

Enhancing the Understanding of Environmental Effects of Wind Energy

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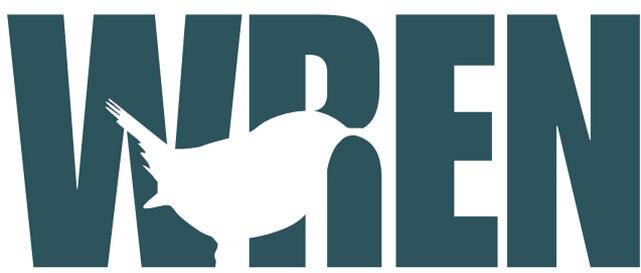
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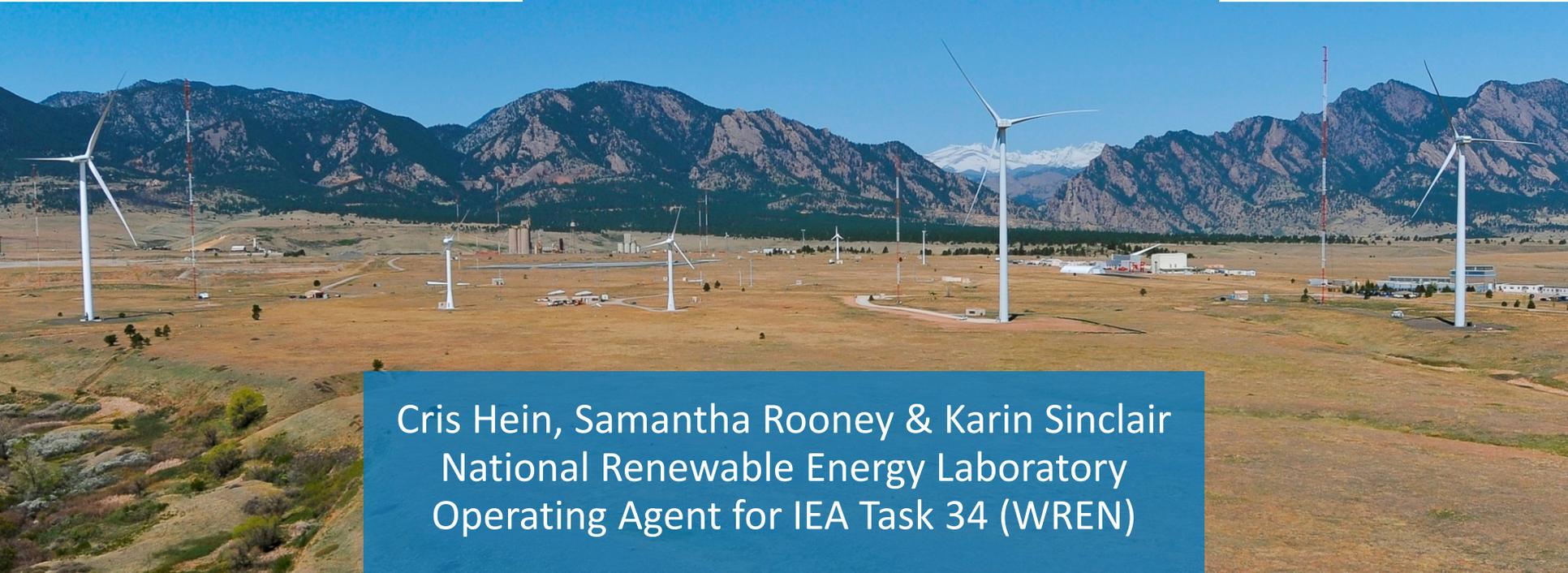
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Working Together to Resolve
Environmental Effects of Wind Energy



iea wind



Cris Hein, Samantha Rooney & Karin Sinclair
National Renewable Energy Laboratory
Operating Agent for IEA Task 34 (WREN)

IEA Wind Technology Collaboration Program



iea wind

- Founded in 1977
 - Advance wind energy research, development & deployment
- 26 member countries participating in 16 Tasks
- 2019–2024 Strategic Objectives
 - Maximize value of wind energy in energy systems & markets
 - Lower cost of land-based & offshore wind
 - **Facilitate wind energy deployment through social support & environmental compatibility**
 - **Foster collaborative research & exchange of best practices & data**

Task 34



- Initiated in Oct 2012



- International forum supporting wind energy deployment through a better understanding of environmental issues, efficient monitoring programs, & effective mitigation strategies



Purpose

- Global growth of the wind industry + broad range or migratory nature of affected species requires international cooperation
- Meet conservation & energy production goals
 - Inform the global community on challenges & opportunities
 - Provide scientifically credible data for decision makers



Humpback whale & calf. Credit: NOAA/NMFS



Melon-headed whales. Credit: NOAA/NMFS/PIFSC

Resources

- 16 Webinars
- 7 Fact sheets & short science summaries
- 4 White Papers / Publications
 - Hanna et al. 2016: Adaptive Management
 - May et al. 2018: Individual Effects to Population-level Impacts
 - Sinclair et al. 2018: Resolving Environmental Effects of Wind Energy
 - Copping et al. 2020: Risk-based Management
-  (<https://tethys.pnnl.gov/about-wren>)

European Wolves and Wind Energy Development

THE SPECIES

Gray wolf (*Canis lupus*) is one of the largest wild canines and a keystone species because of its size and social interactions with humans. Wolves occur throughout the northern hemisphere, exhibiting a variety of behaviors that range from hunting to scavenging. They often live in human-dominated landscapes, particularly in Southern Europe and Asia. Wolves live in family groups, each with a female alpha and well-defined hierarchy, in which they hunt and reproduce. Wolves occur in late spring and pups stay with their parents until summer, at least partially in the den. Wolves are opportunistic omnivores that feed mostly on wild ungulates. Microclimate diversity may exist in wolf territories, particularly in alpine environments. Although wolves are a very adaptable species, they can only cope with a certain level of human disturbance, particularly around breeding sites.

WILDLIFE

Wolves are a keystone species in many ecosystems, particularly in the Northern Hemisphere. They are a highly adaptable species, but they are sensitive to human disturbance, particularly around breeding sites. Wolves are a highly adaptable species, but they are sensitive to human disturbance, particularly around breeding sites.

MAIN RISKS AND EFFECTS

Major concerns, such as wolf attacks on humans, especially when hunting. They show a preference for rugged and isolated areas, such as mountain ridges. These areas are often characterized by good wind resources and are chosen for wind energy development. Although wolves are a very adaptable species, they can only cope with a certain level of human disturbance, particularly around breeding sites.



WREN SHORT SCIENCE SUMMARY

WORKING TOGETHER TO RESOLVE ENVIRONMENTAL EFFECTS OF WIND ENERGY

Bat Interactions with Land-Based Wind Energy: A European and North American Perspective

INTRODUCTION

Wind energy is a clean and renewable source of energy. However, wind energy development can have negative impacts on wildlife, particularly bats. Bats are highly sensitive to wind turbines and can be killed or injured by collisions with the blades. Wind energy developers are increasingly aware of the need to protect bats and are implementing measures to reduce the risk of bat mortality. This includes installing bat deterrents, such as ultrasonic sound emitters, and avoiding construction during peak bat activity periods.

Bats are a diverse group of mammals that play a vital role in ecosystems. They are highly adaptable and can live in a variety of habitats, including forests, caves, and urban areas. Bats are important for pest control and the pollination of certain plants. Wind energy development can have negative impacts on bats, particularly through collisions with turbine blades. Wind energy developers are increasingly aware of the need to protect bats and are implementing measures to reduce the risk of bat mortality.



STATUS OF BATS

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Phase III Objectives & Outcomes

- Objectives
 - Identify priority international research gaps
 - Assess technical readiness & effectiveness of solutions
 - Aggregate & synthesize information on the global state of the science
- Outcomes
 - Expand collaboration within WREN & among non-WREN countries
 - Establish a global monitoring & mitigation technology database
 - Disseminate scientifically-based research & recommended practices

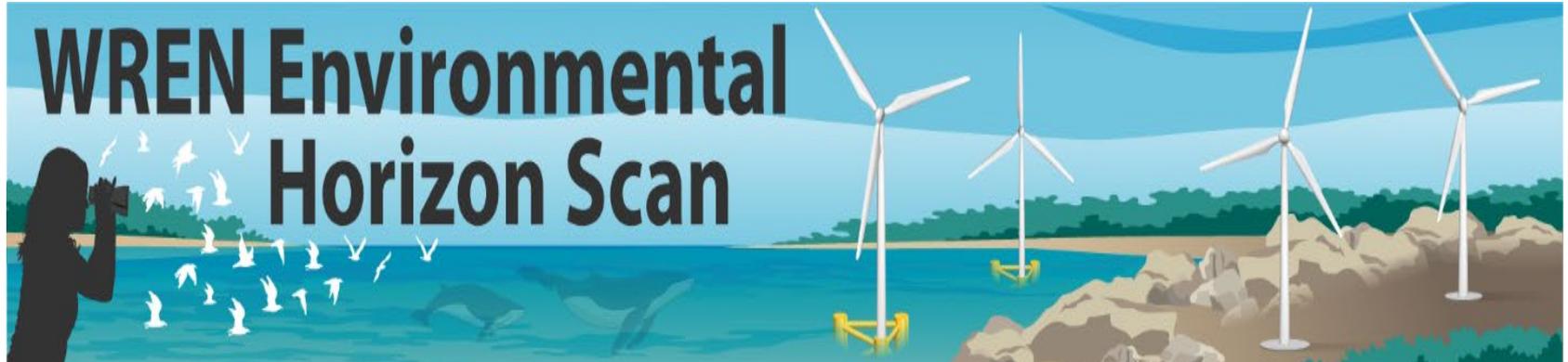


Double rainbow at NREL's Flatirons Campus.
Credit: K. Sinclair

Evaluation of Priorities

Lead by NREL (Rebecca Green & Liz Gill)
Steering Committee (5 WREN members)

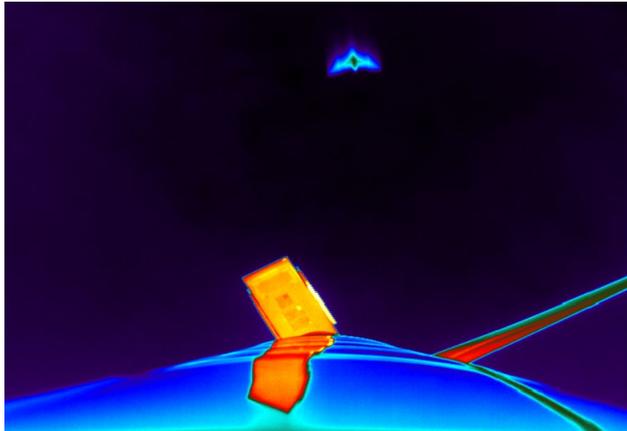
- Conduct a systematic assessment of persistent & emerging issues
 - Repeatable, inclusive & transparent
- Elicit feedback from global community via an iterative process
 - View priorities by land-base or offshore wind, region, & stakeholder



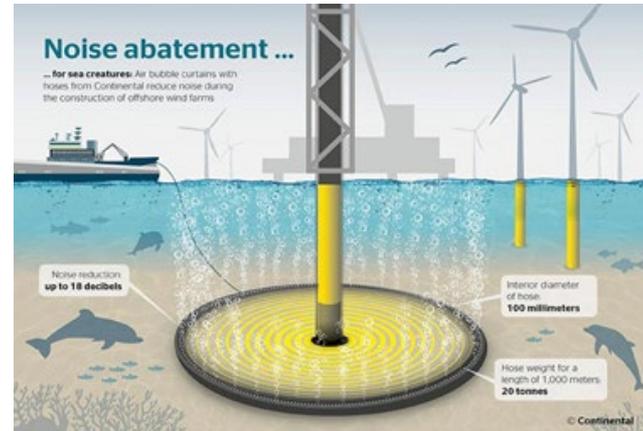
Technology Database

NREL & PNNL collaboration
Input from WREN members &
technology providers

- Develop & maintain a database for monitoring (e.g., camera systems) & mitigation (e.g., bubble curtains) technologies
 - Evaluate the technology readiness level (TRL) for each entry
 - Accessed via *Tethys* & linked to Knowledge Base



Thermal image of a bat & wind turbine. Credit: S. Weaver



Bubble curtain to minimize noise impacts

State of the Science

Lead by WREN Members

- Report on the state of the science on key environmental issues
 - Facilitate dialogue among international community
 - Aggregate & synthesize available resources
 - Engagement & outreach activities to disseminate information
 - Short Science Summaries
 - Webinars
 - Conferences
 - Expert Forums



Golden Eagle. Credit: D. Schroeder

State of the Science



<p>Reduce uncertainty regarding risk for Raptors at wind farms</p>	<p>Raptor behavior & physiology as it relates to interactions with wind turbines</p>	<p><u>Webinar</u> summarizing ongoing research</p>
	<p>Risk modeling efforts</p>	<p><u>Expert forum</u> on approaches to risk modeling</p>
	<p>Summarize behavioral/physiological research investigating drivers of risk</p>	<p><u>Science Summary</u> on drivers of risk</p> <p>Literature to <u>Tethys Knowledge Base</u></p>
<p>Identify effective tools for avoiding, minimizing, and reducing mortality of raptors at wind farms</p>	<p>Development & efficacy testing of monitoring tools/methodologies</p>	<p><u>Expert Forum</u> to identify & compare monitoring approaches</p> <p>Enter all tools in <u>Technology Database</u></p>
	<p>Summarize results of the effectiveness of existing mitigation tools</p>	<p><u>Expert Forum</u> to identify mitigation tools</p> <p>Enter all tools in <u>Technology Database</u></p>
	<p>Research gaps regarding impact monitoring & mitigation tools</p>	<p><u>Workshop & Science Summary</u> on recommended practices & future research priorities</p>

Conclusion

- Engage more with the global community
 - Receive feedback from Asia, Africa, Latin America
- Have greater synergy among WREN tasks
 - *Horizon Scan* informs *State of the Science* activities
- Focus on strategic activities regarding a receptor or stressor
 - Raptors & wind turbine interactions
- Develop various products to reach different audiences
 - Short Science Summary or entry in technology database





Silver-haired bat (Credit: Cris Hein)

Thank you

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