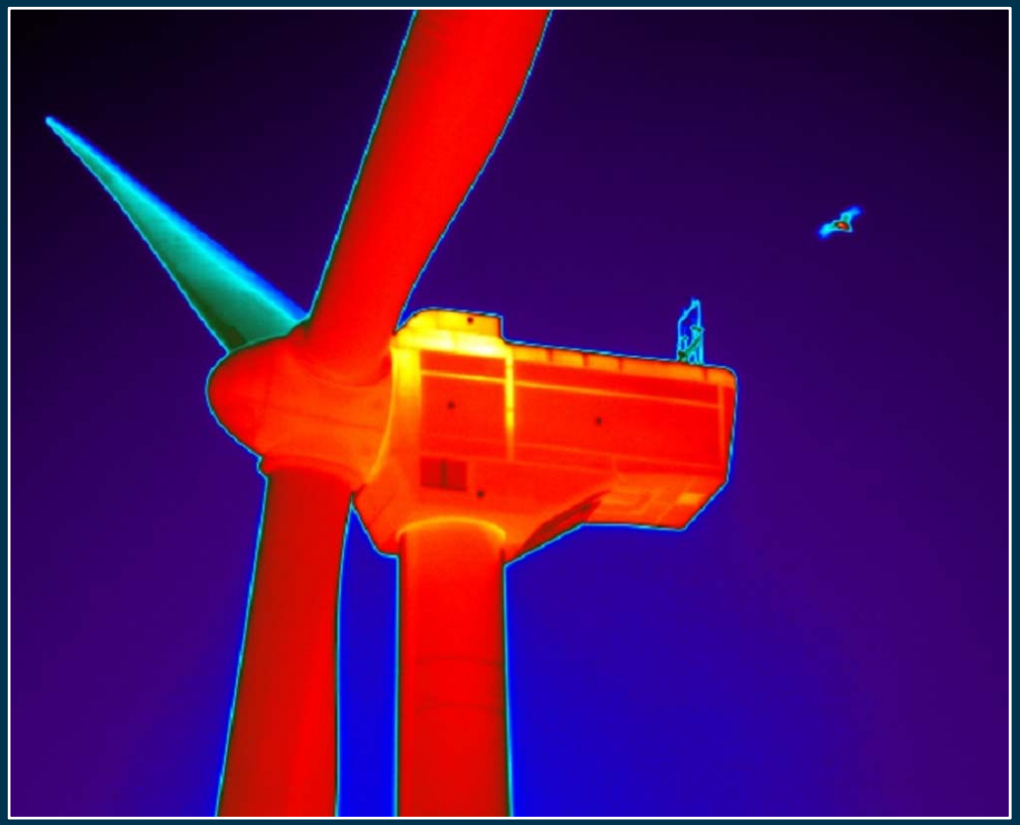
Bats and Wind Energy Cooperative:
Research Priorities to Address Bats and Wind Energy Issues



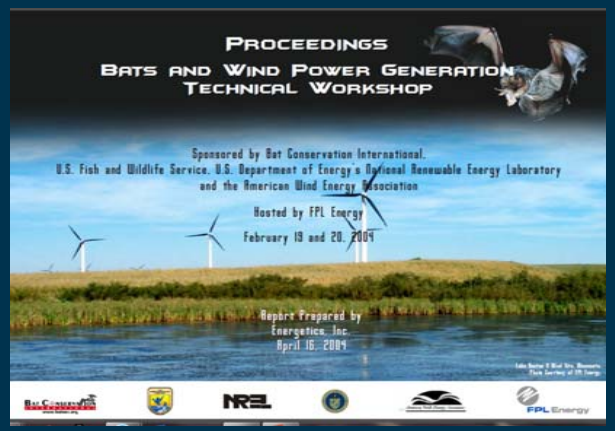
Michael Schirmacher, BCI
mschirmacher@batcon.org

NWCC Webinar
12 April 2019

BWEC
bats and wind energy cooperative

BWEC History

Mission: The Bats and Wind Energy Cooperative (BWEC or Cooperative) is an alliance of experts from government agencies, private industry, academic institutions, and non-governmental organizations that cooperate to develop and disseminate solutions to reduce to the greatest extent practicable or, where possible, prevent mortality of bats at wind energy facilities.



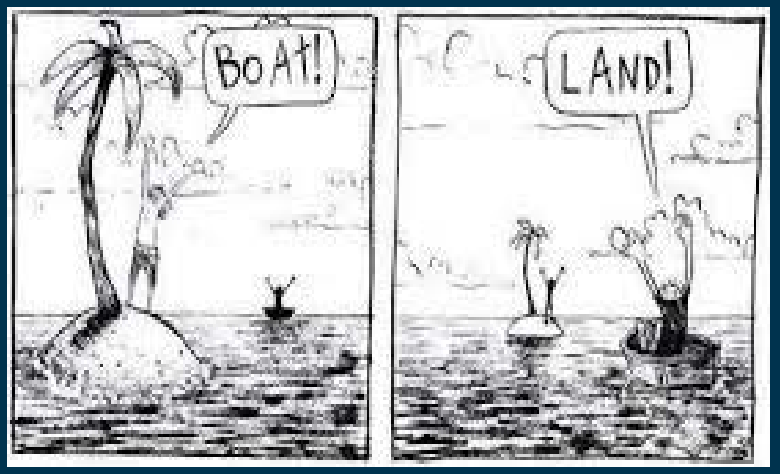
1st BWEC Science Meeting 2004…

The purpose of the workshop was to:

To identify what participants know and do not know about the problem of bat strikes at U.S. wind energy projects…

What is the BWEC?

- Transparent
- Representative and balanced
- Multi-stakeholder perspectives
- Uses science to inform decisions
- Trusted, credible → broad acceptance

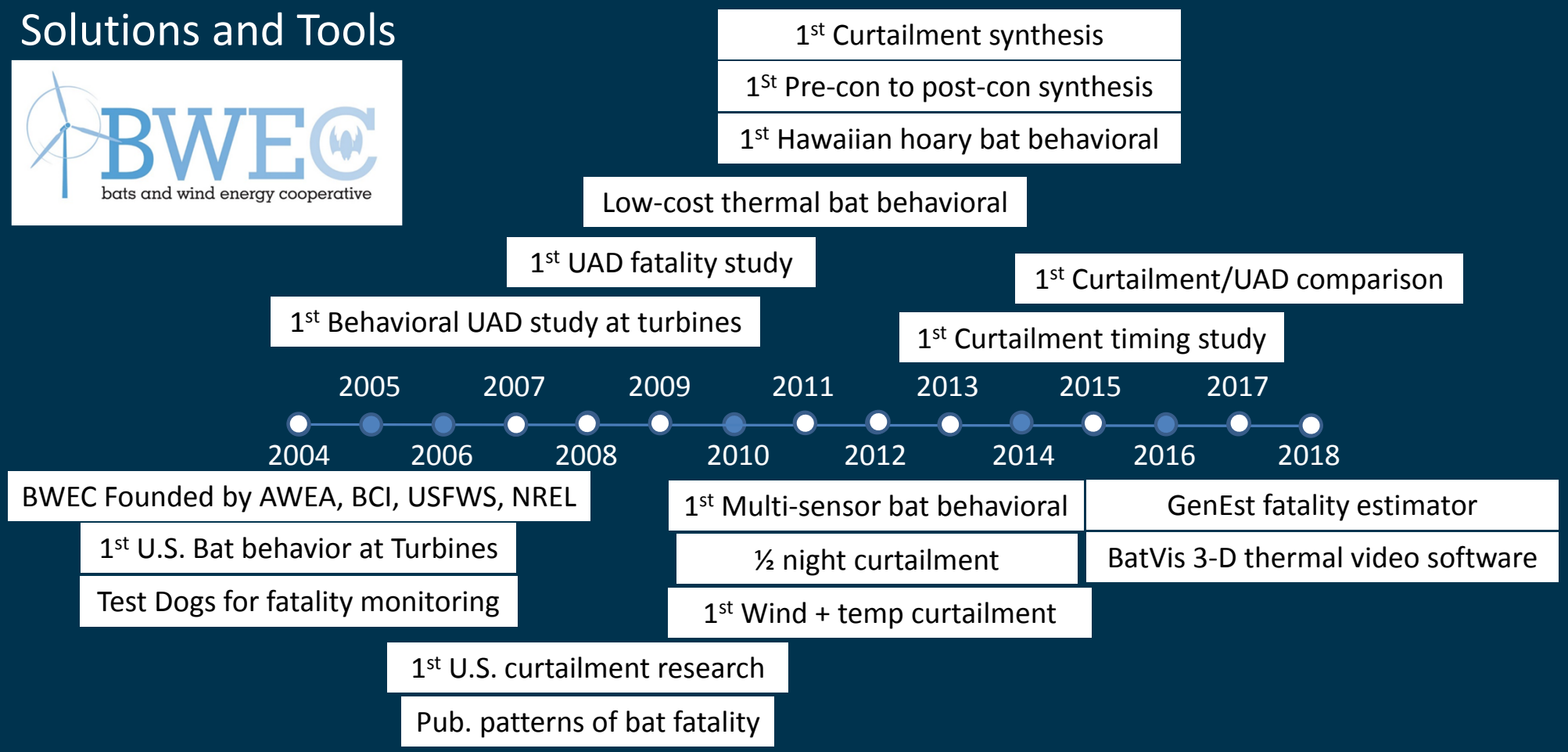


What we do?

- Targeted Research develop practical science-based solutions and tools
  - Almost 30 research projects, including 1st U.S. Curtailment, 1st UAD
- Dissemination
  - 14 publications (cited 2000 times), 28 peer-reviewed reports, 6 book chapters, 8 technical workshops, 5 BWEC science meeting proceedings

Solutions and Tools

BWEC
bats and wind energy cooperative



BWEC Committee Members: Oversight Committee

The BWEC OC…

Responsible for oversight and direction of the BWEC

1. Mark Humpert (AFWA)
2. Mike Speerschneider (AWEA)
3. Mylea Bayless (BCI)
4. Jocelyn Brown-Saracino (DOE)
5. Robert Thresher* (NREL)
6. Mona Khalil (USGS)
7. Rachael London (USFWS)

* BWEC member since 2004

BWEC Committee Members: Science Advisory Committee

The BWEC SAC…

Peer-review panel for all BWEC-sponsored research

1. Taber Allison (AWWI)
2. Robert Barclay (University of Calgary)*
3. Paul Cryan (USGS)*
4. Manuela Huso (USGS)
5. Rodrigo Medellin (Nat. Autonomous University of Mexico)
6. Cris Hein (NREL)
7. Laura Nagy (Avangrid Renewables)
8. Amanda Hale (TCU)
9. TBD

* BWEC member since 2004

BWEC Committee Members: Technical Advisory Committee

The BWEC TAC…

Insight regarding the feasibility and implementation of BWEC objectives

1. Tim Sullivan (USFWS)
2. Dennis Krusic (USFS)*
3. John Anderson (EEI)
4. Sam Enfield (Map Royalty)*
   Christi Calabrese (EDPR)
5. Jim Lindsay (NextEra)*
   Janine Bacquie (NextEra)
6. Joy Page (Defenders)
7. Sean Marsan (USFWS)
8. TBD
9. TBD

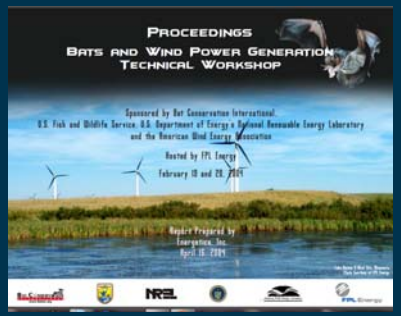
* BWEC member since 2004

BWEC Science and All Committees Meetings

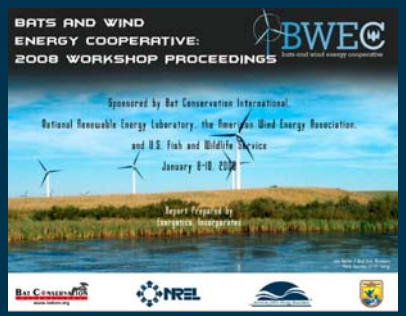
Purpose:

- Occur every 3 years (previously 4 years)
- Review progress to date, current state of knowledge
- Maximize dialogue between subject matter experts
- Develop research priorities to inform Oversight Committee decision-making
- Priorities are intended for stakeholders as a whole, and BWEC itself does not and cannot implement all priorities

2004

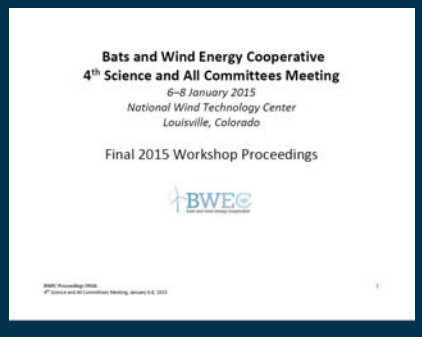


2008



2012

2015



2018

Setting Research Priorities

- Research priorities are established using a multi-stakeholder approach and therefore are representative of the cumulative perspective of the group, not individual stakeholders perspectives
- Presentations and discussions from experts informed process
- Once priority category are identified, BWEC members determined
  - Priority scale: ranking of research objectives 1–5 (1 being the highest)
  - Time: designated number of years to be completed (1–3 years)
  - Feasibility: cost/effort as easy, medium, difficult
  - Objective: primary research strategies to address ≤ 3 years
  - Actions: individual steps needed to complete objective
  - Who: those that are qualified to complete
  - Notes: related considerations

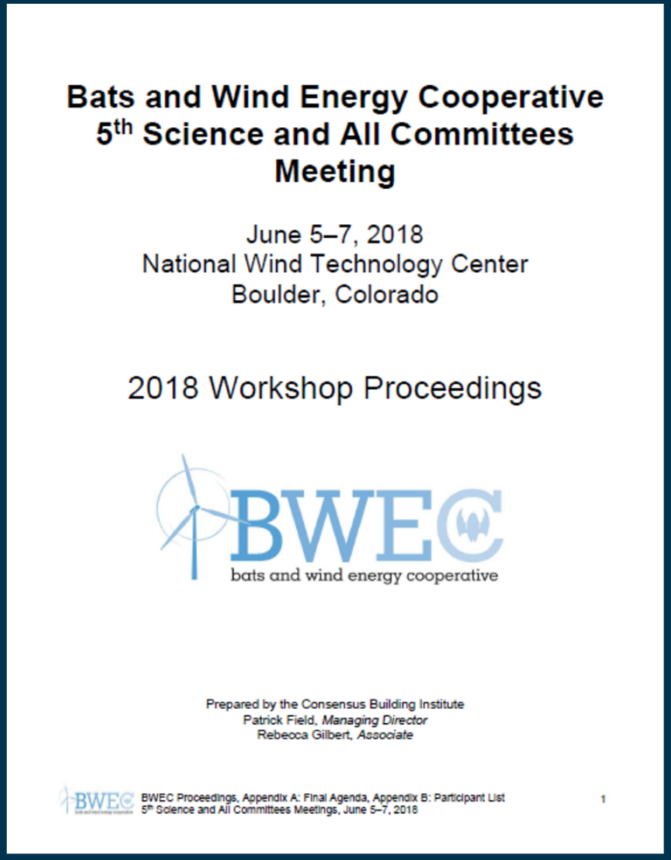
4.1 Priority Category						
Priority	Time	Feasibility	Objective	Action	Who	Notes

BWEC Research Priorities 2019-2021

Available at www.batsandwind.org

7 priority categories; 33 objectives; 57 actions;

1. Population, estimation, modeling, and data collection
2. Fatality estimation, modeling, and sampling
3. Bat behavior at the turbine- or facility-scale
4. Bat behavior at the landscape-scale
5. Operational minimization and smart curtailment
6. Deterrent technology
7. Other issues



Bats and Wind Energy Cooperative
5th Science and All Committees Meeting

June 5–7, 2018
National Wind Technology Center
Boulder, Colorado

2018 Workshop Proceedings

BWEC
bats and wind energy cooperative

Prepared by the Consensus Building Institute
Patrick Field, *Managing Director*
Rebecca Gilbert, *Associate*

BWEC Proceedings, Appendix A: Final Agenda, Appendix B: Participant List
5th Science and All Committees Meetings, June 5–7, 2018 1

Population, Estimation, Modeling, and Data Collection

Importance:

Better understanding of population, demographics are needed so stakeholders can make informed decisions on

- If current or future wind energy impacts are sustainable
- The level of avoidance, minimization, mitigation to reduce probability of population decline

Knowledge gaps:

- What are the population size, structure, for bat species most impacted by wind energy?
- Are wind turbines having a population level impact on bats? What species?
- How are other stressors impacting bat populations?
- What methods/tools are available to estimate bat populations?

In the absence of bat population data, what are other methods/strategies to inform decision making?

Population, Estimation, Modeling, and Data Collection

Three (3) research objectives

- Use population estimation tools to estimate population impacts to better inform the context of turbine-caused bat fatalities and effectiveness of minimization strategies (i.e. improve existing population models)
- Support collection of genetic and demographic data
- Synthesize available genetic and population analysis data

http://research.amnh.org/

BWEC is actively pursuing in 2019

Fatality Estimation, Modeling, and Sampling

Importance:

Improved estimates of bat fatality are needed so stakeholders can make informed decisions on

- If current or future wind energy impacts are sustainable
- The level of avoidance, minimization, mitigation to reduce probability of population decline
- If estimated fatality from PCM can identify "risky" areas

Knowledge gaps:

- Are current estimates of cumulative fatality "representative"?
- How much annual variation is there fatality rates?
- Can the new Generalized Estimator (GenEst) reduce the uncertainty and improve our understanding of impacts or risk?

Fatality Estimation, Modeling, and Sampling

Seven (7) research objectives

- Update the generalized fatality estimator (GenEst)
- Promote use of GenEst
- Explore the development of a standard, valid, and efficient sampling method that is broadly applicable to generate comparable data among sites
- Use existing fatality data & continue to collect data to answer large-scale questions (e.g., cumulative fatality)
- Use GenEst to refine existing data sets
- Conduct pre- and post-construction studies in novel circumstances to develop baseline data on patterns of activity and impacts
- Use a systematic sampling framework to randomly sample data for meta-analysis

BWEC is actively pursuing in 2019

Priority Alert: Promoting Generalized Estimator (GenEst)

GenEst

- Provides unbiased estimates of mortality
  - Help inform development and operational decisions
  - Allows meaningful comparisons across time, sites and regions
- Is easy to use Software with GUI
  - Even easier at GenEst workshops!
- Provides easy-to-interpret results

GenEst does not require

- Changes to monitoring protocols
- Increased monitoring effort
- New prescriptive monitoring objectives

More information at www.batsandwind.or/genest

GENEST
Generalized Mortality Estimator

A Generalized Estimator for Estimating Bird and Bat Mortality at Renewable Energy Facilities

Fatality estimates provide basic information for studying impacts of renewable energy development on wildlife and how to minimize such impacts. Only accurate estimators that don't introduce inconsistent bias will produce estimates that can be compared across time, sites and regions. Multiple methods for statistically estimating bird and bat fatalities at wind energy facilities have been developed over the last 20 years.

Guidance regarding which is the appropriate estimating method - estimator – to use in a situation is not always available and may not be followed when available. Industry and regulatory specialists must decide on their own the most appropriate estimators to use for their situation. These different estimators can provide different results that could lead to confusion and conflict between the renewable energy developer or operator and the regulatory body.

Time and resources are limited. Not every facility or regulatory body has a statistician available to advise which method is most appropriate for each project or study design scenario. GenEst replaces earlier estimators, eliminating confusion about which estimator is most applicable for a given situation.

GenEst
- Provides unbiased estimates of mortality to inform development and operational decisions and allow meaningful comparisons across time, sites and regions
- Is easy to use
- Provides easy-to-interpret results

GenEst does not require
- Changes to monitoring protocols
- Increased monitoring effort
- New prescriptive monitoring objectives

GenEst allows end-users to test assumptions regarding input parameters and select an approach that best reflects their situation and data. Flexible parameter inputs allow GenEst to yield statistically valid, low-bias results across a wide spectrum of study designs with greatly reduced potential for user error.

GenEst provides
- Guidance on study design to increase efficiency and reduce costs of fatality studies
- Information with which to meaningfully interpret regional impacts and temporal trends
- A way to standardize carcass searches and perform data analyses
- Reduction of bias to improve accuracy of fatality estimates, or rates, generated from carcass searches

GenEst is not an evidence of absence type estimator and is not intended for use when few carcasses are found.

For more information visit http://go.usa.gov/xEsYh

USGS Duke

Bat Behavior at the Turbine- or Facility-scale

Importance:

A better understanding of behavior bat at turbines can help to

- Determine why there seems to be disproportionate risk among bat species
- Determining and address the potential cause of attraction
- Develop/test cost-effective solutions to minimization bat fatalities
- Address future implications of taller turbines with longer blades

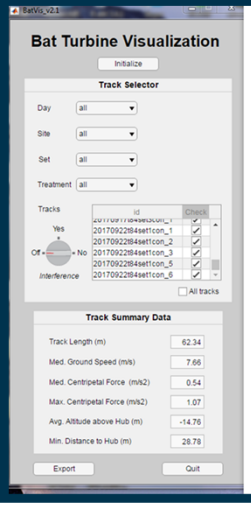
Knowledge gaps:

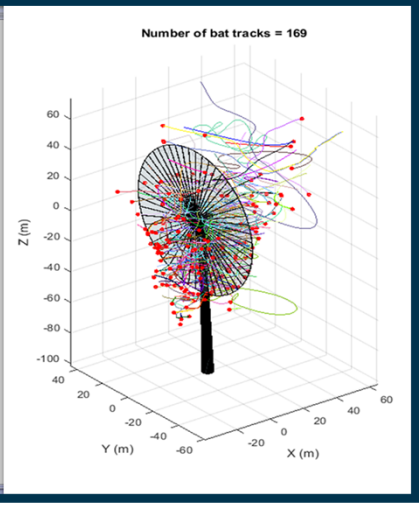
- What factors are attracting bats to turbines? Does it vary by species, spatial scale, etc.
- Can "risky" behavior be predicted or measured to inform minimization?
- Do bats always echolocate near turbines?
- Does the turbine structure influence echolocation type, therefore ability to ID?
- Is thermal videography a cost-effective tool to detect/quantify collisions?

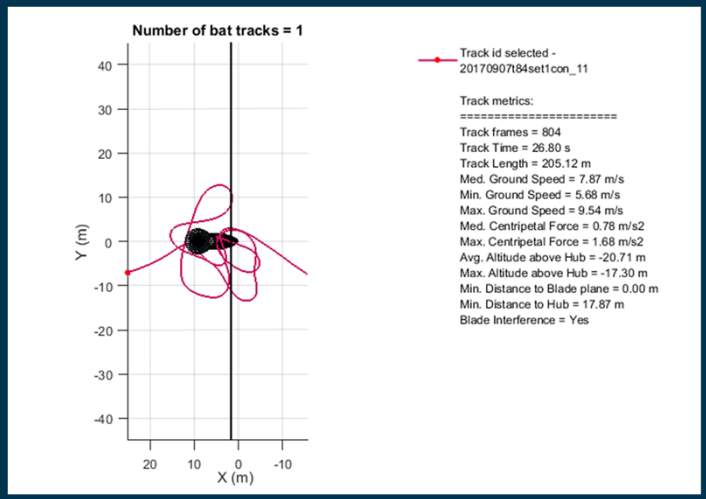
Bat Behavior at the Turbine- or Facility-scale

Four (4) research objectives

- Develop a decision framework for behavior studies
- Use thermal videography to understand bat activity and behavior near wind turbines
- Refine thermal videography field, analysis, and modeling methodology
- Monitor strike detection technology or real-time fatality detection studies







BWEC is actively pursuing in 2019

Bat Behavior at the Landscape-scale

Importance:

A better understanding of how bat use the landscape can help to

- Potentially avoid or minimize impact
- Develop mitigation options to offset "take"
- Inform risk prior to construction

Photo by Ted Weller

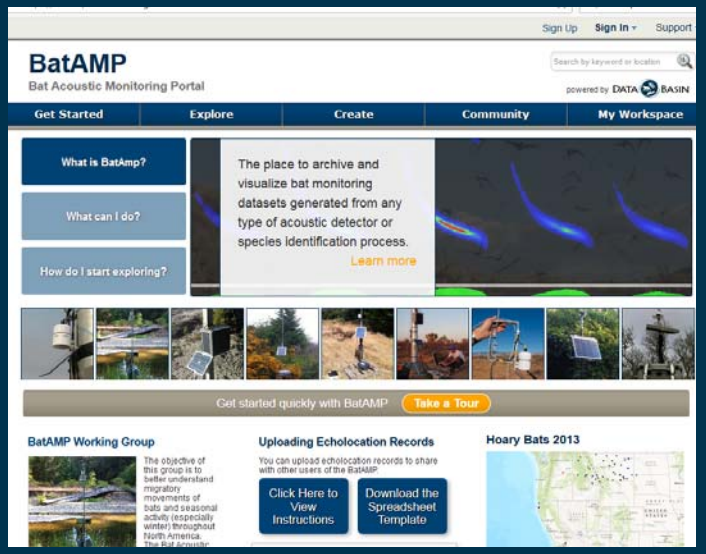
Knowledge gaps:

- Are there migratory corridors?
- Do turbines represent a barrier between habitats?
- How can existing technologies/strategies (e.g. BatAMP, NABat) improve our understanding of bat behavior?
- How can emerging technology (e.g. GPS tags, Motus towers, ICARUS) help address bats and wind energy issues?

Bat Behavior at the Landscape-scale

Four (4) research objectives

- Increasing knowledge of bats temporal & spatial movement over the landscape
- Increase understanding of landscape-scale features and bat fatalities
- Collect and interpret acoustic data appropriately and include in BatAmp and NABat programs
- Synthesize available data related to bat movement patterns



BWEC is actively pursuing in 2019

Operational Minimization and Smart Curtailment

Importance:

Operational minimization is the only scientifically proven and accepted strategy to reduce fatality at operating wind turbines

- Refining this strategy to be more cost-effective benefits all stakeholders
- "Smart" or informed curtailment shows promise
  - Might be the only cost-effective curtailment option as turbine technology becomes more efficient at lower wind speeds or regions

Knowledge gaps:

- Can modifying the curtailment decision framework be more cost-effective than raising the cut-in speed?
- Can we inform curtailment based on predictive models or only in real-time?
- Does curtailment effectiveness vary by species?
- Is there fatality risk during operational transition (e.g. start-up)?

Operational Minimization and Smart Curtailment

Four (4) research objectives

- Summarize results from Curtailment Strategies
- Replicate recent "smart" curtailment studies
- Verify impact of feathering up to the manufacturer's cut-in speed
- Impact Reduction Decision Support Tool

The Future

https://electrek.co/2017/11/02/worlds-tallest-wind-turbine-built-in-germany/

BWEC is actively pursuing in 2019

Deterrent Technology

Importance:

Deterrent technology is a promising reduction strategy that has a number of potential advantages over operational minimization

- Allows flexibility to accommodate factors, such as PPA
- Relatively more predictable cost
- Might be more cost-effective strategy for certain species

Knowledge gaps:

- What factors influence the effectiveness UAD on different species, regions, etc.?
- Can we develop species-specific deterrent signals?
- How will UAD technology do as turbines get larger?
- Is there habituations? What factors might increase the potential of habituation?

Deterrent Technology

Five (5) research objectives

- Advance deterrent technologies
- Advance understanding of the effective range of UAD
- Study effectiveness of combined methods
- Advance early stage UV

BWEC is actively pursuing in 2019

Other issues

Six (6) research priorities

- Expand network of international partners
- Monitor off-shore wind development
- Dissemination & Training
- Pre-Post Relationship
- Explore policy options for implementation of practicable impact reduction strategies
- Monitor distributed wind development

BWEC is actively pursuing in 2019

https://www.nytimes.com/2018/10/08/business/energy-environment/orsted-deepwater-wind-energy.html

Funding Opportunities to Address Bats and Wind Energy Issues

NREL Technology Development and Innovation Program

Supports development, testing, and engineering of low TRL and prototype wildlife risk monitoring and impact minimization technologies

- 20% cost-share
- Due 10 June 2019

https://www.nrel.gov/wind/technology-development-innovation.html

Wind Wildlife Research Fund

"The Fund" is an industry-led initiative that provides funding to advance the research necessary for solutions to wind-wildlife impacts in 2019 and beyond.

- RFP for bats, raptors, eagles, grouse
- Due 20 May 2019

https://awwi.org/get-involved/wind-wildlife-research-fund/

DOE : Advanced Wind R&D to Reduce Costs and Environmental Impacts

Nine projects awarded 6.2 million (9.5 million + in-kind)

- BWEC involved in four
  - EPRI: Experimentally testing TIMR real-time smart curtailment strategy. Fieldwork starts ~2019.
  - NREL: Testing signal criteria (e.g. Freq., intensity, etc.) to deter different bat species using ultrasonic acoustic signals. Fieldwork starts 2019.
  - AWWI: Develop predictive models based on metrics of risk (e.g. acoustics, thermal video, fatality); Incorporate best model into Vestas Bat Protection System (i.e. VBPS) and test effectiveness at reducing turbine-caused bat fatalities. Fieldwork starts 2020.
  - PNNL: Repurpose existing PNNL coded transmitter technology, with a new design, for use on bats. Compare with existing technology and its applicability for bats and wind research. Fieldwork starts ~2020.

https://www.energy.gov/eere/articles/energy-department-awards-6-million-wind-energy-research-projects

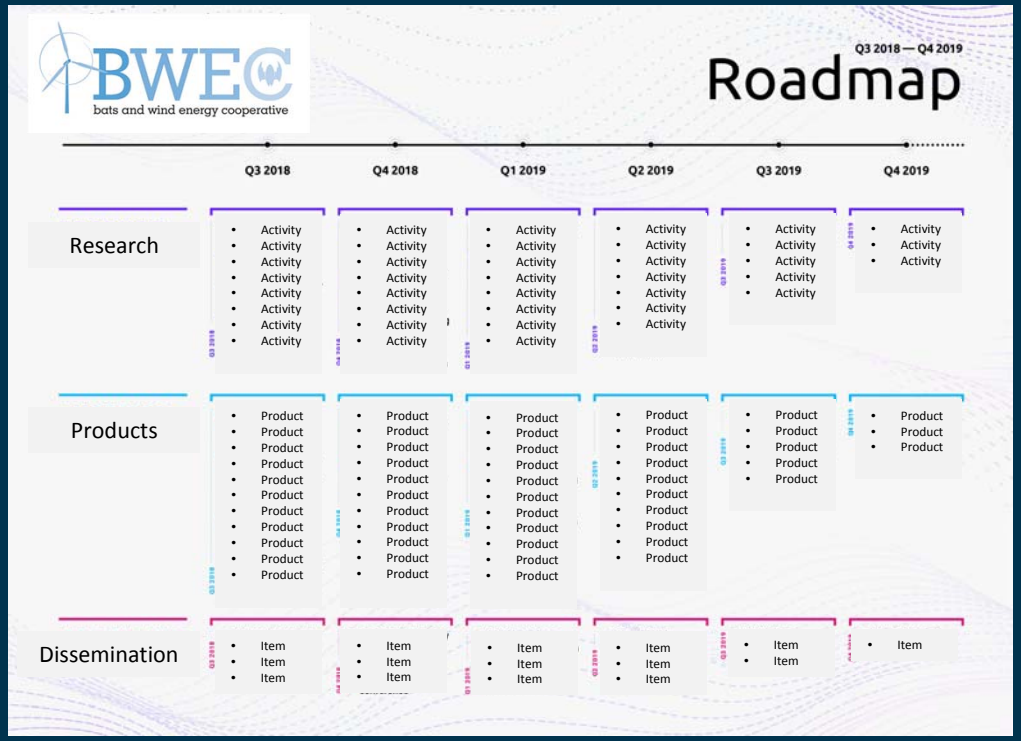
BWEC Overall Strategy for 2019

Strategic planning process in early 2019

- Clarify BWEC vision and direction
- Develop goals to evaluate organizational progress
- Develop criteria to prioritize research
- Use criteria, rank 33 objectives

Improve communication and engagement

- Establish BWEC Working Groups to develop implementation plan
  - Current BWEC committee members to lead
  - Engage other experts, stakeholders
- BWEC Roadmap
- Regular updates to stakeholder groups



https://sonm.com/blog/introducing-new-roadmap/

Summary

Bats and wind energy issues are important and urgent

- We have some solutions but
  - Knowledge gaps are limiting decision makers
- A LOT of recent investment
  - DOE 6.2 Million!
  - WWRF

Success breeds success

- Let's be strategic, to improve our understanding
- Increase pace of research, multiple replicates in the same year
- BWEC has 15th years almost 30 research projects!
  - Consider us a resource
- Coordinate research efforts
  - BWEC is representative and transparent
  - Help us avoid duplication by communicating and working together!

https://pbs.twimg.com/media/CtrljabWAAA3xIy.jpg

Notable BWEC Events

Generalized Estimator Workshop (6)

- 4/17-4/18/19, Boulder, CO
- 5/29-5/30/19, Portland, OR
- 6/05-6/06/19, Pittsburgh, PA
- 6/12-6/13/19, Bloomington, MN
- 6/26-6/27/19, Austin, TX
- 7/10-7/11/19, Carlsbad, CA

GenEst
Generalized Mortality Estimator
GenEst

Anticipated Wind and Wildlife Workshop

- Where: Bloomfield, CO @ NREL
- Date: TBD
- Classroom and field-based workshop
  - Pre-construction assessments
  - Post-construction fatality
  - Fatality estimates field methods and analysis
- **Travel support for ~ 10 State Agency representatives**

More details will be made available at
www.batsandwind.org

BWEC
bats and wind energy cooperative

Thank You BWEC Members!

A leadership meeting was held at BCI headquarters in Austin, Texas to form the Cooperative.

BWEC members retiring in 2018/2019

- Ed Arnett – 15 years SAC
- Gareth Jones – 15 years SAC
- Sam Enfield – 15 years TAC
- Jim Lindsey – 15 years TAC
- Scott Darling – 10 years TAC

Questions?

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