Wings of Clean

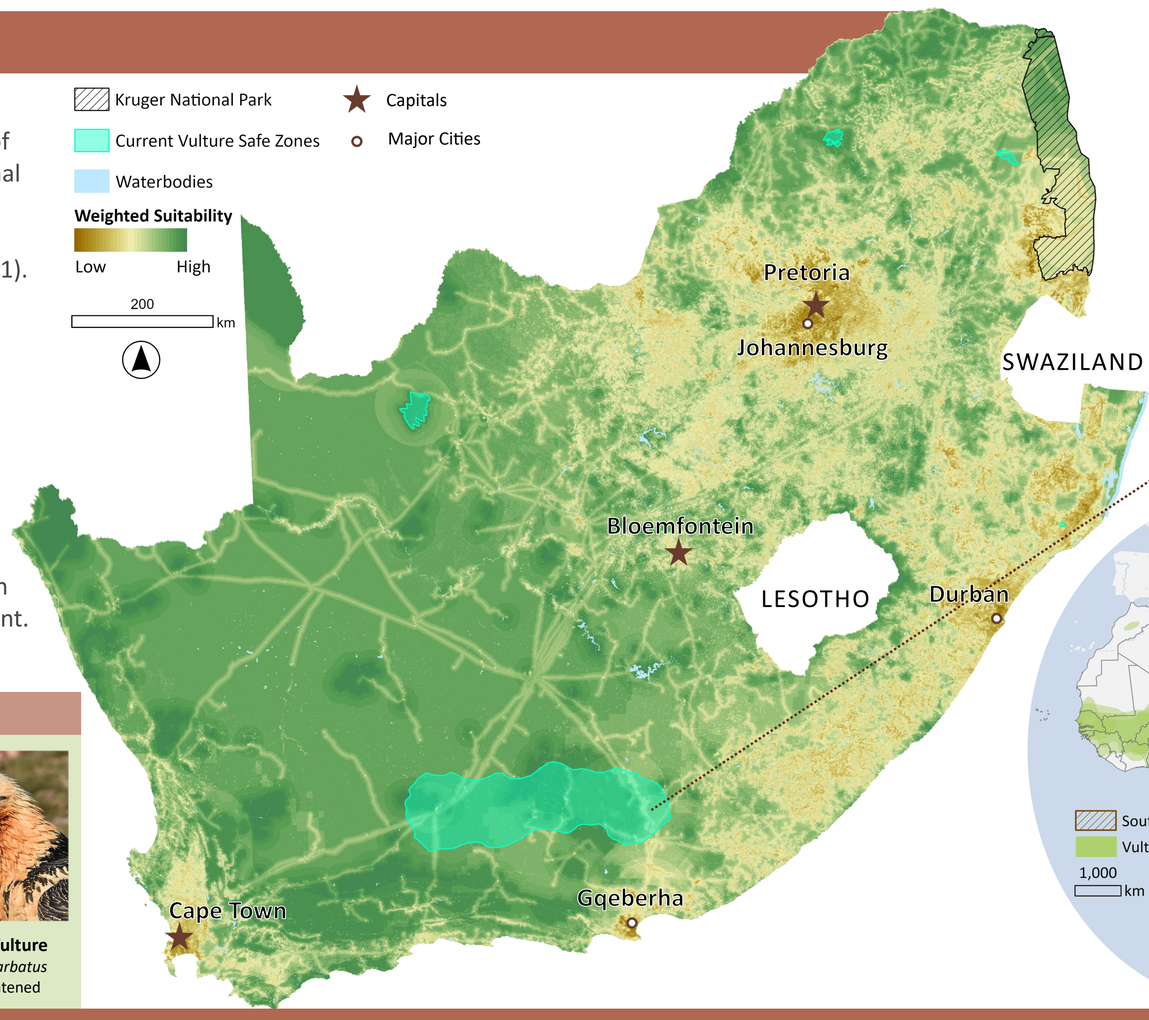
Identifying Suitable Regions to Establish Vulture Safe Zones in South Africa

South Africa Vulture Decline

Vultures, as obligate scavengers, play a vital ecological role by quickly removing decomposing carcasses, which helps prevent disease spread, supports nutrient cycling, and controls populations of problematic facultative scavengers. However, vultures represent the most threatened avian functional group globally. In South Africa, vulture populations have declined sharply over the past decade, disappearing from significant portions of their historical range. Of the eight vulture species in South Africa, two are possibly extinct in the region, and three are classified as Critically Endangered (Table 1).

Major threats to vultures include intentional and accidental poisoning, electrocution, reduced food availability, habitat loss, and harvesting for traditional beliefs. The catastrophic vulture population collapse in South Asia during the mid-1990s highlighted the urgent need for proactive conservation measures to avoid a similar disaster in Africa.

The *Multi-species Action Plan for Vultures* (2017) proposed the establishment of Vulture Safe Zones (VSZs) as a key conservation strategy. VSZs involve collaboration among landowners, government agencies, and communities to secure large, suitable habitats where targeted efforts are made to protect vultures. These efforts include preventing poisoning, implementing vulture-friendly infrastructure, and monitoring populations. Currently, five VSZs are either established or proposed in South Africa. However, given the extensive foraging ranges of vultures, these areas may be insufficient. This analysis aims to identify suitable regions in South Africa for establishing addition VSZs.



Box 1. Karoo Vulture Safe Zone spans 23,571 km², connecting three protected areas and their surrounding unprotected landscapes. Its long-term goal is to facilitate the return of Cape Vultures to their historical ranges in the Great Karoo.

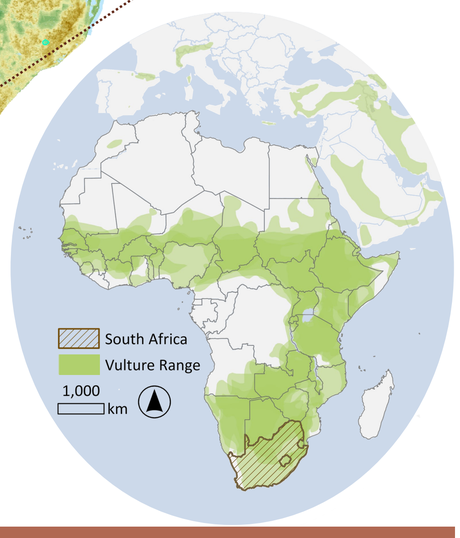


Table 1. Current South Africa Vulture Species

Hooded Vulture
Necrosyrtes monachus
Critically Endangered

White-headed Vulture
Trigonoceps occipitalis
Critically Endangered

White-backed Vulture
Gyps africanus
Critically Endangered

Lappet-faced Vulture
Torgos tracheliotos
Endangered

Cape Vulture
Gyps coprotheres
Vulnerable

Bearded Vulture
Gypaetus barbatus
Near Threatened

Methods & Discussion

To identify suitable regions for Vulture Safe Zones (VSZs), a weighted suitability analysis was conducted using Raster Calculator, incorporating six factors: unintentional poisoning (20%), intentional poisoning (20%), land cover (15%), prey availability (15%), electrocution risk (15%), and human population density (15%). The analysis revealed that suitable areas are predominantly in the northeastern regions of South Africa, particularly in the Northern Cape province, with the most suitable habitats located within protected areas.

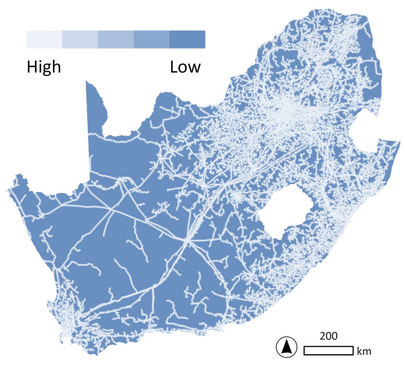
While some studies suggest vultures have limited their ranges to protected areas, others indicate significant time spent outside these zones, increasing their vulnerability to mortality. Thus, collaboration with local residents outside protected areas is essential to expand VSZs. The Karoo VSZ (Box 1) exemplifies such efforts, serving as a model for future initiatives to integrate habitats both within and beyond protected boundaries.

Notably, Kruger National Park (KNP), South Africa's largest national park, was not identified as a top-suitability area. This aligns with reports of poisoning by poachers and harvesting by traditional healers within the park. However, current efforts aim to establish VSZs in KNP and adjacent protected areas in neighboring countries, focusing on mitigating poisoning risks. Future expansions could extend northward from KNP to create a larger interconnected landscape, enhancing safe habitats for vultures across the region.

Table 2. Reclassification Criteria

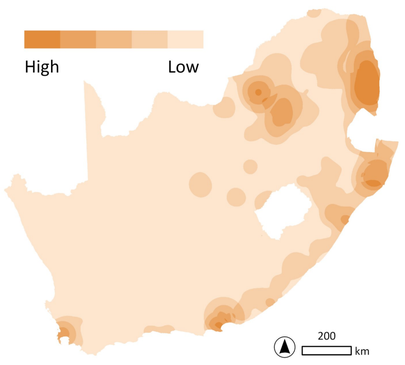
Suitability Factors	Land Cover Type	Distance to Protected & Conservation Area (km)	Distance to Power Line (km)	Human Population Density (per km²)	Livestock Density (per km²)	Carnivore Density (per km²)	Elephant Density (per km²)	Rhino Density (per km²)	Human Conflict Density (per km²)
Weight	15%	15%	15%	15%	10%	10%	6%	6%	8%
1. Very Low Suitability	mines & quarries, permanent crops, temporary crops, built up	> 20	< 1	> 2500	30 - 58	0.3 - 0.47	0.04 - 0.05	0.03 - 0.05	0.15 - 0.23
2. Low Suitability	artificial waterbodies, fallow lands & old fields	10 - 20	1 - 2	501-2500	20 - 30	0.15 - 0.3	0.03 - 0.04	0.02 - 0.03	0.08 - 0.15
3. Average Suitability	wetlands, planted forests	5 - 10	2 - 3	151-500	10 - 20	0.05 - 0.15	0.02 - 0.03	0.01 - 0.02	0.03 - 0.08
4. High Suitability	natural woodland	2 - 5	3 - 5	6-150	5 - 10	0.01 - 0.05	0.01 - 0.02	0.005 - 0.01	0.005 - 0.03
5. Very High Suitability	barren land, natural waterbodies, shrubland, grassland	< 2	> 5	< 5	< 5	< 0.01	< 0.01	< 0.005	< 0.005

Suitability Factors



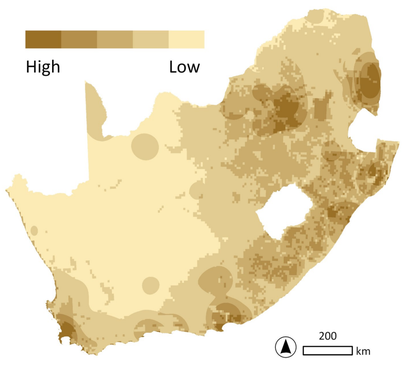
Electrocution Risk

Vultures' large wingspans make them susceptible to fatal collisions with energy infrastructure and electrocution on power lines. In VSZs, all power lines are fitted with measures or designed to prevent these incidents. Electric gridlines from Grid Finder were processed using Distance Accumulation and reclassified on a scale of 1 (high risk) to 5 (low risk) (Table 2).



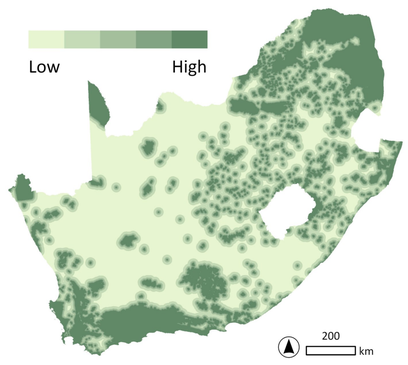
Intentional Poisoning

Poachers kill vultures by intentionally poisoning elephant and rhino carcasses, as circling vultures can signal illicit activities to anti-poaching efforts. Elephant and rhino sightings from iNaturalist, along with human armed conflict occurrences from ACLED, were processed using kernel density and combined in a raster calculator to create this layer. The layer was then reclassified on a scale from 1 (high risk) to 5 (low risk) (Table 2).



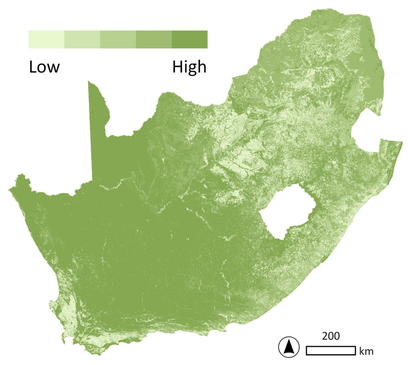
Unintentional Poisoning

Unintentional poisoning occurs when vultures consume carcasses laced with poisons meant to target predators of livestock. The use of veterinary NSAIDs to treat livestock can also accidentally poison vultures. Carnivore sightings from iNaturalist were processed using kernel density and combined with livestock density from FAO in a raster calculator to create this layer. The layer was then reclassified on a scale from 1 (high risk) to 5 (low risk) (Table 2).



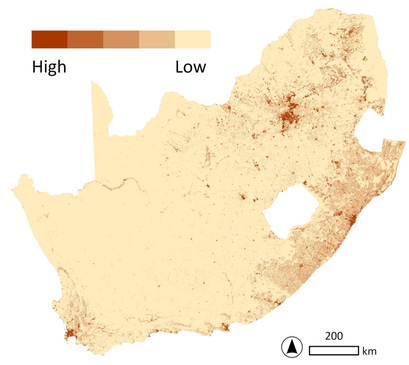
Prey Availability

Protected and conservation areas are used as a proxy for prey availability, as they support high biodiversity and provide wildlife carcasses for vultures. Additionally, "vulture restaurants" in these areas supply safe, non-toxic carcasses for vulture consumption. These areas from South Africa DFFE were processed through distance accumulation and reclassified on a scale from 1 (low availability) to 5 (high availability) (Table 2).



Land Cover Suitability

Vultures typically prefer open areas, such as barren land, shrubland, and open woodlands, where they can easily locate carcasses. Additionally, their prey, large mammals, often gather near natural waterbodies. Human-dominated landscapes are generally unsuitable for vultures. 2022 land cover layer from South Africa DFFE was reclassified on a scale from 1 (least suitable) to 5 (most suitable) (Table 2).



Human Population Density

Vultures generally avoid areas of human habitation and are at risk of being harvested for traditional medicine, where their parts are used for treating diseases or bringing good fortune. Human population density data from WorldPop was reclassified on a scale from 1 (low density) to 5 (high density) (Table 2).

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GIS 101 Intro to GIS | December 20, 2024
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Projection: Hartebeesthoek94 / ZAF BSU Albers 25E
Data Sources: IUCN, iNaturalist, Grid Finder, World Pop, ACLED, FAO, ESRI, South Africa Department of Forestry, Fisheries and the Environment (DFFE)

Special thanks to Rebecca Shakespeare for her support and guidance & Nancy and Andrew for staying with me in the Data Lab

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