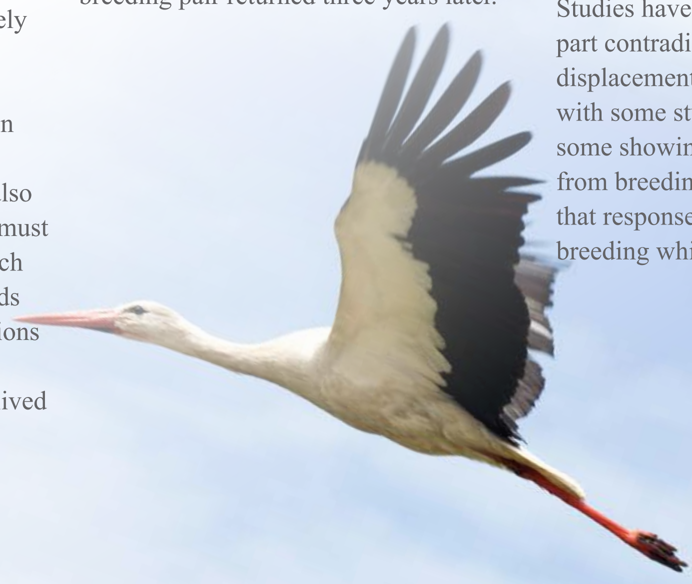
White Storks in Europe Onshore Wind Energy

BACKROUND - THE SPECIES

White Storks are large diurnal birds of the stork family (*Ciconia ciconia*) and have a large range across Africa, Europe, Russia, the Middle East and as far east as India. There are both migrant populations which migrate south to Africa, as well as an increasing occurrence of resident white storks in Europe. Populations were previously extirpated from parts of Europe but now have an increasing population trend, particularly in Germany, France, the Netherlands, and Portugal. White Storks are protected under Annex I of the European Birds Directive, the European Directive on the conservation of wild birds (containing provisions relating specifically to migrating birds), the Ramsar, Bonn and Bern Conventions, as well as by various national nature protection laws (e.g., Austria, Poland, Switzerland). White storks inhabit open-area moist meadows, wetlands, and cultivated agricultural land. They generally search for their prey – which consists of amphibians, reptiles, insects, and small mammals - within a 1-2 km radius from their nests. They generally breed in rural areas and often build their nests on raised structures such as church spires, roofs of buildings or chimneys. Due to their large size, white storks rely on updrafts and subsequently select habitats that promote the soaring and gliding behaviors. These are also often ideal potential sites for wind farms. Storks' reliance on thermal updrafts also restricts the migratory routes as they must avoid long stretches of open water such as the Mediterranean Sea. With regards to wind energy, white storks' populations are a potentially sensitive species to additional mortality as they are long lived species and have low fecundity.



Stork flying in the cloudy blue sky
Photo by iStock, 501614033

THE MECHANISM OF SPECIES RISK FROM WIND ENERGY

Wind turbines may pose a collision risk to white storks. Similar to other soaring birds, there is a link between the spatial and temporal mortality patterns and wind conditions, topography, and flight behaviors. Wind farms located near nesting or foraging areas can pose a risk to local populations, including breeding adults and juveniles. Wind turbines located in migration corridors may also pose a collision risk, particularity to individuals with no experience encountering wind farms. However, data from Gibraltar Strait, southern Spain, showed that migrating white storks rarely interacted or collided with wind turbines.

Avoidance and displacement represent potential indirect risk factors. Varying rates of avoidance behaviors in white storks have been observed spanning from low avoidance (Germany, Switzerland, and Egypt) to high avoidance in (Spain). Short-term displacement was observed in Germany where white storks returned to their nest within one year following construction, another breeding pair returned a year later and yet another breeding pair returned three years later.

Renewable Energy Windmills, Germany
Photo by iStock, 959717200

This could be explained by the fact these birds exhibit loyalty to their breeding territory. In Spain, studies relating to flight behavioural changes indicate that soaring birds, including white storks, can detect the presence of turbines, particularly when rotor blades are spinning, and change their flight direction. Subsequently, these same studies show that population level effects for these species is not a concern. However, because some regional populations are small, annual losses due to juvenile mortality caused by the sudden occurrence of weather conditions, reduced food sources due to intensive agriculture practices as well as loss of wetland areas, and collisions are considerable. Subsequently the potential additive mortality of wind turbines is a concern. Studies have shown differences, and in part contradictory results, in terms of the displacement risk of breeding white storks with some studies showing no effect and some showing displacement of birds from breeding spots. There is evidence that response varies by individual among breeding white stork populations.

RISK MONITORING

Monitoring of migrating birds at a wind farm in its fifth year of operation indicated that no adverse effects were present for white storks. Recent studies suggest that there is no clear relationship between predicted risk identified during the environmental impact assessment and the actual mortality of birds after wind farms have been constructed.

Two storks in their nest on a windy day
Photo by iStock, 173828329

RECOMMENDATIONS AND RISK MANAGEMENT MEASURES

Various studies show that mortality varies by wind farm, and even among wind turbines inside the same wind farm, indicating that proper wind farm siting is crucial. Ensuring an adequate distance is maintained between breeding areas and turbines may effectively mitigate mortality for white storks. Analysis of their flight patterns and behaviors prior to construction at a proposed site should be used to inform turbine siting to avoid frequent flight paths of soaring birds. Aerodynamic models could be used to simulate flight routes at hypothetical wind farm locations to evaluate the relative collision risk of individual turbines on migratory and local white stork populations. This could also be done by modelling wind patterns in a wind tunnel for a given wind park configuration and topography to determine, prior to construction, where the main concentration of soaring birds is likely to occur. Another risk management measure is the appropriate micro siting of wind turbines to optimize the exact configuration. This can be done by siting turbines in shorter rows to avoid potential barrier effects, near roads or in areas with relatively low wind speeds. Barrier effects of newer larger turbine models may be less compared to older smaller models as they are spaced farther apart. However, in recent publications, barrier effects are still treated as a consideration for siting turbines, especially relating primarily to migrating birds. By contrast in a well-known example of wind farms in the Strait of Gibraltar in Spain no barrier effect has been detected.

Storks can be attracted by agricultural lands such as hay fields which they use for foraging. Curtailment (i.e., shut down some or all turbines) immediately following mowing or harvesting of fields near the wind turbines may mitigate this risk. At established wind farms that already impact these soaring birds, reduction of fatalities may be feasible by curtailment of turbines as they approach. This would require biomonitors or camera-based systems to control turbine operations. Additionally, turbine-related mortality can be offset through compensating other human causes of mortality, such as the electrocution by powerlines, provided the relative effect can be quantified.

RESEARCH PRIORITIES

Existing studies on the collision risk of birds in wind farms have predominantly been conducted in Europe and North America. This is, in part, because of the considerable investment in wind energy in these regions. Other assessments of the collision risk have also been conducted at bird convergence locations at the Strait of Gibraltar in the south of Spain (and in southern Israel as the birds fly into continental Africa). Due to increasing interest and investment in wind energy in Africa, new research questions are subsequently arising. These include questions of the risk of planning potential wind farms in proximity to birds overwintering sites in Africa. There are also remaining questions related to the potential risk of collision posed by wind farms planned along corridors that are preferred by migratory birds.

Recent studies have shown that bird abundance is not directly related in increasing collisions. Increasingly other factors such as flight behavior, weather and topography around the windfarm are thought to be important in explaining mortality rates. Gaining a greater understanding of these mechanisms involved in influencing collision risk is essential if the situation is to be managed effectively. For white storks there is still a need to better understand avoidance rates as different studies have shown differing results and to further explore questions around displacement rates that appear to vary by individuals.

For white storks there is a current need to further develop accurate collision prediction models that can be used for planning wind energy development. Subsequently, there is a need for the development of methods and tools that can accurately predict the risks that emerge from the interaction between these birds and wind energy infrastructure. Due to the results of studies showing a lacking relationship between the risk assessment in environmental impact assessments and observed mortality there is an urgent need for new or modified tools to adequately select locations for new wind farms to be constructed in future years.

Written by: Luisa Münter, MSc, nateco AG and Miguel Ferrer, Spanish National Research Council

For more information, visit https://tethys.pnnl.gov/about-wren

WREN
Working Together to Resolve Environmental Effects of Wind Energy

iea wind