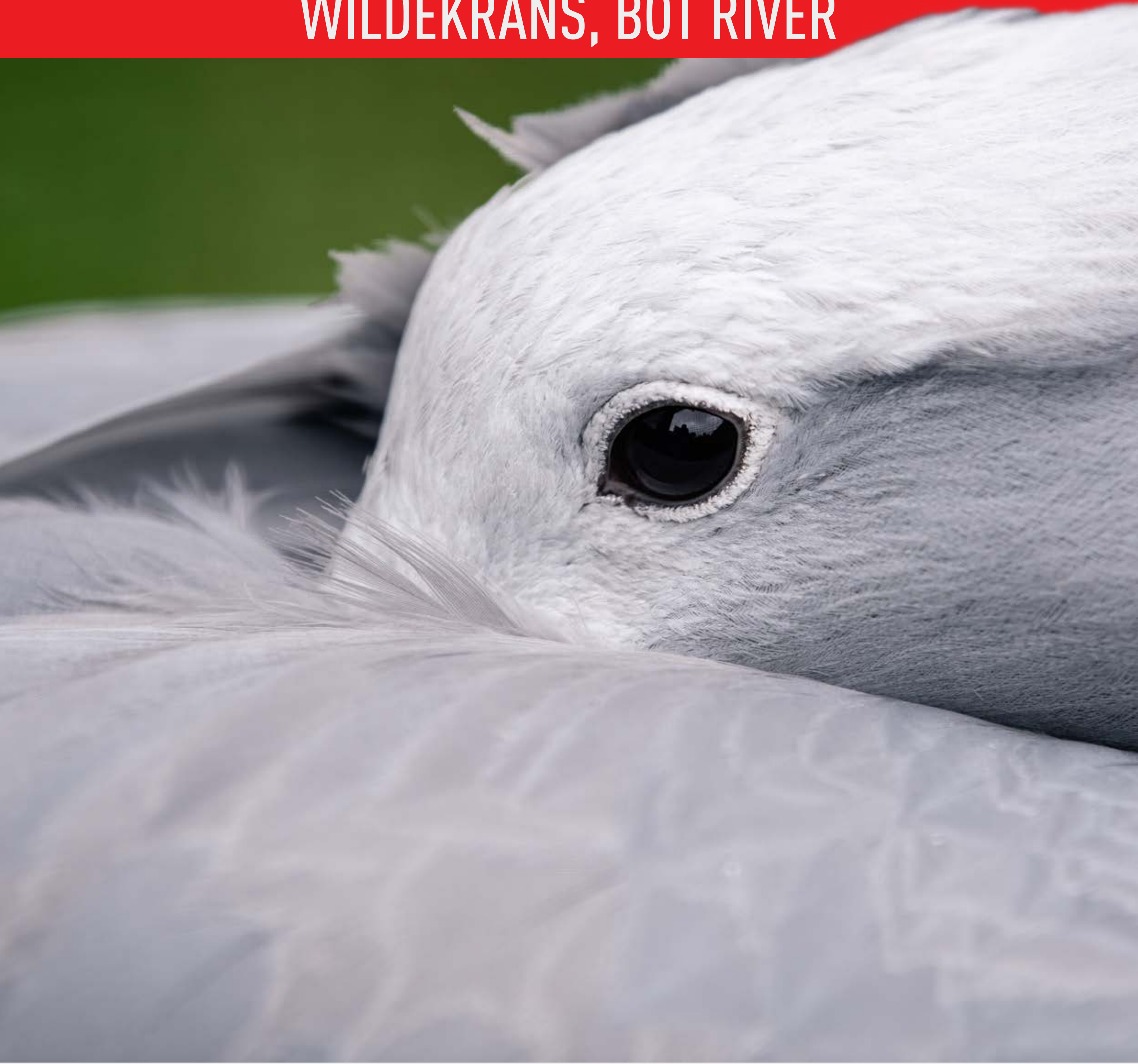
8-10 October 2024 | *Compiled by Christie Craig and Lauren Waller*

BLUE CRANE CONSERVATION PLANNING WORKSHOP

WILDEKRANS, BOT RIVER



EXECUTIVE SUMMARY

The Blue Crane *(Anthropoides paradiseus)* is primarily found in South Africa, with a small population in Namibia. It inhabits grasslands, the Karoo, and intensively farmed areas in the Western Cape, where it has adapted to agricultural landscapes. The species is listed as Vulnerable on the global IUCN Red List and Near-Threatened in South Africa. Despite an overall increase in population since the 1990s, recent studies show a decline, particularly in the Overberg region, where chick survival rates are lower. Major threats include powerline collisions, habitat changes, and climate change impacts. While some regions, like KwaZulu-Natal, show recovery, national numbers are decreasing, prompting a reassessment of its conservation status, and revision of the conservation plan. The last conservation plan was developed in 2000, through a Population and Habitat Viability Assessment. The objectives of the 2024 Blue Conservation Planning Workshop were as follows:

1. Develop a species action plan for Blue Crane
2. Guide the development of the Three Crane Biodiversity Management Plan
3. Build a network of people working together to conserve Blue Cranes

Twenty-eight people attended the workshop in person, and developed the following vision for Blue Crane conservation:

"South Africa's national bird, the Blue Crane is healthy and resilient across agroecological landscapes, as a symbol of successful coexistence."

Photo Credit: Ciming Mei

As part of the conservation planning process, a Population Viability Analysis was run. The PVA model projected a decline in the Blue Crane population to under 10 000 individuals in 100 years. Grassland populations remain stable initially before declining, while other regions show consistent declines. Key factors influencing population trends include:

Breeding Success: A 50% increase in the Overberg and Swartland stabilizes or reverses declines.

Mortality: Reducing juvenile and immature mortality by 20–30% promotes growth, while adult mortality has less impact.

Threat Mitigation: Cutting powerline deaths by 50% stabilizes most populations, while controlling poisoning is crucial to prevent severe declines.

External Threats: Disease at major roosts and high poisoning rates cause sharp declines, with the latter potentially leading to local extinctions. Wind turbine collisions have minimal impact.

While extinction is unlikely within 100 years, significant declines are expected, making targeted conservation efforts to boost breeding success and reduce juvenile and immature mortality is essential for population stability.

The participants split into three working groups (Direct Threats, Land-use in Karoo and grasslands, Agriculture in Overberg & Swartland) to develop goals and actions. The following 27 goals were identified. These goals had a total of 60 actions associated with them.

1. All powerlines in high-risk areas are mitigated
2. All new powerlines are designed and routed in a bird friendly manner.
3. Research the effectiveness of bird flight diverters on all powerline voltages.
4. Promotion of more cost-effective installation methods (includes Independent Power Producers).
5. Reduce the presence of harmful agrochemicals in the landscape occupied by Blue Cranes.
6. Understand the impact of agrochemicals on the Blue Crane population (direct and indirect).
7. When poisoning incidents occur, mitigate mortality.
8. Reduce the presence of lead in the environment.
9. Understand the impact of fences on the Blue Crane population and risk factors for fence entanglements
10. Develop mitigation measures for Blue Crane fence entanglements and disseminate the information
11. Ensure placement of turbines and associated infrastructure to limit mortality of cranes
12. Where unsustainable mortality is recorded ensure appropriate mitigation and adaptation
13. Understand Blue Crane movements within landscapes (Karoo and grasslands)
14. There are appropriate rehab facilities and protocols to treat Blue Cranes
15. Understand the implications and causes of bent leg syndrome
16. Gain a better understanding of the effects of overgrazing on Blue Cranes
17. Reduce the impact of overgrazing by recognizing crane-friendly farmers and farming practices.
18. Use Biodiversity Stewardship and offsets to secure important areas for cranes with a management plan that encourages the correct management practices that benefit cranes
19. Monitor habitat loss (through GIS and observations of current activities causing loss of habitat)
20. Produce numerical and spatial targets for Blue Cranes for incorporation in systematic conservation plan revision (C-Plans)
21. Ensure that invasive species (plants and animals) do not occupy areas within Blue Crane habitats
22. Limit rural sprawl in key crane areas
23. Understand the threat of current mines and the extent of those that have been granted approval and those with prospecting licenses, and identify priority areas where future mines can pose a threat to Blue Cranes
24. Anticipate likely changes in agricultural activities through engagement with the agriculture industry, agricultural economists and climatologists
25. Build partnerships on a foundation of trust, empathy and communication, bridging the gap between threats and solutions.
26. Improved knowledge and implementation and adaptation of best practice activities to improve breeding success and reduced mortality of Blue Crane in agricultural landscapes
27. Understand the interplay between Blue Crane life history and agricultural production to predict how land use change will impact Blue Crane populations.

The next steps of the conservation planning process are as follows. Damian Walters will lead the documentation of the species' conservation history, complementing an ongoing Master's thesis. Stakeholders will stay connected via a WhatsApp group, with Christie Craig coordinating communications. Discussions with DFFE support developing a Biodiversity Management Plan (BMP) for all three crane species, ensuring national and provincial recognition. While concerns were raised about the resources required, it was decided to proceed with a BMP. Outcomes from related workshops and international agreements will be consolidated into a single document for all three crane species.

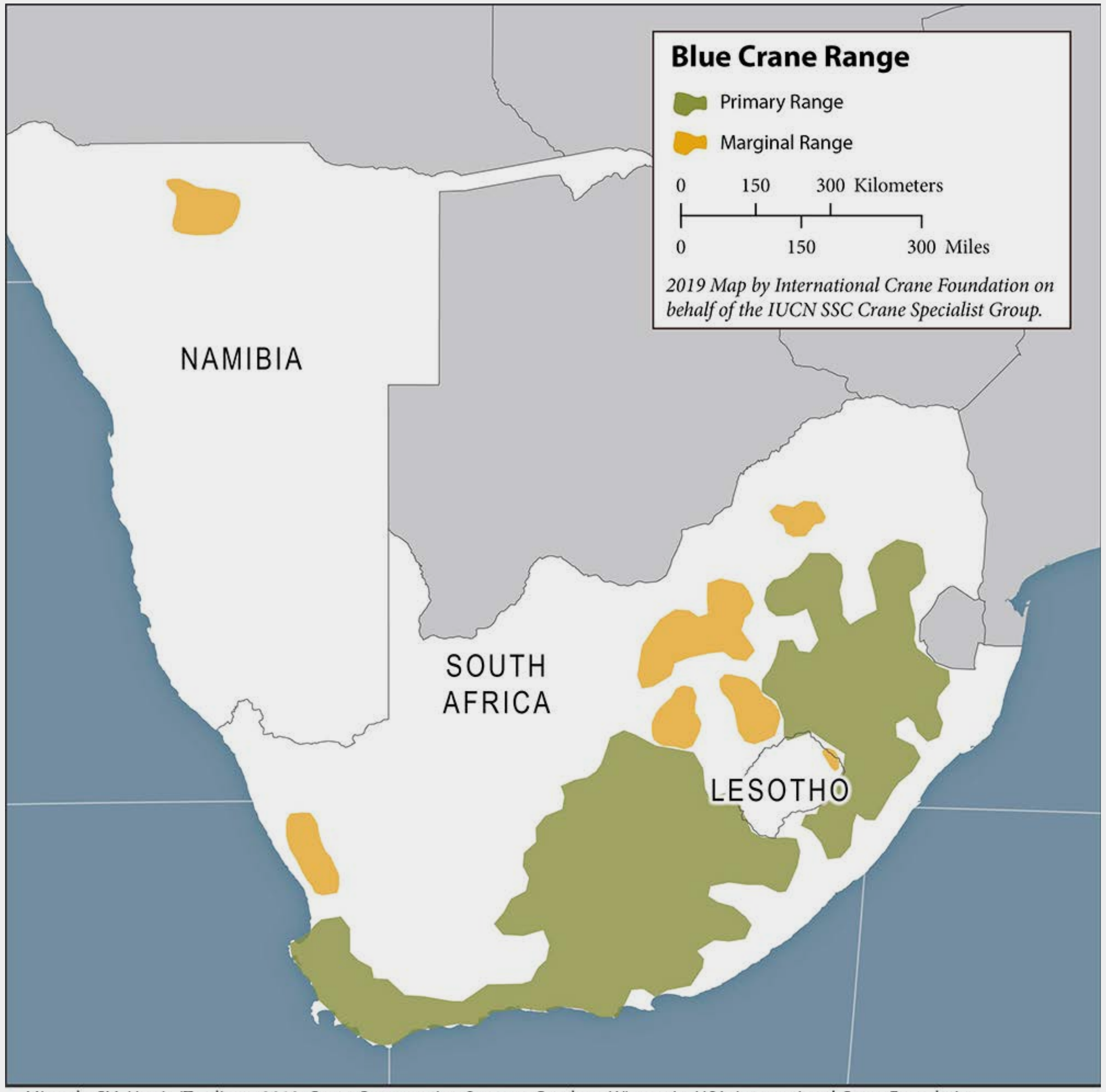
CONTENTS

Photo Credit: Ciming Mei

WORKSHOP REPORT

BLUE CRANE BACKGROUND

The Blue Crane *(Anthropoides paradiseus)* occurs predominantly in South Africa, with a small, isolated population in Namibia of less than 50 birds (Namibia Crane Working Group 2019, 2020) (Figure 1). In South Africa, Blue Cranes have three core sub-populations: one in the eastern grasslands; one in the central Karoo and one in the south Western Cape (Overberg/ Swartland regions), where it is a relatively recent colonizer of agricultural areas i.e. since the early 1900s (Allan 1993).



Mirande CM, Harris JT, editors. 2019. Crane Conservation Strategy. Baraboo, Wisconsin, USA: International Crane Foundation.

Figure 1: Blue Crane *(Anthropoides paradiseus)* global range.

The Blue Crane prefers dry short grasslands, and together with the Demoiselle Crane (*A.virgo*), is the least dependent on wetland habitats for breeding. Within the grasslands, the species is more abundant and evenly distributed in the eastern "sour" grasslands (where natural grazing of livestock is the predominant land use). In the arid Karoo, the species is found in areas where perennial grasslands are dominant over the more typical scrub Karoo vegetation of the region. In the Fynbos, the species is restricted almost exclusively to intensively cultivated habitats (mainly cereal crops and small livestock farming).

Blue Cranes are summer breeders, nesting from late September through to February. Preferred nesting sites are secluded open grasslands or wheatlands with full view around the nest for predator evasion. A clutch of 2 eggs is laid, generally in a shallow grassy depression or simply on the bare ground. Occasionally, Blue Cranes may nest in shallow seasonal wetlands, particularly where livestock numbers are high, and risk of nest trampling is increased. In agricultural areas, they nest in pastures, in fallow fields and in crop fields as stubble becomes available after harvest.

The Blue Crane is termed a partial migrant, gathering in large flocks during the winter months having moved out of their breeding territories. Movements appear to be localized, with flocks moving mostly in large groups within their subpopulations (e.g. the subpopulation in the Karoo biome) with infrequent mixing throughout the country (Allan 1993; van Velden et al. 2016).

Across their range, Blue Cranes are threatened by power line collisions, fence entanglements, poisoning, and breeding disturbance, but these threats are exacerbated in the intensively farmed areas of the Western Cape which are more densely populated by people (Bidwell 2004; McCann et al. 2007; Shaw et al. 2010; Verdoorn 2015; Shaw et al. 2021; Overberg Crane Group 2022; Bouwer 2023; Overberg Crane Group 2023). A further concern in the Western Cape, is that it is predicted to get hotter and drier with climate change, and rainfall patterns are predicted to change; this has already been observed to some extent (Engelbrecht et al. 2009; Engelbrecht et al. 2011; du Plessis & Schloms 2017). This may increase thermal stress for these ground nesting birds (Bouwer 2023). This may also drive changes in agriculture, which has implications for both farmers, and the Blue Cranes that are dependent on the current agricultural mosaic of pastures and cereal crops.

CONSERVATION STATUS OF BLUE CRANES IN SOUTH AFRICA

The stronghold for this species was once the eastern grasslands of South Africa, but as this habitat became degraded through afforestation, mining and agriculture, the population is estimated to have halved since the 1970s, leading to it being listed as Vulnerable on the Global IUCN Red List (Meine & Archibald 1996; BirdLife International 2021). The Blue Crane has remained listed as Vulnerable on the global IUCN Red List ever since. In South Africa however, the species was down-listed to a less threatened category, "Near Threatened", in 2015, as the latest research at the time indicated that Blue Cranes had a healthy and increasing population in the Western Cape, and overall the national population had increased by 200-300% since the early 1990s (Hofmeyr 2012; Taylor et al. 2015).

In the last 10 years there have been a number of research studies looking at Blue Cranes and their threats. Most recently, a PhD study by Christie Craig assessed the conservation status of Blue Cranes in South Africa. This study indicated that the population of Blue Cranes in the Western Cape, namely in the Overberg, is no longer increasing, and in fact, in this region Blue Crane numbers have declined by 22% since 2011 (Craig 2024). As approximately half of South Africa's Blue Cranes are found in the Overberg, this decline has resulted in a national decline of 19% (Figure 2).

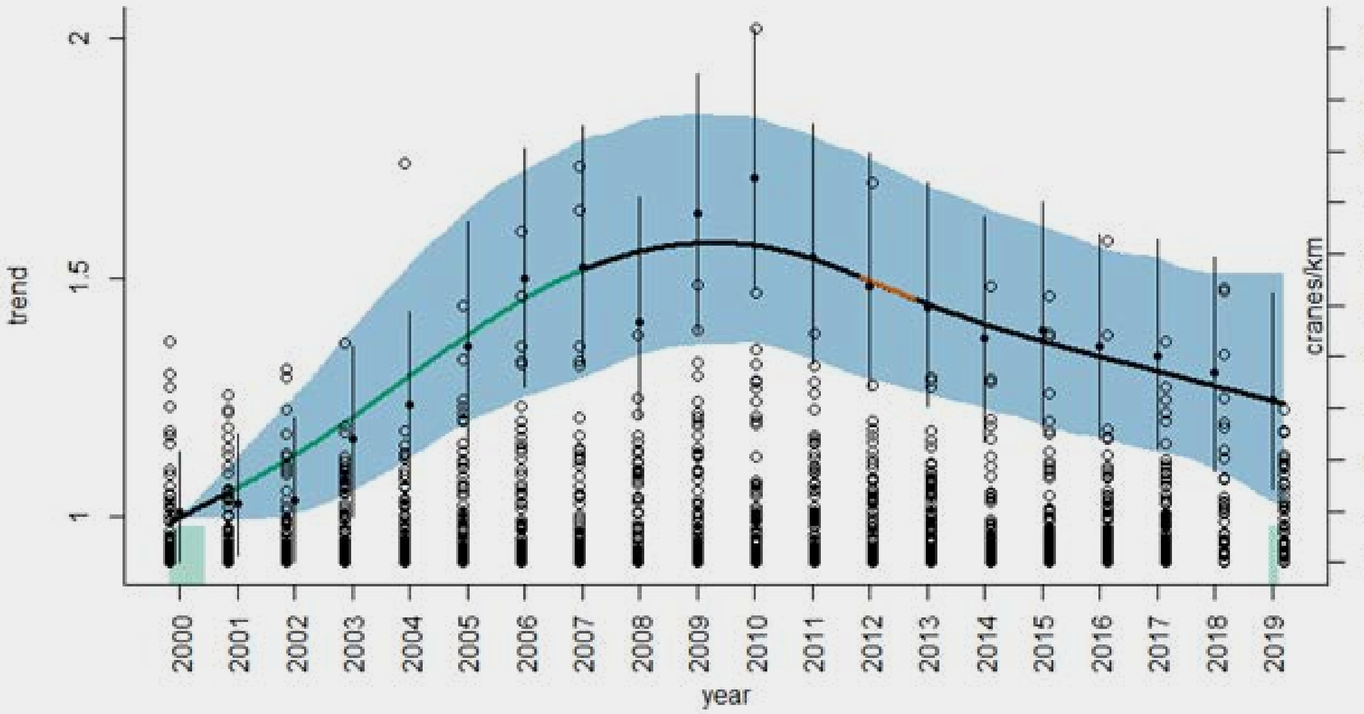


Figure 2: Model fitted to summer Blue Crane road count data from across South Africa (from the Coordinated Avifaunal Road count project), depicting the trend index for the data. The black line indicates the model, with blue shading indicating the uncertainty in the model. The open circles are the raw data. In green are years where there was a statistically significant increase and in red a statistically significant population decline.

Aerial surveys in KwaZulu-Natal indicate that Blue Crane numbers are recovering (Galloway-Griesel et al. 2022). Between 2003 and 2018, Blue Crane counts increased by 366% (Galloway-Griesel et al. 2022). This is encouraging but despite the increase in numbers in KZN, abundance is still relatively low, for example 2522 were counted in KZN in 2021 (Jordan et al. 2021) compared to 9331 in the Karoo in 2021 (Craig 2024), and with an estimated population of 4000 for the grasslands overall, it contributes little to the national trend. The national population is estimated at 51 000. It is estimated that 8% of Blue Cranes are found in the grasslands, 31% in the Karoo and 61% in the Western Cape (Craig, 2024). There is much less data from the Karoo, but drawing from the South African Bird Atlas Project, it seems as though the population has remained mostly stable, compared to the Western Cape and grasslands (Figure 3).

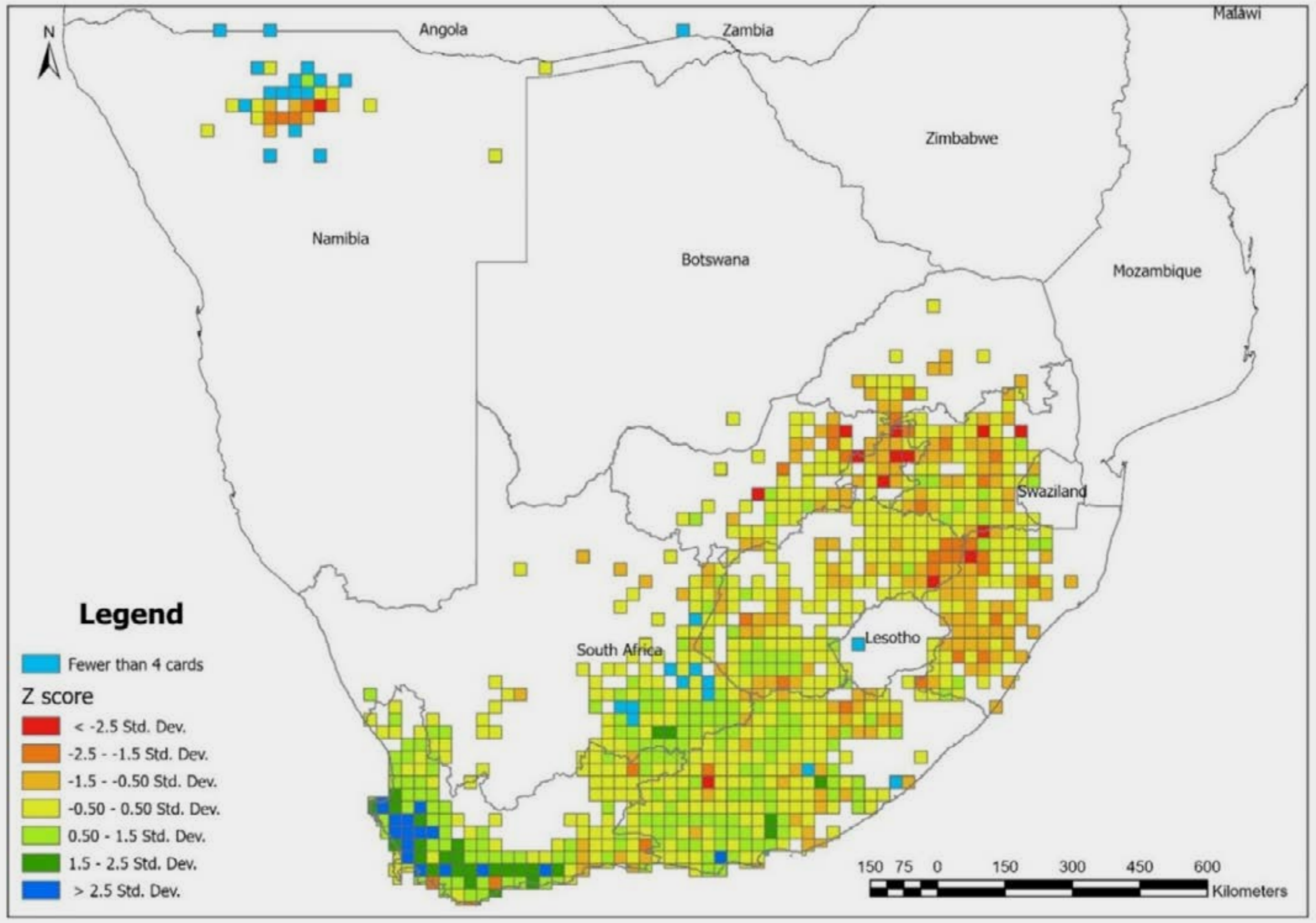


Figure 3: The change in reporting rate for Blue Crane by Quarter Degree Grid Cell between SABAP1 (Southern African Bird Atlas Project) and SABAP2. The strength of the change in reporting rate is indicated by the Z score, factoring in reporting rate and number of SABAP cards submitted. Z scores are displayed by their standard deviation from the mean, red and orange indicate declining reporting rates, yellow a stable or weak change in reporting rate and green or blue increasing reporting rates.

It is difficult to pinpoint the exact reason for the Overberg Blue Crane population tapering off in 2010 and declining since. From EWT breeding monitoring data (Craig 2024), breeding success is lower in the Overberg (average 0.81 fledglings/pair) and Swartland (0.64), compared to the past (1.06) (Aucamp 1993), and compared to the Karoo (1.02) and grasslands (1.01). Michelle Bouwer did her Masters in 2021/2 and investigated whether this reduced breeding success was due to higher clutch failure. She found that nest success (how many eggs hatch) is similar to 18 years ago (Bidwell 2004). This research suggests that it is not nest success but rather chick survival that is the demographic driver of the population decline. It is known that Blue Crane chicks drown in water troughs and get entangled in fences. From ringing Blue Crane chicks in the Swartland, observations have shown that their health is poorer than that in the Overberg and Karoo, where the chicks were weaker on release (Craig, Smith, Gibbons, Jordan. pers. obs.). The reasons for this are unclear at this stage. A postmortem of one ringed chick which died before fledging, indicated the cause of death was starvation. It is possible that in dry years, Blue Cranes chicks in the Swartland are unable to get enough food, but at this stage the data is insufficient to be conclusive.

Blue Crane adult survival is similar in the Western Cape (95% per annum), compared to the Karoo (96% per annum) (Altwegg & Anderson 2009; Craig 2024). The primary cause of mortality for adult Blue Cranes is collision with powerlines. In 2008, Jessica Shaw established that Blue Cranes collide with powerlines at an average rate of 0.31 cranes/km in the Overberg (Shaw et al. 2010). Collision rates are just as high in the Karoo i.e., 0.39 cranes/km (Shaw et al. 2021). Recent powerline surveys show that Blue Cranes are still colliding with powerlines at a similar rate in the Western Cape and Karoo, although rates are lower in the Overberg than they used be, likely due to concerted efforts to mark problematic lines (Craig 2024). A study over 8 years, showed that line marking reduced collision rates for Blue Cranes by up to 90% on transmission lines in the Karoo (Shaw et al. 2021), but Craig (2024) found that collisions are still occurring on marked lines close to water in the Western Cape and Karoo, as cranes fly into these areas in low light to roost.

CONTEXT OF THE BLUE CRANE CONSERVATION PLANNING PROCESS

In 2001 the (then) IUCN/SSC Conservation Breeding Specialist Group in collaboration with the Endangered Wildlife Trust (EWT) and the Overberg Crane Group held a workshop to develop a Population and Habitat Viability Assessment (PHVA) for Blue Crane (McCann et al. 2001).

In the 2001 workshop there were six working groups, focusing on institutional management and policy, education and awareness, habitat and land use, causes of mortality, trade, and population modelling. They each developed a list of recommendations for Blue Crane conservation, the two top interventions for reducing Blue Crane mortality were marking and routing of powerlines.

A population model was developed at the 2001 workshop, which very accurately predicted the 2001-2010 population trend that has been observed in the Western Cape population, i.e., rapid population growth followed by a flattening out in 2010 (Craig 2024). The 2001 model prediction for the grasslands was a 44% decline over 100 years, and an 89% decline in the Karoo, these trends however, have not been realized (Galloway-Griesel et al. 2022; Craig 2024), with the population increasing in the grasslands and staying stable, with possible recent moderate declines in the Karoo.

Since 2001, the Blue Crane population increased until 2010 when it started to decline (Craig 2024). This decline has led to a recommendation that the national Red List status be uplisted to Vulnerable from Near-threatened (Taylor et al. 2015; Craig 2024). This motivated the need for a revised conservation plan for the species. The conservation planning process was initiated in 2023, with an introductory workshop held in October 2023 (Craig & Waller 2023). This workshop brought together Blue Crane stakeholders, from NGOs, government, agriculture, academia and rehabilitation (Figure 4). During the workshop the strengths and weaknesses of the conservation work that had taken place since the previous PHVA in 2001 were evaluated and opportunities and threats to Blue Crane conservation were identified going forward. During this workshop, we identified and prioritised issues (or threats) to Blue Cranes, where the primary issues identified being related to agricultural practices and powerlines. A baseline Population Viability Analysis was presented to stakeholders for feedback. Over the course of 2023/4 a technical team worked on revising the Blue Crane Population Viability Analysis. The October 2023 workshop formed the foundation on which to build a new conservation plan for the Blue Crane.

Figure 4: In-person Stakeholder Group for the October 2023 Blue Crane Conservation Planning Workshop at Trails End, Grabouw.

WORKSHOP OBJECTIVES

The objectives of the 2024 Blue Conservation Planning Workshop were as follows:

1. Develop a species action plan for Blue Crane
2. Guide the development of the Three Crane Biodiversity Management Plan
3. Build a network of people working together to conserve Blue Cranes

South Africa's national bird, the Blue Crane is healthy and resilient across agroecological landscapes, as a symbol of successful coexistence.

VISION FOR BLUE CRANE CONSERVATION IN SOUTH AFRICA

During the 2023 workshop, participants were taken through an exercise to compile a vision for Blue Crane conservation, having been asked what conservation success would look like for Blue Cranes in 30 years. The draft vision compiled in the 2023 workshop was then revisited in the 2024 workshop to ensure all stakeholders had the opportunity to provide input into the vision. During the 2024 workshop, a volunteer group worked on the vision and presented it to participants for comment. The final vision agreed by the group is as follows:

The terms in the vision were defined as follows:

Healthy – Majority of the population should be prosperous, flourishing and growing.

Resilient – Blue Crane population dynamics, distribution (Blue Crane occur across natural and expanded range, thereby reducing chances of extinction and spread of threat), growth rate, fledgling success, absolute numbers, are gravitating to 'stable state', absorbing losses.

Agroecological – Agroecology is a farming practice that uses ecological principles to make agriculture more sustainable. It's a holistic approach that considers the wider ecosystem, sociopolitical issues, and scientific research.

Co-existence – State or fact of living or existing at the same time or in the same place as humans. There was a request for further operationalizing 'resilient' in a quantitative way.

Stakeholders expressed interest in operationalizing the vision i.e. making it measurable. Some ideas for this were:

- A desired population trend
- Population estimates (with the caveat that these are difficult to measure accurately, but the benefit is that that they are easier to communicate)
- Existing figures can be used as baselines
- An estimate of carrying capacity in agricultural landscapes
- Upper-level indicators e.g. IUCN Red List & Green Status

UNDERSTANDING THE SYSTEM: DEFINING ISSUES

In the October 2023 workshop the stakeholders went through a detailed issue identification and prioritization process (Craig & Waller 2023). The stakeholders began at a high level- working with the first tier of the IUCN threat identification scheme (Table 1). The issues were prioritized by voting (Table 1).

Stakeholders then broke into groups by region (grasslands, Karoo and Western Cape (Overberg and Swartland)) and fleshed these issues out according to the regional context, this detail can be found in the 2023 interim report (Craig & Waller 2023).

Table 1: Severity (current and future) and Scope of (prioritized) issues to Blue Cranes nationally. The classification used is H-high; M-medium; L-low; A-absent; U=unknown. Scope was determined according to whether the threat impacted the whole population (>90%); the majority of the population (50-90%); the minority of the population (<50%) or unknown.

ISSUE PRIORITY	ISSUES	CURRENT	FUTURE	SCOPE
1	Agriculture and aquaculture	H	H	>90%
1	Transportation and service corridors	H	H	>90%
2	Energy production and mining	L	M	<50
3	Natural system modification	A	A	A
3	Biological resource use	L	L	<50
4	Residential and commercial development	A	L	<50
5	Pollution	U	U	U
6	Invasive and other problematic species, genes and diseases	M	H (AI=U)	<50 (Avian influenza = U)
7	Climate change and severe weather	A	U	U

In the October 2024 workshop, this information was presented back to the stakeholders to make sure that it still represented the current understanding of issues to Blue Cranes. The stakeholders added to the issues and added comments on knowledge gaps, opportunities, challenges and drivers. This was concluded at the end of day 1. A summary of this preliminary discussion can be found in Figure 5. Some general knowledge gaps were raised during this discussion:

- Role of each population in the national population
- Conservation efforts needed per population
- The history of the BC population- trade, poisoning, afforestation, over-estimation of historical numbers?

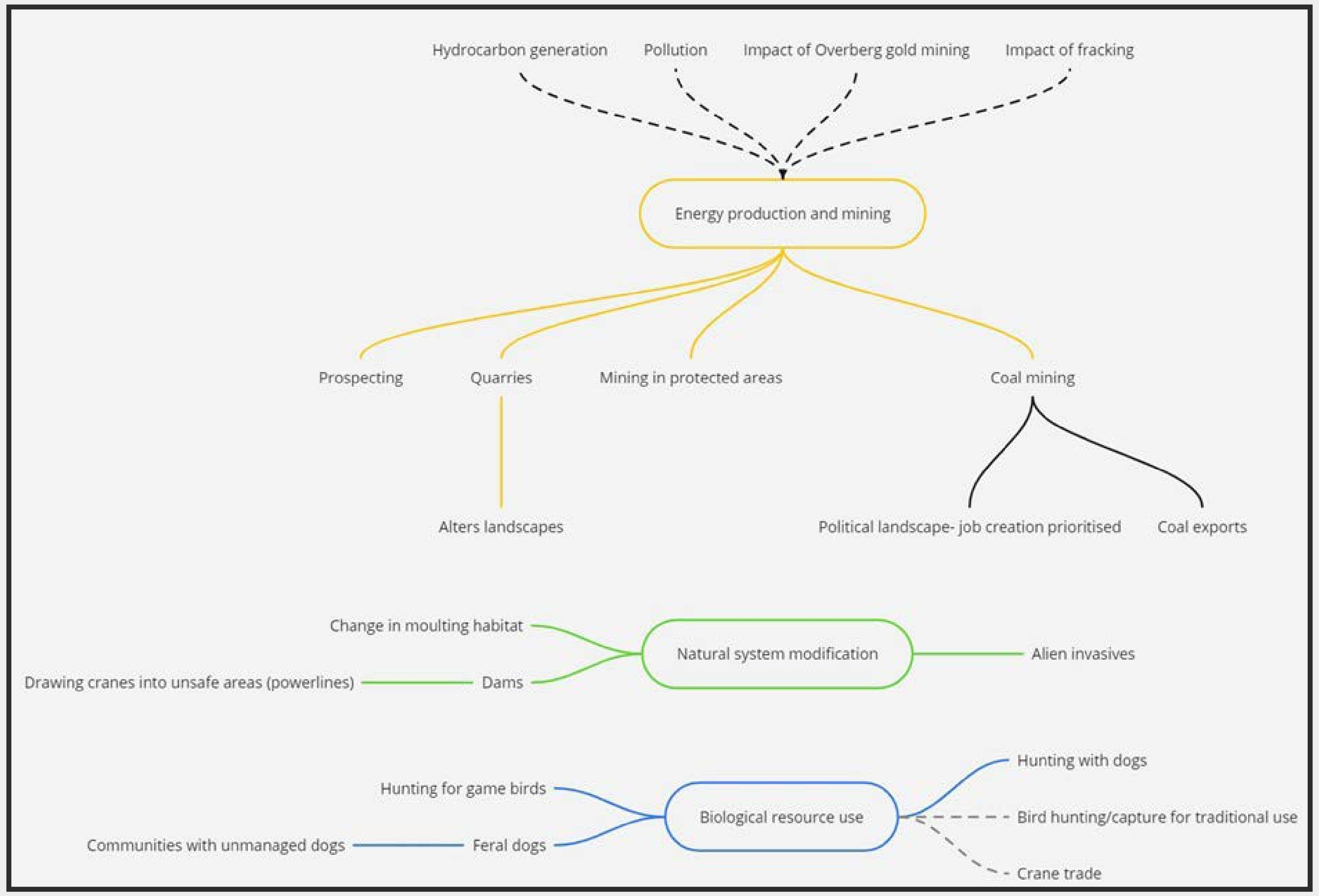


Figure 5 pt 1: Threats map on issues considered relevant to the viability of Blue Cranes in South Africa and their underlying causes. Generated by participants during the 2024 Blue Crane Conservation Planning Workshop.

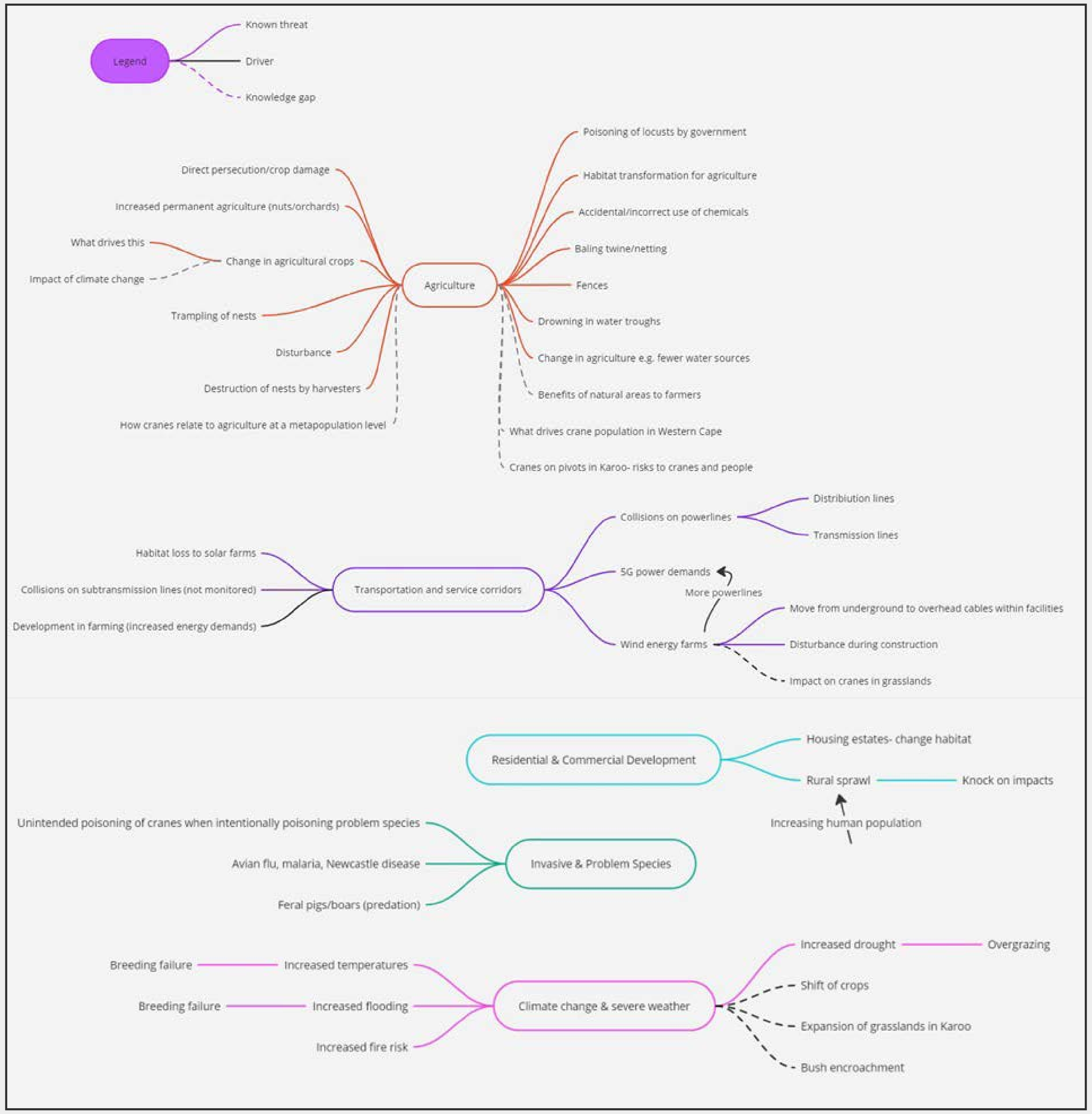


Figure 5 pt2: Threats map on issues considered relevant to the viability of Blue Cranes in South Africa and their underlying causes. Generated by participants during the 2024 Blue Crane Conservation Planning Workshop.

In partnership with

BLUE CRANE POPULATION VIABILITY ANALYSIS

Modeller: Christie Craig, mentored by Phil Miller
Technical team: Brent Coverdale, Ian Rushworth, Kevin Shaw, Lara Fuller

BLUE CRANE POPULATION VIABILITY ANALYSIS

A population viability analysis (PVA) is a process which assesses the risk of decline or extinction in a species population. A PVA is a useful part of a conservation planning process and can aid in decision making. To do a PVA, computer simulations are run, often using a program called Vortex (Lacy & Pollak 2021). These computer simulations, also called models, use demographic information about the species such as birth rates, death rates, longevity and age of sexual maturity to predict the trajectory of the population.

The demographic information can be tweaked to see how changes impact the population. Tweaking different parameters, for example breeding vs. mortality, can show conservationists where the population is more sensitive. For example, improving breeding rates may have more of positive impact on the population than improving survival, therefore management actions can focus on activities that especially impact breeding success.

As with any model, it is only as good as the data you put into it. If you have much uncertainty in your data, or very little data, then the model output will have much uncertainty. Vortex is a powerful tool, with the capability to tweak many different aspects of population dynamics, it therefore requires quite a lot of demographic information. For wild populations of animals, it is very rare that we will have good data for every parameter (or input data) that Vortex requires. In these cases, we can draw information from similar species, or we can make an educated guess on what the parameter should be.

The first step in the modelling process is to develop a baseline model- a model which depicts the status quo for the population currently. We then go on to test the sensitivity of various parameters, for example adjusting the breeding success at intervals, while keeping all other parameters the same to see what impact changes in breeding success has to the population.

Another use of models is to test the impact of different scenarios, whether it is a management scenario or an anticipated reality e.g. climate change. For example, if increased droughts are anticipated with climate change, we can theorise what impact this could have on survival and reproduction and run different scenario models to look at how it impacts the population.

Typically, a draft set of these models are developed ahead of the conservation planning workshop, with a smaller technical team. These models are then distributed ahead of the workshop to all stakeholders so they can familiarise themselves with them and give input. The finalised models are then presented in the workshop and stakeholders can use them to inform their action planning.

PVA DEFINITIONS

In this report you may encounter technical terms, below is a table of definitions.

PVA TERM	DEFINITION
Stochastic vs. deterministic models	A stochastic population model is a mathematical model that incorporates random variability in population dynamics, such as birth and death rates, to account for unpredictable events and fluctuations in population size over time. This is different to a deterministic model where input parameters are assumed to be static. Vortex runs stochastic models, but also reports deterministic results.
λ (lambda)	Lamba is multiplicative population growth rate from one time period to another e.g. change in abundance from year 1 to year 10. A lambda of 1 means that the population stable, a lambda less than 1 indicates a declining population and more than one an increasing population. It can be thought of as a multiplier, a population of 500 × 1 = 500, whereas a population of 500 × 0.99 = 495.
r growth rate	This is the continuous rate of change in a population, or per capita growth rate. A r of 0 indicates a stable population. A positive r (>0) indicates an increasing population and a negative r (<0) indicates a declining population. R can be calculated as follows: r: $\lambda = e^r$

BLUE CRANE PVA MODEL

A PhD study used citizen science data to quantify Blue Crane population trends over the last 30 years (Craig 2024). These models indicate that between 2011 and 2019 the Blue Crane population has declined nationally by 19%. A PVA model was developed for the Blue Crane, aiming to match the trend that has been observed over this period across the subpopulations, as best as possible. The baseline model begins in 2024 and assumes that the trends observed in the latest 10 years of data will continue.

A Blue Crane PVA model was developed over the course of 2023 & 2024. An earlier draft of the model was presented at the first Blue Crane Conservation Planning Workshop in October 2023. The workshop participants gave feedback on the model, which was then revised by the technical team over the last year.

DEVELOPING THE BASELINE MODEL

Vortex 10.5.5.0 (Lacy & Pollak 2021) was used to develop a baseline metapopulation model for the South African Blue Crane populations. The population is modelled as a metapopulation, including four core subpopulations, the grasslands, Karoo, Overberg and Swartland. The Overberg and Swartland were modelled separately as breeding success differs between these populations (Craig 2024). The model was projected over 100 years, starting from 2024. The definition of extinction in the model was one sex remaining. Models were run for 1000 iterations. No catastrophes or harvests/supplementations were included in the baseline. A population-based model was run as opposed to an individual based model, as the large population size meant that individual based models took over 12 hours to run.

SPECIES DESCRIPTION

There is no information available on inbreeding depression in Blue Cranes, and it is a large population, unlikely to be impacted by inbreeding depression, therefore the population was modelled without this factor. There is no information on how survival and reproduction are correlated between subpopulations, so Environmental Variability correlation among populations was set at 0. Likewise, the correlation between reproduction and survival was set to 0, since the primary drivers affecting reproductive success (nest disturbance, predation, fence entanglements, drowning in water troughs) are different from the drivers affecting post-fledging survival (powerline collision, poisoning).

DISPERSAL

From (Craig 2024) and (van Velden et al. 2016), we know that Blue Cranes in the Western Cape are mostly resident, and seldom move between populations. In addition, we know that breeding Blue Cranes often return to the same nest site each year. Given this nest site fidelity, we expect adult (birds of breeding age) dispersal to be rare, and if individuals do move to other populations, they likely return within the year. Accordingly, we only consider juvenile and immature dispersal in the metapopulation model (i.e. cranes < 4 years old). There is no evidence to suggest that there are sex differences in dispersal, so we allow both sexes to disperse in the model. Blue Cranes undertaking long range movements are at higher risk of powerline collision, but we do not set a survival cost to dispersing, as this is accounted for in the juvenile survival/mortality estimates (Table 2).

Western Cape ringing data indicates that only 3.8% of Blue Cranes were recorded in both the Overberg and Swartland and 57% of chicks ringed return to their natal site as adults (van Velden et al. 2016). In van Velden et al. (2016)'s analysis, movements from the Swartland to the Overberg were twice as common (8 records) as the reverse (4 records). We therefore set juvenile dispersal, Swartland to Overberg to 4% and Overberg to Swartland at 2% (Table 2). We do not model dispersal between the grasslands and Karoo or Karoo and Overberg/Swartland, as there is very little evidence that cranes move between these areas (Craig 2024).

REPRODUCTIVE SYSTEM AND RATES

Blue Cranes are long term monogamous breeders, that begin breeding at age four (Del Hoyo et al. 1996; Allan 2005). There is little data to support this however, so we test the sensitivity of the model to age of first breeding, testing ages five and six. Blue Cranes breed at most once per year and produce a maximum of two chicks (Allan 2005). In the Karoo, the sex ratio of chicks is 50:50 (n = 12). In the Overberg and Swartland the ratio may be female biased in both regions 70:30 (Swartland n = 7, Overberg n = 7, see Craig 2024), however this is a very small sample size, so we modelled the population with a 50:50 sex ratio at birth (Table 2).

The oldest known ringed Blue Crane in the wild lived to 30 years old (ring: 972458), the next oldest records are 16 years old, which were still alive when sighted (rings: 9A20008, 9A20018) (FitzPatrick Institute of African Ornithology 2023). We therefore set the maximum age in the model to 30, with no breeding senescence, since other crane species in captivity have been known to remain fertile until their death (Johnsgard 1983).

The parameter that we had greatest uncertainty about was % adult females breeding. We defined this as the % of adult (age 4+) females that pair up and hold territory. The last estimates for the Overberg were 28% of adults in pairs, 47% in the Karoo (Allan 1993) and 35% in the Mpumalanga grasslands (derived from (Morrison 1998)). These estimates are however outdated; for more recent estimates we draw from summer Coordinated Avifaunal Roadcounts (CAR) to look at how many Blue Cranes are paired up during the breeding season (FitzPatrick Institute of African Ornithology 2020).

To calculate the % adult females breeding in the Overberg, we take an annual average and standard deviation of percentage of cranes paired up during summer CAR counts between 2010 and 2019, and for the other regions where data was sparser in recent years, we use data between 2010 and 2017 (Table 2). For the grasslands, the technical team thought that the CAR data was not suitable for estimating this, given that Blue Cranes are sparsely distributed in this area, and CAR data is not reliable for sparsely distributed species (Hofmeyr 2012; Craig 2024). For the grasslands, we use an estimate of 60%, from expert opinion (Coverdale, pers. comm), which is similar to the 61% observed in the Swartland (CAR data) (Table 2).

However, there are complications with using this data. Blue Cranes can only be aged by plumage up until age 1, after this they come into their adult plumage. Vortex asks for proportion of adult (sexually mature = age 4+) females breeding, and since we cannot age Blue Cranes after age one, we can only look at the proportion paired out of the total population, which underestimates the adult proportion as it includes cranes age one to three. To deal with this we use the BirdLife International rule of thumb that 67% of large birds are mature individuals and correct the % according to the assumption that 67% of the Blue Crane population are mature individuals i.e. age 4+ and capable of breeding.

Another source of error is that with these road counts take place in January, some pairs could have bred early and already joined floater flocks. Floater flocks are small flocks of non-breeding birds that form in the summer, while pairs are breeding. In addition, the timing of breeding differs between regions (Allan 2005), with Overberg and Swartland cranes driven by the timing of harvesting and Karoo and grasslands cranes thought to be driven by the timing of summer rains (BG Gibbons, EWT, pers. comm); this introduces an additional layer of uncertainty. Given these uncertainties it is important to test the sensitivity of this parameter.

The % adult females breeding (range 37% in the Karoo, through to 61% in the Swartland; Table 2) indicates that on average cranes breed every second year, or looking at it differently, only half of sexually mature cranes breed annually. This is somewhat surprising as we know from ringed cranes that many do breed every year, and they are certainly capable of doing so. The reasons for the data indicating a lower percentage of them breed annually, could be due to error in the data (discussed above) or there could be a biological reason. It could be because territories are not available/there is not enough breeding habitat, or that many cranes skip a year to recover their condition after breeding, or that some cranes do not breed as soon as they are sexually mature.

When it comes to breeding success of paired individuals, we have breeding monitoring data from each population (Craig 2024; Table 2). Breeding success is defined as successfully producing a fledgling. Therefore, in mortality estimates, age 0 begins from fledging.

MORTALITY RATES

Mortality rates are taken from survival estimates from ringing studies (Altwegg & Anderson 2009; van Velden et al. 2016a) and from trackers (Craig 2024). The immature survival estimates from the tracker data (84%) and van Velden et al. (2016)'s study (87%) were similar, so we used the latter, as it is based off a larger sample size. There are no survival estimates for the grasslands, so we use the Karoo estimates, deducing that the Karoo and grasslands would be more similar in mortality rates than the grasslands and Western Cape, the latter population residing in transformed agricultural landscapes (Table 2). Mortality rates were calculated as 100 minus survival estimates (Table 2).

INITIAL POPULATION SIZE AND CARRYING CAPACITY

Population estimates are taken from Craig (2024) (Table 2). Since the model was starting in 2024, we adjusted the initial population size using the average growth rate over the last 10 years (Table 2) and the year that the population estimate was taken (Craig 2024). For example, the population estimate for the Overberg came from a 2018 aerial survey and the population has had a growth rate (λ) of 0.95, therefore assuming the average growth rate has remained the same, the population in 2024 is 18377. We rounded to the nearest thousand, given the uncertainties in these estimates. The grasslands and Swartland estimates did not need to be adjusted, given the stable growth rate (Table 2).

There are no data available on current carrying capacity of these populations. The highest Blue Crane density in the Overberg was 10 years ago when the population was 22% higher than it is now, so we assume this was the carrying capacity (Table 1). The Swartland population may have already reached carrying capacity (the population trend levelled out in 2007 and has remained stable since), but the Blue Crane range is expanding up the west coast (according to SABAP data), therefore we set the carrying capacity for this region at 10000. In the absence of evidence of a carrying capacity in the Karoo and grasslands, we set them at 20000 and 10000 respectively. Accurately estimating carrying capacity becomes more relevant when populations are increasing and reaching carrying capacity, which is currently not the case in the Karoo and grasslands.

Table 2: Summary of input parameters for baseline Blue Crane PVA in Vortex (Lacy & Pollak 2021).

	Overberg	Swartland	Karoo	Grasslands
Dispersal				
Age of dispersal	1–4			
% survival	100			
% dispersal (from source to destination)	0% to Karoo 2% to Swartland	4% to Overberg	0% to Overberg 0% to Grasslands	0% to Karoo
Reproductive System				
Age of first offspring	4			
Maximum lifespan	30			
Maximum age of reproduction	30			
Maximum no. broods per year	1			
Maximum no. progeny per brood	2			
Sex ratio	50/50			
Reproductive rates				
% adult females breeding (Model: CAR % paired)	40 (SD 8)	61 (SD 4)	37 (SD 9)	60 (SD 13)
Distribution of broods per year (%)				
0 broods	0	0	0	0
1 brood	100	100	100	100
Fledglings produced per female (%)				
Mean	0.55	0.48	1	0.95
SD	1.7	1.67	1.42	1.07
Mortality rates (%) (SD = 20% of value)				
Age 0–1*	40	40	47	47
Ages 1–4	13	13	27	27
Age 4+	5	5	4	4
Initial Population Size	18000	6000	14000	4000
Carrying Capacity (K)	30500	10000	20000	10000

*Age 0 is from when the crane chick fledges (becomes flighted). Age 1 is a year after fledging.

SENSITIVITY TESTING OF BLUE CRANE POPULATION MODEL

Sensitivity testing allows us to test where the sensitives lie in a population. Sensitivity testing can also help us understand where the best intervention points are, for example if the population is very sensitive to changes in breeding success, interventions that aim to improve breeding success will be more effective. It can also help us understand what impact uncertainties in the data can have on our model output, and therefore help us gauge how confident we can be in our model.

To run sensitivity tests, one data input is incrementally changed, while all other data inputs are kept the same, so that the impact of just that data can be understood. We tested the following sensitivities in the model:

- Age of first breeding being 5 or 6, rather than 4.
- No dispersal between subpopulations, as opposed to dispersal between Swartland and Overberg.
- % adult females breeding + and – 10, 20, 30, 40 and 50% of the baseline values for each subpopulation.
- Juvenile (0-1) mortality + and – 10, 20 and 30% of the baselines.
- Immature (1-3) mortality + and – 10, 20 and 30% of the baselines.
- Adult (4+) mortality + and – 10, 20 and 30% of the baselines.
- All ages mortality + and – 10, 20 and 30% of the baselines.
- Breeding success + and – 10, 20 and 30% of the baselines in the grasslands and Karoo, as well as +-50% in the Overberg and Swartland, where breeding success is lower than the Karoo and grasslands.

The sensitivity of mortality of different age groups is tested as certain age groups may be more susceptible to certain threats, for example juvenile cranes in their first year may be more inclined to get stuck in fences than adults.

SCENARIOS RUN FOR BLUE CRANE PVA

Scenarios can be potential realities (e.g. climate change or emerging threats), or can be management interventions that conservationists want to try (e.g. reduce powerline mortality by 10%). A PVA workshop was held on the 27th of September 2024, where stakeholders discussed potential scenarios per subpopulation. Using these insights and insights from the workshop held in October 2023 (Craig & Waller 2023) and October 2024, scenarios that could be quantified were modelled as follows:

- Blue Crane breeding success in the Overberg and Swartland is nearly half of what it is in the Karoo and grasslands (Table 2 and Craig 2024), therefore we double breeding success in the Overberg and Swartland to see the impact on these populations.

- There is little robust data on the relative contribution of different causes of mortality of Blue Crane at a population level. Of a sample of 29 Blue Cranes fitted with trackers in the Western Cape, 4 died (Craig 2024). The causes were unknown, illness, powerline collision and fence entanglement. Based on this very small sample size, we can make an educated guess that powerline collisions cause approximately 20-30% of annual mortality in Blue Cranes. We ran a scenario to investigate what happens if powerline mortality (assumed to be 30% of total annual mortality) is reduced by 50% across age classes and across subpopulations.

- Little is known about disease in Blue Cranes, but other crane species have had mass die offs from avian flu (The Wildlife Society 2022). Stakeholders theorised that worst case scenario all cranes at a major roost site could be infected and die. We modelled a mass disease die off on average every 5 years or every 20 years. The scale of the mortality was set as the numbers of cranes counted at the largest roost site per region (Overberg: 1000 cranes at Witsand, Lourens Leeuwner, pers. comm; Grasslands: 130 at Hlatikulu, Jacquie van der Westhuizen, pers. comm; Karoo: 1000 at Diep Rivier, Bradley Gibbons, pers. comm; Swartland: 250, EWT sightings database). Outbreaks are set to occur randomly between regions, not concurrently. The scenario was run as a catastrophe in vortex, using the proportion of the current population size relative to the largest roost count.

- In the Karoo Blue Cranes can occur in large numbers (1000+) on pivot irrigated lucerne fields, particularly in winter (Craig, 2024). Some farmers are annoyed by this, as cranes are perceived to be damaging the crop. Farmers may use poison to control cranes or other bird species. If a mass poisoning occurred on these fields, it could result in hundreds or thousands of mortalities. We modelled the following poisoning scenarios for the Karoo population:
  - ◊ A mass poisoning of 14% of the population (2000 cranes at the current population size), happening every 20 years
  - ◊ A smaller poisoning of 0.7% of the population (100 cranes at current population size), happening every 20 years
  - ◊ Regular smaller poisonings of 0.7% of the population (100 cranes currently), happening annually

- It was modelled as a relative proportion of the population as we expect flock sizes to decrease as the population increases in size and vice versa with increases. The model was run as a catastrophe in Vortex.

- In the Overberg and Swartland Blue Cranes are more dispersed during the winter as pasture lands are more common in the landscape (compared to the Karoo where many cranes congregate on a small number of lucerne fields). This distribution may make mass poisonings (1000+) less likely. However, the risk of poisoning is still present on an annual basis, as geese and rodents cause damage to crops during the growing season. Some farmers use poison to control these species, which can be eaten by cranes as well. In the Overberg we modelled scenarios of annual poisonings of 30, 100, 200 and 500 cranes given the current population size, resulting in annual poisoning of 0.16%, 0.56%, 1.11% and 2.78% of the population. It was modelled as a relative proportion of the population as we expect flock sizes to decrease as the population increases in size and vice versa with increases. In the baseline model the current rate of poisoning (over the last 20 years) will be included as part of the mortality rate, so these models represent the results of increased poisoning in the landscape. The model was run as a catastrophe in Vortex.

- Wind energy may be an emerging threat to Blue Cranes, so far there have been relatively few fatalities of Blue Cranes (Perold et al. 2020), but this could change based on turbine placement and also with longer term monitoring data. Based on the 18 collisions recorded to date, Blue Cranes collide with turbines at a rate of 0.002 cranes/Megawatt/year (Birdlife South Africa, unpubl. data). The mortality rates used in this PVA are mostly from ringing data that is 10-30 years old, and therefore wind farm mortality is unlikely accounted for in this model. We therefore model it as additional mortality. Using the database of approved and in process Environmental Impact Assessment applications for wind energy, we identified existing and planned wind facilitates with in Blue Crane range, we include all of these facilities, assuming that planned facilities will be built (Department of Forestry 2024). This equates to 20367 MW in the Karoo (including coastal Eastern Cape), 2225MW in the grasslands, 1611 MW in the Overberg and 2320 in the Swartland. Without good data on regional collision rates, we assume that collision rates are equal across regions. At the above-mentioned collision rates, this equates to 41, 5, 3 and 5 crane fatalities per annum, in the Karoo, grasslands, Overberg and Swartland respectively. We modelled this additional fatality as an annual catastrophe in Vortex. In addition, we modelled a scenario where these fatality rates are doubled, to account for variation in collision rates and increased development.

- There are concerns about wind energy development in the grasslands, an area that developers are showing interest in, as grid capacity is limited in other areas. We ran a model where collision rates were 0.002 cranes/MW for the first 10 years and then 0.004 cranes/MW from then on, accounting for a doubling in wind facilities in the region. This model was run as an annual catastrophe in Vortex, as the above model.

RESULTS OF THE BASELINE BLUE CRANE PVA

The baseline model produced an average growth rate that is very similar to the average growth rate observed in the latest 10 years of the CAR data (Table 3).

The modelled growth rate in the grasslands is stable at first but declines slowly long term. The other populations have a declining trend in the model, resulting in the total population reducing to less than 10000 individuals over 100 years, from a starting population of 42000 (Figures 6-8).

The Overberg growth rate was more optimistic in the model, than in CAR (Table 3). CAR data shows that the population declined steeply 2009-2014, but thereafter the decline has been slower (Craig 2024). Given that the mortality and breeding data come primarily from 2018-2022, the model may represent the more recent trends, rather than the steeply declining trends of the early 2010s.

Table 3: The average observed growth rate in the CAR data for the latest 10 years of well counted routes (see Craig 2024 for thresholds) versus the baseline model.

REGION	AVERAGE OBSERVED GROWTH RATE Λ(CAR)1	LATEST 10 YEARS OF DATA IN CAR	BASELINE MODEL
Overberg	0.95	2010-2019	0.97
Swartland	1.00	2008-2017	0.99
Karoo	0.96	2005-2016 (NC) & 2008-2017 (EC)	0.97
Grasslands	1.00	Mixed (range starting at 2004-2010)	0.997
Metapopulation	0.97	2008-2017	0.98

1 These growth rates are calculated on the CAR dataset which has been imputed to account for missing data (see Craig 2024 for details of imputing process)

Photo Credit: Ciming Mei

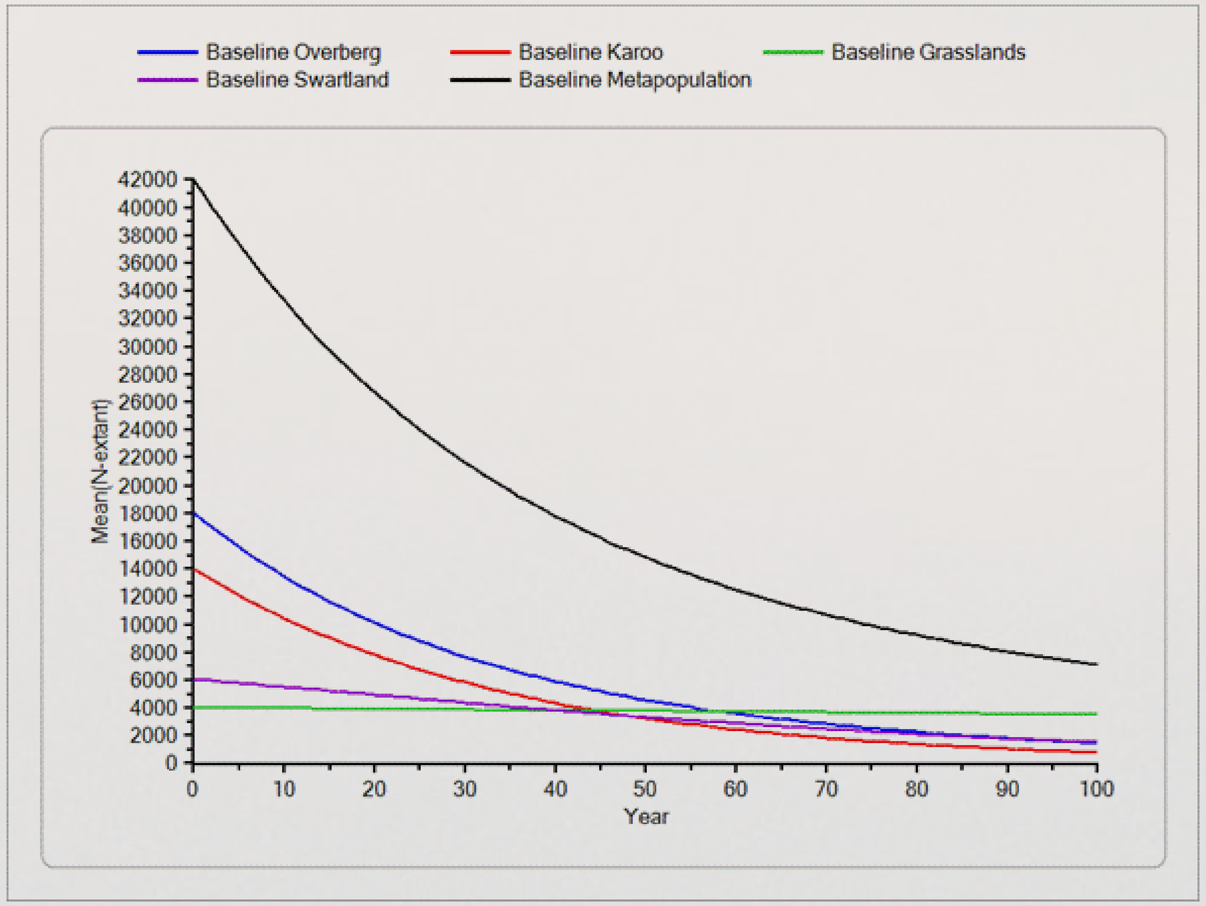


Figure 6: The projected population abundance for the total Blue Crane population (metapopulation), modelled over 100 years, and in the Overberg, Swartland, Karoo, grasslands.

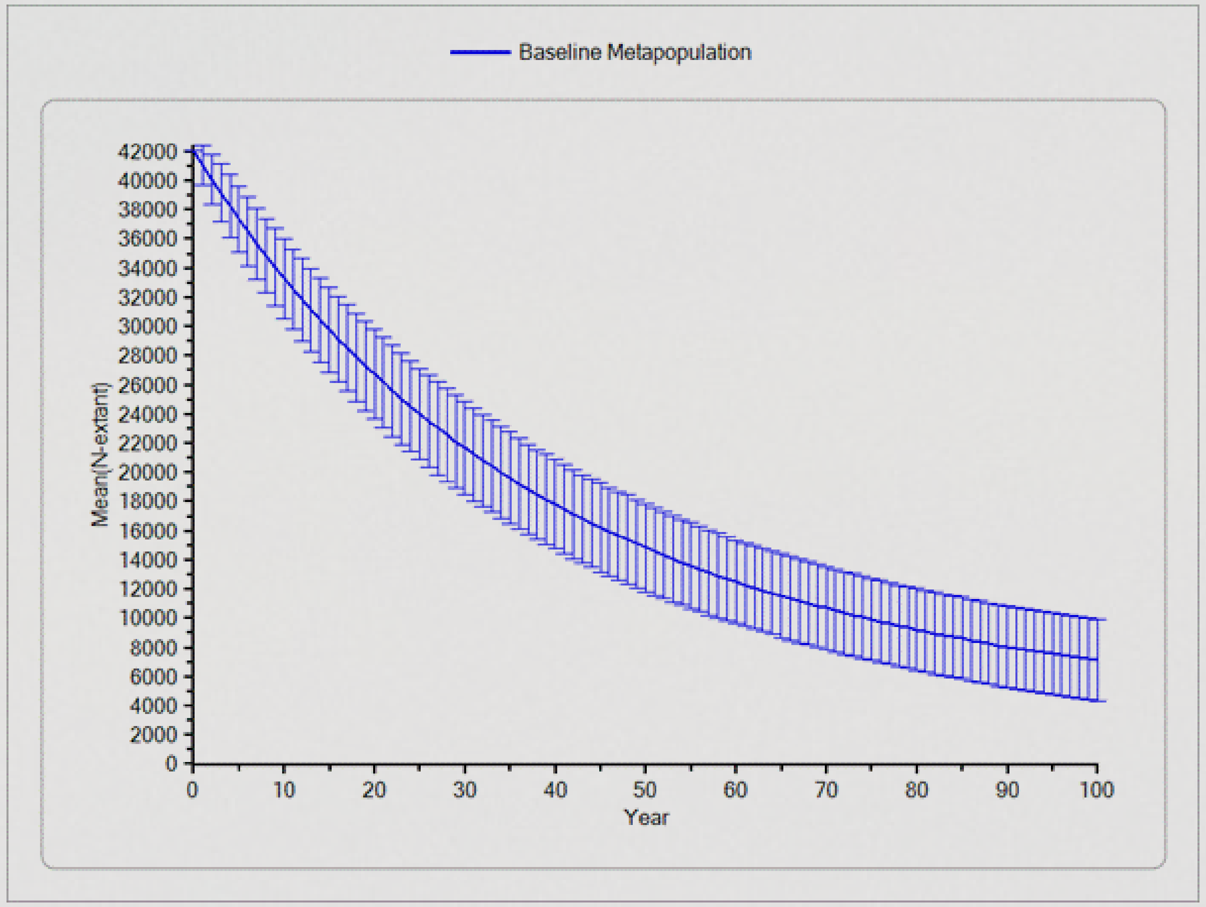
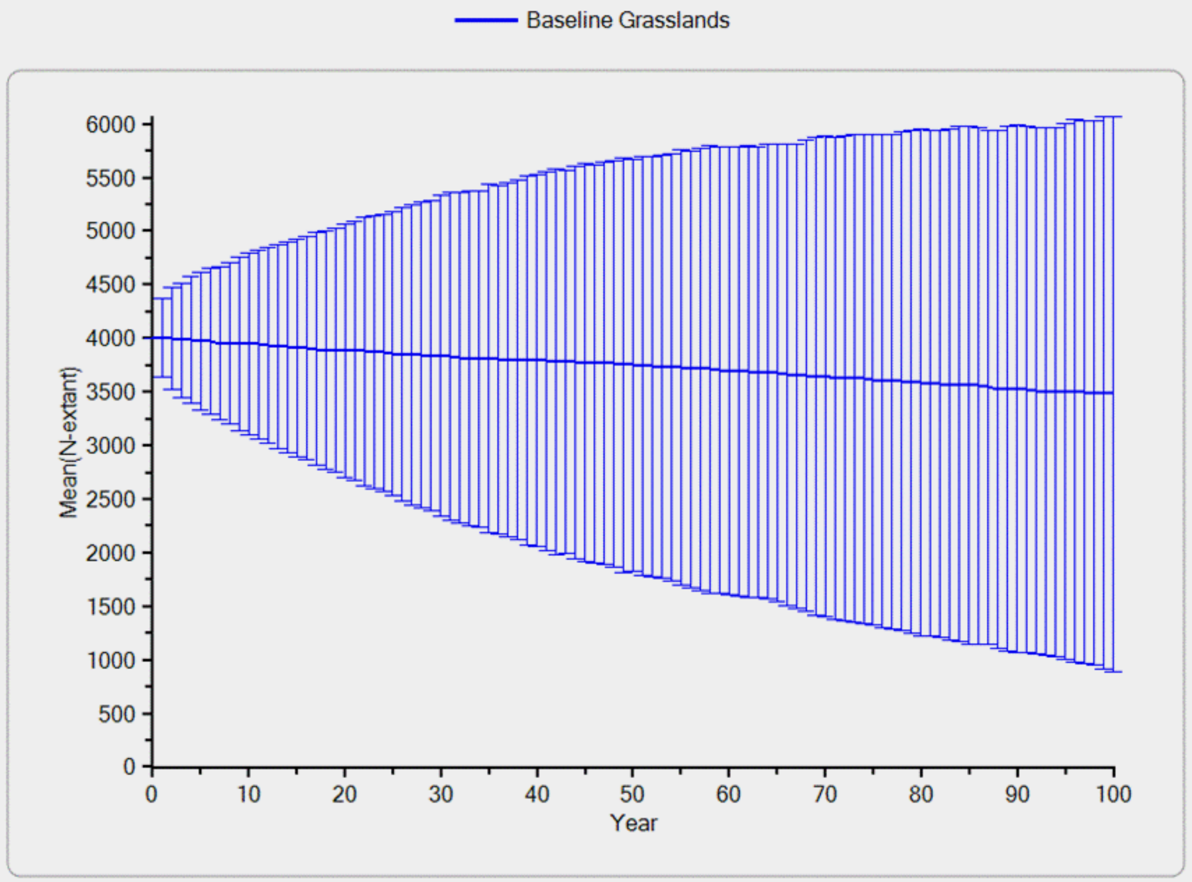
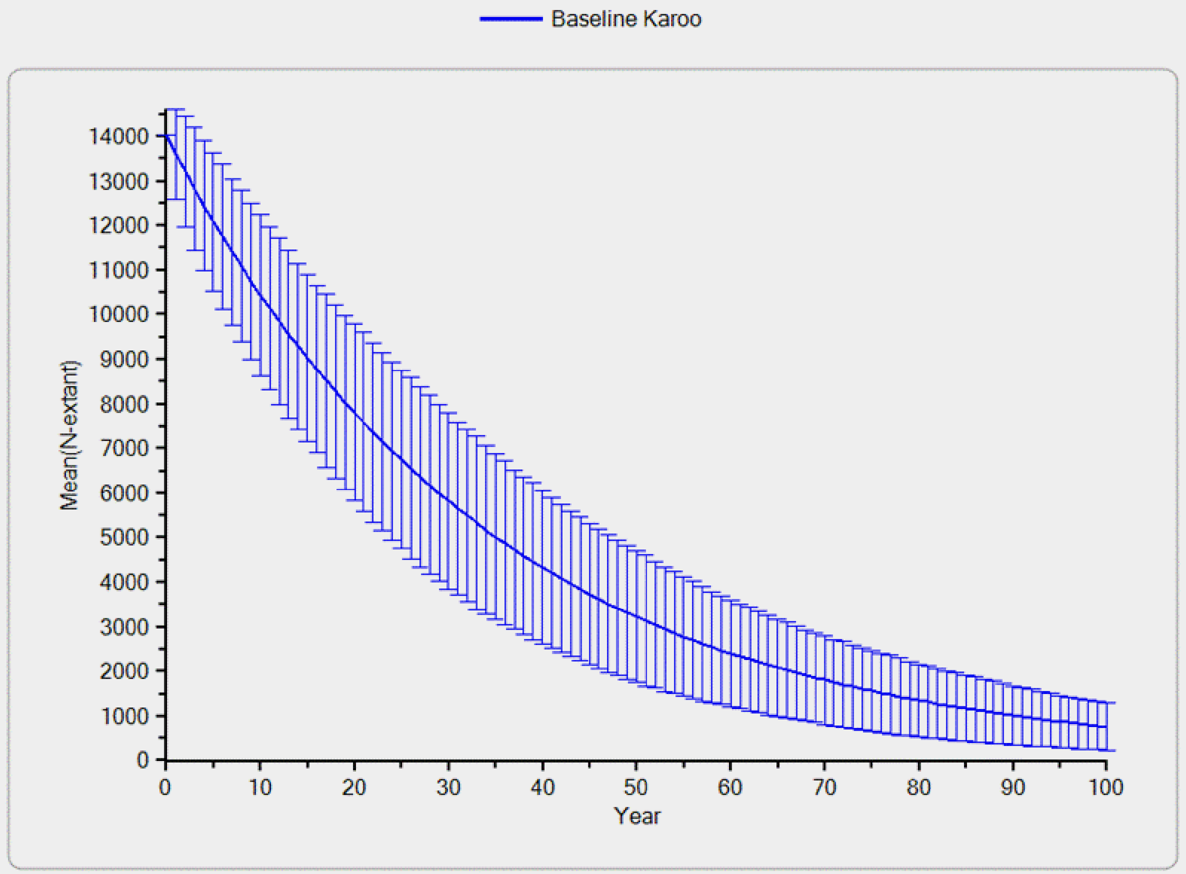
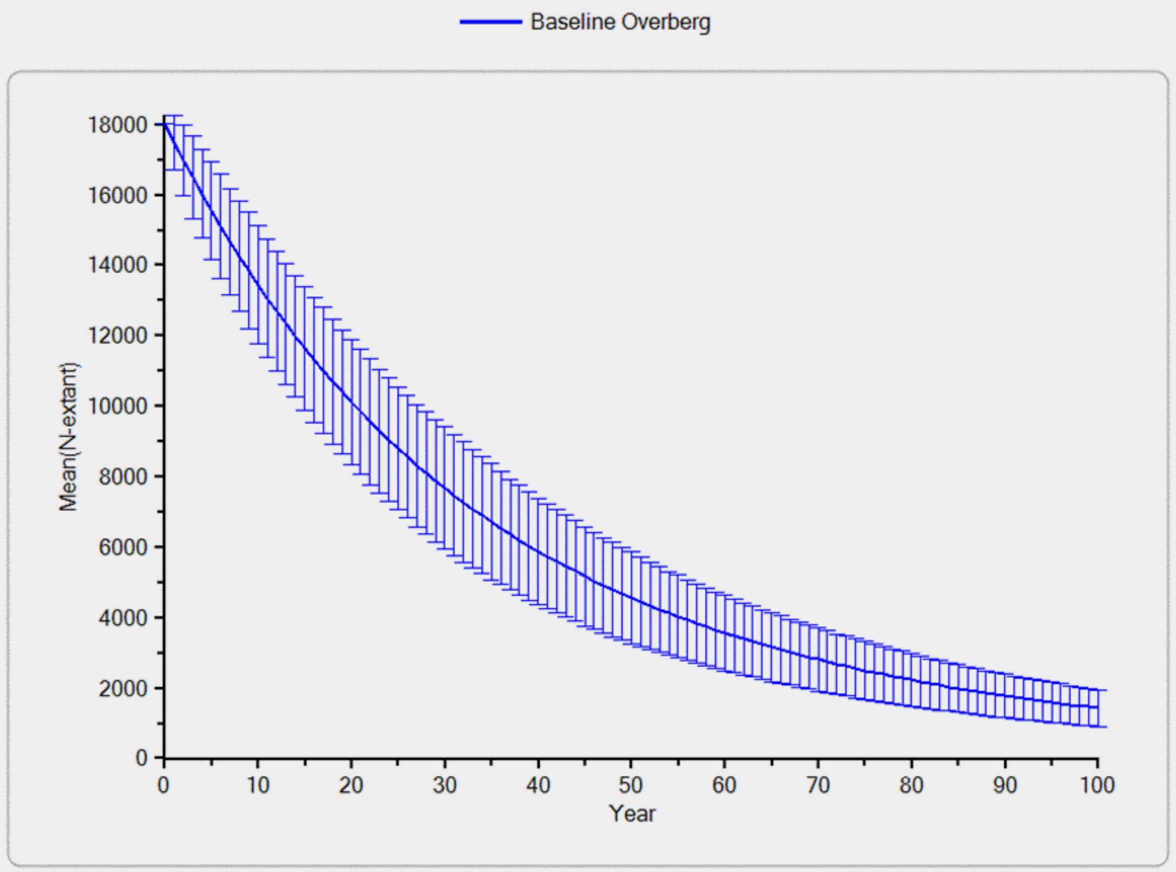


Figure 7: The projected population abundance for the total Blue Crane population (metapopulation), modelled over 100 years, errors bars indicate the approximate 95% of the distribution of the 1000 model runs.







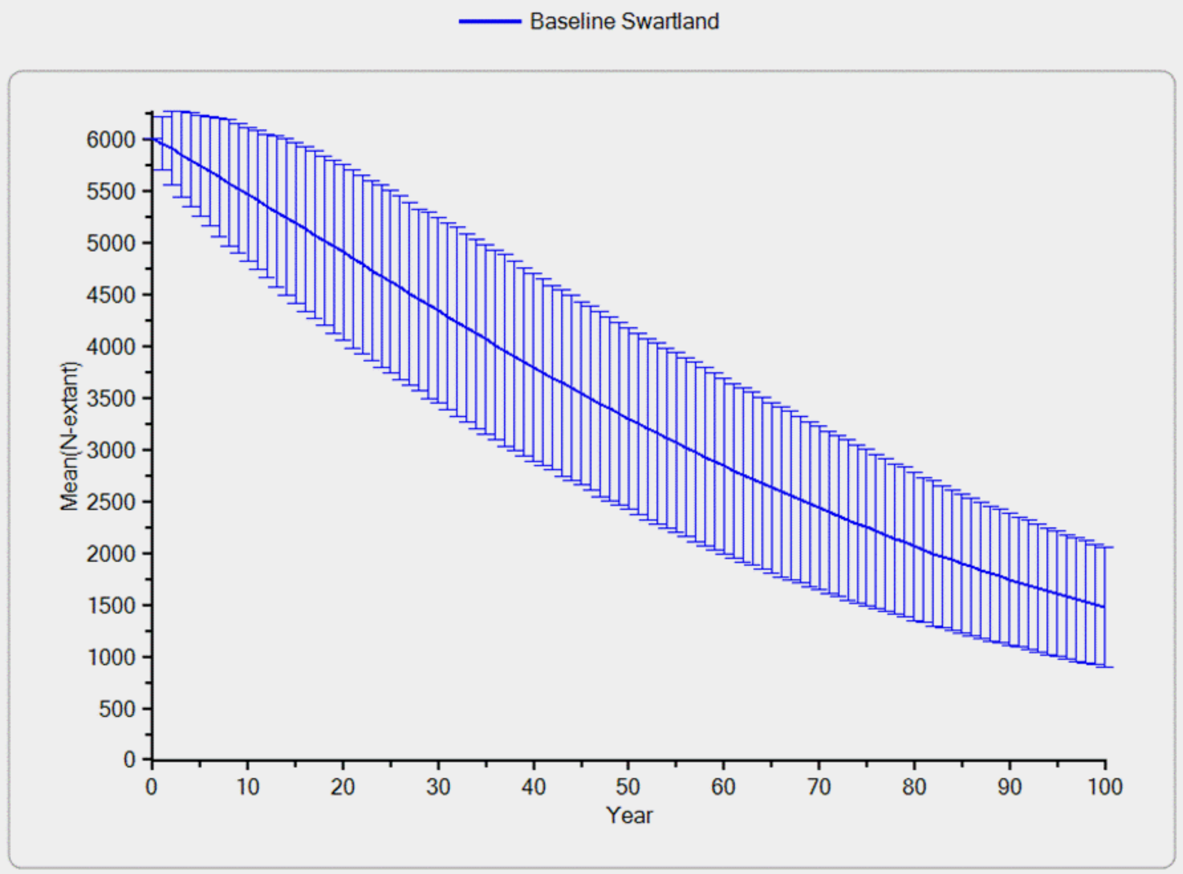


Figure 8: The projected population abundance for Grasslands (top left), Karoo (top right), Overberg (bottom left) and Swartland (bottom right), modelled over 100 years, errors bars indicate the approximate 95% of the distribution of the 1000 model runs.

RESULTS OF THE SENSITIVITY TESTING OF THE BLUE CRANE PVA

- The modelled population trajectory changes dramatically to changes in the % adult females breeding. Given the uncertainty in this data input, this should be considered when interpreting the model (Figure 9).
- Adjustments to the age of first breeding and dispersal had very little impact on the trajectory of the model over 100 years (Figure 10).
- Changes of mortality of just juvenile, immature or adult mortality has a moderate impact on the population trajectory, with the growth rate least sensitive to changes in adult mortality (Figure 11).
- When mortality is changed throughout age groups or to both juvenile and immature age groups, the impact is far more pronounced (Figure 11). In these models, reduction of mortality by 20-30% results in a positive growth rate.
- Incremental changes to breeding success (-30%- +30%) also has a pronounced impact on the population trajectory but none of these models produce a positive growth rate (Figure 11).
- All models have a 0% probability of extinction in 100 years.

Plots of the population abundance trajectories for each of these can be found at Appendix 1 (Figure S1-10).

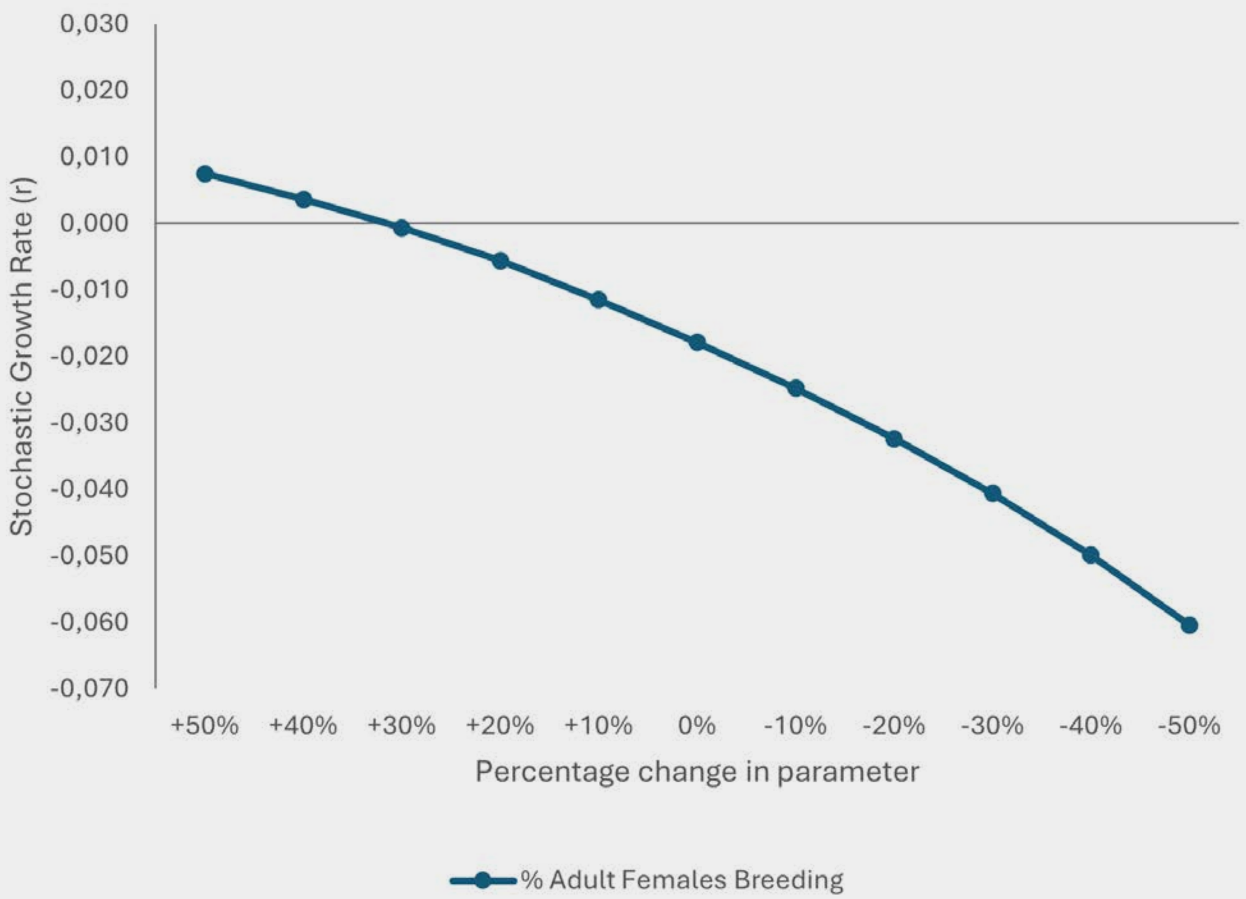


Figure 9: The change in stochastic growth rate of the population to incremental changes to % adult females breeding in the model (-50% - +50%), compared to the baseline (0%).

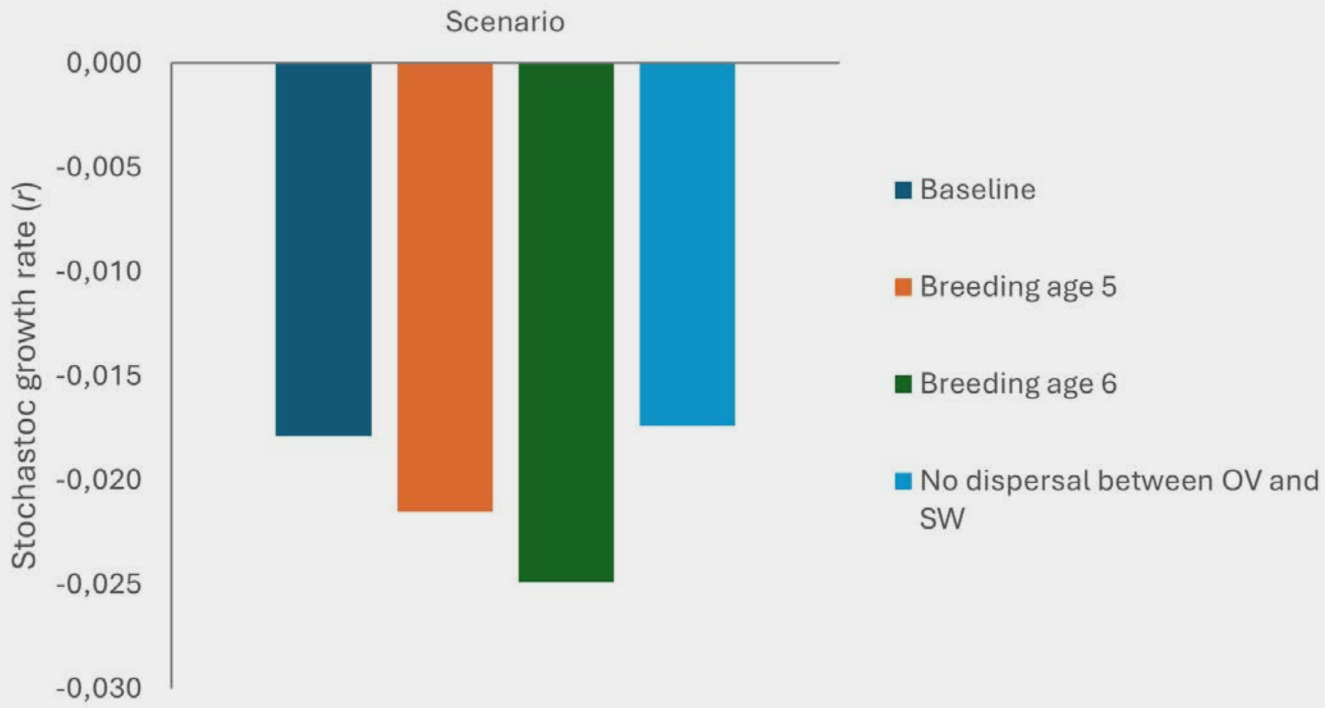


Figure 10: A plot indicating the stochastic growth rate of different model scenarios, comparing the baseline with models where age of first breeding in the metapopulation is 5 or 6 (rather than 4 as in the baseline) and models where there is no dispersal between the Overberg and Swartland (as opposed to 2-4% dispersal between these populations in the baseline).

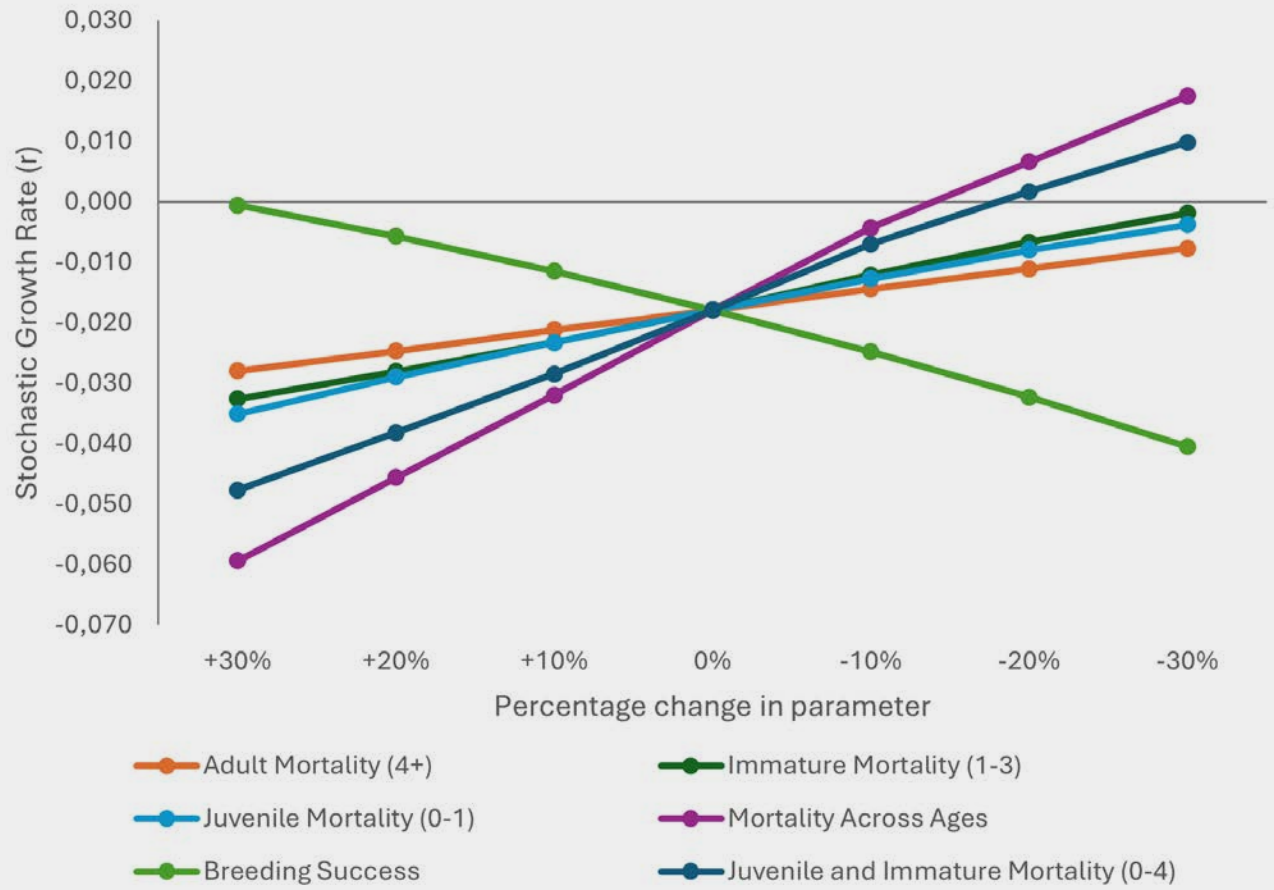


Figure 11: The change in stochastic growth rate of the metapopulation to incremental changes to mortality across all ages, across juvenile and immature ages, as well as just juvenile, immature, and adult mortality, and changes to breeding success (fledglings/pair) in the model (-30% - +30%), compared to the baseline (0%).

RESULTS OF SCENARIOS

- Improving breeding success by 50% in the Overberg and Swartland results in a stable or increasing population trend in these populations (Figure 12).
- Reducing powerline mortality by 50% in the grasslands and Swartland results in a positive growth rate and reaching carrying capacity, whereas in the Karoo it stabilises the negative population trend, and in the Overberg it slows the declining trend (Figure 13 & 14)
- A disease outbreak killing off all cranes at the largest roost site per region, every 5 or 20 years reduced the projected 100-year population abundance from 7111 to 3159 and 5732 respectively (Figure 15).
- If 0.7% of the Karoo population (currently 100 cranes) is poisoned every 20 years, it has little impact on the Karoo Blue Crane population, but if 0.7% are poisoned annually, the population goes extinct after 67 years (Figure 16). Larger (14% of population) infrequent poisonings (on average every 20 years) increase the declining trend but does not result in extinction in 100 years (Figure 16).
- Variable rates of annual poisoning in the Overberg increase the declining trend, at the highest rates of poisoning only 312 cranes remain after 100 years (Figure 17). These poisoning rates are in addition to current baseline poisoning levels.
- At collision rates of 0.002 cranes/MW/year, collisions with wind turbines have little impact on the Blue Crane metapopulation, based on existing and planned wind energy facilities, this likely describes the scenario for the next 5-10 years (Department of Forestry 2024) (Figure 18). The model with higher collision rates (0.004 MW), accounting for increased development or the possible underestimation of collision, also had very little impact on Blue Crane metapopulation trajectory.
- In the grasslands, a model with collision rates of 0.002 cranes/MW for first 10 years and 0.004 from year 10 onwards, resulted in a population of 2728 cranes in the grasslands in 100 years, as opposed to 3425 as predicted by the baseline model (Figure 19).

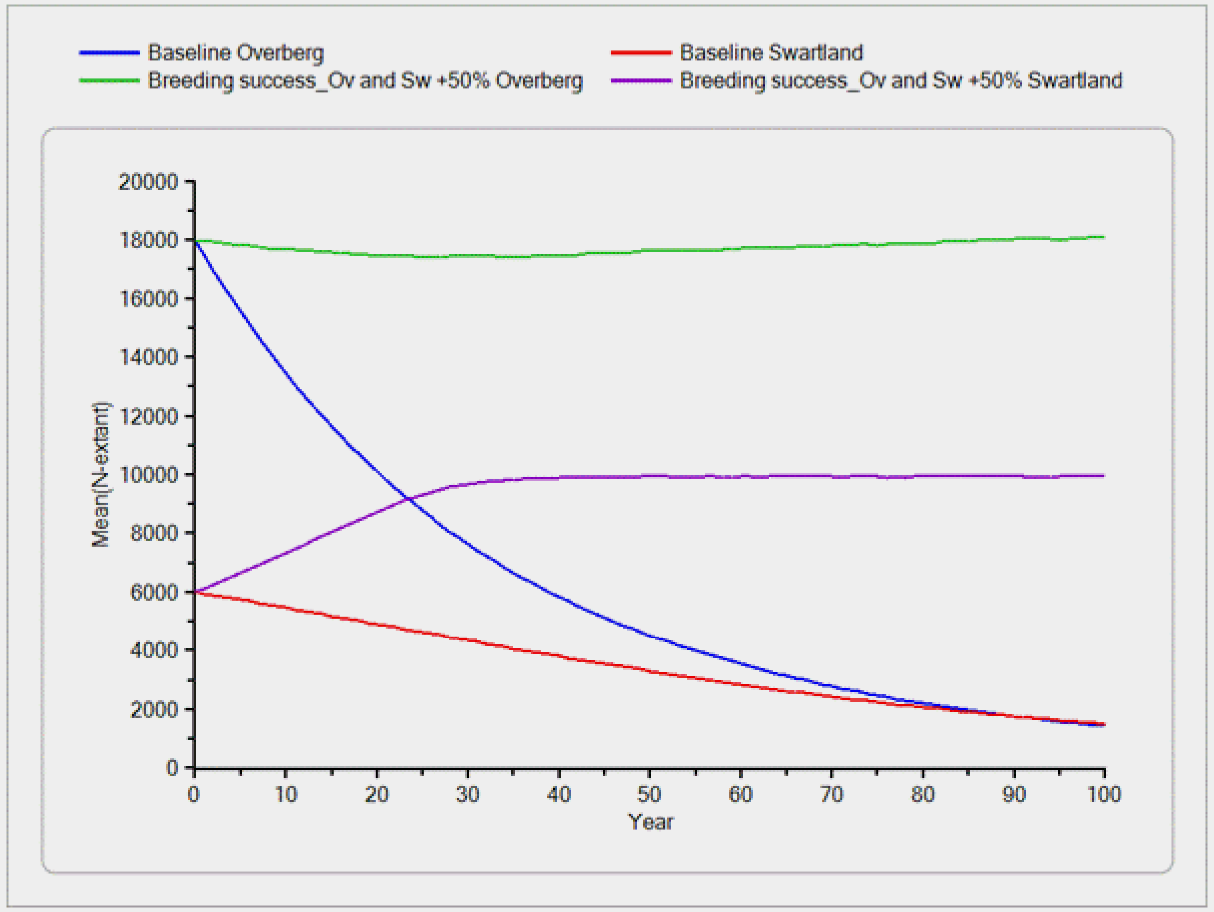


Figure 12: Results of doubling breeding success in Overberg and Swartland, while keeping all other inputs at baseline values, compared to baseline models.

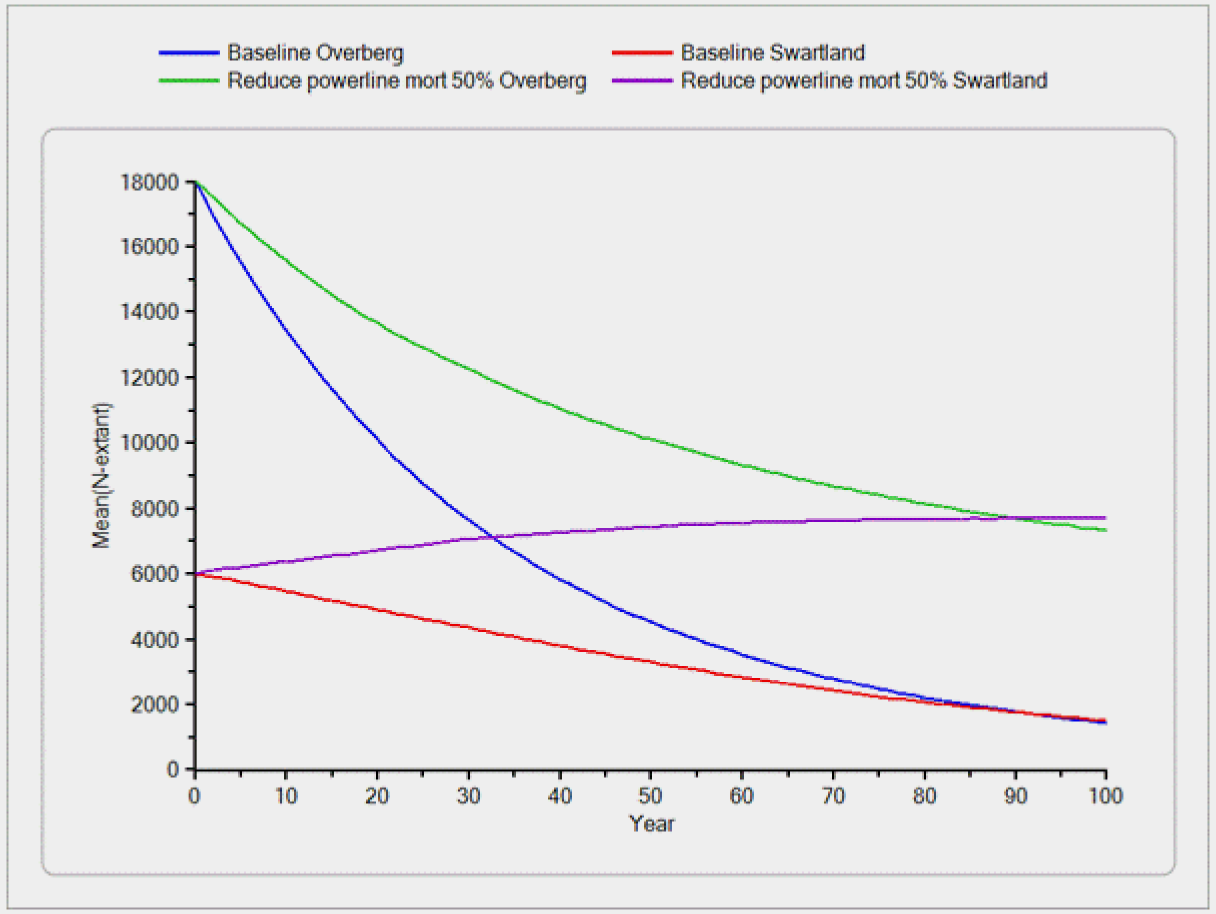


Figure 13: Results of reducing powerline mortality by 50% in the Overberg and Swartland, compared to baseline.

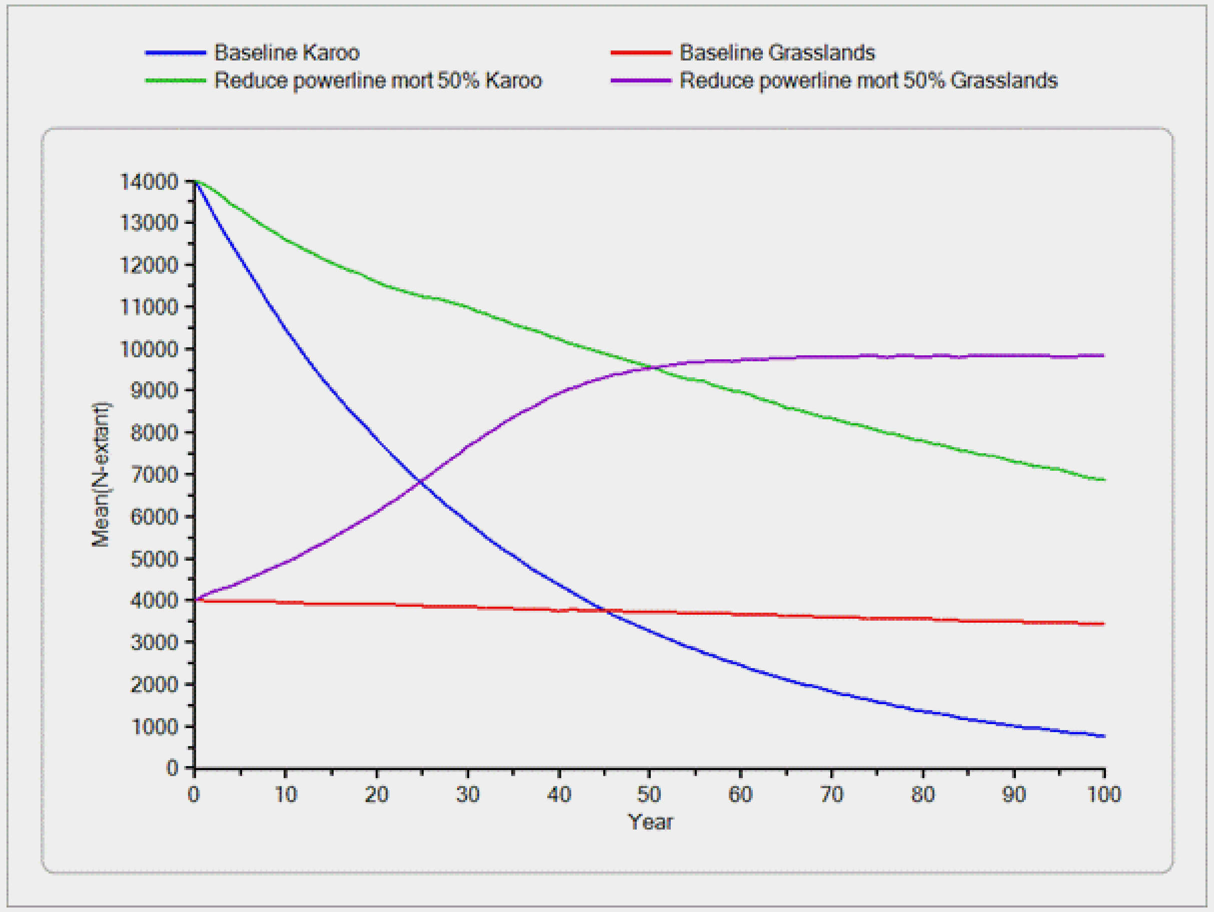


Figure 14: Results of reducing powerline mortality by 50% in the Karoo and grasslands, compared to baseline.

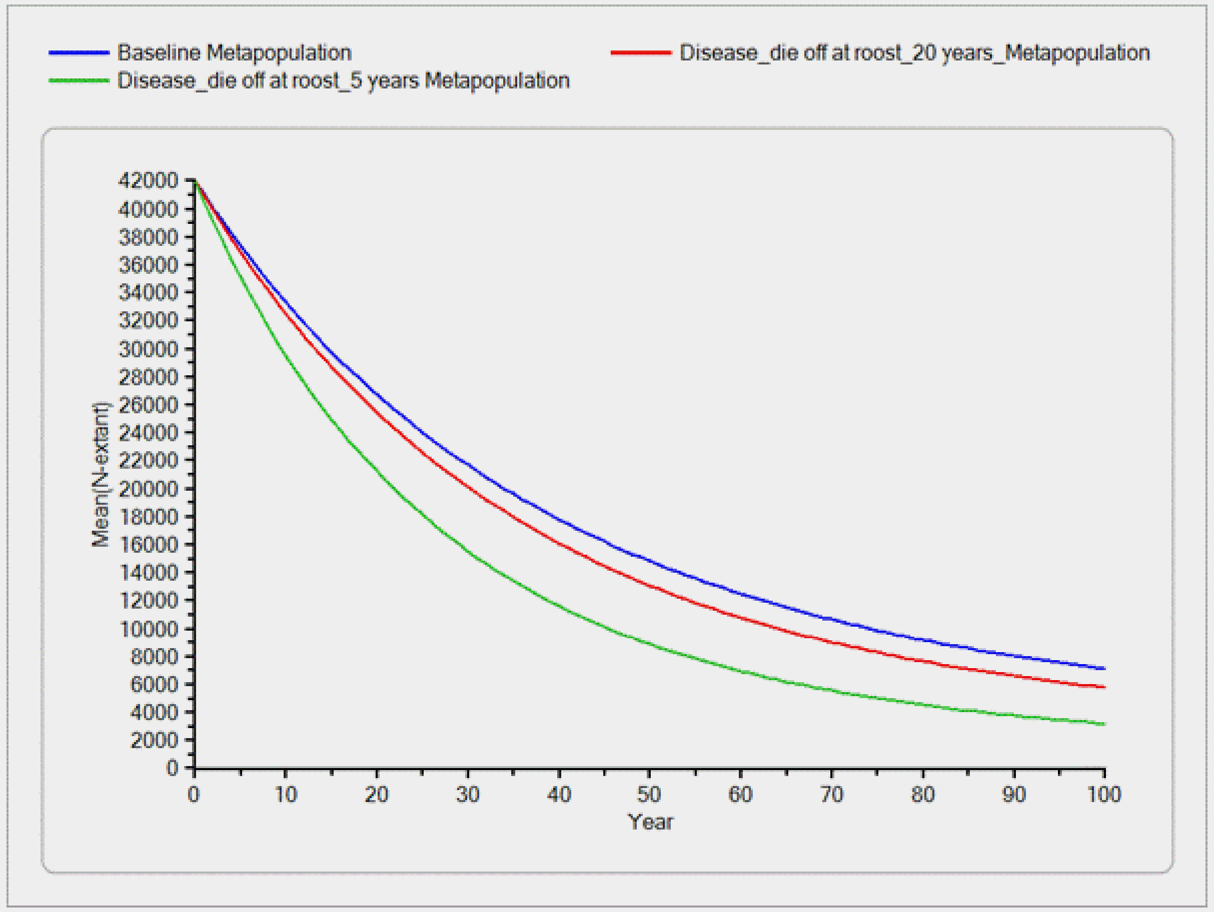


Figure 15: Population trajectory if a mass die off occurs due to disease (mortality at the scale of the size of the largest roost site per region) occurs on average every 5 or 20 years.

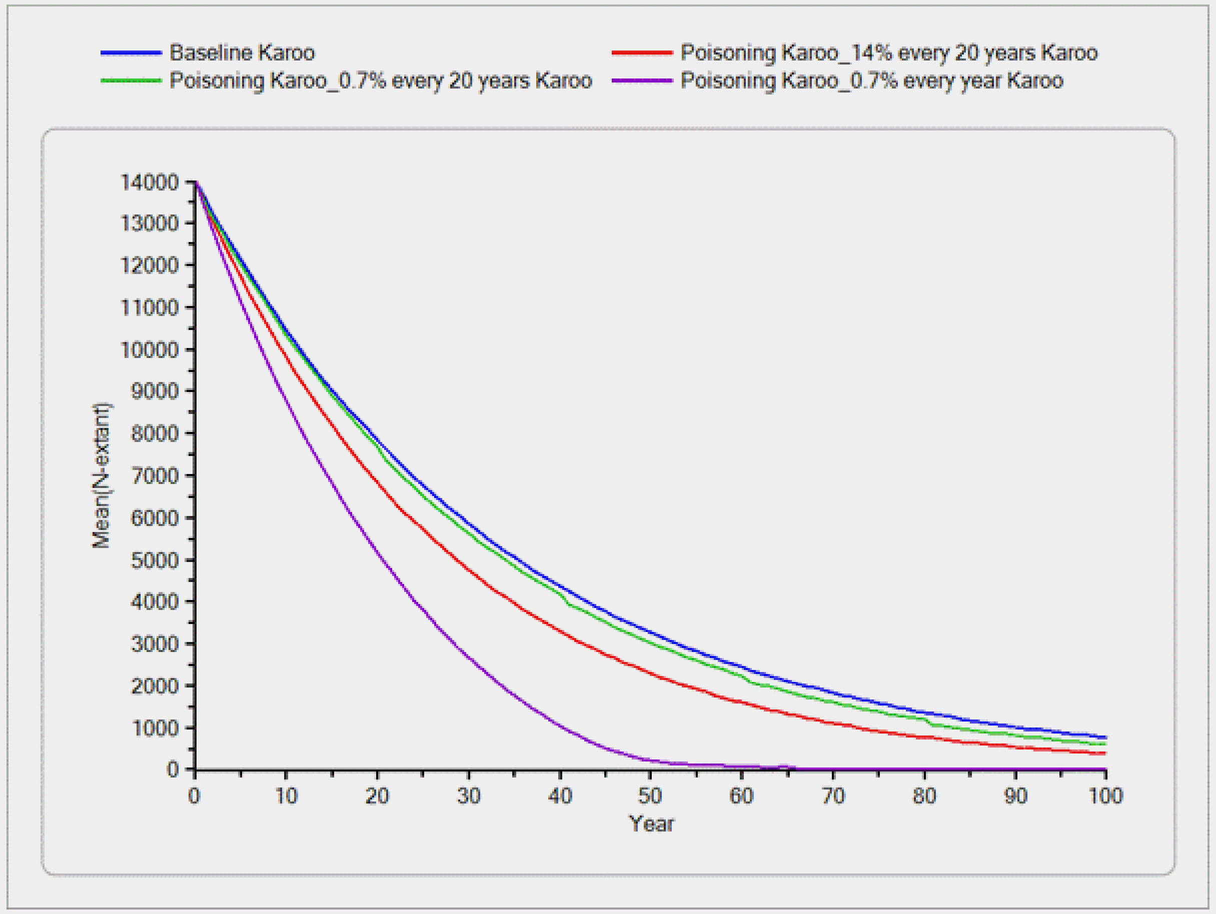


Figure 16: The impact of various rates of poisoning on the Blue Crane population in the Karoo.

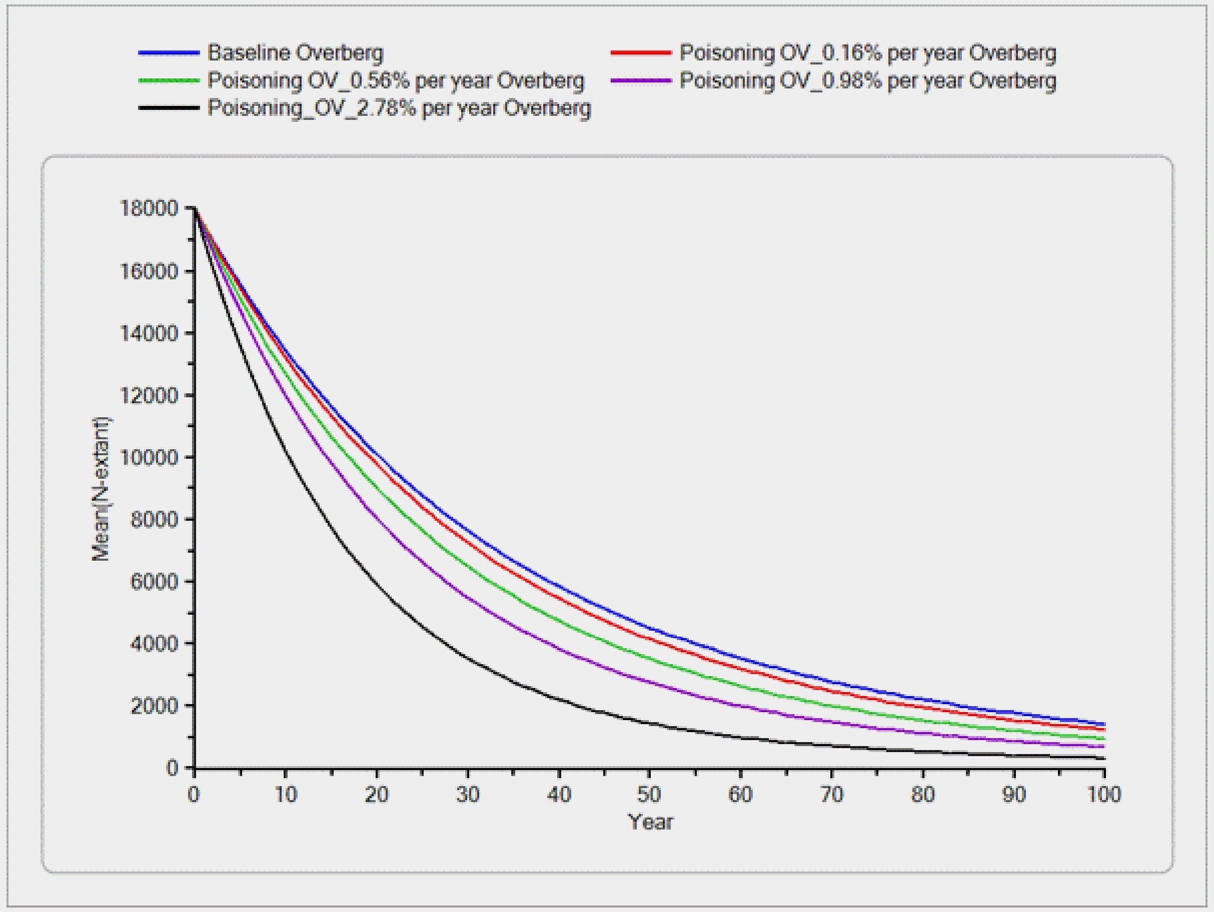


Figure 17: The impact of various rates of poisoning on the Blue Crane population in the Overberg.

CONCLUSION

The baseline model shows a growth rate consistent with the observed trends in the last decade of CAR data, but the overall Blue Crane metapopulation is projected to decline from 42,000 to fewer than 10,000 individuals over 100 years. Grassland populations exhibit initial stability before gradual long-term declines, while other regions display consistent negative trends

.

The model highlights the significant influence of key factors on population trajectories:

Breeding Success: Improved breeding success, particularly a 50% increase in the Overberg and Swartland, stabilizes or reverses declines.

Mortality: Juvenile and immature mortality reductions of 20–30% yield positive growth rates, with adult mortality being less impactful.

Threat Mitigation: Reducing powerline mortality by 50% achieves population stabilization or growth in most regions, while managing poisoning rates prevents catastrophic declines.

External Threats: Disease outbreaks at major roost sites and high rates of annual poisoning result in significant population reductions, with the latter potentially causing extinction in some scenarios. Wind turbine collisions, at current and projected rates, have minimal impact over the next century.

While extinction is unlikely within 100 years, the population is predicted to decline substantially. Targeted conservation measures—improving breeding success, reducing mortality across key age groups (juveniles and immatures), and mitigating powerline and poisoning threats—are critical for stabilising or reversing declines.

APPENDIX 1: SENSITIVITY TESTING POPULATION TRAJECTORY PLOTS

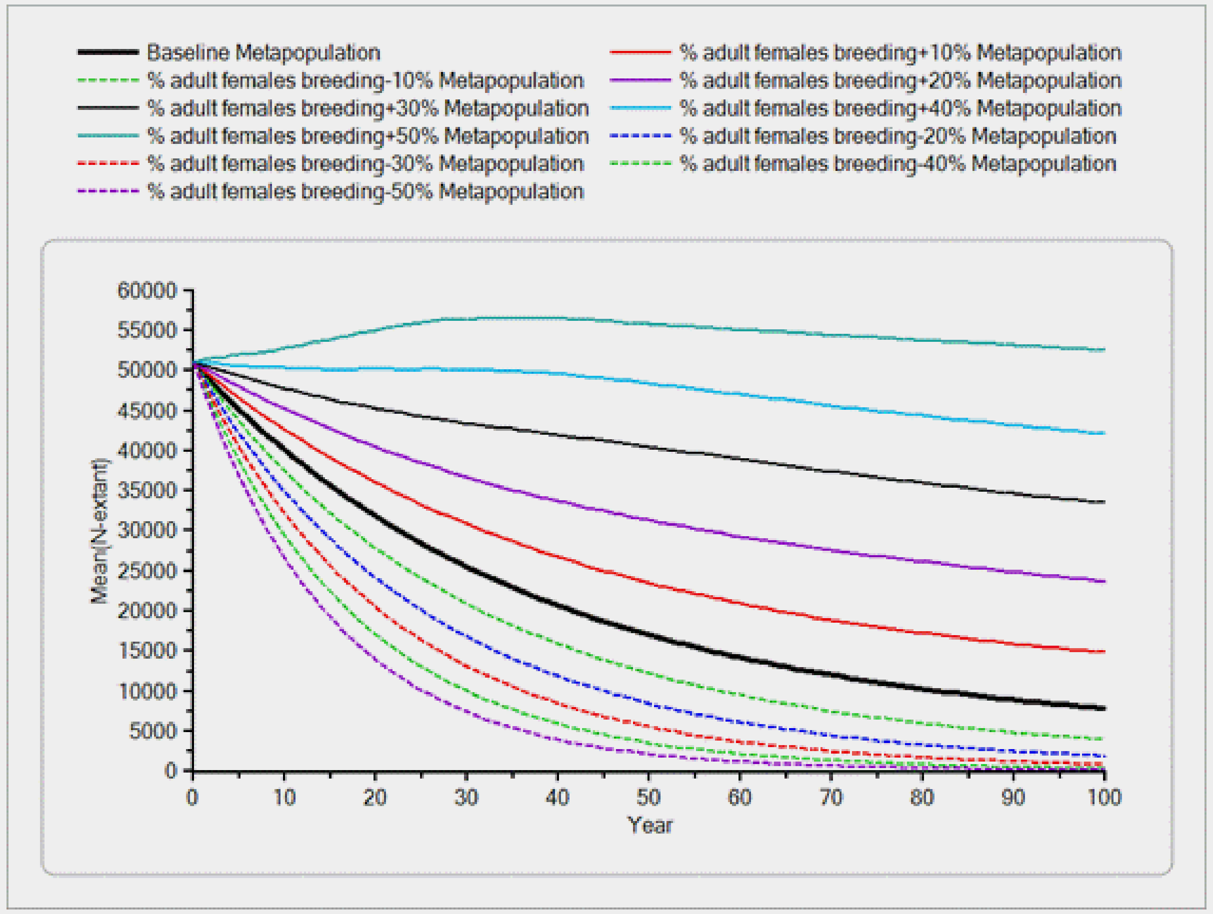


Figure S1: Sensitivity of the population to changes in % adult females breeding, ranging between 10-50% of the baseline value.

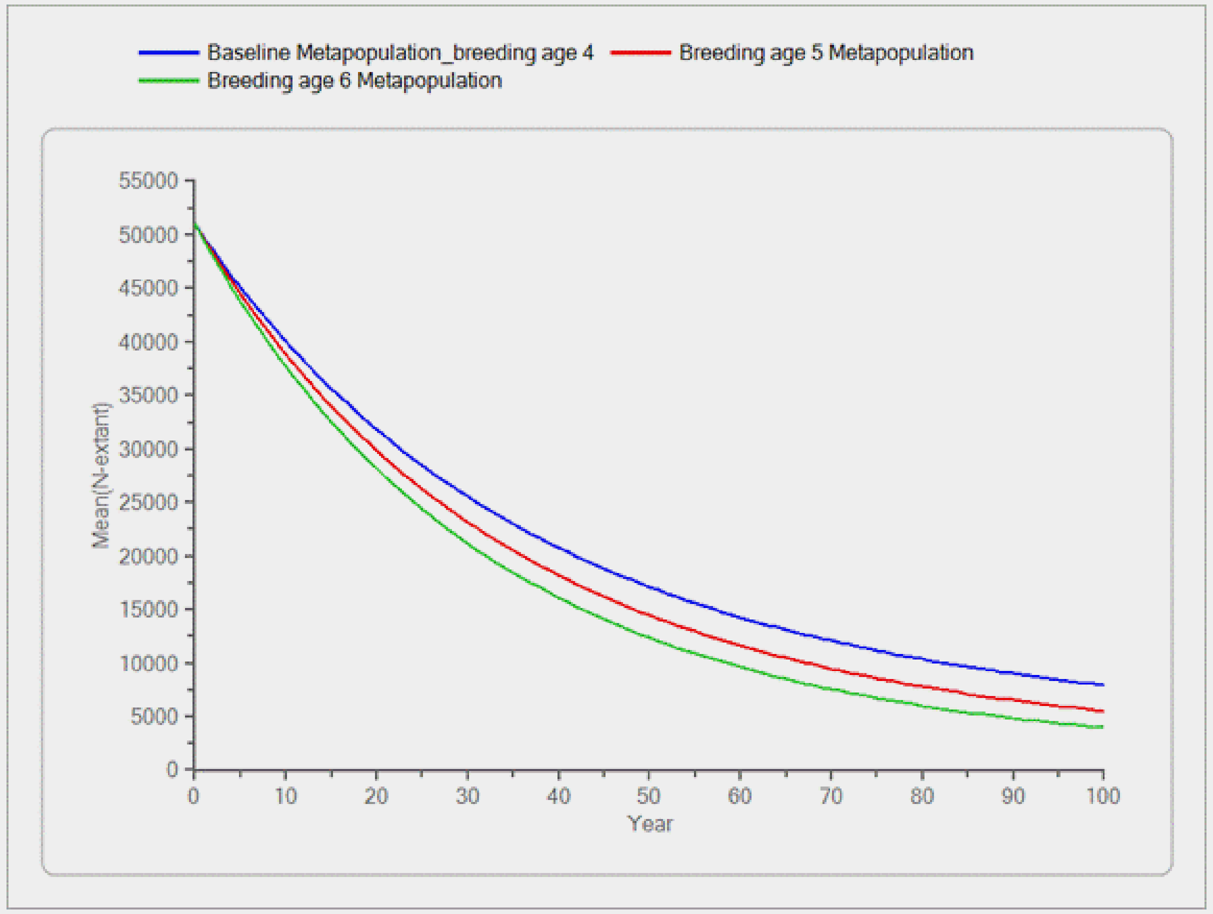


Figure S2: Sensitivity of population to changes in age of first breeding.

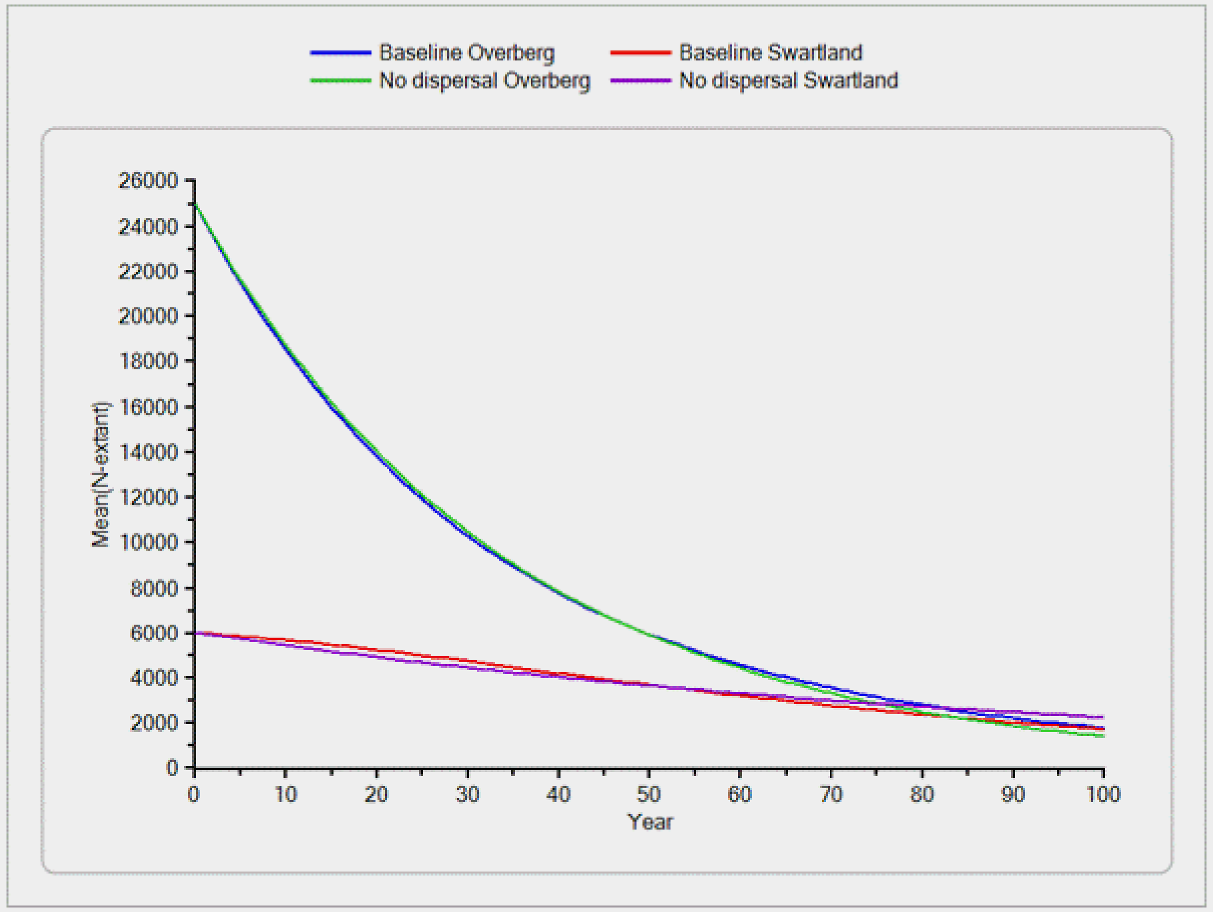


Figure S3: Sensitivity of Overberg and Swartland population to dispersal of 2-4% (baseline) vs. no dispersal between them

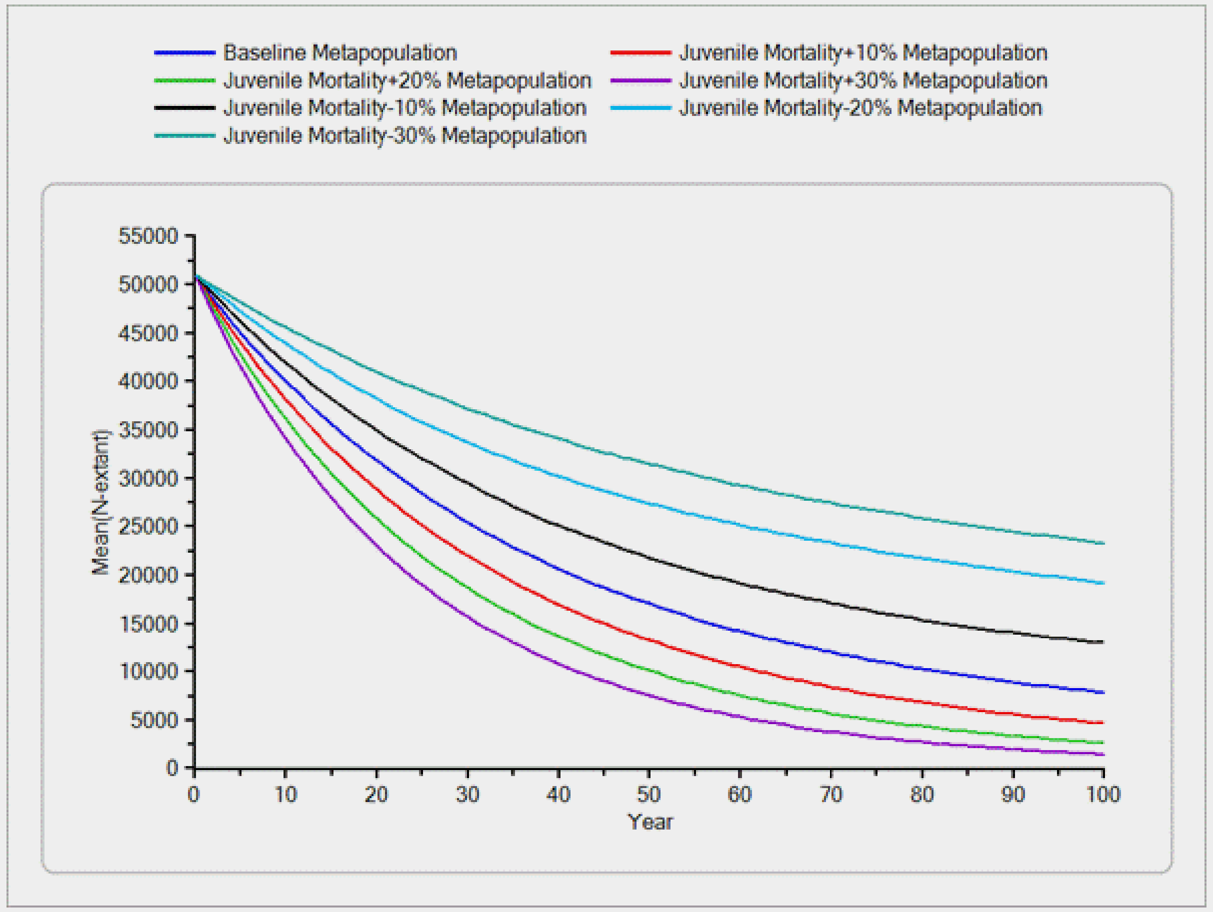


Figure S4: Sensitivity of the population to changes in juvenile (0-1) mortality, in the range of 10-30% of the baseline value.

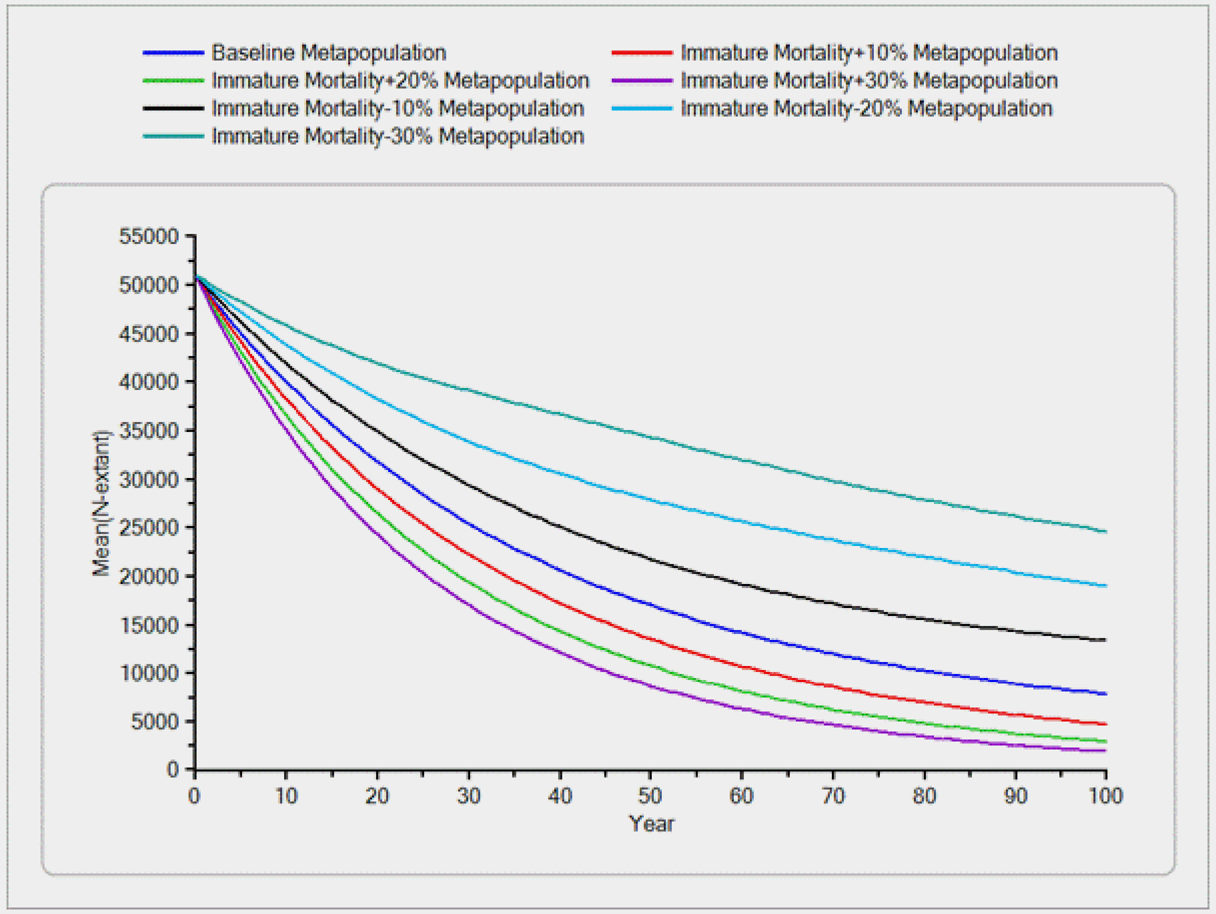


Figure S5: Sensitivity of the population to changes in immature (age 1-3) mortality, in the range of 10-30% of the baseline value.

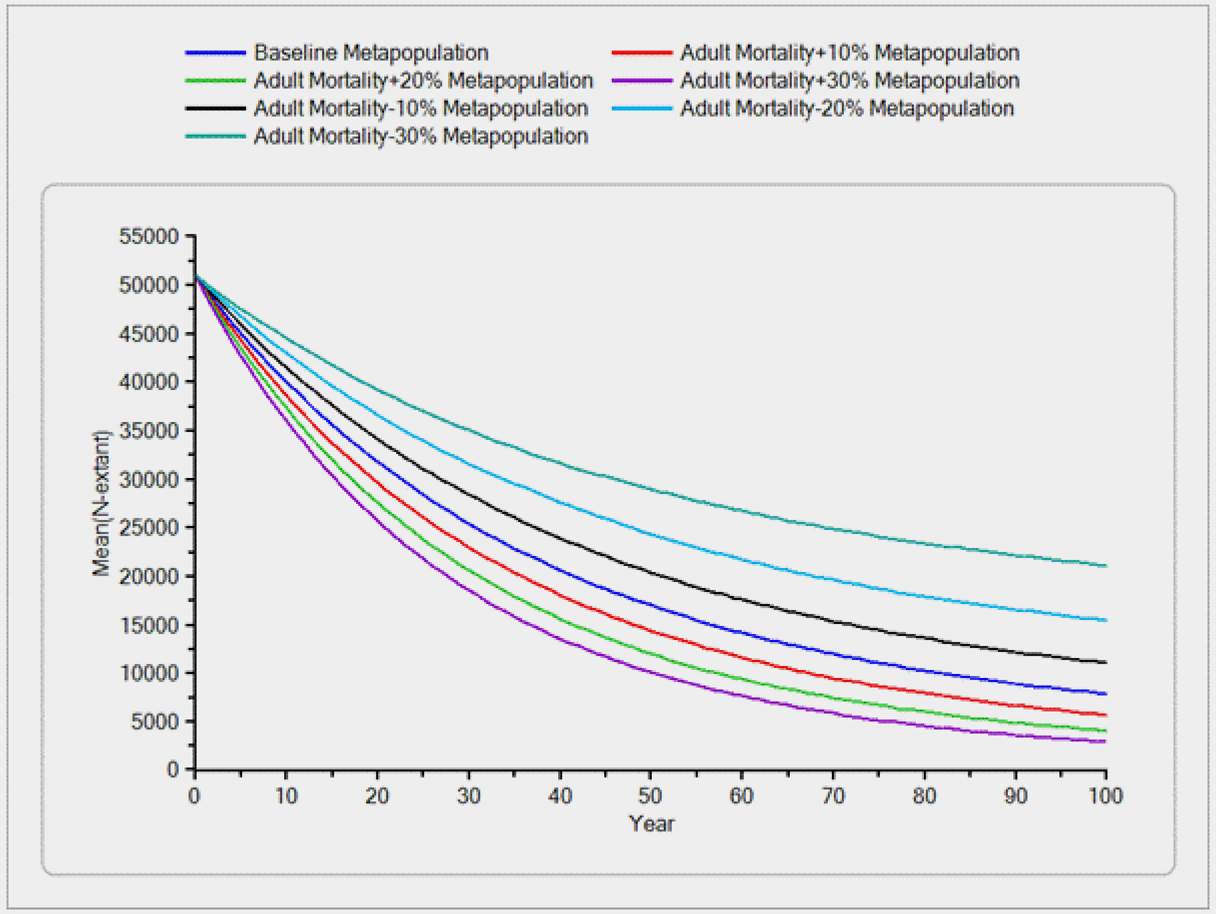


Figure S6: Sensitivity of the population to changes in adult (age 4) mortality, in the range of 10-30% of the baseline value.

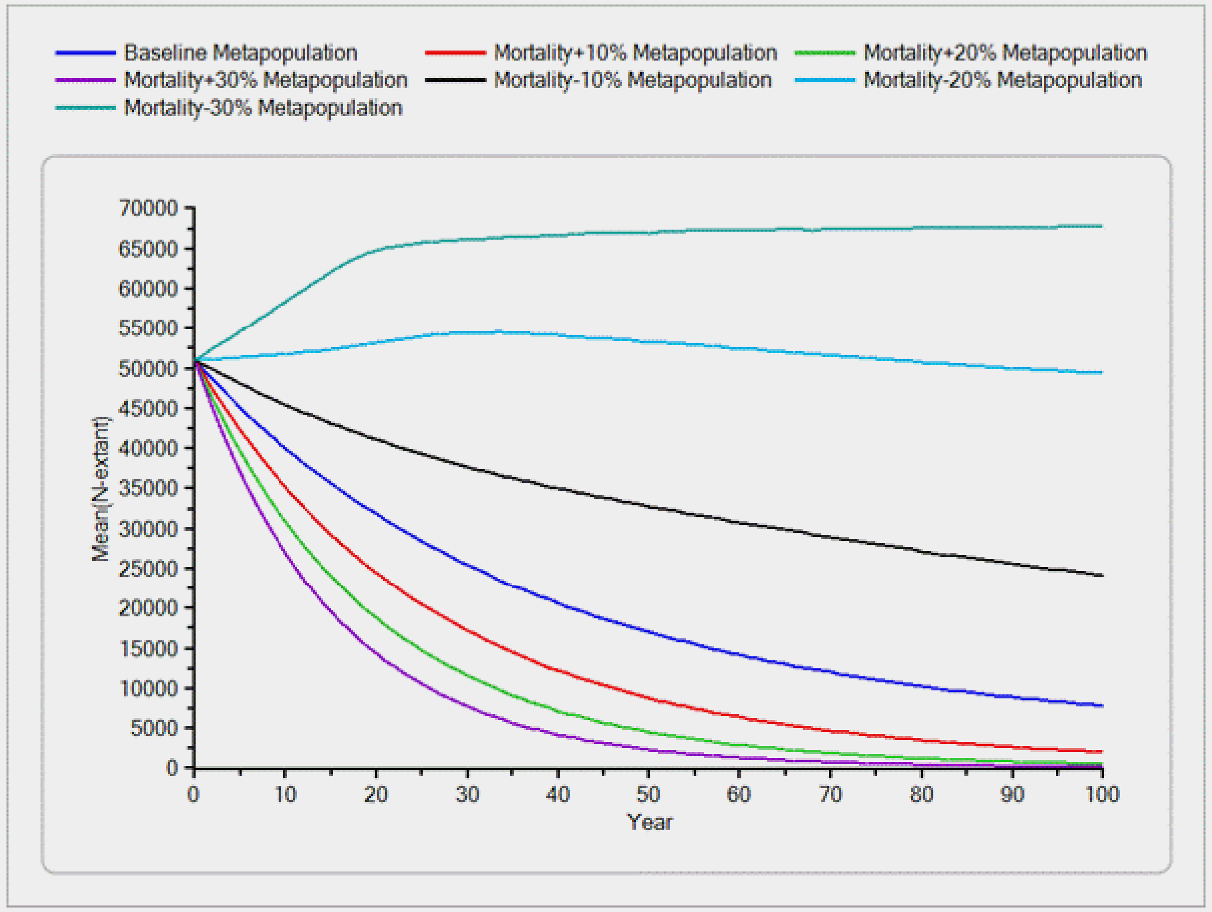


Figure S7: Sensitivity of the population to changes all ages mortality, in the range of 10-30% of the baseline value.

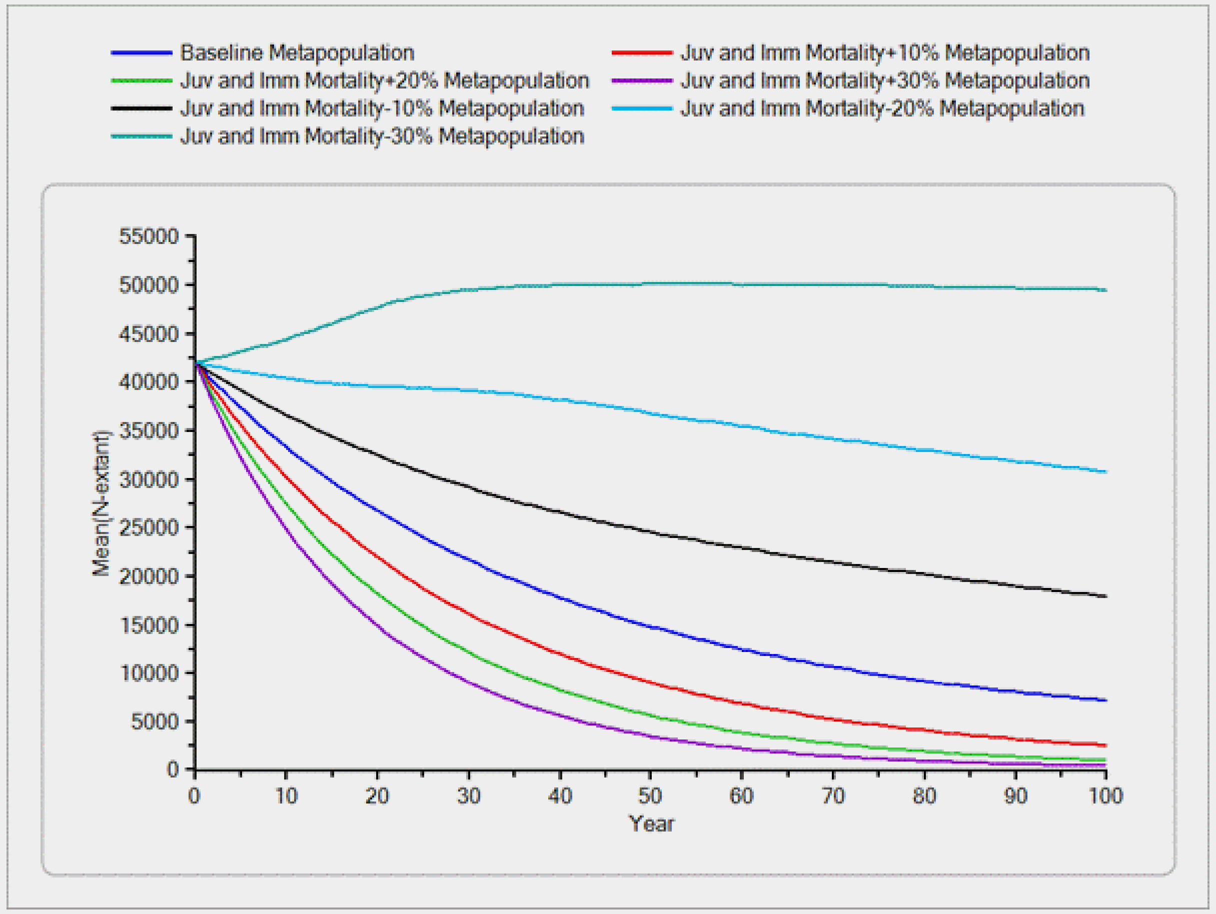


Figure S8: Sensitivity of the population to changes in juvenile and immature (age 0-4) mortality, in the range of 10-30% of the baseline value.

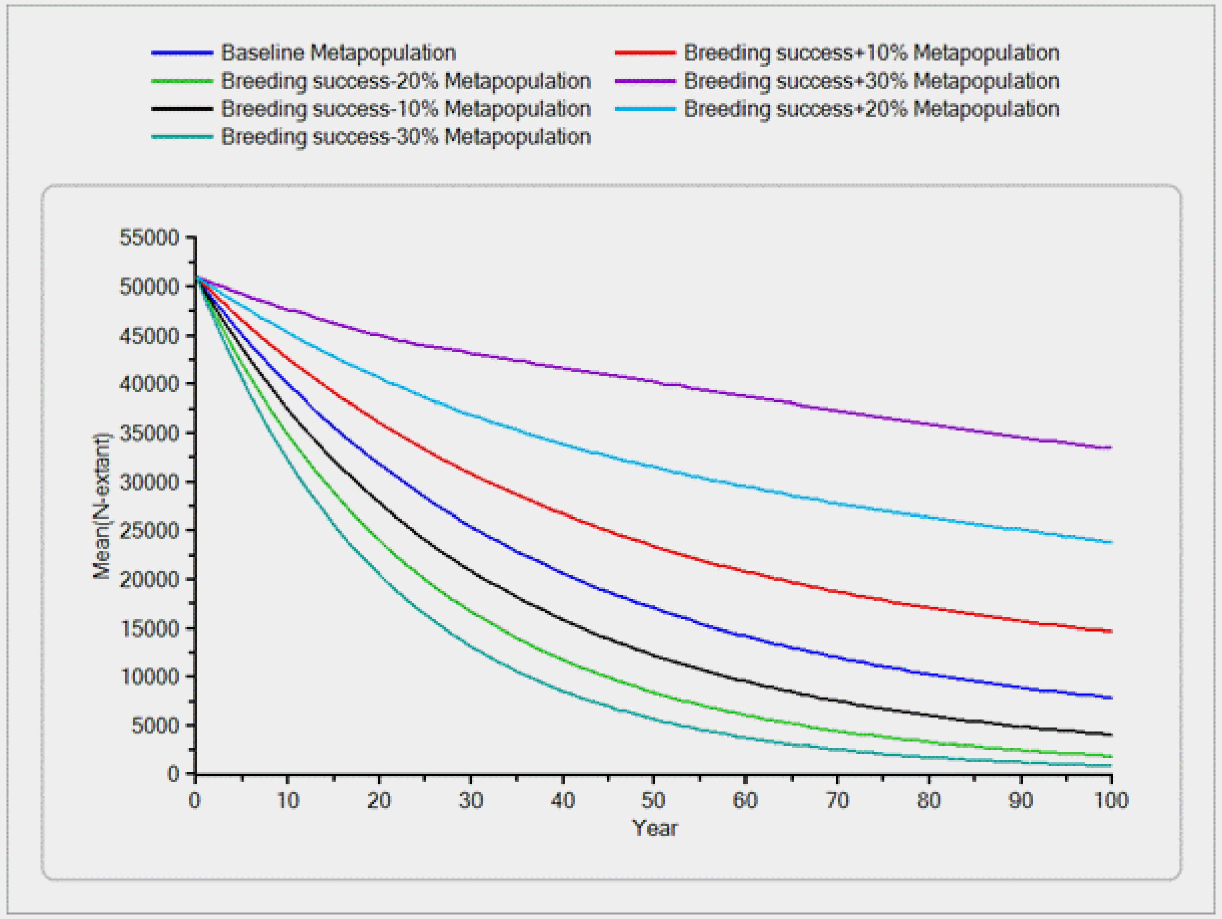


Figure S9: Sensitivity of the population to changes in breeding success, in the range of 10-30% of the baseline value.

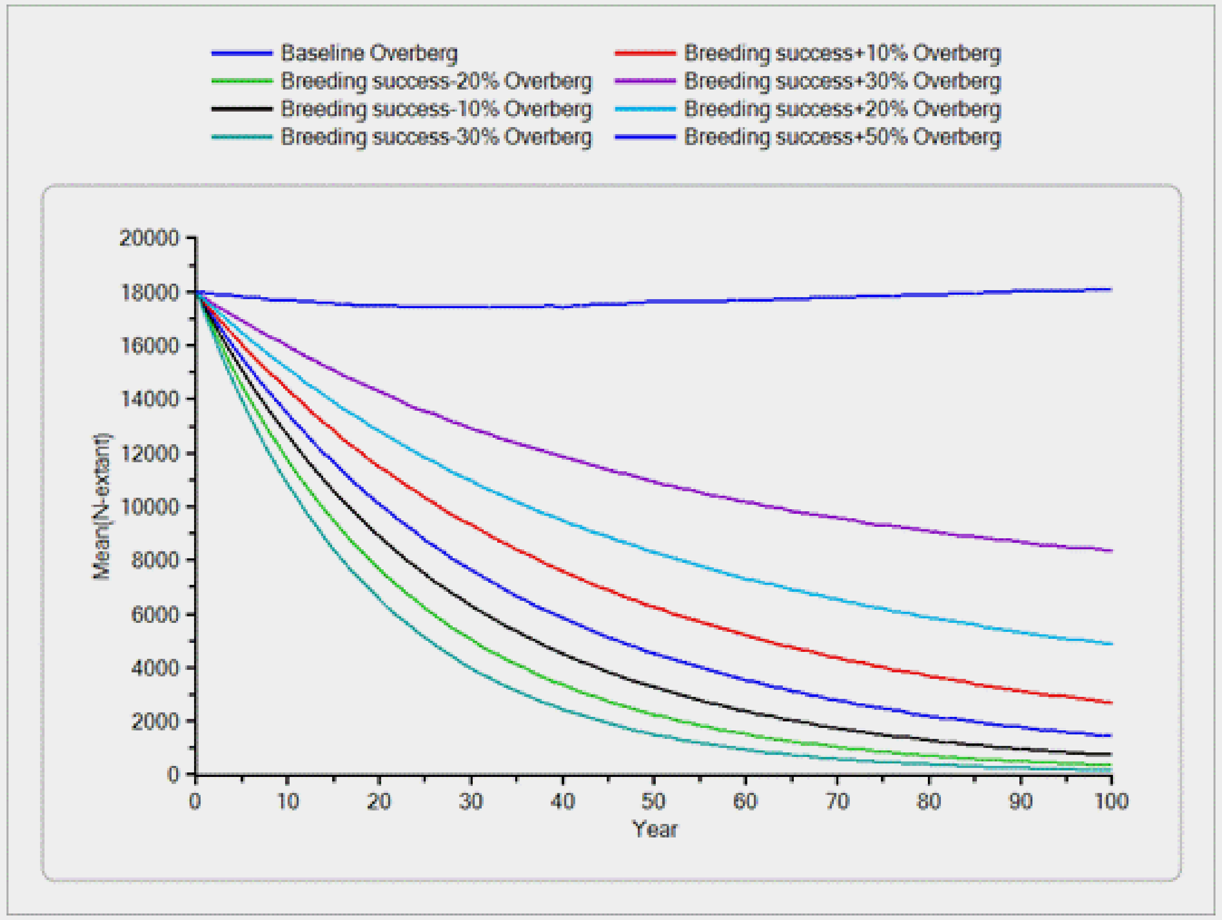


Figure S9: Sensitivity of the population to changes in breeding success, in the range of 10-30% of the baseline value.

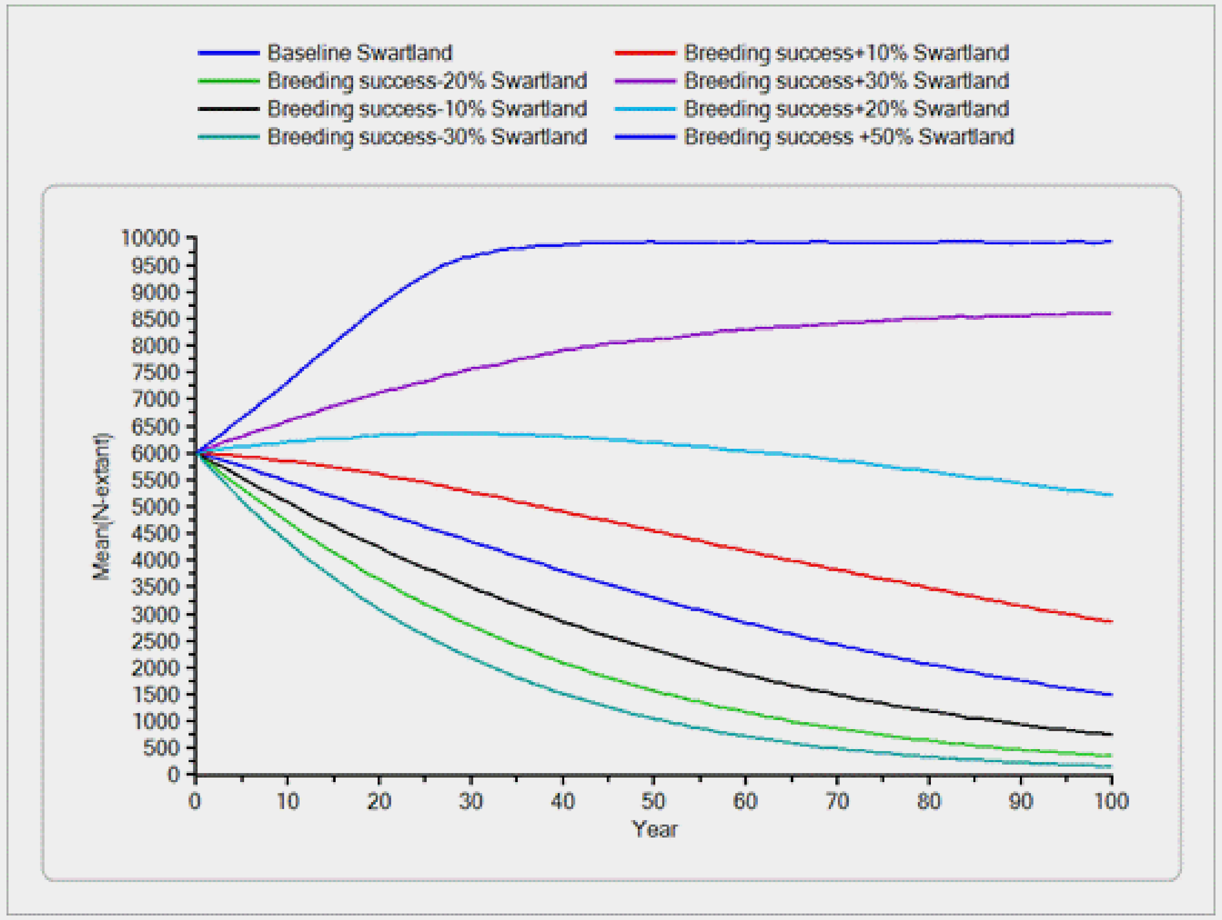


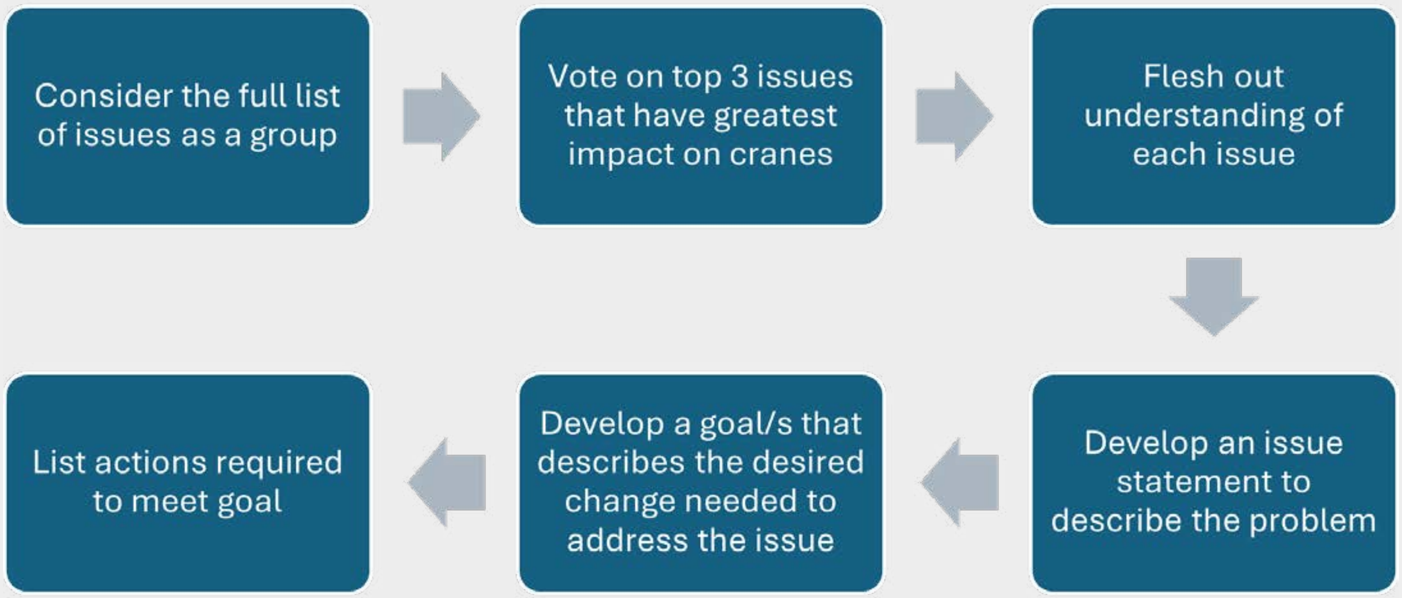
Figure S10: Sensitivity of the Overberg (top) and Swartland (bottom) populations to changes in breeding success, in the range of 10-50% of the baseline value.

DEVELOPING GOALS AND ACTIONS IN WORKING GROUPS

Through consensus the workshop participants decided to group issues facing by the Blue Crane according to the following groups:

- Direct threats to Blue Cranes: Lourens Leeuwner, Lara Fuller (facilitator), Christie Craig, Mmei Matjuda, Kevin Shaw, Brent Coverdale, Ndzalama Chauke
- Land use in the Karoo and Grassland, including agriculture: Damian Walters, Ian Rushworth (facilitator), Lindokuhle Mgwaba, Jacquie van der Westhuizen, Bradley Gibbons
- Agriculture in Blue Crane's artificial habitat (Overberg and Swartland, Western Cape): Jannie Fourie, Michelle Watson, Sanjo Rose, Ross Soller, Alistair Pietersen, Thandeka Mabena, Mick D'alton, Pieter Botha, Lesley Helliwell (facilitator), Kerryn Morrison, Heather D'alton

In groups, 3-5 goals and actions were developed based on the following process:



GOALS

A statement describing each issue discussed in the working groups is provided below. The goals identified to mitigate the issues are also listed in order of priority.

Direct Threats Working Group
Issue headings listed in order of priority per working group

POWERLINES

South Africa is home to some 340 000 km's of powerlines and Blue Cranes are the most collision prone bird species according to the Eskom Central Incident Register (CIR). Blue Cranes fatally collide with powerlines frequently as the lines are not visible to the birds in flight. This is well established through research and monitoring and there are proven mitigation devices available. The following goals were identified:

1. All powerlines in high-risk areas are mitigated.
2. All new powerlines are designed and routed in a bird friendly manner.
3. Research the effectiveness of bird flight diverters on all powerline voltages.
4. Promotion of more cost-effective installation methods (includes Independent Power Producers).

POISONING

Cranes are drawn to agricultural areas where sources of agrochemicals and lead are present which have the potential to impact Blue Crane populations through unintended mortality (indirect poisoning), persecution or sub lethal effects. The following goals were identified:

5. Reduce the presence of harmful agrochemicals in the landscape occupied by Blue Cranes.
6. Understand the impact of agrochemicals on the Blue Crane population (direct and indirect).
7. When poisoning incidents occur, mitigate mortality.
8. Reduce the presence of lead in the environment.

FENCES

There are a vast number of fence lines in South Africa and that are often invisible to Blue Cranes which collide with them while landing or taking off. Fences are also not permeable for non-flying birds (chicks and moulting birds) and therefore the cranes are injured or become fatally entangled in fences. The following goals were identified:

9. Understand the impact of fences on the Blue Crane population and risk factors for fence entanglements
10. Develop mitigation measures for Blue Crane fence entanglements and disseminate the information

WIND TURBINES

There can be an overlap between wind resources and Blue Crane habitat across the country and the global shift away from fossil fuels has created an increase in the number of wind farm developments. Wind turbines are large unnatural structures that Blue Cranes may fly into. These incidents may also be linked to weather conditions. The following goals were identified:

11. Ensure placement of turbines and associated infrastructure to limit mortality of cranes
12. Where unsustainable mortality is recorded ensure appropriate mitigation and adaptation
13. Understand Blue Crane movements within landscapes (Karoo and grasslands).

DISEASE/HEALTH

Due to the gregarious nature of Blue Cranes, there is an increased risk of disease outbreak within the distribution of Blue Cranes resulting in a catastrophic loss to the species. Very little is known about the diseases that can impact Blue Cranes, their transmission and Blue Cranes' susceptibility to disease or about general health issues in Blue Cranes. The following goals were identified:

14. There are appropriate rehab facilities and protocols to treat Blue Cranes
15. Understand the implications and causes of bent leg syndrome

LAND-USE IN THE KAROO AND GRASSLANDS, INCLUDING AGRICULTURE

KAROO OVERGRAZING

Overgrazing by livestock/game/ostriches has a detrimental effect on the breeding of cranes and the carrying capacity of Blue Cranes in the Karoo. The extent of the problem and the nature of the relationship between stocking rates and how they impact cranes (suitability for cranes) is unknown.

16. Gain a better understanding of the effects of overgrazing on Blue Cranes
17. Reduce the impact of overgrazing by recognizing crane-friendly farmers and farming practices.

HABITAT LOSS IN THE GRASSLANDS

Habitat loss, through conversion for agriculture, intensification and afforestation has a negative effect on cranes due to loss of breeding territories, foraging areas and declining carrying capacity. Poor land management is taking place in the grasslands and the extent of this is increasing (e.g. through inappropriate burning regimes, overgrazing), due to farmers becoming more profit driven and less conservation orientated. Management practices such as high intensity short term grazing lead to more Blue Crane breeding disturbance and more fences.

18. Use Biodiversity Stewardship and offsets to secure important areas for cranes with a management plan that encourages the correct management practices that benefit cranes.

19. Monitor habitat loss (through GIS and observations of current activities causing loss of habitat)
20. Produce numerical and spatial targets for Blue Cranes for incorporation in systematic conservation plan revision (C-Plans)
21. Ensure that invasive species (plants and animals) do not occupy areas within Blue Crane habitats
22. Limit rural sprawl in key crane areas

MINING

Mining can have a detrimental effect on crane numbers in the grasslands and Karoo. It's assumed that Blue Cranes will not breed or feed in mining areas due to habitat loss, increased fencing, powerlines, roads and disturbance.

23. Understand the threat of current mines and the extent of those that have been granted approval and those with prospecting licenses, and identify priority areas where future mines can pose a threat to Blue Cranes

CLIMATE CHANGE

Global climate change is likely to impact on the suitability of habitat for cranes, due to changing rainfall patterns, extreme heat and changing farming practices.

24. Anticipate likely changes in agricultural activities through engagement with the agriculture industry, agricultural economists and climatologists

AGRICULTURE IN TRANSFORMED HABITATS (OVERBERG AND SWARTLAND)

LAND USER ENGAGEMENT

There is a lack of communication and stakeholder engagement (between conservationists and land users) on known and unknown threats to Blue Crane and agriculture in the Western Cape. Lack of continued awareness, stakeholder engagement and reliable information dissemination results in misinformation and lack of preparedness for Blue Crane threats and may lead to unintended Blue Crane mortality/decreased population viability. This is exacerbated by a lack of extension support, funding and the development of effective partnerships (leading to low buy-in from landowners to protect Blue Crane on their land). There are opportunities to engage farm workers through existing training through the Wool Growers Association.

25. Build partnerships on a foundation of trust, empathy and communication, bridging the gap between threats and solutions.

AGRICULTURAL ACTIVITIES

There is a lack of integrated best practices (for Blue Cranes) of day-to-day agricultural activities. This is caused by a lack of awareness, knowledge and motivation (in part due to a change from generational farmers & labour to big business agriculture and reduced conservation extension support for farmers) which results in higher mortality rates and reduced breeding success in Blue Cranes.

26. Improved knowledge and implementation and adaptation of best practice activities to improve breeding success and reduced mortality of Blue Crane in agricultural landscapes

LAND USE CHANGE

Evolving/current agricultural practices driven by the economic climate, as well as climate change and risk mitigation, are affecting the amount of suitable habitat for Blue Cranes. This alters the carrying capacity and reduces the number of suitable breeding sites. This is concerning given the crane's dependence on agriculture especially in the Western Cape

27. Understand the interplay between Blue Crane life history and agricultural production to predict how land use change will impact Blue Crane populations.

ACTIONS

POWERLINES

GOAL 1: ALL POWERLINES IN HIGH-RISK AREAS ARE MITIGATED

Action	*Responsible Party*	*Collaborators/ Partners*	*Timeline (within 1-2 years; within 2-5 years; within 5-10 years; ongoing)*	*Priority (1 being highest, 4 being the lowest)*	*Measure of success*
Develop a collision risk model for Blue Cranes across the species range	ICF/EWT	Eskom and National Transmission Company South Africa (NTCSA)	Within 1-2 years	2	An effective reliable collision risk model
Collate Blue Crane roost sites across the country to feed into collision risk model (proximity of lines to roost sites is a major predictor of collision)	ICF/EWT	Conservation agencies, landowners, conservancies, citizen scientists	Within 1 year	1	A current data set containing relevant information on Blue Crane roosts
Continue collaboration with power utilities to ensure implementation of mitigation through both proactive and reactive mitigation strategies, and maintenance of mitigation	ICF/EWT	Eskom, NTCSA & other power utilities (provincial & independent)	Ongoing	1	1. Completed investigation reports for interactions with power infrastructure 2. Implementation of mitigation measures as requested in investigation reports 3. Proactive
Monitor mitigated lines to gather data on effectiveness	ICF/EWT	Eskom, NTCSA	Ongoing	1	Data records of follow up monitoring

GOAL 2: ALL NEW POWERLINES ARE DESIGNED AND ROUTED IN A BIRD FRIENDLY MANNER

Action	*Responsible Party*	*Collaborators/ Partners*	*Timeline (within 1-2 years; within 2-5 years; within 5-10 years; ongoing)*	*Priority (1 being highest, 4 being the lowest)*	*Measure of success*
Continued partnership and collaboration with power utilities to influence wildlife management policies	EWT	Eskom, NTCSA & other power utilities (provincial & independent)	Ongoing	1	
Supply power industry with research backed information and recommendations for best practice in powerline design and routing	ICF/EWT	Eskom, NTCSA & other power utilities (provincial & independent)	Ongoing	1	Best practice guidelines, research reports & publications
Review and comment on specialist reports in high-risk areas for proposed new powerlines (informed by risk model)	All conservation agencies	Eskom, NTCSA & other power utilities (provincial & independent)	Ongoing	1	Record of comments submitted

GOAL 3: RESEARCH THE EFFECTIVENESS OF BIRD FLIGHT DIVERTERS ON ALL POWERLINE VOLTAGES.

Action	Responsible Party	Collaborators/ Partners	Timeline (within 1-2 years; within 2-5 years; within 5-10 years; ongoing)	Priority (1 being highest, 4 being the lowest)	Measure of success
Develop and implement a research project to investigate the effectiveness of mitigation on distribution lines.	Endangered Wildlife Trust and Eskom Research *(dependent on contract)*	Eskom, NTCSA & other power utilities (provincial & independent), universities	2-5 years	2	Research report & publications
Secure funding for above research project to allow implementation	Endangered Wildlife Trust and Eskom Research	Eskom, NTCSA & other power utilities (provincial & independent), universities, donors	1-2 years	2	Secured funding

GOAL 4 : PROMOTION OF MORE COST-EFFECTIVE INSTALLATION METHODS (INCLUDES INDEPENDENT POWER PRODUCERS)

Action	Responsible Party	Collaborators/ Partners	Timeline (within 1-2 years; within 2-5 years; within 5-10 years; ongoing)	Priority (1 being highest, 4 being the lowest)	Measure of success
Finalise the Eskom task manual for Drone deployment of Bird Flight Diverters	Eskom	EWT	July 2025	1	Manual for the deployment of bird flight diverters by drones
Use the technical specification committee to promote Independent Power Producers to use drones to mark lines	EWT	Eskom, IPPs	Within 5 years	2	All IPPs are marking lines using drones


Photo Credit: Ciming Mei

POISONING

GOAL 5: REDUCE THE PRESENCE OF HARMFUL AGROCHEMICALS IN THE LANDSCAPES TO BLUE CRANES

Action	Responsible Party	Collaborators/ Partners	Timeline (within 1-2 years; within 2-5 years; within 5-10 years; ongoing)	Priority (1 being highest, 4 being the lowest)	Measure of success
Engage with BirdLife, National Wildlife Poisoning Prevention Working Group (formalised Government group to address wildlife poisoning), Gerhard Verdoorn & farmers to identify which agrochemicals are presently being used in the landscape & for what purpose to understand the nature of the issue, in relation to cranes	ICF/EWT	Birdlife/ NWPPWG	Before Dec 2025	1	Document/report indicating which agrochemicals are presently been used in the landscape (this is in development by Birdlife SA)
Employ an extension worker within the Overberg to engage with landowners to raise awareness	ICF/EWT	Farmers/Birdlife/ Overberg Renosterveld Conservation Trust/Overberg Crane Group & other local NGOs	2 years	1	Appointment of an extension officer for the Overberg & engagements with farmers
Investigate and promote alternative options to control problem pests e.g. Avipel, owl boxes etc.	ICF/EWT	Birdlife, farmers & agricultural industry	2 years	2	Information collated and widely distributed to farmers

GOAL 6: UNDERSTAND THE IMPACT OF AGROCHEMICALS ON THE BLUE CRANE POPULATION (DIRECT AND INDIRECT)

Action	Responsible Party	Collaborators/ Partners	Timeline (within 1-2 years; within 2-5 years; within 5-10 years; ongoing)	Priority (1 being highest, 4 being the lowest)	Measure of success
Approach Birdlife to explore research opportunities to include Blue Cranes in their work to understand the toxicology of agrochemicals and its sub lethal effects	ICF/EWT	Birdlife/ Onderstepoort	By end of 2025	2	-
Ensure that all known poisoning events are submitted to the African Wildlife Poisoning database.	EWT (houses database)	All conservation agencies	Ongoing	2	Comprehensive records on the African Wildlife Poisoning database

GOAL 7: WHEN POISONING INCIDENTS OCCUR, MITIGATE MORTALITY

Action	Responsible Party	Collaborators/ Partners	Timeline (within 1-2 years; within 2-5 years; within 5-10 years; ongoing)	Priority (1 being highest, 4 being the lowest)	Measure of success
Develop and implement a crane poison response protocol for Western Cape, Northern Cape and Eastern Cape, and provide training to response team	ICF/EWT	Provincial conservation agencies, law enforcement, rehabilitation centres	1-2 years	1	1. Identify and train poison response team for each province 2. Develop poison response protocols for each province
Ensure that KwaZulu-Natal vulture poison response plan is inclusive of cranes	ICF/EWT	Ezemvelo KZN Wildlife	1-2 years	1	

GOAL 8: REDUCE PRESENCE OF LEAD IN THE ENVIRONMENT

Action	Responsible Party	Collaborators/ Partners	Timeline (within 1-2 years; within 2-5 years; within 5-10 years; ongoing)	Priority (1 being highest, 4 being the lowest)	Measure of success
Understand the extent of lead ingestion and presence in Blue Cranes – through opportunistically sampling dead or compromised cranes	To be determined		Ongoing	4	-
Ensure research findings are incorporated into government policy so additional lead is reduced.	National Lead Task Team		Ongoing	4	

GOAL 9: UNDERSTAND THE IMPACT OF FENCES ON THE BLUE CRANE POPULATION AND RISK FACTORS FOR FENCE ENTANGLEMENTS

Action	Responsible Party	Collaborators/ Partners	Timeline (within 1-2 years; within 2-5 years; within 5-10 years; ongoing)	Priority (1 being highest, 4 being the lowest)	Measure of success
Implement a research project in the Overberg to quantify the impact of fences on Blue Cranes, and all associated contributing factors.	To be determined			2	1. A developed research proposal 2. Completed research project

GOAL 10: DEVELOP MITIGATION MEASURES FOR BLUE CRANE FENCE ENTANGLEMENTS AND DISSEMINATE INFORMATION

Action	Responsible Party	Collaborators/ Partners	Timeline (within 1-2 years; within 2-5 years; within 5-10 years; ongoing)	Priority (1 being highest, 4 being the lowest)	Measure of success
Wait for outcome of research project.					Guidelines developed and widely distributed

WIND TURBINES

GOAL 11: ENSURE PLACEMENT OF TURBINES AND ASSOCIATED INFRASTRUCTURE TO LIMIT MORTALITY OF CRANES

Action	Responsible Party	Collaborators/ Partners	Timeline (within 1-2 years; within 2-5 years; within 5-10 years; ongoing)	Priority (1 being highest, 4 being the lowest)	Measure of success
EWT and Birdlife continue to drive Birds and Renewable Energy Specialist Group over next 5 years.	EWT & Birdlife	Renewable energy industry	5 years		An effectively managed BARESG
Crane biologists attend annual Birds and Renewable Energy Forum to stay abreast of developments and to provide input.	EWT	Renewable energy industry	Ongoing		At least one Crane biologist to attend each BAREF workshop/ conference
Seek out new development applications and comment on EIAs in priority crane areas to ensure good placement of turbines and powerlines.	All stakeholders	EAPs	Ongoing		Meaningful input into EIA of developments that would negatively impact cranes

GOAL 12: WHERE UNSUSTAINABLE MORTALITY IS RECORDED ENSURE APPROPRIATE MITIGATION AND ADAPTATION

Action	Responsible Party	Collaborators/ Partners	Timeline (within 1-2 years; within 2-5 years; within 5-10 years; ongoing)	Priority (1 being highest, 4 being the lowest)	Measure of success
Over the next 5 years monitor mortality figures for Blue Cranes at wind farms and promote curtailment (shut down on demand) where necessary	EWT & Birdlife		5 years	2	

GOAL 13: UNDERSTAND BLUE CRANE MOVEMENTS WITHIN LANDSCAPES (KAROO AND GRASSLANDS)

Action	Responsible Party	Collaborators/ Partners	Timeline (within 1-2 years; within 2-5 years; within 5-10 years; ongoing)	Priority (1 being highest, 4 being the lowest)	Measure of success
Using findings of MTPA flyway project and movement data from other areas, create a map showing the no-go areas using information obtained from tracked birds and their flight paths			5 years	2	No-go map for Blue Cranes

DISEASE/HEALTH

GOAL 14: THERE ARE APPROPRIATE REHAB FACILITIES AND PROTOCOLS TO TREAT BLUE CRANES

Action	Responsible Party	Collaborators/ Partners	Timeline (within 1-2 years; within 2-5 years; within 5-10 years; ongoing)	Priority (1 being highest, 4 being the lowest)	Measure of success
Treat injured Blue Cranes at a rehab centre that have been reported or organise the arrangements to transport them to a facility	Rehab centres	Vets, NGOs, provincial bodies	Ongoing	1	Cranes successfully rehabbed and released

GOAL 15: UNDERSTAND THE IMPLICATIONS AND CAUSES OF BENT LEG SYNDROME

Action	Responsible Party	Collaborators/ Partners	Timeline (within 1-2 years; within 2-5 years; within 5-10 years; ongoing)	Priority (1 being highest, 4 being the lowest)	Measure of success
Send samples of any suspected bent leg syndrome cases (blood or whole carcass if mortality) to Ondestepoort for investigation	ICF/EWT, local rehabs & vets	Ondestepoort	Within 1-2 years	1	1. Samples sent to Ondestepoort 2. Build up a database of cases with results 3. Publish results together with Onderstepoort once enough data has been collected
Use SANBI Bio Bank blood samples to develop healthy baseline for Blue Crane (if possible)	ICF/EWT	Ondestepoort/ Bio Bank	Within 1-2 years		Baseline levels are developed for healthy Blue Cranes

NATURAL LANDSCAPES

KAROO OVERGRAZING

GOAL 16: GAIN A BETTER UNDERSTANDING OF THE EFFECTS OF OVERGRAZING ON BLUE CRANES

Action	Responsible Party	Collaborators/ Partners	Timeline (within 1-2 years; within 2-5 years; within 5-10 years; ongoing)	Priority (1 being highest, 4 being the lowest)	Measure of success
Develop a research proposal and find a suitable student to undertake research to understand the requirements of Blue Cranes for breeding sites and the effects of landscape changes caused by factors such as high grazing pressures. Overgrazing	ICF/EWT	Universities	within 1 or 2 years	3	1. 1A document produced 2. Secured funding and student. 3. completed research project 4. dissemination and implementation of research findings

GOAL 17: REDUCE THE IMPACT OF OVERGRAZING BY RECOGNIZING CRANE-FRIENDLY FARMERS AND FARMING PRACTICES.

Action	Responsible Party	Collaborators/ Partners	Timeline (within 1-2 years; within 2-5 years; within 5-10 years; ongoing)	Priority (1 being highest, 4 being the lowest)	Measure of success
Build strong and maintain relationships with landowners and crane custodians	ICF/EWT		Ongoing	1	A database of crane custodians
Revitalise and implement the crane custodian programme	ICF/EWT		Acknowledge 5 new crane custodians per year	1	1. Crane custodian guideline document 2. A database of crane custodians
Increase the reach of nature-based solutions for biodiversity and climate change	ICF/EWT		Ongoing	1	

HABITAT LOSS

GOAL 18 : USE BIODIVERSITY STEWARDSHIP, OFFSETS AND LANDOWNER ENGAGEMENT TO SECURE IMPORTANT AREAS FOR CRANES WITH A MANAGEMENT PLAN THAT ENCOURAGES THE CORRECT MANAGEMENT PRACTICES THAT BENEFIT CRANES

Action	Responsible Party	Collaborators/ Partners	Timeline (within 1-2 years; within 2-5 years; within 5-10 years; ongoing)	Priority (1 being highest, 4 being the lowest)	Measure of success
Identify high density areas with Blue Cranes (such as those with roost sites) that have biodiversity importance and initiate proactive stewardship including OECM	ICF/EWT	Eastern Cape Parks, EKZNW, FS DESTEA, MTPA	Within 1 year and ongoing process	1	Increased number of biodiversity stewardship sites
Continue with work in the area with post-proclamation support	ICF/EWT	Eastern Cape Parks, EKZNW, FS DESTEA, MTPA	Ongoing	1	Each site visited on an ongoing basis
Ensure appropriate engagement with relevant academics and other thinkers in the grazing management sphere and anticipate threats and opportunities for Blue Cranes	ICF/EWT	Academic institutions, GSSA, National and provincial Department Agriculture	Ongoing	3	
Meet with agricultural economists from various sectors of agriculture to understand the intensification of farming within an existing setting	ICF/EWT	Agricultural economists	Within 2 to 5 years	3	

GOAL 19: MONITOR HABITAT LOSS (THROUGH GIS AND OBSERVATIONS OF CURRENT ACTIVITIES CAUSING LOSS OF HABITAT)

Action	Responsible Party	Collaborators/ Partners	Timeline (within 1-2 years; within 2-5 years; within 5-10 years; ongoing)	Priority (1 being highest, 4 being the lowest)	Measure of success
Map current land cover and suitability to cranes (habitat suitability model) and analyse habitat loss/ change in critical areas for Blue Cranes	ICF/EWT	GIS specialist and SANBI	Within 1-2 years	2	Document produced

GOAL 20: PRODUCE NUMERICAL AND SPATIAL TARGETS FOR BLUE CRANES FOR INCORPORATION IN SYSTEMATIC CONSERVATION PLAN REVISION (C-PLANS)

Action	Responsible Party	Collaborators/ Partners	Timeline (within 1-2 years; within 2-5 years; within 5-10 years; ongoing)	Priority (1 being highest, 4 being the lowest)	Measure of success
Set numerical and spatial targets for Blue Crane conservation	ACCP		Next 6 months	1	Targets set
Incorporate targets into KZN, MTPA, E Cape, FS, Northern Cape Conservation plan revision	EKZNW		Next 6 months	1	Blue Cranes incorporated into relevant C-plans of the provinces

GOAL 21: ENSURE THAT INVASIVE SPECIES (PLANTS AND ANIMALS) DO NOT OCCUPY AREAS WITHIN BLUE CRANE HABITATS

Action	Responsible Party	Collaborators/ Partners	Timeline (within 1-2 years; within 2-5 years; within 5-10 years; ongoing)	Priority (1 being highest, 4 being the lowest)	Measure of success
Prioritise sites for alien invasive plant removal	ICF/EWT	Dept Agric	Within 1 to 2 years	1	A list of recommended sites to clear
Contribute to the strategies for the control of invasive species (plants and animals)	ICF/EWT	DFFE Working for Water, KZN EDTEA, Department of Agriculture (CARA)			Alien vegetation cleared
Investigate ways to facilitate assistance for landowners and projects to manage/eradicate invasive species	To be decided				Document/database of existing structures that can assist with the management and eradication of invasive species – with names and contact details

GOAL 22: LIMIT RURAL SPRAWL IN KEY CRANE AREAS

Action	Responsible Party	Collaborators/ Partners	Timeline (within 1-2 years; within 2-5 years; within 5-10 years; ongoing)	Priority (1 being highest, 4 being the lowest)	Measure of success
Guide town planning through liaison with municipalities and traditional authorities, focusing on areas that are crane hotspots	To be decided	Municipalities	Within 1-2 years	3	-

MINING

GOAL 23: UNDERSTAND THE EXTENT THREAT OF CURRENT MINES AND THE EXTENT OF THOSE THAT HAVE BEEN GRANTED APPROVAL AND THOSE WITH PROSPECTING LICENSES, AND IDENTIFY PRIORITY AREAS WHERE FUTURE MINES CAN POSE A THREAT TO BLUE CRANES

Action	*Responsible Party*	*Collaborators/ Partners*	*Timeline (within 1-2 years; within 2-5 years; within 5-10 years; ongoing)*	*Priority (1 being highest, 4 being the lowest)*	*Measure of success*
Using existing geodatabase of mining applications, assess implications for crane habitat loss	ACCP	EKZNW, MTPA and consultation with DMRE and WWF-SA	Within 1-2 years	2	-

CLIMATE CHANGE

GOAL 24: ANTICIPATE LIKELY CHANGES IN AGRICULTURAL ACTIVITIES THROUGH ENGAGEMENT WITH THE AGRICULTURE INDUSTRY, AGRICULTURAL ECONOMISTS AND CLIMATOLOGISTS

Action	*Responsible Party*	*Collaborators/ Partners*	*Timeline (within 1-2 years; within 2-5 years; within 5-10 years; ongoing)*	*Priority (1 being highest, 4 being the lowest)*	*Measure of success*
Meet with agricultural economists from various sectors of agriculture to gain insight into predicted impacts of climate change	ACCP	Agricultural economists	Within 1-2 years	2	Knowledge captured in meeting notes

AGRICULTURAL LANDSCAPES

LAND USER ENGAGEMENT

GOAL 25: BUILD PARTNERSHIPS ON A FOUNDATION OF TRUST, EMPATHY AND COMMUNICATION, BRIDGING THE GAP BETWEEN THREATS AND SOLUTIONS.

Action	*Responsible Party*	*Collaborators/ Partners*	*Timeline (within 1-2 years; within 2-5 years; within 5-10 years; ongoing)*	*Priority (1 being highest, 4 being the lowest)*	*Measure of success*
Develop a communications plan (e.g. include info on BC in the wool association newsletter)	OCG/ICF/ EWT	Everyone	Start immediately with some aspects.	3	1. Media release 2. Articles (be sure to connect with local media platforms) 3. Social media reach 4. Emailer reach 5. Whatsapp campaigns reach
Set up/Join/Connect a landscape initiative – to ensure messaging is coordinated e.g. use Agulhas Biodiversity Initiative or OCG structures or create new one	ICF/EWT	Landowners will be key (e.g. how OCG was originally set up)	By end of 2025 (within a year)		First meeting (mission, vision, minutes, register)
Farm worker training, aspirational approach	National Wool Growers Association and CapeNature (Jannie and Alistair)- potentially others keen to get involved	ICF/EWT to provide information	As soon as information is available	2	Attendance registers.
Gather stakeholders from agricultural sectors	Jannie to lead	ICF/EWT	1-2 years	2	Contact made with stakeholders

AGRICULTURAL ACTIVITIES

GOAL 26: IMPROVED KNOWLEDGE AND IMPLEMENTATION AND ADAPTATION OF BEST PRACTICE ACTIVITIES TO IMPROVE BREEDING SUCCESS AND REDUCED MORTALITY OF BC IN AGRICULTURAL LANDSCAPES

Action	*Responsible Party*	*Collaborators/ Partners*	*Timeline (within 1-2 years; within 2-5 years; within 5-10 years; ongoing)*	*Priority (1 being highest, 4 being the lowest)*	*Measure of success*
Provide correct messages for BC and disseminate information e.g. best practice activities manual	The BC specialists to provide info to Jannie/ CN – should be a two-way street, BC specialists need to hear about risk on the ground	ICF/EWT (Pieter) will help lead that process with input from OCG to help with starter info	Within 1-2 years	1	Compilation of messages which are actionable
Establish transparent communication platforms (who to call/hot line) to ensure incidents don't go unnoticed	Jannie (NWGA)/ CapeNature/ ICF/EWT	Citizen scientists (Ross Soller to lead)	Within 1-2 years	2	Incidents regularly reported
Establish innovative solutions to emerging/ changing threats		BC network/ specialist groups with the feedback loop from the agricultural sector	Ongoing		Changes [ecosystem implications – wider habitat level improvements]
Investigate whether there is wide-scale conflict between farmers and cranes on irrigated lucerne lands in the Karoo	ICF/EWT		1-2 years	1	Results of farmer survey
Develop and implement solutions to crane-farmer conflict on lucerne lands (if needed)	ICF/EWT		1-2 years	2	Solutions implemented successfully

LAND USE CHANGE

GOAL 27: UNDERSTAND THE INTERPLAY BETWEEN BLUE CRANE LIFE HISTORY AND AGRICULTURAL PRODUCTION TO PREDICT HOW LAND USE CHANGE WILL IMPACT BLUE CRANE POPULATIONS.

Action	*Responsible Party*	*Collaborators/ Partners*	*Timeline (within 1-2 years; within 2-5 years; within 5-10 years; ongoing)*	*Priority (1 being highest, 4 being the lowest)*	*Measure of success*
Conduct research on impact of agricultural changes on Blue Crane e.g. minimum till and cover crops	ICF/EWT	Agricultural sector and universities	Ongoing	1	Journal articles
Keep abreast of farmer sentiment towards Blue Cranes (human wildlife conflict), as agriculture changes	ICF/EWT	Farmers, Jannie, CapeNature	Ongoing	3	
Ensure research feedback loop exists	ICF/EWT	Jannie and CapeNature to disseminate	Ongoing/ ASAP as new information arises	2	Publications and the identification of research needs from the agricultural sector.
High level scan of the agricultural industry to predict changes/trends to be proactive and less reactive (with a BC perspective)	ICF/EWT	Cross-cutting: both agricultural and BC specialists	Ongoing	1	Threats/concerns/risks flagged (e.g. shift in crop type changing)

NEXT STEPS

HISTORY OF BLUE CRANE CONSERVATION

Kerryn Morrison gave an overview of the history of Blue Crane Conservation in South Africa on the first day of the workshop. Stakeholders asked for this history to be compiled and documented. Damian Walters agreed to take the lead on this. It was noted that a student is currently writing up the history of Blue Crane conservation for her Masters- the history document could compliment this once her thesis is completed. People to be consulted for historical information are: Kerryn Morrison, Kevin Shaw, Mick & Ann Scott, Mick D'alton, Kevin McCann, Vicki Hudson, Lindy Rodwell, Mark Anderson, Wicus Leeuwner, Glenn Ramke, Brent Coverdale, Ian Rushworth, Henry Davies, Bradley Gibbons, Jon Smallie, Tanya Smith.

WORKING TOGETHER

ICF/EWT intends to have a presence in the landscape and would like to implement work that has buy in and support from all relevant interested parties. The stakeholders at the workshop will keep in contact via the WhatsApp group. Christie will champion and coordinate communications between everyone, in person where possible.

BIODIVERSITY MANAGEMENT PLAN

There have been discussions with DFFE about developing a BMP for all three crane species. The benefit of this is that it helps the species get recognised at the national and provincial levels and facilitates co-working to achieve goals.

In addition to this Blue Crane workshop, a Conservation Planning Workshop was held for Wattled Crane in 2024. There is an African-Eurasian Migratory Waterbird Agreement Single Species Action Plan for Grey Crowned Crane. This is in the process of being adopted by government, and a national plan will follow. There will be a meeting of the parties in 2025 to revisit the international AEWA action plan- this could delay the national plan, unless a national workshop is held to develop a national plan. The outcomes of these meetings and workshops would need to be consolidated into one document for all three species.

Concerns were raised about the significant resources and time needed to do a BMP, and whether it is the most effective use of these. Damian Walters was tasked with making the final call, and it has since been decided that we will go ahead with a BMP for all three crane species.

ACKNOWLEDGEMENTS

A big thank you to the donors who made this workshop possible.

APPENDIX 2: WORKSHOP ATTENDEES

IN-PERSON PARTICIPANTS

NAME	ORGANIZATION
Khungeka Beda	CapeNature
Jannie Fourie	National Woolgrowers Association
Brent Coverdale	Ezemvelo KZN Wildlife
Michelle Watson	Kogelberg Biosphere Wildlife Rehab
Ross Soller	Overberg Bird Guide
Bradley Gibbons	International Crane Foundation/Endangered Wildlife Trust
Sanjo Rose	Birdlife South Africa
Kevin Shaw	Overberg Crane Group
Ndzalama Chauke	International Crane Foundation/Endangered Wildlife Trust
Ian Rushworth	Ezemvelo KZN Wildlife
Damian Walters	International Crane Foundation/Endangered Wildlife Trust
Cynthia Chigangaidze	International Crane Foundation/Endangered Wildlife Trust
Lesley Helliwell	Endangered Wildlife Trust
Lauren Waller	Conservation Planning Specialist Group
Kerryn Morrison	International Crane Foundation/Endangered Wildlife Trust
Lindokuhle Mgwaba	International Crane Foundation/Endangered Wildlife Trust
Marius Wheeler	CapeNature
Allistair Pietersen	CapeNature
Jacquie van der Westhuizen	International Crane Foundation/Endangered Wildlife Trust
Christie Craig	International Crane Foundation/Endangered Wildlife Trust
Lara Fuller	International Crane Foundation/Endangered Wildlife Trust
Pieter Botha	International Crane Foundation/Endangered Wildlife Trust
Heather D'alton	LoveGreen/Overberg Crane Group
Mick D'alton	Nuwejaars SMA/Overberg Crane Group
Thandeka Mabena	CapeNature
Mmei Matjuda	Eskom
Lourens Leeuwner	Endangered Wildlife Trust

APPENDIX 3: WORKSHOP AGENDA

TUESDAY 8TH OCTOBER 2024

8:30	Registration	
	Sessions until 12:30 held Hybrid	
9:00 – 9:30	Welcome, overview of the process, Introductions	Lauren Waller (IUCN CPSG)
9:30 – 9:40	The Biodiversity Management Plan (BMP) Process, and proposal for a Three Crane BMP	Bradley Gibbons
9:30 – 9:50	Recap of the previous workshop	Lara Fuller
9:50 – 10:00	Workshop Objectives, Agenda	Lauren Waller
10:00 – 10:30	History of Blue Crane Conservation	Kerryn Morrison
10:30 – 11:00	Tea Break	
11:00 – 11:30	State of the Blue Crane Population	Christie Craig
11:30 – 11:40	Introduction to PVA	Christie Craig
11:40 – 12:30	Blue Crane Draft PVA	Christie Craig
12:30 – 13:30	Lunch	
13:30 – 14:30	Defining success: Drafting a Vision for Blue Crane Conservation	Lara Fuller
14:30 – 16:00	Understanding the system (Part 1): Developing our understanding of the issues/threats/ pressures to Blue Cranes, their drivers and impacts	Lauren Waller
16:00 – 16:30	Tea Break	
16:30 – 17:00	Identify Working Groups	Lauren Waller
17:00	Close	
19:00	Dinner and Talk (Don Bailey – Bateleurs)	

WEDNESDAY 9TH OCTOBER 2024

8:30 – 9:00	Vision- Feedback on Vision Statement	Lara Fuller
9:00 – 10:00	Understanding the system (Part 2): Working in groups to develop Issue Statements	Working Groups
10:00 – 11:00	Plenary Feedback on Issue Statements	Working Groups
11:00 – 11:30	Tea	
11:30 – 12:30	Finalise Issue Statements	Working Groups
12:30 – 13:00	Feedback on Issue Statements	Working Groups
13:00 – 14:00	Lunch	
14:00 – 15:00	Work on Goal Statements	Working Groups
15:30 – 15:30	Working Tea	
15:30 – 16:30	Finalise Goal Statements	Working Groups
16:30 – 17:00	Plenary Feedback on Goal Statements	Working Groups
17:30	Close	

THURSDAY 10TH OCTOBER 2024

08:30 – 09:00	Present Final Vision for comment	Damian Walters
09:00 – 10:30	Actions – Developing Action Table	Working Groups
11:00 – 11:30	Tea	
11:30 – 13:00	Actions – Developing Action Table	Working Groups
13:00 – 14:00	Lunch	
14:00 – 15:30	Plenary Feedback on Actions	Working Groups
15:30 – 16:00	Tea	
16:00 – 17:30	What does Blue Crane collaboration look like and way forward	Lauren Waller
17:30	Close	

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