New project examining Bearded Vulture movements in southern Africa to inform wind turbine placement

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Central to development goals throughout Africa is the need for greater energy production, and in particular the need for reliable low-carbon, affordable-energy supplies. Wind energy offers one opportunity to provide such energy, and in many countries across Africa wind farms are planned or are already under construction. Although wind energy has the advantage of being a relatively established energy source, we also know from experiences in Europe and the United States that inappropriately sited wind farms can have devastating impacts on the environment. Thus far, the biggest impact of inappropriately sited wind turbines has been on populations of large raptors, particularly eagle and vulture species which collide with the turning blades. In some extreme cases these turbines have led to the deaths of hundreds of vultures and eagles and jeopardised the existence of these populations (Drewitt & Langston 2006).

The best way to minimise the impact of wind farms is to ensure that they are placed in areas away from these vulnerable bird species (Carrete *et al*. 2012). This can be achieved in two ways, each requiring different types of data at different spatial scales.

Firstly, we can try to ensure wind farms are not developed in areas where vulnerable species occur. To do this we need to know the spatial distribution of these vulnerable species, this information can then be used to

build up wind farm sensitivity maps, highlighting the best and the worst locations at a broad scale of where to place wind farms within a country. Such an exercise has now been successfully completed for South Africa (BirdLife SA & EWT 2012).

The second approach operates at a finer scale and aims to ensure that where wind farms and vulnerable species do overlap, wind turbines are sited in the most appropriate locations, thereby decreasing the risks of collision. To achieve this we need good data on how a species uses its environment. Using such data, predictive models can then be built which should be generalizable across a species' range to identify inappropriate locations for turbine placement within a species' home range.

Our current project addresses this second approach for a species which has been identified as being particularly vulnerable to the impacts of wind farms, the Bearded Vulture *Gypaetus barbatus*. This species is classified as *Critically Endangered* in southern Africa, with the entire population found only in Lesotho and the surrounding Drakensberg escarpment and mountains in South Africa. The species has declined by at least 30% over the last three decades and fewer than 100 pairs remain. The exact causes and mechanisms of the decline are being investigated as part of Sonja Krüger's PhD studies at the FitzPatrick Institute. However, the species now faces a new threat in the form of extensive wind farms which are currently planned for the Lesotho highlands. An initial analysis of the potential threat of wind farm impacts on Bearded and Cape Vulture *Gyps Coprotheres* suggests that the impacts could more than double the annual rate of decline of these populations and cause local extinctions in the short term (Rushworth & Krüger in prep).

This project aims to use the information obtained from GPS satellite tags attached to Bearded Vultures to build predictive models of space use. The Bearded Vulture tagging project was initiated by Ezemvelo KwaZulu-Natal Wildlife in 2007 and now forms part of Sonja's PhD. Variables used in these models will be habitat types, topography, distances to feeding sites and distances to known conspecific nest sites. These models will be built firstly in two dimensions (landscape models),

then in three dimensions incorporating the additional height information from the GPS tags. These final models will therefore not only provide information on areas of greatest use, but also the areas where the species will be most vulnerable to collisions with wind turbines. This research therefore aims to understand where wind turbine placement will do least damage to the species, and which locations could prove devastating for the species.

Once we have developed these models, it may also be possible, with minimal extra effort, to apply their use to other vulnerable species with similar tracking data, for example, Cape Vultures *Gyps coprotheres* and Verreaux's Eagles *Aquila verreauxii*. This project is being funded by the South African DST/NRF Centre of Excellence Funding, from Natural Research Ltd (UK NGO) and Ezemvelo KwaZulu-Natal Wildlife.

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