THE IMPACT OF WIND ENERGY ON FLYING PREDATORS AND THE ENVIRONMENT

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As South Africa works to reduce its carbon emissions through renewable energy, wind power has become a central part of the strategy. The number of operational wind turbines increased from **253 in 2014** to **825 in 2017** and in 2024 there is **between 1,148 and 1,722** operational turbines. There are **currently 36 wind facilities / farms** and another 11 projects have been approved.

However, as South Africa embraces this green energy source, there are growing concerns about the impact of wind farms on the environment. The main concern is collision mortality of birds and bats with turbines and associated powerlines. There may also be behavioural changes linked to displacement and habitat loss. Other environmental impacts of large wind energy facilities include disturbance (visual and noise) and local climate change.

A summary is provided by Perold et al. (2020) on the diversity of birds killed by turbine collisions at 20 wind energy facilities across southwest South Africa. Monitoring from 2014 to 2018, they recovered 848 bird carcasses of 130 species (of which 16 were migrants). Raptors were killed most often (36% of carcasses, 23 species) followed by passerines / perching birds (30%, 49 species), waterbirds (11%, 24 species), swifts (9%, six species), large terrestrial birds, such as the blue crane (5%, 10 species), pigeons (4%, six species) and other near passerines (1%, 7 species). See Ralston et al. (2017) for a complete species list (new report due in January 2025 at the website indicated).

Wind Energy and Its Impact on Raptors

Bird fatalities due to wind turbines are a documented issue globally, and South Africa is no exception. Species of conservation concern killed include the endangered Cape Vultures and Black Harriers, and a large number of Jackal Buzzards. All three these species are endemic to southern Africa – in other words, they occur nowhere else in the world. Other mortalities reported, are Verreaux's Eagle, Martial Eagle, African Fish Eagle, Black-chested Snake Eagle, Booted Eagle, Long-crested Eagle and Tawny Eagle, as well as the Spotted Eagle Owl, Barn Owl, various falcons, kestrels and kites. Many raptors are long-lived, with low reproductive rates, which make them vulnerable to increased mortality rates. As apex predators, eagles play a vital role in maintaining the health of ecosystems and their loss could lead to broader ecological repercussions.

The impact on **Verreaux's Eagles** (Black Eagle / *Witkruisarend*) is particularly concerning because they are **already listed as "regionally Vulnerable"** in the Red Data Book of endangered species. Their population is estimated to be fewer than 10,000 mature individuals, and has declined by more than 10% over three generations. While one monitored wind farm saw no eagle fatalities, despite a nest located approximately 4 km from the facility, by 2021, **26** Verreaux's Eagle deaths had been reported across five wind farms. The timing of these fatalities tends to peak during the late breeding season, when eagles are more active. Additionally, poorly designed power lines near wind farms have led to electrocution fatalities, with **ten** eagles killed in this way.

Mitigating the Impact on Raptors

It is crucial to place wind farms away from important eagle habitats, such as nesting sites and areas with high flight activity. Cliffs, ridge tops, steep slopes, and even in relatively flat topography where thermalling flight behaviour is more likely to occur – features that are attractive to raptors

due to updrafts – should be avoided. BirdLife SA has recommended a 3 km buffer around known eagle nest sites to reduce collision risks with a turbine.

While relocating eagles to alternative habitats has been suggested, this approach is **not effective** and could be harmful. Evidence shows that eagles often return to their original territories, and introducing them to new areas may result in territorial disputes or failure to find adequate food sources. **Additionally, disturbing or destroying eagle nests in the name of wind farm development is both illegal and counterproductive.** Such actions can ultimately hinder the development of wind farms and bring legal and reputational risks to developers and landowners.

There are several ways to mitigate the impact of wind turbines on raptors. One method is "curtailment," where turbines are shut down during peak collision risk times – such as during the late breeding season or during poor weather conditions. Another promising approach involves "shut-down on demand," where turbines are halted in real-time when birds are detected in high-risk areas. Shut-downs can be triggered by human observers, or by using automated devices (e.g. radar or camera), or a combination of both. Recent studies have shown that this method, using AI-driven camera systems to detect bird movement, can reduce eagle fatalities by up to 82%.

Making turbines more visible to birds is another key strategy. Raptors see contrast less effectively than humans, making fast-spinning turbine blades difficult to detect. Painting the blades of turbines in high-contrast colors can reduce collisions by improving their visibility to birds.

It is important to ensure that wind farm developers and landowners are fully aware of the legal and ecological implications of eagle conservation. While the presence of eagles may require adjustments to wind farm layouts, it should not be seen as an obstacle to development. Understanding these risks up front can prevent costly mistakes and protect both the wind energy project and the birds.

Looking Forward: A Sustainable Energy Future

Wind farm developers should ensure that the landowner understands the implications of monitoring throughout the lifespan of the wind farm and should thus ensure the necessary arrangements and agreements are in place. Local workers, often from surrounding communities, can be employed to conduct bird surveys, creating valuable employment in rural areas.

As South Africa continues to grow its wind energy capacity (approximately 3600 wind turbines are planned for 2030), it is crucial to balance the benefits of clean energy with the need to protect biodiversity. While wind farms can play a major role in reducing carbon emissions, they must be designed and implemented in ways that minimize harm to wildlife. Effective mitigation strategies combined with long-term monitoring, are essential to achieving this balance.

References

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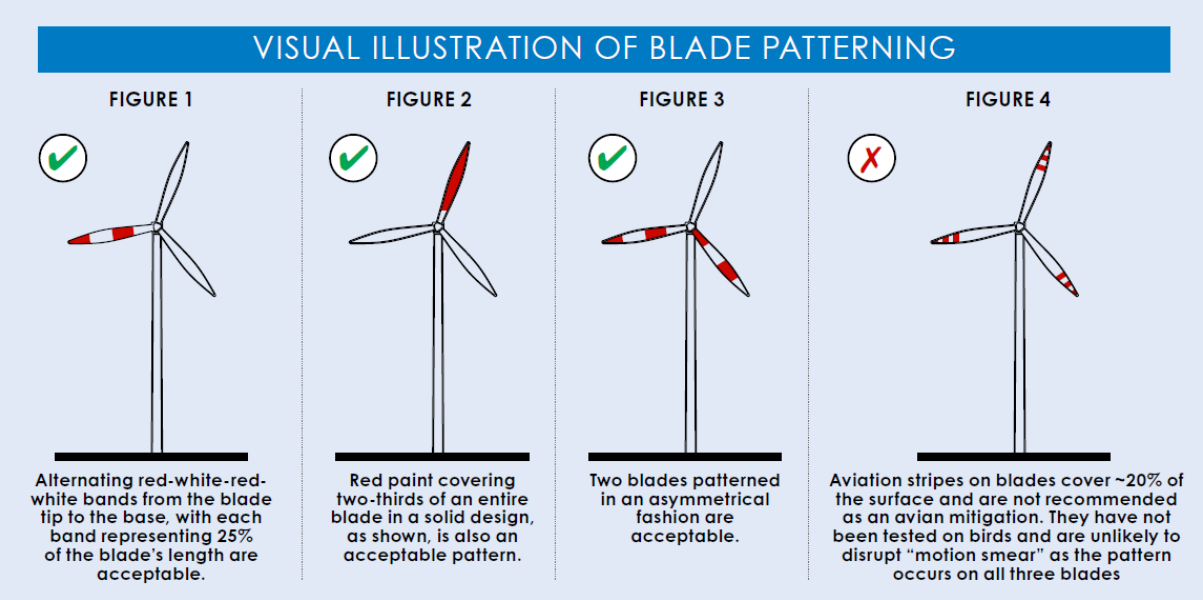
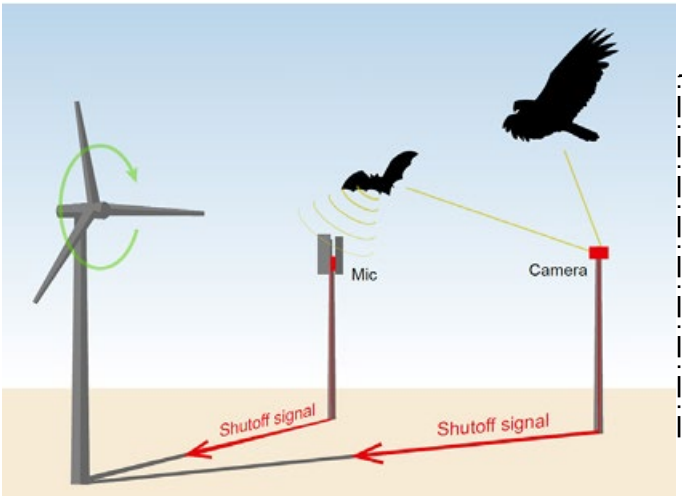


The colour 'red' aligns with colours referenced within the SACAA regulations and AMoC approval, and provides enough of a contrast from white to be visible to birds. Both the front and back of the blade must be painted. [*South African Civil Aviation Authority's (SACAA); Alternative Means of Compliance (AMoC)]* Image from: Blade patterning guidelines (September 2024), https://www.birdlife.org.za/what-we-do/policy-and-advocacy/what-we-do/birds-renewable-energy/



On average, a wind turbine hub height* is 88 m = 26-storey building (range 80–115 m), rotor diameter 103 m (range 86–119 m) and height of blades above ground is 36.0 m (range 25–60 m). Foundation is >20 m in diameter, 3.3 m deep.

Blades turn at over 200 km/h in strong wind & create a strong suction power (vortex).

Automated detection and shutdown technology uses microphones and/or cameras to identify species and can shutdown turbines when necessary. Image from: Allison et al. (2019), Issues in Ecology, Report no 21.

***Statue of Liberty in New York is 93 m and Big Ben in London is 96 m tall.**

PHOTOGRAPH: GETTY IMAGES **Flock of birds flying past wind turbines on a wind still day.**

https://www.economist.com/science-and-technology/2024/01/10/wind-turbines-are-friendlier-to-birds-than-oil-and-gas-drilling

Golden Eagle living in Northern Hemisphere flying close to the hub of a wind turbine. Image from: https://alamedapost.com/features/alameda-life/making-wind-energy-safer-for-golden-eagles/

Verreaux's Eagle, image from https://www.warwicktarboton.co.za/birdpgs/131VeEgl.html

Foundation of a wind turbine can be more than 20 m in diameter and planted 3 m deep. Image from: https://www.backroadsnews.com/news/wind-turbine-construction-expected-begin-next-week

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