ENDANGERED WILDLIFE TRUST

DRYLANDS CONSERVATION PROGRAMME

RECOMMENDED GUIDELINES

For

Camera Trap Surveys for Riverine Rabbits in the Nama Karoo

Version 20 August 2021

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Special thanks to Simon Todd and Jeremy Bolton for their valuable contributions to the document.



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1. Background & Purpose

The Endangered Wildlife Trust's Drylands Conservation Programme (EWT-DCP) focusses its research and conservation work in the Karoo, with the Critically Endangered Riverine Rabbit (*Bunolagus monticularis*) as one of the focal species. The Riverine Rabbit is listed as an Evolutionarily Distinct and Globally Endangered (EDGE) species.

One of the biggest threats to the survival of these rabbits, is the loss of habitat. Approximately two-thirds of its Nama Karoo habitat has been transformed in the past 100 years due to anthropogenic disturbance. Much of the remaining habitat is fragmented and degradation, often due to historical practices, is evident over much of the remaining range. Roads traversing through habitat, electric fencing, overgrazing, hunting with dogs and threats from developments such as mining and hydraulic fracturing pose ongoing risks to the species' survival.

Currently there are three known populations occurring in three landscapes in the Karoo. The first population was discovered in the Nama Karoo in 1901 and is referred to as the northern population. A second population was discovered in 2003 and is referred to as the southern population. This population occurs around the Robertson, Montagu and Touwsriver areas. The extent of the distribution in this area is still being mapped and new locations are still being recorded. All indications are that the rabbits in the southern populations use the landscape much more widely unlike the rabbits in the Nama Karoo, which are confined largely to the distinct riparian vegetation in the Nama Karoo.

The third population, referred to as the eastern population was discovered in 2018 and occurs in the Uniondale area, west of the Baviaanskloof. The distribution of this population is still poorly understood. The southern and eastern populations occur mostly in the Little Karoo, a distinct geographic area within the Succulent Karoo biome.

This document deals exclusively with surveys in the **Nama Karoo** where rabbit distribution across the landscape is well understood. It is aimed at helping consultants and developers understand the level of effort that the EWT-DCP deems necessary for investigations around potential developments where Riverine Rabbits may be impacted.

Surveying for rabbit populations across the southern and eastern landscapes will be dealt with separately.

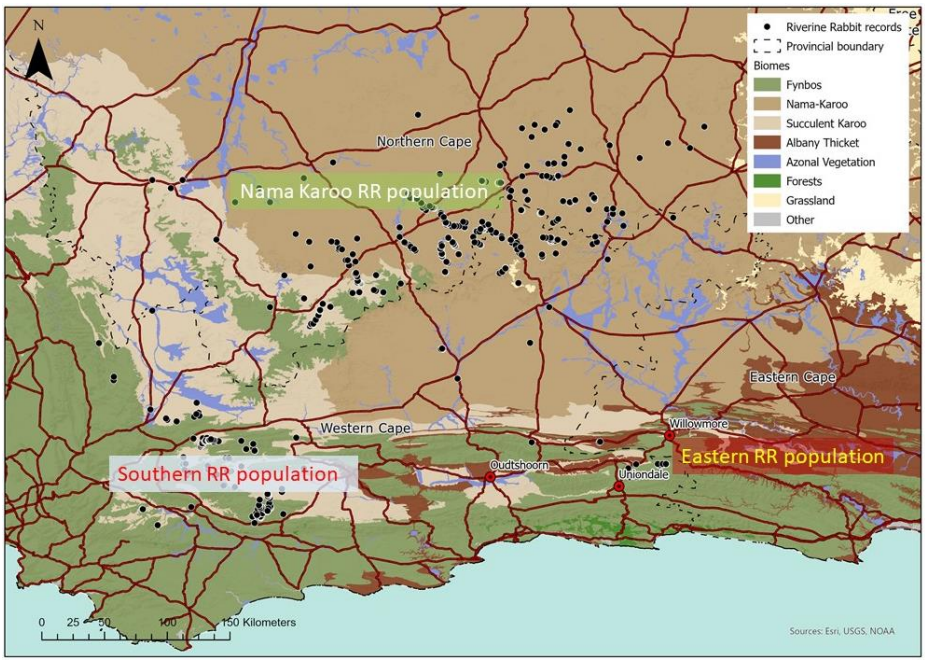

Figure 1: The distribution of the three Riverine Rabbit populations (black dots) over two provinces and in three biomes.

2. Rabbit habitat (Rabitat) in the Nama Karoo

The riparian habitat in the Nama Karoo is distinctive and easily distinguished from the vegetation of the surrounding landscape. Typical features of this habitat include deep alluvial soil and vegetation that is clearly more dense and taller than the surrounding landscape. The vegetation is by no means homogenous and varies from almost impenetrable vegetation over 1,5 m high, to areas with more open patches of vegetation with lower vegetation.

The extent of the riparian vegetation can vary from a few metres wide to a few kilometres wide, depending on the landscape context and size of the drainage feature. The riparian vegetation can include a variety of different species, but common and dominant shrubs include *Lycium* spp, Grootdoringkapok (*Eriocephalus decussatus*) or Kerriebos (*Helichrysum pentzioides*). During a detailed vegetation study, Duthie (1989) found that Rivierganna (*Salsola glabrescens*) and Kriedoring (*Lycium* spp) constituted most of the vegetation cover. Other components include Rivierdraaibos (*Osteospermum spinescens*), Bierbos (*Pteronia erythrocaetha*), Lye brush (*Salsola aphylla*), Ankerkaroo (*Pentzia incana*), Perdekaroo (*Rosenia humilis*), *Galenia procumbens* and Inkbos (*Basia salsoloides*), various unidentified Mesembryanthemaceae and a few grasses (*Eragrostis lehmanniana, Eragrostis bergiana and Stipagrostis obtusa*). Grass is typically poorly represented, but can be abundant during the rainy season and in the more open areas.



Figure 2: Typical rabbit habitat along the Sak River. The dense tall riparian vegetation can be easily differentiated from the adjacent vegetation.

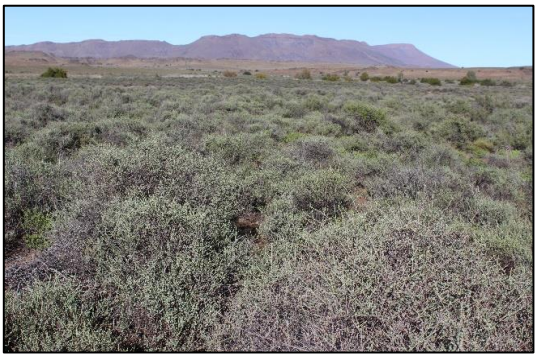



*Figure 3: **Left**: Typical dense healthy riparian vegetation along the Krom River.*

*Figure 4: **Right**: Riparian vegetation near Loxton in the Northern Cape that has been subjected to continuous grazing at high stocking rates, with the subsequent loss of vegetation cover, species diversity and topsoil. This system is no longer fully functional, and rabbits are highly unlikely to still be present.*

The structure and diversity depend largely on the extent and depth of the alluvial soil and depth of the water table. Historical and current grazing practices on a particular property also affect the vegetation structure, cover and species diversity. Protracted droughts and injudicious grazing practices decrease vegetation cover and density and no doubt also impact the density and occurrence of Riverine Rabbits.

The alluvial sediment of the upper Sak River, one of the most important in terms of Riverine Rabbit populations, and typical of the main seasonal rivers of the region, hosts the vegetation classified as azonal (AZi 5), Bushmanland Vloere (Mucina et al. 2006). Bushmanland Vloere is an azonal vegetation type typically located in pans and along the intermittent riverbeds within the Eastern Upper Karoo vegetation unit mentioned above and in other vegetation units within the Bushmanland basin (Mucina et al. 2006). Bushmanland Vloere is characterized by patchy vegetation assemblages dominated by assorted species of the genera Salsola (gannabos) and Lycium (kriedoring), interspersed with various microphyllous (single un-branched leaf-veins) shrubs, some of which are halophytic (salt tolerant). Bushmanland Vloere remains one of the least studied vegetation types in South Africa (Mucina et al. 2006).

However, it is likely that the riparian vegetation should be reclassified as a distinct type at some point as it is not typical of the general area. Research is needed in order to correctly classify this vegetation type.

Riverine Rabbit distribution in the upper Nama Karoo is linear as they are primarily restricted to the distinct riparian vegetation associated with the seasonal rivers of the Upper Karoo. Rabbits occur along first order streams of the Sak River, all the way through to the wide flood plains of the lower multiple order sections of the river. It must be noted that rabbits also occur in lowlands that are not characterised by obvious river channels, but where deep soil and plant structure nonetheless support their distribution (Figure 10). These areas are often overlooked as likely suitable habitat for Riverine Rabbit occurrence, during desktop mapping exercises.

Hares are captured by camera traps more frequently in areas where the vegetation density decrease. Increased hare presence (*Lepus* spp) may also be indicative of a decreasing likelihood of Riverine Rabbit presence. Some overlap does occur, but based on a previous survey, an abundance of hares does not bode well for Riverine Rabbit presence. See Appendix I & 2 detailing the differences between the lagomorph species of interest.



Figure 5: An example of overlap of Riverine Rabbit (right) and hare (left) in the riparian habitat recorded in the Nama Karoo.

Riverine Rabbit distribution, based on current and historical sightings, stretches across the Upper Karoo from near Deelfontein, some 40 km south of De Aar (on the Ongers River), to Calvinia in the west (on the Oorlogskloof River). However, due to habitat loss (>60 %) and fragmentation of the remaining habitat, they most likely no longer occur along some of the rivers in the west such as the Fish- and Renoster Rivers (both east of Calvinia). While there have been no reliable sightings reported on the Ongers River since the original discovery of rabbits there in 1901, there are some unverified reports of relic populations in the Calvinia area. Neither of these areas have been sampled for rabbit presence with camera traps yet.

3. Camera traps as a tool to monitor general species presence

Camera traps are often used as a tool to survey elusive animals and gather information on wildlife ecology (O'Connell et al. 2011, Bahaa-el-din & Cusack 2018). Studies such as the meta-analysis by Wearn & Glover-Kapfer (2019), show that camera-trapping is significantly more effective at consistently detecting species than many traditional surveying techniques (e.g. line transects).

Camera trapping uses fixed cameras, triggered by infra-red sensors, to 'trap' images of passing animals. It is a quantitative technique that has relatively low labour costs, is non-invasive, incurs minimal environmental disturbance, is robust to variation in ground conditions and climate (Rowcliffe *et al.*, 2008). Most importantly, camera traps can be used to gain information on highly cryptic and secretive species and in difficult terrain where other field methods are likely to be less successful (Rowcliffe *et al*., 2008). Camera traps are the preferred tool as they are available at a relatively low cost, and a relatively non-invasive method due to the physical absence of an observer. Though they do emit sound and animals show a response to the camera, this is not considered a severe stressor (Meek *et al*., 2014).

4. Camera traps as a tool to monitor Riverine Rabbits

4.1 Overview

Historically foot surveys were used in the Northern Cape and are still occasionally used in the Western Cape by CapeNature. The EWT-DCP no longer uses foot surveys, as from experience the results do not warrant the cost and logistics compared to camera trap surveys. The most effective methodology available for determining Riverine Rabbit presence is camera traps. The EWT-DCP have used camera traps to successfully detect Riverine Rabbits across all three of its distribution landscapes since 2012.

Nonetheless, it must be remembered that although proven very effective, a limitation remains in that even when sites are intensively sampled, **there is always the possibility that rabbits may go undetected**, regardless of the camera trap array (layout). Camera trapping is not conclusive when inferring absence, but it is the best approach currently available for detecting presence.

Riverine Rabbits have proven to be one of the most elusive species to study. Comprehensive computer modelling, based on the available information, did not predict the presence of Riverine Rabbits in the eastern parts of the Western Cape. The presence of this population, just west of Baviaanskloof, was discovered in 2018 only through the identification of a roadkill.

Therefore, it is better not to make assumptions with regards to the species. In addition, incorrect camera trap placement could contribute to them remaining undetected. It can probably be safely assumed that if the riparian habitat within the known and predicted range is in a reasonable condition, Riverine Rabbits are likely to be present in the broad distribution areas in the Nama Karoo.

A well-planned camera trap survey has a good chance of verifying presence. Placement is paramount and is informed by the behaviour of the Riverine Rabbit, and in the northern population behaviour and habitat usage is relatively well understood.

4.2 Camera models and performance



Figure 6: The above image shows the wide variety of camera traps available on the market today. (Trailcampro.com)

There are a wide variety of camera trap (or "trail camera") models available. Many of them are not optimised for Lagomorph research purposes and are intended for very different research situations (Swann et al. 2011). A number of parameters should be considered when selecting the ideal camera trap (Meek et al. 2012, Apps & McNutt 2018a) particularly when trying to detect Riverine Rabbit presence.

The recommendation would be to familiarise yourself with how camera traps operate and the available settings on the model you have selected. For a good explanation of how camera traps work we recommend reading "Camera traps and how they work" (Apps & McNutt 2018a).

Ideally, a survey should be conducted using a batch of identical cameras, since different models can produce different results, particularly with regards to the difference in sensitivity levels of the different models.

Cameras with lower sensitivity levels work well for larger game species but may miss smaller species such as lagomorphs. The EWT-DCP has achieved good results using Bushnell camera traps, in particular the Bushnell Trophy Cam, which has now been replaced by the Bushnell Core and Prime models. Other research groups have had good results with Cuddeback (white flash), Reconyx and Scoutguard cameras (Glen et al. 2013, Villette et al. 2017). Apps & McNutt (2018b) carried out comprehensive tests to compare between the performance of Bushnell, Cuddeback and Reconyx cameras.

4.3 Price

The cost per camera is an important metric to consider. The cost of an individual camera trap can, depending on model, vary between R2000 – R15000. Increased cost does not always equate to increased performance. Some suppliers may offer discounts on bulk purchases.

The EWT has purchased most of its cameras from Jeremy Bolton at Bushcam Consulting: Cell: 082 45 95 469. Email: jeremy@bushcamconsulting.com . Jeremy also has cameras available for renting. Jeremy was involved

in the initial trials for using camera traps to detect Riverine Rabbits in 2012, as well as some of the subsequent research.

4.4 Camera settings

4.4.1 Trigger speed, delay and recovery

The trigger speed or response time is the time between the camera detecting an animal and a photo being taken. This is more critical with fast moving animals, but on a narrow game trail, a rabbit can pass out of the field of view of a camera very rapidly. The EWT recommends a trigger speed of <0.5 seconds.

A burst of photos reduces the risk of missing smaller animals crossing the path of the camera altogether, or only capturing an image of part of an animal entering or leaving the focal area, making it unidentifiable. You are more likely to get one clear photo if the camera takes several photos each time it is triggered (Meek et al. 2012). In the case of Riverine Rabbits, the EWT recommends a minimum of three photos per trigger event.

A delay should be set between trigger times to reduce the chance of environmental factors such as moving vegetation producing large numbers of empty photos. The EWT recommends a trigger delay of 30 seconds. However, this depends on how long you are going to leave the camera out for and to some extent the model and how vulnerable it is to false triggers. If the camera is going to be left in place for two months or less, then it is advisable to set the trigger delay to 5 second intervals. However, if the cameras are going to be left in place for more than 2 months, then a longer trigger delay, of up to a minute is acceptable. Some cameras are unable to take more than one image each time the camera is triggered, in which case they need to be set at a shorter interval, even as low as every 5 seconds (Latham et al. 2012).

The recovery time is the time required between a photo being taken and before another photo can be taken. In the case of most modern IR flash cameras this is <5 seconds, but some older models, and those that use an incandescent white flash need up to a minute to recover. A faster recovery time offers greater flexibility, so we recommend sourcing a brand of camera with a recovery time of <5 seconds.

4.4.2 Resolution

Images should be set to at least eight megapixels or higher where possible. This gives a high enough resolution to identify the different species of lagomorphs. Depending on the size of the SD card, however, this may limit the number of images that can be stored. More sensitive cameras have also been known to take thousands of photos of moving plants (see also section 4.11). This is also affected by the period the cameras are intended to be out for and the abundance of other fauna in the area, which increases the number of captures of other fauna in the images. In general, a 16MB card can hold between 4000-8000 images of 8-12 megapixels, depending on the camera model.

The typical number of triggers within the Nama Karoo is around 10 images a day for a fairly busy location. Thus, a camera should last for many months before the card fills up. However, in practice, there are usually many false triggers. As each model is somewhat different in this regard, some experience with each model is required before the best compromise between trigger delay, resolution and card size can be found.

In general, for cameras that are vulnerable to false triggers, it is better to increase the trigger delay period rather than compromise on the other settings such as resolution. Where possible, you should also ensure that any plants in the field of view and close to the camera are removed.

4.4.3 Detection angle and detection range

These parameters relate to how far from the camera an animal will trigger the camera sensor. However, this factor is usually not specified on the camera specification and may require testing. For rabbit surveys the detection range is largely irrelevant since given the spatial confines imposed by the dense vegetation, the target animals will most likely have to pass very close to the camera. If you plan to use the cameras for other purposes, however, this could be a factor. Lagomorphs detected much further than 5 m away will be difficult to identify. The detection angle, i.e. the horizontal field of view of the sensor, is typically 45-50 degrees, although the field of view of the lens is often slightly less.

4.4.4 Flash/Exposure

Setting the camera flash at a higher intensity will allow for a greater field of view at night, but risks "whiting" out (overexposed) images near the camera, making identification difficult (Meek et al. 2012). Unfortunately, camera traps are not generally designed to correctly illuminate subjects very close to the camera. Given the low to the ground position that cameras are placed in to capture small mammals, this can be an issue.



Figure 7: Image showing the difference between different flash types.
White Flash: *Produces colour images at night but causes the most disturbance of all the flash types, with white light when triggered (useful identifying individuals).*
Red Flash/infrared/Low-Glow*: Provides good quality black and white images at night- Overall less visual light than white flash, however it still produces a red flash when triggered, which causes low level disturbance.*
Black flash/No-Glow: *Produces low quality black and white images at night- No flash, and no visual disturbance to animals, which means you can capture more skittish species.*

Cameras that use infrared (IR)/Low-Glow should be selected, where possible. White flash cameras are more likely to disturb animals (Meek et al. 2014), however, white flash has the added benefit of making it easier to identify individuals of patterned animal species, such as leopard, as colour photos are also produced at night. Colour photos of the patterned coats aid greatly in individual animal ID.

There are two distinct types of white flash cameras available. Cuddeback cameras use the same form of incandescent strobe flash that regular cameras use. This is very bright, and results in a longer recovery period before the camera is able to trigger again. Some models of Reconyx and Scoutguard cameras use white LEDs to produce colour images at night, but the range is very much reduced. The battery-life of cameras with white flash is usually significantly shorter than the other flash types, with the result that cameras may not last long if there are many night-time photo-triggers.

Some camera trap manufacturers offer "black flash" cameras that eliminate the red glow produced by IR/Low-Glow cameras. Given that many animals are able to hear cameras triggering (Meek et al. 2014,

Henrich et al. 2020), the extra expense involved in “black flash” (or No Glow) models is probably not worth it. These cameras can however be valuable if theft may be an issue, as they reduce the likelihood of humans seeing them at night. As with other IR models, black flash cameras take black-and-white images at night, but they often produce lower quality/blurred images.

The EWT recommends the use of infrared/Low-Glow cameras for Riverine Rabbit surveys, over the use of black flash. The EWT has not used white flash cameras for rabbit surveys, and cannot tell whether the advantages of easier identification would outweigh the disadvantages.



Figure 8: This image shows the effect of the flash on the quality of the image at different distances. Testing the intensity of your brand of camera’s flash using a co-operative domestic animal can help save disappointments in the field.

The Bushnell cameras have adjustable flash settings and we have found that the medium intensity flash setting works best. When we place the cameras, we assess the terrain and vegetation cover and sometimes adjust the flash setting accordingly. For example, if the camera is placed in a bare patch with little vegetation, the likelihood of the light reflecting back is high, therefore we would set the camera to a lower flash setting. Be aware however, that there is no standard for these settings, so “Medium” on one camera model may be equivalent to “High” or “Low” on a different model. A few camera traps do have an “Auto” setting that takes into account the distance to the target, so if this is available it should be used (Rovero et al. 2013).

4.4.5 Sensitivity

The sensitivity relates to the ability to pick out an animal’s heat signature against the background, so in very hot climates a high sensitivity is crucial (Apps & McNutt 2018a). Unfortunately, the detection sensitivity is not standardised, with different manufacturers assigning “High”, “Medium” and “Low” with regard solely to the performance of their own range. Nonetheless, the “Auto” sensory setting is generally a good compromise when available, as this will compensate for temperature in some camera models, or “Medium” when it is not. A higher setting increases the risk of false triggers from the movement of plants, but if the camera is in an area where there is less risk of this, or you have cleared the area in front of the camera, then a “High” setting may increase the likelihood of detecting animals (Meek et al. 2012).

4.5 Memory cards

The size of the memory card you use, is very important. The recommendation would be at least 16 to 32 GB. Be aware that some of the older camera models are not compatible with these larger cards, so it is important to read your camera's information pamphlet to see SD card recommendations. However, it makes sense to use the largest possible SD card size in your camera, to prevent missing the opportunity of recording animal triggers while the camera is out in the field. The speed rating, or class of the card doesn't make any difference regarding camera performance, but higher rated cards will be faster when downloading images. Class 10 (C10) cards are the current highest rating.



Figure 9: Labelling cards to match individual cameras is a handy way to keep track of individual camera performance and data at specific locations.

4.6 Batteries

Most modern camera traps use AA batteries, and often recommend non-rechargeable alkaline or lithium batteries. Rechargeable Nickel-Metal-Hydride (NiMH) batteries are more sustainable, especially where multiple surveys are conducted each year, however some camera trap models perform poorly when using them. You should ensure before purchase that the camera traps you are buying support the use of rechargeable batteries.

Rechargeable batteries should be rated at a capacity of 2300 mAh or above. Less powerful batteries may not have the endurance to last for 6 weeks.

The same brand of batteries with the same capacity should be used in each camera to ensure optimal performance, and to avoid damaging the camera.

4.7 Choosing a location

The initial location for the camera trap array is selected through a desktop process on Google Earth pro or a similar GIS programme. The riparian habitat can usually be fairly easily identified and mapped on the available satellite images.

Preliminary placements for the cameras can also be selected at a desktop level. Ground-truthing to evaluate the preliminary sites can then be carried out. Reviewing the proposed placements with landowners will help identify any additional areas, such as lowlands off the main channels which may have rabbits but which may have been missed during the desktop process. Once on the ground, the best site close to the preliminary placement needs to be selected.



Figure 10: An example where a landowner reported sightings (red pin) well removed from the main channel where historical foot surveys were carried out and rabbits were detected.

Where the person setting the cameras has a good understanding of rabbit habitat preference, subjectively choosing locations to confirm rabbit presence can yield very good results. However, an element of random selection must also be included to ensure that the possible distribution of the species in question across the landscape, which includes the less likely areas, is well tested.

In general, where the primary aim is to detect Riverine Rabbits, it is recommended that 70-80% of the camera trap locations are within potentially suitable habitat, with the remaining cameras located within other habitats. It must be noted that while this approach can be effective in determining presence, it is not suitable for other research questions such as estimating density or developing occupancy models

4.8 Camera trap array options

Camera trap surveys can be arranged in numerous different ways, such as grid arrays, linear arrays, or following landscape features, and individual cameras can be placed randomly or via specific criteria (Meek et al. 2012, Colyn et al. 2018). A higher detection rate can be achieved by utilising existing knowledge of species behaviour to select camera locations, rather than placing them randomly (Karanth & Nichols 2011, Kolowski & Forrester 2017, Colyn et al. 2018). In any case, the area of the planned camera trap deployment should be surveyed in advance in order to determine suitable camera locations.

Woodgate et al. (2021) found that a grid formation was an ineffective method for the detection of Riverine Rabbits during her research at the Sanbona Wildlife Reserve in the Succulent Karoo. Woodgate then tested an alternative approach, placing cameras in clusters of 5 cameras (regarded as non-independent) across the reserve. This approach not only detected presence in the reserve, where Riverine Rabbits were known to occur, but also detected the species in new areas on the reserve. However, a similar approach in the Anysberg Nature Reserve did not yield rabbit captures in a known distribution area.

The theory of this approach is that concentrating the number of cameras in clusters will increase the odds of detecting an individual rabbit within a given area. During the Sanbona Reserve study, clusters of cameras (150 cameras at 30 sites) were randomly placed on average 4.63 km apart (minimum of 1km between sites). Although there is no limit on how close the cameras within a cluster can be to one another, they are typically about 50 m apart, and should be no more than 250 m apart.

A number of studies have confirmed that increasing the number of cameras at a given site within an array does increase detection probability (O'Connor et al. 2017, Evans et al. 2019). The largest increase is found when using two cameras per site instead of one, although some additional benefit is found by adding up to eight cameras to a site. Additional cameras also reduce the chance of data loss due to camera failures where single camera placements are used (vs clusters).

The EWT placed single cameras in riparian areas in the past (2012-2018), not in a fixed grid pattern, but distributed subjectively throughout likely habitat, as well as in marginal areas. This method proved successful in detecting rabbits in known locations as well as novel locations. We have also used the cluster approach, with clusters placed subjectively in likely habitat and had good results in detecting rabbit presence at known as well as novel locations across all three landscapes in which rabbits occur. The correct placement in areas that are likely to be frequented by Riverine Rabbits, is far more important than how many cameras are deployed.

The EWT team is well experienced and efficient in finding rabbits, however, it must be noted that one of the disadvantages of a non-systematic approach is that it depends on the individual doing the survey. If an individual with very little experience in finding a particular species, such as rabbits does not understand the species or its behaviour there is a danger that they may conclude there are no rabbits present, because they sampled in what they considered to be the 'best' areas. This can be weighed against instances where a systematic approach, such as a grid pattern fails to detect presence, most likely because the species is not randomly distributed across the landscape, as is the case with rabbits.

In practice, camera traps for Riverine Rabbits are usually clustered to some degree as most sites do not have large tracts of contiguous Riverine Rabbit habitat. As a result, suitable areas of riparian habitat will often have several cameras in relative proximity to one another. In the Upper Karoo, the home range of Riverine Rabbits is approximately 20 ha, based on a study conducted by Andrew Duthie 1989. As a result, we recommend that every 20 ha of suitable habitat should have at least one camera within it. Although for many sites, there may be numerous cameras within 20 ha of suitable habitat.



Figure 11: An example of clusters of five cameras distributed throughout likely habitat near Loxton. Red pins indicate rabbit presence. Cameras (38) were placed less than 250m apart (within cluster) and clusters approximately 500m apart. The survey covered approximately 5km of the river system.



Figure 12: An example of single camera placements distributed throughout likely habitat near Loxton. This survey was intended to add to distribution data, so only targeted the most optimum areas for presence. Cameras were placed between 200-300m apart (32 cameras). Red markers indicate the presence of Riverine Rabbits. The survey covered approximately 5km of the river system. (A rabbit was subsequently seen between points S13 & 15.)

4.9 Number of cameras

The number of cameras over an area will be determined by the size of the area to be surveyed and the topography. If optimal habitat areas are targeted and the placement is correct, then rabbit detection is highly likely. It is possible that where good habitat occurs but is less optimal due to e.g. drought or overgrazing, it may be possible that rabbits are present, but at lower densities, in which case more cameras will likely be needed, or cameras should be grouped more closely, whether in clusters or as single camera placements.

It is recommended that at least 30 locations are sampled in an area where Riverine Rabbits are potentially present. If 30 cameras are not available then a number of deployments in the area should be undertaken. In general, the more cameras you can deploy, the better the results.

4.10 Period of deployment

The period of deployment is affected by the number of cameras deployed on the site and the season of deployment. In general, camera traps tend to generate a higher rate of false triggers in the summer months than the winter months. This is because the cooler winter conditions trigger the heat-sensitive sensors less than in summer, especially when there is taller vegetation within the camera view field which may blow in the wind. The period of deployment should be related to some extent to the density of cameras within the site, as well as the model of camera, its battery life and the capacity of the SD cards.

We recommend that camera traps be deployed for a **minimum of eight weeks** at a particular location for Riverine Rabbits. However, many consultants keep cameras in the field for several months. It is possible to verify the appropriate camera-trapping period for general faunal surveys by constructing a species vs time plot and checking that the species axis has levelled-off in the same manner as a species-area plot.

There are also a few other factors to consider. During the rainy season the rapid growth of grass in response to rain can impair the field of view. The interval to check camera stations may need to be shortened. Cameras may also be interfered with by animals. Note the presence of some types of animals on the site, such as eland, horses and cattle, all of which are curious about cameras and tend to nose or rub against the cameras. This usually changes their field of view, unless they are very securely attached to something sturdy, and may need more frequent checks.

Also note, if cameras are loaded and set prior to going to the field, it is important to double check that the settings are correct when activating cameras in the field. If a battery is accidentally dislodged (during transport), the cameras can revert to factory settings, which results in inaccurate date information.

4.11 Camera site placement

Perhaps the most important aspect of camera trapping is the way the cameras are set up in the field. This has a significant impact on the number and diversity of species that are recorded with the cameras, and can significantly impact the likelihood of detecting rabbits. Some basic principles are: orientation with regards to sun, pathways, preferred food items, field of view and other animals disturbing the cameras.

Cameras should ideally be set-up facing south or north. Other camera orientations may result in many photographs with lens flare from sunrise and sunset. This can result in many spoilt photographs from the early mornings and evenings which is a high activity time for rabbits. As it is much easier to identify Riverine Rabbits from daylight photographs, these are valuable images and are sometimes the only definitive images obtained.

Orientate cameras along pathways if present or overlooking low-growing common food plants that show signs of browsing. When using pathways or animal tracks, focus where possible on areas where multiple pathways intersect, increasing the likelihood of a capture. The narrow pathways and thick vegetation make setting along pathways very difficult, as the vegetation often limits the field of view.

Place the cameras in such a position that the field of view is as large as possible. If the camera can only see 4m in front of it, it is far less likely that it will pick up more animals than a camera that has an 8 or 10m view. Sometimes, vegetation may need to be cleared in front of the camera to ensure that it has a clear view and to reduce the likelihood of false triggers. This is especially problematic with grass which can grow quickly over a wet season. The EWT has had good results placing cameras on the edge of slightly open patches found within the dense riparian vegetation, or on the edge of these dense patches. These more open, so called "productive patches" are good areas for attracting activity. These patches are usually populated by lower-growing shrubs such as Ink bush (*Basia* spp), and some of the palatable Mesembryanthemums (e.g. *Drosanthemum* spp *and Delospermum* spp), as well as grass, providing a variety of easy to reach low, palatable resources.

It is normally better to back the camera against a bush such as a Lycium bush, as illustrated below, as this helps to prevent animals and livestock from interfering with the camera.

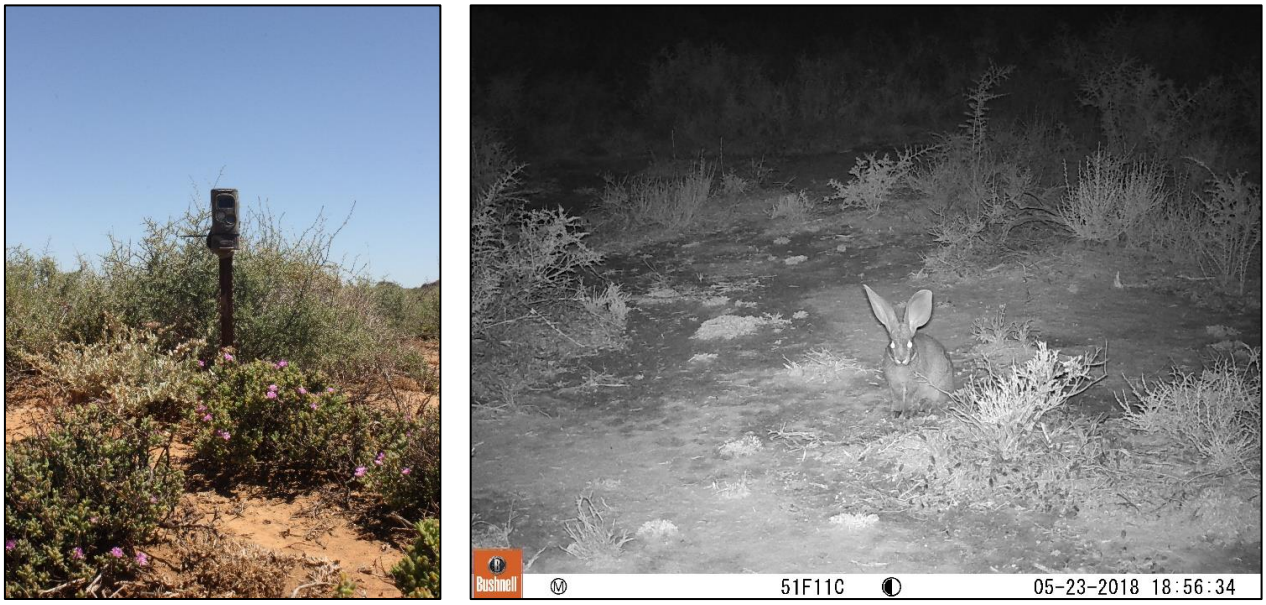

Figure 13: ***Left****: A camera placed backed into a thorny bush can help to protect it from becoming a rubbing post for sheep or wildlife.* ***Left and right:*** *Open patches within the dense scrub, often populated with low-growing palatable shrubs and grass yield good results when surveying for rabbits.*

Avoid placing cameras directly in waterways. Even the dry season can produce its share of unexpected floods, resulting in cameras getting washed away or flooded. In these situations, it is recommended to place cameras on the bank, or among rocks where the camera is somewhat protected from floodwaters.

Where areas adjacent to the riparian zones are surveyed for rabbit presence, the same principles should be followed when surveying the riparian areas. Any areas in proximity of smaller washes or drainage lines with soft soil and some vegetation structure, should be tested for rabbit presence.

4.12 Mounting cameras

There are few natural posts in the field to which cameras can be attached and are often at inconsistent angles. We recommend mounting cameras to a 1 m y-bar (metal y-shaped post) at a height of approximately 50 cm. These posts should be positioned as close to the vertical as possible, since even small changes in mounting angle can degrade the data gathered (Apps & McNutt 2018b). The y-bar has "eyes" through which cable ties or straps can be secured. The camera is mounted against one of the flat surfaces. Placing the y-bar

within the edge of a (preferably) thorny shrub helps protect it from becoming a rubbing post for sheep and game. Secure the camera to the post with at least two cable ties to prevent it being carried off by baboons. Depending on the situation, large cable ties (DIM 388 x 7.8 mm) can be useful, as these can be gently opened by inserting a sharp object in the ratchet mechanism and then reused. However, in the summer these can quickly become brittle in the sun and easily broken. The EWT normally uses cable ties, even where the camera has its own fastening mechanism. If additional protection is required, then you can purchase steel security boxes made to fit most camera trap models, and Python lock chains.

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The EWT would like to extend a special thanks to Simon Todd and Jeremy Bolton for reviewing the document. Thanks also to Cobus Theron, Marienne de Villiers and Liesl Eichenberger for their contributions.

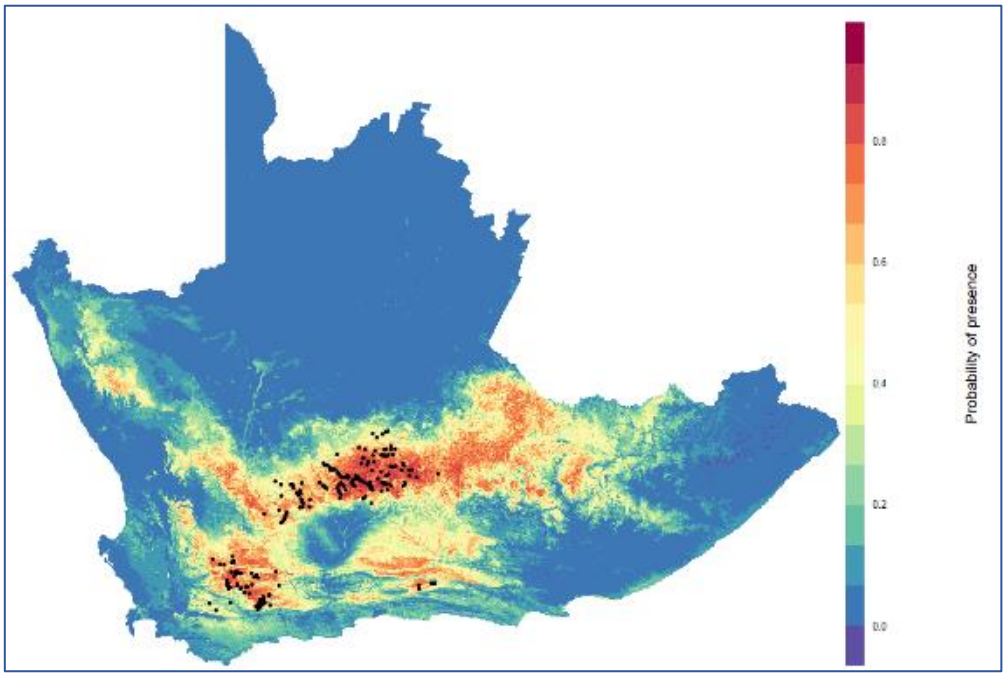
6. Resources and services

6.1 The EWT was integral in terms of developing the screening tool for site selection Screening Tool (environment.gov.za) ; please approach the EWT if you want more details.

6.2 The EWT has data sets on many species, including Riverine Rabbits. Please fill out a data request form for the species you require information on (in some cases a fee may be associated) (Link to data sharing form).

6.3 The EWT maintains a Riverine Rabbit distribution data base. Developers who are interested in historical recordings of rabbits in potential development areas can request information from the EWT, by completing a request for a data sharing agreement (Link to data sharing form).

6.4 The EWT's Conservation Science Unit developed a niche predictive model for potential Riverine Rabbit distribution based on mean habitat suitability, taking into account more than 15 variables (this resource was developed by Dr Dominic Henry). The model was developed using all the available data we have for the current distribution of Riverine Rabbits and included presence points from the third population west of Baviaanskloof. The black dots indicate known locations of Riverine rabbits.



6.5 For more information on the EWT in general, visit https://www.ewt.org.za/

6.6 Consultants are invited to share their proposed camera trap array layout with the EWT for comments prior to camera setting. This will minimise the risk of us questioning the layout later in the EIA/BA process. Please note that this offer is not open ended - and we will charge a fee if onerous demands are made by consultants.

6.7 The EWT is also able to conduct surveys at a fee. Alternatively, the EWT has camera traps for hire to consultants and developers, but this option is dependent on availability and needs to be booked well in advance.

6.8 The EWT Nama Karoo Plant App (available on both Play Store and the Apple App Store) is an excellent resource for help with Nama Karoo-specific plant identification. However, some 250 species in the app are mostly limited to those of significance for livestock farmers. The App was developed in collaboration with Loraine van den Berg, Grootfontein Agricultural Institute.



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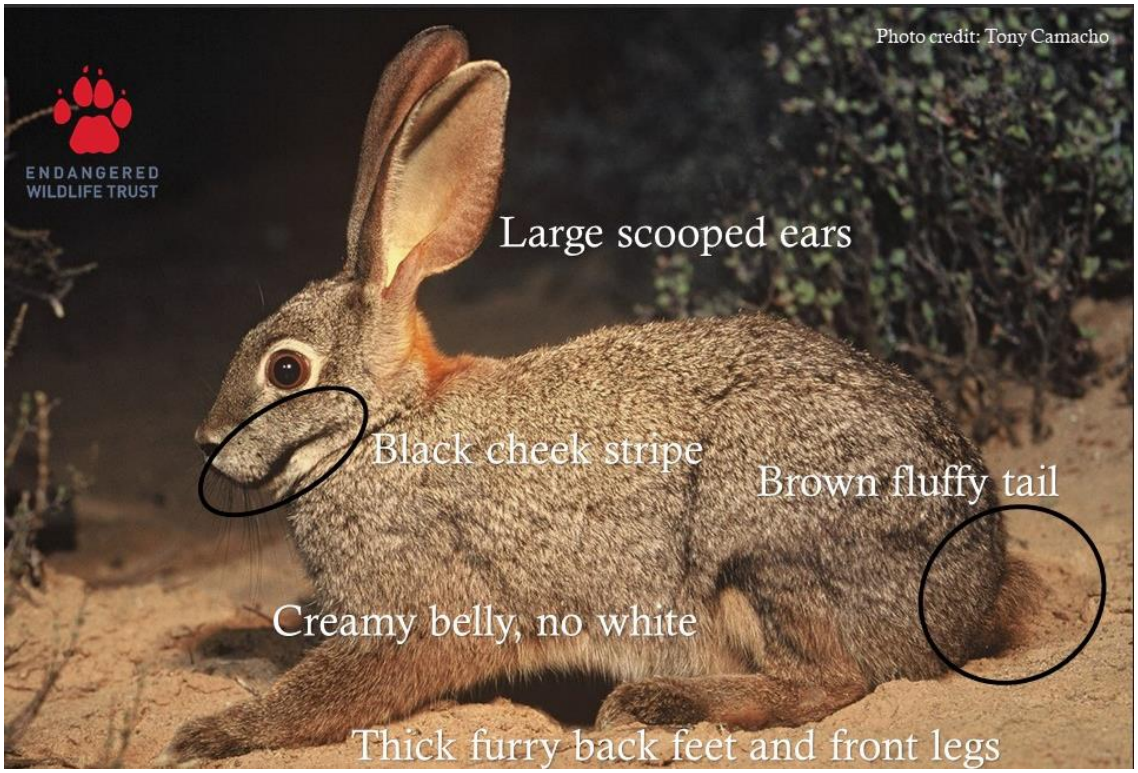
APPENDICES

Appendix 1: Riverine Rabbit identification card



Reference photos for Lagomorphs

Appendix 2:

Riverine Rabbit







Hewitt's Red Rock Rabbit







Hare (Scrub & Cape not differentiated)







Appendix 3: EWT-DCP Decision tree in relation to Riverine Rabbits and Wind Energy Developments. A detailed document on Development Implications and Recommendations will be available in shortly.

