Comments received on the

Revised Basic Assessment Report

Captured according to

Comments and Responses Report entries

ORGANS OF STATE

Department of Water and Sanitation

Savannah Public Process

From: Ackerman Pieter <AckermanP@dws.gov.za>
Sent: Monday, June 21, 2021 10:02 AM
To: Savannah Public Process
Cc: Mulaudzi Nkhumbudzeni; Kuse Lumka; Roets Wietsche; Meulenbeld Paul; Khosa Tsunduka; Tonjeni Mzuvukile; Bila-Mupariwa Ntombizanele Mary; Nthabiseng Dhlamini
Subject: RE: WIND GARDEN WIND FARM AND FRONTEER WIND FARM: Notification of Revised BAR available for review and comment

Hi
Please address water use authorisation as well
Regards

Pieter Ackerman (PrLArch)
Chief Landscape Architect
Department of Water and Sanitation (DWS), South Africa
Sub Directorate Instream Water Use
Tel: 012 336 8217
Cell: 082 807 3512
Fax: 012 336 6608

From: Savannah Public Process [mailto:publicprocess@savannahsa.com]
Sent: 18 June 2021 07:00 PM
To: Ackerman Pieter <AckermanP@dws.gov.za>
Subject: WIND GARDEN WIND FARM AND FRONTEER WIND FARM: Notification of Revised BAR available for review and comment

WIND GARDEN WIND FARM AND FRONTEER WIND FARM NEAR MAKHANDA, EASTERN CAPE PROVINCE
(DFFE Ref. No.: 14/12/16/3/3/1/2314 and 14/12/16/3/3/1/2315 respectively)

Dear Stakeholder and Interested & Affected Party,

Savannah Environmental would like to thank all the stakeholders who submitted their written comments on the Basic Assessment (BA) Reports for the Wind Garden Wind Farm and Fronteer Wind Farm that were made available for review and comment from Thursday, 04 March 2021 until Thursday, 06 May 2021. As per our letter dated 03 May 2021 the BA Reports have been revised in response to the various comments received on the content of the BA Reports during the above-mentioned review period. For ease of reference, the updated information in the Revised BA Reports and the associated specialist reports has been underlined.

Please find attached your notification letter informing you of:

- the availability of the Revised Basic Assessment (BA) Report for review and comment; and
- your invitation to attend any one of the six (6), or all, virtual Public Participation Process Meetings.

The Revised BA Reports can be downloaded from Savannah Environmental's website click here

Please do not hesitate to contact us should you require any additional information or clarification.

Kind regards,

Unsubscribe this type of email

savannah environmental

t: 011 656 3237
f: 086 684 0547

Nicolene Venter
Public Process

e: publicprocess@savannahsa.com
c: +27 (0) 60 978 8396

SAWEA Award for Leading Environmental Consultant on Wind Projects in 2013 & 2015

water & sanitation

Department:
Water and Sanitation
REPUBLIC OF SOUTH AFRICA

Private Bag X6041, Port Elizabeth 6000 **Tel: 041 501 0717** **Enquiries: M. Bloem**

E-mail: **bloemm@dws.gov.za** **Fax 086 537 4689** **Ref**: **Wind Garden and Fronteer**

Savannah Environmental
Woodlands Drive Office Park
Woodmead
2191

Attention: Ms. N. Venter

BASIC ASSESSMENT REPORT ON THE DEVELOPMENT OF A COMMERCIAL WIND FARM AND ASSOCIATED INFRASTRUCTURE IN THE COOKHOUSE RENEWABLE ENERGY DEVELOPMENT ZONE (REDZ), MAKANA LOCAL MUNICIPALITY.

- The proposed activities are located in the following quaternary catchments: P10B, P10A, Q91C and Q91B;
- The geology of the area consists of rocks that form part of the Cape Supergroup and Karoo Supergroup. Shales, sandstones and quartzites of the Witteberg Group (Cape Supergroup) are unconformably overlain by the diamictites, varved shale and mudstones of the Dwyka Group (Karoo Supergroup). The rocks in the study area are folded;
- The rocks have been classified as by their geotechnical investigation to be highly weathered, highly to moderately fractured and medium to very soft;
- The hydrogeology of the area is characteristic of fractured aquifers associated with yields of about 0.5 – 2.0 L/s;
- Wind Garden (Pty) intends to abstract a total volume of 11 230.92 m^3/a from three (3) boreholes for the duration of the project;
- It is advised that Wind Garden (Pty) Ltd apply for a Water Use authorization as determined by the National Water Act 36 of 1998, Chapter 4;
- A lease agreement between property owners and wind farm developers must be presented in support of the water use authorization application;
- The applicant must conduct a comprehensive geohydrological study which will aid in establishing the sustainable yields and quality of the groundwater resource;
- Should the extracted groundwater quality not meet the required water standards as provisioned by law, the necessary treatment infrastructure must be put in place to ensure drinking standards are met;

- Flow meters must be installed at the abstraction points in order to monitor water usage and for management and compliance purposes;
- Wind Garden Pty Ltd is advised to ensure the construction of wastewater facilities (conservancy tanks) is adequately equipped to prevent contamination of groundwater resources and surrounding environment;

Please note that any use of water without an authorization is a contravention as in accordance with Section 151 of the National Water Act, 1998 (Act 36 of 1998).

Yours Faithfully

pp _____

DIRECTOR – PROTO CMA

Date: 01 July 2021

Department of Forestry, Fisheries and the Environment

environment, forestry & fisheries
Department:
Environment, Forestry and Fisheries
REPUBLIC OF SOUTH AFRICA

Private Bag X 447· PRETORIA · 0001· Environment House ·473 Steve Biko Road, Arcadia,· PRETORIA

DEFF Reference: 14/12/16/3/3/1/2314
Enquiries: Mr Lunga Dlova
Telephone: (012) 399 8524 **E-mail:** LDlova@environment.gov.za

Ms Jo-Anne Thomas
Savannah Environmental (Pty) Ltd
PO Box 148
SUNNINGHILL
2191

Telephone Number: (011) 656 3237/3256/3251
Email Address: joanne@savannahsa.com

PER MAIL / E-MAIL

Dear Ms Thomas

COMMENTS ON THE AMENDED DRAFT BASIC ASSESSMENT REPORT FOR THE PROPOSED DEVELOPMENT OF A WIND GARDEN WIND FARM AND ASSOCIATED INFRASTRUCTURE ON A SITE LOCATED APPROXIMATELY 17KM NORTH-WEST OF MAKHANDA (PREVIOUSLY KNOWN AS GRAHAMSTOWN) WITHIN THE MAKANA LOCAL MUNICIPALITY AND THE SARAH BAARTMAN DISTRICT MUNICIPALITY IN THE EASTERN CAPE PROVINCE

The amended draft Basic Assessment Report (BAR) dated June 2021 and received by this Department on 21 June 2021, refer.

This letter serves to inform you that the following information must be included to the final BAR:

(a) Public Participation Process

- The following information must be submitted with the final BAR:
  a) A list of registered interested and affected parties as per Regulation 42 of the NEMA EIA Regulations, 2014, as amended;
  b) Copies of all comments received during the revised draft BAR comment period; and
  c) A comment and response report which contains all comments received and responses provided to all comments and issues raised during the public participation process for the revised draft BAR. Please note that comments received from this Department must also form part of the comment and response report.
- Please ensure that all issues raised and comments received during the circulation of the revised draft BAR from registered I&APs and organs of state which have jurisdiction **(including this Department's Biodiversity Section(including this Department's Biodiversity and Protected Areas Directorate)** in respect of the proposed activity are adequately addressed in the final BAR.
- Proof of correspondence with the various stakeholders must be included in the final BAR. Should you be unable to obtain comments, proof should be submitted to the Department of the attempts that were made to obtain comments. The Public Participation Process must be conducted in terms of Regulation 39, 40, 41, 42, 43 & 44 of the EIA Regulations 2014, as amended.

MEL

Please also ensure that the final BAR includes the period for which the Environmental Authorisation is required and the date on which the activity will be concluded as per Appendix 1(3)(1)(q) of the NEMA EIA Regulations, 2014, as amended.

Should you fail to meet any of the timeframes stipulated in Regulation 19 of the NEMA EIA Regulations, 2014, as amended, your application will lapse.

You are hereby reminded of Section 24F of the National Environmental Management Act, Act No. 107 of 1998, as amended, that no activity may commence prior to an Environmental Authorisation being granted by the Department.

Yours sincerely

Ms Milicent Solomons
Acting Chief Director: Integrated Environmental Authorisations
Department of Environment, Forestry and Fisheries
Signed by: Ms Masina Litsoane
Designation: Control Environmental Officer: National Infrastructure Projects
Date: 21/07/2021

cc	Hylton Cecil Newcombe	Fronteer (Pty) Ltd	Email: hylton@windrelic.net
	Dayalan Govender	Eastern Cape Department of Economic Development, Environmental Affairs and Tourism (DEDEAT)	Email: Dayalan.govender@DEDEA.gov.za
	Moppo Mene	Makana Local Municipality	Email: mmene@makana.gov.za

Department of Forestry, Fisheries and the Environment

Directorate: Biodiversity Conservation

Nicolene Venter

From: MMatlala Rabothata <MRabothata@environment.gov.za>
Sent: Wednesday, July 28, 2021 12:09 PM
To: Nicolene Venter; Savannah Public Process
Cc: Seoka Lekota; Shalot Sekonko; Aulicia Maifo
Subject: FW: 14/12/16/3/3/1/2314 & 14/12/16/3/3/1/2315: Comments Revised BA Reports

Dear Nicolene,

As discussed, I have looked at the revised report and there are no major changes from Biodiversity side. Kindly be informed that for now consider our previous DBAR comments dated 06/05/21 to be submitted with the final report. Everything is still the same except that there are some slight additional changes. I trust that you will receive the revised comments today if not tomorrow.

Trust that you find all in order.

Regards

From: MMatlala Rabothata
Sent: Tuesday, 27 July 2021 14:11
To: Savannah Public Process <publicprocess@savannahsa.com>
Subject: RE: 14/12/16/3/3/1/2314 & 14/12/16/3/3/1/2315: Comments Revised BA Reports

Dear Nicolene,

Thank you for the information and Kindly be informed that from our records the due date is the 30 July, hence the reason I said comments will be submitted before due date. I will relook at the report and do my best to forward them.

Regards

From: Savannah Public Process [mailto:publicprocess@savannahsa.com]
Sent: Tuesday, 27 July 2021 13:40
To: MMatlala Rabothata <MRabothata@environment.gov.za>
Subject: RE: 14/12/16/3/3/1/2314 & 14/12/16/3/3/1/2315: Comments Revised BA Reports

Dear Mmatlala,

All changes made in the BA Reports and appendices have been underlined for ease of reference.

Herewith the link to the Revised Reports https://savannahsa.com/public-documents/energy-generation/eastern-cape-cluster-of-renewable-energy-facilities/and and the release code is: 3dLVEW

The review period ended on the 21st of July 2021 and we are submitting the final BA Reports to Mr Lunga Dlova, Case Officer tomorrow, Wednesday, 28 July 2021 within the regulated time frame as per the EIA Regulations, 2014, as amended.

Should your Department not be in time to submit written comments today, we will forward your written comments, once received, to Mr Dlova as late comments.

Kind regards,

savannah environmental

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Nicolene Venter
Public Process

e: Publicprocess@savannahsa.com
c: +27 (0)60 978 8396

From: MMatlala Rabothata <MRabothata@environment.gov.za>
Sent: Tuesday, July 27, 2021 12:50 PM
To: Nicolene Venter <nicolene@savannahsa.com>; Savannah Public Process <publicprocess@savannahsa.com>
Subject: FW: 14/12/16/3/3/1/2314 & 14/12/16/3/3/1/2315: Comments Revised BA Reports
Importance: High

Dear Nicolene,

My apology to respond late, my emails were not working last week Thursday. Therefore, I couldn't access them.

Please note that the comments will be submitted before the due date.
Would you please be kind to send me the link or we transfer to access the report. What Are the major changes to the revised report?

Warm Regards
Mmatlala.

From: Savannah Public Process [mailto:publicprocess@savannahsa.com]
Sent: Friday, 23 July 2021 17:06
To: BC Admin <bcadmin@environment.gov.za>
Cc: MMatlala Rabothata <MRabothata@environment.gov.za>; Nondumiso Bulunga <Nondumiso@savannahsa.com>
Subject: 14/12/16/3/3/1/2314 & 14/12/16/3/3/1/2315: Comments Revised BA Reports
Importance: High

Dear Mmatlala,

Thank you for your attendance at the Key Stakeholder Workshop held on Tuesday, 06 July 2021 representing the Directorate Biodiversity Conservation.

I would like to follow-up whether we will be receiving written comments from your Directorate on the Revised BA Reports.

If comments were submitted on the two Revised BA Reports, would you please be so kind and resend it.

Mr Lunga Dlova, Case Officer, from the Department of Forestry, Fisheries and the Environment requested that your Directorate's comments must be included and addressed (refer to letters attached).

Kind regards,

savannah environmental

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SAWEA Award for Leading Environmental Consultant on Wind Projects in 2013 & 2015

INTERESTED AND AFFECTED PARTIES

RICHARD SUMMERS INC.
ATTORNEYS

Savannah Environmental
Attention: Ms. Jo-Anne Thomas

Our ref.: CSP20-003
Your ref.:

Per email: joanne@savannahsa.com

8 July 2021

Dear Ms. Thomas

RE: PROPOSED WIND GARDEN AND FRONTEER WIND ENERGY FACILITIES, EASTERN CAPE PROVINCE [DFFE REF. NO.: 14/12/16/3/3/1/2314 AND 14/12/16/3/3/1/2315] – PUBLIC PARTICIPATION PROCESS

1. We refer to the above-mentioned projects and to the online public meeting held on 7 July 2021 by Savannah Environmental. During that meeting, numerous complaints were raised by various stakeholders to the effect that they are prejudiced by the unreasonably short timeframe for commenting on two different projects, each with its own set of revised Basic Assessment Report and associated specialist reports.

2. The volume of the revised reports released for comment on 21 June 2021 in connection with the proposed Wind Garden and Fronteer Wind Energy Facilities makes it difficult for stakeholders to consider all the material and comment meaningfully within a 30-day period. Although Savannah Environmental has repeatedly stated that these are two distinct applications, the fact is there is only one, combined timeframe for commenting on both applications.

3. The essence of this complaint is that the approach in combining the timeframes and the limited 30-day commenting period is procedurally unfair, and places stakeholders at a disadvantage. Several other registered interested and affected parties (I&APs) have expressed similar concerns to the writer.

4. The slavish adherence to timeframes for processing applications in terms of section 24 of the National Environmental Management Act 107 of 1998 in terms of the EIA Regulations is not the sole factor of relevance in determining what constitutes a reasonable commenting period. Upholding the constitutional rights to administrative justice and procedural fairness should take precedence in these circumstances. Ultimately the public participation processes adopted by the Environmental Assessment Practitioner (EAP) must give meaningful expression to these constitutional rights.

Unit 126, Victoria Junction
57 Prestwich Street
De Waterkant, 8001
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5. It is through no fault of registered I&APs that the development company is pursuing this development as two separate applications. For all intents and purposes this is one large development, which is being dealt with through the prism of two separate applications. The distinction is contrived and artificial and duplicates the volume of the assessment reports although the receiving environment is the same. The nature of the development proposed is the same across both application, and from a stakeholder perspective the distinction is entirely artificial and prejudicial for the reasons explained herein.

6. The explanation offered by Savannah Environmental during the meeting held yesterday – namely, that combining the public participation process is done to avoid stakeholder fatigue – is contrived. The opposite effect is achieved by collapsing the commenting period for the two projects and I&APs are overwhelmed. What is effectively a truncated commenting timeframe for two separate applications, has the practical effect of forcing I&APs to review and comment on double the volume of documentation in half the amount of time than would otherwise be the case if these were, indeed, treated as two separate applications.

7. During yesterday's public meeting you, in your capacity as the EAP, indicated that a request to extend the public participation process was made previously to the Department of Forestry, Fisheries and the Environment (DFFE) and that this request was refused. Upon requesting these records, we were referred to Appendix B of the Revised BARs. The documentation contained in Appendix B, properly construed, says nothing of the sort. The letter dated 14 May 2021 from Savannah Environmental to DFFE (in Appendix B) does not expressly request a longer commenting period. The letter does state that the revised reports "*will be subject to another public participation process* ***<u>of at least 30 days</u>***." (My emphasis) Clearly this has not occurred as the bare minimum 30-day period has been provided. This is unreasonable in the circumstances.

8. The letter dated 14 May 2021 from Savannah to DFFE also acknowledges that the original Basic Assessment Reports released for comment earlier this year were deficient and that "*additional and more detail investigations and assessments for the project*" were required. The upshot of this is that substantive new information has been released into the public domain for the first time with the current commenting period for the Revised BARs.

9. During the online public meeting, you undertook to submit a further request to DFFE for an extension to the public participation process. It is entirely unsatisfactory to resolve this by means of a bilateral exchange between the EAP and the Department. I&APs stand to be directly affected by these projects and it is their voice that should be heard. This issue goes to the heart of the stakeholders' rights to procedural fairness. It cannot be left undetermined with reference to some vague undertaking to engage further with the Department. The prejudice to I&APs is tangible and grossly unfair.

10. We are instructed to request an undertaking from you, as the EAP for these projects, that a minimum period of an additional 30 days for comment be provided and that the commenting period shall be extended by 30 days until 21 August 2021. As the expiry of the current (inadequate commenting period) is imminent this request is tabled for your urgent consideration and response.

11. The undertaking to that effect is required before 17h00 on Wednesday 14 July 2021, failing which we instructed to approach the High Court for appropriate relief.

Yours sincerely,
RICHARD SUMMERS INC.

Per: R W Summers

Nicolene Venter

From: Angela Stöger-Horwath <angela.stoeger-horwath@univie.ac.at>
Sent: Thursday, July 8, 2021 12:02 PM
To: Savannah Public Process
Cc: Nondumiso Bulunga; Nicolene Venter; Jeni Williams
Subject: Low-frequency noise
Attachments: Baotic_etal. 2018_animals-08-00167.pdf; garstang2010.pdf

Dear Ladies and Gentlemen,

Please find attached a paper of ours that shows that elephant calls in Adde travel at least up to 1.5, and in some cases 2 km distance (we did not test for greater distances). Other research showed that elephant communicate up to 4 km distance, in some cases even more, up to 10 km. (paper attached).

it is absolutely incorrect to state that low-frequency noise (at a distance greater of 100 meter) does not affect elephants. Low-frequency noise travels far, and it has been shown that the noise of wind turbines travels up to 20 km.

So from a scientific point of view, this statement that elephant and rhino communication and welfare is not effected is dramatically incorrect, and totally unsubstantiated.

Kind regards,

Angela Stoeger

--
Priv.-Doz.Dr. Angela Stoeger
Department of Behavioural & Cognitive Biology
University of Vienna
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animals

MDPI

Article

Field Propagation Experiments of Male African Savanna Elephant Rumbles: A Focus on the Transmission of Formant Frequencies

Anton Baotic [1,*], Maxime Garcia [1,2], Markus Boeckle [3,4] and Angela Stoeger [1,*]

1 Mammal Communication Lab, Department of Cognitive Biology, University of Vienna, Vienna 1090, Austria; maxime.garcia@ymail.com
2 ENES Lab, Neuro-PSI, CNRS UMR 9197, University of Lyon/Saint Etienne, 42023 Saint Etienne, France
3 Department of Psychology, University of Cambridge, Cambridge CB2 3EB, UK; markus.boeckle@gmail.com
4 Department of Psychotherapy, Bertha von Suttner University, St. Poelten 3100, Austria
* Correspondence: anton.baotic@univie.ac.at (A.B.); angela.stoeger-horwath@univie.ac.at (A.S.)

Received: 27 August 2018; Accepted: 25 September 2018; Published: 30 September 2018

Simple Summary: African savanna elephants are highly social and exhibit a complex vocal communication system. They use a low-frequency contact call (termed 'rumble') to maintain social contact over long distances. As sound travels through the environment, however, its intensity level decreases. We used specialized computer software to manipulate acoustic components in male rumbles and simulated different body sizes (large and small). The rumbles were broadcasted and re-recorded at different distances at the Addo Elephant National Park, South Africa. This propagation experiment enabled us to investigate which acoustic components and information content can be transmitted efficiently up to 1.5 km. The results confirm that male rumbles potentially encode information about body size, yet transmission success decreased with distance. Our findings inform on how the environment can influence propagation of savanna elephant rumbles and what kind of information might be transmitted successfully over distance.

Abstract: African savanna elephants live in dynamic fission–fusion societies and exhibit a sophisticated vocal communication system. Their most frequent call-type is the 'rumble', with a fundamental frequency (which refers to the lowest vocal fold vibration rate when producing a vocalization) near or in the infrasonic range. Rumbles are used in a wide variety of behavioral contexts, for short- and long-distance communication, and convey contextual and physical information. For example, maturity (age and size) is encoded in male rumbles by formant frequencies (the resonance frequencies of the vocal tract), having the most informative power. As sound propagates, however, its spectral and temporal structures degrade progressively. Our study used manipulated and resynthesized male social rumbles to simulate large and small individuals (based on different formant values) to quantify whether this phenotypic information efficiently transmits over long distances. To examine transmission efficiency and the potential influences of ecological factors, we broadcasted and re-recorded rumbles at distances of up to 1.5 km in two different habitats at the Addo Elephant National Park, South Africa. Our results show that rumbles were affected by spectral–temporal degradation over distance. Interestingly and unlike previous findings, the transmission of formants was better than that of the fundamental frequency. Our findings demonstrate the importance of formant frequencies for the efficiency of rumble propagation and the transmission of information content in a savanna elephant's natural habitat.

Keywords: African savanna elephant; rumble; vocalization; formant; propagation

1. Introduction

Many group-living mammal species have developed complex social and spatiotemporal association patterns [1]. Depending on the costs involved to maintain social cohesion, groups may temporarily split and vary in size as they move through the environment, helping balance the costs and benefits of grouping. Spatial coordination in such dynamic fission–fusion societies requires communication and information transfer/exchange between multiple signalers and receivers in their active space [2,3]. Vocal signals may transmit information about a caller's identity and physical attributes (age, body size, and sex) and are particularly important for facilitating social recognition and mating success [4]. In this context, a key objective will often be to maximize the propagation distance in the animal's natural habitat [5], which in turn depends on the receiver's ability of assessing a vocal signal's degradation level to determine a nearby caller's distance (termed 'ranging') and to mediate interindividual spacing [6].

In general, as sound waves propagate through the environment, the spectral and temporal structure degrades progressively with distance, yielding a 6 dB attenuation of the signal amplitude (source intensity that corresponds to sound pressure) per distance doubling (termed 'spherical spreading') under frictionless open field conditions, i.e., far from any obstructions. This potentially constrains the signal's active space and thus affects decoding acoustic information by receivers [7–9]. Further factors causing 'excess attenuation' are ambient noise, fluctuations or changes of atmospheric conditions, vegetation strata, topography, and reverberation (frequency-dependent repeated reflections of a signal). Attenuation of higher frequencies and reverberation are more pronounced in dense habitats due to tree trunks, branches, and foliage, whereas open field habitats possess fewer reflecting barriers. In open habitats, however, irregular atmospheric conditions, such as high wind speeds or temperature, may affect sound propagation [7–12]. Studies in baboons [13] and birds [14,15] demonstrated the beneficial effect of sound reflection on sound transmission. Accordingly, reflected sound waves can contribute energy to the source sound wave when both waves overlap and hence affect sound propagation. Ground effects are caused by constructive or destructive interference effects, between sound traveling from a source to a receiver and sound being reflected from the ground that occur at a receiver's location resulting, respectively, either in enhancement or attenuation of a received sound pressure level SPL (usually given in decibels, dB) [16]. But signal amplitude/SPL alone has been suggested not to be a reliable acoustic cue to assess the distance of a sound source as (1) a signaler could vary its amplitude when facing away from or towards a listener and (2) acoustic signals can be affected by the attenuation factors mentioned above [17–19]. These attenuation factors differ between habitats and influence the acoustic characteristics of signals due to overall temporal degradation, frequency-dependent attenuation, and degradation processes [7,8,12]. Additional temporal and spectral structures of a signal are more likely to contribute to a more complete set of acoustic cues for distance assessment and information decoding than only amplitude/SPL, as it has been demonstrated in frogs [20], birds [18], and mammals (e.g., elephant seals [21] and bison [22]). Overall, lower-frequency sound experiences less attenuation than higher-frequency sound [8,12,23,24]; various mammal species use low-frequency vocalizations to maintain social relationships with conspecifics over distance [25–27].

Low-frequency communication is well developed in the African savanna elephant (*Loxodonta africana*) [28], a socially and spatially flexible species [29,30]. Though they produce a range of different vocalizations, the low-frequency 'rumble' is the most frequently produced call type. The rumble is a harmonically-rich vocalization with frequency components near or in the infrasonic range, used for both short- and long-distance communication [28,31–34]. In savanna elephants, rumbles are known to transfer information about identity, sex, age, size, arousal, and reproductive state [32,34–38], and enable communication over long distances to coordinate movements and to maintain contact between spatially separated individuals [34,39].

In general, sound production mechanisms in mammal species can be explained by the 'source–filter' theory, which states that a vocal signal is generated by vibrations of the vocal folds in the larynx (source) and modified acoustically by the vocal tract (filter) between the larynx and the

mouth [40]. The dimensions of the vocal folds (length and thickness) and their average vibration rate define the fundamental frequency (f_o) [40,41]. Comparative perceptual studies in other mammals, such as in deer [42], koalas [43], and domestic dogs [44], showed that vocal tract resonance frequencies (formants) are a reliable cue to body size and are therefore biologically relevant [4]. Vocal tract (VT) length and body size are anatomically correlated in savanna elephants [37,38]; VT length generally determines formant dispersion (FΔ, average spacing between successive formants). This in turn provides acoustic information about body weight and mass. The longer the vocal tract, the lower the formants and the narrower the overall FΔ [45].

The influence of an animal's body size on its sound production and vocal performance is an important biological constraint [46]. In a wide range of terrestrial mammals with pronounced sexual size dimorphism, it has been suggested that individuals, typically males, are able to produce vocalizations with lowered formants and formant dispersions. This may be achieved, for example, by extending the VT (e.g., red deer *Cervus elaphus*), by utilizing additional resonators, or by developing nasal proboscises (e.g., elephant seal *Mirounga* sp.). These adaptations help broadcast an exaggerated impression of body size in vocalizations involved in reproductive contexts (for a comprehensive review see the literature [47]). The savanna elephant's nasal vocal tract is exceptionally elongated compared to its oral vocal tract and hence occupies a special position amongst mammal vocal production. Savanna elephants follow the basic mechanism of mammalian sound production [48] and can make use of their nasal vocal path to emit rumbles. This enables them to lower their formant frequencies compared to orally emitted rumbles, making nasal rumbles particularly suitable to communicate over long distances [49]. Nonetheless, the adaptive significance of formant modulations in savanna elephants remains unknown: do the very low formant frequencies of rumbles reflect sexual (or other social) selection pressures to sound larger, or do they reflect natural selection pressures to maximize call propagation distances? Note that both selection pressures could be operating and are not necessarily mutually exclusive.

In the present study, we applied a resynthesis technique on male savanna elephant social rumbles to create playback stimuli with different formant variations for field propagation experiments. We manipulated the most consistent formant locations (i.e., the first and second formants, *F1* and *F2*, respectively) while leaving the f_o unchanged, and generated stimuli with apparent vocal tract length differences simulating different male body sizes (i.e., two different maturity groups). This approach was designed to determine whether lower formants propagate further than higher formants in comparable conditions while other parameters remain unchanged, and to evaluate the active communication range (information transmission) during daytime conditions. By broadcasting and re-recording rumbles at increasing distance, we quantified the extent to which size-related information degrades with increasing distance in a savanna elephant's natural environment. Our experimental and analytical approach also enabled us to assess the impact of two different habitats and environmental conditions on transmission properties in this long-distance call.

2. Materials and Methods

2.1. Sound Recordings of Playback Stimuli

The rumbles used in the propagation experiments originated from four adult male savanna elephants from four South African private elephant reserves (Table 1) recorded in social (nonreproductive) contexts (e.g., when individuals maintained vocal contact with other group members during free-roaming and browsing activities in areas of 3 to 45 km^2). Acoustic recordings were conducted throughout the day between 7 AM and 5 PM by following the animals on foot accompanied by the keepers, without any interaction with the animals. Recording distances of the selected vocalizations were less than 10 m from the calling individual.

We used an omni-directional Neumann KM183 condenser microphone (fitted with a windshield), modified for recording frequencies below 20 Hz (flat-recording down to 5 Hz). The microphone was

connected to a Sound Devices 722 (frequency response: 10 Hz–40 kHz, +0.1, −0.5 dB (gain controls centered); Sound Devices LLC, Reedsburg, WI, USA), recording rumbles with a 48 kHz sampling rate and an amplitude resolution of 16 bits.

Table 1. Study sites and age for each study subject.

Location, Year of Data Collection	Individual	Age (Years)	Approx. Shoulder Height (m)
Pilanesberg, 2014	Mike	~29	3.20 m
Bela Bela, 2014	Chishuru	~18	2.40 m
Hazyview, 2014	Medwa	~19	2.60 m
Addo Elephant Back Safaries, 2016	Thaba	~31	3.25 m [1]

~ indicates that the exact birth date is unknown. [1] Shoulder height measured in 2014.

2.2. Study Site and Conditions

Transmission experiments were conducted at the Addo Elephant National Park (AENP; 33°30′ S, 25°45′ E), Eastern Cape Province of South Africa, covering an area of approximately 270 km^2 (Roxanne Erusan, AENP Scientific Services, personal communication). The AENP is located in the endemic-rich, xeric succulent thicket vegetation (e.g., succulents, deciduous shrubs, lianas, and grass) of the Eastern Cape [50]. AENP hosts a variety of habitats from areas with a high density of thorny thicket vegetation (the most prominent plant is the succulent 'Spekboom', *Portulacaria afra*) up to 3 m high (rarely higher) to extensive areas of open grasslands [51]. AENP consists of a series of undulating hills with an altitude range of 60 to 350 m above sea level [52].

Propagation trials were carried out at two locations: the 'Rooidam' section, representing a densely vegetated habitat with slight height differences ranging from 1 to 13 m, and at the 'Gorah' section, an open grassland habitat with greater height differences (0–59 m). A total of six recording days (three per habitat) were conducted on 26, 30, and 31 March 2017, and on 1, 2, and 4 April 2017, respectively. Sound propagation in the African savannah is best after sunset and 1–2 h before sunrise when ground level temperature cools down [53]. Experiments started at 05:30 a.m. at the earliest (due to security reasons), and finished at the latest at about 09:00 a.m. under dry and low wind conditions.

2.3. Experimental Design

2.3.1. Preparation of Playback Stimuli

The focus of this study was on long-range nasal rumbles. The predicted formant locations for nasal rumbles are *F1* = 35.0 Hz and *F2* = 105.0 Hz using an estimated vocal tract (VT) length of 2.5 m [32]. In general, in savanna elephant vocalizations only the first two formants are consistently present [54–56]. After visual spectrographic inspection of our sound recordings in Praat [57], we preselected one nasal rumble per individual with low levels of background noise, clear f_0 and upper harmonics including *F1* and *F2*. Rumbles with formants equal or below the predicted values mentioned above were classified as nasally emitted.

For each stimulus a stop Hann band (0–5 Hz) and pass Hann band (6–200 Hz) filter was applied in Praat. This enabled proceeding solely with the relevant frequency ranges and removed as much background noise as possible.

We used the 'To Formant (keep all)' Praat function to inspect each rumble visually and automatically track formants. This yielded the optimal analysis settings (e.g., formant number: 2, maximum formant: 110 Hz, window length: 0.3, pre-emphasis: 5 Hz; note that these setting differed according to the rumble used).

Formants were modified using a custom-written script applying the source–filter resynthesis technique in Praat. Each rumble's formant locations were down- and upshifted by 25%. We additionally used a 0% shift condition, where formants remained in their original position to control for the resynthesis procedure (i.e., original and '0% shifted' rumbles are identical). Other acoustic parameters

(e.g., f_o, duration) remained unchanged for all three variants. All sound stimuli were normalized to a peak intensity of 0.99, yielding a test set of 12 WAV sound files, i.e., three different shift conditions per individual (see Table S1 for the measured formant values).

2.3.2. Field Recordings

To examine the transmission success of rumbles with increasing distance, we played back and re-recorded 504 male rumbles in total (252 per habitat) at 50 m, 100 m, 200 m, 400 m, 800 m, 1000 m, and 1500 m. We used a custom-made subwoofer INFRA10 (dimension: 198 × 166 × 171 mm, weight: ~300 kg) linked to a rechargeable multipower MP45-12 lead-acid battery and a JL Audio HD1200/1 audio amplifier, connected to a 722 Sound Device HDD recorder to broadcast the playback stimuli. The INFRA10 is constructed for low frequencies, giving a flat response from 10 to 200 Hz at peak sound pressure levels measured at 1 m from the source of 110 dB at 10 Hz (referenced to 20 µPa). Stimuli were played back in sequences (with one sequence consisting of all three shift variants) at 105 dB ± 1 dB at 1 m, measured with a NTi NG AL1 sound pressure level meter equipped with a calibrated NTi MiniSPL microphone (settings: max SPL with SPL/RTA mode and FLAT response (unweighted)). In addition, we compared the playback recordings with the original stimuli in order ensure that signals were broadcasted correctly. Re-recordings were conducted using the identical recording equipment and settings used for recording the stimuli. The recording level remained unchanged and the same for all recording distances during the experiments (set at 60.5 dB at the 722 Sound Device recorder).

Two operators, using one Toyota Hilux pick-up each, conducted the field experiments. The subwoofer was mounted and transported on the loading zone of one pick-up, 1 m above the ground (see schematic representation in Figure 1). For each recording distance the subwoofer remained at a fixed position, while the second vehicle (the 'recording vehicle'), from which the playback stimuli were recorded, was moved to the recording distances. During each trial, the playback and recording vehicles were in contact using a Stabo Freecomm 650 PMR radio set and mobile phones. To evaluate each recording distance's position, we used the vehicles' mileage counter and a Nikon Aculon ALL11 laser rangefinder. We additionally used the iOS application GPS Tour 2.0 [58] to track latitude, longitude, and altitude in order to verify the exact position and sea level for each distance (Figure 2). Landmarks were used to permanently mark each relevant distance for the entire experiment. Since GPS receivers use smoothed models of altitude to calculate elevation, we first converted these ellipsoidal heights into topographic heights (using a geoid height calculator [59]) before calculating absolute height differences between recording and subwoofer locations for each transmission distance (Table S2). The microphone was mounted and stabilized on a tripod outside the vehicle. To ensure direct orientation of the microphone towards the subwoofer's broadcast direction, we used Bushnell powerview mid 10 × 42 binoculars for adjustments. Due to limited vision between both vehicles in the densely vegetated habitat (~3 m height of succulents), we used additional landmarks at each recording distance to point towards the subwoofer's direction. To do this, the person operating the subwoofer positioned him- or herself centrally on top of the speaker (to be at the same level as the bush thicket), facing the subwoofer's membrane and broadcasting direction. After visually confirming the subwoofer's operator using a binocular, the person operating the recording equipment set the landmarks indicating the direction of the microphone towards the subwoofer for all follow-up trials.

For each distance, one playback sequence (consisting of the three formant shift variants 25% Down, 0% Unchanged, and 25% Up) for each individual (N = 4) was broadcasted, yielding a total of 84 playbacks across all seven recording distances per habitat and day. Depending on the occurrence or intensity of ambient noise (e.g., passing aircrafts), the respective playback sequence was repeated. To document atmospheric state per sequence, we used an anemometer PCE-THA 10 to measure temperature in °C, wind speed (m/s), and relative humidity (%).

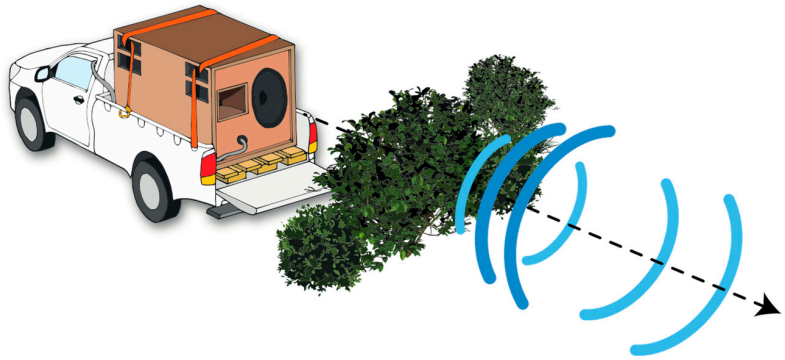

Figure 1. Schematic representation of the positioned infrasonic loudspeaker system at a densely vegetated location. The battery-supplied INFRA10 is mounted on the loading zone of a pick-up and operated inside the vehicle (broadcasting direction of playback stimulus indicated by dashed arrow).

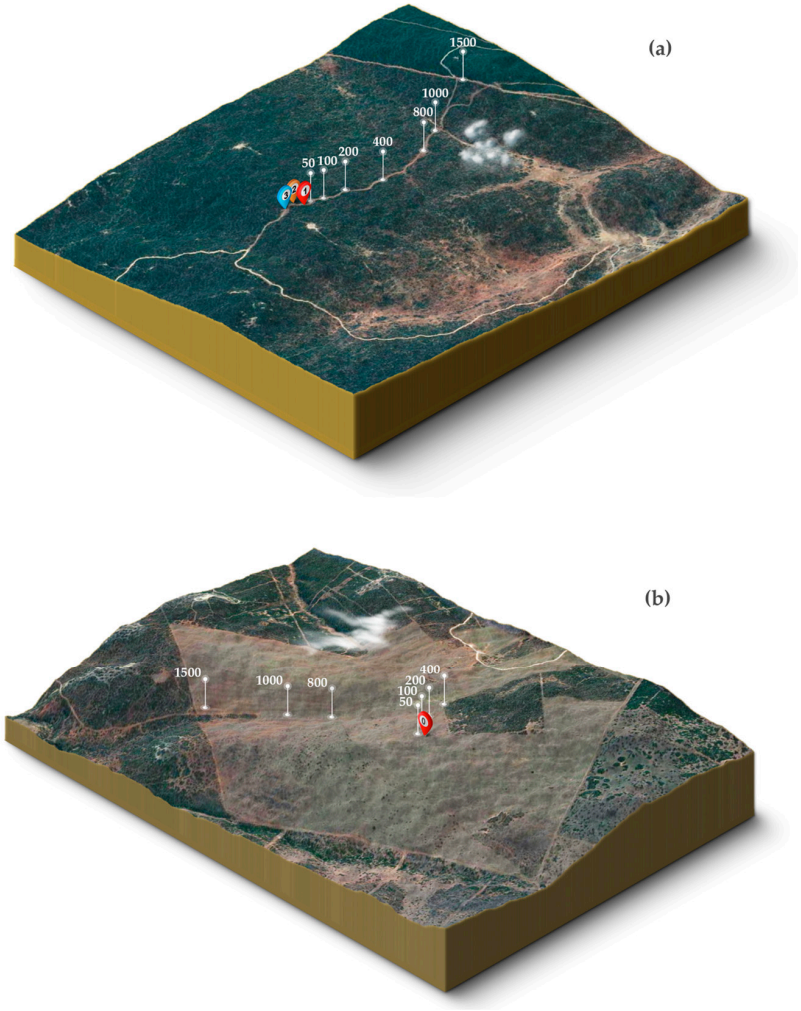

Figure 2. Topographical maps of both study sites, the densely vegetated (**a**) and the open (**b**) habitat. Vertical lines indicate the positions for each recording distance, ranging from 50 to 1500 m. The colored and numbered pins represent the fixed position of the subwoofer. In (**a**), pin #3 (in blue) corresponds to the position of the subwoofer for 1500 m, pin #2 (in orange) to the position of the subwoofer for 1000 m, and pin #1 for all other recording distances. Pin #0 (red) (**b**) represents the subwoofer's position used to broadcast playback stimuli for all recording distances. Figures were generated using 3D Map Generator Terrain v1.4.2 (The Orange Box, Berlin, Germany) and Adobe Photoshop CC 2014 (Adobe Systems Incorporated, San Jose, CA, USA).

2.4. Acoustic Analyses

2.4.1. Fundamental Frequency (f_o) Analysis

Data were segmented by defining the on- and off-set of each rumble using a customized annotation and labeling tool in S_Tools-STx 4.4.6 [60]. We used a custom-written STx script based on an autocorrelation method to automatically extract source-related f_o parameters f_o *min*, f_o *max*, f_o *start*, f_o *end*, f_o *center*, and f_o *mean* (in Hertz). This is based on the total number of measuring points (Ntotal), determined by segment length and f_o *min* (f_o *min* determines the length of the analysis window that has to correspond to three f_o *min* periods; i.e., the lower f_o *min*, the longer the analysis window). We used a 75% overlap between successive kessel analysis windows with a bandwidth of 1 Hz. Only the number of frames with nonzero f_o values (Nf_o) were considered for further analyses.

2.4.2. Formant Frequency Location (F1, F2) Analysis and Vocal Tract Length

Prior to analysis all sound files were downsampled at 500 Hz, resulting in a frequency range of 0 to 250 Hz. Following the computation of LPC (Linear Predictive Coding)-smoothed spectrums in the range of 0 to 250 Hz using S_Tools-STx 4.4.6 (it was not possible to track formant frequencies continuously over the entire signal in Praat in our long-distance re-recordings), we measured the center frequency (in Hz) of the LPC spectral peaks, indicating formant positions. Differing experimental conditions in both habitats, such as higher background noise or wind speed, caused structural variation within the re-recorded sound signals. We therefore allowed a tolerance measurement of ±0.5 s for the re-recordings based on the original measuring point of the corresponding playback stimuli. That is, if the LPC peak of *F1* in the original stimulus was measured at 2.5 s, *F1* in the re-recorded stimulus could be measured between 2 s and 3 s. A comparison of LPC peak measurements of an original and re-recorded stimulus of all formant shift variants is illustrated in Figure 3.

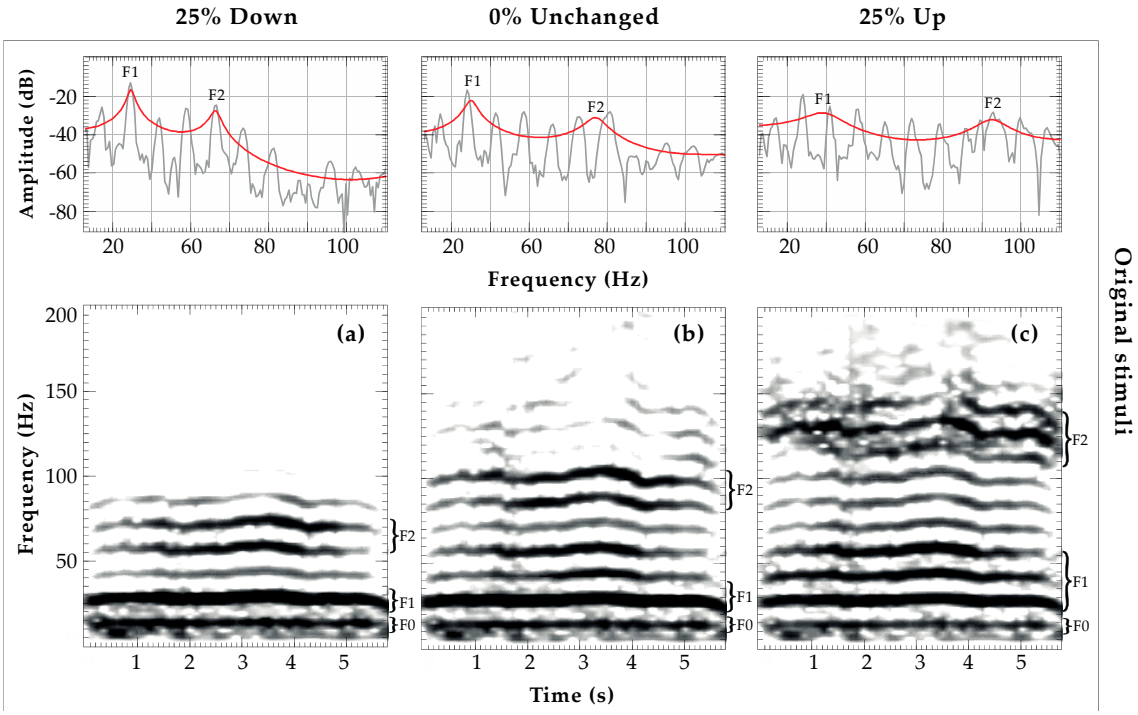

Figure 3. *Cont.*

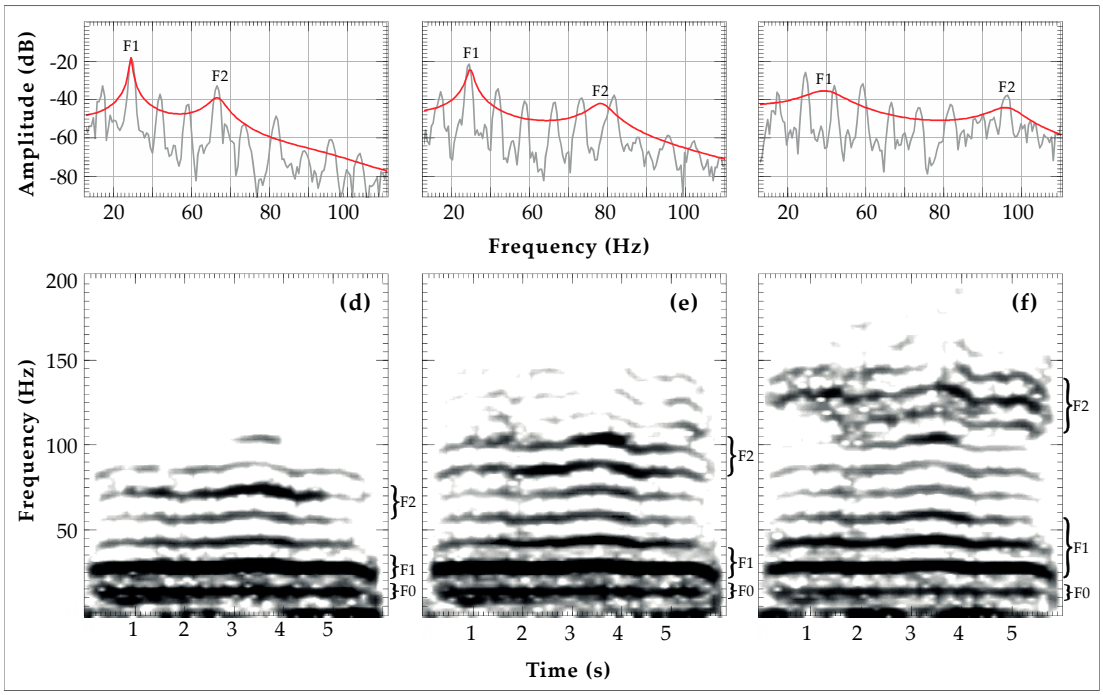

Figure 3. Narrow-band spectrograms and LPC spectra, indicating f_o, *F1*, and *F2* location for each shift variant (25% Down, 0% Unchanged, and 25 % Up) of the original test data set (**a**–**c**) and the corresponding playback recordings from 50 m distance (**d**–**f**) (S_Tools-STx settings; analysis windows: Kaiser kessel, bandwidth: 2, overlap: 75%).

In the present study, the second formant was less consistent than the first one, making it difficult to calculate FΔ and, therefore, a predicted VT length. Since VT length affects the overall formant frequency pattern, and the lowest formant potentially provides some information on VT length [45], we used *F1* to calculate 'estimated VT lengths' based on the equation $F_1 = \frac{c}{4L}$, where *c* is the speed of sound (343.5 m/s [61]), and *L* is the length of the supralaryngeal vocal tract (assuming that the VT is a resonant tube open at one and closed at the other) [40].

2.4.3. Amplitude Attenuation of Acoustic Features (SNR)

To assess the amplitude attenuation of *F1*, *F2*, and f_o over distance in both habitats, we calculated the respective 'Signal-to-noise Ratio' (SNR) of these parameters with a custom-written script in S_Tools-STx. To examine environmental background noise levels alone, we extracted a 0.5 s segment directly before the onset and after the offset of each playback sequence. Root Mean Square (RMS) values for the environmental background noise were then computed at three frequencies (those corresponding to *F1*, *F2*, and f_o in the playback segment) from an averaging of both noise segments. In parallel, for each playback segment, three RMS values were also measured, exactly at *F1*, *F2*, and f_o. For each of these parameters, SNR was then determined by subtracting the RMS of the averaged noise segment (again only at the frequency of *F1* and not over the entire frequency range) from the RMS of the playback segment. This procedure was applied to determine SNR for *F1*, *F2*, and f_o independently.

2.5. Statistical Analyses

To provide a way of determining 'transmission success' of playbacks through the environment, we calculated absolute numbers and percentages of successfully transmitted rumbles for each recording distance. Rumbles with a Nf_o detection rate below 60% were treated as insufficiently detected and hence discarded from further analysis. To assess the stability of the acoustic features, we compared *F1*, *F2*, f_o *mean*, and duration of rumbles with successful transmissions at 100 to 1500 m recording distance

to rumbles obtained from the lowest distance, 50 m, by using nonparametric Mann–Whitney U tests (suited for non-normal distributed data).

Formants in nasal rumbles of savanna elephants encode information on maturity (i.e., age and body size) [37,38]. We therefore used VT length estimations (in m) to split our data set into two size groups ('maturity group 1' > 3 m and 'maturity group 2' ≤ 3 m). To examine differences between those groups per recording distance and per habitat, we performed Mann–Whitney U tests.

To assess attenuation of *F1*, *F2*, and f_o with increasing distance from 50 to 1500 m, for each habitat, the SNR of each acoustic feature was regressed with recording distance using linear regression. The relationship between SNR and distance was then quantified by computing Cohen's effect size index, f [62], for regression models using equation $f = \sqrt{\frac{R^2}{1-R^2}}$. All statistical tests were conducted using IBM SPSS statistics version 23 [63]. Significance levels were set at 0.05 and two-tailed statistics are reported.

3. Results

3.1. Transmission Success

As expected, the propagation experiments conducted at the Addo Elephant National Park showed that the transmission success in two different habitats, densely vegetated and open, decreased with distance. The dense habitat resulted in a transmission success of 93.3% for *F1*, 59.1% for *F2*, and 59.1% for f_o *mean*, whereas in the open habitat f_o *mean* reached 57.5%, *F2* 63.1%, and *F1* 85.7%. The transmission of *F1* was most efficient compared to *F2* and f_o *mean* in both habitats (Figure 4).

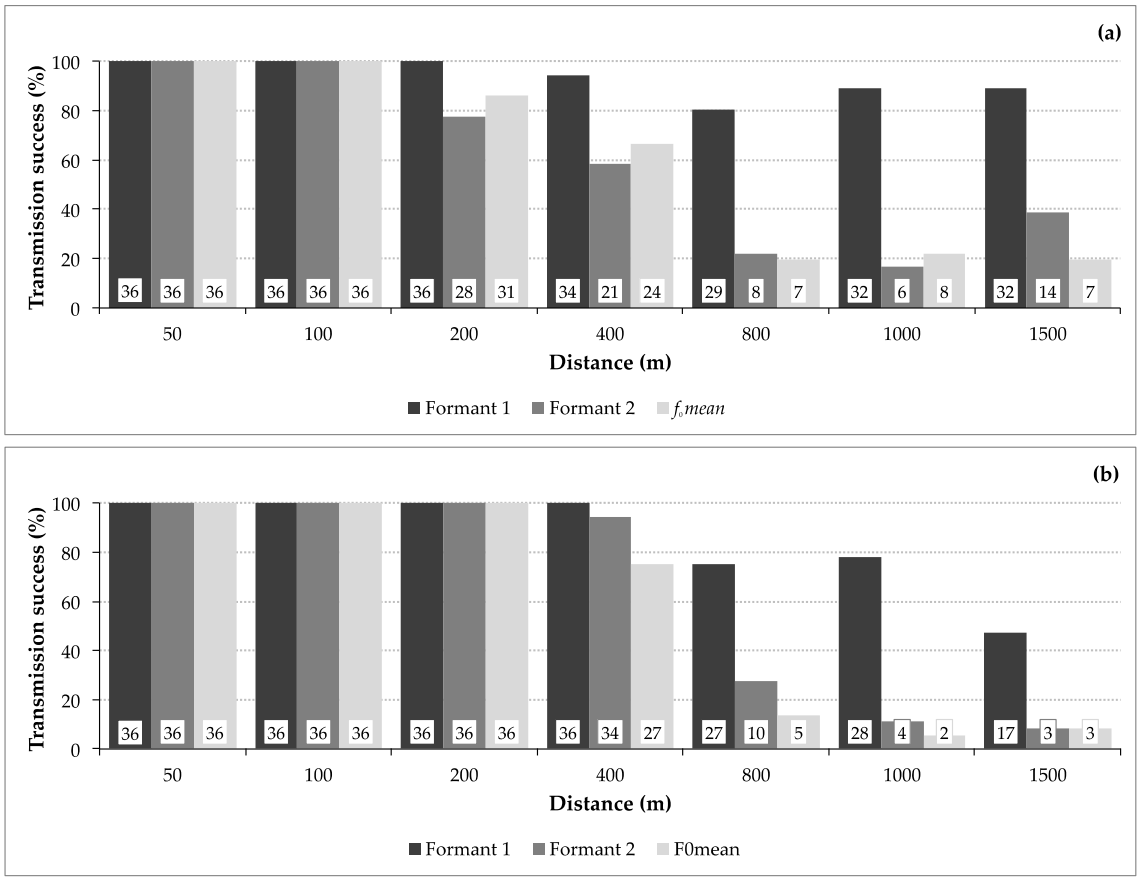

Figure 4. Transmission success (in percent) of *F1*, *F2*, and f_o *mean*: Comparison of each acoustic feature between the (**a**) dense and (**b**) open habitat over 50 to 1500 m distance. Values given at the bottom of the bars indicate the absolute number of recordings successfully transmitted per distance.

Our comparisons of frequency parameters measured at 100 to 1500 m distance to those analyzed at 50 m revealed no significant differences (except for *F2* at 1000 m in the open habitat with $p = 0.038$, note the difference of N = 32 though). In particular, the signal length (duration) of the re-recordings revealed deviations, showing significant differences between 800 m, 1000 m, and 1500 m, respectively (Table 2). Visual examples for successful propagations of 0 % shifted and 25 % downshifted playback stimuli between both habitats can be identified from Figure 5.

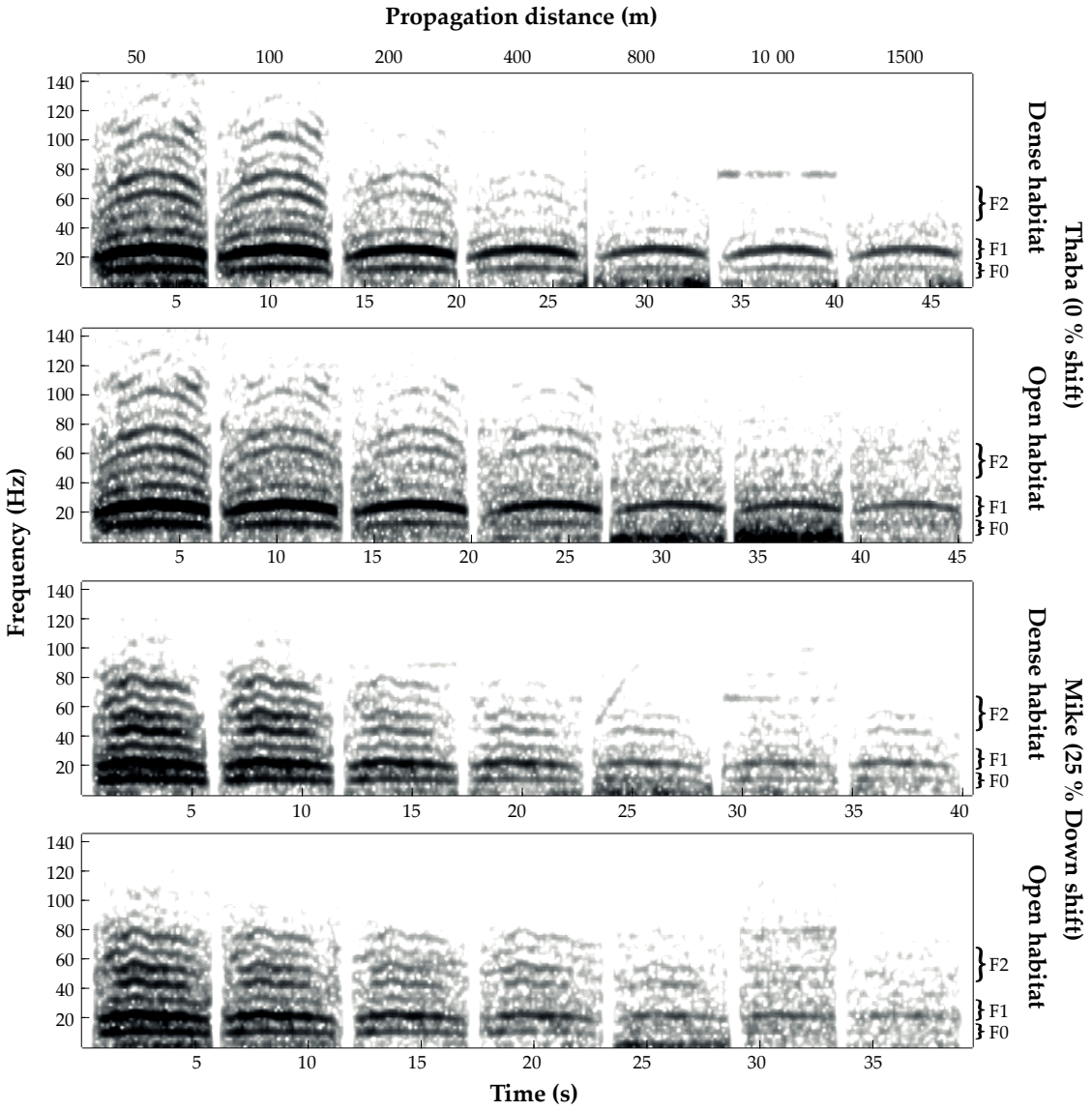

Figure 5. Spectrograms of concatenated 0% (from Thaba) and 25% downshifted (from Mike) re-recordings conducted from 50 to 1500 m for both dense and open habitat, respectively. Curly brackets indicate location for *F1* showing the highest transmission consistency, while f_0 and *F2* were less well-defined (S_Tools-STx settings; analysis windows: Kaiser kessel, bandwidth: 2, overlap: 75%).

Table 2. Acoustic features recorded and measured at 50 m compared to all other distances ranging from 100–1500 m using Mann–Whitney U tests.

Habitat	Distance (m)	Acoustic Features																		
		Formant 1 (Hz)					Formant 2 (Hz)					*f_0 mean* (Hz)					Duration (s)			
		N	TS	U	Z	P	N	TS	U	Z	P	N	TS	U	Z	P	N	U	Z	P
Dense	**50**	36	100	-	-	-	36	100	-	-	-	36	100	-	-	-	36	-	-	-
	50–100	36	100	636	−0.135	0.892	36	100	646	−0.028	0.978	36	100	645	−0.039	0.969	36	622	−0.298	0.765
	50–200	36	100	629	−0.220	0.826	28	78	454	−0.683	0.494	31	86	542	−0.201	0.840	36	604	−0.501	0.616
	50–400	34	94	587	−0.300	0.764	21	58	356	−0.364	0.716	24	67	364	−1.027	0.305	36	557	−1.031	0.303
	50–800	29	81	501	−0.277	0.782	8	22	120	−0.730	0.465	7	19	72	−1.778	0.075	32	376	−2.464	0.014
	50–1000	32	89	556	−0.252	0.801	6	17	72	−1.294	0.196	8	22	129	−0.442	0.659	36	442	−2.320	0.020
	50–1500	32	89	561	−0.184	0.854	14	39	200	−1.124	0.261	7	19	117	−0.313	0.754	36	432	−2.433	0.015
Open	**50**	36	100	-	-	-	36	100	-	-	-	36	100	-	-	-	36	-	-	-
	50–100	36	100	642	−0.068	0.946	36	100	637	−0.130	0.897	36	100	623	−0.282	0.778	36	621	−0.304	0.761
	50–200	36	100	608	−0.451	0.652	36	100	646	−0.023	0.982	36	100	645	−0.039	0.969	36	644	−0.051	0.960
	50–400	36	100	610	−0.434	0.665	34	94	588	−0.282	0.778	27	75	411	−1.042	0.297	36	613	−0.400	0.689
	50–800	27	75	450	−0.500	0.617	10	28	118	−1.665	0.096	5	14	62	−1.117	0.264	34	435	−2.086	0.037
	50–1000	28	78	453	−0.697	0.486	4	11	26	−2.074	0.038	2	6	36	0.000	1.000	31	350	−2.616	0.009
	50–1500	17	47	298	−0.162	0.871	3	8	30	−1.265	0.206	3	8.	45	−0.475	0.635	21	138	−3.979	0.000

N = number of analyzed rumbles at 50–1500 m; TS = Transmission success of Formant 1, Formant 2 and *f_0 mean* in percent (%); U = Mann–Whitney U test U-score; Z = Mann–Whitney U test Z-score, p = significance level ($p = 0.05$).

3.2. Transmission of Size Information

VT length in savanna elephants is a reliable cue to body size [37,38]. By categorizing the recorded signals into two different size groups based on VT length estimations ranged from 2 to 5.47 m, our data showed significant differences for *F1* between rumbles simulating large (maturity group 1, MG 1) and small (maturity group 2, MG 2) male elephants. Dense habitat: $F1_{MG1}$ = 23.55 ± 3.19 Hz (N = 140), $F1_{MG2}$ = 35.28 ± 4.47 Hz (N = 95), X^2 = 169.073, df = 1, $p < 0.001$; Open habitat: $F1_{MG1}$ = 23.67 ± 3.29 Hz (N = 125), $F1_{MG2}$ = 35.40 ± 4.68 Hz (N = 91), X^2 = 157.263, df = 1, $p < 0.001$).

Moreover, Kruskal–Wallis tests confirmed stable transmission of *F1*, with no significant differences of *F1* over distance for MG 1 at the dense (N = 140, X^2 = 2.569, df = 6, p = 0.861, r = 0.2) and open habitat (N = 125, X^2 = 4.855, df = 6, p = 0.563, r = 0.4). MG 2 was not statistically different in the dense habitat (N = 95, X^2 = 7.055, df = 6, p = 0.316, r = 0.7), while there was a significant change in the transmission of *F1* for MG 2 in the open habitat (N = 91, X^2 = 20.681, df = 6, p = 0.002, r = 2.167) over distance. However, performing pairwise comparisons using Dunn–Bonferroni post hoc corrections (adjusted significance level p = 0.002) did still not result in any significant differences for MG 2 in the open habitat ($p > 0.002$).

3.3. Amplitude Attenuation

Figure 6 shows that, overall, each acoustic parameter exhibited stronger attenuation with increasing distance for both habitats, with high effect sizes (f > 0.5) for all regression models. For instance, the SNR for *F1* at 1500 m was 10.4 ± 6.0 dB for the densely vegetated and 8.4 ± 2.2 dB for the open habitat. Mean SNR ± standard deviation for each recording distance (for *F1*, *F2*, and f_o) and per habitat are listed in Table S3. Additional ANOVAs (temperature, wind speed, humidity, and height were not included as covariates due to inhomogeneity of regression coefficients; measurements are given in Table S4) testing for differences between both habitats revealed significant differences for *F1* only (N_{Dense} = 235, 19.1 ± 10.3 dB, N_{Open} = 216, 17.3 ± 8.0 dB; Anova: F = 4.339, df = 1, p = 0.038). In contrast, *F2* (N_{Dense} = 149, 18.6 ± 12.2 dB, N_{Open} = 159, 19.5 ± 7.6 dB; Anova: F = 0.576, df = 1, p = 0.448) and f_o *mean* (N_{Dense} = 148, 20.2 ± 7.8 dB, N_{Open} = 136, 19.9 ± 6.0 dB; Anova: F = 2.080, df = 1, p = 0.150) showed no differences.

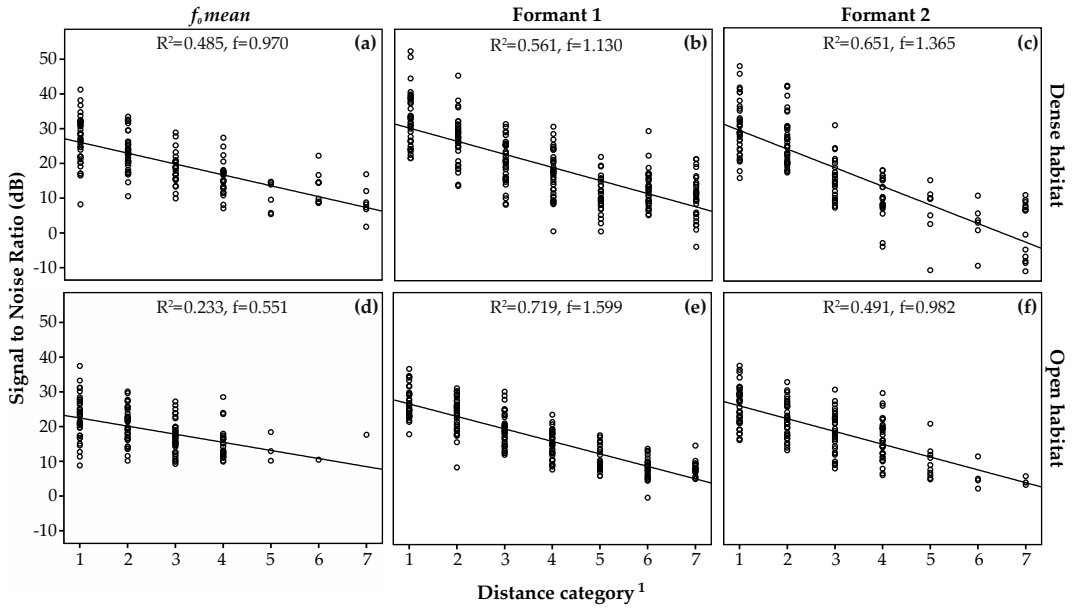

Figure 6. Signal-to-Noise ratio and regression lines for f_o *mean* (**a**,**d**), Formant 1 (**b**,**e**), and Formant 2 (**c**,**f**) per habitat over all recording distances (top three figures represent the densely vegetated and the three bottom figures the open habitat) show formant and f_o attenuation with increasing distances. Cohen's f indicates the effect sizes (f > 0.5 represents a strong effect size). [1] Distance category: 1 = 50 m, 2 = 100 m, 3 = 200 m, 4 = 400 m, 5 = 800 m, 6 = 1000 m, 7 = 1500 m.

4. Discussion

The field propagation experiments described in this paper reveal novel insights into the transmission of the infrasonic and long-ranging savanna elephant rumble. Our results show that the stability of spectral features in rumbles of four male savanna elephants, conveying measurable size-related information [37], prevailed over distances of up to 1.5 km under two different habitats. However, it remains to be investigated whether savanna elephants can indeed perceive rumbles with the obtained SNR values. Sounds are processed within listener's auditory system, but in savanna elephants, to our knowledge there is no data available on their hearing threshold or other hearing capabilities, such as directional hearing, sound localization, antimasking mechanisms, critical bandwidths, and critical ratios [64]. In addition, hearing sensitivity might as well be influenced by sex and age [65–69] in this species.

Previous research using playback experiments demonstrated that savanna elephant rumbles encode acoustic information about sex, reproductive state, and even social identity [38,70–73]. Savanna elephants are capable of not only recognizing rumbles of other family and bond group members within their population but also of discriminating calls from conspecifics they encountered more or less frequently [71]. It has also been shown that savanna elephants detect contact rumbles broadcasted at distances ranging between 0.5 and 2.5 km, revealing their ability to recognize rumbles and to assign them to family members at distances up to 1.5 km [33,54]. Nonetheless, as vocalizations propagate through an animal's natural environment, they degrade over distance in various acoustic parameters such as amplitude (source intensity) and frequency patterns. This can potentially affect the detection of acoustic features and eventually hinder savanna elephants' discriminative abilities. McComb et al. [54] found that *F2* (harmonics region around 115 Hz) was the most prominent and persistent acoustic feature measured in rumbles over distance. They suggested accordingly that frequencies above the infrasonic range play an important role for social recognition in savanna elephants. Our findings provide a key difference to these previous results, as our transmission profiles showed that efficiency and persistency were highest for *F1* and a clear loss of higher harmonics in the *F2* region, as shown in forest elephants [74]. Yet, importantly, our results support McComb et al.'s conclusion highlighting the relevant role of frequencies above infrasound in savanna elephant communication (given that *F1* is usually around 25 to 35 Hz). We observed a similar degradation pattern between *F2* and f_o, where contour detection in both experimental habitats was most consistent between 50 and 400 m, but dropped increasingly from 800 m to 1.5 km.

In contexts of male competition, formant frequencies have been described in several mammal species (e.g., red deer [42] and koala [75]) as robust acoustic indicators of a caller's body size (more so than f_o [45]). In a previous research project we revealed that formant frequencies generated via the nasal vocal tract serve as an honest cue to the maturity status (age and body size) in male savanna elephants [37]. We show that this information is likely to be transmitted over distance since significant differences between both bull size categories ($\leq$3 m and >3 m) remained in both habitats (yet, our sample size is considerably small). Note, however, that VT length estimations, and hence body size predictions in the present study, were based on individual *F1* frequencies instead of formant spacing because *F2* transmission was inconsistent and difficult to identify, particularly at larger distances. Earlier studies raised concerns about the reliability of using one formant as a single cue for VT length, due to environmental factors potentially degrading the chosen frequency band and to sensitivity to possible deviations from the uniform tube assumption [45,76]. Therefore, this might lead to imprecise VT length estimations. Formant dispersion, in contrast, relies on redundant formant spacing patterns and is considered to be more resistant to adverse environmental distortion factors and individual formant variability [45]. Consequently, most playback studies examining the relevance of formants used formant dispersion as a measure of size discrimination [43,44,77,78]. Other perceptual studies, however, showed that some non-human primates place more weight on the position of *F1* than *F2* [79]. Since *F2* was measured inconsistently at longer recording distances, we estimated VT length using *F1* locations. Furthermore, we provide evidence that, particularly, *F1* frequencies propagated with

higher consistency than f_0 and *F2* across and between all measuring points in both tested habitats. Our results demonstrate that *F1* in nasally emitted social rumbles may travel up to 1.5 km and underline their informative value and potential relevance for long-distance communication where body-size assessment matters.

The spectral and temporal acoustic characteristics of a sound determine how far it will travel through the environment [9,11]. However, sound propagation and sound detectability are also critically determined by the habitat structure, ambient noise source, and local atmospheric conditions (such as temperature, wind, and humidity). These can either favor or impede sound propagation [7]. The speed of sound in any given terrestrial environment depends on air temperature. For instance, the approximate speed of airborne sound at 20 °C is 343.5 m/s (using the formula c = 331.4 + 0.607 × ambient temperature (°C)[61]). Rising temperatures boost sound velocity. Humidity may also increase the speed of sound, e.g., at 100% relative humidity and 20 °C, sound velocity is approximately 0.3% greater than at 30% relative humidity [12,61]. Furthermore, empirical data and computer modeling of the African savannah revealed that optimal conditions for elephant low-frequency sound propagation are given under low wind and cool temperatures, particularly 1–2 h after sunset when air at ground level cools down rapidly [80]. Therefore, Garstang et al. [80] proposed that savanna elephants adapt their long-ranging and low-frequency calling rates to atmospheric conditions. These authors suggested that, by making use of near-surface temperature inversions, savanna elephants can increase their call propagation ranges considerably (up to 10 km under ideal atmospheric conditions) [80]. However, whether they actually do adjust their vocalizations to optimal atmospheric conditions is not supported by any data provided so far.

To date, the behavioral responses of wild savanna elephants to playback stimuli have been experimentally documented at a maximum distance of 2.5 km only [54] (but were estimated to be audible to conspecifics at least 4 km away from the source using data extrapolations [33]). Furthermore, wind can be directly related to turbulence and cause more than mere attenuation along a sound's broadcast direction [7]. Our experiments were thus always conducted under low wind conditions. Nonetheless, although wind speed measurements were conducted at the site of the re-recordings, we cannot rule out that sudden wind gusts between both vehicles might have affected the broadcasted signals.

Differences in vegetation, topography, and atmospheric conditions can influence sound transmission via reverberation, amplitude fluctuations, and attenuation at all frequencies, and result in temporal and spectral degradation of various degree [7–12]. While we did not find any frequency-dependent differences in propagation between open and dense habitats, we did observe deviations in call duration at larger recording distances. However, to what extent temporal degradation processes might play a role for signal detection or distance assessment requires further investigation.

Signal detection and recognition strongly depend on the signal-to-noise ratio (SNR), a measure of a signal's maximum amplitude relative to ambient noise. Therefore, ambient noise level (in addition to atmospheric distortion factors) also plays an important role in sound detection [9]. However, it is suggested that signal amplitude alone is not entirely reliable cue for distance assessment and that temporal and/or frequency-specific structures are likely to serve as more complex acoustic cues [17–19]. Our analyses of rumble broadcast data confirmed the prediction for degradation trends for *F1*, *F2*, and f_0 *mean*: transmission efficiency and intensity of rumbles decrease progressively with increasing distance. Not only unnoticed wind gusts between both vehicles during the experiments but height differences might also have played a role in sound transmission through changes in SNRs. The terrain of the open habitat showed greater height differences between the subwoofer and the respective recording distance than the more densely vegetated habitat. However, if this effect on SNR was present it appears negligible as, overall, we found no noticeable differences in transmission efficiency between both habitats. However, low-frequency sound waves tend to be enhanced particularly when traveling above porous surfaces (such as soil or sand) because larger sound wavelengths penetrate the ground pores less [16]. Although this insight was not obtained experimentally, we cautiously assume

that constructive ground effects in the tested habitat could likely enforce long-distance rumbles by superimposed reflections, as it has been recently suggested for the densely vegetated habitat of forest elephants [74].

The pioneering field playback studies in the early 1990s and 2000s conducted by Langbauer et al. [33] and McComb et al. [54] provided first evidence on the nature of rumbles and their importance for long-distance communication. Our results are in general in agreement with savanna elephant's large body size allowing the production of low-frequency and high-intensity rumbles, both favoring propagation to distances over which this species communicates. McComb et al. [54] found that frequency peaks in rumbles re-recorded over several hundred meters remained most prominent and stable in the *F2* region. Our results indicate that formants likely serve as long-range signal in savanna elephants, instead of being merely relevant for short- to medium-range communication, as previously suggested [54]. Importantly (both from a theoretical and practical standpoint), most of the acoustic energy in our study was concentrated and persisted at the *F1* frequency position, compared to *F2* and f_0 *mean*. The use of female rumbles by McComb et al. [54] and male rumbles in our study is a potential factor explaining deviations between both studies, i.e., sexual vocal dimorphism in social rumbles [38], which however requires further testing. Finally, differences between our findings might merely reflect the use of different equipment (e.g., speaker, variation of frequency responses between microphones and analog DAT recorders [54]).

5. Conclusions

In conclusion, our study describes how the environment can influence propagation of rumbles and what kind of information might be transmitted successfully over distance. Future field playback experiments using formant-shifts, and thus different size variants of male rumbles, could provide information on two aspects: assessing the size discrimination abilities of savanna elephant bulls based solely on vocalizations, and identifying how rumble degradation over distance relates to its perception in this species.

Supplementary Materials: The following are available online at http://www.mdpi.com/2076-2615/8/10/167/s1; Table S1: Formant-related features measured in S_Tools-STx; Table S2: GPS coordinates and topographic height per habitat and recording distance; Table S3: Signal-to-noise ratios: mean, ± standard deviation (Stdev); Table S4: Atmospheric conditions (mean ± standard deviation) for each recording distance and habitat.

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CHAPTER 3.2

Elephant infrasounds: long-range communication

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Abstract: Infrasound in the range of 1 to 20 Hz may be generated and/or detected by elephants over distances in excess of 10 km. Complex sounds generated by conspecifics can be interpreted over ranges of kilometers to aid in social cohesion, definition of territory, reproduction, resource utilization and avoidance of predators. Abiotic sounds may be detected over distances of a few hundred kilometers, further aiding in the animals survival. Physical conditions at the surface and in the atmosphere can inhibit or enhance these processes, and evidence is presented to suggest that elephants respond, if not directly, then indirectly to these physical constraints.

Keywords: elephant calling; infrasound; acoustic signaling; atmospheric conditions and vocalization; long-range vocalization; abiotic sounds

I. Introduction

Near infrasound lies in frequencies below human hearing between 1 and 20 Hz, with wavelengths between 350 and 17 m. A number of terrestrial animals generate, detect and respond to infrasonic signals. The African elephant, *Loxodonta africana*, stands out among those as a mammal known to use loud, low-frequency, long-range communication as an integral part of its behavior. Elephants can generate sounds with frequencies below 10 Hz and can detect sounds as low as 1 Hz. The focus of this chapter will be on the African elephant and its use of long-range infrasonic communication.

The concept of acoustic range, when applied to an animal, is a behaviorally-dependent variable. Range is functionally dependent on physical conditions, such as habitat and atmospheric state. Similarly, characterizing range as "long" is not subject to simple definition. For the purposes of elephant infrasonic communication, long range may be considered as beyond visual detection and out of high-frequency acoustic range. The maximum range over which the loudest low-frequency call of an animal can be transmitted and detected by a conspecific is a desirable number since it has implications for territory, reproduction, resources utilization and predation.

Communication can be defined as an association between a sender and a receiver's behavior as a consequence of a signal (Wiley and Richards, 1978). The information contained in a signal at its source, referred to as the broadcast information, always equals or exceeds the received information. Harmonics of infrasonic fundamental frequencies extend into the audible range, and may contain important information (McComb et al., 2003). These higher frequencies will be the first to be attenuated over distance, thus complicating the concept of range. Nevertheless, atmospheric conditions most conducive to the transmission of the fundamental infrasonic signal will mean that the associated higher frequency harmonics will also travel the greatest distance. Long-range, low-frequency communication must therefore be considered both from a theoretical point of view, as well as a practical acoustic and behavioral response.

Sound pressure level (SPL) is measured with respect to a specified level of 20 micropascals and is stated in decibels (dB) relative to that level. For sound sources it is often specified at a fixed distance of 1 m (Pierce, 1981). The distance over which a given animal call can be detected depends on the intensity or loudness of the call and the threshold of hearing of the animal receiving the call. Both numbers are poorly known for animals other than humans. The intensity of a call by an adult elephant is thought to

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approach 120 dB between 14 and 35 Hz (Poole et al., 1988). Heffner and Heffner (1980, 1982) measured the threshold of hearing of a 7-year-old Asian elephant (*Elephus maximus*) of 60 dB SPL calling at 17 Hz and 65 dB SPL at 16 Hz. The uncertainty in numbers describing the intensity of a call and the threshold of hearing for elephants probably results in an uncertainty in the determination of the range over which a given loud, low-frequency call can be heard is at least ±10%. This uncertainty is amplified when translated into area.

Elephants can certainly hear and respond to abiotic infrasonic sounds. Ocean waves breaking on shore lines generate sounds around 1 Hz which can travel thousands of kilometers in the atmosphere (Bedard and Georges, 2000; Boermer, 2006; Bass et al., 2007). Large thunderstorm clouds contain convective eddies which generate infrasound that travels hundreds of kilometers (Garstang, 2004). Helicopter blades similarly produce infrasound that can be heard by animals at ranges of 100 km (Payne, personal communication). Low-frequency elephant vocalizations may be transmitted as seismic waves in the surface substrata (Günther et al., 2004). Equally, elephants may respond to low-frequency sounds produced by other mammals, such as lion (*Panthera leo*) and hippopotamus (*Hippopotamus amphibius*) (Barklow, 2004).

In the sections below we will explore some of the specific adaptations which allow elephants to communicate over long distances at low frequencies, the biological benefits of such long-range communication and the physical conditions of elephant habitat which promote or inhibit communication.

II. Specific adaptations

Although the vocal and auditory characteristics of an elephant are by no means unique in the mammalian world, they both exhibit features which support the ability to generate and detect infrasonic sounds. Probicidians evolved within forests over a period of many millions of years. By the time of the beginning of the Miocene (24 million years ago), forests receded and savannas appeared and most of the morphological features of present-day elephants were well-established (Shoshani, 1998). Large lungs and vocal folds with their own mass and elasticity act as self-oscillating mechanical vibrators generating acoustic energy and fundamental frequencies which are at least as low as 15 Hz.

The supralaryngeal vocal tract of an adult African elephant, extending from the larynx to the tip of the trunk, can measure close to 5 m in length. Elephants have only 5 bones in the hyoid opporatus, as opposed to 10 in most mammals. The more flexible space filled by muscles, tendons, and ligaments favors the production of low-frequency sound. Elephants are capable of extending the larynx (laryngeal descent) as well as extending the trunk (Fitch and Reby, 2001; Reby and McComb, 2003). The pharangeal pouch (just behind the tongue), used to store water, as well as the nasal cavity in the forehead, may further change the acoustic characteristics of the vocal tract. The length of this vocal tract may be equated to a column of air in a tube (such as an organ pipe) which is closed at one end and is equal in length to one-quarter the wavelength measured in meters. For a sound with a frequency of 15 Hz and in air with a temperature of 5°C, the wavelength is approximately 20 m and the length of the tube is 5 m.

The air column within the vocal tract has elasticity and mass which will vibrate preferentially at certain frequencies, termed normal modes or resonances. The vocal tract will shape the final form of oscillations originating in the larynx. The form of the vocal signal will contain the fundamental frequency (FØ), harmonics of this frequency and selectively amplified parts of the signal referred to as formants can be clearly seen in the sonogram shown in Fig. 1.

The vocal tract length governs formant spacing, which is a better predictor of body size than the size of vocal folds or larynx (Fitch, 2000; Fitch and Hauser, 2002; Reby and McComb, 2003). Lower temperatures, because they slow down the speed of sound, favor the production of lower frequencies for the same vocal tract length. On the open savannas, the temperature of inhaled air by an elephant can exceed 50°C during the day and drop below 5°C at night. There is, thus, a bias towards the generation of lower frequencies under cold night-time conditions (Garstang, 2004).

Hearing is interpreted in terms of a behavioral response to sounds which may be used to obtain and interpret information about an animal's environment, including the ability to identify and localize a sound source. In general, the largest terrestrial animals are most sensitive to sound frequencies below 10,000 Hz. The African elephant has large, mobile pinnae and a large skull. The external ears can be raised and extended outwards, behavior noted when elephants are listening (Moss, 1988). The elephant has a large tympanic membrane (ear drum), and the size of the

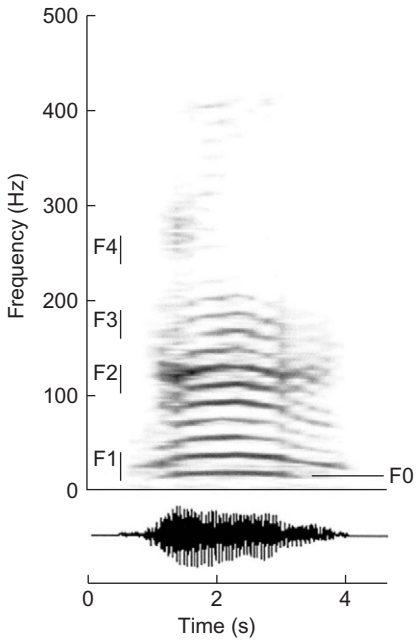

Fig. 1. Waveform of a female contact call showing the fundamental frequency (FØ) and harmonics, and the position of the first four formants (F1–F4). Frequency bandwidth: 8.74 Hz (lower trace); FFT size: 1,024 points; overlap: 50%. After Garstang (2004); from McComb et al. (2003).

ossicles and the shape and size of cochlea, which in *Loxodonta* has two spiral turns, are all conducive to the detection and transmission to the brain of low-frequency sounds (von Békésy, 1960, pp. 506–509).

Localization of a sound source depends on the difference in wave form phases creating a time delay between the two ears (McAlpine et al., 2001). A phase difference, $\Delta\phi$ for a given frequency, f, corresponds to an interaural time difference of Δt where $\Delta t = \Delta\phi/2\ \pi f$ (Hartman, 1999). A 90 degree or pi/2 radius phase shift at a frequency (f) of 15 Hz yields a time delay of 0.017 s. Lower frequencies favor localization and elephants have been shown to be unable to locate sounds with frequencies $\geq$4,000 Hz (Heffner et al., 1982).

The path length of an acoustic wave traveling around the head and ears of an adult African elephant from one ear to the other probably exceeds 150% of the actual perimeter (Kuhn, 1977, 1987; Brown, 1994, pp. 64–69). Heffner and Heffner (1982, 1984) showed that elephants can localize low-frequency sounds within an azimuth angle of one degree. Langbauer et al. (1991), using low-frequency playback calls of an estrous African elephant, demonstrated that males located the sound source over a distance of 2 km.

III. Biological benefits of long-range, low-frequency communication

In African elephants the closest social relationships are between members of the family unit and between different family units called bond groups (Moss and Poole, 1983). Family units are composed of adult females that are matrilineal relatives and their immature offspring. Bond groups are groups of family units that have frequent contact and exhibit mutual recognition. Individual members of the family unit, over a given 24 hour period, may range over a number of kilometers, especially in arid habitats at the end of the dry season. The family unit will, however, assemble, usually near sunset before proceeding to water. Family units move over even larger areas, and depending on resources, tend not to coalesce (Moss and Poole, 1983). McComb et al. (2000) estimate that calls can be recognized by as many as 14 different families, and that individuals within these families can identify 100 other adult females. They further found that the adult females can discriminate between the calls of less frequent associates and identify strangers whom they might regard as representing a threat to their unit. Age is a crucial factor in the ability of the elephant to retain and store information about those whom they encounter, and can affect the social knowledge of the unit as a whole.

These abilities to communicate over long distances have far reaching consequences to the health and survival of elephant populations. McComb et al. (2001) have shown that the ability of the matriarch to retain information that allows her a wide range of recognition materially improves the reproductive success of the group. Social cohesion of the group and avoidance of unnecessary stress brought on by false alarms or failure to recognize the source of the sounds all affect the fitness of the herd.

Elephants use their long-distance calls to maintain separation and so optimize use of scarce resources. Langbauer (2000) has shown that elephant herds maintain a separation for days if not weeks at a time, one herd never crossing the path of another. Garstang et al. (1997) have suggested the concept of a temporal range which is governed by the distance (area) over which an elephant's loud, low-frequency call can be heard by another elephant. Payne (1998, p. 224), delineates areas in which elephants in the Sengwa Reserve in Zimbabwe spend at least 50% of their time. These areas typically have an equivalent radius

of 3–4 km, and are within the potential daytime range of a loud, low-frequency call.

Females in estrous produce frequent loud, low-frequency calls. Forrest and Raspet (1994) and Leong et al. (2003) found no distinct acoustic characteristics in the ovulatory follicular phase of the estrous cycle. The rate of low-frequency calls, however, was highest in the first period of follicular growth potentially attracting males prior to ovulation and resulting in both male–male competition and female choice. Payne et al. (2003) noted a similar result in the wild, showing that females in estrous make long sequences of powerful low-frequency calls. They also noted that there is a relationship between elephant numbers, social complexity, vocalization and calling rates.

Cold temperatures typical of early evening, night and early morning conditions over the dry savannas of Africa and Asia produce pervasive calm conditions with a strongly inverted temperature lapse rate. A cold layer of air in contact with the surface forms a sound channel or duct. Spherical spreading is replaced by the ducting of the low-frequency signal, which now travels over distances potentially greater than 10 km (Garstang et al., 1995; Larom et al., 1997a,b). A loud infrasonic call which during the middle of the day might travel no more than 1 km and be heard over an area of 3 km^2 can now be heard over an area of 300 km^2. No males may be present in the first area, while a significant number will be present in the second, ensuring competition and selection.

Adult elephants drink as much as 200 liters of water a day. As water supplies diminish in the dry season lions and spotted hyenas (*Crocuta crocuta*) will frequent water holes, therefore posing a threat to young elephants (Joubert, 2006; Loveridge et al., 2006). Family units of elephants, as well as bond groups, will assemble together before going to a water hole thus protecting their young by weight of numbers. Social cohesion, definition of territory, reproduction, resource utilization and predation, are all a function of low-frequency communication taking place between elephants over distances equal to or greater than 1 km.

Elephants react to a wide range of low-frequency abiotic sounds. These include infrasound produced by natural phenomena such as thunderstorms and those produced by human activity such as helicopters (Garstang, 2004). It is possible that elephants can detect and interpret these sounds over distances of up to at least a few hundred kilometers.

IV. Physical conditions

The nature of the terrain, vegetation, and the state of the atmosphere in and over habitat occupied by elephants can have a marked effect on both the theoretical distance a given infrasonic call can be transmitted and detected and on a wide range of acoustic characteristics that are attached to the low-frequency signal and that extend into higher frequencies.

Conversely, neglect of fundamental physical factors which influence both the transmission and detection of near infrasonic frequencies can lead to errors of up to an order of magnitude in range, and up to two orders of magnitude in the area ensonified. In the complex field of animal communication where the detection and interpretation of the signal must be measured in terms of the receiver's response, definitive conclusions must be treated with caution.

Sound propagating away from a point source into an unlimited environment (three-dimensional propagation) is subject to an attentuation of 6 dB for every doubling of the distance from the source. Infrasound propagates outwards in a spherical wave in all directions from a source. As the distance or the radius from the source doubles, the surface area of the spherical wave is increased four-fold and the sound pressure level reduced by 10 log 4 or 6 dB. The level of the low-frequency signal emitted must be high enough for the received signal to exceed this attenuation and be above the receiver's threshold of hearing if the signal is to be detected.

In practice, the vertical gradients of temperature and wind above the ground control the propagation of low-frequency sounds which can now be described in two-dimensional cylindrical coordinates with a numerical solution of the Helmholtz form of the acoustic wave equation (Raspet et al., 1985; Franke and Swenson, 1989; Garstang et al., 1995; Larom, 1996).

Temperatures and winds above the earth's surface change with height under virtually all conditions. The sign of the change or lapse rate in both temperature and wind in the atmospheric boundary layer is governed primarily by the presence or absence of heating of the surface by the sun (Garstang and Fitzjarrald, 1999). The dry, cloud-free atmosphere typical of the subtropical savannas making up much of the elephants' habitat leads to rapid daytime heating and high surface temperatures (45–50°C), and rapid night-time cooling and low surface temperatures (10–20°C).

A direct consequence of this diurnal surface heating and cooling is a diurnal cycle in wind speed

(Greco et al., 1992). Daytime heating produces turbulence, mixing higher winds aloft to the surface. Night-time cooling eliminates mixing, producing calm or low-wind speeds at the surface.

In the atmosphere near the surface described above, sound is refracted and sound waves are "bent" upwards, away from the surface during the day and downwards towards the earth's surface at night. Garstang et al. (1995) and Larom (1996) using model calculations based on a simplified subtropical atmosphere (Fig. 2), representing typical daytime, night-time and transitional conditions, show that for a 117 dB signal at 15 Hz and an assumed threshold of hearing of 50 dB, the range changes from near 2 km in the day to near 10 km at night.

When examining the rapid cooling which takes place in the 2 hours before sunset, Garstang et al. (1995) found that the range of the signal expands three-fold, and the area over which the call can be heard changes from about 15 km^2 in the middle of the day to over 300 km^2 soon after sunset. An empirical method which can be applied in the field to determine the presence and depth of a nocturnal inversion and its consequent effect on the range of low-frequency signal is presented in Appendix A.

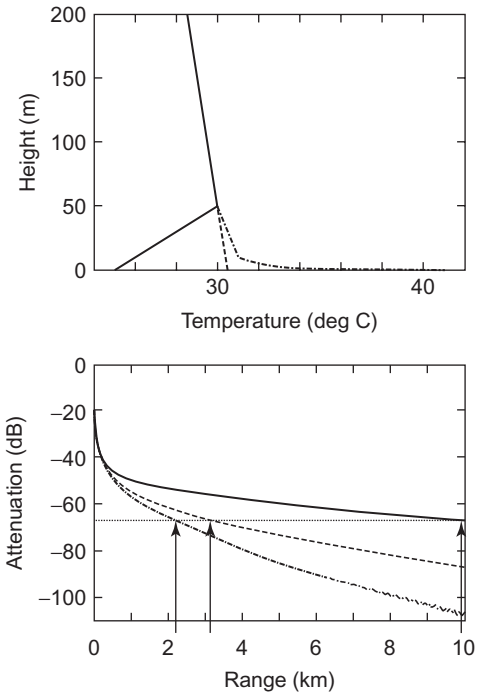

Fig. 2. Idealized temperature profiles (upper graph) and the 15 Hz attenuation profiles predicted from them (lower graph). The temperature profiles show: midday super-adiabatic lapse (dash-dot line); late afternoon, adiabatic lapse (dashed line) and an evening inversion (solid line). The elephant low-frequency calling range based on a −67 dB difference between call strength and hearing threshold is shown by a horizontal line in the lower figure. After Garstang (2004); from Larom et al. (1997).

Atmospheric conditions do not remain static overnight. The stronger winds overlying the cold surface air accelerate over sloping terrain, generating a nocturnal jet and causing episodic incursions of higher winds that penetrate the inversion layer and reach the surface. Acoustic conditions improve in the early morning as the nocturnal jet decays and surface winds once again approach calm conditions (Greco et al., 1992; Garstang et al., 2005).

Turbulence, with eddy sizes ranging from meters to a few hundred meters in diameter, is one of the few processes in the atmosphere that seriously attenuate infra- and near-infrasonic signals. Molecular absorption of infrasound in ambient conditions is essentially negligible. All but the softest surfaces, such as thick forest humus, are excellent acoustic reflectors of low-frequency sounds.

Reverberation and scattering can attenuate infrasound in the presence of obstacles such as trunks, limbs and leaves in a forest. In closed canopy forests or at night over open savannas stratification of the surface air eliminates most, if not all, of the turbulent fluctuations. Wiley and Richards (1978, p. 69), suggest that frequency-dependent attenuation does not differ among major classes of terrestrial habitats. The premise is that non-stationary heterogeneous turbulence increases as vegetation decreases, producing scattering in open habitats equal to that in forests. This is not true in the stably stratified surface atmosphere of the open savannas at night.

Wind is directly related to turbulence and will attenuate a signal along its path, as well as creating flow noise at the elephant's ear, effectively elevating the threshold of hearing and reducing the ability of the animal to detect or interpret the signal.

Conditions within a closed canopy forest are significantly different from those over the open savannas. Scattering by leaves, limbs and trunks affects frequencies mostly above 3,000 Hz. Reverberations in a forest are found to be least between 2,000–8,000 Hz, but may also significantly decrease below 200 Hz (Richards and Wiley, 1978). Tree trunks cause multiple reflections and scattering, and can reduce a 100 Hz signal by 5–6 dB for each doubling of range (Heimann, 2003). For frequencies below 100 Hz, attenuation becomes progressively negligible.

Studies now indicate that African elephants comprise two species: the savanna (*Loxodonta africana*) and the forest (*Loxodonta cyclotis*) elephant (Roca and O'Brien, 2005; Roca et al., 2007). Thompson et al. (2008) have found low-frequency calls of forest elephants between 7 and 8 Hz with a mean frequency at 19 Hz; of 423 forest elephant calls recorded, 95% were below 32 Hz.

The state of the atmosphere in a closed canopy equatorial rain forest reflects the steady-state conditions of an equatorial climate. Day-to-night and season-to-season changes in temperature are extremely small (less than a few °C), with change coming mainly in the form of wet and dry periods or seasons. Similarly, the wind speeds are very low and there is little change in wind regimes. Fig. 3 shows the vertical structure and diurnal changes in temperature, specific humidity and wind speed in a closed canopy forest. Because of high moisture contents in the rain forest, virtual temperature is used instead of temperature. Virtual temperature is the temperature that a parcel of air would have if, at the same pressure and density, all the latent heat contained in the water vapor were converted to sensible heat (AMS, 2000, p. 820).

Both day and night show inversion conditions within the canopy, with the floor of the forest always being colder than the top of the canopy. Wind speeds are low, essentially calm at the forest floor, and only 2 m/s at the top of the canopy. Conditions which favor ducting persist throughout the 24 hours, and may be slightly better during the day (stronger inversion of temperature) than at night. The marked changes in temperature and wind which occur on a regular diurnal basis over the savannas and which dramatically change transmission and reception of sound, are absent in the forest. Thompson (personal communication) found in the forests of the Central African Republic (CAR) that calling rates remained linear with increasing numbers of elephants, regardless of day or night.

Thompson et al. (2008) have measured the detection of calls on four recorders at increasing distances from calling elephants in the forest around the Dzanga bai in the CAR, finding an average range of just over 800 m. More preliminary results from their work suggest that powerful forest elephant calls might travel comparable distances through the forest as those of the savanna elephants do over the open plains under optimal acoustic conditions of ducting and no wind.

Acoustic conditions for the transmission of infrasound in intermediate habitat between closed canopy forests and open savannas are undocumented, but should not differ substantially from those pertaining to the open savannas. Acoustic conditions in broken terrain are complex, due to differential enhancement and attenuation (Piercy et al., 1977; Canard-Caranna et al., 1990; Heimann and Gross, 1999).

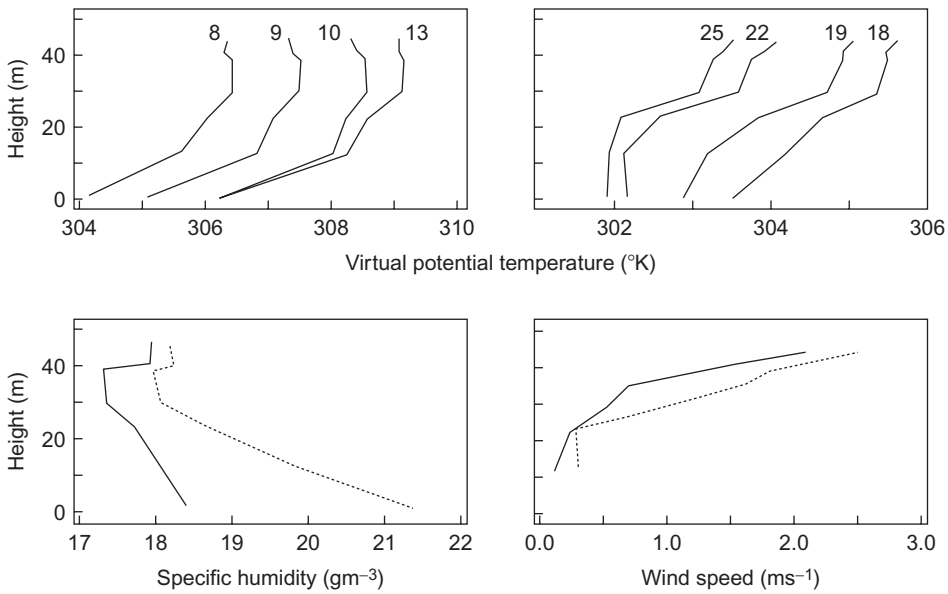

Fig. 3. Mean profiles of virtual potential temperature, (°K), specific humidity q (g/m) (night is solid, day is dotted), and wind speed U (m/s) (night is solid, day is dotted) within a 45 m rainforest. The virtual potential temperature profiles are identified by the hour of day over which they were averaged (12 = 1200; 25 = 0100, local time). After Garstang and Fitzjarrald (1999).

V. Infrasound and elephant behavior

Central to the discussion of infrasound and elephant behavior is the question of the distance or range over which an infrasonic call can be transmitted, detected and interpreted by a conspecific. McComb et al. (2003) have emphasized that a wide range of acoustic characteristics associated with infrasonic calls, but at higher frequencies, may carry important social information. This information, because it is at higher frequencies, is lost over distances shorter than that traveled by the fundamental infrasonic signal.

The frequencies attached to the fundamental infrasonic call are mostly below 300 Hz with wavelengths in excess of 1 m. Such signals under favorable atmospheric acoustic conditions (ducting and no wind) suffer little attenuation with distance. Conversely, these same signals are seriously attenuated in the presence of refraction and scattering (by turbulence), conditions characteristic of the open tropical savannas during the day. It would, therefore, appear appropriate to determine whether elephants show a behavioral response to these pronounced diurnal changes in atmospheric acoustic conditions.

Garstang et al. (2005) recorded loud, low-frequency calls from eight fixed microphones in an array around an isolated water hole in eastern Etosha National Park. The hourly distribution of 1,650 low-frequency calls recorded over seven days is shown in Fig. 4. The calls recorded cluster in the hours following sunset and sunrise (1800 and 0600). The highest number of calls occurs in the two hours after sunrise (184 and 196, or 14% and 15% respectively). The largest number of detected calls in contiguous hours occurs in the three hours following sunset (558 or 42%). Thus, just over 70% of all calls recorded fall in the five hours following sunset and sunrise. Of the remaining 30% of the detected calls, 24% were recorded at night and only 6% recorded during the day.

Model results based on atmospheric measurements made in Etosha National Park (Larom et al., 1997b) are also shown in Fig. 4. The −67 dB attenuation contours of calling range were calculated using the Fast Field Program (FFP) for a 15 Hz call at 117 dB and a threshold of hearing of 50 dB. The model results follow the clear diurnal cycle in calls recorded, and reflect the early evening maximum. Model results

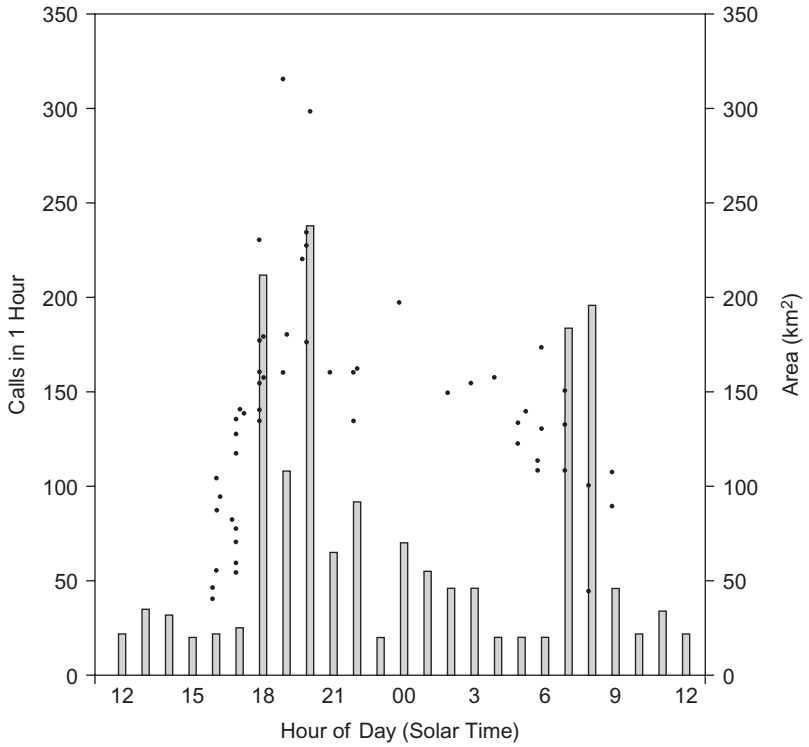

Fig. 4. Total number in each hour of calls recorded (bars: left ordinate) from 8 fixed microphones and the model calculated area (km^2) covered by the −67 dB attenuation contour as a function of time of day (dots: right ordinate).

simulate the increase in calls recorded near sunrise, followed by a marked decline over daytime hours.

Fig. 5 shows that heat is being lost by the atmosphere to the surface nearly one hour before sunset (1800). This negative flux persists for more than one hour after sunrise (0600). Both factors prolong the cold surface night-time conditions, and are reflected in the time of formation and desolation of the nocturnal inversion (Fig. 5, heavy line).

The number of calls detected at the Mushara water hole reflects three dynamic factors: proximity; range of detection; and rate of calling. Elephants were most often observed at Mushara near and following sunset. No breeding herds were seen at the water hole during the day. Proximity clearly contributes to the large number of calls recorded in the early evening, and possibly to the low number of calls recorded during the day.

The pronounced increase in the number of recorded calls following sunrise is not explained by proximity. Tracking by aircraft found no elephants within 3 km of the water hole in the 2 hour period after sunrise. The early morning maximum in calls recorded must depend on changes in detection range or changes in calling rates, or both.

Improvement in acoustic range would result in an increase in the number of recorded calls. Detection of more calls by elephants may trigger more calling, thus a feedback effect results from the improved detection conditions leading to a significant increase in the number of calls recorded. Soltis et al. (2005) found that in captive elephants, females did not produce rumbles at random, but were nearly twice as likely to produce rumbles if rumbles were heard from other group members.

VI. Conclusions

Knowledge of the distance over which an animal's call is likely to travel is essential in any study of animal communication. The basic state of the atmosphere must be known before conclusions can be drawn about range or interpretation of signals. Atmospheric conditions change the area over which a call can be detected, influence the content of the call, and can change the pattern and rate of calling.

Because acoustic conditions over most of the elephant's habitat are poor during the day, field work faces a practical problem of being required to pay particular attention to atmospheric state and to replicate many experiments near and after sunset and before sunrise. At the very least, basic atmospheric measurements must be taken to characterize the acoustic state of the fluid in which the signal is being transmitted in both captive and free-ranging situations.

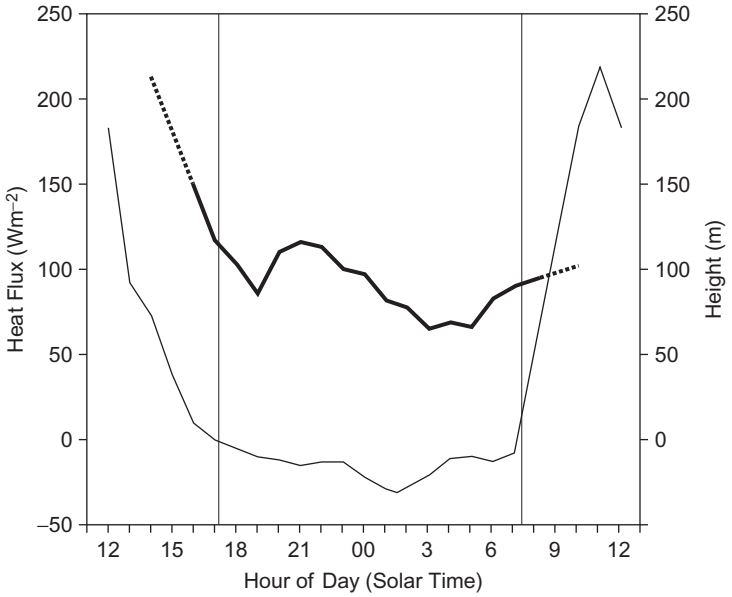

Fig. 5. Sensible heat flux (light black line and lefthand ordinate) at the surface based on eddy flux median values for a three-week period in Etosha National Park, Namibia, and the height of the base of the nocturnal inversion as measured by a vertical pointing sodar and by tethered balloon soundings (heavy black line and righthand ordinate). The vertical lines delineate the times of neutral stability partitioning the 24 hours into stable night-time and unstable daytime conditions. After Garstang et al. (2005).

Transmission and reception of infra- and near-infrasound in a closed canopy forest is in need of particular attention. While near steady-state conditions of temperature, wind and the gradients of these variables suggest that the large changes in the distance these sounds can be transmitted and detected experienced over a diurnal cycle will be absent in a forest, the actual distances traveled are poorly known. Over both the savannas and in the forest, but particularly in the forest, rain or storm conditions may totally disrupt communication.

Acknowledgment

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Appendix A: Graphical determination of the presence and depth of a nocturnal inversion

Two sets of lines are shown in Fig. 6: (1) the dry adiabatic lapse rate, DALR, of temperature (heavy black line), cooling at -1°C/100 m; and (2) a characteristic positive lapse rate of $+4.2$°C/100 m occurring over the tropical and subtropical savannas on clear nights (light black line).

Three measurements are required: (1) two air temperatures, T_1 and T_6, at 1 m and 6 m above the ground; and (2) wind speed at 1 or 6 m. The onset (or decay) of the nocturnal inversion is signaled when $T_1 = T_6$ designated T_0. T_0 determines the reference DALR. The example shown is where $T_0 = 30$°C and the reference DALR line is shown as a heavy black line.

The growth of nocturnal inversion will occur as the 1 m temperature, T_1, continues to drop below T_o. The height (depth) of the inversion is determined by the intersection of the observed T_1 temperature following the positive lapse rate line (light or dashed black line) upwards to intersect the DALR, as shown by the example where $T_1 = 23$°C and the inversion height $h_1 = 135$ m.

Optimum atmospheric acoustic conditions for the transmission of low-frequency sounds exist when the height of the inversion lies between 50 and 200 m and surface winds are less than 2 m/s. Model calculations show that under these conditions a loud, low-frequency elephant call can be detected by another elephant at a range of approximately 10 km.

(Working nomograms to determine inversion presence and height are available at http://www.swa.com/members/publications/HandbookMammalianVocalizationChap3.2nomogram.pdf)

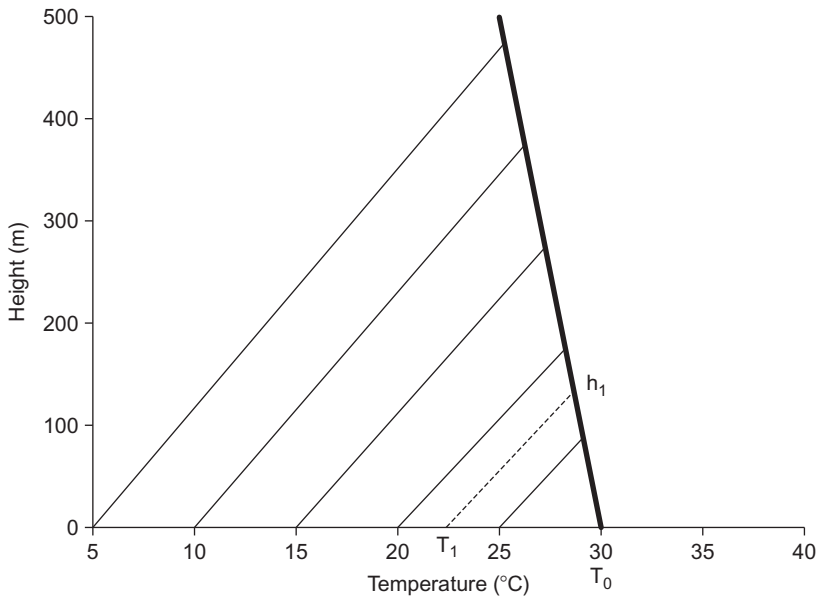

Fig. 6. Height (h_1) of nocturnal inversion, where T_0 = equilibrium temperature following the dry adiabatic line (heavy black line) to intersect with the current temperature at 1 m, T_1, following the characteristic lapse rate (light and dashed black line).

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Savannah Public Process

From: Savannah Public Process
Sent: Tuesday, July 13, 2021 9:11 AM
To: Sarah-Anne Orphanides
Cc: Nondumiso Bulunga
Subject: RE: Response to Wind Garden Wind Farm near Makhanda

Tracking:

Recipient	Delivery
Sarah-Anne Orphanides	
Nondumiso Bulunga	Delivered: 7/13/2021 9:11 AM

Dear Sarah-Anne,

Thank you for enquiring, we are keeping well and save here in Gauteng with the constant increase of the COVID-19 infections. Hope you are all well in the Eastern Cape, especially in and around Makhanda.

Responses to Nosipho's objection letter were included in the Revised Basic Assessment (BA) Reports.

As the objection letter did not indicate that the co-signatories must be registered on the proposed projects' databases, notifications would not have been sent to them. Once we receive such a request, the co-signatories will be registered on the projects' databases.

As you may recall, I requested at the face-to-face public participation process meetings held in March 2021 that the landowners must please provide us with an indication of how they would prefer us to contact their workers and/or occupiers. To date, we have not received any guidance or protocol in this regard from yourself or any of the landowners who attended the meeting.

That said, we can confirm that we are in the process of contacting the affected and adjacent landowners to obtain the best way to contact their workers and/or occupiers to discuss the proposed projects and respond to the concerns raised by workers / occupiers, whether it would be via whatsapp video call or the method of communication as suggested by you and the other landowners.

We had also sent an e-mail to all landowners / occupiers and/or occupants and community members on the project database in April 2021 to which the summary of the Background Information Document and a summary of the BAR translated into Xhosa was distributed. We requested the recipients to please share this information with the occupiers and confirmation of receipt of the information was referenced in correspondence received from occupiers.

As always, it is important to keep occupiers and I&APs safe during the COVID pandemic, and as such appropriate means to ensure consultation will be determined together with the relevant parties.

Kind regards,

savannah environmental

t: +27 (0)11 656 3237
f: +27 (0) 86 684 0547

Nicolene Venter
Public Process

e: Publicprocess@savannahsa.com
c: +27 (0)60 978 8396

SAWEA Award for Leading Environmental Consultant on Wind Projects in 2013 & 2015

From: Sarah-Anne Orphanides <sarahanne.orphanides@gmail.com>
Sent: Thursday, July 8, 2021 12:47 PM

To: Savannah Public Process <publicprocess@savannahsa.com>; Nicolene Venter <nicolene@savannahsa.com>
Subject: Response to Wind Garden Wind Farm near Makhanda

Good Day Nicolene, do hope you are well

As you are aware Nosipho and other concerned citizens in the area do not have email or access to Teams as a form of communication. She thus requested that I send this on her behalf.

Nosipho has had NO response to her submission on 6 May 2021. All cell phone numbers were provided and yet they have had NO communication or engagement on the matter. They also requested that the document be provided to them in Xhosa which has not materialized.

They remain concerned and want for their issues to be addressed and resolved. They continue to object to the proposed Windfarms on the properties where they live.

Many thanks

On Thu, 06 May 2021 at 15:24, Savannah Public Process <publicprocess@savannahsa.com> wrote:

> Dear Sarah-Anne,
>
> Please receive herewith acknowledgement of the comments attached to your e-mail below.
>
> Kind regards,
>
> savannah environmental
> t: +27 (0)11 656 3237
> f: +27 (0) 86 684 0547
>
> Nicolene Venter
> **Public Process**
> e: Publicprocess@savannahsa.com
> c: +27 (0)60 978 8396
>
> SAWEA Award for Leading Environmental Consultant on Wind Projects in 2013 & 2015

From: Sarah-Anne Orphanides <sarahanne.orphanides@gmail.com>
Sent: Thursday, May 6, 2021 3:13 PM
To: Nicolene Venter <nicolene@savannahsa.com>; Savannah Public Process <publicprocess@savannahsa.com>
Subject: Submission on Wind Garden Wind Farm near Makhanda

Please find the attached document for submission.

Please confirm receipt of this email and attachment.

Many thanks

Savannah Public Process

From: Savannah Public Process
Sent: Thursday, July 15, 2021 6:03 AM
To: Christopher Pike
Cc: bradleyg@ewt.org.za; energy@birdlife.org.za
Subject: RE: Wind Garden/Fronteer WEF Avifaunal Report questions

Dear Chris,

Please receive herewith acknowledgement of your written comments submitted below and is forwarded to the project team for responses.

Kind regards,

savannah environmental

t: +27 (0)11 656 3237
f: +27 (0) 86 684 0547

Nicolene Venter
Public Process

e: Publicprocess@savannahsa.com
c: +27 (0)60 978 8396

SAWEA Award for Leading Environmental Consultant on Wind Projects in 2013 & 2015

From: Christopher Pike <chrispike.cs@gmail.com>
Sent: Wednesday, July 14, 2021 3:14 PM
To: Savannah Public Process <publicprocess@savannahsa.com>
Cc: bradleyg@ewt.org.za; energy@birdlife.org.za
Subject: Wind Garden/Fronteer WEF Avifaunal Report questions

Dear Savannah

I, as a direct neighbour to the proposed WEF's, would like to state, that after looking through all Avifaunal reports, and comments related thereto, in the Wind Garden WEF public documents, I believe this report to be flawed. And hence the BAR's to be equally flawed in basing its impact on this Avifaunal report.
(I have not had the hours available to look through the Fronteer WEF as yet but in following the BAR's of both it would indicate that the same faults lie in this proposed WEF as well!)

This statement is based on the following points/questions as listed below:

1.) The Avifaunal Specialist report has not had any changes made since the initial report draft, despite the various inputs from I&APs during the consultation process. Is this correct?
These include input from BirdLife SA, the EWT, a specialist involved as an observer as well as neighbouring land owners.
I have copied BirdLife SA and the EWT in this mail for transparency as I will be using their input/questions as a basis of some of my points of query.

2.) The Avifaunal specialist quotes Ralston - Paton et al 2017 as well as BirdLifeSA(BLSA) Guidelines of 2017 as the basis for complying (with buffers etc) throughout the AV(Avifaunal) report.

However, Sam Ralston - Paton (BLSA) then stated during a public meeting that the buffer widths proposed for these WEF's are not compliant/in line with the most recent information and guidelines.

Why have these buffers not been rectified by the specialist and/or Savannah?

The answer given by Savannah to Birdlife SA in the meeting was that their "comment was noted by the team and will be referred to the AV specialist".

Has this actually been done and what feedback was given? (there was no **Post Meeting Note** in the minutes.

Surely if the person/institution updates the guidelines you used in your research you should do the same?

3.) BirdlifeSA brought up a few other points which included:

a.) According to a new research paper Mugatroyd et al 2021 the buffer sizes for Verreaux Eagle are inadequate
b.) Avoidance rates and buffers are not aligned with what is currently recommended by other specialists and experts on the individual species.
c.) Avifaunal report does not comply with BirdLifeSA best practice guidelines.

The answer given by Savannah to BirdlifeSA in the meeting was that their "comment was noted by the team and will be referred to the AV specialist".

As with the above points:
Has this actually been done and what feedback was given? (there was no **Post Meeting Note** in the minutes.

Surely if the person/institution updates the guidelines you used in your research you should do the same?

4.) Neighbouring properties were not approached to provide any information on possible nests on any target species or for the use of their properties for observation.
When brought up in the meeting, Savannah requested that us as land owners let them know if we have any nests.
a.) Firstly, I find this unacceptable! We have our own farms/reserves to run, our families and that of our staff's to support!
We do not have time to run around doing the specialist's job for them! They must do their due diligence! Not us! All they need to do is pick up the phone and arrange.
When I contacted the specialist through Savannah, He asked me to confirm where Lukhanyo was situated. This is very worrying that the specialist does not know the area in which they are doing their research. Our gate on the R400 has a 2m long sign saying Lukhanyo?
b.) I have expressed my willingness in this regard and no-one has contacted me to set a date and time. And considering I have stated in email to the specialist on 6 April 2021 where my property is and that there are many cliff systems which hold raptors, I have not had any feed back.
c.) I recall 2 land owners in the area stating at the meetings that there were nests on their properties? Were these added into the report?

5.) Red Billed Oxpeckers: In a question in the public meetings regards these birds in the area it was stated that: only a small population of "5 - 10" birds was found 14km west of Makhanda. And that their threat of extinction goes back to poison usage in the distant past.
This brings to the fore some glaring questions regarding this AV report.
a.) How can a report be taken seriously with the statistical variance of this statement of 5 - 10 birds? This is a variance of either 50% or 200%? If the observation data is of this quality the whole report is flawed!

b.) There are Red Billed Oxpeckers on several farms/reserves surrounding these proposed WEF's. Lukhanyo, Vaalkranz and Kwandwe to name a few. These birds have often been observed flying at a good altitude down the valley from Lukhanyo eastwards through the proposed WEF's in the direction of Kwandwe.

c.) To conclude that their extinction is only relevant to historical poisoning is misguided and does not answer the question posed as to how the Wind Farm will affect them. Both from a collision as well as a disturbance of flight path perspective. Please can this be answered?

6.) Mitigation:
Please can you explain how the scores of 56 gets mitigated down to 26 by mitigation measures which are all proposals and not actuals.

Case in point the **Black Blade**: Which has now been confirmed in the last public meeting as a "potential" option but it is not supported by the Manufacturer of the blades or the developer at this time?

7.) Cumulative impacts:
The stand alone impacts seem to be based on just the Wind Garden WEF and the impact of the neighbouring Fronteer WEF is seen as a separate entity only added to the cumulative impacts?
It does not matter how you package it, these 2 projects are for all intensive purposes one large development and the Avifaunal impacts should be treated as one! Not watered down by splitting the impacts over what is best described as a sheep fence!

Your feedback would be appreciated

Regards

Chris Pike
Lukhanyo Reserve
0823500900

Savannah Public Process

From: Christopher Pike <chrispike.cs@gmail.com>
Sent: Wednesday, July 21, 2021 1:09 PM
To: Savannah Public Process; Richard Summers; Angus Sholto-Douglas; Nick Orphanides
Subject: Concern over turbine placement Windgarden/Fronteer WEF

Dear Savannah

I would like to express concern as to the placement of the turbines in the revised BARs and would like to propose that it has been done in a bias towards that of the developer and to the detriment of the environmental and cultural landscapes.

In your presentations to I&APs and in your report you make the statement - the turbine placements shown in the optimised development footprint map have been positioned after considering all impacts/sensitivities assessed in this report.

On being questioned by various I&APs during PP Meetings you confirmed that these positions were inline with reccommendations from the various specialists in their specialist reports.

However, when I look at the Windgarden turbine placements I see that:
Only 16 are in areas with no environmental sensitivity layering!
1 Is in a Verreaux's Eagle nest buffer zone
7 are in a Marshall Eagle nest buffer zone
16 are overlapping or on the direct edge of NO GO zones due to bat fly paths
8 are in Thicket vegetation - marked as High Ecological Sensitivity
1 is in the centre of a plateau - marked as High Ecological Sensitivity.

It should also be noted that, apart from the 1000m buffer zones around Farmsteads, the buffer zones recommended in the Cultural Landscape Assessment report have not been shown on this map. If they were, they would show that only 7 (of the 48) turbine placements are deemed feasible.

The BAR then states: "The project has indicated that the reduction of turbines as recommended by the CLA will not be economically feasible and cannot consider such turbine reductions" And henceforth these buffers have then been ignored.

What one can deduce from these numbers is that the turbines have NOT been placed according to Environmental/Heritage/Cultural considerations as is required but rather where the developer wants them to be situated due to wind resources.

This would indicate a bias towards the Developer and brings into disrepute the indenpendance and therefore validity of this entire BA!

Due to inability to go through both BAR's in the limited time made available I have only used examples of the Wind Garden WEF. However considering the projects are being run simultaneously by the Savannah using the same specialists one can presume that the same issue will be found in the Fronteer WEF.

Regards

Chris Pike
Lukhanyo Reserve

Savannah Public Process

From: Christopher Pike <chrispike.cs@gmail.com>
Sent: Wednesday, July 21, 2021 1:55 PM
To: Savannah Public Process; Richard Summers
Subject: Wind Garden/Fronteer - Post Mitigation figures on Impact tables not in line with Actual Mitigation that will be implemented

Dear Savannah

Please could you indicate why you have published incorrect Post Mitigation numbers(significance of impact) in the BAR's (Wind Garden and Fronteer WEFs)

A case in point: Wind Garden - BAR 10.8.2 Impacts on Cultural Landscape
The Significance before Mitigation is 95(Negative impact) and After Mitigation is set at 55(Negative Impact). However, when one reads the mitigation notes - one finds that the drop to medium impact(55) is based on reducing the turbine numbers from 48 to 7 as the main mitigating factor. (Reduction to 12 turbines in the Fronteer WEF)

When reading the Overall Results: 10.8.3 it is then stated:
. "The project has indicated that the reduction of turbines as recommended by the CLA will not be economically feasible and cannot consider such turbine reductions. The remaining CL recommendations will still result in a marginal reduction of impact. However, the size and bulk of the turbines in the landscape will unlikely be totally mitigatable."

I ask then why, if the recommended mitigation used to get to the figure of 55 is not going to be implemented, is the figure not adjusted accordingly?

This has also been seen in the Avifaunal studies where the mitigation recommended against bird strikes is painting one blade black. According to Savannah at the last PP meeting this is only a concept that is now not feasible. How is it then included in the mitigation calculation?

This shows inaccurate actual impacts and brings into question the accuracy of the entire process.

A response would be greatly appreciated.

Regards

Chris Pike
Lukhanyo Reserve

Savannah Public Process

From: Christopher Pike <chrispike.cs@gmail.com>
Sent: Wednesday, July 21, 2021 2:08 PM
To: Savannah Public Process
Subject: Re: Fronteer Wind Farm - Birds

Dear Savannah

Following on from the below mail dated 6 April 2012:
I would like to state that:

1.) I never received any follow up mail or correspondence of any kind from the Avifaunal Specialist following this mail.
2.) The points brought up on my email dated 15 March 2021 have not been adequately answered.
3.) The concerns brought up by myself as well as other neighbouring properties and I&APs in the PP meetings have not been adequately answered or dealt with.

Regards

Chris Pike
Lukhanyo Reserve

On Tue, Apr 6, 2021 at 9:29 AM Christopher Pike <chrispike.cs@gmail.com> wrote:

> Hi Adri
> Some of my concerns were aired at the public meetings.
> However, on your request, we are situated between the R400 in the South and Hellspoort in the North.
> Regards
> Chris Pike
>
> On Tue, Mar 16, 2021 at 6:50 PM Adri Barkhuysen <adriba@telkomsa.net> wrote:
>
> > Hello Chris
> >
> > Thanks for you comments and concerns.
> >
> > Attached is our permit to have worked during Lockdown year.
> >
> > Please, confirm the location of Lukhanyo but I suspect it is in the Hellspoort area.
> >
> > We conducted monthly Vehicle driving transect surveys (85km to survey the larger area around the proposed site) and therefore through the poort and recorded Verreaux's eagles (VE) on a few occasions.
> >
> > Also the rocky habitat of poort is prime VE habitat, so we suspected a nest in the area, therefore the buffer of 1.5km, which is a pre-cautionary method to avoid turbine installations in that area.
> >
> > If you know of a nest or are concerned re the buffer size, we will look into such.
> >
> > But please, confirm your location?
> >
> >
> > Regards

Adri Barkhuysen

From: Christopher Pike <chrispike.cs@gmail.com>
Sent: Monday, 15 March 2021 17:39
To: Savannah Public Process <publicprocess@savannahsa.com>
Subject: Fronteer Wind Farm - Birds

Att: Savannah Environmental

On looking through your Avifaunal reports I have found a few things I would like clarified.

1.) You have noted a Verreaux's Eagle nest and its buffer zones - but then still place a turbine in this zone?

2) As a direct neighbour to the development, you have not attempted to make contact to do studies of areas that fall within the proclaimed buffer zones around your turbines.

3.) Lukhanyo has several cliff areas that hold raptors which are in close proximity to the proposed turbine positions!

4.) Please could you explain how a complete study of the area was done considering the Extended lockdown period in 2020 where you would not have been allowed to operate? This would include all your study programs?

Regards

Chris Pike

Lukhanyo Game Reserve

Savannah Public Process

From: Christopher Pike <chrispike.cs@gmail.com>
Sent: Wednesday, July 21, 2021 2:11 PM
To: Savannah Public Process
Subject: Re: Fronteer Wind Farm - Visual mitigation

Dear Savannah
I have to date not received feedback on this email dated 15 March 2021
Please may I have feedback on my question!
Regards
Chris Pike
Lukhanyo Reserve

On Mon, Mar 15, 2021 at 5:45 PM Christopher Pike <chrispike.cs@gmail.com> wrote:

> Att: Savannah Environmental
>
> Please could you explain how you are going to mitigate the visual effect of 2 turbines directly in front of the Lukhanyo lodge and well at several others visible from the decks.
> Destruction of this pristine view is not acceptable! It will have a massively negative effect on our tourism.
>
> Regards
> Chris Pike
> Lukhanyo Game Reserve

Savannah Public Process

From: Christopher Pike <chrispike.cs@gmail.com>
Sent: Wednesday, July 21, 2021 2:34 PM
To: Savannah Public Process; Richard Summers
Subject: Visual assessment not acceptable

Dear Savannah

Please see list of comments regarding the VIA of the Wind Garden WEF - Due to time limits I have not been able to look at the Fronteer WEF but i would presume it is along the same lines as the specialists are the same.

1.) Visual montages / study has not been re-assessed after the initial PP Meetings where the neighbouring landowners stated that they would allow access to their properties for Savannah to do this?

The Specialist is still basing their study of impact on what they call “sensitive visual receptors” from observations made from roads in the area and NOT from the actual impacted residences/Lodges/Reserves.

There is not a single montage from a dwelling of any sort? Why is this? What are you hiding? I would suggest that you are hiding the severe visual impact to the view from the neighbouring properties, which include Lukhanyo lodge which will have 9 turbines directly infront of it!

Figure 7.1 and 7.2 are a montage from a site within Kwandwe 12 km away. Why were no neighbouring lodge’s contacted? Especially after the visual specialist shows the list of objecting landowners and lists these as RED/Very High impact.

2.) The visual montage pictures themselves lead me to presume an attempt to minimize actual effects.

If you look at all before vs after pictures – the after pictures with the turbines imposed all have a higher exposure than the before pics. This hides the white of the turbines pretty well!

This is very obvious in montages: 7.7 – 7.8 / 7.10 – 7.11 / 7.13 – 7.14

This seems to indicate a manipulation of the real visual effects!

3.) Visual rating are of concern:

a.) Visual ratings mention in 6.6 of Visual report that the ratings for 0-5km dwellings will be VERY HIGH. Then without possible mitigation these are then dropped to HIGH in the visual rating tables. Please explain?

b.) Visual rating tables were as such:

0 – 5km – rating 64 HIGH

5 – 10km – rating 60 HIGH

10 – 20km – rating 60 HIGH

This maths seems skewed once again. How is there such a small difference between 0-5 and 10 – 20?

c.) Specific WEF Visual impact vs Cumulative Impact scores are equal at 60 vs 60!

Surely having another WEF directly next door would score higher on the cumulative scale?

Feedback on these comments would be appreciated, as these have been brought up before and have not been addressed.

Regards

Chris Pike

Lukhanyo Reserve

Savannah Public Process

From: Christopher Pike <chrispike.cs@gmail.com>
Sent: Wednesday, July 21, 2021 3:37 PM
To: Savannah Public Process; Richard Summers
Subject: Comments on Cultural Landscape Assessment

Dear Savannah

I would like to comment that I disagree strongly with the way Savannah has seemingly brushed aside the finding of the Cultural Landscape Assessment in favour of the developer's requirements.

Please see comments below:

1.) The assessment states that both the Fronteer and Wind Garden WEFs will have an extremely high (95 points) negative effect on the cultural landscape.

2.) It also states that cumulative impacts are not high, but a COMPLETE (100 Points) NEGATIVE

3.) After assessment the CLA states that a total of 7 and 12 turbines for the 2 projects respectively would be acceptable to bring the impacts down to a medium (55 points) negative impact rating.

4.) Point 3 is dismissed by the Developer stating that it is not economically viable.

5.) The EAP then concludes, in the BAR's, in favour of the Developer that these Cultural impacts can be overlooked due to the Positive impacts stated in the Socio economic report. This shows a lack of independence from the EAP.

6.) The way this positive impact on the local economy and energy requirements is being used to effectively destroy the local cultural landscape is a very bitter pill to swallow.
What makes it worse is that the energy generated, after turning the natural landscape into an industrial one, is being exported to be sold to the mining industry in Gauteng.

7.) The recommendations of acceptable mitigation listed in point 3 are included in the BAR's Impact table workings showing much lower impacts after mitigation. Considering that these mitigations are not however , going to be used means that these calculations are incorrect and hide the true effects.

Your feedback would be appreciated

Regards

Chris Pike
Lukhanyo Reserve

Savannah Public Process

From: Christopher Pike <chrispike.cs@gmail.com>
Sent: Wednesday, July 21, 2021 4:49 PM
To: Savannah Public Process; Richard Summers
Subject: Wind GArden/Fronteer - Socio Economic figures - what percentage output are they based on?

Dear Savannah

Please could you answer/clarify the following points so that I may understand where the specialist gets the income/economic figures from?

1.) The turbines listed in the SEIA for Wind Garden are stated as " at a generation capacity of 4.2 MW to 5.6 MW"
a.)Which is it? as there is a 25% and 33% difference mathematically between these two output ratings?
b.) To generate 264 MW(Announced total WEF capacity) using 4.2 MW turbines one would need 62 turbines?
c.) This whole statement in the SEIA is misleading

2.) The total for the Wind Garden is stated at a capacity of 264 MW. Is this the maximum capacity when all the turbines are running at 100% output 100% of the time?

3.) Has the SEIA based its economic outputs on this 100% figure?

4.) If so, I would suggest that the SEIA is fundamentally flawed as no WEF operates at even close to 100%

5.) If not based on 100% operating efficiency/output - what percentage output was used as a baseline for working out the Socio-Economic figures?

The same questions apply to the Fronteer WEF although I have not had the time to look at exact figures due to the time constraints placed on me as an I&AP in having 2 project BA's to look at the the same time.

Regards

Chris Pike

Savannah Public Process

From: Christopher Pike <chrispike.cs@gmail.com>
Sent: Wednesday, July 21, 2021 11:24 PM
To: Savannah Public Process; Richard Summers
Subject: Visual Impacts vs Impact of these on the Socio Economic on the local Tourism industry - Wind Garden and Fronteer WEFs

Dear Savannah

As an affected neighbouring land owner to the proposed WEFs who relies exclusively on eco and hunting tourism as a source of income, I would like Savannah to quantify or explain the following as detailed in the BAR's

1.) In 10.10.2 - Summary of visual impacts during construction and Operation - the impacts are broken down and rated according to distance from the WEF as such:
0 - 5 km - High (Negative impact)
5 - 10 km - High (Negative Impact)
10 - 20 km - High (Negative Impact)

2.) In 10.11.2 - Visual impacts on Socio Economics - Specific impacts on Tourism and game farms - Impacts are rated as:
0 - 20km radius - Medium (Negative Impact)

3.) Why has the Impact on the effects on SE been diluted to a singular 0 - 20km radius?
a.) Lukhanyo Lodge has 9 Wind Turbine positions directly in the immediate view of the front of the lodge. 2 of these are within 1.5km with the other 7 within 5km. This has a VERY HIGH impact on the Economic viability of Lukhanyo. It cannot be grouped with an observer 20km away!
b.) The use of a singular 0 - 20km radius rating is unacceptable and does not reflect the true effects on the visual landscape

4.) The analysis of the effects of the visual impacts on the SE concerning Tourism and Game Farms is nonsensical. The maths of starting with a rating of 60 - 64 points of negative impact, adding the vast number of negative comments and objections lodged against these proposed projects during the public participation process and ending up with a figure of 30 and 28 showing medium impact does not work.
It shows a lack of total lack of consideration by the EAP of the comments made by the I&APs

5.) These questions have up to this point not been adequately answered.

I look forward to your comments

Regards

Chris Pike
Lukhanyo Reserve

Savannah Public Process

From: Savannah Public Process
Sent: Thursday, July 22, 2021 12:49 AM
To: Christopher Pike; Richard Summers
Subject: RE: Late notice Land Occupiers / Staff inclusion in the BA Process for Fronteer and Wind Garden WEFs

Dear Mr Pike,

Please receive herewith acknowledgment of your written comments below.

The comments will be included in the comments and responses report and are being forwarded to the project team for appropriate responses.

Kind regards,

savannah environmental

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Nicolene Venter
Public Process

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SAWEA Award for Leading Environmental Consultant on Wind Projects in 2013 & 2015

From: Christopher Pike <chrispike.cs@gmail.com>
Sent: Wednesday, July 21, 2021 11:39 PM
To: Savannah Public Process <publicprocess@savannahsa.com>; Richard Summers <Richard@summersinc.co.za>
Subject: Late notice Land Occupiers / Staff inclusion in the BA Process for Fronteer and Wind Garden WEFs

Dear Savannah

I received a call last week from Savannah with regards to coming out to talk to any land occupiers on Lukhanyo so as to discuss the WEF's with them. I was not able to get the information required by them at the time as I was traveling.

It must be noted that this is the first contact made by the EAP in this regard!

Savannah followed up today 21/7/2021 to confirm a date this week to come and talk to the occupiers and staff. Unfortunately we have a full lodge and the staff are not able to take the time out of their hosting duties for such a meeting. We will attempt to schedule a meeting next week after the guests have left.

I would like to know why it has been left to the last minute to address this sector of the larger community surrounding the proposed WEF's?

It comes across a box that needs to be ticked by the EAP!

I find this highly discriminatory towards this sector of the community and reiterates the previous comments I have made and that have been echo'd by others; that the entire BA process of Public Participation has only been made available to those who are computer literate and that have access to the internet.

Regards

Chris Pike
Lukhanyo Reserve

Savannah Public Process

From: Christopher Pike <chrispike.cs@gmail.com>
Sent: Wednesday, July 21, 2021 11:49 PM
To: Savannah Public Process; Richard Summers
Subject: Accessibility of the SIA to all community members has not been done - Wind Garden and Fronteer WEF's

Dear Savannah

On Page 69 of the Meeting Minutes it is stated by the EAP that they would look at a way of making the SIA accessible and understandable to all community members.
This was after request from several I&AP's

Up to date this has, as far as I am aware, not been done.

So up to date, only those community members who are computer literate and have access to the internet have been able to participate in the Public Process.

This is not acceptable in terms of the process requirements

Regards

Chris Pike
Lukhanyo Reserve

BirdLife SOUTH AFRICA
Giving Conservation Wings

BirdLife South Africa is a partner of BirdLife International, a global partnership of nature conservation organisations.
Member of IUCN (International Union for Conservation of Nature).
Reg No: 001 – 298 NPO
PBO Exemption No: 930004518

Nicolene Venter
Savanah
Email: publicprocess@savannahsa.com

21 July 2021

Dear Nicolene

Re: Amended Draft Basic Assessment Reports for the Proposed Wind Garden and Fronteer Wind Farms in the Eastern Cape

Thank you for the opportunity to comment on the above reports. Due to limited capacity, BirdLife South Africa has not had an opportunity to review the amended reports in sufficient detail. However, we would we wish to note the following.

1. We remain concerned about the proximity of the proposed development sites to protected areas and conservation corridors. Birds do not observe property boundaries, and activities in the landscape surrounding conservation areas can impact on species within the reserves.
2. We remain concerned that the survey effort is inadequate, especially in light of the receiving environment which includes territories of threatened bird species. BirdLife South Africa's recommendation that two years of monitoring (and 72 hours monitoring per vantage point) be conducted if there is potential overlap with wind turbines and eagle territories is in line with similar international guidance (e.g. U.S. Fish and Wildlife Service, 2012 and NatureScott, 2017).
3. We also remain of the opinion the proposed nest buffers are inadequate. While it may be acceptable to amend the recommended precautionary buffer widths if rigorous data collected for a particular site indicates it is appropriate, as noted above, the data collected does not meet international norms.
4. We note and agree with the avifaunal specialists' concerns about restricting avoidance to circular buffers (buffers should be supplemented by information on topography and the use of a site). However, circular buffers appear to have been the only basis for the recommended" amber caution zones" (as shown in figure 27). We would have expected a more nuanced approach based on observed and predicted use.
5. We remain concerned about the impacts on Secretarybirds, given that an "old" nest was located on the site of the proposed Fronteer Wind Farm. It is likely that birds will return to breed in the area and may be at risk if turbines are built within their home range (please see the attached presentation).
6. While we acknowledge the attempts to address avifaunal impacts through the "draft Ornithological Mitigation Plan", we are concerned that the recommendations in the Plan are vague and not site-specific. Much more work is required to flesh the recommendations out and test the effectiveness and feasibility.
7. Importantly, the draft EMPr does not refer to the Ornithological Mitigation Plan, and as a result, we are concerned that the Plan may not be enforceable or subject to environmental audits.
8. The EMPr proposed one turbine blade is painted black for all turbines within the cautionary buffer. Please confirm that this is has been deemed acceptable by the Civil Aviation Authority and turbine manufacturer. Is this recommended as a condition of approval?
9. While we encourage and support further trials of this promising mitigation strategy, the effectiveness in novel environments and for all species remains uncertain. Therefore, if this development is approved, we are of the opinion that shutdown on demand must be proactively implemented - at least if and until it has been proven unnecessary.

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Member of IUCN (International Union for Conservation of Nature).
Reg No: 001 – 298 NPO
PBO Exemption No: 930004518

10. We reiterate our concern that the operational phase mitigation measures proposed in the EMPr are not proactive and are too vague. The mitigation objective (i.e. to "minimise impacts") is also ambiguous and may result risks and uncertainly for both the wind farm operator and the environment.
11. Lastly, while our comments relate primarily to impacts on birds, we wish to acknowledge the numerous comments by other stakeholders that reflect concerns about impacts on other aspects of biodiversity, as well as concerns about impacts on formal and informal protected areas. We suggest that the need and desirability of the proposed development in this area must be considered very carefully.

Yours sincerely

Samantha Ralston-Paton
Birds and Renewable Energy Project Manager.

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African Rhino Community Centre Trust
T/A African Rhino Conservation Collaboration

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Nicolene Venter
Savannah Environmental
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Email: publicprocess@savannahsa.com

To Whom It May Concern,

Re : Objection to Fronteer and Wind Garden Wind Energy Facilities (WEF's)(revised BA)

ARCC is a registered trust, NPO and SARS registered PBO, in operation since January 2017. ARCC is located in the Eastern Cape of South Africa and operates a holistic conservation programme bringing together protection, awareness, wildlife management, community participation and law enforcement in a coordinated collaboration of individuals, rural communities, organisations and government to ensure the future of rhino and other wildlife in the wild.

Following the submission of comments as a registered interested and affected party as part of the public participation process on the 6th of May 2021, we received notification of the revised basic assessment report on the 18th of June 2021 for these two WEF's (DFFE Ref. No.: 14/12/16/3/3/1/2314 and 14/12/16/3/3/1/2315).

The documentation relevent to the revised basic assesments amounts to 4128 pages for Wind Garden and 4061 pages for Fronteer WEF's with a deadline for comments pertaing to both of 21 July 2021. Given the volume of informartion required to read, understand and comment on in 24 working days in addition to the references quoted we as well as pertinent publications which have not been considered or referenced but which we deem to be relevent to this process, it is our opinion that the times frames are unreasonable and we are not therefore able to participate comprehensively in this process. The current circumstances srround level 4 COVID restrictions, and the pressure placed on livelihoods across this whole community, place additional contraints on our time and make it impossible to dedicate every working hour of every day to this public participation process.

The submission below should be taken as preliminary and incomplete with outstanding comments still required. Under these circumstances the process is, in our opinion, prejudiced.

Nevertheless, the trustees of ARCC would like to express our objection to the proposed Wind Energy Facilities (WEFs) above for the reasons provided in the statements below and linked to the pertaining relevant literature.

Specific reference needs to be made to the document, " A REVIEW OF LITERATURE ON THE IMPACT OF WIND ENERGY FACILITIES ON NATURE BASED TOURISM AND EMPLOYMENT: SOME POLICY KNOWLEDGE GAPS" written by Dr Juniours Marire (PhD) of the Rhodes University Department of Economics and Economic History".

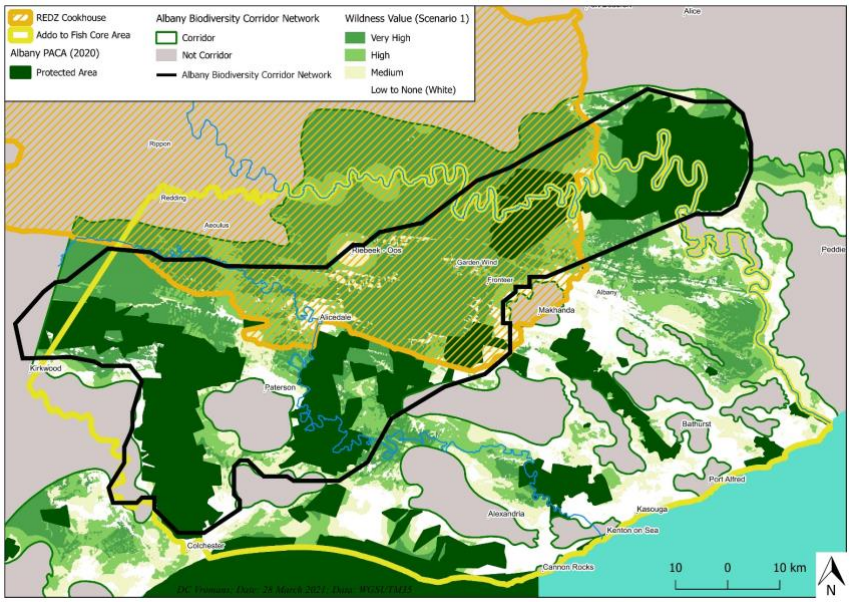
1. **The emergent consensus in literature suggests that the optimal location of WEFs ought to be between 10km and 56 km away from landscapes of high wilderness and tourism value**[i]

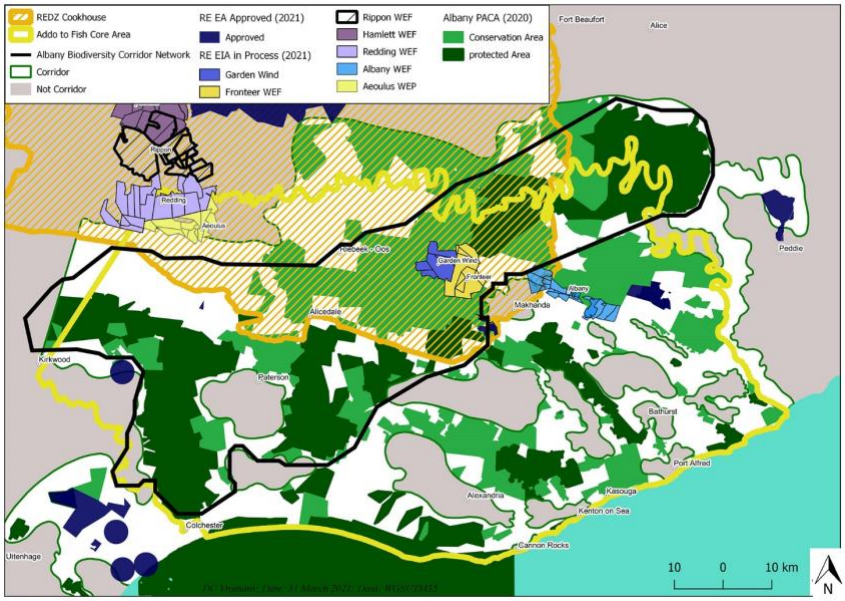
The proposed WEF's of Wind Garden and Fronteer are sited directly adjacent to landscapes of high wilderness and tourism value of which a significant area is already formally protected. These landscapes and protected areas that lie within 20-25km of the proposed wind energy developments and turbine locations and would have dire consequences for the existing ecotourism economy and jobs in this area based in that the sense of place of a very large area will be substantially transformed into an energy landscape. These landscapes and their wilderness character forms the basis of biodiversity stewardship based protected area establishment and management.

2. **Depending on landscape specificities, the optimal siting of WEFs might require focusing on already degraded landscapes or landscapes that are not restorable.**[ii]

The proposed WEF's of Wind Garden and Fronteer are sited on landscapes which are biodiversity rich, and where degraded, are for a large part in process of restoration, and in many areas are fully restorable, and they lie within the strategic footprint of the proposed Albany Mega Reserve and Albany Biodiversity Corridor (also referred to as Addo to Great Fish Corridor as set out in below figures).

The development of these WEF's would fatally compromise the main arm of the various proposed landscape corridors within the Albany Biodiversity Corridor. See map below showing the priority landscape corridor, the "Addo Indalo Great Fish Corridor Priority Area" including wilderness landscape relative to the location of the proposed WEF's.





3. **Although findings of studies relating to WEF and nature tourism are mixed, the majority of studies suggest that the economic effects of situating WEFs closer to landscapes of high aesthetic value include loss of ecotourism revenue, reduction in private funding for biodiversity conservation, and loss of current ecotourism jobs as well as future jobs in nature-based tourism and related enterprises.**[iii]

The proposed WEF's of Wind Garden and Fronteer are sited on properties directly adjacent to landscapes of high aesthetic value which will undoubtedly result in a loss of existing jobs as well as future sustainable job creation. In Desmet and Vromans (2020) "The Albany Biodiversity Corridor", Page 1 of the summary states "The analysis estimates that up to 150 000 ha of mapped biodiversity economy landscape will be visually impaired by the currently proposed WEF projects. The lost economic opportunity as a result of this WEF impact is estimated to be R955 million turnover per annum and 2535 full-time jobs. The nature-based tourism resource potential analysis illustrates the importance of the natural sense of place as a valuable economic resource that should be valued as a national asset and considered more prominently in land use planning."

4. **Evidence suggests that business-people in the ecotourism industry might disinvest in an area following an accepted proposal for, or actual development of a WEF.**[iv]

This statement is locally supported by personal communication with three of the direct neighbours of the proposed WEFs who have expressed intent to disinvest partially or completely should the proposed WEF's be sanctioned. It should be noted that these property owners have already substantially invested in tourism infrastructure anad facilities.

5. **Evidence is mixed about the impact of WEFs on property prices in already degraded, inhabited or transformed landscapes**[v]**, but no study has examined the effect of property prices in landscapes of high wilderness value. Using evidence based on transformed landscapes in deciding to locate WEFs in untransformed landscapes is misleading.**

During the 1st round of the public participation process, it was admitted by one of the authors of the socio-economic impact assessment that not a single direct neighbour to the proposed WEF's of Fronteer and Wind Garden had been consulted in their assessment which is in direct contradiction to statement in the report that stated quote: *"Targeted and structured one-on-one interviews were undertaken as part of the SEIA to collect information from two key groups that are likely to be affected by the proposed wind farm. The first being the*

landowners whose property will be directly impacted by the development of the wind farm, and the second being the surrounding landowners who may be indirectly impacted by the development of the wind farm."

The admission by specialist is unfortuante and tarnishes the intergity of the report and EIA process as a whole. In our opinion, is showed from the start that there was a clear biase in favor of the WEF developer with little inherent intent or conviction to consult those most directly impacted by the proposed development. The report is biased from version 1 of the basic assesment as it did not consider input from any of the neigbouring landowners which would be directly impacted by this proposed development. In addiiton, the report is biased in the revised basic assesment as there has not been sufficient emphasis in ensuring that the staff, residents and service providers of the adjoining properties have access to, translation of (where required) and explantion of the thousands of pages of information contained in these assesments.

In addition, the BA does not adequately reflect or consider the effect on property prices of WEF's in landscapes of high wilderness value where livelihoods are supported by wildlife and nature tourism, hunting and other nature activities. Until a proper tourism impact assessment is undertaken that includes impact on current reserves and hunting operations the true socio-economic impact cannot be defensibly estimated. The current socio-economic impact assessment is flawed, and cannot claim to assess the full impact of this propsed WEF development.

6. **The best evidence suggests that where there is a land use conflict, the precautionary principle would require that policymakers avoid siting WEFs in localities whose socio-economic lifeline is ecotourism and whose landscapes are relatively pristine. Tourists are very sensitive to presence of WEFs in landscapes they cherish for recreational activities and spiritual upliftment.**[vi]

There is a devaluation of wildlife and nature tourism offering if WEFs (or any other highly intrusive developments) are allowed to encroach and this will have a substantial impact on livelihoods. There is a known and expressed conflict of interest between the WEF's and the majority of neighbouring properties and protected areas and nature torusim operations within the viewshed of the proposed WEFs. The statement that *"the proposed wind farm does not conflict with the current land use of the project site (i.e. the affected properties)"* is false as WEFs and wildlife and nature tourism are conflicting land uses and are mutually exclusive. Degradation of the environmental goods and services of reserves upon which nature and wildlife tourism product is based would imply a certain "disinvestment" in the nature and wildlife tourism sub-sector for the regions, the province and even on a national scale. Due consideration is to be afforded to the biodiversity stewardship that nature and wildlife tourism affords the national protected area estate. Therefore, the precautionary principle should require the competent authority to reject this WEF application.

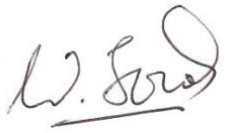
7. **Evidence also suggests that the benefits of WEFs accrue mostly to international and regional economic hubs, but negative effects of WEFs are borne locally, especially in rural economies that are ecotourism dependent.** [vii]

The proposed WEF's of Wind Garden and Fronteer are stated to have little local benefit to permanent job creation and the local economy when compared to the biodiversity based economy that already exists let alone the growth trajectory pertaining to local employment and economic revenue which is evident in "A study of the conservation, economic and social activities of Indalo Private Game Reserves in the Eastern Cape" by Antrobus & Snowball (2019).

The comments made in the revised BA do not adequately address the points made above and those made specifically pertaining to the socio-economic benefits promised by the proponent through a percentage of revenue pledged to communities, carry little weight amongst communities who have observed how local unrest and protests have been fueled through failure of operational WEF's to deliver on promises in the nearby Cookhouse and Bedford areas.

Given the volume of science pleading against the proposed WEF's, as well as the clear gaps in applicable data that exist in the understanding of the specific impact of these proposed WEF's, we strongly oppose the application for the development of these WEF's for the reasons listed above; as well as for all those reasons pertaining to impacts known and currently unknown on local fauna and flora, and, therefore, the unique and globally valuable natural biodiversity of this area.

Signed for, and on behalf of, the Trustees of the African Rhino Conservation Collaboration on 21st July 2021 in Makana, Eastern Cape



Dr C.W. Fowlds BVSc

ARCC : Trustee

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Savannah Public Process

From: Savannah Public Process
Sent: Thursday, July 22, 2021 12:47 AM
To: 'Richard Summers'
Cc: Angus Sholto-Douglas; Grant Soulé Vaalkrans, Assegai; Nick Orphanides; Dr William Fowlds; Christopher Pike; Clarice Arendse; Kirstin Meiring
Subject: RE: WIND GARDEN AND FRONTEER WIND FARMS: Extended Timeframe - Correspondence from the DFFE

Dear Richard,

Please receive herewith acknowledgment of your written comments attached to the e-mail and the content of the e-mail below.

The comments will be included in the comments and responses report and are being forwarded to the project team for appropriate responses.

Kind regards,

savannah environmental

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Nicolene Venter
Public Process

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SAWEA Award for Leading Environmental Consultant on Wind Projects in 2013 & 2015

From: Richard Summers <Richard@summersinc.co.za>
Sent: Wednesday, July 21, 2021 11:48 PM
To: Savannah Public Process <publicprocess@savannahsa.com>
Cc: Angus Sholto-Douglas <angus@kwandwe.co.za>; Grant Soulé Vaalkrans, Assegai <grant@inyathigame.co.za>; Nick Orphanides <nickorph@iafrica.com>; Dr William Fowlds <william@ikhalavet.com>; Christopher Pike <chrispike.cs@gmail.com>; Clarice Arendse <clarice@summersinc.co.za>; Kirstin Meiring <Kirstin@summersinc.co.za>
Subject: RE: WIND GARDEN AND FRONTEER WIND FARMS: Extended Timeframe - Correspondence from the DFFE

Dear Nicolene

Given the unreasonable and truncated timeframes for public comment, we are submitting under cover hereof preliminary comments on behalf of our clients in connection with the revised reports. The sheer volume of information across two projects made it impossible to consult, collate and integrate the range of issues and concerns expressed by our clients in connection with the revised reports within a 30 day period. We sought in good faith to raise these concerns with Savannah but you have opted to persist with the bare minimum period allowable for public comment. The approach is both unreasonable and prejudicial.

There are many areas of the assessments where further responses, queries and issues requiring clarification from the EAP are unresolved and it is indeed regrettable that this matter has been forced prematurely into the realm of decision-making. It is palpably clear that the assessment is incomplete in several material respects.

Additional specialist information commissioned in support hereof will be sent directly to the DFFE. Additional comment, if any, will be tabled directly before the DFFE.

Kind regards,

Richard Summers

RICHARD SUMMERS INC.
DIRECTOR

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Unit 126, Victoria Junction, 57 Prestwich Street, De Waterkant, Cape Town

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From: Savannah Public Process <publicprocess@savannahsa.com>
Sent: Wednesday, 21 July 2021 6:12 PM
To: Richard Summers <Richard@summersinc.co.za>
Subject: WIND GARDEN AND FRONTEER WIND FARMS: Extended Timeframe - Correspondence from the DFFE

WIND GARDEN WIND FARM AND FRONTEER WIND FARM NEAR MAKHANDA, EASTERN CAPE PROVINCE
(DFFE Ref. No.: 14/12/16/3/3/1/2314 and 14/12/16/3/3/1/2315 respectively)

Dear Stakeholders and Interested & Affected Parties,

Please find attached for your perusal the correspondence received today via email from the Department of Forestry, Fisheries and the Environment.

The letters are in response to the request for extension of the review and comment periods for the Revised Basic Assessment Reports as per the request received from Interested and Affected Parties.

Kinds regards,
Unsubscribe this type of email

savannah environmental

t: 011 656 3237
f: 086 684 0547

Nicolene Venter
Public Process

e: publicprocess@savannahsa.com
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SAWEA Award for Leading Environmental Consultant on Wind Projects in 2013 & 2015

RICHARD SUMMERS INC.
ATTORNEYS

Savannah Environmental (Pty) Ltd

Per e-mail: nicolene@savannahsa.com

Our ref: RWS/cfa/CSP20-004
Your ref:

21 July 2021

Dear Ms. Venter

RE: COMMENTS ON THE REVISED BASIC ASSESSMENT REPORTS FOR THE PROPOSED WIND GARDEN WIND ENERGY FACILITY AND FRONTEER WIND ENERGY FACILITY, EASTERN CAPE PROVINCE [DFFE REF. NO.: 14/12/16/3/3/1/2314 AND 14/12/16/3/3/1/2315 RESPECTIVELY]

INTRODUCTION

1. Richard Summers Inc was appointed by Kwandwe Private Game Reserve ("Kwandwe"), Mr N Orphanides (of the Farm Clifton), Dr Mark Bristow (of Lukhanya Game Reserve) and Escape Airtours Charters and Transfers (of the Vaalkrans Garm Farm) to review and comment on the Revised Basic Assessment Reports ("BARs") for the proposed Wind Garden[1] and Fronteer[2] Wind Energy Facilities.

2. As registered interested and affected parties, we submit these preliminainy comments on behalf of our clients. Due to the nature of the concerns and comments raised herein in connection with the revised BARs, specialist studies and the assessment process as a whole, these comments illustrate that the assessment is flawed in several key respects.

3. The purpose of this letter is to record our clients' preliminary comments in connection with the revised BARs and revised specialist studies. The comments submitted previously by our clients stand in so far as the majority thereof have not been addressed.

[1] DFFE reference number 14/12/16/3/3/1/2314.
[2] DFFE reference number 14/12/16/3/3/1/2315.

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4. We object to the process on the basis that the bare minimum of 30 days provided for comment on two separate applications and two separate projects is inadequate. Stakeholders have complained about the prejudice that arises by virtue of having to comment on two separate applications each with its own basic assessment report and array of specialist studies within a 30-day period which would qualify as the bare minimum timeframe for public comment for one project.

5. Our concerns in this regard are well motivated and substantiated in our previous correspondence with you. Our clients and other I&APs had requested that the commenting timeframe be extended on account of it being unreasonable. The EAP's motivation for an extension to the DFFE in this regard failed to motivate the requested extension with reference to the specific concerns raised by I&APs in this regard. Ultimately the DFFE saw fit not to extend the commenting period which result perpetuates the prejudice.

6. A 30-day commenting period is procedurally unfair and compromises the ability of I&APs to meaningfully engage. It is almost inevitable in the circumstances that this "triumph of form over substance" will result in an appeal insofar as the Department decides to ignore the concerns raised herein. It was for this reason that we attempted to draw the Department's attention to this concern (about the unreasonable commenting timeframe) at the earliest opportunity.

7. Given the Department's failure to grant the request for an extension, our concerns in this regard will be amplified in the appropriate forum in due course. However we wish to formally record that the imperatives of the Department and the EAP in blindly adhering to the timeframes contemplated in the EIA Regulations by providing for the bare minimum period of 30 days for public comment undermines the spirit, purpose and efficacy of public participation.

8. It cannot be gainsaid that the current public participation process is being undertaken in a time of unprecedented crisis in the country and globally. Many of our clients are deeply affected by the current Lockdown, and the impact of the COVID 19 pandemic on their daily lives. The expectation that I&APs are simply required - in these circumstances - to get on with it and

engage with a significant volume of the material released for public comment is unreasonable and entrenches the unfairness of the process.

9. It is widely recognised that the main aim of public participation is to encourage the public to have meaningful input into the decision-making process. In circumstances such as those that prevail in the country at present, and with reference to the fact that numerous stakeholders have complained about being overwhelmed by the volume of information, the suggestion that the process has allowed meaningful input is rejected outright.

10. Given the unreasonably short commenting timeframes, the purpose of this letter is primarily to draw the Department's attention to key aspects of the impact assessment which are deficient and to highlight material omissions regarding concerns tabled during the process.

11. We have previously engaged external specialists to assist us with this review. Again, given the truncated timeframes ,not all the specialists were available to assist at short notice. Some are travelling and some are incapacitated.

12. To the extent that we managed to obtain additional input we reserve the right to table that information before the Department and the latter will be obliged to take such information into account.

Procedural and substantive non-compliance

13. At the outset we point out that the revised BARs and the specialist studies do not address many of the issues raised in previous comments and specialist external opinion obtained by I&APS. We raise concerns as to the adequacy of the revised BARs in providing a balanced and fair account of the motivation for the project and a comprehensive account of the risks, externalities and cost-benefit trades-offs that are at play in connection with these projects.

14. Previously we commissioned an independent external review of the draft BARs by Prof François Retief of NWU (Global Green April 2021). That review highlighted several substantive failings and omissions in the draft BARs. It identified impacts that were inadequately assessed or not

assessed at all.

15. The issues identified by Global Green are superficially dealt with in the Comments & Responses Reports dated June 2021 (Annexure C9 a) which for the most part simply disregard the findings of Prof Retief.

16. The substance of the issues and concerns raised in the independent external review by Global Green remain unresolved and unaddressed. This gives rise to material non-compliance with the EIA Regulations. For this reason, and with reference to the revised BARs Global Green has concluded that "*We are of the opinion that this current failure to respond highlights procedural and substantive non-compliance with the EIA regulations*."

17. On that basis alone the DFFE has no alternative but to reject the BARs and to refuse the environmental authorisation in terms of Regulation 20(1)(b). A copy of the Global Green letter dated 19 July 2021 will be sent directly to the Department.

Impact on tourism

18. The impact on tourism remains one of the most significant concerns which remains inadequately assessed.

19. The high negative impact on landscape integrity, visual aesthetic quality, and key receptors is unresolved. The high negative visual impact and landscape impact is confirmed by the specialists studies and the independent external specialist reviews we have commissioned. This impact on tourism) is key project impact which must be resolved before a decision is taken on the applications for authorisation in terms of s 24 of NEMA.

20. To date this serious impact has only been evaluated through limited means namely desk-top research, literature reviews and ad hoc consultations with select stakeholders. In the circumstances, the EAP and relevant specialist have taken a narrow view of their obligations in terms of the EIA Regulations to assess in detail each identified project-related impact.

21. What is clear is that an independent study of this impact is required to support the decision-making process. As a consequence of the failure to resolve this impact, the reports are defective in material respects. Insofar as it is suggested that the DFFE is able to apply their minds to the impact of the proposed projects on tourism (on the basis of the information tabled in the reports) that will give rise to a reviewable irregularity.

Impact on socio-economic conditions

22. The revised BARs and specialist studies evidence a disproportionate concern with the financial feasibility of the proposed projects. The reports pay lip service to the impact of the proposed projects on the existing ecotourism operations and existing game reserves in the area. This imbalance reinforces the need for a dedicated tourism impact assessment.

23. A concern repeated throughout this process by numerous stakeholders has been that the proposed wind farms will affect the sustainability of existing ecotourism operations and game reserves. This will have wide ranging implications for those reserves, the biodiversity economy and consequences for the job security of the employees of those ecotourism operations and game reserves. These impact and the impact on neighbouring game reserves and landowners in particular has not been quantified. The impact on socio-economic conditions is unresolved.

24. With the impact on socio-economic conditions not having been quantified, the DFFE will be unable to make an informed decision. The lack of credible information and data regarding what has been identified from the outset by numerous stakeholders as a key concern is a fatal flaw in the assessment process.

25. Based on the conclusions in the specialist studies regarding high negative visual impact and the high negative impact on integrity of cultural landscape the proposed WEFs **will** lead to adverse impacts on feasibility (and the closure) of some or all of the existing ecotourism operations, lodges and game reserves in the area. This will have consequences for the region and broader environment. Those direct impacts on receptors and regional impacts have not been quantified.

26. The studies are disproportionately concerned with the SED commitment of the proposed projects to the exclusion of a considered assessment of the socio-economic benefits associated with the current predominant land use (game reserves and ecotourism operations). Independent studies indicate that the number of people employed on game reserves increased by a factor of four or more compared to livestock farming (Muir et al., 2011).

27. The game reserve and ecotourism sector is a significant contributor to the local and regional economy. Why is the impact of the projects measured only in terms of the positive SED contributions those projects seemingly will have to the exclusion of the clear socio-economic benefits associated with existing land uses? This creates an inherent bias in favour of the projects and an inaccurate basis for fair and credible assessment.

28. Genuine concerns regarding negative tourism impact that were raised by (a few select) stakeholders during interviews but this did not influence the findings of the revised socio-economic impact reports ("SEIAs").

29. A general concern is that, while the Revised SEIAs did take into account the opinions of come stakeholders who had not previously been engaged, the substance of the findings in the Revised SEIAs have not changed in any meaningful way to accommodate the new information that was made available to the author through the interviewing process.

30. It is incomprehensible that the specialist has undertaken extra work to interview stakeholders but that the inputs provided by those stakeholders during the public participation process has had no bearing on the outcomes in the revised reports. This is inexplicable and suggests that the outcome of the impact assessment is preconceived.

31. The conclusion that the author draws in respect of the Broekel & Alfken study is not fully aligned with the findings contained in the study. The study demonstrates that tourists will tend to avoid their preferred destinations in instances where these destinations are characterized by large wind turbines and where these destinations fall within a broader region less exposed to wind turbines. Although tourism activity is not less, it is different because tourists opt to stay in the

greater region and therefore choose locations that are in the vicinity of the original destinations with less wind turbines.

32. When describing the effect of wind farms on visitor and business performance, the author indicates that the feedback was gathered from game lodges and nature-based establishments that predominantly cater for domestic tourists. The revised reports do not elaborate on the significance of this caveat and does not explain that the perspective of international guests may differ.

33. It is illogical that the final evaluation of the effect on tourism is unchanged in the revised specialist studies, especially given the negative feedback received by Thompson's Africa and the fact that "there is a high to very high likelihood that international guests would either complain or choose not to return to such game farms if turbines were erected nearby". Again this suggests the outcome was preconceived.

34. The game farm owners and representatives who were interviewed in the Terblanche study (2020) were not visually affected by the wind farms as the range in distance is stated to be between 8 to 40 km away. These representatives stated that they had received no complaints from guests and have noted no changes to the performance of their game farms as a result of the presence of wind farms.

35. The fact that these establishments were not visually impacted is a key limitation in the qualitative data that should have been clearly highlighted by the author of the Revised SEIA as it may well have been the reason for the representatives not receiving complaints from their clients about the impact of the wind farm on their clients' tourism experiences. In light of the shortcomings of the Terblanche study, the author's reliance on this report to show that "development of wind farms in their areas had not had any negative effect on their businesses" is flawed. The cannot be extrapolated in the current prevailing circumstances.

36. The revised report states that "the experience of a homeowner and tourist residing in a rural property is likely to be somewhat similar" and that studies which consider places of "primary

residence" (i.e. homes) are relevant. The comparison between a home and an upmarket eco-tourism venture is unsound. Tourists who visit eco-tourism farms have vastly different expectations from residents, which include expectations about what they aim to experience and see.

37. When discussing the potential losses from the development on the Fronteer and Wind Garden WEFs, the author of the SEIAs recognises that the number of tourists may decrease with the development of the wind farms.

38. The Revised SEIAs state that directly affected properties on which the development will occur are characterised primarily by livestock farming with some tourism and game farming activity, and that the wider area is noted for its wildlife and game farm tourism. The author notes that the sentiment amongst directly affected property owners (i.e. stock farming) are positive but is silent on the effect on indirectly affected property owners in the broader area (i.e. wildlife and game farm tourism).

39. Due to the truncated public comment period there has not been an adequate amount of time to fully investigate the findings of the Revised SEIAs and the specific concerns of our clients in this regard and we reserve the right to supplement these comments.

Impact on receiving environment

40. Previously marginal and unproductive landscapes have reverted to wildlife as a land use (Taylor et al., 2015). The primary driver of this shift back to wildlife was landowners seeking to use their land in a manner that is ecologically and economically sustainable.

41. This is particularly evident in the receiving environment and the Albany Thicket region of the Eastern Cape. Kwandwe Private Game Reserve as well as other members of the Indalo Association (e.g., see Antrobus and Snowball, 2019) are significant contributors to this bioregional conservation initiative.

42. The impact on biodiversity conservation and the ecological landscape / corridor from a bioregional planning and conservation perspective have not been assessed.

Impact on endangered species

43. Kwandwe Private Game Reserve, as well as a number of other properties comprising the Indalo PE make a substantial contribution to the conservation of D.b. minor by hosting and securing an important population approaching a significant number os individuals. Together with the combined contribution made by other reserves a significant population of black rhino are thus conserved by the private sector through the local biodiversity economy.

44. The impact on this initiative has not been assessed.

Impact on the biodiversity economy

45. The studies fail to to recognize the synergistic and catalytic roles that the various game reserves and members of Indalo PE play in conservation initiatives at the bioregional scale, and the importance that economies of scale make towards the region being a success and sustainable land use. For example, from a rhino security perspective, by being able to work together and by sharing costs, the collective initiative has been able to launch and maintain an effective security operation that focuses regionally rather than on each property and which has a strong intelligence network, and through this to keep poaching to levels which are substantially below national figures.

46. The potential exists for the region to make further contributions to the biodiversity economy . The biodiversity economy is not saturated and the size of the biodiversity economy in the Albany Thicket has potential to expand further. Initial discussions have been held to discuss managing the various populations of each species of black rhino in the area as a single “meta-population”. This makes considerable sense from a conservation biology perspective; what remains is to incentivize more properties to join the collective and to adopt a biodiversity objective. The incompatibility with use of properties in the area for WEFs threatens this initiative. These risks to existing and future conservation initiatives are not in any way addressed in the reports.

47. Due to the unacceptably high visual impacts and the impacts on the landscape, the proposals will result in the underlying biodiversity and landscape resources of the region being compromised. The risk associated with very high visual impact and very high impact on cultural landscape reduces or disincentivizes the opportunity for nature based wildlife tourism. This in turn implicates the regional biodiversity economy.

48. The impacts of the proposed projects therefore will place not only the existing operations and contributions at risk but there will be future opportunity costs to consider as well (and none of this has been identified in the reports). As the region is successfully contributing to three state several national strategies, any decision to authorise the proposed wind farms will involve a significant trade-off that promotes economic development of two projects over and above the severe socio-economic and environmental adverse impacts.

49. In the exclusive focus on benefits of the projects to the exclusion of other costs, the studies display an inexplicable lack objectivity and impartiality. They fail to produce a very clear cost-benefit analysis demonstrating that the projects are a better alternative. The attempt at cost benefit analysis such as it is, is not informed by relevant data.

50. In summary the key concerns are:

    50.1. The BAR and specialist study (Appendix L: Socio-economic impact) give inadequate recognition of the potential risks, and the effects on the sustainability posed to the Kwandwe Private Game Reserve and other game reserves and ecotourism operations by the proposed developments and the subsequent degrading of the natural resource base that the biodiversity economy is based on.

    50.2. The BAR and specialist study (Appendix L: Socio-economic impact) give inadequate recognition of the potential risks posed to the biodiversity economy of the collective (Indalo PE and other reserves) and the consequential impact if one of its members (e.g. Kwandwe Private Game Reserve) is compromised and lost due to the negative consequences of the proposed developments.

    50.3. The synergies and economies of scale of the conservation initiatives on private land are

integral to the operation and resilience of the local biodiversity economy, and this will be at risk if one of the game reserves is lost due to the erosion of the natural resource base on which it depends.

50.4. The BAR and specialist study (Appendix L: Socio-economic impact) give inadequate recognition of the potential for a complete collapse of the Indalo PE, Kwandwe Private Game Reserve and other ecotourism industry players and the reversion of the land to livestock farming.

50.5. There is no recognition in the studies undertaken of the potential for significant biodiversity gains made and contributions to all three national biodiversity strategies being reversed, with significant negative consequences.

Impacts on megafauna

51. The studies fail to highlight the absence of scientific evidence / data tabled about the impact of wind turbines on large mammal sociology and ecology. Given the context of the proposals this is a material omission.

52. The studies ignore how this impact may affect the quality of the natural resource base upon which protected areas such as Kwandwe Private Game Reserve depend.

53. This impact is unresolved and unassessed. The precautionary principle therefore applies in this instance but the implication of the lack of relevant data has been ignored in the studies and the BARs.

54. The absence of relevant data in the studies undertaken proves that a precautionary approach should be adopted.

Applicable policy

55. The BARs and specialist studies (Appendix L: Socio-economic impact) have failed to address the full policy context applicable to the proposed developments in this context and the range of project impacts. Rather the studies entrench the distortion towards policy that supports the proposed development to the exclusion of policy relevant to the biodiversity economy and protected areas management.

56. This has the knock-on effect of rendering the need and desirability evaluation in the BARS heavily weighted in favour of development. This biased approach is unsustainable and not based on an accurate description of the applicable policy context.

57. A key omission is the failure to recognise the Biodiversity Economy Strategy (2016) and what the implications of this policy are for the current land use (status quo) compared to the impact of the proposed projects on game reserves, and the biodiversity economy.

58. The selective focus in the studies and bias towards policies that promote the projects deprives the competent authority of a balanced consideration of the full policy context. This is problematic and cannot sustain a justifiable and rational decision regarding need and desirability. For example, no meaningful recognition is given in the studies to the contribution of Kwandwe Private Game Reserve and the Indalo Protected Environment to achieving and implementing the aims of Biodiversity Economy Strategy (2016).

59. The BARs have not adequately addressed a key aspect of the applicable policy context namely the regional biodiversity economy and do not provide adequate insight and relevant information to sustain a defensible basis for decision-making or trade-offs which implicate the bioregional economy.

60. The direct contribution of the Kwandwe Private Game Reserve and other reserves comprising the Indalo Protected Environment (and indeed the other game reserves in the area) requires appropriate recognition in how those properties contribute directly to furthering the objectives of three national strategies. This is significant factor and this does not receive recognition in

the studies and there is no balancing of this consideration against other policy imperatives. The issue of policy compatibility is unresolved.

61. Given the direct impact on game reserves in the area, a much greater effort is required to ensure that the full range of impacts on affected game reserves and their direct positive contribution to the local bioregional economy is properly evaluated, assessed and considered.

62. Every effort should be made that risks to the sustainability of such operations are appropriately investigated and assessed. The data currently points to a significant threat to such reserves but there is no evidence to prove that the affected game reserves will not be compromised.

63. As significant contributors to the local economy the affected reserve must be provided with an enabling environment to grow and remain sustainable and this includes avoiding incompatible land uses with high negative impacts on the receiving environment. The studies have failed to quantify the risks to the sustainability of the affected reserves. The absence of information cannot support a final decision.

Impact on National Protected Area Expansion Strategy (NPAES)

64. Kwandwe Private Game Reserve and other members of the Indalo PE contribute to the NPAES by legally committing their land under NEM:PA and contributing 700 km2 to the conservation of the under-conserved Albany Thicket. Not only is this land now conserved but where appropriate it is undergoing significant restoration. The conservation management and the restoration of these properties is funded through the landowners, and this is only possible if there is a viable and sustainable economy underpinning their enterprises.

65. The BAR and specialist studies make a cursory mention of the National Protected Area Expansion Strategy (2016), the current contribution of properties to that strategy and the potential for future contributions to this strategy through connecting to properties if the base line conditions are conducive.

66. Kwandwe Private Game Reserve has potential to link through to the GFRNR and to other areas to the west, but this is unlikely to happen if the underlying value of the landscape is compromised (as confirmed by the CLA and visual studies) and the socio-economic sustainability placed at risk by the proposed developments.

67. The reports fail to address the impacts associated with incompatibility of land use. As such the reports have not adequately addressed a key aspect of the region to contribute to the NPAES and do not provide adequate insight and information to provide decisions on trade-offs.

68. The BAR and specialist studies do not consider the risks and future opportunity costs of placing and operating of turbines - essentially an industrial land use - in a landscape that contributes directly to promoting to at least three national strategies, i.e., the Biodiversity Economy Strategy, the National Protected Area Expansion Strategy and the Biodiversity Management Plan for Black Rhino.

69. The BAR and specialist studies do not consider the BSP and its contribution to the NPAES. A key recognition in the BSP is that the future of biodiversity conservation and protected areas requires contributions from the private sector as well as the state. Private sector contributions need to be incentivized and not to have the contributions they make be undermined by developments that reduce the value of the resource base on which their economy depends.

70. The review by Oberholzer (2021) confirms that the visual resource which is a primary component of defining landscape quality and character is significantly and negatively impacted by the projects.

Cultural Landscape & Heritage Assessments

71. Despite the delineation of heritage sensitive areas from a cultural landscape perspective, and the demarcation of a no-go buffer areas indicated on Figures 52 and 49 in the respective Cultural Landscape Assessments (CLA) the BARs, the revised HIA reports incomprehensibly fail to integrate the core finding of the CLA. The core findings is that many of the proposed turbine

positions are considered not suitable for development). This specialist input has effectively been ignored which the EAP motivates on the basis of financial feasibility.

72. The CLA correctly identifies the area and receiving environment as having high to very high cultural landscape heritage value. This is supported by external specialist opinions of S Winter (2021) and B Oberholzer (2021). Based on the rating of high to very high heritage value the CLA correctly identifies that a cautionary approach to heritage management is required. A cautionary approach has not been adopted by the EAP

73. The identification of impact avoidance measures and no-go areas in order to mitigate and manage impacts on heritage resources and the landscape (as identified in the specialist CLA) has been ignored in the BARs. This is inexplicable.

74. The identification of no-go areas in the CLA is based on a range of sensitive heritage receptors including scenic routes and historical farmsteads, as well as visually sensitive mountain slopes and ridgelines. The overlay of turbine positions with these heritage sensitive areas clearly indicates the number of problematic turbine positions. As a result of this layer of sensitivity a range of turbines are fatally flawed yet this finding is not integrated or carried over into the BARs. The omission is inexplicable. The same hold true for visual impacts.

75. The heritage impact of the proposed WEFs on the cultural landscape has an impact rating of very high negative impact without mitigation. The mitigation of this impact to an acceptable moderate level of impact from a cultural landscape perspective is very clear. The CLA concludes that the development should be limited to low lying areas and maintaining buffers around routes and farmsteads.

76. The assessments show that the majority of proposed turbines for both the Wind Garden WEF, and the Fronteer WEF are fatally flawed. Notwithstanding this fact there has been no attempt integrate these findings into the revised BAR in a meaningful manner. The omission is inexplicable and the sole motivation (to allow the developer to achieve economic feasibility) offends the section 2 NEMA principles.

77. As noted by Oberholzer (July 2021), there is a degree of consistency between the heritage sensitivity maps produced by Hearth Heritage (June 2021) and the visual sensitivity maps produced by visual specialists (LOGIS May 2020) and similar maps produced by Winter (April 2021). From a combined heritage and visual perspective, a very large proportion of the proposed turbine positions are fatally flawed as they give rise to unacceptable impacts.

78. Notwithstanding the critical new information provided by the specialist CLAs, the primary findings around the limited carrying capacity of the cultural landscape (receiving environment) and the significant fatal flaws in terms of numbers of turbines and proposed turbine positions have been dismissed in the revised HIA reports and the BARs. This selective integration of specialist findings smacks of biased and compromised assessment / reporting.

79. The findings of the CLA are dismissed in the revised HIA reports on the basis that the projects will be economically unfeasible and that the overall impact on heritage resources after the other 'economically sustainable' mitigation measures are implemented is acceptable. This is irrational and inexplicable.

80. The HIA process is required to satisfy the requirements of section 38 of the NHRA for the findings of a heritage specialist to be dismissed based on the economic feasibility of a project. The credibility of the impact assessment process is called into questions. The approach is seriously problematic and does not satisfy environmental practice.

81. The BARs and revised heritage reports rely overwhelmingly on the question of economic feasibility. This approach is incompatible with the provisions of Section 38 (3) (d) of the NHRA, which refers to an evaluation of the heritage impact of development relative to the sustainable social and economic benefits to be derived from the development. Neither NEMA nor the Constitution provide justification for economic consideration to override environmental considerations irrespective of cost or impact.

82. The conclusion of the revised HIA reports that the development will constitute an additional layer to the cultural landscape and that through the implementation of 'economically feasible' recommendations will 'preserve' and in some cases 'enhance' the 'older layers' in the cultural

landscape is self-serving and absurd. In terms of acceptability this statement represents a gross misconception of heritage management principles. It undermines the role of cultural landscape assessment in HIA processes.

83. The effect of the failure to integrate the CLA findings in a balanced and acceptable manner calls into question the impartiality of the authors of the revised BARs and the revised HIA reports. The findings of the CLA are downplayed and/or ignored in order to promote development at any costs. Anny decision by DFFE to authorise the proposed projects on this basis will involve a significant trade-off that promotes economic development over and above the socio-economic and environmental impacts

84. The primary recommendations of the CLA have been dismissed good reason. Cultural landscape issues therefore remain inadequately addressed in the revised HIA reports due to the fact that the primary recommendations of the specialist Cultural Landscape Assessments have not been adequately integrated into the revised reports.

85. Based on external specialist review by S Winter (2021) the revised HIA reports still fail to satisfy the requirements of Section 38 (3) of the NHRA for the above reasons.

Visual Receptors

86. A major concern expressed during the initial commenting period was that not all sensitive receptors / viewpoints have been identified and assessed, nor had adequate photomontages been provided for those receptors most affected.

87. The VIA specialist's response to this concern is that:

A total of 76 potential sensitive visual receptors were identified and listed within the study area, including 12 with specific objections. It is not possible to consult with all of these, nor is it possible to provide photo simulations for all that are affected. The photo simulations are representative of what the wind turbine would look like from varying distances and not intended to show the wind farm from all directions.

88. The response by the VIA specialist fails to mention that only 5 viewpoints (and photomontages) were selected for the purpose of the VIA. It fails to mention that the same 5 were used for both WEFs. It fails to mention that 3 of which were from public roads. It fails to mention that 1 viewpoint was from inside the site for the Wind Garden WEF site which is therefore not a sensitive viewpoint. That means there was only 1 viewpoint from a sensitive neighbouring property.

89. This approach to visual impact assessment is deeply flawed and it seriously undermines the credibility of the VIA. The number of viewpoints should have been informed by the context and the number of directly affected game reserves and surrounding landowners. The impact on sensitive visual receptors is unresolved and unassessed.

90. This issue has therefore not been addressed and no further relevant information is given in the current (revised) reports. The VIA report is therefore rejected and does not form a valid basis for informed decision-making.

Impacts of Lights Pollution

91. The original review of the VIA by Oberholzer indicated that, other than an abstract example, (from elsewhere), no visual simulations of the lights at night from sensitive viewpoints are provided. This is not only unusual given the importance of the rural / wilderness experience of the immediate area, and the proximity of the Kwandwe Nature Reserve, it is also inadequate.

92. The response on this is aspect in the revised BARs is utterly deficient. The impact is simply assumed and no information has been made available to I&APs to be able to understand the implications of this impact.

93. The night-time lighting of the existing Grahamstown WEF (Waaihoek) is visible at night from distances up to 50kms. The response to this concerns glibly suggests that Needs-based night-time lighting is recommended as mitigation measure. This response is inadequate and fails to

address the substance of the project relate impact. The issue is unresolved.

94. The impact has not been addressed an no further information is given in the current VIA. The external review by Oberholzer (2021) specifically demonstrated the potentially significant visual impacts at night but the EIA team has sought to ignore this impact. This constitutes a material omission.

Visual Sensitivity Mapping

95. With reference to credible external opinion, in the comments on the draft BARs it was expressly noted that is incumbent on the visual specialists undertaking the specialist assessment to first employ avoidance measures, in terms of the mitigation hierarchy. Avoidance must be implemented as it is effective in reducing potential visual impacts. This would ideally occur at the early screening stage of the project to inform the layouts of the two projects but for the reasons stated in the previous comments this screening process was not undertaken transparently during the assessment process. That is an issue that has already been highlighted as a concern in the independent external review by Global Green.

96. The response to this issue in the revised reports confirms that the approach is flawed and the methodology at best inadequate. The visual specialist for the projects confirms that avoidance measures were only partially implemented based on the visual sensitivity assessment. Furthermore this was done by the project proponent when they produced the final layout. This assessment identified problem turbines and listed them. T

97. he VIA specialist LOGIS also provides an earlier guidelines document with a series of maps, (May 2020), presumably from the screening stage, which identifies problem turbines that should be relocated or removed. The specialist concedes that this was only partially implemented by the proponent.

98. For some inexplicable reason these guidelines, indicating visual sensitivity, (or an updated version based on the current layout), are not included in the original nor the current VIA, and

despite the Reviewers having provided a similar series of visual sensitivity maps.

99. A further response by the VIA specialist notes that:

"I would recommend that I update the Visual Sensitivity Assessment (2020-5-21) with the final turbine layouts and identify potential problem turbines. This sensitivity assessment should be appended to the existing report. Recommendations should be made regarding the removal/relocation of problem turbines, but the onus should ultimately fall on the project proponent to address these."

100. In response to this we record that the specialist (LOGIS) has not carried out their own recommendation for a visual sensitivity assessment, nor have they updated the current VIA as suggested. This is inexplicable. It equates to an admission by LOGIS that the visual sensitivity mapping is missing from the VIA. Unfortunately, this renders the VIA incomplete and therefore flawed. The VIA is non-compliant with the level of assessment required in terms of the NEMA Regulations.

101. Despite the numerous flaws identified in the earlier review of the VIAs for the projects, including the lack of adequate inclusion of sensitive viewpoints and absence of visual sensitivity mapping, the VIA specialist has chosen not to remedy these flaws in their VIAs for the two proposed wind farms. In fact, no changes have been made to the flawed Reports. Only the date has changed on the cover. This is unacceptable.

102. The conclusion therefore remains as previously stated that the assessment of visual impacts remains deeply flawed. There are too many omissions to warrant an informed recommendation regarding the visual acceptability of the two proposed wind farms.

103. The desktop mapping by the Reviewers indicates that parts of the wind farm layouts are clearly problematic from a visual perspective, resulting in fatal flaws for many of the proposed wind turbines in both the Fronteer and Wind Garden WEFs.

104. The impact is unresolved.

Noise Impacts

105. The finding on noise impact remained unchanged. Given the substance of the concerns the EAP is required to provide a reasoned opinion on whether the proposed activity should be authorised; and the acceptability of the proposed activity. Serious concerns have bene raised by stakeholders were raised about the deficiency of the impact of noise. Notwithstanding these flaws, the finding has not changed. The revised BAR is rejected on this basis alone.

106. In relation to noise impacts and impacts on fauna, the BAR and specialist study (Appendix J: Noise impact) make no mention of the decay of the sound energy for the IF and LF frequencies over distance and under varying atmospheric conditions (wind, temperature, humidity).

107. Based on inadequacy of the studies there is no data regarding how far and at what intensity the sound in this frequency range will travel. This is a material omission. The impact this could have on the terrestrial mammals and megafauna in particular is unassessed unresolved.

108. Ambient sound levels were not measured in the wilderness areas i.e. in a context away from human habitation, and are therefore not representative of wilderness areas.

109. An increase in noise levels from ambient wilderness levels to operational wind turbine conditions will require a greater adjustment for animals than the incorrect situation presented in the noise assessments undertaken.

110. The BARs and specialist studies (Appendix J: Noise impact) do not pay adequate attention to the potential direct impact of the operational noise of the wind turbines.

111. The specialist study falls substantially short of considering adequate detail of how sound may affect the natural ecology of large mammal wildlife, and particularly black rhino and elephant communication, on surrounding properties including Kwandwe Private Game Reserve, and of acknowledging where there is inadequate knowledge and data to guide effective decision making. The implications of insufficient data are not acknowledged anywhere in the revised BARs.

112. The studies give inadequate recognition of the risks posed to the Kwandwe Private Game Reserve by the proposed development and the subsequent degrading of the natural resource base that the economy is based on due to noise.

113. One of the co-authors of Field Propagation Experiments of Male African Savanna Elephant Rumbles: A Focus on the Transmission of Formant Frequencies (2018) has raised concerns about the efficacy of the assessment of noise impact on megafauna and in particular elephant. The concerns include:

113.1. Research shows that elephant calls travel at least up to 1.5, and in some cases 2 km distance. Other research showed that elephant communicate up to 4 km distance, in some cases even more, up to 10 km.

113.2. It is incorrect to state that low-frequency noise (at a distance greater of 100 meter) does not affect elephants.

113.3. Low-frequency noise travels far, and it has been shown that the noise of wind turbines travels up to 20 km.

113.4. The statement that elephant and rhino communication and welfare is not affected is incorrect, and totally unsubstantiated by scientific evidence.

114. If anything these concerns highlight the need for this impact to be fully investigated. This impact is unresolved and unassessed. The precautionary principle therefore applies in this instance but the implication of the lack of relevant data has been ignored in the studies and the BARs.

115. The absence of relevant data in the studies undertaken proves that a precautionary approach should be adopted. The assessment of noise impacts is defective.

Cumulative Impacts

116. The development of these WEFs in close proximity to one another increase the adverse impact on the environment. The risk that comes to mind is the unsustainable use of groundwater, visual intrusion and light.

117. Mindful of this possibility, NEMA requires that the cumulative impact of a proposed development, together with the existing developments on the environment, socio-economic conditions and cultural heritage must be assessed.

118. The cumulative effect of the proposed development must naturally be assessed in the light of existing developments. A consideration of socio-economic conditions therefore includes the consideration of the impact of the proposed development not only in combination with the existing developments, but also its impact on existing ones.

119. The thresholds for determining and assessing cumulative impacts is not supported by the extent of impact particularly the visual impact on key receptors and the impact at night of light pollution. Based on the current data and approach the assessment of cumulative impacts is inadequate.

SUMMARY OF KEY ISSUES & CONCERNS

120. The assessment belittles and compromises the environment and identified sensitive environmental features in favour of development at any cost.

121. The approach flies in the face of s 24 of the Constitution which recognises the need for the protection of the environment while at the same time it recognises the need for social and economic development.

122. These comments highlight several shortcomings of the revised BAR's and the revised specialist studies. The BAR's and the conclusions drawn from them should be rejected, as the reports are not deemed to be factually correct or objective. The underlying data used to support the

conclusions and findings is not credible and critical scientific evidence is lacking in key respects.

123. The assessment approach undermines ss 2, 23 and 24 of NEMA which contemplate the integration of environmental protection and socio-economic development. NEMA read with s 24 of the Constitution envisages that environmental considerations will be balanced with socio-economic considerations through the ideal of sustainable development.

124. The critical importance of integration is apparent from section 24(b)(iii) of the Constitution which provides that the environment will be protected by securing "ecologically sustainable development and use of natural resources while promoting justifiable economic and social development". Sustainable development and sustainable use and exploitation of natural resources are at the core of the protection of the environment. The comments show how this objective is subverted by the current assessment.

125. The assessment approach undertaken in connection with these two projects – by deliberately brushing off and ignoring key identified constraints from a heritage / cultural landscape / visual perspective is deeply flawed. The extent to which the revised BARs and specialist reports suggest that 'economic sustainable' mitigations measures can somehow result in an acceptable levels of impact is unfounded.

126. It is very clear from several studies undertaken (and confirmed by external independent opinion) that the number of turbines and turbine positions are fatally flawed. There are no grounds to dispute this information.

127. Direct impacts on neighbouring game reserves and landowners referred to above continue to be ignored. Impacts on the immediate receiving environment (on neighbouring game reserves and landowners) have not been assessed. Impacts for the region and broader environment have not been quantified.

128. The reports make no mention of the risks to rhino conservation through the increased presence of people working on the border of the Kwandwe Private Game Reserve or more regionally in the properties of the Indalo PE. Indeed to the broader benefits of the existing network of game

reserves in the area and in terms of the biodiversity economy are myopically ignored in favour of a clear bias in favour of the projects being developed.

129. Based on the sensitivity mapping prepared by LOGIS (May 2020), but not included in their VIA Reports, as well as similar mapping by the Reviewers (April 2021) and by Heath Heritage (June 2021), the results indicate that about half of the proposed turbine positions are clearly unsuitable for development.

130. This highlights the fact that the screening process was deeply flawed (our previous comments refer) and the impact assessment has not responded to environmental constraints. This is inexplicable.

131. On balance the impact assessment process for the two projects is deficient and based on the identification of environmental sensitivities the proposed projects are poorly conceived and not desirable in terms of the severe negative impacts.

Yours sincerely

Richard Summers Inc

Per RW Summers

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Our GAME

21 July 2021

Ms Nicolene Venter

Savannah Environmental

(publicprocess@savannahsa.com)

P.O. Box 148

Sunninghill

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Dear Ms Venter

RE: PUBLIC COMMENTS ON SAVANNAH ENVIRONMENTAL (2021) THE REVISED BASIC ASSESSMENT REPORT FOR THE FRONTEER WINDFARM AND ASSOCIATED INFRASTRUCTURE, EASTERN CAPE PROVINCE.

Kindly receive the attached document with Wildlife Ranching South Africa's comments to the Revised Basic Assessment Report made available for review on Monday, 21 June 2021.

Please confirm in writing on receiving of this e-mail.

Kind Regards

Richard York

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We have considered the responses that have been provided in relation to the comments submitted in terms of the Basic Assessment Report(s) and their revisions and annexures ("The Reports").

Considering our comments and the responses we submit the following feedback:

1. Generally, range of our comments have not been substantively addressed and consequently the respective issue at hand remain unaddressed. The mere fact that there is a response does not imply an adequate and acceptable response.
2. Generally, comments have been brushed aside, deflected or not addressed at all and consequently the issues at hand remain unaddressed.

The following examples demonstrate the inadequate consideration or disregard of the comments placed on record and before the authors of The Reports:

1. The SAM methodology that is used in the assessment is the basis of the socio-economic impact assessment is a blunt tool that is used in the reports to estimate the specific local impacts of the development. The SAM that is used suffers a number of noteworthy shortcomings that cannot be ignored and which will have a fundamental impact on the conclusions that will be reached:
    a. The shortcomings are:
        i. The model and data is outdated with provincial data from 2006
        ii. It has only a provincial perspective and does not have a resolution on a local level or context in the in the actual local domain where the development is proposed. To assess the local impact the local context must be considered.
        iii. No evidence is provided to substantiate the appropriateness of the methodology or any of the assertions related to the datedness of the underlying data used in its specification.
        iv. The approach uses historical data (backcasting) to predict the future impact (forecasting). This approach assumes that what which exists in the past will persist in the future. Clearly this is not necessarily an accurate future scenario and there is an inherent and unavoidable risk that the assumption will not hold. Consequently, there is a high probability that the methodology and its assumptions will lead to inaccurate forecasts and an assessment of the impact.
    b. As a result of these indisputable shortcomings the methodology that is used to determine the socio-economic impact is very questionable and has a high risk of inaccuracy and therefore any conclusions about the socio-economic impact and consequent recommendations from this process are equally tainted with probability of a lack of precision and a high risk of conceptual flaws.
    c. Notwithstanding these significant and fundamental shortcomings and risks in the methodology the specialists persist with the methodology and the conclusions that are

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drawn from the analysis as if these flaws that have been pointed out are of no concern or consequence.

d. While the input output and/or social accounting matrix is presented "as is" as the tool to conduct the socio-economic impact for the proposed projects the model has not been published nor is there any proof that the model has been subjected to any peer review process, as would be an acceptable professional practice. The bone fides of the model are therefore still not beyond doubt and consequently neither are the findings and recommendations that flow from the use of the specific model in the specific context.
e. The response that local data collection addresses a lack of granularity of the socio-economic impact at the local level is disputed on the basis that no actual quantification of the local impacts has been done or added to the revised reports.

2. The collection of data and inputs from a local context was a significant and blatant shortcoming of the process to solicit local inputs about the impacts. The further process to address this fundamental gap is noted but remains inadequate.
    a. These shortcomings are:
        i. Organizations that had publicly expressed an interest and need to participate in a consultation process have not been part of the further consultations. This includes WRSA, who offered inputs and requested participation into the process at a public meeting and which invitation was welcomed at the meeting. WRSA has not been consulted in this process at all. This is against the spirit of open consultation in an important process that affects stakeholders in the domain of WRSA.
        ii. Whereas parties within viewshed of the installation may have been contacted to bolster the consultation database it is unthinkable that a comprehensive and representative consultation process with parties that will be directly or indirectly affected by the installation was still not performed. It is blatantly obvious that the socio-economic impact of the installation stretches beyond whether a specific party will actually see the installation (as per the viewshed of the installation) or not.
        iii. There is still no methodical quantification of the overall negative impacts that are expected as a result of the installation to that the purported benefits can be weighed against the expected damages as a result of the project.
    b. As a result of these indisputable shortcomings in the further data collection process and in addition to the earlier shortcomings related to data collection the adequacy of the local data used to inform the opinions of the specialist remains fundamentally insufficient and flawed for the reasons noted above. As a result, any conclusions or recommendations that flow from the local analysis have a high risk of not being

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representative of the local context due to a lack of comprehensive and representative consultation with parties that will be directly and/or indirectly impacted. The methodological appropriateness of the actual sampling of respondents as discussed in the report is statistically disputable in terms of representativeness.

c. Notwithstanding the flaws that have been pointed out in terms of two attempts to appear to collect comprehensive and representative local data the specialists persist with an approach that does not address the specific need to collect an appropriate amount of data from an appropriate sample of respondents. There is no effort to justify the adequacy of the data collected. The consequence is that local consultation and data collection remains methodologically inadequate and any conclusions and recommendation that are drawn from the analysis may well not be an accurate representation of the local impacts.

3. In the context of the game ranching sector it was also specifically noted that a very high density of game ranches and game reserves are located in the Makhanda region. These businesses depend on 1.) trophy hunting, 2.) local hunting, and 3.) eco-tourism to exist (Source: An assessment of the economic, social and conservation value of the wildlife ranching industry and its potential to support the green economy in South Africa). The very extensive wildlife-based enterprises in the immediate region of the proposed projects are also not mentioned and the basic assessment which is a very significant shortcoming of the report. As noted herein and as widely accepted such businesses depend on a pristine environment and natural landscape to offer an authentic experience for 1.) trophy hunting, 2.) local hunting, and 3.) eco-tourism and consequently their prominence in the particular landscape cannot be disregarded or be made irrelevant to the specific developments. **Moreover, it is reasonably obvious that the impacts on these nature-based businesses are not limited parties to directly adjacent properties or properties in viewshed of the installation. These impacts must be considered in the full extent to which the impact will ripple through these businesses or parties in whichever way or extent the are affected.** Mindful of the intent of this comment the following is noted:
    a. The prominence of wildlife-based businesses in the vicinity of and in the general areas has been flagged as an important consideration in terms of the impacts of the proposed. The request was not for an assessment of individual properties but for a **comprehensive assessment of the vast network of nature-based properties and business in the particular landscape that will be irreversibility affected by the development of the installation**. These should be considered as a whole and as a significant feature of the current landscape.
    b. The **Reports continue to avoid a comprehensive and quantified analysis of the impacts that the proposed installation will have, specifically on nature-based business** that have invested in and have been operating in the general area where the

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installations are planned. At best, the assessment and its revised versions merely venture an opinion about the likely impact on game farms, game reserves and other nature-based enterprises in the general area. **The reports also ignore evidence from their own data collection processes that windfarm installations have significant detrimental impacts on game farm businesses** despite the reports 'assertions that downplay this impact. Refer to the comments in this regard.

c. It is asserted that the **socio-economic assessment cannot avoid substantive, methodical quantification of both positive and negative impacts to objectively demonstrate socio-economic impact** and desirability of the installations. Because the reports don't methodically quantify the negative impacts of the installation the extent of the detrimental impact of the proposed installation remain hidden from view and are not weighed against alleged benefits.

d. The **refusal to quantity and consider the actual negative impact of the developments, specifically on prominent nature based sectors in the specific landscape is a substantial flaw in ensuring a balanced and impartial assessment of the impacts.**

These three examples above demonstrate the inadequate consideration or disregard of the comments placed on record and before the authors of The Reports in an attempt to improve The Reports so that a robust and balanced assessment can be placed before decision-makers. It is, however, clear that the initial reports and their revised versions are largely being defended with limited regard for the substantial inputs made.

As a consequence of the current state of the Revised Basic Assessment Reports each and every comment made in the first process of comments are submitted again in their entirety in relation to the Revised Basic Assessment Reports due to partial or wholly inadequate consideration or disregard of the comments placed on record and before practitioners.

In conclusion, The Reports continue to be blemished as a result of a number of shortcomings in the process and in the content that have been specifically pointed out and which remain unaddressed and/or disputed. As a consequence, we assert that:

1. The Reports continue to provide a substantively inadequate assessment of the impacts of the development and the fail to provide a basis from which the competent authority can assess the impacts in their totality in a balanced and even-handed way.
2. The conclusions and recommendations made in the various reports are derived from unconvincing processes and methods. Most importantly the assessment cannot escape methodical quantification of both positive and negative impacts at the appropriate level of resolution if it should substantively demonstrate impact.
3. The Basic Assessment Report(s), and specifically the socio-economic report and its revisions cannot and should not be used for decision making in current its current form.

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Without prejudice we reserve our rights to make further comments as may be necessary.