

**Decision Framework Workshop:
A Summary of a Workshop Held
September 15, 2008
National Renewable Energy Laboratory
Golden, Colorado**

**WIND TURBINE GUIDELINES ADVISORY
COMMITTEE FEDERAL ADVISORY
COMMITTEE MEETING #5**

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Adaptive Management

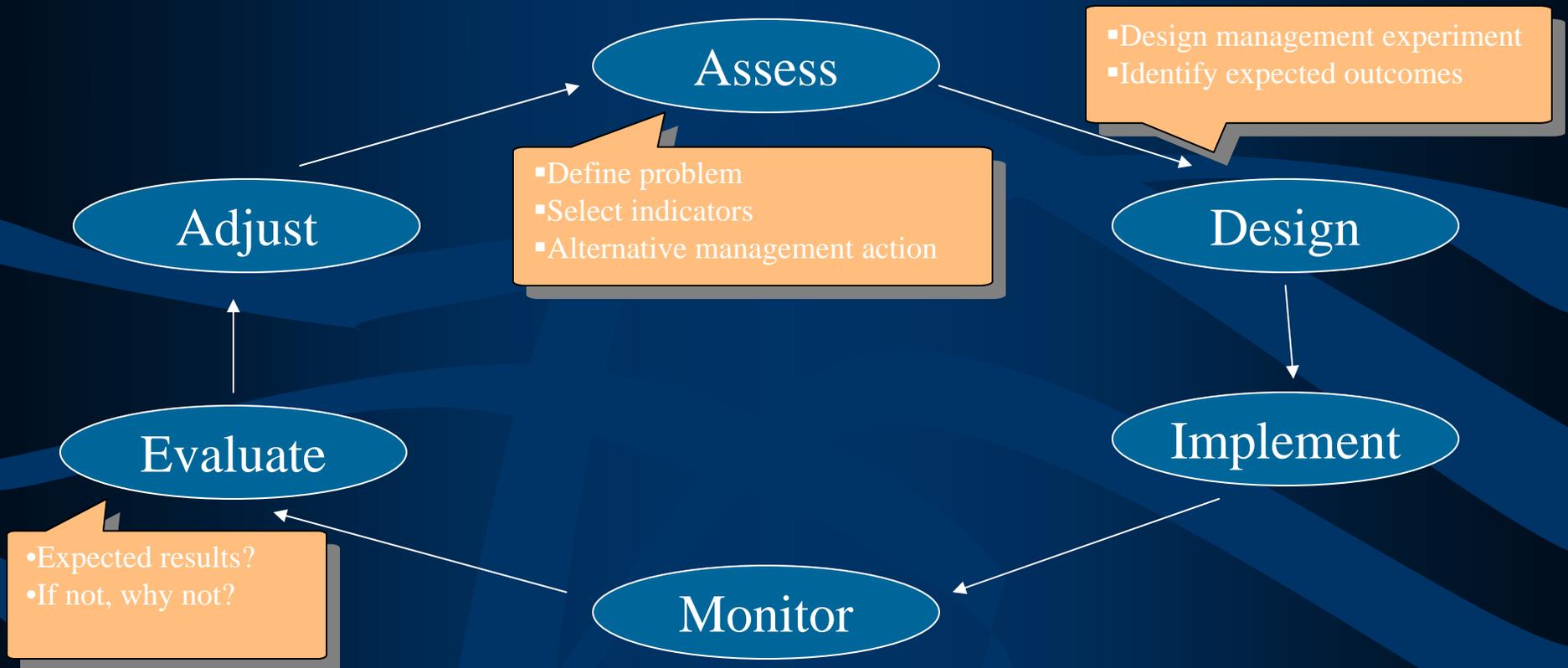
*“Management by
experiment.”*

*- Carl Walters,
University of British
Columbia*

*““Managing in the face of
uncertainty, with an emphasis
on its reduction.”*

*- B.K. Williams and F.A.
Johnson, USGS-BRD*

The Six Steps of Adaptive Management



➤ Adaptive management is a problem-solving approach to resolve uncertainty

➤ Uncertainty in management is an Adaptive Management learning opportunity

Conclusions Relevant to Wind Energy Development

- Within facilities
 - Adaptive management is a logical and efficient approach to managing risk in existing facilities in the face of uncertainty (e.g., facility modification to reduce avian risk, design of future phases of development)
- Among facilities
 - Large scale application (multiple facilities) to solve common problems has potential (e.g., bat deterrence, FAA lighting)
- Development uncertainty may be an issue

Structured Decision Making

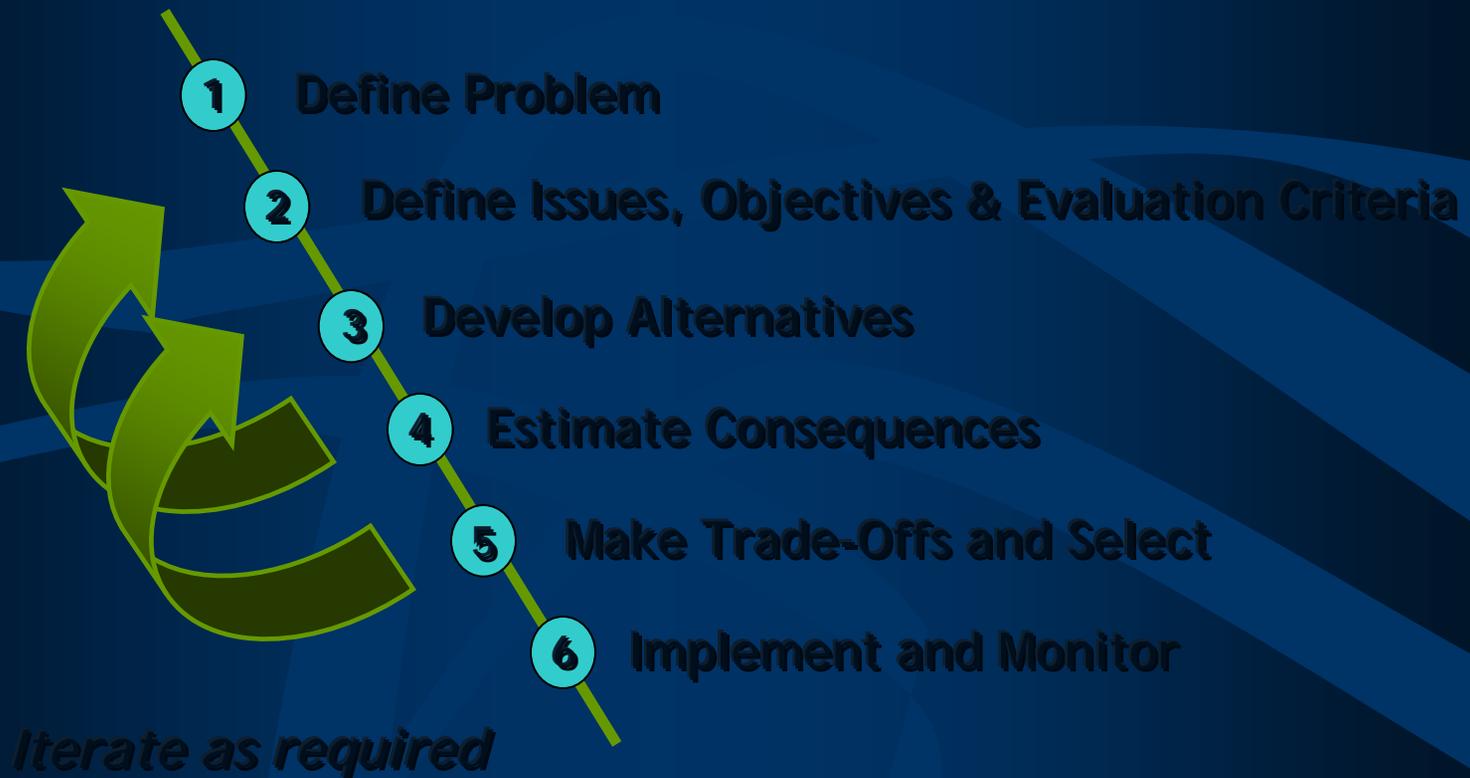
Excerpts from a presentation by

Robin Gregory

Decision Research

“A formalization of common sense for decision problems which are too complex for informal use of common sense.” (*Ralph Keeney*)

Steps in structured decision making



Introduction to SDM - Example

- In this example, our objectives might be to:
 - Minimize bird deaths
 - Possible indicator(?): expected number of bird deaths per year
 - Minimize cost
 - Possible indicator(?): Levelized \$ per year
 - Minimize visual impacts
 - Possible indicator(?): scale, where 1= Worst and 0= Best

Using SDM, develop a matrix or consequence table:

| Objective | Indicator | Alt A | Alt B | Alt C |
|-------------------------|--|-------------|--------------|--------------|
| Minimize Bird Deaths | Expected number of bird deaths per year (50 th %ile estimate) | 5,000 | 200 | 200 |
| | Expected number of bird deaths per year (10 th %ile estimate) | 2,000 | 10,000 | 2,000 |
| Minimize Costs | Levelized \$ per year | \$ 1million | \$ 2 million | \$ 3 million |
| Minimize Visual Impacts | Scale (1= Worst and 0= Best) | 0 | 1 | 1 |

Summary of SDM

- A decision-focus leads to a different emphasis when evaluating risks
 - Compares choices across multiple objectives
 - Clearly defines measures of performance for each objective
 - Includes multiple alternatives
 - Links consequences to objectives, and includes estimates of uncertainty
 - Examines tradeoffs explicitly
- These steps are necessary to defensibly address the key questions identified earlier:
 - 1) Information needed to understand the impacts of wind turbines on wildlife
 - 2) Decide whether these impacts to wildlife are acceptable (issue permit?)

Ecological Risk Assessment

Excerpts from a presentation by
William Warren-Hicks, Ph.D.
EcoStat, Inc.

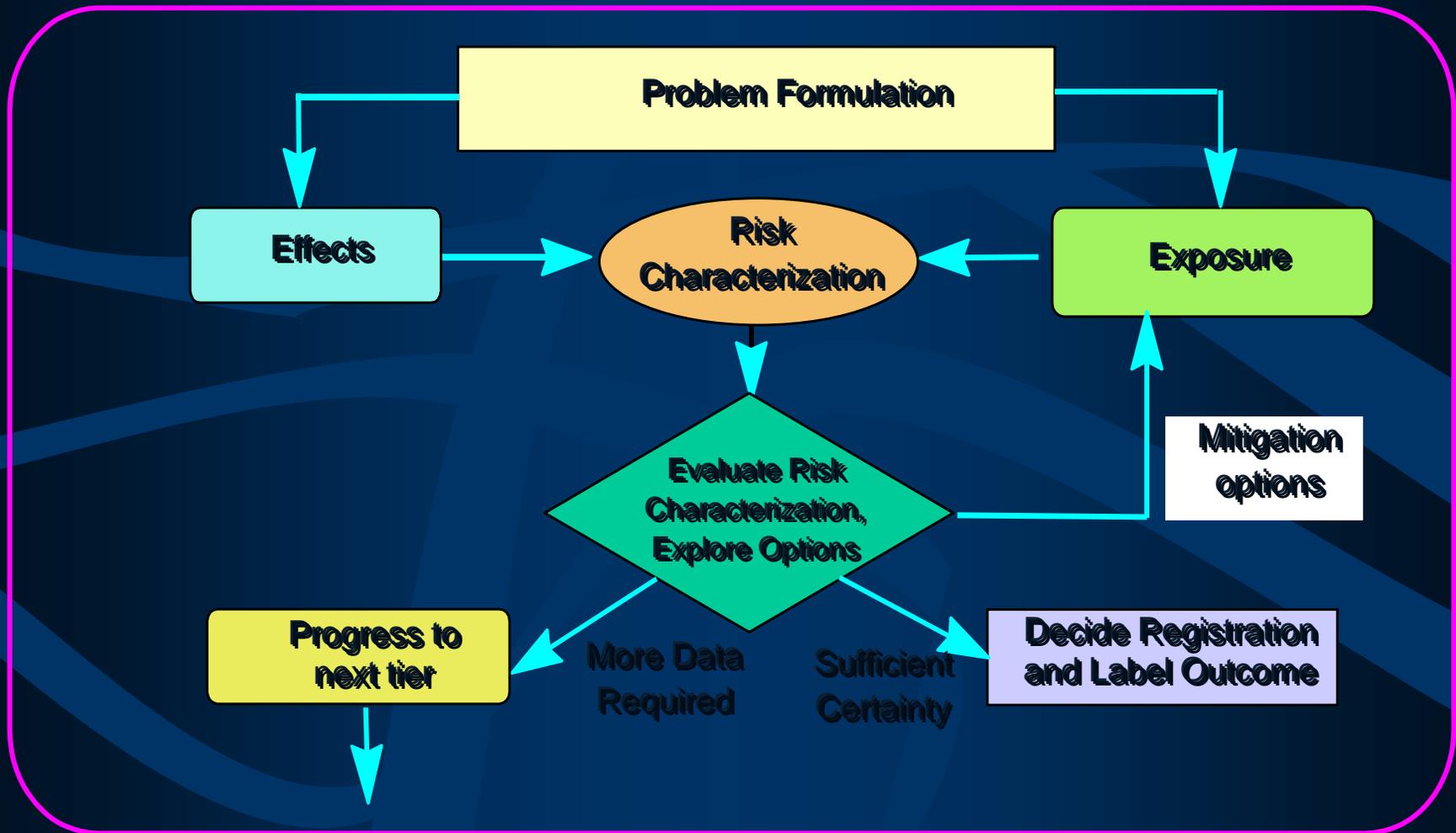
The process that evaluates the likelihood that adverse effects may occur, or are occurring,

to individual birds or bats, or populations of birds or bats, as a result of the ecological stress caused by wind power generation.

Core Concepts

- Decision oriented
- Tiered approach
 - Lower tiers: less data, conservative assumptions
 - Higher tiers: probabilistic, refined assessment
 - Focus on major concerns
- Feedback mechanism for decision-making
- Effective communication of risk and uncertainty to managers and lay audiences
- Stakeholder input
- Unifying framework that follows accepted format, making use of existing body of knowledge

Ecological Committee On FIFRA Risk Assessment Methods (ECOFRAM)

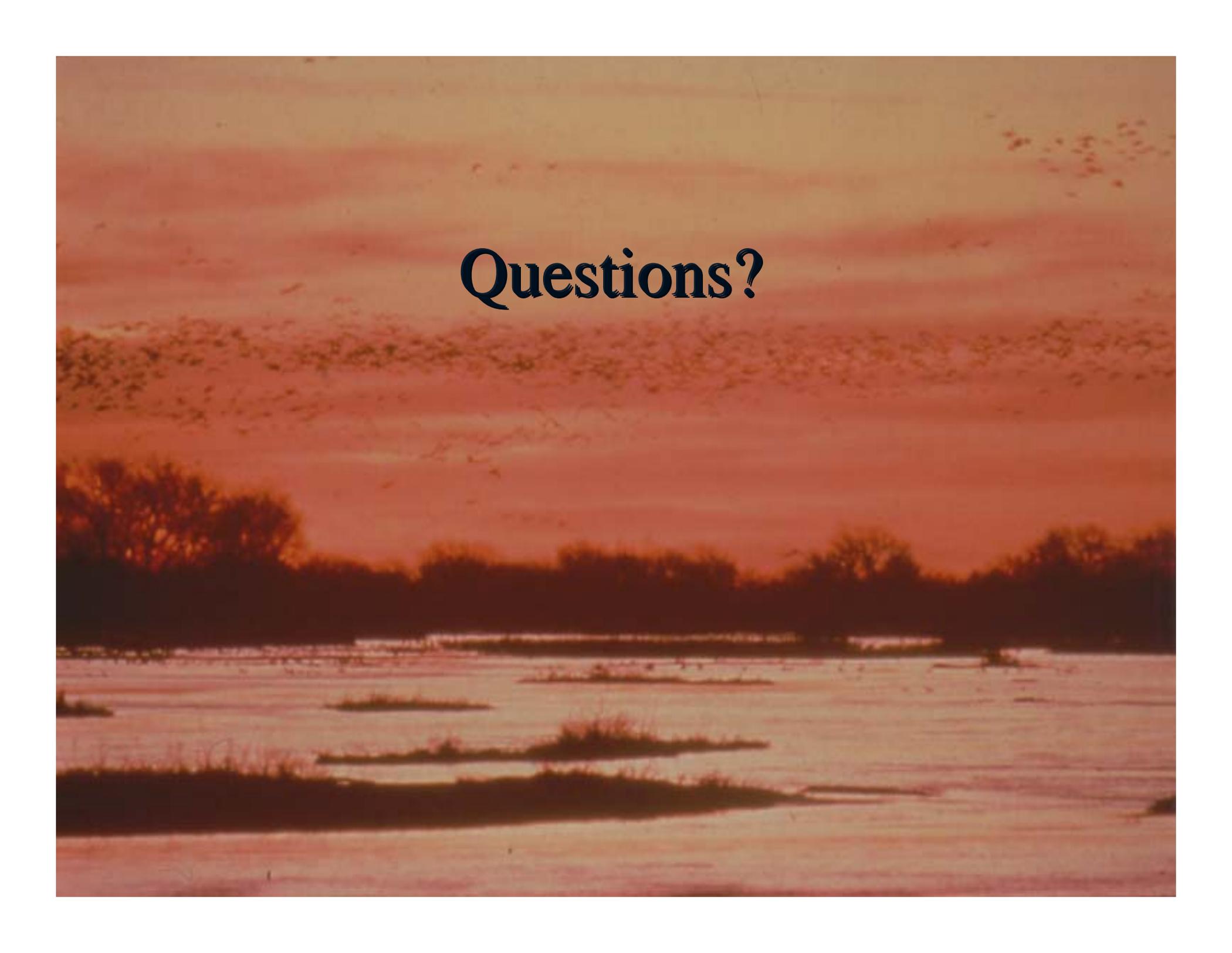


Bottom Line:

- Flexible and adaptable framework
- Objective: Increase uniformity of scientific decision process
- Increase consistency in what to measure, how much to measure, how to make decisions
- Cost-effective process: additional cost only when required
- In other regulatory programs: ensures input from stakeholders as part of standardized decision process
- Vocabulary can be an issue

Summary of Workshop

- Formal ecological risk assessment approach and structured decision making are foreign languages to those who are unfamiliar with them.
- Take principles used in tiered risk assessment and apply to wind energy wildlife problem.
- Use principles from adaptive management and structured decision making where appropriate.
- Prepare a draft tiered frame work.

A photograph of a snowy landscape at sunset or sunrise. The sky is filled with a large flock of birds in flight, silhouetted against the warm, orange and red light of the setting or rising sun. The ground is covered in snow, with some dark patches of grass or vegetation visible. The overall scene is serene and captures a moment of natural activity in a winter setting.

Questions?