
Wildlife Workgroup Meeting June 20-21, 2006 Boulder, CO***Meeting Summary***

The National Wind Coordinating Committee Wildlife Workgroup Core Group met on June 20-21, in the greater Denver Metro area. For a list of meeting participants, please see Attachment A.

Day 1**A. Welcome and Introductions**

Abby Arnold reviewed the purpose of the meeting:

- to start to develop a list of priority research items related to wind/wildlife interaction,
- update members on the Wildlife Workgroup activities,
- prepare for the upcoming Wildlife Research Meeting VI and
- discuss use of expert and peer review for upcoming Wildlife Workgroup products.

Meeting participants agreed on the purpose and proposed agenda.

B. Priority Research Items Related to Wind/Wildlife Interactions

In preparation for the prioritization discussion, RESOLVE staff conducted phone surveys with Core Group members and technical advisors to draw out critical research questions that need to be addressed. A draft “white paper” summarizing responses from the phone interviews was written by staff and distributed prior to the meeting. See Attachment B for the original white paper and list of who was interviewed. In addition, two other memos were distributed to meeting participants. A memo prepared by Tim Cullinan, Washington State Audubon, summarized an informal poll of representatives of wildlife conservation organizations (See Attachment C). The ideas in this memo are largely reflected in the RESOLVE staff’s summary of phone interviews. The third memo was drafted by Al Manville, US Fish & Wildlife Service. This memo listed research needs from Service staff’s perspective, but had not undergone extensive internal review and was therefore not meant as policy (See Attachment D).

The first step for the group was to determine how to consolidate the information provided in all three memos and set a priority research agenda. After a lengthy discussion, meeting participants elected to start by editing the memo prepared by Al Manville. Members then went through each question in the FWS document, consolidated some of the items, edited the language for clarity and began assigning a high/medium/low priority to research questions. The result of this discussion can be found in Attachment E.

The resulting document and discussion related to each question was documented by NWCC staff in a research priority white paper (See Attachment F for draft).

The group decided on the following next steps for the white paper:

NWCC staff will format the edited white paper, adding discussion surrounding each question and additional items from the NWCC survey, as necessary. NWCC staff will send the revised white paper to the Gaps Subgroup. Members of the Subgroup are:

Jeff Deyette, Michael Fry, Al Manville, Michael Morrison (tentative), Karin Sinclair, Linda Spiegel, Dale Strickland, Steve Ugoretz, and Chris Taylor.

The Subgroup will conduct the following tasks:

- Review the white paper to make sure all issues are captured.
- Prioritize any new items that were added to the list, then those suggestions will go on to the entire Core Group.
- Aim to have the white paper ready to share at the November Wildlife Research VI Meeting.
- After the November meeting is complete, review other products on similar issues (December NAS study release, the Wildlife Society position on wind) and finalize the white paper and present it to the Wildlife Workgroup Core Group for review and approval.

When complete, the paper will be used to talk with members of the Wildlife Workgroup and other public and private organizations about the need to launch a concerted effort to identify and fund research on priority items.

During the discussion, issues were raised relating to prioritizing research. For example, wind development staff raised the need to make a business case for conducting and paying for wildlife research. In order to get approval for funding research associated with site selection, staff need to “sell” pre-construction risk assessment at the beginning of a project. It is possible to make a business case that the pre-construction research benefits reduce risk. Industry’s goal is to select sites that will have the highest return and least risk. There is motivation to conduct studies if the studies minimize the risk of impacts that will require extensive resources post-construction. Similarly, state agencies require information from these studies to minimize impacts on wildlife.

Developers are required by wildlife agencies to answer specific research questions, so studies for site selection are designed to answer only those defined questions and not the overarching mechanistic question of what factors are causing wildlife fatalities. Therefore, research from a specific site does not necessarily answer the larger research questions discussed by the Core Group at this meeting. A scientist would set up a research protocol for researching specific questions. Research that is conducted for site selection may be limited in its value, in terms of answering the larger mechanistic questions noted in the white paper.

One challenge was in regards to when environmental information about sites becomes available to the public. NGOs and federal and state agencies are interested in getting information about a site as soon as possible. The challenge is that before a permit application is formally filed, information, including environmental assessment information about a site, offers companies a competitive advantage. It is not in their best interest to make information about a specific site

public before an EIA or other assessment is complete. Site selection is becoming more competitive and that is why developers are more cautious about making information public.

To address the industry's need for confidentiality in assessing possible project sites, and still allow for research results to be shared earlier in the process, one participant suggested developing a mechanism for the wind industry that would offer exclusive rights to investigate a site, and then if the site proves promising, the permit could be extended. Along with the exclusive right would come full disclosure of the research conducted at the site. If the site is not promising, the developer could opt out of the agreement. With this suggestion, the industry could avoid competition over development sites and the wind/wildlife community could have access to the research conducted.

Other members felt that the issue of confidentiality is a less serious one, and the real set-back to achieving access to all studies is that not all of the information is being released consistently. They agreed that there needs to be a better sharing mechanism for research once the information is made public.

The Core Group discussed how to get from the white paper to action, to assure that the white paper precipitates research in order to begin answering the questions. Group members agreed the white paper should be used to corral interest and funding to get research going on these gaps – to make sure there is action.

The Core Group needs to reach out to additional organizations, such as AFWA, WMI, Clean Energy States Alliance and others to build more support for additional research to be conducted.

The NWCC's GS3C prairie chicken research was mentioned as a good case study for identifying and filling a research gap. For that process a research gap was identified, a collaborative group was formed, they wrote a scope of work, and obtained funding to begin the project.

Another option for making sure the white paper precipitates research is to get it to the right committee in AFWA where it can travel up to entities like independent wildlife research units and colleges and universities that have wildlife research units. The goal would be to use the NWCC Wildlife Core Group as a foundation to launch a more systematic and proactive research program.

C. Wildlife Research VI Meeting

The Core Group reviewed the most recent list of abstracts submitted for the Wildlife Research VI Meeting. Additional abstracts are still being collected. The research meeting's planning group will consider extending the deadline for abstracts to early fall. The planning group is also in the process of accepting nominations for abstract reviewers and moderators to chair sessions during the meeting.

NWCC staff is also developing a panel for the session on Risk Assessment. The planning group anticipates a conversation between two panels; one panel of risk assessment experts and another panel of policy/decision-makers who have questions about risk assessment. The goal of the session is to have a conversation about the needs for risk assessment and various tools and

methodologies that can be utilized. NWCC staff is in the process of identifying individuals who are available to sit on each of these panels.

NWCC's Mitigation Subgroup is working on an abstract that will fit into the meeting's Mitigation session. If others would like to be involved and review the draft abstracts, please contact Madeleine West, mwest@resolv.org.

Group Discussion

One meeting participant suggested bringing up the issue of the benefits of wind energy vs. other energy sources when assessing risk to wildlife. Another pointed out that understanding the effects of coal on wildlife would force the coal industry to look at the wildlife issue as well. Conversely, some Core Group members were concerned that the time and effort required to look at the relative impacts of all energy sources on wildlife would be better spent by focusing specifically on wind/wildlife impacts. However, members did agree that including a discussion on the relative impacts of all energy sources at the Wildlife Research VI Meeting could be done in a respectful way and would be beneficial if it served as a driver to attract public attention. Bob Gough, Native Wind Powering America, was asked to identify a good tribal representative to help contribute to this conversation at the meeting.

It was also suggested that sections be added to the meeting for a discussion on state guideline development, processes for documenting research needs and updates from other research meetings. If there is not time within the formal meeting agenda, this information could possibly be presented in a poster session.

D. Updates on Other Research or Activities

Martin Damus & Mélanie Cousineau, Canadian Wildlife Service

The Canadian Wildlife Service (CWS) of Environment Canada has research proposals to answer questions such as: how useful radar is to track the movements of birds across landscapes in Quebec, what protocols for searching for dead birds on the ground are most effective, and what corrections for the area searched need to be applied to improve estimates of the number of birds actually killed. The CWS is currently developing partnership among Federal agencies, universities, and NGOs to execute these studies and more.

The Government of Canada has developed guidelines for wind farm siting that are to be used in the context of environmental assessments of new wind energy installations. The federal Canadian government has been working with Canada's counterpart to AWEA, the CanWEA (Canadian Wind Energy Association); they have received public comments and have been consulting with universities and NGOs. The guidelines have been submitted for final approval.

The CWS has developed a "protocols cookbook" as a companion to the guidelines. The protocols guide describes the methods a wind energy proponent would be expected to use to assess potential wind energy sites for impacts to birds, and to gauge the actual impacts of the installation after construction is completed. The CWS is also collaborating with the CanWEA to develop a database that will contain bird-(and potentially bat-) related environmental assessment information gathered in the context of wind energy projects which will be accessible to the public, with the level of access (for example, to proprietary information) being dependent on the

audience (government agencies, developers, the public). Precise details on levels of access (including outside of Canada) are not yet known, but developers will be expected to deposit not only analysed data, but also raw data and to deposit digital copies of point count recordings etc..

Canada is planning changes to their Migratory Birds Regulations (following recent amendments to the Migratory Birds Convention Act) that would provide for an exemption to the prohibition to kill migratory birds and destroy their nests and/or a permitting system that is balanced by obligations on the part of an entity desiring to engage in an activity that may result in incidental take to manage the take and to compensate for the take. These changes are desired by both industry and the federal government, to end legal uncertainty over the taking of birds and their nests and to improve the conservation of birds as populations.

The Québec Region of Environment Canada is working with provincial partners in Québec to initiate a research group that will look into bird and bat migrations. Proposed projects are focused on increasing current knowledge of migrations (migration “corridors”, behaviour, timing, influential variables, etc.) in order to be better equipped to assess the risk of tall structures in the landscape to birds and bats. The provincial government has expressed concern for potential bat interactions and fatalities with tall structures (bats are of provincial jurisdiction in Canada), but resources are few.

Bob Gough, Native Wind Powering America

In the new energy bill, tribes have the opportunity to take over authority for siting energy projects on their reservations. Title 5 states that a tribe can submit their plan to the Energy Secretary so that that tribe may take regulatory authority for siting issues on the land. This could particularly apply to smaller renewable projects and offshore projects in the Great Lakes region. Tribes are not yet organized to obtain this authority, but they are beginning to explore it.

Al Manville, U.S. FWS

The FWS is co-sponsoring “Toward Wildlife-Friendly Wind Power: A Focus on the Great Lakes” in Toledo, OH June 27-29. The purpose of the meeting is to encourage wildlife friendly wind development in the Great Lakes Basin. The conference is intended for those with interests in wind and wildlife. The GAO tasked the FWS to look at the Great Lakes Basin wind/wildlife issue and this meeting is a follow-up from the activities that took place at AFWA’s North America Wind Energy Development and Wildlife Management Workshop in Columbus, OH on March 21. More information on the meeting can be found at <http://www.fws.gov/midwest/greatlakes/windpower.htm>.

Janet Ruth, USGS, Ft. Collins office, is heading a workshop on radar in Albuquerque, NM October 24-26. The meeting is invitation-only and approximately 75 people have been invited, including an AWEA representative, a power and utility representative and consultants. The meeting will look at other energy generation sources as well as wind, and will most likely be exclusively land-based focused for wind. Some of the wind topics will include; Nexrad, USGS work in the country, and techniques such as thermal imagery. A summary will be available after the meeting.

U.S. FWS Guidelines – The FWS has been exploring how best to amend or modify their voluntary interim guidelines. After a stakeholder group meeting was canceled in February 2006 the FWS has had discussion with Interior’s dispute resolution office, general solicitors and others to look at different options. One option is to develop a Federal Advisory Committee, however the FWS Director is not ready to commit to that plan so it is uncertain at this time how the Service will move forward. A challenge for the FWS is that a number of state agencies are currently developing guidelines and the FWS does not want to release guidelines after states have developed their own. Also, the service is still exploring the question of developing regulatory vs. voluntary guidelines. The FWS would like to utilize recommendations and expertise from the NWCC for this process.

Linda Spiegel, California Energy Commission

The California Energy Commission is starting a research project in the East Bay Regional Parks that own land both in the Altamont (with turbines) and land adjacent to Altamont (without turbines). On the non-turbine land, the study is looking at manipulating under the turbines to make the area less attractive (using grazing sheep). The study is also looking at raptor use in the turbine area vs. the non-turbine area to see how the raptors are utilizing the landscape.

Terry Yonker, Marine Services Diversified, LLC

Buffalo, NY is currently conducting an onshore assessment of the relationship between a 20,000-bird gull colony and a turbine development approximately 100m away. The city is looking at other migration and radar studies of cable bridges to see if there is a comparable impact between wind turbines and other tall structures.

Day 2

E. Subgroup Updates

Risk Assessment Subgroup

Risk Assessment – The NWCC organized a presentation on Risk Assessment at the last Core Group meeting in February 2006. At that time, the Core Group decided that there was not interest in investing more resources on the topic and the issue was shelved for the time being.

At this meeting, the group discussed the difficulties with addressing risk assessment and that it is a complex issue. There are differences in how technical experts use the term “risk.” There was interest in pursuing discussion of risk assessment at future NWCC meetings.

A decision was made to reconvene the Risk Assessment subgroup for the purposes of the Wildlife Research VI Meeting panel and to advise on what the NWCC Wildlife Workgroup should plan to do on the issue in 2007.

Grassland/Shrub Steppe Species Subgroup

Kansas State University researchers launched the prairie chicken project this spring, with a base set up in Burden, Kansas. Trapping has also begun on one of the 3 proposed wind sites, located in Butler County, KS. A control site for the Butler County experimental site has not yet been established, partially due to the low prairie chicken density on neighboring property. On the

Geary County site, initial surveying for leks has begun. No work has been done on the Cloud County site.

GS3C Oversight Committee members have expressed concern over the low number of birds marked in the first year. Dr. Sandercock, lead researcher, has indicated that the late start and declining population numbers on the Butler County site contributed to the low number of tagged birds. The trapping method may be altered next year to increase bird capture. The lack of a control site is another concern. Oversight Committee members are planning to assist in obtaining landowner permission to set up control sites in Butler County.

The researchers are required to submit quarterly reports to Karin Sinclair, project monitor, with the first report due in early August.

The subgroup has discussed whether the 2006 research season counts as the first year of the project. The sentiment was expressed that because the required protocol was not followed in terms of marking birds and obtaining a control site, this first year cannot be counted. Dr. Sandercock expressed his view of this year as a pilot year, going full force in 2007. Construction on the Elk River 2 site in Butler County is slated for Spring 2007. In Geary County, a control site has been established and lek identification is underway. Surveying for lek sites will begin this Fall in Cloud County.

The draft songbird protocol, written by Wally Erickson, Dale Strickland, Doug Johnson and Jill Schaffer, was circulated among the NWCC Wildlife Workgroup technical advisors and comments were passed to the protocol authors to review. Some reviewers wanted the protocol to call for a more thorough, exhaustive study. The authors are considering two approaches to address this concern.

- A two-tier approach, recognizing that different users of the protocol have different time and money resources available to conduct studies. But the concern is that people would always opt for the easier, cheaper option.
- Focus on the minimum level of assessment needed to establish whether there is an impact or not, which could be followed by a second stage to determine sources of any impact as needed.

The Ornithological Council team has submitted the first draft of the literature review. The review was sent to the Subgroup for comment. Once all comments are collected they will be sent back to the team for inclusion.

Nocturnal Subgroup

Dr. Tom Kunz, Boston University, and his team are developing a companion document to the NWCC publication *Studying Wind Energy/Bird Interactions: a Guidance Document* covering nocturnal activity of birds and bats. The team is running behind their original schedule because of a start delay and a busy field season. They anticipate having a first draft out in mid- August. NWCC staff has extended the contract through December 31, 2006, but hopes that a good working draft of the document will be available in time for the November 14-15 Wildlife Research VI Meeting.

Mitigation Subgroup

The Mitigation Subgroup has hired a summer intern to compile a mitigation “toolbox” that will provide a comprehensive reference on the types of mitigation that can be used by the wind industry to compensate for adverse impacts to wildlife. The intern work plan was drafted by Lynn Sharp, Tetra Tech, and with input from Kevin Rackstraw, Clipper; Karin Sinclair, NREL; and other Subgroup members. The intern will be supervised by Karin Sinclair and will work out of the National Wind Technology Center. Funding for the internship was obtained through a grant from the Energy Foundation.

The Subgroup has also worked to develop an abstract for the Mitigation session of the Wildlife Research VI Meeting. Lynn Sharp drafted an abstract that is currently undergoing review within the Subgroup.

F. Update from the Association of Fish and Wildlife Agencies (AFWA) Meeting

Steve Ugoretz, WI DNR and Rob Manes, TNC Kansas

AFWA held a meeting June 19 in Denver, CO. The group has organized an Energy and Wildlife Policy Committee that will look at a number of energy areas including oil on and offshore, wind transmission corridors, climate issues including carbon sequestration, and also coal and hydro (but not as a priority). The committee was charged with focusing on energy development and generation in North America and impacts on fish and wildlife resources and their landscapes. They will be an active liaison with Federal and Provincial agencies and tribal governments on policy and regulations development that impact fish and wildlife resources. The committee will monitor Federal programs and funding opportunities for these activities, make policy recommendations, and interact with other AFWA committees.

Membership of the committee was constructed to provide broad geographic and subject matter representation. The Committee intends to divide itself into subgroups by energy source (i.e. wind, oil, etc.) and identify subgroup chairs.

At this first meeting of the Energy Committee, participation appeared heavy on the Western fish and wildlife agencies. It was observed that the Great Plains states were totally unrepresented and there was little tribal representation. There was, however, excellent participation from a diverse array of energy industries.

At their meeting the Committee acknowledged the NWCC as an important source of information. The NWCC siting guidelines were referenced and it was acknowledged that other states are currently developing wind guidelines.

During discussion, Core Group members recognized the need for information sharing between NWCC and AFWA. Steve Ugoretz and Rob Manes will currently serve as informal liaisons between the two groups. Members also discussed the opportunity to share with AFWA’s Energy Committee the research priority white paper.

Next steps in developing a relationship with AFWA are to:

- NWCC staff will reach out to AFWA staff and determine how to coordinate.

- NWCC staff will send the completed white paper to Amber Pairis and Joanna Lackey, AFWA, with a cover memo explaining what the NWCC is doing and how it might be beneficial to AFWA's engagement in this activity.
- Industry representatives should determine amongst themselves and with AWEA whether to nominate an industry representative participate on the Energy Committee.

G. Peer and Expert Review Options and Proposed Review Processes for NWCC

Documents

The Core Group is committed to incorporating expert and "peer review" to enhance legitimacy and accuracy of NWCC wildlife meetings and products in the view of all parties. The fundamental challenge is that there are a range of perspectives about what peer review is, how to distinguish peer review from expert review, and what type of peer review process is appropriate for NWCC Wildlife Workgroup meetings and products.

At the February 2006 Core Group meeting, members asked NWCC staff to outline peer review options for a discussion on this topic. At the same time, the Nocturnal Subgroups was looking for guidance on how to review the companion to the Methods and Metrics document that Dr. Tom Kunz et al. are working on, and planners for the Wildlife Research VI Meeting were grappling with how a review process for the meeting's proceedings. NWCC staff drafted a memo summarizing proposals by each group for Core Group members to review. The memo also provided an overview of select peer review processes including a brief discussion of the value of peer review, and what types of processes exist. Information for the memo was collected through interviews with the Fish and Wildlife Service, the Journal of Wildlife Management, the Ornithological Council and the Wildlife Society, in addition to on-line research.

Nocturnal Document

The Nocturnal subgroup made the following recommendation to the Core Group for review of the companion document:

- Dr. Kunz and research team will write the first draft.
- The draft will undergo review by the Nocturnal Subgroup and Dr. Kunz and team will incorporate those comments into a second draft.
- The second draft will undergo technical review by the Wildlife Workgroup Core Group and technical advisors. Dr. Kunz and team will incorporate comments into a third draft; which will be available to the public on the NWCC web site.
- The third draft will undergo an independent review (paid or voluntary) either through a journal or through the NWCC and Dr. Kunz and team will incorporate those comments into a final draft. The final draft will be published as a white paper (in either electronic or hardcopy format). Dr. Kunz and team likely will need additional funds for this third task.

The Core Group discussed the importance of an independent review to lend credibility and thought universities might be a low-cost option. Core Group Members decided on the following process for review of the Nocturnal Method and Metrics companion document:

- Dr. Kunz and research team will write the first draft.

- The draft will undergo review by the Nocturnal Subgroup and a few additional experts proposed when the Kunz team was selected, and Dr. Kunz and team will incorporate those comments into a second draft.
- The second draft will undergo an independent review by a small group of reviewers. NWCC staff will ask Core Group members and technical advisors for nominees and/or volunteers, bringing back a list of available reviewers to Core Group members for approval.
- Dr. Kunz and team will incorporate comments from the independent review into a third draft for the Core Group to approve.
- Publication of the document has yet to be determined. NWCC staff will explore how long a journal review and publication process would take and bring information back to the Core Group.
- NWCC staff will explore whether the NWCC/NREL contract would allow restricted access of an NWCC document through the journal publication process.

Wildlife Research VI Meeting Proceedings

The meeting's planning group, a small subset of the Wildlife Workgroup, made the following recommendation for review of the Wildlife Research VI Meeting Proceedings:

- A technical editor will prepare the proceedings and include as many of the presented papers that are available.
- Once compiled, the proceedings will be reviewed similar to a journal process where a number of qualified experts comment on the papers.

The planning group only began an initial discussion of peer review options for the meeting proceedings and is looking for further guidance from the Core Group.

Core Group members agreed that a review of the proceedings would add to its credibility. They also acknowledged that it would be difficult to review research from the meeting that is preliminary in nature – only completed research will be reviewed. Based on this discussion, the group decided on the following process for review and publication of the Wildlife Research VI Meeting Proceedings:

- The proceedings will include two types of presentations; those that have preliminary results and those that are completed research. Those presentations that include completed results will be peer reviewed, while presentations that report on preliminary results will be summarized by a technical editor.
- The proceedings will not be published in a journal, but a summary of the meeting may be submitted to a less formal publication like the Wildlife Society Bulletin.

H. Next Steps

Action items agreed to by meeting attendees include:

- The Gaps Subgroup will work to have the research priorities white paper ready to share at the November Wildlife Research VI Meeting.
- NWCC staff will continue to identify panel members for the Risk Assessment panel for the Wildlife Research VI Meeting. The Risk Assessment Subgroup (with Bonnie Ram) will work to develop what direction the panel should go in and how to include a conversation on the relative impacts of all energy sources on wildlife.

- The NWCC Mitigation Subgroup will continue to revise an abstract for the meeting's Mitigation panel.
- NWCC staff will convey to the Nocturnal Subgroup the Core Group's recommended peer review process. NWCC staff will also explore publication options, including how long a journal review process would take, for the Core Group to consider.
- NWCC staff will convey to Wildlife Research VI planners the Core Group's recommended review process for the meeting proceedings.
- The Risk Assessment Subgroup will be reconvened to develop a direction for the Risk Assessment panel of the Research VI Meeting and to identify 2007 risk assessment activities for the NWCC Wildlife Workgroup.

ATTACHMENT A



NATIONAL WIND COORDINATING COMMITTEE WILDLIFE CORE GROUP MEETING

National Wind Technology Center
Boulder, CO
June 20-21, 2006

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ATTACHMENT B

TO: NWCC Wildlife Work Group Core Group

FROM: Abby Arnold, Katie Kalinowski, Madeleine West, NWCC Staff

RE: Draft Summary of Results from the Core Group Research Gaps Survey

DATE: June 15, 2006

In May of 2006 RESOLVE staff surveyed Core Group members and technical advisors to obtain information on current gaps in wind/wildlife – related research (see Attachment B). The information below summarizes responses received from these surveys. The language used in the research questions reflects what respondents stated. The survey results will be discussed at the June 20-21, 2006 Core Group meeting in Boulder, CO.

At the meeting in Boulder members will participate in an exercise to discuss and prioritize the survey results attached. The list outlines research gaps for avian species and bats separately. Within the avian species and bat groupings, NWCC staff categorized the suggested research gaps into questions that address impacts and risk, behavior and activity, methods for assessing impact, and other. Prioritization efforts at the Core Group meeting will ultimately create the foundation for a white paper on research gaps that will be presented at the NWCC's Wildlife Research Meeting VI in November 2006.

Appendix A is a list of the survey questions that were asked. Appendix B shows which Core Group members and technical advisors were contacted, and which responded to the survey.

In preparation for the June Core Group meeting please consider the following questions while reviewing the list of research gaps.

- Does the list include all priority research gaps?
- Is there a better way to sort the list of gaps? (study design, detection, mechanism of mortality, mitigation, etc.)¹
- What would your priorities be for top, near and long-term research gaps?

¹ See Proceedings from the Bats and Wind Power Generation Technical Workshop, February 19-20, 2004. Sponsored by BCI, USFWS, USDOE NREL, and AWEA.

What are critical research questions that need to be asked for pre- and post construction avian issues on a national or regional level?

I. Critical Research Questions related to interactions for avian species:

Pre-Construction

- a. Is there a relationship between pre-construction assessment and post-construction fatalities for birds?
- b. Can you predict the hazard of wind turbines to birds?
- c. What will avian fatalities be like in habitats that are unstudied or undeveloped (e.g. coastal areas, offshore, mid-atlantic highlands, Appalachians)?
- d. Are there areas of high bird /bat density at the national or regional scale where risks of mortality can be predicted to be higher, lower?

Post-Construction

- a. What is the risk of raptor and other diurnal migrant strikes along raptor- concentrating geographical features (e.g. Great Lake shorelines and northern Rockies)
- b. What are the displacement effects of wind projects on wildlife?
- c. What are potential biologically significant impacts to birds and bats? Can we determine whether impact will harm species at the national, regional or local level? (see methods section)
- d. Are cumulative impacts biologically significant? (see methods section)
- e. Are fatalities correlated with specific weather events?
- f. What factors are critical determinants of interactions between wildlife and wind turbines?
- g. What are the conditions under which birds collide with wind turbines? (birds of prey in the west, songbirds in the east)
- h. What are the impacts of different types of lighting on mortality?
- i. Is the impact to birds and bats from newer, taller turbines greater or less, compared to smaller ones?
- j. Do wind farms create fragmentation? Does habitat fragmentation impact specific species?
- k. Are there relative and cumulative impacts of wind development on avian species?
- l. Are there indirect effects on bird populations and demography?
- m. How are transmission lines affecting bird populations?

II. Critical Research Questions related to the behavior and activity of avian species:

Pre-construction

- a. Do landscape features play a role in creating flyways? Do flyways follow ridgelines, rivers, coastlines? Can they be identified?
- b. What is the altitude at which nightflying songbirds migrate?
- c. Can we predict when low cloud ceiling events will occur (and will push migrating birds to lower altitudes)? Are birds channelizing during low ceiling events? Should this variable be a determination for siting wind facilities?
- d. What are the migratory patterns of birds over space and time?

Post-construction

- a. Are there times when birds are most likely at risk; daytime, nocturnal, dawn/dusk? When are there known collisions?

- b. Does windfarm development alter the habitat in such a way that it becomes more suitable, drawing predators in and therefore increasing avian kills?
- c. Are mortalities at towers incidental or do towers function as attractants?
- d. What are bird avoidance behaviors? What is the percentage of birds that detect turbines? Are birds able to adjust migratory paths to avoid turbines? Does the presence of turbines reduce the breeding/stopover density and/or reproductive success of birds under and within surrounding habitat?

III. Critical Research Questions related to methods for assessing impact to avian species:

- a. Do comparative radar studies for bird migration and night migrations determine whether or not there are topographic influences?
- b. What methods are available to measure the effects of post construction on migrating birds, chicken-sized birds, and Columbidae (doves and pigeons) and rallidae?
- c. Are there methods to better measure factors (e.g. scavenging rates, searcher proficiency/rates, dispersion/state of bodies after striking turbines) and correct carcass counts to give an estimate of actual casualties?
- d. Are methods available to show the quantitative accuracy of pre-construction project impact assessments? How close are actual impacts to predicted impacts?
- e. Do all day and night metrics correlate with bird fatality estimates?
- f. What methods are available to monitor offshore fatalities?
- g. What methods are most cost-effective for post-construction monitoring?
- h. What methods are available to determine the context of the number of fatalities related to the number of birds moving through the airspace (proportionality)?
- i. Can weather radars help identify bird migration corridors and height of flight?
- j. What methods are available to best assess the threat of coastal, land-based and offshore wind farms to birds (nocturnal migrants and marine / coastal birds) especially under conditions of inclement weather?
- k. What methods are available to determine whether habitat avoidance can be affected by breeding birds at wind farms on native prairie grasslands?
- l. How effective can adaptive resource management strategies be in managing impacts of weather events on mortality?
- m. What is the appropriate duration and sample size for a survey?
- n. What are the best methods for predicting risk? What are the best methods to address biological impacts and population impacts?
- o. When performing nocturnal studies what methods are available to differentiate between single birds and small flocks?
- p. What methods are available for performing risk analyses and assessments of windfarms from a bird standpoint?
- q. What methods are available to effectively reduce adverse impacts to wildlife from wind turbines?

IV. Other Critical Research Questions related to avian species:

- a. What are the direct and indirect impacts of other forms of energy generation on birds?
- b. What is the mortality data from other types of similar structures (buildings)?
- c. What are successful mitigation measures?
- d. What are thresholds of bird use that should be avoided?

What are critical research questions that need to be asked for pre and post-construction bat issues on a national and regional level?

V. Critical Research Questions related to interactions for bats:

Pre-construction

- a. Is there a relationship between pre-construction assessment and post-construction fatalities for bats?

Post-construction

- a. What is the level of bat mortality on ridgetops, besides Appalachian ridgetops? Is there a regional consistency?
- b. What are the bat fatalities in unstudied areas like Texas?
- c. Are bat fatalities associated with specific habitat types?
- d. Are interactions often more prevalent during migration than in other periods?
- e. Are there conditions under which bats collide with turbines? Are there different fatality numbers at similar sites?
- f. What mortality levels at a given site would be considered biologically significant?
- g. Are there relative and cumulative impacts of wind development on bats?

VI. Critical Research Questions related to the behavior and activity of bats:

- a. Are there times of the day that bats are most at risk?
- b. When dispersing from their colonies are bats more susceptible to striking wind towers than at other times?
- c. Can bats detect and move around active turbines, and what factors might influence this detection rate?
- d. What types of sites do bats use during migration (e.g. any high elevation sites, riparian habitats, sites near potential roost/stopover sites?)
- e. What are the migratory and behavioral activities of red and hoary bats?

VII. Critical Research Questions related to methods for assessing impact to avian species:

- a. What methods are available to estimate the bat abundance around proposed areas or existing plants?
- b. Are there methods available to predict the hazard of wind turbines to bats? What could be a pre-construction evaluation tool?
- c. Are there predictors for bat use of an area during migration or breeding (e.g. season, weather, proximity to stopover/breeding sites, and susceptibility of age/sex/species, etc.) that correspond to actual risk posed by nearby wind farms?
- d. Are there methods available to determine the context of the number of fatalities related to the number of bats moving through the airspace (proportionality)?
- e. Can bat migration routes be mapped, and how?
- f. What methods are most appropriate for determining bat use?

- g. Using methods available, what proportion of the bat population are we able to detect?

VIII. Other Critical Research Questions:

- a. What can fatalities at existing sites teach us about fatalities at future sites?
- b. What are successful mitigation strategies?
- c. Can turbines or layouts be modified to repel or warn bats? Which methods have proven most effective?
- d. Is there a difference in mortality between moving and stationary turbine blades?
- e. What are the economic costs of curtailment?

What is a reasonable timeframe for addressing these critical research questions?

Many respondents believed that work should begin immediately to address knowledge gaps related to the wind/wildlife interaction issue. Opinions vary on required study duration for collecting data (from 1-5 years), and other issues were brought up that may affect study duration; they included availability of funding, site access for post-construction studies, and the concern that bat studies may require a longer period of time because so much less is known about impacts to bats.

Are there any other wildlife taxa (i.e. not birds or bats) in your region that are potentially affected by wind development?

Some interviewees believe that while no data exists to show that there is an impact on other wildlife taxa several species could potentially be impacted. Other respondents stated that no other wildlife taxa is affected by wind development because current development is occurring in already cleared land, like agricultural areas, or in open spaces. These interviewees also believed that installation of a wind turbine does not create too significant of a disturbance to the groundcover. One respondent stated that wind development causes no more of an impact to other wildlife than private property development does.

Several respondents expressed a concern for the effects that habitat fragmentation may have on other wildlife species. The impact of fragmentation is unknown, but many respondents felt that it has the potential to have an effect because, among other things, development and roads could increase access for predators and the spread of non-native species. Several respondents also noted that endangered insects may be threatened by wind farms developed along migration routes or within their habitats.

Regionally, respondents reported that research is needed on direct and habitat impacts of wildlife taxa such as the desert tortoise in California, the endangered ground squirrels of Washington and Oregon, black bears in Vermont, and flying squirrels in the Mid-Atlantic as well as big game, like elk, deer, mountain sheep and caribou. One interviewee mentioned an instance when ground squirrels were controlled to reduce raptor use at a development site. Increases in this type of activity could threaten terrestrial species around windfarms.

On what habitat, region or species would you want more information for avian issues?

Respondents primarily asked for more information on specific habitats in regions around the country.

- East pre and post-construction data for deciduous and coniferous forests, ridgelines and mountaintops;
- West coastal impacts, and species activity in Southern California;
- Plains East of the Rocky mountains;
- Upper Midwest where there is a mix of habitats and landuse;
- Texas and Great Lakes offshore..

Additionally, information is needed on particular avian species, such as nocturnal migrants, migrants and breeders in the prairie, and specific impacts to raptors should be studied further. It was also recommended that more behavioral and observational data be collected on avian species.

On what habitat, region or species would you want more information for bat issues?

The interviewees agreed that there is very little conclusive data available for bats. More information was recommended on all habitats, especially forested areas in the East and in California, agricultural areas, ridgelines and mountaintops.

Regions of particular interest were the East, Southwest, and Texas where interactions between bats and wind development was described as a complete unknown to many outside the state. Additional pre-construction data was requested for the West (are there bat flyways in California?) and Midwest. Appalachian forested ridgetops were of concern to many respondents who asked specifically to look at the region to determine if past kills reflect a broader problem.

Species of particular interest to respondents were red and hoary bats, Indiana bats, and Mexican freetail bats. One respondent noted that full seasons of data be collected on species to determine if it is adequate to perform studies in the spring through the fall only.

What are your priority research questions related to experimental design for birds and bats?

Reactions from respondents varied on the question of experimental design. Several interviewees mentioned that it is most important to figure out what the appropriate design is to answer a given research question, as the research question drives the design. Interviewees also emphasized that the methods used in a study are as important as study design, and that the methods should be reviewed to fit the particular site.

A number of respondents used this question as a forum to raise issue with current methods and point out areas for improvement. The parties expressed a need for more standardized monitoring and surveying in pre and post-construction, as well as a need for better methods in the following areas:

- estimating offshore fatalities;
- estimating bat exposure;
- using Nexrad information;

- remote sensing techniques;
- accounting for year to year variability;
- correlating observed passage rates to impacts;
- differences in scavenging rates for different avian species;
- incorporating detectability into monitoring;
- determining the relationship between pre-construction use and post-construction mortality;
- improving the ability to assess the probable numbers and locations of carcasses in an area; and
- designing studies that collect reliable data in 1-2 years instead of 3-5.

Where is there a lack of resources (financial, informational, logistical)?

Financial:

The majority of interviewees stressed the lack of financial resources for conducting necessary research. Besides requiring more funds for general research, respondents cited specific funding needs that included; more Federal and State funding and public financing so that most money is coming from sources other than industry, support for longer studies (3-5 years of pre and post construction), a larger budget for the Natural Resources Ecology Lab (NOREL) for support of projects, and the development of a pool of money that researchers can borrow from for pre-construction assessments.

Informational:

Several people mentioned the need for an adequate data management system, or a technical clearinghouse for storing and referencing data from research projects. One interviewee suggested a web-based data repository and management tool. The benefit of such a database would be the ability to fully understand data patterns and assist in the development of more meta studies.

Other informational resource needs mentioned were:

- an update of the 2001 comparative impact paper
- coverage of wide geographic scales to characterize the effects of regional and habitat variables
- access to information within industry's proprietary research

Logistical:

Respondents reported that there is a lack of logistical resources in gaining access to sites for surveying and monitoring.

Are current studies (either required or voluntary) in this field consistent with each other? Would consistent types of studies be an improvement?

The majority of respondents felt that current studies are not consistent. Specific instances of inconsistencies mentioned were in the collection of bat data, nocturnal avian radar studies, and guidance from Federal agencies.

The majority of those interviewed agreed that consistency is needed across studies. Basic and consistent designs could be dictated for studies that are then adjustable to site specifics. Interviewees stated that consistency among studies allows for meta analysis, in some instances can reduce the need for duplication of studies, can improve the overall quality of data, and can encourage a proactive approach to determining impacts. The respondents that favored consistency also provided a caveat that consistent measures should be flexible and that consistency should be paired with a study design that is appropriately tailored to the issue.

Some respondents encouraged the development of consistent minimum requirements on a Federal and State level in order to create consistency. One interviewee even mentioned that consistency could be achievable with the updated Federal Environmental Assessment guidelines that are being released in summer 2006. One or two other respondents believed that consistency in studies can be improved by peer review of the research. Another interviewee suggested that the NWCC Methods and Metrics document be updated to serve as a guide for how to standardize methods.

A couple of interviewees did not agree that consistency in studies is as important a factor. They felt that the most important aspect of a study is that the design is good and valid. They also noted that different types of studies encourage a divergence of thought and research design which may lead to new results.

Should/can steps be taken to standardize data so that information collected is comparable?

Most interviewees felt that the standardization of data collection and storage measures would be extremely helpful. Many believe that the creation of comparable data sets (collected and stored in an information clearinghouse, for example) will lead to better analysis of long-term and collective effects of wind development on wildlife. The kinds of data mentioned that would benefit from standardization included types of data, methods and the kinds of information that are collected (e.g. siting guidelines, site identification methods, altitude, habitat types, and lighting systems).

Permitting and reviewing agencies were suggested as outlets for encouraging or requiring standardization. Peer review was also mentioned as a means for increasing standardization. While standardization was encouraged, several people pointed out that required standards should be cost-effective, and that the analysis of the collected data should remain independent.

A few respondents did not feel that standardization of data was critical and suggested that not all sampling methods require standardization in order to achieve comparison. A primary component for data collection is that the study designs are good and that enough data is collected to form validated and reliable results. One respondent believed that Metrics should be standardized, but methods should not because standardization has its limits and there is a significant value in new methods. New methods should be combined with validated methods in order to maintain integrity but still allow for creativity and innovation in studies.

Survey Questions: Wildlife Research Gaps

1. What are 2-3 critical research questions that need to be asked for pre- and post construction avian issues on a national level? On a regional level?
2. What are 2-3 critical research questions that need to be asked for pre and post-construction bat issues on a national level? On a regional level?
3. What is a reasonable time frame for addressing these research questions?
4. Are there any other wildlife taxa (i.e. not birds or bats) in your region that are potentially affected? If so, please identify and list possible impacts.
5. On what habitat, region or species would you want more information for pre- and post-construction avian issues?
6. On what habitat, region or species would you want more information for pre- and post-construction bat issues?
7. What are your priority research questions related to experimental design for birds, for bats, or common to both?
8. Where is there a lack of resources (financial, logistical, informational) to address these questions?
9. Are current studies (either required or voluntary) in this field consistent with each other? Would consistent types of studies be an improvement?
10. Should/can steps be taken to standardize data so that information collected is comparable?

May we attribute these comments to you at the June Core Group meeting?

Survey Respondents

First Name	Last Name	Organization	Membership	Interview status
Dick	Anderson	California Energy Commission (retired)	Technical advisor	No response as of 6/12
Ed	Arnett	Bat Conservation International	Technical advisor	completed
Clait	Braun	Grouse Inc.	Technical advisor	completed
Mélanie	Cousineau	Environment Canada, Canadian Wildlife Service	CG	completed
Tim	Cullinan	Washington State Audubon	CG	completed
Noel	Cutright	We Energies	CG	Completed (response included comments from others in NGO community)
Martin	Damus	Environment Canada, Canadian Wildlife Service	CG alt	completed
Deanna	Dawson	USGS		No response as of 6/12
Jeff	Deyette	Union of Concerned Scientist	CG	completed
Terri	Donovan	USGS		completed
Sam	Enfield	PPM Atlantic Renewable	CG	
Wally	Erickson	Western EcoSystems Technology	Technical advisor	No response as of 6/12
Michael	Fry	American Bird Conservancy	CG alt	No response as of 6/12
Tom	Gray	American Wind Energy Association	CG	completed
Shalini	Gupta	Izaak Walton League of America, Midwest Office	CG	No response as of 6/12
Alex	Hoar	U.S. Fish and Wildlife Service	CG	No response as of 6/12
Laurie	Jodziewicz	American Wind Energy Association	CG alt	completed
Tim	Jones	US FWS		completed
Adam	Kelly	Detect, Inc.	Technical advisor	No response as of 6/12

Caroline	Kennedy	Defenders of Wildlife	CG	No response as of 6/12
Paul	Kerlinger	Curry & Kerlinger	Technical advisor	completed
Eric	Odell	Colorado Dept of Wildlife	WL WG (alternate for Dave Klute)	completed
Ron	Larkin	Illinois Natural History Survey	Technical advisor	No response as of 6/12
Jim	Lindsay	FPL Group	CG	No response as of 6/12
Andy	Linehan	PPM Energy	CG alt	completed
Todd	Mabee	ABR Inc.	Technical advisor	completed
Al	Manville	U.S. Fish and Wildlife Service	CG	No response as of 6/12
Laura	Miner	U.S. Department of Energy	CG	completed
Michael	Morrison	Texas A&M University	Technical advisor	completed
Jim	Newman	Pandion Systems	Technical advisor	No response as of 6/12
Allan	O'Connell	USGS		completed
Ellen	Paul	Ornithological Council	WL WG	completed
Karin	Sinclair	National Renewable Energy Laboratory	CG alt	completed
Shawn	Smallwood		Technical advisor	No response as of 6/12
Linda	Spiegel	California Energy Commission	CG	completed
Rick	Stamm	U.S. Bureau of Land Management	CG	No response as of 6/12
Dale	Strickland	Western EcoSystems Technology	Technical advisor	completed
Chris	Taylor	Horizon Wind Energy	CG	completed
Carl	Thelander	BioResource Consultants	Technical advisor	No response as of 6/12
Bob	Thresher	National Wind Technology Center	CG	No response as of 6/12
Greg	Turner	Pennsylvania Game Commission	Technical advisor	completed

Steve	Ugoretz	Wisconsin Department of Natural Resources Integrated Science Services	CG	completed
Terry	Yonker	Marine Services Diversified, LLC	Technical advisor	completed

ATTACHMENT C

Questions: Wildlife/Wind Energy Research Gaps

June 14, 2006

Compiled by Tim Cullinan in preparation for the June 20-21, 2006 NWCC Wildlife Core Group Meeting in Boulder, CO.

These comments were obtained by conducting an informal poll of representatives of wildlife conservation organizations familiar with the issues surrounding interactions of wildlife and wind energy. Their comments were edited and are summarized below. This is not an exhaustive list of research priorities recognized by the environmental community. Other individuals and organizations in the environmental caucus made additional comments independently to the NWCC.

Contributors to this paper were:

Keith Bildstein	Hawk Mountain Sanctuary
Greg Butcher	National Audubon Society
Tim Cullinan	Audubon Washington
Mike Denny	Blue Mountain Audubon Society
Garry George	Los Angeles Audubon Society
Shirley Muse	Blue Mountain Audubon Society
Gil Randell	Hawk Migration Association of North America
Curtis Smalling	Audubon North Carolina

What are the critical research questions that need to be asked for *pre-construction* avian issues?

What is the minimum duration and extent of pre-construction bird inventories necessary to adequately assess risk? There seems to be a great deal of blind faith in the assertion that one year or one season is sufficient, yet we have no empirical evidence that this is true.

How do you measure risk? Are there topographic, vegetation, or meteorological factors that will allow us to anticipate areas of high bird density, if any, and the zones of bird risk? Are there species that are more predisposed to fly at altitudes that coincide with the rotor-swept area? Are there ways to build predictive models that will allow us to anticipate the dates, seasons, and weather conditions that are the safest/riskiest for migratory birds?

What is an acceptable level of risk? Are there areas where the potential risks are so high that wind development should either be avoided altogether or more scrupulously studied before construction? [These may be a policy question, not scientific ones. The Europeans are far ahead of us in answering these questions. Why is there not more study of the European literature to help us with this?]

Post-construction avian issues?

What are the cumulative effects of wind energy development in North America? This question applies to 1) mortality caused by collisions, 2) habitat loss and fragmentation, and 3) ability of rare species to effectively utilize habitat (avoidance behavior effects). Current assessment of impacts has looked only at individual energy facilities, not at additive impacts. What will the cumulative effects be over the next fifteen to twenty years? Some U.S. Department of Energy projections predict that the amount of energy generated by wind will increase from the currently less than 10,000 MW to approximately 100,000 MW by 2020.

At present, it is not possible to reliably answer these questions due to the paucity of data on post-construction impacts. There is a need to conduct credible post-construction mortality monitoring at *all* major wind energy facilities, using standardized, peer-reviewed, transferable protocols that allow us to make comparisons among different sites, then use these data in a meta-analysis to answer questions such as: What distinguishes sites with high mortality from those with low mortality (at both the macro and the micro scales)? Under what conditions are turbines most dangerous to birds? What are the influences of time of day, time of year, lighting conditions, topography, habitat or land use (e.g. wheat fields vs. rangeland vs. native prairie), size and spacing of turbines, design of turbines, configuration of turbine strings? What are impacts over the long term? (There is a need for monitoring to continue more than a few years after construction, because patterns of bird migration and wildlife habitat use change over time.)

At a minimum, there must be a commitment on the part of wind energy facility operators to allow research on post-construction impacts. This includes permitting access by researchers to operational sites to conduct assessments of bird and bat mortality. There must also be a concerted effort to obtain data in those parts of the continent where little or no post-construction monitoring has been done.

Some of these high priority research questions also apply at the site-specific scale. We are only beginning to address questions about habitat loss and fragmentation and avoidance behavior. This research should continue. What are the impacts of roads, transmission lines, met towers, substations, noise, and lighting? What is the impact of removing or fragmenting habitat to make way for turbines? Some bird and mammal species are specifically adapted to forests on ridge tops. E.g. during migration, the Broad-winged Hawk depends on ridge top forests for roosting habitat. How will clearing these forests impact such species?

Pre and post-construction bat issues?

All questions that apply to birds also apply to bats. However, the questions regarding cumulative effects are particularly important for bats because bats have much lower fecundity rates than birds, and therefore cannot recover from mortality events as quickly.

Are these questions critical for your region only or nationally?

The questions regarding risk analysis and the need for a broad scale meta- analysis apply nationally. As noted above, some questions regarding impacts on habitat may apply only regionally.

Are there any other wildlife taxa in your region that are potentially affected? If so, please identify and list possible impacts.

There is a need for research on impacts on fossorial mammals—does vibration have impacts on burrowing species such as Washington ground squirrel, a threatened species?

What habitat, region or species would you want more information on for pre-construction avian issues? Post-construction avian issues? Pre and post-construction bat issues?

The need for better information on bird/bat behavior and habitat use to support risk assessment applies to all regions of the continent where there is likely to be the most development of wind energy.

As noted above, there has been almost no research or monitoring on the impacts of wind facilities in the southern Great Plains region. This is particularly true in Texas and Oklahoma.

Are there any priority research questions related to experimental design for birds, for bats, or common to both?

Are there better ways to conduct operational phase monitoring to detect songbird mortality? Are some carcasses being missed? Are the assumptions about detectability of carcasses valid? Are there better ways to test these assumptions than the current methods using placement of known carcasses to test ability of observers?

Where is there a lack of resources (financial, logistical, informational) to address these questions?

This could be the topic for an entire symposium. There is always a lack of resources to address conflicts over natural resources.

Part of the problem is that the cost of answering these questions almost always falls on the developer. In most states counties have the sole permitting authority, and state or federal permitting agencies are rarely involved. Consequently, we have a piecemeal, site-by-site approach that fails to standardize monitoring protocols and does not allow us to build a meta-database to address the high priority questions on a regional or continent-wide scale, or to address cumulative effects.

ATTACHMENT D

- *DISCUSSION DRAFT* -

Available for Release to the Public

Prioritized² Research Needs and Information Gaps Regarding the Impacts of Wind Facilities on Wildlife and Their Habitats – Key Questions Which Should Be Addressed

[Wind Energy Research Priorities & Information Needs.doc]

Prepared by: Al Manville
U.S. Fish & Wildlife Service
Division of Migratory Bird Management, Arlington, VA
Last Updated: June 16, 2006

I. PRE-CONSTRUCTION NEEDS

A. Potential Impacts to Wildlife Trust Resources

1) How do birds and bats use airspace on a temporal and spatial basis in and around areas proposed for wind development?

a) Have any assessments been conducted to critique spatial and temporal use of airspace by birds, bats, and insects (food for birds and bats) during the daytime, at night, season-to-season, year-to-year, and during inclement weather?

b) What are the best tools available to assess use of airspace – *e.g.*, modified marine radars, thermal imaging, acoustic monitoring, night-vision scopes, radio telemetry, mist nets, point counts, NEXRAD, other technologies?

c) What are the capabilities and limitations of these tools?

d) Should 1 tool from the options above be used to “ground-truth” another?

e) Should research protocols that assess temporal and spatial use of airspace be developed in a consistent way, capable of being stepped down to the regional and local levels?

² Please note that this list has yet to be vetted to FWS staff, members of the Agenda Committee, members of the Wildlife Workgroup’s Core Group, or other interested stakeholders for feedback and review. It represents issues of particular interest, concern, and need which the Service hopes will be addressed in regard to the development of wind energy and its impacts on wildlife trust resources and their habitats. This document is being made available for public distribution for purposes of discussion.

f) Should such protocols be peer-reviewed and published in refereed scientific journals? What other review options are appropriate?

g) What duration should be used (1-2 seasons, 2-3 years) and at what frequency (daily/nightly vs. weekly, bi-monthly, every 3 weeks) to assess use of airspace?

h) What constitutes a scientifically “appropriate” level of analysis and review? Which provides most meaningful results and at what cost?

i) Since songbirds frequently migrate in “broad fronts” -- *e.g.*, en mass from the Rocky Mountain Front to the Atlantic Ocean – which varies between seasons and between years in concentration and timing – how can the most bird- (and presumably bat-) friendly locations be best determined?

j) What methods are best for identifying bird and bat flight paths through a proposed wind facility and can turbines be realistically sited away from known flight paths to minimize collisions – given the information above?

k) How do birds and bats use mountain ranges and mountain-top ridges during breeding season and migration?

l) Do estimates of “background/natural/compensatory mortality” made available prior to facility installation provide useful information for siting facilities?

m) What metric(s) regarding bird and bat use at a site is most appropriate for use when making a comparison to another site(s) – should it be birds and/or bats seen per unit area/hour, “flying vertebrates” detected below 200 m AGL airspace/season using radars or thermal imagery, number of birds and bats detected acoustically/hour/turbine, or another metric?

2) How should data from pre-construction studies of avian and bat abundance and utilization be applied to impact studies from post-construction monitoring and assessments? What is the best way to scientifically validate (or negate) a hypothesis developed from pre-construction assessment that the site will minimally impact trust resources and their habitats once constructed?

a) What specific types of data are collected during pre-construction monitoring?

b) Are these datasets the best and most useful for comparing impacts garnered from post-construction monitoring?

c) Would the development of a consistent, scientifically sound protocol be helpful for comparing pre- and post-construction studies? If so, what specifically would be needed?

3) Are there sufficient scientific data and information regarding minimal use and presence of trust wildlife resources at a proposed wind development site to eliminate or at least minimize the need for pre-construction monitoring at a specific proposed site?

a) What current/recent datasets are available that validate minimum use of a site by birds and/or bats – radar, thermal imagery, point counts, other surveys, natural heritage databases, GIS information, telemetry data, others?

b) How close to and under what similar conditions do operating sites need to be to compare research findings from operating sites to adjacent proposed sites for wind development that would eliminate the need for pre-construction monitoring?

c) What constitutes “historical” data (how far back)? Given (often rapid) changes in habitat composition, species presence, and climatic variation are historical data useful in predicting impacts?

d) How does the British Government make that determination under their DEFRA offshore wind regulations? How does the German Institute of Avian Research view these datasets?

B. Potential Impacts to Wildlife Habitats

1) What, if any, studies have been conducted on “surrogate structures” (*e.g.*, communication towers, power transmission towers, oil/gas facilities, well heads, and fences) in proximity to a site being proposed for wind development to assess potential impacts from future wind facilities on wildlife trust resources and their habitats?

2) What pre-construction monitoring/evaluation have been conducted attempting to assess likely indirect impacts and effects of a proposed wind facility on:

a) Reduced nesting/breeding density?

b) Loss of population vigor and overall density?

c) Habitat and site abandonment, and increased isolation between patches?

d) Loss of refugia?

e) Attraction to modified habitats?

f) Effects on behavior including stress, interruption, and modification?

g) Disturbance, avoidance, displacement, and habitat unsuitability?

C. Assessing and Ranking Bird- and Bat-friendly Sites

- 1) Are there any protocols in place which are (could) being used to assess and rank potential wind development sites – *e.g.*, FWS Potential Impact Index protocol, U.K. DEFRA assessments, German Avian Institute protocols, others?
- 2) Have any of these protocols been validated through use and scientific peer review?
- 3) If such protocols are being used, do they provide sufficient information and delineate specific risk to justify their use and the time and expense necessary to perform them?
- 4) Would documents like the electric utility *Suggested Practices* manuals be of use to the wind industry, trust agencies, consultants, researchers, and other stakeholders if they could be developed, peer reviewed, and made available to the wind industry? How long might it take to create such a manual?
- 5) Would a scientifically sound, consistent type protocol for assessing and ranking sites be useful, provided it can be stepped down to the regional as well as local levels?
- 6) Does an assessment and ranking process help to forecast likely future impacts to birds, bats, and their habitats? If not, what might work?
- 7) How do we characterize the difference between risk and impact assessment in regard to wind development?
- 8) What specific information/data are needed to perform scientifically valid and robust risk and impact assessments? Are existing probability models for predicting risk valid? If not, what would need to be improved to make them useful? What risk predictions are most important to help make models more reliable? How should impact be predicted in the most scientifically valid way? Is there a need for consistent, scientifically valid, risk and impact assessment models?
- 9) What should constitute risk and impact assessment for assessing potential sites for future development? Should there be scientifically accepted protocols to perform these assessments?

II. DURING- AND POST-CONSTRUCTION NEEDS

A. Impacts to Wildlife Trust Resources

- 1) What tools are available to credibly count carcasses – *e.g.*, linear and concentric circular transects (with use of dogs), catchment nets, thermal imagery validation, Bird Strike Indicator technology, others?
- 2) What metrics are most comparable between sites for assessing mortality at different wind facilities – *e.g.*, birds and/or bats killed/turbine, birds and/or bats killed/kWh, birds and/or bats killed per rotor swept area, or another variable?

- 3) Do these metrics (above) account for variability of documented mortality within a specific facility such as increased mortality at end-of-row turbines, turbines in gaps, and turbines on steep slopes?
- 4) How and why are birds, bats and insects attracted to turbines (if they are)? What appears to be the specific mechanism? What role, if any, do blade-tip vortices, clear-air turbulence, inclement weather, lighting, sound, and other conditions play in attracting “flying vertebrates” and insects?
- 5) Is there a difference in the mechanism(s) of attraction for raptors, passerines, waterbirds, and other suites of avifauna?
- 6) What happens to small birds and bats when they are struck by rapidly moving blades?
- 7) How helpful are trained dogs in finding dead bird and bat carcasses and injured animals? Is dog use a scientifically valid procedure?
- 8) How quickly do scavengers (*e.g.*, crows, ravens, foxes, coyotes, and skunks) learn that turbines may equate to “meals” regarding the presence of bird and bat carcasses due to strikes?
- 9) Does the size, composition, and state (*i.e.*, frozen or thawed) of species used in scavenger removal and searcher efficiency trials matter for these trials? Is there a “best” surrogate? Should killed birds be left in place during scavenger removal studies? Would this confound scavenger removal results?
- 10) What is the most scientifically sound protocol(s) for comparing pre-construction assessment data to post-construction impact monitoring when attempting to validate or refute whether pre-construction risk and impact assessments/estimates were actually scientifically valid?
- 11) Which pre-construction risks and impacts are most useful for determining the selection of the most suitable habitats for siting wind facilities based on post-construction monitoring?
- 12) Does the Before-After Control Impact (BACI) design allow for determination of significant changes in bird and bat behavior once wind facilities are installed? Specifically, does BACI design allow for determination of changes in bird and bat migration, nesting/brooding, feeding/foraging, resting, and loafing?
- 13) What duration, frequency, and size of studies are most scientifically valid and appropriate for assessing mortality at a site? What are acceptable scavenging removal and searcher efficiency (*i.e.*, based here on the duration between carcass searches) biases?

14) How does the scientific community including biometricians feel about large interval searches?

15) What levels of “take” are being documented regarding [2003] *Birds of Conservation Concern* frequently retrieved during post-construction mortality studies? Is this mortality additive to existing natural mortality to these trust species? What are the cumulative impacts of wind facilities on birds and bats (if these impacts can be determined)?

B. Impacts to Habitats and Indirect Impacts to Wildlife

1) In addition to direct mortality impacts, have post-construction assessments been viewed in light of indirect impacts – *e.g.*, reduced nesting/breeding density, loss of population vigor and overall density, habitat and site abandonment, increased isolation between patches, fragmentation, loss of refugia, attraction to modified habitats, effects on behavior (stress, interruption, and modification), disturbance, avoidance, displacement, and habitat unsuitability? Specifically, what variables have been analyzed?

2) What studies have been performed to assess indirect impacts from wind facilities, especially to grassland/sage/steppe obligate songbirds and “prairie grouse”?

3) What are the long-term impacts of wind facilities on avian and bat populations (*e.g.*, 2004 Univ. Birmingham, UK, studies raise troubling concerns about long-term impacts of wind facilities on avian populations in Europe)?

III. DETERRENTS, MITIGATION, OTHER PROTECTIVE MEASURES

A. Deterrents

1) How effective are blade feathering/seasonal shutdowns, blade painting (specifically which designs), end-of-row pylons acting as bird diverters, reduction in prey base, minimizing burrowing of fossorial mammals, (further) minimization in lighting (specifically strobes), sound (ultra-sound and infrasound), removal of structures of attraction (*e.g.*, rock piles), bird flight diverters on power line wires, and other tools?

2) Is there any deterrent that works better than another for terrestrial wind facilities? Is there any deterrent which has been shown to be statistically significant in reducing strikes?

3) Are current FAA-recommended wind facility lighting regimes (*i.e.*, 1-2 red strobes on top of nacelles, every 3rd to 5th turbine lit, lights flashing synchronously at night in the entire facility) most effective in reducing avian, bat and insect attraction to wind facilities?

B. Mitigation

1) Does relocation of turbines documented to kill a greater proportion of birds and/or bats reduce mortality? What decisions need to be considered in the relocation of problem turbines? How many turbines may need to be moved at particular sites? How would that conclusion be reached?

2) Is it possible to synchronize turbines within entire rows/strings, and would synchronization reduce mortality? How could this be validated?

3) Where site disturbance, habitat fragmentation, and site avoidance by birds and/or bats has been documented, what practices should be employed to compensate for habitat loss? How should this selection best be scientifically determined?

C. Other Needs?

ATTACHMENT E

Options discussed for how to develop a list of priority research questions, based on three documents received by Wildlife Workgroup Core Group members before the meeting.

Option 1: Work to identify which research questions can currently be answered in a collective forum, without the need for more research.

- Some members felt that many of the research questions had been worked on to some extent for the past several years, without agreement. So the meeting attendees might find it difficult to agree on what collective knowledge is relating to those issues.
- Industry representatives noted the difficulty in building partnerships and funds to do research on these complex issues. Prioritization of the most critical research questions would help utilize available funds and resources as efficiently as possible.

Option 2: Create a table with 2 axes; priority level (high, medium, low) and amount of info currently collected (a lot, some, a little, none). Then place each identified research gap into the table.

Option 3: Distill the list into mechanisms for why fatalities are happening, how we can solve the problem, and whether there are indirect impacts. Mechanisms could include:

- Migratory vs. resident populations
- Local conditions that concentrate birds and bats
- Inclement weather
- Lighting

Option 4: Work with Al Manville's information gap document to begin prioritizing the issues listed.

Option 5: Sort the list of research questions into three categories and subcategories.

- Pre-construction site assessment
 - Is there a national risk, broad in scope?
 - Is there a regional risk?
 - Is there a knowledge risk?
- Post-construction or validation issues,
 - Is there a national risk, broad in scope?
 - Is there a regional risk?
 - Is there a knowledge risk?
- Mechanistic research (rather than assessment or monitoring)
 - Is there a national risk, broad in scope?
 - Is there a regional risk?
 - Is there a knowledge risk?

Option 6: Prioritize the list of research gaps by looking at risk by region and species.

- Regions/country
 - Problems?
 - Fatalities
 - What we know
 - What we don't know
 - Mechanisms: behavior, abundance
 - Habitat impact/displacement
 - Population Effects

- Risk Prediction and Impact
- Groups of wildlife that seem to be at most risk
 - Problems?
 - Fatalities
 - What we know
 - What we don't know
 - Mechanisms: behavior, abundance
 - Habitat impact/displacement
 - Population Effects
 - Risk Prediction and Impact

ATTACHMENT F

DRAFT

NATIONAL WIND COORDINATING COMMITTEE WILDLIFE WORKGROUP CORE GROUP Summer 2006



Prioritized Research Needs Related to Wind/Wildlife Interactions

Growing demands for clean energy have increased the need to address real and perceived issues associated with impacts of wind development on wildlife and habitat. While there are many research activities at prospective and developed sites across the country that look into various research questions, there is not a national research strategy or program in the United States. Additionally, in various states across the country there is an increasing effort to better understand the dynamics of wind and wildlife, and habitat, on a case by case basis.

In the past the NWCC Wildlife Workgroup has tried to anticipate and follow research in the United States, Canada, and Europe. Five National Wildlife Research Meetings have been held since 1994 where various experts shared their research and results. Additionally, the Wildlife Workgroup has in the past developed lists of research needs.

In the last few years many people including, but not limited to, the wind industry, state agency staff, wildlife specialists in universities, non-governmental representatives, and federal agency staff have become interested in better understanding the dynamics between wind and wildlife issues and addressing these questions with high quality research to address how to minimize the negative impacts of wind development on wildlife and habitat.

In preparation for this prioritization discussion, RESOLVE staff conducted phone surveys with NWCC Wildlife Work Group Core Group members and technical advisors to draw out critical research questions that need to be addressed. A draft “white paper” summarizing responses from the phone interviews was drafted by staff and distributed prior to the meeting. In addition, two additional memos were distributed to meeting participants. A memo prepared by Tim Cullinan, Washington State Audubon, summarizing an informal poll of representatives of wildlife conservation organizations. And another memo drafted by Al Manville, US FWS, was circulated. This white paper attempts to summarize the research questions that need to be addressed and proposes a list of priorities to offer guidance on which items to fund first.

This paper is organized into three sections:

- Potential Impacts to Wildlife;
- Potential Impacts to Habitat; and
- Risk Assessment.

This is the first of many drafts, as consensus was not achieved for each research question. The Wildlife Work Group Core Group hopes that by setting out this paper it will generate

dialogue and debate. A hope of the group is for this brief to catalyze agreement on the critical issues surrounding the wind/wildlife debate and to have this information precipitate the necessary research.

A. Potential Impacts to Wildlife (Trust) Resources

1) How do birds and bats use airspace on a temporal and spatial basis in and around areas proposed for wind development? Metrics?

High Priority

2) Pre-construction. How do you predict what fatalities will occur, what data do you need to collect to accurately predict fatality impact? (e.g. presence, abundance, species, season, weather, stop over site)

High Priority

3) Post-construction. What data do I need to have to validate estimates?

What contributed to fatalities, was this data set incorporated into estimates? (May depend on the habitat are working in.)

Conditionally, High Priority - *Most Core Group members felt this question deserved a high priority status, although noted that it may not be a high priority in every situation. It is important to validate methods the first few times, then develop mitigation efforts. A high priority should be placed in situations where not much is known. In situations where there is enough confidence in validation models the question may not be a high priority.*

B. Potential Impacts to Wildlife Habitats

1) What studies need to be conducted to assess likely indirect impacts and effects of a proposed wind facility on:

- a) Altered nesting/breeding density?
- b) Loss of population vigor and overall density?
- c) Habitat and site abandonment, and increased isolation between patches?
- d) Loss of refugia?
- e) Attraction to modified habitats?
- f) Effects on behavior including stress, interruption, and modification?
- g) Disturbance, avoidance, displacement, and habitat unsuitability?
- h) habituation
- i) modification of related ecological processes?

Medium/High Priority

2) What are appropriate surrogate structures, and what do we know about them? If any studies have been conducted on “surrogate structures” (e.g., communication towers, power transmission towers, oil/gas facilities, well heads, and fences) in proximity to a site being proposed for wind development to assess potential impacts from future wind facilities on wildlife trust resources and their habitats? Is it valid to use surrogate studies to determine impact of wind facilities?

Medium Priority

C. Risk Assessment

1) What should a good predictive model to assess risk to a local and/or regional population include? (e.g. model that captures exposure, behavior, presence, magnitude, abundance)

Medium/High Priority - *Prioritization may depend on what sector you represent (USFWS, State agency, industry etc.) in light of areas of responsibility and availability of resources. Issues the group grappled with related to communicating the true definition of risk assessment, identifying the magnitude of risk to a species. One industry representative determined this question to be of low priority because he believes that an accepted model for risk assessment is far from being developed.*

2) How does the risk manager use the risk assessment to make a decision regarding whether to permit a facility? When is the risk too big, how do you deal with uncertainty, magnitude? *The group was unable to prioritize this question and discussed how risk management depends on who you are (Federal, State, industry, NGO) and what is required to help the decision maker.*

D. Assessing and Ranking Bird- and Bat-friendly Sites

1) What should a scientifically sound, consistent type protocol include to assess sites? What decision maker would use the model? (industry, federal, state, local agency?) Are there existing protocols that we could adopt (COWRIE, DEFRA, planning for alternative corridors for transmission (PACT), suggested practices manual)?

Medium/High Priority - *For this question the group was somewhat split. Industry representatives felt this was of medium-high priority while Federal and State agency representatives, along with consultants, believed it to be of high priority. The two groups were looking for different tools; one for assessing risk to a project or company, and another to assess risk to trust species.*

DURING- AND POST-CONSTRUCTION METHOD NEEDS

E. Impacts to Wildlife Trust Resources

1) Peer review of protocols specific to wind development, being used for pre construction and post construction monitoring assessment. Recognize the need to allow for innovation, feedback mechanisms, continual input of new findings and discoveries.

Medium/High Priority - *The group discussed the need for a mechanism to review protocols, perhaps review by an independent body of researchers and storage in a clearing-house. Some participants felt that Agency employees would benefit from a peer reviewed protocol because they do not always have the substantive expertise and would feel more confident in the protocol's validity if it had undergone peer review. Additional considerations for peer review of protocols were the extra time required to undergo review, and the extra cost of the service.*

Al Manville will help NWCC staff in developing an attachment listing what would be peer reviewed. The list would include:

- a. What tools are available to credibly count carcasses – *e.g.*, linear and concentric circular transects (with use of dogs), catchment nets, thermal imagery validation, Bird Strike Indicator technology, others?
- b. What metrics are most comparable between sites for assessing mortality at different wind facilities – *e.g.*, birds and/or bats killed/turbine, birds and/or bats killed/kWh, birds and/or bats killed per rotor swept area, or another variable?
- c. Do these metrics (above) account for variability of documented mortality within a specific facility such as increased mortality at end-of-row turbines, turbines in gaps, and turbines on steep slopes?
- d. How and why are birds, bats and insects attracted to turbines (if they are)? What appears to be the specific mechanism? What role, if any, do blade-tip vortices, clear-air turbulence, inclement weather, lighting, sound, and other conditions play in attracting “flying vertebrates” and insects?
- e. Is there a difference in the mechanism(s) of attraction for raptors, passerines, waterbirds, and other suites of avifauna?
- f. What happens to small birds and bats when they are struck by rapidly moving blades?
- g. How helpful are trained dogs in finding dead bird and bat carcasses and injured animals? Is dog use a scientifically valid procedure?
- h. How quickly do scavengers (*e.g.*, crows, ravens, foxes, coyotes, and skunks) learn that turbines may equate to “meals” regarding the presence of bird and bat carcasses due to strikes?
- i. Does the size, composition, and state (*i.e.*, frozen or thawed) of species used in scavenger removal and searcher efficiency trials matter for these trials? Is there a “best” surrogate? Should killed birds be left in place during scavenger removal studies? Would this confound scavenger removal results?
- j. What is the most scientifically sound protocol(s) for comparing pre-construction assessment data to post-construction impact monitoring when attempting to validate or refute whether pre-construction risk and impact assessments/estimates were actually scientifically valid?
- k. Which pre-construction risks and impacts are most useful for determining the selection of the most suitable habitats for siting wind facilities based on post-construction monitoring?

- l. Does the Before-After Control Impact (BACI) design allow for determination of significant changes in bird and bat behavior once wind facilities are installed? Specifically, does BACI design allow for determination of changes in bird and bat migration, nesting/brooding, feeding/foraging, resting, and loafing?
 - m. What duration, frequency, and size of studies are most scientifically valid and appropriate for assessing mortality at a site? What are acceptable scavenging removal and searcher efficiency (*i.e.*, based here on the duration between carcass searches) biases?
 - n. How does the scientific community including biometricians feel about large interval searches?
 - o. What levels of “take” are being documented regarding [2003] *Birds of Conservation Concern* frequently retrieved during post-construction mortality studies? Is this mortality additive to existing natural mortality to these trust species? What are the cumulative impacts of wind facilities on birds and bats (if these impacts can be determined)?
- 2) Methodologies are needed to look at bat fatalities (abundance of bats in an area, how to use information available on bat fatalities).
Add material, Linda Spiegel and others to help review what other methodology needs there are.

DETERRENTS, MITIGATION, OTHER PROTECTIVE MEASURES

F. Deterrents

- 1 a) What types of deterrents and turbines designs are the most effective?
Evaluation of effectiveness is needed.
- b) Is one lighting protocol better than another?

Low-High Priority – *The group believed that methods of deterrents should be evaluated.*

G. Mitigation Techniques

- 1) Which of the various mitigation techniques available and are most effective at a particular site? (e.g. synchronizing turbine strings, repowering with different size turbines, painted blades, sound or visibility techniques, and the possible use of shut downs in limited circumstances species and times.)

High Priority – *The group discussed the need for evaluation of mitigation measures. All members were not able to agree on the validity of shutdowns as a mitigation method. Most members were able to agree that shutdowns could be used in limited circumstances, but others remained firm that shutdowns were an absolute last resort because of their economic impact.*

- 2) Where site disturbance, habitat fragmentation, and site avoidance by birds and/or bats has been documented, what practices should be employed to compensate for habitat loss? How should this selection best be scientifically determined?

***High Priority** – While some members of the group voted this question as a high priority, they pressed that there needs to be agreement on thresholds for compensating for habitat loss, otherwise different developers could attempt to determine their own mitigation efforts which could add to competition among developers.*

H. Other Needs?

ATTACHMENT G

DRAFT AGENDA



NATIONAL WIND COORDINATING COMMITTEE
WILDLIFE CORE GROUP MEETING
to be held at
NREL's National Wind Technology Center
18200 State Highway 128, Boulder, CO
June 20-21, 2006

Meeting Purpose:

The Wildlife Workgroup Core Group will prioritize research gaps related to wind/wildlife interaction in preparation for a gaps discussion at the November Wildlife Research VI Meeting. A secondary purpose for the meeting will be for the group to discuss peer review procedures and options for NWCC publications.

Day One: Tuesday, June 20, 2006

8:45 – 9:00 am *Check-in*

9:00 – 9:30

Welcome & Introductions

Abby Arnold, RESOLVE

- Introductions
- Review purpose of meeting
- Review and adopt agenda

9:30 – 11:30

Priority Research Items Related to Wind/Wildlife Interactions

*Abby Arnold, RESOLVE
Core Group Members*

A. Review Survey Results

B. Discussion of Gaps/Priority Items Collected by NWCC Staff

- a. Does the list include all priority research gaps?
- b. Is there a better way to sort the list of gaps? (study design, detection, mechanism of mortality, mitigation, etc.)³
- c. What would your priorities be for top, near and long-term research gaps?
- d. What would you list as criteria for

³ See Proceedings from the Bats and Wind Power Generation Technical Workshop, February 19-20, 2004. Sponsored by BCI, USFWS, USDOE NREL, and AWEA.

prioritization?

- Members who proposed research item describe its importance
- Add any additional priorities not already captured and combine similar priorities as warranted

Group discussion on items

11:30 – 11:45 **Break**

11:45 – 12:45 **C. Prioritization Exercise**
Through an exercise the group will choose the priority topics and see if there is consensus.

*Abby Arnold, RESOLVE
Core Group Members*

12:45 – 1:45 **Lunch**

1:45 – 2:45 **Reconvene Prioritization Exercise (if necessary)**

*Abby Arnold, RESOLVE
Core Group Members*

2:45 – 3:15 **D. White Paper & November Presentation
(NWCC staff will draft the white paper
describing the priority)**

- Schedule for writing and reviewing the white paper
- Discuss desired outcomes from this exercise and how/who will present the white paper at the November meeting

Abby Arnold, RESOLVE

3:15 – 3:30 **Break**

3:30 – 4:00 **Review Current Status of Wildlife Research VI Meeting**

Abby Arnold, RESOLVE

4:00 – 5:00 **Update on Other Current Research Activities**

Core Group Members

5:00 pm **Adjourn Day 1**

5:00 – 6:00 **Optional Hike or Tour of Wind Facility**

Day Two: Wednesday, June 21, 2006

8:30 – 9:00 am **Reconvene and Recap from Day 1 Discussions**

Abby Arnold, RESOLVE

9:00 –9:30	<u>Subgroup Updates</u>	<i>Madeleine West, RESOLVE</i>
9:30 – 11:30	<u>Peer and Expert Review Options and Proposed Review Process for NWCC Documents</u>	<i>Abby Arnold, RESOLVE</i>
	A. Presentation: Overview of Peer Review Options	
	B. Recent Documents That Have Raised Peer Review Questions	
	➤ Nocturnal Subgroup: companion to Methods and Metrics document	
	➤ November Research Meeting VI Proceedings	
	<i>Group discussion of ways to proceed in the future</i>	
11:30 – 12:00	<u>Wrap-up and Next Steps</u>	<i>Abby Arnold, RESOLVE</i>
12:00 pm	<u>Adjourn</u>	