudu bull hiding in a bush – this bull will be easily missed on any game count! © U. Tubbesing

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For repeatability's sake, and to enable you to compare results from count to count, it is important that the same counting technique(s) is/are used. If a **change in counting technique** is needed, it is advised that both counting techniques be applied for at least two counts before the old technique is discontinued. This gives the opportunity to compare and adjust old to new data, thus enabling you to continue with data collection that yields "repeatable" results.

Wild animals are often distributed unevenly. **Since different species occur in different habitat types, it is essential to ensure that the game count covers a proportional section of each habitat type.** Use aerial photographs of the farm are available (or download from Google Earth!) and laminate them. Use these to mark exact locations of animal numbers and species counted. This information can then be correlated to vegetation maps on a farm and, with time, will show specific trends of preferred vegetation for specific species. This will lead to better habitat management which is especially important where one farms with expensive species that show distinct habitat preferences (e.g. sable, roan, lechwe ..) where it will optimize their (re-)production and ensure their successful survival on the farm. Matching preferred species habitat to specific farm zones will also yield very useful information with regard to the (advisable and realistic) stocking rate of certain species.

> *Real-life example: during repeated surveys on a large game farm in the Lowveld it was noted that Sable antelope concentrated mainly on one specific plant community, which only covered 10% of the farms surface area.*
>
> *It would be unwise and expensive to stock this farm with sable based on a LAU/ha ratio!!*

Game counts are best done when the visibility of the game is optimal. This will vary between species and habitat types. For example, on open plains, animals will contrast nicely against a low stand of green grass following the first rains of the season, whereas sparse leaf cover on trees in late winter will increase the visibility of game in densely bushed areas.

In summer, game counts are best avoided during the heat of the day, i.e., between 10:30 and 15:00, when the animals are inactive and rest in the shade of trees. In winter animals tend to be less active early on a cold morning. Mid-morning and early afternoon are thus optimal times to conduct counts during cold winter months.

<div align="center">

Aerial game counts are best conducted in winter till early spring, when leaf cover on most trees should be at its low, thus optimizing air to ground visibility!

</div>

Most farmers use a "magic figure" of an acceptable stocking rate for their farm, say 12 ha/ large animal unit. They ignore the fact that this figure is usually based on optimal pasture conditions and should be adjusted annually depending on food availability. A devastating veld fire can drastically reduce the carrying capacity of a farm within hours!

Irrespective of game and/or livestock numbers on a farm, the condition of major food plants gives an immediate and usually accurate indication of the appropriateness of a farms stocking rate. A stripped farm is most likely overstocked! While doing your game count, note the habitat preferences of animals, and monitor 'habitat hot spots' for signs of degradation.

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What is in the numbers?

There is little use doing a game counts if the technique employed is dubious and/or if we do not make thorough use of the information obtained to plan and improve the overall management of our game ranch. To simply have a sheet filled with numbers of animals of each species counted is useless. We need to know how to convert and apply this information into a meaningful expression of stocking rate which will enable us to make management decisions.

Game populations can be managed in many ways (live capture of excess species and/or purchase of species that are absent or in low numbers, biltong hunting, indiscriminate culling, selective culling, trophy hunting etc.). Each management technique will exert certain selection forces on your herd, resulting in a specific outcome. Overharvesting bulls (by trophy or biltong hunt) will soon result in an excess of females and a lack of quality trophy animals while also leading to an increased annual % population growth which may aggravate an overpopulation problem.

Thus, in addition to total numbers, **information concerning sex and age ratios of the various species on a farm is vitally important.** This allows you to determine trophy quotas to be allocated as well as plan optimal population control measures for each species.

For this reason, we strongly recommend the combination of an aerial or road strip count (to obtain numbers) combined with water hole counts (to obtain demographic information).

This is worrying Dad: The migrating wildebeest count is really low this year...

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Game count techniques

Aerial game counts

Helicopters and fixed-wing aircrafts are commonly used to count game, and are a useful way to obtain fairly reliable information on game on your farm. In large areas this is usually the only practical and realistic way of counting animals.
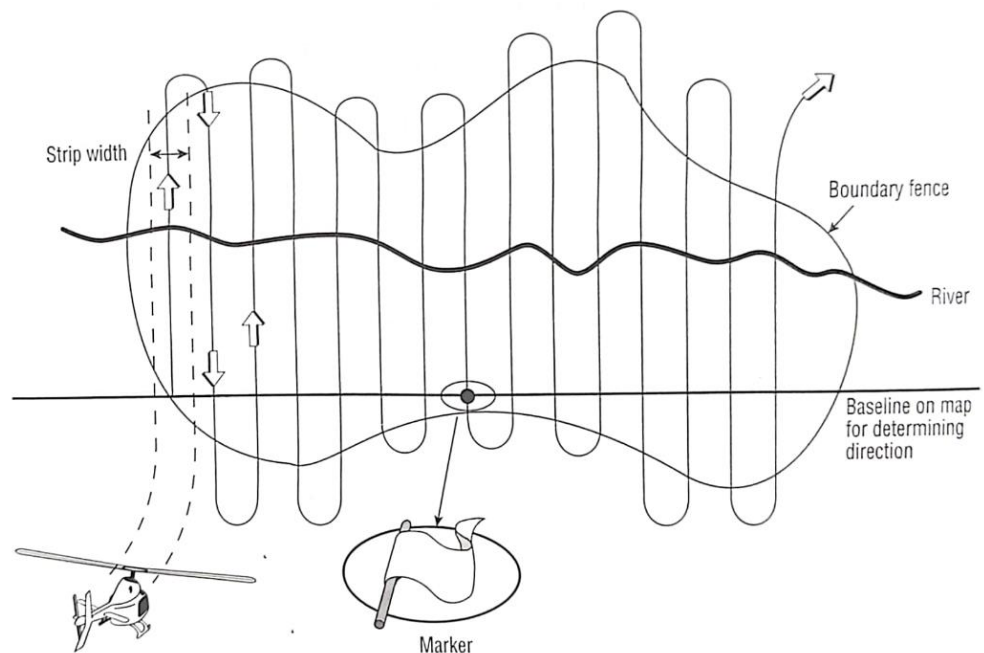
Although aerial counts might be relatively expensive, they are less time consuming than any of the other techniques. Depending on the terrain and species density, about one hour is needed to cover 2,000-3,000 hectares. Flight/ferry costs can be greatly reduced if farmers in the same area plan and do game counts or game capture operations at the same time.

Few people believe it is possible to miss large animals from the air, but there is ample proof that this often happens! Spotting game from the air, especially when they are not moving, is not as easy as it may seem. To obtain reliable results, it is best to:

Flying over a herd of blue wildebeest ©
Simon Wildlife Services

- ❦ Make use of experienced pilots and game spotters. This operation costs money and thus should be seen a professional job and not a family outing; avoid taking "non-counters and tourists" on board since they do not contribute but will most likely detract counters attention. The more spotters you have, the better the results obtained. A 6-seater fixed wing plane or 4-seater helicopter are ideal. This allows for 1-2 observers per side, essentially giving you 1-2 counts per strip (side) that could be averaged out to arrive at a more reliable count. Sex ratios etc. can also be better judged.
- ❦ Communication between all occupants of the helicopter or plane should be optimal (4-6 functional headphones).
- ❦ Fly up and down in S shaped strips, ideally from E ↔ W, minimizes the strain of sun glare on the counters, while the pilot and co-pilot can compensate for the sun without adversely affecting the count. Oblique sunrays are best for aerial counts, while sun shining into the eyes of the spotters results into poor visibility.

Aerial count by helicopter, flying in transects © Van Lavieren (1982)

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- Be prepared to take notes i.e., have clipboard with spreadsheets with species to be counted, aerial photos etc. on board.
- Airsickness does not help to count accurately! Use medication if need be and instruct counters to report any discomfort immediately so that they can be replaced. Ideally have a person on standby if one of the persons cannot continue.
- Rainy or overcast weather and strong prevailing winds make for unfavorable conditions to conduct game counts, and should be avoided.
- Avoid exhaustion of the counters by limiting flying time to 1,5-hour blocks, with counting strips ideally no longer than 15 km.
- As a general rule, the ideal flying height is 90-100 meters above the ground, and the flying speed should be as slow as safely possible. Due to the ability of a helicopter to fly at slow speed, turn, circle or hover over large herds of animals as well as the vastly enhanced visibility, this is the ultimate flying machine for conducting game counts.
- Depending on the vegetation in the area where the game count is conducted, a strip width of 100 – 200 m (max.) on both sides of the helicopter or plane should be easily observed and only game observed WITHIN that strip is counted. As a general rule, the far border of the strip to be counted should not be further away than the distance at which the most difficult species in that terrain can be reliably spotted.

Specially for fixed-wing aerial game counts:

- Where a fixed wing aircraft is used, it should ideally have its wings mounted on top (better visibility) and with air to ground radio communication. Ideally a person on the ground should be recording data (which is often difficult due to terrain!)
- A microlite is not an ideal aircraft for once-off game counts. It is, however, suitable for own use, where a farmer repeatedly flies over certain areas and, with time, gets a very good idea of game distribution and numbers in certain areas.
- The pilots main job would be to concentrate on keeping the plane on course, at the ideal speed (slowest possible!) and altitude (90 – 100 m above ground to allow for best game visibility) and with the wings as level to the ground as possible (to standardize the width of the strips counted on both sides of the plane) while someone who knows the area very well e.g. farm owner or manager should act as "co-pilot" to assist the pilot in staying on track etc. and to take notes as the count progresses. In fixed wing counts the pilot and "co-pilot" do not actively participate in the count.
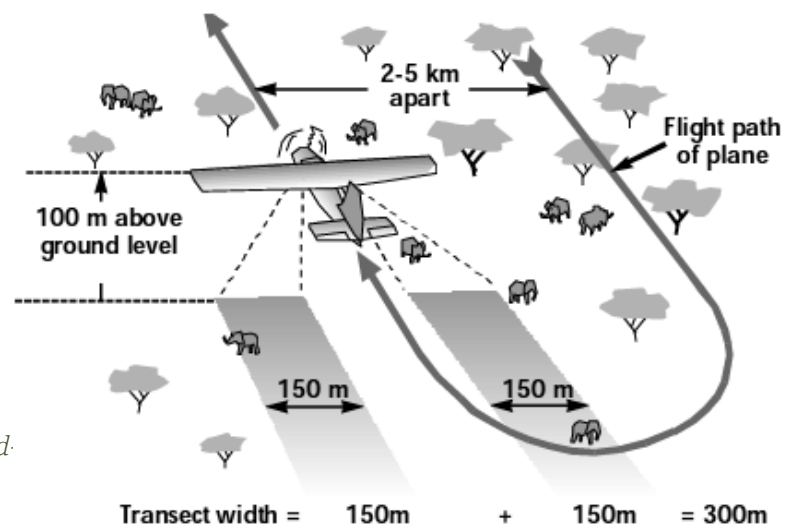
An example of an aerial strip count, where transects are flown with a fixed wing aircraft © WWF

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Known Groups

Certain species, such as wildebeest, zebra and giraffe, tend to form fairly constant groups. By repeatedly monitoring and recording the number of animals, sex ratios and age classes of individual herds, a fairly accurate count of and knowledge of their habitat preferences can be obtained. Highly territorial animals (e.g., Damara dik-dik, klipspringer etc.) can be counted in a similar way. The same applies where limited numbers of a certain species are present on a farm (e.g., sable and roan antelope).

The composition of these groups or herds can change radically during the mating season and when patchy rainfall (early raining season or in drought) may cause animals to come together in large herds.

Road Strip Counts

In a road strip count a vehicle is driven along a selected network of roads. Most farms have a more or less well-developed network of roads which can be used for road strip counts, provided:

1) The roads traverse areas proportionally representative of the entire habitat on a farm,
2) The game visibility from these roads is good,
3) Minimal hunting is done from vehicles,
4) The road/vehicle condition is such that a vehicle can approach game without making too much noise (i.e., the game does not run at the first sight/noise of a vehicle coming along).

The road strip count is well described in scientific literature. Techniques described aim at best possible accuracy but in so doing are not very practical for the farmer. However, with minor adjustments, this can be quite a useful and economical counting technique, and repeated road strip counts can give you useful information regarding game numbers.

For a road strip cunt, certain roads are driven at regular intervals, at slow speed, with counters on the back of the vehicle recording all animals (species, numbers, sex and age groups etc). Make sure that only game within a definitive visibility strip width (say 50 m, depending on bush density, topography etc.) of the middle of the road are counted.

The data obtained can then be converted to animals counted/ ha. Results should be averaged out over a few counts to obtain greater accuracy and are then compared with counts of previous seasons/ years to obtain trends.

An example:

The farm size is 10,000 hectares. A 20 km distance was travelled, with an average visibility of 50 meters each side of the road. Total area that was surveyed = +/- 200 ha (100 m x 20,000 m).

Animals spotted: 10 kudu, 17 oryx, 12 red hartebeest.

To get an estimate of the numbers per species, multiply the count by 50 (10,000 ha total / 200 ha surveyed) =

500 kudu, 850 oryx, 600 red hartebeest.
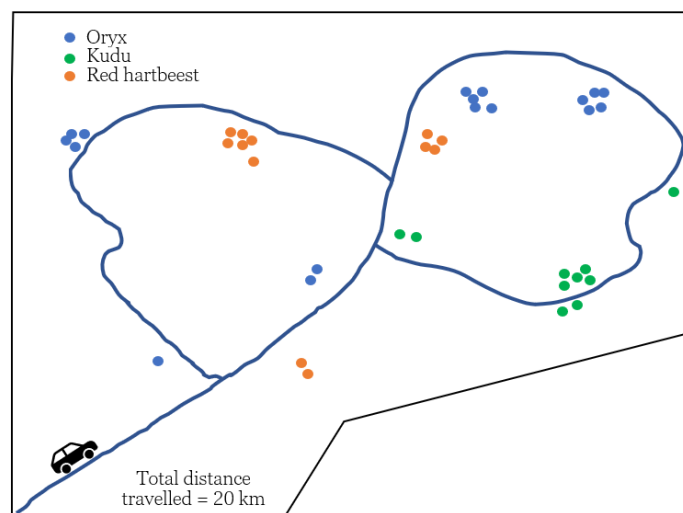
An example of a road strip count, whereby a particular route is travelled, and animals are counted along the sides of the road © M. Bijsterbosch

To ensure that the data obtained are useful, take the following precautions:

- ❤ Make sure that the roads selected go through representative habitat types for the farm in proportion to the surface area these comprise of the farm. Don't just use the roads where you know from experience game occurs in high numbers (e.g., in river beds, close to feeding sites etc). Repeatedly survey the same road.
- ❤ The bigger the sample size (i.e., the more km road-strip counted and thus the greater % of the farm surface sampled), the more accurate and useful the statistical data become.
- ❤ Counts should ideally be conducted every 3 months or more frequent, following new moon (where animal activity is highest during the day).
- ❤ The starting point of the drive, type of vehicle and driving speed (ideally about 30 km/h) should be kept as consistent as possible.
- ❤ Do the counts at the same time of day e.g., starting an hour after sunrise to allow for optimal lighting conditions and maximal animal activity.
- ❤ Obviously, the accuracy of each count is directly related to the ability of the game spotters to see and count the game. Ideally use experienced farm workers, one observing each side of the road with a 3rd person keeping records - this should thus not be a tourist activity.

FIRST ROUTE COUNTED

ANIMAL FLEEING DIRECTION

DON'T COUNT HERE!!
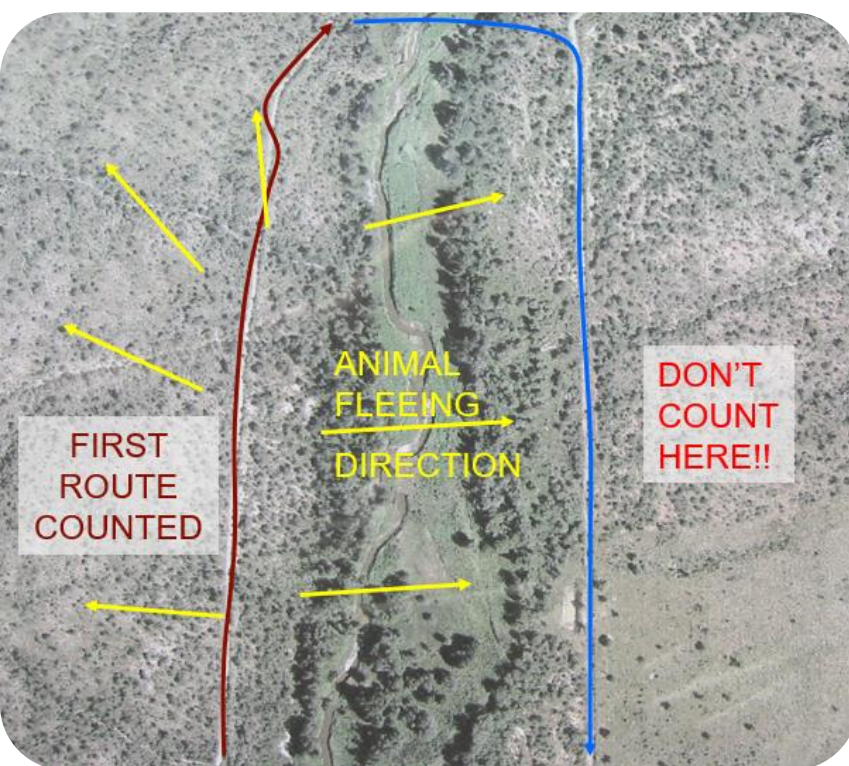
- ❤ DO NOT count animals spotted further away from the road than your estimated "guaranteed visibility distance" since this will overestimate stocking density.
- ❤ Select roads in such a way that the chance of counting the same animals or groups of animals twice during a count is minimized. This becomes more of a problem in small game camps of "game farms" of under 500 ha in size.

Game tends to concentrate along river beds. To avoid counting the same animals again one should avoid counting game along two roads running near parallel and in close proximity to each other © Ulf Tubbesing

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- ❤ Stop the vehicle immediately when animals are spotted to allow an "accurate count and recording" without chasing the animals off.
- ❤ On farms where animals are hunted extensively from vehicles, and/or where the roads are in bad shape (massive approaching noise), this method will consistently yield poor counting accuracy. In these areas counts on horseback or bicycle may be of more use.
- ❤ Small, shy, well camouflaged animals preferring dense vegetation, as well as nocturnal animals, are usually vastly under counted by road strip counts (as well as by other counting techniques).

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The problem of underestimating animal densities on farms with dense bush cover can be reduced, if one predetermines the mean visibility distance on both sides of the entire road strip to be counted.

During the actual count, all animals seen are then recorded, even if they fall outside the mean visibility strip. The calculation for population estimates are then conducted as before, using the mean visibility distance (MVD).

MVD x 2 for both sides of the road x length of the road strip counted = the area counted.

The principle behind this suggested count modification, is that as many animals within the mean visibility distance are not counted (standing behind trees etc.,) as are the animals that are spotted and thus counted outside the mean visibility distance.
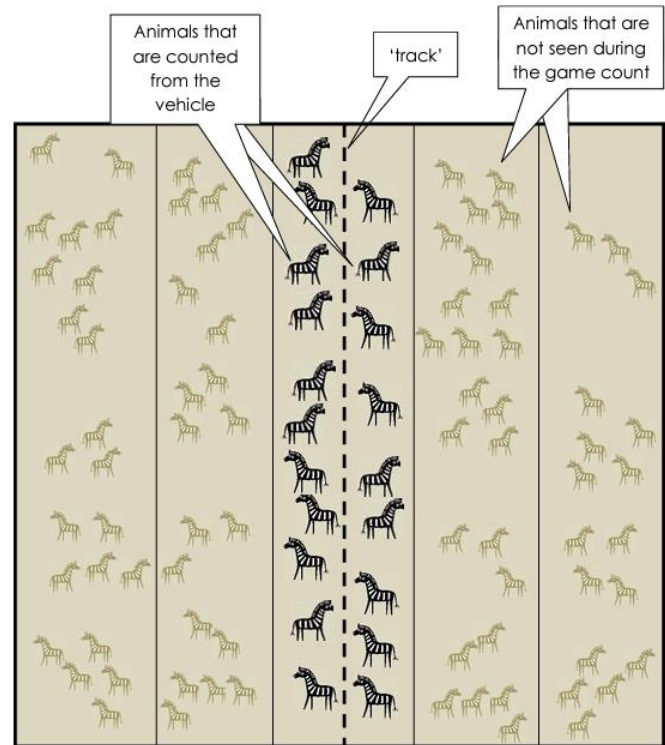
On road strip game counts animals will be underestimated as you won't see all animals, some are hiding behind bushes for example © NASCO

Spotlight census technique

The so-called "spotlight census technique" commonly described in American game management literature basically is the same as the road strip count, BUT counts are conducted at night with the use of spotlights. One can drive around with vehicles and spot the animals, or one stands on a fixed spot (more useful for rivers; spotting hippos/crocodiles for example). It is important that the method is kept the same:

- 🐾 Use the same type of spotlight at the same strength.
- 🐾 Use the same method and distance of shining.
- 🐾 Spot at the same times at night.
- 🐾 Record weather and moon phase (e.g., 0 = new moon, 1 = quarter moon, 2 = half-moon, 3 = three quarter moon, 4 = full moon, 5 = unknown) as this might change your results.

Since we have a number of game species with predominant nocturnal activity patterns, identical road strip counts conducted during the day and night will yield very interesting results and most certainly add to your data. Some species e.g. klipspringer can be spotted and counted much easier by searching mountain sides with a spotlight at night than during the day.

Obviously the MVD for the night "spotlight count" would have to be adapted! Before you start, decide on whether to use a bright light with, or without a red filter. Red filters are less disruptive for animals at night.

Left photo: spotting crocodiles from the river bank in India © VADODARA/ANAND
Right photo: Spotlight with red light filter showing a leopard © Chiawa Safaris

Waterhole counts

Waterhole game counts are ideally suited to obtain data on population demographics (sex and age ratios) of various species, which are not as easily obtained by the other census techniques. This information, when extrapolated to the total population "counted", will yield vital information guiding game management strategies for various species.

Waterhole counts can give a crude idea of game numbers if regular, simultaneous and continuous (24 – 48 hour) game counts are performed (usually at full moon) from hides overlooking a permanent waterhole.

Obviously, this is only feasible during the dry season and in the absence of other nearby waterholes and/or constant flowing rivers. By plotting and measuring (on an aerial photograph) the most likely area each water hole may feed, one may be able to deduct the relative game density around certain water holes and from there extrapolate the data to the entire farm.

Definite disadvantages of waterhole game counts:

A scenario:

You do a helicopter game count, and observe 300 kudus on your farm. It is generally recommended that one does not exceed a 5% harvest in trophy bulls. Based on the count of 300 kudus you could theoretically plan on marketing 15 kudu trophies for the next year. In addition, you decide to reduce the kudu population to 220 animals by culling another 65 kudus.

Would you take the same decision if you knew that the sex ratio in your kudu population was 3 females for 1 male (irrespective of age) and that you only have 20 sexually mature males amongst the 75 bulls?

With this information at hand, how would you manage this population?

1) Very time and labour intensive.
2) Require dedicated, reliable and knowledgeable people doing the counts to prevent the same herds concentrating around water holes being counted more than once.
3) Several factors (ambient temperature, availability of salt licks, moisture content in available vegetation, species differences etc.) affect how often game of different species will drink. Some species will be under- and others overcounted.

Eland, zebra and warthogs at a waterhole © M. Bijsterbosch

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New technologies

Technology does not stand still. As a result, new technologies are being tested with the aim of improving the accuracy of game counts.

An example is the use of drones and un-manned airplanes. Transects are flown, and the drone/airplane takes photos (often with infra-red cameras that will pick up animals standing under a thick canopy of trees). These photos are then processed by specific software which makes use of AI, to both count and identify animals (much like face recognition software works). Some of these software programs have a "learning function", thus getting 'smarter' every time they process more photos. This eventually enables them to differentiate between say mountain and plains zebras.

At the moment this technology is still (very) expensive, but we are sure with time it will become more accessible. Something to definitely keep an eye on!

Waterhole / Road strip game count example form

Farm:							Date:			
From:		To:								
Start time:		End time:								
Observers:										

Time	Species	Numbers						Area name	Grid reference	Habitat
		Adult		Sub-adult		Juvenile				
		M	F	M	F	M	F			

Aerial game count example form

GAME COUNT ON FARM:		FARM SIZE:		DATE:		TIME/DATE OF COUNT:
PILOT AND HELICOPTER:		COUNTERS:				

BLESBOK													
DAMARA DIK-DIK													
DUIKER													
ELAND													
ELEPHANT													
GIRAFFE													
HARTEBEEST													
IMPALA													
KLIPSPRINGER													
KUDU													
LECHWE													
NYALA													
ORYX													
OSTRICH													
ROAN													
RHINO, BLACK													
RHINO, WHITE													
SABLE													
SPRINGBOK													
STEENBOK													
WILDEBEEST, BLACK													
WILDEBEEST, BLUE													
ZEBRA, BURCHELL'S													
ZEBRA, HARTMANN													
OTHER;													
OTHER;													
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OTHER;													