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## INSTITUTION

Norwegian Institute for Nature Research (NINA)

## POSITION

Senior Research Scientist

## PRESENTATION

**Solutions for a sustainable management.**

## ABSTRACT

Although wind energy is generally recognised as a ‘green’ renewable energy source with a relatively small footprint, adverse impacts of wind farms on wildlife cannot be neglected. Implementation of the mitigation hierarchy throughout the life cycle of a wind farm ensures that impacts can be mitigated at or below acceptable thresholds. This presentation aims to provide an overview over options for mitigating wildlife impacts, drawing upon research from Norway and elsewhere, and the framework within which these are set for each step of the mitigation hierarchy. The prioritised steps of the mitigation hierarchy are tiered to the consecutive decision gates for wind farm development: (1) avoid when planning, (2) minimise while designing, (3) reduce at construction, (4) compensate during operation, and (5) restore as part of decommissioning. The efficacy of mitigation measures, however, also depends on the sensory, behavioural and aerodynamic capabilities of the species at risk and is highly site-specific. Still, the ecological mechanisms guiding species’ responses and potential vulnerability to wind farms can be expected to be fundamental in nature. A more cohesive understanding of the causes, patterns, mechanisms, and consequences of animal movement decisions will thereby facilitate successful mitigation of impacts. This requires adaptive planning approaches that implement the mitigation hierarchy effectively to reduce risks to species of concern. At larger geographical scales, limiting population-level and cumulative impacts of multiple wind farms (and other anthropogenic activity) require still novel approaches such as life-cycle assessments. Although the uptake of the entire mitigation hierarchy throughout the management cycle of a wind farm has been slow to date, its application can contribute towards the goal of lowest possible environmental costs per kilowatt-hour from wind energy

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