

## An automatic AI-based bird identification system to reduce mortality risks by collision and down time of wind turbines

E. Clausen<sup>1</sup>, Dr. T. Liesenjohann<sup>1</sup>, Dr. J. Paul<sup>1</sup>, S. Manoharan<sup>2</sup>, T. Rassmann<sup>2</sup>, Dr. G. Nehls<sup>1</sup>

<sup>1</sup>BioConsult SH GmbH & Co. KG, Schobüller Str. 36, D-25813 Husum, Germany

<sup>2</sup>ProTecBird GmbH, Brinckmannstraße 31, D-25813 Husum, Germany

### Introduction and Background

The growing numbers and dimensions of wind turbines lead to conflicts with legal provisions for protected bird species (e.g., Red kite) when these species are exposed to a higher individual risk of collision mortality. Thus, areas close to breeding sites are not permissible for energy pro-

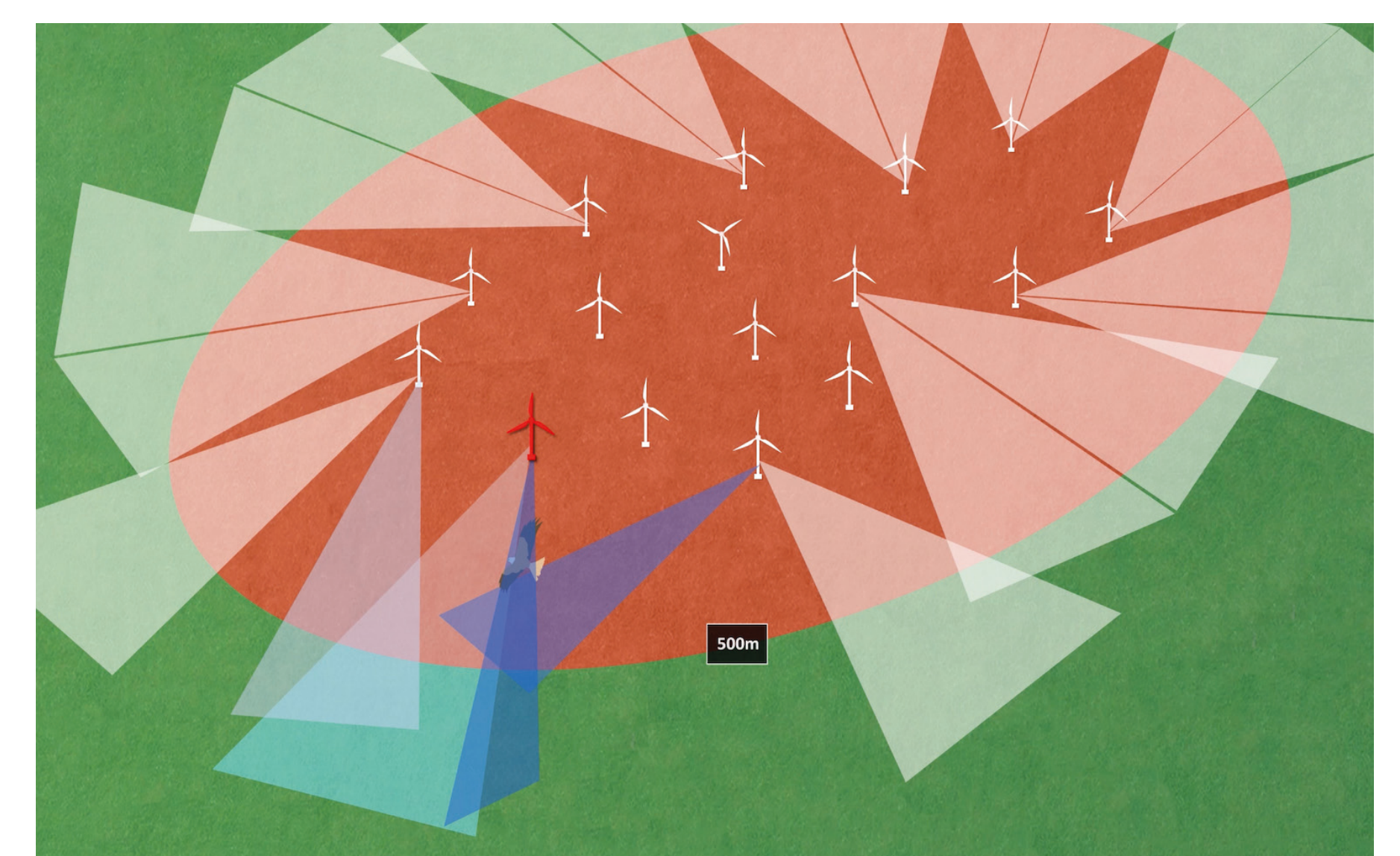
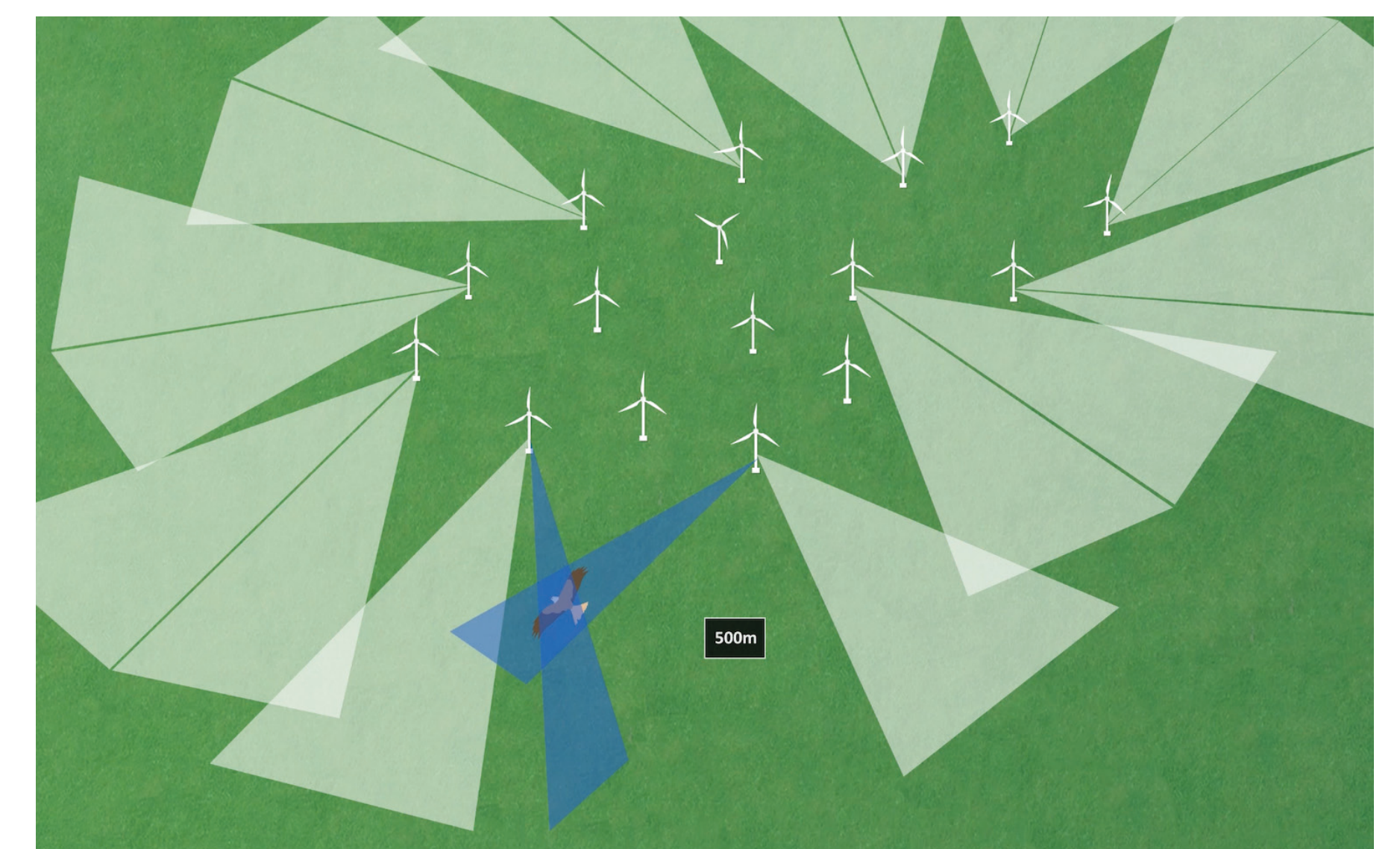
duction or have long mandatory seasonal shut-down times during breeding season or high bird activity in the area. A solution provides shut-down on demand systems that reduce rotational speed only when protected birds directly approach the danger zone.



### Material and Methods

AVES is a camera-based bird detection and species identification system installed directly on the tower of the wind turbines. The system processes video footage of several cameras in real-time within the following steps:

- **Automatic tracking** Detect and track flying objects in 1.000 m.
- **Filter** Target species and unwanted objects.
- **AI-identified target species** Set cameras on tracking and triangulation, capable to track multiple objects simultaneously.
- **Collision risk calculation** Target species approaching danger zone < 500 m and flight direction is leading to a collision track.
- **Signal transmission** Reduce rotor speed of the respective wind turbine(s).
- **Follow target** Track until bird leaves the danger zone, restart the wind turbine.



### Results

Results from windfarm test sites and mobile systems in 2023 in the reaction area (500 m; Species: Red Kite) reach the required levels of target detection and classification to significantly reduce mortality risk:

<b>Set-up with single cameras:</b>		<b>- two corresponding cameras:</b>	
Detection rate:	74,4 %	Detection rate:	80,9 %
Recognition rate:	92,9 %	Recognition rate:	96,4 %

The AVES system reduces the mandatory downtime from a scheduled shutdown to an on-demand short term shutdown lasting only few minutes during risk scenarios.

### Conclusion

If the flight direction leads into the reaction zone and the bird is classified as target species, the system will send a command to the wind turbine to either shut down or lower the rotational speed of the rotor.

AVES reduces the mandatory shutdown times from general to an on-demand short term shutdown lasting only a few minutes during risk scenarios. Maintaining a high level of protection while reducing efficiency losses.



Esther Clausen, e.clausen@bioconsult-sh.de

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