Inyanda-Roodeplaat Wind Energy Facility

Inyanda Energy Projects (Pty) Ltd.

Pre-construction bird monitoring

Progress report 3

6 June 2014

Jon Smallie

1. INTRODUCTION

Inyanda Energy Projects (Pty) Ltd (IEP) plans to develop a wind energy facility named Inyanda-Roodeplaat, just north-west of Uitenhage in the Eastern Cape (see Figure 1). The facility will consist of up to approximately 35 turbines and associated infrastructure. In accordance with the best practice guidelines on this matter (Jenkins *et al*, 2012) IEP has initiated pre-construction bird monitoring on this site and WildSkies Ecological Services has been contracted to implement this.

The monitoring programme was started in July 2013 and has so far completed three site visits: winter, spring and summer. This report describes the progress made on this monitoring programme to date.

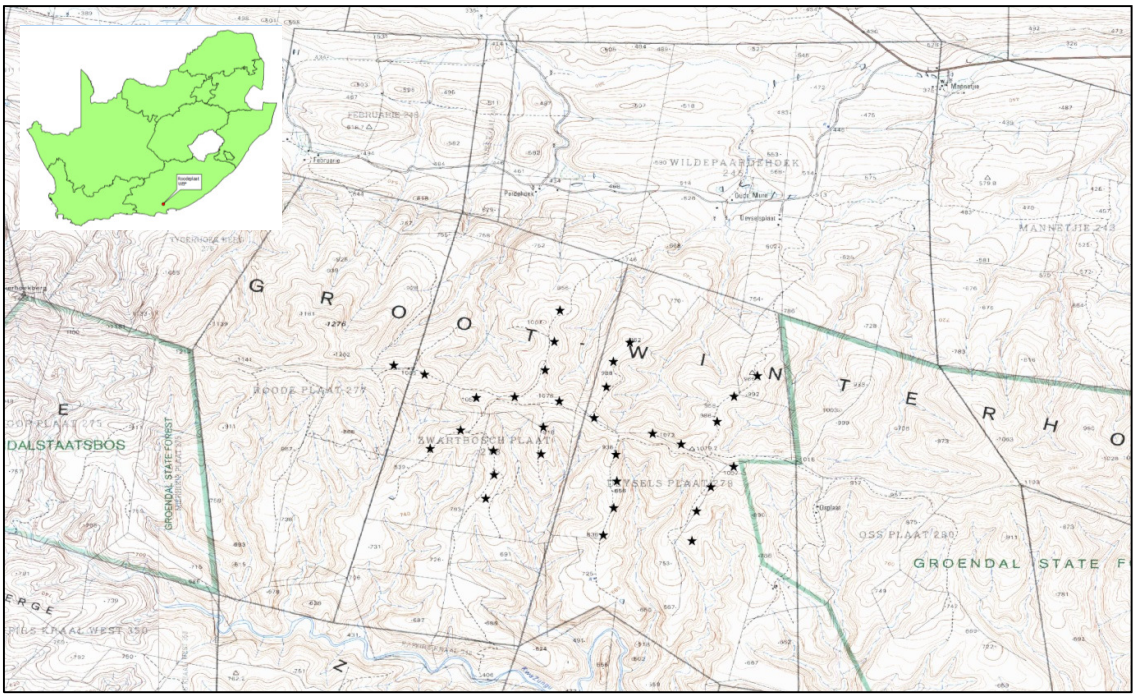

Figure 1. The preliminary layout of the Inyanda-Roodeplaat Wind Energy Facility

2. MONITORING METHODOLOGY

2.1 Aims & objectives

The primary aims of pre-construction bird monitoring at Inyanda-Roodeplaat are:

(i) To estimate the abundance of key bird species regularly present or resident within the broader impact area of the WEF before its construction.
(ii) To document movement patterns for key bird species in the vicinity of the proposed WEF before its construction (e.g. Erickson *et al.* 1999).
(iii) To estimate the frequency with which individuals or flocks of key bird species fly through the future rotor swept area of the proposed WEF (Morrison 1998, Band *et al.* 2007).
(iv) To establish a pre impact baseline of bird numbers, distributions and movements
(v) To inform the avifaunal impact assessment report
(vi) To mitigate any significant impacts by informing the final design, construction and management strategy of the development.

2.2 Definition of the 'inclusive impact zone' (monitoring study area)

Due to their mobility and the fact that one of the main possible impacts of the wind energy facility, that of bird collision, occurs whilst birds are mobile, the zone within which bird activity is relevant to the WEF is potentially far larger than the WEF itself. An important step in designing a monitoring programme is therefore defining this zone, so that monitoring activities can cover this area effectively. In this case the density of Verreaux's Eagles *Aquila verreauxii* breeding in the broader area is an aspect which needs careful consideration and has influenced the size of the study area.

2.3 Description of the study area and bird micro habitat classification

Vegetation and the micro habitats available to birds on site are important in determining avifaunal abundance and movement on site. The vegetation on site has been described based on the work of Mucina & Rutherford (2006), and micro habitats available to birds were classified based on field work on site and the specialists' experience.

2.4 Development of a target species list

In order to identify which species are of particular concern on site the following steps were taken: An inclusive list of species likely to occur on site was compiled using the SABAP1 and SABAP2 data. The relative abundance of these species in the area, the importance of the area for their populations, and their conservation status was examined. The species list used to develop the 'Avian wind sensitivity map for South Africa' by BirdLife South

Africa and the Endangered Wildlife Trust was consulted (Retief *et al*, 2011) to identify a list of the target species which will form the primary focus of all subsequent monitoring and assessment.

2.5 Determination of monitoring effort

Two factors were considered in determining the monitoring effort: the facility size (in hectares and turbine number); and the avifaunal sensitivity of the site. In addition to the guidance offered in Jenkins *et al* (2012), members of the Birds and Wind Energy Specialist Group (BAWESG) have informally arrived at a 'best practice' of approximately 12 hours of observation per vantage point per site visit. As discussed later in this report, the high sensitivity of this site makes it necessary to invest additional effort to collect sufficient data in order to allow robust findings.

2.6 Data collection activities

2.6.1 Sample counts of small terrestrial species

Although not traditionally the focus of wind farm–bird studies and literature, small terrestrial birds are an important component of this programme. Due to the rarity of many of our threatened bird species, it is anticipated that statistically significant trends in abundance and density may be difficult to observe. More common, similar species could provide early evidence for trends and point towards the need for more detailed future study. Given the large spatial scale of WEF's, these smaller species may also be particularly vulnerable to displacement and habitat level effects. Sampling these species is aimed at establishing indices of abundance for small terrestrial birds in the study area. These counts should be done when conditions are optimal. In this case this means the times when birds are most active and vocal, i.e. early mornings. A total of 9 walked transects (WT) of 1 kilometre were established on the Inyanda-Roodeplaat site. These WT's are positioned to represent the bird micro habitats available. During these transects, all bird species seen or heard, and their position relative to the transect line are recorded. This data collection method is particularly valuable on this site, where Fynbos vegetation elements are present, with associated Fynbos endemic bird species.

2.6.2 Counts of large terrestrial species and raptors

This is a very similar data collection technique to that above, the aim being to establish indices of abundance for large terrestrial species and raptors. These species are relatively easily detected from a vehicle, hence vehicle based (VT) transects are conducted in order to determine the number of birds of relevant species in the study area. Detection of these large species is less dependent on their activity levels and calls, so these counts can be done later in the day. Three VT's have been established on suitable roads in the area. For more detail on exact methods of conducting Vehicle Based transects see Jenkins *et al* (2012).

2.6.3 Focal site surveys and monitoring

Any particularly sensitive sites such as wetlands, dams, cliffs, breeding sites are typically identified and monitored on each site visit. At Inyanda-Roodeplaat there are three Focal Sites identified to date, although this could increase with time. In each case the Focal Site (FS) is a small gorge with suitable nesting substrate for cliff nesting bird species, and Verreaux's Eagle breeding sites.

This mountain range is home to a high density of breeding Verreaux's Eagles. As discussed elsewhere in this report, this is almost certainly the most important avifaunal aspect for this project. A specific focused survey of the 5 closest eagle territories and nests was undertaken in the winter of 2013 to assess breeding status as a baseline. This report is attached as APPENDIX 1 to this report. This report recommends a repeat survey for the coming 2014 eagle breeding season.

2.6.4 Incidental observations

This monitoring programme comprises a significant amount of field time on site by the observers, much of it spent driving between the above data collection activities. As such it is important to record any other relevant information whilst on site. All other incidental sightings of priority species (and particularly those suggestive of breeding or important feeding or roosting sites or flight paths) within the broader study area are carefully plotted and documented. Where patterns in these observations are identified this may lead to additional focal site surveys in future.

The above efforts allow us to arrive at an estimate of the abundance or density of the relevant species on site. This will allow the identification of any displacement and disturbance effects on these species post construction. However in evaluating the likelihood of these species colliding with turbine blades, their abundance is not sufficient. We also need to understand their flight behaviour. It is the flight behaviour which determines their exposure to collision risk. A bird which seldom flies, or typically flies lower than blade height is at lower risk than a frequent flier that typically flies at blade height. In order to gather baseline data on this aspect, direct observations of bird flight behaviour are required. This is the most time consuming and possibly the most important activity to be conducted on site, and is elaborated on below.

2.6.5 Direct observation of bird movements

The aim of direct observation is to record bird flight activity on site. An understanding of this flight behaviour will help explain any future interactions between birds and the WEF. Spatial patterns in bird flight movement may also be detected which will allow for input into turbine placement. Direct observation is conducted through counts at a number of vantage points (VP) in the study area. A total of 4 VP's have been identified. Three of these VP's aim to obtain data on the site itself, and overlook potential turbine positions, whilst the fourth is to the east, overlooking the nearest of the identified Verreaux's Eagle nests. The aim at VP4 is to obtain data on the movement of these birds close to the nest, and to ascertain whether they in fact move up onto the higher ground where turbines are planned. Vantage Points were identified using GIS (Geographic

Information Systems), and then fine-tuned during the project setup, based on access and other information. Since these VP's aim at capturing both usage and behavioural data, they are positioned mostly on high ground to maximise visibility. The survey radius for VP counts is 2 kilometres. VP counts are conducted by two observers, seated at the VP and taking care not to make their presence so obvious as to effect bird behaviour. Data should be collected during representative conditions, so the sessions are spread throughout the day, with each VP being counted over 'early to mid-morning', 'mid to late morning', 'early to mid-afternoon', and 'mid-afternoon to evening'. Each session is 3 hours long, resulting in a total of 12 hours of observation being conducted at each vantage point on each site visit. Three hours is believed to be towards the upper limit of observer concentration span, whilst also maximising duration of data capture relative to travel time required in order to access the VP's. A maximum of two VP sessions are conducted per day, to avoid observer fatigue compromising data quality. For more detail on exact criteria recorded for each flying bird observed, see Jenkins *et al* (2012).

One of the most important attributes of any bird flight event is its height above ground, since this will determine its risk of collision with turbine blades. Since it is possible that the turbine model (and hence the exact height of the rotor swept zone) could still change on this project, actual flight height is estimated rather than assigning flight height to broad bands (such as proposed by Jenkins *et al* 2012). This 'raw' data will allow flexibility in assigning to classes later on depending on final turbine specifications.

2.7 Control sites

A suitable control site has been identified to the east of the Inyanda-Roodeplaat site. Activities on the control site consist of 1 Vantage Point, 1 Vehicle Transect, and 3 Walked Transects. Due to the proximity of the control site to a Verreaux's Eagle nest, the data collected will be particularly valuable in the long term.

2.8 Data management

Whilst on site, observers capture data onto paper datasheets. This is then captured electronically each night into Microsoft Excel spread sheets. The spatial data – flight paths drawn on paper maps - is digitised by the specialist once these hard copy datasheets are received. Electronic data is emailed to the specialist and hard copy data is couriered at the end of the site visit. In this way, data is kept in both hard and soft copy version as a backup against any mishap.

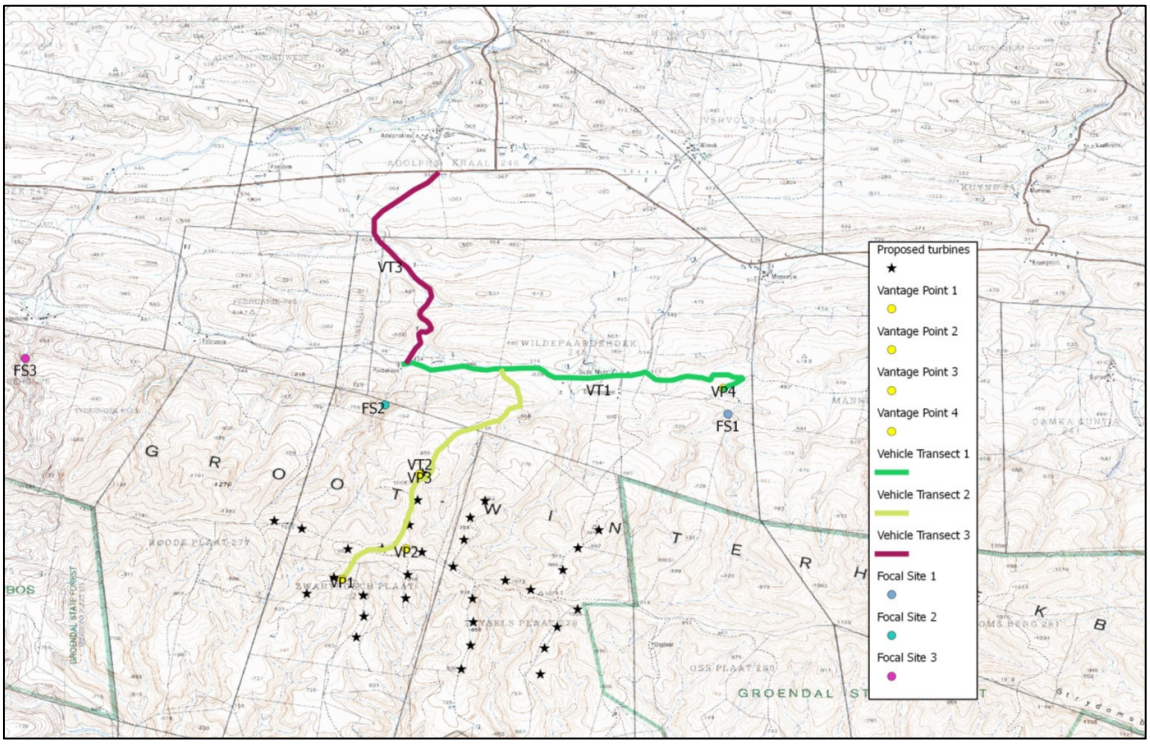

Figure 2. The layout of the bird monitoring activities on site.

2.9 Assumptions and limitations

Due to the steep terrain on and around the Inyanda-Roodeplaat site, roads to the top of the ridge are few and far between, and exceptionally rough. The road to the measuring masts is the only good quality road at present. This has constrained the layout of the monitoring activities. Access to the easternmost turbine strings was not possible by vehicle, and proved to be prohibitively time consuming to access on foot. The bird monitoring activities are therefore concentrated in the western part of the site. It is believed that since the habitat and topography on site is extremely uniform between the eastern and western parts of the site, extrapolation of results to the inaccessible portions of the site will be acceptable. In addition, Vantage Point 4 has been placed to the east, but in lower ground, and should provide some indication of the movements of that pair of Verreaux's Eagle, the primary species of concern at this site.

3. RESULTS & DISCUSSION

3.1 Definition of the 'inclusive impact zone' (monitoring study area)

Ideally this zone would encompass the likely range of all bird species likely to be affected by the WEF. However in the case of large birds of prey for example this could be tens of kilometres, and it is not considered feasible to monitor all of this. The area identified as relevant for Inyanda-Roodeplaat has been influenced by the high density of breeding Verreaux's Eagles along this ridge line (as discussed in 3.9). The final zone that is covered by this monitoring programme is shown in Figure 2.

3.2 Description of the study area and bird micro habitat classification

The proposed site is in the 'Grootwinterhoekberge', on a narrow ridge line that runs approximately east-west. The proposed turbine positions are all on the higher ground, classified as "Kouga Grassy Sandstone Fynbos" and "Kouga Sandstone Fynbos". In both cases it is the Fynbos element that is important for avifauna. We can expect bird species associated with Fynbos to be prevalent on site, such as Orange-breasted Sunbird for example. Lower down the slopes one can find Albany Thicket, which is a very different vegetation type, with different avifaunal community. The extent to which the bird species associated more with Albany Thicket would move up onto the Fynbos areas will have to be determined by monitoring. Likewise the low lying area to the north of the site consists of more open vegetation, and could accommodate species such as bustards, cranes, and Secretarybird. It is considered unlikely however that these species would visit the ridge top where the turbines are proposed. Data collected through this monitoring programme will confirm this.

3.3 Target bird species

The target species for this monitoring programme can be seen in Table 1. A total of 20 species have been identified as being of particular relevance on this site.

Of these target species, the species of most concern at present is the Verreaux's Eagle. This species is classified as 'Least Concern' globally on the IUCN 2012 Red List. The most recent edition of the Southern African Red Data book of birds (Taylor, 2014) has classified this eagle as 'Vulnerable'. These eagles can exist at quite high density compared to other eagle species, with some territories as small as 10km² (Davies, 2010). They also tend to occupy remote mountainous areas largely unaffected by development (until the advent of wind energy in SA that is). Davies recognizes wind farms as a 'new and worrying' threat, although the main threat to the species to date is considered to be the loss of prey populations (Rock Hyrax). Davies recorded home ranges of 10 to 50km², with an average of 24km². The furthest recorded flight from the nest for food was 7 kilometres, although it is almost certain that they will fly further when required (Davies, 2010). Juveniles disperse from their home ranges 4 months after fledging and are not allowed to return to these territories by the adults. There is a suspected high mortality rate amongst juveniles due to the difficult in finding suitable territories.

Table 1. Target bird species for the Inyanda-Roodeplaat pre-construction bird monitoring programme.

Common name	***Species name***	**Ecological group**	**Taylor 2014**	**IUCN 2012**	**TOPS classification**	**Theoretical interactions with wind energy**
Verreaux's Eagle	*Aquila verreauxii*	Raptor	VU	LC		C, D, DI, HD, E
Jackal Buzzard	*Buteo rufofuscus*	Raptor				C, DI, HD, D, E
Steppe Buzzard	*Buteo vulpinus*	Raptor				C, E
Rock Kestrel	*Falco rupicolus*	Raptor				C, DI, HD, D
Southern Pale Chanting Goshawk	*Melierax canorus*	Raptor				C, DI, HD, D
Martial Eagle	*Polemaetus bellicosus*	Raptor	EN	NT	VU	C, DI, HD, D, E
African Harrier-Hawk	*Polyboroides typus*	Raptor				C, DI, HD, D
Black Harrier	*Circus maurus*	Raptor	EN	VU		C, DI, HD, D
Cape Clapper Lark	*Mirafra apiata*	Small terrestrial				DI, HD, D
Long-billed Pipit	*Anthus similis*	Small terrestrial				DI, HD, D
Grey-winged Francolin	*Scleroptila africanus*	Small terrestrial				DI, HD, D, C
Orange-breasted Sunbird	*Anthobaphes violacea*	Small terrestrial				DI, HD, D
Cape Long-billed Lark	*Certhilauda curvirostris*	Small terrestrial				DI, HD, D
Black-shouldered Kite	*Elanus caeruleus*	Raptor				C, DI, HD, D
Lanner Falcon	*Falco biarmicus*	Raptor	VU	LC		C, DI, HD, D
Peregrine Falcon	*Falco peregrinus*	Raptor		LC	VU	C, DI, HD, D
Kite, Yellow-billed	*Milvus aegyptius*	Raptor				C, DI, HD, D
Booted Eagle	*Aquila pennatus*	Raptor				C, DI, HD, D
African Crowned Eagle	*Stephanoaetus coronatus*	Raptor	VU	NT		C, E, DI, HD, D
Cape Eagle Owl	*Bubo capensis*	Raptor				DI, HD, D

VU = Vulnerable; NT = Near-threatened; LC = Least concern; C = Collision with turbines and/or power lines; DI = Displacement from site; D = Disturbance; HD = Habitat destruction; E = Electrocution on power lines. TOPS = Threatened or Protected Species list under the National Environmental Management Biodiversity Act. These are species identified as requiring national protection.

There are an estimated 12-13 breeding pairs of Verreaux's Eagles on the Grootwinterhoekberge between Uitenhage and Cockscomb (APPENDIX 1). This equates to a nest every 4 – 5 kilometres on average. This is an extremely high density of eagles and suggests that the habitat is optimal on this mountain range for this species. Five of these known breeding sites are within 6 kilometres of planned turbine positions for this project.

3.4 Monitoring effort

This project comprises 4 Vantage Points on site, each of which is monitored for 12 hours in each season (4 seasons). This will result in 48 hours of observation on site each season. In addition to this, as Verreaux's Eagle breeding has been identified as a priority, a focused survey of the five breeding territories closest to the Inyanda-Roodeplaat site was conducted in winter 2013, and repeat survey is recommended for the 2014 breeding season.

3.5 Sample counts of small terrestrial species

During winter, the Walked Transects recorded a total of 25 bird species, of which five were target species. Most frequently recorded were Cape Grassbird *Sphenoeacus afer*, Orange-breasted Sunbird *Anthobaphes violacea* and Wailing Cisticola *Cisticola lais*. Of these only the Orange-breasted Sunbird is a target species. On the control site 19 species were recorded in total. Wailing Cisticola, Sombre Greenbul *Andropadus importunus* and Southern Boubou *Laniarius ferrugineus* were most frequently recorded.

During the spring survey a total of 41 bird species were recorded, 5 of which are target species: Orange-breasted Sunbird; Jackal Buzzard; Martial Eagle; Verreaux's Eagle; and Grey-winged Francolin. Additional noteworthy species recorded include Cape Rockjumper; Cape Rock Thrush and Hottentot Buttonquail.

During the summer survey 46 species were recorded by walked transects, including four target species, the Orange-breasted Sunbird, Long-billed Pipit, Cape Clapper Lark and Rock Kestrel.

3.6 Sample counts of large terrestrials and raptors

During winter the drive transects recorded only 4 bird species, three of which are target species: Rock Kestrel *Falco rupicolus*, Jackal Buzzard *Buteo rufofuscus*, and Southern Pale Chanting Goshawk *Melierax canorus*.

During the spring survey only two species were recorded, the Rock Kestrel and Southern Pale Chanting Goshawk.

During the summer survey four target species were recorded, the: Southern Pale Chanting Goshawk; Rock Kestrel; Jackal Buzzard; and Common Buzzard. Interestingly no Verreaux's Eagles were recorded using this method.

3.7 Focal site surveys

Notable records at Focal Sites during winter include: one Verreaux's Eagle and 1 African Harrier-Hawk at FS1 where a Verreaux's Eagle nest is present, but no breeding activity was observed; 2 Verreaux's Eagles suspected breeding, but nest not yet found at FS2; and 1 Verreaux's Eagle breeding on a nest at FS3.

In between the formal winter and spring site visits a dedicated eagle nest survey was undertaken – see APPENDIX 1. This survey visited the 5 nearest known eagle nests to the proposed turbines. Of the 5 nests all were active, with large chicks on three nests (Nest 6 was revisited subsequent to the report in APPENDIX 1, with the nest being found), a small chick on one nest, and eggs on the last nest. All five nests were therefore active during the 2013 breeding season.

During spring the findings at these three Focal Sites were as follows: FS1: 2 adult Verreaux's Eagle seen at nest area; **FS2: 1 adult seen flying. Three burned nests seen. (See discussion below and in Appendix 2);** FS3: 2 adults & 1 juvenile seen on nest.

On 28 September the team found that at a nest had been burnt in the vicinity of the Perdeberg eagle nest location (see Appendix 2).

During the summer survey (conducted in February) no birds were recorded at any of the three eagle nest Focal Sites. This is understandable given that this survey was conducted in the middle of the Verreaux's Eagle non-breeding season, a time when adult birds would have less fidelity to the nest site, and immature birds would have dispersed from the area.

3.8 Incidental observations

A total of five target species were recorded during winter. Most notable of these were: 1 record of a single Martial Eagle; and 1 of a single Verreaux's Eagle. A juvenile Southern Pale Chanting Goshawk was also recorded twice. This indicates that this species may have possibly bred somewhere in the vicinity in the last year.

During spring four target species were recorded: Martial Eagle; Southern Pale Chanting Goshawk; Rock Kestrel and African Harrier-Hawk. Once again a juvenile Southern Pale Chanting Goshawk was recorded on site.

During summer only five incidental observations of target bird species were made. These were a Southern Pale Chanting Goshawk; a Jackal Buzzard; a Common Buzzard; a Booted Eagle; and, most importantly a juvenile Verreaux's Eagle.

3.9 Vantage point observations

Six target species were recorded in flight during winter. Most frequently recorded was Jackal Buzzard, followed by Rock Kestrel and Verreaux's Eagle. African Harrier-Hawk, Black Harrier and Martial Eagle were also recorded flying. The majority of flight for all these species was at approximate rotor height, i.e. between 30 and 150 metres above the ground. At Vantage point 4 a total of 11 records of Verreaux's Eagle flight were made. This high level of flight activity is to be expected close to nest sites, particularly during breeding season. This aspect will be discussed in more detail as more data becomes available from future site visits.

During spring 7 target species were recorded in flight. The most frequently recorded species were Verreaux's Eagle and Jackal Buzzard. Two interesting Red Listed species recorded (although not identified as target species for this project) were Black and Yellow-billed Stork, each recorded flying once.

During summer 4 target species were recorded flying on site: Booted Eagle; Jackal Buzzard; Rock Kestrel and Verreaux's Eagle. Jackal Buzzard and Rock Kestrel were the most common of these. Verreaux's Eagle was recorded five times, three of these involving a juvenile bird. Two of these eagle records were at VP4 which is off the area where turbines will be placed. Three of the Verreaux's Eagle records can be considered to have placed the bird at risk of collision with turbines once they were built.

3.10 Early warnings or 'red flags' for the development

The implications of this wind farm for the Verreaux's Eagles will be the key focus area of this monitoring programme. At this stage it is possible to surmise that potential effects of the wind farm on the birds could include: disturbance of birds whilst breeding (particularly if infrastructure is constructed too close to nests); destruction of foraging habitat; displacement of birds from the site (if the birds avoid the site); and collision of birds with turbine blades. The effects of disturbance of eagle breeding can likely be managed by ensuring that no infrastructure is sited too close to the nest sites. This will be a probable recommendation of the final bird monitoring report, and it is likely that a buffer of approximately 1.5 to 2km around each nest site will be recommended, within which no infrastructure should be built. The effects of habitat destruction and displacement are more complex and will require more detailed study in order to understand. Collision of birds with the turbines is a factor that is likely to affect adults of the closest breeding pairs as well as young birds produced each season. The two –three eagle territories (and their occupants) closest to the proposed turbines will be the most relevant. If resident adult birds are killed through collision with the turbines this could result in

a ‘sink’ situation whereby ‘replacement’ birds are continually drawn into the area only to be killed. If juvenile birds are killed this could mean that recruitment to the wider population is reduced. This aspect will be elaborated on as more data becomes available.

The final bird monitoring report will need to make a decision on the significance of the risk to these birds (based on all data collected) and a suitable course of action to mitigate this risk. It is WildSkies opinion that additional data on Verreaux’s Eagle movement on site will need to be collected in order to inform this decision. It may be necessary to conduct more vantage point counts at different locations, perhaps closer to nest sites, in order to collect sufficient data in time to fit into the EIA for this project.

In addition, there is a need to conduct a follow up survey of eagle breeding success at the five closest breeding sites. This will require two site visits during the period July to November, by a suitably qualified raptor expert.

4. CONCLUSION & RECOMMENDATIONS

At this stage the most important avifaunal factor to consider for the proposed Inyanda-Roodeplaat wind energy facility is the risk to resident Verreaux's Eagles. The proposed project is situated in prime Verreaux's Eagle habitat and more or less in the middle of a line of 12 to 13 eagle nests along the mountain range. Due to the high density of breeding pairs of Verreaux's Eagles on this mountain range, the risk to these birds can be considered high. This means that we need to make sure that we collect sufficient data in the correct manner in order to make decisions about the risk of the project to birds. There are two possible outcomes of the monitoring:

1. The risk is judged to be acceptable and the project proceeds, in which case we will need excellent data on which to make this decision and on which to base mitigation measures during operation of the facility; or
2. The risk is judged to be too high for the project to proceed, in which case this decision would need to be based on excellent data in order to reduce subjectivity.

The current monitoring programme collects data on site for a total of approximately 40 days of the year. This is in my opinion not going to be adequate in terms of the data required above. I strongly recommend that in addition to this monitoring programme, additional data on eagle movement be collected. Such data will allow us to make more informed decisions on the risk posed by the project to these eagles, and to develop effective management measures. It is also recommended that the breeding success of the 5 eagle pairs closest to site be determined during the 2014 eagle breeding season (July to November) by means of two surveys of these sites by a suitably qualified expert.

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APPENDIX 1. VERREAUX'S EAGLE *AQUILA VERREAUXII* NEST SURVEY

See attached pdf report.

BLACK EAGLE NEST SURVEY

For the proposed development of the
Roodeplaat WEF
on the farm Perdehoek
(northwest of Uitenhage)

Report prepared by:

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Date: 15 September 2013

Prepared for: Mr Jon Smallie
Wild Skies Ecological Services

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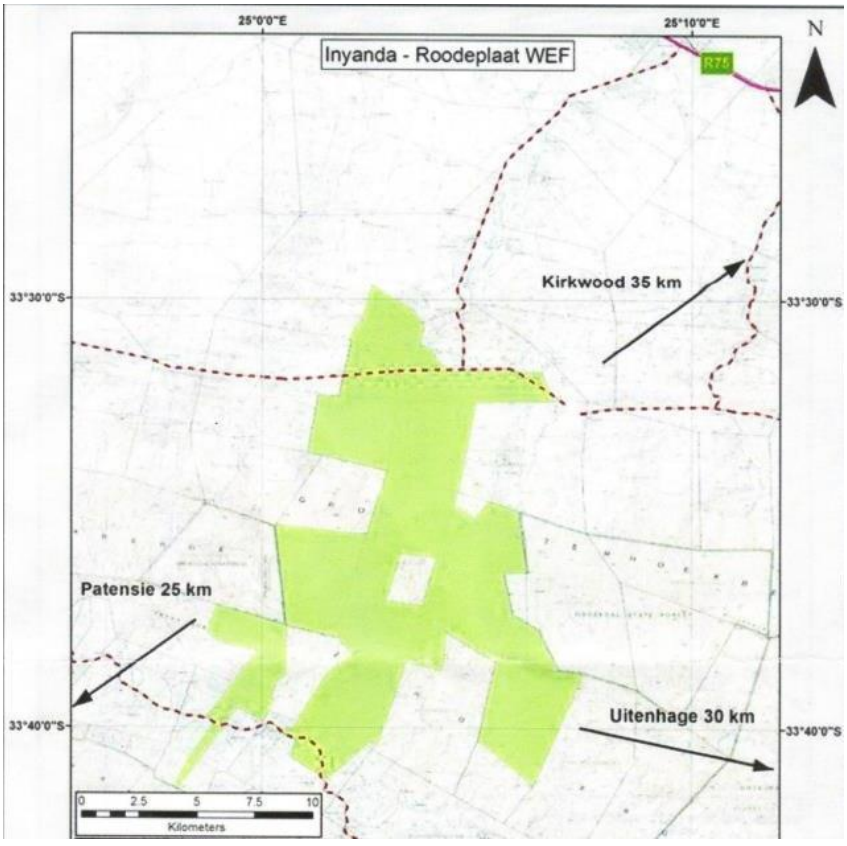
TERMS OF REFERENCE

East Cape Diverse Consultants has been requested by Jon Smallie of Wild Skies Ecological Services to conduct a nest survey of five known Black eagle nest sites to determine the content and activity. This is part of the avian assessment for the proposed Roodeplaat Wind Energy Facility (WEF), which has applied for environmental authorization from the Department of Environmental Affairs.

(map from the EIA public participation notification)



INTRODUCTION

After decades of eagle persecution, especially Black eagles *Aquila verreauxii,* by local farmers in the Cockscomb road region, conservationists and a concerned group of locals questioned the sustainability and survival of such population. Therefore, in 2002, I initiated a nest search and monitoring project to determine the density and breeding success of Black eagles between the towns of Uitenhage and Steytlerville. With landowner surveys and with the assistance of many volunteers from Birdlife Eastern Cape and the Mountain Club Eastern Cape section, a population of 27 pair territories was established, with 13 along the northern slopes of the Groot Winterhoek mountain range (stretching 50km in a linear line) and the rest in a more open area (staggered over a 90km distance).

The study area had a perfect lay-out for a comparative population analysis. The study did not really concentrate on the breeding biology of the eagles (see Gargett 1990) but more on understand their hunting tactics and foraging behaviour. Comparisons of reproductive success and prey taken between the two populations (mountain and open area populations) could also be made. Furthermore the effects of human disturbance or interference on their survival and the evolutionary responses of the eagles could also be addressed. In addition, the interest created by the study was an excellent conservation tool for landowner awareness and understanding.

The total breeding success for the three years (2003, 2004 and 2005) monitored was 58.5% while the mountain population was 71.8% and the open population was 45.2%. In 2005 the chick survival rate was the lowest, especially in the open population with only 21.4%; however this was the driest year in terms of rainfall.

The prey remains data showed that the main prey was Rock dassie *Procavia capensis*. While domestic lambs, Red Rock rabbit, Meerkat, Vervet monkey, Yellow mongoose Mountain tortoise, Rock monitor-lizard and Helmeted guineafowl were also recorded. The open population nests had more domestic stock remains on their nests, probably

as a result of more scavenging opportunities. With the pairs that were more successful in breeding, domestic lamb or goat kid remains were never found on their nests.

Later in the conclusion, I will make comparisons between the Mountain and the Open populations because these small changes or differences would otherwise be very difficult to note.

STUDY AREA

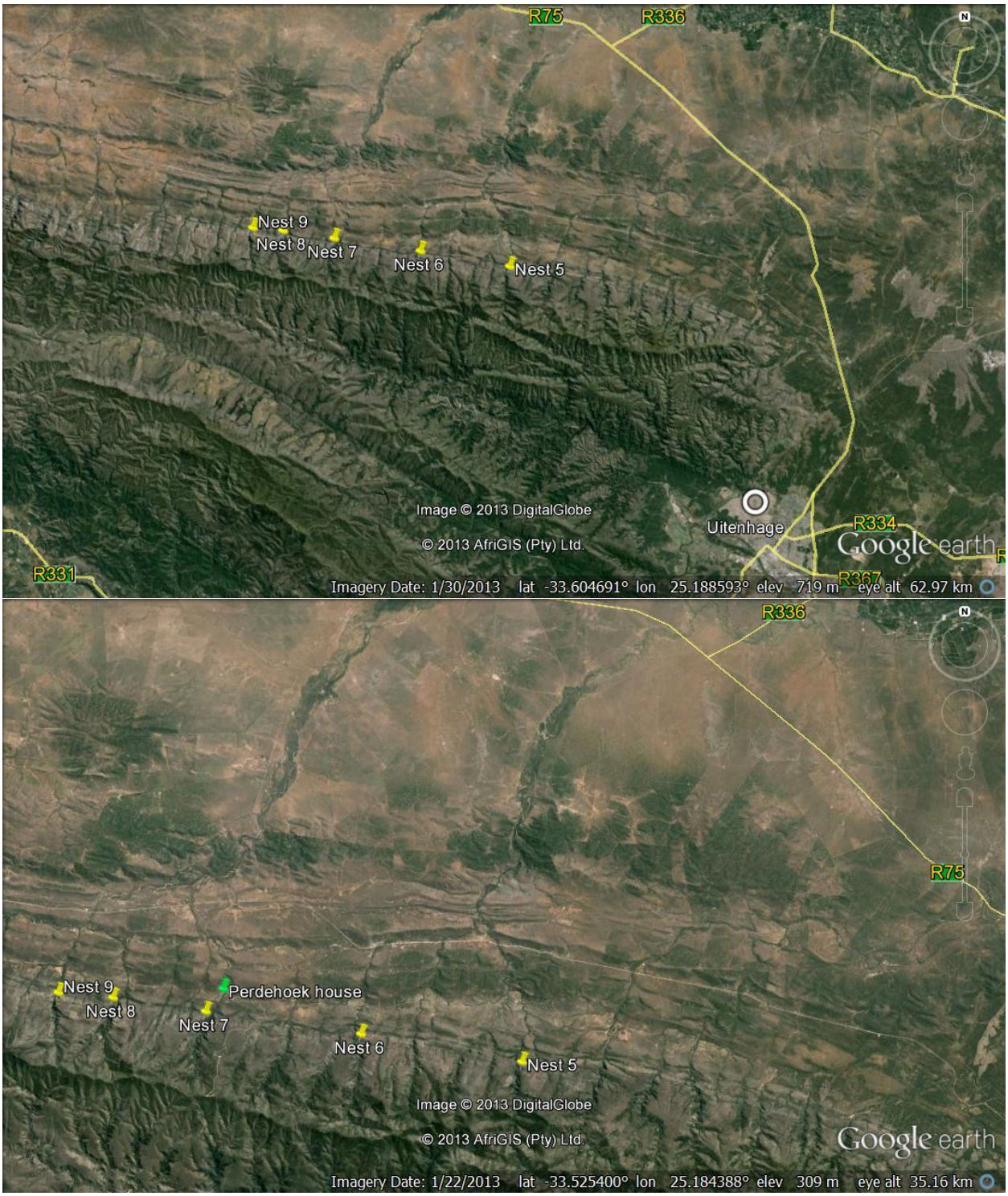


FIGURE 1 Study area showing the five surveyed nests

In terms of the proposed Roodeplaat WEF, which will roughly be situated in the centre of the 13 nest sites along the northern slopes of the Groot Winterhoek mountain range, considerations will follow.

The nests in the mountain population were along the northern slope of the Groot Winterhoek Mountain range, which runs east to west for about 70km and is part of the Cape Fold Mountains. Nests were all in kloofs/gorges that drain the mountain's northern slopes. This is a more open and drier area than the southern slopes, which are more wooded and moist. This habitat is therefore perfect for Black eagles, in contrast to the southern side, which is ideal for African Crowned eagles, thus leaving the top of the mountain available for Martial eagles. The top is more an alpine zone of mountain grasslands while a transitional zone of fynbos vegetation is just below that. Figure 1 shows the area of the five nests surveyed along the northern slope of the Groot Winterhoek Mountain range. Therefore this mountain range provides suitable habitats for each species of the three large eagles of southern Africa.

As background information, the nests of the open population were in a larger area, where smaller hills and mountains created habitat for Black eagles. This area is notably much less rocky than the area/habitat of the Mountain population. This area was also more utilised for small stock farming than the mountain range. In recent years, many of these farms were converted to private game reserves with larger game and therefore a change in land-use.

METHODS

In terms of this survey report, the five nests were visited during August and September of 2013 to monitor their occupancy or breeding attempt. The five nests were in the area along the northern slopes of the Groot Winterhoek Mountain range. A telescope was used and pictures were taken.

RESULTS

Five pictures below will illustrate the results found during the survey visits while a summary is given on page 10.

The coordinates of the five nests surveyed are:

Nest 5 - Guntia	s -33.5876	e25.1412
Nest 6 - Holbak	s-33.5775	e25.1221
Nest 7 - Perdehoek	s-33.5694	e25.0556
Nest 8 - February	s-33.5646	e25.0158
Nest 9 - Tygerberg	s-33.5625	e25.9923

FIGURE 2 Nest 5 – Guntia the active new nest is 5m to the left of the large nest

FIGURE 3 Nest 6 – Holbak this nest was not used

FIGURE 4 Nest 7 – Perdehoek a large chick on the nest

FIGURE 5 Nest 8 – February two eggs visible on the nest in the centre of the picture

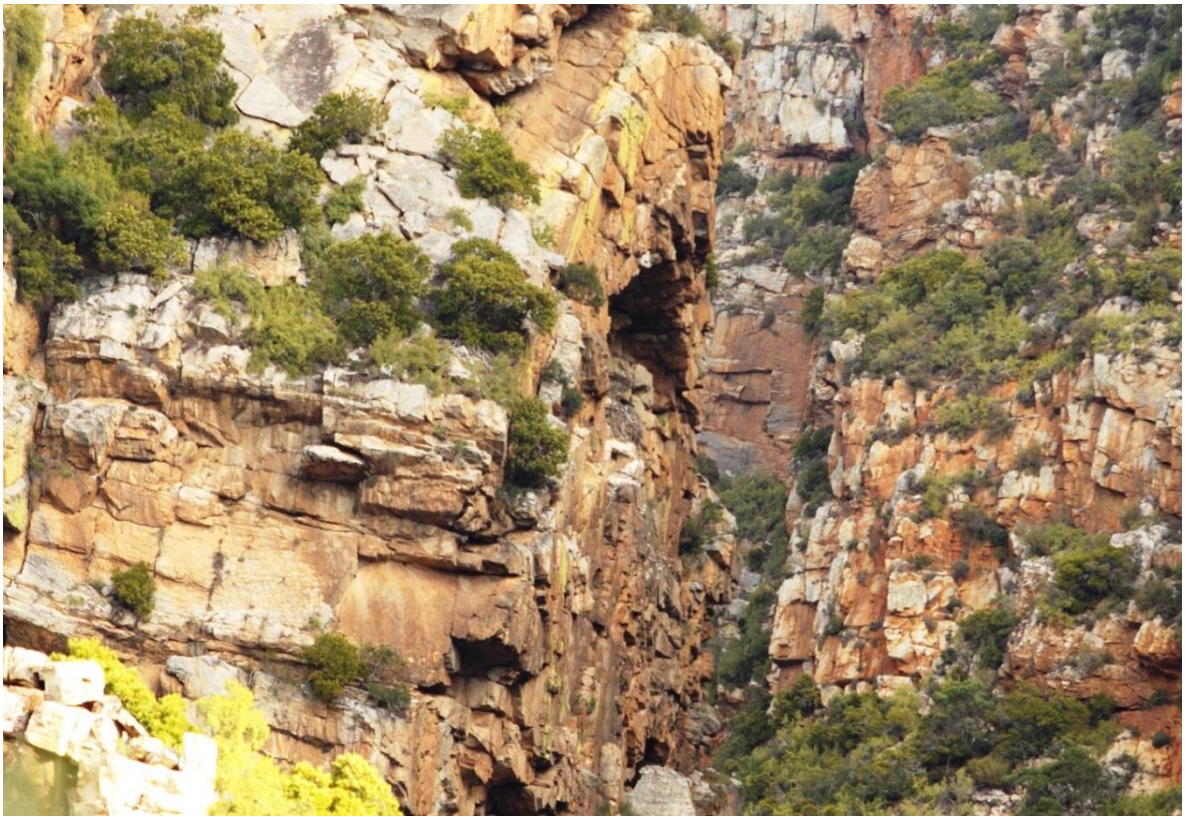


FIGURE 6 Nest 9 – Tygerberg the female eagle feeding a 6-8 week old chick on the nest

Nest 5 This large nest in Figure 2 was used during the first year, and then the pair had a chick for the next two consecutive years in a new smaller nest higher up. After all these years they have now built another new nest (just to the left of the large nest in Figure 2). A large chick probably 9-11 weeks old is visible in the picture.

Nest 6 The regular nest used by the pair was not active (Figure 3) and nor was the second nest nearby. During my visit, the eagles were seen flying past and they behaved like a pair with an active nest. However I searched the area extensively for a new nest but was unable to find it. Bad weather conditions during my visit made it impossible to cross the kloof to the other side in search of a nest; therefore an additional visit will be needed to get a result for this site.

Nest 7 A very large near-fledging stage chick was found on the nest. The nest was at a new location, which was historically a White-necked raven nest as can be seen in Figure 4, the smaller base of the nest. The two nests that were used in my earlier study were still visible. However this pair was one of the most unsuccessful pairs in the Mountain population during the earlier study. I have many points of view about this outcome but then again have been unable to find a sound conclusion. This pair was the pair most often seen with domestic stock as prey - once flying with a small goat kid and twice seeing prey remains on their nest in the mountain population.

Nest 8 Two newly laid (very white) eggs were found on a new nest. This nest was much lower down than the old nest. In my earlier study, this pair always started breeding very late but was regularly successful. Perhaps because it is a south facing cliff and therefore the hot summer sun could is unlikely to reach and over heat a chick on the nest.

Nest 9 A large downy chick was found on the regular nest, with protruding primary feathers visible. This nest was always difficult to access and therefore I did not ring the chicks although it was always a very successful pair.

FIGURE 7 illustrates the low cloud cover over the mountain at the start of a cold front – it can get covered within one hour

CONCLUSION

In addition to the Black eagles, there are numerous other raptor species breeding in the mountains and especially in the kloofs. It is common to find Booted eagle *Hieraaetus pennatus*, Jackal buzzard *Buteo rufofuscus*, Rock kestrel *Falco tinnunculus* and Gymnogene *Polyboroides typus*; as well as Whitenecked raven breeding in the same kloof as the Black eagles. There are also Lanner falcons *Falco biarmicus* and Black stork *Ciconia nigra* breeding on the north side of the mountain. The lower ridges host Martial eagle *Polemaetus bellicosus* and Pale chanting goshawk *Melierax canorus* nests. Forest raptors like African Crowned eagle *Stephanoaetus coronatus*, Black sparrowhawk *Accipiter melanoleucus*, African goshawk *Accipiter tachiro* and Little sparrowhawk *Accipiter minullus* breed along the southern slopes of the mountain while Peregrine falcon *Falco peregrinus* are also breeding on the south side.

Therefore these drainage kloofs in the mountain are very important in providing recruits of various species of birds of prey to a much wider area than the study area or the mountain and thereby making populations more resilient. Many other raptor species were recorded during the three years of the initial study.

The results show that the five nests/breeding pairs surveyed appeared to be quite successful in their annual breeding. On the other hand, the ‘killing’ or elimination of one mate of a breeding pair could result in a drop in the reproductive success of such a pair. Since, it will take a ‘new’ pair a few years to re-establish a successful breeding outcome - if the male gets killed, in terms of their territorial dominance and if the female gets killed in terms of her breeding ability. In contrast, if breeding mates of a few pairs are killed or eliminated, the entire population might show a reproductive decline, which as mentioned will take some years to re-establish.

During the three year study, a total of 14 non-territorial adult Black eagles were regularly noted in the mountain population, therefore making an estimated total of forty adults in the Mountain population (in a linear of 50km). These eagles were recorded as a third adult eagle within or near an existing pair’s territory and were tolerated, especially by

the male. In one recorded incident, a black adult eagle stole a piece of carcass (skin with bones) from a nest with a 9-11 week old chick while the two parent eagles were circling above. It will take a Black eagle juvenile about three to four years to moult into a totally black bird. These 'floater' birds will act as a 'reserve bank' to replace killed territorial birds. In addition numerous juvenile and immature (brown) Black eagles were seen. Once more, the mountain population had more 'floaters' than the open population while a few observations were recorded of four adults living harmoniously together in the territory of a pair in the mountains - perhaps the resident pair and probably their offspring of different years.

Therefore, adding to the above (elimination of eagles), if these floaters also collide with turbine blades, the 'reserve bank' may become depleted. Possibly during the years of eagle persecution, the 'floaters' (the reserve bank) were killed more often than breeding adults because younger birds scavenged more often, therefore these populations (measured by nest sites visited) showed resilience in declining. While on the contrary, such biased 'killing' (of only/more floaters) will be unlikely if these eagles end up getting killed by turbine blades, then both groups - adults and floaters – will get killed.

From my experience, it would be possible to predict that these eagles are likely to cope fairly well with the turbines. But then again I would be very sceptical to guarantee this during two certain behavioural circumstances, firstly in times of hunting during low visibility and secondly during times of territorial display.

With regards to the first point, I noted that while ringing Black eagle chicks on their nests during the three years, after a 'cold front' I could find two to four Rock dassies on a nest. I refer to cold front as the weather conditions that occur regularly during the regions winter months, when cold and gale force south-westerly winds hit the interior. This food 'storage' could be that the eagles' hunting tactics are more successful during periods of a cold front. Therefore it is likely that the cloudy and windy conditions hence low visibility, during a cold front could assist the eagles in pursuing and capturing their prey, especially Rock dassie. Gargett (p.73-74, 1990) also mentions surplus dassie prey

during inclement weather on nests but concludes that it is as a result of a stimulus of a hatching chick – in one incident, the chick was 11-weeks old.

Figure 7, shows the change in the weather conditions at the start of a cold front, this can happen within one hour from sunny conditions to covering the mountain in a blanket of cloud. So, if these animals are likely using adverse weather conditions to increase their hunting success, it will increase their probability to collide with turbine blades in these low visibility weather conditions. I would surmise, searching for or seeing dassie prey between the rocks and vegetation while hunting in the mist and gust; would be somewhat different from reacting to avoid an unexpected, turning turbine blade in mid-air in the mist and gust. On a different note, it appeared that the other prey mentioned is captured more during periods of good weather, perhaps the eagles were using a different hunting tactic.

The second point, Black eagles are very much silent birds (Steyn 1982), especially in terms of territorial display, therefore using visual territorial flight displays to show-off their territorial status (Gargett 1990). During 2004 and 2005, the synchronised flight displays of the Black eagles in the Mountain population was studied on Eagle Observation Days. This involved monitoring ten neighbouring Black eagle nest territories for five hours on the same day by ten observers (volunteers from the bird club). The exercise was completed once during the periods of: egg-laying (in May), incubation (in July), hatching (in September) and fledging (in November) for each of the two years.

The fact that these eagles perform territorial displays by means of steep pendulum dives above their nest sites (Gargett 1990), to show their territorial status to neighbouring pairs, might make them vulnerable to colliding with turbine blades. When neighbouring pairs respond and counter display, the territorial aggression might overcome the eagle's learnt behaviour of remembering or even noting the turbines. These displays can vary in position but will not be more than 500m away from a nest

kloof and probably do not happen during cloudy conditions, because of the visibility - your neighbours will not see you anyway.

Additionally there is the chance that these eagles might fly around at night, perhaps to deter predators, i.e. owls or nocturnal feline cats, which will again increase their potential risk of a collision with the turbine blades.

Furthermore it is somewhat inconsiderate in terms of wilderness areas to even propose such activity bordering onto a wilderness area. These are areas where eagles can still be eagles, because in farmlands there are fewer eagles and cities are devoid of these large eagles. Then there are still the many other animals and all the ecological functions occurring there that should be considered.

RECOMMENDATIONS

As we know there are two likely scenarios that might arise if this proposed WEF development gets the go-ahead – there is a chance that the eagles will disappear or be displaced totally because of the disturbance of the turbines, which will have a negative impact. Secondly a few eagles might get killed but hopefully they will learn and adapt to living with the turbines, although the population size is likely to slowly decline, with the chance that it will never recover fully.

Further studies will be needed to get a better understanding of above factors and of the potential effects of the proposed WEF. Perhaps mitigations to counter negative impacts, would be to limit the turbines to the open areas only and not in the mountains.

REFERENCES

STEYN, P. 1982 Birds of Prey of Southern Africa. David Philip Books, Cape Town

GARGETT, V. 1990 The Black eagle: a Study. Acorn Books, Randburg

APPENDIX 2. DETAILS OF BURNT NEST AT FOCAL SITE 2

On 28 September the team found that at a nest had been burnt in the vicinity of the Perdeberg eagle nest location. It is in my opinion not possible for these nests to burn without human involvement, due to being surrounded by rock. There was also no surrounding vegetation burnt, which means it is unlikely to have been a natural fire. The burnt nest may not be the eagle's current nest (these birds typically have more than one alternative nest), or may be the nest of another raptor species. Without more evidence it would be difficult to understand exactly what happened here, but if this nest was burnt by someone, the intention by the responsible party is presumed to be to persecute the eagles.

The relevant legislation for such a situation is the “Nature and Environmental Conservation Ordinance – 19 of 1974” of the Eastern Cape. The definition of ‘hunt’ in this ordinance is as follows

““**hunt”** in relation to any wild animal means by any means whatsoever to hunt or search for, to kill, capture or attempt to kill or capture, or to pursue, follow or drive with intent to kill or capture, or to shoot at, poison, lie in wait for or wilfully disturb;”

Reading this definition, in particular ‘wilfully disturb’ in conjunction with Section 29 which reads:

No person shall unless he is the holder of a permit authorising him to do so, hunt any wild animal—
(a) by means of fire or poison;

It is possible to interpret the burning of such a nest as a criminal offence.

Despite the challenges of proving responsibility for this offence, if this occurs again WildSkies will be left with no choice but to report this to the authorities and request them to investigate further. In the meantime it is recommended that Inyanda-Roodeplaat issue a written communication to all relevant landowners warning them of the consequences of such persecution of eagles on their properties.